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Transporting Nebraska Grain And Oilseeds: Changing Markets In A Changing World Economy

by
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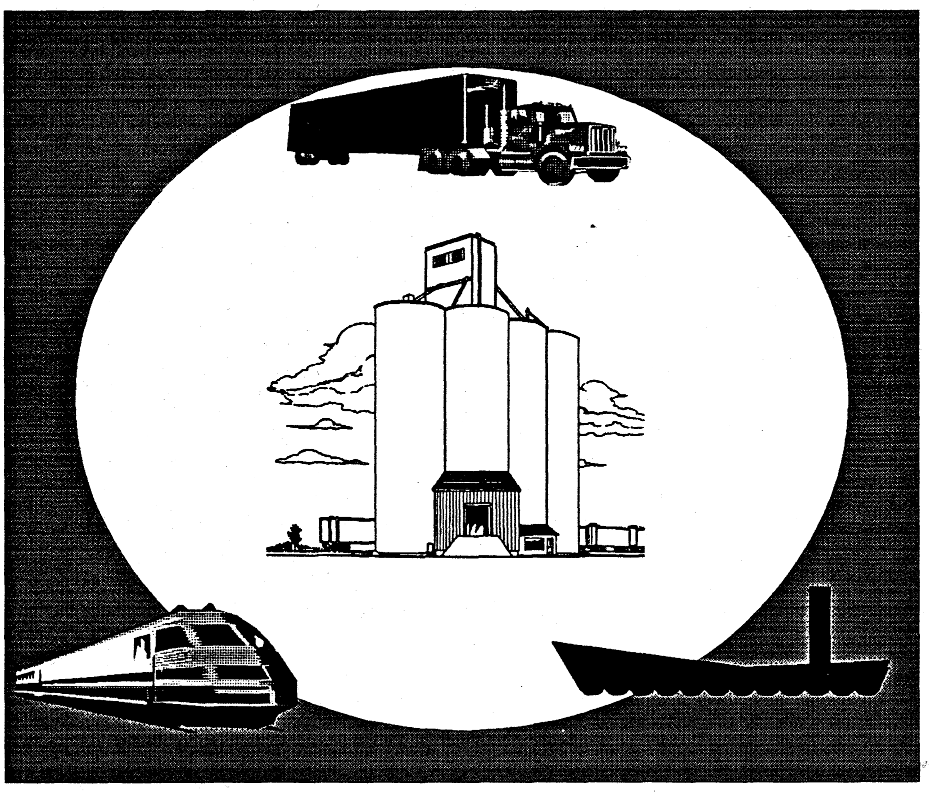

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FOREWORD

This report compares and contrasts findings from a series of surveys aimed at tracking the flows of Nebraska grain through markets in the nation at large. Most of the information comes either from personal interviews of grain elevator operators or questionnaires mailed to grain elevators, processors and feed lots. The findings are presented and interpreted in the context of the rapidly changing environment in which grain and oilseed transporters and handlers have operated in the second half of the twentieth century.

Chapter 1, the Introduction, describes the nature of the surveys from which the larger part of the report's findings are drawn -- how the surveys were conducted and how their findings were analyzed.

Chapter 2 discusses supply trends and Chapter 3 important demand developments which have transpired since the 1950s, when the first of a series of Nebraska grain/oilseed-flow surveys was conducted. These trends and developments have affected the volume of shipments of the state's grain, the modes by which it has been transported and its geographic destinations and uses. Important events include government policies and programs in the U.S. and in importing and competing nations; international conflicts; economics as well as politics of international trade; local, U.S. and world population trends; technological innovations in grain production, handling and transportation; weather patterns; crop pests; and other natural and human-contrived phenomena.

Chapter 4 summarizes major changes occurring over time in the state's grain-handling system, and how storage, merchandising and pricing have affected grain flows from the state. Chapter 5 examines the grain transportation system, its evolution over time and implications for grain flows.

Chapters 6-9 present the comparative grain-flow survey findings, one grain (or oilseed) per chapter and within each chapter a summary of that grain's flow patterns over time in terms of both mode of transport and destination. Comparison findings for 1992, from Interstate Commerce Commission Railroad Waybill data, provide a partial update of the surveys. These four chapters also provide additional crop-specific U.S. trade patterns over time, with emphasis on years covered by the surveys: 1954-59, 1969, 1977, 1985, and for the "Waybill" year 1992.

Chapter 10 summarizes the findings, emphasizing major changes in patterns of flows over time, their apparent causes and implications and a brief prognosis for the future.

The research was supported by the Agricultural Research Division of the Institute for Agricultural Resources, University of Nebraska, most recently under Project No. 10-71. Much of the work was done in cooperation with North Central Regional research efforts, the latest of which was NC-137, "Effect of Changes in Transportation on Performance of the U.S. Agricultural Transportation System." Participants in the regional projects undertook regional grain-flow surveys in 1955-58 and coordinated nation-wide surveys in 1977 and 1985. The Nebraska Station supported an independent state-focused survey in 1969 as well as the present efforts to review and interpret the findings of the entire series of surveys. Other financial supporters for the most recent (1985) Nebraska survey included the Nebraska Soybean Development, Utilization and Marketing Board; the Nebraska Corn Development, Utilization and Marketing Board; and the U.S. Army Corps of Engineers.

Special thanks are due the more than 100 elevator managers, the 24 grain processors and 27 livestock feeders whose cooperation in the interviews was essential to the completion of the 1985 survey.

Numerous persons assisted in reviewing draft questionnaires and in compiling the lists of elevators and grain users; these included Mr. Robert Andersen, Nebraska Cooperative Council; Mr. Jack Aschwege, State Statistician; Mr. Alvin Clark, ASCS, USDA; Mr. Mike Gauthier, Nebraska Public Service Commission; Mr. Kenneth Jackson, Feed and Agricultural Chemicals Division, Nebraska Department of Agriculture; and Mr. Richard Sanee, Nebraska Grain and Feed Dealers Association. Professor Michael S. Turner, a colleague in the Department of Agricultural Economics, has provided much valuable advice on grain market structure and trends over the course of the research. Colleagues Turner and Roy Frederick made many helpful suggestions for improving a review draft.

The 1985 survey was conducted during the summer of 1986 by Mr. Terry Akeson and Mr. Brian Horning, undergraduate students at UN-L. Graduate students Mr. John Morrill and Mr. Dan Koroma provided data processing services. Mr. Michael Bauer, Mr. Lee Potts, Mr. Henry Vogt and Ms. Sara Wellman assisted in verifying and tabulating survey results and in obtaining and tabulating secondary data. Ms. Nancy Pritchett produced the tables and graphs; her word-processing and computer-graphics skills greatly improved the overall presentation of all of the material. The author has solicited valuable council and advice from many people during the course of this effort; an attempt to acknowledge each would surely lead to omissions.

The presentation, interpretation and accuracy of the findings are, of course, the responsibility of the author alone.

EXECUTIVE SUMMARY

Transportation is a critical element in the marketing of heavy and bulky products such as grain and oilseeds, especially when markets are situated far from production. Nebraska's central location in relation to various relatively distant markets often makes the state a residual supplier of grains to major markets. Nebraska's producers and the land they farm are residual claimants of profitability as product and input prices respond to the forces of competition. At the same time, Nebraska shippers potentially can supply many of these markets depending on market conditions at the moment.

Shipping patterns for Nebraska grains tend to be unstable and can vary significantly from one year to the next. Relevant crops and markets can change quickly as prices respond to world market forces. As always, however, the state's own livestock producers are a major local source of demand for feed grains and local processors make a market for a large part of soybean production.

Information describing where and how agricultural commodities move once they leave the state's farms and ranches, especially in relation to the market forces shaping the movements, is helpful in exploiting market opportunities, in understanding long-term market changes, in facility planning and in exploring policy needs and implications. Taken together, a number of intermittent UN-L surveys, made between 1954 and 1985, along with a 1992 ICC Railroad Waybill report, offer some insights into the nature and sources of the more important trends.

Volumes and patterns of trade in relation to local availability have greatly influenced flows of grain from Nebraska. In 1954, the state's production was much smaller than in the years to come. Sorghum and soybean crops were so small as to be insignificant. Trade volumes were very small, Marshall Plan shipments having been exhausted by the time of the 1954 survey. World market demands were small in comparison to the U.S. capacity to out-produce local demands. Public Law

480, passed in 1954 and destined to be a major market factor later in the 1950s and 1960s, had not yet taken effect. The system for storing, handling and transporting U.S. grains was not in any case sufficiently developed at the time to accommodate the vastly increased volumes which were to materialize in later years.

What world market there was for U.S. wheat, feed grains and soybeans, was mainly accounted for by Western Europe in the 1950s, although Japan was rapidly becoming a customer of consequence. The European market eroded quickly in the face of Common Market policy initiatives, and had reached relative insignificance by 1985 as a market for U.S. wheat and feed grains. West Europe has continued, however, to be the dominant importer of American soybeans. Japan was soon to emerge as the first-ranking customer for every one of Nebraska's major crops. The (former) Soviet Union was a major market force in some years when its own crops were poor. Less-developed countries, including most notably, Mexico, emerged in the early 1970s as major grain customers. Their purchases faltered in the early '80s as debt burdens accumulated during the world economic boom beginning in the late '70s turned sour in the face of tightening U.S. monetary policies and resulting rising interest rates.

Rail has always been a major mode by which grain has moved from Nebraska elevators and has been dominant in shipments moving beyond the state's borders. Rail carriers compete nationally with barges for the greater part of the long-haul traffic, although barges carry only a very small part of Nebraska's grain in interstate commerce. Railroads have become increasingly important in Nebraska shipments to out-of-state destinations, carrying more than half of feed grain shipments in 1985, compared with from 7-16 percent in the mid-1950s. The overall trend toward rail is consistent with the state's production of a growing exportable surplus; the development of automated signaling and car-control systems, continuous-welded track and jumbo covered hopper cars moving in dedicated train-load lots; abandonment of branch-line trackage; end-to-end rail consolidations allowing single carriers to reach a wider range of distant markets; the construction of train-loading elevator facilities and upgraded port facilities; and a major growth of foreign markets.

Railroad rates, once designed to capture and retain grain shipments from country elevators to transit points and on through to final destinations, have given way to a rate structure aimed at generating cost savings from shipping large lots, over long distances and in larger volumes over time. Attempting to capitalize on their comparative advantage in long-haul traffic, railroads have abandoned a large part of their branch-line mileage since the 1950s and reduced the availability of transit rates. These adjustments were slow in coming to Nebraska, having transpired a number of years earlier in states in the eastern Corn Belt and Southeast. In their generally westerly progression, pressures for elevator consolidation reached the feed grain areas of Iowa before those in eastern and central Nebraska and are only by the 1990s, exerting major pressures for accommodation in the wheat areas of the Panhandle and southwest.

Trucks have become increasingly competitive for shorter-haul shipments from country elevators to local feed lots and processors in Nebraska and adjacent states, especially those to the south and west. Tight supplies of rail equipment and availability of back-hauls have at times prompted truck movements of several hundred miles. Trucks are competitive for some feed grain hauls to inland points as distant as Arkansas and the High Plains of Texas. Deregulation of the trucking industry in 1980 made it easier for trucks to obtain back-hauls and has allowed railroads to relinquish unprofitable short-haul traffic.

Wheat has sometimes been trucked from western Nebraska to facilities in eastern Nebraska, in direct competition with BNSF and UP Railroads, the opening of Interstate Highway 80 being a major competitive factor. Soybean shipments to processors in eastern Nebraska now move almost entirely by truck, a major change from the 75 percent share the railroads had in 1954.

The pattern of flows of the state's grain over time was little affected by world trade events until upgraded domestic handling systems began to enable the state's grain to reach ports on the West as well as the Gulf Coasts. Improved railroad organization and technologies have been accompanied by extensive road and highway upgrading, country-elevator consolidation and upgrading, and port and port elevator development and improvement.

The foregoing developments were complemented by the relaxation of extensive Federal regulatory restrictions covering rail and truck transportation in 1980. This major institutional change has provided added incentive for changes in the private sector, improving the operating efficiency of both carrier modes and shaping the division of traffic between the two in ways more consistent with relative comparative advantage of each.

Important flow developments include the rise of the Pacific Coast market, its decline after 1985, its resurgence in the mid 1990s, and the greater reliance on trucks for intrastate movements. The latter reflects the almost total disappearance by 1985 of grain transited through terminal or subterminal points in the state. Grain increasingly moves to interstate destinations directly from some 141 train--loading stations across the state.

Local processing capacity absorbs in most years the larger part of Nebraska's soybean crop. Approximately 60 percent of 1985 soybean flows terminated within the state, nearly all going by motor carrier. Nebraska wheat, by contrast is milled almost entirely outside the state and is moved mainly by rail to often relatively distant points. The milling industry, located in the 1950s in the wheat-surplus Great Plains States, is now oriented toward the urban centers of the nation. The latter development was precipitated by a revised railroad rate structure, making flour more costly to ship than unprocessed wheat.

The pattern of flows from Nebraska elevators has gradually widened from what was a very narrow geographic reach in the 1950s. Kansas City and other points in Kansas and Missouri were predominant early destinations. Colorado was the number-one corn destination in 1954. By 1969, states further to the south and east began to emerge as additional destinations. California and the Gulf Coast became important markets for Nebraska sorghum. Soybean patterns were widening too, although three-fourths of the crop in the latter year went to in-state points. The Western European market for wheat was virtually gone by 1969. Food for Peace, however, had become an important new wheat outlet, marking the beginning of what has since become a major market in the developing world.

Continued railroad track abandonment, upgrading of elevator handling capacities, growth in multiple-car shipping, growing traffic moving directly from country elevator to final destinations and a large increase in world grain trade were dominant features of 1977 flows. The destination pattern had widened to a number of additional states. The Texas Gulf was the largest export market for Nebraska corn, sorghum and wheat. Soybeans for export moved mainly through the East and Louisiana Gulf ports.

The list of states receiving Nebraska grain had lengthened still further by 1985. The PNW became the largest export outlet for Nebraska wheat and feed grains. Exports of Nebraska corn through the Texas and Louisiana Gulf together equaled those to the PNW. Soybean direct exports were small, going largely to Mexico. Interstate shipments of soybeans had, however, risen from less than one-fourth of the total in 1977 to 40 percent in 1985. Kansas and Missouri continued to be important markets for all Nebraska crops.

The West Coast market had declined in relative importance by 1992, and to some extent the Gulf as well. Large amounts of Nebraska feed grains were trucked for domestic consumption to Arkansas, Kansas, Oklahoma and Texas. The PNW was still the biggest export market for Nebraska corn, although Texas and Louisiana Gulf shipments taken together were larger. Sorghum went heavily to the Texas Gulf. Texas and PNW ports took modest amounts of soybeans. More than twice as much Nebraska wheat went to Texas as to PNW ports. Kansas City as always was an important wheat destination.

The integration of the nation's agricultural enterprise into world commodity markets has created an interdependence of economic interests between Nebraska grain producers and producers and consumers in nearly every corner of the world. This interdependence is reflected in the pattern of grain shipments leaving the farms and markets of the State. The volume and pattern of shipments in the future will depend on the size and mix of its crops and the intensity of buying pressures in alternative markets and the relative efficiency of transportation and handling systems. The policies of governments at home and abroad may have direct and indirect impacts of much consequence for the pattern as well as the size of flows.

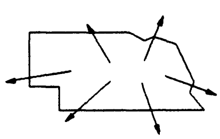
SHIPPING PATTERNS FOR NEBRASKA GRAIN AND OILSEEDS: CHANGING MARKETS IN A CHANGING WORLD ECONOMY

by
Dale G. Anderson*

Chapter 1

INTRODUCTION

Background



Nebraska's location near the center of the nation but far from major centers of population is at once a handicap and an opportunity for the state's grain producers and handlers. Producer prices are discounted by transport costs to distant markets but relative equidistance to potential market opportunities in several directions enables shippers to take advantage of alternative markets when and where they may develop. The pattern of grain flows can vary widely from one time to another depending on market demands relative to available stocks. Over longer periods of time, technological changes have improved the efficiency of grain production, handling and transportation systems, enabling Nebraska shippers to reach more distant markets. Changing government policies and regulations have affected productivity and relative competitiveness of each of these systems and therefore the pattern of grain flows.

The integration of the Nation's agricultural enterprise into world commodity markets has created an interdependence of economic interests between grain producers in Nebraska and producers and consumers in nearly every corner of the world. This interdependence is reflected in the pattern of grain shipments leaving the farms and markets of the state. Growing interdependence is also an explanation for much of the increasing variability of grain shipping patterns. Each year's markets are

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unique in some respects, including the years of grain-flow surveys on which this report focuses.[1] Because the pattern of flows grows out of the larger market setting of which the flows are a part, the nature of national and world market conditions over the period covered by the report, especially during the survey years, are summarized in relation to the more recent (1996-97) situation for an updated perspective.

The purpose of this report is to bring together and to interpret the more important findings from an intermittent series of surveys of country elevators made between 1954 and 1985.[2] Railroad Waybill statistics provide a means for partially extending the results to 1992 (U.S. Interstate Commerce Commission 1993). Missouri River barge loadings compiled by the Corps of Engineers provide a means for extending estimates of river traffic (U.S. Army Corps of Engineers). Historical series from the foregoing supplementary sources also afford cross-checks with the survey results.

The surveys on which the present report is largely based describe the pattern of flows of grain and soybeans (hereafter shortened to "grain") during the course of each of the years in which surveys were taken (1954-59, 1969, 1977 and 1985). The results, when compared over time, provide insights into larger patterns of change, their sources and implications. Such information is useful to persons who would better understand the spatial dimension of grain markets. It is useful in identifying and developing new markets for the state's primary products. It is useful to those making decisions about the location of grain marketing investments. A better understanding of where and how grain moves

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[1]The various sources reporting detailed procedures and findings of these University-of-Nebraska surveys are cited in the "Procedures" section of Chapter 1, below.

[2]Some of these surveys contributed to more comprehensive regional or national surveys; published results of these flow studies are referenced in the "Procedures" section of the present chapter.

is useful to public policy makers in comprehending or anticipating the implications of alternative government actions.

Data describing the flow of Nebraska's grain by mode of transport to major destinations are not generally elsewhere available. The USDA uses relative production volumes of each crop (U.S. Department of Agriculture, various issues (a)) in estimating each state's contribution to the national total of grain exports, based on the premise that export shares are proportional to respective shares of production, a clearly insupportable presumption. Interstate Commerce Commission (ICC) Waybill data (U.S. Interstate Commerce Commission, various years(a,b)) provide estimates of rail shipments, but those for years prior to 1981 are of questionable reliability (Wolfe 1986 and 1991) and those for every year have gaps in their coverage. The U.S. Army Corps of Engineers (various years) compiles some aggregated data (origins by waterway segment) on inland waterway traffic but nothing at a state-to-state level.[2]

Procedures

The most recent detailed survey of grain shipments from Nebraska origins reports 1985 traffic. Comparisons with earlier years are facilitated by comprehensive surveys in 1977 (Linsenmeyer 1982) and 1969 (Anderson and Breuer 1971; 1971a); similar surveys from the mid-to-late 1950s provide historic comparisons (Farrell 1958; Miller 1960; and Miller and Nelson 1962). Discussion of the environment leading up to the survey years puts the shipping patterns of each period in historical perspective. Highlights of the current environment, including Waybill and Waterborne Commerce data noted above, provide insights into the post-survey shipping situation. Limited updating to 1992 draws

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[2]Use of the Waybill for estimating traffic flows is discussed further under "Procedures," below.

upon Waybill (U.S. Interstate Commerce Commission 1993) and Waterborne Commerce (U.S. Army Corps of Engineers various years) data.

The 1985 estimates resulted from a personal interview survey of grain-handling firms taken during the summer of 1986. Procedures of this latest survey vary in some respects from those of earlier surveys, but are broadly representative of all. Data reflect calendar year 1985 operations.[3] The sample included 99 inland elevators, one river elevator, 21 feed manufacturers, 3 flour millers and 27 feedlot operators. The total sample of grain elevators was stratified into sub-samples to assure representation of major geographic areas (each of the state's eight crop reporting districts), small- as well as large-capacity elevators and train-loading as well as single-car-loading elevators. The full population of elevators accounting for the largest 25 percent of total storage capacity was included, along with a 10-percent random sample of the remaining elevators in each area. All river elevators were contacted, although only one was sampled. The full population of elevators with capability for loading 54 or more cars at a time was interviewed and a 10-percent random sample was drawn from those able to load between 25 and 53 cars.

The 1985 Nebraska survey was part of a larger survey effort involving participants from 33 major grain-producing and -consuming states. Overall results were combined to provide a picture of

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[3]The 1985 and 1977 surveys used personal interviews; the 1969 study relied on mail questionnaires. Surveys in the 1950s employed a combination of mail and personal interview techniques. The latter surveys had a crop-year coverage (generally the 12 months beginning with the harvest; subsequent surveys tracked calendar-year grain flows.

interstate flows for the entire nation.[4] Discrepancies between volumes states reported receiving and what other states reported having been shipped to them were reconciled through meetings of survey supervisors from the various participating states.

As might be expected of work undertaken independently by several different investigators, and over a period of several decades, procedures are not entirely uniform. Data collection processes have varied and the aggregation and presentation of the results have been even more variable. And the industry itself has changed significantly since the first surveys were conducted; the participating businesses are different, the market environment in which they conduct their operations is significantly different and the roles of participants radically changed.

Surveys taken in the 1950s excluded elevator sales to local farmers and feeders while subsequent ones included local sales as part of truck shipments. Some surveys have focused largely or even entirely on country elevator purchases and shipments, others have compiled separate data for country, subterminal and terminal elevator sectors of the market. More recent surveys, in keeping with a loss of distinction among the roles of the latter elevator types, have surveyed all elevators as a single group.[5]

Of course, the terminal and subterminal flows at the time of the earlier surveys originated almost entirely from country elevators and in that sense, their addition in surveys, at least those prior

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[4]The earlier Nebraska surveys were also part of regional collaborations. North Central Regional results of part of the 1950s-era studies are found in Farrell. The 1977 results are in Hill, Leath and Fuller 1981; Leath, Hill and Fuller 1981; Leath, Hill and Fuller 1981a and Leath, Hill and Fuller 1981b. The 1985 survey findings are in Fruin, Halbach and Hill 1990; Hill, Patterson, Vercimak, Fuller and Anderson 1990; Larson, Smith and Baldwin 1990; and Reed and Hill 1990.

[5]The 1954 survey reported combined flows from country, subterminal and terminal elevators; 1969 results provided separate treatment of each of the three elevator types; 1977 and 1985 surveys sampled a population of all elevators in the state.

to say 1985, or perhaps 1977, yields an over-count of total flows within the state. Ideally, the out-of-state shipments might be aggregated to yield a more accurate picture where Nebraska grains ultimately go. Although some of these problems are not fully unresolved in the present report, attention is called, at appropriate places in the discussion, to the more troublesome inconsistencies. Because grain in more recent years is seldom transhipped from one elevator to another within the state, the distinction between country and terminal/subterminal elevators has been largely erased. While some elevators may specialize in serving out-of-state markets, with others shipping relatively more grain by truck to meet local needs, transhipments have become uncommon.

The problem of how local sales are treated applies almost exclusively to corn and sorghum since on-farm demand for soybeans and wheat is negligible. Such local demand as there is for soybean and wheat seed and, in the unusual circumstance of wheat prices being sufficiently depressed relative to prices of coarse grain, for feed wheat. Because a large part of the soybean crop has always been processed within the state, transhipments of this crop from one intrastate elevator to another have never been significant. Wheat, by contrast, has always been transhipped to a major degree, some railroad transit rates for this crop having lingered into the 1980s and beyond.

Most of the data for corn and sorghum shipments for 1969 have been combined, along with those for oats, into a single category, "feed grains," hampering comparisons with results of surveys from other years when corn and sorghum were reported as separate categories. Nebraska sorghum flows in 1977 were combined with those for Kansas in order to avoid disclosure problems; findings for that year are therefore not comparable with those for other survey years when the findings were reported separately for Nebraska.

Secondary data had a part in sorting out some of these inconsistencies in the 1977 and 1985 regional surveys. Data from the U.S. Army Corps of Engineers (various years) magnetic tapes of river-borne traffic and those of the ICC's Waybill Sample of railroad traffic (U.S. Interstate Commerce Commission (various years, (a, b)) were particularly useful. As useful as these latter sources are for comparison purposes, independently they have generally been neither as complete nor as reliable as university survey sources. The accuracy of the Waybill, especially that of earlier years, begins to break down at state and sub-state levels owing to sampling-rate problems. Improved sampling procedures beginning in mid-1981 have, however, greatly improved the Waybill as a source for rail shipment information. Early Waybills sampled 1 percent of the shipments, a rate which proved to be far too small for multiple-car lots moving under a single waybill; current procedures call for larger samples for larger shipments (Wolfe 1986 and 1991).

The Waybill data, from which 1992 and some earlier limited comparison estimates were drawn for the present study, were historically organized by freight territories, of which there are presently five; state-to-state estimates of generally poor reliability were also published. More recent Waybills, including the 1992 public use computer tapes used in the present report as an independent source for that year, identify, where disclosure rules permit, shipments from one Business Economic Area (BEA) to another, of which there are 183, including one each in Alaska and Hawaii. Overlaps complicate attempted state-level aggregations of the BEA data, which are useful for comparisons with other data series. Interpolations of the data based on relative production of grain in overlapping (county-by-county) portions of one state relative to another are used in the present application to deal with state-boundary overlaps of BEAs across shipment origins.

Although recent Waybill data are apparently generally more reliable than in the past, the most reliable (regional) data are much more aggregated than the elevator survey results; ICC regions are identified in Figure 1-1. While the ICC tabulates data collected from every size of population, the Public Use Tapes (U.S. Interstate Commerce Commission 1993) available for research purposes, owing to disclosure rules applying to small populations, omit tabulations which might identify individual shippers or carriers. It is possible to deduce where some of these "unknowns" must have gone. As it happens, any BEA which had either known shipments or receipts cannot be either source or destination for any of the unknown shipments. Furthermore, the rail mileage associated with each observation is identified for unknown as well as known origin-destination pairs. By examining the reported distance associated with each unknown observation in the context of "unknown" BEAs, one can make educated guesses about where the shipments must actually have gone. The foregoing procedure was used in the present report for reducing the extent of the unknowns in the 1992 flow data.

The U.S. Army Corps of Engineers (various years) data describe traffic carried over major segments of the inland waterway system and between major ports but provide no state-to-state estimates. Unfortunately, no secondary sources of truck shipments are available for comparison.

The present study brings together the more important insights from these various sources, emphasizing the apparent reasons for changing patterns of flows over time. Results may provide some insight as well into present and possible future patterns.

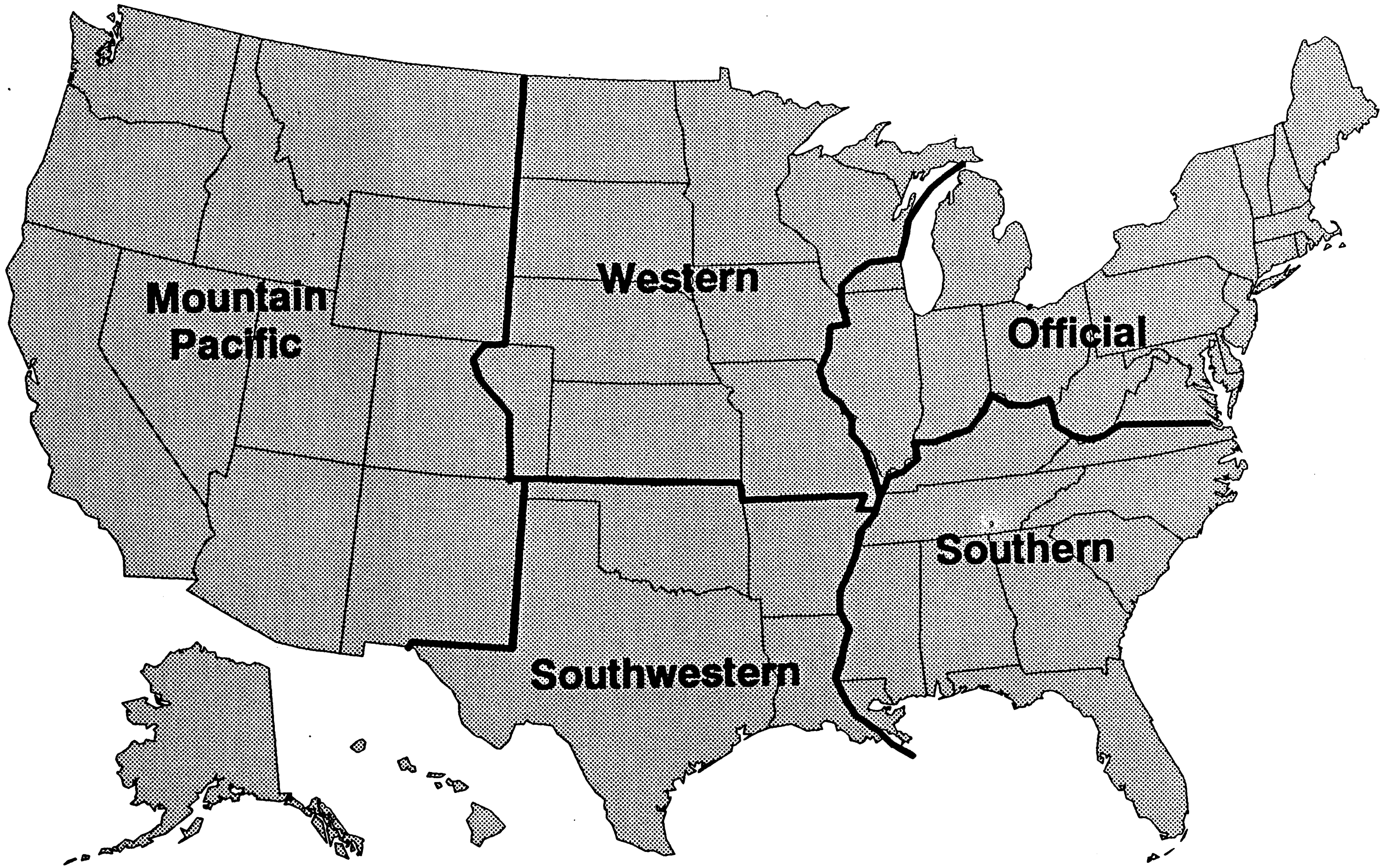
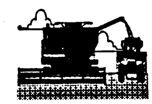


Figure 1-1. Interstate Commerce Commission Freight-Rate Territories.

CHAPTER 2

GRAIN SUPPLY TRENDS

Overview



Grain shipment patterns are a reflection of both local and broader national and world supply and demand conditions that in turn are affected by a variety of factors, the combination of which is unique to any given period of time. A brief background of major trends since mid-century, with emphasis on the setting at the time each of the surveys was taken, may help to place the grain-flow findings in their proper context.

Circumstances have changed significantly since the first surveys of Nebraska grain shipping patterns were made in the early 1950s. Grain supplies as well as demands have increased sharply. There is much more grain to move and, because production has grown faster than local demand, much more to be transported. The present chapter focuses on trends in grain supplies since mid-century and major underlying bases for the trends.

Chapter 3 examines demand developments since mid-century. Chapters 6-9, which recount results of surveys tracing flows of grain from Nebraska origins, also provide further insights into factors bearing on the patterns of these flows; these latter chapters include tabular detail of production and yield trends outlined in the present chapter and illustrated in Figures 2-1 through 2-16.[1]

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[1]Much of the present chapter is adapted from information in *Nebraska Agricultural Statistics* (Nebraska Department of Agriculture and USDA various years). Other sources are cited in the text as appropriate. Tables 6-1, 7-1, 8-1 and 9-1 in Chapters 6 through 9 are the source of production and yield trend summaries.

Before mid-century, growth in total world food production came primarily from additional land being brought under production. Since that time, the greater part of the growth in production has come from increasing crop yields. What is true for the whole is not necessarily true for each individual food production enterprise. Shifts among enterprises have meant that for some crops yield growth has contributed less than cultivated area growth. Thus, world production of corn and soybeans has grown faster than yields, while for sorghum and wheat yield growth has exceeded that of production.

World corn production increased 233 percent, from 5.6 billion bushels in 1954 to 18.8 billion in 1995. Average world corn yields were 25 bushels per acre in 1954, 66.8 bushels in 1994, an increase of 167 percent (Figures 2-1 and 2-2). Simple average annual growth in yield was 4 percent per year from 1954 through 1960, declining to 2.1 percent during the decade of the 1960s, peaking at 3.2 percent in the '80s, falling again in the first half of the '90s to 1.2 percent per year. The rapid early spurt of growth may have come from adoptions of hybrids, which came later in many parts of the world than in the United States.

World grain sorghum production has also grown, but more slowly than that of corn. Total world sorghum production in 1954 was 1.6 billion bushels; by 1995 it had risen 31 percent, to 2.1 billion bushels. Yields grew 84 percent, from 12.4 bushels per acre in 1954 to 22.1 bushels in 1994, a rate much higher than the increase in output (Figures 2-5 and 2-6). The improvement came relatively evenly over the entire period, with no evidence of abrupt breakthroughs in productivity.

World soybean production increased 510 percent, from 738 million bushels in 1954 to 4.5 billion bushels in 1995. Average yields increased by 89 percent, from 17.1 bushels per acre in 1954 to 32.4 bushels in 1994 (Figures 2- 9 and 2-10). Soybean yield growth came slowly at first, averaging

0.7 percent per year from 1954-60, increasing to 1.9 percent per year during the decade of the '60s, to a peak of 2.8 percent during the 1970s, dropping to only 0.6 percent during the '80s, and increasing again to 1.3 percent per year during the period 1990-94.

World wheat production grew from 7 billion bushels in 1954, to 19.7 billion in 1995, an increase of 98 percent. Yields increased by 148 percent over roughly the same period, from 15.1 bushels per acre in 1954 to 37.5 bushels in 1994 (Figures 2-13 and 2-14). Wheat yields grew on average 1.8 percent per year over the period 1954-60, by 2.8 percent annually from 1960-70, increasing to 3.0 percent from 1970-80, to a peak of 3.7 percent per year from 1980-90, and falling during 1990-94 to a minus 0.1 percent per year. As with other crops, growth in acreage would depress yield averages to the extent new lands are of lower than average productivity.

Mid-Century

The post-WW II period marked the beginning of major changes in U.S. and world supply and demand conditions for grain and its transportation. On the world scene, agricultural research breakthroughs, beginning in the late 1950s, at the International Rice Research Institute in Los Baños, Philippines and the International Maize and Wheat Research Center near Mexico City, and continuing at these and 16 additional centers subsequently created in other locations (mergers left a total of 16 by 1996), set the stage for sharp increases in yields of some crops and the birth of the "Green Revolution" (Tribe 1994). World production of corn grew a little less than 35 percent during the short period 1954 to 1960, soybean production grew 27.4 percent, that of wheat 16.6 percent. Sorghum production declined, however, by 0.9 percent owing to 1960 being an unusually poor year for the crop and to minimal research attention having been accorded this crop.

In the United States, relatively plentiful land but scarce labor supplies had heretofore provided economic incentives for systematic and organized agricultural research aimed more at increasing productivity of human than of land resources. Incentives for yield-enhancing research had largely awaited the exhaustion of the land frontier; the implications of this transition did not begin to become manifest until shortly before mid-century.

The adoption of corn hybrids very quickly became universal in the United States in the years just before and during the war, with resulting sharp increases in yields. Whereas only 3 percent of U.S. corn acreage was planted to hybrids in 1926, by 1949, hybrids accounted for more than 78 percent of U.S. corn acreage; by 1958, the percentage was nearly 94. Nebraska was slightly ahead of the curve, almost 98 percent of the state's corn acreage having been planted to hybrids by 1958 (U.S. Department of Agriculture various years). Average Nebraska corn yields over the period 1925-29, pre-hybrid years, were 24 bushels per acre; by 1954 they were 28 and by 1957 (a normal sort of crop year, better than the previous two drought years), they were 46.5 bushels, an increase of 94 percent. Production was up only 11 percent owing to a reduction over the period of harvested acreage (Nebraska Department of Agriculture and Inspection and USDA various years).[2]

Yield increases for sorghum, soybeans and wheat also accelerated with the gradual accumulation of research breakthroughs. Sorghum was not a crop of any consequence in Nebraska in the 1920s; production in 1925-29 averaged only 262 thousand bushels compared with 13.4 million in 1954 and 77.3 million bushels in 1957. Hybrid sorghums appeared later than those in corn, but with

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[2]Much of the production background in the following several paragraphs is from Nebraska Department of Agriculture and Inspection and USDA, various years; and Nebraska Department of Agriculture and USDA, various years. Data for 1925-29 are from Nebraska Department of Agriculture and Inspection and USDA, 1956. Figures 2-1 through 2-16 provide a graphic picture of yield and production trends, beginning with 1954, at state, national and world levels.

eventual similar effect. But sorghums are almost always grown under dry-land conditions, in areas of marginal rainfall and with resulting yields that fail to match those of irrigated corn. Sorghum for grain yields in Nebraska increased 212 percent, from 12.5 bushels per acre in 1925-29 to 39 in 1957. Soybean yields in 1941-45 (no records were kept in the 1920s) were 14.8 bushels per acre compared with 27 in 1957, an increase of 82 percent (Figure 2-9). Soybean production in 1941-45 was only 468 thousand bushels compared with 4.2 million in 1954 and 3.8 million bushels in 1957; production in 1938, the first year of record, was only 12 thousand bushels. Nebraska winter wheat yields in 1954 were 19.8 bushels per acre, those in 1957 27 bushels, compared with 15.5 bushels in the period 1925-29, the latter an increase of 74 percent; production increased 54 percent.

As always, there was considerable year-to-year variation in crop yields in the 1950s. The 1954 crop year was a reasonably good one for corn, sorghum and soybeans, a rather poor one for wheat. Crop years 1955 and 1956 were a time of severe drought in Nebraska. Precipitation was far below normal over the entire year in 1956. Total crop production in the state in 1956 was lowest since 1940. Irrigation wells were being drilled at an unprecedented rate, marking the beginning of a major transformation of dry-land to irrigated cropping, especially across the central and east-central areas of the state. The wheat areas in the western part of the state were less affected by the drought, 1955 in particular being a relatively good year for wheat.

By contrast, all Nebraska crops were extremely good in 1957, even better in 1958; corn yields set new records in each of these years. Soybean yields were also a record, Nebraska having the highest average yields in the nation in 1958, production being nearly two and one-half times the average of the previous two years. Wheat yields and production were both all-time highs in 1958.

Nebraska Irrigated corn had record high yields in the drought year 1956 but dry-land yields were far below the trend. Corn yields on average were only 20.0 bushels per acre in 1955, 23.5 in 1956, compared with 46.5 bushels per acre in 1957 and 53.0 in 1958. Production in the former years averaged 95.2 million bushels, well under half the 253.2-million-bushel average of the latter two (Figures 2-1 and 2-4).

The drought of the mid-1950s cut Nebraska sorghum yields more sharply, since little of this crop was irrigated: 11.0 bushels per acre in 1955, 14.0 in 1956, compared with 39.0 and 48.0 bushels per acre, respectively, in 1957 and 1958. Sorghum production in 1957 (77.3 million bushels) was nearly 10 times the level in 1955 (7.9 million bushels) (Figures 2-5 and 2-8).

Soybean yields and production were similarly impaired, yields in 1955 and 1956 being only 10.5 and 11.5 bushels per acre, respectively, compared with 27.0 and 30.0 bushels per acre in 1957 and 1958. The small yield increase in 1956 over that of 1955 resulted from expanded acreage under irrigation. Production in the drought years of 1955-56 averaged 1.8 million bushels, that in the succeeding two years 5.007 million (Figures 2-9) and 2-12.

The wheat crop in 1954 was the smallest of the mid-to-late '50s, with a yield of 18.1 bushels per acre and production of only 61.6 million bushels, compared with average production of 71.5 million in 1955-56 and 96.1 million bushels in 1957-58. Drought as well as hail depressed wheat yields in 1955 and 1956 to 24.9 and 19.5 bushels per acre, respectively. By contrast, yields were 27 bushels per acre in 1957 and 33.0 in 1958, the latter, however, being exceptionally good years (Figures 2-13 and 2-16).

While there has been much year-to-year variation around the trend, as for example the poor crop years of 1955-56 compared with record-breaking crops in 1957-58, Nebraska crop yields and production have grown significantly since the 1950s. Yields have generally exceeded national averages and the state's share of national production of corn, sorghum and soybeans has increased sharply since the 1950s (Figures 1-1, 2-5, 2-9 and 2-13; for more detail see Tables 6-1, 7-1, 8-1 and 9-1). Relatively high yields are an important reason for the state's high production rankings, a pattern already well established by the 1950s.

Nebraska corn yields were consistently below those of the nation in the 1950s (although virtually equivalent in 1958), being only about half the U.S. average in the drought years of 1955 and 1956, and a little below even the world average in the latter year (Figure 2-1). Irrigation development and improved weather were soon to reverse this relationship, with Nebraska corn yields having consistently exceeded those for the U.S. as a whole since the early 1970s. Nebraska's share of national corn production grew steadily from 6.4 percent during the period 1954-59 to 11.9 percent during the first half of the 1990s, when the state ranked third among corn-producing states (compare Figures 2-9 and 2-10).

Sorghum yields in Nebraska have nearly always been above those of the nation, although 1955 and 1956, years when drought depressed the state's yields to some 60 percent of those of the U.S., were notable exceptions (Figure 2-5). Nebraska's share of national sorghum output, only 10.5 percent in the late 1950s, rose steadily to 15.8 percent in the late '90s, making the state the third-ranking producer of the crop.

Nebraska soybean yields often exceed those of the nation by a small margin. This was true already in the 1950s except for the drought-plagued 1955-56 period when the Nebraska crop yielded only about one-half that of the U.S. average (Figure 2-9). Soybeans came late to the Nebraska scene, the state's contribution to national production being only 0.8 percent in the late 1950s. By the late

1990s, Nebraska produced a respectable 4.6 percent of national output and was the seventh-ranking producing state.

Nebraska's wheat yields are normally a few bushels above those of the nation. This was already the case in the 1950s, with the exception of 1956 when U.S. wheat yields were a fraction of a bushel per acre higher than those in Nebraska (Figure 2-13). The state's wheat output has been erratic, with no clear trend discernable. The Nebraska share of national production has slipped from 7.2 percent in the late 1950s to only 3.3 percent in the first half of the 1990s, an apparent result of acreage being diverted to other (irrigated) crops in Nebraska and other crops to wheat nationally because of farm program anomalies.

The 1960s and 1970s

While world food output grew on average during the decades of the '60s and '70s, there were ups and downs at times and in places. World corn production grew by 32.6 percent between 1960 and 1970, sorghum production by 35.1 percent, soybean production by 63.4 percent and wheat output by 30.9 percent. Adverse weather in the early 1970s contributed to marked shortfalls in world grain production, beginning with poor Soviet wheat harvests in 1972 and 1973 and in marginal harvests for several years thereafter. The Soviet Union made record grain imports to cover its initial shortfalls, leading to sharp increases in world prices. Several Asian countries experienced repeatedly poor grain crops through much of the 1970s. Africa became a major trouble spot during the late 1970s and early '80s as drought ravaged a large part of the continent. Nor was the U.S. immune from the whims of nature. Reduced crop harvests resulted in 1970 from corn leaf blight and in 1974-75 and again in 1983 from drought (Fornari, pp. 106-7).

U.S. corn production increased nearly 60 percent between 1960 and 1980, sorghum was down 6.9 percent, soybeans up 223.8 percent and wheat up 175.8 percent. Because 1980 was a relatively poor crop year, its use as the end point of the series underestimates the rate of increase over the two decades (Figures 2-1 through 2-16).

Nebraska yields and production of corn, sorghum and soybeans increased significantly over the decades of the 1960s and '70s. Many annual yield and production records were broken. Wheat yields also continued to increase, but production varied greatly year by year, with no long-term trend apparent. There was significant year-to-year variability in yields of all crops owing primarily to weather, and variance in production owing to yield and acreage fluctuations (Figures 2-1 through 2-16).

The period began favorably, total crop production in the state in 1960 being 56 percent above the 1947-49 average, setting a new record. Timely rains were the big factor. Corn and sorghum crops both set production records in 1960. Corn yield was a near-record 51 bushels per acre, while the sorghum yield of 50 bushels was a new record. Average state wheat yield was 28.5 bushels per acre, second only to the 1958 record year.

Fertilizer use was on the rise in the early 1960s; record nitrogen applications to improved crop hybrids and varieties contributed to rising crop yields. Year-to-year production variations were occasioned in part by government programs. Production of corn and sorghum was down, for example, in 1961, owing to provisions of the Feed Grain Program. Soybean production in the same year was at an all-time high because of acreage shifts out of feed grains. The shifts continued, with feed grain production declining in 1964 owing to government program acreage diversions (and reduced yields resulting from hot, dry summer weather and an early frost). Corn acreage in 1964 was the lowest since the major drought year 1934; soybean acreage reached another high in 1964, although yields and production were down.

The 1969 survey year was pretty much on trend. Total Nebraska crop production set a new record even though spring rains delayed sorghum plantings and cool temperatures slowed row-crop emergence and early growth. Yields were new records: corn 93 bushels per acre, sorghum 76 bushels, soybeans 33.5 bushels. These records followed good crops in the preceding three years, total crop production records being set in 1966 and 1967 and total crop output in 1968 was third largest on record. Wheat yield in 1969 averaged a respectable 31.5 bushels per acre, the record to that time having been 35 bushels in 1966.

The 1977 survey year also saw new state production records for corn, sorghum and soybeans. While the previous three years had been relatively dry, above-normal moisture supplies in 1977 brought favorable yields. Although dry planting conditions, winter kill and wind erosion affected wheat yields, acreage was up and wheat production was the highest since 1958.

The 1980s and 1990s

World Production of corn, soybeans and wheat continued to grow during the 1980s and '90s. Corn output increased by 18.5 percent between 1980 and 1995, the latter a poor crop year. Sorghum production declined by 9 percent, soybean production increased 32.1 percent and wheat output grew 22.2 percent.

Crop yields continued to grow in the 1980s and '90s, although at slower rates than those over the previous 25 years. Variability in yields from one year to another marked the effects of variable crop-growing conditions. Production was affected by variations in yields, farm policies, carry-over stocks and the pull of demand.

The 1985 survey year was one of mixed world agricultural indications. The Soviet Union had poor grain crops in 1984 and much of Africa had disappointing crops in both 1984 and 1985, setting the scene for an increased volume of world agricultural trade during the latter year. African countries relied heavily on concessional financing of grain imports to meet their growing deficits. China, India and the European Common Market all became exporters during 1985 in response to favorable weather and government policies increasingly supportive of expanded agricultural output and exports. World grain stocks increased during 1985, largely because of accumulations in the U.S., a reflection of the nation's declining share of world agricultural trade.

The 1985 crop year featured sharply increased U.S. grain production (Figures 2-3, 2-7, 2-11 and 2-15), declining exports, growing inventories and depressed commodity prices. A vigorous recovery from the production slump occasioned by the drought and the acreage restrictions associated with the Payment-in-Kind (PIK) program of 1983 began to take shape in 1984 and gathered momentum in 1985. High government price supports in the latter year encouraged large plantings in both the state and nation; favorable weather produced high yields in both 1984 and 1985. New production records were set in 1985 when U.S. feed grains output exceeded 1983 levels by 114 percent and those of 1984 by some 15 percent. Corn, sorghum and soybean crops all set records in 1985 (U.S. Department of Agriculture, 1987).

The 1985 U.S. corn crop was a record 8.9 billion bushels. The crop was fully 112 percent above that of 1983 and 38 percent above the 1977 level (Figure 2-10).

Production of grain sorghum was up sharply in 1984, a result of relatively favorable weather and increased plantings. The 1985 crop was the largest ever, 1.1 billion bushels, 128 percent higher than in 1983, 40 percent above that of 1977.

U.S. soybean production in 1985 was a little less than 2.1 billion bushels, 28 percent larger than the 1.6 billion-bushel 1983 crop and 19 percent larger than the 1.8 billion bushels produced in 1977, but below the record set in 1979. U.S. wheat production in 1985 -- 2.4 billion bushels -- was virtually the same as that in 1983, 19 percent higher than in 1977. The 1983-84 PIK program for wheat remained in effect in 1984-85, although slightly less land was idled under programs of the latter year. U.S. wheat production increased 8 percent, from a little more than 2.4 billion bushels in 1983, to nearly 2.6 billion in 1984, declining again by 7 percent to slightly more than 2.4 billion bushels in 1985.

Turning to production at the state level, the decade of the '70s had ended with record-high 1979 yields and production of corn and sorghum and respectable soybean and wheat yields. The decade of the 1980s began less auspiciously; yields were down because of hot weather and drought. Production was lower too in spite of record high acreages planted to corn and soybeans. Sorghum and soybean yields did benefit, more than did corn, from mid-August rains. Wheat yields were favorable because of good spring rains.[3]

A good year in 1981 and a more average one in 1982 were followed by lower state production in 1983; total crop production was down 30 percent in the latter year from that in 1982. Acreage was lower due to heavy participation acreage reduction programs. Corn acreage in 1983 was the smallest since 1970; grain sorghum acres the fewest since 1956. Corn, sorghum and soybean yields were down; high summer temperatures affected pollination. Heavy snows delayed soybean harvests. Although the average state wheat yield set a record high, acreage was the lowest since 1941.

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[3]Information on state conditions is drawn largely from Nebraska Department of Agriculture and USDA, various years.

Nebraska produced record crops in the 1985 survey year; corn production was nearly 954 million bushels, a then all-time high, 47 percent above 1977 and 103 percent greater than 1983 output.

Sorghum output in 1985 of more than 154 million bushels was the second highest ever (after 1981) and 5 percent above 1977, 157 percent above that in the poor crop year of 1983.

Favorable weather brought higher Nebraska soybean yields and an increase in production in 1984 over the relatively depressed level of 1983. The 1985 crop was still larger, a new production record of 85 million bushels, 44 percent above the 59.5 million bushels produced in 1983 and 109 percent above the 40.7 million-bushel crop in 1977.

The state's wheat production -- just short of 90 million bushels -- was 10 percent below that in 1983, 15 percent below the 1977 level (Figures 2-2, 2-4, 2-6 and 2-8). But yields declined from 43 bushels per acre in 1983 to only 36 bushels in 1984, recovering to 39 bushels per acre in 1985. With acreages relatively constant over the three-year period (but significantly lower than those of a few years earlier), production was off 18 percent, from 98.9 million bushels in 1983 to 81 million in 1984, increasing again by 12 percent to 89.7 million bushels in 1985. Slumping prices and active participation in the PIK program depressed fall 1985 plantings to a level of 2.3 million acres, 12 percent below those of a year earlier -- the lowest seeded acreage since records were first kept in 1909 (Nebraska Department of Agriculture and USDA 1986).

The 1985 calendar year was a time of rising grain stocks, both in Nebraska and in the U.S. generally; corn stocks followed that pattern. Nebraska stocks of corn in all positions grew from a little less than 738 million bushels at the beginning of the year to nearly 988 million bushels at the close, an increase of 34 percent (Nebraska Department of Agriculture and USDA 1986). U.S. corn stocks in all positions increased 35 percent, from more than 5.9 to nearly 7.9 billion bushels (U.S. Department of Agriculture 1987a).

On the federal policy scene, survey year 1985 marked a turning point in U.S. grain policy. The PIK program in 1983 had sharply reduced U.S. harvested acres, wheat acres, for example, having been cut by 23 percent from those of a year earlier. High support prices combined with acreage diversions had encouraged overseas competitors to expand their production and exports.

The 1985 Farm Act aimed at reducing loan rates, overall stocks and the size of government-owned stocks in particular. Price supports were lowered accordingly, starting in 1986, in an effort to reduce the diversion of markets to foreign competitors and large export subsidies were put in effect. Target prices were frozen through 1987 and subsequently reduced. Lower domestic prices and export assistance programs were aimed at forcing other countries to share in supply adjustments. In the meantime, reduced acreage as a result of declining world prices and lower yields owing to drought brought world stocks in 1987-88 to lows not seen since the 1970s. The North American drought in 1988 and poor weather in the U.S. again in 1989 further reduced production and stocks. By 1992, generally favorable weather in the U.S. and overseas had led to a slump in world prices and a growth in stocks in the face of weak export demand.

World coarse grain production in 1992-93 was an estimated 869.1 million tons, up 6 percent from the previous year and 2 percent above the previous crop record set in 1985. World coarse grain consumption in 1992-93 was also at record levels of approximately 840.7 million tons, much of the increase being accounted for by the United States. Nevertheless, world ending stocks were the largest in five years, 162.8 million tons (U.S. Department of Agriculture 1995).

Calendar year 1992 was one of record crop production, growing stocks, increasing domestic use and relatively high exports. World coarse grain production in 1992-93 was 869 million tons, up 8.5 percent from a year ago and 3.2 percent above the previous record of 842 million tons in the 1985-86 crop year. World coarse grain consumption at record levels, owing in considerable part to high demands in the U.S. (Wisner and Tabesh). Nevertheless, world ending stocks in 1992-93 were the largest in five years, nearly 163 million tons (U.S. Department of Agriculture 1996).

The 1992 corn and soybean crops set records for both yields and production in Nebraska and the U.S. Sorghum yields were at record levels in both Nebraska and the United States; U.S. production was third highest ever. U.S. wheat yields were a near record and production was the largest since 1984. Demands placed upon the transportation system by these record crops were also of record proportions.

U.S. grain sorghum production was 884 million bushels in 1992, the third largest crop after 1986 and the all-time record of 1.1 billion bushels set in 1985; yields and acreage were both up sharply from depressed levels of 1991. Domestic demand in 1993 was strong; January 1, 1993 cattle on feed numbers were up 8 percent; December 1, 1992 hog inventories were up 4 percent from a year earlier (Table 3-1). Ending crop-year stocks were 127 million bushels, up from 1991-92 but below 1990-91 levels. Sorghum yields in Nebraska reached an all-time high of 94 bushels per acre and production (143.8 million bushels) was fourth highest on record, after 1981, 1985 and 1979. The size of the crop moved in 1992-93 was comparable to that of survey year 1985, although as noted in Chapter 7 the pattern of destinations has changed somewhat (U.S. Department of Agriculture 1993b).

U.S. soybeans in 1992 yielded a record average of 37.6 bushels per acre, 10 percent above the previous record. Nebraska soybean production in 1992 was 103.3 million bushels; yield was a record 42 bushels per acre. The crop was at that time the second largest on record, 2.2 billion bushels.

The U.S. hard red winter wheat crop was up 7 percent in 1992, even as 1992-93 stocks declined by 100 million bushels to 1.16 million bushels. Ending stocks in the following marketing year declined further to record low levels of a little over 500 million bushels (U.S. Department of Agriculture various issues (d)). The 1992 U.S. Wheat crop of 2.46 billion bushels was virtually identical to that in 1985 (2.42 billion bushels). The Nebraska crop was much lower than that in 1985: 55.5 million bushels compared with 89.7 million bushels in the earlier year. Nebraska's production had declined fairly steadily through the 1980s from an all-time high of 112.1 million bushels in 1980. Total transportation requirements for the Nebraska wheat crop have obviously slackened significantly since the time of the 1985 survey, even more so since the 1977 survey when output was 103.3 million bushels.

More recently, world production of total grains declined 4.8 percent, from 1.786 billion metric tons in 192-93 to 1.701 billion tons in 1995-95 (USDA various issues (d). The following year, 1996-97, was much improved, estimated total world grain production increasing 8.3 percent to 1.8 billion metric tons. Ending stocks dropped from 301.4 million metric tons in 1994-95 to 244.4 million metric tons in 1995-96, and rose again after the big crop of 1996-97 to an estimated 277.7 million metric tons by the close of the most recent crop year (USDA various issues (d).

World coarse grain production, 869.1 million MT in 192-93, fell to 795.7 million MT in 1995-96 and rose again in 1996-97 to an estimated 885.4 million MT. Ending stocks were 162.8 million MT in 1992-93, 114.3 million MT in 1995-96 and 115.3 million MT in 1996-97, the latter two values being estimates.

World oilseed production and stocks have increased since 1992. Production was 227.4 million MT in 1992-93, rising to 255.7 million MT in 1995-96 (estimated) and 255.3 million MT in 1996-97 (estimated). Stocks, however, have declined owing to heavy demand, from 23.5 million MT in 1992-93 to an estimated 22.3 million MT in 1995-96 and 20.2 million MT in 1996-97.

World wheat production fell from 588 million MT in 1992-93 to an estimated 536 million MT in 1995-96, rising again in 1996-97 to an estimated 579.6 million MT in 1996-97.

United States production and stocks have led the world trends, production in 1995-96 being down from 1992-93, increasing again to record levels in 1996-97 (estimated values). Corn production in 1992, a record 9.48 billion bushels, declined to only 7.37 billion in 1995, but was up again in 1996 to an estimated 9.27 billion. Stocks of corn fell from 2.113 billion bushels in 1992 to only 426 million in 1995, but had increased again by the close of 1996 to an estimated 1.2 billion bushels. U.S. sorghum production and stocks followed the same post-1992 pattern; production was 875 million bushels in 1992, only 460 million in 1995 and an estimated 820 million bushels in 1996. Ending stocks went from 175 million bushels in 1992 to 18 million in 1995 and an estimated 85 million bushels in 1996.

U.S. soybean production has been more stable in recent years, being 2.2 billion bushels in 1992, 2.2 billion in 1995 and an estimated 2.4 billion bushels in 1996. Ending stocks went from 292 million bushels in 1992 to 183 million in 1995 and 210 million bushels in 1996.

United States wheat production fell in 1995 from its 1992 all-time record of 2.5 billion bushels to 2.2 billion bushels, rising again in 1996 to an estimated 2.3 billion bushels. Ending stocks fell from 531 million bushels in 1992 to 375.9 million in 1995 to an estimated 434.7 million at the end of 1996.

Production of corn, sorghum and soybeans has grown markedly since mid-century, in the state, nation and world. Wheat output expanded sharply at the national level, but was little different in Nebraska in the 1990s than it had been in the 1950s. Most of the increase in total grains production has resulted from higher yields, although there have been acreage shifts within the grains group. Total production in Nebraska and the nation has grown faster than local and national consumption and has generally led that of the world as a whole, leaving a growing surplus of feed grains, especially, for export (see Chapter 3 for demand trends). Demands upon the transportation system have grown significantly owing to much larger volumes being moved toward more distant markets.

Summary

Grain supplies have increased dramatically since the 1950s when the first surveys were made. Agricultural research breakthroughs began at that time to have major effects on crop yields in Nebraska, the nation and the world.

Nebraska's share of U.S. corn, sorghum and soybean production has grown while that of wheat has declined. Yields and production have varied greatly, year by year. Variation at the state level exceeds that at U.S. and world levels because of the greater uniformity of growing conditions during any given year across the narrower geographic confines of the state alone.

Average Nebraska corn yields in 1954 were 28 bushels per acre, production 188.2 million bushels; the year was not extraordinary, but much better than 1955 and 1956 when drought depressed yields to only 20 and 23.5 bushels per acre, respectively. Production in the latter years was only half the 1954 level. Results by 1969 were much improved; corn yields averaged a record 93 bushels per acre and production was a record 429.7 million bushels. The 1977 survey year featured a yield of 99 bushels per acre and another production record of 648.5 million bushels. New yield and production records were set again in 1985, 128 bushels per acre and 953.6 million bushels output. The 1992 Waybill year was yet another record-breaker, with a yield of 135 bushels per acre and production of 1.067 billion bushels of corn.

Average sorghum yields in Nebraska in 1954 were 26 bushels per acre, production 13.4 million bushels. The next year, 1956, was a time of drought; yield dropped to only 11 bushels per acre and output to 7.9 million bushels. The picture was vastly improved by the time of the 1969 survey year when average sorghum yield was a record 76 bushels per acre and production 118.6 million bushels. Yield in 1977 was 71 bushels per acre and production a record 147 million bushels. The yield record was tied in 1985 at 80 bushels per acre (same as in 1981); production was now 154.4 million bushels, second largest on record after 1981. Yield in 1992 was another new record, 94 bushels per acre, production 143.8 million bushels on a smaller acreage base.

Average Nebraska soybean yield in 1954 was 22 bushels per acre, approximately double that of the following drought years of 1955 and 1956. Production in 1954 was only 4.18 million bushels. In 1969, yield was a record 33.5 bushels per acre and production a new high of 25.7 million bushels. Records were set again in 1977 when yields reached 36 bushels per acre, production 40.7 million bushels. Yields in the 1985 survey year were 36 bushels per acre, less than 1981's record 38, but production on a larger acreage was a record 85 million bushels. New records were achieved again in 1992 with a yield of 42 bushels per acre, production of 103.3 million bushels.

Nebraska wheat yields averaged 19.8 bushels per acre in 1954, smaller than in any subsequent year except 1956 and 1962 when they were only 19.5 bushels. Wheat yields were not as much affected by the drought of 1955 and 1956 as were those of feed grains and soybeans. Yields in 1955 were, in fact, a respectable 24.9 bushels per acre. Wheat production in 1954 was only 61.6 million bushels, lower than in any year since save 1962, 1965 and 1992. Wheat yields have made progress since 1954, but there has been much year-to-year variability. The 1969 survey year was a moderately good one for Nebraska wheat, yield being 31.5 bushels per acre, production 87.6 million bushels. Yields in 1977 reached 35 bushels per acre and production 103.3 million bushels, the latter second highest ever after 1958. By 1985, yields were 39 bushels and production, on a reduced acreage, was 89.7 million bushels. Yields in 1992 were below the trend, only 30 bushels per acre, production the lowest in the entire 1954-96 series, only 55.5 million bushels.

The survey years, except for 1954, happened to be relatively favorable for the feed grains and soybeans; 1954 was a relatively good one for wheat, wheat production was exceptionally low in 1992, while the other grains attained record or near-record harvest totals. Yields and production in Nebraska, the nation and the world have climbed rapidly, with the exception of Nebraska wheat production, but with some ups and downs along the way. Because production variability in the outside world translates into variability in demand for U.S. exports, this issue is explored further in Chapter 3, which focuses on demand.

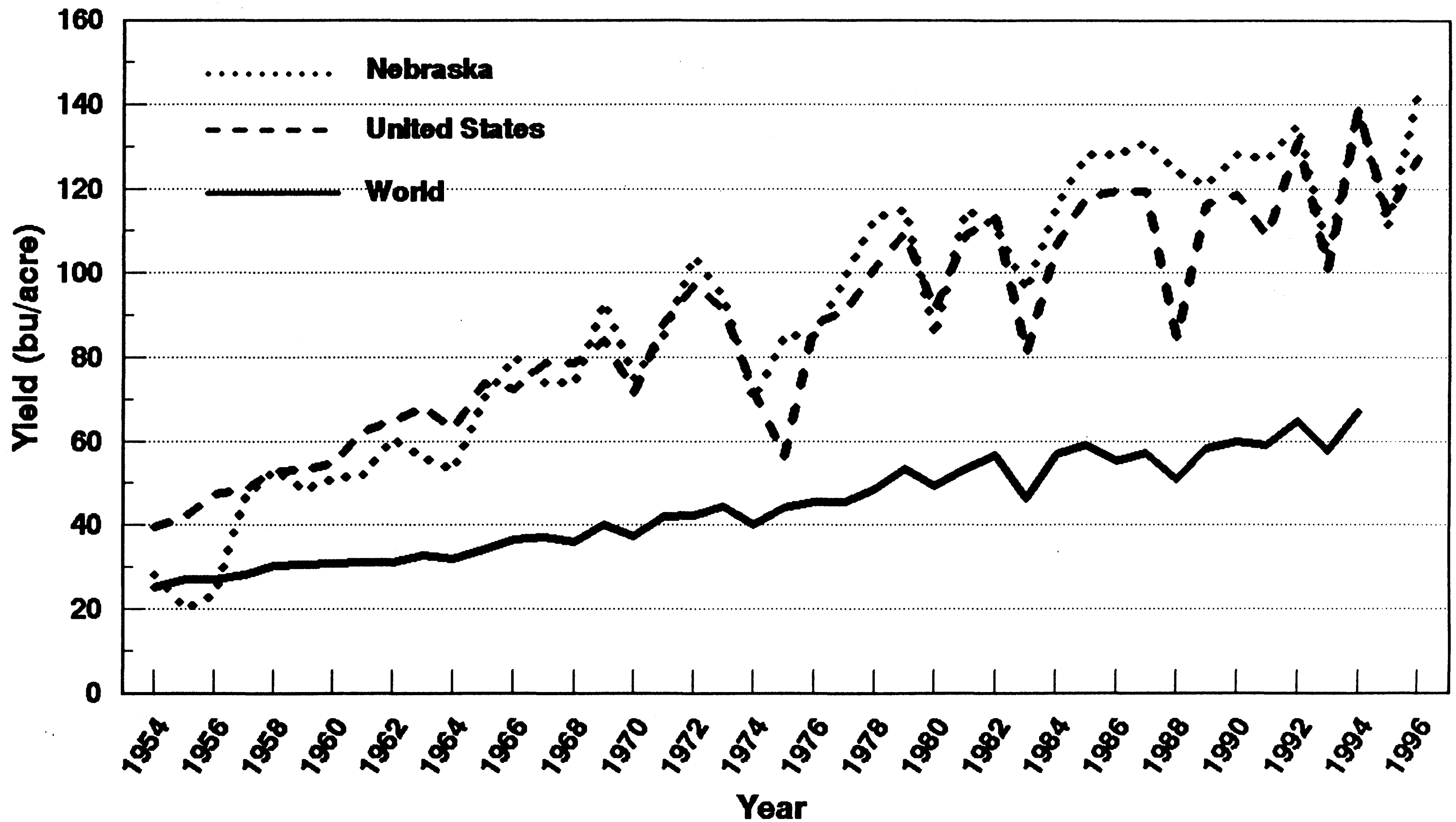


Figure 2-1. Corn Yields, Nebraska, United States and the World, 1954-1996.

Source: Appendix Table 6-1.

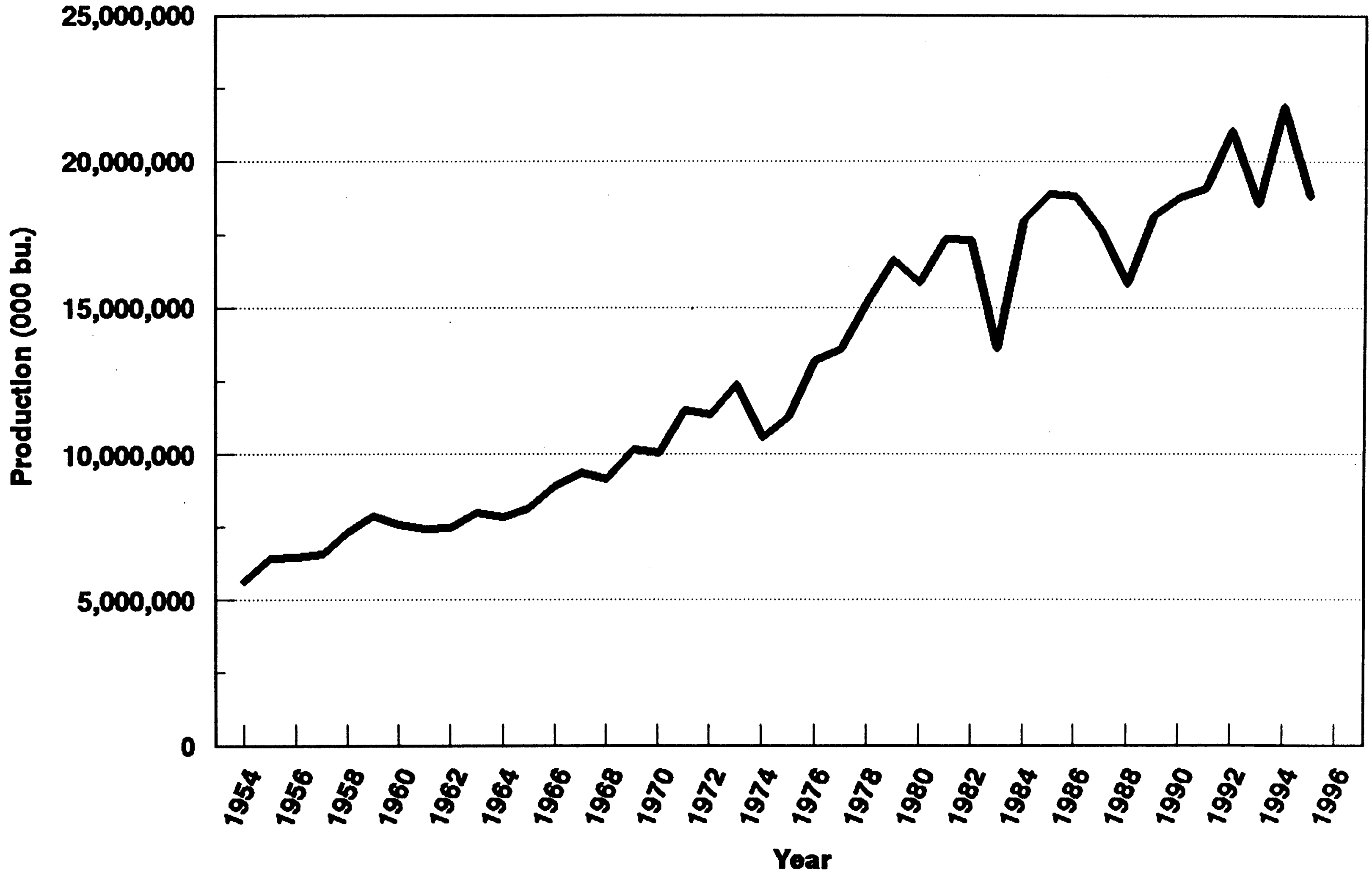


Figure 2-2. Annual Production of Corn, World, 1954-1996

Source: Appendix Table 6-1.

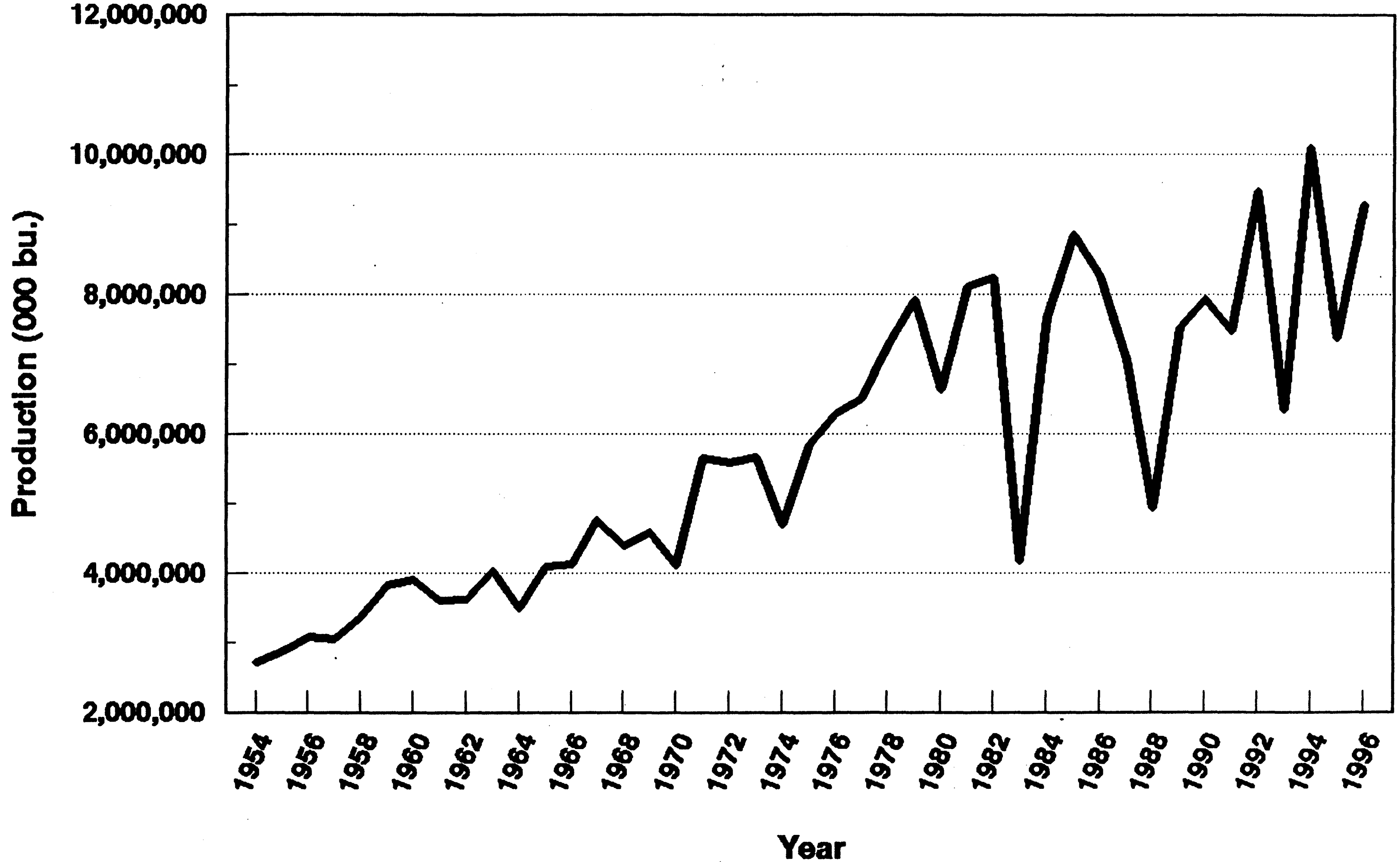


Figure 2-3. Annual Production of Corn, United States, 1954-1996

Source: Appendix Table 6-1.

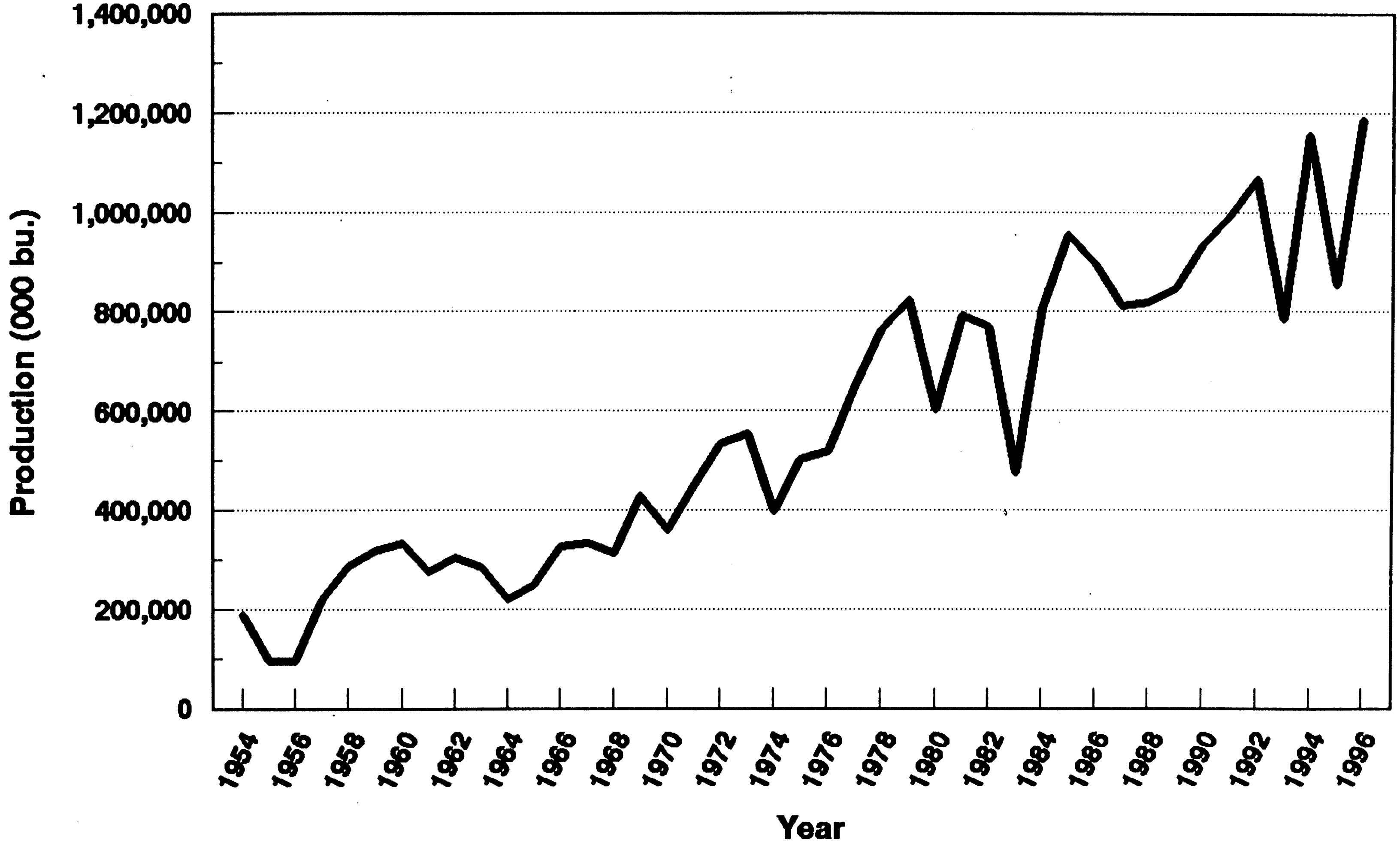


Figure 2-4. Annual Production of Corn, Nebraska, 1954-1996

Source: Appendix Table 6-1.

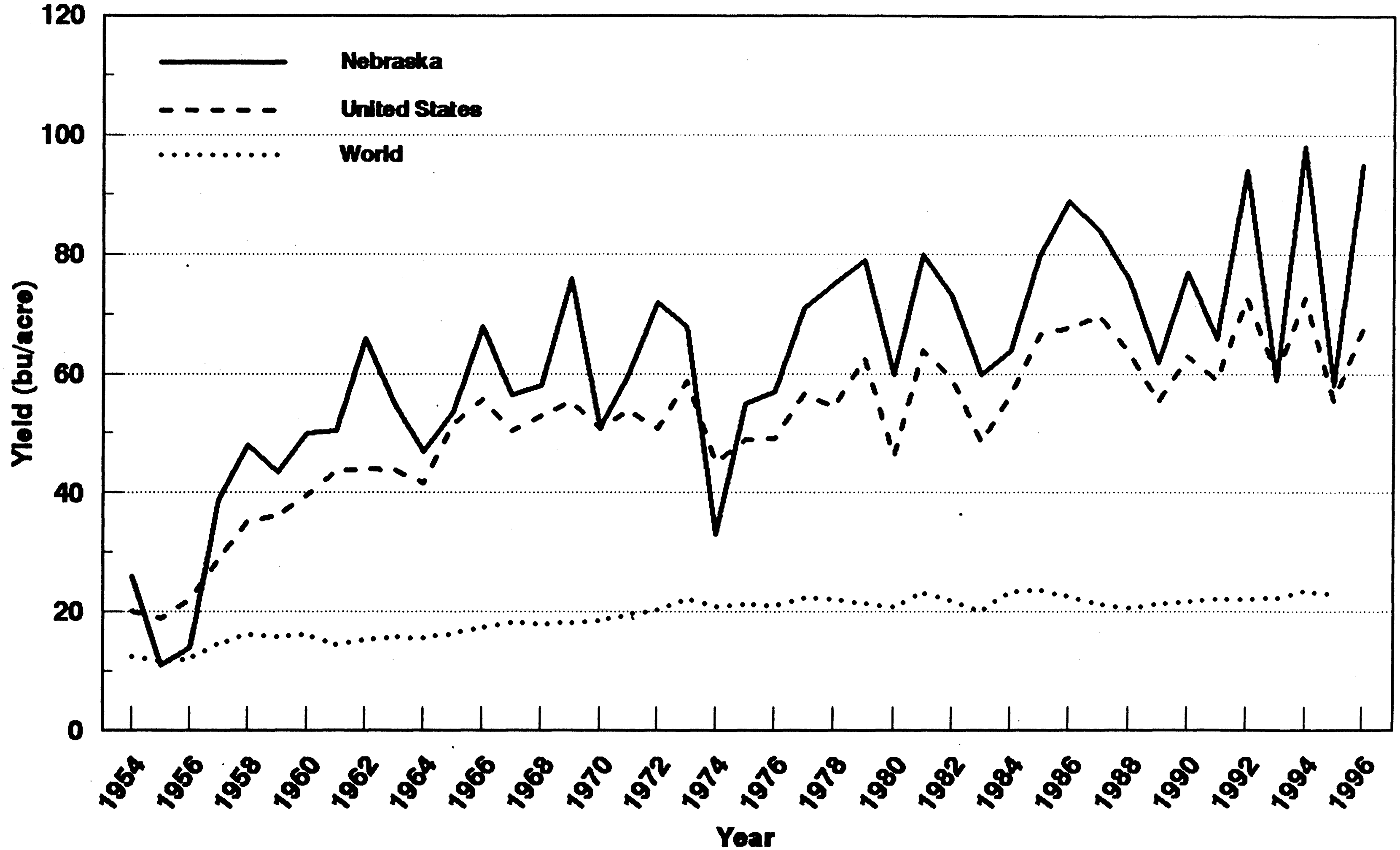


Figure 2-5. Sorghum Yields, Nebraska, United States, and the World, 1954-1996.

Source: Appendix Table 7-1.

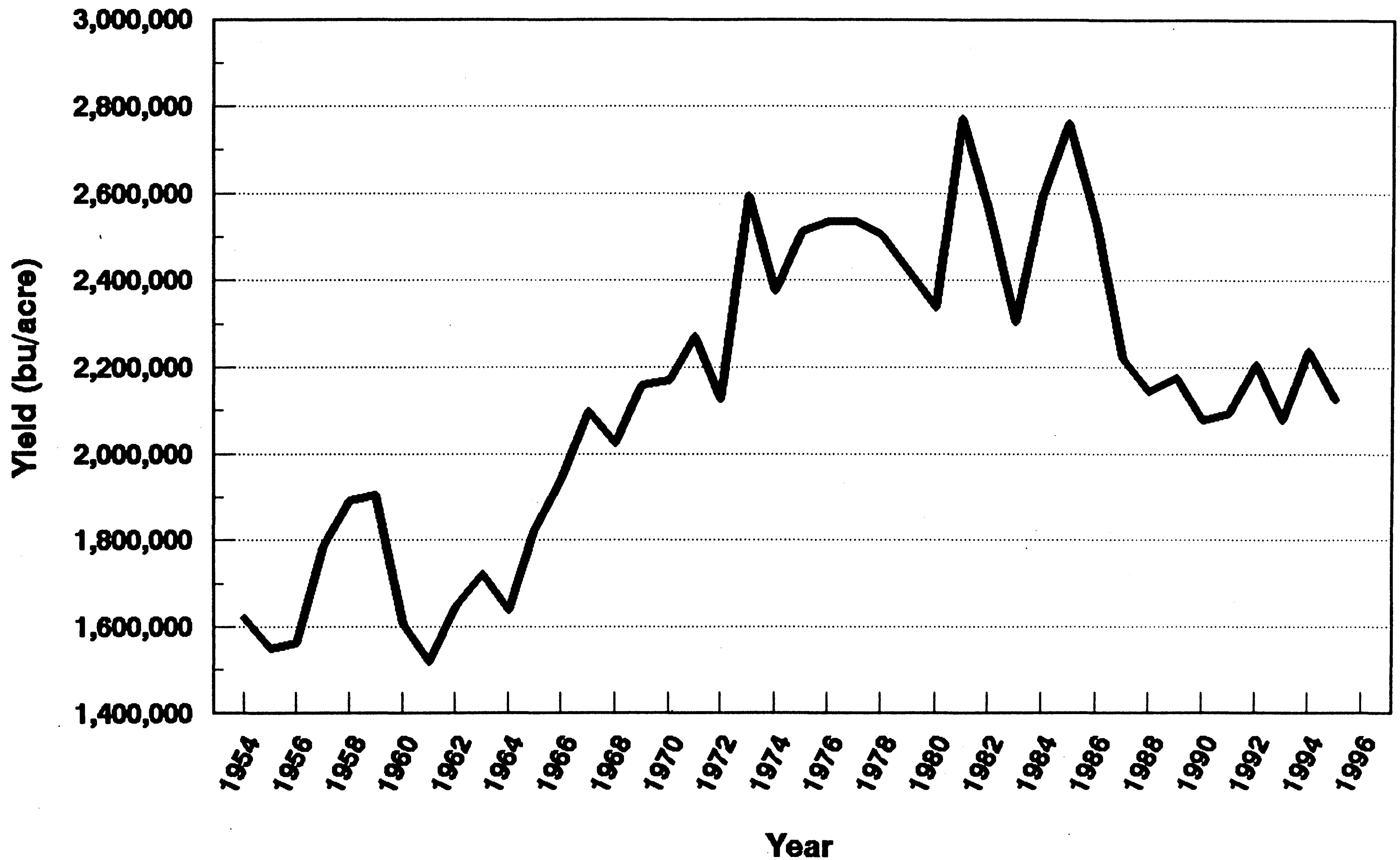


Figure 2-6. Annual Production of Sorghum, World, 1954-1996

Source: Appendix Table 7-1.

Figure 2-7. Annual Production of Sorghum, United States, 1954-1996

Source: Appendix Table 7-1.

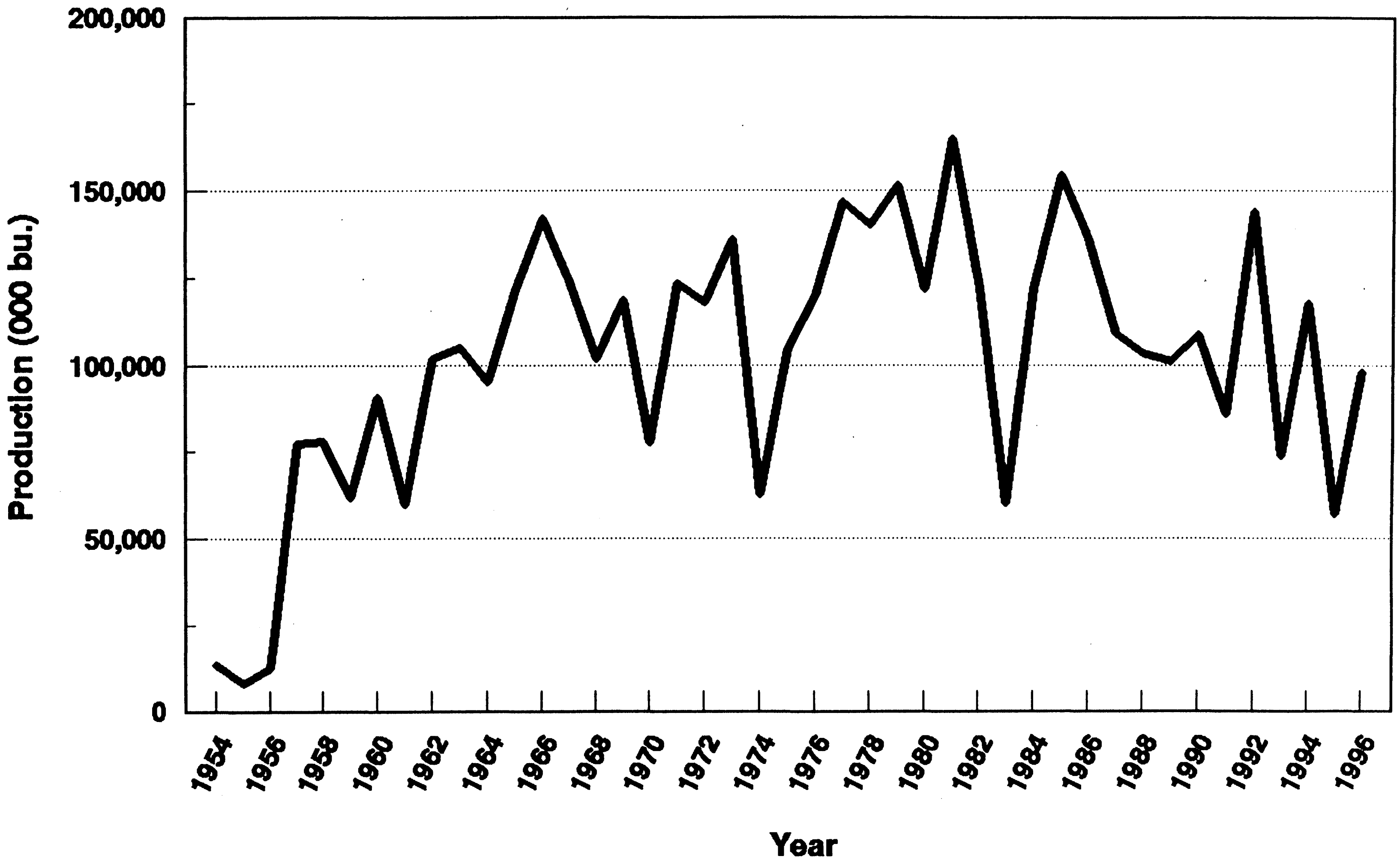


Figure 2-8. Annual Production of Sorghum, Nebraska, 1954-1996

Source: Appendix Table 7-1.

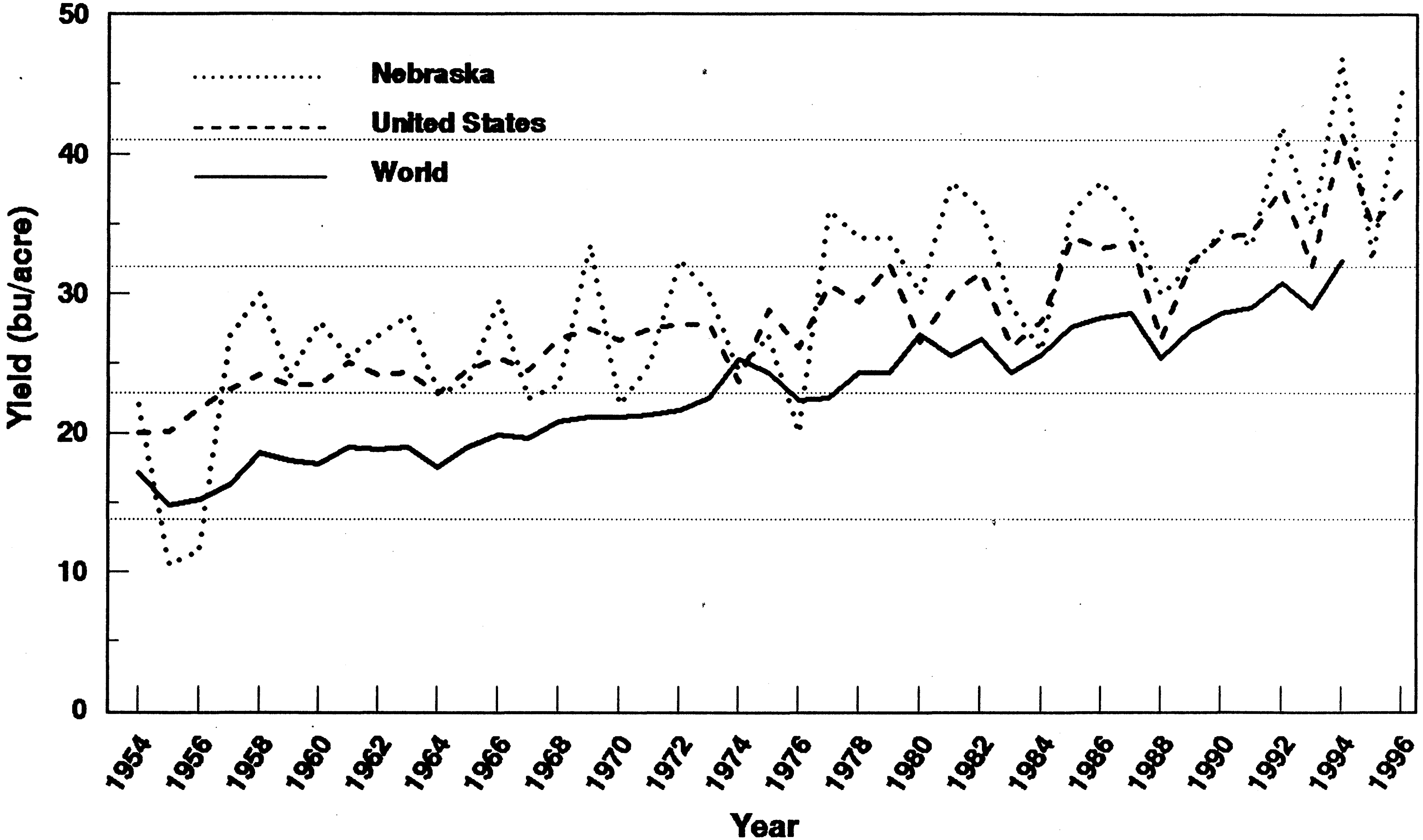


Figure 2-9.Soybean Yields, Nebraska, United States and the World, 1954-1996

Source: Appendix Table 8-1.

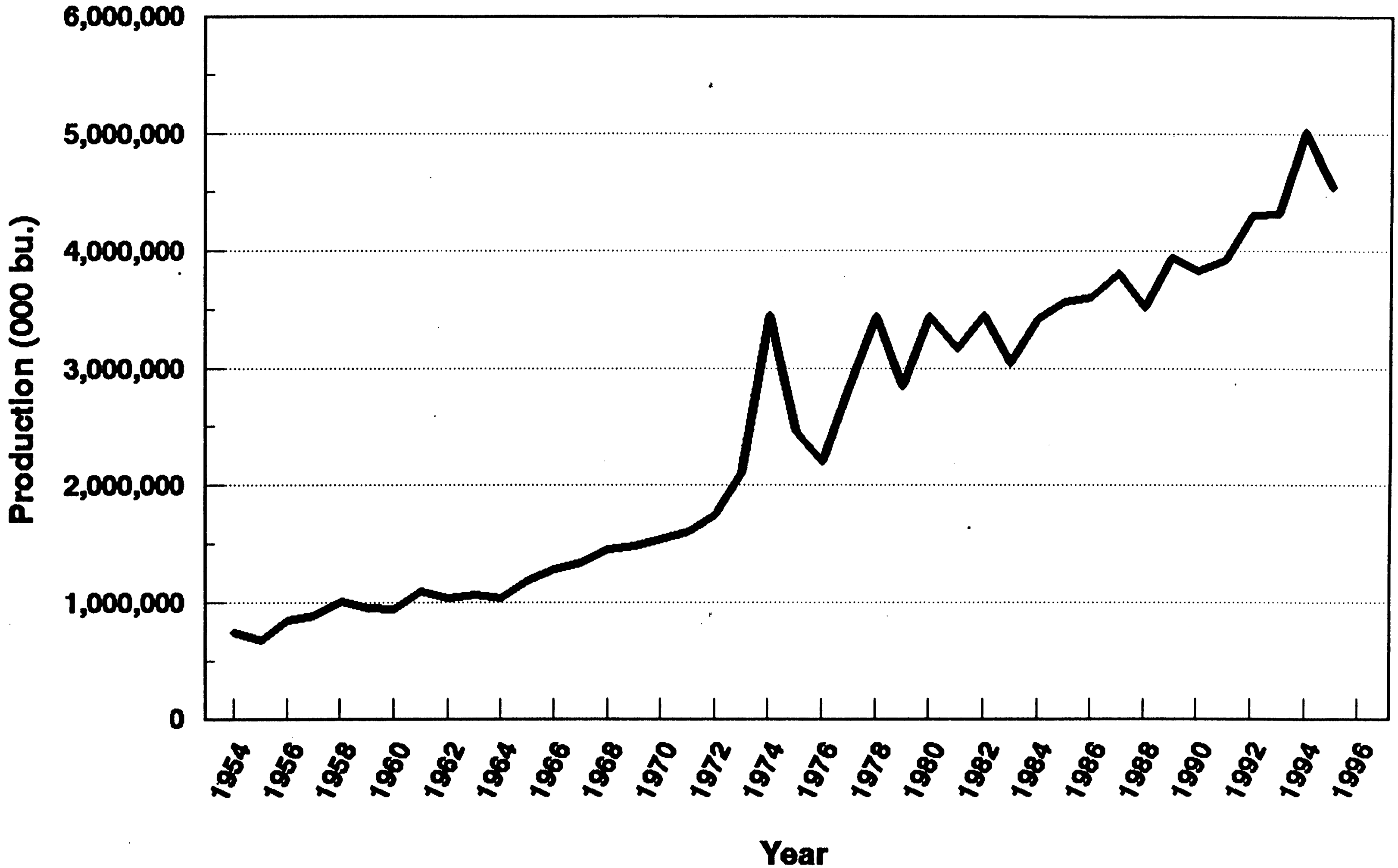


Figure 2-10. Annual Production of Soybeans, World, 1954-1996

Source: Appendix Table 8-1.

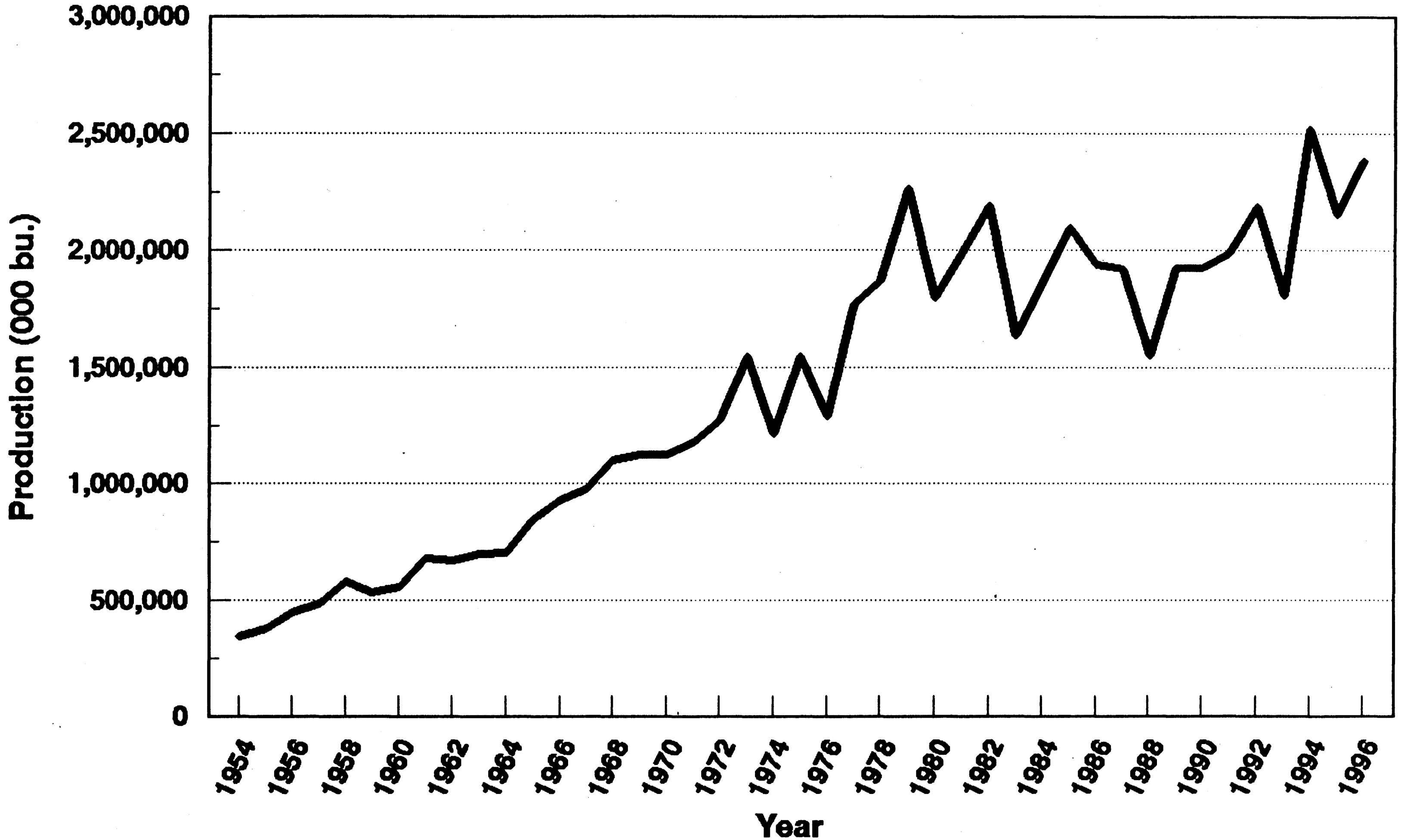


Figure 2-11. Annual Production of Soybeans, United States, 1954-1996

Source: Appendix Table 8-1.

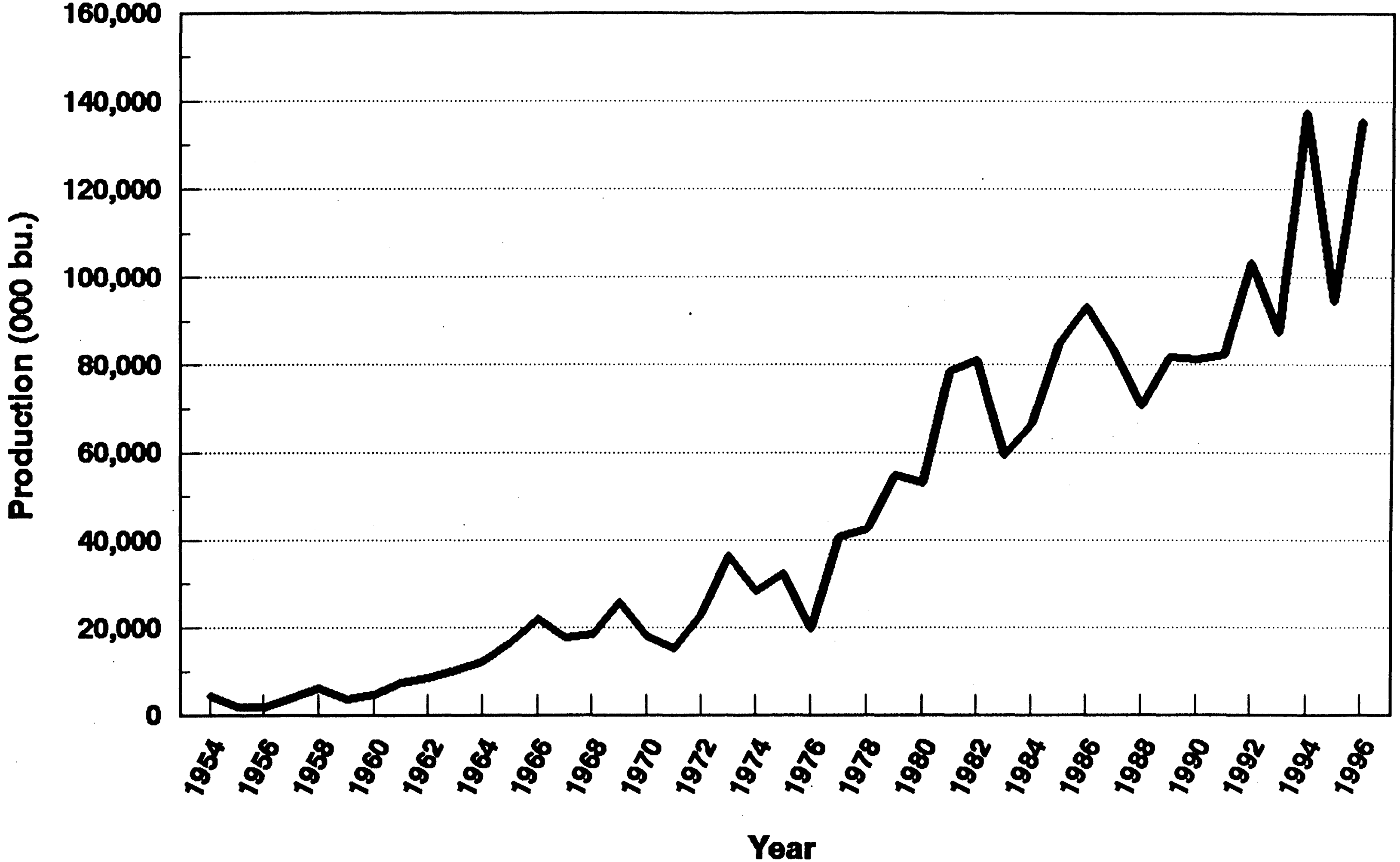


Figure 2-12. Annual Production of Soybeans, Nebraska, 1954-1996

Source: Appendix Table 8-1.

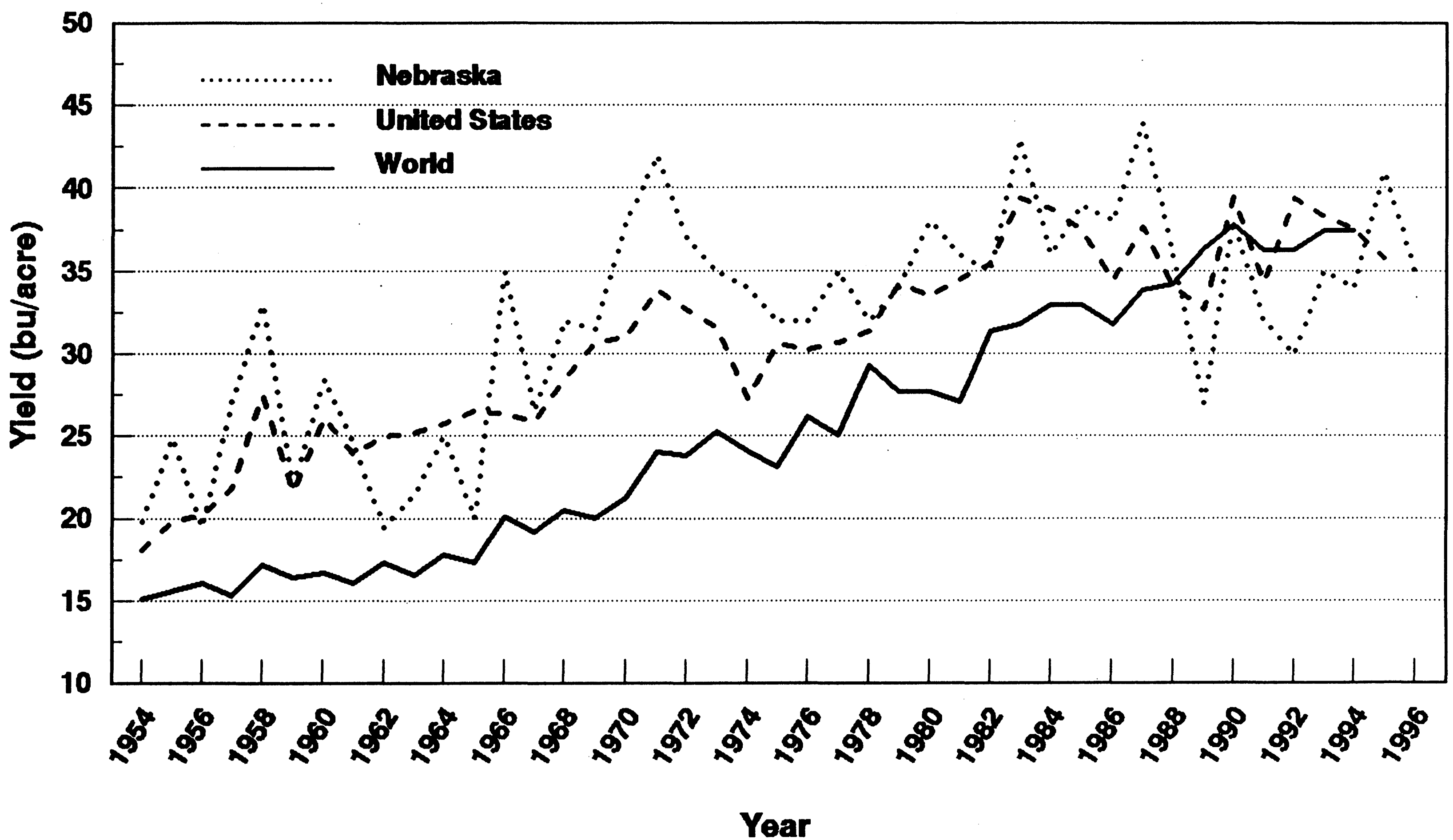


Figure 2-13. Wheat Yields, Nebraska, United States and the World, 1954-1996

Source: Appendix Table 9-1.

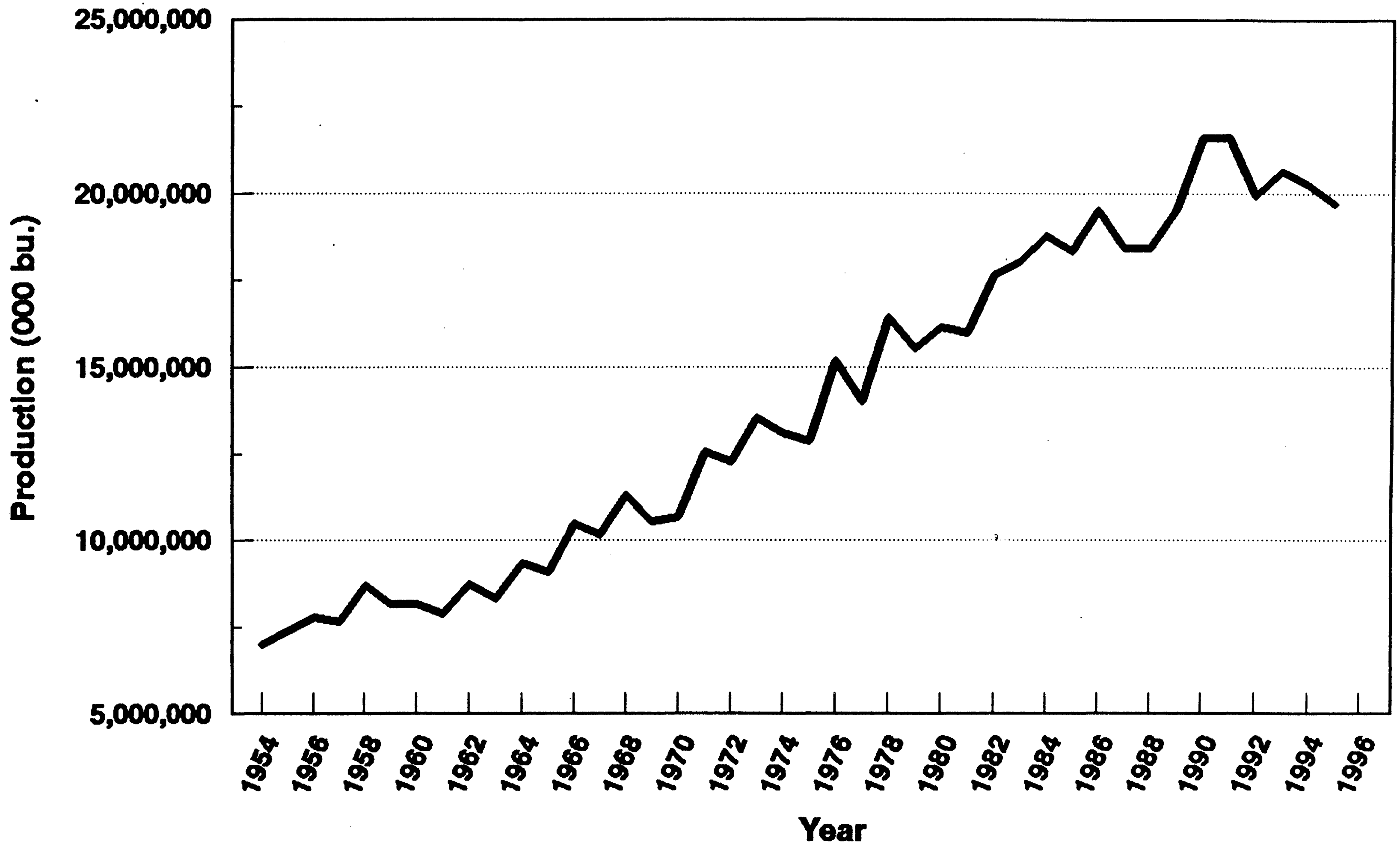


Figure 2-14. Annual Production of Wheat, World, 1954-1996

Source: Appendix Table 9-1.

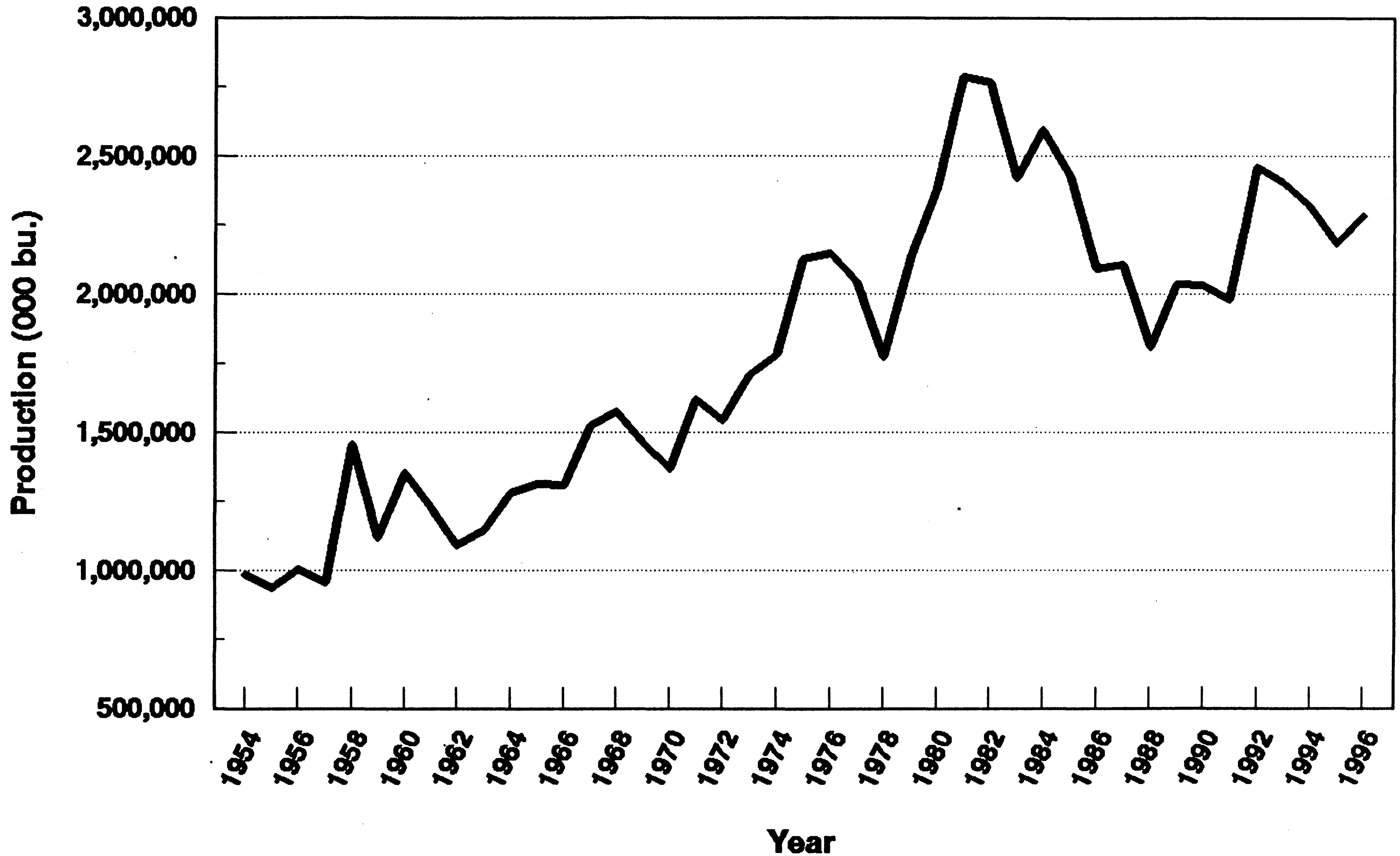


Figure 2-15. Annual Production of Wheat, United States, 1954-1996

Source: Appendix Table 9-1.

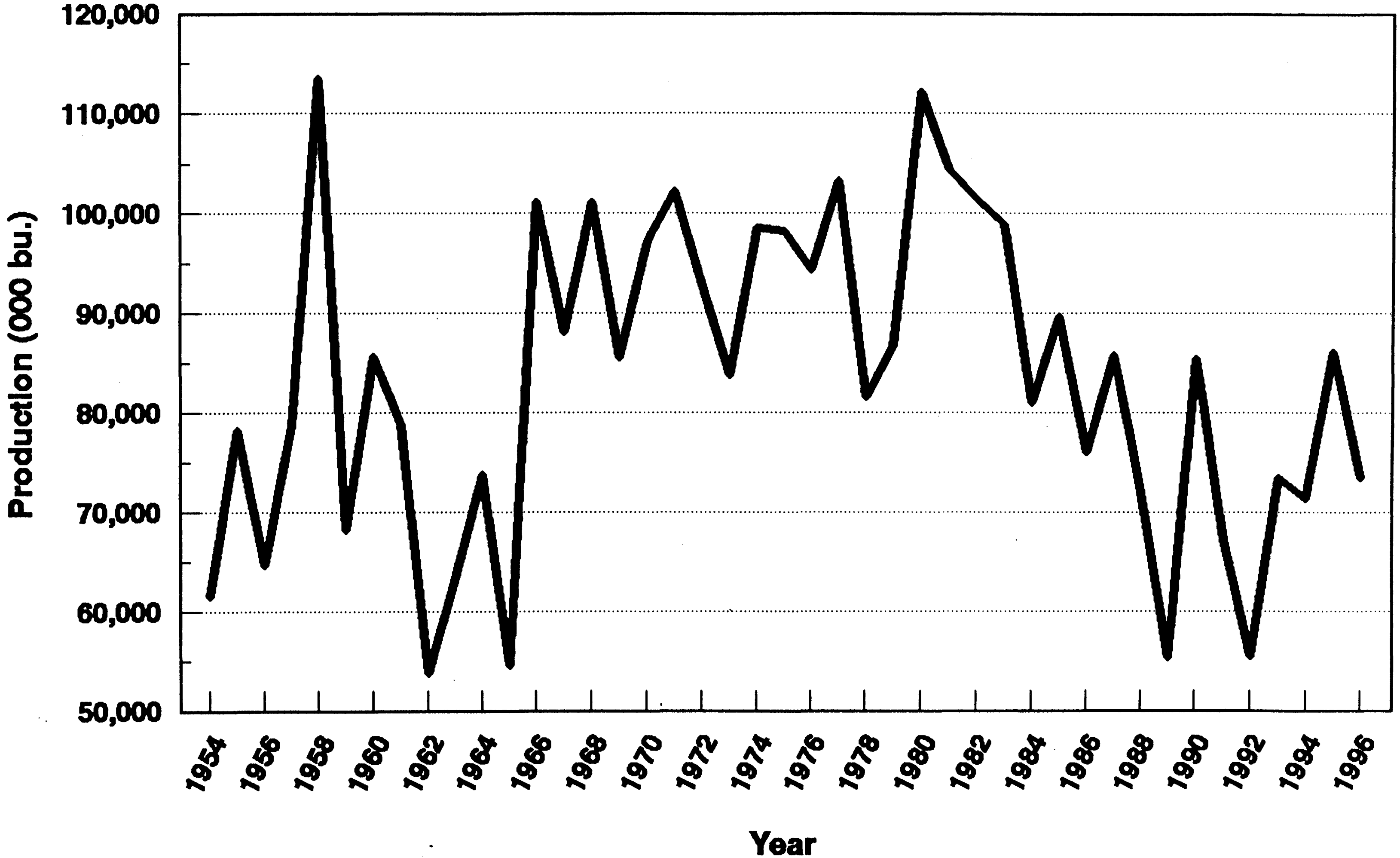
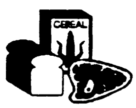


Figure 2-16. Annual Production of Wheat, Nebraska, 1954-1996

Source: Appendix Table 9-1.

CHAPTER 3

DEMAND DEVELOPMENTS



Domestic demand for rapidly-expanding American food production has grown gradually but steadily in the second half of the twentieth century, primarily in response to moderate growth in the nation's population. World food demand in total has grown much faster, driven by rapidly increasing population and some significant improvements in per capita incomes in some regions. Exports accordingly have become a much larger part of a much larger marketing picture. The combination of growth in both domestic and international markets has led to growing demands on the nation's transportation system.

The locus of grain consumption has changed markedly, both nationally and internationally since the 1950s. The pattern of U.S. domestic demand has been affected by a major shift in the locus of population from rural regions to urban centers since World War II. Rural areas in Nebraska have lost population more or less consistently during most of the 20th century (U.S. Department of Commerce). Growth of urban areas and declining rural populations have concentrated domestic demand in places increasingly distant from sources of production. Transportation's task in supplying the growing urban agglomerations, most of them particularly long distances from Nebraska, and the agricultural heartland generally, has grown accordingly. At the same time, however, local demands for feed grains and soybeans have strengthened with the growth of Nebraska's livestock sector.

Internationally, demand for imported grain in Western Europe, a major post-war American market, has faltered in the face of rapid growth in the region's domestic production, slow growth in population and demand that has become unresponsive to income. At the same time, U.S. markets in Asia have expanded rapidly, driven by growing incomes in this region. Growth in both population and incomes in Third-World nations has led to an especially rapid increase in their demand for food, and to rapid and significant growth in international markets for U.S. grains.

Domestic Demand

U.S. population grew from 152.3 million in 1950 to 265.2 million at mid-1996, or 74 percent over the period (U.S. Department of Commerce; and Population Reference Bureau), and with it the demand for food. The relatively slow rate of population growth has provided for modest growth in domestic demand for grain for feed. Growing per capita incomes have further increased demand, although less so for grains than for some other food products. The demand for both food and feed grains is price-inelastic at average income levels prevailing in the United States. Total red meat and poultry consumption had, however, reached an all-time high of 174.1 pounds in 1993 as had the demand for feed grains and soybeans. U.S. consumption per capita of food products made from corn as well as wheat has also increased since the mid-1950s (U.S. Department of Agriculture 1994a).

Feed Uses

In the 1950s, much feed grain production was fed locally, often by producers themselves (Fornari, p. 115); by the 1990s, most moved into commercial channels. Meanwhile, the decline in the number of draft animals in the U.S. had sharply reduced the local demand for oats as a feed grain, releasing acreage for the production of other feed and food grains and contributing to the commercialization of feed grain output. In Nebraska, as nationally, oats rapidly declined in importance along with the population of work horses. Corn made up 85 percent of all U.S. feed grain, wheat feed and residual use in 1994-95. Domestic production of feed and residuals has always been the major use of corn, accounting in 1994-95 for a record 5.4 million bushels (estimated) or 62 percent of total (domestic and export) uses for corn (U.S. Department of Agriculture 1994).

Total feed grain usage in Nebraska has grown over the long-term, owing to increasing cattle and hog numbers, both absolutely and relative to U.S. numbers, with implications for expanding short-haul truck movements of feed grains[1]. The average total number of cattle and calves in the 1990s (through 1996) was almost 28 percent above that in the late 1950s (1954-59) in Nebraska, only 4 percent higher for the nation at large. Numbers had been even higher during the 1970s -- almost 43 percent above the 1950s for Nebraska, 26 percent for the nation. Nebraska's role in the cattle feeding business also grew much faster than that of the U.S. in total. The number of cattle on feed in the state in the 1990s exceeded those in the 1950s by nearly 250 percent, while those in the nation as a whole were only some 110 percent higher in the '90s than in the '50s (Table 3-1).

Some of the changes over time reflect cyclical ups and downs in herd size. In 1996, local demand for feed grains was supported by large numbers of Nebraska (and U.S.) cattle on feed; cattle inventories had grown as the end of the cattle cycle was approaching. Cattle prices had reached a level low enough to cause culling of range herds, bringing even larger numbers of animals into feed lots. Meanwhile, exports of beef (as well as pork and broilers) were up substantially, adding another source of demand for locally-fed animals and therefore for feed (U.S. Department of Agriculture various issues (d)).

The 1970s were a high mark for hog numbers in both the state and nation, the national count being almost 17 percent above that of the 1950s. In Nebraska, hog numbers in the 1970s were 51 percent above those of the '50s and still growing. Nebraska hog numbers in the 1990s were nearly

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[1]Numbers are the main, but not the only factor. Average slaughter weight of cattle has increased since the 1950s, while efficiency of feed conversion for both hogs and cattle has improved.

94 percent above those in the '50s, compared with an increase of less than 15 percent for the U.S. (calculated from data in Table 3-2).

Nebraska's poultry production has also grown significantly since the 1950s, but it is small relative to U.S. output and small in its local feed demand relative to that of the state's cattle and hogs. Turkey production in the state was 83 percent higher in the 1990s than in the '50s; national production grew by more than 110 percent. Broiler production grew by 123 percent in the nation, while in Nebraska, 1990 numbers were not quite 87 percent of those in the 1950s. However, the total number of chickens in the U.S. declined by the 1990s to only 96 percent of those in the 1950s, whereas Nebraska numbers were up by almost 37 percent (calculated from data in Tables 3-2 and 3-3). Per capita consumption of red meat in the U.S. has reached a level at which it is no longer responsive to increases in income, although consumer concerns about implications for health, has apparently been an important limiting factor during the 1980s and early '90s.

Total U.S. red meat consumption per capita (boneless equivalent) peaked in 1976 at 134 pounds, falling to 112.5 pounds by 1993. The decline was prompted by falling beef consumption, which also peaked in 1976 at 89 pounds, declining steadily since then and reaching only 61.6 pounds per capita in 1993. While there have been significant ups and downs along the way, no clear trend in rate of pork consumption is apparent; average per capita consumption in 1970 was 48.5 pounds, that in 1993 was 49.2; the high was 53 pounds in 1971, the low in recent times 38.4 pounds in 1975 (Table 3-1).

Growing poultry demand has more than offset the decline in beef consumption. Broiler meat purchases per person have nearly doubled since 1970, increasing over the period from 25.2 pounds per capita in 1970 to 46.4 pounds in 1993. Turkey meat consumption has more than doubled -- from

6.4 pounds per person in 1970 to 14.1 pounds in 1993 (Tables 3-2 and 3-3; U.S. Department of Agriculture 1994a).

Although demand for grain tends to be less variable in domestic than in international markets, owing to the general stability of total food consumption in the United States, local feed demand can vary significantly over time with cyclical changes in livestock herd size. Livestock numbers (especially those of cattle) follow a cycle of herd buildup and decline occasioned by the inelasticity of demand for livestock products in the face of a lag between price signals and production response (see Table 3-1 for trends over time). The effects for feed grain and protein supplements demand can be significant and, in the context of inelastic product demand, effects on price can be much more momentous.

Food and Industrial Uses

A series of other domestic demand developments have been largely peculiar to the 1980s and '90s. The first, the energy crisis beginning in the 1970s (discussed below, under "Exports"), prompted government incentives (at both state and federal levels) for use of corn in the production of grain alcohol (ethanol), which is blended with gasoline to produce motor fuel ("gasohol"). Provisions of the 1990 amendments to the Clean Air Act and subsequent actions of the Environmental Protection Agency mandating that oxygenates be blended into fuels have enlarged the market for ethanol-blended motor fuels (U.S. Department of Agriculture 1994). This disposition of corn grew from only 35 million bushels (less than 0.0l percent of total corn uses) in 1980-81 to an estimated 510 million bushels or 6 percent of total corn usage in 1994-95 (U.S. Department of Agriculture 1994). The use of corn as an ethanol feed-stock is dependent not only on government subsidies but on the price of corn. Record high prices drove many grain alcohol plants out of the gasohol market and temporarily out of business during the summer of 1996. As a result, some grain that would have been moved by truck to ethanol processors moved instead to other perhaps more distant markets served by rail.

A second important domestic development has been a rapid growth in other industrial uses for corn. In 1980-81, some 151 million bushels of corn (2 percent of total uses) went into the production of cornstarch. By 1994-95, cornstarch accounted for 250 million bushels of corn, or some 3 percent of corn use. New uses for starches have been a factor in this growth, most being industrial applications (U.S. Department of Agriculture 1994).

Third, rising prices for sugar prompted by government's protection of U.S. sugar interests from import competition had led, by the 1980s, to widespread substitution of corn-based sweeteners for sugar from cane and beet sources, especially in formulations for a large and growing market for soft drinks. Production of glucose and dextrose accounted for 225 million bushels of corn in 1994-95, or 3 percent of total corn usage, up from 2 percent in 1980-81. Use of corn in production of high-fructose sugar (HFC) grew rapidly after a 1974 surge in sugar prices. This use accounted for 455 million bushels in 1994-95, or 5 percent of corn usage, compared with 2 percent in 1980-81. Per-capita consumption of corn syrup increased fully 776 percent, from only 8.8 pounds in 1954 to 77.1 pounds in 1993, the greater part of the increase occurring since the early 1970s (U.S. Department of Agriculture 1994).

Beer and distilled spirits together made up 1 percent of total corn use in both 1980-81 and 1994-95. (U.S. Department of Agriculture 1994). Other food uses for both corn and wheat have grown significantly. Domestic consumption of all corn-food products required 128 million bushels of corn in 1954, 815 million bushels in 1993, an increase of 537 percent. Per capita consumption of corn meal was 9.3 pounds in 1954, dropping to only 5.7 pounds in 1977 but increasing gradually to a high of 9.3 pounds in 1993. Starch consumption as food grew steadily from 1.8 pounds per person in 1954 to 4.5 pounds in 1993. Food products accounted for 0.07 percent of total corn uses in 1980-81, more than 1 percent of total uses in 1994-95 (U.S. Department of Agriculture various issues).

Domestic consumption of wheat for all food purposes increased more than 80 percent, from 473 million bushels in 1954 to 853 million bushels in 1993. Wheat flour consumption per capita was 126 pounds in 1954, but declined steadily during the 1950s and 1960s, reaching a low of 110 in 1970; consumption has since recovered gradually, reaching 139 pounds in 1993. Wheat cereal consumption per capita has followed a similar pattern, declining slowly from 3.2 pounds in 1954 to a low of 2.6 in 1962 and 1963, climbing back slowly, reaching 3.7 in 1987 and 5.0 pounds in 1993 (U.S. Department of Agriculture various issues).

Thus, a combination of population growth and new grain uses has expanded domestic markets for feed grains and soybeans. Although Nebraska's livestock industry has grown, the state's production of feed grains has grown even faster. Local processing plants attract much but not all of a very large increase in Nebraska soybeans. Total wheat consumption has also increased in line with expanding U.S. population. Demands upon the transportation system have expanded accordingly, with trucks meeting most short-haul local transport needs, railroads carrying most of the long-haul interstate traffic.

Exports[2]

World population increased 129 percent, from 2.52 billion in 1950 to 5.77 billion at mid-1996. (U.S. Department of Commerce; and Population Reference Bureau). Growing per-capita incomes

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[2]For further detail on the evolving pattern of grain exports, see crop-specific discussion in Chapters 6-9 and the Appendix Tables at the end of this paper.

in some countries, including Japan, South Korea and Taiwan, in the early part of the period, and in a number of Third-World countries in more recent decades, have contributed strongly to growing overseas demand for U.S. grains. Japan, for example, had become by 1970 the top buyer of U.S. wheat and of U.S. agricultural products in total (Fornari, p. 108). In the 1990s, less-developed nations as a group have imported much more corn and wheat than did the developed countries, taking as well a very large and growing part of sorghum and soybeans (Appendix Tables).

Surplus-Disposal Efforts

The time between the grain-flow surveys of the 1950s and the one in 1969 were characterized by efforts to deal with growing stocks associated with government price supports. It was a time of continued rapid growth in world production and limited trade opportunities. Consumption was increasing in response to growing population and incomes but it failed to keep pace with increasing output. Exports did grow over the interval, becoming later and at times, as in the late 1970s and early '80s, a very major demand factor. However, the U.S. government's policy focusing on domestic markets was to persist until the 1996 Farm Act eliminated the price floors of previous legislation. The 1996 legislation signaled finally that world market forces are to provide the critical price reference in the future.

Returning to mid-century, accelerating yield increases, in combination with limited export opportunities, led to enlarged government efforts toward absorbing and disposing of the growing surpluses and later on toward their control. The idea for food aid for the poorer regions of the world, as an instrument for alleviating human suffering, supporting economic development and disposing of U.S. surpluses, grew out of the rapid post-war success of the Marshall Plan. Section 416(b) of the Agricultural Act of 1949 authorized government donations of food to the poorer regions of the world. The Mutual Security Act of 1951 provided food aid aimed at furthering security and military objectives, and was in force until 1961.

Passage of the Agricultural Trade and Development Act (Public Law 480) in 1954 opened the way for much-expanded U.S. government-subsidized shipments of grain and other food products to the less-developed nations where food needs were and still are growing faster than either local production or ability to pay for imports. The Act aimed at meeting nutritional and larger development needs of less-developed countries while at the same time disposing of the growing U.S. government-financed grain stockpiles.

The PL-480 program was implemented rapidly, 158 million bushels of wheat (or equivalent in flour) being exported in 1954 under the new law or the already-extant Mutual Security Program -- 58 percent of exports and 16 percent of U.S. production in that year. Only two years later, 1956, food-aid programs hit an early high point, government assistance accounting for 375 million bushels or 68.3 percent of the 549 million bushels of wheat exports for the year, a total volume not exceeded until 1961, when President Kennedy's Food for Peace program brought even larger exports. In the first year of PL-480 (1954), government-financed wheat and flour exports were 158 million bushels; for the year beginning July 1, 1955 they were 240 million bushels and for 1956, 375 million bushels. Total 1956 wheat exports reached 549 million bushels, an amount not exceeded until 1961. By 1963, PL-480 made up practically all of the 503.4 million bushels of wheat and flour shipped under government concessionary terms. Total exports were almost 75 percent of production in that year. Concessional exports made up nearly 59 percent of the total. The volume of wheat and flour exports under government programs exceeded commercial exports for the first time in 1954 and continued to do so through the rest of the 1950s and all of the '60s (Fornari, pp. 104-5).

Mutual security considerations regained some favor in the 1980s, accounting for as much as 18 percent of government shipments in one year, 1988. The peak of PL-480 shipments came, however, in 1965, when 569.1 million bushels of government-subsidized wheat shipments amounted to 44.4 percent of U.S. wheat production. PL-480 has continued to be a significant outlet for U.S. wheat; in the survey year 1969, for example, PL-480 shipments were 269.2 million bushels, some 18.4 percent of production; in 1977 they were 149.5 million bushels, or 7.3 percent of production; 179.1 million bushels, 7.4 percent of output in 1985; and 228.8 million bushels or 9.3 percent of production in 1992 (U.S. Department of Agriculture various issues).

Feed grains are also exported under both PL-480 and Mutual Security programs, mostly the former, but the amounts have been much smaller, both in total and relative to U.S. production, than those of wheat. In 1954, subsidized feed grains exports were a little less than 43 million bushels, or 1.5 percent of U.S. production of corn and grain sorghum combined. By 1959, total government shipments had risen to nearly 135 million bushels, or 3.1 percent of production. Shipments in 1969 were 47 million plus bushels or 0.9 percent of production; nearly 80 million bushels or 1.1 percent in 1977; 27.6 million bushels or 0.3 percent in 1985; and, in 1992, an all-time peak of 207.2 million bushels, accounting for 2 percent of production (U.S. Department of Agriculture various issues).

Commercial Exports

Commercial feed grain exports have become much larger than those under subsidy programs and have become relatively more important in more recent years. Corn export trends are indicative of a major shift in market emphasis. U.S. exports were a minor disposition of corn before World War II (well under 100,000 bushels per year and less than 2 percent of total usage), Argentina was the dominant exporter (U.S. share of the world market was often as low as 2 percent).

Exports have grown rapidly over the past 30 years, becoming, for example, the second largest component of U.S. feed grain use. Export growth in the 1960s was occasioned by growing European demand. New markets in Japan and the Soviet Union and Eastern Europe brought continued growth in the 1970s. U.S. corn exports grew fourfold during the period, peaking at more than 2.4 billion bushels in 1979. The U.S. export share of the world corn market peaked at 33 percent in 1980. Exports declined in the 1980s but rebounded briefly toward the end of the decade, slipped again in the early 1990s, dropping to only 17% of the total world market in 1993-94, and strengthened again in 1994 and 1995 to near-record levels. Europe, the major market in the 1960s, has been eclipsed by Asia as the major export destination of U.S. corn. Corn is also exported indirectly, relatively more of it being shipped over time in the form of red meat and poultry (U.S. Department of Agriculture 1994).

Mid-Century. Export demand for U.S. grain escalated sharply during World War II and remained robust for a time thereafter as Marshall Plan food shipments substituted for war-disrupted food production and markets in Western Europe and Japan. Rapid recovery of the war-torn economies soon brought a sharp decline in the need for U.S. assistance and in world demand for U.S. grain. Because livestock herds in Europe had been decimated by World War II, the end of the war failed to give rise to the rapid increase in export demand for feed grains that had occurred for wheat. However, the pent-up demand for meat in the U.S. resulted, at the end of the war, in a sharp increase in domestic demand for feed grain. But feed grain exports were small, as they always had been, relative to production. At the same time, given the massive U.S. production base, even modest relative exports can be significant absolutely.

The Korean War contributed in 1951 to a temporary increase in wheat exports, pushing prices above support levels, and brought a decline in CCC stocks. But by 1952, stocks were again on the rise owing to larger crops and carryover stocks of 903 million bushels, 850 million of which were held by the government. By 1954, half the crop was under loan (Fornari, p. 103).

Western Europe continued, as the 1950s wore on, as a buyer of some consequence, soon becoming the major regional customer of American grains, especially wheat. Meanwhile, however, the same improved technologies which were having startling effects on U.S. grain yields began to be available to European farmers. Favorable agricultural policies soon encouraged an enormous increase in European crop yields and total production, leading in turn to import restrictions and government export subsidies to dispose of the growing surpluses at prices held well above world levels. Thus, world as well as domestic production was increasing rapidly.

1960s and 1970s. The Treaty of Rome, signed in March 1957, by six countries of Western Europe, marked the birth of the European Economic Community (EEC) or "Common Market" as it came to be known. Creation by the new organization of a "Common Agricultural Policy" institutionalized and expanded upon protectionist policies already in force, with the result by 1962 of a major expansion of wheat production, especially in France. "Intervention prices" were established at levels well above those in world markets and enforced with "variable levies," duties on imports which varied depending on what was required to discourage imports. Former deficits of wheat and other grains now became large surpluses. U.S. wheat producers had all but lost the important European market and faced increased competition in other markets from subsidized EEC exports. What was left of EEC wheat imports was durum and some high-protein bread wheats to meet blending needs (Fornari, pp. 106-8). The Green Revolution had also brought large increases in grain output in some of the former PL-480 countries, although the growing production was rarely able to keep pace with growing demand generated by improving incomes.

Rapidly increasing domestic and world agricultural productivity, in combination with more moderate growth in domestic demand and a slump in post-war export demand had led by the 1950s to declining U.S. commodity prices and farm incomes. The U.S. government responded with price supports, storage programs and acreage controls. Just as in Western Europe, import restrictions were imposed to protect the resulting gap between domestic and world prices. While government farm programs also worked actively toward promoting exports, domestic production continued to grow, leading to a carryover on July 1, 1960 of 1.3 billion bushels of wheat, an amount equal to that year's entire crop (Fornari, p. 104).

Among the more important of the circumstances at the time of the 1977 survey was the dominance of the OPEC cartel in international oil markets, the redistribution of world incomes that it was effecting and the responses by oil producers and consumers and their respective governments. Although the most obvious effects of rising oil prices for the Nebraska farmer may have been higher costs of major variable inputs--fuel, fertilizer, chemicals--farmers responded with reduced usage of these energy-intensive inputs, resulting in lower output of grain and higher grain prices. The implications for grain demand, outlined below, were much more significant but less widely appreciated (Schuh).

Growing balance-of-payments surpluses of "petrodollars" in the oil-exporting nations were recycled as loans and grants to less-developed countries (LDCs), even larger loans to middle-income countries and still larger loans to the United States in support of its growing balance-of-payments deficit. Oil-exporting LDCs used part of their oil revenues to fund major development projects and their projected future revenues to support borrowing to finance even larger projects.

U.S. balance-of-payments deficits caused the dollar to depreciate against the currencies of creditors, making American food exports less expensive to foreign buyers. The recycling of petrodollars to LDCs, whose consumers' food purchases are highly responsive to increased incomes, began to release enormous demands for food grains in the poorer of these nations and for both food and feed grains in those with somewhat higher average incomes. U.S. food consumers, whose food purchases on the whole are very unresponsive to income, reacted hardly at all to rising domestic prices.

The redistributed petroleum wealth also created greater demand for industrial goods, which were supplied increasingly by newly-industrializing countries such as South Korea, Taiwan and Brazil. Consumers in these middle-income countries also spend a high proportion of any increase in income on food, especially meat, leading to a major growth in imports of feed as well as food grains. Finally, foreign exchange remittances from Middle Eastern oil-field workers who had emigrated temporarily from several of the low-income countries also went heavily for food. Much of this food was grain from America.

Growth in agricultural exports during the late 1970s and early '80s was also greatly influenced by the expansionary effects of deficit government spending in the U.S. and the subsequent expansion that it stimulated in the larger world economy. U.S. government budget deficits were accompanied by lax monetary policies, with resulting negative real interest rates and further expansionary pressures. Federal tax cuts widened the deficits as American consumers tended to spend rather than invest their tax savings. The LDCs were notable beneficiaries of the rapidly expanding world economy. They were encouraged in the euphoria of the 1970s to borrow ever larger amounts to finance both current consumption and investments. They imported both food and feed grains to support the needs and wants of their growing and increasingly affluent populations.

Commodities became favored instruments of speculation as price inflation pushed prices ever higher and speculators pushed them higher still. Prices of basic commodities, including petroleum, products of forests, mines and agriculture, all benefitted from this combination of circumstances, most of which had been set in motion by 1977. The weak U.S. dollar and world economic expansion led, even in the face of rising domestic prices, to record levels of U.S. agricultural exports which, for the grains, peaked in 1980-81. The rapid increase in U.S. government budget deficits after 1980, a product of tax cuts and unchecked government spending, pushed rates of price inflation, even in the now-faltering economy, to double-digit levels.

1980s and 1990s. The economic climate changed abruptly as the U.S. Federal Reserve, under Paul Volcker, its new chairman, undertook corrective measures in monetary policy. Interest rates climbed well into the double digits, contributing to a major economic recession which spread to the rest of the world's market economies. The high interest rates and sharply curtailed world economic activity devastated LDC trade programs, both exports and imports. In the meantime, the U.S. dollar had appreciated sharply against West European and some Asian currencies, peaking in 1985, as foreign investment was attracted to the U.S. by the high interest rates and expanding economy (record levels of deficit federal spending continued unabated).

As the World Bank and western commercial bank lenders faced the prospect of massive default on their large loans to a group of middle-income LDCs, the International Monetary Fund (IMF) began pressing these borrowing nations to adopt "austerity measures" aimed at reducing imports and expanding their exports. Thus, they were forced to scale back still further their already declining imports of food and other goods and to seek expanded markets for their exports (often agricultural products) in a world market that was by this time awash with low-priced commodities. The implications for U.S. agricultural exports were disastrous.

Although government price supports and deficiency payments served at the time to moderate the revenue effects for U.S. grain producers, the farm economy of the state and nation was seriously depressed in 1985. Many farmers who had mortgaged their land and equipment on the strength of export-driven prices of a few years earlier now faced cash-flow problems growing out of low prices for their products and high prices for inputs, especially capital, as the Federal Reserve worked to contain price inflation by pushing up interest rates. Meanwhile, lenders watched helplessly as their collateral dwindled along with plunging farm real estate prices.

U.S. grain stocks in all positions increased from 8.9 billion bushels on January 1, 1977 to 11.9 billion at the outset of 1980 and to 14.5 billion bushels in 1983 (Association of American Railroads, p. 34). The Payment-in-Kind (PIK) program introduced in the latter year was designed to reduce government stockpiles and to move U.S. grain prices toward lower, international market-clearing levels. Stocks did decline by January 1, 1984 to 9.9 billion bushels, in the face of a drought-ravaged 1983 U.S. grain crop that was only 64 percent that of the year before, increasing only to 10.4 billion bushels at the outset of 1985. Expiration of the PIK program, increased production and further weakening of foreign demand had led, by the end of 1985, to accumulation of stocks of 14.1 billion bushels (Association of American Railroads, p. 8).

Increasing production brought, in the face of nearly constant domestic demand for wheat products and a weak export demand for feed grains, to rapid growth in inventories. U.S. corn stocks grew from 1.0 billion bushels at the outset of the 1984 marketing year to 1.6 billion bushels at its close, to 4.0 and 5.5 billion bushels, respectively, at the conclusions of the 1985 and 1986 marketing years. Soybean stocks increased from 176 million to 600 million bushels over the same period. Sorghum stocks expanded from 287 million to 593 million bushels from the start of the 1984 marketing year to the end of the 1986 year. U.S. wheat holdings increased from 1.4 billion bushels at the start of marketing year 1984 to 1.9 billion bushels at the beginning of 1986, but declined to 1.8 billion by the close of the 1986 marketing year (Nebraska Department of Agriculture and USDA 1986).

Nebraska grain stocks grew modestly during 1984, substantially more so during calendar year 1985, after a decline during the marginal crop year of 1983. Corn stocks in all positions increased from just short of 737 million bushels at the start of 1985 to almost 988 million bushels at the close of the same year. Sorghum stocks increased from 173.5 million to 223.7 million bushels, soybean stocks from 60.3 million to 79.6 million bushels and wheat stocks from 99.9 million to 116.3 million bushels during 1985 (Nebraska Department of Agriculture and USDA 1986).

The worst of the trade effects of the foregoing circumstances had passed by 1985; grain exports remained well below those of the boom of the late '70s but were well above those of the 1960s and very early '70s (Table 3-5). The 1985 survey year was one of mixed world agricultural indications. The Soviet Union had poor grain crops in 1984 and much of Africa had disappointing crops in both 1984 and 1985, setting the stage for an increased volume of world agricultural trade during the latter year. African countries relied heavily on concessional financing of grain imports to meet their growing deficits. China, India and the European Common Market were all exporters during 1985 in response to favorable weather and government policies which were increasingly supportive of expanded agricultural output and exports. World grain stocks increased during 1985, largely because of accumulations in the U.S., a reflection of the nation's then-declining share of world agricultural trade.

Total U.S. grain exports declined from their peaks of 128 million metric tons in 1980 and 1981 to 122, 113 and 92 million metric tons in 1982, 1983 and 1985, respectively (Table 3-4). The loss of foreign markets pushed prices for U.S. corn, sorghum and wheat below government-program loan levels, causing government stocks to build as farmers forfeited their mortgaged grain to the Commodity Credit Corporation.

Although exports recovered modestly in 1984 from their 1983 levels, they were down again in 1985 and well below their highs of 1981 and 1982. U.S. grain became increasingly uncompetitive in world markets; the dollar peaked against other major currencies in the second quarter of 1985; buying nations reduced their purchases, while competing sellers fought for the remainder. Export volume declines through 1985 ranged from 44 percent for wheat from its high in 1981 to 17 percent for sorghum from highs reached in both 1980 and 1981. Corn exports fell 20 percent from a high in 1980, soybeans by 23 percent from a high reached in 1981. Declining prices in world markets further depressed earnings from the reduced volumes. The value of U.S. corn exports decreased 39 percent in 1985 from a high in 1981, while that of sorghum exports was down 39 percent from a 1980 high and their volume down by 30 percent from a 1981 high. Soybean exports were 40 percent lower in value in 1985 than at their high in 1981, while wheat exports declined in value fully 54 percent from their 1981 high (Table 3-4; and Appendix Tables).

Several circumstances combined to dampen exports of U.S. soybeans and soybean products in 1984 and 1985. Sales of beans and meal to the European Community (EC) declined in response to a weak world economy, higher delivered prices occasioned by unfavorable foreign exchange rates, a drought-shortened U.S. crop in 1983, acreage restrictions attendant to the Payment-in-Kind (PIK) program in the same year, expanded EC purchases of corn gluten, increased feeding of wheat and an EC dairy-surplus reduction program. Purchases of corn gluten from the U.S. provided a substitute for the higher-priced soybean meal. Increased feeding of wheat, a relatively high-protein cereal, resulted from depressed world prices for wheat stemming from a large world wheat crop in 1984-85 (Wisner and Nourbakhsh 1986).

A record world oilseeds crop in 1984-85 resulted from good weather in several areas, expiration of the U.S. PIK program, increased palm oil production in Malaysia and larger plantings in South America. U.S. soybean stocks rose significantly in 1985 in the face of the large domestic crop and weak foreign demand. Nebraska stocks increased by 32 percent, from 60.3 million bushels at the beginning of the year to 79.6 million bushels at its close (Nebraska Department of Agriculture and USDA 1986). At the U.S. level, soybean stocks rose from 1.4 billion bushels on January 1, 1985 to 1.8 billion bushels on January 1, 1986, an increase of 24 percent (U.S. Department of Agriculture 1987).

Meal stocks rose in the face of increased competition from wheat and depressed demand for livestock feed. Since much of the increased meal production came from soybeans and sunflowers, crops relatively high in meal and low in oil content, meal stocks increased much more rapidly than those of oil. Oil stocks increased, but rather slowly and prices remained well above levels of the late 1970s and early '80s. Soybean oil exports go mainly to the less-developed countries, where income growth and production of competitive oils are the major demand factors. Oil sales did decline sharply in 1985 and early '86 as competition from palm oil and from other domestic oils became more intense.

Domestic demand for oil is very unresponsive to price, and exports are highly variable as a result (Wisner and Nourbakhsh 1986).

A record U.S. corn yield of 131.4 bushels per acre led to the largest crop ever in 1992, almost 9.5 billion bushels and nearly 7 percent above the previous record of 8.9 billion bushels in 1985. Domestic consumption of the large crop was bolstered by new uses for corn (sugar substitutes and ethanol for motor fuels) and a larger number of grain-consuming animal units owing to lower feed prices. Feed and residual uses for corn were a record 5.3 million bushels during 1992-93. Food, seed and industrial uses for corn alone were a record 1.5 billion bushels. Total corn use was, at 8.5 billion bushels, a record, but not enough to prevent stocks from doubling to 2.1 billion bushels at the close of the 1992-93 year (U.S. Department of Agriculture 1993, 1995).

At the approach of the fall 1996 harvest in the Northern Hemisphere, world grain stocks were at record low levels but demand remained strong even in the face of record high prices. The picture contrasted sharply with that of only a decade earlier when growing supplies in the face of weakening overseas demand acted to depress market prices from previous highs reached in 1980 and 1983. The high prices were temporary; record 1996 feed grain crops in Nebraska and the nation led to growth in carry-over stocks, depressing prices once again. Exports were, however, moving again, at the juncture of the new year, to near-record levels.

Soybean exports for 1992 were 19.8 million MT (726.9 million bu.), the highest since 1987 (Table 3-4). Domestic crush was nearly 1.3 billion bushels, a third consecutive record. The resulting total 1992 disappearance exceeded the previous record set in 1982 (U.S. Department of Agriculture 1993).

Summary

The growth of U.S. population and its increasing centralization in urban areas have expanded demand for long-distance (rail) transport. At the same time, growing decentralization of feed processing and soybean crushing activities has increased the demand for short-haul (truck) transport. An expansion of locally-oriented corn processing into ethanol and sweeteners has also favored short-haul transport. Whether markets for these latter products will continue to prosper will depend heavily on government policy. Wheat milling, a largely production-oriented activity at mid-century, has become consumer-oriented, with resulting greater demand for long-distance transport of wheat.

Although the livestock industry has grown in Nebraska, growth in the demand for red meats nationally, and therefore for transport of feed grains to local livestock feeding enterprises, has moderated owing apparently to consumer concerns about health implications of diets high in animal fats. At the same time, growing consumption of broilers and turkeys has strengthened the demand for transport of feed grains to Arkansas and other points in the south and east. Recent growth in exports of red meats and broilers has added an important element of domestic demand for feed grains and for their transportation to local markets.

The export market for all grains has grown significantly since the time of the 1954 survey, with resulting implications for transportation to ports of export. Although the Marshall Plan brought a brief boom of post-war exports to Western Europe, this program had been terminated by 1954, prompting a search for other markets for production which by then was growing faster than domestic demand. Public Law 480, enacted in 1954, sought to dispose of the glut through exports to food-short nations in the Third World. Surplus-disposal programs began to account for a large part of total wheat exports in the mid-to-late 1950s and grew rapidly through the 1960s. Feed grains and soybeans also became prominent exports under concessional programs.

Commercial exports were soon to become a major outlet for growing U.S. grain production, far exceeding those under government concessionary programs. Western Europe gradually became the most important buyer of U.S. grain, especially wheat, in the 1950s and 1960s; these were waning, however, at the close of the 1960s. EEC policies favoring home-country production rapidly eroded this market, leading in fact to competition with U.S. shipments to other overseas markets. Production was also growing elsewhere, including some of the developing nations. Japan, Eastern Europe and the Soviet Union became the important buyers in the 1970s. With these and other new world markets, United States grain and grain products exports had grown to enormous importance by the late 1970s. Exports slumped sharply in the mid-1980s, but returned again to prominence in the 1990s.

The rapid export growth in the late 1970s was fueled by the recycling of petrodollars, accumulating in oil-exporting countries, to food-short developing countries and by lax monetary and fiscal policies in the United States which contributed to global economic expansion. A subsequent collapse of exports by the mid-1980s owed in large part to sharply tightened U.S. monetary policies and the ensuing Third-World debt crisis. Foreign demand for both food and feed grains had declined sharply by mid-1985 from highs in the late 1970s and early '80s, although exports remained far above those of the 1960s and earlier times. The crisis was felt at home as well as abroad as American farmers struggled in the mid-'80s to accommodate to sharply higher interest rates on large debts assumed during the export-fueled boom of a few years earlier, and to much lower farm prices caused by good crops and slumping export demand.

The more recent situation has featured strong domestic as well as export demand. Exports since 1985 strengthened, 1995 levels approaching those of the earlier peaks. Domestic consumption of record feed grain crops in 1992 and 1994 was bolstered by the growing market for corn as a feed-stock for sweeteners and ethanol as well as large livestock inventories. Feed, seed and industrial uses for corn set records. Exports of corn in 1995 were the highest since 1989, those of soybeans the largest since the record 1982 year. Exports have benefitted from a major recovery of LDCs from the debt problems of the 1980s, Asian economies in particular having made striking rates of progress in recent years.

Control of mounting grain stocks became, nevertheless, a major concern of U.S. commodity programs; acreage controls became a central feature of government subsidy programs, remaining so until the 1996 farm bill removed price supports and thus the buffer against world price fluctuations.

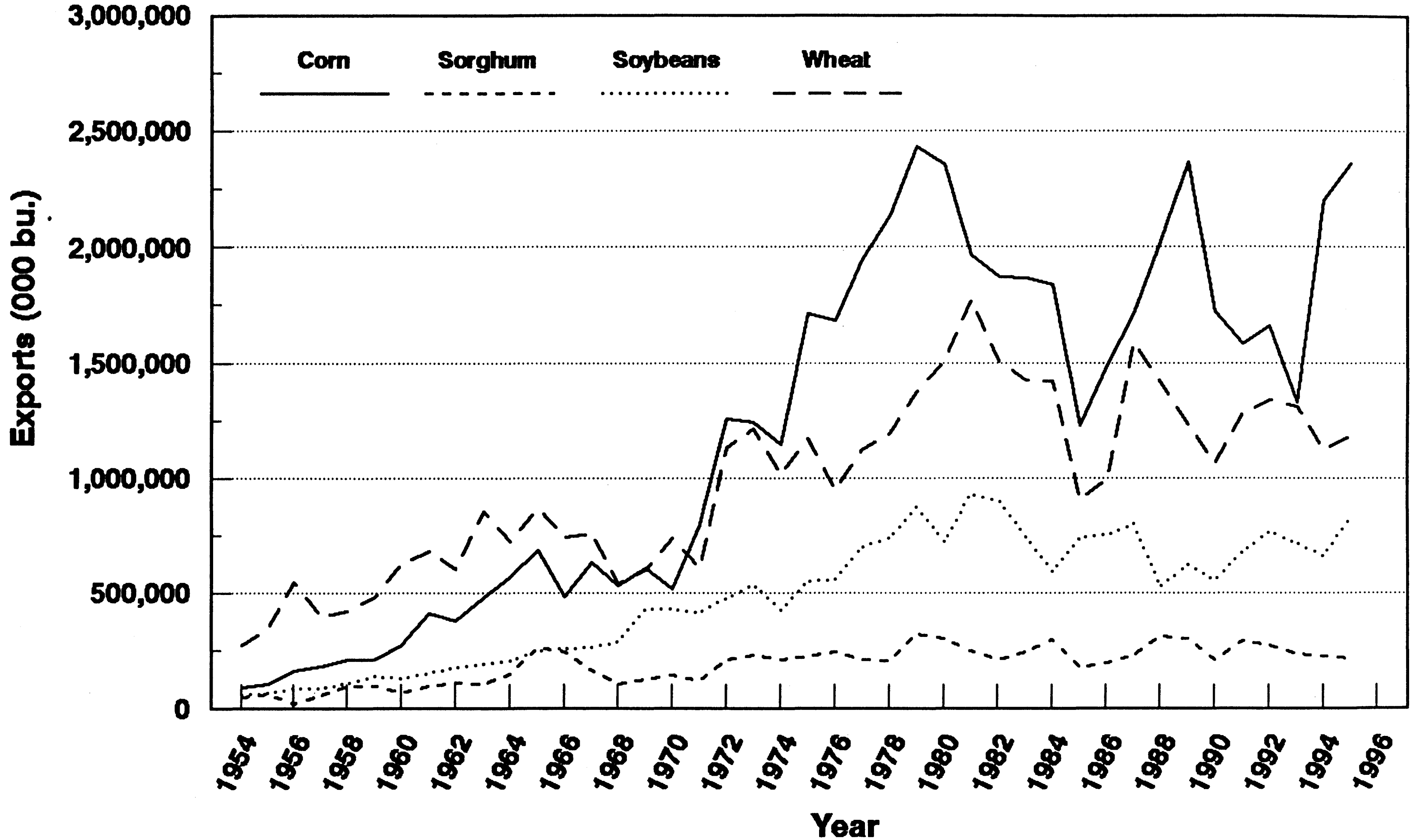


Figure 3-1. Total U.S. Exports, by Commodity, 1954-1995

Source: Table 3-4.

Table 3-1. Cattle and Calves on Feed and Cattle and Calves Numbers,[a] Nebraska and United States, 1954-1996.

	Cattle & Calves		Cattle on Feed	
	U.S.	Nebraska	U.S.	Nebraska
	(000)			
1996	103,819	6,350	12,792*	1,900
1995	102,755	6,000	12,431	1,940
1994	100,988	6,150	13,034	2,110
1993	99,176	5,900	12,789	2,130
1992	97,556	5,800	11,942	1,990
1991	96,393	5,900	12,715	2,250
1990	95,816	5,700	11,626	2,060
1989	98,065	5,600	11,440	1,950
1988	99,622	5,700	11,872	2,060
1987	102,118	5,500	11,277	1,860
1986	105,378	5,800	11,731	1,900
1985	109,582	6,100	12,453	1,880
1984	113,360	6,900	11,594	1,760
1983	115,001	7,200	12,040	1,880
1982	115,444	7,250	10,619	1,640
1981	114,351	6,850	11,598	1,640
1980	111,242	6,400	12,223	1,680
1979	110,864	6,450	13,274	1,800
1978	116,375	6,500	13,472	1,700
1977	122,810	6,450	12,580	1,580
1976	127,980	6,550	12,941	1,390
1975	132,028	6,900	10,170	1,160
1974	127,788	7,410	13,643	1,525
1973	121,539	6,865	14,432	1,581
1972	117,862	6,780	13,912	1,450
1971	114,578	6,457	12,770	1,422
1970	112,369	6,330	13,190	1,477
1969	110,015	6,330	12,534	1,430
1968	109,371	6,394	11,417	1,230
1967	108,783	6,377	11,268	1,308
1966	108,862	6,259	10,582	1,227
1965	109,000	6,002	9,979	1,027
1964	107,903	6,048	9,845	1,022
1963	104,488	5,773	9,702	898
1962	100,369	5,434	8,520	845
1961	97,700	5,134	8,048	699
1960	96,236	5,072	7,574	665
1959	96,851	4,999	6,601	545
1958	93,350	3,961	5,898	543
1957	94,502	4,531	6,122	560
1956	96,804	4,759	5,929	543
1955	96,592	5,065	5,795	625
1954	95,679	4,752	5,370	607

Source: Nebraska Agricultural Statistics Service. *Nebrasaka Agricultural Statistics*, various issues, Lincoln: Nebraska Department of Agriculture and USDA Cooperating; U.S. Department of Agriculture, 1994, *Red Meats Yearbook*. Washington, DC: GPO; and historical USDA statistics compiled by Livestock Marketing Information Center, Denver, CO, 1996.

[a] Numbers counted on January 1 of each year.

Table 3-2. Hog and Chicken Numbers,[a] Nebraska and the United States, 1954-1995.

	Chickens		Hogs and Pigs	
	U.S.	Nebraska	U.S.	Nebraska
	(000 head)			
1995	60,200	4,100	384,241	
1994	59,992	4,350	383,829	10,600
1993	57,904	4,300	379,640	9,000
1992	58,202	4,600	364,180	9,250
1991	57,649	4,500	362,821	7,900
1990	54,416	4,300	351,616	6,200
1989	53,788	4,200	356,234	5,250
1988	55,469	4,150	356,105	4,150
1987	54,384	4,050	377,727	4,450
1986	51,001	3.950	369,131	4,000
1985	52,314	3,900	368,548	3,970
1984	54,073	3,700	374,008	4,000
1983	56,694	4,000	364,880	3,850
1982	54,534	3,800	378,609	4,050
1981	58,698	4,100	384,838	4,150
1980	64,462	3,900	392,110	4,000
1979	67,318	4,150	400,585	3,930
1978	60,356	3,650	396,933	4,200
1977	56,539	3,150	386,518	4,090
1976	54,934	3,100	378,361	3,830
1975	49,267	2,700	379,754	4,250
1974	54,693	3,050	394,101	4,450
1973	60,614	3,455	412,503	4,630
1972	59,017	3,300	406,241	4,427
1971	62,412	3,322	425,576	6,295
1970	67,285	3,961	433,903	5,996
1969	57,046	2,839	422,096	5,715
1968	60,829	3,226	425,158	6,560
1967	58,818	3,043	428,746	6,942
1966	57,125	2,954	393,019	6,719
1965	50,519	2,761	375,424	7,253
1964	53,052	2,809	369,959	7,586
1963	58,119	2,727	366,823	8,023
1962	58,883	2,648	368,452	9,224
1961	55,506	2,452	361,685	9,938
1960	59,026	2,502	369,484	10,425
1959	50,045	2,453	387,002	11,372
1958	51,517	2,044	370,884	11,079
1957	51,703	1,841	390,137	11,615
1956	55,173	2,423	382,846	11,167
1955	50,474	2,423	390,708	11,563
1954	45,114	2,308	396,776	11,246

Source: U.S. Department of Agriculture. *Agricultural Statistics*. Washington, DC: GPO; and updates from Nebraska Agricultural Statistics Service.
[a] Numbers counted on December 1 of each year.

Table 3-3. Commercial Broiler and Turkey Production, Nebraska, 1954-1994.

Year	Broilers Number[a]	Broilers Production	Turkeys Number[a]	Turkeys Production
	(000)	(000 lbs.)	(000)	(000 lbs.)
1994[b]	2,800	18,200	N/A	N/A
1993	2,700	17,800	2,250	47,430
1992	2,500	17,250	2,110	37,980
1991	2,400	16,800	2,110	36,081
1990	2,950	20,060	2,090	38,038
1989	2,150	13,975	2,050	36,080
1988	1,129	6,210	1,770	30,798
1987	1,074	5,907	1,942	35,344
1986	832	3,744	1,437	27,159
1985	885	3,629	918	16,938
1984	1,050	4,515	639	12,141
1983	1,250	4,875	814	14,978
1982	1,950	7,800	715	13,514
1981	1,580	6,636	680	13,532
1980	2,000	8,400	811	15,977
1979	1,950	7,800	654	12,164
1978	1,530	5,508	490	9,849
1977	1,680	6,720	471	9,656
1976	1,820	7,280	473	9,886
1975	1,720	6,880	487	9,545
1974	2,312	9,248	557	11,363
1973	2,267	9,068	858	18,876
1972	1,733	6,412	933	20,339
1971	1,412	4,660	811	17,599
1970	1,371	4,524	652	13,366
1969	1,318	4,349	711	14,853
1968	1,292	4,264	951	19,899
1967	1,404	4,493	913	19,158
1966	1,468	4,991	913	18,285
1965	1,184	4,026	1,169	23,578
1964	1,260	4,032	1,139	22,977
1963	983	3,047	914	18,184
1962	1,003	3,109	1,151	21,957
1961	1,892	5,865	1,477	28,940
1960	2,175	7,178	1,115	22,482
1959	2,620	8,908	1,983	19,404
1958	2,280	7,296	1,079	21,306
1957	2,280	7,068	907	16,724
1956	3,040	9,120	955	18,584
1955	3,577	10,731	816	15,322
1954	4,471	13,413	868	17,233

Source: Nebraska Agricultural Statistics Service. *Nebrasaka Agricultural Statistics*, various issues, Lincoln: Nebraska Department of Agriculture and USDA Cooperating; U.S. Department of Agriculture, 1994, *Red Meats Yearbook*. Washington, DC: GPO; and historical USDA statistics compiled by Livestock Marketing Information Center, Denver, CO, 1996.

[a] Total number raised each year.

[b] Not published for turkeys to avoid disclosing individual operations.

Table 3-4. U.S. Agricultural Exports,[a] by Commodity, 1954-1995.

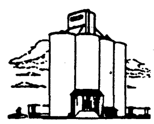
Year	Corn	Sorghum	Soybeans	Wheat/Flour
	(000 bu)			
1995	2,362,784	217,394	836,534	1,187,436
1994	2,200,000	227,212	664,024	1,121,886
1993	1,328,000	238,015	713,682	1,308,904
1992	1,663,000	275,000	769,578	1,340,000
1991	1,584,000	292,000	683,943	1,280,000
1990	1,725,000	232,000	557,315	1,068,000
1989	2,368,000	303,000	622,886	1,232,000
1988	2,026,000	312,000	526,501	1,415,000
1987	1,716,000	232,000	801,686	1,588,000
1986	1,492,000	198,000	756,914	999,000
1985	1,227,000	178,000	740,672	909,000
1984	1,838,000	297,000	598,174	1,421,000
1983	1,865,000	244,000	742,760	1,426,000
1982	1,870,000	214,000	905,158	1,509,000
1981	1,967,000	249,000	929,080	1,771,000
1980	2,355,000	305,000	724,295	1,514,000
1979	2,433,000	325,000	875,173	1,375,000
1978	2,133,000	207,000	739,154	1,194,000
1977	1,948,000	214,000	700,484	1,124,000
1976	1,684,000	246,000	564,071	950,000
1975	1,711,000	229,000	555,094	1,173,000
1974	1,149,000	212,000	427,342	1,018,000
1973	1,243,000	234,000	539,129	1,217,000
1972	1,258,000	212,000	479,443	1,135,000
1971	796,000	123,000	416,829	610,000
1970	517,000	144,000	433,800	741,000
1969	612,000	126,000	432,600	603,000
1968	536,000	106,000	286,776	544,200
1967	633,000	166,000	266,577	761,100
1966	487,000	248,000	261,591	744,300
1965	687,000	266,000	250,591	867,400
1964	570,000	148,000	205,879	725,000
1963	478,759	106,219	191,158	856,100
1962	379,732	112,872	180,347	603,717
1961	415,674	99,103	153,154	684,741
1960	276,552	70,550	130,064	631,138
1959	211,529	98,480	141,382	485,210
1958	214,410	99,795	110,072	422,404
1957	183,628	57,286	85,507	401,738
1956	164,789	22,239	85,361	548,695
1955	108,809	66,192	67,618	345,645
1954	92,563	47,685	60,618	274,634

Source: U.S. Department of Agriculture. *Agricultural Statistics*. Washington, DC: GPO, various issues.

[a] Exports of corn, soybeans and wheat include products as well as unprocesses grain.

CHAPTER 4

THE GRAIN HANDLING SYSTEM



Grain marketing in the 1950s and early '60s was characterized by government supply controls. The Agricultural Assistance Act of 1949 provided for commodity price supports under the implicit presumption of continued high levels of domestic production. Government became the buyer and often the storer of whatever amounts the market failed to clear at the supported prices. Commodity Credit Corporation (CCC) bin sites were situated across the grain-growing areas of the state and nation. Public attention was also turned toward diverting U.S. surpluses toward meeting the food needs of developing countries. The Agricultural Trade and Development Act (PL-480), passed by Congress in 1954, provided for shipment of surplus grain stocks to less-developed countries at low or no cost to the recipients. Domestic shipments of grain moved relatively short distances to market, largely to local or regional feeders or millers. Commercial export markets had not yet developed to any great extent.

Physical Storage and Merchandising Facilities

Important technological changes have occurred in the storage, handling and transportation of grain. These changes featuring, most importantly, larger-scale, more capital-intensive facilities and enterprises, have yielded cost savings but have brought social disruptions as well. They have helped to make Nebraska more competitive in supplying distant grain markets, but have impaired the value of existing assets of smaller-scale grain handlers and processors. Carrier bankruptcies, consolidations and track abandonments attest to major adjustments having been borne by the railroads as well. The changes have been interactive and often mutually reinforcing. The developments inevitably have had impacts as well for the pattern of grain flows from areas of surplus such as Nebraska to areas of national and international deficit.[1] The present chapter focuses on developments in grain handling and processing. The evolving transportation system is explored in Chapter 5.

As recently as the early 1960s, before the emergence of significant export markets and the development of unit-train shipping methods, grain transported from Nebraska farms moved in a highly predictable pattern, going first from farm to country elevator and from there either direct to meeting local feed-grain needs or to subterminal or terminal elevators. The subterminals often shipped to terminals and both in turn shipped to final destinations including feed lots, domestic flour or feed processors and, less often, ports of export. Omaha elevators, in their association with the grading and price-making function of the Omaha Grain Exchange, were known as "terminals." Other large elevators buying their grain primarily from country elevators, located in Fremont, Grand Island, Hastings and Lincoln, and whose purchases were also largely from country elevators, were called "subterminals."

Railroad transit privileges and a system of freight rates that tended to equalize opportunities for shippers of disparate sizes and locations, and imposed little or no penalty for stopovers enroute or for circuitous routings, contributed to industry stability. The size and location of grain merchandising, storage and processing facilities were much less critical considerations than are now the case. Capital construction in the grain business was a less risky undertaking then than now. Changes have been so sweeping that the traditional classification of elevators as "country," "subterminal" or "terminal" has lost most if its meaning. Today, a more meaningful nomenclature distinguishes between those elevators which can load trains of 50-54 cars or more and those which cannot. Ability

[1]Further crop-specific information on the setting specific to the time of the surveys upon which this report is largely based is found in the "Background" sections of Chapters 6-9.

to load and ship trains of 100 or more cars is in fact rapidly becoming the *sine qua non* of competitive grain marketing.

Most of the old terminal/subterminal facilities, wherever they may be located, now play a role little different from that of train-loading country elevators. Some of the terminal facilities are out of the merchandising business, having become little more than long-term store houses, as grain increasingly moves in train lots directly from train-loading country houses to final out-of-state destinations, bypassing the urban elevators. The Omaha Grain Exchange building, the marketing focus of the former terminals, serves other users and its broker members now operate from offices scattered across the city. The old subterminals[2] today find themselves in direct competition with country elevators for volumes of grain purchases large enough to support train-load movements.

Along with their changing role, the number of country elevators, which peaked in the late 1950s, has greatly diminished. Miller (1960) identified 842 grain elevators in Nebraska in 1954-55; in 1959-60 he counted 882 (Miller and Nelson). The authors offered no explanation for the apparent growth in numbers between those early periods, although they did note that guaranteed government storage was apparently encouraging some expansion of facilities and they observed also that the number of co-operative and independent elevators was growing relative to the number of line elevators (Miller and Nelson). It is also possible that some of the earlier line elevators may have consolidated their survey responses for more than one location into a single report, concealing the

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[2] To simplify the discussion, the two groups, "terminals" and "subterminals," will hereafter be referred to collectively as "terminals."

presence of other locations[3]. Whatever the circumstances prompting the seeming growth in the number of elevators in the 1950s, they clearly have not prevailed since. By 1968, the state had 756 total elevators, 31 of which were terminals (Anderson and Breuer 1971; by 1977 there were 740 total. In early 1986 the count was 716 (Nebraska Grain and Feed Dealers Association 1987), and by 1996 it was only 653[4], a 26 percent decline since 1959-60. The Nebraska Department of Agriculture reports that the state had only 547 commercially licensed off-farm grain storage facilities as of December 1, 1996 (Nebraska Department of Agriculture and USDA 1997).

Declining numbers do not tell the full story of the consolidation. The number of elevator organizations is today much smaller than the number of separate facilities or "elevators"; there were 319 of the former in 1995, of which 99 were co-operatives, 220 non-cooperative businesses. The co-operatives had 165 branch locations, the non-cooperatives 169.[5]

It is clear that there are still far more elevators than needed to accommodate the available business; even by 1982, as grain exports were already beginning to taper off from their highs in the late 1970s, Nebraska elevators had well over 200 percent of the capacity needed to meet then current

[3] There is also some dispute over the earlier figure; Farrell (1958) reported that Nebraska had 870 country elevators plus 10 terminals in 1954. It is not clear whether Miller's count was exclusive of terminals. Note, however, that Miller provided the data used by Farrell and that Miller's paper is more recent than Farrell's.

[4]Interview with Professor Michael S. Turner, Department of Agricultural Economics, UN-L, August 30, 1996; count based on Nebraska Grain and Feed Dealers association sources.

[5]*Ibid.*

unit-train shipping demands;[6] their rate of exit from the industry has been moderated by the relatively long life of fixed assets and by limited potential for their alternative employment.

The line-up of firms owning and operating line elevators in the state has undergone change. Among the larger firms represented in 1987 were Agrex, Bunge, Cargill, ConAgra (Peavey), Continental Grain, Lincoln Grain, Pillsbury and Scoular. By 1996, Lincoln Grain had become part of Continental, the Scoular organization had downsized and regional co-operatives were directly managing some member elevators experiencing financial difficulties. Most line-elevator organizations have a combination of train-loading and single-car facilities, although Agrex is specialized in the former while Bunge has only the latter; some had moved actively by the mid-1980s to lease additional elevators (Anderson 1987). More recently the leasing trend may have reversed, with Scoular, for example, abandoning a number of its leases.

Some smaller country elevators have joined in associations allowing them to pool their out-shipments, sometimes in the form of multiple-origin train-load shipments, sometimes combining them at a single origin. While such arrangements may be most common among cooperatives and among groups of (line) elevators that are part of a larger corporate organization, necessity has at times made compatriots of assorted elevator types. Pooling has been more common among wheat shippers in the west than among feed grain shippers in central and eastern areas of the state.

Cooperatives had 72 (60 percent) of the train-loading elevators and 154 or 26 percent of the state's remaining elevators in 1986 (Nebraska Grain and Feed Dealers Association 1987). Scattered as they are across the state, cooperatives remain an important factor in local grain markets.

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[6]Interview with Professor Michael Turner, Department of Agricultural Economics, UN-L, May 15, 1992.

Along with the decline in the total number of elevator facilities there has been much turnover. Far-Mar-Co, the former regional cooperative, for example, is gone from the scene and its terminal/subterminal facilities acquired by other firms. Attrition has been especially high among smaller country elevators lacking rail service. Some of the latter have been bought by larger farmers who have put them to private storage use. Many others became little more than storehouses, taking advantage of government storage payments which in the mid-1980s continued to provide dependable revenues. By 1996, with government farm programs de-emphasizing nonrecourse loans, long-term storage payments were all but gone. Open markets offer little incentive for commercial storage for periods longer than that from one harvest to the next. Shorter-term storage, however, remains crucially important to the marketing of commodities which are harvested annually, during a relatively short period of time, but for which the demand, domestically at least, varies little over the course of the year. The transportation system cannot reasonably be expected to be able to move the entire season's production promptly to destination-oriented storage. Production-oriented stores logically remain a key to the satisfaction of demand generally lacking in a seasonal variability.

Nebraska ranked fifth among states in 1986 capacity of commercial grain facilities, with 702 million bushels of storage space; farmers had nearly twice as much, 1.204 billion bushels (Nebraska Department of Agriculture and USDA 1986). But the trend, even in the face of growing production, has been toward relatively less production-oriented storage. By December 1, 1996, Nebraska continued to rank fifth among states, but its commercial grain storage capacity was now 640.3 million bushels, down 1.5 percent from 649.9 million a year earlier and nearly 9 percent lower than in 1986. On-farm storage declined by 12 percent over the same 10-year period to 1.06 billion bushels (Nebraska Department of Agriculture and USDA 1997).

Efforts on the part of Nebraska's rail carriers to price their services in direct proportion to the intensity of demand may in the future increase the importance of origin-keyed storage. The BNSF has adopted a pricing program involving what it calls "Certificates of Transportation" or simply "COTS," by which its freight rates are separated into two components, one a charge for the transport service, the other a charge for the use of the rail cars employed in that service. The car charges vary with changing market conditions, increasing for example, during the immediate post-harvest season when the demand for cars is greatest.[7] The UP has recently adopted a similar system. Rail rate variability interjects still another element of pricing uncertainty into the management of grain elevator businesses, but may offer some assurance of the availability of cars at some price. By spreading shipments more evenly over time the new system will also require more production-oriented storage space.

Some elevators lacking rail service have merged with others which do have rail access. Others survive because they are diversified into feed, fertilizer, petroleum or other farm supplies; a Nebraska study conducted in 1969-70 showed the state's elevators to be a highly diversified lot, a condition that may provide a measure of protection in an unforgiving economic environment (Anderson and Helgeson 1970, 1974 and 1974a).

Some elevators, often those without rail service, buy a part of their grain FOB the farm, transporting it in their own or in leased trucks directly to buyers, by-passing their own elevator. Other elevators have formed transportation pools and coordinate the use of jointly-owned vehicles for their trucking needs. Some elevators survive by meeting local feed grain demands, for which trucks are the only relevant shipping mode.

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[7]Turner, August 30, 1996, *op. cit.*

Technological and structural changes have made many remaining elevators more competitive. As elevators have declined in number they have grown in size, a trend already underway as early as the late 1950s. Miller estimated that the average supply area for Nebraska country elevators grew from 8 miles radius in 1954 to 14 miles in 1959, although overlap in supply areas was apparent (Miller and Nelson). The average size of farm delivery vehicle has grown greatly since the 1950s. Tractor-drawn wagons were being replaced in the 1950s by tractor-pulled, rubber-tired trailers and these in turn were giving way to farm trucks of growing size. These changes have been spurred by growing average farm size (471 acres state average in 1954, 841 in 1995)[8], continued improvements in roads and vehicles, the switch from the harvest and storage of ear corn to combine harvesting of shelled grain (Nebraska Department of Agriculture and USDA various years). All of these changes have increased the productivity of farm labor and management and have contributed toward increasing opportunity cost of time. To the extent grain is hauled at harvest time directly from field to elevator, the delivery activity is a potential bottleneck in the harvesting operation. Harvest delays occasion much greater physical losses in machine-harvested corn than under the traditional hand-picked operation still common before and even during the Second World War. Unlike hand-harvesters, the machine cannot retrieve ears that have fallen to the ground.

Elevators installed driers to accommodate direct and rapid flows of corn from field to market. The latter trend originated in the 1950s as reported by Miller and Nelson, only 60,000 bushels of corn having been custom dried by Nebraska elevators in 1954, compared with over 16 million bushels in 1959.

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[8]These numbers are not fully comparable owing to a change, beginning with 1975, in the way size is measured.

Growing specialization of agricultural enterprises has enabled elevators to specialize as well. Oats, rye and barley, still important crops in the mid-1950s, are of little significance in the 1990s. Most elevators now specialize in not more than two or three grains, each of which has significant markets beyond as well as within the state's boundaries. Of course some of the present specialization is in crops not generally grown in the state in the 1950s. Soybeans and sorghum were only beginning to be important crops by the mid-1950s (Tables 7-1 and 8-1 and Figures 2-8 and 2-12). But by 1957, in apparent reaction to the drought of the mid-1950s, farmers had planted an much-expanded acreage of this drought-resistant crop and sorghum output reached a level just short of that of the state's wheat crop. Soybeans were slower to catch on; their production in 1957 being less than 4 million bushels, slightly lower than that in 1954 and a trifle compared with the more 135 million bushel crop in 1996 (Tables 8-1 and 9-1). The crowding out of the earlier minor crops and increased regional specialization of exportable crops (old as well as new) have simplified elevator handling and storage operations and is consistent with the trend toward specialization in train-load shipping volumes of a single grain type. Respondents to Miller's 1959 elevator survey indicated that the number of grains handled was a more serious capacity constraint than was storage space in total (Miller and Nelson).

Elevator owners and managers had limited incentive to adopt merchandising innovations in the 1950s when the government owned half or more of the grain stored in Nebraska elevators. In 1959-60 the government owned 73 percent of the elevator-stored grain, elevators virtually none. It took no high degree of business acumen to be successful in leasing one's storage space to the CCC at generous rates and over extended periods of time. Along with rapid tax write-offs for new storage construction, guaranteed government storage payments turned elevators into long-term storage houses and the elevator business into a low-risk enterprise. Government storage is now all but gone and the 1996 farm policy outlook promises no early return to the golden days of old. Perhaps nowhere is the contrast with the past sharper than in the 1995-96 "hedge-to-arrive" contracts, instruments aimed at controlling farmers' price risk, while guaranteeing elevators their business, but which in practice, owing to defaulted delivery contracts, have threatened the financial integrity of some country elevators.

More important, from the standpoint of meeting the demands of the more distant grain buyers, has been the trend in train-loading capability. In 1977, Nebraska had only eight elevators capable of accommodating unit trains, all of which operated as terminals or subterminals (Anderson 1987). By 1981, fully 106 elevators had train-loading facilities and by 1986 120 elevators were capable of shipping in lots of 25 or more cars (Nebraska Grain and Feed Dealers Association 1987). The train-load shippers included most of the 11 or so old terminal/subterminal houses (some of which were under new ownership). By 1995, 127 elevators shipped lots of 25 or more cars, 79 of these could load 50 cars or more at a time, 11 of them 100 or more (Nebraska Grain and Feed Dealers Association 1996).

Expanded and modernized port facilities are capable of rapid transfer of unit-train traffic into ocean vessels of growing size. Extensive port development on the Columbia River, in Puget Sound and in southern California responded to and complemented the rise of Asian markets and the development of unit-train technology.

The foregoing cumulative changes have thoroughly transformed the grain marketing process. Larger feasible grain assembly territories, reinforced by growing economies of size in elevator operations and, eventually, in rail rate incentives for facilities accommodating train-load shipments in jumbo hopper cars, have led to a major consolidation of elevator businesses and facilities. A relative few train-loading elevators now account for the greater part of the state's out-shipments. Little grain moves from one in-state elevator to another. Shipments to out-of-state destinations have grown in relative importance and now originate at first-collection points rather than in the terminals which drew their grain from country houses in the system of the 1950s.

The foregoing patterns have interacted with technical and institutional developments in transportation. Unit-train technology is perhaps the foremost technical factor. Passage of the Staggers Act of 1980 (deregulating railroads) and the contracting opportunities it has opened have been a key institutional development, one serving to legitimize and intensify patterns of change that were well established by the time the law was enacted. And passage of the Motor Carrier Act of 1980 (deregulating trucking) has helped to make truckers more competitive. These latter developments are discussed further in Chapter 5, below.

Pricing[9]

Most grain traditionally has been purchased by country elevators from farmers on a cash or "spot" basis, although some elevators have reported limited use of forward pricing. This pattern is likely to change with the withdrawal of government price floors mandated by the 1996 farm bill. The hedge-to-arrive contract problems which emerged in 1995-96 illustrate the pitfalls as well as the potential for alternative means for stabilizing prices in the absence of government intervention. Grain is normally priced delivered at the elevator, but some elevators do take delivery at the farm in their own or contracted trucks. Elevators also frequently provide custom storage of grain, allowing the farmer time to decide subsequent to delivery when to sell it.

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[9]Much of this section originated from results of mail and telephone surveys of Nebraska elevator managers conducted by the author under contract with the U.S. Interstate Commerce Commission in 1987 (Anderson 1987).

In 1985, little more than a decade ago, with cash prices for corn, sorghum and wheat below government loan rates, both commercial and farm storage facilities were largely filled with grain mortgaged to the U.S. government. Many of the sales were of CCC grain being redeemed with PIK certificates. Local feeders were sometimes forced to pay premiums above the going price of corn and sorghum in alternative markets in order to acquire their needs. It should be noted that local feed grain demand has long been and continues to be a major factor in local price determination, with prices at some Nebraska locations on occasion rising above Chicago spot prices. The basis has in fact narrowed over time as local feed demands have grown, Pacific Coast markets have emerged and transportation has become more efficient.

Elevator managers may protect their bid prices by contracting for resale of the grain as they buy it, sometimes by working with brokers who make a market for their purchases. Line elevators may rely on their organization's main office to take the necessary protection while the latter were common practices 20 years ago, they are now much less common. Today elevators more commonly protect their price bids by making their own offsetting hedges in the futures market. The larger independents and cooperatives are more likely than the smaller ones to undertake their own hedging activities. The need for train-lot shippers to accumulate relatively large volumes of grain, in the context of growing variability in both grain prices and rail shipping rates, makes some form of price protection virtually essential.

Multiple-car shipping obligations cause some elevators with limited storage capacity of their own to contract for future delivery of farm-stored grain, a practice which had become common as long as 15 years ago. In the spring and summer of 1996, "hedge-to-arrive" contracts, obligating farmers to future delivery of specified amounts of grain at specified prices, were much in the news, having created major margin-call problems for elevators as farmers sought to delay deliveries in hopes of benefitting from sharply rising market prices (Killman). Protection of shipping obligations at other times has been achieved through purchases from or shipping agreements with other nearby elevators. The latter grain is sometimes assembled at the collecting elevator by truck, sometimes by rail. Sometimes, especially in the wheat areas of western Nebraska, railroads have provided rates that allow for multiple-origin assembly of unit trains. The latter were an exception at their outset from railroad policy stipulating that train-load rates apply only to shipments originating from a single station and are even more exceptional today.

The relatively large amount of on-farm storage capacity in the state (double the amount of commercial storage) was a little more than enough to hold the entire 1986 corn, soybean and sorghum crops, although only enough for three-fourths of the much larger 1996 crops. Local storage affords farmers added flexibility in trucking grain to more distant elevators with higher bids. Time involved in making the deliveries later in the crop year may be less valuable than time spent delivering direct from combine to elevator at harvest time.

Country elevators have traditionally made their price bids by subtracting a profit margin and their costs of business, including transportation, from prices bid to them. The process reflects the inherently competitive nature of the system. Given the excess capacity in present-day car-loading capacity, in combination with transportation innovations not equally available to all shippers, the reality of shrinking margins for some elevators is apparent. There is at least anecdotal evidence that lower freight rates for Nebraska shippers in the years immediately following deregulation in 1980 (rates averaging from one-fourth to one-third their pre-1980 tariff levels) were associated with higher grain price bids to farmers (Anderson 1987).

Elevators selling grain for their own account and moving that grain under tariff rates have traditionally paid their own freight bills. It appears, however, that the preponderance of contracted freight rates involving Nebraska elevators in the 1980s and '90s have been negotiated between the railroads and grain receivers rather than shippers. These "destination" contracts thus involve payment of freight charges by the receiver and call for pricing of the grain FOB the country elevator. Such contracts relieve the elevator manager of the potentially rigorous task of negotiating for the terms of transport, including possible separate arrangements for use of either shipper- or railroad-owned cars. The availability of destination contracting opportunities may thereby provide for some improvement in potential terms of transport for elevators large enough to make multiple-car shipments but too small to negotiate for themselves the most favorable freight rates. Destination shipping contracts continue in 1997 to be the rule, affording potential special advantages to elevators that are part of large, integrated grain-handling organizations.

As this was first written in early fall 1996, carryovers of all grains into the next crop year were at record lows. The 1995 harvest was down nationally and world-wide. By the time the writing was finished in March of 1997, the 1996 crops were in and accounted for; it was a harvest of record proportions (see Tables 6-1, 7-1, 8-1 and 9-1), stocks had increased and prices had slumped to 1995 levels. However, demand pressures in both years were strong in export as well as domestic markets and market prices remained well above CCC loan rates. As the paper was going to press, in mid-1998, financial problems in major Pacific Rim customer nations, in the face of favorable U.S. crop prospects, had driven U.S. prices still lower.

CCC bin sites are long gone in any case. Federal budget deficits and a new farm bill featuring a phased withdrawal of government price supports suggest that the days of any sort of government-sponsored storage are numbered as well. Increasing price variability seems likely, owing to inelastic domestic demand for grains, inherent variability in foreign demand and diminished government supply and price interventions. There will be intense pressures for both farmers and elevator managers to find means for controlling the risks stemming from this variability, including the risks associated with transport availability and pricing.

Summary

The grain marketing system has undergone major changes since the time of the first grain-flow survey in 1954. Major improvements in physical facilities have occurred. The system of both rural feeder roads and highways has been modernized. Steady increases in the average size of Nebraska farms, crop yields and degree of enterprise specialization have increased the volume and lot size of grain marketed per farm. Trucks of growing size have replaced tractor-drawn wagons and trailers for shipping grain to country elevators. The rise of combine harvesting of grains has hastened the tempo of the harvest, shortening its length and heightening seasonal peaks in grain deliveries to elevators. Country elevators in their turn have been enlarged and upgraded to accommodate unit-train out-shipments of a single grain; they have expanded intake capacities and installed grain driers to accommodate early and rapid harvesting.

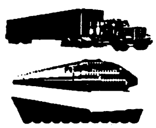
Rapid upgrading of port facilities in California and the Pacific Northwest enables these ports to provide rapid turnarounds for train-load shipments from Nebraska and other Plains States and rapid loading of increasingly large ocean-going vessels.

Withdrawal in 1996 of government from price-floor programs, following the earlier demise of storage-guarantees exposes grain elevators to greatly increased market uncertainties. Published railroad rate tariffs have given way, with the relaxation of the federal railroad regulatory environment, to uncertainties surrounding negotiated contract rates.

In short, enterprises in the revised system are of much larger scale, they accommodate vastly increased volumes of grain and are adapting to the complexities of an environment driven increasingly by market forces, including those emanating from the world at large.

CHAPTER 5

THE GRAIN TRANSPORTATION SYSTEM



The historic evolution of Nebraska's network of transportation facilities and the pattern of their contemporary usage have been shaped perhaps most significantly by four interrelated factors. First, agriculture is the state's major sector of economic activity; second, Nebraska's average density of population, at 20.5 persons per square mile in 1990, is 8th lowest of all states; third, the state is located in the heartland of the nation, far from major centers of population, commerce and industry and far from the port gateways to the world; and fourth, government has played a major historic role in the development, financing and regulation of transportation activities. In short, products of agriculture are heavy and bulky and often must be transported long distances to the markets of the nation and world. These realities of geography and natural resource endowment impose heavy demands upon the state's transportation system, conditioning both mode of transport and level of service and attracting both public assistance and regulation.

Regulation and Deregulation

Government land grants and other financial assistance were key factors in the building of the transcontinental railroads. Government built and continues to maintain both roadways and inland waterways. Government regulation of motor and rail carriers was a key element in shaping the pattern of development and operation of both of these systems.

Railroads were the first mode to be regulated, essentially as public utilities, by the Federal government. Much of the pressure for their regulation came from farmers in the heartland of the nation who, in the 1880s, relied almost exclusively on rail carriers for shipping their produce to distant markets and for delivering both production inputs and consumer items; they were often served by a single railroad which had ability as well as incentive to charge as much as the traffic would bear for their services. Because some shippers had fewer alternatives or in other respects were able to pay more than others, rates became highly discriminatory (Anderson and Mariska; Felton 1967).

Passage of the Interstate Commerce Act in 1887 resulted in the creation of the Interstate Commerce Commission (ICC). The ICC was charged with controlling the entry of new rail carriers in order that market shares might be sufficient to exploit economies of scale. In return for this protection from competition, railroads were subjected to ICC oversight of their freight rates and quality of service. In theory, regulation aimed to achieve cost efficiencies, rates which would pass the resulting savings along to shippers, and good service.

Theory and reality are perhaps seldom perfectly coincident and so it was with railroad regulation. The theoretical rationale for economic regulation of the sort applied to railroads in 1887 was that the industry was, first, a "natural monopoly," which is to say economies of scale were exceedingly large relative to the size of the market for the industry's service; and second, the industry provided a service of critical importance to its customers. The second condition was clearly met; a case has already been made for the vital importance of transportation, especially in its service to shippers of heavy, bulky goods and who are in relative geographic isolation from major actual or potential markets. As to the second condition, that of natural monopoly, the railroads were the only relevant mode of transport for commodity shippers across much of the nation, but particularly so for those in the heartland. Neither the motor truck nor the airplane had been invented in 1887 and inland waterways were neither developed nor available in their undeveloped form to the larger part of the shipping public. Moreover, the rail enterprise is one of great capital intensity. The fixed cost of constructing the roadway and acquiring the necessary motive power and rolling stock are enormous relative to the variable costs associated with the enterprise's operation. Thus it was imperative that the preponderant fixed costs be spread over a large volume of traffic. Furthermore, the temptation of an unregulated railway to discriminate among shippers, charging those most dependent on service excessively high rates and those with better alternatives less, is apparent. Charges by farmers, their collective cries voiced by the Granger Movement, that they were the victims of such discrimination, were instrumental in gaining the passage of the regulatory legislation. As regulatory experience evolved over the succeeding decades, discrimination was never eliminated, nor perhaps could or should it have been. The ICC sanctioned much discrimination on the basis of its being necessary to the coverage of full costs of railway ownership and operation (Anderson and Mariska; Felton 1967).

There is the further related matter of service and the financial capacity of the railways to provide it. Regulation limited the ability of railroads to reduce or withdraw service to shippers on their lines. Railroads were required to obtain ICC permission for track abandonments, often a lengthy and uncertain process. The ICC was similarly involved in rail-car distribution to shippers, having authority to issue "car service orders" directing the delivery of cars from one carrier to another (Anderson, Gaibler and Berglund; Felton 1970). These interventions notwithstanding, shipper service complaints were not quelled by regulation. Abandonment of little-used branch-line track was often delayed by regulatory forces but was rarely thwarted. Nor was the ICC able to deal administratively with car-supply problems whose root was in lack of financial incentives for carriers to meet fully the peak-load demands occasioned by seasonal supplies of grain in the face of more uniform demands. Track abandonment and car supply issues are discussed further in "Rail: Dominant Long-Haul Carriers," below. For further commentary on the implications of track abandonment see Anderson, Helgeson and Berglund (1976).

Pressure for regulation of trucking mounted during the Great Depression of the 1930s as regulation of railroads was increasingly complicated by growing competition from the emerging trucking industry. The industry lobbied for its own regulation, citing "disorderly" competition occasioned by truckers desperately competing for a rapidly diminishing volume of depression-era business. Congress responded with passage of the Motor Carrier Act of 1935, which brought commercial trucking enterprises under regulation, subjecting their rates and services to the scrutiny of the ICC in return for limiting the entry of new firms to the industry. Clearly the trucking industry was not, however, a natural monopoly. Economies of scale are small relative to market size and trucking assets are highly mobile, making exit from as well as entry to the industry quite easy. Its major financial assets, the trucks themselves, were both literally and figuratively highly mobile, and readily transferrable to other markets. The exercise of monopoly power was not an issue because the industry had an inherently competitive structure, comprised as it was of many thousands of small operators. Protection for the carriers, both truckers and railroads, rather than of the shipping public, was the rationale for this regulatory incursion.

Although farming interests strongly supported regulation of the railroads, they lobbied forcefully against extension of regulation to the trucking industry. Farmers were fearful that regulatory restrictions would hamper the free movement of their supplies and production. They perhaps could see clearly for themselves the competition that prevailed among truckers, commercial truckers of farm products at the time most often being farmers' relatives, friends and neighbors. Congress compromised by exempting the shipment of unprocessed agricultural products from regulation under the Act of 1935. The original act forbade any truck that had ever carried non-agricultural goods from enjoying the provisions of the agricultural exemption, although that restriction was later relaxed.

While the exemption gave truckers of agricultural products added flexibility, the fact that shipments of these commodities were outbound from farming areas while the preponderance of shipments of farm inputs and other goods were inbound, regulation of non-agricultural products shipments compromised truckers' ability to obtain back-hauls (Anderson and Huttsell).

Agricultural cooperatives, as carriers of agricultural products, were also exempted from major regulatory restrictions of the Act, giving them rights to carry back-haul traffic in non-exempt goods; Congress subsequently (in 1968) limited carriage of non-exempt back-hauls for non-members to 15 percent of total tonnage hauled annually (Anderson and Huttsell).

The passage of time made the lack of economic logic of the motor carrier regulatory solution increasingly apparent. Government regulations specifying what individual truckers could carry and what they could not, the routes they were to follow, the points they must serve on those routes and the frequency of service they were to provide detracted in a major way from operating efficiency. Carriers' rates reflected both this inefficiency and that of the artificial monopoly which regulation had created. It was also widely argued that competitive trucking and the already-unregulated water carrier systems would provide sufficient competitive discipline for railroads too and that railroading as well as trucking industries had ought therefore to be deregulated.

Sentiments for deregulation grew steadily over an extended period of time. Every U.S. president from Kennedy through Carter called for legislation aimed at trucking deregulation. Passage by Congress came finally, in 1980, during the Carter Administration. The Staggers Act of that year substantially deregulated the railroads and the Motor Carrier Act of 1980 did much the same for the trucking industry (Anderson and Huttsell). An especially meaningful feature of the latter act was its provision for much freer entry of new firms into the trucking business.

Today the division of traffic among the three major modes of bulk freight carriage is largely determined by the inherent comparative advantage of each. The deregulation of both railroads and trucks has made competition the key consideration in the allocation of traffic among the modes. The long-haul transport of grain falls mainly to carriers specializing in bulk commodities -- railroads and inland barge lines and the ocean vessels with which they interface at ports, especially those on the Gulf of Mexico and Pacific Ocean. The latter two modes have never been subjected to economic regulation. Railroads are the primary long-haul carriers of Nebraska grain. Barge shipment of grain and soybeans through Missouri River Ports is important to producers adjacent to the river, but of limited consequence for the state as a whole. Trucks move the grain to rail or (occasionally) barge heads and are the carriers of choice for shipments to local processors.

Trucks: Short-Haul Specialists

The trucking industry is of relatively recent origin, having come into being between the two world wars and having blossomed into prominence during and after World War II. The industry was still relatively new even by the 1950s; trucks were not major haulers of grain to, let alone from, country elevators until after the war. Horse- and, later, tractor-drawn wagons and trailers moved farmers' grain into country elevators and railroads moved it out. And of course major highway improvements, including the building of the Interstate Highway System, have been made since the war. These developments were beginning to affect the modal pattern of grain movements by the 1950s. Miller and Nelson (1962) found that truckers in the '50s were highly competitive with railroads for the shorter-haul traffic, and were becoming more so; they had also, by that time, begun to provide some measure of service to out-of-state destinations.

Nebraska today has an extensive system of roads and highways, comprising 95,883 miles of public roads. The state highway network, nearly all of which is hard surfaced, accounts for 9,951 of the total; 481 miles are part of the Federal Interstate Highway System. Some 600 miles of highways have been identified for upgrading over the next several years to expressway standards, including a route which will connect Scottsbluff with Rapid City, South Dakota; U.S. Highway 81 from border to border; and Nebraska Highway 2 from Lincoln to Nebraska City, the latter completing a four-lane connection between I-80 west of Lincoln and I-29 in Iowa (Nebraska Department of Roads). Some of the construction was in progress as this was being written in the summer of 1996.

Almost 93 percent of the 78,496 miles of locally-maintained rural roads are unpaved; most form the rectangular grid laid out at one-mile intervals during the original land surveys in the 19th century. The grid pattern is most characteristic of country roads in the eastern half of Nebraska, the source of most of the state's feed grain and soybean production; these roads, along with the primary roads connecting most communities, serve as the network of grain-gathering roads. The pattern is similar, although somewhat less dense, in the wheat-growing areas of the panhandle and southwest.[1]

Bridges are a large part of the roadway investment and present some costly maintenance problems. The total number of state bridges in 1992 was 15,668; counties are responsible for 74 percent of them; 6,017 or 38 percent of the total have been identified as being deficient either structurally or functionally (U.S. Department of Transportation). Branch-line abandonment and related developments outlined below (see "Rail: Dominant Long-Haul Carriers" section) have resulted in larger trucks operating over longer distances in moving grain to and from collection points. Meeting

[1]Information in the foregoing two paragraphs is from various Nebraska Department of Roads unpublished sources.

the needs of this growing volume and intensity of truck traffic presents an expanding challenge to state and local road construction and maintenance authorities.

Trucks compete actively for shorter-haul movements of grain away from country elevators, provisioning local cattle, hog and poultry operations and grain processors in Nebraska and adjacent and nearby states to the south and west. Virtually all shipments from farm to elevator are by motor carrier. Tight supplies of rail equipment and availability of back-hauls have at times combined to prompt truck movements of several hundred miles. Wheat, for example, is sometimes trucked 400 or more miles from western Nebraska to elevators or mills in Lincoln and Omaha, via Interstate 80, a route paralleling the mainline of the BNSF and UP Railroads (Anderson 1987).

Demands for soybean movements to processors in eastern Nebraska are supplied almost entirely by motor carrier. Nebraska feed grains are often trucked to feed lots in eastern Colorado, sometimes to poultry producers in Arkansas and regularly to feed lots in Kansas, Oklahoma and northern Texas. The limited scope and relative circuity of the north-south rail system in the Great Plains and the considerable dispersal of buyers are factors in the truckers' competitiveness in serving southern feed grain markets. Availability to truckers of back-hauls of fertilizer and other products may be equally important, trucking deregulation in 1980 having facilitated access to these back-hauls.

Rail: Dominant Long-Haul Carriers

Rail has long been the dominant mode by which grain has moved from Nebraska elevators; it remains overwhelmingly dominant in shipments moving beyond the state's borders. Nebraska's rail lines are part of a national rail network which competes with barges for the greater part of the national long-haul traffic, although trucks have become increasingly competitive for hauls to some relatively distant inland points as noted above.

Ten railroads, operating over 4200 miles of track, served Nebraska as recently as 1984. The Burlington Northern (BN) had more than 54 percent of the track, the Union Pacific (UP) nearly 30 percent and the Chicago and North Western (CNW) 10.5 percent of total state trackage. The BN and UP together carried more than 89 percent of total tonnage and accounted for some 98 percent of the state's rail ton-mileage in 1984 (Nebraska Department of Roads 1986). Nebraska's major rail carriers also ranked high nationally in the grain transport business. Measured in revenue car-loadings of grain, BN ranked first among U.S. railroads in 1985, UP was in second place and CNW was fourth (Association of American Railroads, 1991).

By 1993, the BN and UP were the only railroads of consequence providing service to the state. They, together with the Chicago and Northwestern (C&NW) and eight short-line railroads operated 4,093 miles of track in Nebraska. The BN had 2,284 miles of track, the UP 1,049 miles. Abandonments have reduced total track in the state by 1,518 miles since 1970. Another 461 miles had been identified by the railroads as candidates for abandonment, including the C&NW's 320-mile route between Chadron and Norfolk.[2] The C&NW has subsequently abandoned its line across Nebraska.

[2]Discussions with Nebraska Department of Roads officials, 1994.

Because grain shipping patterns tend to have pronounced peaks and valleys over time, because provision of carrying capacity sufficient to meet peak demands for service would result in costly surplus capacity at other times, and because ICC restrictions limited carriers' ability to key rates to changing temporal demands, railroads were historically unwilling or unable fully to meet peak demands. These variations in demand in the context of relative availability of service are reflected in turn in varying temporal, modal and geographic patterns of grain traffic. The destination of shipments may be affected by car availability as when one railroad has cars and another does not or when cars are owned by some terminals or mills and not by others. Truck and barge traffic may expand when rail cars are not available. Linsenmeyer (1979) reported, for example, that during ". . . the 1979 post-harvest period access to rail cars was such a critical factor that [car] availability, not necessarily competitive grain pricing, determined the timing and destination of grain sales."

"Car shortages" are usually manifested in a failure of railroads to meet shipper requests for cars, although other (somewhat longer-term) bottlenecks may be occasioned by insufficient locomotive power, track sidings, track carrying capacity or other elements in the system. Freight-car shortages have been a source of shipper concern since the earliest days of rail service to the Great Plains; they were the subject of the very first case docketed before the ICC, several shippers having complained that the St. Paul, Minneapolis and Manitoba Railroad Co. had denied them cars (Holbrook v. St. Paul, Minneapolis Railroad Co.).[3]

Access to rail cars was a particularly contentious issue in the late 1970s. Outmoded box cars were being rapidly retired from service. Hopper-car fleets were growing, but not fast enough to keep up with growing demand for service prompted by expanding export markets. Meanwhile, railroads

[3]For further discussion of rail-car issues see Felton (1970).

continued to be restricted by regulatory authority from using flexible pricing to moderate seasonal-peak car orders and to provide incentive to acquire more cars. The potential benefits from having a more even movement of grain over time through the marketing system were accentuated by the growing fixed investment in handling as well as transportation facilities and equipment. For the system at large, a high level of utilization of fixed investments favored production-oriented storage and gradual flows of grain to market. In the absence of rail pricing incentives, limited car supplies serve to ration peak-season shipments and provide for a more even flow of grain through time.

Shippers began buying and leasing cars in the 1970s in efforts to gain assured service. The Federal tax code provided incentives for independent investors to do the same (Linsenmeyer). Sharply increased interest rates in the 1980s and problems in keeping the cars in use over the longer term (the same problems which led to a failure of railroads to provide car capacity sufficient to meet peak-load demands) created financial difficulties for many of these erstwhile railroaders. Elevators were piling farmers' grain deliveries on the ground when their storage space became filled and grain continued to arrive faster than rail cars could be had to carry it away. Similar circumstances have prevailed at many elevators in many harvest seasons.

In a free market setting, prices (rates) for transportation services would be responsive to these variations in demand, rising as demand intensifies, falling as it wanes, providing service to all who are willing to pay at the going rate and providing incentives as well for long-term adjustments in car supplies. But as a regulated industry, railroads were required to publish their rates in tariffs which could not readily be adjusted to rapidly changing demand conditions; nor did rates have a built-in seasonal element to key them even to anticipated post-harvest surges in grain supply and transportation demand.

Although deregulation in 1980 relaxed the requirement that railroad rates must have ICC approval, which could be gained only by means of a long and tortuous process, carriers have been slow in exercising their newly-gained pricing freedom. UN-L Professor Emeritus J.R. Felton (1970) outlined the elements for such a market-driven allocation system as early as 1970, a decade before deregulation, suggesting at the time its implementation by the ICC; but the idea languished until the BN (now the BNSF) finally adopted a version of it in its Certificates of Transportation or "COTS" program in 1996. The new pricing scheme separates transport charges into two components, one for the haul itself and another for the use of the rail cars. COTS charges in theory had ought to be bid up during periods of seasonal demand peaks, encouraging shippers to delay moving their grain until times when COTS are priced more favorably.

These innovations notwithstanding, complaints of car shortages persist to this day. Long delays in railroads' filling shipper car orders were reported in late 1995 and well into 1996 as strong demand for grain and high grain prices brought the commodities out of storage, putting extraordinary demands on the transportation system. Some of the car shortfalls on BN lines reportedly were compounded by problems that the railroad was having in absorbing its recent acquisition of former C&NW trackage in Iowa.[4] Problems were especially intractable in the fall of 1997 when this paper was being readied for press. Record crops, a strong economy and resulting high demand for rail transport of other goods, and Union Pacific's problems in absorbing its recent merger partner Southern Pacific combined to create major difficulties in meeting shipper car demands.

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[4]Interview with Michael Turner, *op. cit,* June 23, 1996. The BN had also merged with the Santa Fe, the combination now known as the Burlington Northern Santa Fe (BNSF).

As the end of the century approaches, the rail enterprises serving Nebraska and the nation, in spite of some apparent remaining problems, have become generally better-managed and much more financially-secure businesses. The new order is in sharp contrast with the old. The period immediately following World War II was a time of chronic financial difficulty for the railroads. Public investments in highways and inland waterways had combined with carrier innovations to make these competing modes increasingly efficient. Higher-valued traffic, where timely and convenient service was of more concern to shippers than the rates charged, was diverted to an expanding system of motor and even air carriers. Unregulated barges and unregulated motor carriers of unprocessed agricultural products were competing effectively for some bulk traffic, grain in particular, which had traditionally been carried by the railroads. The St. Lawrence Seaway opened for business in 1959, competing for bulk traffic moving from North Central States toward the Eastern Seaboard. The railroads were hampered in their response to these growing threats by their own uninspired management and by unenlightened government regulation. Nor had there been strong incentive for cost-containing innovations in a regulated environment in which revenues were the product of some prescribed rate of return and the carrier's asset base. For carriers seeking higher rates, the incentive to inflate the asset base is apparent. Averich and Johnson pointed out this flaw in public utility regulation in a much-cited paper in 1962.

Railroad management persisted, in fact, with the acquiescence of the ICC, in the view that higher-valued products could be made to bear much higher rates than lower-valued goods, even in the face of an obviously major diversion of freight traffic to the motor carriers. Passengers as well were abandoning the railroads in droves in favor of faster and more convenient options afforded by automobiles, buses and airplanes. A number of U.S. railroads became bankrupt, including, most prominently, the Penn Central in the northeast. In Nebraska, the Milwaukee Road and the Rock

Island both became insolvent, most of their trackage in the state eventually being abandoned. The very concept of economic regulation had become outmoded for an industry whose economic power was being increasingly eroded by competing forms of transport.

The recession of 1958 was a particularly difficult time for U.S. railroads, but a time of reawakening as well. The rail carriers had been seeking, to that time, redress of their financial woes in general freight rate increases, and were supported in this stratagem by the ICC. Nearly all railroad rate requests before the ICC from 1955 through part of 1958 were for increases, as carriers struggled to deal with low rates of return. The resulting diversion of traffic over time to competing modes had even more dire financial consequences. But the turnabout was sharp when it finally came. By 1958, railroad management was finally being jolted into an awareness that the forces of competition were not to be ignored. As Ulrey (p. 20) put it, ". . . the need to meet intermodal competition for specific hauls became the major determinant in railroad proposals for rate changes." Rate reduction proposals became the order of the day. And Federal regulatory authorities began finally to be responsive to this imperative. For all commodities, the index of rail rates (1950 = 100) declined from 121 in 1958 to 105 in 1965. The ICC was slower in adapting; only by the late 1960s did it begin to accept railroad requests for rate reductions on a routine basis (Ulrey).

Pressures for railroads to innovate in their service to shippers of agricultural products became especially strong owing to the generally unregulated nature of competing modes, the barges and the trucks. Barges competed for long-haul traffic and trucks, unregulated in the carriage of raw agricultural products, had become effective competitors for short- and sometimes intermediate-length hauls of grain by the 1950s. But ICC reluctance to sanction rate experimentation had dampened carrier incentives to seek cost-saving innovations in support of rate reductions.

Finally, however, the dam broke and major reductions in export rail rates for grain began to be approved, beginning slowly in 1957, the tempo picking up in 1958, and continuing through about 1962. These rate cuts were associated with more limited transit privileges and inspections (they came to be known as "bare-bone rates") and were aimed at being competitive with barge, truck, and combination truck-barge rates. The first of these new rates were, for the most part, for shipments to the Gulf and Pacific Northwest from origins in Montana, Oklahoma and Kansas (Nightingale).

Railroads pressured the ICC to approve even sharper rate reductions justified by radical cost-saving innovations compared with the old single-car, widely-blanketed system of rates. The Southern Railway System succeeded in 1965, after a four-year struggle with the ICC and the courts, in the renowned "Big John" case, in gaining ICC approval for deep rate cuts for shipments in blocs of five 90-ton, "jumbo" cars from a single origin to a single destination. The new rates applied to shipments of wheat from Ohio and Mississippi River crossings to destinations in the southeast. Resulting rates for five-car shipments between Kansas City and Atlanta were 44.4 cents per cwt, compared with 86.5 cents for the old single-boxcar rates. Flour rates were unaffected, remaining at 86.5 cents. The new rates set in motion a course of events which was to radically alter over time the patterns of grain and grain product shipments and the locations of production and processing activities (Nightingale).

The Southern filed a unit-train export rate for grain moving from Louisville, KY to Charleston, SC in September 1965. The rate was challenged (unsuccessfully) by the Kansas City Milling Company, which voiced concern that the spread of non-transit rates would jeopardize the milling industry. The new rates were a sharp departure from the ICC's insistence in 1930 that wheat and flour should take the same rate. The latter dictum had served to secure the position of intermediately-located millers. The proposed new rates, it was feared, would handicap Kansas and Missouri River millers, located as they were intermediate between wheat sources and flour buyers. In any case, flour shippers were in no position to move lots as large as five 90-ton cars from a single origin to a single destination, even if equivalent rates had been offered (Nightingale). The fears were not unfounded. The wheat/flour rate differential effectively sealed the doom of production- and intermediately-oriented wheat-flour milling. Flour milling commenced a long-term decline in the Great Plains, a concurrent expansion in the southeast and elsewhere (Maillie and Solum).

By April 1965 the Southern Railway had a fleet of 1,075 100-ton covered-hopper cars and other railroads were rapidly following its lead. The Soo Line and Pennsylvania Railroads published a joint unit-train wheat tariff from Duluth/Superior and Minneapolis to Buffalo, NY which was 45 percent of existing rates. Other competing lines soon filed identical rates (Nightingale).

Meanwhile, the southeastern region of the United States was experiencing growth in population and making rapid economic progress. Cattle, hog and broiler production was expanding rapidly. The area was becoming increasingly deficit in both food and feed grains. Barges and trucks, unregulated as to rates and services for shipments of basic agricultural products, responded by expanding their service into the area in the early 1960s. The grain traffic provided a back-haul for truckers carrying fruits and vegetables toward the north and west. The Big John case and the emulations it encouraged characterized railroads' attempts to compete with barges and trucks for the rapidly-growing traffic (Nightingale).

Once given initial government regulatory approval, the new technology spread rapidly. The new rate structure generally disallowed transit stops for storage, milling, elevation or mixing, and subjected the grain to increased charges for demurrage and switching. The demise of the old system of staged handling was sealed. The revised system featured more rapid turnaround and thus improved utilization of cars. Equalized opportunity gave way to the forces of economic reality which generally dictated that storage and processing activities be oriented toward either production or final market, not somewhere between. Location of facilities, a factor whose importance had heretofore been minimized by economic regulation, began to matter a great deal. Storage generally became most efficient near points of origin, and processing most efficient at either origin or destination, depending heavily on costs of shipping raw vs. finished products (Nightingale).

Recent growth in "factory" hog finishing operations in North Carolina may be seen as a continuation of this trend. While state laws restricting large-scale pork production enterprises in Nebraska and elsewhere may be a factor in the acceleration of production in the southeast, technological changes, leading to lower-cost transportation and to larger returns to scale in hog and poultry production, are perhaps more fundamental factors. Significant deregulation of rail and truck transportation in 1980 has both enhanced incentives for seeking and applying new rail technologies and widened the scope for back-haul truck traffic. While Nebraska may not be a major source of feed grains moving to the South Atlantic States, it is an important supplier to poultry operations in Arkansas and, of course, growing southern markets for grain from the eastern Corn Belt have released export opportunities for western Corn Belt shippers.

While the traditional system of single-car railroad rates remains in place and may serve as a bench-mark against which other rates are quoted or negotiated, it attracts few shippers aside from those too small to qualify for the more favorable multiple-car rates. Even the smaller shippers make limited use of the traditional rates since they often have better alternatives, including participation in "protected" 50- or 54-car shipments through other collection points, participation in multiple-origin train shipments and, of course, truck service. Although much less used than in the past, transit rates have continued to draw some wheat from some of the smaller elevators to terminals such as Kansas City, Hutchinson, and Wichita, Kansas (Anderson 1987).

By the mid-to-late 1980s, most rail shipments were moving in train lots of 25 to 75 cars each under either tariff or negotiated (contract) rates, with the latter having become predominant. Some larger elevators today load 110-car trains for shipments to Gulf and southeastern destinations. While contracting may have been slow to become established once it had become legal -- the first BN contract was not put in place until the fall of 1982 -- it was by 1987 the dominant means for the pricing of rail shipments of grain from Nebraska. Officials of some of the larger elevator operations estimated in the latter year that at least half of all Nebraska grain out-shipments then going by rail and 90 percent or more of those going directly to ports of export were moving under contract rates. Contracting has been much more widely used for feed grains than for wheat, a significant amount of wheat continuing by 1987 to move under transit billings (Anderson 1987). Some wheat shipments still used transit billings in 1996, but the proportion has greatly diminished.[5]

The removal in January 1987 of the requirement that rates and other terms of contracts be kept confidential from the public may have dampened somewhat carrier enthusiasm for contracting, although greater price flexibility remains a legacy of the 1980 Staggers Act (Association of American Railroads 1988). It is safe to say that virtually all train-load grain shipments now move under contract rates, most negotiated by recipients rather than shippers of the grain.

U.S. railroads as a group are clearly more efficient and far more financially secure today than they were in the 1950s. The UP and the BNSF, the two lines providing nearly all of Nebraska's rail

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[5]Interview with Professor Michael Turner, Department of Agricultural Economics, UN-L, June 23, 1996.

service, are the largest and perhaps the strongest of the lot. Improvements stem in part from rail managements' eventual recognition that growing barge and truck competition had rendered obsolete their complacency about the operation of businesses under the protection of public utility status. Second, the ICC began in the 1960s to be supportive of more aggressive competitive actions by the railroads. Economic regulation of the railroads was further eroded by a much more relaxed ICC administrative stance in the mid-1970s. Finally, Congress ratified and expanded upon this "administrative deregulation" with its passage of the Staggers Act in 1980 and abolition of the ICC in 1995, what was left of the latter agency's duties being absorbed by the Department of Transportation and the newly-created Surface Transportation Board (STB).

The revitalization of the nations's railroads stems ultimately from a series of innovations the carriers have been impelled to take toward improving the efficiency of their operations. The more important of these include adoption of diesel locomotives, centralized traffic control systems, automated classification yards, covered hopper cars and unit-trains; installation of heavier and continuous-welded track; gradual abandonment of large portions of an extensive system of branch-lines not applicable to unit-train operations; extensive mergers which have consolidated duplicative managerial functions and facilities; and evolution of a more realistic pricing policy, making the railroads more competitive for traffic for which they have greatest comparative advantage (Felton and Anderson 1971).

These changes have had implications for grain producers and handlers, who have in turn had to make major adjustments of their own. Changes made by both railroads and shippers have been enormous and the process of change continues. Nebraska's only two railroads of consequence, the BNSF and the UP, have recently undertaken major mergers, leading them to become increasingly dominant on the national scene as well.[6] The nation's railroads today carry far more grain than ever before and they do it with a smaller car fleet and a much smaller system of trackage. Average car size is of course larger than ever and train size longer. Although the railroads have lost the larger part of their higher-value traffic, they remain dominant in the long-haul carriage of bulk commodities, especially grain and coal.

While rail carriers are operating more efficiently, the jury is still out on the question of the extent to which cost savings will be shared with shippers in the longer term. The new railroads are much larger in average size and vastly reduced in number. Will the forces of competition, in the absence of regulation, be sufficient to force rates in line with reduced costs in this more concentrated industry? Will competition among the railroads, in combination with that from motor and water carriers, prevent monopoly pricing and unwarranted discrimination? While the long-term combined effects of the forces of deregulation and the major technological changes and carrier reorganization that have swept over the industry with such great force have yet to be played out, experience to date seems generally to have been positive.

[6]Major mergers in the 1990s -- the BN and the Santa Fe, creating the Burlington Northern Santa Fe; and those of the UP with the Missouri Pacific and the Southern Pacific -- have vastly expanded the size and market coverage of the two remaining carriers.

Barges: A Minor Factor[7]

Historically, 50-60 percent of U.S. corn shipments and 60-70 percent of soybean exports have moved to ports by barge (U.S. Department of Agriculture 1993). Barges are inherently well suited to carry heavy, bulky, relatively low-valued products such as grain. Average shipment size dwarfs that of competing carriers. A single barge 35 feet wide and 195 feet long (the most common size) holds 1,500 tons (more than 53,500 bushels of corn), or as much as 15 one-hundred-ton railroad hopper cars, or 60 motor trucks. Moreover, these barges are lashed into tows of as many as 40 barges each (Gaibler 1977).

Barge has traditionally been the lowest-cost mode for long-distance transit of bulk commodities where conditions permit movement of the traffic in lot sizes large enough to capture the economies. Average barge costs per ton-mile for all commodities carried in 1979, as an example, were approximately 0.5 cent per ton-mile compared with 2.3 cents by rail and 9.9 cents by truck (Barksdale 1979). Moreover, barges are more fuel-efficient than competing modes. A gallon of diesel fuel moved a ton of freight in 1972 an average of 276 miles by barge, 197 miles by rail, but only 53 miles by truck (Federal Energy Administration 1974). Finally, waterways are available and apparently physically capable of carrying more traffic. No government regulations limit the entry of new barge carriers, and potential sites for new or expanded river grain terminals are clearly not exhausted.

Barge traffic on the Missouri River is greater than it was in the 1950s, before major navigation improvements were made by the Corps of Engineers, but is highly variable from year to year and is but a trickle on average in comparison to the vast amounts shipped on the Mississippi River and its tributaries, the Ohio and the Illinois Rivers (U.S. Army Engineer Institute for Water Resources 1979).

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[7]This section draws heavily from Anderson (1979).

There are good reasons for the disparity in volume of traffic between the two rivers, reasons which make it unlikely, short of Federal subsidies even more massive than those of the past, that the Missouri River will ever be a major artery of grain traffic.

Total tonnage of grains moved anywhere on the Missouri River declined sharply from a peak in 1979 of 1.3 million tons to only 399 thousand tons in 1992. While there are large variations from year to year owing to variations in grain supply, demand and river conditions, the trend has clearly been downward from the late 1970s when strong export demand was a major factor in heavier use of the river (*Waterborne Commerce of the United States*, cited in Fruin and Halbach).[8] Table 5-1 has further detail on trends since 1955.

Barges are thus of minor significance in Nebraska's grain transport picture. Very modest amounts of grain are moved down the Missouri River (U.S. Army Corps of Engineers), and the railroads compete aggressively for Gulf markets. Its merger in 1982 with the Missouri Pacific gave the UP direct access to the Gulf. Both BNSF and UP can reach either Gulf or Pacific Northwest (PNW) markets and both have access to the growing Mexican market.

The problem is not a shortage of marketable grain in Nebraska and other states adjacent to the Missouri River. Nor is it a regulatory problem limiting the entry of new firms or the efficiency of existing carriers. Nor is there a lack of handling facilities on the river. Nebraska has 19 barge terminals on the Missouri River at seven locations between Blair and Brownville. Ten of the terminals ship grain; some are specialized in one or two products, with grain, fertilizer, cement and molasses

[8]Total movements of grain and grain products on the segment of river between Sioux City and Kansas City in 1955 were 16,997 short tons. The volume in 1958 was 46,858 tons, increasing to 533,217 tons by 1968; 1977 was one of the high points, with 1,012,828 tons carried. Movements have since declined, to 447,107 tons in 1985, only 291,000 in 1993, the latest year for which data were available (Table 5-1 and U.S. Army Corps of Engineers various years).

being frequent specializations. The actual limits to traffic expansion are inherent in the nature of the river itself (Anderson 1979).

The Missouri River is shallower, narrower, swifter and has more and sharper bends than the Mississippi, the Ohio or the Illinois. Traffic on the Missouri must accommodate to these limitations. The average number of barges per tow on the Missouri in 1976 was 3.25 between Sioux City and Rulo, NE and six plus between Kansas City and the mouth.[9] As a general rule, tows are limited to two barges from Sioux City to Omaha and four from Omaha to Kansas City (see "Despite Millions Spent, River Isn't Answer 1979). Nine per tow from Kansas City to the mouth are common. By contrast, 15 barges per tow are normal on the upper Mississippi, the Ohio and the Illinois, although adverse river conditions sometimes limit the number to 9-11. Below St. Louis, 30 to 35 barges are the usual number, and occasional tows contain as many as 40 (Gaibler 1976 and 1977).

Minimum navigable depth of the Missouri River is only eight feet, compared with nine on the Mississippi and its other navigable tributaries. As a result, 195-foot barges on the Missouri are filled to an average of only 1,350 tons, only 90 percent of their 1,500-ton capacity (Anderson 1979).

Ice and low-water conditions limit the average operating season on the Missouri to about eight months or a little less. The Ohio, Illinois, middle and lower Mississippi Rivers are open all year. The upper Mississippi (north of the mouth of the Ohio to Minneapolis) is open about eight months per year (Anderson 1979).

The only major advantage of the Missouri River is its freedom from locks. The 30 locks on the Mississippi River above St. Louis were costly to build, are expensive to operate and impede the

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[9]Telephone conversation with Mr. Ronald Roberts, U.S. Army Corps of Engineers, Omaha, Nebraska, September 19, 1979. Roberts indicated that it was possible at times to move six-barge tows as far north as Omaha.

flow of traffic (Schnake and Franzmann). As a whole, however, the Missouri is far more costly both to navigate and to maintain in navigable condition. The river is relatively expensive to navigate, even though all of the development and most of the waterway maintenance and operating expenses are borne by the public rather than the carriers. One study reported costs to the carriers of barging grain from Sioux City to New Orleans were 0.40 cent per ton-mile, while those from Dubuque, Iowa on the Mississippi River were only 0.25 cent (Moser and Wolverton). The smaller tows of unfilled barges on the Missouri are more costly to operate per ton-mile of cargo, including costs of fuel per ton-mile of operation. Ton-mile fuel comparisons, in fact, are misleading for river traffic in general, since the river routes are more circuitous than competing rail routes, involving in some cases substantially longer hauls. Estimated public waterway costs for the Missouri River, based on 1973 traffic levels, were 1.30 cents per ton-mile, those for the entire Mississippi only 0.02 cent and those for the Ohio and Illinois Rivers 0.04 cent per ton-mile. About one-half of these costs may be attributable to navigation needs (Bunker).

The imposition of user charges high enough to cover variable maintenance and operating costs, a long-sought goal of those who would reduce the dependence of American industry on government subsidy, would probably kill all traffic moving on the Missouri River. A 1977 study in Illinois (Bunker) found that user charges of 0.2 cent per ton-mile would reduce grain traffic out of central Illinois on the Illinois River by 94 percent. A charge of 0.25 cent would divert all barge traffic to the railroads. Truck traffic would decline as well, with the cessation of short-haul movements to river terminals. User charges sufficient to cover the 0.65 cent per ton-mile costs of keeping the Missouri navigable at the time of the study would obviously end all commercial freight traffic on that river. Charges at the lower levels considered in the Illinois study would affect traffic on the Missouri

River much more adversely that than that on the Illinois River since carriers' costs on the Illinois are lower than those on the Missouri.

A 1978 study at Virginia Polytechnic Institute (Binkley, Havlicek and Shabman) determined that traffic on the Mississippi River would be affected very little by imposition of user charges aimed at recovery of 100 percent of variable maintenance and operating costs. Traffic on the Missouri, however, would be drastically reduced if the charges were levied uniformly across all waterway traffic, and eliminated if the charges were aimed at recovery of costs specific to each segment of the waterways system. Uniform tolls would limit the grain gathering area to a much narrower band along the river than that served at present.

A system of tolls was phased into effect October 1, 1981, with imposition of a four-cents per gallon tax on diesel fuel consumed by tow boats. The tax increased by two cents per gallon annually through 1985 when the rate reached 10 cents. While the effective tax rates per ton-mile of traffic do vary inversely with efficiency of the various barging operations and therefore have a relatively larger impact on Missouri River operations, the overall incidence is relatively uniform across all rivers and the level falls far short of full recovery of costs. The tax does, however, serve to make barges at least that much less competitive with the railroads, and those on the Missouri River a little less so than those on the Mississippi.

Railroads serving Nebraska have been able to compete effectively with barge lines for the export grain traffic; they had become adept, even prior to deregulation in 1980, at setting their rates to compete for traffic they find remunerative. A 1971 University of Nebraska study found that barge traffic was a significant factor in the level of rail rates from eastern Nebraska to the Gulf Coast (Anderson and Mariska). It is evident that rail carriers serving Nebraska have been intent upon preserving their long-haul grain-hauling advantage. Unit-train rates have done much to reinforce that advantage.

The relative competitiveness of barges with railroads for export shipments at any given time depends also on how competitive ocean vessels are for grain traffic in Pacific Rim markets. To illustrate, ocean shipping rates increased in the 1970s, tilting the comparative advantage of Nebraska grain in meeting Asian market demands from Gulf to Pacific ports and, thereby, from Gulf-bound barges to Pacific Coast-bound railroads. The disadvantage of longer ocean voyage times from Gulf ports to Pacific Rim markets grows with increasing unit transport costs. The need for passage through the Panama Canal also limits the size of Orient-bound vessels loading at Gulf ports, becoming a more critical cost issue when ocean rates are higher.

Relative Gulf vs. Pacific Port shipping rates are affected by demands on the world ocean-going fleet, which in turn are affected by the state of the world economy. The healthier the world economy, the greater the demand for shipping service and the higher the negotiated ocean shipping rates These rates have never been regulated and are free to fluctuate with the dictates of supply and demand.

Ocean shipping costs also increased in the 1970s because of the steep rise in petroleum prices following the formation of the OPEC cartel. The petroleum price rise in turn provided incentive for controlling fuel conservation by reducing vessel speeds, which in their turn increased vessel turn-around times, reducing carrying capacity of the fleet and competitiveness of operators faced with longer hauls. Gulf shipments were thus more adversely affected than those from Pacific Coast ports.

Favorable unit-train rates for western rail shipments were the critical factor in the rise of the West Coast market, setting the stage for the interplay in these Gulf-Pacific Coast relationships. But while the system for moving grain through Pacific ports is in place and accommodates at any given time a large part of Nebraska's exports, the Gulf market is much the larger of the two for the grain exports of the nation. The same generally can be said for grain export shipments from Nebraska, which go in most circumstances predominantly by rail to Gulf markets. The Pacific Coast has functioned in this respect as an overflow market.

In short, while barge traffic has indeed expanded since the 1950s, the significant increases have occurred on inland waterways other than the Missouri River. Traffic on these waterways is likely to continue to grow relative to that on the Missouri. Unfortunately, the costs of barging grain on the Missouri are high relative to costs of water movements on the other major inland waterways and high relative to costs of long-haul rail movements to Gulf or Pacific ports. There are no significant long-term barriers to increased barge traffic on the Missouri River except the relatively high costs of the traffic.

Summary

Because grain is heavy and bulky and must be moved long distances from its sources of production in Nebraska to ultimate markets in the nation and world, an efficient transportation system is of critical concern to the state's agricultural interests. Major changes have overtaken the system since the middle of the twentieth century, most bringing improved efficiency.

Among the more important developments have been the invention and application of the 100-ton covered hopper rail car, the initiation of unit-train shipments, development of more efficient rail-car classification and train-control systems, the adoption of diesel locomotives, installation of heavier and continuous-welded rail track, the gradual withdrawal of railroads from grain-gathering functions through track abandonment and the phasing out of most transit rates, and consolidation of railroads into fewer and larger lines. These innovations have been complemented by consolidation of country elevators into larger units serving larger gathering areas and the upgrading of port-elevator facilities on the West Coast.

Government has shaped the transportation system through its role as developer, financier and regulator of transportation activities. Although its role in funding railroad activities has long passed, government continues to be the builder and maintainer of the rural-road, highway and waterway systems. Government's role as a regulator of railroad and trucking business, a pervasive factor in how and where grain was marketed through the 1970s, has now been vastly reduced by the effective deregulation of these industries occurring in 1980.

Government-funded roads and highways have been critical to the rapid ascendancy of trucks in short-haul markets. Deregulation has reinforced the comparative advantage of trucks in shorter hauls as well as that of railroads in longer hauls. Market forces have become far more important in the allocation and termination of transportation investments and in the nature and pricing of transportation services. Thus, deregulation of freight transportation has had profound implications for the pattern of marketing of the state's grain production.

Government's recent actions relaxing regulatory constraints and its long-term role in building and improving the system of roads and highways have hastened the rate of changes coming from private sources. Results have favored trucks as the first gatherers of marketed grain, enhancing this mode's efficiency in meeting shorter-haul transportation needs. Railroads, for their part, have become the mode of choice for shipments to ports and most other more-distant destinations. Deregulation has given both rail and trucking industries increased managerial freedom as well as improved incentives for creating and adapting to the forgoing changes. Grain-flow survey findings reported in succeeding chapters support the common understanding of the clear shift in short-haul advantage to the trucks along with a concurrent trend toward railroad domination of long-haul traffic.

Rail-car shortages have been a long-standing and continuing phenomenon. Railroads have not moved decisively in the post-regulatory era to price their services according to seasonal demand variations. Thus, the seasonal if not the annual pattern of grain flows reflects in part the availability of cars which in turn is affected by supply and demand conditions for the grain itself. Seasonal pricing of rail services would encourage a more gradual flow of grain through the system and therefore an improved utilization of fixed investments in transportation as well as other elements in the grain marketing system.

Missouri River barge traffic has never been regulated, but neither has it ever been a significant factor in meeting the needs of Nebraska grain shippers, owing to the physical limitations of the river itself. Barge traffic has declined steadily since the late 1970s, while long-haul rail shipments have attracted a growing share of a growing volume of production and marketings.

The present transportation system is more than ever market-driven; traffic is allocated among truck, rail and barge modes much more nearly in accordance with their relative comparative advantage. The revised order has had major implications for grain shippers and handlers as well as for the transportation industries. Rail rate adjustments, for example, have affected the location of facilities, even whole industries. Flour mills moved, after wheat shipping rates were reduced relative to those for flour, from locations in production areas and places intermediate to production and consuming areas, toward urban centers of flour consumption. Grain elevators too have had to make major adjustments, terminals and subterminals losing grain supplies once coming from country elevators have had to play other roles. Country elevators losing their rail service, or their business to train-loading competitors, are either adapting to new roles or leaving the industry. One important factor in the growing concentration of hog and poultry operations in the southeast is the growing availability of competitive transportation for their feed requirements. Changing transportation rates and services have indeed had widely-felt effects.

Table 5-1. **Missouri River Downstream Loadings, Grain and Grain Products, by River Segment or Port[a], Selected Years, 1955-1993.**

Commodity/Origin	Year					
	1955	1958	1968	1977	1985	1993
	(Short Tons)					
CORN						
Sioux City to Kansas City	2,977	25,073	1,324	147,224	21,954	12,000
Kansas City to Mouth	9,712	25,668	2,122	17,753	16,877	13,000
Port of Kansas City	9,712	25,668	946	4,519	1,200	8,000
SORGHUM						
Sioux City to Kansas City	–	4,534	120,735	8,025	74,153	95,000
Kansas City to Mouth	–	11,334	152,056	–	9,149	53,000
Port of Kansas City	–	11,334	152,056	–	9,149	53,000
SOYBEANS						
Sioux City to Kansas City	4,231	7,813	7,502	85,412	91,184	126,000
Kansas City to Mouth	10,074	6,262	57,091	47,158	50,360	69,000
Port of Kansas City	4,458	6,262	34,987	11,893	8,319	–
WHEAT						
Sioux City to Kansas City	9,789	9,438	304,733	344,350	206,913	3,000
Kansas City to Mouth	79,458	172,008	460,037	557,545	295,969	111,000
Port of Kansas City	77,249	157,996	453,738	532,000	263,654	103,000
WHEAT FLOUR						
Sioux City to Kansas City	–	2,087	26,266	–	–	–
Kansas City to Mouth	–	8,149	–	–	–	–
Port of Kansas City	–	8,149	–	–	–	–
GRAIN MILL PRODUCTS, M.E.C.						
Sioux City to Kansas City	–	504	–	235,091	93,590	4,000
Kansas City to Mouth	–	1,861	–	12,033	1,391	–
Port of Kansas City	–	1,861	–	11,017	–	–
ANIMAL FEEDS						
Sioux City to Kansas City	794	16,023	22,657	178,345	66,740	51,000
Kansas City to Mouth	–	–	–	1,248	5,564	5,000
Port of Kansas City	–	–	–	1,248	–	–

Source: U.S. Army Corps of Engineers. *Waterborne Commerce of the United States. Part 2, Waterways and Harbors, Gulf Coast, Mississippi River System and Antilles.* Washington, D.C.: Department of the Army, various years.

[a] Kansas City Port loadings are a subset of Kansas City to Mouth traffic.

CHAPTER 6

CORN FLOWS

Trade Patterns[1]

U.S. corn exports in 1945 were a minuscule 784 thousand MT (31 million bu.).[2] Oats exports in that year rivaled those of corn -- some 305 thousand MT (21 million bu.) -- more than at any time since 1925. Corn, however, was poised to become the overwhelmingly dominant U.S. feed grain export, soon exceeding by many times that of oats (Fornari, pp. 115 and 127).

The following year, 1946, brought a record U.S. crop, a much poorer one in Europe. U.S. corn exports soared to 3.455 million MT (136 million bu.), the largest since 1937, and domestic prices reached a record high in September 1947 of $2.40 per bushel. U.S. corn production in 1948 was, however, an all-time high of 76.203 million MT (3 billion bu.) on a yield of 43 bushels per acre; exports declined to 2.997 million MT (118 million bu.); and the number of hogs was down, pushing corn prices below the support level, and CCC holdings of corn, by the fall of 1950, to a record high of 16.510 million MT (650 million bu.) (Fornari, p. 116).

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[1]Except where otherwise credited, trade data presented in this section are either from Tables A6-1 through A6-23 or the ultimate source of the tables (U.S. Department of Agriculture various years (a)). Export trends are summarized in Table 3-4. Graphic interpretations (Figures 6-1 through 6-5) are presented for the survey years. Production and yield trends are summarized in Table 8-1.

[2]Because contemporary international trade data are almost always expressed in metric tons (MT) while domestic production and disappearance data are usually in bushels, both units of measure are included for comparison in the "Trade Patterns" section of this and the following three chapters. The tabular presentations of trade flows are in metric tons only while domestic data from the elevator surveys are in bushels, in keeping with respective conventions. One metric ton equals 39.368 bushels of corn or sorghum, 36.744 bushels of wheat or soybeans.

Korean War demands began, however, to bolster prices. Less corn was placed under loan and CCC stocks declined to 7.620 million MT (300 million bu.) by the close of the 1951 crop season. Corn exports in 1951 fell, nevertheless, to 2.083 million MT (82 million bu.), rising again in 1952-53 to 3.683 million MT (145 million bu.) as buyers favored corn over sorghum, a crop that had competed more strongly in the previous year (Fornari, p. 117).

Stocks increased once again, to a new high of 19.305 million MT (760 million bu.), by the close of the 1953 season. Government offers in April 1954 of stored 1948- and 1949-crop corn at export prices below those in the U.S. domestic market failed to dent the growing CCC stocks. PL-480 came to the rescue in 1955; some 4.648 million MT (183 million bu.) of feed grains in that year were exported under government surplus disposal programs. Half of 1956 feed grain exports of 7.493 million MT (295 million bu.) were PL-480 grains (Fornari, pp. 117-8).

As the decade wore on, however, commercial exports began to greatly exceed those under government-subsidy. Japan and Western Europe, owing to rapid growth in per-capita meat consumption, driven by strong economic growth, accounted for most of the increase. U.S. corn exports in 1954 had been only 1.947 million MT (76.7 million bu.), of which 767 thousand MT (30.1 million bu.) went to the United Kingdom, most of the rest to other Western European countries. Canada and Japan were the only other buyers of significance, Canada buying 203 thousand MT (8 million bu.), Japan 160 thousand MT (6.3 million bu.) (Figure 6-1). By 1955-59, average annual exports had more than doubled to 4.384 million MT (161 million bu.), the UK still being the best customer, buying 1.476 million MT (58.1 million bu.) of feed grains. The Netherlands again was in second position with 555 thousand MT (21.9 million bu.). Mexico had also emerged as an important buyer, taking 343 thousand MT (13.5 million bu.). Canada bought 333 thousand MT (13.1 million bu.), and most of the rest went to a number of Western European nations (Table A6-1). U.S. corn exports continued to increase, reaching 5.842 million MT (230 million bu.) in both 1958 and 1959; the 85 million MT (3.4 billion bu.) of production in 1958, 6 percent of the 97 million MT (3.8 billion bu.) 1959 crop. Exports rose again in 1960 to 7.366 million MT (290 million bu.), and once more in 1961 to 11.050 million MT (435 million bu.) (Fornari, p. 118).

Feed grain consumption rates in major buying nations were only a fraction of those in the U.S. at the outset of the 1960s, leaving enormous scope for further growth; their own production capacity at the time could not meet the rapidly growing demand (Fornari, p. 118).

Completion of the St. Lawrence Seaway in 1959 gave further impetus to exports, especially those coming out of the upper Midwest. Wheat as well as Corn shipments grew immediately and sharply upon the opening of the new waterway, shipping totals for the two grains more than tripling by 1968 (Fornari, p 118).

Exports of feed grains to Europe continued during the early '60s, owing to poor harvests in Eastern European countries which had previously met Western European shortfalls. Spain became a buyer, having made the transition from PL-480 to commercial customer in 1963. Corn exports to Europe reached about 12.701 million MT (500 million bu.) in 1963 (Fornari, p. 119).

The U.S. exported 17.451 million MT (687 million bu.) of corn in 1966, setting a record to that date on strong demand occasioned by poor overseas crops, especially in Spain and India. The U.S. share of the world corn market also peaked that year at 55 percent. But the picture was to change with the final phase-in of European Common Market policies in 1967. Countries within the Market (France in particular), aided by high price supports and major export subsidies, now began to meet each others' needs as well as those of buyers outside the Common Market. Spain, not yet a member of the Common Market, also bought heavily from France as well as from Argentina and Brazil. Surplus wheat was diverted for feed use, further limiting opportunities for U.S. feed grains exports (Fornari, pp. 120-2).

There was some recovery in exports by 1969-70, with the U.S. share of the world corn market at a little more than half, that for sorghum two-thirds. Mexico became a customer in 1970 owing to drought-shortened local crops (Fornari, p. 122).

The 1969 Nebraska grain-flow survey came a year after the southern corn leaf blight had reduced that year's corn crop to 104.145 million MT (4.1 billion bu.). The blight notwithstanding, the U.S. exported to 15.873 million MT (624.9 million bu.) in 1969, fully 715 percent above the level of 1954 exports. Optimism was running high as U.S. grain exports built toward a peak in 1969 and to a succession of new peaks in the 1970s. Japan had become by far the best customer, taking 4.492 million MT (176.9 million bu.). Western Europe received most of the remainder, the largest customers being the Netherlands[3] with 2.217 million MT (87.3 million bu.) and the UK 1.838 million MT (72.4 million bu.). Countries bordering the Mediterranean Sea had also become important customers (Figure 6-2).

The 1970s would make the export levels of the '60s look small. Corn exports had reached 49.156 million MT (1.9 billion bu.) by the time of the 1977 survey year, 210 percent above those in 1969 and fully 2,425 percent higher than in 1954. Japanese sales had nearly doubled to 8.610 million MT (339 million bu.), while a large part of the remainder continued to go to Europe. Mediterranean countries, including Spain, Greece, Egypt, Israel and Italy were important customers (Figure 6-3).

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[3]Corn arriving at the Rotterdam harbor in the Netherlands may have been transshipped to other European countries.

Corn exports peaked between the time of the 1977 and 1985 surveys, records having been set in 1979 and 1980 when 59.2 million MT (2.3 million bu.) and 63.0 million MT (2.5 billion bu.), respectively, of corn were exported. Along with the rise and fall in total volume there were big changes in the pattern of exports.

Export optimism was soon to collide, however, with the reality of sharply declining demands from the less-developed world in the face of mounting debt problems and structural adjustment solutions imposed by international lenders (Chapter 2, above, has further detail; see also Chapter 3, above). Expansionist agricultural policies in the European Community (EC) began to prompt production sufficient to more than supply domestic EC needs, largely drying up this formerly major market for U.S. coarse grains. Japanese and Korean purchases had also declined slightly. China, a significant buyer from 1975 through 1982, ceased its purchases altogether and began to export corn in 1983 (Wisner 1986).

Not all the 1980s export news was grim, however. Soviet purchases surged in the marketing year ending September 30, 1985, as U.S. grain replaced the drought-shrunken 1984 local crop, pushing U.S. exports to that nation to record levels. This boomlet stalled, however, with improved Soviet harvests in 1985-86 (Wisner 1986). Exports in calendar 1986 were only 20 percent of those of the previous year .

Less-developed countries imported 12.131 million MT (477.5 million bu.) of corn in 1985 or 27.5 percent of the total, developed market economies 17.905 million (704.7 million bu.) or 40.7 percent and centrally planned countries 14.0 million MT (551.2 million bu.) or 31.8 percent of total exports. Major corn importing regions included Asia (17 million tons/669.3 million bu.), Western Europe (6.0 million tons/236.2 million bu.), Latin America (3.5 million tons/137.8 million bu.) and

Africa (3.1 million tons/122 million bu.), their respective shares being 27.5 percent, 40.7 percent and 31.8 percent of that year's total U.S. corn exports. The USSR was the largest single country buyer, taking 13 million tons (511.8 million bu.). Japan was second with 11 million tons (430 million bu.) and Taiwan third with 3 million tons (48.1 million bu.) of imports. Other importers of special note were South Korea, Egypt, Mexico and Portugal (Figure 6-4).

The net result of the cross currents in sales was that total U.S. corn exports in calendar year 1985 (44.1 million MT/1.4 billion bu.) were 8 percent below their 1983 level, and 30 percent off their high of more than 63 million MT (2.5 billion bu.) in 1980, and were the lowest since 1971. Falling world prices caused the value of U.S. corn exports to fall even faster, by 18 percent between calendar years 1983 and 1985. The decline was 39 percent from the nearly $8.5 billion peak in 1980 to a little less than $5.2 billion in 1985.

U.S. corn exports in the 1992 Railway Waybill year were 42.993 million MT (1.7 billion bu.), nearly the same as in the 44.052 million MT (1.7 billion bu.) exported in the survey year of 1985 and comparable as well to the 49.156 million tons (1.9 billion bu.) in survey year 1977. More than 40 percent of U.S. corn exports in 1992 went to developing countries, 17.3 million metric tons (679.2 million bu.), compared with 19.6 million tons (771.6 million bu.) to developed nations. Incomes in the developing world, especially across most of Asia, were rising as were their imports of grain.

Asia in total alone imported 22.449 million tons (881.8 million bu.) in 1992; Japan was the largest Asian importer and the single largest U.S. corn customer, buying 13.359 million tons (527.5 million bu.). Countries of the former USSR together bought more than 6.127 million tons (241.2 million bu.) Taiwan bought 5.203 million tons (204,7 million bu.).

Central European crops were lower in 1992 because of drought, but real-income declines in these now-market-oriented economies moderated import demands. Mexico, a major emerging market, procured a record 1.137 million tons (433 million bu.) of U.S. corn in 1992 as well as 4.957 million tons (2 billion bu.) of sorghum. Other major importers included the Republic of South Africa, South Korea, Spain and Egypt. Canada had a poor crop in Ontario Province in 1992, but a weakening Canadian dollar dampened its effect on imports (Figure 6-5).

U.S. exports of coarse grains were lower in 1993 -- corn exports declined by nearly 3 million tons (118.1 million bu.) from 1992 levels to 40.0 million tons (1.6 billion bu.) total, sorghum exports by 1.5 million tons (59.1 million bu.) to 6.046 million tons (238.2 million bu.) total -- this in spite of lower prices stemming from record production. Asia took more than half of U.S. corn exports in 1993. Japan was the largest buyer, with 1993 purchases of 14.664 million MT (577.3 million bu.). Other major customers included Taiwan (5.326 million MT/209.7 bu.), former USSR (5.161 million MT/203.2 million bu.) and Egypt (1.909 million MT/751.4 million bu.). Less-developed nations accounted for 42 percent of total U.S. corn exports.

Corn exports to the former Soviet Union (FSU) declined in 1993 from a year earlier by nearly a million tons (39.4 million bu.) owing to the disrupted economy of the region, declining livestock inventories (livestock numbers are no longer a purely political decision) and shortages of hard currencies. Most FSU grain imports are financed through U.S. commodity programs and levels in the immediate future may depend as much on U.S. as on FSU politics.

The more recent picture has been mixed, corn exports having shrunk sharply in 1994 to only 35.645 million tons (1.4 billion bu.) but recovering dramatically in 1995 to 60.018 million MT (2.4 billion bu.) (U.S. Department of Agriculture various issues (d), February 1997).

Asian nations continued to be dependable buyers in the slack export year 1994, importing 21.396 million MT (842.3 million bu.), or some 60 percent of total U.S. corn exports in that year. Japan, at 12.075 million MT (475.4 million bu.) was the largest single buyer. Taiwan, Mexico and South Korea ranked 2nd through 4th. Less-developed countries took 20.273 million tons (798.1 million bu.) or 57 percent of the total.

Asia continued to dominate corn imports from the U.S. in 1995, a year of much larger U.S. corn exports, with purchases of 42.319 million MT (1.1 million bu.), or 70.5 percent of the total. Japan was number one with 15.968 million tons (628.6 million bu.). Korea ranked second with 8.956 million MT (352.6 million bu). Taiwan and Mainland China were in the number three and four spots. Mexico, Egypt, Spain and Malaysia were other significant buyers. Less-developed countries imported 32.698 million MT (128.7 million bu.), 54 percent of total U.S. corn exports.

By 1996, developing economies had shaken off the worst effects of the debt crisis. Many Asian countries, in particular, have vibrant economies, with rapidly growing demands for feed grains. Projected corn exports for the 1996-97 crop year are 48.263 million MT (1.900 billion bushels), below the 1995 level but well above 1994.

Shipping Patterns

Information in this section is from University of Nebraska grain-flow surveys and, for 1992, the ICC Waybill for that calendar year. Since the Waybill reports only rail shipments, neither modal splits nor destination data for truck or barge shipments are available for 1992.

Volume of Receipts and Shipments

The size of annual elevator receipts (and shipments) of corn depends upon crop size and imports into the state as well as market conditions during the year. Strong local feed demand in some years reduces the relative surplus available for export from the state. Differences in out-shipments also reflect inventory changes, the latter in turn being affected by market conditions and government storage programs as well as crop size.

The relationship between annual production and elevator receipts (and shipments) of corn varies greatly from year to year. The proportion of annual production sold through the state's elevators has generally increased since 1954 (Figure 6-6 and Table 6-2), suggesting an increase in the degree of commercialization of the crop over time. Elevator receipts have increased sharply, volume in 1985 being 566 percent greater than in 1954, for example. This trend is consistent with increasing specialization and growing productivity of the state's agricultural enterprises since the 1950s. Receipts in the 1950s generally ranged from 39 to 68 percent of production, except for 1955 when they spurted to 177 percent of production, a result perhaps of a drought-induced local shortage, with a large part of receipts coming out of farm stores and some from in-shipments from other states. Estimated elevator receipts in 1977 were nearly 100 percent of the state's corn production in that year, those in 1985 more than 72 percent of production (Figure 6-1 and Table 6-2).

Although Nebraska has been a net-surplus producer of corn, small amounts of corn do enter the state's elevator system from other states, primarily those bordering Nebraska. Information on these flows is available only for the survey years 1977 and 1985 plus limited insights for 1956 and 1957. State imports varied widely across survey years, those of all grains being much larger in 1956 (22 million bu.) than in 1957 (only 3.5 million bu.); the larger shipments in the former year, coming mainly from South Dakota, Minnesota and Iowa, must have been prompted by strong local demand in the face of poor Nebraska crops during the previous two years; the proportions accounted for by corn alone are not identified (Miller, p. 27). At the same time, northeastern Nebraska has been and remains a feedgrain deficit area and may be expected to draw imports from neighboring states as well as from Nebraska.

Some 11.6 million bushels of corn entered the state from outside its borders in 1977, more than 80 percent coming from Iowa, 13 percent from Missouri, 5.7 percent from South Dakota, plus negligible amounts from Colorado and Kansas (Table 6-3). Adding to the total receipts in 1985 were about 27 million bushels of corn shipped to Nebraska from neighboring states; nearly 100 percent came by truck, suggesting that the imports may have been largely cross-border deliveries by farmers. Iowa was the source of nearly 57 percent of the in-shipments while Missouri and South Dakota together accounted for 39 percent (Table 6-4). Note that these inflows are offset to the extent that Nebraska producers ship directly to elevators in other states; the size of these latter movements is not known. The flows from farmers on either side of the border were assumed to cancel each other in the regional survey to which the Nebraska results contributed (Fruin, Halbach and Hill 1990).

Country elevator receipts of corn have generally exceeded shipments for the survey years represented here, a result apparently of the lottery effect. Elevator stocks are enlarged in some years and are depleted in others but, absent bias in survey procedures and ignoring shrinkage, the two must coincide on average over time.

Mode

Railroads have become increasingly important in the transportation of Nebraska grain to out-of-state destinations, while trucks have become much more prominent in intrastate movements. Including elevator sales to local farmers and feeders in the totals, the proportion of all corn shipped by rail increased from 37.2 percent in 1956 to 46.6 percent by 1969. The rail proportion peaked in 1977 at 53.7 percent, declining in 1985 to 50.8 percent, lower than in either 1969 or 1977 but still well above levels of the 1950s (Figure 6-7 and Table 6-5). Rail's share is of course larger if local sales are excluded, being 67.3 percent in 1954 and 51.7 percent in 1969 (Tables 6-6 and 6-7); comparisons for other years are not available.[4]

The overall apparent trend toward rail is consistent with the state's production of a growing exportable surplus, the development of train-loading elevator facilities and growth of foreign markets. The slight decline in rail share in 1985 may reflect in part the state's growing prominence in fed cattle production, but is probably more a result of actual growth in truckers' share of shorter-haul markets. At the same time, deregulation of the trucking industry in 1980 has facilitated truckers' ability to obtain back-hauls of formerly regulated traffic. Deregulation of railroads has reinforced this mode's emphasis on long-haul traffic. Note, also, that corn moves relatively more by truck than does grain sorghum (see Chapter 7, Table 7-5, below), a finding consistent with a higher proportion of corn than sorghum being fed locally in the state.

Tables 6-6 to 6-9 provide further detail, identifying truck-rail shares by destination of shipments for survey years. These comparisons are more meaningful than the foregoing totals because the data across surveys are more comparable and because it is useful to know more specifically where modal shifts are occurring. In 1954, trucks carried 39.5 percent of interstate shipments, railroads 60.5 percent. The rails, at the same time had 83.5 percent of the traffic within Nebraska, the trucks only 16.5 percent. The large rail share of intrastate traffic was a reflection of the grain-handling system of the 1950s, featuring country elevators as consolidators of grain destined ultimately for subterminal

[4]Data for every year in the 1950s, except 1956, exclude truck shipments to local farmers and feeders, and thus overstate the rail proportion of total shipments for those years. Note also that the 1954 destination data, like those for 1977 and 1985 reflect shipments from all elevators, terminal subterminal and country, those for 1969 do not.

and terminal elevators which further consolidated the grain for movement to ultimate destinations. Railroad transit privileges allowed the grain to move even short distances from country to subterminal elevators at rates competitive with truck shipments. Trucks dominated interstate hauls to nearby states, meeting feeders' needs in Colorado, and supplying terminal elevators in Kansas and Missouri. Trucks also competed for some longer hauls to the south, including Texas (Table 6-6), where circuitous routing, often involving more than one railroad, limited rail carrier competitiveness. This picture was about to change radically, however.

In 1969, rail carriers accounted for nearly 88 percent of interstate shipments of corn from Nebraska, the other 12 percent moving by truck. Trucks, at the same time, had begun to expand their share of the intrastate market, now hauling 38.4 percent, the rails carrying 61.6 percent (Table 6-7).

By 1977, trucks hauled only 17.5 percent of corn moving beyond the state's borders; railroads carried 81.8 percent (Table 6-8). The railroads' share of interstate traffic declined to about 69 percent in 1985, trucks hauling the remaining 31 percent. Truckers accounted for more than 95 percent of intrastate corn traffic in 1985, the rails' share having shrunk to less than 5 percent (Table 6-9). The decline in the rail share between 1977 and 1985 may in part reflect effects of the deregulation occurring in 1980, which has made it easier for grain truckers to obtain back-hauls and for railroads to charge rates that reflect more nearly the cost realities of different lengths of haul. Transit rates for corn had become a thing of the past, by 1985 railroads competing instead with multiple-car rates for un-switched traffic moving to ultimate destinations.

Destination

Destination comparisons across surveys are complicated by variability in survey procedures from one year to another. In some cases, intrastate totals are reported inclusive of sales to local farmers and feeders, while in other cases local shipments are not included (a problem unique to corn and other feed grains). Surveys in 1977 and subsequent years have not distinguished among country, subterminal and terminal elevators. However, if the objective is to trace net flows from the state, exports from all of these types should be combined for a complete picture of interstate shipments. The latter was not a problem in any case in 1977 and 1985 since by this time this measure of elevator type had become obsolete and survey samples were therefore drawn from all elevators, the samples being stratified by size range. Finally, destination results were not reported in the 1955-59 surveys.

In 1954, 70.7 percent of corn shipments from country elevators were to interstate destinations, 29.3 percent to points within the state, the latter exclusive of shipments to local customers. Intrastate shipments in that year were almost entirely to terminal and subterminal markets. Interstate shipments went largely to Colorado (27.4 percent of those shipments), the latter almost exclusively by truck; Kansas City (23.9 percent), almost entirely by rail; and "South," not otherwise identified (24.8 percent), moving exclusively by rail. Smaller amounts went to several destinations, including by rail to Oklahoma (6.1 percent), and by truck to Texas (5 percent) and Kansas (3.5 percent) (Figures 6-8 and 6-9; and Table 6-6).

Terminal elevators in 1954 shipped 31.8 million bushels of feed grains to unknown destinations; 99 percent moved by rail, 1 percent by truck (Omaha Grain Exchange, cited in Anderson and Breuer 1971).

The 1969 survey showed 62.8 percent of corn shipments from country elevators moving to interstate destinations, 37.2 percent to points within the state, the latter exclusive of local shipments (see Figures 6-10 and 6-11 and Table 6-7). Local sales were an important part of elevator business in 1969, comprising nearly 35 percent of total country elevator shipments (more than 68 percent of truck shipments, inter- and intrastate). Non-local Intrastate shipments went largely to termi nal/subterminal markets from which they would later have moved on, probably as transit balances, to other markets. The relative importance of country, subterminal and terminal shipments, respectively, can be judged from 1969 data for which a separation (of total feed grains) shipments by elevator type is available. Total country elevator shipments in that year were 293.2 million bushels (including local shipments), subterminal shipments 43.7 million bushels and terminal shipments 36.6 million bushels. Thus, approximately 22 percent of all elevator shipments were from terminals/subterminals. There is double-counting of grain in such a reporting since subterminals and terminals both received grain from country elevators as well as from each other (Anderson and Breuer 1971).

Colorado was the major destination of interstate shipments of corn in 1969, taking almost 65 percent of interstate shipments, more than 34 percent of all shipments. But in contrast to 1954 when shipments to Colorado were nearly all moved by truck, more than 87 percent of 1969 corn went by rail (compare Tables 6-6 and 6-7). Kansas City was again in 1969 the second most important destination, accounting for 16 percent of interstate and 8.5 percent of total corn shipments. Kansas City received 21 percent of interstate and 12.2 percent of total feed grain (corn and sorghum) shipments, most of which went by rail, as was the case in 1954. Kansas and Missouri, exclusive of Kansas City, were important destinations, together receiving 10.3 percent of Nebraska's interstate corn shipments; the latter being much larger than in 1954 and, in contrast to the earlier year, moved mostly by rail. California was next most important, with 5.4 percent of interstate shipments, all moving by rail (Figures 6-8 through 6-12; and Tables 6-6 and 6-7).

Subterminals shipped 90 percent of their feed grains in 1969 by rail; nearly half (48.5 percent) of the rail shipments went to California. Gulf markets received nearly 18 percent, Kansas City, Texas, Arkansas and Colorado together took about 28 percent of the rail shipments (Figures 6-12 and 6-13). Omaha terminal elevators moved 93 percent of their feed grain shipments in 1969 by rail, 6 percent by truck and 1 percent by barge, to unknown destinations, probably much the same ones receiving subterminal shipments (Omaha Grain Exchange, cited in Anderson and Breuer 1971).

Corn shipments in 1977 went 52 percent to interstate destinations, 48 percent moving to points within the state; the trucked portion included local shipments. The 1977 sample did not distinguish by elevator function, combining instead country, subterminal and terminal shipments into a single data set; the distinction had become of little consequence since country elevators by this time had begun shipping directly to ultimate destinations.

The pattern of destinations had changed in some important ways by 1977. California had become the number-one recipient of Nebraska's corn, taking more than 15 percent of total shipments, more than 29 percent of interstate shipments alone, all moving by rail. Colorado, the first-place customer in previous surveys, was still important, with 18.5 percent of interstate shipments, 9.6 percent of the total, three-fourths of which went by rail. Kansas (Kansas City was not identified as a separate destination) was in fourth place with 14.3 percent of interstate shipments. Arkansas ranked fifth with 11.5 percent of interstate movements; Texas had 4.2 percent (Figures 6-14 and 6-15; and Table 6-8).

The export market had emerged by 1977 as a significant outlet for Nebraska corn. Part, possibly most, of the California shipments may have been exported. The Texas Gulf took 6.7 percent of the interstate traffic, Pacific Northwest ports 2.5 percent and the Louisiana Gulf 1 percent (Figures 6-14 and 6-15; and Table 6-8). Barges moved only 0.7 percent of interstate shipments, all going to the Louisiana Gulf.

The Pacific Northwest was the major destination in 1985, receiving over 29 percent of Nebraska's interstate corn shipments, all of which moved by rail. Kansas was second with 17 percent, 81 percent of which was hauled by truck. California and Texas each received 11 percent of the interstate shipments (Table 6-9). All of the California grain moved by rail, while Texas shipments were about equally divided between truck and rail. In 1977, California had been the major receiving state, Colorado was second, followed by Kansas and Arkansas. The Gulf Ports were a minor factor in both 1985 and 1977, accounting, respectively, for less than 2 and 4 percent of direct annual shipments. It is likely, however, that some, perhaps significant, proportion of the corn shipped to Kansas and Missouri eventually found its way in each year to Gulf ports. Barge shipments accounted for only 0.1 percent of interstate corn shipments from the state in 1985, all going to the Louisiana Gulf (Figures 6-16 through 6-18; and Tables 6-8 and 6-9).

Only rail information was available for 1992; exports were a large factor in that year's shipments, nearly 38 percent of total known rail movements terminating at ports of export. The Pacific Northwest, with 20.5 percent of all shipments was, as in 1985, the single largest destination (Figure 6-19 and Table 6-10). Other port areas receiving corn in 1992 were California, 12.6 percent, Texas 3.2 percent and Louisiana 1.6 percent. Inland Texas destinations received 17.4 percent of Nebraska's rail shipments of corn, Arkansas 7.6 percent, Iowa 5 percent, Colorado 4.8 percent and

Kansas City 4.3 percent of the movements. The remainder went in relatively smaller amounts to a large number of southern and western states. The pattern generally resembled that in 1985.

Summary

Exports were a very small part of the pattern of corn shipments from Nebraska in 1954, but were growing rapidly during the 1950s and '60s. Western Europe was by far the major destination for what exports there were. The United Kingdom (UK) was the first-ranking country buyer, with 39.4 percent of the total, the Netherlands were second, Canada third and Japan fourth. PL-480 exports first emerged as an export factor in 1955 and were an important outlet for the nation's growing production through the 1960s. Within a few years, however, commercial exports exceeded those under government surplus-disposal programs. Western Europe remained an important importing region in 1969, but its share was on the decline. Japan was now the first-ranking country buyer, with 28.3 percent of the total, the Netherlands second and the UK now third in importance.

The destination pattern had greatly widened by 1977; Japan remained first, buying nearly twice as much as in 1969, but its share of the total had fallen to 17.5 percent, the Netherlands was second and West Germany third. Total exports in 1985 had grown 2,425 percent from their level in 1954. The USSR had become the largest buyer, taking nearly 30 percent of the total, almost as much as all U.S. exports in 1969; Japan was second and Taiwan third. Western Europe now ranked well behind East Asia and the USSR as regional buyers. By 1995, Western Europe had slipped to fourth place among regions, behind East Asia, North Africa and Central America. Japan, South Korea, Taiwan and Mainland China were the ranking country buyers in a still-growing export market.

Less-developed countries as a group have accounted for a large and growing share of U.S. corn imports in recent years, 27.5 percent in 1985, 40 percent in 1992 and 54 percent in 1995.

Once dominant in both short- and long-haul markets, railroads have given up the larger part of intrastate corn shipments to trucks; they have strengthened their hold on interstate markets, although trucks have been competitive in some long-hauls to the south and southeast. Deregulation of trucks and railroads in 1980 has encouraged each mode to expand service in terms of its own respective comparative advantage.

Export markets being small in the 1950s, there was little scope for shipments over the West Coast. Neither railroads nor western ports were geared for large shipments. Neither was there much direct rail traffic to Gulf ports. Whatever shipments may have gone to the Gulf went indirectly through terminals in Kansas and Missouri. Colorado was the single most important out-of-state destination for Nebraska corn in 1954. Kansas City was also an important market and possibly a conduit for shipments to Europe via the Gulf ports. Although exports had become an important factor in the disposition of U.S. corn by 1969, they were little apparent in shipments leaving Nebraska. Colorado continued to be the largest recipient of Nebraska corn at the time of the 1969 survey.

Export markets continued to grow, becoming a major outlet for Nebraska corn by the time of the 1977 survey, and peaking in importance between the times of the 1977 and 1985 surveys. California was the number-one destination, bumping Colorado from the position it had held in both 1954 and 1969. California and Texas were both important recipients of Nebraska shipments in 1985. Direct Gulf shipments were small in 1985 as they had been in 1977. Exports in 1992 were on the increase again, the PNW being the number-one destination, California number two.

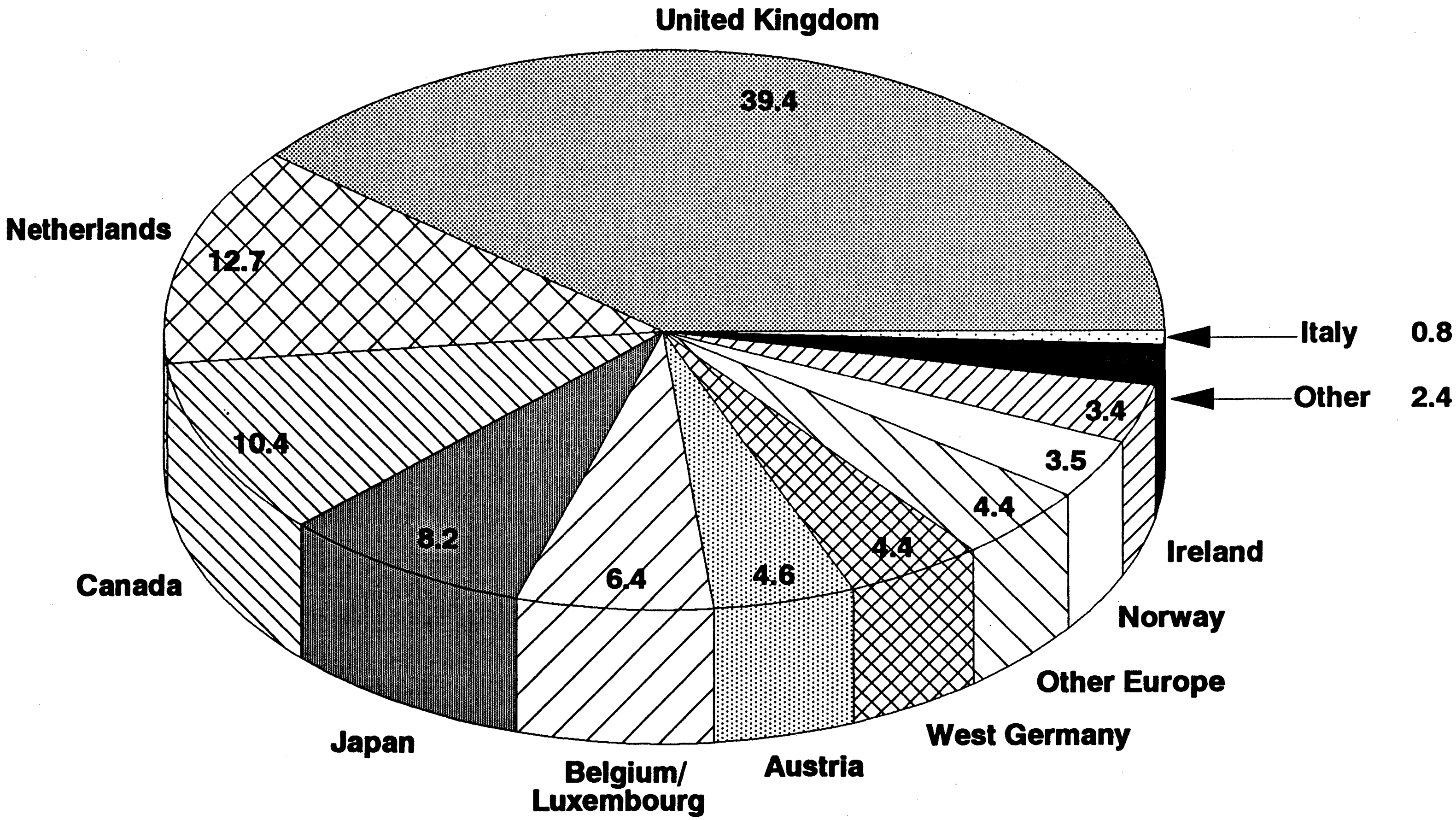

Figure 6-1. Percent Shares of Top Importers of U.S. Corn, 1954

Source: Appendix Table A6-1.

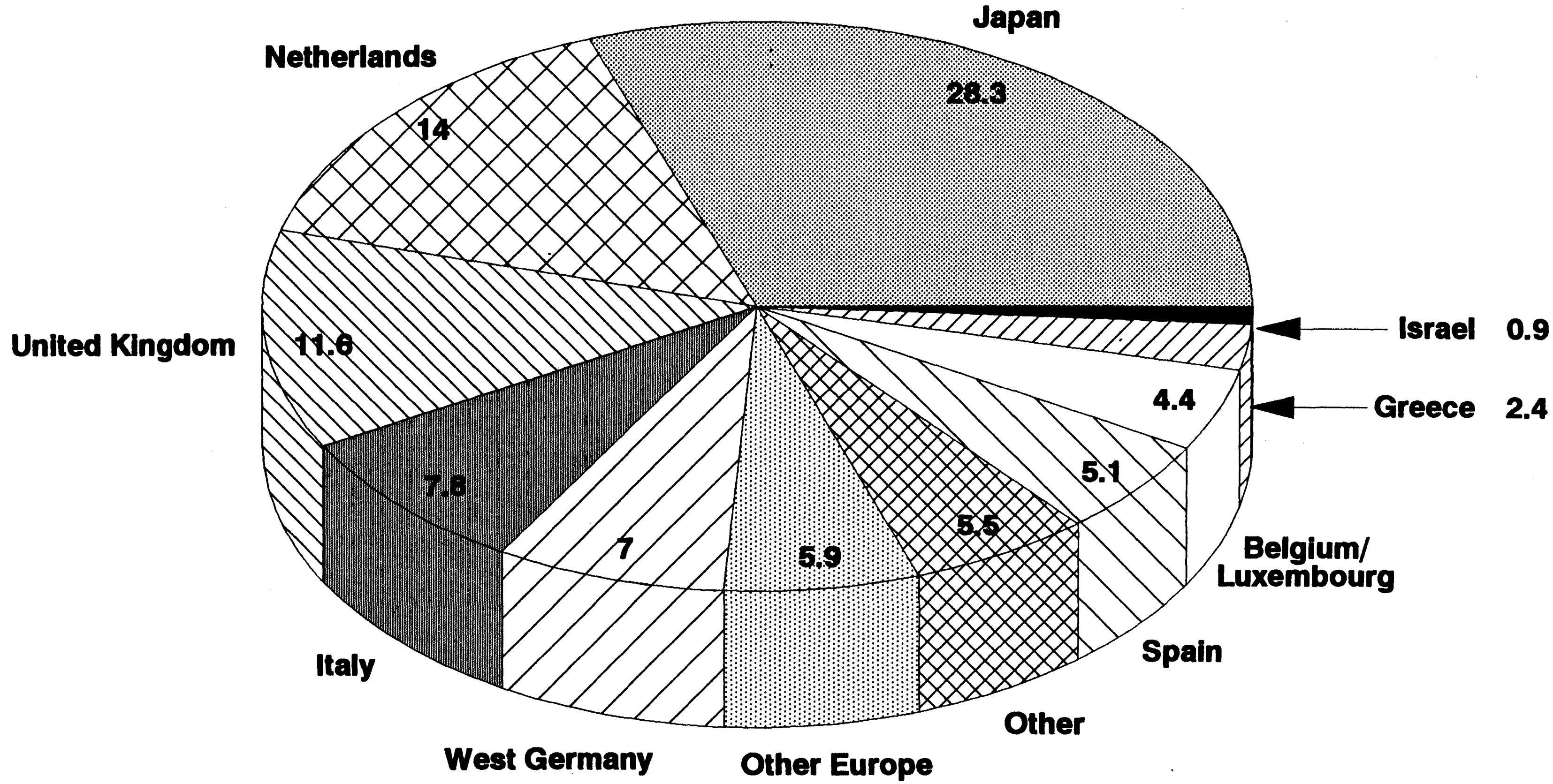

Figure 6-2. Percent Shares of Top Importers of U.S. Corn, 1969

Source: Appendix Table A6-1.

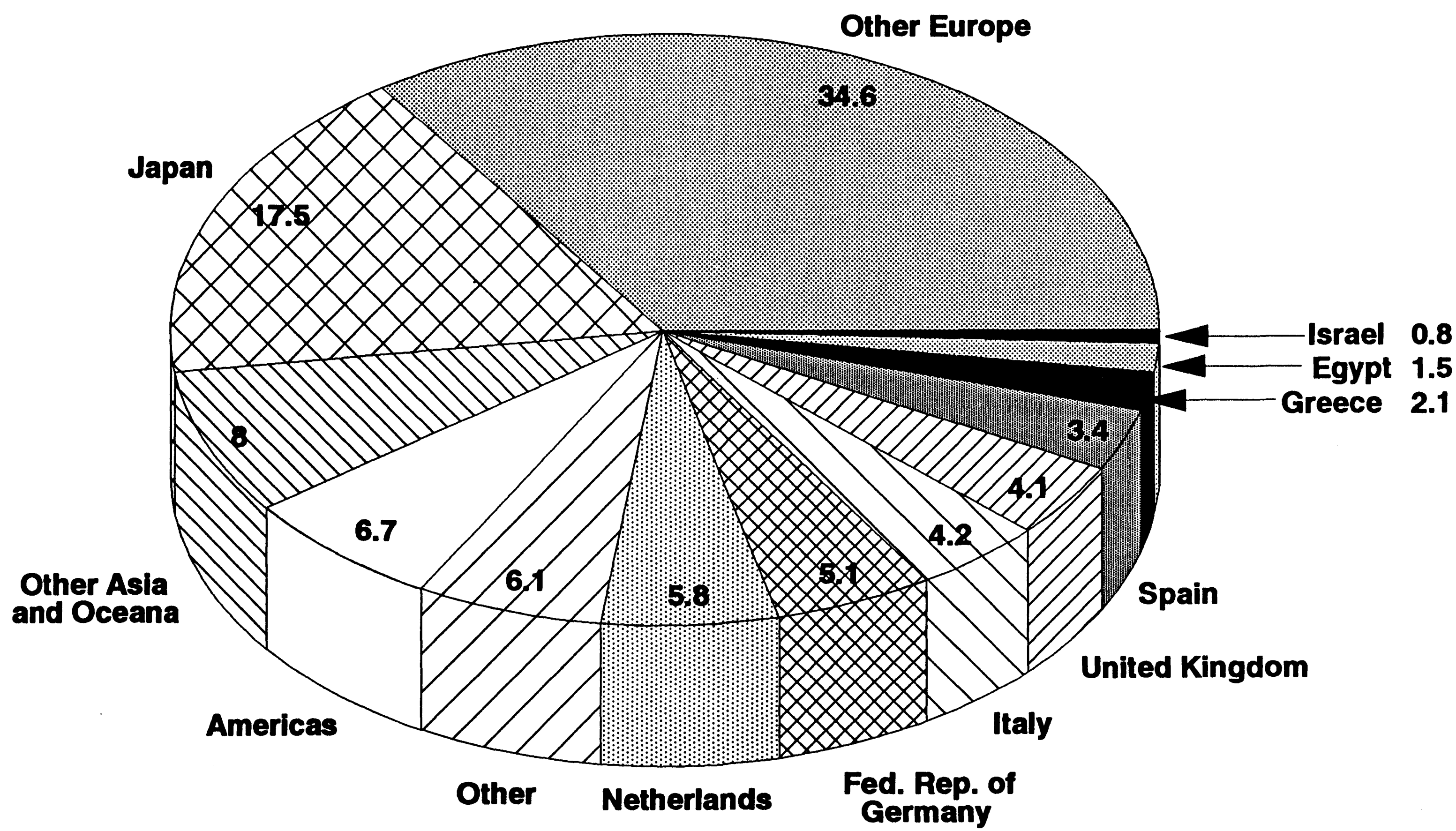

Figure 6-3. Percent Shares of Top Importers of U.S. Corn, 1977

Source: Appendix Table A6-1.

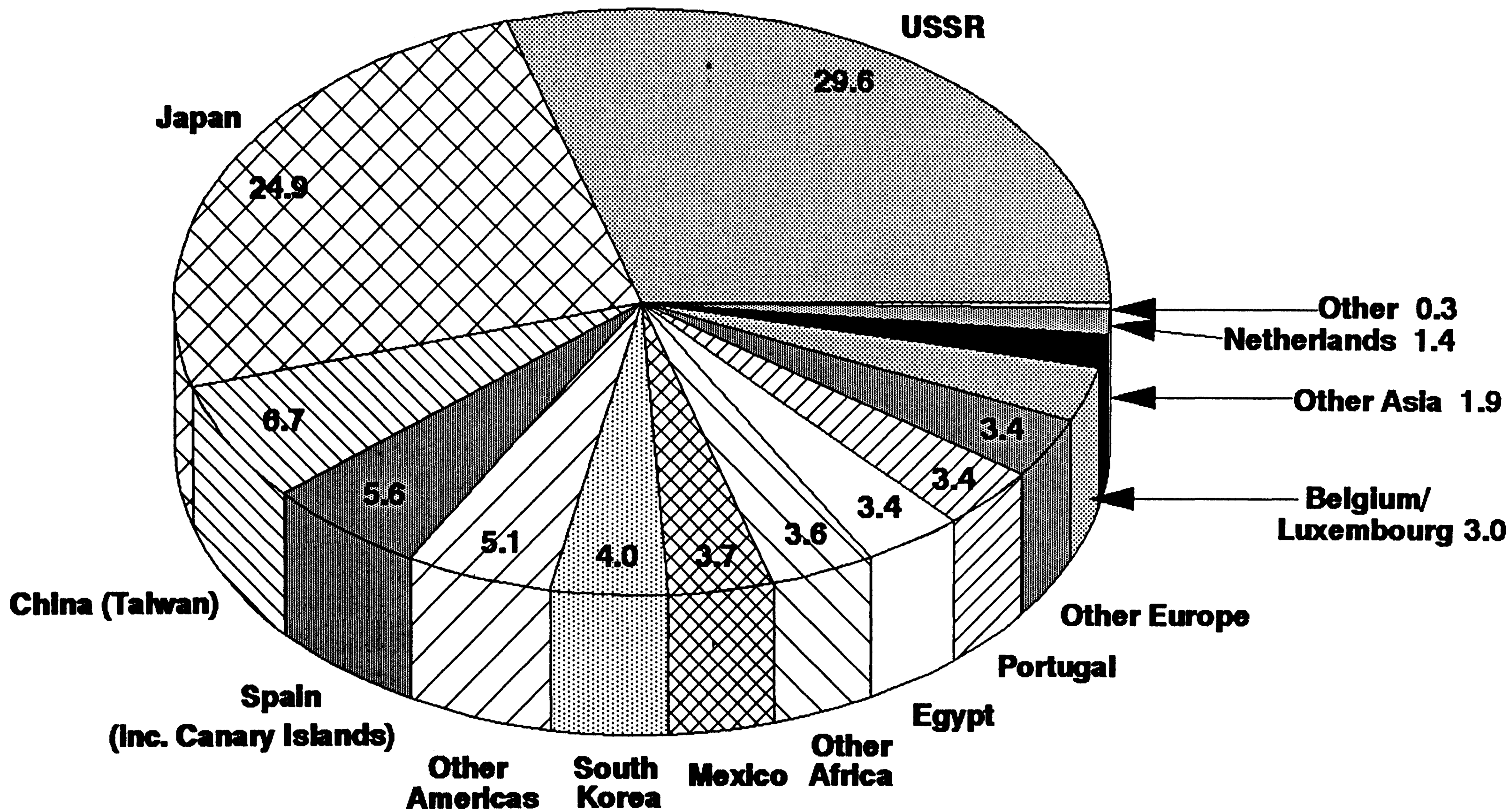

Figure 6-4. Percent Shares of Top Importers of U.S. Corn, 1985

Source: Appendix Tables A6-2 and A6-3.

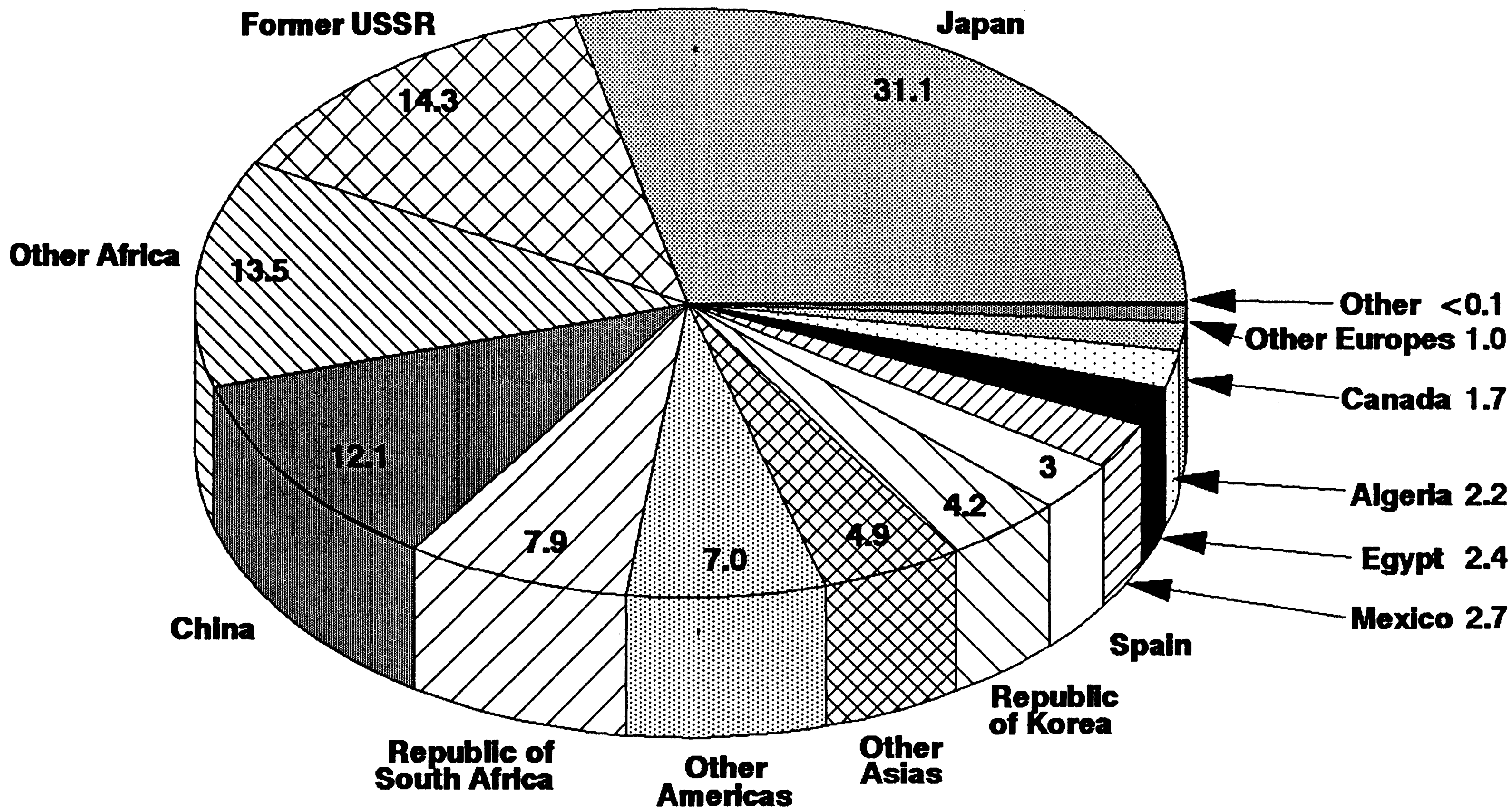

Figure 6-5. Percent Shares of Top Importers of U.S. Corn, 1992

Source: Appendix Tables A6-16 and A6-17.

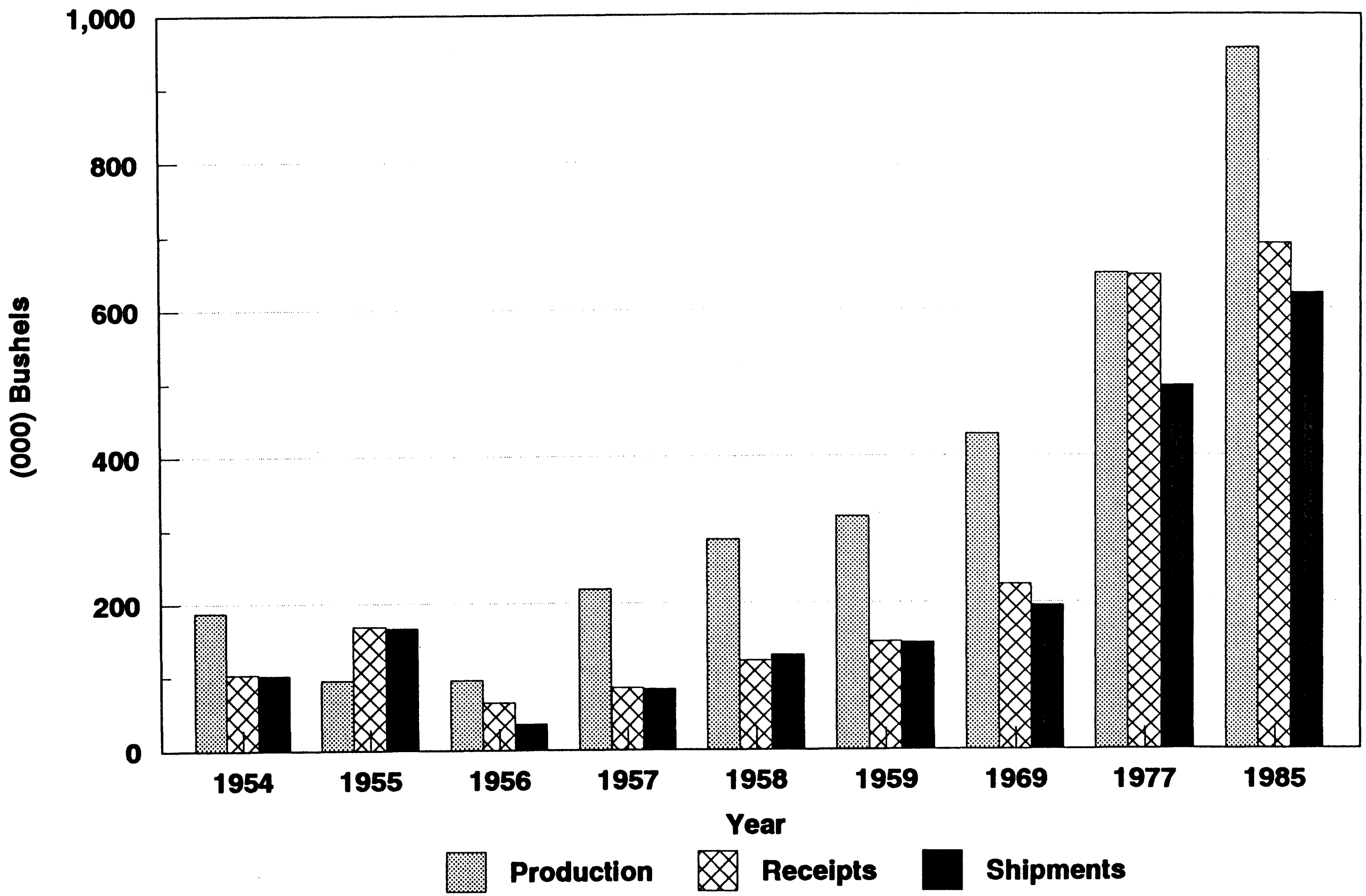

Figure 6-6. Corn Production, Receipts and Shipments, Nebraska, Selected Years, 1954-1985.

Source: Table 6-2.

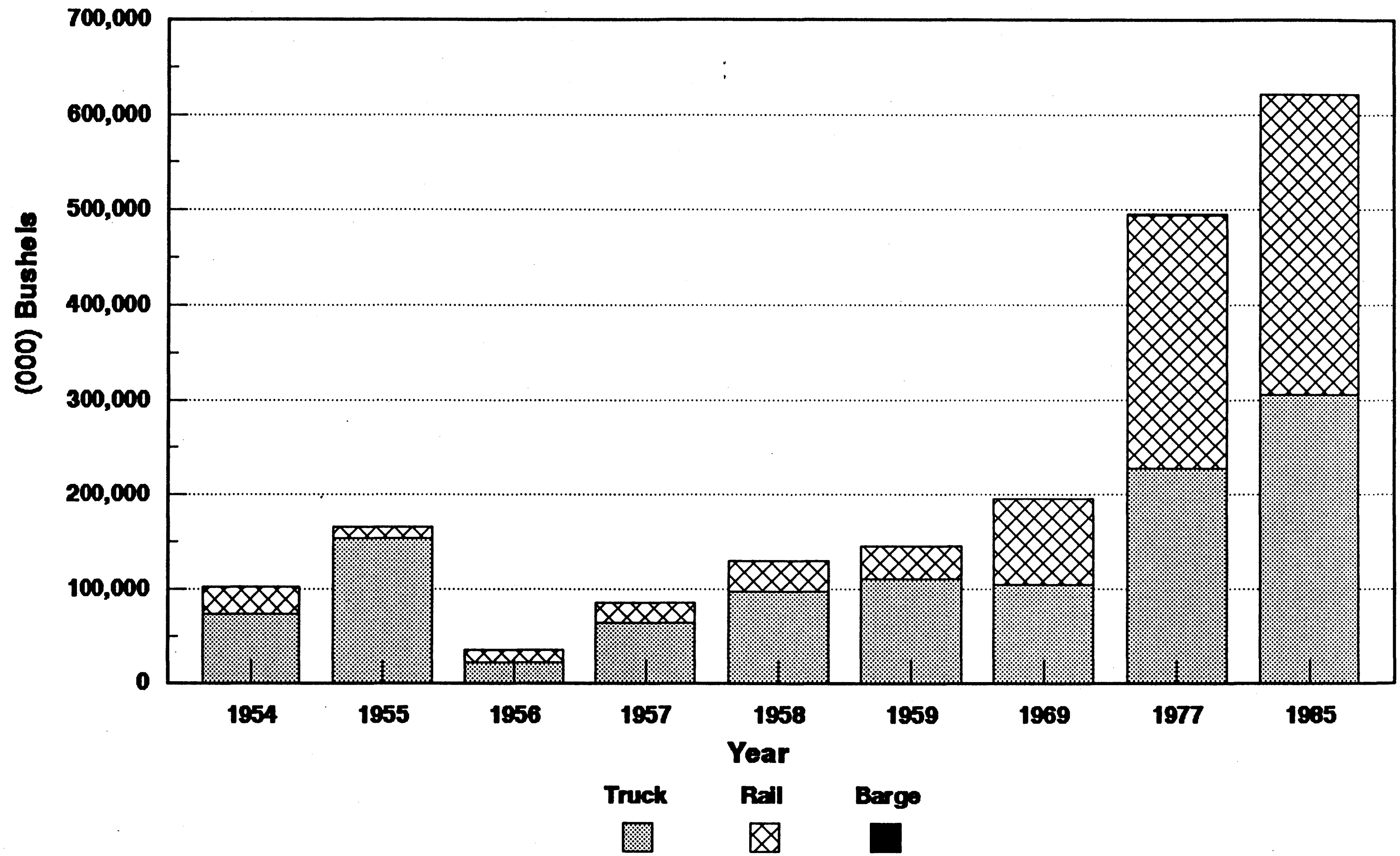

Figure 6-7. Corn Shipments from Nebraska Elevators by Mode of Transport, Selected Years, 1954-1985

[a] Barge data only available for 1977 and 1985, and too inconsequential in the latter year to register on the graph.
Source: Table 6-5.

Figure 6-8. Percentage of Interstate Corn Shipments from Nebraska Elevators to Various Destinations, by Truck, 1954.

Figure 6-9. Percentage of Interstate Corn Shipments from Nebraska Elevators to Various Destinations, by Rail, 1954.

Figure 6-10. Percentage of Interstate Corn Shipments from Nebraska Country Elevators to Various Destinations, by Truck, 1969 (exclusive of unknown destinations).

Figure 6-11. Percentage of Interstate Corn Shipments from Nebraska Country Elevators to Various Destinations, by Rail, 1969 (exclusive of unknown destinations).

Figure 6-12. Percentage of Total Feed Grain Shipments from Nebraska Subterminal Elevators to Various Destinations, by Rail, 1969

Figure 6-13. Percentage of Total Feed Grains[a] Shipments from Nebraska Subterminal Elevators to Various Destinations, by Barge, 1969

[a] Of the total barge shipments of feed grains, 97% was grain sorghum.

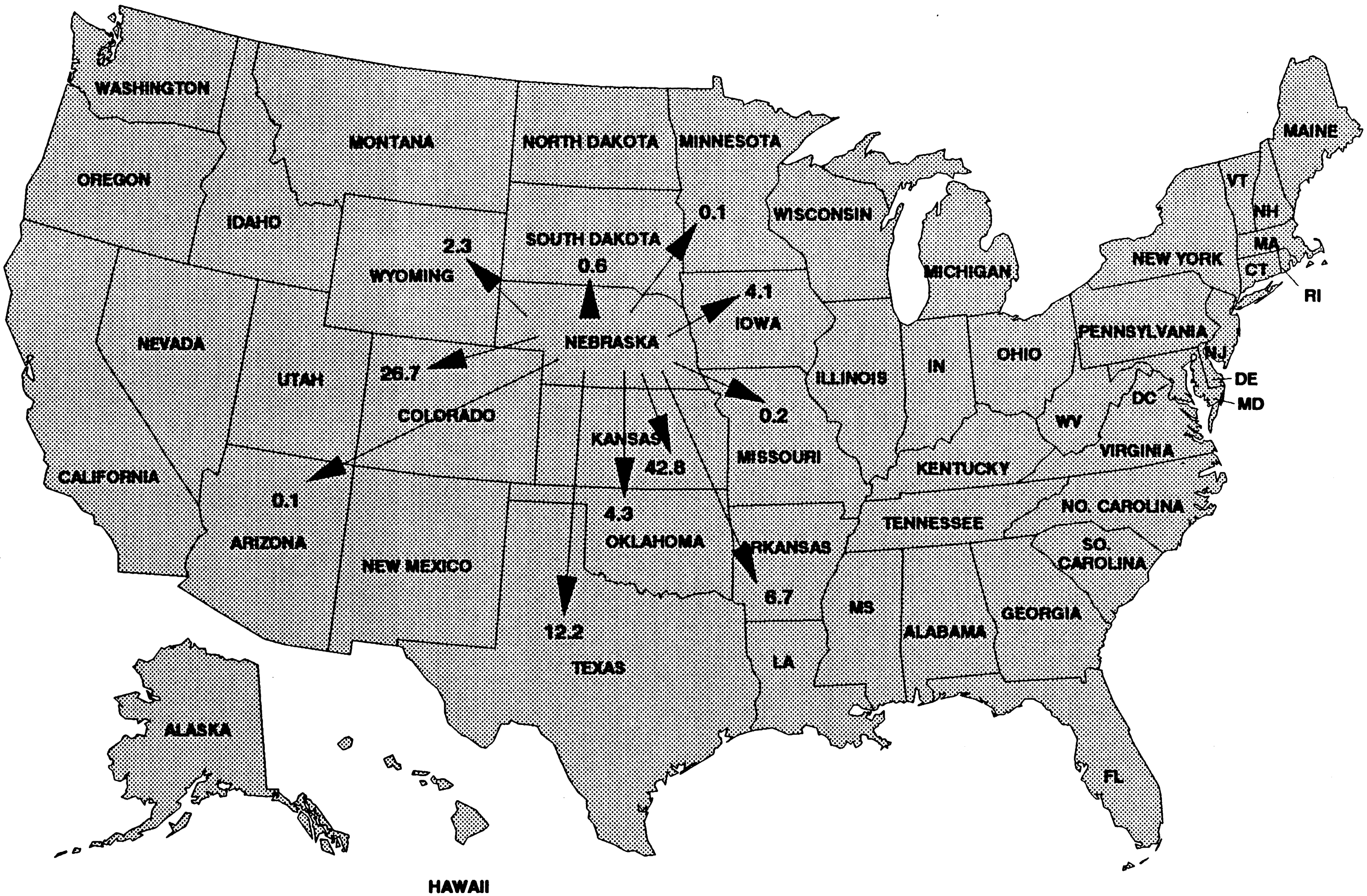

Figure 6-14. Percentage of Interstate Corn Shipments from Nebraska to Various Destinations, by Truck, 1977

Figure 6-15. Percentage of Interstate Corn Shipments from Nebraska to Various Destinations, by Rail, 1977

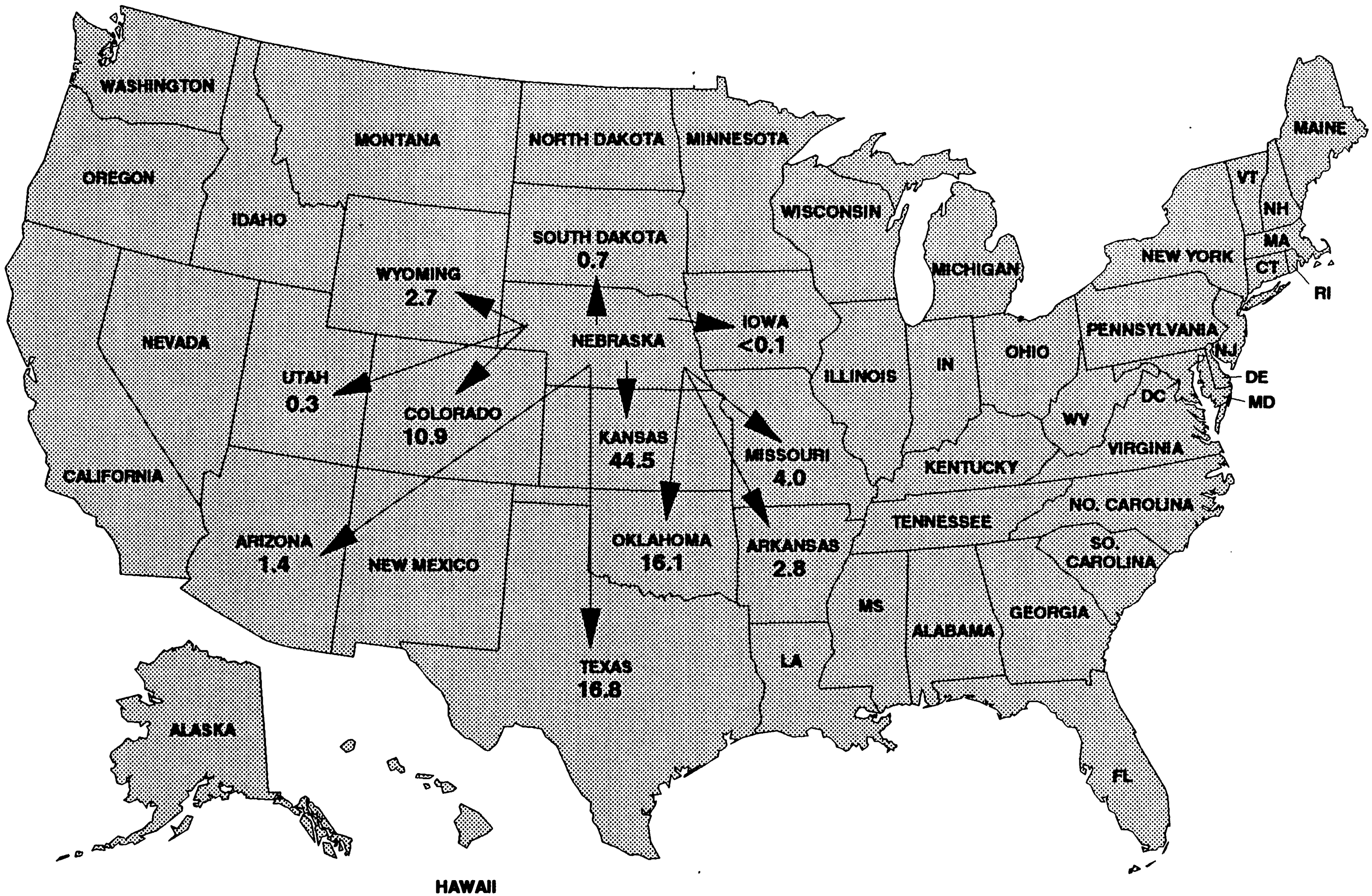

Figure 6-16. Percentage of Interstate Corn Shipments from Nebraska to Various Destinations, by Truck, 1985.

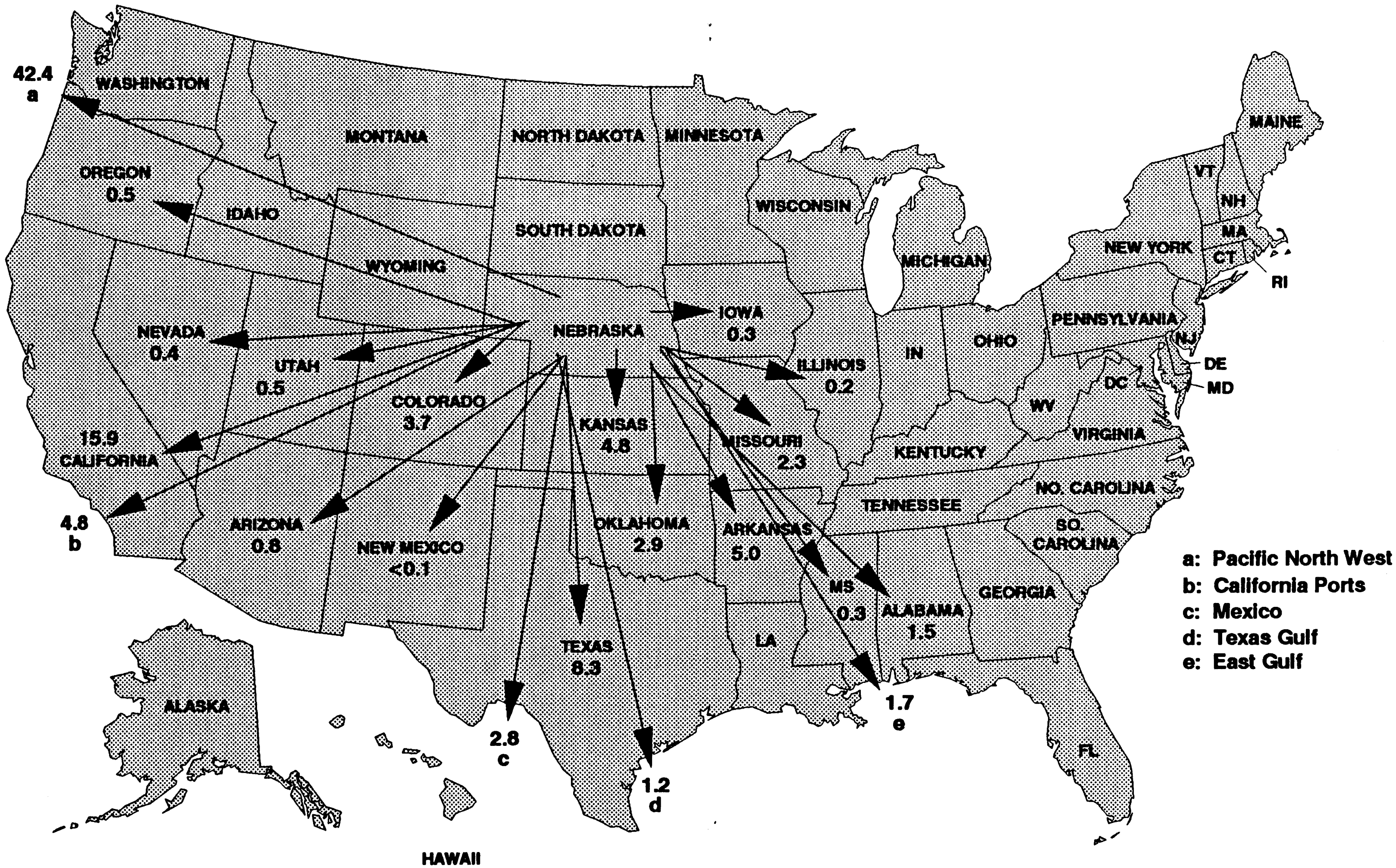

Figure 6-17. Percentage of Interstate Corn Shipments from Nebraska to Various Destinations, by Rail, 1985.

Figure 6-18. Percentage of Corn Shipments from Nebraska to Various Destinations, by Barge, 1985.

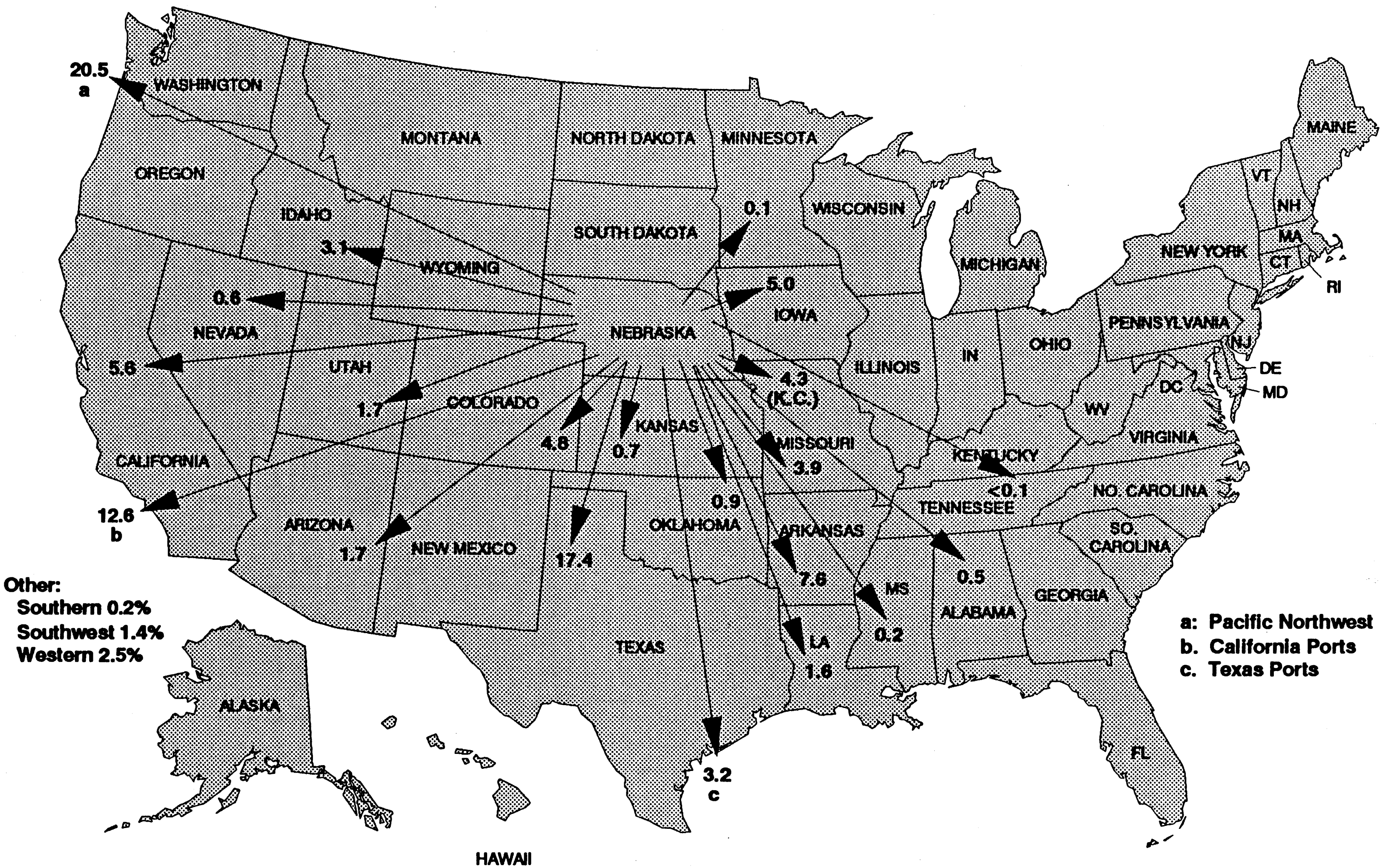

Figure 6-19. Percentage of Corn Shipments from Nebraska to Various Destinations, by Rail, 1992.

Table 6-1. Corn Production and Yield, Nebraska, United States and World, 1954-1996.

	WORLD		UNITED STATES		NEBRASKA	
	Average Yield	Production	Average Yield	Production	Average Yield	Production
Year[a]	(bu./acre)	(000 bu.)	(bu./acre)	(000 bu.)	(bu./acre)	(000 bu.)
1996[b]	(NA)	(NA)	127.1	9,293,435	143.0	1,186,900
1995[b]	(NA)	18,799,770	113.5	7,374,000	111.0	854,700
1994	66.8	21,883,726	138.6	10,103,000	139.0	1,153,700
1993	57.8	18,542,289	100.7	6,344,045	104.0	785,200
1992	64.8	21,039,322	131.4	9,478,914	135.0	1,066,500
1991	59.1	19,085,803	108.6	7,474,480	127.0	990,600
1990	59.9	18,794,677	118.5	7,934,028	128.0	934,400
1989	58.3	18,145,341	116.3	7,525,493	121.0	847,000
1988	51.0	15,824,440	84.6	4,928,681	124.0	818,400
1987	57.2	17,666,862	119.4	7,072,073	131.0	812,200
1986	55.3	18,814,440	119.3	8,249,864	128.0	896,000
1985	59.0	18,888,648	118.0	8,865,006	128.0	953,600
1984	56.9	17,989,562	106.7	7,674,020	116.0	806,200
1983	46.4	13,614,124	81.1	4,174,678	96.0	475,200
1982	56.6	17,339,399	113.2	8,235,101	111.0	770,200
1981	53.4	17,370,618	108.9	8,118,650	115.0	791,200
1980	49.2	15,864,989	91.0	6,639,396	85.0	603,500
1979	53.4	16,649,751	109.5	7,928,139	115.0	822,250
1978	48.3	15,194,355	101.0	7,267,927	113.0	762,750
1977	45.4	13,606,722	90.8	6,505,041	99.0	648,450
1976	45.4	13,238,317	88.0	6,289,169	85.0	518,500
1975	44.1	11,280,349	56.4	5,840,757	85.0	503,200
1974	40.0	10,571,725	71.9	4,701,402	70.0	399,000
1973	44.5	12,387,417	91.3	5,670,712	94.0	554,600
1972	42.3	11,359,046	97.0	5,579,832	104.0	534,040
1971	42.0	11,500,062	88.1	5,646,260	85.0	450,500
1970	37.4	10,043,722	71.6	4,099,493	75.0	360,375
1969	40.1	10,146,748	83.9	4,582,534	93.0	429,660

Table 6-1, continued

	WORLD		UNITED STATES		NEBRASKA	
	Average Yield	Production	Average Yield	Production	Average Yield	Production
Year[a]	(bu./acre)	(000 bu.)	(bu./acre)	(000 bu.)	(bu./acre)	(000 bu.)
1968	35.9	9,145,585	78.6	4,393,273	74.0	313.686
1967	37.0	9,393,598	78.6	4,760,076	74.0	333,740
1966	36.4	8,949,100	72.3	4,117,355	80.0	328,000
1965	34.1	8,157,900	73.8	4,084,342	70.0	249,550
1964	31.8	7,850,000	62.9	3,484,253	53.0	220,798
1963	32.7	8,015,000	67.9	4,019,238	56.0	284,536
1962	31.1	7,485,000	64.7	3,606,311	60.5	304,376
1961	31.0	7,430,000	62.4	3,597,803	52.0	275,392
1960	30.9	7,577,000	54.7	3,906,949	51.0	333,438
1959	30.5	7,880,000	53.1	3,824,598	48.5	318,063
1958	30.1	7,340,000	52.8	3,356,205	53.0	286,995
1957	28.1	6,575,000	48.3	3,045,355	46.5	219,387
1956	27.1	6,490,000	47.4	3,075,336	23.5	94,870
1955	26.9	6,435,000	42.0	2,872,959	20.0	95,500
1954	25.0	5,635,000	39.4	2,707,913	28.0	188,160

Source: Nebraska Department of Agriculture and U.S. Department of Agriculture. *Nebraska Agri-Facts*. Lincoln: Nebraska Agricultural Statistics Service, January 18, 1996; Nebraska Department of Agriculture and U.S. Department of Agriculture. *Nebraska Agricultural Statistics*. Lincoln: Nebraska Agricultural Statistics Service, 1995; and U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, various issues; U.S. Department of Agriculture. *World Agricultural Supply and Demand Estimates*. Washington, D.C.: USDA U.S. Department of Agriculture, June 12, 1996; and U.S. Department of Agriculture. *Agricultural Statistics*. Washington, D.C.: GPO, various years.

[a] "Year," in the world data series prior to 1988, refers to year of harvest. Southern Hemisphere crops which are harvested in the early part of the year are combined with those of the Northern Hemisphere harvested the latter part of the same year. After 1977, the report year includes Northern Hemisphere crops harvested in the late months of the year combined with Southern Hemisphere and certain Northern Hemisphere crops harvested in the early months of the following year.

[b] Estimated.

Table 6-2. **Corn Production, Elevator[a] Receipts and Shipments, Nebraska, Selected Years, 1959-1985.**

Year	Production	Receipts	Shipments
	(000 bu.)	(000 bu.)	(000 bu.)
1985	953,600	688,639	620,917
1977	648,450	646,536	495,728
1969	429,660	224,971	195,434
1959	318,063	146,311	145,273
1958	286,995	121,070	129,305
1957	219,387	84,707	82,926
1956	94,870	64,458	35,201
1955	95,500	169,090	166,436
1954	188,160	103,394	102,127

Source: Production data are from Nebraska Department of Agriculture and USDA, *Nebraska Agricultural Statistics*, Lincoln: Nebraska Crop Reporting Service, various issues. Receipts and shipments data are from a 1985 elevator survey conducted by the author, partial results of which appear in Fruin, Halbach and Hill (1990); results of a 1977 survey by Dean Linsenmeyer, partial results of which appear in Hill, Leath and Fuller (1981); findings from a 1969 survey (Anderson and Breuer 1971); and surveys of crop years 1954-59 (Miller 1960; and unpublished records from the latter surveys).

[a] Data sets for 1954-69 were from country elevators, those for 1977 and 1985 were all elevators.

Table 6-3. **Corn Shipments to Nebraska from Other States, by Mode of Transport and Origin, 1977.**[a]

Origin	Truck	Rail	Barge	Total	% of Total[a]
	Mode of Transportation				
	(000 bu./%)				(%)
Colorado	50	0	0	**50**	0.4
Iowa	8,545	800	0	**9,345**	80.3
Kansas	0	71	0	**71**	0.6
Missouri	1,516	0	0	**1,516**	13.0
South Dakota	571	92	0	**663**	5.7
Total	10,682	963	0	**11,645**	100.0
% of Total[a]	91.7	8.3	0	**100.0**	

Source: 1977 elevator survey.

[a]Percent detail may not add to totals because of rounding.

Table 6-4. Corn Shipments to Nebraska from Other States, by Mode of Transport and Origin, 1985[a].

	Mode of Transportation				
Origin	**Truck**	**Rail**	**Barge**	**Total**	**% of Total[a]**
	(000 bu./%)				(%)
Colorado	150	208	0	**358**	1.3
Iowa	12,612	2,777	0	**15,389**	56.7
Kansas	794	0	0	**794**	2.9
Missouri	6,000	0	0	**6,000**	22.1
S. Dakota	4,079	500	0	**4,579**	16.9
Total	23,635	3,485	0	**27,120**	100.0
% of Total[a]	87.1	12.9	0	**100.0**	

Source: 1985 elevator survey.

[a] Percent detail may not add to totals because of rounding.

Table 6-5. **Corn Shipments from Nebraska Elevators[a], by Mode, Selected Years, 1969-1985.**

Year	Truck		Rail		Barge		Total
	(000 bu.)	(% of total)[b]	(000 bu.)	(% of total)[b]	(000 bu.)	(% of total)[b]	(000 bu.)
1985[c]	304,948[d]	49.1	315,469	50.8	500	0.1	**620,917**
1977[c]	277,767[d]	45.9	266,136	53.7	1,825	0.4	**495,728**
1969[c]	104,302[d]	53.4	91,132	46.6	NA	NA	**195,434**
1959	110,698	76.2	34,575	23.8	NA	NA	**145,273**
1958	97,065	75.1	32,240	28.9	NA	NA	**129,305**
1957	63,453	76.5	22,473	27.1	NA	NA	**82,926**
1956	22,110[d]	62.8	13,091	37.2	NA	NA	**35,201**
1955	153,690	92.9	11,746	7.1	NA	NA	**165,436**
1954	73,123	71.6	29,004	28.4	NA	NA	**102,127**

Source: Data from a 1985 elevator survey conducted by the author, partial results of which appear in Fruin, Halbach and Hill (1990); results of a 1977 survey by Dean Linsenmeyer, partial results which appear in Leath, Hill and Fuller (1981); findings from a 1969 survey (Anderson and Breuer, 1971); and surveys of crop years 1954-59 (Miller 1960; and unpublished records from the latter surveys).

[a] Data sets for 1954-69 were from country elevators, those for 1977 and 1985 were all elevators.

[b] Percent detail may not add to total because of rounding.

[c] Shipments reported "unknown" as to mode have been allocated in proportion to known shipments.

[d] Includes local, as well as out-of-state shipments.

Table 6-6. Corn Shipments from Nebraska Country Elevators by Mode of Transport and Destination, 1954.[a]

	Mode of Transportation				
Destination	Truck[b]	Rail	Total	% of Interstate[c]	% of Total[c]
	(000 bu./%)			(%)	
California	101	0	101	0.2	0.1
Colorado, unspecified	13,741	196	13,937	27.4	19.4
Denver	0	811	811	1.6	1.1
Kansas	1,788	0	1,788	3.5	2.5
Missouri, unspecified	340	0	340	0.7	0.5
Kansas City	430	11,719	12,149	23.9	16.9
St. Joseph	108	475	583	1.2	0.8
Oklahoma	0	3,120	3,120	6.1	4.3
Texas	2,515	0	2,515	5.0	3.5
Utah	938	0	938	1.9	1.3
Wyoming	104	0	104	0.2	0.1
South	0	12,625	12,625	24.8	17.6
Southeast	0	1,806	1,806	3.6	2.5
Total Interstate	20,065	30,752	50,817	100.0	70.7
% of Interstate[c]	39.5	60.5	100.0		
Nebraska, unspecified	31	553	584	2.8	0.8
Fremont, NE	1,778	0	1,778	8.4	2.5
Lincoln, NE	0	2,354	2,354	11.2	3.3
Omaha, NE	1,682	13,924	15,606	74.0	21.7
South Sioux City, NE	0	782	782	3.7	1.1
Total Intrastate	3,491	17,613	21,104	100.0	29.3
% of Intrastate[c]	16.5	83.5	100.0		
Total	23,556	48,365	71,921		100
% of Total[c]	32.8	67.3	100.0		

Source: 1954 elevator survey (Farrell).

[a] The total and modal flows reported here do not correspond with those in Table 6-5. Data in the present table are from Farrell while those in 6-5 are taken from Miller and Nelson; both sources, however, draw upon the same elevator survey. They do differ structurally in at least one respect: the Miller and Nelson data reflect only shipments from country elevators, but include local as well as commercial truck shipments, Farrell's data include shipments from terminal and subterminal as well as country elevators but exclude local shipments. The percentage data in the present table are likely to be more reliable than the bushel volume estimates and provide at least a sense of where the corn was going in 1954.

[b] Does not include truck shipments to local farmers and feeders.

[c] Detail may not add to total due to rounding.

Table 6-7. **Corn Shipments from Nebraska Country Elevators, by Mode of Transport and Destination, 1969[a].**

Destination	Mode of Transportation: Truck	Rail	Total	% of Interstate[b]	% of Total[b]
	(000 bu./%)			(%)	
Arizona	0	316	316	0.5	0.3
Arkansas	527	10	537	0.9	0.5
California	0	3,216	3,216	5.2	2.7
Colorado	5,075	35,387	40,462	64.8	34.4
Iowa	10	0	10	<0.1	<0.1
Kansas	395	2,729	3,124	5.0	2.7
Kansas City	190	9,825	10,015	16.0	8.5
Missouri	21	3,258	3,279	5.3	2.8
Oklahoma	359	0	359	0.6	0.3
South Dakota	81	0	81	0.1	0.1
Texas	5	79	84	0.1	1.6
Wyoming	913	53	966	1.6	0.8
Total Interstate[c]	7,576	54,873	62,449	100.0	62.8
% Interstate[b]	12.1	87.9	100.0		
Nebraska[c]	14,213	22,769	36,982		37.2
% of Intrastate[b]	38.4	61.6	100.0		
Unknown	9,354	8,729	18,083		15.4
% of Unknown[b]	51.7	48.3	100.0		
Total[d]	31,143	86,371	117,514		100.0
% of Total[b]	26.5	73.5	100.0		

Source: 1969 elevator survey (Anderson and Breuer, 1971).

[a] These data exclude 10,218 bushels transported by an unknown mode, and 67,703 bushels shipped to local farmers and feeders; adding these excluded items, the grand total would be 195,434 bushels.

[b] Percent detail may not add to total because of rounding.

[c] Exclusive of unknown destinations.

[d] Inclusive of unknown destinations.

Table 6-8. Corn Shipments from Nebraska Elevators by Mode of Transport and Destination, 1977.

	Mode of Transportation					
Destination	Truck[a]	Rail	Barge	Total	% of Interstate[b]	% of Total[b]
	(000 bu./%)				(%)	
Arizona	36	1,543	0	1,579	0.6	0.3
Arkansas	3,018	26,533	0	29,551	11.5	6.0
California	0	74,949	0	74,949	29.1	15.1
Colorado	12,056	35,619	0	47,675	18.5	9.6
Iowa	1,847	2,848	0	4,695	1.8	1.0
Kansas	19,302	17,596	0	36,898	14.3	7.4
Louisiana	0	324	0	324	0.1	<0.1
Minnesota	47	206	0	253	<0.1	<0.1
Mississippi	0	3,458	0	3,458	1.3	0.7
Missouri	104	9,142	0	9,246	3.6	1.9
Nevada	0	162	0	162	<0.1	<0.1
Oklahoma	1,920	725	0	2,645	1.0	0.5
Oregon	0	1,415	0	1,415	0.6	0.3
South Dakota	252	0	0	252	<0.1	<0.1
Tennessee	0	3	0	3	<0.1	<0.1
Texas	5,505	5,238	0	10,743	4.2	2.2
Utah	0	2,351	0	2,351	0.9	0.5
Washington	0	3,953	0	3,953	1.5	0.8
Wyoming	1,030	0	0	1,030	0.4	0.2
East Gulf	0	180	0	180	<0.1	<0.1
Louisiana Gulf	0	611	1,825	2,436	1.0	0.5
Pacific NorthWest	0	6,514	0	6,514	2.5	1.3
Texas Gulf	0	17,119	0	17,119	6.7	3.5
Total Interstate	45,117	210,489	1,825	257,431	100.0	51.9
% of Interstate[b]	17.5	81.8	0.7	100.0		
Nebraska	182,650	55,647	0	238,297		48.1
% of Intrastate[b]	76.7	23.4	0	100.0		
Total	227,767	266,136	1,825	495,728		100.0
% of Total[b]	46.0	53.7	0.4	100.0		

Source: 1977 elevator survey.

[a] Includes farm as well as commercial truck shipments.

[b] Percent detail may not add to totals because of rounding.

Table 6-9. Corn Shipments from Nebraska Elevators, by Mode of Transport and Destination, 1985.

Destination	Truck[a]	Rail	Barge	Total	% of Interstate[b]	% of Total[b]
	Mode of Transportation					
	(000 bu./%)				(%)	
Alabama	0	4,501	0	54,501	1.0	0.7
Arizona	1,900	2,340	0	4,240	0.9	0.7
Arkansas	3,845	15,313	0	19,158	4.3	3.1
California	0	48,854	0	48,854	10.9	7.9
Colorado	15,147	11,383	0	26,530	5.9	4.3
Illinois	0	752	0	752	0.2	0.1
Iowa	11	882	0	893	0.2	0.1
Kansas	61,738	14,625	0	76,363	17.1	12.3
Mississippi	0	779	0	779	0.2	0.1
Missouri	5,605	7,067	0	12,672	2.8	2.0
Nevada	0	1,212	0	1,212	0.3	0.2
New Mexico	0	127	0	127	<0.1	<0.1
Oklahoma	22,286	8,793	0	31,079	7.0	5.0
Oregon	0	1,521	0	1,521	0.3	0.2
South Dakota	991	0	0	991	0.2	0.2
Texas	23,256	25,512	0	48,768	10.9	7.8
Utah	415	1,374	0	1,789	0.4	0.3
Wyoming	3,682	0	0	3,682	0.8	0.6
East Gulf	0	5,168	0	5,168	1.2	0.8
Louisiana Gulf	0	0	500	500	0.1	<0.1
Texas Gulf	0	3,774	0	3,774	0.8	0.6
Pacific N.W.	0	130,303	0	130,303	29.2	21.0
California Ports	0	14,626	0	14,626	3.3	2.4
Mexico	0	8,474	0	8,474	1.9	1.4
Total Interstate	138,876	307,380	500	446,756	100.0	71.9
% of Interstate[b]	31.1	68.8	0.1	100.0		
Nebraska	166,072	8,089	0	174,161		28.1
% of Intrastate[b]	95.4	4.6	0	100.0		
Total	304,948	315,469	500	620,917		100.0
% of Total[b]	49.1	50.8	<0.1	100.0		

Source: 1985 elevator survey.

[a] Includes shipments to local farmers and feeders.

[b] Percent detail may not add to totals because of rounding.

Table 6-10. Corn Shipments by Rail from Nebraska to Various Destinations, 1992.

Destination	Amount	% of Total[a]
Alabama	3,434	0.5
Arkansas	49,521	7.6
Arizona	11,073	1.7
California	36,903	5.6
Colorado	31,380	4.8
Idaho	20,579	3.1
Iowa	32,469	5.0
Kansas (except Kansas City)	4,394	0.7
Kansas City	28,419	4.3
Louisiana	10,180	1.6
Minnesota	378	0.1
Mississippi	1,083	0.2
Missouri (except Kansas City)	25,499	3.9
Nevada	4,135	0.6
Oklahoma	6,180	0.9
Tennessee	15	<0.1
Texas (inland)	113,702	17.4
Utah	10,835	1.7
California Ports	82,683	12.6
Texas Ports	20,709	3.2
Pacific Northwest	134,311	20.5
Southern	1,172	0.2
Southwest	8,866	1.4
Western	16,622	2.5
Total	654,543	100.0

Source: U.S. Interstate Commerce Commission. 1993. *1992 Public Use Waybill Sample*. Computer tape of Waybill Sample observations edited for public use. Washington, DC: ICC.

[a] Percent detail may not add to totals because of rounding.

CHAPTER 7

SORGHUM FLOWS

Trade Patterns[1]

Only 1.706 million MT (67.2 million bu.) of sorghum grain were exported per year on average from the United States over the period 1955-59. The larger part of these exports were to countries in Western Europe. Belgium and Luxembourg together took the largest amount, 349.8 thousand MT (13.8 million bu.). The Netherlands, the UK and West Germany were in 2nd, 3rd and 4th places. Other significant importers included Israel, Denmark, Norway, India, Japan and Poland (Figure 7-1).

By the time of the 1969 grain-flow survey, total exports had grown 77 percent, to 3.024 million MT (119.1 million bu.). Japan had become the number-one importer of U.S. sorghum, taking 1.955 million MT (77.0 million bu.) of the crop. Israel was second, with purchases of 567.9 thousand MT (22.4 million bu.), followed by India, Belgium/Luxembourg, Netherlands and Mexico, in that order. Exports to Western Europe were no longer of much significance, EC policies having encouraged domestic production to the point that the region was becoming an exporter of feed grains (Figure 7-2).

By the 1977 survey year, total exports were 5.423 million MT (213.5 million bu.), an increase of 79 percent over 1969, and 218 percent above the 1955-59 average. Japan continued as the largest sorghum importer, buying 2.440 million MT (96.1 million bu.), or 45 percent of total U.S. sorghum

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[1]Except where otherwise credited, trade data presented in this section are either from Tables A7-1 through A7-23 or the ultimate source of the tables (U.S. Department of Agriculture various years (a)). Export trends are summarized in Table 3-4. Graphic interpretations (Figures 7-1 through 7-5) are presented for the survey years. Production and yield trends are summarized in Table 8-1.

exports in 1977. Israel was the second most important destination, taking 633.9 thousand MT (25.0 million bu.) of imports from the U.S. Mexico was third, Poland fourth and Norway fifth in relative sorghum imports (Figure 7-3).

Western Europe was virtually out of the market for U.S. feedgrains by 1985, expansionist agricultural policies of the European Community having made the region self-sufficient. Sales to Japan were also off their peaks in the early '80s owing to competition from other exporting nations (Figure 7-4). The rise of China, a good U.S. feedgrains customer between 1975-76 and 1982-83, to corn exporting status, was a factor in reduced sales to both Japan and South Korea (Wisner and Nourbakhsh 1986).

Japan remained, however, the largest single buyer in the 1985 survey year, taking 2.426 million tons (95.5 million bu.) of U.S. sorghum, an amount equal to that in 1977; Mexico moved up to a strong second place, with 1.733 million tons (68.2 million bu.). Other important importers in 1985 were Venezuela, with 941 thousand tons (37 million bu.); Israel, 484 thousand MT (19 million bu.); Sudan, 440 thousand tons (17.3 million bu.); and several developing and newly-developed countries in Asia, Africa and South America (Figure 7-4). Less-developed countries as a group received 56 percent of U.S. sorghum exports in 1985, developed countries only 44 percent of the total.

The Soviet Union became a major feed-grains importer in 1984-85, buying even more U.S. corn than it did during its subsequently-well-publicized, covert purchasing activities in 1981-82 and improving, as a result, sorghum's prospects in other export markets. These large purchases, made to cover shortfalls occasioned by drought-shortened Soviet harvests, were scaled back in 1985-86 when weather became more favorable and local crops much larger.

While exports had grown enormously since the 1950s, year-to-year variations in both destinations and volumes were large as well. The implications of the foregoing developments for exports were significant. U.S. sorghum exports, peaked in 1980 and 1981 at nearly 8 million MT (315 million bu.) in each year, but had declined by 1983 to less than 5.3 million MT (209 million bu.). Export volume in 1984, the year of the big Soviet purchases, was 6.8 million MT (268 million bu.), a little less than 6.7 million MT (264 million bu.) in 1985. The latter was 28 percent above 1983 but 17 percent below peak 1980 and 1981 levels. Dollar export sales volumes were $737.1 million in 1985, up 5 percent from the $699.1 million in 1983, but only 64 percent of the $1.151 billion level of 1980.

Only about half of sorghum movements in 1985 went directly to out-of-state destinations compared with nearly 72 percent of corn movements (compare Tables 6-9 and 7-9). The proportions of corn and sorghum shipped directly from the state were, however, essentially the same (half and half) in 1977, a year when, nevertheless, a much larger proportion of sorghum than of corn moved by rail (Tables 6-8 and 7-8).

The increased proportion of out-of-state shipments occurring between 1977 and 1985 may have resulted largely from the 47 percent increase in production in the face of increases of cattle and hog populations of less than half that magnitude (recall Tables 3-1 and 3-2). The decline in relative amount of sorghum as compared with corn leaving the state may reflect a growing acceptance of sorghum as a feed grain within the state.

A large 1985 crop in the face of declining export demand resulted in expanding inventories, in both Nebraska and the nation. Nebraska grain sorghum stocks in all positions were 4.407 million MT (173.5 million bu.) on January 1, 1986, a 29 percent increase over the 5.69 million MT (224.2

million bu.) on January 1, 1985. U.S. stocks grew from 18.418 million tons (725.1 million bu.) on January 1, 1985 to 25.565 million tons (994.3 million bu.) on January 1, 1986, a 37 percent increase (Nebraska Department of Agriculture and USDA, 1986; U.S. Department of Agriculture, 1987).

Sorghum exports in 1992 were 7.548 million MT (297.2 million bu.), up from the 5.915 million MT (232.9 million bu.) of a year earlier, and above both the 6.664 million MT (263.8 billion bu.) exported in 1985, and the 5.423 million MT (213.4 million bu.) in the 1977 survey year. The 1992 level was exceeded only by the 8.282 million MT (326.8 million bu.) of sorghum exported in 1989.

Mexico had become the single largest U.S. sorghum customer, importing a record 4.957 million tons (195.1 million bu.) of U.S. sorghum, and accounting for 65 percent of all U.S. exports of the crop in 1992. Japan was number two, buying 1.803 million tons (71 million bu.). Mexico and Japan together have accounted for 90 percent of U.S. sorghum exports over the three years ending in 1992. Spain, Turkey, Israel, South Africa, Jordan and Sudan were the remaining importers of consequence (Figure 7-5). Less-developed countries as a group had become a growing market for U.S. sorghum, taking 71 percent of the total in 1992.

U.S. sorghum exports in 1993 were down 20 percent from 1992 levels to 6.046 million MT (238 million bu.). Mexico continued to be the number-one importer, taking 3.614 million MT (142.3 million bu.) in 1993. Asia received 2.140 million MT (84.2 million bu.), Japan being the major Asian customer, with 1.898 million MT (74.7 million bu.) of sorghum imports from the U.S. Spain was a distant third, Israel fourth and Turkey fifth in relative import importance. Less-developed countries as a group received 3.806 million MT (149.9 million bu.), or 63 percent of U.S. sorghum exports in 1993.

Total sorghum exports from the U.S. in 1994 declined another 4 percent from the 1993 level, to 5.800 million MT (228.3 million bu.). Mexican imports (3.373 million MT/228.3 million bu.) declined marginally but still accounted for 58 percent of total U.S. sorghum exports. Japan took 1.719 million MT (67.7 million bu.), 30 percent of the total. Spain, Australia and Ethiopia were next in order, but far behind the leading importers. Less-developed countries received 3.591 million MT (141.4 million bu.), 62 percent of the total.

Total U.S. sorghum exports were down again in 1995, to 5.522 million MT (217.4 million bu.), 4.8 percent behind those of a year earlier. Mexican imports were off by nearly 37 percent, to 2.153 million MT (84.7 million bu.), in the wake of that nation's serious economic trauma and a much-devalued peso. Mexico remained, nevertheless, the best U.S. customer, with 39 percent of its total export market. Japan's imports strengthened a bit in 1995, to 1.862 million MT (73.3 million bu.), an amount equal to nearly 34 percent of U.S. sorghum exports. Spain was in third place, with 682 thousand MT (26.8 billion bu.), or 12 percent of the total. Israel, Italy and Australia were a distant fourth, fifth and sixth in importance. Developing countries slipped in relative importance, in large part because of declining Mexican imports, to 2.341 million MT (92.2 million bu.), or a little more than 42 percent of the total.

Projections for crop-year 1996-97 are for exports of 5.715 million MT (225 million bu.), up from 1995, but far below records set in the 1980s (U.S. Department of Agriculture various issues (d): February 1997).

Shipping Patterns

Information in this section is from University of Nebraska grain-flow surveys and, for 1992, the ICC Waybill for that calendar year. Since the Waybill reports only rail shipments, neither modal splits nor destination data for truck or barge shipments are available for 1992.

Volume of Receipts and Shipments

Sorghum was a minor crop in Nebraska at the time of the 1954 elevator survey, only 13.4 million bushels having been produced, 6.3 million moving during that year into the state's elevator system. Production grew rapidly during the remainder of the 1950s and the 1960s in response to improved yields and larger harvested acreage (Table 7-1).

More recently, yields have continued to grow, but expanded irrigation has increased acreage of corn at the expense of sorghum. The state's sorghum production peaked in 1981 at 164.8 million bushels, a level 1,130 percent above that in 1954. Production at the time of the 1985 survey was 154.4 million bushels, 1,051 percent higher than in 1954, but 6.3 percent below that in the peak year. Average Nebraska yield in the very favorable 1994 crop year was 98 bushels per acre, 277 percent above 1954's 26 bushels. Production in 1994 was 117.6 million bushels, almost 777 percent above the 1954 level. The 1995 crop was much smaller, only 56.8 million bushels, owing to declining acreage and a drought-impaired yield of only 58 bushels per acre; but even in the latter year production was almost 324 percent higher than that in 1954, although less than half the level of the previous year and 65.5 percent below the peak. Production in 1996 was an estimated 97.9 million bushels, on the second highest yield ever of 95 bushels per acre (Table 7-1).

As with other grains, the size of annual elevator receipts (and shipments) of sorghum depends upon crop size and imports into the state as well as market conditions during the year. Strong local feed demand in some years reduces the relative surplus available for export from the state. Differences in out-shipments also reflect inventory changes, the latter in turn being affected by market conditions and government storage programs as well as crop size (Figure 7-6 and Table 7-2).

As it happens, elevator receipts have generally exceeded out-shipments in the survey years, just as they did for corn (Chapter 6). This seeming anomaly results from stock accumulations having occurred in these particular years. For example, sorghum shipments from Nebraska elevators were only 3 percent less than the state's production in 1985. Elevator receipts were 80 percent larger than out-shipments, evidence of growing commercial inventories during the year (Figure 7-6 and Table 7-2).

Although Nebraska consistently produces a large net surplus of sorghum, some amounts are at the same time imported from out-of-state sources, the volume varying significantly from one survey year to another. As noted in Chapter 6, some 22 million bushels of <u>all grains</u> were shipped into the state in 1956, only 3.5 million in 1957. Feed grains in those years entered the state from South Dakota, Minnesota and Iowa, the large shipments in 1956 owing perhaps to drought conditions in that and the previous year in Nebraska (Miller, p. 27). In-shipments in 1977 were negligible, only 325 thousand bushels, or less than 0.2 percent of total elevator receipts (Table 7-3). Imports in 1985 were larger, 17.4 million bushels, or 6.4 percent of total elevator receipts (Table 7-4). All of the imports in each of these years came from bordering states, nearly all moving by truck, suggesting that they came directly from farmers. Similar amounts may have been delivered by Nebraska farmers to elevators in bordering states.

Mode

Modal shares of total Nebraska sorghum shipments (including those to local farmers and feeders) have varied widely from one survey year to another, the rail proportion ranging from a high of 87.8 percent in 1954 to a low of 5.9 percent in 1955, a year of drought and reduced surplus for export from the state. Railroads carried on average 46.3 percent of the total sorghum traffic during the period 1954-59.[2] Trucks carried virtually all of the remainder in each year (Figure 7-7 and Table 7-5).

That sorghum shipments rely relatively less on trucks than do those of feed grains in total is consistent with the widely-held view that a higher proportion of corn than sorghum is fed locally in the state, but at odds with recent reality. About half of the sorghum movements in 1985 went directly to out-of-state destinations (Table 7-9) compared with nearly 72 percent of corn movements (Table 6-9). The proportions of corn and sorghum shipped directly from the state had been essentially the same (half and half) in 1977, a year when, nevertheless, a much larger proportion of the sorghum than of corn moved by rail (Tables 6-8 and 7-8).

It is perhaps more enlightening to examine separately the modal splits of traffic moving within the state and those moving into interstate markets. Railroads' share of interstate traffic increased from 86.7 percent in 1954 to 92.5 percent in 1969, holding at about the latter level in 1977 and 1985. The

[2]Clearly 1954 was something of an "outlier" among survey years of the 1950s, contrasting especially with 1955 when less than 6 percent of total sorghum shipments went by rail, 94 percent by truck. Data for 1954, like those for the other survey years of the 1950s, except 1956, exclude truck shipments to local farmers and feeders, and thus overstate the rail proportion of total shipments. Note also that the 1954 destination data, like those for 1977 and 1985 (but not for 1969) reflect shipments from terminal and subterminal elevators as well as those from country houses. The average split over the entire span of 1950s surveys, 1954-59 (rail about 46 percent, truck 54 percent), may provide a more reliable picture of the modal division during that period of time.

intrastate rail share, however, shrank dramatically over the same period, from 90.8 percent in 1954 to only 17.7 percent in 1985; the rail share in the former year was, as noted above, exceptionally high. Trucks, once a minor factor in traffic moving within the state, have come to dominate these shipments. Their share only 9.2 percent in 1954, trucks had nearly 41 percent of intrastate shipments in 1969 (the latter feed grains in total), 42.3 percent of sorghum shipments by 1977 and 82.4 percent in 1985 (Tables 7-6 through 7-9).

The high rail share of interstate markets in both 1977 and 1985 suggests that rail carriers' comparative advantage in longer hauls was being widely exploited. The modest increase in the proportion of interstate shipments by rail is also consistent with the state's production of a growing exportable surplus and expanding train-loading shipping capacities keyed to serving growing foreign markets. A decline in the rail/truck mix in 1985 to 51 percent of all feed grains (intra- as well as interstate) moving by rail (54 percent of sorghum) may reflect increased feed demand associated with larger numbers of Nebraska hogs and cattle on feed in the latter year (Tables 3-1, 3-2 and 7-5).

The major decline in the rail share of intrastate shipments from 58 percent in 1977 to 18 percent in 1985 may reflect in part effects of trucking deregulation in 1980 which have made it easier for grain truckers to secure back-hauls, and in part, rail carriers' having conceded the shorter gathering hauls which they had once dominated to the more efficient motor carriers, specializing instead in train-load hauls to distant markets where railroads have the comparative advantage (Tables 7-8 and 7-9).

Destination

The same caveats about the data as noted in the discussion of corn flows (Chapter 6) apply here. Survey procedures varied somewhat over time. Thus, intrastate totals sometimes include local sales to farmers and feeders, and sometimes do not (a problem unique to sorghum and other feed grains). The 1977 and subsequent surveys did not distinguish among country, subterminal and terminal elevators. Combination data are not a major problem for 1977 and 1985 since most grain by the time of these surveys no longer transited through in-state terminals or subterminals on its way to ultimate out-of-state destinations. For the earlier years, adding the flows from all elevator types results in double-counting of the total traffic since some of the shipments are simply second or third legs of original shipments. However, if the objective is to trace net flows from the state, exports from all of these elevator types should be combined for a complete picture of interstate shipments. The latter surveys are therefore comparable with the earlier ones for some purposes.

Sorghum movements from Nebraska country elevators in 1954 went 73 percent directly to out-of-state destinations, 27 percent to in-state points. Intrastate shipments went to Omaha and Lincoln. Kansas City was by far the major interstate recipient, accounting for more than 73 percent of the shipments beyond Nebraska borders. St. Joseph, Missouri was second with 14.4 percent, and Colorado third with 9.5 percent. Most of the Kansas City shipments were by rail as were all of those to St. Joseph. Most Colorado shipments moved by truck (Figures 7-8 and 7-9 and Table 7-6). Shipments to Kansas City and St. Joseph probably moved on to points further south and east by barge or by rail under transit balances. Nebraska terminal elevators shipped 31.8 million bushels of feed grains in 1954 (sorghum portion unknown); 99 percent moved by rail, 1 percent by truck (Miller).

The pattern in 1969 featured a much larger volume of shipments than in 1954 (80.812 million bushels,[3] up 1,096 percent from the 6.755 million bushels in the former year), and a much wider range

[3]Of the total, 8.816 million bushels went to unknown destinations. The discussion which follows describes the relative pattern of the known flows only; recipient-state percentages sum to 100 percent of known shipments.

of destinations. Intrastate traffic from country elevators made up a larger proportion of total traffic: 54.5 percent in 1969, only 26.8 percent in 1954. Kansas City remained the first-ranking destination, with 30.7 percent of interstate shipments. Colorado was second, with 25.3 percent and Kansas (exclusive of Kansas City) third with 12.4 percent. Other important destinations included Missouri (exclusive of Kansas City), 9.2 percent; Minnesota, 7.7 percent; and Texas, 6.8 percent. The remainder went to several states to the south and west (Tables 7-6 and 7-7).

Interstate shipments trucked from country elevators in 1969 went 36 percent to Colorado, 20.5 percent to Kansas City, 15.1 percent to Kansas (exclusive of Kansas City) and 12 percent to Texas, with smaller amounts to other, mostly surrounding, states (Figure 7-10; and Table 7-7). Rail shipments, 92.5 percent of the total, followed a similar pattern; 31.5 percent went to Kansas City, 24.5 percent to Colorado, 12.2 percent to Kansas (exclusive of Kansas City). Missouri, Minnesota, California and Texas were also important destinations (Figure 7-11; and Table 7-7).

The 1969 survey also offers limited insights into terminal and subterminal operations in that year. More than 94 percent of the latter went by rail, a little less than 5 percent by barge and the remaining 3 percent by truck. Feed grain shipments from Nebraska subterminals moved to a large number of points in 1969, nearly 98 percent out-of-state. California was the number-one recipient, with 48.5 percent of the rail traffic, "Gulf points" were second with 18 percent and Kansas City third with 7.7 percent of the rail shipments (see Figures 6-12 and 6-13 in Chapter 6; and Anderson and Breuer 1971). Sorghum destinations are not reported separately in the 1969 survey results but it is known that 56.5 percent of feed grain receipts by subterminals in 1969 were sorghum (corn was 43.2 percent and oats 0.3 percent); sorghum's share of subterminals' feed grains business was out of proportion to its relative production in the state (Anderson and Breuer 1971).

Feed grain shipments (sorghum portion unknown) from terminal elevators in 1969 totaled 36.6 million bushels; 93 percent moved by rail, 6.2 percent by truck and 1 percent by barge (Omaha Grain Exchange, cited in Anderson and Breuer 1971).

The Texas Gulf was by far the leading destination in 1977, with 63.5 percent of all interstate shipments. Kansas was also a major recipient in 1977, receiving 17 percent of the interstate shipments, some of which also may have reached the Gulf. The Pacific Northwest (PNW) had not yet become a major destination, receiving only 0.2 percent of 1977 shipments. California was also a minor market, taking only 3.9 percent of the interstate sorghum flows (Table 7-8).

Interstate shipments by truck in 1977 as in 1969 went heavily to bordering states: 44.4 percent to Kansas, 27.5 percent to Colorado. Some longer hauls also assumed a measure of prominence: Arkansas received 13 percent, Arizona 5.3 percent, Illinois 3.7 percent (Figure 7-12; and Table 7-8). A large number of states received rail shipments of Nebraska sorghum in 1977. The Texas Gulf took the most, 68.1 percent; Kansas was second, with 14.1 percent; and Texas inland points third with 5.8 percent of interstate shipments (Figure 7-13; and Table 7-8).

A little more than half of 1985 sorghum shipments were to points within the state; 82 percent of the latter went by truck. The PNW was the largest single out-of-state destination, taking 26 percent of all interstate sorghum shipments from Nebraska. Almost 18 percent went to inland California points and more than 15 percent to Texas. The Pacific Coast market dominated exports in 1985. Including the 4.1 percent shipped through California ports, total movements of Nebraska sorghum over the West Coast amounted to 29 percent of the total. Another 10 percent was shipped to various Kansas destinations, much of it to the north-central part of the state where it may have moved on by rail or been fed locally to livestock (Table 7-9).

The constant proportions of local to interstate shipments in 1977 and 1985 may be surprising in the face of the much larger crop in the latter year, which might be expected to have led to relatively larger out-shipments of the surplus. The strong Texas Gulf market in the earlier year may have exerted a particularly strong pull on sorghum, leading to large out-shipments even in the face of the smaller crop (Tables 7-7 and 7-8). Nine-tenths of the barge shipments (only 2.1 percent of all shipments) went to Louisiana ports, the remainder to Mississippi (Figure 7-11; and Table 7-9).

Truck shipments in 1985 went primarily to neighboring states, Kansas receiving the most, 46.4 percent, Missouri 26.2 percent and Colorado 10.2 percent. Significant amounts moved as far as Oklahoma (10.6 percent) and Arkansas (4.9 percent) (Figure 7-13). Rail shipments went much further afield, the PNW (28 percent), inland California (19.2 percent) and Texas (16.2 percent) being the major destinations. Export markets were in fact the destination for the greater part of the sorghum leaving Nebraska by rail in 1985 (compare Figures 7-13 and 7-15; and Tables 7-8 and 7-9). The Gulf, the first-ranking destination in 1977, received sorghum only by barge in 1985, the amount in the latter year being less than 2 percent of total interstate shipments by all modes. Some of the substantial shipments to Kansas and Missouri may, of course, eventually have found their way to Gulf ports along with the already noted barge shipments to Mississippi and Louisiana (Figure 7-16; and Table 7-9).

Rail shipments in 1992, as reported in the ICC Waybill, went entirely out of state; nearly 36 percent were traceable only to ICC territories, as disclosure rules prevented divulsion of more specific destination information. The largest part of reported state shipments (45 percent) went to Missouri, some of which may have been transhipped by rail or water to further destinations. Texas ports received 15.1 percent. The 36-percent remainder was identifiable only as to territory of destination:

Southern 13.1 percent, Mountain Pacific 11.3 percent, Western 7.7 percent and Southwest 1.7 percent (Figure 7-17 and Table 7-10).

Summary

Sorghum was a minor crop in 1954, its development as an important feed grain not gaining much momentum until later in the 1950s. The modest export flows of the U.S. sorghum crop (only 1.7 million tons per year on average over the period 1955-59) went mainly to Western Europe. By 1969 and again in 1977, Japan was the largest importer; Israel was second. Common Market agricultural subsidies were turning Western Europe into an exporter of feed grains by 1977. Mexico had, however, become an importer in 1969 and was the third-ranking U.S. sorghum customer by 1977. Ranking regional customers in 1985 were East an South Asia, Central America (including Mexico) and South America. Japan was still the number-one country customer, Mexico was second and Venezuela third. Not a single European country fell within the top ten in 1985. By 1992, Central America (defined to include Mexico) was by far the major regional customer, East Asia second and West Asia third. Mexico alone took 66 percent of all U.S. sorghum exports in that year. Japan ranked second and Spain a distant third. In recent times, Mexico and other LDCs as a group have accounted for the larger part of the export market for U.S. grain sorghum, taking more than half of total U.S. exports of the grain in 1985, 71 percent in 1992; the proportion declined to 42 percent in 1995 owing to faltering Mexican purchases in the face of that nation's financial crisis, a problem which seems, by early 1997, to have largely passed.

Trucks have come to dominate intrastate traffic for sorghum just as they have for corn. Railroads, however, have become increasingly dominant in interstate traffic. Both modes are exploiting their comparative advantage under deregulation.

Sorghum shipments moved almost exclusively directly from country elevators to their final destinations by the 1980s, in contrast with a pattern of transshipments from country houses through subterminals and terminals which dominated flows of the 1950s and 1960s. Kansas City was the major destination in 1954, St. Joseph, Missouri second, Colorado third. Kansas City shipments in 1954 went mainly by rail, reflecting that city's role as a transit point. The pattern of rail destinations had widened by 1969; Kansas City again was first, Colorado second. Other points in Kansas and Missouri were also important 1969 destinations; the remainder of the sorghum went to several states in the south and west. Trucked sorghum in 1969 went to nearby states and some as far away as Texas. California had become the number-one market for movements from subterminal elevators, Gulf markets second.

The Texas Gulf was the dominant interstate destination in 1977, reflecting the rapid growth of export markets in the late 1970s. Shipments to bordering states continued to dominate the truck market, but some went also as far as Arkansas and Arizona. In 1985, by contrast, the PNW dominated interstate traffic. Remaining shipments were to a variety of places, in contrast to the narrow destination focus of 1954. The Gulf again assumed greater importance in 1992, when Texas ports received more than 15 percent of rail shipments of Nebraska sorghum. Large shipments also went to Missouri and may have been destined ultimately for the Gulf.

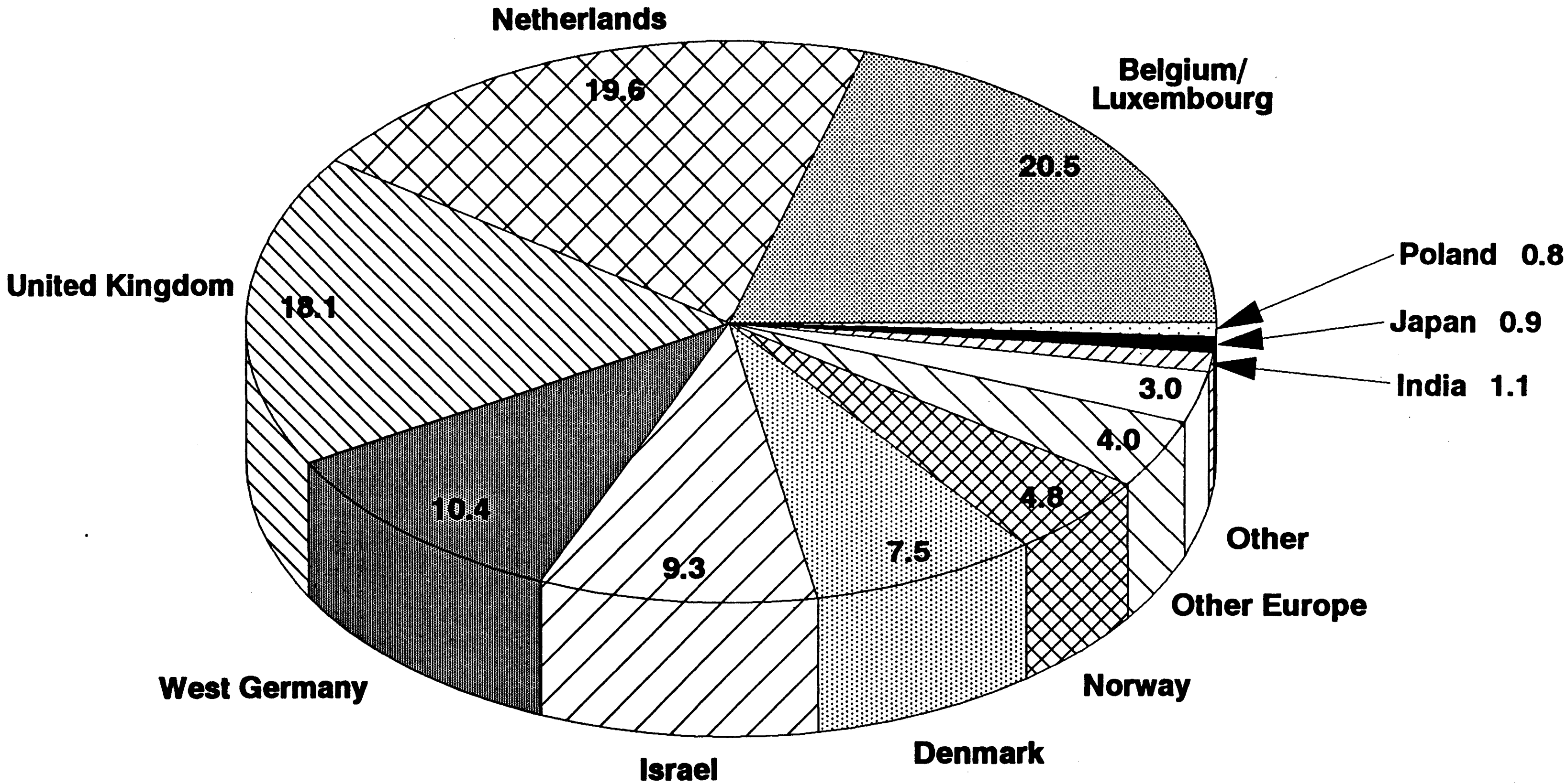

Figure 7-1. Percent Shares of Top Importers of U.S. Sorghum, 1955-59

Source: Appendix Table A7-1

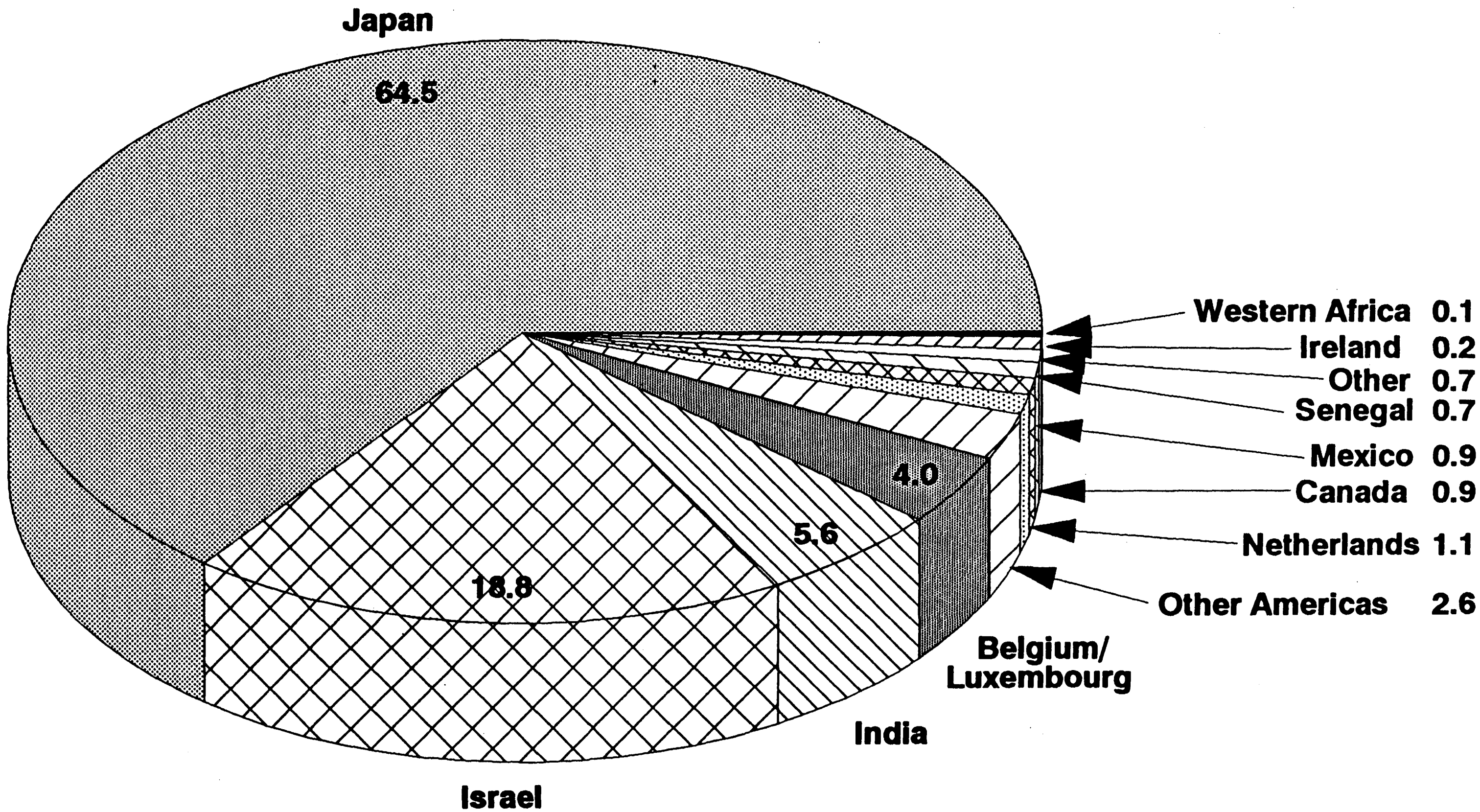

Figure 7-2. Percent Shares of Top Importers of U.S. Sorghum, 1969

Source: Appendix Table A7-1.

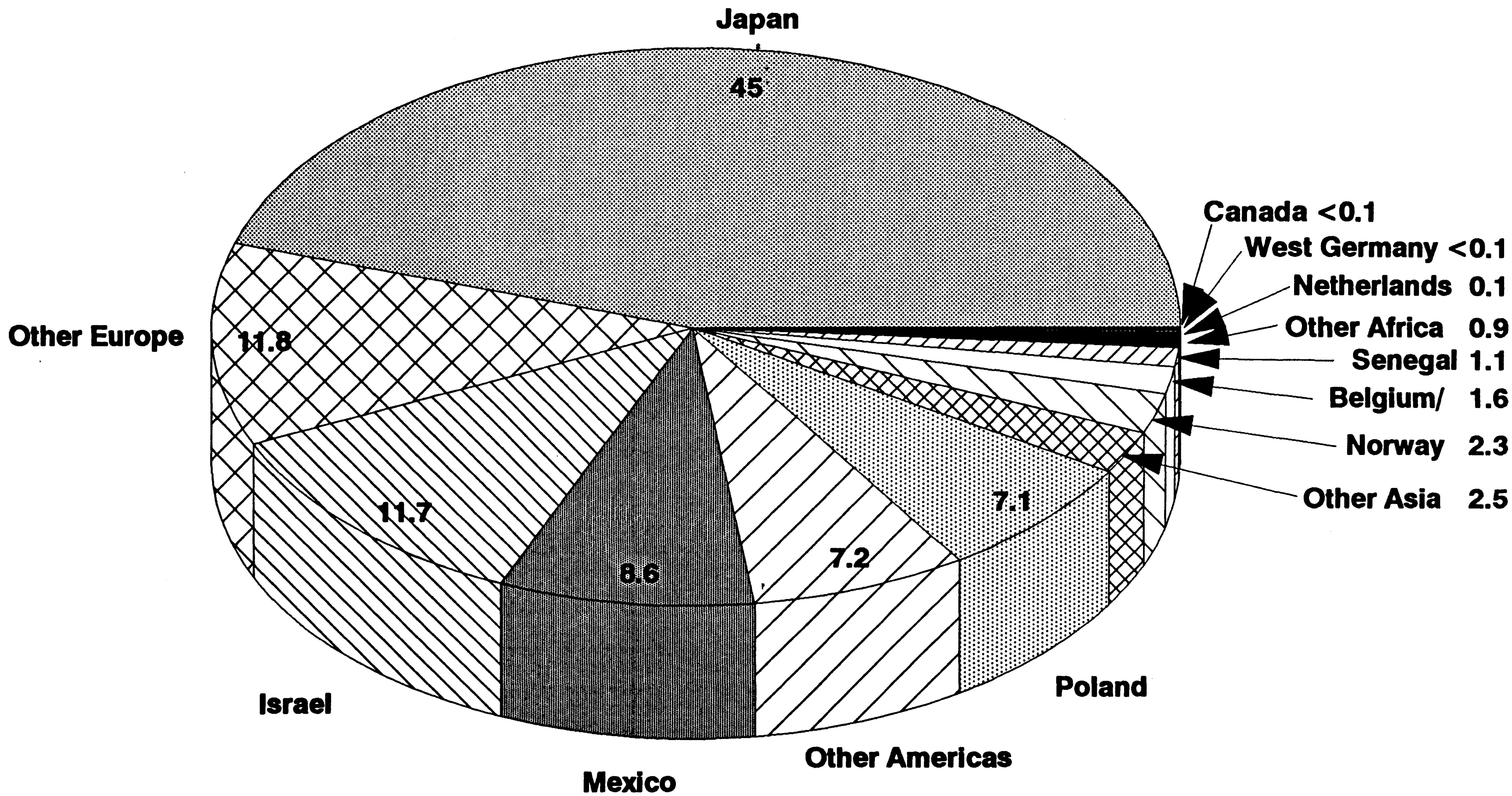

Figure 7-3. Percent Shares of Top Importers of U.S. Sorghum, 1977

Source: Appendix Table A7-1.

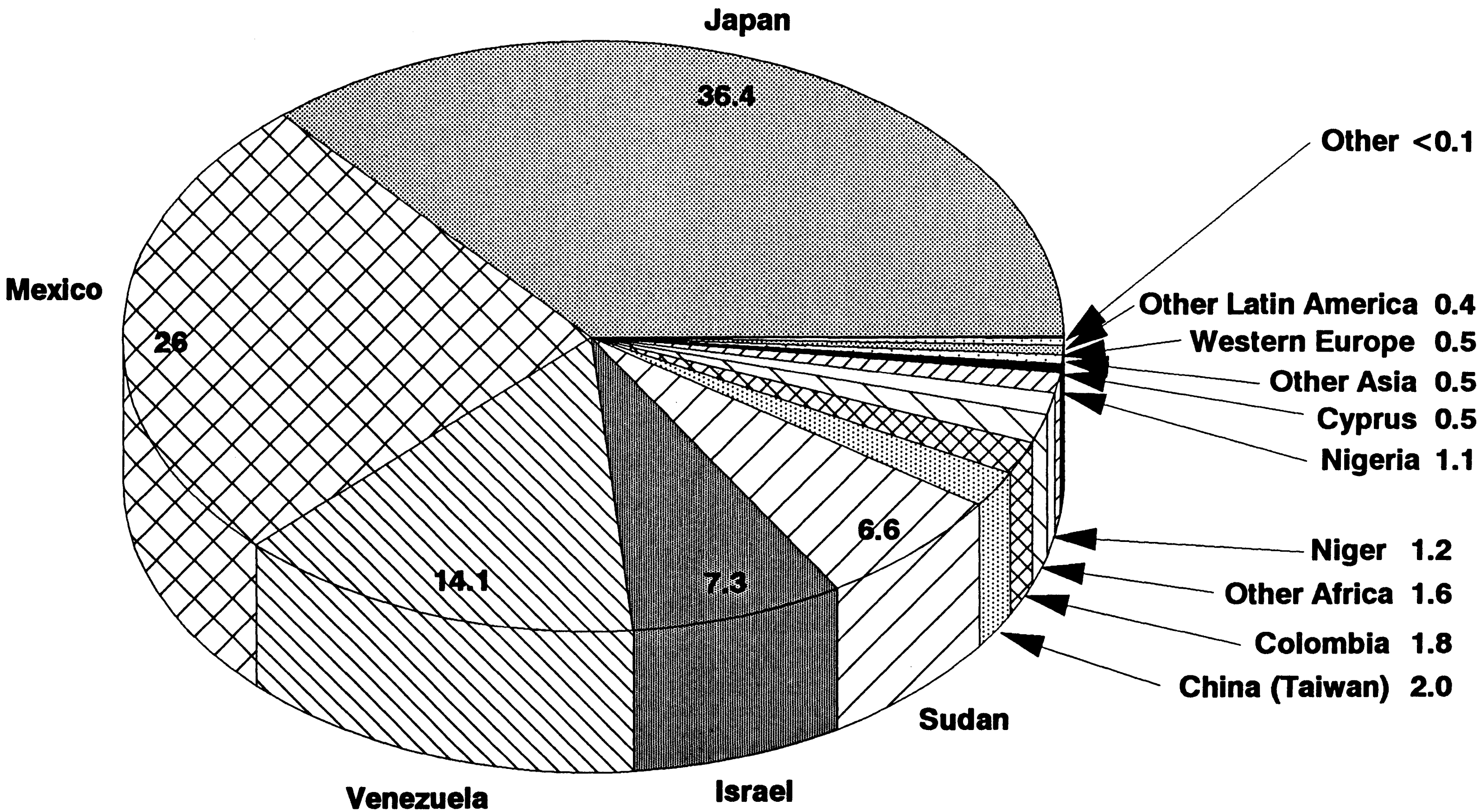

Figure 7-4. Percent Shares of Top Importers of U.S. Sorghum, 1985

Source: Appendix Table A7-3.

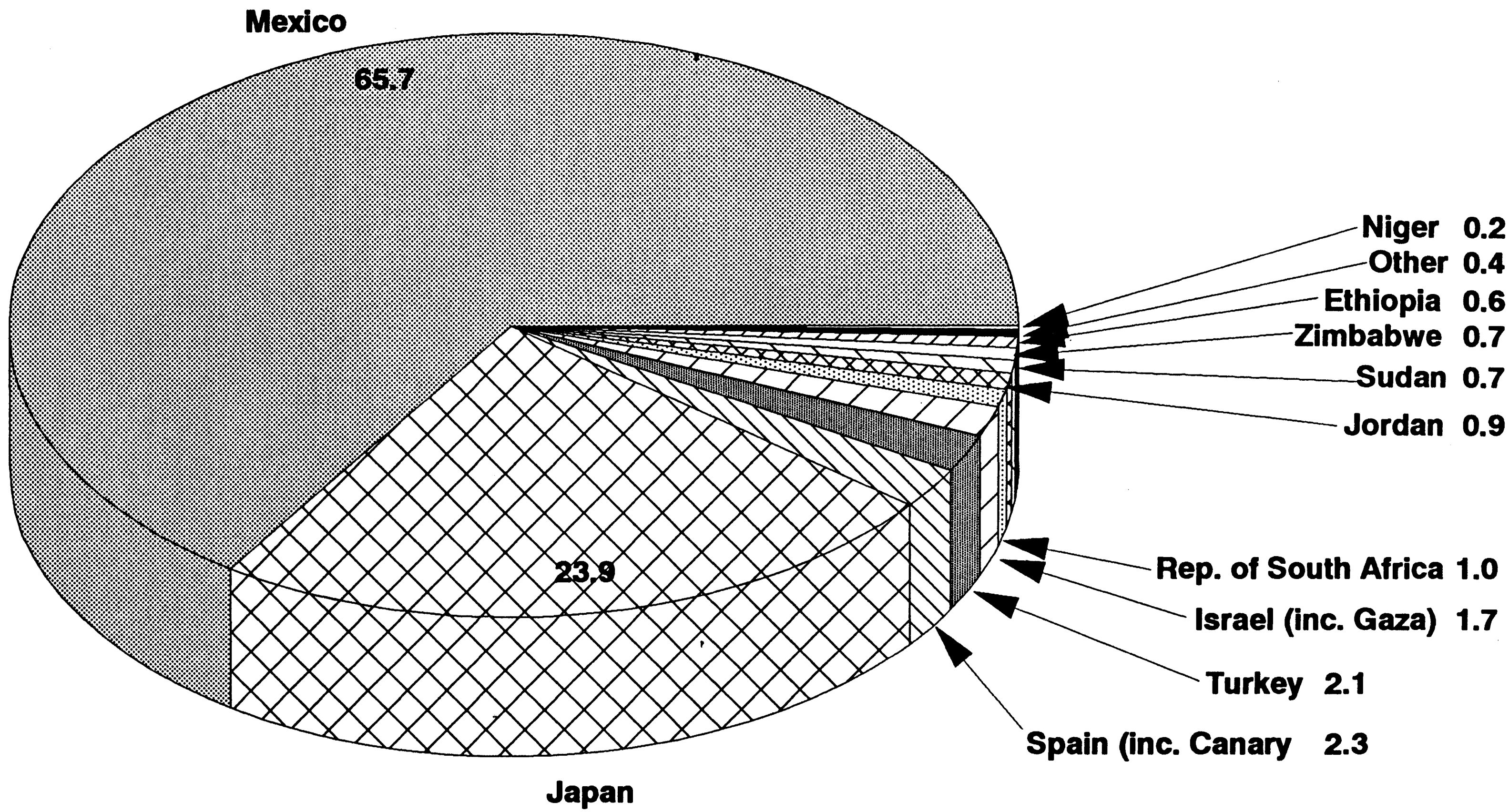

Figure 7-5. Percent Shares of Top Importers of U.S. Sorghum, 1992

Source: Appendix Table A7-17.

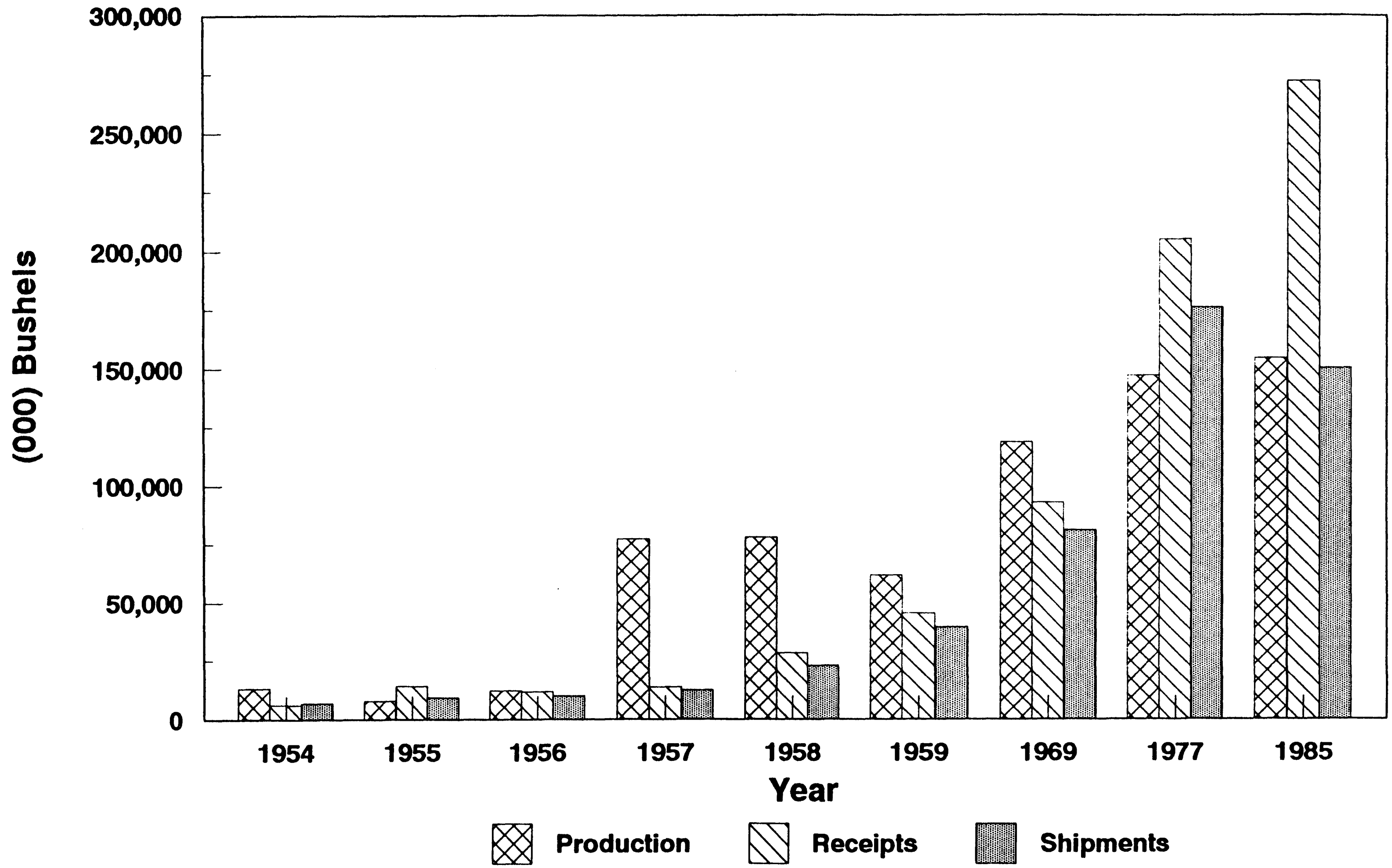

Figure 7-6. Sorghum Production, Elevator Receipts and Shipments, Nebraska, Selected Years, 1954-1985

Source: Table 7-2.

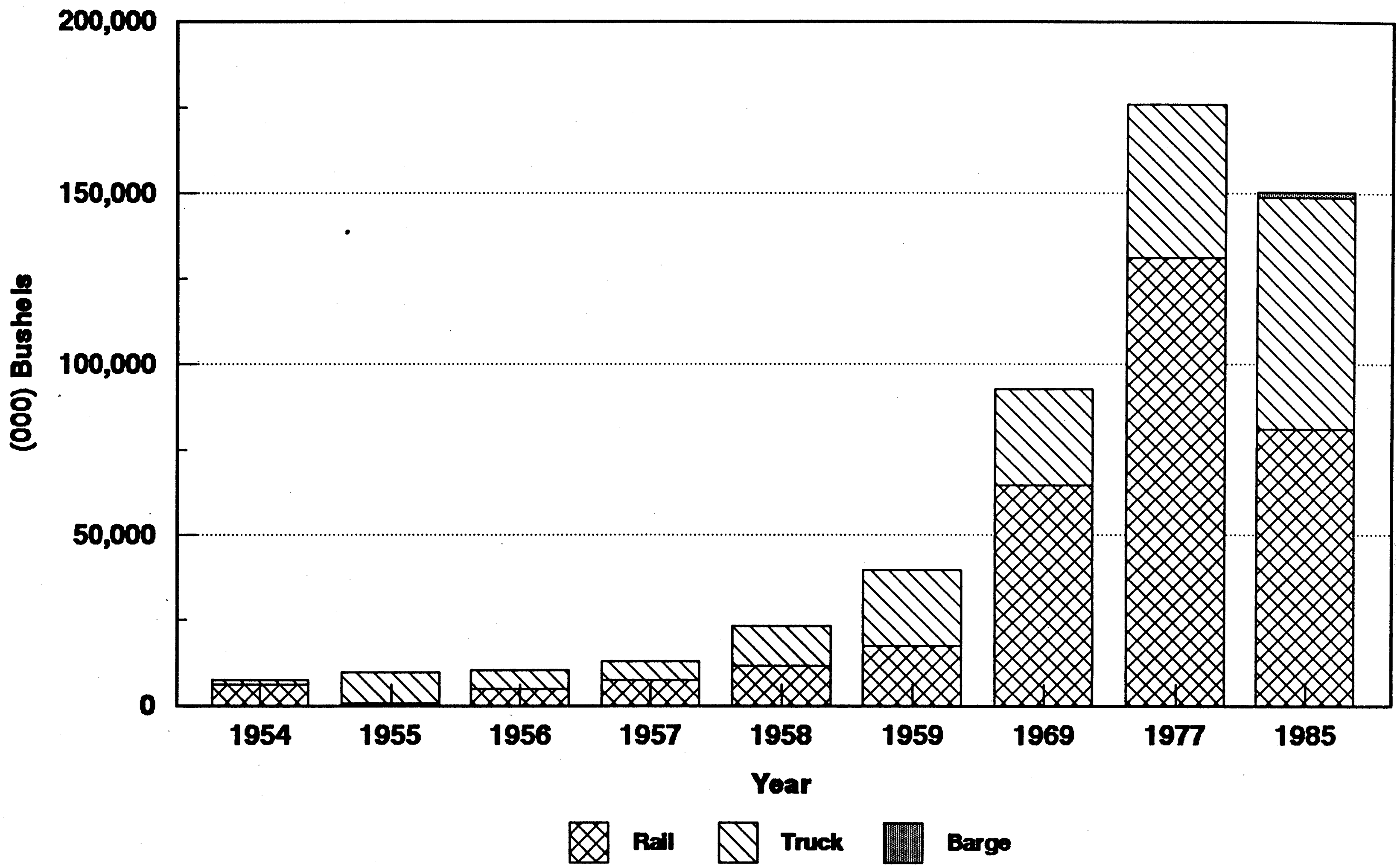

Figure 7-7. Total Sorghum Shipments from Nebraska Elevators by Mode of Transport, Selected Years, 1954-1985.

Source: Table 7-5.

[a] Barge data only available for 1985.

Figure 7-8. Percentage of Interstate Sorghum Shipments from Nebraska Elevators to Various Destinations, by Truck, 1954.

Figure 7-9. Percentage of Interstate Sorghum Shipments from Nebraska Country Elevators to Various Destinations, by Rail, 1954.

Figure 7-10. Percentage of Interstate Sorghum Shipments from Nebraska Country Elevators to Various Destinations, by Truck, 1969.
(exclusive of unknown destinations)

Figure 7-11. Percentage of Interstate Sorghum Shipments from Nebraska Country Elevators to Various Destinations, by Rail 1969.

(exclusive of unknown destinations)

Figure 7-12. Percentage of Interstate Sorghum Shipments from Nebraska to Various Destinations, by Truck, 1977.

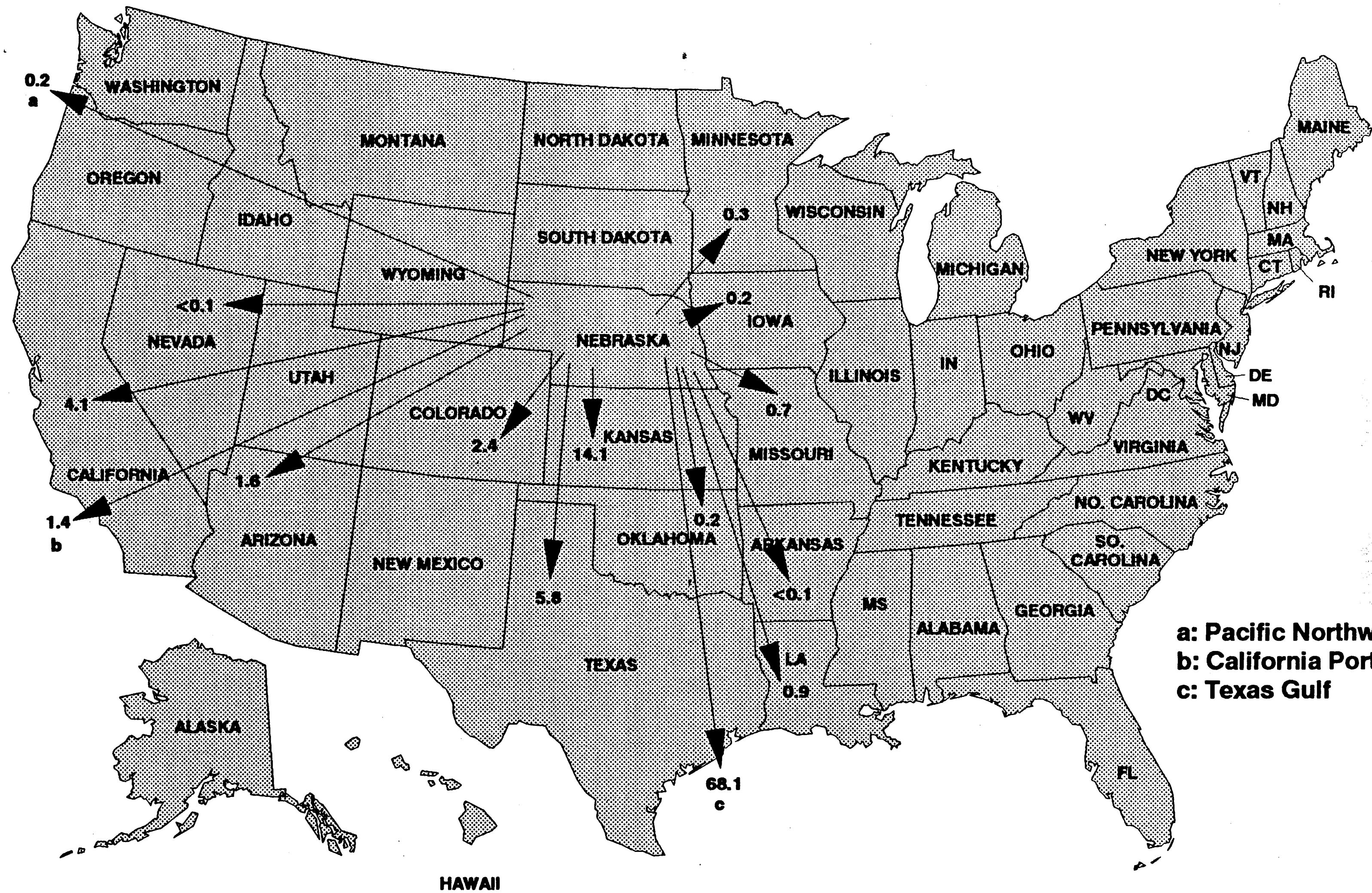

Figure 7-13. Percentage of Interstate Sorghum Shipments from Nebraska to Various Destinations, by Rail, 1977.

Figure 7-14. Percentage of Interstate Sorghum Shipments from Nebraska to Various Destinations, by Truck, 1985.

Figure 7-15. Percentage of Interstate Sorghum Shipments from Nebraska to Various Destinations, by Rail, 1985.

Figure 7-16. Percentage of Sorghum Shipments from Nebraska to Various Destinations, by Barge, 1985.

Figure 7-17. Percentage of Sorghum Shipments from Nebraska to Various Destinations, by Rail, 1992.

Table 7-1. Sorghum Production and Yield, Nebraska, United States and World 1954-1996.

	WORLD		UNITED STATES		NEBRASKA	
	Average Yield	Production	Average Yield	Production	Average Yield	Production
Year[a]	(bu./ac)	(000 bu.)	(bu./ac)	(000 bu.)	(bu./ac)	(000 bu.)
1996[b]	NA	NA	67.5	802,974	95.0	97,850
1995[b]	22.8	2,125,256	55.6	460,000	58.0	56,840
1994	23.4	2,238,794	72.8	649,000	98.0	117,600
1993	22.4	2,078,880	59.9	567,867	59.0	73,750
1992	22.2	2,206,512	72.8	884,010	94.0	143,820
1991	22.1	2,092,895	59.0	579,490	66.0	85,800
1990	21.8	2,078,998	63.1	573,303	77.0	108,570
1989	21.2	2,175,568	55.4	615,420	62.0	101,060
1988	20.7	2,144,664	63.8	576,686	76.0	103,360
1987	21.3	2,219,858	69.7	739,686	84.0	109,200
1986	22.7	2,531,221	67.7	938,124	89.0	136,170
1985	23.6	2,760,935	66.7	1,112,571	80.0	154,400
1984	23.5	2,590,077	56.4	866,241	64.0	121,600
1983	20.2	2,303,161	48.7	487,521	60.0	60,000
1982	21.7	2,563,660	59.1	835,083	73.0	121,910
1981	23.2	2,771,722	64.0	875,835	80.0	164,800
1980	20.9	2,336,388	46.3	579,343	60.0	121,800
1979	21.4	2,421,423	62.6	807,422	79.0	151,680
1978	22.1	2,504,529	54.5	731,270	75.0	140,250
1977	22.3	2,535,552	56.6	780,944	71.0	146,970
1976	21.0	2,446,855	49.1	710,797	57.0	119,700
1975	21.3	2,512,639	49.0	754,354	55.0	104,500
1974	20.9	2,375,008	45.1	622,711	33.0	62,700
1973	22.1	2,594,801	58.8	823,224	68.0	136,000
1972	20.4	2,126,043	50.7	801,350	72.0	118,080
1971	19.6	2,270,328	53.8	867,997	60.0	123,420
1970	18.4	2,170,057	50.7	696,454	51.0	77,520
1969	18.1	2,157,853	55.3	747,280	76.0	118,636
1968	17.9	2,025,536	52.9	739,695	58.0	101,732

Table 7-1, continued

YEAR	WORLD		UNITED STATES		NEBRASKA	
	Average Yield	Production	Average Yield	Production	Average Yield	Production
Year[a]	(bu./ac)	(000 bu.)	(bu./ac)	(000 bu.)	(bu./ac)	(000 bu.)
1967	18.1	2,096,753	50.4	755,936	56.5	123,904
1966	17.4	1,941,209	55.8	714,992	68.0	142,052
1965	16.3	1,825,584	51.6	672,698	53.5	121,498
1964	15.5	1,638,467	41.7	489,796	47.0	95,175
1963	15.8	1,721,180	43.9	585,394	55.0	105,050
1962	15.1	1,645,593	44.1	510,284	66.0	101,640
1961	14.4	1,518,748	43.7	480,208	50.5	59,842
1960	16.1	1,606,697	39.7	619,954	50.0	90,692
1959	15.8	1,905,660	36.1	555,441	43.5	61,683
1958	16.1	1,891,605	35.2	581,012	48.0	77,952
1957	14.7	1,784,760	28.8	567,506	39.0	77,337
1956	12.1	1,560,400	22.2	204,881	14.0	12,446
1955	11.5	1,549,141	18.8	242,638	11.0	7,920
1954	12.4	1,621,145	20.1	235,575	26.0	13,416

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, various issues; and Food and Agricultural Organization of the United Nations. *Yearbook of Food and Agricultural Statistics.* Rome: FAO, various issues.

[a] "Year," in the world data series prior to 1988, refers to year of harvest. Southern Hemisphere crops which are harvested in the early part of the year are combined with those of the Northern Hemisphere harvested the latter part of the same year. After 1977, the report year includes Northern Hemisphere and certain Northern Hemisphere crops harvested in the early months of the following year.

[b] Estimated.

Table 7-2. **Sorghum Production, Elevator Receipts and Shipments, Nebraska, Selected Years, 1954-1985.**

Year	Production	Receipts	Shipments
	(000 bu.)	(000 bu.)	(000 bu.)
1985	154,400	271,993	150,146
1977	146,970	204,873	175,784
1969	118,636	92,824	80,812
1959	61,683	45,510	39,733
1958	77,952	28,438	23,078
1957	77,337	13,968	12,751
1956	12,446	11,818	10,313
1955	7,920	14,460	9,542
1954	13,416	6,286	6,958

Source: Production data are from Nebraska Department of Agriculture and USDA, *Nebraska Agricultural Statistics*, Lincoln: Nebraska Crop Reporting Service, various issues. Receipts and shipments data are from a 1985 elevator survey conducted by the author, partial results of which appear in Hill, Patterson, Vermiak, Fuller and Anderson (1990); results of a 1977 survey by Dean Linsenmeyer, partial results of which appear in Leath, Hill and Fuller (1981); findings from a 1969 survey by Anderson and Breuer (1971); and surveys of crop years 1954-59 by Miller (1960 and unpublished records from the latter surveys).

[a] Data sets for 1954-69 were from country elevators, those for 1977 and 1985 were all elevators.

Table 7-3. Sorghum Shipments to Nebraska, by Mode of Transport and Origin, 1977.

	Mode of Transportation					
Origin	Truck	Rail	Barge	Total	% of Interstate[a]	% of Total[a]
	(000 bu/%)				(%)	
Iowa	28	14	0	42	9.0	<0.1
Kansas	171	0	0	171	55.0	0.1
Missouri	70	0	0	70	22.5	<0.1
South Dakota	42	0	0	42	13.5	<0.1
Total Interstate	311	14	0	325	100.0	0.2
% of Interstate[a]	95.7	4.3	0	100.0		
Intrastate	152,354	52,194	0	204,548		98.8
% of Intrastate[a]	74.5	25.5	0	100.0		
Total	**152,665**	**52,208**	**0**	**204,873**		**100.0**
% of Total[a]	**74.5**	**25.5**	**0**	**100.0**		

Source: 1977 elevator survey.

[a] Percent detail may not add to total because of rounding.

Table 7-4. Sorghum Shipments to Nebraska, by Mode of Transport and Origin, 1985.

	Mode of Transportation					
Origin	Truck	Rail	Barge	Total	% of Interstate[a]	% of Total[a]
	(000 bu/%)				(%)	
Kansas	6,518	3,741	0	10,259	59.1	3.8
South Dakota	7,093	0	0	7,093	40.9	2.6
Interstate	13,611	3,741	0	17,352	100.0	6.4
% of Interstate[a]	78.4	21.6	0	100.0		
Intrastate	254,005	636	0	254,641		93.6
% of Intrastate[a]	99.8	0.2	0	100.0		
Total	267,616	4,377	0	271,993		100.0
% of Total[a]	98.4	1.6	0	100.0		

Source: 1985 elevator survey.

[a] Percent detail may not add to totals because of rounding.

Table 7-5. **Sorghum Shipments from Nebraska Elevators[a], by Mode of Transport, Selected Years, 1954-1985.**

Year	Truck		Rail		Barge		Total
	(000 bu.)	(% of total[b])	(000 bu.)	(% of total[b])	(000 bu.)	(% of total[b])	(000 bu.)
1985[c]	67,550[d]	45.0	81,061	54.0	1,535	1.0	**150,146**
1977[c]	44,596[d]	25.4	131,188	74.6	NA	NA	**175,784**
1969[c]	28,134[d]	30.3	64,690	69.7	NA	NA	**92,824**
1959	22,449	56,5	17,284	43.5	NA	NA	**39,733**
1958	11,608	50.3	11,470	49.7	NA	NA	**23,078**
1957	5,534	43.4	7,217	56.6	NA	NA	**12,751**
1956	5,458[d]	52.9	4,855	47.1	NA	NA	**10,313**
1955	8,979	94.1	563	5.9	NA	NA	**9,542**
1954	1,296	17.9	5,931	82.1	NA	NA	**7,227**

Source: Data are from a 1985 elevator survey conducted by the author, partial results of which appear in Hill, Patterson, Vercimak, Fuller and Anderson (1990); results of a 1977 survey by Dean Linsenmeyer, partial results of which appear in Leath, Hill and Fuller (1981); findings from a 1969 survey by Anderson and Breuer (1971); and surveys of crop years 1954-1959 (Miller 1960; and unpublished records from the latter surveys).

[a] Data sets for 1954-69 were from country elevators, those for 1977 and 1985 were all elevators.

[b] Percent detail may not add to the total because of rounding.

[c] Shipments reported "unknown as to mode have been allocated in proportion to known shipments.

[d] Includes local as well as out-of-state shipments.

Table 7-6. **Sorghum Shipments from Nebraska Elevators, by Mode of Transport and Destination, 1954[a].**

	Mode of Transportation				
Destination	**Truck[b]**	**Rail**	**Total**	**% of Interstate[c]**	**% of Total[c]**
	(000 bu/%)			(%)	
Colorado	422	49	471	9.5	7.0
Kansas City, MO	99	3,528	3,627	73.4	53.7
St. Joseph, MO	0	710	710	14.4	10.5
St. Louis, MO	20	0	20	0.4	0.3
South	116	0	116	2.4	1.7
Total Interstate	657	4,287	4,944	100.0	73.2
% of Interstate[c]	13.3	86.7	100.0		
Nebraska, unspecified	147	443	590		8.7
Lincoln	0	369	369		5.5
Omaha	20	832	852		12.6
Total Intrastate	167	1,644	1,811		26.8
% of Intrastate[c]	9.2	90.8	100.0		
Total	**824**	**5,931**	**6,755**		**100.0**
% of Total[c]	**12.2**	**87.8**	**100.0**		

Source: 1954 elevator survey (Farrell).

[a] The total and modal flows reported here do not correspond with those in Table 7-5. Data in the present table are from Farrell while those in 7-5 are taken from Miller and Nelson; both sources, however, draw upon the same elevator survey. They do differ structurally in at least one respect: The Miller and Nelson data reflect only shipments from country elevators, but include local as well as commercial truck shipments. Farrell's data include shipments from terminal and subterminal as well as country elevators but exclude local shipments. The percentage data in the present table are likely to be more reliable than the bushel volume estimates and provide at least a sense of where the sorghum was going in 1954.

[b] Does not include truck shipments to local farmers and feeders.

[c] Detail may not add to total due to rounding.

Table 7-7. **Sorghum Shipments from Nebraska Country Elevators, by Mode of Transport and Destination, 1969.[a]**

	Mode of Transportation				
Destination	**Truck**	**Rail**	**Total**	**% of Interstate[b]**	**% of Total[b]**
	(000 bu/%)			(%)	
Arizona	0	101	101	0.3	0.1
Arkansas	112	115	227	0.6	0.3
California	0	2,418	2,418	6.2	3.0
Colorado	1,059	8,874	9,933	25.3	12.3
Idaho	12	0	12	<0.1	<0.1
Illinois	11	0	11	<0.1	<0.1
Iowa	80	5	85	0.2	0.1
Kansas (except Kansas City)	443	4,443	4,886	12.5	6.1
Kansas City	604	11,424	12,028	30.7	14.9
Louisiana	0	18	18	0.1	<0.1
Minnesota	4	3,032	3,036	7.7	3.8
Missouri (except Kansas City)	84	3,508	3,592	9.2	4.4
Oklahoma	173	48	221	0.6	0.3
South Dakota	6	0	6	<0.1	<0.1
Texas	354	2,311	2,665	6.8	3.3
Total Interstate[c]	2,942	36,297	39,239	100.0	54.5
% of Interstate[b]	7.5	92.5	100.0		
Nebraska[c]	10,705	22,052	32,757		45.5
% of Intrastate[b]	32.7	67.3	100.0		
Unknown	3,750	5,066	8,816		
% of Unknown	42.5	57.5	100.0		
Total[d]	17,397	63,415	80,812		100.0
% of Total[b]	21.5	78.5	100.0		

Source: 1969 elevator survey (Anderson and Breuer 1977).

[a] These data exclude 1,829,000 bushels transported by an unknown mode, and 10,183,000 bushels shipped to local farmers and feeders; adding these excluded items, the grand total would be 92,824,000 bushels.

[b] Percent detail may not add to totals because of rounding.

[c] Exclusive of unknown destinations.

[d] Inclusive of unknown destinations.

Table 7-8. Sorghum Shipments from Nebraska Elevators, by Mode of Transport and Destination, 1977.

Destination	Truck[a]	Rail	Barge	Total	% of Interstate[b]	% of Total[b]
	Mode of Transportation					
	(000 bu.)				(%)	
Arizona	308	1,295	0	1,603	1.9	0.9
Arkansas	748	35	0	783	0.9	0.5
California	8	3,262	0	3,270	3.9	1.9
Colorado	1,585	1,890	0	3,475	4.1	2.0
Illinois	214	0	0	214	0.3	0.1
Iowa	96	133	0	229	0.3	0.1
Kansas	2,565	11,147	0	13,712	16.2	7.8
Louisiana	0	673	0	673	0.8	0.4
Minnesota	0	203	0	203	0.2	0.1
Missouri	0	574	0	574	0.7	0.3
Nevada	0	3	0	3	<0.1	<0.1
Oklahoma	88	120	0	208	0.3	0.1
Texas	117	4,595	0	4,712	5.6	2.7
California Ports	0	1,111	0	1,111	1.3	0.6
Pacific N.W.	0	174	0	174	0.2	0.1
Texas Gulf	45	53,779	0	53,824	63.5	30.6
Total Interstate	5,774	78,994	0	84,768	100.0	48.2
% of Interstate[b]	7.7	92.3	0	100.0		
Nebraska	38,822	52,194	0	91,016		51.8
% of Intrastate[b]	42.3	57.7	0	100.0		
Total	44,595	131,188	0	175,784		100.0
% of Total[b]	25.4	74.6	0	100.0		

Source: 1977 elevator survey.

[a] Includes farm as well as commercial truck shipments.

[b] Percent detail may not add to totals because of rounding.

Table 7-9. **Sorghum Shipments from Nebraska Elevators, by Mode of Transport and Destination, 1985.**[a]

Destination	Truck	Rail	Barge	Total	% of Interstate	% of Total
	Mode of Transportation					
	(000 bu.)				(%)	
Arizona	0	260	0	260	0.4	0.2
Arkansas	230	1,605	0	1,835	2.5	1.2
California	0	12,955	0	12,955	17.6	8.6
Colorado	480	1,764	0	2,244	3.0	1.5
Illinois	0	4,906	0	4,906	6.6	3.3
Iowa	56	0	0	56	0.1	<0.1
Kansas	2,186	5,085	0	7,271	9.9	4.8
Mississippi	0	0	140	140	0.2	0.1
Missouri	1,234	3,895	0	5,129	7.0	3.4
Oklahoma	500	2,212	0	2,712	3.7	1.8
Oregon	0	1,500	0	1,500	2.0	1.0
Texas	0	10,926	0	10,926	14.8	7.3
Utah	21	531	0	552	0.8	0.4
Louisiana Gulf	0	0	1,395	1,395	1.9	0.9
Pacific N.W.	0	18,937	0	18,937	25.7	12.6
California Ports	0	3,012	0	3,012	4.1	2.0
Total Interstate	4,707	67,588	1,535	73,830	100.0	49.2
% of Interstate	6.4	91.6	2.1	100.0		
Nebraska	62,843	13,473	0	76,316		50.8
% of Intrastate	82.4	17.7	0	100.0		
Total	67,550	81,061	1,535	150,146		100.0
% of Total	45.0	54.0	1.0	100.0		

Source: 1985 elevator survey.

[a] Percent detail may not add to totals because of rounding.

Table 7-10. Sorghum Shipments from Nebraska to Various Destinations, by Rail, 1992.

	Amount	% of Total[a]
Destination	(000 bu.)	
Arizona	160	0.2
Los Angeles	1,133	1.2
San Diego	600	0.6
New Orleans	2,460	2.6
Kansas City	10,898	11.5
St. Louis	30,903	32.5
Brownsville	911	1.0
Houston	13,466	14.2
El Paso	455	0.5
Pacific Northwest	1,995	2.1
Western	7,303	7.7
Southern	12,489	13.1
Southwest	1,566	1.7
Mountain Pacific	10,714	11.3
Total	**95,052**	**100.0**

Source: Adapted from U.S. Interstate Commerce Commission, *Public Use Waybill Sample*, computer tape of Waybill Sample observations edited for public use. (Washington, D.C.: ICC), 1993.

[a] Detail may not add to totals because of rounding.

CHAPTER 8

SOYBEAN FLOWS

Trade Patterns[1]

Being on the western fringe of the nation's major soybean production area but in the midst of an area of intensive livestock production, it is not surprising that the state looks to local processors as a major source of demand for its soybeans. At the same time, its central location in the nation gives Nebraska potentially a pivotal role in moving shipments for export through either Pacific or Gulf ports as market conditions dictate. Unit-train railroad technology has provided at least the potential for Nebraska to compete in the future for these long-haul markets.

U.S. soybean production was negligible before the mid-1930s and the crop was not carried in government export reports until 1938, when 108.9 thousand MT (4 million bu.) were exported. Production grew rapidly during World War II, following the first price supports in 1941 and strong war-time demand. The government worked around its own war-inspired product price ceilings by buying soybeans from farmers at the support price and reselling them to processors at a lower price at which there was a processing incentive (Fornari, p. 132).

Production in 1946-47 reached a record 5.525 million MT (203 million bu.). War-torn Europe and Asia provided significant export markets starting in 1948-49. Some 626 thousand MT (23 million bu.) of soybeans, 136.1 thousand MT (300 million lbs.) of oil and 68 MT (151,000 lbs.) of meal were exported in the latter crop year (Fornari, p. 133).

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[1]Except where otherwise credited, trade data presented in this section are either from Tables A8-1 through A8-23 or the ultimate source of the tables (U.S. Department of Agriculture various years (a)). Export trends are summarized in Table 3-4. Graphic interpretations (Figures 8-1 through 8-5 are presented for the survey years. Production and yield trends are summarized in Table 8-1.

The U.S. harvest in 1954-55 was a record 9.281 million MT (341 million bu.), nearly 18 percent of which was exported. Soybeans had come into their own as a major crop, with big foreign as well as domestic demand. The development of solvent as opposed to traditional mechanical extraction processes enlarged the glut of the joint product, oil. PL-480, the 1954 law providing for subsidized shipments of food to developing countries, came to the rescue; between 227 and 408 thousand MT (500 to 900 million lbs.) of soybean oil per year were exported under concessional terms during the last half of the 1950s. Commercial exports too were on the rise, particularly to Europe (Fornari, p. 134).

Total U.S. soybean exports in 1954 were 1.650 million MT (60.6 million bu.). Japan, the number-one customer, took a third of the total (553.9 thousand MT/2.4 million bu.). Western Europe was the largest importing region and West Germany the number-two importing country, the latter taking 221.6 thousand MT (8.1 million bu.). Canada was third with 220.6 thousand MT (8.1 million bu.). The Netherlands[2] took almost as much (198.9 thousand MT/7.3 million bu.), followed by Formosa (Taiwan), Denmark and Israel (Figure 8-1).

By 1959, total U.S. soybean exports had more than doubled from 1954 levels, to 3.848 million MT (141.4 million bu.). Japan, still the number-one buyer, took 1.093 million MT (40.2 million bu.), nearly twice as much as in 1954. Netherlands was number two with 716.5 thousand MT (26.3 million bu.). Canada was third with 429 thousand MT (15.8 million bu.), followed by West Germany, Denmark and Israel. Western Europe remained the dominant importing region.

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[2]Shipments to the Netherlands' port of Rotterdam may have been destined ultimately for other countries in the region.

By 1960, exports of beans had reached 1.823 million MT (67 million bu.), meal 649 thousand MT (1.431 billion lbs.) and the growth continued. By 1965-66, U.S. production was 22.997 million MT (846 million bu.) compared with 15.105 million MT (555 million bu.) in 1960-61. Exports of soybeans in the latter year were 6.804 million MT (250 million bu.), those of meal 2.6 million tons (5.7 billion lbs.) and oil more than 454 thousand MT (a billion lbs.) (Fornari, p. 135).

Increased price supports (from \$2.25 to \$2.50 per bushel between 1966 and 1968) encouraged still further production, peaking in a crop of 30.019 million MT (1.103 billion bushels in 1968. By the 1969 survey year, the CCC held 408 thousand MT (150 million bu.) of soybeans. Although support prices were reduced in 1969 to \$2.25 per bushel, production increased (to 30.645 million MT/1,126 million bu.) in 1969-70; exports of the now cheaper commodity increased sharply to 11.774 million MT (432.6 million bu.). Meal exports rose from 3 million tons (6.614 billion lbs.) in the previous year to 4 million tons (8.818 billion lbs.). Soybeans and soybean products became the number-one U.S. agricultural export, with a value of more than \$1.5 billion. Japan was the largest single importing country, Western Europe the largest regional importer. Eastern European countries had also become an important market (Fornari, pp. 136-137).

U.S. soybean exports at the time of the 1969 grain-flow survey (11.774 million MT or 432.6 million bu.) were 606 percent above 1959 levels. Japan remained the largest buyer in 1969, with purchases of 2.759 million MT (101.4 million bu.); its share of the total, however, had declined to 23 percent from 28 percent in 1959 and 34 percent in 1954; absolute volumes were, of course, much smaller in the earlier years. Canada, with imports of 1.904 million MT (70.0 million bu.), was number two, with a 16-percent share of exports. The Netherlands, in third place, received 1.592 million MT

(57.4 million bu.). West Germany bought 1.137 million MT (41.8 million bu.). Spain, Italy and Taiwan rounded out the top seven. Western Europe remained the major buying region (Figure 8-2).

Exports in survey year 1977 were 19.061 million MT (700.375 million bu.), 62 percent higher than in 1969. Europe was still the major buying region. Netherlands had more than 21 percent of the market, with purchases of 4.086 million MT (150.132 million bu.). Japan was second most important country buyer, with 3.636 million MT (133.6 million bu.) of imports and now only 19 percent of U.S. soybean exports. Spain bought 1.521 million MT (55.9 million bu.). Others of importance included West Germany, Italy, Taiwan, the Soviet Union and the U.K. (Figure 8-3).

Soybean exports peaked in 1982 at 25.5 million MT (925.9 million bu.), but declined by 1984 to 19.5 million MT (716.5 million bu.). A further decline in 1985 cut the volume to 16.9 million MT (661.0 million bu.), 51 percent below the peak of 1982, 26 percent under the 22.7 million MT (834.1 million bu.) level of 1983. The value of the exports declined even more sharply owing to falling prices. The $6.2 billion value of 1982 sales had declined 15 percent to $5.4 billion in 1984, by 67 percent to only $3.7 billion in 1985 (Table 2).

Exports by the time of the 1985 survey totaled 16.889 million MT (620.6 million bu.), of which Western Europe took the largest (45 percent) share (7.640 million MT/280.7 million bu.). East and South Asia together imported almost as much as Western Europe in 1985: 6.561 million MT (241.1 million bu., 39 percent of the total. Japan was the largest single buying country, taking 4.375 million MT (160.8 million bu.), 26 percent of U.S. soybean exports. The Netherlands was second, taking 2.857 million MT (105.0 million bu.). Taiwan (1.358 million MT/49.9 million bu.), Spain (1.195 million MT/43.9 million bu.) and Mexico (963 thousand MT (35.4 million bu.) were all major customers. Less-developed countries obtained 3.850 million MT (141.5 million bu.), just short of 23 percent of the total (Figure 8-4).

It is clear that soybeans have become a major export crop since their debut in world markets in the 1940s and 1950s. In 1992, 19.825 million MT (728.4 million bu.) of U.S. soybeans were exported, an amount equal to about one-third of U.S. production in that year. A weakened U.S. dollar since 1985 has favored exports, although the dollar did strengthen somewhat against major European currencies beginning late in 1992. At the same time, however, drought in Europe cut local oil-seed yields.

Although total exports were larger in 1992 than in 1985, the pattern of export markets was much the same in both years. Western Europe, East Asia and Central America (including Mexico) were the largest importers just as they were in 1992. Major importing regions at the time of the 1992 Waybill survey were Western Europe and East/South Asia. Japan was the single most important buyer in 1992, accounting for 20 percent of the total and taking 3.876 million MT (142.4 million bu.). The Netherlands was second, its 3.435 million MT (126.2 million bu.) purchases being 17 percent of the total, and Taiwan third with 2.073 million MT (76.2 million bu.) or 11 percent of the market. Several countries in Western Europe were important buyers including, as well as the Netherlands and Spain, Belgium, Luxembourg, Germany and Italy. The European Community (EC) has not applied its variable levy system, an effective deterrent to wheat and feedgrain imports, to soybeans, and EC countries remain the largest export market for the U.S. crop (Figure 8-5).

Japanese imports of U.S. soybeans in 1992 were relative strong owing to high incomes in that nation, a weak dollar/yen exchange rate and political pressures, applied by the U.S. government, aimed at helping reduce the large trade deficit with Japan. Taiwan, an important soybean importer, has been increasing its purchases. South Korea, another key East Asian buyer, increased its soybean imports from the U.S. by 33 percent between 1985 and 1992. The Mexican market has grown significantly since 1985, becoming the fourth-ranking country market for U.S. soybeans in 1992; (U.S. Department of Agriculture, 1993). Less-developed countries received 3.850 million MT (141.5 million bu.), 33.2 percent of total U.S. soybean exports in 1992.

Soybean exports in 1993, at 19.423 million MT (713.6 million bu.) were largely unchanged from 1992. Western Europe, with imports of 7.853 million MT (288.5 million bu.) and East/South Asia (7.399 million MT/271.9 million bu.) were the leading customers. Japan was the first-ranking buying country, with 4.051 million MT (148.8 million bu.) in imports. The Netherlands was again second, with purchases of 2.981 million MT (109.5 million bu.). Taiwan, Mexico, Spain, South Korea and Germany, in that order, were all major buyers. Less-developed countries received 6.555 million MT (240.9 million bu.), 33.7 percent of total U.S. soybean exports.

Exports in 1994 were down marginally, to 18.072 million MT (664.0 million bu.). Western Europe and East/South Asia were again by far the major importing regions, taking 7.245 million MT (266.2 million bu.) and 6.102 million MT (224.2 million bu.), respectively. The line-up of major country buyers remained essentially the same as in 1992 and 1993. Japan ranked first, with purchases of 3.349 million MT (123.1 million bu.). Netherlands was a close second, with 3.063 million MT (112.5 million bu.). Mexico, with 2.073 (76.2 million bu.), was third; and Taiwan, with imports of 1.827 million MT (67.1 million bu.) fourth. Less-developed countries received 6.898 million tons (253.5 million bu.), 38 percent of total U.S. soybean exports. Mexico was by far the largest among the latter recipients.

Calendar year 1995 was a near-record year for U.S. soybean exports, a total of 22.767 million MT (836.5 million bu.) being shipped into world markets. Western Europe and East/South Asia were, as usual, the top-two destinations, with respective sales of 9.684 million MT (355.8 million bu.) and 9.064 million MT (333.0 million bu.). Of the individual countries, Japan had 18 percent, (4.004 million MT/147.1 million bu.), the Netherlands 17 percent at 3.902 million MT (143.4 million bu.). Taiwan (11 percent) was third with 2.534 million MT (93.1 million bu.), Mexico (9 percent) fourth with 2.018 million MT (74.1 million bu.). Spain, South Korea and Germany rounded out the top seven importers. Less-developed countries received 8.053 million MT (295.9 million bu.), 35.4 percent of total U.S. soybean exports. Projected exports are up again for the 1996-97 crop year, to 24.63 million MT (905 million bu.).

Shipping Patterns

Information in this section is from University of Nebraska grain-flow surveys and, for 1992, the ICC Waybill for that calendar year. Since the Waybill reports only rail shipments, neither modal splits nor destination data for truck or barge shipments are available for 1992.

Volume of Receipts and Shipments

The size of annual elevator receipts (and shipments) of soybeans depends upon crop size, imports into the state, unrecorded farm-to-elevator exports from the state and market conditions during the year. Nebraska's soybean processors are a major source of demand, leaving relatively modest amounts for export from the state in most years. Differences in out-shipments also reflect inventory changes, the latter in turn being affected by market conditions and government storage programs (in earlier survey years) as well as crop size.

On average over time, assuming cross-border farm-to-elevator shipments are the same in both directions and no on-farm bean consumption, production should approximately equal both elevator receipts and shipments. Beans saved or sold for seed would cause expected receipts (and out-shipments) to be only slightly smaller than production. In practice, the relationship between annual production and elevator receipts (and shipments) of soybeans has varied widely from year to year, as it reasonably can, as stocks are either accumulated or drawn down.

Soybean shipments from Nebraska elevators were 141 percent of production in 1985, a result apparently of delayed shipments of 1984 crop beans until 1985 (Figure 8-6 and Table 8-2). The delay apparently was in shipments off the farm since elevator receipts in 1985 were 78 percent of shipments. Commercial bean inventories actually increased during the year in spite of the large volume of out-shipments.

The State's own production is not the exclusive source of soybean flows. In 1977, 22.8 million bushels were shipped to Nebraska from other states, Iowa and Missouri being the major sources, but smaller amounts also came from as far as Oklahoma and Texas. Rail shipments predominated, although imports from Missouri came about equally by truck and rail (Table 8-3). About 10.5 million bushels were imported during 1985 from nearby states, 72 percent coming by truck, suggesting that much of the imports may have been delivered to Nebraska elevators by farmers from across the border (Table 8-4). These latter shipments were not net since Nebraska farmers may have delivered similar amounts of their beans to elevators in neighboring states.

Mode

The proportion of soybeans shipped from elevators by truck has grown over time, while that moved by rail has declined. More than three-fourths went by rail in 1954 and the average rail share for all surveys in the 1950s was 58 percent. By 1969, the railroad share was down to 51 percent and by 1985 it was only 15 percent, with trucks carrying 84 percent and barges 1.3 percent of total soybean shipments from Nebraska elevators. The modal shares for 1977 are not known since Nebraska and Kansas data were combined; shares for the two states together were rail 60 percent, trucks 26 percent and barge 14 percent (Figure 8-7; Table 8-5; and Leath, Hill and Fuller 1981).

The large and expanding role of trucks in moving soybeans from Nebraska elevators reflects in part the relatively short hauls for most of the shipments. Most soybeans are grown in the eastern one-third of the state in close proximity to processors. Deregulation of the trucking industry in 1980 has made it easier for truckers to obtain back-hauls of previously-regulated commodities, possibly extending in some cases the feasible length of soybean hauls. The withdrawal of transit privileges, which once assured railroads a large share of traffic assembled at consolidation and processing points, along with improved truck efficiency, has led to the diversion of most of this gathering traffic to motor carriers.

It is perhaps more meaningful to examine separately the respective modal trends of intra- and interstate traffic since they offer insights into trends for varying lengths of haul; Tables 8-6 through 8-9 provide such detail. Railroads in 1954 carried all of Nebraska's interstate soybean commerce; they had nearly 59 percent of all movements within the state. By 1969, the rail share of interstate shipments of soybeans had increased to 72 percent, but their intrastate business had declined to 45 percent, the remainder going to trucks. Railroads in 1977 had 59 percent of interstate traffic in soybeans, only 27 percent of shipments moving within the state. Railroads' share of both inter-and intrastate traffic had further declined by 1985 to only 35 percent of that moving beyond the state (trucks had 62 percent of the latter, barges 3.3 percent. The mix of soybean traffic in the latter year was approximately three-fifths intrastate, two-fifths to out-of-state destinations. Modal mix data for 1992 are not available, but it is significant that estimated total interstate rail traffic in that year was 63.6 million bushels, up 305 percent from the 16.7 million in 1986. The Waybill reported no intrastate rail shipments in 1992.

Destination

Destination comparisons across surveys are complicated by variability in survey procedures from one year to another. Among other problems, surveys in 1977 and subsequent years have not distinguished among country, subterminal and terminal elevators. If the objective is to trace net flows from the state, exports from all of these types should be combined for a complete picture of interstate shipments. On the other hand, adding the flows from all types results in double-counting of the total traffic since some of the shipments are simply second or third legs of original shipments. The latter was not, however, a problem in 1977 and 1985, since by this time this measure of elevator type had become obsolete and survey samples were drawn from all elevators, the samples being stratified by size range. Finally, destination results were not reported in the 1955-59 surveys.

Only 31 percent of soybean traffic from Nebraska origins in 1954 moved to out-of-state destinations. Shipments went to only two states, Missouri and California. St. Joseph, Missouri received 78 percent of the interstate flows; Kansas City, Missouri 11 percent; and the State of California 11 percent. All of the interstate shipments were by rail. Intrastate markets were terminal and subterminal elevators, receipts at the latter arriving about 59 percent by rail (Figure 8-8; and Table 8-6). Terminal elevators shipped 2.3 million bushels from Nebraska in 1969, all moving by rail; no destination information is available (Omaha Grain Exchange, cited in Anderson and Breuer 1971).

By 1969, the proportion of interstate traffic was less than that in 1954, only 26 percent, that moving within the state 74 percent of the total. Recognize that some unknown portion of the in-state movements no doubt moved subsequently to out-of-state destinations. Several new destination states appeared in 1969. Iowa was the major recipient, taking 47 percent of Nebraska's interstate shipments; 44 percent of these Iowa movements went by rail, 56 percent by truck. Missouri (exclusive of Kansas City) was the second-ranking destination, with 30.2 percent of interstate shipments, nearly all moving by rail. Kansas City alone accounted for 16 percent of interstate hauls, all by rail. Kansas, Colorado, Illinois and Minnesota also received Nebraska soybeans (Figures 8-9 and 8-10; and Table 8-7).

Some insights into the role of terminal and subterminal elevators appears in the 1969 survey results. Subterminals shipped only 1.5 million bushels of soybeans, 55 percent by rail 27 percent by barge and 16 percent by truck. Nearly three-fourths of the rail shipments went to out-of-state points, while all of the trucked soybeans were shipped to Nebraska destinations (Figure 8-11; and Anderson and Breuer 1971). Terminal elevators shipped 6.8 million bushels in 1969, 97 percent of it by rail, 4.5 percent by barge and 2.9 percent by truck. No destination information is available (Omaha Grain exchange, cited in Anderson and Breuer 1971).

Interstate traffic in 1977 was less than one-fourth of the total, local processors continuing to provide the market for more than three-fourths of the shipments from Nebraska elevators. Missouri and Iowa continued to be important destinations, with 27 and 16 percent, respectively, of the interstate traffic. The Missouri shipments moved 58 percent by rail, 42 percent by truck; those to Iowa went 74 percent by truck. The big news in 1977 was the emergence of important export markets. The East Gulf received 19 percent of interstate volume, the Louisiana Gulf 17 percent; lesser amounts went to the Pacific Northwest (3.7 percent) and the Texas Gulf (3.3 percent). Shipments to

East and Texas Gulf ports went by rail, those to the Louisiana Gulf mostly by barge, while those to the PNW were split between truck and rail. Arkansas was also a major recipient, with 13 percent of the interstate shipments, all in rail cars (Figures 8-12 and 8-13; and Table 8-8).

More than 60 percent of all shipments in 1985 were to Nebraska destinations, less than 40 percent to other states. By comparison, fully three fourths of the traffic in 1969 and 1977 was to interstate destinations. The 1985 crop being much the largest of the previous survey years (Table 8-1), Nebraska processors apparently took a smaller proportion of the larger crop, with the excess going, perhaps by necessity, into interstate markets. Interstate shipments in 1985 were not as oriented toward world markets, at least not as clearly as they had been in 1977. Nearly 84 percent of the interstate shipments in 1985 were to the bordering states of Iowa, Kansas and Missouri; Missouri and Kansas together received nearly 62 percent of the shipments, the latter probably destined ultimately for Gulf ports. While more than 39 percent of interstate shipments in 1977 had moved directly to Gulf ports, the Gulf took only 4.6 percent in 1985. Shipments to the PNW were only 2.5 percent of the total in 1985. But Mexico emerged for the first time as an importer, with 3.8 percent of Nebraska's interstate soybean shipments. To the extent the Missouri and Kansas shipments went to the Gulf, export markets in total may still have accounted for the bulk of soybean shipments leaving the State (Figures 8-14 and 8-15; and Table 8-9). Barge shipments, a minor part of the total (3.3 percent), went largely to the Louisiana Gulf (Figure 8-16).

Railroad shipments of Nebraska soybeans were much larger in 1992 than they had been in 1985, owing perhaps to higher production (Table 8-1) and stock adjustments. Kansas City was the major destination, with 29.3 percent of the rail shipments. Exports were a smaller part of the picture, Louisiana taking 7.6 percent, the PNW 5.7 percent and Texas ports 4.5 percent of total rail shipments. Specific destinations were unknown for more than 43 percent of the traffic, the larger part of which moved to Western and Southwestern destinations, some of it probably to export markets. The Waybill reported no intrastate rail traffic (Figure 8-17 and Table 8-10).

Summary

Soybeans, like sorghum, are a relative newcomer to both the Nebraska and U.S. agricultural scenes, developing into a crop of some significance for the first time during World War II. Production grew rapidly after the war, faster than domestic demand could cope; PL-480 shipments helped for a time, beginning in 1955, to make a market for the expanding output.

Japan was the number-one national customer in 1954 and Western Europe the major regional buyer. Exports were growing rapidly in the late 1950s, the level in 1959 being more than twice that in 1954. Japan and Western Europe remained the largest buyers. By the late 1960s, soybeans and their products had become the largest U.S. agricultural export, as measured by value. Japan and West Europe remained the major buyers in 1969 and again in 1977. Canada also emerged as an important customer. The picture was not greatly different in 1985 when Western Europe and East Asia together accounted for 84 percent of U.S. soybean exports. Japan was the number-one country buyer by a wide margin, Netherlands second and Taiwan third. In 1992 and again in 1995, Western Europe remained the top buyer, East Asia was a close second and Central America (including Mexico) third. Japan was the major buying nation followed by Netherlands, Taiwan and Mexico.

Less-developed countries, including, prominently, Mexico, provide a substantial and growing part of the export market for U.S. soybeans, although their share is less than that for corn, sorghum and wheat. LDCs as a group did take 23 percent of U.S. soybean exports in 1985 (75 percent went to developed countries, less than 3 percent to centrally-planned nations). The LDC market had grown to more than 33 percent by 1992 and over 35 percent in 1995.

The larger part of Nebraska's soybean production is processed locally, reducing the importance of long-haul transportation of this crop. The state's close proximity to local demand for soybean meal provides a significant processing advantage. At the same time, being at the western fringe of U.S. soybean production gives the state an advantage in supplying western U.S. as well as Asian market demands.

The trucked proportion of elevator shipments has grown over time just as rail shipments have declined relatively. Trucks had only one-fourth of total shipments in 1954, nearly 84 percent by 1985. Trucks owe their dominance to the relatively short hauls that predominate in the movement of beans to local processors. Deregulation of both trucks and railroads in 1980 has reinforced the inherent cost advantage of trucks in serving these short hauls.

Interstate shipments of soybeans from Nebraska in 1954 went to only two states, Missouri and California; all moved by rail. By 1969 and 1977, shipments were going to a wider range of destinations, those to Iowa and Missouri predominating. But exports had begun to make a major market for Nebraska soybeans by the latter year, the East and Louisiana Gulf together taking 36 percent of interstate traffic from the state; another 3.7 percent went to the PNW and 3.3 percent to the Texas Gulf.

A much larger 1985 crop and a still larger one in 1992 went mostly to neighboring states. Direct shipments to ports were very small in 1985, recovering somewhat in 1992. Some unknown part of the dominant Kansas and Missouri shipments may have been transshipped to Gulf ports.

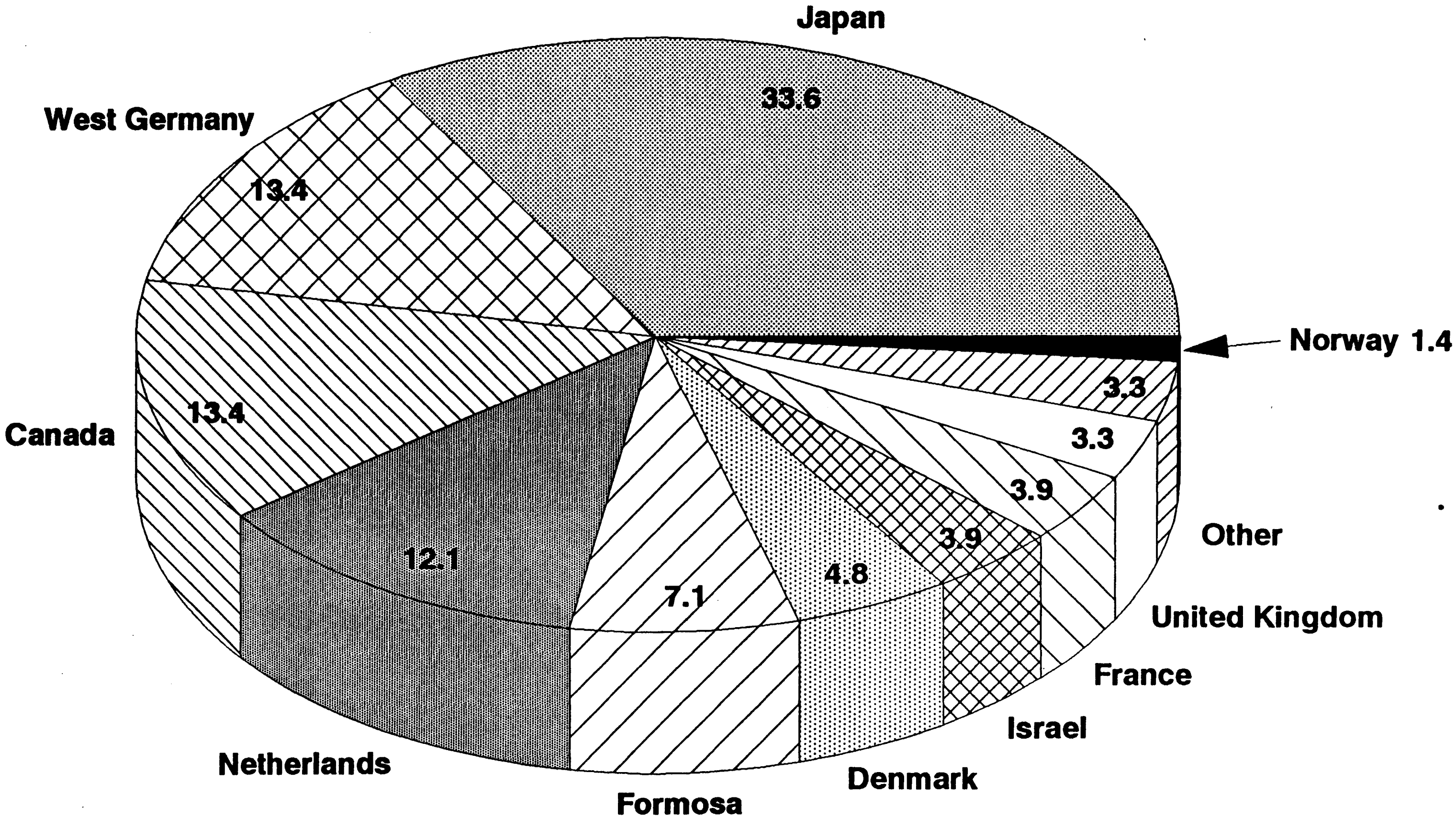

Figure 8-1. Percent Shares of Top Importers of U.S. Soybeans, 1954

Source: Appendix Table A8-1.

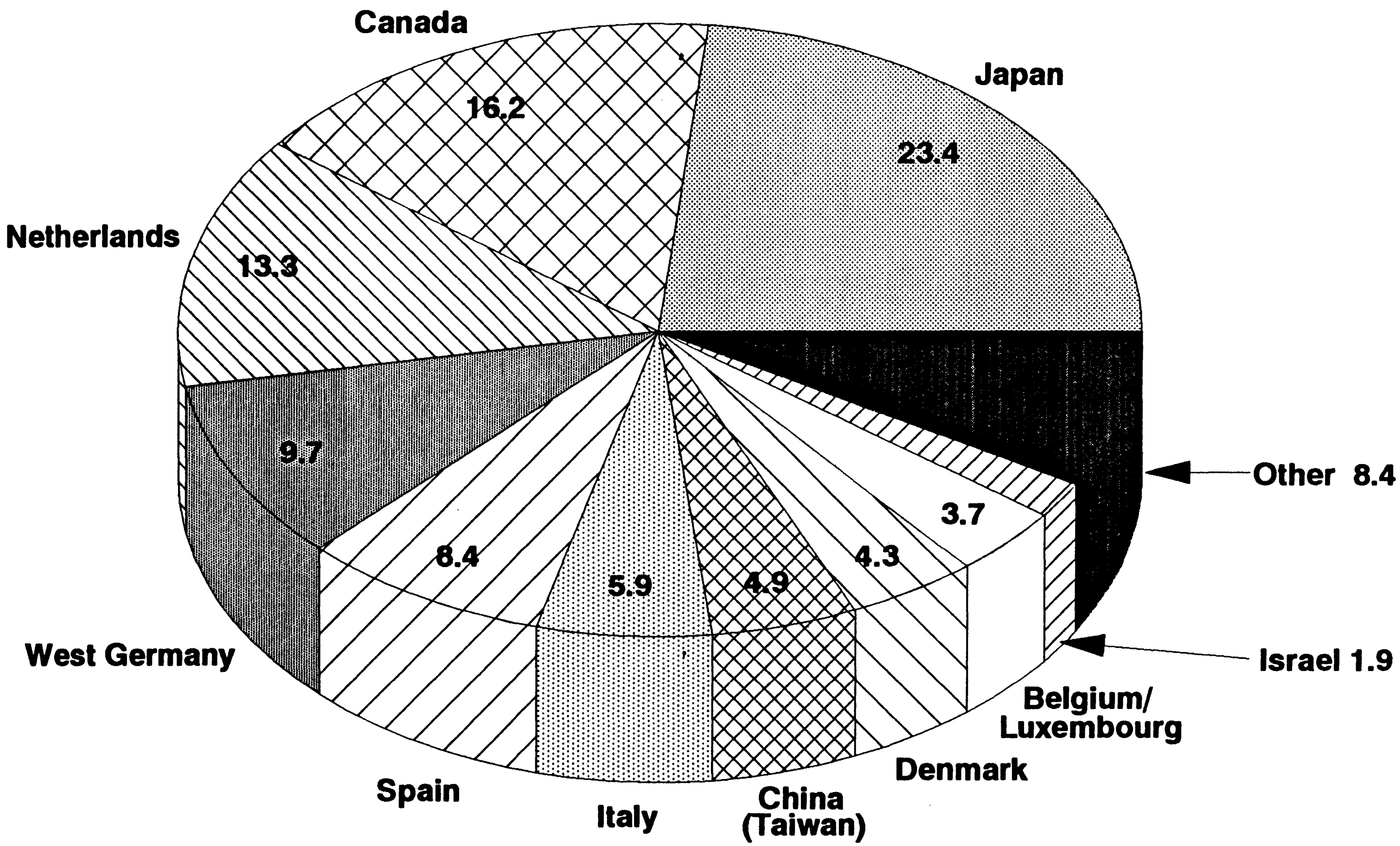

Figure 8-2. Percent Shares of Top Importers of U.S. Soybeans, 1969

Source: Appendix Table A8-1.

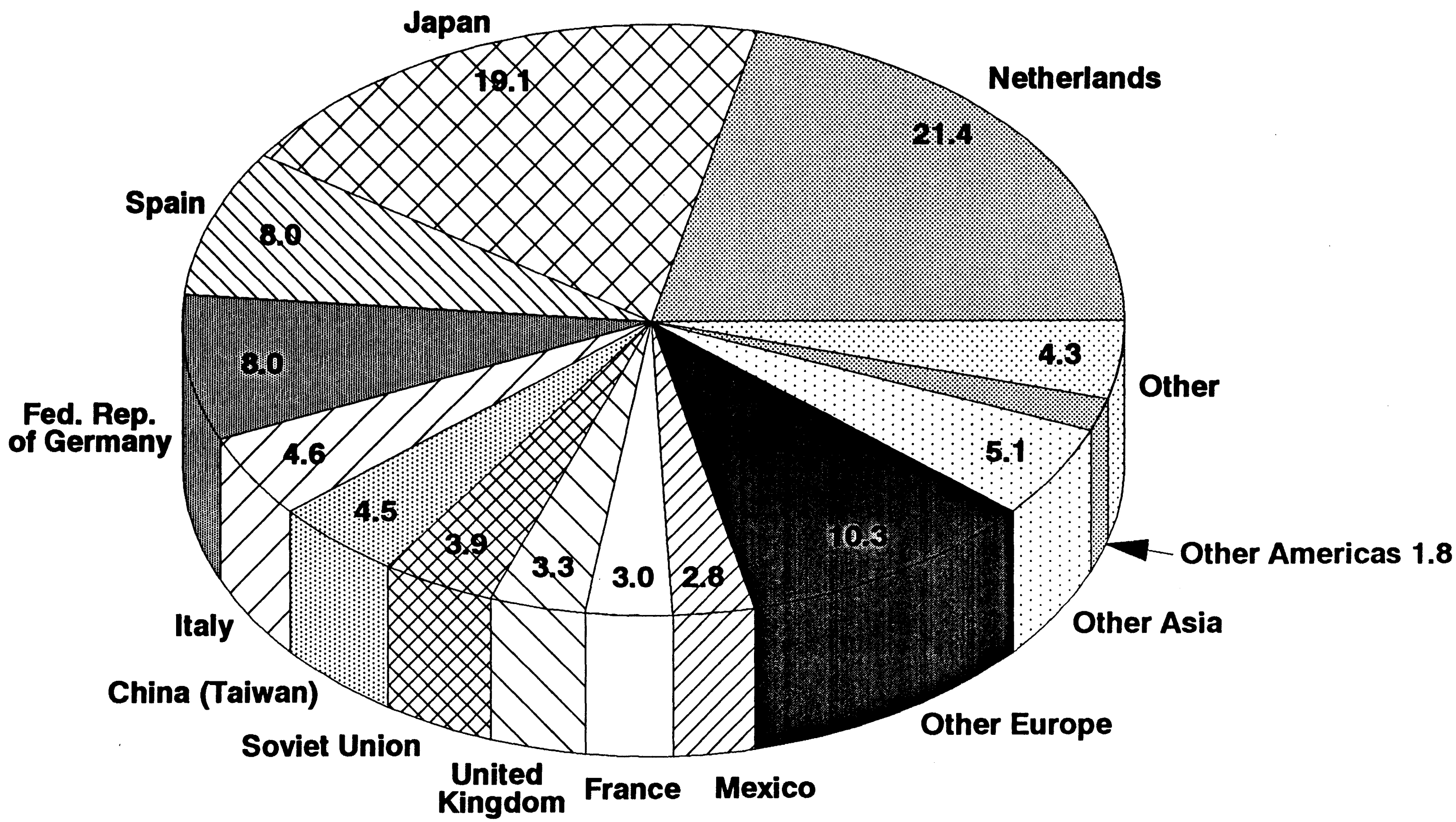

Figure 8-3. Percent Shares of Top Importers of U.S. Soybeans, 1977

Source: Appendix Table A8-1.

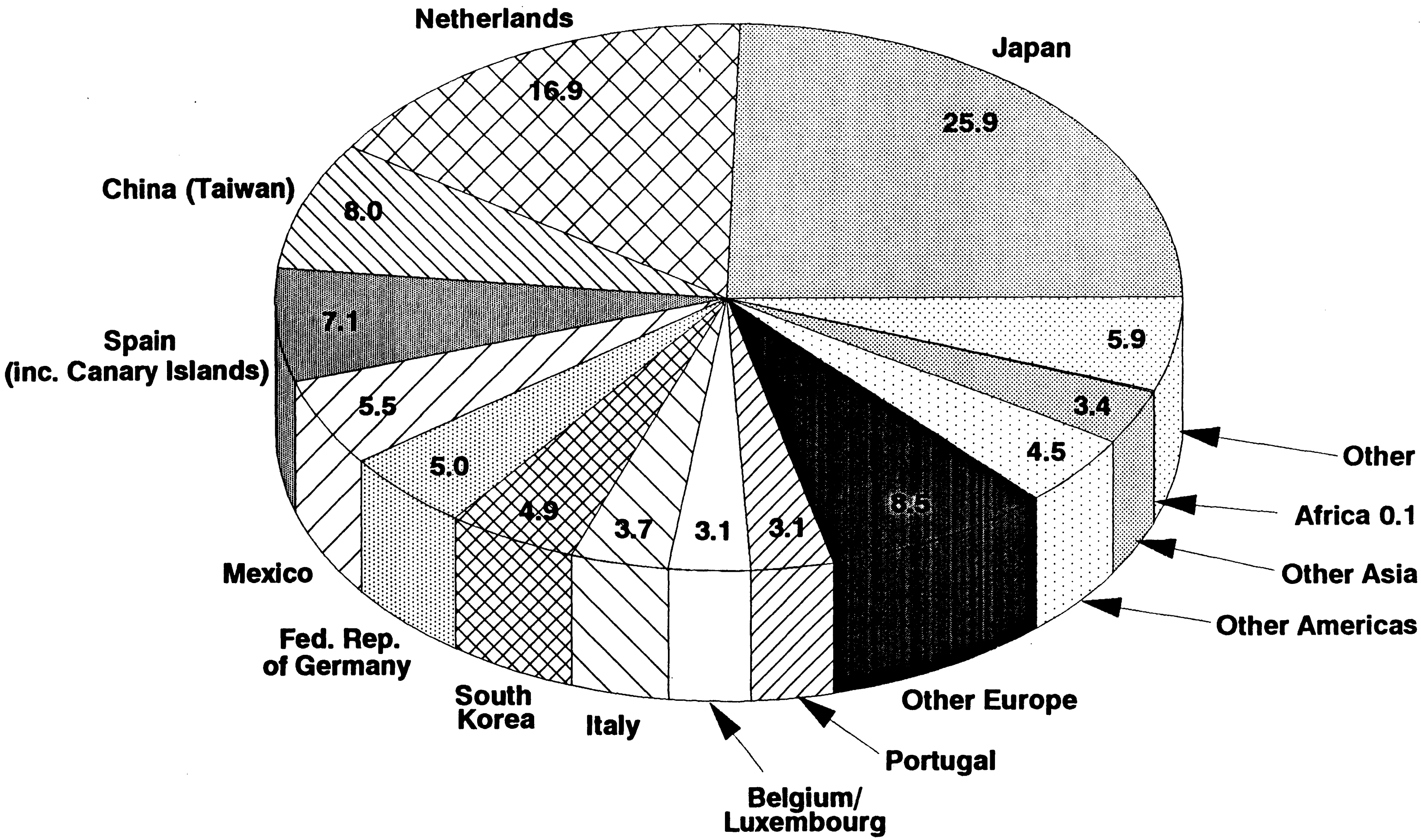

Figure 8-4. Percent Shares of Top Importers of U.S. Soybeans, 1985.

Source: Appendix Table A8-3.

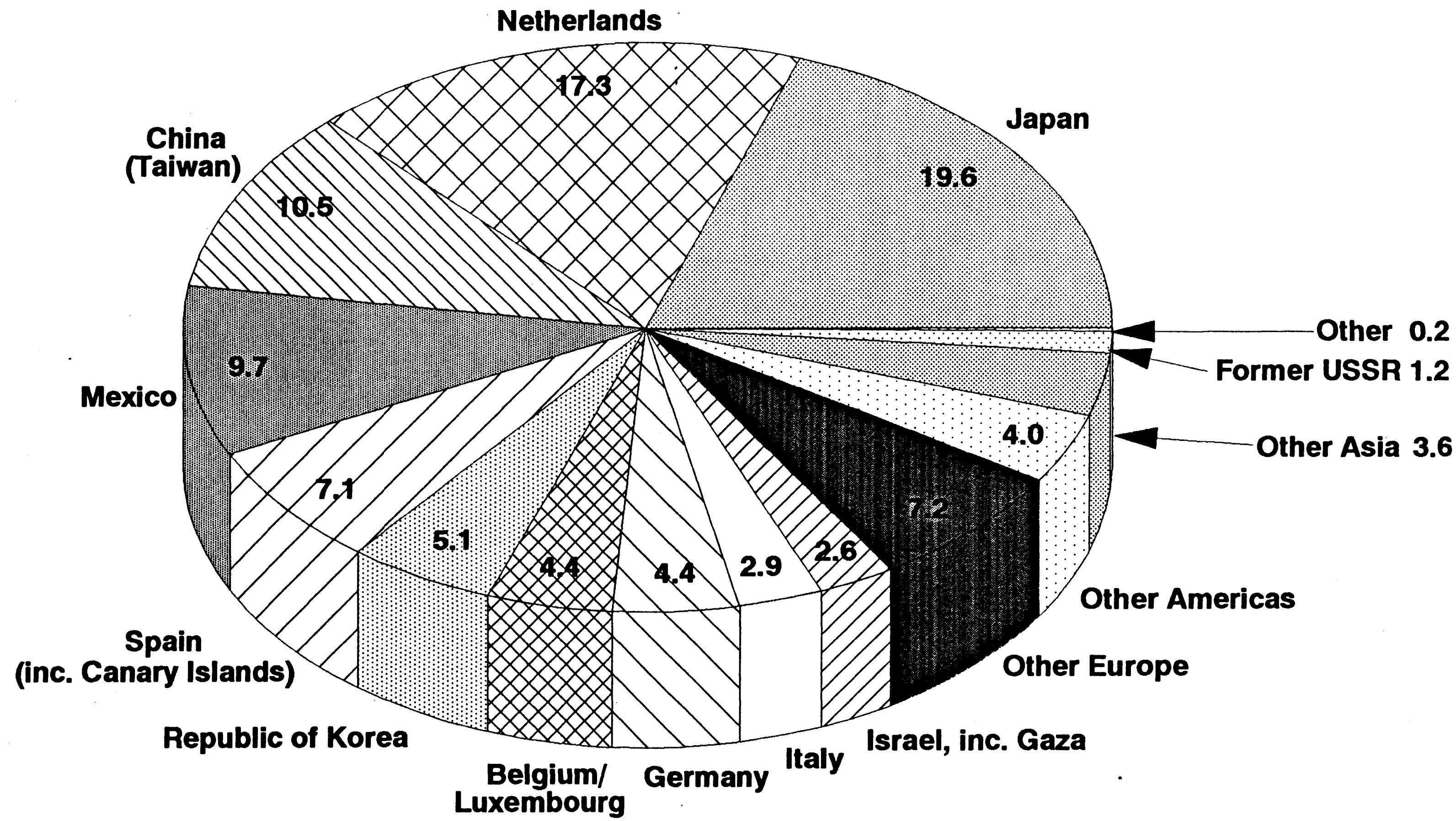

Figure 8-5. Percent Shares of Top Importers of U.S. Soybeans, 1992.

Source: Appendix Table A8-17.

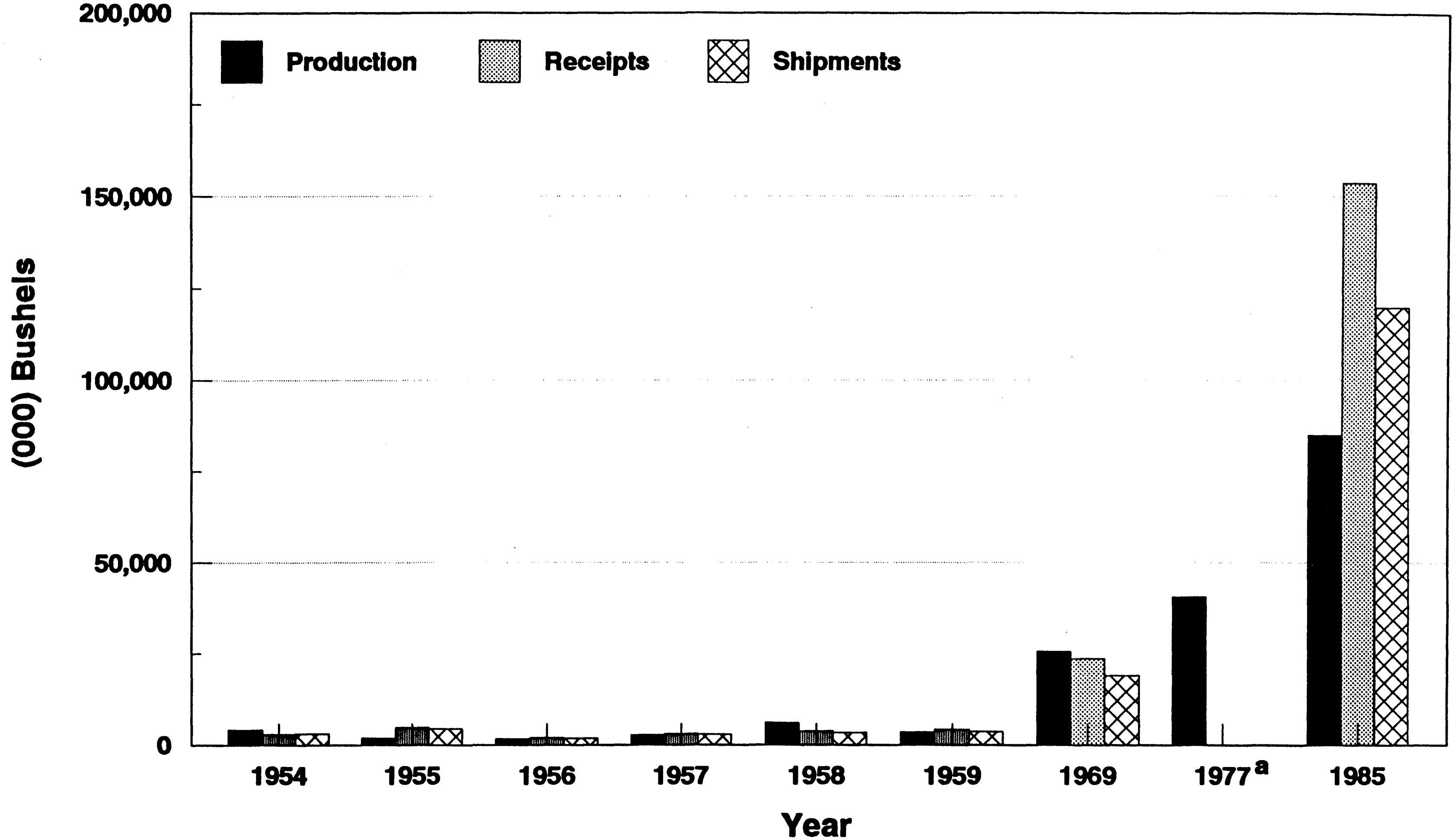

Figure 8-6. Soybean Production, Elevator Receipts and Shipments, Nebraska, Selected Years, 1954-1985.

[a]Receipts and shipments not available for 1977.
Source: Table 8-2.

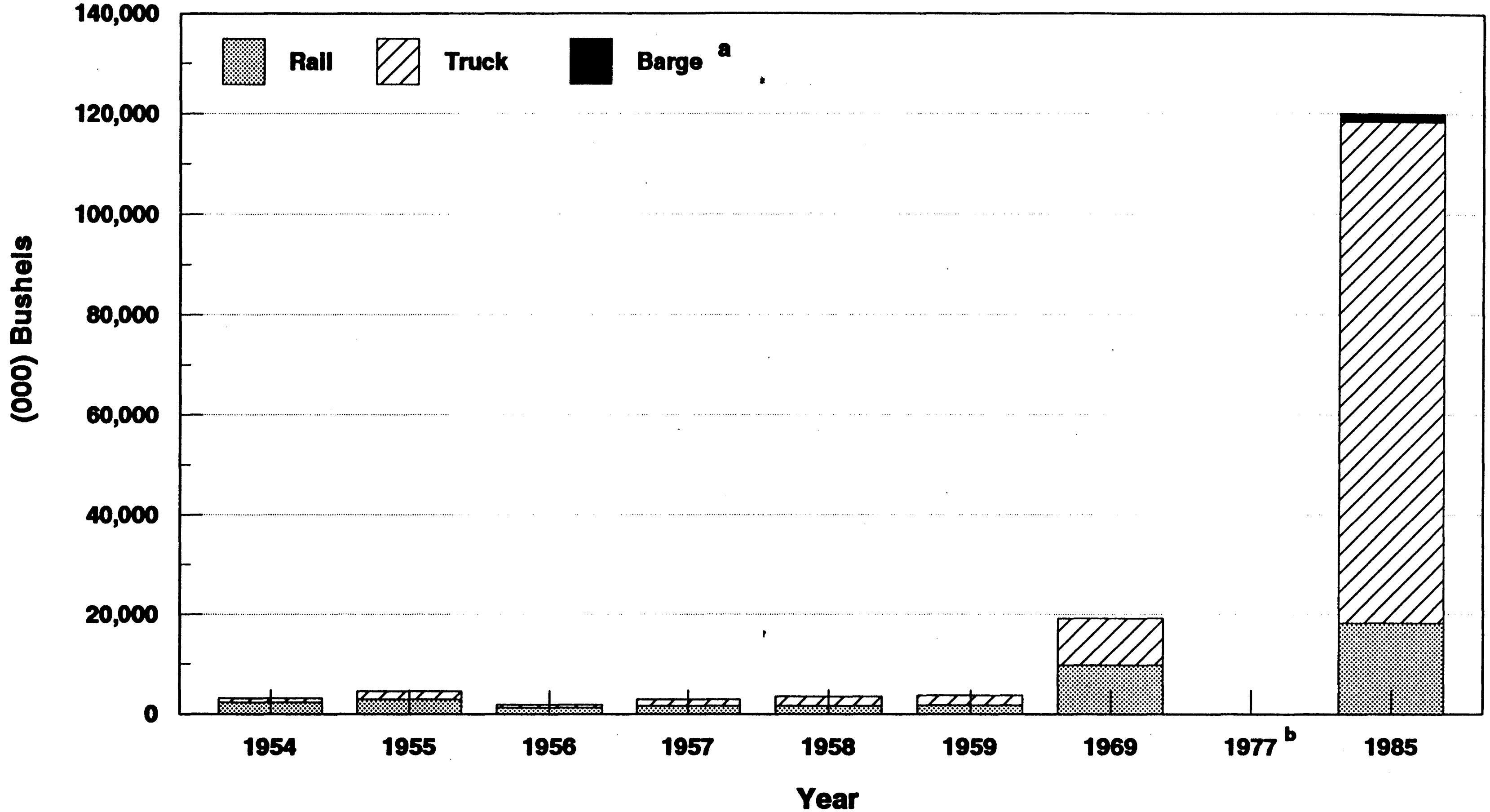

Figure 8-7. Soybean Shipments from Nebraska Elevators, by Mode of Transport, Selected Years, 1954-1985.

[a] Barge data only available for 1977 and 1985.

[b] Nebraska and Kansas data were combined in 1977; modal split for the two states was 61.7% by truck, 34.5% by rail and 3.8% by barge.

Source: Table 8-5.

Figure 8-8. Percentage of Interstate Soybean Shipments from Nebraska Elevators to Various Destinations, by Rail, 1954

Figure 8-9. Percentage of Interstate Soybean Shipments from Nebraska Country Elevators to Various Destinations, by Truck, 1969.

Figure 8-10. Percentage of Interstate Soybean Shipments from Nebraska Country Elevators to Various Destinations, by Rail, 1969.

Figure 8-11. Percentage of Soybean Shipments from Nebraska Subterminal Elevators to Various Destinations, by Rail, 1969.

Figure 8-12. Percentage of Interstate Soybean Shipments from Kansas and Nebraska to Various Destinations, by Truck, 1977.

Figure 8-13. Percentage of Interstate Soybean Shipments from Kansas and Nebraska to Various Destinations, by Rail, 1977.

Figure 8-14. Percentage of Interstate Soybean Shipments from Nebraska to Various Destinations, by Truck, 1985.

Figure 8-15. Percentage of Interstate Soybean Shipments from Nebraska to Various Destinations, by Rail, 1985.

Figure 8-16. Percentage of Soybean Shipments from Nebraska to Various Destinations, by Barge, 1985.

Figure 8-17. Percentage of Soybean Shipments from Nebraska to Various Destinations, by Rail, 1992.

Table 8-1. Soybean Production and Yield, Nebraska, United States and World, 1954-1996.

	WORLD		UNITED STATES		NEBRASKA	
Year[a]	Average Yield	Production	Average	Production	Average	Production
	(bu./ac)	(000 bu.)	(bu./ac)	(000 bu.)	(bu./ac)	(000 bu.)
1996[b]	(NA)	(NA)	37.6	2,382,364	45.0	135,450
1995[b]	(NA)	4,544,093	34.9	2,152,000	32.5	94,450
1994	32.4	5,014,964	41.4	2,517,000	47.0	137,280
1993	29.0	4,311,065	32.0	1,808,538	35.0	87,500
1992	30.8	4,307,501	37.6	2,187,904	42.0	103,320
1991	29.0	3,926,395	34.3	1,985,564	33.5	82,410
1990	28.6	3,827,040	34.1	1,925,947	34.5	81,420
1989	27.4	3,945,061	32.3	1,923,666	32.0	81,920
1988	25.4	3,513,984	26.8	1,548,821	30.0	70,800
1987	28.6	3,809,330	33.7	1,922,762	35.5	83,425
1986	28.3	3,601,177	33.3	1,940,101	38.0	93,100
1985	27.7	3,565,388	34.1	2,098,531	36.0	84,960
1984	25.7	3,420,324	28.1	1,860,863	26.0	66,300
1983	24.4	3,042,378	26.2	1,635,772	29.0	59,450
1982	26.8	3,451,556	31.5	2,190,297	36.0	81,000
1981	25.6	3,170,981	30.1	1,989,110	38.0	78,660
1980	27.1	3,439,982	26.5	1,797,543	30.0	53,100
1979	24.4	2,842,640	32.1	2,260,665	34.0	54,740
1978	24.4	3,439,982	29.4	1,868,754	34.0	42,500
1977	22.5	2,837,532	30.6	1,767,267	36.0	40,680
1976	22.4	2,203,740	26.1	1,288,608	20.0	19,600
1975	24.4	2,455,177	28.9	1,548,344	27.0	32,400
1974	25.3	2,450,989	23.7	1,216,287	24.5	28,175
1973	22.5	2,107,545	27.8	1,547,543	30.0	36,300
1972	21.6	1,743,783	27.8	1,270,680	32.5	22,978
1971	21.3	1,600,556	27.5	1,176,101	25.0	15,225
1970	21.1	1,536,254	26.7	1,123,740	22.0	17,864
1969	21.1	1,481,469	27.5	1,126,314	33.5	25,661
1968	20.8	1,454,223	26.8	1,103,129	23.5	18,377

Table 8-1, continued

	WORLD		UNITED STATES		NEBRASKA	
	Average	Production	Average Yield	Production	Average	Production
Year[a]	(bu./ac)	(000 bu.)	(bu./ac)	(000 bu.)	(bu./ac)	(000 bu.)
1967	19.6	1,340,764	24.5	976,060	22.5	17,595
1966	19.9	1,279,351	25.4	928,481	29.5	21,978
1965	19.0	1,190,410	24.5	845,608	23.5	16,356
1964	17.5	1,035,715	22.8	700,921	23.0	12,029
1963	19.0	1,063,050	24.4	699,165	28.5	10,146
1962	18.8	1,031,405	24.2	669,186	27.0	8,370
1961	19.0	1,092,420	25.1	678,554	25.5	7,446
1960	17.8	940,050	23.5	555,085	28.0	4,592
1959	18.0	949,625	23.5	532,899	24.0	3,504
1958	18.6	1,006,500	24.2	580,250	30.0	6,180
1957	16.2	879,360	23.2	483,425	27.0	3,834
1956	15.2	848,595	21.8	449,251	11.5	1,748
1955	14.8	767,990	20.1	373,682	10.5	1,890
1954	17.1	737,720	20.0	341,075	22.0	4,180

Source: Nebraska Department of Agriculture and U.S. Department of Agriculture. *Nebraska Agri-Facts*. Lincoln: Nebraska Agricultural Statistics Service, January 18, 1996; Nebraska Department of Agriculture and U.S. Department of Agriculture. *Nebraska Agricultural Statistics*. Lincoln: Nebraska Agricultural Statistics Service, 1995; and U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, various issues; U.S. Department of Agriculture. *World Agricultural Supply and Demand Estimates*. Washington, D.C.: USDA U.S. Department of Agriculture, June 12, 1996; and U.S. Department of Agriculture. *Agricultural Statistics*. Washington, D.C.: GPO, various years.

[a] "Year," in the world data series prior to 1988, refers to year of harvest. Southern Hemisphere crops which are harvested in the early part of the year are combined with those of the Northern Hemisphere harvested the latter part of the same year. After 1977, the report year includes Northern Hemisphere crops harvested in the late months of the year combined with Southern Hemisphere and certain Northern Hemisphere crops harvested in the early months of the following year.

[b] Estimated.

Table 8-2. Soybean Production, Elevator[a] Receipts and Shipments, Nebraska, Selected Years, 1954-1985.

Year	Production	Receipts	Shipments
	(000 bu.)	(000 bu.)	(000 bu.)
1985	84,960	153,662	119,913
1977[b]	40,680	NA	NA
1969	25,661	23,595	19,090
1959	3,504	4,379	3,675
1958	6,180	3,812	3,412
1957	3,834	3,087	2,886
1956	1,748	2,048	1,810
1955	1,890	4,854	4,465
1954	4,180	2,921	3,084

Source: Production data are from Nebraska Department of Agriculture and USDA, *Nebraska Agricultural Statistics*, Lincoln: Nebraska Crop Reporting Service, various issues. Receipts and Shipments data are from a 1985 elevator survey conducted by the author, partial results of which appear in Reed and Hill (1990); results of a 1977 survey by Dean Linsenmeyer, partial results of which appear in Leath, Hill and Fuller (1981); findings from a 1969 survey (Anderson and Breuer 1971); and surveys of crop years 1954-59 (Miller 1960; and unpublished records from the latter surveys).

[a] Data sets for 1954-69 were from country elevators, those for 1977 and 1985 were all elevators.

[b] Receipts and shipments for Kansas and Nebraska were combined in the 1977 survey; a Nebraska separation is not available.

Table 8-3. Soybean Shipments to Kansas[a] and Nebraska from Other States, by Mode of Transport and Origin, 1977.

	Mode of Transportation				
Origin	Truck	Rail	Barge	Total	% of Interstate[b]
	(000 bu.)				(%)
Iowa	9,162	168	0	9,330	40.9
Missouri	6,410	6,627	0	13,037	57.1
Oklahoma	325	111	0	436	1.9
Texas	33	0	0	33	0.1
Total	15,930	6,906	0	22,836	100.0
% of Total[b]	69.8	30.2	0	100.0	

Source: 1977 elevator survey.

[a]Kansas and Nebraska results from the 1977 survey were combined; results for Nebarska separately are not available.

[b] Percent detail may not add to totals because of rounding.

Table 8-4. Soybean Shipments to Nebraska from Other States, by Mode of Transport and Origin, 1985.

Origin	Mode of Transportation				
	Truck	Rail	Barge	Total	% of Total[a]
	(000 bu.)				(%)
Iowa	440	922	0	1,362	13.0
Kansas	1,540	40	0	1,580	15.1
Minnesota	0	954	0	954	9.1
Missouri	1,565	0	0	1,565	14.9
South Dakota	4,000	1,028	0	5,028	47.9
Total	7,545	2,944	0	10,489	100.0
% of Total[a]	71.9	28.1	0	100.0	

Source: 1985 elevator survey.

[a] Percent detail may not add to totals because of rounding.

Table 8-5. Soybean Shipments from Nebraska Elevators[a], by Mode of Transport, Selected Years, 1954-1985.

Year	Truck		Rail		Barge		Total
	(000 bu.)	(% of total)[b]	(000 bu.)	(% of total)[b]	(000 bu.)	(% of total)[b]	(000 bu.)
1985[c]	100,150[d]	83.5	18,195	15.2	1,568	1.3	**119,913**
1977[c,e]	NA	61.7	NA	34.5	NA	3.8	**NA**
1969[c]	9,362[d]	49.0	9,728	51.0	NA	NA	**19,090**
1959	2,021	55.0	1,654	45.0	NA	NA	**3,675**
1958	1,880	55.1	1,532	44.9	NA	NA	**3,412**
1957	1,267	43.9	1,619	56.1	NA	NA	**2,886**
1956	590[d]	32.6	1,220	67.4	NA	NA	**1,810**
1955	1,643	36.8	2,822	63.2	NA	NA	**4,465**
1954	762	24.7	2,322	75.3	NA	NA	**3,084**

Source: Data from a 1985 elevator survey conducted by the author, partial results of which appear in Larson, Smith and Baldwin (1990); results of a 1977 survey by Dean Linsenmeyer, partial results which appear in Leath, Hill and Fuller (1981); findings from a 1969 survey (Anderson and Breuer, 1971); and surveys of crop years 1954-59 (Miller 1960; and unpublished records from the latter surveys).

[a] Data sets for 1954-69 were from country elevators, those for 1977 and 1985 were all elevators.

[b] Percent detail may not add to totals because of rounding.

[c] Shipments reported "unknown" as to mode have been allocated in proportion to known shipments.

[d] Includes local as well as out-of-state shipments.

[e] Nebraska and Kansas data were combined in 1977 and are therefore not comparable with those for other years. Totals for the two states were: rail 17,251, truck 30,870 and barge 1,878 thousand bushels.

Table 8-6. Soybean Shipments from Nebraska Elevators, by Mode of Transport and Destination, 1954.[a]

Destination	Truck[b]	Rail	Total	% of Interstate[c]	% of Total[c]
	Mode of Transportation				
	(000 bu/%)				
California	0	97	97	11.3	3.5
Kansas City, MO	0	96	96	11.2	3.5
St. Joseph, MO	0	666	666	77.5	24.3
Total Interstate	0	859	859	100.0	31.4
% of Interstate[c]	0	100.0			
Nebraska, unspecified	12		12		0.4
Fremont	633	211	844		30.8
Lincoln	14	63	77		2.8
Omaha	0	831	831		30.4
S. Sioux City	114	0	114		4.2
Total Intrastate	773	1,105	1,878		68.6
% of Intrastate[c]	41.2	58.8	100.0		
Total	**773**	**1,964**	**2,737**		**100.0**
% of Total[c]	**28.2**	**71.8**	**100.0**		

Source: 1954 elevator survey (Farrell).

[a] The total and modal flows reported here do not correspond with those in Table 8-5. Data in the present table are from Farrell while those in 8-5 are taken from Miller and Nelson; both sources, however, draw upon the same elevator survey. They do differ structurally in at least one respect: The Miller and Nelson data reflect only shipments from country elevators, but include local as well as commercial truck shipments. Farrell's data include shipments from terminal and subterminal as well as country elevators but exclude local shipments. The percentage data in the present table are likely to be more reliable than the bushel volume estimates and provide at least a sense of where the soybeans were going in 1954.

[b] Does not include truck shipments to local farmers and feeders.

[c] Detail may not add to total due to rounding.

Table 8-7. Soybean Shipments from Nebraska Country Elevators, by Mode of Transport and Destination, 1969.[a]

	Mode of Transportation				
Destination	Truck	Rail	Total	% of Interstate[b]	% of Total[b]
	(000 bu/%)				
Colorado	61	0	61	1.3	0.3
Illinois	16	0	16	0.3	0.1
Iowa	1,262	1,009	2,271	46.8	12.1
Kansas (excluding Kansas City)	0	251	251	5.2	1.3
Kansas City	0	775	775	16.0	4.1
Minnesota	0	10	10	0.2	0.1
Missouri (excluding Kansas City)	6	1,459	1,465	30.2	7.8
Total Interstate	1,345	3,504	4,849	100.0	25.9
% of Interstate[b]	27.7	72.3	100.0		
Nebraska, unspecified	2,137	78	2,215		11.8
Lincoln	5,516	3,561	9,077		48.5
Omaha	9	2,585	2,594		13.9
Total Intrastate	7,662	6,224	13,886		74.1
% of Intrastate[b]	55.2	44.8	100.0		
Total	**9,007**	**9,728**	**18,735**		**100.0**
% of Total[b]	**48.1**	**51.9**	**100.0**		

Source: 1969 elevator survey (Anderson and Breuer 1971).

[a] Mode of shipment of 3 percent of the traffic was unknown. Destination of 10 percent of the rail shipments and 21 percent of the truck shipments was reported as "unknown." The unknowns have been allocated in proportion to distribution of known shipments. Does not include shipments to local farmers and feeders.

[b] Detail may not add to total due to rounding.

Table 8-8. Soybean Shipments from Kansas[a] and Nebraska Elevators, by Mode of Transport and Destination, 1977.

Destination	Truck[b]	Rail	Barge	Total	% of Interstate[c]	% of Total[c]
	Mode of Transportation					
	(000 bu/%)				(%)	
Arkansas	0	1,500	0	1,500	12.7	3.0
Iowa	1,426	503	0	1,929	16.4	3.9
Louisiana	0	90	0	90	0.8	0.2
Missouri	1,317	1,824	0	3,141	26.6	6.3
Alabama and Tennessee	0	66	0	66	0.6	0.1
East Gulf	0	2,233	0	2,233	18.9	4.5
Louisiana Gulf	0	139	1,878	2,017	17.1	4.0
Pacific Northwest	253	182	0	435	3.7	0.9
Texas Gulf	0	384	0	384	3.3	0.8
Total Interstate	2,996	6,921	1,878	11,795	100.0	23.6
% of Interstate[c]	25.4	58.7	15.9	100.0		
KS & NE	27,874	10,330	0	38,204		76.4
% of Intrastate[c]	73.0	27.0	0	100.0		
Total	**30,870**	**17,251**	**1,878**	49,999		**100.0**
% of Total[c]	**61.7**	**34.5**	**3.8**	100.0		

Source: 1977 elevator survey.

[a] Kansas and Nebraska results from the 1977 survey were combined; results from Nebraska separately are not available.

[b] Includes farm as well as commercial truck shipments.

[c] Percent detail may not add to totals because of rounding.

Table 8-9. Soybean Shipments from Nebraska Elevators, by Mode of Transport and Destination, 1985.

	Mode of Transportation					
Destination	Truck	Rail	Barge	Total	% of Interstate[a]	% of Total[a]
	(000 bu/%)				(%)	
Alabama	0	350	0	350	0.7	0.3
Arkansas	17	1,223	0	1,240	2.6	1.0
Colorado	100	0	0	100	0.2	0.1
Illinois	621	0	0	621	1.3	0.5
Iowa	10,544	0	0	10,544	22.1	8.8
Kansas	8,447	2,613	0	11,060	23.2	9.2
Missouri	9,500	8,862	0	18,362	38.5	15.3
South Dakota	262	0	0	262	0.6	0.2
East Gulf	0	350	46	396	0.8	0.3
Louisiana Gulf	0	0	1,522	1,522	3.2	1.3
Texas Gulf	0	285	0	285	0.6	0.2
Pacific N.W.	0	1,212	0	1,212	2.5	1.0
Mexico	0	1,800	0	1,800	3.8	1.5
Total Interstate	29,491	16,695	1,568	47,754	100.0	39.8
% of Interstate[a]	61.8	35.0	3.3	100		
Nebraska	70,659	1,500	0	72,159		60.2
% of Intrastate[a]	97.9	2.1	0	100.0		
Total	**100,150**	**18,195**	**1,568**	**119,913**		**100.0**
% of Total[a]	**83.5**	**15.2**	**1.3**	**100.0**		

Source: 1985 elevator survey.

[a] Percent detail may not add to totals because of rounding.

Table 8-10. Soybean Shipments from Nebraska Elevators, to Various Destinations, by Rail, 1992.

Destination	Amount	% of Total[a]
	(000 bu.)	(%)
Illinois	523	0.8
Iowa	2,591	4.1
Kansas (excluding Kansas City)	2,087	3.3
Kansas City	18,648	29.3
Louisiana	4,829	7.6
Minnesota	965	1.5
Pacific Northwest	3,598	5.7
Texas Ports	2,830	4.5
Official	360	0.6
Western	17,907	28.2
Southwest	9,231	14.5
Total	**63,567**	**100.0**

Source: Adapted from U.S. Interstate Commerce Commission. *Public Use Waybill Sample*. Observations edited for public use. Washington, DC: ICC, 1993.

[a] Percent detail may not add to total because of rounding.

CHAPTER 9

WHEAT FLOWS

Trade Patterns[1]

The post-war wheat setting was one of rapidly expanding U.S. production and accumulation of stocks. Production in 1949 was a then all-time record of more than 22.216 million MT (1 billion bu.). Exports of wheat and wheat flour (8.165 million MT/300 million bushels) were too small in that year to prevent Commodity Credit Corporation (CCC) stockpiling and payment of subsidies to farmers of 54 cents per bushel. By July, 1950, CCC stocks of wheat had reached 9.825 million MT (361 million bu.), (Fornari, p. 102-3).

The Korean War brought fears of scarcity; prices in 1951 exceeded the government support level, reducing quantities placed under CCC loan. Meanwhile, exports of wheat and wheat flour grew to 9.961 million MT (366 million bu.) in 1950, and 12.927 million MT (475 million bu.) in 1951. But the tide was soon to turn. Government stocks began to grow once again in 1952 owing to large harvested acreage, high yields and declining exports. Bumper crops were achieved in both 1952 and 1953. Half of the 1953 crop was placed under loan and CCC stocks reached 23.132 million MT (850 million bu.) by the end of June 1954 (Fornari, p. 103).

Total U.S. wheat exports in 1954 were only 6.186 million MT (227.3 million bu.). Europe was the primary destination, although several regions were represented in the trade. Yugoslavia was the major importing country, taking 1.101 million MT (40.5 million bu.), nearly 18 percent of the total. Japan was in second place, with 908.5 thousand MT (33.4 million bu.), nearly 15 percent of the

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[1]Except where otherwise credited, data presented in this section are from Tables A9-1 through A9-23. Readers are also referred to these appendix tables for further detail.

total. West Germany, U.K., Netherlands and Greece were also important buyers, accounting as a group for more than 34 percent of total U.S. wheat exports in 1954 (Figure 9-1).

Surpluses continued to mount even in the face of sharp reductions in both wheat acreage and price supports under the terms of a farmers' referendum and free-market policies promoted by the new U.S. agriculture secretary, Ezra Taft Benson. Congress sought to reduce the surpluses through expanded exports; the Agricultural Trade Development and Assistance Act of 1954 (Public Law 480, or simply "PL-480"), an initiative championed by Minnesota Senator Hubert Humphrey, authorized shipments of wheat and other "surplus" agricultural commodities for relief of the world's hungry. In the first year of the Act's existence, 4.3 million MT (158 million bu.) of total U.S. wheat and wheat flour exports of 7.457 million MT (274 million bu.) moved under government-financed programs (Fornari, p. 104).

By the period 1955-59, average annual exports had increased 65 percent to 10.198 million MT (374.6 million bu.). India, a major recipient of PL-480 assistance, had become the number-one importer of U.S. wheat, taking 2.112 million MT (77.6 million bu.), or almost 21 percent of total shipments. Japan bought 1.078 million MT (39.6 million bu.). Yugoslavia had fallen to a third-place, 7-percent share, with 722 thousand MT (26.5 million bu.) of imports. The U.K. was fourth, buying 684.0 million MT (25.1 million bu.), about 7 percent of U.S. wheat exports. Pakistan was fifth, taking 5.5 percent of the total. Other important customers were West Germany, Brazil, Netherlands, Turkey and Poland.

The 1960s began on a positive export note; expansion of the Food for Peace Program under the Kennedy Administration contributed to record wheat exports. Concessional exports, under various arrangements, continue to the present time, although they have declined both absolutely and relative to commercial sales.

The Soviet Bloc first emerged as a major market following poor crops in 1963, buying more than 2.722 million MT (100 million bu.) of wheat from the U.S. alone. The Soviet sales, along with large exports to India, Pakistan and Brazil, under PL-480, worked toward reducing stocks in the U.S. which by July 1, 1966 stood at 11.567 million MT (425 million bu.), (Fornari, pp. 105-6). Japan, in the meantime, was rapidly emerging as a major new market, wheat use in that country having grown by more than 40 percent from 1960-69, in response to rapidly growing Japanese incomes and apparent effectiveness of U.S. promotional efforts (Fornari, p. 108).

U.S. wheat exports in elevator-survey year 1969 were 14.716 million MT (540.7 million bu.), 44 percent above the 1955-57 level and 138 percent higher than those in 1954. Japan had by then become the first-place buyer, with 2.382 million MT (87.5 million bu.) in purchases, a share of more than 16 percent. India was a close second, with 2.314 million MT (85 million bu.), and nearly 16 percent of U.S. wheat exports. Pakistan (987.5 thousand MT/36.3 million bu.), South Korea (973.7 thousand MT/35.8 million bu.) and Brazil (906.0 thousand MT/33.3 million bu.) were all major customers, with a combined market share of nearly 20 percent. Venezuela, Turkey, Netherlands, Philippines and Taiwan were other significant destinations for U.S. wheat. The Western European market had all but disappeared by 1969, EC production-support and market-protection policies having effectively eliminated this region's need for imports (Figure 9-2).

U.S. wheat exports more than doubled, to 31.813 million MT (1.169 billion bu.), between 1969 and 1977. Japan remained the largest buyer in the 1977 survey year, with purchases of 3.175 million MT (116.6 million bu.), but its share of the doubled market had declined to 10 percent. Brazil accounted for 8.5 percent of U.S. exports, with purchases of 2.693 million MT (98.9 million bushels). South Korea was third, with a market share of a little more than 5 percent and purchases of 1.629 million MT (59.9 million bu.). Iran and Pakistan together had nearly 10 percent of the market and respective purchases of 1.130 million MT (41.5 million bu.) and 1.064 million MT (39.1 million bu.), (Figure 9-3).

The Soviet Union produced record amounts of wheat in 1984 in the face of an unusually poor local crop. Although total U.S. exports recovered significantly in that year from the post-1981 slump, the U.S. share of an expanded world market continued to erode. Chinese purchases of wheat declined sharply starting in fiscal year 1984-85 and Soviet purchases fell in 1985-86 from their high in the prior year. The net result was an increase in U.S. wheat exports during 1984 to a level just short of their 1981 peak, followed by a sharp decline in 1985. The peak in 1981 was more than 43.9 million MT (1.613 billion bu.), with a market value greater than $7.8 billion. The interruption in 1984 of the subsequent decline brought export sales of more than 42.2 million MT (1.551 billion bu.); prices were lower than in 1981, however, and dollar value of the sales had slumped to a little more than $6.4 billion. By survey year 1985, export volume was only 24.803 million MT (911.4 million bu.), a 44 percent reduction from the 1981 high; dollar value of the sales was down by 54 percent to $3.6 billion.

In grain-flow-survey year 1985, East and South Asian countries accounted for 9.397 million MT (345.3 million bu.) of U.S. wheat exports, nearly 38 percent of the total. South America was second, with 4.364 million MT (160.3 million bu.); North Africa third, with 2.984 million MT (109.6 million bu.); and Sub-Saharan Africa was the fourth largest recipient region, with 2.382 million MT

(87.5 million bu.) of wheat receipts. Western Europe, once the dominant purchasing region, was in fifth place with 1.777 million MT (65.3 million bu.).

Japan was the top buying nation in 1985, with purchases of 3.120 million MT (114.6 million bu.); Brazil was second, with 2.043 million MT (75.1 million bu.); and South Korea third, with 1.892 million MT (69.5 million bu.). Egypt, Nigeria, USSR, Algeria and Mainland China rounded out the top eight in recipient rankings (Figure 9-4).

Greatly increased production of white wheats in the European Community had, by 1985, made this area a significant exporter and resulted in sharply reduced purchases of hard wheat varieties from the U.S. India, a long-term U.S. customer, produced an exportable surplus in the 1985-86 crop year. At the same time, competition from other producing nations reduced U.S. markets in the Middle East. Exports to Latin America continued to rise, however, and African markets expanded in the face of chronic production shortfalls across much of that continent (Wisner, 1986).

Less-developed nations imported 17.477 million MT (642.2 million bu.) of U.S. wheat in 1985, or nearly 71 percent of the nation's total wheat exports in that year. Centrally-planned nations took 1.970 million MT (72.4 million bu.), about 8 percent of the total; and developed countries 5.357 million MT (196.8 million bu.), nearly 22 percent of total U.S. wheat exports in 1985.

Calendar year 1985 was one of rising grain stocks, both in Nebraska and the nation, as the U.S. assumed the role of residual supplier to a world in which total production was growing faster than utilization. Nebraska wheat stocks in all positions increased 16 percent during 1985, from 2.719 million MT (99.9 million bu.) to 3.165 million MT (116.3 million bu.). Nationwide, the increase was 18 percent, from 58.241 million MT (214.0 million bu.) to 68.855 million MT (2.53 billion bu.) (Nebraska Department of Agriculture and USDA, 1986).

World wheat stocks were large in the mid-1980s -- nearly 30 percent of annual utilization. U.S. policy changes, including the PIK program which brought grain out of CCC stocks, along with a drought in 1988, contributed toward a lowering of world stocks to about 15 percent of utilization. U.S. stock adjustments accounted for a large part of the decline and stock levels have continued to slump even in the face of higher production (U.S. Department of Agriculture, 1987a).

Because domestic wheat use in the United States is highly stable over time, exports are the crucial factor in demand variability. Exports in the 1992 Waybill survey year were 33.710 million MT (1.239 billion bu.), well above the 24.804 million tons (911.4 million bu.) in 1985, a little more than the level at the time of the 1977 survey (31.813 million MT/1.169 billion bu.), but significantly below the 42.2 million tons (1.551 billion bu.) in 1984.

The export situation varied greatly from one importing area to another in 1992. An improved wheat crop in the Former Soviet Union (FSU) interacted with severe financial problems in the region to limit imports by this part of the world. The FSU was, nonetheless, the second largest regional importer of U.S. wheat, taking 7.457 million MT (274.0 million bu.); East/South Asia was number one, with 14.077 million MT/517.2 million bu.; North Africa was third, with 5.916 million tons (217.4 million bu.), while the countries of the FSU together formed the largest importing group. Egypt was the single largest importing country, taking more than 4.044 million tons (148.6 million bu.), 12 percent of total U.S. exports. Japan was second, with a 10.5-percent market share, more than 3.545 million MT (130.3 million bu.). Mainland China was third with 9-percent or 2.982 million tons (109.6 million bu.), in spite of its having a record wheat crop of its own in 1992. Pakistan ranked fourth, with 1.758 million tons (64.6 million bu.); total South Asian wheat imports were up in 1992. The Philippines, in fourth place, imported 1.483 million tons (54.5 million bu.). Wheat production in

Mexico was down in 1992 because of wet weather; imports from the U.S., 409 thousand tons (15 million bu.) helped to make up the shortfall, with PL-480 being an important factor. Finally, wheat sales to Africa and Eastern Europe were up. The Export Enhancement Program (EEP) was a factor in 1992, sales being 30 percent above the level of a year earlier (Figure 9-5).

Less-developed regions and countries were the dominant importers in 1992, accounting for 18.421 million tons (676.9 million bu.) compared with only 4.811 million going to developed nations (the remainder went to centrally-planned countries or former members of that group). East/South Asia 14.077 million MT (517.2 million bu.), North Africa 7.457 million tons (217.4 million bu.), South America 1.463 million MT (53.8 million bu.) and West Asia 1.367 million MT (50.2 million bu.).

The distribution of U.S. wheat exports differed significantly in 1992 from that at the time of the 1985 survey; the African continent had imported much more in 1992 (7.049 million tons/259.0 million bu.), compared with (5.366 million tons or 197.2 million bu.) in 1985. South America took much more in 1985 (4.364 million tons or 160.4 million bu.), East/South Asia only two-thirds as much (9.397 million tons/345.2 million bu.) and West Asia much less in 1985 (1.430 million tons/52.5 million bu.). Another major difference was Western Europe, which took 1.777 million tons (65.3 million bu.) in 1985, only 535 thousand tons (19.7 million bu.) in 1992. The share of the less-developed regions was 17.477 million tons (642.2 million bu.) or 70.5 percent of U.S. exports to the world in 1985 compared with 18.421 million MT (676.9 million bu.) or 54.7 percent of a much larger total in 1992; developed nation imports were nearly identical in each of the years (roughly 5 million tons/184 million bu.), but centrally-planned countries and their successors took more than five times as much in 1992 as in 1985.

Wheat exports were down by 6 percent in 1993 from the level of a year earlier. North Africa was the largest recipient region, taking 6.379 million MT (243.4 million bu.), for a market share of 18 percent. The nations of the Former USSR took 11.6 percent (4.115 million MT/151.2 million bu.). Japan was still the major buying nation, with imports of 3.247 million MT (119.3 million bu.) and a 9 percent market share. Mainland China was second, having 2.717 million MT (99.8 million bu.) imports, for a 7.6 percent share. Egypt was the third largest recipient, at 2.458 million MT (90.3 million bu.) and a share of 7 percent. Morocco imported 2.093 million MT (976.9 million bu.). The Phillipines, South Korea, Algeria, Nigeria and Pakistan received more than a million MT each. Less-developed countries imported 23.569 million MT (866.0 million bu.), nearly two-thirds of total U.S. wheat exports.

Exports declined again in 1994, to 30.533 million MT (1.122 billion bu.). North Africa again was a major buying region, with imports of 7.201 million MT (264.6 million bu.), or 24 percent of the total. East and Southeast Asia together, was, however, by far the largest recipient region, with imports of 13.580 million MT (499.0 million bu.) and a share of 45.5 percent of all U.S. wheat exports. Egypt was the first-ranking country importer, with a share of nearly 17 percent and receipts of 5.158 million MT (189.5 million bu.). Japan was second, with 3.268 million MT (120.1 million bu.) and a 10.7-percent share. The Philippines was third, with 2.016 million MT (74.1 million bu.). Mainland China, Pakistan, Former USSR, South Korea and Algeria followed, in that order, and with a combined share of 26 percent. Less-developed countries accounted for 22.285 million MT (818.8 million bu.), or 73 percent of the total.

Exports in 1995 were 5 percent higher than in the previous year, 32.317 million MT (1.187 billion bu.). East/South Asia was by far the largest regional recipient, with 15.223 million MT (559.3

million bu.) of imports and 47 percent of the total. North Africa was again second, with 6.335 million MT (232.8 million bu.). South America was an important regional importer, with 2.643 million MT (97.1 million bu.). Egypt was the major importing nation, with 5.376 million MT (197.5 million bu.) and a share of 16.6 percent. Mainland China was second, with 3.649 million MT (134.1 million bu.); Japan was in third place, having imports of 2.886 million MT (106.0 million bu.) and a share of 8.9 percent. The Philippines, Pakistan and South Korea were next in order of imports, with a combined market share of 15 percent. The less-developed countries' imports were 23.079 million MT (848.0 million bu.), 71 percent of the U.S. wheat export market. Export levels to these latter nations in the future will depend largely on their rate of economic growth and the relative equality of its distribution. Successful structural reforms in the LDCs, providing an increasing market orientation, will also bode well for growth in wheat trade.

Shipping Patterns

Information in this section is from University of Nebraska grain-flow surveys and, for 1992, the ICC Waybill for that calendar year. Since the Waybill reports only rail shipments, neither modal splits, nor destination data for truck or barge shipments are available for 1992.

Volume of Receipts and Shipments

The size of annual elevator receipts (and shipments) of wheat depends upon crop size and imports into the state as well as market conditions during the year. Modest milling capacity within the state leaves most annual production available for out-shipment. Wheat is occasionally used as a feed grain when its price relative to that of corn and sorghum is low enough to make it competitive in this use. Differences in out-shipments also reflect inventory changes, the latter in turn being affected by U.S. and world market conditions and government storage programs as well as local crop size.

The relationship between annual production and elevator receipts (and shipments) of wheat varies greatly from year to year. In some years, production has exceeded receipts and shipments, in others it has been less, depending on inventory changes and relative volume of in-shipments (Figure 9-6 and Table 9-2). Double-counting of shipments may also have inflated traffic counts for 1977 and 1985, since data for these years alone were drawn from all classes of elevators (country, terminal, subterminal). Railroads have been slower in withdrawing transit privileges for wheat than for feed grains and, in fact, 57 percent of wheat flows in 1977 were intrastate, in spite of the state's relative insignificance in milling. Nearly 44 percent of intrastate shipments went by truck in 1977, compared with just over 25 percent in 1985 (Tables 9-8 and 9-9).

Nebraska is an importer as well as an exporter of wheat (Tables 9-3 and 9-4). A large part of the in-shipments apparently come from deliveries to Nebraska elevators of wheat from farmers in adjacent states who live near the Nebraska border. Nebraska farmers may deliver comparable amounts to elevators in other states. Some wheat is also imported into the state to meet milling requirements that can best be fulfilled by types of wheat not available locally.

The amount of wheat delivered to Nebraska elevators during calendar year 1985 was 1.8 times as much as the year's production (Table 9-2). The difference reflects delayed movement of the 1984 and earlier crops. Inventory adjustments stemming in part from the expiration of the PIK program shifted wheat from farm to commercial storage.

Shipments from other states have at times been a significant part of Nebraska elevator receipts and can apparently vary greatly from year to year. The 38 million bushels imported into the state in

1985 (Table 9-4), made up 20 percent of Nebraska elevator receipts in that year. In-flows in 1977 were only 30 percent of those in 1985, and only 6 percent of receipts. Because total receipts were much greater than production in each of these years, the imports were a much larger proportion of Nebraska production, 10.8 percent in 1977, 42.3 percent in 1985 (compare Table 9-2 with 9-3 and 9-4). A little over 43 percent of the 11.2 million bushels entering the state in 1977 came by truck, while 60.6 percent of the much larger (38 million bu.) flows in 1985 were moved by truck. Virtually all of the shipments in each of these years were from neighboring states. Colorado and South Dakota were the predominant truck shippers in 1977, Colorado and Kansas in 1985 (Tables 9-3 and 9-4).

Mode

Railroads have declined in their relative importance in the shipment of wheat, their share slipping from 97.9 percent of all shipments in 1954, to 86.7 percent of all shipments (both intra- and interstate) in 1969. The rail share eroded further, to 57.3 percent in 1977 and 56.4 percent in 1985. Data for the latter two years were drawn from all elevator types, however, while they came in the earlier survey years from country elevators alone, a circumstance that may have contributed to increased double-counting in the later years and to an expectation for a higher truck share of the market. But declining use of transit rates (albeit not to the extent having occurred in other grains) would have also contributed to a declining rail share of total wheat flows (Figure 9-7 and Table 9-5).

Further examination of the data yields further insights. In 1954, the rail share of interstate traffic was 99.6 percent, that of the intrastate traffic 98.6 percent (Table 9-6). The rails had nearly as large a share of total flows in 1969 -- 87.8 percent -- but their share of intrastate flows had declined to 83.6 percent, that of interstate shipments 95.2 percent (Table 9-7). By 1977, railroads carried 75.4 percent of interstate wheat shipments, from Nebraska, only 43.6 percent of intrastate traffic (Table 9-8). In 1985, the final year for which modal splits are available, the rail share of interstate traffic had increased to 83.5 percent, while its intrastate share had fallen to 25.4 percent of wheat traffic (Table 9-9). The fact that the erosion in rail share has been largely in its short-haul intrastate traffic suggests that diminishing importance of transit rates and, coincidentally, growing motor carrier competitiveness in the wake of deregulation in 1980, have been key causal factors. Attempting to capitalize on their comparative advantage in long-haul traffic, railroads have abandoned much of their branch-line mileage since the 1950s and reduced the availability of transit rates, leading to an erosion of their dominance over short-haul wheat traffic. Barges have never had a significant share of the traffic; they carried 2.6 percent of the total and 5 percent of interstate shipments of Nebraska wheat in 1985, down from 3.2 and 7.6 percent, respectively, in 1977 (Tables 9-8 and 9-9).

Destination

Some of the same caveats about the data as noted in the discussion of other grain flows apply here. Survey procedures varied somewhat over time. For example, the 1977 and subsequent surveys did not distinguish among country, subterminal and terminal elevators. However, combination data are not a major problem for 1977 and 1979 since much grain, by the time of these surveys, no longer transited through in-state terminals or subterminals enroute to ultimate out-of-state destinations. For the earlier years, adding the flows from all elevator types does result in double-counting of the total traffic since some of the shipments are simply second or third legs of original shipments. However, if the objective is to trace net flows from the state, exports from all of these elevator types should be combined for a complete picture of interstate shipments. The later surveys are not in this sense incomparable with the earlier ones in this respect.

In 1954, only 56 percent of wheat shipments from Nebraska country elevators went directly to out-of-state destinations, the latter exclusive of shipments to local customers (Table 9-6). The out-of-state shipments went heavily to terminals in adjoining states, from where at least part of the wheat no doubt moved later on to ultimate destinations. Kansas City, an important milling site, at the time as well as a transit point for wheat, was by far the most important destination, accounting for 86 percent of the interstate traffic. Nearby St. Joseph, Missouri took another 3.5 percent. Denver, Colorado was second most important, with receipts 6.5 percent of all interstate shipments. The small remainder went to several destinations in the nearby states of Iowa, Kansas and Minnesota. Nearly all of these shipments were by rail (Figures 9-8 and 9-9; and Table 9-6).

Omaha Grain Exchange reported that Omaha terminal elevators shipped 17.7 million bushels of wheat from Nebraska in 1954. Nearly all (99.9 percent) moved by rail, the small remainder went by truck. No information is available about the destination of these shipments the elevator ???? identified 22.6 million bushels leaving out of all Omaha origins, all going by rail (Table 9-6).Omaha Grain Exchange, cited in Anderson and Breuer 1971b).

The pattern in 1969 had begun to change. Traffic in that year went 63.7 percent to points in Nebraska, 36.3 percent to other states. Many new states had been added to the list of destinations. Consistent with 1954, Missouri had 27.6 percent of the interstate shipments, Kansas City had another 15.7 percent and the state of Kansas 10.6 percent. But Colorado had become the number-one recipient, taking 31.7 percent of interstate volume, nearly all moving by rail. The PNW emerged for the first time as a shipping point, Washington receiving 5.9 percent and Oregon 4.8 percent of interstate flows. The remainder went in smaller amounts to a number of states, including Iowa, Minnesota, Oklahoma, South Dakota, Texas and Utah, with railroads carrying 95.2 percent of all interstate traffic (Figures 9-10 and 9-11 and Table 9-7).

Some insight into the role in 1969 of subterminal elevators is found in Figures 9-12 and 9-13. Subterminals, as can be seen, moved the largest amounts of their wheat shipments (45.8 percent) to Minnesota (to mills, apparently); they shipped 18.4 percent to Kansas City and 12.5 percent to other Kansas destinations. Other recipients of importance were Iowa, Texas and Nebraska itself. The Gulf showed up for the first time as a (very minor) destination.

Omaha terminal elevators shipped 12.9 million bushels of wheat in 1969, of which 85 percent went by rail, 11.1 percent by barge and 3.9 percent by truck. Destinations of these shipments are not known (Omaha Grain Exchange, cited in Anderson and Breuer 1971b).

Although wheat still does not move in train-load lots to the extent that corn does, unit trains had begun to make an appearance by 1977, as is suggested in the growing direct traffic to out-of-state destinations. Total wheat traffic in that year was 57.1 percent to Nebraska destinations, 42.9 percent to other states. The Texas Gulf was the big destination in 1977, taking 28.5 percent of the interstate traffic. Kansas and Missouri remained important destinations, receiving together 31.1 percent of interstate traffic from Nebraska elevators. Minnesota was also important, accounting for 13.1 percent of interstate shipments. The PNW market continued to presage signs of its subsequent emergence, receiving 2.4 percent of interstate shipments in 1977 (Figures 9-14 through 9-16; and Table 9-8).

Nebraska's wheat went to a variety of destinations in 1985, some to the domestic milling industry, some to ports of export enroute to international destinations. A little more than half (53.3 percent) of elevator shipments were to out-of-state destinations. A large part of intrastate shipments are later transshipped to other destinations since the state's milling industry is of modest proportions.

The Pacific Northwest (PNW) was the most important direct destination in 1985, taking 17 percent of interstate shipments. Texas and Louisiana Gulf ports together received 17 percent of the interstate flows and the states of Kansas and Missouri accounted for another 31.4 percent, much of the latter probably destined ultimately for the Gulf as well. The Gulf is clearly the dominant destination, a not-surprising finding given the predominance of export destinations accessible from Gulf ports, including Africa, South and West Asia, Western Europe and South America (Figures 9-17 through 9-19; Tables 9-9, A6-2 and A6-3).

The key feature of 1992 was the central importance of export markets. The ICC Waybill reported that 94.4 percent of rail shipments of wheat from Nebraska origins went to out-of-state destinations. Of the latter, Texas ports were most important, with 29.3 percent of the interstate shipments. Second most important was the PNW with 11.5 percent and third Kansas City with 11.2 percent of interstate rail volume. Colorado took 8.5 percent, Minnesota 8.3 percent and Kansas (exclusive of Kansas City 7.9 percent. The remainder went to a large number of states scattered across the nation (Figure 9-20; and Table 9-10).

Summary

Nebraska's wheat production capacity in the 1950s was growing faster than demand, with resulting downward pressures on prices and growing political pressures on government to intervene. PL-480 became an important factor in 1955 in moving growing CCC stocks to nations in the less-developed world. Europe had been the primary destination for U.S. wheat in 1954, Yugoslavia the top country buyer, Japan second. In 1955-56, India, the largest PL-480 recipient, became the number-one customer for U.S. wheat exports, Yugoslavia was second and Japan third. Western Europe remained an important regional destination for U.S. wheat shipments.

Concessional exports under the Food for Peace plan contributed to growing exports in the 1960s. In 1963, the Soviet Union became a large buyer. Meanwhile, the Japanese market continued to grow rapidly, becoming by 1969, the number-one country destination. But the Western European market had nearly disappeared by 1969 under pressure of Common Market policies favoring domestic production.

Nebraska wheat production was 18 percent higher in 1977 than it was in 1969, a modest change compared with 40 percent growth for the U.S. and 33 percent for the world. Japan remained the largest buyer in 1977; Brazil emerged as the second largest customer. Soviet purchases were large in some years (e.g. 1984), down in others (1985). Both Soviet and Chinese purchases fell sharply in 1985 from highs of a year earlier, and exports in total were down in that year. Major regional importers in both 1977 and 1985 were Asia, South America and North Africa. Japan, Brazil, South Korea and Egypt, in that order, were the major national customers in 1985.

By 1992, East Asia was the largest buying region, the former USSR second and North Africa third. Egypt had become the largest country importer of U.S. wheat. Japan, Mainland China and Pakistan were important Asian buyers. Regional rankings in 1995 had East Asia first, North Africa second and South America third. States of the former USSR had fallen to eighth place in the regional rankings. Egypt remained the ranking national customer, Mainland China coming in second and Japan third.

LDCs have dominated the import scene in the 1990s, taking from half to nearly three-fourths of the total in each year. They provide a large but variable export market for U.S. wheat.

In spite of the growth in exports, the rail share of Nebraska's wheat traffic has slipped from nearly 100 percent in 1954 to 57 percent in 1985. The rail decline has been largely in intrastate traffic, its interstate share having grown from 75.4 percent in 1977 to 83.5 percent in 1985,thus supporting the view that deregulation has sharpened the comparative advantage of trucks in short-haul traffic, and rails in the longer hauls.

Because Nebraska has only modest wheat-milling capacity, and since wheat prices are normally too high relative to those of corn and sorghum for it to be an economical feed grain, most wheat is shipped beyond the state for milling. Intrastate movements are large, nevertheless, as wheat remains more likely than other grains to be transhipped from smaller elevators to larger ones, owing apparently to a persistence of rail transit rates for wheat.

Wheat moved in 1954 went roughly half to Nebraska terminals, half to out-of-state points, much of the latter to Kansas for apparent subsequent shipment elsewhere. The geographic market for Nebraska wheat had widened by 1969, traffic still going heavily to Kansas City, but Colorado having emerged as the largest recipient, and with Pacific Coast ports also an important destination.

Unit-train shipments had begun to make an important mark on flow patterns by 1977, the Texas Gulf being the primary market and the PNW also taking small amounts. By 1985, the PNW had become the single most important destination, although taken together, Texas and Louisiana ports did equal the PNW in importance. Exports continued to dominate (rail) flows in 1992, the Texas Gulf and PNW together accounting for nearly 41 percent of the total, the Texas Gulf alone more than 29 percent.

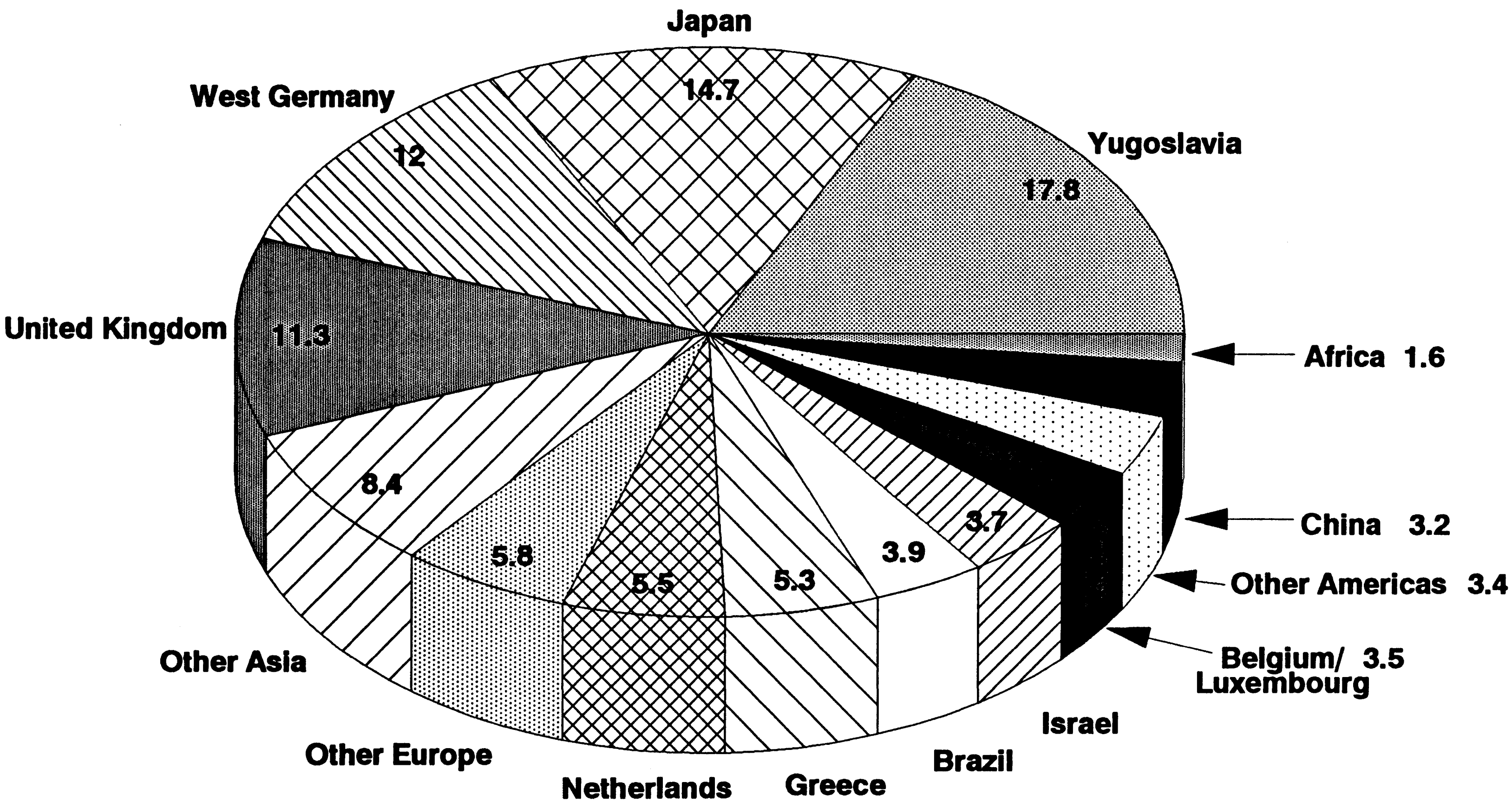


Figure 9-1. Percent Shares of Top Importers of U.S. Wheat, 1954

Source: Appendix Table A9-1.

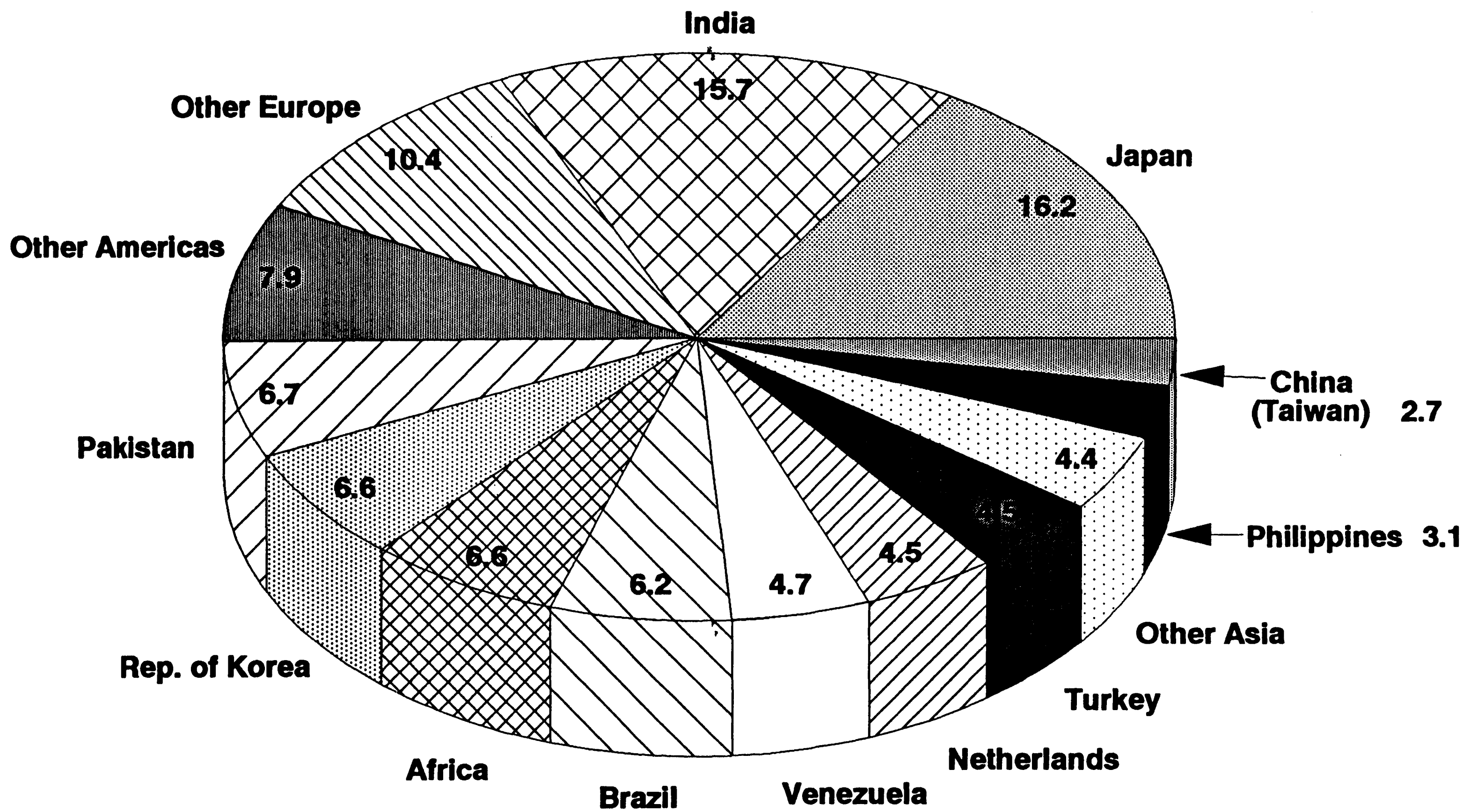


Figure 9-2. Percent Shares of Top Importers of U.S. Wheat, 1969

Source: Appendix Table A9-1.

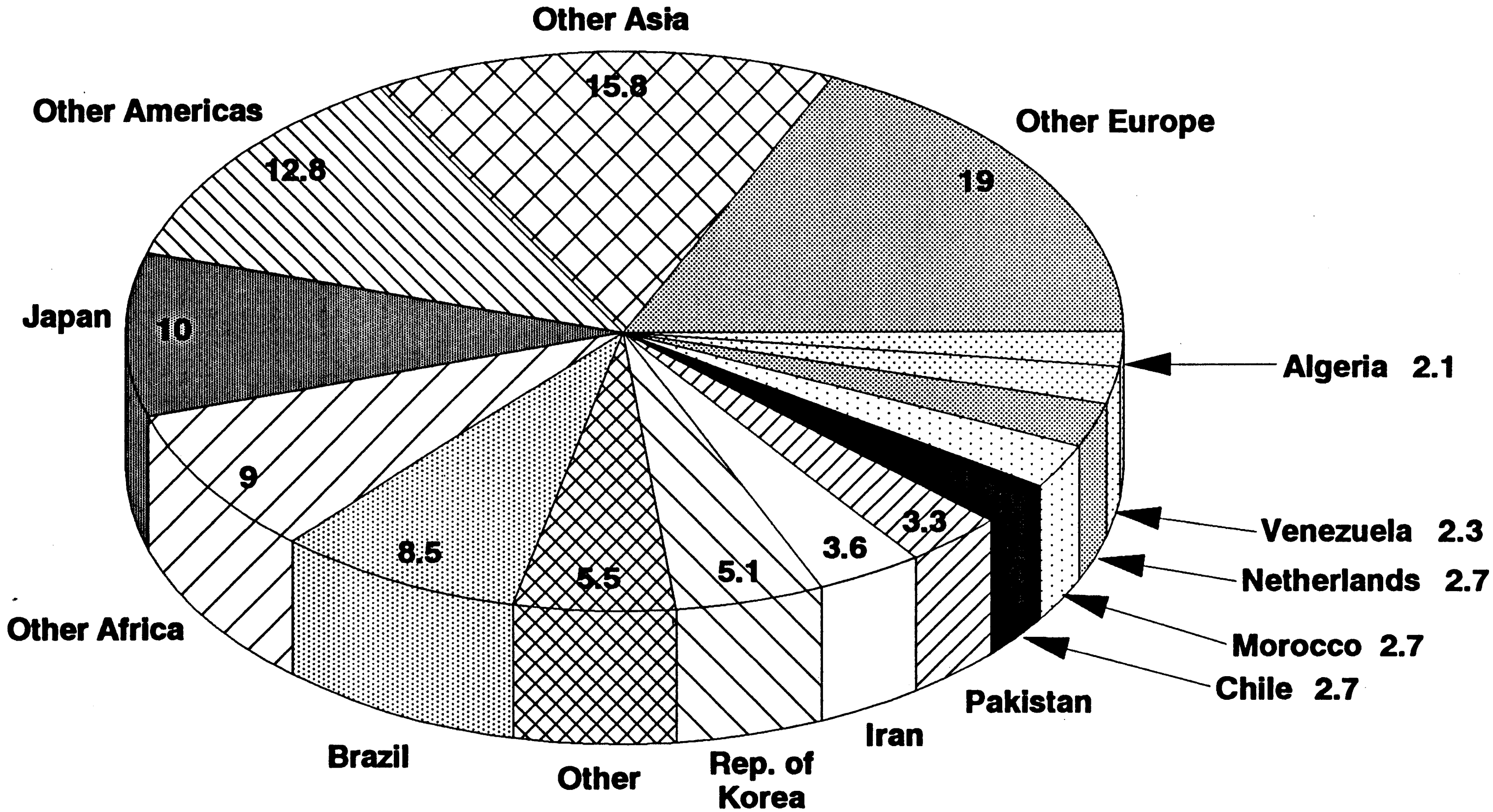


Figure 9-3. Percent Shares of Top Importers of U.S. Wheat, 1977

Source: Appendix Table A9-1.

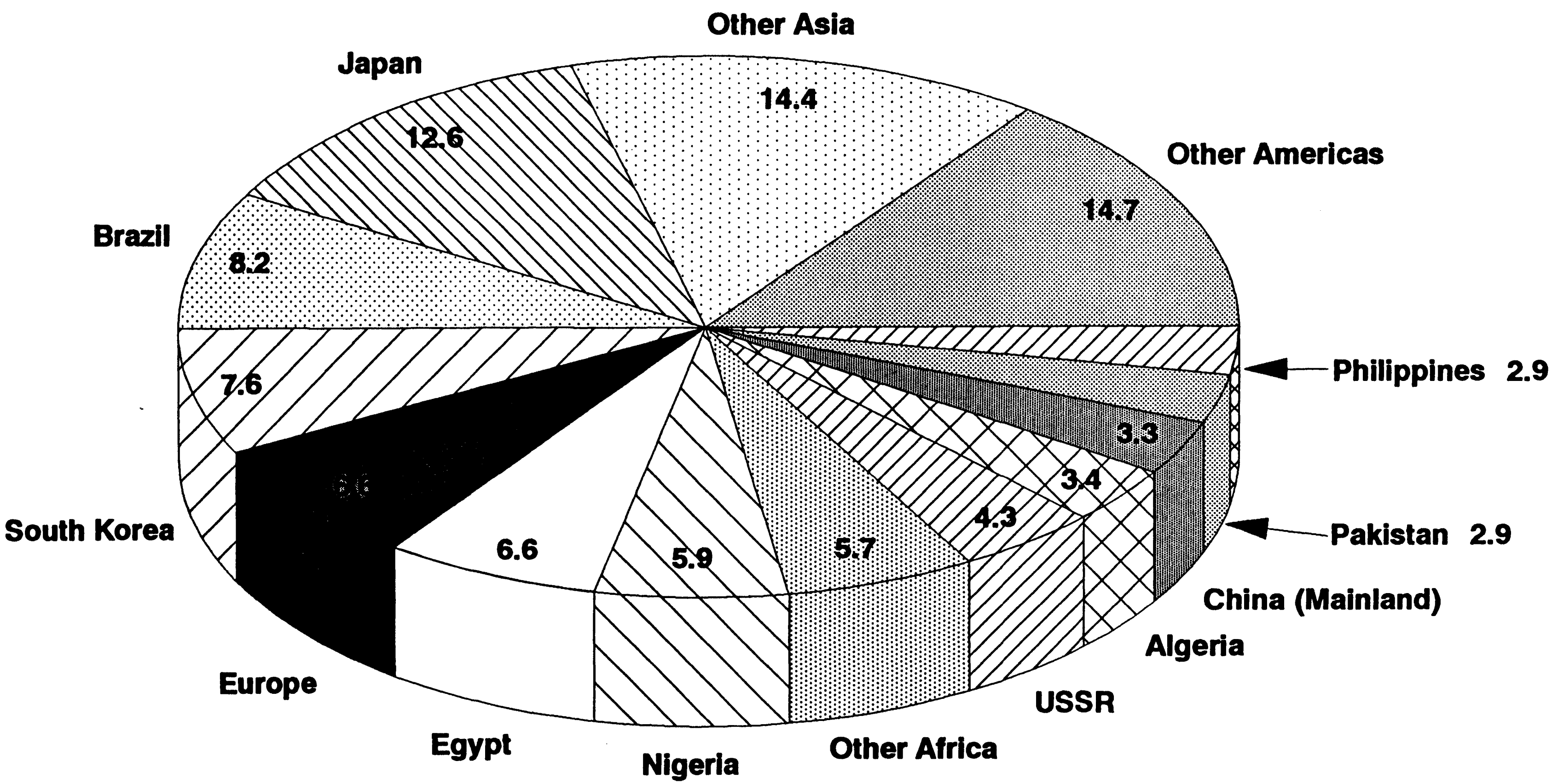


Figure 9-4. Percent Shares of Top Importers of U.S. Wheat, 1985

Source: Appendix Table A9-3.

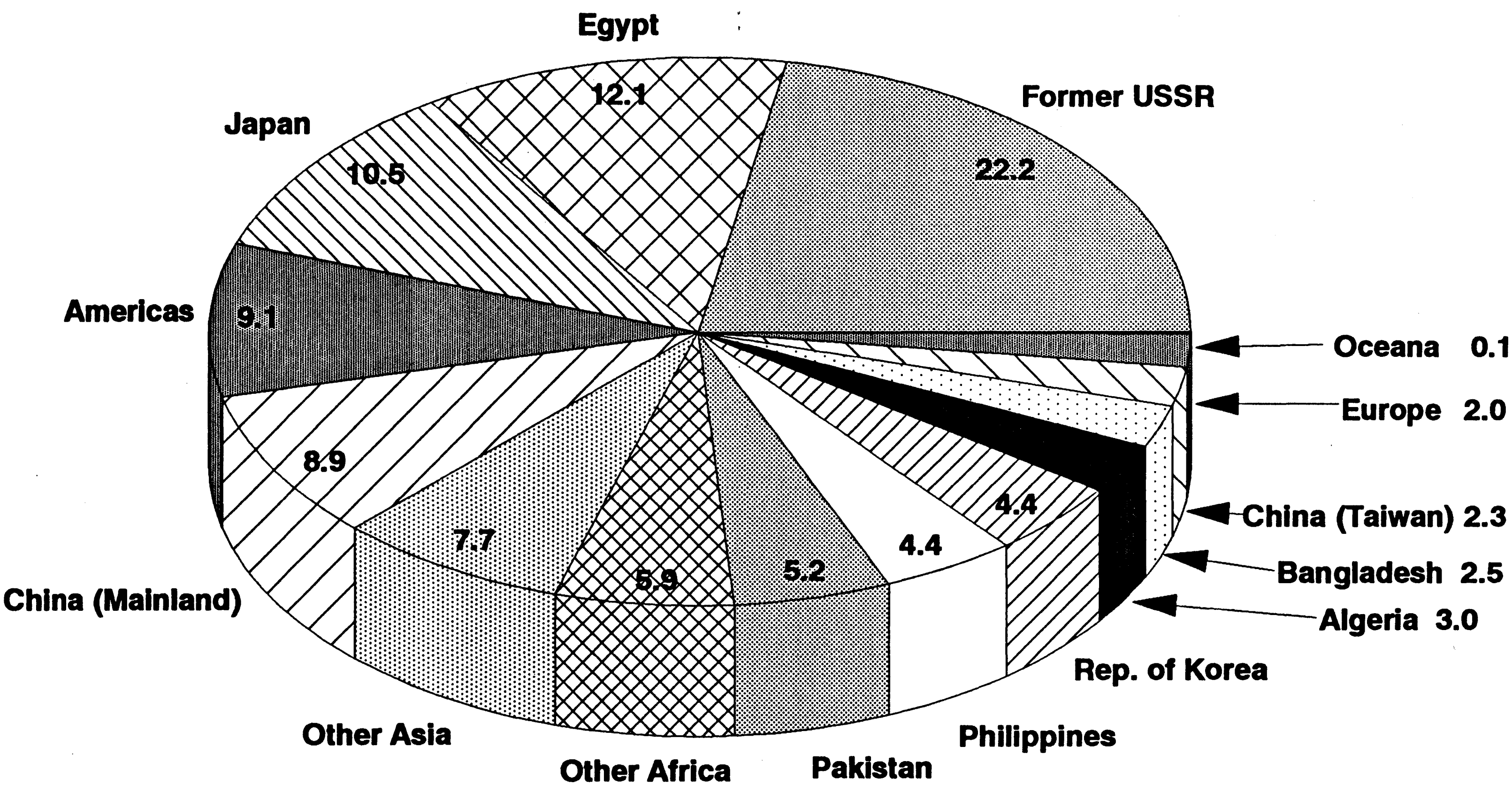


Figure 9-5. Percent Shares of Top Importers of U.S. Wheat, 1992

Source: Appendix Table A9-16.

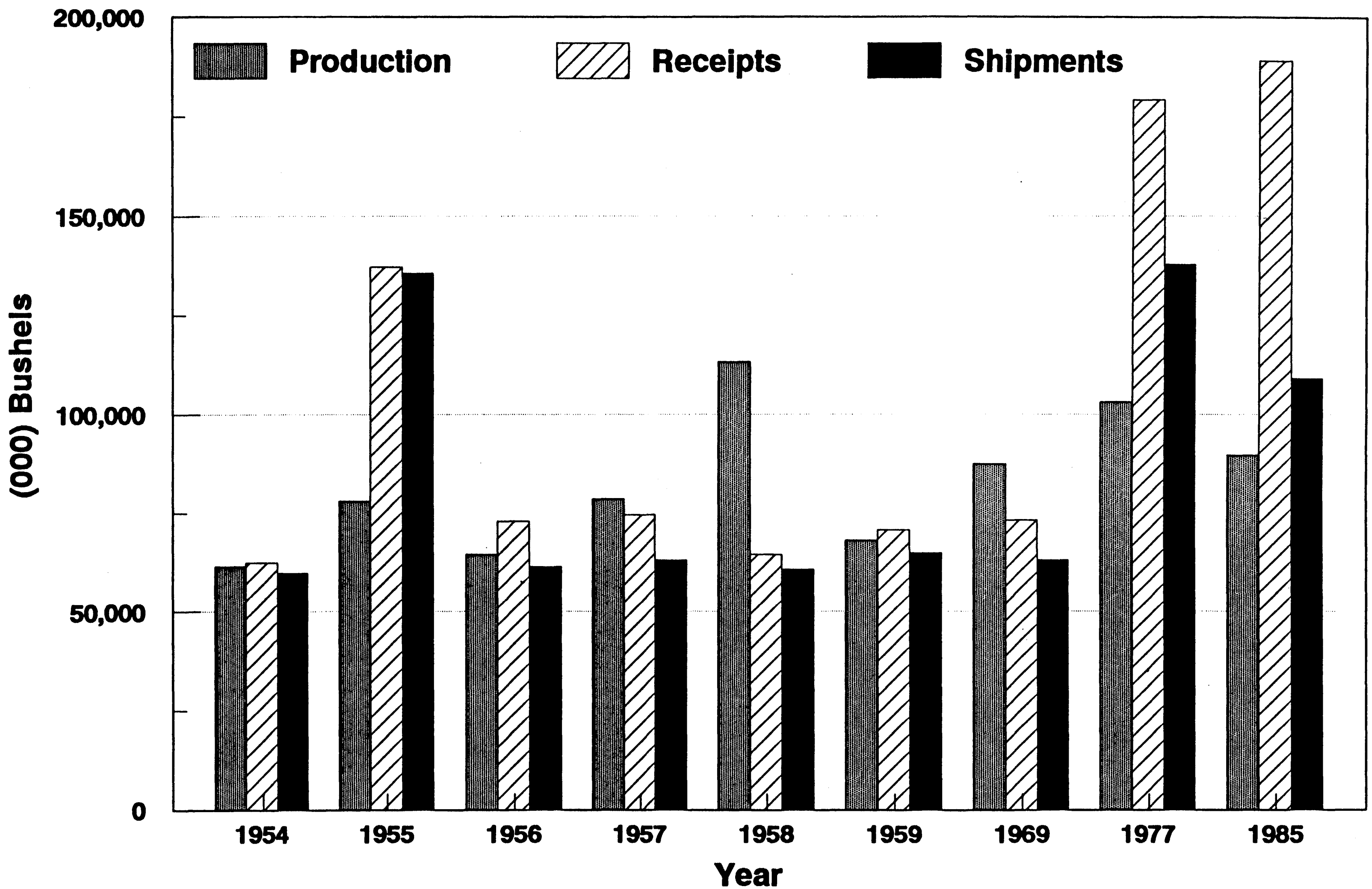


Figure 9-6. Wheat Production, Elevator Receipts and Shipments, Nebraska, Selected Years, 1954-1985.

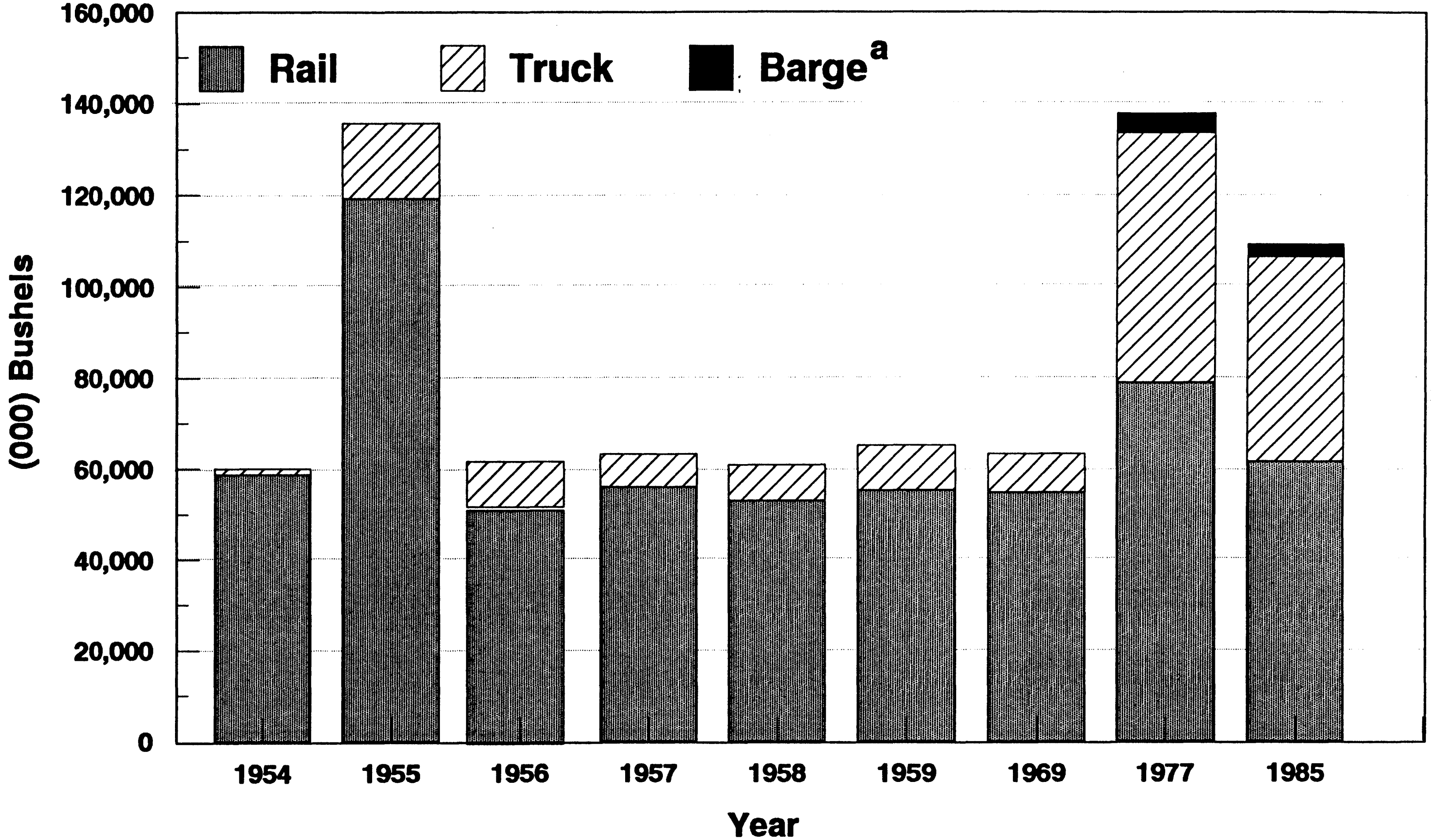


Figure 9-7. Wheat Shipments from Nebraska Elevators by Mode of Transport, Selected Years, 1954-1985.

[a] Barge data only available for 1977 and 1985.

Figure 9-8. Percentage of Interstate Wheat Shipments from Nebraska Elevators to Various Destinations, by Truck, 1954.

Figure 9-9. Percentage of Interstate Wheat Shipments from Nebraska Country Elevators to Various Destinations, by Rail, 1954.

Figure 9-10. Percentage of Interstate Wheat Shipments from Nebraska Country Elevators to Various Destinations, by Truck, 1969.

Figure 9-11. Percentage of Interstate Shipments from Nebraska Country Elevators to Various Destinations, by Rail, 1969.

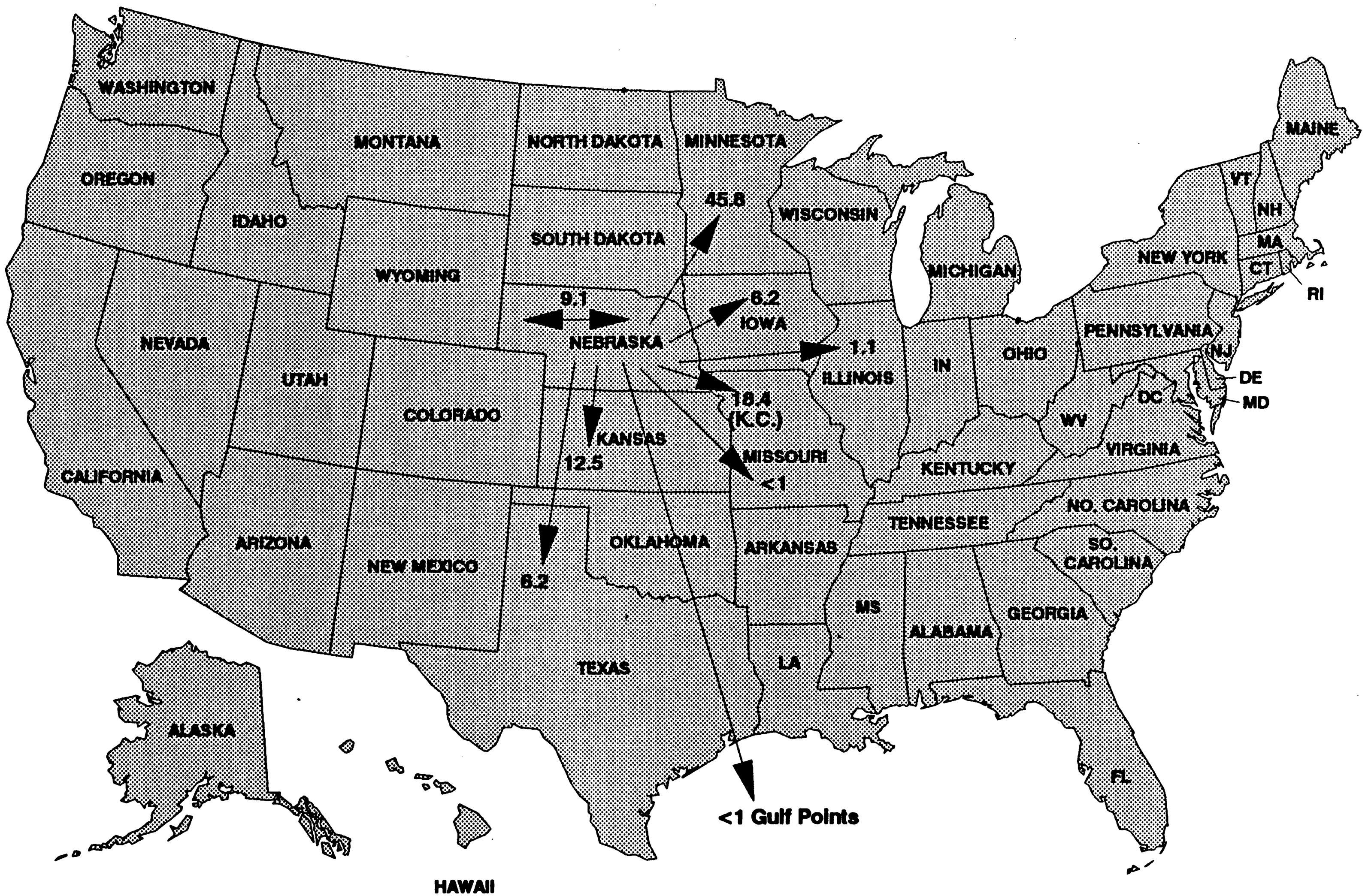


Figure 9-12. Percentage of Wheat Shipments from Nebraska Subterminal Elevators to Various Destinations, by Rail, 1969.

Figure 9-13. Percentage of Wheat Shipments from Nebraska Subterminal Elevators to Various Destinations, by Barge, 1969.

Figure 9-14. Percentage of Interstate Wheat Shipments from Nebraska to Various Destinations, by Truck, 1977.

Figure 9-15. Percentage of Interstate Wheat Shipments from Nebraska to Various Destinations, by Rail, 1977.

Figure 9-16. Percentage of Wheat Shipments from Nebraska to Various Destinations, by Barge, 1977.

Figure 9-17. Percentage of Interstate Wheat Shipments from Nebraska to Various Destinations, by Truck, 1985.

Figure 9-18. Percentage of Interstate Wheat Shipments from Nebraska to Various Destinations, by Rail, 1985.

Figure 9-19. Percentage of Wheat Shipments from Nebraska to Various Destinations, by Barge, 1985.

Figure 9-20. Percentage of Interstate Wheat Shipments from Nebraska to Various Destinations, by Rail, 1992.

Table 9-1. Wheat Production and Yield, Nebraska, United States and World, 1954-1996.

	WORLD		UNITED STATES		NEBRASKA	
	Average	Production	Average Yield	Production	Average	Production
Year[a]	(bu./acre)	(000 bu.)	(bu./acre)	(000 bu.)	(bu./acre)	(000 bu.)
1996[b]	(NA)	(NA)	(NA)	2,282,000	35.0	73,500
1995[b]	(NA)	19,714,832	35.8	2,186,000	41.0	86,100
1994	37.5	20,228,987	37.6	2,321,000	34.0	71,400
1993	37.5	20,627,325	38.3	2,402,055	35.0	73,500
1992	36.3	19,936,580	39.4	2,458,948	30.0	55,500
1991	36.3	21,596,845	34.3	1,981,139	32.0	67,200
1990	37.8	21,596,845	39.5	2,030,874	38.0	85,500
1989	36.4	19,540,888	32.7	2,036,618	27.0	55,350
1988	34.2	18,423,659	34.1	1,812,201	36.0	72,000
1987	33.9	18,428,693	37.7	2,107,480	44.0	85,800
1986	31.8	19,498,191	34.4	2,091,635	38.0	76,000
1985	33.0	18,328,125	37.5	2,424,765	39.0	89,700
1984	33.0	18,793,043	38.8	2,594,777	36.0	81,000
1983	31.8	18,038,658	39.4	2,419,824	43.0	98,900
1982	31.4	17,660,823	35.5	2,764,967	35.0	101,500
1981	27.1	15,991,850	34.5	2,785,357	36.0	104,400
1980	27.7	16,138,054	33.5	2,380,934	38.0	112,100
1979	27.7	15,522,413	34.2	2,134,060	34.0	86,700
1978	29.3	16,431,856	31.4	1,775,524	32.0	81,600
1977	25.1	14,021,433	30.7	2,045,527	35.0	103,250
1976	26.2	15,188,413	30.3	2,148,780	32.0	94,400
1975	23.1	12,862,389	30.6	2,126,927	32.0	98,240
1974	24.1	13,095,822	27.3	1,781,918	34.0	98,600
1973	25.3	13,532,815	31.6	1,710,787	35.0	83,800
1972	23.8	12,271,808	32.7	1,546,209	37.0	92,833
1971	24.0	12,540,662	33.9	1,618,636	42.0	102,228
1970	21.3	10,684,333	31.0	1,370,225	38.0	97,204
1969	20.0	10,561,205	30.7	1,460,187	31.5	87,570
1968	20.5	11,317,501	28.5	1,576,251	32.0	101,088

Table 9-1, continued

	WORLD		UNITED STATES		NEBRASKA	
	Average	Production	Average Yield	Production	Average	Production
Year[a]	(bu./acre)	(000 bu.)	(bu./acre)	(000 bu.)	(bu./acre)	(000 bu)
1967	19.2	10,174,331	25.9	1,522,382	26.5	88,112
1966	20.1	10,490,000	26.3	1,310,642	35.0	101,185
1965	17.3	9,075,000	26.5	1,315,613	20.0	54,540
1964	17.8	9,327,000	25.8	1,283,371	25.0	73,825
1963	16.6	8,315,000	25.2	1,146,821	21.5	63,490
1962	17.3	8,735,000	25.0	1,091,958	19.5	53,820
1961	16.1	7,880,000	23.9	1,232,359	24.5	78,807
1960	16.7	8,160,000	26.1	1,354,709	28.5	85,712
1959	16.4	8,150,000	21.6	1,117,735	22.0	68,204
1958	17.2	8,700,000	27.5	1,457,435	33.0	113,488
1957	15.3	7,645,000	21.8	955,740	27.0	78,741
1956	16.1	7,785,000	20.2	1,005,397	19.5	64,698
1955	15.6	7,400,000	19.8	937,094	24.9	78,255
1954	15.1	7,000,000	18.1	983,900	19.8	61,623

Source: Nebraska Department of Agriculture and U.S. Department of Agriculture. *Nebraska Agri-Facts*. Lincoln: Nebraska Agricultural Statistics Service, January 18, 1996; Nebraska Department of Agriculture and U.S. Department of Agriculture. *Nebraska Agricultural Statistics*. Lincoln: Nebraska Agricultural Statistics Service, 1995; and U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, various issues; U.S. Department of Agriculture. *World Agricultural Supply and Demand Estimates*. Washington, D.C.: USDA U.S. Department of Agriculture, June 12, 1996; and U.S. Department of Agriculture. *Agricultural Statistics*. Washington, D.C.: GPO, various years.

[a] "Year," in the world data series prior to 1988, refers to year of harvest. Southern Hemisphere crops which are harvested in the early part of the year are combined with those of the Northern Hemisphere harvested the latter part of the same year. After 1977, the report year includes Northern Hemisphere crops harvested in the late months of the year combined with Southern Hemisphere and certain Northern Hemisphere crops harvested in the early months of the following year.

[b] Estimated.

Table 9-2. Wheat Production, Elevator Receipts and Shipments, Nebraska, Selected Years 1954-1985.

Year	Production	Receipts	Shipments
	(000 bu.)	(000 bu.)	(000 bu.)
1985	89,700	189,091	109,230
1977	103,250	179,313	137,901
1969	87,570	73,326	63,270
1959	68,204	70,922	65,166
1958	113,488	64,623	60,920
1957	78,741	74,801	63,289
1956	64,698	73,032	61,678
1955	78,255	137,259	135,710
1954	61,623	62,595	60,058

Source: Production data are from Nebraska Department of Agriculture and USDA, Lincoln: Nebraska Coop and Livestock Reporting Service, various issues. *Nebraska Agricultural Statistics*, . Receipts and shipments data are from a 1985 elevator survey conducted by the author, partial results of which appear in Reed and Hill (1990); results of a 1977 survey by Dean Linsenmeyer, partial results of which appear in Leath, Hill and Fuller (1981); findings from a 1969 survey (Anderson and Breuer 1971); and surveys of crop years 1954-59 (Miller 1960; and unpublished records from the latter surveys).

[a] Data sets for 1954-69 were from country elevators, those for 1977 and 1985 were from all elevators.

Table 9-3. Wheat Shipments to Nebraska, by Mode of Transport and Origin, 1977.

Origin	Truck	Rail	Barge	Total	% of Interstate[a]	% of Total[a]
	(000 bu/%)				(%)	
Colorado	2,598	1,862	--	4,460	40.0	2.5
Iowa	405	390	--	795	7.1	0.4
Kansas	376	2,500	--	2,876	25.8	1.6
Minnesota	--	949	--	949	8.5	0.5
Missouri	179	18	--	197	1.8	0.1
Montana	27	1	--	28	0.3	<0.1
South Dakota	1,191	632	--	1,823	16.3	1.0
Wyoming	27	--	--	27	0.2	<0.1
Total Interstate	4,803	6,352	--	11,155	100.0	6.2
% of Interstate[a]	43.1	56.9	--	100.0		
Nebraska	133,822	34,336	--	168,158		93.8
% of Intrastate[a]	79.6	20.4	--	100.0		
Total	**138,625**	**40,688**	**--**	**179,313**		**100.0**
% of Total[a]	**77.3**	**22.7**	**--**	**100.0**		

Source: 1977 elevator surveys.

[a] Percent detail may not add to totals because of rounding.

Table 9-4. Wheat Shipments to Nebraska, by Mode of Transport and Origin, 1985.

Origin	Mode of Transportation: Truck	Rail	Barge	Total	% of Interstate[a]	% of Total[a]
	(000 bu/%)				(%)	
Colorado	14,213	2,447	0	16,660	43.9	8.8
Illinois	0	127	0	127	0.3	0.1
Iowa	0	196	0	196	0.5	0.1
Kansas	7,721	7,093	0	14,814	39.0	7.8
Louisiana	0	23	0	23	<0.1	<0.1
Michigan	0	327	0	327	0.9	0.2
Montana	9	0	0	9	<0.1	<0.1
North Dakota	0	832	0	832	2.2	0.4
South Dakota	944	3,822	0	4,816	12.7	2.5
Wyoming	65	90	0	155	0.4	0.1
Interstate	23,002	14,957	0	37,959	100.0	20.1
% of Interstate[a]	60.6	39.4	0	100.0		
Nebraska	149,583	1,549	0	151,132		79.9
% of Intrastate[a]	99.0	1.0	0	100.0		
Total	172,585	16,506	0	189,091		100.0
% of Total[a]	91.3	8.7	0	100.0		

Source: 1985 elevator survey.

[a] Percent detail may not add to totals because of rounding.

Table 9-5. Wheat Shipments from Nebraska Elevators[a], by Mode of Transport, Selected Years, 1954-1985.

Year	Truck		Rail		Barge		Total
	(000 bu.)	(% of total)[b]	(000 bu.)	(% of total)[b]	(000 bu.)	(% of total)[b]	(000 bu.)
1985[c]	44,769[d]	41.0	61,565	56.4	2,896	2.6	109,230
1977[c]	54,465[d]	39.5	78,952	57.3	4,484	3.2	137,901
1969[c]	8,438[d]	13.3	54,832	86.7	NA	NA	63,270
1959	9,840	15.1	55,326	84.9	NA	NA	65,166
1958	7,859	12.9	53,061	87.1	NA	NA	60,920
1957	7,215	11.3	56,074	88.7	NA	NA	63,289
1956	10,060[d]	16.3	51,618	83.7	NA	NA	61,678
1955	16,402	12.1	119,308	87.9	NA	NA	135,710
1954	1,261	2.1	58,797	97.9	NA	NA	60,058

Source: Data from a 1985 elevator survey conducted by the author, partial results of which appear in Reed and Hill (1990); results of a 1977 survey by Dean Linsenmeyer, partial results which appear in Leath, Hill and Fuller (1981b); findings from a 1969 survey (Anderson and Breuer 1971a); and surveys of crop years 1954-59 (Miller 1960; and Miller and Nelson, 1962).

[a] Data sets for 1954-59 were country elevators, those for 1977 and 1985 were all elevators.

[b] Percent detail may not add to totals because of rounding.

[c] Shipments reported "unknown" as to mode have been allocated in proportion to known shipments.

[d] Truck and local shipments combined.

Table 9-6. Wheat Shipments from Nebraska Elevators, by Mode of Transport and Destination, 1954[a].

Destination	Truck[b]	Rail	Total	% of Interstate[c]	% of Total[c]
	(000 bu/%)				
Denver, CO	0	2,465	2,465	6.5	3.6
Davenport, IA	0	154	154	0.4	0.2
Sioux City, IA	0	327	327	0.9	0.5
Atchison, KS	0	198	198	0.5	0.3
Salina, KS	0	458	458	1.2	0.7
Topeka, KS	0	227	227	0.6	0.3
Wichita, KS	0	164	164		
Minneapolis, MN	0	5	5	0.4	0.2
Kansas City, MO	150	32,633	32,783	86.0	47.8
St. Joseph, MO	0	1,340	1,340	3.5	2.0
Total Interstate	150	37,971	38,121	100.0	55.6
% of Interstate[c]	0.4	99.6	100.0		
Nebraska, unspecified	108	1,117	1,225		1.8
Columbus	0	23	23		<0.1
Fremont	106	1,012	1,118		1.6
Grand Island	0	428	428		0.6
Lincoln	211	4,900	5,111		7.5
Omaha	0	22,560	22,560		32.9
Total Intrastate	425	30,040	30,465		44.4
% of Intrastate[c]	1.4	98.6	100.0		
Total	**575**	**68,011**	**68,586**		**100.0**
% of Total[c]	**0.8**	**99.2**	**100.0**		

Source: 1954 elevator survey (Farrell).

[a] The total and modal flows reported here do not correspond with those in Table 9-5. Data in the present table are from Farrell while those in 9-5 are taken from Miler and Nelson; both sources, however, draw upon the same elevator survey. They do differ structurally in at least one respect: The Miller and Nelson data reflect only shipments from country elevators, but include local as well as commercial truck shipments. Farrell's data include shipments from terminal and subterminal as well as country elevators but exclude local shipments. The percentage data in the present table are likely to be more reliable than the bushel volume estimates and provide at least a sense of where the wheat was going in 1954.

[b] Does not include truck shipments to local farmers and feeders.

[c] Detail may not add to total due to rounding.

Table 9-7. Wheat Shipments from Nebraska Country Elevators, by Mode of Transport and Destination, 1969[a].

Destination	Truck	Rail	Total	% of Interstate[b]	% of Total[b]
	Mode of Transportation				
	(000 bu./%)				
Colorado	220	6,977	7,197	31.7	11.5
Idaho	18	0	18	0.1	<0.1
Iowa	138	0	138	0.6	0.2
Kansas	169	2,242	2,411	10.6	3.9
Kansas City	71	3,493	3,564	15.7	5.7
Minnesota	12	233	245	1.1	0.4
Missouri	209	6,044	6,253	27.6	10.0
Oklahoma	51	0	51	0.2	0.1
Oregon	0	1,097	1,097	4.8	1.8
South Dakota	0	45	45	0.2	0.1
Texas	57	98	155	0.7	0.3
Utah	155	0	155	0.7	0.3
Washington	0	1,343	1,343	5.9	2.2
Total Interstate	1,100	21,572	22,672	100.0	36.3
% of Interstate[b]	4.9	95.2	100.0		
Nebraska,unspecified	1,682	3,651	5,333		8.5
Hastings	164	7,790	7,954		12.7
Lincoln	1,649	11,417	13,066		20.9
Omaha	3,010	10,402	13,412		21.5
Total Intrastate	6,505	33,260	39,765		63.7
% of Intrastate[b]	16.4	83.6	100.0		
Total	**7,605**	**54,832**	**62,437**		**100.0**
% of Total[b]	**12.2**	**87.8**	**100.0**		

Source: 1969 elevator survey (Anderson and Breur, 1977a).

[a] Mode of shipment of 4 percent of traffic was unknown. Destination of 8 percent of the rail shipments and 14 percent of the truck traffic was reported as "unknown." The unknowns have been allocated in proportion to distribution of known shipments. Does not include truck shipments to local farmers and feeders.

[b] Detail may not add to total due to rounding.

Table 9-8. Wheat Shipments from Nebraska Elevators, by Mode of Transport and Destination, 1977.

	Mode of Transportation					
Destination	**Truck**	**Rail**	**Barge**	**Total**	**% of Interstate**[a]	**% of Total**[a]
	(000 bu/%)				(%)	
Arizona	300	0	0	**300**	0.6	0.2
California	0	330	0	**330**	0.6	0.2
Colorado	54	2,040	0	**2,094**	3.5	1.5
Idaho	0	21	0	**21**	<0.1	<0.1
Illinois	3,001	241	0	**3,242**	5.5	2.4
Indiana	0	0	80	**80**	0.1	<0.1
Iowa	52	2,948	40	**3,040**	5.1	2.2
Kansas	1,158	8,787	0	**9,945**	16.8	7.2
Louisiana	0	0	1590	**1,590**	2.7	1.2
Minnesota	3,678	4,087	0	**7,765**	13.1	5.7
Missouri	798	7,609	0	**8,407**	14.3	6.1
North Carolina	0	74	0	**74**	0.1	<0.1
Oklahoma	0	178	0	**178**	0.3	0.1
South Dakota	117	0	0	**117**	0.2	0.1
Tennessee	0	32	350	**382**	0.6	0.3
Texas	0	678	0	**678**	1.1	0.5
Virginia	0	235	0	**235**	0.4	0.2
East Gulf	0	0	244	**244**	0.4	0.2
Louisiana Gulf	0	0	2140	**2,140**	3.6	1.6
Pacific N.W.	0	1,406	0	**1,406**	2.4	1.0
Texas Gulf	869	15,950	40	**16,859**	28.5	12.2
Total Interstate	10,027	44,616	4484	**59,127**	100.0	42.9
% of Interstate[a]	17.0	75.4	7.6	**100.0**		
Nebraska	44,769	34,336	0	**78,774**	133.2	57.1
% of Intrastate[a]	56.4	43.6	0	**100.0**		
Total	**54,465**	**78,952**	**4484**	**137,901**	**233.2**	**100.0**
% of Total[a]	**39.5**	**57.3**	**3.2**	**100.0**		

Source: 1977 elevator survey.

[a] Percent detail may not add to totals because of rounding.

Table 9-9. Wheat Shipments from Nebraska Elevators, by Mode of Transport and Destination, 1985.

	Mode of Transportation					
Destination	Truck	Rail	Barge	Total	% of Interstate[a]	% of Total[a]
	(000 bu/%)				(%)	
Alabama	0	0	702	702	1.2	0.6
Arkansas	20	0	0	20	<0.1	<0.1
California	0	376	0	376	0.6	0.3
Colorado	215	556	0	771	1.3	0.7
Idaho	0	326	0	326	0.6	0.3
Illinois	0	2,216	411	2,627	4.5	2.4
Indiana	0	886	0	886	1.5	0.8
Iowa	812	3,869	0	4,681	8.0	4.3
Kansas	1,332	8,280	0	9,612	16.5	8.8
Missouri	2,076	6,576	24	8,676	14.9	7.9
Montana	1,817	0	0	1,817	3.1	1.7
Ohio	0	2,012	0	2,012	3.5	1.8
Oklahoma	0	93	0	93	0.2	<0.1
Pennsylvania	0	1,901	0	1,901	3.3	1.7
South Dakota	11	0	0	11	<0.1	<0.1
Tennessee	0	0	225	225	0.4	0.2
Utah	240	3,236	0	3,476	5.9	3.2
Wyoming	215	0	0	215	0.4	0.2
Louisiana Gulf	0	2,067	1,534	3,601	6.2	3.3
Texas Gulf	0	6,292	0	6,292	10.8	5.8
Pacific N.W.	0	9,918	0	9,918	17.0	9.1
Total Interstate	6,738	48,604	2,896	58,238	100.0	53.3
% of Interstate[a]	11.5	83.5	5.0	100.00		
Nebraska	38,031	12,961	0	50,992	87.6	46.4
% of Intrastate[a]	74.6	25.4	0	100.0		
Total	**44,469**	**61,565**	**2,896**	**109,230**	**187.6**	**100.0**
% of Total[a]	**41.0**	**56.4**	**2.6**	**100.0**		

Source: 1985 elevator survey.

[a] Percent detail may not add to totals because of rounding.

Table 9-10. Wheat Shipments from Nebraska to Various Destinations, by Rail, 1992.

Destination	Amount	% of Interstate[a]	% of Total[a]
	(000 bu.)		
Arizona	358	0.4	0.4
Los Angeles	219	0.3	0.2
Colorado	7,473	8.5	8.1
Illinois	881	1.0	1.0
Iowa	7,473	8.5	8.1
Kansas (excl. Kansas City)	6,885	7.9	7.4
Kansas City	9,777	11.2	10.5
Minnesota	7,231	8.3	7.8
Missouri (excl. Kansas City)	817	0.9	0.9
New York	5,102	5.8	5.5
Oklahoma	263	0.3	0.3
Texas Ports	25,648	29.3	27.6
Utah	1,807	2.1	2.0
Pacific Northwest	10,112	11.5	10.9
Official	885	1.0	1.0
Southern	217	0.3	0.2
Southeast	354	0.4	0.4
Western	21,280	2.5	2.4
Total Interstate	87,682	100.0	94.4
% of Interstate[a]			
Total Intrastate	5,165		5.6
% of Interstate[a]			
Total	**92,847**		**100.0**
% of Total[a]			

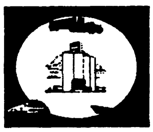
Source: Adapted from U.S. Interstate Commerce Commission. *Public Use Waybill Sample*. Computer tape of Waybill Sample observations edited for public use. Washington, D.C.: ICC, 1993.

[a] Percent detail may not add to totals because of rounding.

CHAPTER 10

PAST, PRESENT AND FUTURE

Background Trends



Transportation is a critical element to the economic well being of the people of Nebraska and their agricultural interests in particular. The state's relative isolation from major centers of population subjects its shippers, of mostly heavy and bulky products, to transportation costs that are high relative to the delivered value of the products.

A central location also has some advantages, a major one being potential access to numerous markets. When one market declines another may strengthen. Feed grains, for example, move in any given year to a variety of destinations, including by rail or rail/barge to Mexico and to ports in Texas and Louisiana; by rail to ports in California and the Pacific Northwest; by rail and truck to feed lots in Texas and poultry operations in Arkansas; and by truck to feed lots in Nebraska and Colorado. Much of the demand is local, coming from the state's own processors and livestock producers.

Knowing where and how agricultural commodities move once they leave the state's farms and ranches is helpful in understanding long-term market changes, in facility planning and in exploring policy alternatives. Unfortunately, reliable information is not available on a regular and comprehensive basis. Taken together, however, a number of UN-L surveys, made during the years 1954-59, 1969, 1977 and 1985, along with annual Interstate Commerce Commission (ICC) Railroad Waybill surveys, offer some insights into the more important trends. The present paper summarizes and compares the findings of these sources.

Shipping patterns for Nebraska grains tend to be unstable, sometimes varying significantly from one year to the next. Being further from major markets than most competing states, the state's producers and the land they farm are residual claimants of profitability as product and input prices respond to the forces of competition. The relative efficiency of transportation services is therefore a key determinant of returns to these resources. Being centrally located in the nation, the state's shippers often face comparable prices for delivery to Gulf and Pacific ports as well as to various domestic markets. Relative prices in these alternative markets can vary from time to time, however, depending on the interplay of supply and demand and in relation to transportation costs from alternative supply areas. Relevant crops and markets can change quickly as prices respond to market forces at local, national and international levels. The present paper summarizes the pattern of these flows during the latter half of the twentieth century and the major events shaping them.

Major changes have overtaken producers and handlers of grain since the middle of the present century. Grain production in Nebraska increased 416 percent between 1954 and 1995, that in the United States 313 percent.[1] Far more grain must be transported and it must be shipped further than ever since a larger proportion of the state's expanding production leaves the state, much of it bound for international export markets.

The featured survey years were, with few exceptions, years of good yields and new production records at state, national and world levels. Crop size in the survey years was "normal" in this sense because the trend since 1954 has been sharply upward. New records, year by year, have been the rule. Variability around the trend has been relatively small at national and world levels. The Nebraska trend, sharply upward as well, has been somewhat more variable; Nebraska, in fact, has generally led the nation and world in yields. The state's wheat production has been an exception, output having been much more variable, owing more to swings in acreage than in yields. Wheat

[1]Total of corn, sorghum, soybeans and wheat.

production in the state has fallen in recent years, because of declining area seeded, from highs reached in the early 1980s and even from earlier peaks in a number of years as far back as 1958. The growth in U.S. and world wheat production has been much less variable.

Transportation and handling systems and the environment within which they operate have changed significantly. Physical grain-handling and transportation systems have been transformed to meet growing demands for their services. Elevators have consolidated and upgraded to accommodate train-load shipments. Railroads have replaced their side-door box cars with much larger covered-hopper cars and upgraded their trackage, locomotives and control systems for sharply improved productivity. Pacific Coast gateway ports have been greatly expanded and modernized. A growing reliance on trucks for shipments within the state reflects the sharp decline by 1985 in grain transited through Nebraska terminals or subterminals.

Demands on the transportation system continue to increase, with growing volumes of grain production and longer hauls owing to increasing export volumes. Nationwide, both barge and rail traffic have grown steadily since the mid-1950s.

Attempting to capitalize on their comparative advantage in long-haul shipments, U.S. railroads have abandoned a large part of their branch-line mileage since the 1950s and reduced the availability of transit rates, leading to a decline in their share of short-haul traffic. Nebraska railroads have continued to shrink their branch-line mileage, some 1,467 miles of track having been abandoned between 1970 and 1990. More recently, the abandonment by the C&NW of its trackage across northern Nebraska leaves the state with two rail carriers of consequence, the BNSF and the UP. Both of these are, however, viable carriers by most measures they are the strongest in the nation. Together, they have something less than 4,000 miles of track in the state, about half of which is branch-line. And while trackage has declined, the carrying capacity of remaining lines has been vastly improved.

Trucks have also become more efficient owing to improvements in public roads and highways and in the trucking fleet. Trucks have gained much short-haul traffic owing to railroads' abandonment of branch-line track and of the transit rates which formerly encouraged elevators to choose the rails for their short-haul needs. The Interstate Highway System has been a factor in trucking competitiveness for some of the longer hauls. Deregulation of the trucking industry has afforded truckers much greater flexibility, increasing in particular their opportunities for back-hauls.

Modal Trends

Shipments from Nebraska elevators are augmented each year by the addition to grain from local sources of amounts coming from other states. Nearly 15 percent of the volume leaving Nebraska elevators in 1985 came from other, mostly adjoining states. Three-fourths of the incoming volume moved by rail, one-fourth by truck.

More than half of all rail traffic originating in Nebraska in 1992 consisted of agricultural products. Grains move increasingly by rail to interstate destinations directly from train-loading elevators across the state. Railroads have come to dominate long-haul bulk shipments such as grain moving from Plains States to ports on the Gulf of Mexico and the Pacific Coast and to distant domestic milling and feed-deficit destinations.

Rail has long been a major mode by which grain has moved from Nebraska elevators and its dominance in shipments moving beyond the state's borders has been growing. Rail carriers compete nationally with barges for the greater part of the long-haul traffic, although barges are of minor significance in Nebraska's transport picture. Railroads carried more than half of **feed grain** shipments from Nebraska elevators in 1985, compared with from 7-16 percent in the mid-1950s. The overall trend toward rail is consistent with the state's production of a growing exportable surplus, improvements in railway efficiency, the development of train-loading elevator facilities, growth of foreign markets and a more relaxed Federal regulatory environment.

Trucks have become increasingly competitive for shorter-haul shipments of **feed grains** from country elevators to local feed lots and processors in Nebraska and adjacent states, especially those to the south and west. Tight supplies of rail equipment and availability of back-hauls have at times prompted truck movements of several hundred miles. Trucks move grain to rail and barge heads and are the exclusive carriers of Nebraska-slaughtered and -processed meat and meat products, milk and milk products and many other locally-processed agricultural products.

Railroads once dominated both short and long hauls of **feed grains**. Today, trucks perform most of the shorter hauls. Trucks, have even been competitive for some relatively long hauls such as to the Texas High Plains, Arkansas and other points to the south and southeast where direct rail service in unit-train lots has not been feasible owing to track limitations and relative dispersal of buyers. Motor carrier deregulation in 1980 has facilitated access to back-hauls. Trucks carry most of the state's intrastate **sorghum** traffic, while railroads have come to dominate the interstate movements. Both modes are taking advantage of their particular inherent strengths in a deregulated era.

Long-haul transportation of Nebraska's **soybeans** has always been minimal because of strong local processing demand. Trucks have been increasingly aggressive in meeting these local transport needs, their share of total shipments growing from about one-fourth in 1954 to almost 84 percent in 1995. The trend is consistent with the dictates of comparative advantage in an unregulated market.

Being at the western fringe of U.S. soybean production, in an era of train-load rail shipping, also provides the state with some potential for reaching West Coast markets.

Railroads' share of total **wheat** traffic from the state declined from nearly 100 percent in 1954 to 56 percent in 1985. Most of the decline has been in intrastate shipments and is consistent with the imperatives of comparative advantage. Wheat is often trucked 400 or more miles from western Nebraska to facilities in Lincoln and Omaha in direct competition with BNSF and UP Railroads.

Barge shipment of **grain** and **soybeans** through Missouri River ports is important to some producers near the river and to river terminal operators, but of modest consequence for the state as a whole. Inherent physical constraints limit the number and volume of barges per tow and winter ice limits the length of the shipping season, hampering this mode's ability to compete with railroads for long-haul traffic.

Trade and Flow Trends

Because the flow data are available only for selected years, the following year-by-year discussion summarizes the more important patterns of both U.S. grain trade and the flows from Nebraska prevailing in the survey years, highlighting major events which have conditioned them.

1954

Production was small in 1954 compared with that in subsequent survey years. **Sorghum** and **soybeans**, particularly, were very minor crops in Nebraska in 1954, although both were growing rapidly in importance during the latter part of the 1950s. Nebraska corn production in 1954 was less than 18 percent of output in 1992, sorghum a little over 9 percent, soybeans only 4 percent. However, the state's wheat production in 1954, a relatively good year for wheat, was 111 percent of that in 1992, a rather poor year.

Railroads moved grain and soybeans in 50- and 60-ton boxcars in single-car lots in 1954. Most grain moved from country elevators through subterminal or terminal elevators, sometimes both), located both within and outside the state, on its way to ultimate markets.

ICC regulation of railroad and trucking industries substituted much Federal administrative decision-making for that of carrier management. Transit rates made short-haul shipments by rail artificially cheap. Transit balances were equalized between **wheat** and **flour**, a major inducement for flour milling at intermediate locations. Shippers on branch lines and merchandising, storage and processing facilities located at points intermediate between sources of production and consumption, were thus protected from the forces of competition.

The geographic destinations of 1954 shipments were very narrowly focused compared with those in later survey years. Western Europe provided the major market for most of what was exported from the U.S., although this outlet diminished in importance after the completion of the Marshall Plan program. Exports were not an important part of total marketings from the nation or state.

Rapidly growing domestic production was beginning to far exceed demand at then-prevalent government support prices. PL-480, enacted in 1954, and aimed at disposing of the growing surpluses, had not yet become the major safety valve it was to be beginning in 1955.

U.S. **corn** exports in 1954 were very small, but were to grow rapidly in the 1950s and '60s. The UK was the top buyer, with 39.4 percent of total U.S. corn exports. The Netherlands were second, Canada third and Japan fourth. Western Europe was by far the largest regional buyer. The West Coast market for corn had not yet emerged in 1954 owing to modest Asian demands, poorly developed western ports and railroad technologies keyed to small-scale shipments. Traffic to the Gulf moved indirectly through staging points in Kansas and Missouri, from which it was transshipped on its final leg by barge or, facilitated by transit rates, by railroad. Colorado was the number-one destination of Nebraska corn in 1954, Kansas City second.

Sorghum exports were very modest in 1954, only 1.7 million MT on average during 1955-59. Most went to Western Europe. Kansas City was the major destination of Nebraska sorghum, St. Joseph Missouri second and Colorado third.

National **soybean** production grew rapidly after the war, faster than domestic demand, and PL-480 was to become an important outlet in the following crop year. Total U.S. exports were very minor in 1954, but commercial as well as concessional exports grew rapidly during the late 1950s. Japan was the best country customer for the small 1954 market, Western Europe the largest regional customer. Because Nebraska production was small in relation to local processing demands, little of the state's crop moved into interstate markets. Soybean flows from Nebraska in that year went only to California and Missouri, all moving by rail.

U.S. production of **wheat**, in particular, was expanding faster than demand in the 1950s. PL-480 began only in 1955 to move some of the excess into developing countries. Europe was the major regional customer, Yugoslavia the number-one country customer in 1954. India, the first-ranking PL-480 recipient, became the number-one U.S. wheat customer in 1955-56; Yugoslavia was second, Japan third. About half the shipments of Nebraska wheat in 1954 were to in-state terminals or subterminals, the other half to interstate destinations. Kansas City was an important milling center at the time and the predominant destination for Nebraska wheat; some of the shipments may have moved beyond Kansas City as wheat under transit balances; some may have moved on by barge.

1969

The pattern of destinations had widened markedly by 1969 compared with that in 1954, especially for **wheat** and the **feed grains**. Multiple-car shipments in 100-ton covered hopper cars were an important new innovation which was already in 1969 beginning to reshape the structure of grain merchandising, storage and transportation systems in some radical ways. Railroad abandonment of branch-line trackage and its implications for the economic survival of small shippers were major concerns at the time. The Federal Interstate Highway System was largely completed by 1969, making truck transportation more efficient and more competitive with railroads for some relatively distant hauls.

Western Europe had diminished greatly in importance as a U.S. market for all except **soybeans** as a result of Common Market policies supporting high domestic prices and high levies against imports. **Wheat** exports were especially hard hit.

Western Europe remained the number-one regional buyer of U.S. **corn** in 1969, but its share had diminished. Japan was the first-ranking country customer, taking 29.3 percent of the total, Netherlands was second, the UK third. Growing export markets were little apparent in the pattern of corn leaving Nebraska in 1969. Colorado remained the major interstate destination.

Japan remained the largest importer of U.S. **sorghum** in 1969, Israel second. In a portent of future trade patterns, Mexico had emerged as a small importer. Kansas City was, however, still the number-one recipient of sorghum from Nebraska country elevators and Colorado second. But significant amounts were moving to other points in Kansas and Missouri as well as to several states to the south and east. California had emerged as the number-one market for shipments leaving the state's subterminal elevators; Gulf markets were second in importance.

Western Europe remained the major buying region for U.S. **soybeans**. The crop had become by this time the most valuable U.S. agricultural export. Japan was the number-one country importer. The destination pattern of interstate shipments of Nebraska soybeans had widened considerably by 1969, but with Iowa and Missouri shipments predominating. Nearly three-fourths of all shipments were to destinations within Nebraska, up from 69 percent in 1954.

Food for Peace exports became a major U.S. **wheat** market factor in the 1960s. The Soviet Union was a major buyer in 1963. The Japanese market continued to grow rapidly, having reached number-one status by 1969. The Western European market had nearly disappeared as EEC policies promoted domestic production. The market for Nebraska wheat had widened by 1969, just as had that for the other grains; a large number of destination states had appeared, although Kansas City was still the primary destination and Colorado second most important. The Pacific Coast had also emerged as an important destination, significant amounts going to Oregon and Washington.

1977

Continuing abandonment of railroad branch-line track, growth in the hopper-car fleet (which many branch lines could not accommodate), declining box-car numbers, expansion of the multiple-car shipping mode to full unit trains and a rapid upgrading of select country elevators to unit-train loading capability had significantly altered the nature of grain marketing in the state. Much of the grain was by this time bypassing terminals and subterminals in favor of direct shipment to ultimate markets.

Meanwhile, the volume of international trade had grown sharply since 1969. Lax U.S. fiscal and monetary policies had contributed to international as well as domestic economic expansion, fueling the demand for food imports, especially by the more rapidly-developing of the Third World nations. OPEC's success in controlling the prices for petroleum had led to an enormous increase in liquidity which was lent heavily by U.S. and European commercial banks and by international assistance agencies, to LDCs to finance food imports, among other things. These countries had become as a result significant customers for U.S. grain.

Europe had virtually disappeared as a market for U.S. **wheat** and **feed grains**. Asia in general and Japan in particular had, however, emerged as a very large market. The Texas Gulf Coast was Nebraska's major outlet in serving these rapidly-growing export demands.

A major widening in the destination pattern of U.S. **corn** shipments had occurred. Japan was still first (buying more than twice its 1969 purchases), but its share had fallen from 28.3 percent in 1969 to 17.5 percent in 1977. The Netherlands was second, West Germany third. Growing export markets were evident in the 1977 pattern of interstate corn flows from Nebraska, the latter being 62 percent of all shipments from the state in that year. California had displaced Colorado as the number-one destination. Arkansas was third, Kansas fourth and the Texas Gulf fifth in importance.

Japan was the first-place U.S. **sorghum** customer in 1977 as it had been in 1969; Israel was second, Mexico third. Mexico and other Third-World importers were accounting for a growing share of U.S. sorghum exports. The Texas Gulf had become the first-ranking destination of Nebraska sorghum by 1977, a reflection of the rapid growth in U.S. exports which had occurred since 1969. Truck shipments continued to go primarily to nearby states, but some also went as far afield as Arizona.

Japan and Western Europe remained, respectively, the largest national and regional markets for U.S. **soybeans** as they were in 1969. EEC policies had not impaired European purchases of U.S. soybeans as they had those of wheat and feed grains. Iowa and Missouri continued to predominate as destinations for Nebraska soybeans in 1977. Direct exports also appeared for the time as a major outlet, 36 percent of interstate shipments going to the East and Louisiana Gulf, 3.7 percent to the PNW and 3.3 percent to the Texas Gulf.

Japan remained the largest buyer of U.S. **wheat**, Brazil was now second. Only the Netherlands among European nations appeared, as number eight, on the list of top-ten wheat importers. Seven of the top importers were less-developed countries. The Texas Gulf became for the first time in 1977 the primary market for Nebraska wheat. The PNW also received modest shipments. Kansas, Missouri and Minnesota all took significant amounts.

1985

A major new element in the 1985 situation was the substantial deregulation of both railroad and truck transportation which had occurred in 1980. Deregulation complemented the trends, already underway, toward consolidation of railroad shipments from a declining base of country elevators, in train-load lots, moving directly to port and other distant destinations. Grain shipments from country elevators to in-state terminal and subterminal elevators had virtually disappeared. The trucking industry, meanwhile, was assuming a larger role in meeting shorter-haul shipping needs to feeders and processors.

The international lending boom fueled by low interest rates, associated with lax U.S. fiscal and monetary policies and a glut of OPEC petrodollars, collapsed in the early 1980s in the face of sharply-tightened U.S. monetary policies and a faltering OPEC cartel. The dollar made a strong recovery against major foreign currencies, making U.S. exports more expensive to buyers. While these developments had driven trade volumes from their highs of a few years earlier, exports remained well above levels of the 1950s and '60s.

The European market had declined further by 1985, rapidly growing Asian markets taking up much of the slack. Mexico was a key customer as were a number of other developing countries, these purchases coming in spite of relatively adverse economic conditions in the developing world.

The PNW was the major export outlet for Nebraska grain in 1985. Large exportable surpluses and strong demand for ocean carriers worked in favor of the shorter voyages in serving Pacific Rim countries offered by Pacific ports compared with the much more circuitous traverse of the Panama Canal.

Total U.S. **corn** exports by 1985 were fully 2,425 percent higher than in 1954, even though 1985 levels were below those of their peak in 1979. Western Europe was now in third place among regional importers, outranked by the USSR (defined as a region) and East/South Asia. North Africa and Central America (including Mexico) were fourth and fifth. The USSR, Japan, South Korea, Taiwan and Spain were the top-ranking buying countries. Less-developed nations accounted for nearly 28 percent of U.S. corn exports in 1985. The PNW took more than 29 percent of Nebraska's out-of-state shipments of corn. Kansas received 17 percent; Alabama, California and Texas ranked third, fourth and fifth. Gulf shipments were a minor factor in 1985.

East/South Asia, Central America (including Mexico) and South America were the ranking regional customers of U.S. **sorghum** in 1985. Western Europe was a very distant sixth. Japan remained the top country customer, Mexico was second and Venezuela third. No European Country appeared among the top ten. As with corn, the PNW dominated Nebraska's sorghum shipments to interstate destinations in 1985. Gulf shipments were very small. Sorghum moved to a great variety of places, California, Texas and Kansas ranked next, and in that order, after the PNW.

Western Europe and East/South Asia together dominated the U.S. **soybean** trade, accounting for 84 percent of the totals. Japan was the ranking buying nation, Netherlands second and Taiwan third. Less-developed countries as a group received almost 23 percent of U.S. soybean exports in 1985. Interstate shipments of Nebraska soybeans went primarily to nearby states in 1985, Missouri, Kansas and Iowa providing the largest markets. Direct exports were relatively small; Mexico, taking 3.8 percent, was the largest of these.

East/South Asia, South America and North Africa were the top-ranking regional U.S. **wheat** customers in 1985, Asia taking more than twice the amount of second-ranking South America. Japan, Brazil, South Korea and Egypt were the top national customers in 1985. The PNW was now the most important interstate destination for Nebraska wheat, although Texas and Louisiana port shipments combined equaled the PNW amounts. Kansas and Missouri were the second- and third-ranking destinations.

1992

A number of economic considerations had changed significantly since 1985. First, the U.S. dollar, at a local high against major world currencies early in 1985, weakened sharply during the latter half of the 1980s; it had firmed somewhat against European currencies by 1992, although not against the Japanese yen. More recently, the dollar has strengthened also against the yen. A weak dollar makes U.S. grain a better buy on world markets, thus favoring exports.

A deepening and persistent world economic recession was having negative effects for U.S. grain trade in 1985. Although the American economy had strengthened by 1992, recession persisted to some extent in the economies of some trading partners. Relatively large imports by the Soviet Union in the early post-1985 period diminished sharply in the 1990s owing to severe shortages of hard currencies brought on by the political and economic crises besetting the reformed republics of the former nation. The Soviet Union had imported record amounts of corn from the U.S. (nearly a third of all U.S. corn exports) in 1985 to offset the effects of drought and large livestock inventories. Soviet purchases declined steeply during the next three years, but corn imports increased sharply again in 1988-89 because of drought in the face of large livestock inventories and because Argentina, a major competing supplier, had a severe drought of its own. East Asian economies, however, were booming and are continuing in 1997 to import record amounts of grain. The trade effects of the financial crisis which overtook Japan and South Korea late in 1997 were yet to be determined at the time of this writing.

The West Coast market diminished markedly after 1985 and, to a lesser extent, the Gulf market as well, as Nebraska grain was out-competed by shippers with lower-cost access to these outlets. The Gulf market strengthened against that of Pacific Coast markets owing to the weaker world economy, reduced trade volumes and reduced imperative for ocean vessel operators to be concerned about the added time occasioned by the greater circuity of the Panama Canal as a route to Asian markets.

Japan was the largest buyer of U.S. **corn** in 1992, taking more than 31 percent of American exports. Former USSR was second and Taiwan third. Western Europe by this time ranked a distant seventh. Less-developed nations received 40 percent of U.S. corn exports in 1992, 54 percent in 1995. Strong export markets were reflected again in 1992 shipping patterns for Nebraska corn. The PNW was the top destination, taking nearly 21 percent of rail shipments from the state. Texas inland points were second with 17.4 percent, California ports third with almost 13 percent.

Central America (defined to include Mexico) was now the first-ranking regional customer for U.S. **sorghum**; East/South Asia was second and West Asia third. Mexico was by far the largest country customer, with nearly 66 percent of U.S. sorghum exports in 1992, Japan was second and Spain a distant third. In 1995 regional rankings, Western Europe replaced West Asia as the third-place customer. Country rankings were the same as those in 1992. The Texas Gulf was the major direct export destination for Nebraska sorghum in 1992, taking more than 15 percent of total rail shipments from the state. Missouri was the largest single recipient.

Western Europe was still the first-ranking regional buyer of U.S. **soybeans** in 1992; East/South Asia was a close second, Central America (including Mexico) third. National rankings were Japan first, Netherlands a close second, Taiwan and Mexico third and fourth. The picture in 1995 was similar, top regional and country rankings being the same as in 1992. Kansas City took the largest part of the known rail shipments of Nebraska soybeans in 1992. The PNW and Texas Ports received 5.7 and 4.5 percent, respectively.

South and East Asia was the ranking regional **wheat** customer in 1992 followed by the states of the former USSR and North Africa. Egypt was now the top country customer, Japan, Mainland China and Pakistan followed in that order. Regional rankings in 1995 had East Asia still in first place, but Former USSR dropped all the way to eighth spot. North Africa was now second, South America third. Egypt held its place in 1995 as top-ranking country customer, followed by Mainland China and Japan. Exports were the dominant factor again in 1992 in the pattern of wheat shipments from Nebraska. Texas ports took the largest proportion (more than 29 percent); the PNW was second with almost 12 percent and Kansas City, always a contender, was third most important.

Conclusions

The integration of the nation's agricultural enterprise into world commodity markets has created an interdependence of economic interests between Nebraska grain producers and producers and consumers in nearly every corner of the world. This interdependence is reflected in a highly variable pattern of grain shipments leaving the farms and markets of the state.

The state of the transportation system is critical in the pattern of grain shipments from the state. Trucks, railroads and ocean-going vessels are the only modes of consequence in the movement of Nebraska grain from points of production to ultimate destination. Inland water carriage has not been and is unlikely ever to be a major contender for Nebraska's grain transport business. Deregulation occurring in 1980 has reduced the role of government in determining relative efficiency of the rail and truck modes, making competition a more critical arbiter of comparative advantage. The relative shift in short-haul traffic away from rail and toward trucks, and the growing dominance of railroads in long-haul shipments especially since the time of the 1977 survey, suggests that market forces have been effective in allocating traffic in the direction of the comparative economic advantage of each mode. Government policies, both nationally and internationally, can be a powerful force for better or worse in affecting private economic decisions and outcomes.

Looking Ahead

The volume and pattern of Nebraska's grain shipments in the future will depend on the size and mix of its crops and the intensity of buying pressures in alternative markets. These in turn will depend upon the forces of supply and demand in local, national and world markets. Weather is of course always a critical supply factor in any given year. Global warming may in the longer run have the potential for causing much larger and more permanent weather changes, altering the pattern of regional comparative advantages.

In the longer term, a number of unfolding international developments may have major effects on grain purchases as well as producer output decisions. First, are the political and economic disruptions in the new states born out of the dissolution of the Former Soviet Union (FSU); these emerging nations need more food but have limited dollars with which to pay for it. Political decisions taken in both the FSU and in the United States will have crucial implications for grain trade between the two. Second, are the expected positive effects from the generally successful outcome of the General Agreement on Tariffs and Trade (GATT) and North American Free Trade Agreement (NAFTA) negotiations. Declining trade barriers should lead to expanded U.S. grain exports. Third, the large and growing U.S. Federal debt is a dark cloud overhanging economic security of the entire world. The welfare of U.S. agriculture is very much dependent upon economic conditions both at home and abroad. Fourth, growth in world food production shows signs of tapering off. Disruptions in the FSU and elsewhere are growing recognition of the scope of environmental costs of increased production and call into question the ability of world agriculture to meet the growing demands occasioned by increasing population and incomes. Meanwhile, hunger is endemic to most of Sub-Saharan Africa and to large parts of Asia and Latin America.

The size of export flows will be a major factor in future demand for grain and grain transport. This in turn will depend on the outcome of trade negotiations, developments in the FSU and former eastern block nations and growth in the incomes of Third-World consumers. Rapidly expanding grain imports by developing countries in Asia illustrate the explosive effects for food demand and trade of improved incomes in low-income countries.

Growth in domestic demand for U.S. grains is limited by a relatively slow-growing domestic population. Demand for meat (and therefore for feed grains) has become relatively unresponsive to increases in consumer income in the United States. Consumption of red meats has in fact declined from highs of a few years ago, an apparent response to concerns about the implications of meat intake for health. Alternative uses, such as corn for alcohol and sweetener, have grown, but remain dependent for their success on government policies and programs. These realities suggest that future growth in demand for U.S. grain must come largely from trade with developing countries.

The future mix of railroad and truck traffic will depend upon where (how far away) the markets are, energy costs and relative efficiency of the two modes. The latter in turn will depend heavily on the future rate of technological and innovational progress, facility investments and public policy decisions. Half of remaining Nebraska rail mileage being branch-lines, the potential for further abandonments is apparent. Railroads are likely to continue their dominance of longer-haul traffic. There is potential for the role of trucks in short-haul grain movements to expand further in the years to come. Strong support for a high-quality system of public roads and highways will be a key factor in continued truck dominance of short hauls.

Long distance to most major markets and relatively low state density of people and goods will continue to pose major transportation challenges. Over-building of railroad track in the 19th century and growing truck competition in the late 20th century have prompted a gradual abandonment of feeder-rail trackage. This trend seems likely to continue in unregulated transportation markets in which competitive forces seem sure to favor further track abandonment and consolidation of train-loading elevators.

Big challenges have yielded big solutions. But the state's "end-of-the-road" location, along with expected world-scope competitive challenges of the coming century, reinforce the need for making a relatively good transport system better still.

APPENDIX TABLES

U.S. Grain & Oilseed Export Patterns

Selected Years, 1954 - 1995

APPENDIX A-6

U.S. Corn Export Patterns
Selected Years, 1954 - 1995

Table A6-1. U.S. Corn Exports,[a] Top Importers and World Total, 1954, 1955-59 Average, 1969 and 1977.

1954		1955-59 Ave.	
Destination	**Quantity**	**Destination**	**Quantity**
United Kingdom	766,786	United Kingdom	1,476,394
Netherlands	247,789	Netherlands	555,296
Canada	202,676	Mexico	342,814
Japan	160,078	Canada	333,188
Belgium/Luxembourg	111,613	Belgium/Luxembourg	310,199
Austria	89,158	West Germany	267,271
West Germany	85,958	Japan	243,116
Norway	69,117	Austria	179,993
Ireland	66,627	Greece	58,803
Italy	15,038	Italy	58,143
Other Europe	86,008	Other Europe	271,997
Subtotal	1,900,848	Subtotal	4,097,214
World	1,947,155	World	4,383,713

1969		1977	
Destination	**Quantity (MT)**	**Destination**	**Quantity (MT)**
Japan	4,492,406	Japan	8,610,030
Netherlands	2,216,890	Netherlands	2,870,037
United Kingdom	1,838,488	Fed. Republic of Germany	2,500,606
Italy	1,238,486	Italy	2,065,454
West Germany	1,109,118	United Kingdom	2,034,225
Spain	815,760	Spain	1,669,670
Belgium/Luxembourg	690,786	Greece	1,045,813
Greece	373,220	Egypt	731,403
Israel	138,614	Israel	395,022
Other Europe	935,989	Other Europe	17,021,398
Americas	721,195	Other Asia & Oceana	3,950,092
Other Asia	431,899	Americas	3,281,011
Subtotal	15,002,851	Subtotal	46,174,761
World	15,872,704	World	49,156,204

Source: U.S. Department of Agriculture. *Agricultural Statistics*. Washington, DC: GPO; 1956.

[a] Exclusive of corn products.

Table A6-2. U.S. Corn Exports, Top Ten Regional Importers, Volume and Value, 1985.

Destination	Quantity	Value
	(MT)	(000 $)
East and South Asia	15,739,569	1,879,034
USSR[a]	13,045,055	1,540,672
West Europe	6,005,347	685,820
North Africa	2,384,657	273,578
Central America[b]	1,767,701	212,653
West Asia (Mideast)	1,287,113	157,667
South America	1,245,419	152,685
East Europe	850,089	93,881
Sub-Sahara	725,720	91,568
Caribbean	469,832	58,339

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1987.

[a] Single-country "region"; not included in any other region.

[b] Including Mexico.

Table A6-3. U.S. Corn Exports, Top Ten Country Importers and World Total, Volume and Value, 1985.

Destination	Quantity	Value
	(MT)	(000 $)
USSR	13,045,055	1,540,672
Japan	10,977,346	1,292,583
China (Taiwan)	2,967,068	373,528
Spain (inc. Carary Islands)	2,460,582	277,149
South Korea	1,769,825	209,626
Mexico	1,632,832	198,656
Egypt	1,524,010	175,944
Portugal	1,482,387	172,487
Belgium/Luxembourg	813,082	88,062
Netherlands	608,407	73,295
Subtotal	37,280,594	4,402,002
Developed Countries	17,905,261	2,084,922
Less Developed Countries	12,131,408	1,470,857
Centrally Planned Countries	14,014,995	1,650,252
World	44,051,664	5,206,031

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1987.

Table A6-4. U.S. Corn Exports, Top Ten Regional Importers, Volume and Value, 1986.

Destination	Quantity	Value
	(MT)	(000 $)
East and South Asia	13,387,256	1,265,525
USSR[a]	2,671,214	290,683
North Africa	2,401,113	218,129
West Europe	2,273,229	231,162
South America	1,739,439	164,625
Central America[b]	1,552,318	153,422
West Asia (Mideast)	1,152,419	107,723
East Europe	740,964	73,095
Canada[a]	496,973	38,386
Caribbean	479,948	49,533

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1988.

[a] Single-country "region"; not included in any other region.

[b] Including Mexico.

Table A6-5. U.S. Corn Exports, Top Ten Country Importers and World Total, Volume and Value, 1986.

Destination	Quantity	Value
	(MT)	(000 $)
Japan	9,170,655	866,290
China (Taiwan)	2,695,519	269,924
USSR	2,671,214	290,683
Egypt	1,696,472	158,542
South Korea	1,521,082	129,311
Mexico	1,433,985	140,994
Brazil	1,365,802	131,278
Spain (inc. Canary Islands)	1,037,568	114,743
Portugal	711,256	66,686
Canada	496,973	38,386
Subtotal	22,800,526	2,206,837
Developed Countries	12,251,543	1,165,532
Less Developed Countries	11,309,890	1,071,396
Centrally Planned countries	3,468,677	368,019
World	27,030,110	2,604,947

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1988.

Table A6-6. U.S. Corn Exports, Top Regional Importers, Volume and Value, 1987.

Destination	Quantity (MT)	Value (000 $)
East and South Asia	22,053,450	1,757,968
USSR[a]	5,319,887	393,230
Central America[b]	3,589,735	297,028
North Africa	2,604,573	201,571
West Europe	2,328,313	176,141
West Asia (Mideast)	1,794,076	143,966
South America	1,187,325	93,136
East Europe	972,147	71,076
Caribbean	675,895	56,582

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1989.

[a] Single-country "region"; not included in any other region.

[b] Including Mexico.

Table A6-7. U.S. Corn Exports, Top Ten Country Importers and World Total, Volume and Value, 1987.

Destination	Quantity	Value
	(MT)	(000 $)
Japan	12,855,529	1,022,592
USSR	5,319,887	393,230
South Korea	4,518,839	355,934
Mexico	3,333,154	275,115
China (Taiwan)	3,023,381	249,923
Egypt	1,503,216	119,518
China (Mainland)	1,250,841	94,926
Algeria	838,576	62,636
Spain (inc. Canary Islands)	629,599	48,315
Portugal	567,543	42,887
Subtotal	33,840,565	2,665,076
Developed Countries	15,810,869	1,247,185
Less Developed Countries	17,411,197	1,402,463
Centrally Planned Countries	7,542,875	559,232
World	40,764,941	3,208,880

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1989.

Table A6-8. U.S. Corn Exports, Top Ten Regional Importers, Volume and Value, 1988.

Destination	Quantity	Value
	(MT)	(000 $)
East and South Asia	22,855,329	2,513,534
USSR[a]	8,521,669	961,834
Central America[b]	3,500,829	397,060
West Europe	3,041,285	316,786
North Africa	2,560,209	263,802
West Asia (Mideast)	2,290,772	243,571
East Europe	1,240,002	125,711
Caribbean	726,608	76,640
South America	600,792	61,352
Canada	498,150	32,090

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1990.

[a] Single-country "region"; not included in any other region.

[b] Including Mexico.

Table A6-9. U.S. Corn Exports, Top Ten Country Importers and World Total, Volume and Value, 1988.

Destination	Quantity	Value
	(MT)	(000 $)
Japan	14,495,658	1,600,970
USSR	8,521,669	961,834
China (Taiwan)	4,149,426	461,277
South Korea	3,983,886	428,859
Mexico	3,248,989	367,161
Spain (inc. Canary Islands)	2,198,781	231,746
Algeria	1,166,217	119,923
Egypt	1,075,558	111,175
Iraq	646,930	71,900
Saudi Arabia	587,446	61,382
Subtotal	40,065,560	4,416,227
Developed Countries	18,403,432	1,988,133
Less Developed Countries	18,118,457	1,967,059
Centrally Planned Countries	9,761,671	1,087,545
World	46,283,560	5,042,737

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economomics, Statistics, and Cooperative Service. Washington: GPO, 1990.

Table A6-10. U.S. Corn Exports, Top Ten Regional Importers, Volume and Value, 1989.

Destination	Quantity	Value
	(MT)	(000 $)
East and South Asia	22,893,824	2,733,955
USSR[a]	18,566,139	2,135,393
Central America[b]	4,200,681	477,330
North Africa	2,284,550	268,246
West Asia (Mideast)	2,247,699	260,073
West Europe	2,196,134	252,023
East Europe	1,640,338	187,707
Caribbean	766,188	86,876
Canada[a]	625,643	61,334
South America	284,724	32,694

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1991.

[a] Single-country "region"; not included in any other region.

[b] Including Mexico.

Table A6-11. U.S. Corn Exports, Top Ten Country Importers and World Total, Volume and Value, 1989.

Destination	Quantity	Value
	(MT)	(000 $)
USSR	18,566,139	2,135,393
Japan	13,159,106	1,554,378
South Korea	5,279,184	639,603
China (Taiwan)	4,454,724	539,886
Mexico	3,844,294	435,220
Egypt	1,067,045	125,397
Bulgaria	1,010,176	119,150
Algeria	981,455	115,105
Spain (inc. Canary Islands)	868,606	104,903
Saudi Arabia	646,239	74,309
Subtotal	49,876,968	5,843,344
Developed Countries	16,278,395	1,901,872
Less Developed Countries	19,657,758	2,321,076
Centrally Planned Countries	20,508,746	2,356,627
World	56,444,899	6,579,575

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1991.

Table A6-12. U.S. Corn Exports, Top Ten Regional Importers, Volume and Value, 1990.

Destination	Quantity	Value
	(MT)	(000 $)
East and South Asia	23,496,265	2,785,954
USSR[a]	9,471,208	1,100,917
Central America[b]	4,028,539	464,200
North Africa	3,426,039	377,541
West Europe	3,284,870	366,588
East Europe	2,261,038	251,230
West Asia (Mideast)	2,545,019	285,561
South America	1,599,408	181,605
Caribbean	804,637	91,712
Canada[a]	661,054	72,050

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1992.

[a] Single-country "region"; not included in any other region.

[b] Including Mexico.

Table A6-13. U.S. Corn Exports, Top Ten Country Importers and World Total, Volume and Value, 1990.

Destination	Quantity	Value
	(MT)	(000 $)
Japan	14,044,970	1,640,293
USSR	9,471,208	1,100,917
Republic of Korea	4,984,465	602,484
China (Taiwan)	4,459,206	541,951
Mexico	3,468,369	401,130
Egypt	1,817,747	197,578
Spain (inc. Canary Islands)	1,793,359	199,287
Algeria	1,243,402	140,303
Yugoslavia	844,960	93,484
Portugal	803,804	91,081
Subtotal	42,931,490	5,008,508
Developed Countries	18,026,503	2,083,516
Less Developed Countries	33,837,929	3,928,534
Other Countries	139,506	15,033
World	52,003,938	6,027,083

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1992.

Table A6-14. U.S. Corn Exports, Top Regional Importers, Volume and Value, 1991.

Destination	Quantity	Value
	(MT)	(000 $)
East and South Asia	20,607,841	2,324,775
Former USSR	11,310,794	1,231,011
West Europe	2,808,175	301,805
North Africa	2,677,323	290,505
West Asia (Mideast)	2,045,738	224,918
Central America[a]	1,971,844	223,039
South America	1,055,408	115,194
Caribbean	789,747	85,723
East Europe	572,288	60,619
Canada[b]	231,380	24,585

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1993.

[a] Including Mexico.

[b] Single-country "region"; not included in any other region.

Table A6-15. U.S. Corn Exports, Top Ten Country Importers and World Total, Volume and Value, 1991.

Destination	Quantity	Value
	(MT)	(000 $)
Japan	13,701,080	1,513,879
Former USSR	11,310,794	1,231,011
China (Taiwan)	5,375,285	633,086
Republic of Korea	1,529,922	177,639
Spain (inc. Canary Islands)	1,339,405	144,865
Mexico	1,317,672	148,354
Algeria	1,227,123	134,262
Egypt	1,072,420	115,356
Belgium & Luxembourg	915,475	97,680
Saudi Arabia	712,721	77,282
Subtotal	38,501,897	4,273,414
Developed Countries	17,096,912	1,879,713
Less Developed Countries	27,268,383	3,036,213
World	44,365,295	4,915,926

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1993.

Table A6-16. U.S. Corn Exports, Top Ten Regional Importers, Volume and Value, 1992.

Destination	Quantity	Value
	(MT)	(000 $)
East and South Asia	20,381,858	2,263,686
Former USSR	6,127,016	661,596
Sub-Sahara	5,463,519	601,739
North Africa	2,298,239	244,972
West Asia (Mideast)	2,067,159	218,453
South America	1,685,114	178,447
West Europe	1,663,521	180,545
Central America[b]	1,609,183	182,870
Caribbean	862,824	93,091
Canada[a]	42,158,433	

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1994.

[a] Single-country "region"; not included in any other region.

[b] Including Mexico.

Table A6-17. U.S. Corn Exports, Top Ten Country Importers and World Total, Volume and Value, 1992.

Destination	Quantity	Value
	(MT)	(000 $)
Japan	13,358,937	1,473,038
Former USSR	6,127,016	661,596
China (Taiwan)	5,203,268	586,226
Republic of South Africa	3,385,596	368,617
Republic of Korea	1,802,675	203,390
Spain (inc. Canary Islands)	1,307,683	143,430
Mexico	1,137,238	128,886
Egypt	1,019,107	108,234
Algeria	945,788	102,346
Canada	739,985	73,740
Subtotal	35,027,293	3,849,503
Developed Countries	19,614,215	2,144,246
Less Developed Countries	17,251,386	1,902,416
Other Countries	6,127,016	661,596
World	42,992,617	4,708,257

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1994.

Table A6-18. U.S. Corn Exports, Top Ten Regional Importers, Volume and Value, 1993.

Destination	Quantity	Value
	(MT)	(000$)
East and South Asia	20,447,255	2,185,089
Former USSR	5,161,425	527,700
North Africa	3,632,026	373,013
West Asia (Mideast)	2,468,572	253,031
South America	1,636,298	182,374
West Europe	1,413,802	144,531
Sub-Sahara	1,322,398	140,646
East Europe	1,063,756	103,025
Central America[a]	1,057,421	120,802
Carribbean	984,770	104,582

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1995.

[a] Including Mexico

Table A6-19. U.S. Corn Exports, Top Ten Country Importers and World Total, Volume and Value, 1993.

Destination	Quantity	Value
	(MT)	(000$)
Japan	14,664,131	1,537,219
China (Taiwan)	5,325,997	598,751
Former USSR	5,161,425	527,700
Egypt	1,908,633	199,823
Algeria	1,200,115	119,632
Spain (inc. Canary Islands)	1,122,537	114,808
Saudi Arabia	845,168	88,070
Canada	815,461	80,414
Venezuela	762,334	87,410
Republic of South Africa	733,109	75,979
Subtotal	32,538,910	3,329,806
Developed Countries	18,043,328	1,879,036
Less Developed Countries	16,841,158	1,813,660
Other Countries	5,161,425	527,700
World	40,045,911	4,220,396

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1995.

Table A6-20. U.S. Corn Exports, Top Ten Regional Importers, Volume and Value, 1994.

Destination	Quantity	Value
	(MT)	(000$)
East and South Asia	19,463,572	2,170,875
Central America[a]	3,952,659	444,462
North Africa	3,400,247	356,525
South America	2,395,998	263,582
West Asia (Mideast)	1,932,055	205,439
West Europe	1,879,719	214,086
Caribbean	840,935	93,552
Canada[b]	807,000	80,189
Sub-Sahara	431,281	50,829
Former USSR	122,450	14,163

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1996.

[a] Including Mexico.

[b] Single-country "region"; not included in any other region.

Table A6-21. U.S. Corn Exports, Top Ten Country Importers and World Total, Volume and Value, 1994.

Destination	Quantity	Value
	(MT)	(000$)
Japan	12,075,301	1,356,199
China (Taiwan)	4,966,513	565,035
Mexico	3,054,111	340,440
Korea, Republic of	2,414,801	248,886
Egypt	1,601,193	167,197
Algeria	1,346,797	144,247
Spain (inc. Canary Islands)	1,218,406	140,389
Saudi Arabia	838,172	93,449
Canada	807,000	80,189
Venezuela	727,649	84,238
Subtotal	29,049,943	3,220,269
Developed Countries	15,214,008	1,697,836
Less Developed Countries	20,272,583	2,220,391
Other Countries	158,450	17,673
World	35,645,041	3,935,901

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1996.

Table A6-22. U.S. Corn Exports, Top Ten Regional Importers, Volume and Value, 1995.

Destination	Quantity	Value
	(MT)	(000 $)
East and South Asia	38,735,259	4,725,845
North Africa	4,076,391	488,297
Central America[a]	3,738,619	464,571
West Europe	3,657,397	430,827
West Asia (Mideast)	3,583,308	427,443
South America	2,976,569	372,916
Canada[b]	1,024,413	112,436
Caribbean	965,025	115,255
Sub-Sahara	817,543	108,467

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1995.

[a]Including Mexico.

[b] Single-country "region"; not included in any other region.

Table A6-23. U.S. Corn Exports, Top Ten Country Importers and World Total, Volume and Value, 1995.

Destination	Quantity	Value
	(MT)	(000 $)
Japan	15,968,039	1,904,247
Korea, Republic of	8,955,947	1,107,139
Taiwan	6,061,433	769,873
China	5,356,522	629,253
Mexico	2,858,829	359,123
Egypt	2,651,714	319,471
Spain (inc. Canary Islands)	2,411,748	279,563
Malaysia	1,399,866	187,370
Canada	1,024,413	112,436
Saudi Arabia	949,397	115,830
Subtotal	47,637,908	5,780,883
Developed Countries	21,783,928	2,594,976
Less Developed Countries	32,697,947	4,058,031
Other Countries	5,535,636	650,699
World	60,017,511	7,303,707

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1996.

APPENDIX A-7

U.S. Grain Sorghum Export Patterns
Selected Years 1954 - 1995

Table A7-1. U.S. Sorghum Exports,[a] Top Importers and World Total, 1954, 1955-59 Average, 1969 and 1977.

1954		1955-59	
Destination	Quantity (MT)	Destination	Quantity (MT)
		Belgium/Luxembourg	349,827
Detail		Netherlands	335,044
		United Kingdom	308,296
		West Germany	177,657
Not		Israel	158,073
		Denmark	127,667
		Norway	82,554
Available		India	17,883
		Japan	15,800
		Poland	14,250
		Other Europe	59,871
		Africa	23,141
		Americas	21,312
		Other Asia	14,860
Subtotal		Subtotal	1,706,235
World	47,685	World	1,706,235

1969		1977	
Destination	Quantity (MT)	Destination	Quantity (MT)
Japan	1,955,385	Japan	2,439,817
Israel	567,869	Israel	633,939
India	168,664	Mexico	467,965
Belgium/Luxembourg	120,097	Poland	383,307
Netherlands	32,412	Norway	126,705
Mexico	27,154	Belgium and Luxembourg	87,052
Canada	25,808	Senegal	60,555
Senegal	20,956	Netherlands	6,712
Ireland	5,131	Canada	1,628
Western Africa	2,337	West Germany	246
		Other Europe	639,114
		Other Americas	391,358
		Other Asia	137,958
		Africa	46,555
Subtotal	2,925,813	Subtotal	5,422,911
World	3,024,318	World	5,422,911

Source: U.S. Department of Agriculture. *Agricultural Statistics*. Washington, DC: GPO; 1956.

[a] Exclusive of sorghum products.

Table A7-2. U.S. Sorghum Exports, Top Regional Importers, Volume and Value, 1985.

Destination	Quantity	Value
	(MT)	(000$)
East and South Asia	**2,593,260**	**257,431**
Central America[a]	1,733,228	213,510
South America	1,083,772	121,480
Sub-Sahara	699,354	86,335
West Asia (Mideast)	517,583	54,275
West Europe	32,808	3,620

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1987.

[a] Including Mexico.

Table A7-3. U.S. Sorghum Exports, Top Ten Country Importers and World Total, Volume and Value, 1985.

Destination	Quantity	Value
	(MT)	(000$)
Japan	2,425,873	240,862
Mexico	1,733,228	213,510
Venezuela	941,002	107,256
Israel	483,524	50,633
Sudan	439,576	55,052
China (Taiwan)	134,389	13,019
Colombia	117,875	11,277
Niger	77,872	10,009
Nigeria	75,0730	8,728
Cyprus	34,008	3,634
Subtotal	6,462,420	713,980
Developed Countries	2,954,228	296,532
Less Developed Countries	3,709,522	440,571
World	6,663,750	737,103

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1987.

Table A7-4. U.S. Sorghum Exports, Top Regional Importers, Volume and Value, 1986.

Destination	Quantity	Value
	(MT)	(000$)
East and South Asia	2,509,595	207,039
South America	642,850	65,047
Central America[a]	507,313	51,381
West Asia (Mideast)	386,762	33,128
West Europe	82,537	6,139
Sub-Sahara	5,421	515
Caribbean	85	13

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1988.

[a] Including Mexico.

Table A7-5. U.S. Sorghum Exports, Top Ten Country Importers and World Total, Volume and Value, 1986.

Destination	Quantity	Value
	(MT)	(000$)
Japan	2,144,714	177,363
Venezuela	642,708	65,034
Mexico	507,313	51,381
Israel	386,762	33,128
China (Taiwan)	364,881	29,676
Portugal	78,524	5,859
Chad	5,371	509
Netherlands	4,013	280
Nigeria	50	6
Subtotal	4,134,354	363,236
Developed Countries	2,614,106	216,641
Less Developed Countries	1,520,465	146,619
World	4,134,571	363,261

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1988.

Table A7-6. U.S. Sorghum Exports, Top Regional Importers, Volume and Value, 1987.

Destination	Quantity	Value
	(MT)	(000$)
East and South Asia	2,850,124	220,284
South America	965,822	78,333
Central America[a]	688,270	57,361
West Asia (Mideast)	294,952	22,741
East Europe	157,518	8,124
Sub-Sahara	23,690	2,105
West Europe	9,432	449
Canada[b]	6,353	631

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1989.

[a] Including Mexico.

[b] Single-country "region"; not included in any other region.

Table A7-7. U.S. Sorghum Exports, Top Ten Country Importers and World Total, Volume and Value, 1987.

Destination	Quantity	Value
	(MT)	(000$)
Japan	2,352,319	180,844
Venezuela	924,440	75,209
Mexico	688,270	57,361
China (Taiwan)	482,056	38,302
Israel (incl. Gaza Strip)	294,952	22,741
Poland	131,958	6,330
Ecuador	41,135	3,085
Yugoslavia	25,500	1,785
Indonesia	15,749	1,138
Mauritania	13,330	1,168
Subtotal	4,969,709	388,053
Developed Countries	2,666,921	205,018
Less Developed Countries	2,172,059	176,942
Centrally Planned Countries	157,518	8,124
World	4,996,498	390,083

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1989.

Table A7-8. U.S. Sorghum Exports, Top Ten Regional Importers, Volume and Value, 1988.

Destination	Quantity	Value
	(MT)	(000$)
East and South Asia	2,219,172	227,933
South America	1,804,347	180,409
Central America[a]	1,290,700	134,684
West Asia (Mideast)	341,058	33,550
West Europe	276,192	25,424
East Europe	184,604	15,602
Sub-Sahara	173,455	18,982
USSR[b]	126,491	13,566
North Africa	53,401	5,205
Oceania	6,600	741

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1990.

[a] Including Mexico.

[b] Single country "region"; not included in any other region.

Table A7-9. U.S. Sorghum Exports, Top Ten Country Importers and World Total, Volume and Value, 1988.

Destination	Quantity	Value
	(MT)	(000$)
Japan	2,137,472	219,858
Venezuela	1,706,359	170,956
Mexico	1,290,700	134,684
Israel (inc. Gaza and West Bank)	341,058	33,550
Spain (inc. Canary Islands)	276,192	25,424
Poland	184,604	15,602
USSR	126,491	13,566
Nigeria	103,284	10,464
China (Taiwan)	81,660	8,068
Ecuador	75,744	6,880
Subtotal	6,323,564	639,052
Developed Countries	2,763,029	279,715
Less Developed Countries	3,406,526	347,577
Centrally Planned Countries	311,095	29,168
World	6,480,650	656,460

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1990.

Table A7-10. U.S. Sorghum Exports, Top Ten Regional Importers, Volume and Value, 1989.

Destination	Quantity	Value
	(MT)	(000$)
East and South Asia	3,149,979	344,790
Central America[a]	2,268,379	269,509
South America	1,007,200	113,911
USSR[b]	845,491	93,447
West Asia (Mideast)	651,497	70,447
West Europe	245,974	26,789
North Africa	60,659	6,463
Oceania	21,088	2,364
Sub-Sahara	17,356	2,333
East Europe	11,574	1,223

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1991.

[a] Including Mexico.

[b] Single country "region"; not included in any other region.

Table A7-11. U.S. Sorghum Exports, Top Ten Country Importers and World Total, Volume and Value, 1989.

Destination	Quantity	Value
	(MT)	(000$)
Japan	3,067,345	335,835
Mexico	2,268,379	269,509
Venezuela	945,785	106,937
USSR	845,491	93,447
Israel (inc. Gaza and West Bank)	363,260	40,866
Jordan	235,995	24,620
Spain (inc. Canary Islands)	165,954	18,951
Norway	79,999	7,828
Ecuador	61,369	6,968
Turkey	52,242	4,961
Subtotal	8,085,819	909,922
Developed Countries	3,698,652	405,962
Less Developed Countries	3,726,263	430,979
Centrally Planned Countries	857,065	94,670
World	8,281,980	931,611

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1991.

Table A7-12. U.S. Sorghum Exports, Top Regional Importers, Volume and Value, 1990.

Destination	Quantity	Value
	(MT)	(000$)
Central America[a]	2,899,982	328,331
East and South Asia	2,833,757	312,129
West Asia (Mideast)	551,855	59,882
West Europe	286,292	30,433
North Africa	139,514	14,888
South America	20,460	2,141
Sub-Sahara	19,426	2,456
Oceania	12,601	1,468

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1992.

[a] Including Mexico.

Table A7-13. U.S. Sorghum Exports, Top Ten Country Importers and World Total, Volume and Value, 1990.

Destination	Quantity	Value
	(MT)	(000$)
Mexico	2,899,982	328,331
Japan	2,820,801	310,632
Israel (incl. Gaza & West Bank)	370,780	40,304
Spain (incl. Canary Islands)	259,926	27,629
Jordan	154,907	16,876
Tunisia	114,997	12,171
Norway	26,250	2,790
Turkey	26,168	2,702
Algeria	24,517	2,716
Ecuador	20,460	2,141
Subtotal	6,718,788	746,292
Developed Countries	3,491,730	383,005
Less Developed Countries	3,274,370	369,012
World	6,766,100	752,016

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1992.

Table A7-14. U.S. Sorghum Exports, Top Regional Importers, Volume and Value, 1991.

Destination	Quanitity	Value
	(MT)	(000$)
Central America[a]	3,313,175	372,560
East and South Asia	1,642,799	175,442
West Asia (Mideast)	331,264	35,800
Sub-Sahara	287,277	31,599
West Europe	179,664	18,814
North Africa	100,000	10,026
South America	58,100	6,245

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1993.

[a] Including Mexico.

Table A7-15. U.S. Sorghum Exports, Top Ten Country Importers and World Total, Volume and Value, 1991.

Destination	Quantity	Value
	(MT)	(000$)
Mexico	3,313,113	372,560
Japan	1,642,799	175,442
Sudan	165,177	18,613
Israel (inc. Gaza and West Bank)	162,266	17,733
Spain (inc. Canary Islands)	161,973	16,840
Egypt	100,000	10,026
Turkey	88,468	9,384
Jordan	70,502	7,649
Ecuador	48,600	5,317
Mali	37,198	3,919
Subtotal	5,790,096	637,483
Developed Countries	1,986,462	212,222
Less Developed Countries	3,928,462	438,715
World	5,914,924	650,937

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1993.

Table A7-16. U.S. Sorghum Exports, Top Regional Importers, Volume and Value, 1992.

Destination	Quanitity	Value
	(MT)	(000$)
Central America[a]	4,956,647	548,474
East and South Asia	1,803,449	191,140
West Asia (Mideast)	355,519	35,337
Sub-Sahara	243,294	27,684
West Europe	171,597	19,110
South America	10,038	1,096
Caribbean	6,197	1,221

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1994.

[a] Including Mexico.

Table A7-17. U.S. Sorghum Exports, Top Ten Country Importers and World Total, Volume and Value, 1992.

Destination	Quantity	Value
	(MT)	(000$)
Mexico	**4,956,584**	**548,474**
Japan	1,803,449	191,140
Spain (inc. Canary Islands)	171,134	19,064
Turkey	158,538	16,474
Israel, (inc. Gaza)	126,982	12,363
Republic of South Africa	74,833	8,296
Jordan	69,999	6,500
Sudan	52,693	6,675
Zimbabwe	50,000	4,630
Ethiopia	42,150	4,786
Subtotal	**7,506,362**	**818,402**
Developed Countries	7,506,363	818,402
Less Developed Countries	5,369,880	593,159
World	7,548,263	824,264

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1994.

Table A7-18. U.S. Sorghum Exports, Top Regional Importers, Volume and Value, 1993.

Destination	Quantity	Value
	(MT)	(000$)
Central America[a]	3,613,513	366,066
East and South Asia	1,897,968	196,592
West Asia (Mideast)	241,533	23,345
West Europe	170,722	16,764
Sub-Sahara	62,412	7,187
South America	44,814	4,517
East Europe	10,129	988
Caribbean	2,572	289

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1995.

[a] Including Mexico.

Table A7-19. U.S. Sorghum Exports, Top Ten Country Importers and World Total, Volume and Value, 1993.

Destination	Quantity	Value
	(MT)	(000$)
Mexico	3,613,513	366,066
Japan	1,897,670	196,562
Spain (inc. Canary Islands)	168,893	16,581
Israel (inc. Gaza)	168,495	16,365
Turkey	73,038	6,980
Chile	22,713	2,263
Mauritania	15,116	1,499
Senegal	12,201	1,321
Kenya	10,427	1,234
Niger	10,191	1,222
Subtotal	5,992,257	610,093
Developed Countries	2,239,477	230,006
Less Developed Countries	3,806,392	386,017
World	6,045,869	616,023

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1995.

Table A7-20. U.S. Sorghum Exports, Top Regional Importers, Volume and Value, 1994.

Destination	Quantity	Value
	(MT)	(000$)
Central America[a]	3,402,464	390,120
East and South Asia	1,718,719	182,664
West Europe	192,074	22,792
Oceania	187,274	19,102
Sub-Sahara	172,790	19,610
West Asia (Mideast)	119,292	12,925
Caribbean	5,541	760
South America	452	45

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1996.

[a] Including Mexico.

Table A7-21. U.S. Sorghum Exports, Top Ten Country Importers and World Total, Volume and Value, 1994.

Destination	Quantity	Value
	(MT)	(000$)
Mexico	3,373,289	386,390
Japan	1,718,719	182,664
Spain (inc. Canary Islands)	189,783	22,562
Australia	187,274	19,102
Israel (inc. Gaza)	109,869	11,790
Former Ethiopia	86,697	8,961
Sudan	60,346	7,535
Burundi	10,000	1,105
Saudi Arabia	9,423	1,135
Somalia	6,998	847
Subtotal	5,752,398	642,091
Developed Countries	2,209,417	236,567
Less Developed Countries	3,590,926	411,696
World	5,800,343	648,263

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1996.

Table A7-22. U.S. Sorghum Exports, Top Regional Importers, Volume and Value, 1995.

Destination	Quantity	Value
	(MT)	(000 $)
Central America[a]	2,149,678	254,730
East and South Asia	1,861,583	217,640
West Europe	905,527	122,041
West Asia	253,053	30,677
Oceana	154,832	18,372
Sub-Sahara	121,420	14,534

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1996.

[a] Including Mexico.

Table A7-23. U.S. Sorghum Exports, Top Ten Country Importers and World Total, Volume and Value, 1995.

Destination	Quantity	Value
	(MT)	(000 $)
Mexico	2,152,606	255,147
Japan	1,861,583	217,640
Spain (inc. Canary Islands)	681,960	89,130
Israel (inc. Gaza)	253,053	30,677
Italy	135,222	20,332
Australia	94,488	10,602
New Zealand	53,344	6,898
Netherlands	40,560	5,543
Thailand	37,775	8,049
Belgium & Luxembourg	29,600	4,379
Subtotal	5,295,731	641,796
Developed Countries	3,173,500	388,539
Less Developed Countries	2,341,164	281,371
World	5,522,064	669,915

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1996.

APPENDIX A-8

U.S. Soybean Export Patterns
Selected Years, 1954 - 1995

Table A8-1. U.S. Soybean Exports,[a] Top Importers and World Total, 1954, 1959, 1969 and 1977.

1954 Destination	Quantity (MT)	1959 Destination	Quantity (MT)
Japan	553,837	Japan	1,093,440
West Germany	221,616	Netherlands	716,532
Canada	220,637	Canada	429,026
Netherlands	198,891	West Germany	416,426
Formosa	117,599	Denmark	235,769
Denmark	78,544	Israel	165,471
Israel	64,528	China (Taiwan)	143,725
France	64,501	Denmark	122,933
United Kingdom	53,724	Italy	109,706
Norway	22,208	United Kingdom	106,358
Subtotal	1,596,085	Subtotal	3,539,386
World	1,649,780	World	3,847,765

1969 Destination	Quantity (MT)	1977 Destination	Quantity (MT)
Japan	2,759,169	Netherlands	4,085,923
Canada	1,903,784	Japan	3,636,412
Netherlands	1,562,092	Spain	1,532,049
West Germany	1,137,012	Fed. Rep. of Germany	1,521,358
Spain	989,259	Italy	870,277
Italy	691,629	China (Taiwan)	854,215
China (Taiwan)	577,678	Soviet Union	744,180
Denmark	500,984	United Kingdom	622,685
Belgium/Luxembourg	438,579	France	572,533
Israel	225,318	Mexico	525,027
		Other Europe	1,964,021
		Other Asia	976,617
		Other Americas	338,855
Subtotal	10,785,504	Subtotal	18,244,152
World	11,773,512	World	19,061,083

Source: U.S. Department of Agriculture. *Agricultural Statistics*. Washington, DC: GPO; 1956.

[a] Exclusive of soybean products.

Table A8-2. U.S. Soybean Exports, Top Regional Importers, Volume and Value, 1985.

Destination	Quantity	Value
	(MT)	(000 $)
West Europe	7,639,882	1,665,309
East and South Asia	6,561,023	1,458,876
Central America[a]	970,346	231,174
South America	490,990	110,813
West Asia (Mideast)	465,226	100,771
East Europe	367,930	80,668
Africa	20,284	4,289

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1987.

[a] Including Mexico.

Table A8-3. U.S. Soybean Exports, Top Ten Country Importers and World Total, Volume and Value, 1985.

Destination	Quantity	Value
	(MT)	(000 $)
Japan	4,375,137	951,680
Netherlands	2,856,582	638,289
China (Taiwan)	1,358,093	321,720
Spain (incl. Canary Islands)	1,194,853	252,646
Mexico	962,927	229,424
Fed. Rep. Germany	846,460	185,043
South Korea	827,793	185,476
Italy	627,778	138,036
Belgium/Luxembourg	529,092	112,029
Portugal	517,653	110,533
Subtotal	13,096,368	3,154,876
Developed Countries	12,607,908	2,745,263
Less Developed Countries	3,850,357	893,449
Centrally Planned Countries	430,931	93,232
World	16,889,196	3,731,944

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1987.

Table A8-4. U.S. Soybean Exports, Top Regional Importers, Volume and Value, 1986.

Destination	Quantity	Value
	(MT)	(000 $)
West Europe	10,035,426	1,994,734
East and South Asia	6,973,132	164,123
USSR[a]	1,518,594	312,981
Central America[b]	852,823	184,942
South America	503,559	101,764
East Europe	476,875	99,586
West Asia (Mideast)	410,467	83,549
Caribbean	103,403	20,807
Canada	164,541	35,441

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1988.

[a] Single-country "region"; not included in any other region.

[b] Including Mexico.

Table A8-5. U.S. Soybean Exports, Top Ten Country Importers and World Total, Volume and Value, 1986.

Destination	Quantity	Value
	(MT)	(000 $)
Japan	4,225,283	856,132
Netherlands	3,427,609	679,477
Spain (incl. Canary Islands)	1,783,812	348,520
China (Taiwan)	1,735,037	358,750
USSR	1,518,594	312,981
Fed. Rep. Germany	1,165,795	230,376
South Korea	1,012,712	206,091
Belgium/Luxembourg	960,308	196,728
Mexico	823,086	178,201
Italy	743,052	152,066
Subtotal	18,295,288	3,519,322
Developed Countries	14,824,034	2,965,856
Less Developed Countries	4,451,705	921,960
Centrally Planned Countries	2,119,964	437,973
World	21,395,703	4,325,790

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1988.

Table A8-6. U.S. Soybean Exports, Top Ten Regional Importers, Volume and Value, 1987.

Destination	Quantity	Value
	(MT)	(000 $)
West Europe	10,321,851	2,030,042
East and South Asia	7,525,914	1,541,640
Central America[a]	1,097,454	227,605
South America	889,056	184,360
East Europe	592,300	118,484
West Asia (Mideast)	459,354	93,968
USSR[b]	221,334	42,705
Canada	195,927	39,772
Caribbean	166,340	33,389
Africa	91,267	18,836

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1989.

[a] Including Mexico.

[b] Single-country "region"; not included in any other region.

Table A8-7. U.S. Soybean Exports, Top Ten Country Importers and World Total, Volume and Value, 1987.

Destination	Quantity	Value
	(MT)	(000 $)
Netherlands	23,971,006	803,146
Japan	3,928,901	811,550
China (Taiwan)	1,871,800	379,935
Spain (incl. Canary Islands)	1,724,804	343,335
Fed. Rep. Germany	1,438,472	285,817
South Korea	1,139,543	232,188
Mexico	1,042,633	214,482
Belgium/Luxembourg	886,196	177,410
Portugal	611,395	122,842
Brazil	450,198	93,793
Subtotal	17,064,948	3,464,498
Developed Countries	14,908,397	3,016,853
Less Developed Countries	5,441,288	1,114,116
Centrally Planned Countries	1,242,757	247,084
World	21,592,442	4,378,054

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Staticstics, and Cooperative Service. Washington: GPO, 1989.

Table A8-8. U.S. Soybean Exports, Top Ten Regional Importers, Volume and Value, 1988.

Destination	Quantity	Value
	(MT)	(000 $)
West Europe	7,796,187	1,971,386
East and South Asia	6,706,077	1,856,947
Central America[a]	1,292,867	521,953
USSR[b]	777,574	169,344
East Europe	483,622	122,052
West Asia (Mideast)	458,526	133,315
South America	378,630	105,399
Caribbean	140,528	.38,6190
Canada[b]	105,248	36,096
North Africa	67,671	18,126

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1990.

[a] Including Mexico.

[b] Single-country "region"; not included in any other region.

Table A8-9. U.S. Soybean Exports, Top Ten Country Importers and World Total, Volume and Value, 1988.

Destination	Quantity	Value
	(MT)	(000 $)
Japan	3,706,130	1,036,299
Netherlands	3,406,517	875,299
China (Taiwan)	1,794,231	491,782
Mexico	1,238,799	367,494
Spain (incl. Canary Islands)	1,153,273	294,065
Fed. Rep. Germany	1,014,456	209,947
South Korea	975,827	272,045
USSR	777,574	169,344
Begium/Luxumbourg	583,580	150,624
United Kingdom	509,729	143,807
Subtotal	**15,060,116**	**4,010,706**
Developed Countries	12,112,638	3,194,053
Less Developed Countries	4,921,067	1,377,284
Centrally Planned Countries	1,261,196	291,396
World	18,294,901	4,862,733

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1990.

Table A8-10. U.S. Soybean Exports, Top Regional Importers, Volume and Value, 1989.

Destination	Quantity	Value
	(MT)	(000 $)
West Europe	6,605,041	1,685,499
East and South Asia	6,041,004	1,596,179
Central America[a]	1,053,411	293,717
West Asia (Mideast)	318,236	84,687
USSR[b]	296,576	82,289
Caribbean	220,626	62,196
South America	186,484	53,179
Canada[b]	144,823	34,155
East Europe	110,615	30,428

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1991.

[a] Including Mexico.

[b] Single-country "region"; not included in any other region.

Table A8-11. U.S. Soybean Exports, Top Ten Country Importers and World Total, Volume and Value, 1989.

Destination	Quantity	Value
	(MT)	(000 $)
Japan	3,284,651	865,969
Netherlands	2,584,308	661,281
Spain (incl. Canary Islands)	1,350,229	346,857
China (Taiwan)	1,683,382	447,177
Mexico	978,861	273,012
South Korea	828,457	219,999
Fed. Rep. Germany	698,633	179,485
Belgium & Luxembourg	638,300	156,400
Portugal	314,916	81,228
USSR	296,576	82,289
Subtotal	12,658,313	3,313,697
Developed Countries	10,333,298	2,666,058
Less Developed Countries	4,302,368	1,163,693
Centrally Planned Countries	407,191	112,717
World	15,042,857	3,942,468

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1991.

Table A8-12. U.S. Soybean Exports, Top Regional Importers, Volume and Value, 1990.

Destination	Quantity	Value
	(MT)	(000 $)
West Europe	6,526,013	1,470,153
East and South Asia	6,151,880	1,457,887
Central America[a]	926,885	224,777
East Europe	484,828	107,430
West Asia (Mideast)	366,498	84,055
Canada[b]	283,451	65,684
USSR[b]	274,432	61,076
Caribbean	182,271	42,140
South America	71,172	17,060

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1992.

[a] Including Mexico.

[b] Single-country "region"; not included in any other region.

Table A8-13. U.S. Soybean Exports, Top Ten Country Importers and World Total, Volume and Value, 1990.

Destination	Quantity	Value
	(MT)	(000 $)
Japan	3,475,486	821,284
Netherlands	2,322,416	519,163
China (Taiwan)	1,715,992	411,327
Spain (incl. Canary Islands)	1,295,443	291,160
Fed. Rep. of Germany	843,246	193,063
Mexico	842,002	203,377
Republic of Korea	825,696	193,814
Belgium & Luxembourg	463,061	103,297
United Kingdom	410,420	92,808
Portugal	369,723	82,701
Subtotal	12,563,485	2,911,994
Developed Countries	10,718,293	2,456,845
Less Developed Countries	4,640,883	1,094,654
World	15,359,176	3,551,449

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1992.

Table A8-14. U.S. Soybean Exports, Top Ten Regional Importers, Volume and Value, 1991.

Destination	Quantity	Value
	(MT)	(000 $)
East and South Asia	7,151,783	1,630,669
West Europe	6,772,457	1,505,732
Central America[a]	1,582,125	367,205
Former USSR	741,776	166,509
West Asia (Mideast)	472,103	105,214
Caribbean	220,412	49,612
East Europe	181,897	40,533
South America	154,642	34,354
Canada[b]	153,148	35,366
Oceana	86,326	18,778

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1993.

[a] Including Mexico.

[b] Single-country "region"; not included in any other region.

Table A8-15. U.S. Soybean Exports, Top Ten Country Importers and World Total, Volume and Value, 1991.

Destination	Quantity	Value
	(MT)	(000 $)
Japan	3,812,261	864,432
Netherlands	2,650,110	591,966
China (Taiwan)	2,022,532	466,818
Mexico	1,481,395	343,418
Spain (inc. Canary Islands)	1,457,958	322,806
Republic of Korea	1,058,732	240,018
Fed. Rep. Germany	751,420	166,568
Former USSR	741,776	166,509
Belgium & Luxembourg	518,647	114,539
Israel (inc. Gaza and West Bank)	471,901	105,165
Subtotal	14,966,732	3,299,827
Developed Countries	11,296,093	2,529,768
Less Developed Countries	6,235,172	1,427,592
World	17,531,265	3,957,360

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Sevice. Washington: GPO, 1993.

Table A8-16. U.S. Soybean Exports, Top Regional Importers, Volume and Value, 1992.

Destination	Quantity	Value
	(MT)	(000 $)
West Europe	8,357,927	1,811,913
East and South Asia	7,712,080	1,728,926
Central America[a]	2,016,358	464,153
West Asia (Mideast)	568,380	124,931
South America	432,626	93,164
Former USSR	242,354	53,830
East Europe	200,964	44,547
Caribbean	181,365	39,778

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1994.

[a] Including Mexico.

Table A8-17. U.S. Soybean Exports, Top Ten Country Importers and World Total, Volume and Value, 1992.

Destination	Quantity	Value
	(MT)	(000 $)
Japan	3,875,696	873,801
Netherlands	3,435,236	743,498
China (Taiwan)	2,072,889	460,909
Mexico	1,914,113	439,996
Spain (incl. Canary Islands)	1,399,675	301,398
Republic of Korea	1,102,523	245,821
Belgium & Luxembourg	870,387	190,068
Germany	862,637	188,756
Italy	574,117	124,376
Israel, inc. Gaza	518,579	114,169
Subtotal	16,625,852	3,682,792
Developed Countries	12,864,671	2,825,542
Less Developed Countries	6,582,277	1,427,994
Other Countries	377,971	83,512
World	19,824,919	4,387,047

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1994.

Table A8-18. U.S. Soybean Exports, Top Ten Regional Importers, Volume and Value, 1993.

Destination	Quantity	Value
	(MT)	(000$)
West Europe	7,852,730	1,830,561
East and South Asia	7,399,217	1,778,968
Central America[a]	1,910,622	454,179
West Asia (Mideast)	480,640	112,493
Canada[b]	229,772	58,300
South America	208,494	48,646
Caribbean	198,603	45,672
Africa	111,024	25,503
Former USSR	65,155	15,345
East Europe	34,961	8,876

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1995.

[a] Including Mexico.

[b] Single-country "region"; not included in any other region.

Table A8-19. U.S. Soybean Exports, Top Ten Country Importers and World Total, Volume and Value, 1993.

Destination	Quantity	Value
	(MT)	(000 $)
Japan	4,050,565	976,770
Netherlands	2,981,064	699,057
China (Taiwan)	2,335,320	554,989
Mexico	1,758,386	415,723
Spain (inc. Canary Islands)	1,176,046	272,726
Korea, Republic of	1,011,163	246,554
Germany	939,876	215,971
Belgium & Luxembourg	779,013	179,390
Italy	695,842	164,050
Indonesia	446,051	106,691
Subtotal	15,734,443	3,831,921
Developed Countries	12,704,697	2,998,174
Less Developed Countries	6,555,185	1,562,154
Other Countries	163,378	38,345
World	19,423,260	4,598,673

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1995.

Table A8-20. U.S. Soybean Exports, Top Regional Importers, Volume and Value, 1994.

Destination	Quantity	Value
	(MT)	(000 $)
West Europe	7,244,971	1,676,134
East and South Asia	6,101,926	1,499,481
Central America[a]	2,214,898	568,942
South America	839,429	184,876
West Asia	447,405	107,997
Caribbean	178,247	44,800
Africa	100,309	22,075

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1996.

[a] includes Mexico.

Table A8-21. U.S. Soybean Exports, Top Ten Country Importers and World Total, Volume and Value, 1994.

Destination	Quantity	Value
	(MT)	(000 $)
Japan	3,349,093	832,550
Netherlands	3,062,863	711,921
Mexico	2,073,116	533,436
Taiwan	1,827,112	441,804
Spain (inc. Canary Islands)	1,179,694	269,148
Korea, Republic of	925,154	224,932
Germany	822,068	215,971
Brazil	620,637	133,797
Belgium & Luxembourg	531,907	126,152
Israel (inc. Gaza)	416,293	100,979
Subtotal	14,807,937	3,590,690
Developed Countries	11,140,297	2,638,837
Less Developed Countries	6,898,350	1,692,904
Other Countries	33,142	8,686
World	18,071,789	4,330,427

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1996.

Table A8-22. U.S. Soybean Exports, Top Regional Importers, Volume and Value, 1995.

Destination	Quantity	Value
	(MT)	(000 $)
West Europe	9,684,056	2,265,979
East and South Asia	9,063,617	2,180,038
Central America	2,167,319	515,251
West Asia	632,931	148,264
South America	331,476	76,401
Africa	181,311	43,893
Caribbean	123,465	28,945
North Africa	121,430	29,516
East Europe	58,027	15,149

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1996.

Table A8-23. U.S. Soybean Exports, Top Ten Country Importers and World Total, Volume and Value, 1995.

Destination	Quantity	Value
	(MT)	(000 $)
Japan	4,003,705	973,662
Netherlands	3,901,986	917,443
Tawain	2,534,485	600,467
Mexico	2,017,558	479,270
Spain (inc. Canary Islands)	1,525,195	352,217
Korea, Republic of	1,420,980	335,769
Germany	1,187,004	273,525
Belgium & Luxembourg	769,767	179,992
Italy	632,675	150,951
Israel (inc. Gaza)	520,958	122,755
Subtotal	**18,514,313**	**4,386,051**
Developed Countries	14,407,886	3,409,736
Less Developed Countries	8,052,528	1,915,134
Other Countries	306,324	75,168
World	22,766,738	5,400,038

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1996.

APPENDIX A-9

U.S. Wheat Export Patterns
Selected Years, 1954 - 1995

Table A9-1. U.S. Wheat Exports[a], Top Importers and World Total, 1954, 1955-59 Average, 1969 and 1977.

1954		1955-59	
Destination	Quantity (MT)	Destination	Quantity (MT)
Yugoslavia	1,101,442	India	2,111,738
Japan	908,483	Japan	1,077,601
West Germany	744,428	Yugoslavia	722,274
United Kingdom	695,685	United Kingdom	683,955
Netherlands	337,529	Pakistan	563,879
Greece	328,519	West Germany	539,304
Brazil	242,654	Brazil	498,372
Israel	227,876	Netherlands	323,811
Belgium/Luxembourg	216,989	Turkey	310,421
China (Tawain)	197,476	Poland	301,793
Other Asia	517,068	Other Europe	1,061,132
Other Europe	360,601	Other Asia	875,932
Other Americas	208,417	Other Americas	639,238
Africa	99,065	Africa	450,932
Subtotal	6,186,232	Subtotal	10,159,514
World	6,186,232	World	10,197,830

1969		1977	
Destination	Quantity (MT)	Destination	Quantity (MT)
Japan	2,381,825	Japan	3,174,685
India	2,314,467	Brazil	2,692,885
Pakistan	987,463	Republic of Korea	1,629,061
Republic of Korea	973,664	Iran	1,129,889
Brazil	905,952	Pakistan	1,063,596
Venezuela	684,336	Chile	872,626
Turkey	665,311	Morocco	865,324
Netherlands	659,542	Netherlands	864,577
Philippines	453,030	Venezuela	722,046
China (Taiwan)	392,503	Algeria	682,153
Other Europe	1,522,601	Other Europe	6,032,386
Other Americas	1,154,646	Other Asia	5,025,068
Africa	971,949	Africa	2,850,682
Other Asia	648,574	Other Americas	2,461,973
Subtotal	14,715,863	Subtotal	30,066,771
World	14,715,863	World	31,812,555

Source: U.S. Department of Agriculture. *Agricultural Statistics*. Washington, DC: GPO; 1956.

[a] Exclusive of wheat products.

Table A9-2. U.S. Wheat Exports, Top Regional Importers, Volume and Value, 1985.

Destination	Quantity	Value
	(MT)	(000$)
East and South Asia	9,397,151	1,370,896
South America	4,364,063	648,197
North Africa	2,983,916	393,966
Sub-Sahara	2,382,104	352,145
West Europe	1,777,464	254,776
West Asia (Mideast)	1,429,670	213,149
USSR[a]	1,068,121	162,290
Caribbean	711,394	106,293
Central America[b]	604,228	92,873

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1987.

[a] Single-country "region"; not included in any other region.

[b] Including Mexico.

Table A9-3. U.S. Wheat Exports, Top Ten Country Importers and World Total, Volume and Value, 1985.

Destination	Quantity	Value
	(MT)	(000$)
Japan	3,120,324	268,970
Brazil	2,043,015	307,992
South Korea	1,892,369	270,158
Egypt	1,645,829	207,060
Nigeria	1,472,303	225,709
USSR	1,068,121	162,290
Algeria	844,062	123,028
China (Mainland)	816,448	105,005
Pakistan	722,089	95,743
Philippines	700,260	115,105
Subtotal	**14,324,820**	**1,881,060**
Developed Countries	5,356,699	787,066
Less Developed Countries	17,477,189	2,540,319
Centrally Planned Countries	1,970,073	279,445
World	24,803,961	3,606,830

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1987.

Table A9-4. U.S. Wheat Exports, Top Regional Importers, Volume and Value, 1986.

Destination	Quantity (MT)	Value (000$)
East and South Asia	9,034,877	1,168,511
North Africa	5,542,967	608,104
South America	2,936,574	370,259
West Asia (Mideast)	2,170,450	270,300
Sub-Sahara	1,931,328	223,568
West Europe	1,270,230	159,571
Caribbean	697,496	91,904
Central America	598,629	79,374
East Europe	423,195	40,286

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1988.

Table A9-5. U.S. Wheat Exports, Top Ten Country Importers and World Total, Volume and Value, 1986.

Destination	Quantity	Value
	(MT)	(000$)
Japan	3,224,286	424,330
Egypt	2,071,359	215,783
South Korea	1,937,399	240,388
Algeria	1,680,862	199,721
Morocco	1,294,137	138,886
Nigeria	937,073	109,773
Venezuela	841,472	132,206
Philippines	798,169	106,702
Iraq	711,138	86,922
China (Taiwan)	700,439	101,505
Subtotal	**14,196,334**	**1,562,006**
Developed Countries	5,213,216	668,565
Less Developed Countries	18,990,538	2,305,404
Centrally Planned Countries	423,195	40,206
World	24,626,949	3,014,255

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1988.

Table A9-6. U.S. Wheat Exports, Top Ten Regional Importers, Volume and Value, 1987.

Destination	Quantity	Value
	(MT)	(000$)
East and South Asia	10,422,117	1,116,471
North Africa	6,737,483	604,725
USSR[a]	4,847,180	392,491
West Asia (Mideast)	2,239,441	235,253
South America	1,810,478	216,948
East Europe	1,339,333	103,922
Sub-Sahara	1,043,634	107,795
West Europe	771,326	92,288
Central America	713,533	89,798
Caribbean	690,678	83,387

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1989.

[a] Single country "region"; not included in any other region.

Table A9-7. U.S. Wheat Exports, Top Ten Country Importers and World Total, Volume and Value, 1987.

Destination	Quantity	Value
	(MT)	(000$)
USSR	4,847,180	392,491
Japan	2,998,896	352,280
Egypt	2,458,132	234,531
Morocco	2,024,900	154,489
Algeria	1,917,642	175,848
China (Mainland)	1,915,904	139,202
South Korea	1,904,127	213,349
Iraq	910,333	84,347
Poland	902,513	70,374
Philippines	870,156	104,366
Subtotal	20,749,783	1,921,277
Developed Countries	4,313,369	506,321
Less Developed Countries	18,201,730	1,901,522
Centrally Planned Countries	8,102,417	635,615
World	30,617,516	3,043,458

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1989.

Table A9-8. U.S. Wheat Exports, Top Ten Regional Importers, Volume and Value, 1988.

Destination	Quantity	Value
	(MT)	(000$)
East and South Asia	17,450,382	2,217,075
USSR[a]	8,035,900	755,110
North Africa	6,406,194	781,198
South America	1,819,802	261,273
West Asia (Mideast)	1,657,780	237,543
Central America[b]	1,432,309	185,544
East Europe	1,250,092	10,734
Sub-Sahara	1,020,912	131,778
West Europe	804,936	117,621
Caribbean	609,428	87,810

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1990.

[a] Single country "region"; not included in any other region.

[b] Including Mexico.

Table A9-9. U.S. Wheat Exports, Top Ten Country Importers and World Total, Volume and Value, 1988.

Destination	Quantity	Value
	(MT)	(000$)
USSR	8,035,990	755,110
China (Mainland)	6,592,153	697,838
Japan	2,920,788	425,510
Egypt	2,814,293	372,144
South Korea	2,043,397	286,127
India	1,841,591	223,674
Algeria	1,629,943	191,204
Morocco	1,316,255	151,425
Poland	1,061,351	92,541
Philippines	975,738	119,829
Subtotal	**29,231,499**	**3,315,402**
Developed Countries	4,118,931	599,890
Less Developed Countries	20,524,142	2,726,011
Centrally Planned Countries	15,878,235	1,563,683
World	40,521,308	4,889,583

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1990.

Table A9-10. U.S. Wheat Exports, Top Regional Importers, Volume and Value, 1989.

Destination	Quantity	Value
	(MT)	(000$)
East and South Asia	17,454,982	2,841,480
North Africa	5,716,321	888,910
USSR[a]	5,342,659	827,133
West Asia (Mideast)	2,611,742	433,185
South America	1,963,999	330,856
West Europe	1,039,606	169,597
Central America[b]	1,006,712	167,370
Caribbean	607,913	101,218
Sub-Sahara	544,460	90,545

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1991.

[a] Single country "region"; not included in any other region.

[b] Including Mexico.

Table A9-11. U.S. Wheat Exports, Top Ten Country Importers and World Total, Volume and Value, 1989.

Destination	Quantity	Value
	(MT)	(000$)
China (Mainland)	7,400,509	1,107,125
USSR	5,342,659	827,133
Egypt	3,390,968	529,574
Japan	2,734,837	475,762
Pakistan	1,880,076	324,952
South Korea	1,738,212	297,903
Algeria	1,279,572	197,917
Iraq	1,010,922	179,110
Bangladesh	914,775	152,523
Philippines	908,703	160,726
Subtotal	26,601,233	4,252,725
Developed Countries	4,297,107	733,788
Less Developed Countries	19,267,613	3,184,090
Centrally Planned Countries	12,800,605	1,945,082
World	36,365,325	5,862,960

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1991.

Table A9-12. U.S. Wheat Exports, Top Ten Regional Importers, Volume and Value, 1990.

Destination	Quantity	Value
	(MT)	(000$)
East and South Asia	12,453,246	1,753,167
North Africa	3,972,648	4,888,925
USSR[a]	3,690,373	542,547
South America	1,845,338	267,145
West Asia (Mideast)	1,787,809	258,650
Central America[b]	1,119,520	165,794
Sub-Sahara	950,066	127,118
West Europe	833,391	113,822
Caribbean	588,905	89,132
East Europe	155,596	18,542

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1992.

[a] Single country "region"; not included in any other region.

[b] Including Mexico.

Table A9-13. U.S. Wheat Exports, Top Ten Country Importers and World Total, Volume and Value, 1990.

Destination	Quantity	Value
	(MT)	(000$)
China (Mainland)	3,691,678	497,348
USSR	3,690,373	542,547
Japan	2,838,183	420,051
Egypt	1,653,703	213,390
Republic of Korea	1,596,912	216,230
Algeria	1,432,875	173,999
Philippines	1,086,882	158,685
Pakistan	894,969	121,950
China (Taiwan)	680,556	110,898
Venezuela	633,056	101,698
Subtotal	18,199,187	2,576,769
Developed Countries	4,327,606	627,503
Less Developed Countries	19,438,206	2,708,933
Other Countries	3,691,678	497,348
World	27,957,490	3,833,784

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1992.

Table A9-14. U.S. Wheat Exports, Top Ten Regional Importers, Volume and Value, 1991.

Destination	Quantity	Value
	(MT)	(000$)
East and South Asia	13,977,317	1,573,427
North Africa	5,557,193	519,383
Former USSR	4,918,841	421,906
South America	2,152,395	261,855
Central America[a]	1,136,957	140,785
West Asia (Mideast)	1,089,749	126,072
Sub-Sahara	907,239	96,166
West Europe	636,561	79,498
Caribbean	509,945	60,756
East Europe	65,465	8,421

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1993.

[a] Including Mexico.

Table A9-15. U.S. Wheat Exports, Top Ten Country Importers and World Total, Volume and Value, 1991.

Destination	Quantity	Value
	(MT)	(000$)
Former USSR	4,918,841	421,906
China (Mainland)	4,372,817	363,339
Japan	3,181,692	422,071
Egypt	3,078,676	285,211
Algeria	1,666,982	156,404
Rep. of Korea	1,649,328	209,458
Philippines	1,332,082	141,138
Pakistan	948,039	126,817
China (Taiwan)	785,500	108,993
Brazil	643,196	72,040
Subtotal	**22,577,153**	**2,307,377**
Developed Countries	4,372,975	576,046
Less Developed Countries	22,231,278	2,359,286
Other Countries	4,402,817	366,960
World	31,007,070	3,302,292

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1993.

Table A9-16. U.S. Wheat Exports, Top Ten Regional Importers, Volume and Value, 1992.

Destination	Quantity	Value
	(MT)	(000$)
East and South Asia	14,076,732	1,942,500
Former USSR	7,457,468	939,953
North Africa	5,916,093	693,092
South America	1,463,146	204,537
West Asia (Mideast)	1,367,202	194,630
Sub-Sahara	1,132,954	138,921
Central America[a]	1,092,734	167,562
West Europe	535,009	78,073
Caribbean	487,453	64,798
Canada	2,214	3,236

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1994.

[a] Including Mexico.

[b] Single-country "region"; not included in any other region.

Table A9-17. U.S. Wheat Exports, Top Ten Country Importers and World Total, Volume and Value, 1992.

Destination	Quantity	Value
	(MT)	(000$)
Former USSR	7,457,468	939,953
Egypt	4,044,070	463,480
Japan	3,545,243	584,317
China (Mainland)	2,982,448	272,951
Pakistan	1,757,858	251,595
Philippines	1,482,596	202,011
Korea, Republic of	1,481,494	235,193
Algeria	1,010,471	123,794
Bangladesh	829,572	105,668
China (Taiwan)	761,143	118,806
Subtotal	25,352,363	3,297,768
Developed Countries	4,811,457	772,070
Less Developed Countries	18,421,400	2,462,892
Other Countries	10,439,916	1,212,905
World	33,710,019	4,447,866

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1994.

Table A9-18. U.S. Wheat Exports, Top Ten Regional Importers, Volume and Value, 1993.

Destination	Quantity	Value
	(MT)	(000$)
East and South Asia	13,714,095	1,879,059
North Africa	6,378,602	713,590
Former USSR	4,114,557	517,531
West Asia	2,738,421	347,793
Sub-Sahara	2,639,179	328,404
South America	2,183,176	317,731
Central America[a]	1,846,315	274,589
East Europe	770,395	94,578
West Europe	687,501	106,546
Caribbean	510,127	78,036

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1995.

[a] Including Mexico.

Table A9-19. U.S. Wheat Exports, Top Ten Country Importers and World Total, Volume and Value, 1993.

Destination	Quantity	Value
	(MT)	(000$)
Former USSR	4,114,557	517,531
Japan	3,247,411	518,974
China (Mainland)	2,717,399	278,391
Egypt	2,458,069	255,702
Morocco	2,093,013	244,022
Philippines	1,611,230	222,256
Korea, Republic of	1,513,340	227,603
Algeria	1,338,755	161,900
Nigeria	1,218,060	144,556
Pakistan	1,184,997	139,191
Subtotal	21,496,831	2,710,126
Developed Countries	5,200,474	803,182
Less Developed Countries	23,568,649	3,061,886
Other Countries	6,853,411	799,302
World	35,622,534	4,664,369

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1995.

Table A9-20. U.S. Wheat Exports, Top Ten Regional Importers, Volume and Value, 1994.

Destination	Quantity	Value
	(MT)	(000$)
East and South Asia	13,579,656	1,914,827
North Africa	7,200,913	800,930
Sub-Sahara	2,242,981	280,643
West Asia (Mideast)	2,133,295	265,287
Former USSR	1,579,857	191,899
Central America[a]	1,483,119	231,281
South America	1,347,458	214,981
West Europe	525,235	84,665
Caribbean	313,641	49,603
East Europe	106,100	16,771

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States.* Economics, Statistics, and Cooperative Service. Washington: GPO, 1996.

[a] Including Mexico.

Table A9-21. U.S. Wheat Exports, Top Ten Country Importers and World Total, Volume and Value, 1994.

Destination	Quantity	Value
	(MT)	(000$)
Egypt	5,157,922	540,422
Japan	3,268,325	591,737
Philippines	2,015,797	270,745
China (Mainland)	1,913,484	166,228
Pakistan	1,837,041	196,299
Former USSR	1,579,857	191,899
Korea, Republic of	1,505,061	227,732
Algeria	1,091,061	134,174
Bangledesh	939,971	126,005
Sri Lanka	733,481	83,826
Subtotal	**20,042,000**	**2,529,067**
Developed Countries	4,754,294	815,258
Less Developed Countries	22,285,100	2,880,605
Other Countries	3,493,341	358,128
World	30,532,735	4,053,991

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1996.

Table A9-22.U.S. Wheat Exports, Top Ten Regional Importers, Volume and Value, 1995.

Destination	Quantity	Value
	(MT)	(000$)
East and South Asia	15,222,630	2,508,093
North Africa	6,335,098	1,031,484
South America	2,643,272	482,141
West Asia	2,315,572	390,211
Sub-Sahara	2,106,56	355,899
Central America[a]	1,630,852	295,023
West Europe	799,637	153,924
Former Soviet Union	688,791	118,375
Caribbean	566,136	104,174
East Europe	4,987	925

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1996.

[a] Including Mexico.

Table A9-23. U.S. Wheat Exports, Top Ten Country Importers and World Total, Volume and Value, 1995.

Destination	Quantity (MT)	Value (000$)
Egypt	5,375,544	850,183
China (Mainland)	3,648,745	499,791
Japan	2,885,596	511,104
Philippines	1,807,064	298,725
Pakistan	1,624,387	280,391
Korea, Republic of	1,461,231	260,361
Bangladesh	922,693	146,192
Sri Lanka	911,474	141,975
Taiwan	818,505	156,293
Mexico	791,473	144,897
Subtotal	20,246,712	3,289,912
Developed Countries	4,900,554	871,239
Less Developed Countries	23,078,622	3,951,333
Other Countries	4,337,536	618,167
World	32,316,712	5,440,738

Source: U.S. Department of Agriculture. *Foreign Agricultural Trade of the United States*. Economics, Statistics, and Cooperative Service. Washington: GPO, 1996.

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