NO. 493. MARCH 1967 INSTITUTE OF AGRICULTURE, UNIVERSITY OF MINNESOTA

Minnesota Farm Business Notes

U.S. Demand for Wheat for Food by Classes

J. C. Chai and R. P. Dahl

Wheat, the premier food grain, is not a homogeneous commodity. Wheat consists of several classes with distinct characteristics and uses. But wheat price support programs make little distinction between classes, thereby contributing to the imbalances between supply and demand among classes. In 1961, when our wheat surplus was at a maximum, this imbalance was severe. Since then, stocks by classes have been brought into closer balance with demand (table 1).

Although each class is best suited for particular uses, the classes are somewhat interchangeable. Substitution of one wheat for another may occur in response to changes in relative prices. The purpose of the study on which this article is based was to analyze substitutability of wheat classes in response to price changes.

Table 1. Estimated carryover of wheat by classes, United States, July 1, 1961 and 1966

Class	1961	1966
	million bushels	
Hard red winter	1,108	275
Hard red spring	237	186
Durum	12	55
Soft red winter	12	8
White	38	12
All wheat	1,407	536

Geographic Distribution of Production

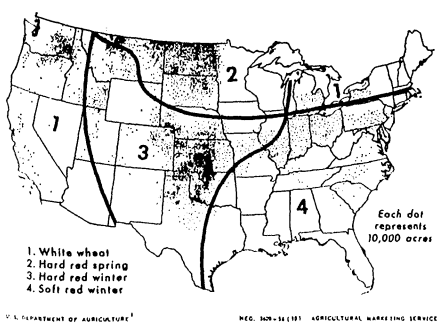
The production regions of the major classes are shown on the map. **Hard red winter** represents more than half of the total wheat production. Leading producing states are Kansas, Oklahoma, Texas, Nebraska, and Montana. This wheat is used primarily for commercial bread and family flours.

The second major class of bread wheat is **hard red spring.** It is produced mostly in North Dakota, South Dakota, Montana, and northwestern Minnesota. It is best suited for specialty bread flours, such as those used for hard rolls and hearth breads, and for commercial bread flour.

Durum, a special type of spring wheat, is ground into semolina from which macaroni and spaghetti are made. Most durum is produced in five northeastern North Dakota counties. This area is often referred to as the "durum triangle."

Soft red winter wheat is grown in high rainfall areas such as Indiana, Illinois, Ohio, and Missouri. It is used primarily for cake, pastry, and cracker flours.

Although **white** wheat is grown primarily in the Pacific Northwest, a sizable acreage also is found in Michigan. Most white wheats are soft and are used for cracker and pastry flours.



U.S. wheat acreage by region.

Wheat Quality and Uses

Wheat use is influenced by both protein content and quality. Protein content of wheat varies greatly among classes, from 7 percent for white wheat to 17 percent for some hard red spring. Protein content greatly affects wheat purchases by the domestic milling industry. However, there is no quick and accurate test for protein quality. And quality often varies—more within some classes of wheat than within others.

The largest single use of food wheat is for commercial bread flours. Hard red winter and hard red spring wheats share this market. Flours for commercial pan breads are often blends of the

(Continued on page 3)

Red River Valley Potato Industry in Transition

J. K. Hanes and F. J. Smith

Dynamic stability was the keynote of the U.S. potato industry during the first half of this century. That period was marked by an expanding population, declining per capita consumption of potatoes, rapidly declining acreage, sharply increasing yields, and major shifts among production areas. But despite these many internal changes, the total market remained remarkably stable. There was little tendency for growth or decline and little change in the product itself or in the manner in which it reached the consumer.

Between 1910 and 1950, the U.S. population increased about 60 percent. This demand-expanding force was almost offset by a 45-percent decline in per capita potato consumption. The volume of potatoes produced during 1950-54 was only 6 percent greater than that produced during 1910-14.

Beginning in the early 1950's, rapid and dramatic changes in the size and composition of the U.S. potato market got underway. Per capita consumption of all potato products began to stabilize, halting a long downward trend. The aggregate market for potatoes began to expand in step with population increases. Production in 1960-64 was 19 percent greater than in 1950-54. The reversal of downtrend in consumption and the associated expansion of production are attributed primarily to the introduction and rapid consumer acceptance of new processed potato products.

Changing Consumption Patterns

Prior to World War II the only processed products of any importance were potato chips, canned potatoes, and potato flour. In 1940 the consumption of processed potato products was less than 2 pounds per person compared to about 120 pounds for fresh tablestock potatoes.

Since World War II and especially since 1950, the processing industry has expanded rapidly. Per capita consumption of processed products increased from 6.3 pounds (fresh weight basis) in 1950 to 36 pounds in 1965—almost a sixfold increase. Although the consumption of potato chips almost tripled between 1950 and 1965, the greatest consumption change occurred for new dehydrated and frozen products. Per capita consumption of dehydrated

(Continued on page 2)

Potato Industry . . .

(Continued from page 1)

flakes and granules increased from zero in 1950 to 5.5 pounds in 1965. During the same period, per capita consumption of frozen products increased from less than 1 to 14.7 pounds.

The expansion of processing stabilized the consumption of all potato products. Nevertheless, fresh potato consumption per capita continued to decline rapidly—from 100 to 67.8 pounds between 1950 and 1965. This downtrend in fresh consumption began before the turn of the century and probably will not be reversed in the foreseeable future.

Potato Production in the Red River Valley

Production of potatoes in the Red River Valley has more than doubled since the 1920's. The Valley's share of production in the central states increased from 11 percent in 1920-24 to 41 percent in 1960-64.

This increase reflected not only a shift among states but also a major shift within Minnesota and North Dakota. While the Valley accounted for only 34 percent of the two states' production in 1920-24, it accounted for 82 percent in 1960-64.

The greatest production increase in the Valley occurred during the past decade. The volume of potatoes sold increased by one-third, from 13.8 million cwt. in 1956 to 20.8 million cwt. in 1963.

The tablestock market is still the most important outlet for Red River Valley producers. During the 1963 crop year, 9.9 million cwt.—66 percent of the potatoes sold for food—went to the tablestock market. This amount represented an absolute increase from the 8.8 million cwt. that went for tablestock in the 1956 crop year. But in 1956 that figure included 83 percent of the potatoes sold for food.

Chip Processing

Potato chip processors provide the largest processing outlet for Valley producers. This segment of the industry is not new; the Valley has been an important supplier of chipstock since before World War II. But until recent years, chipstock represented only a small part of the total market.

The volume of Valley potatoes sold for chipping more than doubled since the mid-1950's, increasing from 1.7 million cwt. in 1956 to 3.6 million cwt. in 1963. Of the volume of potatoes sold for food in 1963, chipstock represented only 13 percent of the U.S. total but 24 percent of the Red River Valley total.

The two chip plants in the Valley produce primarily for nearby distribution. The vast majority of potatoes for chipping is shipped fresh to distant plants located in or near consuming centers.

Freezing and Dehydrating

The freezing and dehydrating segments of the processing industry have developed at a much slower and more irregular rate in the Valley than in other producing areas of the country. These segments began to grow elsewhere shortly after World War II. The dehydrated flake process was developed under public patent in 1956. But no processing plant existed in the Valley until 1959-60.

During the 1962 crop year, two plants produced frozen french fries and five plants produced dehydrated flakes and slices in the Valley. These seven plants processed 1.7 million cwt. of potatoes in 1962 and 1.5 million cwt. in 1963.

Organizational Changes

While the most striking recent development has been the advent and rapid growth of potato processing, changes in procurement practices of large, integrated, retail organizations also have had a major impact on the potato industry. As integrated retail organizations enlarge, they tend to bypass terminal markets and purchase potatoes directly at the shipping point. Because these large-scale buyers often have differing and specialized product requirements, they turn to a relatively few large sellers who can accept their specifications.

Production units and associated marketing firms are rapidly decreasing in number and increasing in size. Potato storage, handling, and marketing techniques are changing. Multiproduct operations that combine both fresh and processed items are developing in many production areas.

The number of farms harvesting potatoes in the 10 northern counties of the Red River Valley declined from 4,560 in 1954 to only 1,313 in 1964. Meanwhile, acres harvested per farm increased over 400 percent—from 29.9 acres to 122.

Paralleling these changes at the production level, the number of marketing firms in the Valley declined by more than one-fourth but the average firm size more than doubled. Although the number of firms paying federal inspection fees declined from 1,075 in 1955 to 750 in 1963, the total volume of inspections increased. The average marketing firm paid inspection fees on 8,000 cwt. in 1955 and 21,000 cwt. in 1963.

Not only are typical Valley firms increasing in size, they also are rapidly adopting efficient storage and handling techniques. In the past, storage capacity often consisted of small storage facilities located on individual farms. And many of these facilities were underground. While such storage was economical a few years ago, it is not suitable for packing the high quality and large volumes of potatoes required today.

Recent potato storage design takes advantage of modern bulk handling methods. Many large, modern, aboveground storage facilities have been constructed by rail sidings in the Valley. These facilities are usually equipped with flume systems; potatoes are moved by water pressure from storage bins to high capacity packing lines.

These large new facilities generally have automatic temperature and humidity controls for individual storage bins. As facilities increase in size and processing grows as a market outlet, automatic environment control becomes increasingly important to firms selling to processors.

In 1963, the total storage capacity available in the Valley was about 26.1 million cwt. One-fourth of total capacity—only 6.4 million cwt.—was located on individual farms. Trackside storage accounted for 19.7 million cwt.

The Incomplete Transition

Although the size of typical Valley firms has been increasing rapidly, it is still far short of the most efficient size. According to study findings, economies of size exist both in production and in storage and packing operations.

In one study the cost of production declined rather rapidly from 89 to 74 cents per cwt. as the production unit increased from 80 to 200 acres (from approximately 10,000 to 28,000 cwt.).[1] Costs decreased less rapidly—from 74 to 68 cents per cwt.—as the production unit increased from 200 to 400 acres (from approximately 28,000 to 66,000 cwt.). Although this analysis only included production units of 400 acres or less, production costs probably continue to decline (or at least do not increase) over a much larger range of

[1] M. G. Maier and L. D. Loftsgard. Sept. 1964. *Potato Production Costs and Practices in the Red River Valley.* North Dakota State Univ. Bull. 451.

Demand for Wheat . . .

(Continued from page 1)

two classes with proportions determined by their qualities and prices.

Hard red spring wheat is usually higher in both protein quantity and quality than hard red winter. The latter often varies considerably in quality within a given protein level. Since commercial bakers have rigid requirements for flour, the proportion of hard spring wheat in commercial flour blends tends to increase when hard winter quality is low.

Because hearth breads and hard rolls are not baked in pans, they require a flour high in protein quantity and quality. Nearly all such breads are baked from spring wheat flours.

The protein requirements for family flour, a multipurpose flour, are not so rigid. Wheats used for such flour vary, depending upon home baking practices in different sections of the country. In the North, either hard red winter or a blend of hard red winter and hard red spring usually is used. Amounts of each class used are influenced by their prices.

Soft red winter wheat is preferred for pastry flours for cakes, crackers, and cookies. In certain areas, limited amounts of soft white and some low protein hard winter wheats may be used for these purposes.

Durum wheat has almost no competitors for the semolina market. However, when durum has been in short supply, hard red winter has been used.

The development of air classification milling enables millers to alter protein levels and other characteristics of flour made from a given class of wheat. However, this process is not widely used and probably has relatively little impact on the demand for wheat by classes.

Demand Relationships

The amount of food wheat consumed in the United States has remained relatively unchanged over a considerable period in spite of the expanding population. Diets have changed, resulting in decreases in per capita consumption. As shown in table 2, annual average wheat consumption was 480 million bushels in 1946-63 as compared with 490 million bushels in 1929-41. However, annual average wheat production increased from 772 million bushels in 1929-41 to 1,143 million in 1946-63. Wheat exports, largely under government programs, have become increasingly important in disposing of expanded production.

Domestic uses of hard red winter, durum, and white wheats have changed little. But the annual average food use of hard red spring wheat increased 34 million bushels from 1929-41 to 1946-63. At the same time, food use of soft red winter wheat declined by a similar amount. The increased demand for hard red spring and the decreased demand for hard red winter are probably due to the decline in home baking. Commercial bakeries require flours made from very high protein wheats.

Table 2. Production and food use of wheat by classes, United States, 1929-41 and 1946-63

Class	Annual average production		Annual average food use	
	1929-41	1946-63	1929-41	1946-63
	million bushels			
Hard red winter	326	580	207	201
Hard red spring	124	183	85	119
Durum	32	33	22	20
Soft red winter	201	187	131	97
White	89	160	45	43
All wheat	772	1,143	490	480

The consumption of all wheat as a group for food is extremely unresponsive to changes in average price. However, because one class of wheat can be substituted for another in the manufacture of certain flours, changes in the consumption of one class may occur as the price of a substitute class changes relative to its own price.

The substitution relationships between classes of wheat derived from this study can be summarized with two examples. In each case, we assume that initially: (1) all wheat prices are $2 per bushel, and (2) the domestic consumption of each class is at its 1946-63 level.

Hard Red Winter vs. Hard Red Spring—As expected, substitutability between hard red winter and hard red spring wheats, the two bread wheats, is greater than between wheats of other classes. If the price of hard red winter wheat increases by 10 cents to $2.10 while other wheat prices remain unchanged, the food demand for hard red spring increases by about 7 million bushels from its 1946-63 average of 119 million bushels.

Soft Red Winter vs. Hard Red Winter—If the price of soft red winter wheat increases by 10 cents to $2.10 while other wheat prices remain unchanged, the food demand for hard red winter increases by about 5.7 million bushels from its 1946-63 average of 201 million bushels. Therefore, soft wheat-hard wheat substitution due to relative price changes is less likely than substitution between bread wheats.

Information obtained in a survey of the flour milling industry supports the above results. Millers also indicated that there is only limited substitutability between soft red winter and white wheats in spite of their similar characteristics.

Conclusions

Results of this study have policy implications concerning wheat stocks needed for national emergency. Because substitutability among wheat classes is not perfect, consideration should be given to the makeup of wheat stocks by classes as well as to total wheat stocks. Also, a wheat program that makes inadequate distinction among classes may not be the best policy.

Finally, the shift from home baking to commercial baking in the United States suggests that as per capita incomes rise in wheat importing countries, their demand for high protein hard wheats will increase since commercial bread will replace home baking. ■

---

sizes. Seven firms in the Valley harvested 1,000 or more acres of potatoes in 1962. The production of these seven firms ranged from 141,000 to over 200,000 cwt.

In a University of Minnesota study (soon to be published), the cost of storing and packing potatoes in 100-pound burlap sacks declined from 51 to 37 cents per cwt. as the size of the storing and packing unit increased from 42,000 to 240,000 cwt. As capacity increased from 240,000 to 386,000 cwt., costs declined only 1 cent more—from 37 to 36 cents. That there are few economies beyond the 240,000 cwt. size is further supported by the fact that only 13 firms packed more than 240,000 cwt. in 1962-63. And only five of these firms exceeded 350,000 cwt. in a single facility.

While there may be additional economies beyond the sizes discussed, they are probably small. From the standpoint of physical efficiency, these results suggest that four production units of about 400 acres each, organized into one storage and packing operation of about 240,000 cwt. capacity, would provide an efficient organization. However, these results are not conclusive. Additional work, now underway, must be completed before definite conclusions can be reached. ■

In perspective

Food Price Trends

Ronnie L. Burke

While retail food prices have increased steadily during the 1960's, a sharp upturn in the trend occurred in 1966. In 1962, 1963, 1964, and 1965, retail food prices averaged 3.6, 5.1, 6.4, and 8.8 percent, respectively, above the 1957-59 average (see figure 1). But 1966 retail food prices averaged about 14 percent higher than the 1957-59 average. In August 1966, the retail food price index peaked at a record high of 15.8 percent above the 1957-59 average.

This price trend has been caused by increasing per capita food consumption, strong civilian demand for food, and large military food purchases. The expanding food demand also has been augmented by a world food shortage, a stepped-up food stamp program, and reduced unemployment. Also contributing to increased food prices have been declines in the production of some foods—chiefly food grains, vegetables, deciduous fruits, and milk.

Retail food price increases appear even more pronounced when examined on the basis of 1950 average prices (see figure 2). From 1950 to 1966, prices of almost all commodity groups (meat, dairy products, fruits and vegetables, and cereal and bakery products) experienced relatively high increases. During the same period, prices of fats and oils exhibited a slightly increasing trend. Poultry was the only food group that experienced a decreasing price trend. Factors that caused the general price increases during the entire 1950-66 period were similar to the factors which caused the increases from 1957-59 to 1966.

Farm and Wholesale Prices

Prices received by farmers and wholesale processed food prices varied considerably during the 5 years of 1962-66 (see figure 1). Although farm prices showed a cyclic pattern, both general price levels demonstrated increasing trends.

During 1966, difference between these price levels decreased relative to previous years. For the third quarter of 1966, wholesale prices were up 7 percent and farm prices were up 9 percent. Retail prices averaged 4.5 percent above the same period for 1965. So farmers received a larger proportion of the consumer's food dollar in 1966 than in recent years.

Retail Food Prices in 1967[1]

Retail food prices for 1967 should average above 1966 average retail prices but the increase will not be as great as it was in 1966. Factors contributing to increased retail food prices are: (1) increased export demand for foods, (2) increased defense requirements for food, (3) a generally strong economy, and (4) decreased supplies of some foods. Increasing supplies of many farm products will moderate the price increase in 1967 relative to 1966.

Compared to 1966, consumers can expect to pay higher prices for beef, dairy products, cereal and bakery products, fats and oils, and many processed fruits and vegetables. But 1967 prices should be lower for pork, poultry, eggs, and citrus fruits. These projected changes will be due mainly to changes in available supplies of these foods.

[1] Data taken from: USDA. Nov. 1966. *National Food Situation.* NFS-118.

In Summary

- The retail price trend for food probably will continue to increase through 1967.
- Farmers received a larger proportion of the consumer's food dollar in 1966 than in recent years.
- Consumers will pay higher prices for food in 1967, but this increase will not be as large as it was in 1966. ■

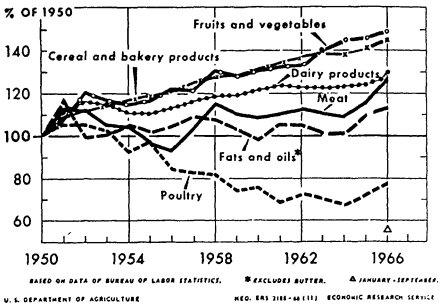


Fig. 1. Prices: retail, wholesale, and farm.

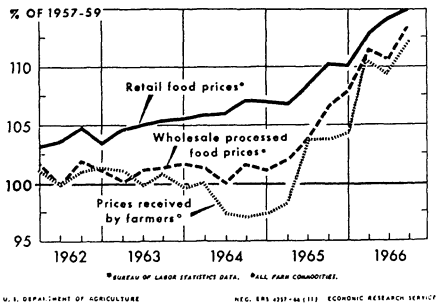


Fig. 2. Retail food prices.

Minnesota Farm Business Notes

Prepared by the Department of Agricultural Economics and the Agricultural Extension Service.

Published by the University of Minnesota, Agricultural Extension Service, Institute of Agriculture, St. Paul, Minnesota 55101.

Agricultural Extension Service
Institute of Agriculture
University of Minnesota
St. Paul, Minnesota

Luther J. Pickrel, Director

Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

OFFICIAL BUSINESS

2-67 1,895

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF
AGRICULTURE