United States
Department of
Agriculture

Economic
Research
Service

Agricultural
Economic
Report
Number 515

The U.S. Beef Cow-Calf Industry

Henry C. Gilliam, Jr.

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U.S. BEEF COW-CALF INDUSTRY, by Henry C. Gilliam, Jr., National Economics Division, Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report No. 515.

Abstract

The number of beef cows in each of the four major U.S. cow-calf production regions declined by about one-fifth between 1975 and 1980 in response to sharp reductions in feeder cattle prices and increases in production costs during the midseventies. Several physical measures of performance indicate that most resources were used more efficiently in beef cow-calf production in 1980 than in 1975. This report identifies the structural characteristics and operating practices for beef cow-calf production operations in the United States.

Keywords: Beef cattle, beef cows, cattle, cattle raising, cow-calf operations, feeder calves, feeder cattle, stocker cattle.

Note

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Washington, D.C. September 1984

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Summary

The January 1 U.S. inventory of beef cows totaled 37.1 million head in 1980, down 19 percent from the 1975 peak of 45.7 million. Geographic distribution of cow-calf production changed little during this 5-year period. Beef cow inventories in each region in which cow-calf production is a major agricultural enterprise—the South, North Central, Great Plains, and West—declined proportionately in response to sharp reductions in feeder cattle prices and increases in production costs during the midseventies.

More than 80 percent of the national beef cow inventory in 1980 was included in herds of 20 or more brood cows in these four regions. Production characteristics of very small cow-calf enterprises, those with fewer than 20 brood cows each, are not reported.

As in 1975, the 1980 distribution of beef cows by herd size differed greatly among regions. Small herds, those with 20-99 brood cows, comprised more than 90 percent of all cow-calf enterprises with 20 or more cows in the North Central region and the South, compared with 82 percent in the Great Plains and 64 percent in the West.

In the four regions combined, almost 50 percent of all beef cows in herds of 20 or more cows were included in small herds, but regional proportions ranged from about 75 percent in the North Central region to less than 25 percent in the West. At the other extreme, ranches with large herds, 500 or more brood cows, accounted for 30 percent of the beef cows in the West. Less than 3 percent of the cows in the North Central region were included in large herds.

Most cow-calf operations in the North Central region were supplemental enterprises on farms relying on crops and/or other livestock enterprises, principally hogs. The same was true in the South except for large cow-calf herds, which were concentrated on specialized ranches in central and southern Florida. By contrast, beef cattle were the only type of livestock sold by more than four-fifths of the cow-calf operators in the Great Plains and the West, and less than half of the cow-calf producers in these two regions sold any crops (other than hay) in 1980.

Individual proprietors operated more than three-fourths of the cow-calf enterprises in 1980 in the South and North Central regions, the only regions in which data on type of business organization were collected. Partnerships, often comprised of family members, operated most of the remaining small and medium-sized herds, while large herd operators were frequently organized as family or nonfamily corporations. Except for a small increase in the frequency of partnerships in the North Central region, a similar pattern of legal organization prevailed in 1975.

Many measures of livestock performance in cow-calf production were more favorable in 1980 than in 1975, resulting from improvements in herd management practices such as cow-herd culling, disease control measures, herd-sire selection, and increasing though still limited use of artificial insemination. The number of herd bulls maintained per 100 cows declined from 4.5 in 1975 to 4 in 1980. The average calving rate increased from 79 to 87 percent of all cows and heifers exposed to a bull or artificially inseminated. Calf losses declined from 5.5 to 4.4 percent of live births. Average weight of feeder cattle sold or placed on feed, influenced by growth rate and age of feeder cattle at time of sale as well as by calving and loss rates, increased from 290 to 342 pounds per cow in the herd. Yet, the proportion of feeder cattle sold as calves, rather than as yearlings, was greater in 1980.

Except in the West, less privately owned land was used per cow for grazing in 1980 than in 1975. There were large differences from region to region in the type, acreage per cow, and treatment of grazing land. Native rangeland comprised about 95 percent of the privately owned land grazed in both the West (where one-third of all producers and nearly two-thirds of those with 500 or more cows also grazed publicly owned lands on a permit basis) and the Great Plains, while improved pastures were predominant in the eastern half of the country. More than 40 percent of the total grazing acreage in the South was fertilized in 1980, compared with 20 percent in the more fertile North Central region and less than 2 percent (mostly irrigated pasture) in the Great Plains or the West.

Grass hay, grown and harvested by the cow-calf producers, was the principal type of supplemental forage fed to cow-calf herds in all regions. Feeding rates varied from 1.25 tons per cow in the South to 1.63 tons in the North Central region. In all regions, producers with larger herds generally used larger grazing acreages per cow to offset lower harvested forage feeding rates.

The hay harvesting and handling technology used by cow-calf producers changed rapidly between 1975 and 1980. Mower-conditioners were used to cut nearly 40

percent of all hay on cow-calf farms and ranches in 1980, compared with only 5 percent in 1975. Less than 10 percent of the hay in each region was packaged in large, round bales in 1975; by 1980, large, round bales were predominant in the South and the North Central region and were equal in tonnage to conventional rectangular bales in the Great Plains.

Cow-calf herd operators and other unpaid workers (usually operator family members) provided four-fifths of all the labor used directly in cow-calf production in 1980, compared with two-thirds of the total in 1975. Total enterprise labor use averaged 18 hours per cow in 1980, compared with 16 hours per cow in 1975. During both years, producers with herds of 500 or more cows used less than half as much labor per cow as was used by operators of small herds.

Definitions

Airtight upright silo: A sealed upright, cylindrical (tower) silo designed to prevent air from circulating within the ensiled feedstuffs.

Annual pasture: Land, usually cropland, on which annually seeded grasses and/or legumes are established and used primarily for grazing; also, plant materials grazed from such intensively managed pastureland.

Beef cows: Female cattle, kept for nondairy purposes, which have calved one or more times (sometimes termed brood cows).

Beef cow-calf production: An enterprise in which cows are bred and maintained for the primary purpose of producing stocker or feeder calves and/or yearlings.

Breeding herd: Cattle used or intended primarily to produce progeny, rather than for direct use as stocker, feeder, or slaughter cattle.

Bulls: Intact (noncastrated) male cattle.

Calf loss rate: The number of calves lost because of death, theft, and other causes during a calendar year per 100 calves born alive during that calendar year.

Calving: Giving birth to a calf.

Calving rate: Number of calves born alive during the production year per 100 sexually mature female cattle (cows plus breeding-age heifers) exposed to a bull or artificially inseminated approximately 9 months earlier.

Cattle cycle: A period of approximately 10 years in which the number of beef cattle in the Nation is alternately expanded and reduced for several consecutive years in response to perceived changes in the profitability of beef production. (See figure 2.)

Cattle disposition: Cattle sale, for feedlot placement without ownership transfer.

Cattle feeding: The feeding of grain and other concentrate feedstuffs to produce slaughter cattle grading Good or better.

Corporation: A joint-stock company, chartered by the State, which can conduct business as a legal entity, apart from the stockholders who own it, under the guidance of a board of directors.

Cow and replacement heifer loss rate: The number of cows and replacement heifers lost because of death, theft, and other causes during a calendar year per 100 cows and yearlings or older heifers exposed to a bull or artificially inseminated to produce a calf during that calendar year.

Cropland pasture: Land suitable for the cultivation and harvesting of crops used exclusively for grazing during one or more consecutive growing periods; also, plant materials grazed from such land.

Crop residue pasture: Plant materials grazed on land from which a crop has been harvested during the production year.

Estrus: The period, normally triggered by ovulation, during which a cow or sexually mature heifer willingly permits natural insemination; the heat period.

Feed bunk: A container (trough) designed to hold and provide livestock access to feedstuffs.

Feeder calf: An animal mature enough to be placed in a feedlot, but less than 1 year old.

Feeder yearling: An animal suitable for feedlot placement that is older than 1, but less than 2 years old.

Feedlot: An enterprise in which cattle are fed grain and other concentrate feedstuffs to produce carcasses grading Good or better when slaughtered.

Fenceline bunk: A container (trough) designed to hold and provide livestock access to feedstuffs, which is constructed as part of the lot enclosure and serviced from outside the lot.

Forages: Plant materials grazed or harvested as hay or silage for livestock feed.

Front-end loader: A hydraulically operated implement mounted on the front of a tractor used for collecting and lifting materials, especially feedstuffs and manure in cow-calf operations.

Grass silage: Any harvested nongrain crop forages stored at a moisture content high enough to allow fermentation and preservation in a silo.

Headgate: A facility consisting of a pair of adjustable vertical bars, mounted in a passageway, which can be closed around the neck of cattle to restrict forward and backward movement.

Heifers: Immature female cattle.

Horizontal silo: Any type of silo constructed horizontally on or below the surface of the ground; sometimes called a bunker silo (above ground) or trench silo (excavated).

Improved perennial pasture: Pastureland, covered with predominantly perennial grasses and/or legumes, managed relatively intensively through recurring application of such agronomic practices as reseeding, fertilization, and/or mechanical or chemical weed control; also, plant materials grazed from intensively managed perennial pastureland (sometimes termed tame pasture).

Individual proprietorship: A business organized and directed by a sole owner.

Large bale mover: Tractor-mounted spikes or trailed implements designed to lift, transport, and unload large round (cylindrical) hay bales.

Lot: A relatively small, fenced enclosure for cattle; a pen or corral.

Mechanical stack mover: A machine that loads, transports, and unloads mechanically formed hay stacks.

Mobile grinder-mixer: A tractor-powered machine that both grinds and mixes feedstuffs and can be used to transport and distribute feeds.

Mower-conditioner: A machine that both mows (clips) forage crops and conveys the mowed plant materials through rollers which crush or crimp plant stems to speed drying.

Native pasture: Unimproved or nonintensively managed open (nonforested) pastureland; also, plant materials from predominantly native or escaped (introduced but unintentionally spread) species, grazed from nonintensively managed pastureland.

Nonairtight upright silo: An unsealed (conventional), upright, cylindrical (tower) silo in which air circulation is retarded only by the density of the ensiled feedstuffs.

Partnership: A business organized under the direction of two or more joint owners.

Pasture: Land used for grazing; also, deliberately established and/or naturally occurring plant materials grazed.

Portable bunk: A container (trough) designed to hold and provide livestock access to feedstuffs which is situated inside a lot or pasture and which can be moved with tractor power.

Pregnancy testing: Physical examination, usually manual palpation of the reproductive organs, by a trained examiner (often a veterinarian) to determine pregnancy.

Range: Large tracts of relatively unmodified grazing land, usually in the West; also, plant materials from predominantly native species grazed from rangeland.

Replacement heifers: Immature female cattle selected at or after weaning to be bred and added to the brood cow herd.

Self-feeder: A feed container consisting of a storage compartment designed to release feedstuffs gradually into an attached bunk (trough), manger, or other feed provider to which livestock have free access.

Shrink: Livestock weight loss often associated with handling (processing) and transportation of livestock during the marketing process.

Sickle mower: A machine that mows (clips) standing forage crops.

Small grain pasture: Land on which small grains (wheat, oats, barley, and/or rye) are grazed during the early vegetative growth stage prior to subsequent grain or forage harvest or complete utilization for grazing; also, plant materials grazed from immature small grains.

Squeeze chute: A cattle restraint facility consisting of a headgate and adjustable side(s) with access doors used to immobilize cattle for detailed inspection or treatment; a squeeze chute that can be pivoted to raise the animal's feet from the ground is sometimes called a calf or bull table.

Stacker wagon: A self-propelled or tractor-powered machine that picks up, stacks, transports, and unloads rectangular hay bales.

Steers: Male cattle castrated before sexual maturity.

Stocker cattle: Cattle (calves or older animals) maintained primarily on pasture, range, or harvested forages to increase weight and maturity before being placed in a feedlot.

Stocker-feeder enterprise: An enterprise in which grazing or harvested forages are the predominant feeds used to grow stocker calves into feedlot-ready feeder cattle.

Swather: A machine that mows (clips) forage crops and accumulates the mowed plant materials into swaths or windows.

Tractor front-end stacker: An implement mounted on the front of a tractor that picks up and stacks rectangular hay bales.

Woodland pasture: Forested land used for grazing; also, plant materials grazed from forested land.

Yearling loss rate: The number of yearlings lost because of death, theft, and other causes during a calendar year per 100 calves born alive during that calendar year.

U.S. Beef Cow-Calf Industry

Henry C. Gilliam, Jr.*

Introduction

Beef cow-calf production, the maintenance and breeding of cows to produce stocker or feeder calves or yearlings, is relatively widespread and economically important in most U.S. regions. The wide range of climatic, topographic, and agronomic conditions under which cow-calf enterprises are operated helps to account for the diversity in resource use, production practices, and other agricultural enterprises associated with feeder cattle production. This diversity in production organization enlarges the range of natural and economic forces affecting profitability of parts or all of the beef cow-calf sector. It also influences the nature, extent, and speed of production adjustments within the sector.

Objectives

This report identifies and describes major characteristics of U.S. beef cow-calf production during 1980 and evaluates recent changes in some important features of the sector. Specific objectives are: (1) identify the regional and herd-size distributions of cow-calf enterprises in the United States in 1980, (2) describe and compare the composition and organization of farms and ranches which include cow-calf enterprises, (3) specify livestock and forage production practices used on these farms and ranches, (4) provide detailed information on the types and amounts of resources used and feeder cattle produced, and (5) evaluate changes between 1975 and 1980 in selected production characteristics.

Detailed input-output relationships summarized in this report also provide a principal basis for estimating cow-calf production costs.

Data Sources

Data from the census of agriculture are used to determine regional distributions of beef cows and of farms and ranches with cow-calf enterprises by size of cow herd (*14*).[1] Data published by the Statistical Reporting Service (SRS) and the Economic Research Service (ERS), U.S. Department of Agriculture (USDA), provide information on trends in livestock inventories and agricultural land uses.

Most information in this report, however, is taken from a personal interview survey of beef cow-calf producers conducted by SRS and ERS in 1981, focusing on 1980 production organization, practices, and performance. The survey area included all or parts of 36 States. Of the conterminous United States, only West Virginia, the Northeast, and northern counties of Michigan, Wisconsin, and Minnesota were excluded (fig. 1). States in the survey area accounted for 98 percent of the total U.S. inventory of beef cows (table 1).

Subregions delineated along crop reporting district or State lines in the West, the Great Plains, and the South, plus the North Central region in its entirety, were specified as geographic strata for the survey (fig. 1). Lists of cow-calf producers in each of the resulting 17 geographic areas were developed and stratified by size of enterprise (number of beef cows) from existing SRS records. The sample of producers to be surveyed was selected at random from these stratified lists.

A weight to account for probability of selection in the sample was assigned to data from each producer surveyed to provide representative results within each subregion-enterprise size stratum. These data were then weighted to reflect the proportion of total regional or national beef cow or farm and ranch numbers attributable to producers in each subregion-enterprise size group. Aggregations of the weighted data thus reflect average overall relationships for the region or Nation.

Producers with the following characteristics were eliminated from the survey sample: (1) producers who either started or got out of the cow-calf business during 1980, (2) those for whom the sale of dairy products represented 25 percent or more of the total income from the cattle enterprise during 1980, (3) producers whose sales of breeding stock amounted to 25 percent or more of all cattle sold during the year, (4) those who

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[1]Italicized numbers in parentheses represent items cited in the References section.

did not raise from their own cow herds at least 90 percent of the calves and yearlings that they sold during 1980, (5) producers whose cattle sales during the year included 10 percent or more of grain-fattened slaughter cattle, and (6) those who did not have as many as 20 beef brood cows at some time during 1980.

These restrictions were imposed to ensure that the survey data represented results of a full year of operation of relatively typical, commercial beef cow-calf enterprises. Restriction number 1 eliminated producers whose experience and records did not cover the entire survey year. Restrictions 2 through 5 deleted mixed operations which may have involved, respectively, dairy, purebred beef-breeding stock, purchased stocker-feeder, or cattle-feeding activities in addition to (or instead of) cow-calf production. Restriction 6 eliminated very small cow-calf herds, frequently maintained for personal, rather than economic, reasons. Based on 1978 Census of Agriculture data, more than 50 percent of the farms with beef cows, but only about 14 percent of the beef cow national inventory, were excluded from the survey as a result of this restriction (table 2).

The survey obtained information not available from other sources concerning beef cow-calf production practices and physical input-output relationships during 1980. Similar information relating to 1975 production was collected in a producer survey conducted by SRS and ERS in 1976, permitting selected comparisons and analyses of change over this 5-year period (*1*).

Physical data from the 1976 survey in conjunction with available current input and product price information have been used to derive annual estimates of cow-calf enterprise costs and returns. Data from the 1981 survey

Figure 1

Regions and Subregions for Beef Cow-Calf Survey

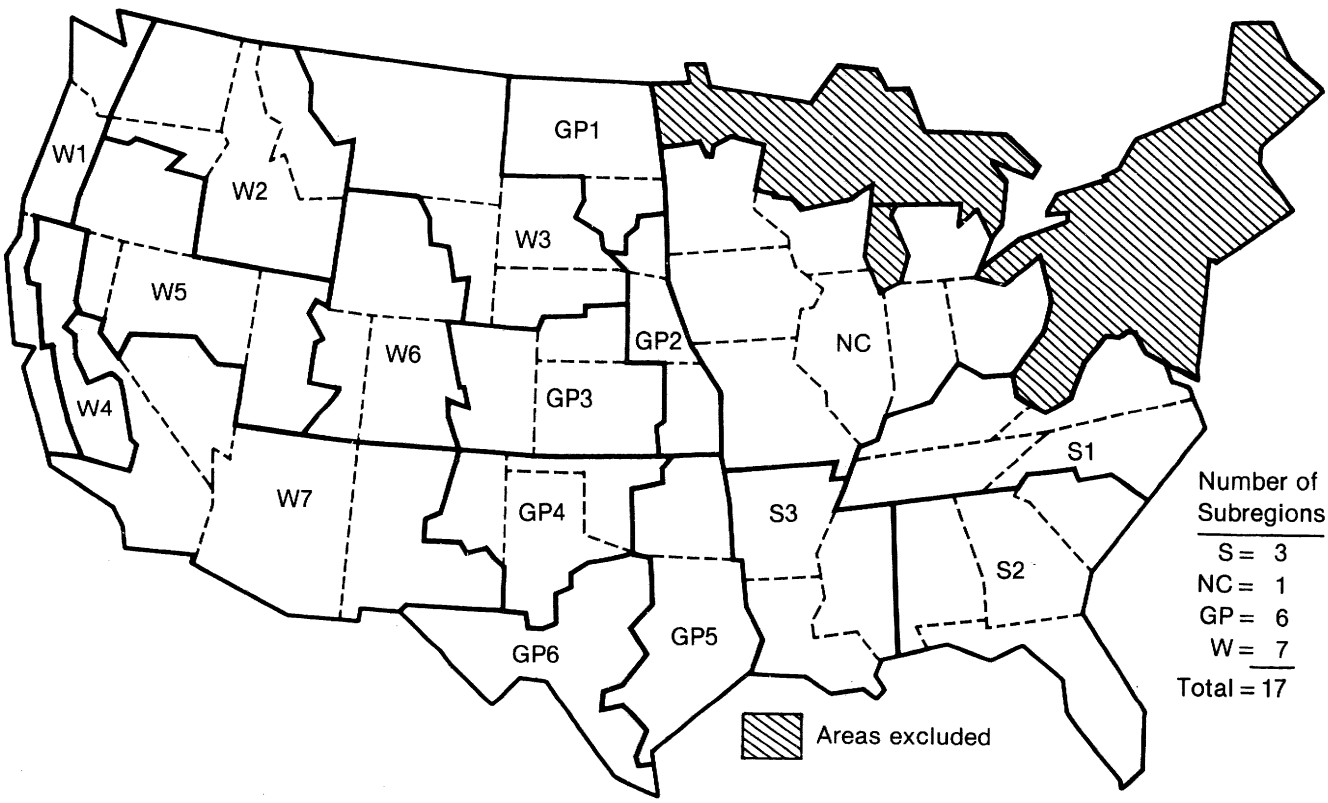


Table 1—Number and distribution of U.S. beef cow herd, by selected regions and States, January 1, 1980

Region and State	Number[1]	Proportion of regional total	Proportion of U.S. total
	1,000 head	*Percent*	
U.S. total	37,086	—	100.0
Northeast[2]	419	100.0	1.1
South:	9,112	100.0	24.6
Alabama	847	9.3	2.3
Arkansas	1,069	11.7	2.9
Florida	1,173	12.9	3.1
Georgia	747	8.2	2.0
Kentucky	1,106	12.1	3.0
Louisiana	674	7.4	1.8
Mississippi	901	9.9	2.4
North Carolina	412	4.5	1.1
South Carolina	284	3.1	.8
Tennessee	948	10.4	2.6
Virginia	710	7.8	1.9
West Virginia	241	2.7	.7
North Central:	6,581	100.0	17.7
Illinois	699	10.6	1.9
Indiana	515	7.8	1.4
Iowa	1,746	26.6	4.7
Michigan	140	2.1	.4
Minnesota	560	8.5	1.5
Missouri	2,278	34.6	6.1
Ohio	395	6.0	1.0
Wisconsin	248	3.8	.7
Great Plains:	13,903	100.0	37.5
Kansas	1,716	12.3	4.6
Nebraska	1,950	14.0	5.3
North Dakota	962	6.9	2.6
Oklahoma	2,160	15.6	5.8
South Dakota	1,530	11.0	4.1
Texas	5,585	40.2	15.1
West:	7,071	100.0	19.1
Alaska	3	*	*
Arizona	258	3.6	.7
California	869	12.3	2.4
Colorado	853	12.1	2.3
Hawaii	83	1.2	.2
Idaho	642	9.1	1.7
Montana	1,427	20.2	3.9
Nevada	305	4.3	.8
New Mexico	626	8.8	1.7
Oregon	681	9.6	1.8
Utah	325	4.6	.9
Washington	379	5.4	1.0
Wyoming	620	8.8	1.7

*Less than 0.05 percent.
[1]Beef cows and heifers that have calved.
[2]Includes Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
Source: (*13*).

will be a primary basis for cost and return estimates and analyses.[2]

Background

The terms cow-calf production and beef cow-calf production are used interchangeably in this report to include any cattle-breeding enterprise operated primarily for the production and sale of young cattle subsequently grown out and/or conditioned for slaughter. Included under this broad definition are enterprises not selling all, or any, of the young cattle until they are more than 1 year old (but usually less than 2 years old). These are sometimes called cow-calf-yearling or cow-yearling operations to differentiate them from operations selling all young cattle as calves (before they are 1 year old).

Cow-calf production is the first stage of the rather lengthy production process resulting in retail beef. About 2-1/2 years usually elapse between the breeding of beef cows and heifers and the time when the resulting beef is available for retail sale. A decision by a cow-calf producer to expand production may not result in additional retail beef for another 4-1/2 years (fig. 2). The action taken by cow-calf producers to expand production (retaining and breeding heifers that would have been available for slaughter if no expansion in production were attempted) causes beef production to *decrease* before it increases.

Conversely, to reduce production, cow-calf producers normally retain fewer heifers for breeding and/or cull more brood cows than would be feasible if output were to be maintained. Slaughter of these additional cattle causes beef output to *increase* before declining.

Average production costs of and prices received for feeder cattle are major profit factors of cow-calf production. Feeder cattle prices are affected by prices paid for fed cattle which, in turn, are affected by consumer demand for beef as reflected in retail beef prices. Actions on the part of cow-calf producers to increase (decrease) production in response to high (low) beef prices are slow in taking effect and are likely to intensify the perceived need for change during the interim, promoting overreaction.

[2]Budgets of costs and returns for cow-calf enterprises of different sizes, types, and geographical subregions are assembled annually by the ERS Firm Enterprise Data System based at Oklahoma State University. Estimates of regional and national average costs and returns are also published annually. See, for example, (*8*).

Table 2—Distribution of beef cows and of farms and ranches with beef cows, by cow herd size and selected regions, 1978

Region	Cow herd size (head)				
	1-19	20-99	100-199	200-499	500 or more
			Percent		
Beef cows and heifers which have calved:[1]					
U.S. total	14.2	41.3	15.6	15.2	13.7
Northeast	52.5	38.1	5.3	3.2	.9
South	22.4	45.6	12.2	9.7	10.1
North Central	20.9	58.5	12.5	6.0	2.1
Great Plains	9.7	41.6	18.5	16.8	13.4
West	5.4	21.0	17.5	27.3	28.8
Farms and ranches with beef cows:					
U.S. total	58.3	35.3	4.1	1.9	.4
Northeast	88.2	11.2	.4	.1	.1
South	66.2	30.4	2.3	.9	.2
North Central	60.4	36.6	2.4	.5	.1
Great Plains	45.6	44.7	6.4	2.7	.6
West	52.5	30.7	8.6	6.2	2.0

[1]Distribution of beef cows and heifers among herds of 200-499 and 500 or more cows was estimated for States in which census data were combined to avoid disclosure of individual operations.
Source: (*14*).

This helps to explain the periodic swings in beef cattle numbers, a phenomenon termed the cattle cycle. The number of beef cows in the United States on January 1 almost tripled from 1950 to 1975, increasing from 16.7 to 45.7 million head (fig. 3). This long-term expansion was temporarily reversed during 1955-57, and slowed drastically during the midsixties. More recently, a sharp decline in beef cow numbers starting in 1975 and lasting for 5 years reduced the national inventory by 19 percent to 37.1 million head by January 1, 1980. Numbers then increased to 39.4 million on January 1, 1982, but declined by 1.2 million (to 38.1 million) before the year's end.

Year-to-year changes in the U.S. beef cow inventory would probably be even more pronounced if feeder cattle prices were the only factor affecting cow-calf production profits. Because cattle are routinely transported, changes in cattle prices tend to be similar for all areas of the country. By contrast, changes in annual costs of production, the other major determinant of cow-calf profitability, are more variable from area to area, partially because of differences in the cost of providing forages for grazing, the principal feed source in cow-calf production.

Cropland pasture comprises more than 30 percent of the total area grazed in the North Central region, for example, and more than 25 percent of the total in the South, compared with less than 2 percent in the West (table 3). Cropland pasture is usually fertilized regularly and tilled periodically to prepare for reseeding. Thus, petroleum price increases have a greater impact on costs of grazing resources in the eastern half of the Nation than in western range areas. On the other hand, changes in public land grazing fees affect cow-calf production costs in the West much more than in any other region. Abnormal weather conditions during any given time period may also cause forage productivity and costs to differ drastically among regions or more localized areas within regions.

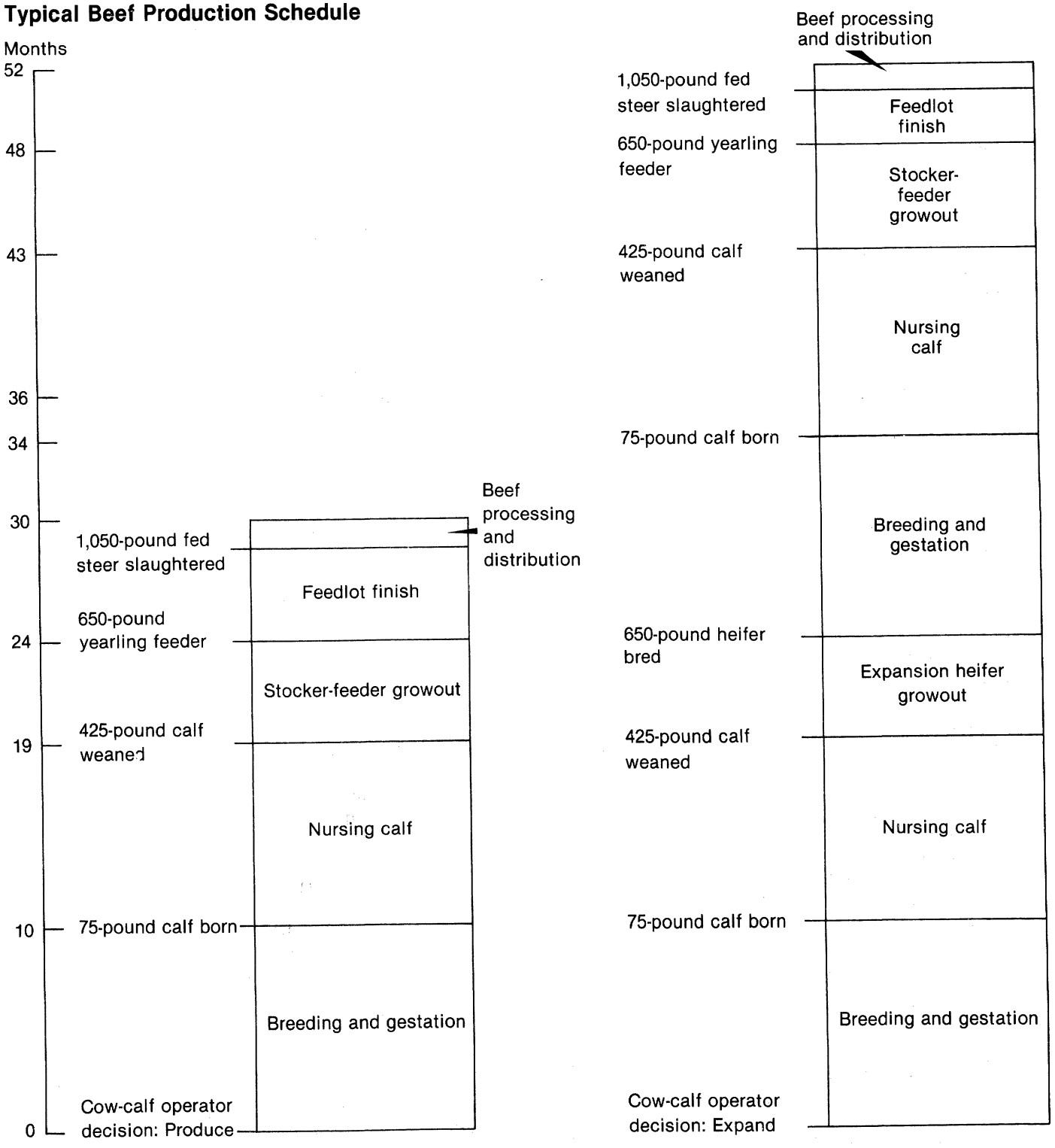
The relative importance and costs of resources other than forages used in cow-calf production also vary from area to area and over time. Information on all such differences and changes is needed to analyze and predict developments in the beef cow-calf sector.

Regional and Herd-Size Distributions

Climate, topography, soil fertility, and cultural practices are major factors affecting resource and product characteristics of beef cow-calf production. Each area differing appreciably in ecological or type-of-farming attributes would ideally be studied separately in an analysis of the cow-calf sector. Resources available for this analysis, however, limited the extent of geographical detail to the 17 subregions delineated in figure 1. Separate input-output relationships were derived for each of these subregions. For brevity, however, information in this report is summarized at the broader regional level.

Figure 2

Typical Beef Production Schedule



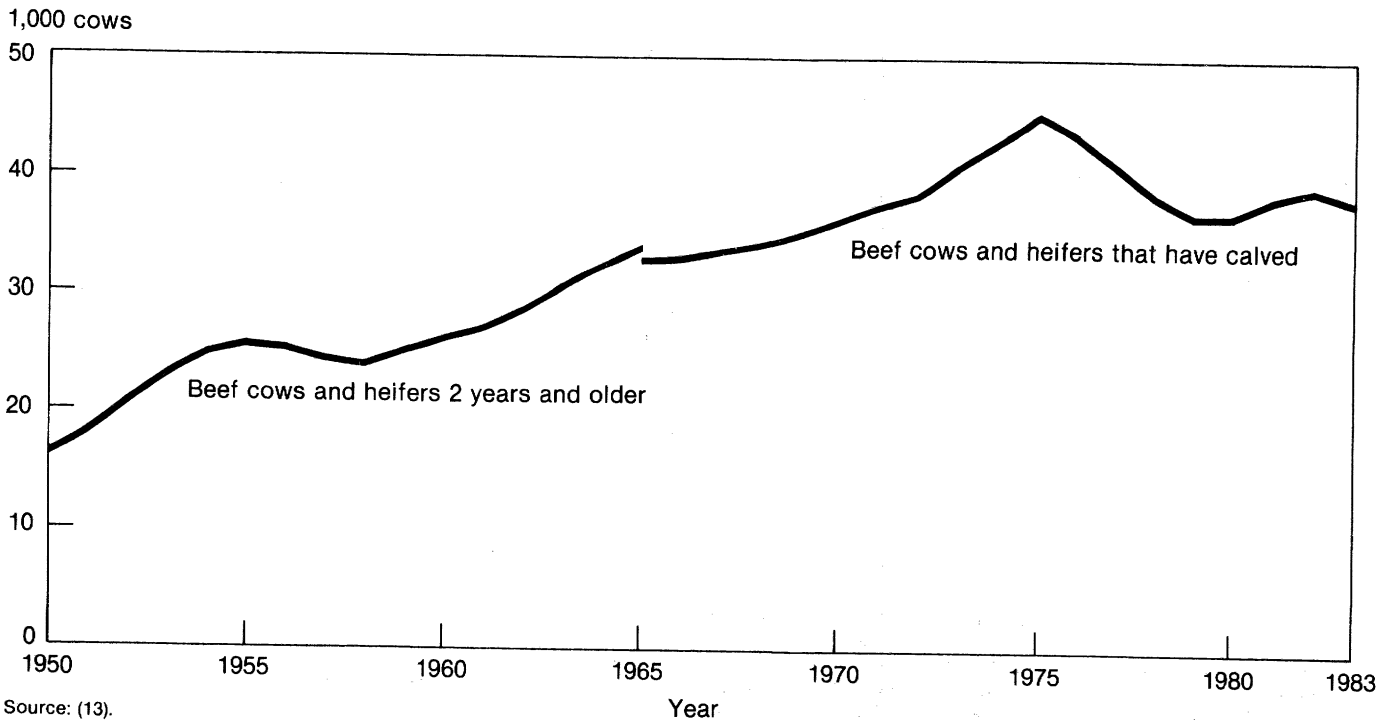
Regional Descriptions

Moderate temperatures, abundant precipitation, and infertile soils predominate in the 11 States designated as the South (fig. 1). Diversity characterizes the natural resources of the South to a greater extent than in some of the other regions. For example, the freeze-free growing season ranges from year-round in southern Florida to less than 6 months in the higher elevations of the southern Appalachian Mountains in Virginia and Kentucky. Annual average temperatures range from about 75 to only 50 degrees Fahrenheit, respectively, in these two areas. Annual precipitation is highest, at more than 70 inches in semitropical southern Florida, but ranges to near 40 inches in western Arkansas. Less than 10 percent of all land in the Mississippi Delta area is forested. Up to 80 percent of some Appalachian counties are woodland; yet woodland pasture is of little importance, especially in Tennessee, Kentucky, Virginia, and the Carolinas. Improved perennial grasses requiring periodic reestablishment and frequent fertilization are the principal source of grazing and hay over most of the region. However, Kentucky bluegrass provides good native pasture in the higher elevations of the more northern States, unimproved Bermudagrass is grazed over much of the region, and true native grasses, sedges, and forbs provide range in southern Florida and along the gulf coast. Most cow-calf operations are relatively small enterprises on row crop farms, but quite large, specialized cattle ranches are common in central and southern Florida.

The North Central region comprises the fertile Corn Belt and the Lake States. Annual precipitation ranges from less than 30 inches along the western border to near 50 inches in southern Ohio and Indiana. The freeze-free growing season ranges from less than 5 months in the central Lake States to more than 7 months in southeastern Missouri. Woodland grazing is common on steeply sloping land in southern areas of Missouri and Illinois, while native prairie grasses and bluegrass are pastured on nontillable land in other parts of the region. Permanent or rotation pastures seeded to orchardgrass, brome, or fescue, in combination with alfalfa or other legumes, provide high-quality grazing and hay. Corn silage is widely used as winter feed, especially on farms that have, or recently had, beef cattle feeding or dairy enterprises. Residues from

Figure 3

Number of Beef Cows in the United States, January 1



Source: (13).

the corn and soybean crops which are usually primary enterprises on farms with cow-calf operations provide abundant forage for fall grazing.

The Great Plains region includes most of both the northern and southern Plains. Northeastern New Mexico and the eastern half of Colorado are included in the Great Plains. The western half of South Dakota and northwestern Nebraska, areas in which grazing on federally owned public land is common, are considered part of the West. Annual precipitation in the Great Plains ranges from more than 40 inches in eastern Texas to less than 20 inches along the western border of the region. The freeze-free period varies from only about 100 days in northern North Dakota to more than 10 months in southern Texas. The dominance of wheat production (spring wheat in the northern half, winter wheat in the south) has led to the label "breadbasket of the country" for this region. Corn, an increasing proportion of which is irrigated from east to west, is also an important crop in southeastern South Dakota and eastern Nebraska and Kansas, as is grain sorghum in Nebraska, Kansas, and Texas and cotton in Oklahoma and Texas. However, much of the land, especially in the western half of the region, is in native range on which precipitation limits productivity. Alfalfa and prairie hay and/or corn silage are fed when snow cover or drought curtails range grazing. Crop residues are also grazed. Winter

Table 3—Total acreage of pasture and range by type, animal units grazed, and acreage per animal unit grazed, January 1

Region and year	Cropland used only for pasture[1]	Permanent grassland pasture and range[2]	Woodland pasture and forest land grazed[2]	Total pasture and range	Total animal units grazed[3]	Pasture acres per animal unit grazed
	1,000 acres				*1,000 units*	*Acres*
U.S. total:						
1969	88,220	603,615	198,046	889,878	80,911	11.0
1974	82,736	597,833	179,419	859,988	91,969	9.4
1978	76,159	586,721	171,771	834,651	80,649	10.3
Northeast:						
1969	3,669	3,162	2,238	9,069	4,228	2.1
1974	3,106	3,390	1,902	8,398	3,998	2.1
1978	3,117	2,963	2,147	8,227	3,861	2.1
South:						
1969	24,746	27,358	41,679	93,783	16,271	5.8
1974	23,643	26,288	35,053	84,984	18,482	4.6
1978	21,505	20,826	34,205	76,536	17,505	4.4
North Central:						
1969	22,179	20,123	16,710	59,012	18,908	3.1
1974	19,780	18,983	13,701	52,464	21,859	2.4
1978	17,883	16,725	11,403	46,011	18,105	2.5
Great Plains:						
1969	28,106	184,289	28,699	241,094	25,634	9.4
1974	28,140	185,323	25,530	238,993	30,795	7.8
1978	25,752	184,685	22,870	233,307	26,682	8.7
West:						
1969	9,520	368,683	108,717	486,920	15,870	30.7
1974	8,067	363,849	103,233	475,149	16,835	28.2
1978	7,902	361,522	101,146	470,570	14,496	32.5

[1]Excludes acreage used for hay aftermath or crop residue grazing after, or small grain pasture grazing before, a crop was harvested.
[2]Includes land not in farms, such as Federal lands.
[3]Animal unit equivalents estimated as follows: January 1 inventories of milk cows plus beef cows plus bulls 500 lb. and over = 1 animal unit each; all heifers 500 lb. and over plus steers 500 lb. and over minus cattle and calves on feed January 1 = 0.67 animal unit each; January steers, heifers, and bulls under 500 lb. = 0.5 animal unit each; January 1 stock sheep 1 year and older plus goats clipped = 0.2 animal unit.
Sources: (*2, 3, 4*).

wheat usually provides nutritious winter pasture in the southern Plains, but stocker calves are more frequently used than beef cows to utilize this high-quality grazing. Large ranches producing only hay fed on the ranch or no crops at all are common in southwestern areas of the region, but most cow-calf production is attributable to the vast majority of operators who also have one or more major crop enterprises.

Extremes in ecological conditions are common in the West. Elevations vary, often abruptly, from less than 500 feet in the broad, fertile, intensively cultivated river valleys of California to peaks of more than 14,000 feet in the Sierra Nevada and Rocky Mountains. The freeze-free period ranges from year long in southern California coastal areas to less than 2 months on the higher plateaus. Annual precipitation averages more than 100 inches in the higher elevations of western Washington and Oregon, but 25 inches or less in most river valleys and down to 6 inches or less in intermountain basins and southern desert areas. Much of the land outside the river valleys is owned by the Federal or State governments which regulate grazing of privately owned livestock through grazing permits administered by the U.S. Bureau of Land Management (BLM), U.S. Forest Service (FS), or State agencies. Cow-calf operators who run cattle on these public lands normally depend on privately owned property for additional grazing (either native range or tame pastures) and hay or crop residues during seasons when public land grazing is unavailable.

Regional Production

Actual output of the beef cow-calf sector cannot be estimated directly; no data are available concerning the pounds of feeder cattle and cull breeding stock produced during any specified time period. Beef cow numbers are most frequently used to approximate production. The number of farms and ranches with cow-calf enterprises is less useful as an indicator of regional production because of large variations in average size of cow herds from region to region. But this indicator does give some information about dispersion of production.

The census of agriculture is the only consistent source of substate information on numbers of beef cows and associated farms. The South, with nearly one-third of the national total, had more cow-calf farms than any other region, according to the 1978 census (fig. 4). The Great Plains included more than one-fourth of all operations, almost one-fourth were in the North Central region, and the West accounted for only one-tenth.

By contrast, more than one-fifth of all beef cows were included in the West, only slightly fewer than in the South (fig. 4). More than one-third of the national beef cow inventory was in the Great Plains, while the North Central region included about one-sixth.

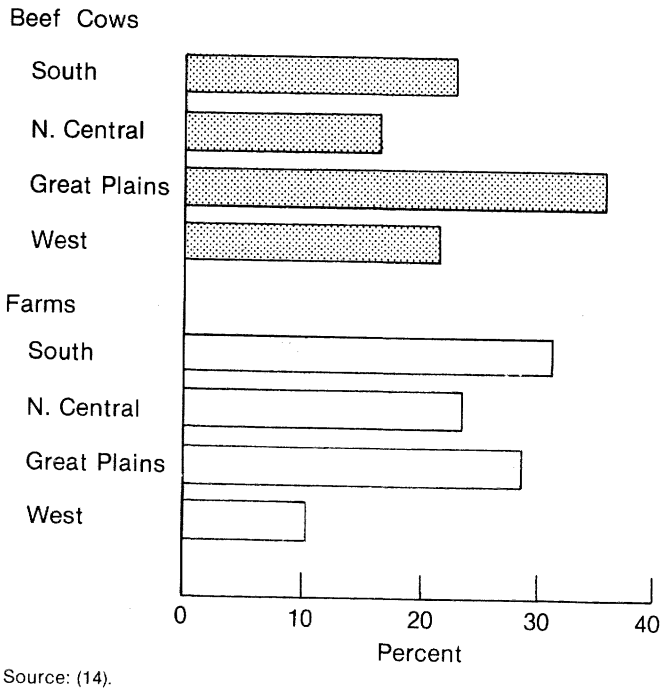
Regional proportions of the U.S. beef cow herd have changed relatively little during the last 20 years, even though the national inventory has ranged from fewer than 30 million to more than 45 million cows. The share in each region varied by no more than 2 percentage points from one year to another, according to data from the last four censuses of agriculture (fig. 5). Producers in each region tended to expand or decrease beef cow numbers at the same times during this period. The relative magnitude of inventory changes within regions was least, however, in the West, where rangeland suitable only for grazing is most important in cow-calf production. The greatest relative change occurred in the North Central region, where more of the land may be grazed or cropped, depending on economic conditions.

Size of Enterprise

The beef cow-calf production sector has always included many producers with very small herds. In 1974, only

Figure 4

Distribution of Beef Cows and of Farms with Beef Cows, 1978



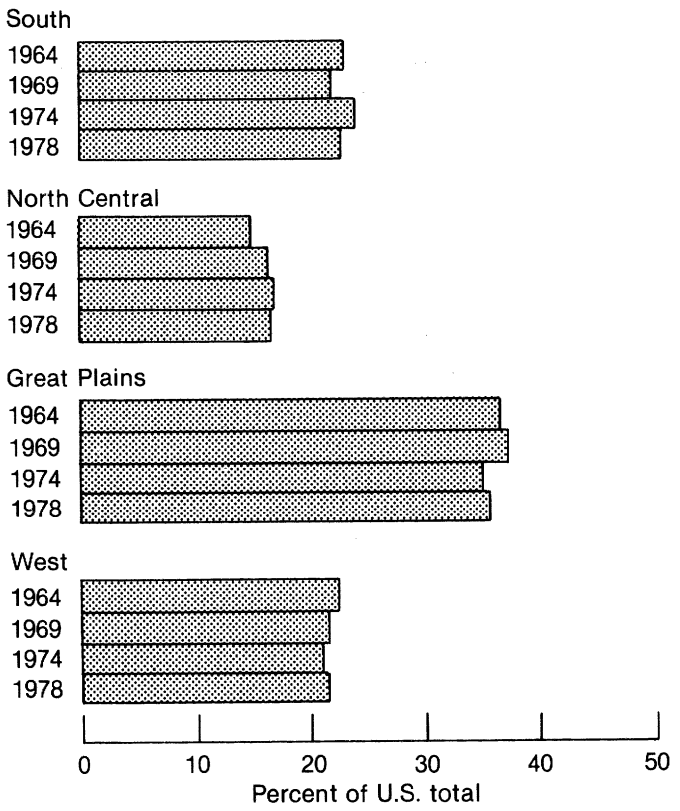
Source: (14).

1 year before the U.S. beef cow inventory reached an all-time high, for example, one-fourth of all cow-calf herds included fewer than 10 brood cows, and almost half contained fewer than 20 cows each. The overall average herd size was 40 cows (*14*).

Average herd size declined with the rapid reduction in beef cow numbers beginning in 1975. The average U.S. beef cow-calf herd had dropped to 34 brood cows by 1978, the last year for which comprehensive data are available. More than 58 percent of all herds contained fewer than 20 cows (table 2). As in the past, such very small operations were predominant in the Northeast (excluded from this study) where herds of fewer than 20 cows each accounted for seven-eighths of all operations and more than half of all beef cows. Two-thirds and three-fifths of all herds in the South and North Central regions, respectively, had fewer than 20 cows each in 1978. One-fifth or more of the total beef cow inventories in these regions were excluded from the 1981 survey and are not represented in this report. Less than one-tenth of all cows were excluded in the Great Plains and the West, although close to half of all herds were too small for inclusion in this study.

Figure 5

Regional Distribution of Beef Cows, 1964-78



Source: (14).

Thus, the following information applies specifically to only about 40 percent of all beef cow-calf operations—those with 20 or more brood cows located in the four major cattle-raising regions. These operations, however, included more than 80 percent of all beef cows in the Nation, accounting for the majority of the Nation's commercial beef cow-calf production.

Analysis of Herd Sizes

General observation and past studies indicate strongly that the types, quantities, and per-head costs of inputs used in beef cow-calf production in a given area often differ considerably for enterprises of different sizes (*1, 7, 15*). Data are summarized separately in this report for the following three herd-size classes: (1) small herds with 20 to 100 cows, which are usually supplementary enterprises on commercial crop farms or major enterprises on part-time farms or ranches; (2) medium-sized herds of from 100 to 500 cows, which are normally a major or only enterprise on the farm or ranch; and (3) large herds of 500 or more cows, which are almost always located on ranches specializing in cow-calf production.

Almost six-sevenths of the farms and ranches with 20 or more beef cows in the four regions combined had herds with fewer than 100 cows each, based on data from the 1981 survey and the 1978 Census of Agriculture (table 4). The proportion ranged from less than two-thirds in the West, where specialized cattle ranching is dominant, to more than nine-tenths of the North Central farms with cow-calf herds of 20 or more brood cows. Most of these included one or more major crop enterprises and many had other livestock in addition to beef cattle. The proportion of herds comprised of 100-499 brood cows was nearly twice as great in the West as in the Great Plains, and more than four times as large as in the North Central region. Large operations, with 500 or more beef cows, were scarce in the North Central region, but comprised more than 1 in 25 of the ranches in the West.

Distribution of beef cows among the three herd-size groups was considerably less extreme than was the distribution of farms and ranches. Less than half of all cows in herds of 20 or more were included in herds of 20-99 cows in the four regions combined, while operations with 500 or more cows accounted for nearly one-

Table 4—Distribution of farms and ranches with, and beef cows in herds of, 20 or more cows, 1980

Region	Cow herd size (head)							
	Farms and ranches				Beef cows			
	20-99	100-499	500 or more	All sizes	20-99	100-499	500 or more	All sizes
	----------*Percent*----------			*1,000 farms*	---------- *Percent* ----------			*1,000 cows*
South	89.7	9.7	0.6	110.2	58.3	28.4	13.3	6,317.5
North Central	92.5	7.3	.2	101.2	74.0	23.3	2.7	4,820.1
Great Plains	81.9	17.0	1.1	141.5	46.1	39.8	14.1	11,456.0
West	64.3	31.3	4.4	52.3	24.1	46.0	29.9	7,191.0
All regions	84.4	14.4	1.2	405.2	47.9	36.2	15.9	29,784.6

sixth of the total (table 4). In terms of cows as well as operations, large herds were least important in the North Central region but most important in the West. The West, in fact, was the only region in which herds of 500 or more cows contained a higher proportion of the total inventory in 1980 than herds with fewer than 100 cows.

Farm and Ranch Characteristics

Most feed nutrients used in beef cow-calf production come from grazed forages. Experimental units have been designed to weaken or break this traditional tie between feeder calf production and grazing land. In these units, all feeds are transported to brood cows maintained under drylot conditions similar to those generally used in the feedlot fattening of slaughter cattle. However, few commercial applications have survived. Despite development of machinery which facilitates collecting, packaging, and transporting of such low-cost forages as corn stalks or other crop residues, cow-calf production in drylot has not proven economically competitive (*7*).

Farm or ranch acreage and land quality thus have a direct influence on cow-calf production potential. Among other general farm characteristics that may affect the magnitude, timing, production practices, and/or profitability of cow-calf production are enterprise combinations, operator experience in cow-calf or general farm production, legal form of business organization, and operator tenure.

Some characteristics important in the humid eastern half of the country (the South and North Central regions) are relatively less important in the more arid western regions (the Great Plains and the West) and *vice versa*. The frequency, variety, and importance of row crops produced in conjunction with feeder cattle constitute an example; most cow-calf farms in the South and the North Central region also produce crops for sale, while many ranchers in the Great Plains and the West produce no crops other than hay for their own cattle. On the other hand, the provision and costs of livestock water are a much more important consideration in the western regions. Because of such differences, information on some aspects of cow-calf production was collected during the 1981 survey from producers in only the eastern or the western regions.

Acreage and Type of Land

Farms and ranches with cow-calf herds of 20 or more brood cows in 1981 were relatively large, averaging just under 1,200 acres in the four regions combined (table 5). The average size of all commercial farms (farms with annual sales of $2,500 or more) in these regions in 1978 was only 510 acres. But farms with cow-calf enterprises were apparently less productive than average; cropland comprised only 22 percent of all land on beef cattle farms and ranches, less than half the proportion on all farms. Cropland proportions of all land on cow-calf farms versus all farms varied by region: South, 35 percent cropland on cow-calf farms versus 56 percent on all farms; North Central, 52 versus 78 percent; Great Plains, 23 versus 44 percent; and West, 12 versus 21 percent. These data appear to support the widely held view that beef cow-calf production cannot compete economically for top quality farmland, at least not at the relatively low feeder calf prices prevailing during 1980.

Farm acreages associated with each herd-size group were consistently smallest in the fertile North Central

Table 5—Acres of land operated per beef cow-calf farm or ranch, 1980

Region	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	All land	Cropland	All land	Cropland	All land	Cropland	All land	Cropland
	Acres							
South	337	144	1,328	402	10,298	780	498	173
North Central	243	137	897	381	5,710	884	300	156
Great Plains	720	288	3,094	509	29,252	667	1,439	330
West	1,214	324	5,218	545	30,601	1,402	3,756	440
All regions	527	209	3,088	483	26,233	1,047	1,198	258

region (table 5). Farms in the South with small- and medium-sized cow herds were almost half again as large as those in the North Central region. Farms in the South with large herds included 80 percent more total acres and nearly twice as much noncropland as those in the North Central region. But the average number of cows in large herds was 50 percent greater in the South than in the North Central region. In the more arid Great Plains, from three to more than five times as much total farmland as in the North Central region was operated by the average cow-calf producer with herds of comparable sizes. Ranches in the West were from five to six times as large as North Central cow-calf farms. Many producers in the West also depended to some extent on public grazing lands.

Changes in Acreage and Herd Size, 1975 to 1980

Specific information on changes in farm organization between 1975 and 1980 was requested in the 1981 survey only from producers in the South and the North Central regions. Data were recorded only for respondents who were farm operators in both 1975 and 1980. However, very few newcomers to farming were contacted during the 1981 survey. More than 97 percent of the cow-calf producers in each herd size grouping in both regions were also farming 5 years earlier (table 6).

Cow-calf producers surveyed in the South operated 9 percent more farmland in 1980 than in 1975, while the number of cows in their combined herds was essentially unchanged (table 7). In the South, producers with herds of 500 or more cows were the only group expanding beef cow inventories in about the same proportion as the acreage operated. These large producers, heavily concentrated in central and southern Florida, tend to specialize in cow-calf production on land suitable only for grazing. Southern producers with medium-sized herds expanded beef cow inventories only about one-fourth as much as acreage operated. Those with herds of fewer than 100 cows reduced cow numbers while increasing farmland acreage by 5 percent. Reduction in cow numbers in relation to land was probably influenced by a rapid increase in fertilizer prices and drought-induced reductions in forage productivity in 1980. In addition, low prices and profitability of feeder cattle (except in 1979) in relation to soybeans promoted an increased emphasis on crop production on many crop-livestock farms.

A 6-percent reduction between 1975 and 1980 in land operated by producers with herds of fewer than 100 cows surveyed in the North Central region more than offset the 14-percent increase in acreage on the much smaller number of farms wtih medium and large cow-calf herds (table 7). Producers with small herds increased beef cow numbers slightly during this period, perhaps in an attempt to compensate for their smaller crop operations. In contrast, producers with herds of 500 or more cows made little change in the average size of their feeder cattle operations as they acquired more farmland which may have lacked fencing or other cattle facilities.

Unlike any other group of producers surveyed in either region, North Central farmers with herds of 100-499 cows made major expansions in both farmland acreage and cow-calf production from 1975 to 1980 (table 7).

Table 6—Percentage of 1980 beef cow-calf producers in the Eastern United States who were farming in 1975

Region	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Percent			
South	98.3	98.7	98.3	98.4
North Central	99.5	97.8	100.0	99.5

Producers within this group whose 1980 land base was about the same as the acreage that they operated in 1975 (within 25 percent) as well as those with moderate (25 to 100 percent) increases in farmland expanded their cow-calf enterprises by more than 60 percent (table 8). Unless these producers were greatly understocked in 1975 (which seems unlikely because the number of beef cows in the regions was near the record high), additional pasture, fencing, and other livestock facilities were probably required to accommodate such large cow herd expansions. These improvements may have been obtained at bargain costs as integral parts of farmland added by some farmers. But those who did not acquire additional land apparently made sizable investments in feeder cattle facilities as well as in breeding stock during this 5-year period. Information obtained in the survey did not suggest the motivation for such strong long-term commitment to expanded feeder cattle production during a period of generally poor profitability for cow-calf producers.

Other Livestock Enterprises

Presence of almost any other livestock enterprise on the same farm or ranch is likely to affect characteristics and profitability of a cow-calf enterprise, at least indirectly. For example, a feeder cattle growout enterprise including purchased stocker calves competes with the cow herd for available pasture or harvested forages. Such competition effectively constrains cow herd size if forages are limited. On the other hand, marketing fees, transportation costs, and attendant shrink are avoided on any stocker calves produced in

Table 7—Percentage change from 1975 to 1980 in acres operated and beef cow numbers per cow-calf farm in the Eastern United States[1]

Change per farm	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	South	North Central	South	North Central	South	North Central	South	North Central
	Percent							
Acres operated	5	-6	22	14	7	14	9	-2
Beef cow numbers	-5	4	5	57	6	-1	0	12

[1]Includes only farms with beef cow-calf enterprises in both 1975 and 1980.

Table 8—Percentage change from 1975 to 1980 in beef cow numbers per cow-calf farm in the Eastern United States with specified percentage changes in acres operated, 1980[1]

Percentage change in acres operated	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	South	North Central	South	North Central	South	North Central	South	North Central
	Percent							
More than 100 increase	39	55	61	25	140	*	50	46
26 to 100 increase	19	1	42	64	51	-8	26	10
25 decrease to 25 increase	-1	6	1	61	-4	1	-1	14
26 to 50 decrease	-50	-7	-69	-18	-45	*	-57	-10
More than 50 decrease	-15	*	-74	*	-50	*	-49	-

*Too few observations to permit estimate.
[1]Includes only farms with beef cow-calf enterprises in both 1975 and 1980.

the cow-calf enterprise rather than being purchased. Similar advantages apply to the extent that a cattle feeding enterprise uses home-raised feeder calves. Sheep or goat enterprises compete for, but also complement use of, grazing resources by consuming weeds or brush that compete with species preferred by cattle. Poultry or hog manure may provide relatively inexpensive fertilizer for cow-calf pastures. Any livestock enterprise is likely to require some equipment or facilities, the use and cost of which may be shared by the cow-calf enterprise.

Only producers whose beef cattle production operations were predominantly oriented to the sale of stocker or feeder calves or yearlings produced in their own cow herds were included in the 1981 survey. Producers who sold 10 percent or more of their cattle as grain-fattened slaughter cattle were excluded from the survey, as were operators who produced in their own cow herds less than 90 percent of the feeder calves and yearlings that they sold annually.

These "enterprise purity" restrictions were imposed to eliminate confounding effects of other phases of beef cattle production on characteristics associated with cow-calf production. They ensure that any cattle feeding or purchased stocker-feeder activities of the survey respondents were minimal in relation to their cow-calf operations. In fact, producers in the Great Plains and the West who passed the purity test (85 percent of the survey sample) were not asked whether they fed any cattle or bought any stocker calves. These questions were asked, however, of respondents in the South and North Central regions, where enterprise impurity eliminated 15 and 35 percent, respectively, of the sample producers.

About 1 out of 10 "pure" cow-calf farmers in the North Central region reported some cattle feeding or stocker-feeder enterprises which included some purchased stocker calves in 1980. A slightly higher proportion of cow-calf producers in the South fed some cattle to slaughter finish, but purchased stockers were less common in the South, especially on farms with small cow herds (table 9). In both regions, the few cattle fed by "pure" cow-calf producers were used primarily to provide freezer beef for the cow-calf producer, employees, and/or personal acquaintances. Stocker calves were usually purchased by producers who retained all or part of their own calves, and added a few extra, for sale as yearling feeders.

Almost half the farmers surveyed in the North Central region and about one-third of those in the South had some other type of livestock in addition to beef cattle. By contrast, beef cattle were the only type of livestock on more than four-fifths of the farms and ranches with cow-calf herds in the Great Plains and the West (table 9). Most of this difference is attributable to hogs. Hog enterprises were common on cow-calf farms in the North Central region, parts of the South, and the corn-growing, east-central fringe of the Great Plains, but were rarely found on ranches in other parts of the Plains or the West. Hog enterprises were relatively important parts of the farm businesses on many of the cow-calf farms that had them.

In the North Central region, gross revenue from hog and pig sales averaged almost $19,000 in 1980. North Central farms with herds of 100-499 beef cows had larger hog enterprises on average than farms with either small or large cow-calf enterprises. Swine sales averaged $52,800 per farm with medium-sized cow herds, compared with $16,300 on farms with herds of fewer than 100 cows, and $21,500 on those with 500 or more beef cows. In the South, however, average size of hog enterprises varied directly with cow herd size. Gross receipts from hog and pig sales ranged from

Table 9—Percentage of beef cow-calf farms and ranches with specified other livestock enterprises, 1980

Region and type of enterprise	Cow herd size (head)			
	20–99	100–499	500 or more	All sizes
	Percent			
South:				
Cattle feeding	13	11	7	12
Purchased stockers	5	13	24	6
Hogs	22	20	16	22
Poultry	7	9	2	7
Sheep	2	6	2	2
Dairy	0	1	1	*
North Central:				
Cattle feeding	11	2	6	10
Purchased stockers	10	20	0	11
Hogs	29	31	41	29
Poultry	6	0	6	5
Sheep	14	9	0	14
Dairy	0	0	0	0
Great Plains:				
Sheep	2	3	13	5
Goats	2	2	7	3
Other livestock	13	13	1	10
West:				
Sheep	9	8	5	7
Goats	*	0	0	*
Other livestock	9	6	7	7

*Less than 0.5 percent.

$14,800 on farms with fewer than 100 cows to $200,000 on farms with 500 or more cows, and averaged $18,400 overall.

Table 9 probably understates the proportions of cow-calf producers in the West or Great Plains who also had sheep. A survey of sheep producers, conducted simultaneously with the 1981 cow-calf survey, was limited to the Great Plains and the West. Producers in these two regions whose names appeared in the sheep survey sample were eliminated from the cow-calf survey.

Crop Production and Use

Sales of crops other than hay were reported by little more than a third of the cow-calf producers in the West and by less than half of those in the Great Plains. No information was collected in these regions concerning the production or use of specific crops. In the eastern regions, by contrast, one or more crops in addition to pasture and hay were included on more than three-fourths of the North Central cow-calf farms and on most in the South except those with 500 or more cows, which were usually specialized cattle ranches.

Corn harvested for grain was the most widely grown nonhay crop in both regions (table 10). Corn silage was also produced on one-fifth of the North Central farms with medium-sized cow-calf herds and on nearly half of those with large herds. Soybeans were second in frequency in both regions, followed by tobacco in the South and oats, especially on farms with small cow herds, in the North Central region.

Almost two-thirds of the corn grown on surveyed farms in the South (almost all on farms with large cow herds) was, or would be, fed to livestock on the same farms. By contrast, North Central producers with large herds fed less than half of the corn they produced in 1980, and only one-eighth was fed to livestock on all farms combined (table 11).

All corn silage grown by cow-calf producers in both regions was used or intended as inplace feed. Silage is seldom transported far, either before or after storage, due to its high-moisture content and consequent low feed value per unit of weight.

Oats were used primarily as feed only by producers with medium-sized herds in both regions and those in the North Central region with large herds. Little wheat was fed, especially in the North Central region.

Most hay was produced to be fed on the same farm. Only producers in the South with large cow herds sold more than one-third of the alfalfa hay or more than 10 percent of the other types of hay that they harvested.

Legal Organization of Farms

A great majority of cow-calf enterprises in the eastern half of the Nation are operated on family farms. Individual proprietorships are still the predominant type of legal organization, except for North Central farms with herds of 500 or more cows where corporations limited to family members are slightly more numerous (table 12). Large farms in the North Central region are the

Table 10—Percentage of beef cow-calf farms in the Eastern United States reporting production of selected crops, 1980

Crop	Cow herd size (head)							
	20–99		100–499		500 or more		All sizes	
	South	North Central	South	North Central	South	North Central	South	North Central
	Percent							
Corn, grain	36	44	38	64	8	40	36	46
Corn, silage	5	5	12	20	8	47	5	6
Oats	3	16	3	7	2	6	3	16
Wheat	8	4	13	27	3	34	9	6
Soybeans	18	37	29	33	19	40	19	38
Tobacco	14	0	10	0	*	0	14	0
Alfalfa hay	6	43	11	65	9	30	7	44
Other hay	62	42	85	47	99	82	64	43

*Less than 0.5 percent.

only group for which ownership by nonfamily corporations is significant. Partnerships, many of which are comprised of members of the same family, operate about one-seventh and one-fifth of all cow-calf farms in the South and North Central regions, respectively.

Little change occurred between 1975 and 1980 in the legal organization pattern of cow-calf farms in the South. In the North Central region, however, partnerships increased by 6 percentage points at the expense of individual proprietorships (*1*). Such a trend to shared ownership and responsibility will probably continue with the growth of the complexities, financial requirements, and risks of operating large farm businesses.

Feeder cattle enterprises operated by individual proprietors in the South were smaller on average than those operated under other types of legal organization; individual proprietors ran 82 percent of the farms, but owned less than 75 percent of all beef cows (table 12). This was not the case in the North Central region, where herds operated by individual proprietors were larger than the average for all forms of legal organization combined. Partnerships accounted for 22 percent of all farms but only 14 percent of the beef cows in this region. Reasons for this anomaly are not clear.

Corporations operated larger than average feeder cattle enterprises within each herd-size group in both regions and owned higher proportions of the farms with herds of 500 or more cows. As a result, corporation-owned herds were more than four times as large as herds under all forms of ownership in the South and nearly three times as large as those in the North Central region.

Farmland Tenure

For producers who lease grazing land, rental payments are normally a nonpostponable annual cash cost. Owners of mortgaged land usually have more flexibility in the timing of interest and principal payments. For debt-free owners, annual land charges represent a noncash opportunity cost which may be postponed indefinitely.

Improvements making land more valuable in cow-calf production, such as fencing, development of livestock water sources, brush control, and sod seeding require relatively large initial capital outlays and provide long-term benefits which landowners expect to capture over time. Tenants, by contrast, risk losing their leases before they can realize advantages of such long-term and expensive improvements.

More than 50 percent of the farms with cow-calf enterprises in the South and 60 percent of those in the North Central region were fully owned by their operators in 1980 (table 13). Operators who owned part and rented part of the land they farmed comprised most of the remainder. Fully rented farms represented less than 1 percent of the total in each region in 1980.

More than 2 percent of the cow-calf producers in the South and almost 14 percent of those in the North Central region used rented land exclusively in 1975 (*1*). Part owners also represented smaller proportions of the total in each region in 1980 than in 1975. These trends to less use of rented land probably stem from the poor economic results of cow-calf production over this 5-year period during which enterprise returns were

Table 11—Percentage of selected crop production fed to livestock on beef cow-calf farms in the Eastern United States, 1980

Crop	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	South	North Central	South	North Central	South	North Central	South	North Central
	Percent							
Corn, grain	64	11	42	24	95	47	62	12
Corn, silage	100	100	100	100	100	100	100	100
Oats	18	18	67	76	12	100	22	24
Wheat	4	0	12	14	2	0	5	1
Alfalfa hay	72	73	68	90	28	100	72	74
Other hay	90	99	91	99	71	100	90	99

Table 12—Distribution of beef cow-calf farms and of beef cows on farms in the Eastern United States by type of farm business organization, 1980

Business organization	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	South	North Central	South	North Central	South	North Central	South	North Central
	Percent							
Farms:								
Individual proprietorship	83.6	76.3	65.6	75.5	55.9	35.0	81.7	76.2
Partnership—								
General	14.0	21.7	25.2	21.3	10.6	6.1	15.1	21.7
Limited	1.2	.2	1.4	.8	3.6	0	1.2	.2
Corporation—								
"Standard C" family[1]	1.2	1.8	3.7	.9	23.3	12.3	1.6	1.7
"Subchapter S" family[2]	0	0	3.3	0	2.9	28.2	.3	.1
All nonfamily	0	0	.7	1.5	1.4	18.4	.1	.1
Other types	0	0	.1	0	2.3	0	0	0
Cows:								
Individual proprietorship	80.0	83.5	64.1	78.7	42.2	29.3	70.5	81.0
Partnership—								
General	16.4	12.5	25.7	16.4	15.3	5.3	18.9	13.2
Limited	1.5	.4	1.4	.9	3.3	0	1.7	.5
Corporation—								
"Standard C" family[1]	2.1	3.6	5.0	1.6	28.9	10.7	6.5	3.3
"Subchapter S" family[2]	0	0	2.3	0	6.0	20.0	1.5	.5
All nonfamily	0	0	1.4	2.4	1.3	34.7	.5	1.5
Other types	0	0	.1	0	3.0	0	.4	0

[1]A "Standard C," or regular, corporation is subject to Federal income tax as a business entity, apart from the stockholders (unlimited as to number or type) who own it.

[2]A "Subchapter S" corporation is not subject to Federal income tax directly; instead, all net earnings of the corporation are assigned and taxed to the stockholders (limited to 35 or fewer, all of which must be individuals, estates, or certain types of trusts) in proportion to the interest of each in the corporation.

Table 13—Percentage of beef cow-calf farms with various land tenure characteristics in the Eastern United States, 1980

Land tenure	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	South	North Central	South	North Central	South	North Central	South	North Central
	Percent							
Fully operator owned	56.0	61.9	27.4	33.4	34.0	12.2	53.1	59.8
Part owned	43.4	37.4	70.2	64.4	64.7	76.1	46.2	39.4
Fully rented	.6	.7	2.4	2.2	1.3	11.7	.7	.8

usually inadequate to cover average production costs, even when no land costs were charged to the enterprise (*5, 8, 9, 10, 15*).

Production Practices and Performance

Changes in husbandry practices used in beef cow-calf production have been less dramatic than in most other livestock production sectors. Advances in nutrition, disease control, and environmental modification technologies in poultry and swine production or the feedlot fattening phase of beef production have led to confinement and feeding of large numbers of animals in quite limited space. But beef cows are still maintained primarily on range or pasture. Production systems eliminating the need for grasslands have not become economically acceptable to commercial producers. Improvements in reproductive performance of beef cows have also been more gradual than for most other species. Technology to promote multiple births in cattle is available, but remains operationally and/or economically unattractive to most producers. Thus, production of even one calf per year from each cow maintained in the herd is still only a goal for commercial cattle producers.

Calving rate is an initial indication of cow herd performance. Death rates for both breeding stock and calves, as well as calf rate of gain and age, affect the types and weights of cattle available for disposition annually. A number of production practices or characteristics associated with these measures of performance are discussed in this section.

Breeding and Calving Programs

The ratio of cows and sexually mature heifers to bulls in the herd during the breeding season can have a major impact on breeding success. Among factors affecting the number of cows which each bull may be expected to breed, length of the breeding period is one obvious example; the longer bulls are left with the cow herd, the more cows are likely to be successfully mated. There are, however, important advantages to short breeding seasons: (1) choice grazing or extra feed, if necessary, can be provided to both cows and bulls immediately before and during a short breeding season to ensure that they are in top health and physical condition; (2) little extra time is required to observe the herd carefully for breeding problems, such as bull injuries, illness, or return to heat by cows which have been mated; (3) accidental breeding of young heifer calves is avoided; (4) less labor is required to provide extra attention to the cows during the resulting calving season; (5) calving can be better timed to match availability of grazing or other feed resources and to avoid periods of unfavorable weather; and (6) calves that are near the same age are more uniform in size and appearance at sale time and often sell for higher average prices. Thus, more successful producers usually limit breeding periods to 3 months or less.

Cow-to-bull Ratios

A healthy, vigorous mature herd bull might be expected to breed 50 or more cows during a 3-month period under ideal conditions. One bull for each 20 to 30 cows is usually recommended, however, because conditions are seldom ideal. The average cow-to-bull ratio in herds of all sizes in all regions combined was about 25 to 1 in 1980 (table 14). The comparable ratio reported in 1975 was 22 cows per bull (*1*). The greater ratio in 1980 is probably due primarily to two developments.

First, cow-calf production was generally unprofitable during the late seventies. Many producers chose or were forced to sell breeding stock to meet financial commitments. Bulls were likely culled relatively more heavily than cows during this period, as there was little incentive to incur the additional expense of keeping "backup" or "insurance" bulls.

Second, use of artificial insemination (AI) in beef cow-calf herds increased during the late seventies. Perhaps the biggest deterrent to the use of AI with beef cows is the extra labor needed to detect cows in heat on open pasture or range and then to confine individuals for insemination. This problem was partially overcome with the approval for use of hormonal materials that can be injected to synchronize estrus. More than half of an entire cow herd may be bred successfully during a single day by a skilled inseminator using this method.

Three percent of all producers used AI on at least some of their cows in 1980 (table 15). In total, 1.5 percent of the beef cow inventory in all regions combined was bred artificially. The percentage of producers using this

Table 14—Average number of cows and replacement heifers per herd bull on beef cow-calf farms and ranches, 1980

Region	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Number			
South	26.8	27.7	24.0	26.7
North Central	28.6	26.2	27.7	28.0
Great Plains	23.9	26.0	20.9	24.3
West	21.7	23.4	20.6	22.2
All regions	25.6	25.5	21.5	24.9

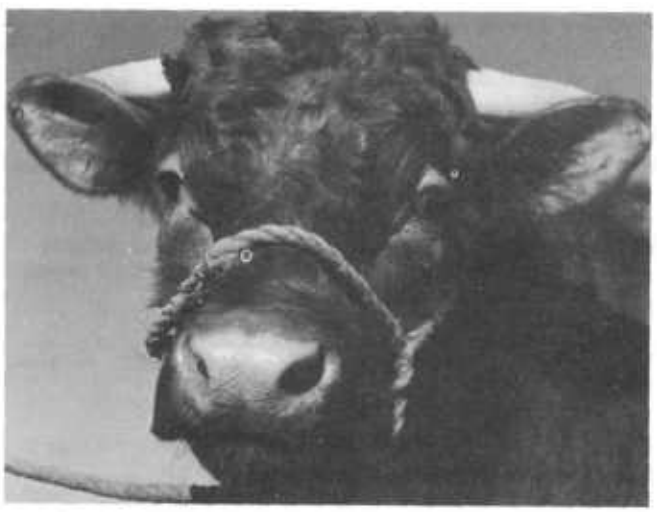
Table 15—Percentage of beef cow-calf farms and ranches using artificial insemination and percentage of cows and replacement heifers artificially inseminated, 1980

Region	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	Farms	Cows	Farms	Cows	Farms	Cows	Farms	Cows
	Percent							
South	*	*	5	1	8	2	1	1
North Central	2	1	20	4	24	4	3	2
Great Plains	2	1	7	2	7	2	3	2
West	3	2	6	2	15	2	4	2
All regions	2	1	8	2	12	2	3	2

*Less than 0.5 percent.

breeding practice increased with size of the cow herd in each region and was especially high for medium and large herds in the North Central region. An abundance of AI purveyors and experienced inseminators, developed to service the large dairy industry in the North Central region, may account for the more rapid adoption of AI by cow-calf producers in that region.

The cow-to-bull ratios in various regions varied inversely with acreage of grazing land used per cow. Each bull serviced an average of 28 cows on the productive pastures of the North Central region in 1980 (table 14). At the other extreme, one bull was used for each 22 cows in the West, where the grazing is often sparse and cow herds are more likely to be scattered over extensive areas. The same general regional relationships prevailed in 1975.



Use of artificial insemination is a limited but growing practice in beef herds, encroaching on the traditional prerogatives of the bull.

Calving Rates

The calving rate, as defined for this report, is a percentage term expressing the number of calves born alive per 100 cows and breeding-age heifers exposed to a bull or artificially inseminated to produce a calf during a specified year. This is a direct and more conservative measure of breeding success than a frequently cited alternative ratio, which is computed as the number of calves born divided by the January 1 inventory of cows that have calved (rather than cows and heifers bred). It is usually more conservative also than the ratio of calves born per 100 cows and bred heifers remaining in the herd at the end of the calving season, a concept excluding cows and heifers culled after breeding but before calving time.

The calving rate in 1980 averaged 87 percent for all cow-calf producers surveyed (table 16). This is an increase of more than one-tenth from the overall average rate of 79 percent reported 5 years earlier. Increases occurred in every region, ranging from 5 percentage points (6 percent) in the Great Plains to nearly 11 percentage points (about 15 percent) in the South and West (*1*). Several factors contributed to these dramatic improvements. Many open, slow-breeding, aged, and other poor performing cows were sent to slaughter as a result of the heavy culling and herd dispersals in every region between 1975 and 1980; the more productive cows were retained. As a result, replacement heifers comprised a smaller proportion of the breeding herd in 1980 than in 1975, and heifers normally calve at a lower rate than the average for cows that have calved before. Another development particularly important in the South was improvement in the control of brucellosis, a disease that may cause embryonic mortality and other breeding problems.

Despite improvements in control, diseases adversely affecting reproductive performance remained more prevalent in the South than in any other region in 1980. This is one reason why the average calving rate in the South remained from 3 to 5 percentage points lower than in the other three regions (table 16).

Except for the North Central region, where the calving rate was highest in herds of 100-499 cows, the average rate was progressively lower in each larger herd-size group in 1980 (table 16). Inability of producers to give as much attention at calving time to individual cows in larger herds, which are likely to be scattered over a greater area, probably contributes to this trend. In addition, cows in large ranch-type operations may be maintained on a lower average plane of nutrition during breeding and/or gestation. This is particularly likely in the South, the region in which the calving rate in large herds was relatively (and absolutely) lowest. Most large herds in this region are located in southern Florida or along the gulf coast and depend heavily on native grasses low in nutritive value.

Table 16—Average calving rate on beef cow-calf farms and ranches, 1980[1]

Region	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Percent			
South	86	82	76	84
North Central	86	91	83	87
Great Plains	91	87	85	89
West	90	88	84	87
All regions	88	87	83	87

[1]Number of live calves born per 100 cows and heifers exposed to a bull or aritificially inseminated to produce a calf during 1980.

Pregnancy Testing

Calving rates discussed above are based on the number of cows and heifers exposed to a bull or artificially inseminated. Thus, pregnancy tests conducted after the end of the breeding season have no bearing on the calving rate, unless the nonpregnancy rate is so high that another, later breeding period is used. Rebreeding of open cows is more convenient for operators who use a split calving season. It may be a necessity, however, under any herd management plan if the herd bull(s) used initially was infertile or ineffective for some other reason. Thus, early knowledge of which cows are pregnant and which are open is quite useful information for management decisions affecting profitability of the cow-calf enterprise. Open cows can be culled at once to minimize costs, held until cow prices are higher, or maintained on lower quality grazing and other feeds than needed by pregnant cows.

Slightly less than one-fifth of the operators tested some or all of their cows for pregnancy in 1980 (table 17). Except in the North Central region, pregnancy testing was progressively more common in larger enterprises; more than half of all cattle producers with herds of 500 or more cows had at least some of their cows checked. The large operators were apparently less able or willing to rely on general observation to detect and identify open cows. A result of the greater use of pregnancy testing in larger enterprises was that the overall proportion of cows tested was greater, at 21 percent, than the proportion of operators using this practice.

The percentage of cattle producers using pregnancy testing was greatest in the North Central region, but more of the total cow inventory was tested in the West (table 17). Producers in the South made least use of this management practice. However, southern producers who did pregnancy tests probably benefited most;

Table 17—Percentage of beef cow-calf farms and ranches using pregnancy testing and percentage of cows and replacement heifers tested for pregnancy, 1980

Region	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	Farms	Cows	Farms	Cows	Farms	Cows	Farms	Cows
	Percent							
South	7	4	18	12	43	25	8	10
North Central	29	30	23	20	65	67	29	29
Great Plains	11	9	32	22	40	24	15	16
West	13	12	43	38	65	46	25	34
All regions	15	14	31	25	53	35	18	21

about 14 percent of all cows tested in the South were found to be open, compared with less than 10 percent in any other region (table 18).

Table 18—Percentage of cows and heifers tested for pregnancy found to be open on beef cow-calf farms and ranches, 1980

Region	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Percent			
South	9	13	18	14
North Central	6	8	10	7
Great Plains	11	7	12	9
West	7	9	9	9
All regions	8	8	11	9

Calving Dates

The period extending from the onset of labor until a few hours after birth is critical for most mammals. The level of stress and probability of mortality for offspring and/or dams are relatively high at best and increasingly so under adverse environmental conditions. Producers of some species (hogs, for example) have largely offset effects of weather by providing housing in which temperature and humidity can be modified, facilitating year-round birthing (farrowing).

Most beef cows, however, are still managed to calve on open pasture or range, with only natural vegetation or terrain to provide protection from the elements. Therefore, many cow-calf producers attempt to minimize environmental stress by scheduling most calving during seasons of moderate temperatures and precipitation, especially in regions with extreme seasonal variations. Winter calving is seldom planned where subfreezing average temperatures and/or snow accumulations are common. Summer calving is also normally avoided to minimize adverse effects of heat stress, insects, and drought-related reductions in availability or quality of grazing.

There are several advantages to scheduling calving in the early spring to coincide with the onset of rapid pasture and range growth. Lush pasture promotes milk production by the cows as well as direct grazing by calves at a young age, when high-quality feeds are most beneficial. Daily total digestible nutrient (TDN) requirements of dry cows in the last 3 months of gestation are only about three-fourths as great and digestible protein needs are less than half as great as those of cows nursing young calves. Spring calving cows are dry during the winter and thus need a minimum of high-cost supplemental feeds. Calves born in the spring can be sold at desirable weights as stocker or feeder calves in the fall, so that the cow-calf operator does not have to provide them with any expensive winter feeds. Or, they can be sold as yearlings after only one winter.

Beef calves are usually born on open pasture or range, with only natural vegetation or terrain to provide protection from the elements. Producers frequently schedule calving in the early spring, a month or two before the onset of lush pasture or range growth which stimulates milk production by brood cows and provides high quality forage for direct consumption by young calves.

On the other hand, fall calving may be preferred, particularly in areas with mild winters and hot, humid sur mers. Calves born in the fall may be sold as stockers the spring, minimizing the potentially adverse impact heat, insects, internal parasites, and poor-quality grazing on calf gain. High-quality grazing provided by cove crops seeded in the fall is best used by calves born in the fall. Stocker calf prices are frequently higher in the spring or early summer than in the fall, due, at least partially, to the lower available volume.

About 58 percent of the calves in all regions and herd sizes combined were born during March-May in 1980 (table 19). The proportions ranged from 70 percent in the West and North Central regions to 57 percent in the Great Plains, where calving was more concentrated in February than in May, and to little more than one-third in the South, where more calves were born in November-February than in May. A similar calving pattern was reported in 1975, but the concentration in March-May was considerably greater in the Great Plains (91 percent) and North Central region (83 percent) and lower in the West (57 percent) during the earlier year (*1*).

In 1980, fall calving tended to increase with size of the cow herd in each region. This was due largely to the

greater use of split (spring and fall) calving seasons by operators of the larger enterprises. Few producers scheduled calving exclusively or predominantly for the fall except in the Deep South, where more calves in large herds were born in November than in any month other than February (table 19).

Cattle and Calf Production and Disposition

A high calving rate is only the first critical step to success in cow-calf production. Once calves are born, emphasis shifts to keeping them healthy and growing until time of sale or addition to the breeding herd. Decisions concerning the stage at which feeder animals are to be sold (whether as weaned calves or yearlings) must be made, and sometimes modified, based on calf growth rate and availability, type, quality, and cost of grazing and other feed and nonfeed resources. Timing of sales may be influenced by these same factors as well as anticipated changes in cattle prices. The overriding essential requirement, of course, is to keep the cattle alive.

Death Losses

Death losses among beef calves are usually greatest soon after birth; the death rate tends to decline as the calves become older and stronger, although some management procedures, such as castration and dehorning or anything else causing unusual stress, may offset this trend.

Losses of calves prior to weaning averaged 4.4 percent of the calves born alive during 1980 (table 20). This represents an improvement over 1975, when the death rate in all regions and herd sizes averaged 5.5 percent (*1*). Losses during 1980 were lower in each region, but the biggest improvements occurred in the Great Plains where the rate dropped to 4.2 percent from 9.1 percent in 1975. Two factors account for much of this drastic change. An unusually late and heavy snowstorm in the northern Plains in 1975 caused abnormally heavy losses, and different geographical boundaries were specified for the region in the two surveys. Most of Montana; all of South Dakota, Wyoming, and Colorado; and eastern Utah were included in the Great Plains region designated for the 1975 study. By contrast, western parts of South Dakota and Colorado, as well as the entire States of Montana, Wyoming, and Utah—a predominantly mountainous area in which the calf death rate is usually relatively high because of heavy dependence on extensive rangeland acreage for forage, even during the spring when severe snowstorms and low temperatures are common—were included in the West rather than the Great Plains for the more recent survey (fig. 1).

Table 19—Percentage of calves born each month on beef cow-calf farms and ranches, 1980

Region and month	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Percent			
South:				
January	12.3	14.1	9.1	12.4
February	16.8	21.6	30.1	19.8
March	18.1	20.5	11.1	17.9
April	12.1	10.3	8.6	11.2
May	7.7	4.9	11.1	7.4
June	2.9	2.2	3.2	2.7
July	1.6	1.5	.5	1.4
August	3.2	1.5	1.5	2.5
September	2.6	2.0	2.5	2.4
October	5.6	5.2	3.5	5.3
November	7.6	9.3	15.3	9.0
December	9.5	6.9	3.5	8.0
North Central:				
January	.4	1.1	0	.6
February	7.7	6.2	8.6	7.4
March	15.4	21.4	28.2	17.2
April	40.7	31.0	22.1	37.8
May	13.7	17.9	13.4	14.7
June	3.1	5.9	4.4	3.8
July	1.0	3.7	.7	1.6
August	2.9	3.7	.3	3.0
September	6.5	5.5	4.4	6.2
October	3.4	2.1	5.0	3.1
November	4.3	1.0	9.4	3.7
December	.9	.5	3.5	.9
Great Plains:				
January	6.7	6.9	10.7	7.3
February	12.9	12.1	13.3	12.6
March	23.8	25.4	19.7	23.9
April	25.2	27.2	14.7	24.5
May	8.4	9.7	8.8	9.0
June	3.2	2.3	3.4	2.9
July	1.8	1.0	2.6	1.6
August	1.8	.9	1.5	1.4
September	3.0	2.0	4.2	2.8
October	4.0	3.0	7.0	4.0
November	4.7	5.0	8.4	5.3
December	4.5	4.5	5.7	4.7
West:				
January	2.9	3.1	4.4	3.4
February	10.4	11.8	8.8	10.6
March	29.5	28.2	22.5	26.9
April	31.9	33.6	32.8	32.9
May	8.8	9.7	12.3	10.2
June	2.5	1.6	4.2	2.6
July	1.4	1.0	1.2	1.1
August	1.9	1.3	1.0	1.4
September	2.1	1.8	2.3	2.0
October	3.7	2.8	4.0	3.4
November	3.1	2.9	3.3	3.1
December	1.8	2.2	3.2	2.4
All regions:				
January	6.1	6.2	7.3	6.3
February	12.3	12.8	13.9	12.7
March	21.0	25.1	19.8	22.3
April	26.5	27.0	22.2	26.0
May	9.6	9.8	10.9	9.9
June	3.0	2.5	3.8	2.9
July	1.5	1.4	1.6	1.5
August	2.4	1.4	1.2	1.9
September	3.6	2.3	3.0	3.0
October	4.2	3.2	5.0	4.0
November	5.2	4.6	7.2	5.3
December	4.6	3.7	4.1	4.2

The reported calf death rate was lowest in the largest enterprises in each region (table 20). Failure of operators to see as high a proportion of the calves when or very soon after they are born on the large pastures or range areas normally used with enterprises of 500 or more cows may account for this. Calves born alive but that died before they were first (if ever) spotted were probably considered stillbirths (or breeding failures) rather than deaths, thus lowering the reported death rate (defined as deaths as a percentage of calves born alive). This would also help to explain the fact that reported calving rates were lowest for the large herd-size group in each region (table 16).

Calf losses were attributed to a number of known and unknown causes varying in importance from region to region and for enterprises of different sizes within each region (app. table 1). Weather was the most important specified cause of calf deaths in all regions except the West, where more deaths were attributed to scours than any other cause (scours ranked second as a cause of calf losses in each of the other regions). Weather problems were especially serious in the Great Plains, accounting for a third of all calf losses in that region in 1980. Dogs killed very few calves in the Great Plains or the West, but were more of a problem, especially for operators with small herds, in the more heavily populated South and North Central regions. Coyotes, blamed for more losses than dogs in each region, caused 5 to 7 percent of the total deaths.

Losses of weaned calves and yearlings averaged less than 1 percent during 1980. Losses were heaviest in the West and lowest in the North Central and the South (table 21). Unknown or unspecified problems caused most of the losses in each region.

Losses of cows and replacement heifers in 1980 ranged from 2.8 percent in small herds in the South to 1.2 percent in large herds in the North Central region, and averaged about 2.1 percent overall (table 22). This is quite similar to results reported for 1975, indicating a loss rate of 1.9 percent for all cattle weighing 500 pounds or more (weaned calves and yearlings as well as cows and replacements) (*1*). The loss rate of cows was progressively lower in the larger enterprise size groups in each region during 1980. This is consistent with the lower calving rate in larger herds (table 16), as most cow death losses occur during calving.

Number and Type of Cattle Sold

Disposition of cattle—sale or placement on feed in the operator's own or a custom feedlot in which ownership of the cattle is retained by the cow-calf producer—in

Table 20—Average calf loss rates from all causes prior to weaning on beef cow-calf farms and ranches, 1980

Region	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Percent[1]			
South	4.1	4.2	2.4	3.9
North Central	4.7	4.8	3.1	4.7
Great Plains	4.4	4.5	3.2	4.2
West	5.2	5.2	4.1	4.9
All regions	4.5	4.7	3.5	4.4

[1]Computed by multiplying 100 times the ratio: number of calves lost prior to weaning in 1980 divided by number of calves born alive in 1980.

Table 21—Average loss rates of weaned calves and yearlings from all causes on beef cow-calf farms and ranches, 1980

Region	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Percent[1]			
South	0.4	0.4	0.5	0.4
North Central	.2	.8	.6	.4
Great Plains	.6	.7	.5	.6
West	.8	.8	1.0	.9
All regions	.5	.7	.7	.6

[1]Computed by multiplying 100 times the ratio: number of weaned calves and yearlings lost in 1980 divided by number of calves born alive in 1980. All yearlings and most weaned calves lost during 1980 were born in 1979, so the computed loss percentages are approximations, correct only to the extent that the same number of calves were born in 1979 and 1980 on the farms and ranches surveyed.

Table 22—Average losses of cows and replacement heifers from all causes on beef cow-calf farms and ranches, 1980

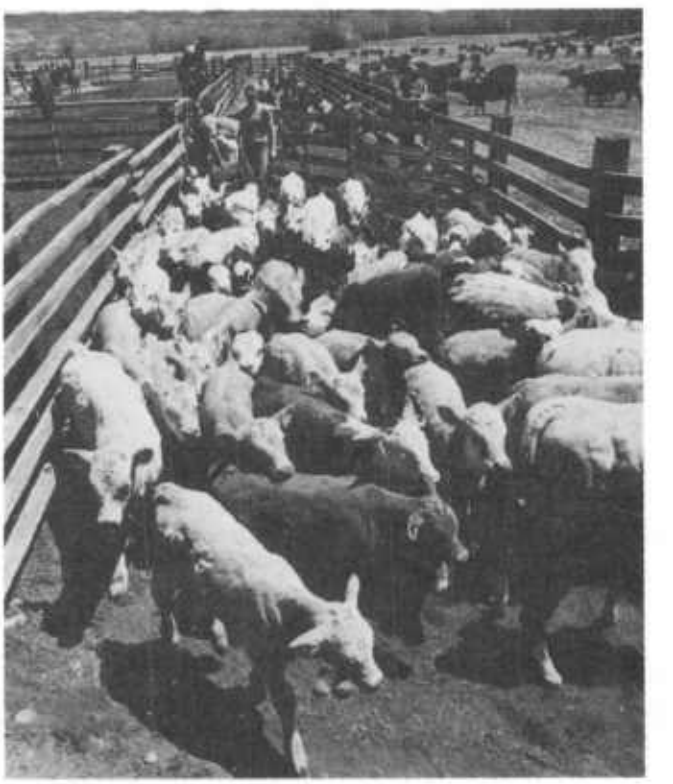
Region	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Percent[1]			
South	2.8	2.0	1.6	2.4
North Central	1.8	1.6	1.2	1.8
Great Plains	2.5	2.1	1.7	2.2
West	2.2	1.8	1.7	1.8
All regions	2.4	1.9	1.6	2.1

[1]Computed by multiplying 100 times the ratio: number of cows and replacement heifers lost in 1980 divided by number of cows and heifers exposed to a bull or artificially inseminated to calve in 1980.

any given year is not necessarily the same as production during that year. At one extreme, a few small cow-calf producers included in the survey elected to dispose of no feeder cattle or breeding stock in 1980. On the other hand, some producers sold quite a few more cattle than were born in their herds (or purchased for resale) in 1980 by reducing inventories of feeder or breeding stock (the only requirement for inclusion in the survey was that the herd not be completely dispersed during the year). All feeder yearlings, by definition, and some feeder calves disposed of in 1980 were born in 1979, while many producers retained part or all of their 1980 calf crop for disposition in 1981. In the aggregate, therefore, cattle dispositions during a year are likely to be similar to production in that year only if regional inventories remain relatively constant.

Disposition of all types of cattle in 1980 averaged about 0.75 head per cow, and ranged from 0.68 head per cow in the North Central region to 0.79 per cow in the Great Plains (app. table 2). Disposition of female cattle accounted for this regional difference. Sale plus feedlot placement of steers per brood cow were almost identical in all regions except for the South, where the calving rate is traditionally lower. By contrast, producers disposed of only 0.28 females per cow in the North Central region compared with 0.38 in the Great Plains. Not only did North Central producers cull their collective cow herd less severely than in any other region, they also retained more of their heifer calves for selling, feeding, or breeding in 1981.

About four-fifths of all feeder cattle sold in the South in 1980 were sold as calves, continuing the traditional predominance of the cow-calf, compared to cow-yearling, system of production in this region. In each of the other regions, however, the ratio of sales was approximately three calves to two yearlings (table 23). Compared with 1975, the percentage of calf sales increased,



Two-thirds of the feeder cattle sold from beef cow-calf operations in 1980 were calves (less than 1 year old) that were sold at or soon after weaning.

Table 23—Average distribution of feeder cattle sold from beef cow-calf farms and ranches, 1980[1]

Region	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	Calf	Yearling	Calf	Yearling	Calf	Yearling	Calf	Yearling
	Percent							
South	82	18	76	24	80	17	80	20
North Central	62	38	52	48	71	29	59	41
Great Plains	62	38	57	43	52	48	59	41
West	70	30	65	35	43	57	60	40
All regions	68	32	62	38	53	47	64	36

[1]Excludes feeder cattle placed on feed by the cow-calf producer (app. table 2).

and yearling sales decreased, proportionately in each of the four regions. The shift was especially great in the West, where more than half of all feeder cattle were sold as yearlings in 1975 (*1*). Differences in the relationship between feeder yearling and calf prices may account for this change. In 1975, when the price of corn was high in relation to cattle prices, the Kansas City average price of 600- to 700-pound feeder steers was higher than the price of 400- to 500-pound steer calves. With the relatively lower feed prices in 1980, the average price of steer calves was one-eighth higher than the average for yearling steers (*13*).

As in 1975, the proportion of yearling sales in 1980 increased with size of enterprise in the Great Plains and the West. In the South and North Central regions, however, producers with large herds sold more of their feeder animals as calves than did producers with all herd sizes combined in 1980 (table 23).

Average weight per head of steers, both calves and yearlings, sold in 1980 was lowest in the South and progressively higher in each region farther west (app. table 3). Heifer calves and yearlings were also sold at lighter average weights in the South than in any other region. The heaviest yearling heifers were sold by producers in the Great Plains, while operators in the North Central region sold the heaviest heifer calves. Heifer calves sold in the North Central region were heavier, hence probably older, than steer calves sold in that region.

Cull cow weights averaged less than 900 pounds per head in the South, around 950 pounds in the North Central region and the Great Plains, and nearly 1,000 pounds in the West (app. table 3). For all regions combined, the average weight of cull cows sold in 1980 was 950 pounds, almost 20 pounds heavier than the 1975 average (*1*). The increasing popularity of crossbred

Producers with livestock scales usually monitor animal weight gains as a basis for deciding when to sell feeder calves or yearlings.

cows resulting from crossing standard British beef breeds (Angus, Hereford, or Shorthorn), with Brahman, Holstein, or large exotic European breeds (such as Charolais, Simmental, or Limousin) probably accounts for this increase in average cow size.

Greater use of crossbreeding, selection within breeds of herd bulls with rapid growth rates, and increasing use of growth-stimulating implants and/or feed additives contributed to increases in the average weights of each class of feeder cattle sold in 1980, compared with those in 1975. Average weights by class in 1980 and 1975, respectively, were: steer calves, 444 versus 427 pounds; heifer calves, 426 versus 415; yearling steers, 662 versus 630; and yearlings heifers, 610 versus 593 pounds.

Total weight of feeder calves and yearlings sold or placed on feed per cow bred is an indication of physical productivity reflecting birth and death rates as well as average weight per head at time of disposition. Sale or feedlot placement of all feeder cattle averaged 342 pounds per cow in 1980 (table 24). Great Plains producers reported the greatest total feeder weight per cow, 9 percent more pounds than the average for all regions. The high proportion of lightweight calves in the South, by contrast, caused feeder weight per cow to average only about four-fifths as much as in all regions combined.

Timing of Cattle Sales

More than half of all stocker and feeder calves were sold during the fourth quarter of 1980 (table 25). Two-thirds of the calves in the West were sold in the fourth quarter, probably soon after the fall roundups traditional on most western ranches. On the other hand, less than one-sixth of the total in the West were sold during the second and third quarters combined, during which grazing on publicly owned rangeland is most frequently permitted.

Seasonality of calf sales was least pronounced in the South, where quarterly sales ranged only from one-eighth to two-fifths of the annual total. The more dispersed calving period in this region is one contributing factor (table 19). In addition, the peak period of calf sales, timed to accommodate calves born during January-April, extends from August-November, thus including parts of both the third and fourth calendar quarters.

The uneven quarterly distribution of calves sold from all regions combined is, of course, poorly matched to the year-round need for feeder cattle by commercial feedlots. However, many calves, particularly lighter weight ones, go through a growout phase before they are placed in a commercial feedlot to be fattened on a ration composed primarily of grain. Length of the growout phase, during which the cattle may be fed a forage-based ration

Table 24—Average weight of feeder cattle per cow and replacement heifer on beef cow-calf farms and ranches, 1980[1]

Region	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Pounds			
South	269	302	250	276
North Central	304	367	267	318
Great Plains	379	381	332	373
West	349	368	378	367
All regions	328	362	337	342

[1]Includes calves and yearlings sold or placed on feed by the cow-calf operator. Excludes breeding stock and cull cows sold as well as calves retained as replacement heifers.

Table 25—Percentage of feeder calves sold each calendar quarter on beef cow-calf farms and ranches, 1980

Region and calendar quarter	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Percent			
South:				
I	13	15	7	13
II	18	14	15	17
III	27	31	40	29
IV	42	40	38	41
North Central:				
I	13	39	16	18
II	12	15	5	13
III	14	5	7	11
IV	61	41	72	58
Great Plains:				
I	19	20	8	18
II	12	10	7	11
III	20	20	43	22
IV	49	50	42	49
West:				
I	21	18	12	18
II	7	6	10	7
III	5	9	12	8
IV	67	67	66	67
All regions:				
I	16	20	10	17
II	13	10	10	12
III	19	17	29	19
IV	52	53	51	52

(in a "warmup" feedlot) or grazed (in a stocker-feeder enterprise) varies with the caloric concentration of the diet as well as with initial weight and type of calves involved. The result is a dispersion or leveling over time of the supply of cattle suitable for full-feed finishing.

Cow herd operators selling yearling feeders also help to even out the feeder cattle supply. Yearling sales by cow-calf producers (defined to include cow-yearling operators) varied much less from quarter to quarter in 1980 than did calf sales (tables 25 and 26). Only in the North Central region were yearling sales in any specified quarter appreciably less than one-fifth of the annual total. For all regions combined, yearling sales varied only from 19 percent in the third quarter to 32 percent in the first (table 26).

Timing of the sale of cull breeding stock in 1980 was similar to that for calves, although slightly less concentrated in the fourth quarter (tables 25 and 27). Most producers base their decision as to whether or not to cull producing cows on the weight and grade of their last calves, information not usually definite until calf sale time. Cows failing to calve on schedule in the spring, the heaviest calving season, probably account for much of the relatively greater cull cow than calf sales in the second quarter. The increasing use of pregnancy testing, especially in the West and North Central regions, is at least partially responsible for the higher proportion of cull cow than of calf sales in the third quarter, soon after the end of the peak breeding season.

As was the case for calf sales, seasonal cull cow sales varied least in the South (table 27). By contrast, seasonal cull sales varied most in the North Central region. Many producers in this region, especially those with small herds, sold very few culls during the second quarter, a period of peak labor use in row crop production.

Table 26—Percentage of feeder yearlings sold each calendar quarter on beef cow-calf farms and ranches, 1980

Region and calendar quarter	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Percent			
South:				
I	18	26	27	22
II	29	32	21	29
III	21	13	36	20
IV	32	29	16	29
North Central:				
I	79	48	20	69
II	2	19	1	7
III	5	16	48	9
IV	14	17	31	15
Great Plains:				
I	36	27	6	28
II	26	32	31	29
III	17	23	27	21
IV	21	18	36	22
West:				
I	36	20	7	18
II	29	25	33	29
III	18	23	22	21
IV	17	32	38	32
All regions:				
I	45	28	8	32
II	21	28	31	25
III	14	21	25	19
IV	20	23	36	24

Table 27—Percentage of cull cows sold each calendar quarter on beef cow-calf farms and ranches, 1980

Region and calendar quarter	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Percent			
South:				
I	26	9	22	20
II	21	21	20	21
III	25	28	21	25
IV	28	42	37	34
North Central:				
I	29	10	14	22
II	1	18	22	8
III	6	31	13	15
IV	64	41	51	55
Great Plains:				
I	19	18	14	17
II	18	17	31	21
III	27	21	17	22
IV	36	44	38	40
West:				
I	14	16	10	14
II	22	20	11	17
III	11	20	29	21
IV	53	44	50	48
All regions:				
I	22	15	13	17
II	16	19	20	18
III	20	23	23	22
IV	42	43	44	43

Feed Production and Use

Efficiency in the provision and use of feeds is critical to the success of any livestock enterprise. Costs of producing or purchasing feedstuffs frequently comprise more than half of the total direct production cost in cow-calf production. Types and costs of feeds used in cow-calf production are quite variable, however, because of the broad range of cellulosic materials which can be utilized by ruminants. Major aspects of feed production and use are thus a very important component of the organization and operation of cow-calf production.

Pasture and Range

Cow-calf producers normally rely on grazing. Nutrients obtained through grazing are usually less costly than those provided through harvested forages, grains, or other processed feeds. In addition, the dispersion of cattle over the pasture or range acreage needed to supply adequate nutrition from grazing helps to minimize other problems, such as disease epidemics, frequently associated with production in drylot or other restricted areas. Sizes and systems of feeder cattle production are consequently usually planned, and may be modified, to fit the anticipated supply of grazing during the forage grazing season.

Amount and Type of Forage Grazed

Accurate measurements of feed nutrients from grazed forages are extremely difficult to obtain. Lack of a widely understood and consistently evaluated measurement unit for pasture and range production and utilization is part of the problem. Such precise and nutritionally meaningful measurements as calories of net energy (NE), digestible energy (DE), or quantities of total digestible nutrients (TDN) are almost never known by, or even meaningful to, most cow-calf producers. Proxy measurements, such as animal months, animal unit months, cow days, or tons of hay equivalent are more adequately understood (though sometimes loosely or inconsistently defined) and frequently used in some regions, but are little understood or used in others. Thus, despite its obvious imprecision as an indicator of feed quantity or value, acreage appears to be the only widely used measurement unit for pasture and range. Cow-calf producers in all regions reported pasture and range which they owned in acreage terms. Most rented or leased grazing was also reported in acres in all regions except the West, where about one-fourth of all ranchers surveyed in 1980 used publicly owned land managed by the U.S. Bureau of Land Management (BLM) and one-seventh used Forest Service (FS) land. All grazing permits on FS and most BLM lands are measured in animal months. More than 10 percent of all ranchers in the West and about 3 percent in the Great Plains also rented or leased range or pastureland from private or other public landowners (such as States or Indian tribes) on an animal month basis. None of this land is included in the acreage data discussed below.

In addition to land leased by the animal month, in 1980 cow-calf producers in all regions combined used nearly 11 acres per brood cow exclusively for grazing cattle (cows and associated calves, yearlings, bulls, and herd replacements) in their herds (table 28). Land used only for grazing ranged from about 3 acres per cow in the humid South and North Central regions to 13 acres in the Great Plains, and almost 20 acres per cow in the arid West. In all regions except the West, less grazing land was used per cow in 1980 than in 1975 (over 15 percent less in the two eastern regions), although beef cow inventories in each region were considerably smaller in 1980. The fact that the average per-acre value of farm real estate in the United States almost doubled during this 5-year period is consistent with the increased intensity in grazing land use (*11*).

Cow-calf herds are also grazed on land used primarily for other purposes. Crop residues and accumulated weeds are frequently grazed for limited periods following harvest of corn, grain sorghum, soybeans, small grains, and other crops in all regions, as is hay aftermath. Fall-seeded small grains, especially winter wheat, are grazed during the winter and early spring, then allowed to mature for grain harvest, in the South-

Table 28—Acres of land per cow used only for grazing on beef cow-calf farms and ranches, 1980[1]

Region	Cow herd size (head)			
	20–99	100–499	500 or more	All sizes
	Acres			
South	2.6	3.1	4.7	3.0
North Central	2.6	2.5	5.5	2.7
Great Plains	8.8	12.8	27.2	13.0
West	15.9	18.9	24.3	19.8
All regions	6.5	12.0	21.3	10.8

[1]Acres grazed by the entire cow-calf herd, divided by the number of brood cows. Excludes (1) publicly owned lands administered by BLM or FS, (2) pasture or range leased or rented on a per-head basis from any source, (3) wheat or other small grains grazed but subsequently harvested for grain, (4) hay aftermath, and (5) corn stalks, grain stubble, or other harvested crop residues grazed.

ern Plains. Use of these secondary sources of grazing in 1980 ranged from less than 0.5 acre per cow in the Great Plains to more than 0.8 acre in the South (app. table 4). Producers with smaller cow-calf enterprises generally used larger acreages of secondary grazing per cow. This is consistent with the finding that producers with smaller herds tended to operate larger acreages of cropland per cow, but smaller total cropland acreages per farm or ranch.

Producers with smaller herds, however, use less land per cow exclusively for grazing. In both the North Central and Great Plains regions, the acreage of pasture and rangeland used per cow in 1980 was less than half as great for herds with fewer than 100 cows as for herds of 500 or more (table 28). A similar direct relationship between grazing acres per cow and herd size was reported in 1975 (*1*).

Differences in native productivity of the land grazed appear to be a major reason for this continuing relationship. In each region, the large cow-calf enterprises tend to be concentrated in areas in which competition for land use from crops or other profitable alternatives is least. In the North Central region, for example, most large cow-calf herds are located in southern Missouri, outside the central Corn Belt.

Seeded or vegetatively established (sprigged) perennial grasses and/or legumes represent the principal types of improved pasture grazed by cow-calf herds in the two eastern regions, the South and North Central regions (app. table 4). Fescue alone or interseeded with red and/or white clover is predominant in the southern Appalachian States and in the North Central region, where orchard grass and brome, sometimes interseeded with clovers and/or alfalfa, are also common. Hybrid bermudagrass, bahia, and, especially in Florida, pangola are principal seeded perennial pasture grasses in the Deep South.

Common bermudagrass, dallisgrass, bluegrass (in the Appalachian States), and various native grasses, sedges, and forbs are major forages in native pastures in the South, while bluegrass predominates in the North Central region.

In the South, ryegrass or small grains for winter grazing and/or millet, sudangrass, or sudan-sorghum crosses for summer grazing comprise most annual pastures, which are usually fertilized and grazed relatively intensively. In the North Central region, only producers with small herds reported the use of annual pastures—small grains, which may have been harvested later as grain, hay, or silage.

Use of small grains, predominantly wheat, for pasture prior to grain harvest is more widespread in the southern Great Plains (app. table 4). Irrigated pasture in the Great Plains and, to a much greater extent, the West is the only other type of grazing in the western half of the Nation which normally receives annual application of variable inputs comparable in cost to the mechanical and chemical weed control measures and fertilizer applications normally used on seeded perennial pastures in the North Central region and particularly the South. In both the Great Plains and the West, dry (nonirrigated) native range, on which cultural operations are minimal, provides an overwhelming share of the grazing.

Grazing Land Tenure

Two-thirds of the nonfederally owned land used by cow-calf producers exclusively for grazing in 1980 was owned by the cattle enterprise operators; one-third was rented (table 29). Comparable data for 1975 are not available, although larger proportions of operators in the South and North Central regions rented part or all of the land in their overall farming operations in 1975 than in 1980.

Cattle producers in the North Central region rented only 15 percent of the land on which they grazed cattle in 1980, less than half the average for all regions. This may be due to a relative shortage of adequately fenced grassland on farms in the region that do not include cattle enterprises.

Crops are harvested from most North Central farmland, more than 60 percent of the total land in farms in each State except Missouri and Wisconsin (*14*). Much of the grassland is in relatively small meadow areas interspersed among cropland fields. Fencing of such areas is expensive for several reasons: (1) the amount of fencing per acre enclosed is progressively greater for smaller acreages (that is, a mile of fence will enclose a square area containing 40 acres, while 0.5 mile is required for a 10-acre plot), (2) fences must be tightly constructed and well maintained to restrain cattle when adjacent areas contain plants as palatable as growing corn, and (3) fences curtail the movement of crop machinery from field to field. With the increasing size of modern row crop machinery, small fenced fields necessitate increasingly wide turn rows and the attendant loss of cultivable land at the ends of cropland fields. As a result, few farmers who do not have livestock are willing to add fences to obtain the potential income from renting grazing rights. Many who deleted livestock enterprises as they expanded grain acreages in the late seventies eliminated fences to facilitate cropping activities.

Cow-calf producers in the Great Plains leased the highest percentage of the grazing land that they used in 1980. Availability of native rangeland in the region and the scarcity, in relation to the West, of federally owned lands on which grazing rights are generally less costly help to account for this situation.

The Great Plains is the only region in which percentage of grazing land leased was not consistently related to herd size in 1980; operators of medium-sized herds in this region leased the highest proportion of land used exclusively for grazing (table 29). The percentage of leased range in the West decreased with herd size, but the importance of both BLM and FS lands as a source of grazing increased. In both the South and North Central regions, operators of larger cow-calf enterprises leased larger proportions of their grazing land. Multiple

Table 29—Percentage of acres used only for grazing leased in by beef cow-calf farms and ranches, 1980[1]

Region	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Percent			
South	13	39	43	27
North Central	13	16	30	15
Great Plains	36	45	33	39
West	34	32	30	31
All regions	31	38	32	34

[1]Excludes (1) publicly owned lands administered by BLM or FS, (2) pasture or range leased or rented on a per-head basis from any source, (3) wheat or other small grains grazed but subsequently harvested for grain, (4) hay aftermath, and (5) corn stalks, grain stubble, or other harvested crop residues grazed.

In the Great Plains and West, native rangeland provides most of the grazing for beef cow-calf herds. Privately owned land used exclusively for grazing in 1980 varied from 3 acres per cow in the humid South and North Central regions, to 13 acres in the Great Plains, and almost 20 acres per cow in the semiarid West, where publicly owned lands administered by the U.S. Forest Service and Bureau of Land Management are also grazed on a permit basis.

individual or corporate landlords frequently supplied the land leased by larger herd operators, reflecting the predominance of small individual farms in these regions.

Grazing Land Rental Fees

Annual rental fees paid for grazing land in 1980 averaged $6.90 per acre (table 30). The average ranged from more than $17 per acre in the North Central region, where leasable grassland is usually rather productive and in relatively short supply, to $5.40 in the South, where productivity depends most heavily on application of variable inputs, especially fertilizer.

In each region, operators of larger herds paid lower rents. The fact that larger cow-calf enterprises are frequently concentrated in less productive areas helps to account for this relationship.

Table 30—Average annual rent per acre of grazing land leased in by beef cow-calf farms and ranches, 1980[1]

Region	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Dollars			
South	8.10	5.42	3.38	5.40
North Central	19.76	14.35	8.42	17.18
Great Plains	8.02	7.65	5.07	7.11
West	7.59	6.33	5.72	6.38
All regions	8.39	7.07	5.31	6.90

[1]Excludes (1) publicly owned lands administered by BLM or FS, (2) pasture or range leased or rented on a per-head basis from any source, (3) wheat or other small grains grazed but subsequently harvested for grain, (4) hay aftermath, and (5) corn stalks, grain stubble, or other harvested crop residues grazed.

Grazing Land Fertilization

The 1976 survey of cow-calf producers indicated that dryland range in the Great Plains and the West is very rarely fertilized; fertilizer applications to grazing land are confined to the minimal acreage of irrigated pasture. As a consequence, no data on forage fertilization were collected in these regions during the 1981 survey.

In the North Central region and particularly the South, by contrast, regular fertilizer applications are needed to realize the productive potential of nearly all types of seeded pastures. Periodic applications of lime, nitrogen, phosphate, and/or potash to native pasture are also usually beneficial and economically justifiable.

More than half of the seeded or sprigged perennial pasture acreage was fertilized in 1980 in the South, compared to just over one-fifth in the North Central region (table 31). Cow-calf producers in the North Central region, where the dominant native pasture forage is bluegrass, which is relatively responsive to fertilizer, fertilized almost as high a proportion of their native as of their seeded pastures. In the South, particularly in the Gulf Coast States, marsh grasses, wiregrass, and sedges, which are not as responsive to fertilizer, are major native pasture species. Much of the native pastureland is too wet or, in the mountainous areas, too steep to accommodate machinery. About 1 acre out of 12, on average, was fertilized in 1980.

Ninety percent of the annual pasture used in the South received one or more fertilizer applications. Most of the remaining 10 percent was grown on land which contained considerable residual plant nutrients as a result of heavy fertilization of preceding crops. Naturally fertile soils and/or residual fertilizers were apparently considered adequate for the small acreage of annual pastures used by North Central cow-calf producers.

Table 31—Percentage of pasture acreage fertilized on beef cow-calf farms in the Eastern United States, by type of pasture, 1980

Pasture type	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	South	North Central	South	North Central	South	North Central	South	North Central
	Percent							
Annual	86	0	99	*	86	*	90	0
Seeded perennial	52	15	47	34	82	22	55	21
Native	21	20	5	22	2	1	8	19
All types	50	17	34	33	42	16	43	20

*Not applicable.

Fertilization rates were generally highest for annual pastures in the South. In both regions, rates per acre were higher for seeded perennial than for native pastures.

Harvested Forages

Although beef cow-calf herds are kept on pasture or range throughout the year in much of the Nation, few producers depend on grazing alone to furnish an adequate year-round supply of forage for their cattle. Snow cover prevents grazing, at least occasionally during the winter, in most areas except the Deep South and the Southwest. Even in these areas, growth or nutritive content of pasture and range plants frequently varies enough during the year, due to temperature or moisture fluctuations, so that the provision of adequate grazing during nonproductive periods would require too much area per cow to be economically feasible. Thus, most producers feed some harvested forages, predominantly hay, almost every year.

Some producers who normally use little supplemental forage purchase all that they feed. Most, however, harvest part or all of their annual supply from surplus pasture or range growth during peak growing periods or from land used primarily for hay or silage production.

Acreage and Type of Harvested Forages Produced

An average of slightly less than 1 acre per cow was used in 1980 by operators of cow-calf herds of all sizes in all regions to produce hay or grass silage (table 32). Regional differences were relatively small, ranging only from 0.8 acre per cow in the South to 1 acre per cow in the West and North Central regions. In each region, however, the per-cow allocation of land to forage for harvest declined sharply as herd size increased. The fact that operators of larger herds used more grazing land per cow helps to explain their need for less hay land.

Relatively few cow-calf producers have the equipment and facilities to harvest and feed silage. Most who do have the equipment and facilities ensile grain crops—corn, sorghum, and/or small grains—not included in the harvested forage acreage data collected in the 1981 survey. Even when multiple cuttings from the same acreage are counted, only about 1 acre of grass silage was harvested in 1980 per 100 cows in all regions combined (app. table 5). Operators of midsized herds in the North Central region and Great Plains made the greatest use of nongrain crops, primarily alfalfa, for silage.

Some of the acreage in alfalfa and hybrid bermudagrass was harvested three or more times for hay during 1980 by individual cow-calf operators, while others cut their fields only once. Overall, however, producers in each region averaged about 1.4 cuttings per acre of land used for hay (table 32 and app. table 6). Aftermath was then grazed from varying proportions of the hay land acreage, ranging from one-third of the total in the Great Plains and North Central regions to three-fourths of the acreage on cow-calf farms in the South (table 32 and app. table 4).

Table 32—Acres per cow of land used for harvested forages on beef cow-calf farms and ranches, 1980[1]

Region	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Acres			
South	1.1	0.6	0.2	0.8
North Central	1.1	.8	.4	1.0
Great Plains	1.1	.8	.2	.9
West	1.3	1.0	.8	1.0
All regions	1.1	.8	.5	.9

[1]Excludes grain crops harvested as silage and crop residues mechanically harvested for forage.

Forage Harvesting Technology

Implements traditionally used to mow hay—sickle mowers in the humid eastern half of the country and either sickle mowers or swathers in the western half—are being replaced rapidly by the more technologically advanced mower-conditioners. In 1980, larger proportions of the hay acreage on cow-calf farms in both the South and North Central region were harvested with tractor-powered mower-conditioners than with any other type of implement. A few producers with midsized or large herds used self-propelled mower-conditioners (table 33). The curing time for forage crops harvested with a mower-conditioner is usually reduced by one-fourth or more compared to that required when a sickle mower or swather and no conditioner is used, a particularly big advantage in the South and the North Central region where rain showers are frequent during the hay-harvesting season.

The danger of rain during curing is less of a problem in the Great Plains and the West. Perhaps the biggest advantage of mower-conditioners in these regions is that they crush the stems of forage crops, facilitating more uniform drying of stem and leaf fractions. This operation produces leafier, higher quality hay. Mower-conditioners were used in 1980 to cut about one-fourth

Table 33—Percentage of acres covered by various types of hay mowers on beef cow-calf farms and ranches, 1980

Region and mower type	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Percent			
South:				
Sickle mower	39	26	14	35
Self-propelled mower-conditioner	1	4	2	1
Tractor-drawn mower-conditioner	49	58	46	51
Swather	0	1	4	1
All other	11	11	34	12
Total	100	100	100	100
North Central:				
Sickle mower	52	10	10	43
Self-propelled mower-conditioner	2	6	3	3
Tractor-drawn mower-conditioner	41	82	85	50
Swather	5	1	2	4
All other	0	1	0	*
Total	100	100	100	100
Great Plains:				
Sickle mower	29	29	9	28
Self-propelled mower-conditioner	3	11	23	7
Tractor-drawn mower-conditioner	20	20	18	20
Swather	46	35	36	42
All other	2	5	14	3
Total	100	100	100	100
West:				
Sickle mower	23	20	13	19
Self-propelled mower-conditioner	22	23	27	24
Tractor-drawn mower-conditioner	9	10	3	8
Swather	45	46	55	48
All other	1	1	2	1
Total	100	100	100	100
All regions:				
Sickle mower	36	23	13	30
Self-propelled mower-conditioner	5	14	24	9
Tractor-drawn mower-conditioner	30	28	10	28
Swather	26	31	47	29
All other	3	4	6	4
Total	100	100	100	100

*Less than 0.5 percent.

of the hay on cow-calf farms and ranches in the Great Plains and nearly one-third of the total acreage in the West, although swathers, many of which may have had conditioner attachments, were still the most used implement in both regions. Unlike the situation in the other three regions, self-propelled mower-conditioners are more widespread than tractor-drawn machines in the West. The scarcity of large tractors on many ranches in the West that have no crop enterprises and the prevalence of relatively large commercial hay enterprises in some areas are probable reasons for this difference.

In 1980, cow-calf producers in all regions combined harvested nearly 40 percent of their total hay acreage with mower-conditioners (table 33). Unpublished data from the 1976 survey indicate that mower-conditioners were used to cut less than 10 percent of the hay acreage in 1975.

The form in which hay is packaged by cow-calf producers also changed dramatically in all regions except the West between 1975 and 1980. Data from the 1976 survey indicate that less than a tenth of the hay in each region was packaged in large round bales in 1975. By 1980, large bales were the predominant hay form in the South and North Central region, and were used as much as small rectangular bales in the Great Plains. In the West, by contrast, almost two-thirds of all hay was still packaged in traditional small rectangular bales (table 34).

Hay packaged in large round bales is less subject to damage from precipitation when stored outdoors than is conventionally baled hay. This feature is of little value in much of the West, however, where precipitation is so low that rectangular bales can be stored in outdoor stacks without unacceptable weather damage. Farmers can bale hay sooner after mowing and at higher moisture content in large round bales, compared with the smaller rectangular form. But, this is less of an advantage to western farmers who face less risk of rainfall after mowing and before baling. Further, tractor power is required to move large round bales. Western ranches generally have fewer tractors than do ranches and farms in other regions which frequently include crop enterprises.

In addition, western cow-calf producers have mechanized the handling of conventional rectangular bales to a greater extent than producers in any other region, at least partially offsetting the labor-saving advantage of round balers. Almost four-fifths of the conventionally baled hay was field loaded mechanically in the West, compared to half in the Great Plains and less than 15 percent in the South or North Central region (app. table 7). Mechanical stacker wagons or tractor-mounted, front-end stackers were the field-loading implements most used. Few producers in any region used mechanical bale kickers that throw bales directly from the baler to a trailing wagon equipped with hay racks.

Table 34—Percentage of hay produced in various forms on beef cow-calf farms and ranches, 1980

Region and hay form	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Percent			
South:				
Small bales[1]	46	35	23	42
Large bales[2]	54	62	62	57
Cubes or pellets	0	0	0	0
Chopped or shredded	0	0	0	0
Mechanical stacks[3]	0	2	0	*
All other[4]	0	1	15	1
Total	100	100	100	100
North Central:				
Small bales[1]	44	16	24	38
Large bales[2]	49	73	62	54
Cubes or pellets	0	0	0	0
Chopped or shredded	1	2	3	1
Mechanical stacks[3]	6	9	11	7
All other[4]	0	0	0	0
Total	100	100	100	100
Great Plains:				
Small bales[1]	49	31	43	42
Large bales[2]	33	52	43	41
Cubes or pellets	0	0	2	0
Chopped or shredded	1	2	0	1
Mechanical stacks[3]	10	9	11	10
All other[4]	7	6	1	6
Total	100	100	100	100
West:				
Small bales[1]	71	65	46	63
Large bales[2]	10	14	20	14
Cubes or pellets	*	*	*	*
Chopped or shredded	3	*	1	1
Mechanical stacks[3]	9	9	15	11
All other[4]	7	11	18	11
Total	100	100	100	100
All regions:				
Small bales[1]	50	42	43	47
Large bales[2]	38	42	27	39
Cubes or pellets	*	*	*	*
Chopped or shredded	1	1	1	1
Mechanical stacks[3]	7	9	14	8
All other[4]	4	6	15	5
Total	100	100	100	100

*Less than 0.5 percent.
[1]Bales light enough to be handled manually.
[2]Bales heavy enough to require mechanical power for handling.
[3]Stacks formed by mechanical harvester.
[4]Manually formed stacks or loose storage.

Stacker wagons were also used to transport more hay in the West than any other implement (app. table 8). Large bale movers, as expected, earned this distinction in the South and North Central regions. General purpose farm wagons or trucks were also widely used in these regions as well as in the Great Plains. Use of specialized implements designed to transport mechanically formed hay stacks was confined largely to the Great Plains and the West, as few producers in the two eastern regions used mechanical stackers to package hay.

Fertilization of Harvested Forages

No data concerning fertilization of forage crops harvested as hay or silage were collected from respondents in the Great Plains or the West during the 1981 survey. More than three-fourths of the total acreage harvested as hay or silage on cow-calf farms in the South was fertilized in 1980 (table 35). The proportions of various forage types fertilized ranged from about two-thirds of the native grasses to nearly all of the annual grasses harvested.

On the more fertile soils of the North Central region, annual grasses were the only type of mechanically harvested forage always fertilized each year. Fertilizer applications were made to seeded perennial grasses about 2 years out of 5 and to alfalfa or other legumes an average of once only every 4 years.

Supplemental Feeding

Cow-calf producers use various types of feeds to extend or supplement nutrients which their cattle obtain from grazing available pasture, range, and crop residue sources. Hay is fed in greater quantities than any other supplemental feed by most beef cow-calf producers. However, the occasional producer who uses silage as a primary supplemental forage must feed about 3 pounds of nongrain crop silage to provide the amount of total digestible nutrients (TDN) contained in 1 pound of good quality hay. The much higher moisture content of silage accounts for the greater amount needed.

Mature dry beef cows will normally consume enough grass hay or silage of average quality to meet their nutritional requirements. By contrast, hay or silage made from mature or unfertilized grasses may not contain a high enough concentration of TDN to supply all of the energy needed by nursing cows or by replacement heifers which must gain weight rapidly and steadily enough to breed at 13-15 months of age and to calve successfully as 2-year-olds. Such animals are frequently fed limited amounts of concentrate feeds, usually grains, in addition to forages of average or poor quality. Some producers also use grains as creep feeds to promote rate of gain in calves to be sold as feeder animals. They provide grains in enclosed areas (creeps) with entrances

Snow cover prevents grazing during the winter at least occasionally in most regions. Cow-calf producers feed an average of more than 1 ton of hay annually per brood cow as supplemental forage. The proportion of hay handled as large round bales has increased rapidly since the midseventies.

Table 35—Percentage of harvested forage acreage fertilized on beef cow-calf farms in the Eastern United States, by type of forage crop, 1980

Forage Crop	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	South	North Central	South	North Central	South	North Central	South	North Central
	Percent							
Alfalfa or other legume	92	20	71	57	95	88	90	26
Annual grass	95	100	100	100	95	100	94	100
Seeded perennial grass	71	40	76	37	86	67	73	40
Native grass	62	0	66	*	56	*	63	0
All types	77	31	76	44	87	76	77	34

*Not applicable.

large enough to admit calves but that are too small for cows to enter. This practice is most common when grain prices are low in relation to feeder calf prices and when available forages are limited in quantity or quality.

The protein content of hay, silage, or mature pasture and range plants frequently limits milk production of lactating cows and growth rate of young cattle unless legumes are included in the sward, or high levels of nitrogen fertilizers are applied to pure grass sods. Many producers prefer to use protein supplement feeds when needed, usually oilseed meals or commercial blends of grain, grain byproducts, and a nonprotein nitrogen source such as urea. They do this rather than incurring the added grazing management problems and expense usually associated with legume establishment and maintenance or the high costs and uncertain results of applying additional nitrogen to their forage crops.

Some cow-calf producers use creep feeders—feeders in enclosures with entrances large enough to admit calves but too small for cows—to provide grain or other concentrate feeds to unweaned calves, especially when pasture quality is poor and grain prices are low relative to anticipated feeder calf prices.

Quantities and Types of Roughages

Cow-calf producers in all regions fed an average of 1.25 tons of hay and 0.32 ton of silage per brood cow in their herds during 1980 (table 36). Feeding rates reported for 1975 were quite similar—1.21 tons of hay and 0.44 ton of silage per cow (*1*).

Regional variations in roughage feeding rates appear consistent with the duration and severity of winter weather. Assuming that 3 tons of silage equal 1 ton of hay equivalent, total forage feeding rates were lowest, and almost equal, in the South and in the Great Plains, where much of the regional beef cow inventory is located in the mild winter southern Plains States (Texas and Oklahoma). Total roughage feeding averaged about 1.25 tons of hay equivalent per cow in these two regions, compared with about 1.36 tons in the West and about 1.63 tons in the North Central region (table 36).

Regional differences in average rates of roughage feeding were not as large, however, as average differences by size of enterprise within each region. Producers with large cow-calf herds fed the least amount of roughage per cow and, except in the North Central region, those with small herds fed the most (table 36). The fact that producers with larger herds provided more grazing land per cow (table 28) and the tendency for large herds to be concentrated in the southern areas of some regions may help to account for these relationships.

Table 36—Average quantities of hay and silage fed per cow on beef cow-calf farms and ranches, 1980

Region	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	Hay[1]	Silage[2]	Hay[1]	Silage[2]	Hay[1]	Silage[2]	Hay[1]	Silage[2]
	Tons							
South	1.38	0.11	1.13	0.56	0.33	0.25	1.17	0.26
North Central	1.39	.35	1.82	.80	1.08	.46	1.48	.46
Great Plains	1.51	.44	1.06	.44	.27	.04	1.16	.38
West	1.65	.11	1.37	.29	.92	.14	1.30	.20
All regions	1.46	.29	1.25	.45	.60	.13	1.25	.32

[1]Includes small quantities of straw fed by a few producers.
[2]Primarily corn silage, but also includes small quantities of small grain silage and grass-legume silage or haylage (plant material partially dried before storage in a silo) fed by some producers.

Hay made from various types of grasses was the most widely used type of harvested forage fed by cow-calf producers in 1980. More than three-fourths of the 1981 survey respondents fed some grass hay, while less than one-third used alfalfa hay. Fewer than a tenth fed hay made from legumes other than alfalfa (app. table 9). Alfalfa hay was both fed and purchased to the greatest extent by cow-calf producers in the West, where this high-quality roughage is most frequently produced under irrigation as a commercial enterprise. Nearly two-thirds of the cow-calf ranchers in the West fed some alfalfa hay, one-fifth of which was purchased. Proportions of cow-calf operators using alfalfa hay and percentages of this feed purchased in 1980 declined progressively in the more humid regions, where risk of weather damage during curing and severity of alfalfa disease problems are greater.

Purchased hay as a proportion of all hay fed in 1980 was relatively constant across herd-size groupings in the West, where cow-calf enterprises are least likely to be parts of or comingled with general crop farms. In the other three regions, however, producers with small herds purchased more of their hay than those with medium- or large-sized herds (app. table 9). Annual hay requirements of cattle producers with fewer than 100 brood cows are generally too small to justify ownership of modern hay-harvesting equipment, and custom harvesting of small acreages may be more expensive or difficult to schedule when forage crops are near optimum maturity. In the Great Plains and North Central regions, cattle producers with herds of 500 or more cows also bought higher proportions of their hay than producers with medium-sized herds. Operators of many of these larger herds are specialized ranchers who have limited alternative uses for tractors large enough to power efficient hay-harvesting equipment. In addition, they may be able to buy hay at lower prices by taking delivery in carload or other wholesale-sized lots.

Relatively few operators feed silage to their cow-calf herds; most who do use corn ensiled in their own facilities. Only in the Great Plains was silage fed by as many as 10 percent of all cow-calf producers in 1980. And, in all regions except the West, more than 90 percent of the silage fed was produced by the cattle producers who used it (app. table 10).

Quantities and Types of Concentrate Feeds

U.S. producers fed an average of 170 pounds of grain and 157 pounds of protein supplement feeds per cow in their herds in 1980 (table 37). These feeding rates compare quite closely with rates reported for 1975, 201 pounds of grain and 154 pounds of protein supplement per cow (*1*).

The quantity of grain fed was inversely related to herd size in all regions combined, although this was not invariably the case in some regions. More grain was fed per cow in herds of 100-499 cows than in small herds in the West and North Central regions (table 37). In each region, however, producers with large cow-calf enterprises did feed much less grain per cow than those with medium-sized or small herds.

This relationship may be due, at least partially, to differences in the onfarm availability of grains, which were generally produced more frequently in conjunction with small and medium-sized than with large cow-calf enterprises. Thus, cattle producers with large herds had to purchase more than three-fourths of the corn that they fed, compared with less than half of the corn fed in medium-sized herds and only one-third of the total fed by operators of small herds (app. table 11). Oats were fed to cow-calf herds more frequently than any grain other than corn. Percentages of oats fed that were purchased by operators of large, medium, and small herds in 1980 were 45, 19, and 15 percent, respectively.

Table 37—Average quantities of grains and protein supplements fed per cow on beef cow-calf farms and ranches, 1980

Region	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	Grain	Supplement	Grain	Supplement	Grain	Supplement	Grain	Supplement
	Hundredweight							
South	2.40	1.19	1.91	1.32	0.39	1.22	1.99	1.23
North Central	2.10	.97	3.84	1.03	1.21	3.03	2.48	1.04
Great Plains	1.76	1.94	1.63	2.52	.34	2.40	1.51	2.24
West	1.25	.86	1.52	1.44	.78	.97	1.23	1.16
All regions	1.95	1.37	1.87	1.83	.57	1.56	1.70	1.57

Cattle producers in each region tended to feed the various grains roughly in proportion to the regional production of each grain. In the South, where relatively little grain other than corn and wheat, which is usually higher priced than feed grains, is produced, corn was fed by more than 10 times as many cattle producers as was either grain sorghum or oats (app. table 11). Corn was also fed more frequently than sorghum and oats combined in the North Central region. In the Great Plains, by contrast, slightly more cow-calf producers fed oats than corn, and sorghum feeding was also rather common, particularly in the southern Plains. Corn, oats, and barley were fed with about equal frequency in the West.

There was also considerable regional variation in the average amounts of grains and protein supplements fed per cow. Producers in the North Central region, where feed grain production is concentrated and grain prices are consequently lowest, fed twice as much grain per cow as producers in the West. Protein supplement feeding rates were equally variable, ranging from about 100 pounds per cow in the North Central region, where the additional grain provided some supplemental protein, to almost 225 pounds per cow in the Great Plains, where dry range grasses which have low protein content are used most extensively as a primary source of winter feed (table 37).

Facilities and Equipment

"Wild West" portrayals of cattle ranching in novels, movies, and television indicated few facilities or equipment associated with cow-calf production. A bunkhouse for the cowhands when they were not out on the range "punching dogies" and a chuck wagon to transport their beans and coffee when they were, a pile of brush or a few logs across the mouth of a box canyon to serve as a corral at roundup time, a few horses, saddles, and ropes essentially completed the inventory.

Modern cow-calf production involves considerably more use of facilities, improvements, equipment, and machinery than indicated above. Although beef cows are kept on pasture or range most of the time, many producers provide some shelter to cattle during unusually cold and wet weather. Some shelter for hay is usually provided, especially in the more humid regions where hay deteriorates rather rapidly if exposed to the elements. Fencing is required to confine cattle in desired locations and to prevent their encroachment of crops. Even in the humid regions, water from natural lakes or streams is seldom available on each separately fenced pasture or range parcel, making investments in watering facilities necessary.

Virtually all cow-calf operations include one or more corrals with holding pen(s), loading chute, and working chute equipped with either a headgate, calf table, or squeeze chute. Livestock trailers, sprayers, and scales are other equipment used by some producers. In addition, feed processing and distribution equipment is used by many producers, and manure handling implements are considered necessary in some operations, particularly those in which much of the winter feeding is done in small lots or other centralized locations. Finally, most producers assign at least partial use of one or more pickups or larger trucks to their cow-calf enterprises. Tractor power is commonly used directly for cattle production tasks (in addition to feed production) by operators who harvest their own forages or who operate other livestock or crop enterprises requiring tractors.

In the West and Great Plains regions, information was collected only regarding the provision of fencing and livestock water facilities. Data on use of livestock and feed storage buildings as well as the use of selected items of equipment were, however, obtained from producers surveyed in the South and North Central regions.

Livestock Water Sources

Natural lakes and streams and constructed drainage canals and ponds are major sources of livestock water in the humid regions. Some cow-calf producers, particularly in the South, rely exclusively on sources involving no development, maintenance, or operating costs. However, most operators in all regions must develop surface or underground water resources to ensure adequate, unfrozen supplies of water in locations accessible to the various locations at which the cattle are maintained.

The number and types of developed sources used to provide water for cow-calf enterprises in 1980 were strongly related to both size of enterprise and region of production. Producers in the South and North Central region with herds of fewer than 100 cows used slightly more than three different facilities in 1980 which involved past or current development cost; ranchers in the West with herds of 500 or more cows used an average of 104 stockwater facilities (table 38). Surface impoundments (excavated or artificially dammed ponds) were strongly predominant in the South and only slightly less so in the North Central region, while subsurface sources (wells or developed springs) were about as common as ponds in the Great Plains and predominated in the West.

Windmills pumped water for nearly half the wells used in the Great Plains and the West, where water facilities

Table 38—Livestock water sources on beef cow-calf farms and ranches, 1980[1]

Region and water source	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Number			
South:				
Pond	2.6	5.4	11.9	3.0
Well, windmill	*	*	1.2	*
Well, other power	.4	1.2	3.2	.5
Spring or other	.2	.3	1.8	.2
Total	3.2	6.9	18.1	3.7
North Central:				
Pond	2.0	6.8	26.3	2.4
Well, windmill	.2	*	.1	.2
Well, other power	.7	2.0	3.7	.8
Spring or other	.2	.2	.2	.2
Total	3.1	9.0	30.3	3.6
Great Plains:				
Pond	2.6	7.8	28.6	3.8
Well, windmill	.6	1.7	13.7	1.0
Well, other power	.9	1.7	4.4	1.0
Spring or other	.5	1.5	2.5	.7
Total	4.6	12.7	49.2	6.5
West:				
Pond	1.7	4.6	28.5	3.8
Well, windmill	.4	1.6	24.1	1.8
Well, other power	1.1	1.8	21.3	2.2
Spring or other	1.3	4.4	30.0	3.6
Total	4.5	12.4	103.9	11.4
All regions:				
Pond	2.4	6.4	25.9	3.2
Well, windmill	.3	1.1	16.4	.6
Well, other power	.7	1.7	12.4	1.0
Spring or other	.4	1.9	15.6	.8
Total	3.8	11.1	70.3	5.6

*Less than 0.05 per farm.
[1]Excludes streams as well as springs and lakes involving no development, maintenance, or operating cost to the farm or ranch operator as a livestock water source.

in locations considerable distances from ranch headquarters and alternative power sources are frequently necessary. On the more intensively developed farms in the North Central region, only one-fifth of all wells are pumped with windmills. Some other power source, usually electricity, is used to pump 98 percent of the wells used for stockwater in the South (table 38).

Investments in and operating costs of any given type of water development may vary markedly by situation. Ponds, for example, can be anything from excavated pits with limited capacities to relatively large lakes. Wells may vary in depth from less than 50 to more than 1,000 feet. Nevertheless, the fact that Great Plains producers provide nearly twice as many separate water sources and producers in the West more than three times as many, on average, as producers in the South or North Central regions indicates the increasing cost of providing livestock water in more arid areas.

Fencing

Fencing is often the most costly improvement in beef cow-calf production. Virtually every producer uses some fencing, although both types and amounts vary considerably depending on characteristics of the cattle enterprise.

The amount of fencing used per cow depends on the shape and size of individually fenced areas as well as on the pasture or range acreage allocated per animal. The cumulative and, to some extent, offsetting effects of pasture shape, size, and acreage per cow are reflected in producer estimates of fencing use. Producers with herds of all sizes in all regions combined reported an average of 0.17 mile (54.4 rods) of permanent fencing per brood cow in 1980 (table 39) to provide about 11 acres of pasture and range per cow (table 28). Because of the relatively small size and irregular shape of individual pastures, producers in the South and North Central regions with herds of fewer than 100 cows used 0.15 mile of fencing to allow grazing of only 2.6 acres of pasture per cow. At the other extreme, ranchers with herds of 500 or more cows operating on the vast ranges of the Great Plains grazed more than 27 acres per cow with an average of only 0.1 mile of fence per cow. Producers in the Great Plains provided much larger grazing acreage per cow in each herd-size grouping than farmers in the South and North Central regions, but used little more fencing per cow because of the large size and predominantly rectangular shape of individually fenced range areas in the Great Plains. The rough, mountainous terrain in much of the West constrained both size and shape of individual pastures to some extent. In addition, one-third of the total fencing reported in the West was used to graze publicly owned (BLM and FS) lands not included in the table 28 acreage

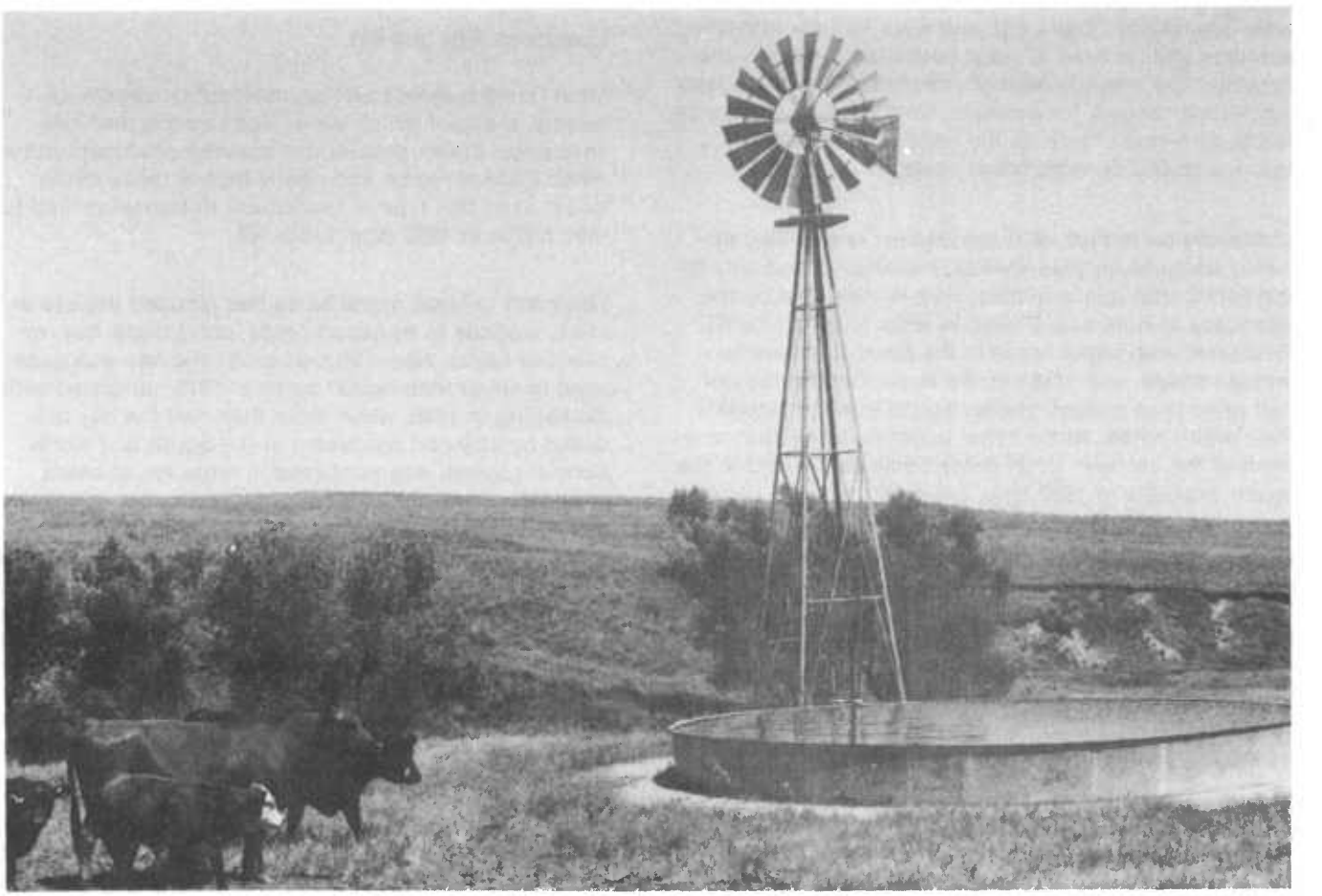
Table 39—Miles of fence per cow on beef cow-calf farms and ranches, 1980

Region	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Miles			
South	0.15	0.09	0.06	0.12
North Central	.15	.08	.08	.13
Great Plains	.17	.12	.10	.14
West	.24	.35	.22	.28
All regions	.17	.18	.15	.17

data. Thus, producers in the West used twice as much fence, but grazed only about 1½ times as much privately owned acreage per cow as was grazed in the Great Plains.

Barbed wire is the fencing material traditionally associated with cattle ranching. Data collected in the 1976 survey indicate that higher proportions of the producers in each region used barbed wire than any other type of fence when cattle were the only type of livestock being grazed. Pastures also being used by or originally designed to accommodate other types of livestock, such as sheep or hogs, were more commonly fenced with woven wire (field fencing). Woven wire was also used more frequently in the North Central region and the South, where pastures tend to be smaller, more of the fences are adjacent to heavily traveled roads, and adjacent fields are more likely to contain crops subject to livestock intrusion. Electrified wire was often used primarily for temporary fencing to permit gleaning of crop residues from fields not permanently fenced (*1*).

No data on type of fencing were collected in the Great Plains or the West during the 1981 survey. In the North Central region and the South, however, barbed wire comprised larger proportions of all fencing in 1980 than in 1975. The continuing rapid decline in the use of pasture in hog production and the dwindling sheep inventory in both regions were likely factors in this switch to barbed wire. A significantly lower investment per unit required to install or replace fencing with barbed than with woven wire during a period of rapidly escalating production costs and relatively low feeder cattle prices may also have contributed to this change.



Windmills provide pumping power for nearly half of the wells used to supply livestock water in the Great Plains and West, where subsurface water must be provided in remote locations to permit effective grazing of large dryland range areas.

Buildings and Other Improvements

Most buildings used in cow-calf production generally provide only basic shelter for livestock or harvested forages. Buildings originally constructed for other livestock or crop enterprises or for general farm shelter are frequently used in cow-calf production with little or no modification. Investment in and annual costs of such buildings per unit of space provided thus tend to be minimal. Such use contrasts to some other livestock enterprises, such as hog production or cattle feeding in confinement, in which the animals are kept in specialized buildings with elaborate facilities for environmental control and waste management.

Slightly fewer than half of the cow-calf producers in the South and nearly three-fourths in the North Central region provided shelter buildings for their cattle in 1980 (app. table 12). Many buildings used for cattle shelter, especially on farms with small cow-calf enterprises, were constructed years ago and were initially intended, and may still be used at least partially, for some other purpose. The average date of construction or last major renovation ranged, for example, from the early fifties on farms with small herds to the early to midsixties on farms with 500 or more brood cows.

Cattle shelter in both of these regions is provided primarily because surplus shelter is available, and only to the extent that it is available. This is indicated by the adequacy of floor space used in relation to herd size. Producers with small herds in the South had nearly enough space, and those in the North Central region had more than enough shelter space to accommodate their entire herds. At the other extreme, fewer than one-sixth of the cattle in large herds could be housed in the space available in 1980 (app. table 12).

Roughly 75 percent of all cow-calf producers in both the South and North Central regions stored at least part of their hay supplies in barns or sheds in 1980 (app. table 13). Hay storage buildings were used by about 90 percent of the producers in these two regions in 1975 (*1*). This trend to outside storage is apparently a result of the expanded use of large round bales as the packaging method for hay in 1980.

Many hay storage buildings used in the South, and particularly the North Central region, are quite old (app. table 13). Producers with small herds had more than enough building space to store all hay fed in 1980, while operators of large herds did not (table 36 and app. table 13).

As suggested by the data concerning silage feeding (app. table 10), silos were available in 1980 on very few farms with small cow-calf enterprises in the South and North Central regions (app. table 14). Conventional non-airtight tower silos were used almost exclusively by these small producers.

Because cattle in cow-calf enterprises spend most of their time on pasture or range even during the winter in the South and much of the North Central region, the advantages of paved lots are rarely considered great enough to offset investment and maintenance costs. Less than 1 percent of the southern producers used paved lots in 1980, compared with 11 percent of all producers in the North Central region (app. table 15). Many paved lots used by North Central producers were initially installed for and used by some other livestock enterprise, such as cattle feeding, which was once much more common on farms in the region.

Livestock Equipment

Most farmers owned one or more utility wagons or trailers, many of which were used in more than one enterprise. Three-fifths of the cow-calf producers in the North Central region and nearly half of those in the South used this type of equipment to transport feed to their cattle in 1980 (app. table 16).

The trend to large round bales has reduced the use of utility wagons to transport feeds, particularly hay, to cow-calf herds. About 90 percent of the hay was packaged in small rectangular bales in 1975 compared with packaging in 1980, when more than half the hay produced by cow-calf producers in the South and North Central regions was packaged in large round bales (table 34). Forty-one percent of all producers in each region and almost 90 percent of the large herd operators in the North Central region used large bale movers to feed hay in 1980 (app. table 16).

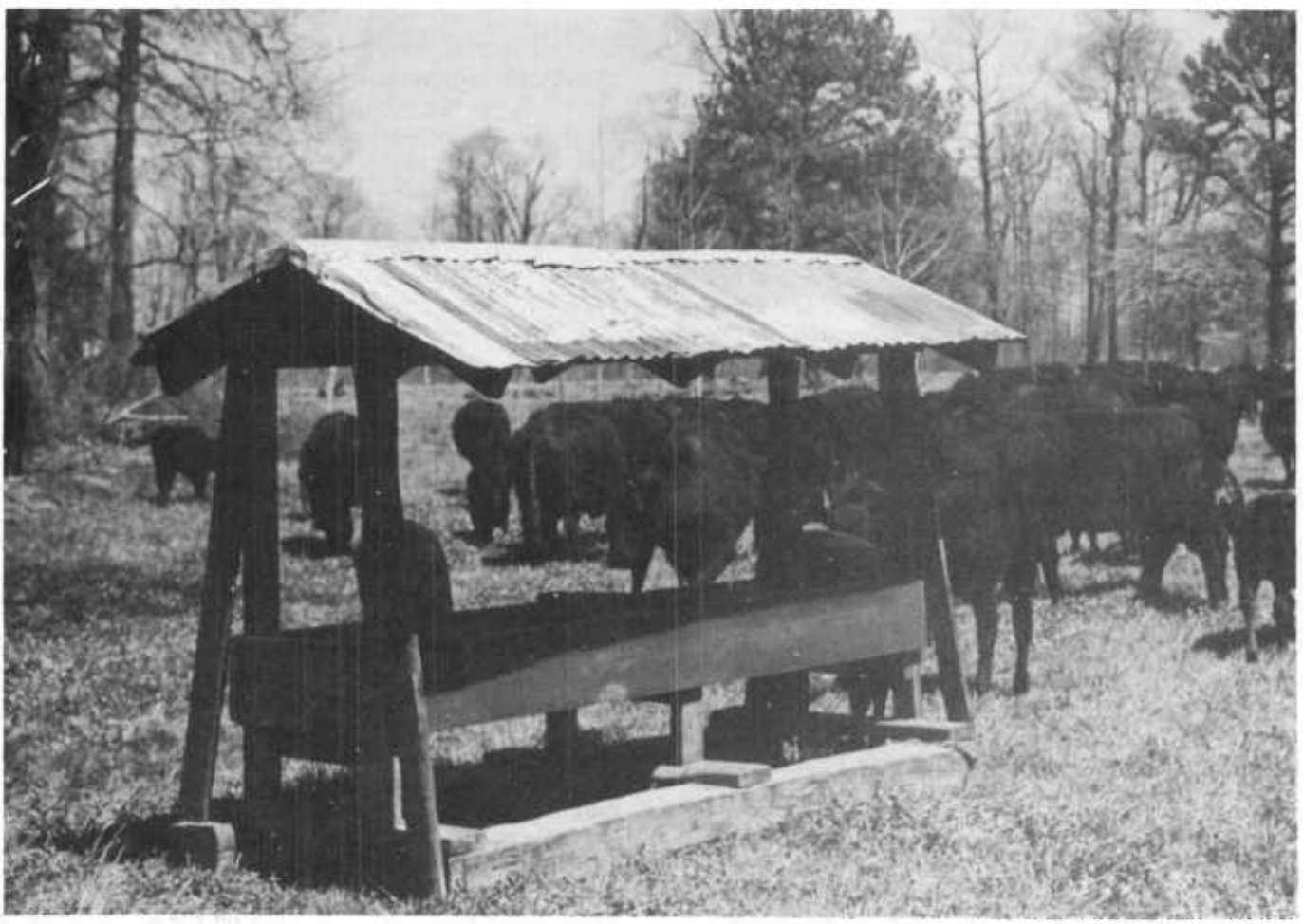
Self-unloading feed wagons—feed boxes mounted on wagons or trucks that include mechanically driven auger unloaders—were seldom used by cow-calf producers with small herds, which account for large proportions of all producers in the South and the North Central regions (app. table 16). This implement is particularly useful to operators regularly transporting and distributing large tonnages of feed. Cow-calf producers using silage as a major source of harvested forage tend to fit this description. There was a close correlation between self-unloading wagon use and silage feeding in 1980 (app. table 10).

Absence of self-unloading equipment does not necessarily imply, however, that feeds were distributed manually. About one-sixth of the producers in each region owned feed grinders used to process cattle feed in 1980. Most feed grinders were mobile grinder-mixers equipped with unloading augers. Producers with these machines frequently used them to transport and distribute as well as to process grains and protein supplements.

Types of feed bunks (troughs) used in the South and North Central regions were influenced by types and amounts of feeds fed and distribution methods used (app. table 17). A large proportion of producers in the South used no feed bunks at all. These producers apparently fed only hay which was distributed directly on the pasture sod.

Waste management is much less of a problem in cow-calf production than in most other livestock enterprises, because beef cows and their calves usually spend so much time on relatively large pasture areas. Significant accumulations of manure, spoiled feeds, or other wastes usually occur only where winter feeding is concentrated in barns or small lots. About a third of the cow-calf producers in both the South and North Central regions used tractor-mounted blades for waste management in 1980 (app. table 18). Almost as high a proportion in the North Central region and one-fourth of all southern producers used front-end loaders. Manure spreaders were used by only one-fifth of the southern producers, compared with two-thirds of those in the North Central region.

Almost all cow-calf producers have some facilities and equipment designed to confine all or part of their herds and to constrain animals needing special treatment. Few rely solely on their skill with a rope to catch animals on open pasture or range. Such facilities may



Portable feed bunks that can be towed from location to location in the pasture to minimize mud and manure buildup in feeding areas are often used to feed grain and protein supplement feeds.

range, however, from a simple catch pen in the corner of a pasture to rather elaborate corrals equipped with a series of gates and pens for separating the herd, loading chutes elevated to match the height of various types of trucks or trailers, and working chutes with electrically operated constraining equipment. Information on ownership of four relatively expensive items of equipment—squeeze chutes, livestock sprayers, livestock or truck scales, and livestock trailers—was collected during the 1981 survey from producers in the South and North Central regions.

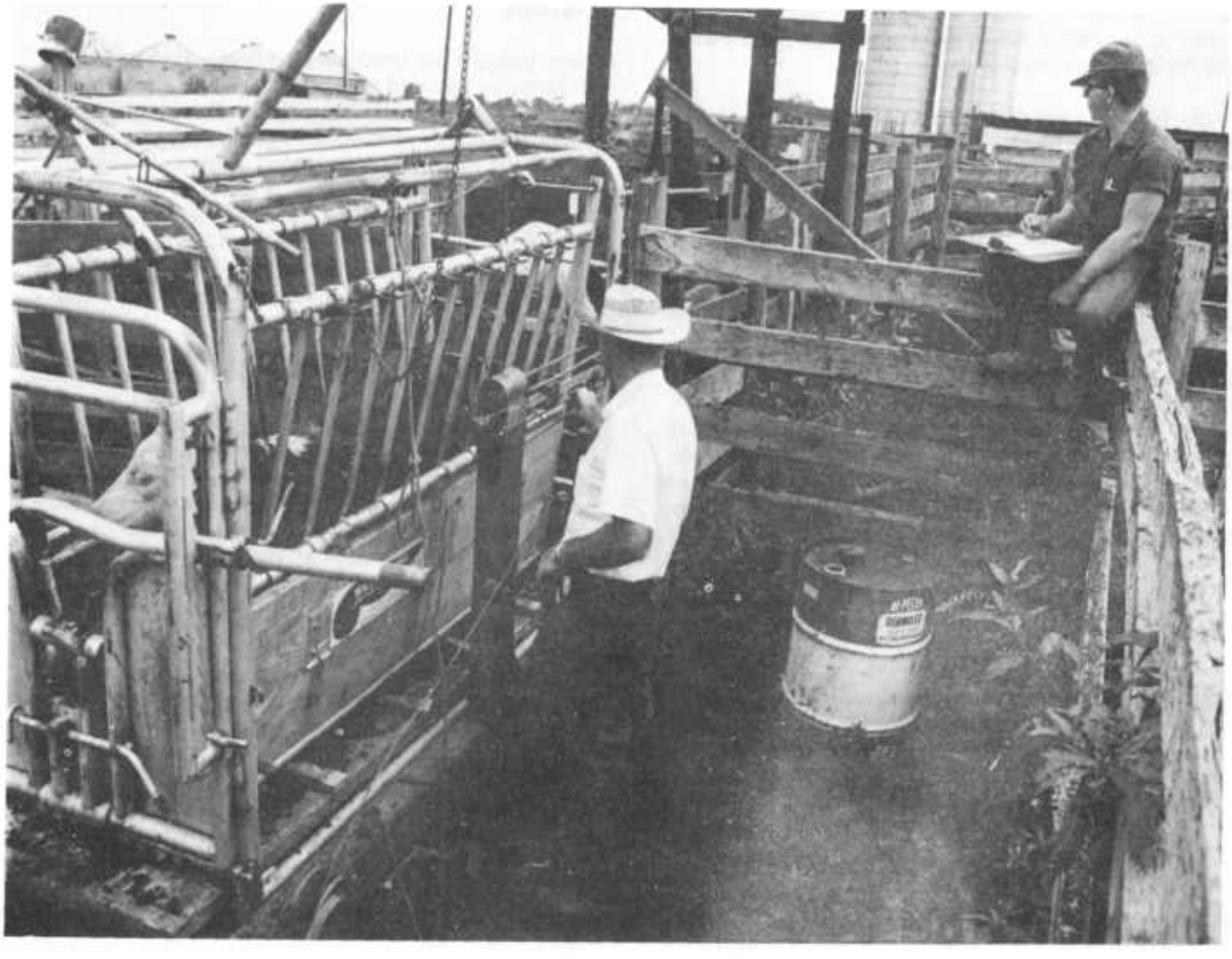
More than twice as high a proportion of all producers in the South (39 percent) as in the North Central region (16 percent) owned squeeze chutes in 1980 (app. table 19). This is a reversal of the situation in 1975, when 28 percent of all producers surveyed in the North Central region reported that they owned squeeze chutes, compared with 23 percent in the South (*1*). The rapidly increasing popularity of identification branding, especially freeze branding, as a basis for herd improvement programs being emphasized in many Southern States helps to account for the increased ownership of squeeze chutes in the South.

Use of sprayers for external parasite control increased slightly between 1975 and 1980 in the North Central region and more than doubled in the South, where nearly 25 percent of producers with small herds and close to 90 percent of those with herds of 500 or more cows sprayed their cattle in 1980 (app. table 19). Parasites are considered a greater problem in the warmer, more humid climate of the South.

A squeeze chute that can be pivoted to raise the animal's feet from the ground, sometimes called a calf table, is used to immobilize this calf for vaccination, castration, dehorning, treatment for control of internal and external parasites, and insertion of a growth stimulating implant beneath the loose skin of his ear.

Scales of sufficient capacity and design to weigh mature cattle were common only among producers with large cow-calf enterprises. Five percent or less of the producers in each region owned this type of equipment, which is especially useful for evaluating herd or individual animal performance and as an aid in marketing feeder cattle (app. table 19).

Many cow-calf producers depend primarily on custom haulers or, in the case of onfarm sales, buyers to provide transportation for most of their feeder cattle, usually sold infrequently and in sizable groups. However, more than half of all operators in the South and a third of all in the North Central region owned one or more cattle trailers in 1980 (app. table 19). Although some large producers owned commercial-type equipment (double-deck trailers and fifth-wheel, over-the-road tractors), most had smaller trailers with capacities of 15 or fewer mature cattle which could be towed behind pickups or general duty, light trucks. Such equipment is often used to move cattle among noncontiguous pastures as well as to haul culls or other small lots of cattle to market. One major advantage of trailers of this type, compared with commercial trailers or trucks with livestock racks, is that they are usually constructed with the floor low enough for cattle to load and unload from the ground, eliminating need for elevated loading ramps.



Cattle scales are used to evaluate animal performance and as an aid in marketing feeder cattle.

Trucks

A cow-calf producer without a pickup truck (truck with classified capacity of 1 ton or less) is a rarity. In 1980, 96 percent of all producers in the South and 98 percent in the North Central region owned at least one pickup used in the cattle enterprise. Data from the 1976 survey indicate much the same situation in other regions.

Pickups are used for nearly every cattle raising chore involving light hauling or basic transportation from hauling cattle and supplies to inspecting cattle, pastures, water sources, and fencing. Thus, the pickup has largely replaced the horse as the basic mode of transportation in cattle raising enterprises, especially the smaller operations in the East which rely heavily on easily accessible, improved pastures. Larger trucks used for heavier hauling were also reported by roughly one-third or more of the producers in each region with cow herds of 100 head or more.

Truck mileage allocated to cow-calf enterprises in the South and North Central regions averaged 66 and 32 miles per cow, respectively, in 1980 (table 40). Producers in the South reported almost exactly the same mileage per cow in 1975, while North Central operators drove less than half as much in 1980 as in 1975, possibly due to higher gasoline prices (*1*). Producers in the South did not, apparently, consider it feasible to make an adjustment based on fuel costs.

Southern truck mileage per cow declined consistently as average size of cow-calf enterprise increased. Producers with herds of fewer than 100 cows drove almost three times as many miles per cow as producers with herds of 500 or more brood cows (table 40). By contrast, North Central producers with small herds reported the lowest truck mileage per cow. Survey data provided no explanation for this difference, which largely accounted for the much lower average mileage per cow in all herds in the North Central region than in the South. It may be, however, that small North Central producers used automobiles for a greater proportion of their incidental travel attributable to cow-calf production than did southern producers. No auto mileage data were collected in the survey.

Average size of trucks used in cow-calf enterprises increased with size of enterprise in both regions. Most mileage driven by small herd operators involved pickups; ton-miles averaged 0.8 of total truck mileage per cow. At the other extreme, producers with herds of 500 or more cows averaged 1.2 to 1.3 ton-miles per mile driven, as much of their hauling of feed and other supplies was done with trucks classified as 2-ton or larger.

Tractors

Farm tractors are used for field operations on almost all farms or ranches on which crops, including forages, are produced and harvested. Some operators of small farms and highly specialized ranches depend entirely on custom operators, equipment lessors, or acquaintances to obtain needed tractor services. But most farmers own at least one tractor. For example, of all cow-calf producers included in the 1976 survey, 98 percent of those who had crop enterprises owned one or more tractors, as did more than 50 percent of those with no crop operations (*1*).

No data on tractor ownership or use were collected in the Great Plains or the West during the 1981 survey, nor were producers in the South or North Central regions asked about ownership or use of tractors in crop (including cattle feed) production. Producers in the South and North Central regions were asked, however, about tractor use directly attributable to their cow-calf enterprises for tasks such as feed processing and distribution, water hauling, and waste management.

Table 40—Annual miles and ton-miles of truck use per cow in the beef enterprise on beef cow-calf farms in the Eastern United States, 1980

Mileage	Cow herd size (head)							
	20–99		100–499		500 or more		All sizes	
	South	North Central	South	North Central	South	North Central	South	North Central
Miles per cow	78	26	58	48	27	39	66	32
Ton-miles per cow[1]	63	21	57	53	36	47	57	29

[1]Truck miles per cow multiplied by the tonnage rating of trucks driven; for example, a half-ton pickup truck driven 10 miles equals 5 ton-miles of truck use.

Nearly 11 percent of the cow-calf operators in the South and 7 percent in the North Central region did not use a tractor in their cattle enterprises (except possibly for pasture or harvested feed production) in 1980 (table 41). In both regions, nonuse was highest among producers with large herds; one-fourth of the operators in the South and one-third in the North Central region with herds of 500 or more cows did not use tractors directly in their cow-calf enterprises. Most of these producers were probably cattle specialists with no other major farm enterprises and thus few alternative uses for tractors. In addition, they probably hauled feed to the cattle on pastures distant enough from feed storage areas to justify use of trucks rather than tractors for feed transport and distribution.

North Central producers generally used more tractors in their cow-calf enterprises than did southern producers with herds of comparable size (table 41). North Central cattle producers tended to have larger crop acreages (table 10) and consequently to own more tractors than did their southern counterparts. The data suggest that farmers in both regions occasionally used the most conveniently available tractor(s) for their cow-calf enterprises.

Producers in the South used 9 percent more hours of tractor time per cow on average than did North Central producers. However, the average size of tractors used by southern producers was 51 horsepower, compared with a 54-horsepower average for all North Central trac-

Most cow-calf producers who also have crop enterprises, and many with no crops, use tractors for feed distribution, waste management, or other livestock tasks. Pickup trucks are used for light hauling and basic transportation by almost all producers, but have not completely replaced saddle horses on some cattle farms and ranches, especially those with large acreages of native range.

tors. As a result, horsepower-hours per cow used directly in cow-calf enterprises were quite similar in the two regions (table 42).

Producers in both regions reduced tractor use in cow-calf production between 1975 and 1980. In 1975, tractor use attributed directly to cow-calf enterprises averaged 4.8 hours per cow in the South and 6.6 hours per cow in the North Central region (*1*). Average use was 25 percent less in the South and only 50 percent as great in the North Central region in 1980 (table 42). The fact that fuel prices (both gasoline and diesel fuel) more than doubled during this 5-year period helps explain these changes.

Diesel-fueled tractors provided four-fifths of the tractor power used in southern cow-calf enterprises, compared with slightly less than half in the North Central region (app. table 20). Gasoline was the predominant tractor fuel reported in the North Central region, although most of the newer, larger tractors on North Central farms operate on diesel fuel. These data suggest that producers, particularly in the North Central region, used older and smaller tractors for most of their cow-calf chores in 1980. Savings in fuel resulting from use of smaller tractors probably more than offset the higher prices of gasoline compared with prices of diesel fuel.

Labor

Flexibility in the timing and, to some extent, the amount of labor used is frequently cited as a major advantage of beef cow-calf production, compared with most other livestock and crop enterprises. Peak labor use is usually associated with supplementary feeding, calving, and infrequent husbandry tasks such as calf branding, castrating, dehorning, immunizing, weaning, and selling.

Except for supplementary feeding, usually occurring in the winter when labor demands of crop enterprises are minimal, these intensive labor periods can be timed to match periods of peak labor availability. This timing is a particular advantage on multi-enterprise operations which include crop enterprises. During the growing season, when labor demands of crop enterprises are usually heaviest, routine cow-calf chores (such as inspecting cattle, checking pasture or range forage and water supplies, and moving the herd from pasture to pasture) can frequently be accomplished before or after the optimal hours for field work or on days when weather interrupts cultivation or harvest.

A result of such flexibility in labor inputs is that many producers have rather poor records of the labor actually devoted to their cow-calf enterprises. Further, producer estimates of livestock labor use may be rather imprecise. Time spent in the production of pasture and harvested forages is often included by producers in livestock labor estimates, unless the distinction between feed production and livestock enterprise labor is emphasized. Some operators overlook inspection and routine chore time during the grazing season. Others, particularly those with few or no other farm enterprises, tend to report full-time, year-round employment (or the entire residual not attributed directly to other enterprises) as cow-calf labor, based on the rationalization that they are on call at all times.

To minimize such confounding factors, the 1976 and 1981 surveys provided respondents examples of tasks to be included or omitted from cow-calf labor estimates. In 1981, for example, producers were advised to "include all time spent on calving, feeding, hauling manure, your own vet work, etc. Exclude maintenance labor on machinery and facilities as well as any crop labor," with crop labor defined to include pasture and forage production.

Table 41—Distribution of beef cow-calf farms in the Eastern United States, by number of tractors used in the beef enterprise, 1980

Number of tractors	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	South	North Central	South	North Central	South	North Central	South	North Central
	Percent							
None	10	7	12	7	25	35	11	7
1	49	28	33	34	27	6	48	28
2	32	29	32	31	21	35	31	29
3	8	24	14	22	7	18	8	24
4 or more	1	12	10	6	20	6	2	12

Table 42—Annual hours and horsepower-hours of tractor use per cow in the beef enterprise on beef cow-calf farms in the Eastern United States, 1980

Tractor use	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	South	North Central	South	North Central	South	North Central	South	North Central
Tractor hours per cow	5.0	3.7	2.0	2.2	0.7	2.1	3.6	3.3
Horsepower-hours per cow[1]	236.0	186.0	130.0	152.0	65.0	184.0	183.0	178.0

[1]Hours of tractor use multiplied by the horsepower rating of tractors used; for example, 10 hours of use of a 100-horsepower tractor equals 1,000 horsepower-hours.

Hours per Cow

Producers were encouraged to estimate the amount of time actually used in their cow-calf enterprises rather than their conceptions of labor requirements. Separate estimates were requested for time worked by the operator, other unpaid family members, and hired laborers on a weekly basis during each calendar quarter (in the South and North Central regions) or operational period; that is, time worked during the calving season, roundup season, supplementary feeding season, and nonsupplementary feeding season (in the Great Plains and West).

Operators of cow-calf enterprises of all sizes in all regions combined estimated that they used 18.2 hours of direct labor per cow on average in 1980 (table 43). This is 11 percent more than the average of 16.4 hours per cow estimated for 1975 (*1*). Virtually all of this increase in hours used per cow is attributable to herds of fewer than 100 cows each. Producers with 500 or more cows reported almost the same average labor per cow in both surveys, and those with herds of 100-499 cows estimated that their labor use per cow was 13 percent lower in 1980 than in 1975.

Efficiency of labor use increases dramatically with size of enterprise, according to data from both surveys. Producers with herds of 500 or more brood cows reportedly used less than half as many hours per cow in both 1980 and 1975 as producers with fewer than 100 cows.

Average labor use in 1980 analyzed by region was highly correlated with amounts of supplemental forages fed, which, in turn, generally reflect the length and severity of winter nongrazing seasons. Producers in the South fed the least hay and silage (table 36) and used the least labor per cow (table 43). North Central producers were at the opposite extreme.

Table 43—Annual labor used per cow on beef cow-calf farms and ranches, by source of labor, 1980

Region and labor source	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Hours			
South:				
Operator and other unpaid workers	16.7	8.7	2.2	12.5
Hired labor	2.9	5.6	5.8	4.1
Total	19.6	14.3	8.0	16.6
North Central:				
Operator and other unpaid workers	22.3	11.0	2.8	19.1
Hired labor	.3	2.9	5.2	1.0
Total	22.6	13.9	8.0	20.1
Great Plains:				
Operator and other unpaid workers	23.1	8.7	2.3	14.5
Hired labor	1.5	3.8	8.0	3.3
Total	24.6	12.5	10.3	17.8
West:				
Operator and other unpaid workers	28.7	13.4	3.4	14.1
Hired labor	2.8	4.3	7.6	4.9
Total	31.5	17.7	11.0	19.0
All regions:				
Operator and other unpaid workers	21.9	10.4	2.8	14.7
Hired labor	1.7	4.1	7.3	3.5
Total	23.6	14.5	10.1	18.2

Sources of Labor

Nearly all labor, including routine management, is performed by hired workers on some large cattle ranches. Such operations are the exception, however. Cow-calf

production is largely a family-oriented business in which an unpaid operator and family members provide management and much or all of the labor input.

Operators and other unpaid workers (usually family members of the operators) supplied four-fifths of all labor used in cow-calf production during 1980 (table 43). But operator and family labor in 1975 comprised slightly less than two-thirds of the total (*1*). Changes between 1975 and 1980 in the herd-size distribution in the cow-calf production sector accounts for much of this difference.

Operations consisting of 20-99 brood cows contained 48 percent of all beef cows in herds of 20 or more cows in the four regions combined in 1980, compared with less than 20 percent in 1975. Large operations with 500 or more cows accounted for only 16 percent of the total beef cow inventory in 1980, compared with 25 percent in 1975. During both years, unpaid operators and family members provided nine-tenths or more of all labor used in small herds but less than one-third of the total in large enterprises.

The effect of herd-size distribution is also reflected in the regional labor data. Only 5 percent of the direct cow-calf labor was hired (table 43) in the North Central region, where 74 percent of the beef cows in 1980 were included in herds of 20-99 cows and less than 3 percent were in herds of 500 or more (table 4). In the West, where more than one-fourth of all labor was hired, 30 percent of the beef cows were contained in large herds, compared with 24 percent in small herds.

Higher proportions of the labor used in small and medium-sized cattle raising enterprises were hired in the South than in any other region (table 43). Availability of hired labor at relatively low marginal cost probably explains this relationship. Many southern producers with cow herds in this size range employ year-round hired workers primarily to help with crop enterprises, such as tobacco, which have heavy labor requirements during the spring and summer but low requirements during the winter. Such workers often help with supplemental feeding or other livestock chores for little or no extra wages when crop production work is impossible or unneeded.

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Appendix

Appendix table 1—Average calf losses by cause prior to weaning on beef cow-calf farms and ranches, 1980[1]

Region and cause of loss	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Percent			
South:				
All predators	0.67	0.37	0.20	0.53
Dogs	.28	.19	.06	.23
Coyotes	.38	.09	.02	.25
Other	.01	.09	.12	.05
Other known causes	2.20	2.71	1.72	2.28
Weather	.62	1.18	.52	.76
Scours	.41	.65	.45	.49
Poison plants	.03	.02	.01	.02
Theft	.04	.02	.05	.04
Other	1.10	.84	.69	.97
Unknown causes	1.20	1.14	.44	1.09
North Central:				
All predators	.46	.29	.17	.41
Dogs	.19	.08	.02	.15
Coyotes	.27	.20	.14	.25
Other	0	.01	.01	*
Other known causes	1.06	4.16	2.68	1.83
Weather	.19	1.01	1.05	.41
Scours	.17	.75	.59	.32
Poison plants	0	.25	0	.06
Theft	.05	.01	.12	.04
Other	.65	2.14	.92	1.00
Unknown causes	3.20	.39	.23	2.47
Great Plains:				
All predators	.20	.28	.41	.26
Dogs	.02	.02	.03	.02
Coyotes	.18	.23	.35	.22
Other	0	.03	.03	.02
Other known causes	3.10	3.02	2.18	2.94
Weather	1.36	1.59	1.38	1.45
Scours	.70	.81	.34	.69
Poison plants	0	.11	.11	.06
Theft	.20	.01	0	.10
Other	.84	.50	.35	.64
Unknown causes	1.08	1.18	.56	1.05
West:				
All predators	.33	.40	.46	.40
Dogs	.02	.04	.05	.04
Coyotes	.24	.29	.34	.29
Other	.07	.07	.07	.07
Other known causes	3.88	3.98	2.93	3.65
Weather	.89	.84	.75	.83
Scours	1.35	1.81	1.14	1.50
Poison plants	.08	.09	.07	.08
Theft	.06	.17	.17	.14
Other	1.50	1.07	.80	1.10
Unknown causes	1.03	.83	.71	.85

*Less than 0.005 percent.

[1]Computed by multiplying 100 times the ratio: number of calves lost prior to weaning in 1980 divided by number calves born alive in 1980.

Appendix table 2—Average number of cattle disposed of per cow and replacement heifer on beef cow-calf farms and ranches, by class, method of disposition, and sex, 1980

Region, class, and disposition method	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	Male	Female	Male	Female	Male	Female	Male	Female
	Number							
South:								
Calves sold	0.28	0.21	0.27	0.22	0.24	0.16	0.27	0.21
Calves placed on feed	0	0	*	*	.05	.03	.01	.01
Yearlings sold	.06	.05	.09	.06	.07	.03	.07	.05
Yearlings placed on feed	0	0	0	0	0	0	0	0
Breeding stock sold	0	.01	0	.01	0	.01	0	.01
Cull cows sold	0	.05	0	.07	0	.07	0	.06
Total	.34	.32	.36	.36	.36	.30	.35	.34
North Central:								
Calves sold	.27	.10	.17	.15	.21	.18	.25	.12
Calves placed on feed	0	0	.02	.02	0	0	.01	*
Yearlings sold	.14	.09	.17	.13	.11	.05	.14	.10
Yearlings placed on feed	*	*	*	*	0	0	*	*
Breeding stock sold	0	0	0	.01	0	0	0	.01
Cull cows sold	0	.04	0	.08	0	.08	0	.05
Total	.41	.23	.36	.39	.32	.31	.40	.28
Great Plains:								
Calves sold	.26	.21	.22	.18	.16	.13	.23	.19
Calves placed on feed	0	*	0	0	.01	.01	*	*
Yearlings sold	.16	.12	.18	.12	.20	.06	.17	.10
Yearlings placed on feed	*	0	.01	.01	*	.01	.01	.01
Breeding stock sold	0	.01	0	.01	0	.01	0	.01
Cull cows sold	0	.06	0	.07	0	.10	0	.07
Total	.42	.40	.41	.39	.37	.32	.41	.38
West:								
Calves sold	.25	.20	.24	.18	.15	.10	.22	.16
Calves placed on feed	*	.01	*	*	*	*	*	.01
Yearlings sold	.13	.07	.14	.09	.22	.12	.16	.09
Yearlings placed on feed	0	0	.02	.02	.03	.02	.02	.01
Breeding stock sold	0	.01	0	.02	0	.01	0	.01
Cull cows sold	0	.07	0	.09	0	.09	0	.09
Total	.38	.36	.40	.40	.40	.34	.40	.37

*Less than 0.005.

Appendix table 3—Average weight per head of cattle disposed of by beef cow-calf farms and ranches, by class, method of disposition, and sex, 1980[1]

Region, class, and disposition method	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	Male	Female	Male	Female	Male	Female	Male	Female
	Pounds							
South:								
Calves sold	424	412	429	412	421	396	425	410
Calves placed on feed	*	*	*	*	447	474	447	474
Yearlings sold	596	567	622	607	616	604	608	584
Yearlings placed on feed	*	*	*	*	*	*	*	*
Cull cows sold	*	878	*	878	*	904	*	881
North Central:								
Calves sold	424	445	483	465	440	428	434	450
Calves placed on feed	*	*	481	481	*	*	481	481
Yearlings sold	635	626	638	608	626	585	636	620
Yearlings placed on feed	*	*	*	*	*	*	*	*
Cull cows sold	*	956	*	963	*	859	*	955
Great Plains:								
Calves sold	447	417	453	433	447	423	449	424
Calves placed on feed	*	367	*	*	481	440	481	423
Yearlings sold	640	593	648	588	731	610	658	592
Yearlings placed on feed	626	*	645	623	621	852	639	688
Cull cows sold	*	957	*	960	*	898	*	946
West:								
Calves sold	467	443	469	442	449	416	464	438
Calves placed on feed	377	399	*	*	*	*	377	399
Yearlings sold	699	653	687	643	726	658	705	651
Yearlings placed on feed	*	*	656	585	556	613	605	598
Cull cows sold	*	994	*	1,000	*	975	*	991
All regions:								
Calves sold	437	423	456	434	441	414	444	426
Calves placed on feed	377	389	481	481	455	459	457	447
Yearlings sold	641	603	655	607	718	641	662	610
Yearlings placed on feed	626	*	652	599	563	660	618	625
Cull cows sold	*	943	*	964	*	933	*	950

*Not applicable.
[1]Excludes calves or yearlings sold as breeding stock and calves retained as replacement heifers.

Appendix table 4—Acres per cow of various forage sources grazed on beef cow-calf farms and ranches, 1980[1]

Region and forage source	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Acres			
South:				
Annual pasture	0.14	0.18	0.15	0.15
Seeded perennial pasture	2.05	1.68	2.15	1.96
Native pasture	.38	1.21	2.36	.88
Hay aftermath	.78	.41	.20	.60
Crop residue	.38	.09	.03	.25
Total	3.73	3.57	4.89	3.84
North Central:				
Annual pasture	.04	0	0	.03
Seeded perennial pasture	1.53	2.20	3.90	1.75
Native pasture	1.05	.33	1.56	.90
Hay aftermath	.26	.61	.18	.34
Crop residue	.20	.58	.23	.28
Total	3.08	3.72	5.87	3.30
Great Plains:				
Irrigated pasture	.03	.01	*	.02
Small grain pasture	.01	.02	.40	.07
Dry range	8.80	12.74	27.22	12.96
Hay aftermath	.33	.29	.08	.28
Crop residue	.21	.12	.02	.15
Total	9.38	13.18	27.72	13.48
West:				
Irrigated pasture	.83	.34	.39	.47
Small grain pasture	*	0	0	*
Dry range	15.08	18.59	23.93	19.34
Hay aftermath	.80	.54	.53	.60
Crop residue	.04	.05	*	.03
Total	16.75	19.52	24.85	20.44

*Less than 0.005 acre.
[1]Excludes BLM and FS land grazed, and grazing land leased or rented on a per-head basis from all other sources; includes crop residue and hayland grazed.

Appendix table 5—Acres of grass silage harvested per cow, all cuttings, on beef cow-calf farms and ranches, 1980

Region	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Acres			
South	*	0.01	0.02	0.01
North Central	*	.06	.01	.01
Great Plains	0.01	.04	*	.02
West	*	.01	.02	.01
All regions	*	.03	.01	.01

*Less than 0.5 percent.

Appendix table 6—Acres of hay harvested per cow, all cuttings, on beef cow-calf farms and ranches, 1980

Region	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Acres			
South	1.3	0.9	0.3	1.1
North Central	1.5	1.2	.5	1.4
Great Plains	1.5	1.1	.2	1.2
West	2.0	1.3	1.0	1.4
All regions	1.5	1.1	.6	1.3

Appendix table 7—Distribution of field loading methods used for hay production in small bales on beef cow-calf farms and ranches, 1980

Region and loading method	Cow herd size (head)			
	20–99	100–499	500 or more	All sizes
	Percent			
South:				
From baler—				
Mechanically	3	6	8	3
Manually	18	18	28	19
From ground—				
Mechanically	6	19	21	9
Manually	73	57	43	69
Total	100	100	100	100
North Central:				
From baler—				
Mechanically	3	0	6	2
Manually	31	18	25	30
From ground—				
Mechanically	0	2	12	1
Manually	66	80	57	67
Total	100	100	100	100
Great Plains:				
From baler—				
Mechanically	6	2	0	5
Manually	5	5	14	5
From ground—				
Mechanically	48	40	61	46
Manually	41	53	25	44
Total	100	100	100	100
West:				
From baler—				
Mechanically	2	3	9	4
Manually	1	5	1	3
From ground—				
Mechanically	68	79	84	75
Manually	29	13	6	18
Total	100	100	100	100
All regions:				
From baler—				
Mechanically	4	3	8	4
Manually	12	7	5	10
From ground—				
Mechanically	34	57	77	44
Manually	50	33	10	42
Total	100	100	100	100

Appendix table 8—Distribution of hay transport equipment used on beef cow-calf farms and ranches, 1980

Region and hay transport equipment	Cow herd size (head)			
	20–99	100–499	500 or more	All sizes
	Percent			
South:				
Stacker wagon	3	2	10	3
Tractor front-end stacker	19	6	7	16
Truck	26	25	26	26
Wagon	23	24	18	22
Mechanical stack mover	2	3	9	3
Large bale mover	27	40	30	30
Total	100	100	100	100
North Central:				
Stacker wagon	0	0	0	0
Tractor front-end stacker	2	0	0	1
Truck	13	8	26	12
Wagon	39	25	13	36
Mechanical stack mover	5	9	18	6
Large bale mover	41	58	43	45
Total	100	100	100	100
Great Plains:				
Stacker wagon	19	5	9	13
Tractor front-end stacker	8	6	16	7
Truck	25	28	26	26
Wagon	12	13	6	13
Mechanical stack mover	19	27	18	22
Large bale mover	17	21	25	19
Total	100	100	100	100
West:				
Stacker wagon	42	41	34	40
Tractor front-end stacker	15	11	15	13
Truck	11	10	7	10
Wagon	13	10	3	10
Mechanical stack mover	12	23	33	21
Large bale mover	7	5	8	6
Total	100	100	100	100
All regions:				
Stacker wagon	14	17	28	16
Tractor front-end stacker	10	7	14	9
Truck	20	19	12	19
Wagon	21	15	5	18
Mechanical stack mover	11	20	28	16
Large bale mover	24	22	13	22
Total	100	100	100	100

Appendix table 9—Percentage of operators feeding various types of hay and percentage of each type purchased on beef cow-calf farms and ranches, 1980

Region and type of hay	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	Oper. feeding	Purch.	Oper. feeding	Purch.	Oper. feeding	Purch.	Oper. feeding	Purch.
	Percent							
South:								
Alfalfa	5.9	4.8	9.4	10.9	8.8	0.7	6.2	7.0
Other legume	12.3	.2	13.3	.4	1.1	0	12.4	.2
Grass	83.4	21.3	85.7	12.5	74.7	3.1	83.7	16.9
All types	*	18.8	*	12.2	*	6.0	*	16.5
North Central:								
Alfalfa	20.5	13.9	59.7	2.5	30.1	0	23.4	11.0
Other legume	5.6	0	11.4	5.1	22.7	100.0	6.0	3.6
Grass	69.2	46.4	52.2	4.1	88.3	35.1	67.9	36.6
All types	*	30.2	*	3.5	*	27.5	0	24.2
Great Plains:								
Alfalfa	34.9	14.9	43.2	8.7	26.1	23.9	36.2	12.5
Other legume	6.6	6.8	7.6	3.3	.4	6.6	6.7	5.3
Grass	93.0	20.7	86.6	8.5	75.2	15.1	91.7	16.4
All types	*	18.3	*	8.3	*	17.4	*	14.6
West:								
Alfalfa	66.0	17.4	67.2	20.5	55.1	20.4	65.9	19.4
Other legume	3.4	5.6	4.5	5.9	.8	2.3	3.6	5.6
Grass	48.9	9.1	45.6	15.3	55.5	8.5	48.2	11.6
All types	*	14.1	*	18.0	*	13.7	*	15.9
All regions:								
Alfalfa	25.6	15.0	45.9	13.4	37.7	19.4	28.7	14.9
Other legume	7.7	2.0	8.3	3.7	1.5	2.1	7.7	2.9
Grass	79.4	25.1	70.6	10.5	66.0	9.0	78.0	19.0
All types	*	20.7	*	11.4	*	14.2	*	16.8

*Not available.

Appendix table 10—Percentage of operators feeding various types of silage and percentage of each type purchased on beef cow-calf farms and ranches, 1980

Region and type of silage	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	Oper. feeding	Purch.	Oper. feeding	Purch.	Oper. feeding	Purch.	Oper. feeding	Purch.
	Percent							
South:								
Corn	4.6	0	15.7	4.3	6.0	0	5.7	2.8
Sorghum	0	0	1.5	0	6.7	0	.2	0
Small grains	0	0	0	0	0	0	0	0
Grass	0	0	.4	0	2.1	0	.1	0
All types	4.6	0	*	3.7	*	0	*	2.3
North Central:								
Corn	5.3	0	23.1	11.8	46.6	0	6.7	3.6
Sorghum	0	0	8.0	0	0	0	.6	0
Small grains	2.1	0	0	0	0	0	1.9	0
Grass	0	0	6.5	16.3	33.7	0	.5	16.1
All types	*	0	*	9.0	*	0	*	3.7
Great Plains:								
Corn	8.9	7.9	16.9	11.2	4.4	5.9	10.2	9.4
Sorghum	1.7	8.1	3.2	0	0	0	1.9	4.4
Small grains	.3	0	.5	0	0	0	.3	0
Grass	1.2	17.9	.6	0	0	0	1.1	13.6
All types	*	8.1	*	9.2	4.4	5.9	*	8.6
West:								
Corn	3.2	10.4	12.1	23.2	9.9	4.8	6.3	18.3
Sorghum	0	0	.8	0	.2	0	.3	0
Small grains	.1	0	.1	0	.4	0	.1	0
Grass	2.8	0	.6	8.5	3.2	15.7	2.2	11.5
All types	*	9.1	*	21.2	*	7.3	*	16.7
All regions:								
Corn	6.1	4.5	16.1	12.4	8.8	3.4	7.6	5.2
Sorghum	.6	8.1	2.8	0	1.1	0	.9	4.7
Small grains	.7	0	.2	0	.2	0	.6	0
Grass	.7	15.4	1.3	8.8	3.0	8.5	.8	5.4
All types	*	4.9	*	10.4	*	4.1	*	5.0

*Not available.

Appendix table 11—Percentage of operators feeding various types of grain and percentage of each type purchased on beef cow-calf farms and ranches, 1980

Region and type of grain	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	Oper. feeding	Purch.	Oper. feeding	Purch.	Oper. feeding	Purch.	Oper. feeding	Purch.
	Percent							
South:								
Corn	43.6	32.5	41.1	60.4	29.9	62.2	43.3	40.6
Sorghum	2.3	1.8	3.3	0	1.8	48.8	2.4	1.3
Oats	3.9	10.2	3.1	30.8	4.0	52.2	3.8	14.7
Barley	.4	28.7	1.0	5.7	0	0	.5	21.1
Other	1.3	30.4	2.9	35.5	0	0	1.4	32.8
North Central:								
Corn	50.4	37.8	78.4	23.2	84.3	33.7	52.5	30.7
Sorghum	12.3	83.0	.5	0	2.4	100.0	11.4	78.5
Oats	18.1	1.8	2.8	18.3	34.0	0	17.0	2.5
Barley	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0
Great Plains:								
Corn	13.0	37.4	15.8	33.9	7.9	91.3	13.4	37.8
Sorghum	8.7	17.9	12.4	12.4	8.5	55.7	9.3	17.7
Oats	14.3	17.2	18.7	18.2	4.4	78.3	14.9	18.2
Barley	.3	52.9	2.9	63.4	1.0	16.1	.7	59.4
Other	.8	99.1	4.5	93.7	1.9	81.4	1.4	93.5
West:								
Corn	9.8	11.3	19.5	71.7	10.5	97.6	12.9	69.0
Sorghum	.6	100.0	2.8	22.0	0	100.0	1.3	26.9
Oats	10.2	56.5	13.3	34.1	6.9	44.6	11.0	42.1
Barley	11.4	18.0	12.8	40.1	16.0	39.2	12.0	35.1
Other	2.7	.6	2.6	56.9	3.2	64.4	2.7	25.0
All regions:								
Corn	31.8	34.4	29.4	44.4	15.1	78.0	31.2	40.2
Sorghum	7.0	40.0	6.5	12.3	3.3	56.0	6.9	22.3
Oats	11.9	15.1	12.3	19.0	6.6	44.7	11.9	17.6
Barley	1.3	27.2	5.0	41.5	8.1	38.5	1.9	37.6
Other	.9	15.4	3.1	82.2	2.2	67.6	1.2	55.0

Appendix table 12—Characteristics of cattle shelter use on beef cow-calf farms in the Eastern United States, 1980

Characteristic	Unit	Cow herd size (head)							
		20-99		100-499		500 or more		All sizes	
		South	North Central	South	North Central	South	North Central	South	North Central
Cattle shelters	Pct. of farms using	49	74	42	44	37	59	48	71
Average date of construction	Year	1952	1951	1959	1955	1965	1962	1954	1951
Average capacity, all herds	Head space per cow[1]	0.93	1.21	0.54	0.31	0.06	0.15	0.70	0.97

[1]Total head capacity of cattle shelter on all farms, including those with no cattle shelter, divided by the total number of brood cows on all farms.

Appendix table 13—Characteristics of hay shelter use on beef cow-calf farms in the Eastern United States, 1980

Characteristic	Unit	Cow herd size (head)							
		20-99		100-499		500 or more		All sizes	
		South	North Central	South	North Central	South	North Central	South	North Central
Hay shelter	Pct. of farms using	79	72	71	50	57	59	78	70
Average date of construction	Year	1957	1944	1958	1949	1963	1962	1958	1945
Average capacity, all herds	Tons per cow[1]	3.08	2.38	1.90	0.75	0.21	0.49	2.36	1.95

[1]Total capacity of hay shelter on all farms, including those with no hay shelter, divided by the total number of brood cows on all farms.

Appendix table 14—Percentage of farms with specified silo types, beef cow-calf operations in the Eastern United States, 1980

Silo type	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	South	North Central	South	North Central	South	North Central	South	North Central
	Percent							
Upright:								
Airtight	0	0	2	2	3	0	*	*
Nonairtight	4	3	8	3	6	6	4	3
Both	0	0	1	0	1	0	*	0
Horizontal	1	0	4	18	11	47	1	1
Upright and horizontal	*	0	2	*	4	6	1	*

*Less than 0.5 percent.

Appendix table 15—Percentage of farms with paved lots, beef cow-calf operations in the Eastern United States, 1980

Region	Cow herd size (head)			
	20-99	100-499	500 or more	All sizes
	Percent			
South	1	5	2	1
North Central	11	6	6	11

Appendix table 16—Percentage of farms using specified types of feed handling equipment, beef cow-calf operations in the Eastern United States, 1980

Equipment type	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	South	North Central	South	North Central	South	North Central	South	North Central
	Percent							
Feed grinder	16	14	26	60	18	56	17	18
Self-unloading feed wagon/truck	5	4	15	23	20	53	6	6
Utility wagon	42	62	51	44	37	36	43	60
Large hay bale mover	39	39	52	73	40	88	41	41
Silo unloader	*	3	6	7	8	6	1	3

*Less than 0.5 percent.

Appendix table 17—Percentage of farms using specified types of feed bunks, beef cow-calf operations in the Eastern United States, 1980

Feed bunk type	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	South	North Central	South	North Central	South	North Central	South	North Central
	Percent							
Fenceline	2	11	6	20	4	18	3	12
Portable	18	72	29	70	48	65	19	71
Fenceline and portable	0	10	1	10	*	18	*	10
Self-feeder	16	23	32	55	46	82	18	25

*Less than 0.5 percent.

Appendix table 18—Percentage of farms using specified types of waste handling equipment, beef cow-calf operations in the Eastern United States, 1980

Equipment type	Cow herd size (head)							
	20-99		100-499		500 or more		All sizes	
	South	North Central	South	North Central	South	North Central	South	North Central
	Percent							
Scraper blade	36	36	37	38	39	18	36	36
Front-end loader	24	28	32	64	49	41	25	30
Manure spreader	21	66	23	69	12	47	21	66

Appendix table 19—Percentage of farms using specified types of livestock equipment, beef cow-calf operations in the Eastern United States, 1980

Equipment type	Cow herd size (head)							
	20–99		100–499		500 or more		All sizes	
	South	North Central	South	North Central	South	North Central	South	North Central
	Percent							
Squeeze chute	35	11	72	75	98	65	39	16
Sprayer	23	21	55	17	86	30	27	21
Scales	4	1	11	7	60	41	5	2
Livestock trailer	53	30	62	65	87	94	55	33

Appendix table 20—Distribution of tractor horsepower-hours used in the beef enterprise, beef cow-calf operations in the Eastern United States, by tractor fuel type, 1980[1]

Fuel type	Cow herd size (head)							
	20–99		100–499		500 or more		All sizes	
	South	North Central	South	North Central	South	North Central	South	North Central
	Percent							
Gasoline	29	62	8	30	1	31	19	54
Diesel	70	38	91	70	99	69	80	46
L.P. gas	1	0	1	0	*	0	1	0
Other	*	0	0	0	0	0	*	0

*Less than 0.5 percent.

[1]Horsepower-hours are computed by multiplying hours of tractor use by the horsepower rating of tractors used; for example, 10 hours use of a 100-horsepower tractor equals 1,000 horsepower-hours.