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By L. T. Smythe and C. R. Hoglund[1]

Three fourths of South Dakota's agricultural cash income is derived from livestock, and naturally the feed grains are important contributors to this income. The livestock feeder and the cash-crop farmer are both interested in the price relationships between feed grains, but the man who raises these grains mainly for his own livestock is usually less concerned with the price of his crop than is the cash-crop farmer, who must carefully study changes in grain prices in order to receive maximum returns per acre.

The price problem which the livestock feeder faces, however, is unusually complex. If he is short of feed, he wants a low buying price. If he has surplus feed, he wants a high selling price, but he also wants to know whether he should carry the surplus in storage instead of selling. No farmer can maintain an exact balance between feed and livestock year in and year out, and some farmers, particularly in the Great Plains, have known surplus and deficit problems successively for many years.

In order to help farmers and other stock feeders to solve these problems, a study was made of feed-grain prices covering a 50-year period (1890-1939) to determine their relationships. From these data, factors contributing to seasonal and annual changes in the prices of the chief feed grains—corn, barley, and oats—were also studied. Information was also obtained on the supply relationships and demand relationships of the feed grains.

This bulletin primarily concerns the counties comprising four of the seven agricultural production areas of South Dakota—Areas I, II, III, and IV—(Fig. 1). The study was confined chiefly to these areas because the price data available for the other areas[2] cannot be relied upon heavily. Since the counties studied are not chronically deficient in feed, local prices as shown in this study are somewhat independent of central-market prices and inconsistent with them under conditions existing when these counties were shipping grain in instead of out. Nevertheless, apart from quantitative findings, most of the conclusions from this study have general application over the entire state.

Feed Grains Important in South Dakota

The importance of feed grains is sometimes underestimated because of the relatively small proportion of them sold as cash grain. As a source of cash income, wheat led corn by almost 3 to 1 in 1924-40, but in farm value the corn-wheat ratio was about 7 to 4. The cash income from corn, oats, and barley equaled only two thirds of that from wheat, but their farm value was three times the farm

[1] This study was started by L. T. Smythe, Assistant Station Economist on leave with the U. S. Army, and completed by C. R. Hoglund, Assistant Station Economist.

[2] Price data for the three feed grains were obtained from a De Smet elevator.

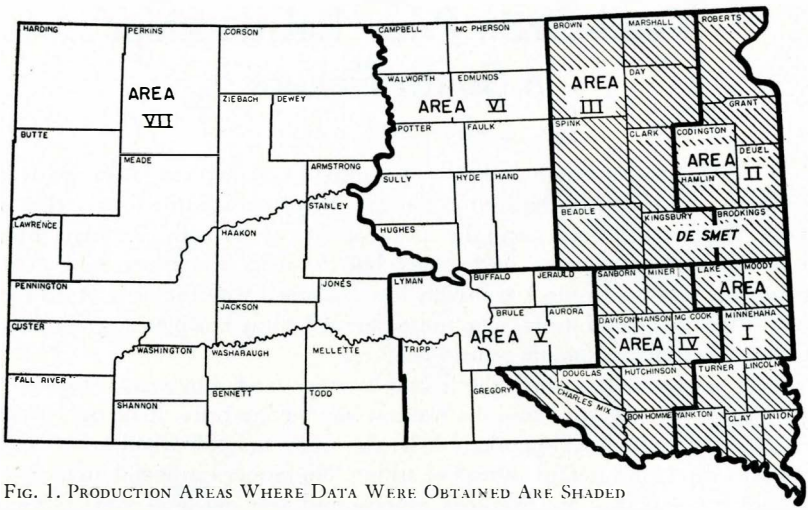

FIG. 1. PRODUCTION AREAS WHERE DATA WERE OBTAINED ARE SHADED

value of wheat. The explanation for these facts is that about five sixths of the wheat is sold as cash grain, but only one sixth of the corn and oats and one third of the barley is sold for cash.

The dominance of the feed grains is even more striking in Areas I, II, III, and IV than in the entire state. In these areas during 1941 corn contributed 35 percent of the farm value of the principal crops; wheat, 21 percent; oats, 17 percent; and barley, 13 percent. In 1940 these areas raised 89 percent of the corn produced in the state, 93 percent of the oats, 80 percent of the barley, and 65 percent of the wheat. In 1941 they raised 90 percent of the corn, 81 percent of the oats, 65 percent of the barley, and 53 percent of the wheat.

Trends in Feed-Grain Prices

A long-time decline in the general price level culminated in 1896. Thereafter prices rose slowly until the outbreak of World War I and then increased at a much more rapid rate. Following the World War I inflation they fell precipitously but they remained through the twenties at a level somewhat higher than the prewar level. The decline in prices in the late twenties and early thirties and the price rise from 1932 to the present is recent and familiar.

While this description applies to the general price level, it can also be applied to farm prices and to feed-grain prices in particular. These same trends are discernible in the average and yearly range of prices for barley, oats, and corn (Figs. 2 and 3). The spread between the high point and the low point in the yearly price was much smaller for barley than for corn or oats. During the period of 1890-1914, year-to-year-corn prices fluctuated less than did the prices of oats.

Apart from fluctuations in the general price level, several other distinct influences affected the feed-grain situation during 1890-1939. There were the rapid

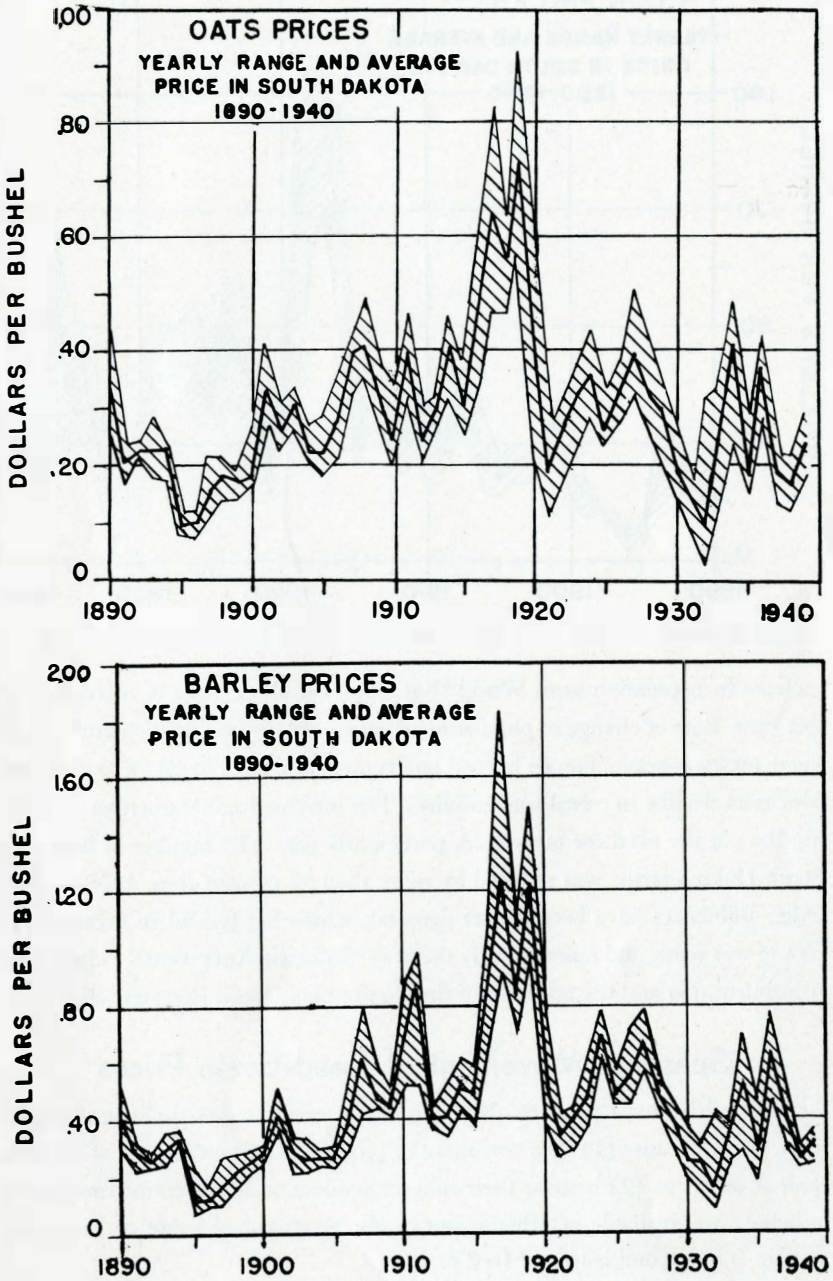

FIG. 2. TRENDS OF FEED-GRAIN PRICES SIMILIAR TO THOSE OF GENERAL PRICE LEVEL

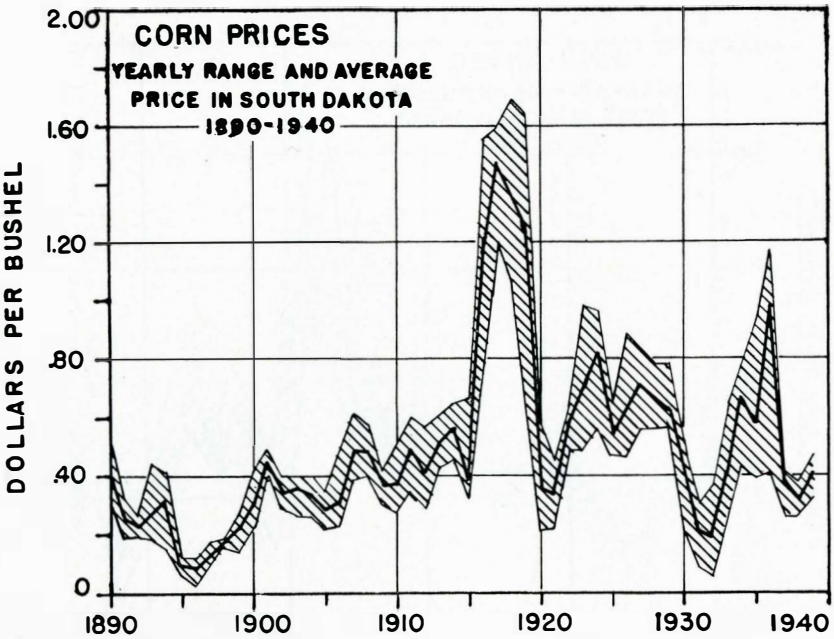

Fig. 3. Prior to World War I Corn Prices Fluctuated Less Than Barley Prices

increase in population until World War I and the slower rate of increase since that time. Rate of change of population of course determines the potential size of the domestic market. Trends in food habits must also be allowed for, such as the per-capita decline in cereal consumption. The increased mechanization of farming has cut the need for horse feed, particularly oats. The number of horses on South Dakota farms was reduced by more than 50 percent from 1925 to 1943. Other influences have been export demand, which has tended to decrease, except in war years, and more recently the program of the Agricultural Adjustment Administration and the activities of the Commodity Credit Corporation.

Seasonal Movement of Feed-Grain Prices

Most agricultural products display a characteristic seasonal change in price level, either because (1) they cost more to produce at certain seasons of the year than at others or (2) because their time of production is determined by nature and they are available at other seasons only by reason of more or less costly storage. This second is true of feed grains.

Feed-grain prices are low right after harvest in July and August but rise in the fall and later because of the cost of storage. This basic pattern for feed-grain-

price fluctuations is modified by seasonal variations in the consumption of grain and by advance reports on the new crop. Knowledge of this usual seasonal behavior of prices is helpful to the farmer in making plans for selling, buying, or storing grain to the greatest advantage. However, no two years are precisely alike. Those farmers who are skilled enough to allow for seasonal price variations

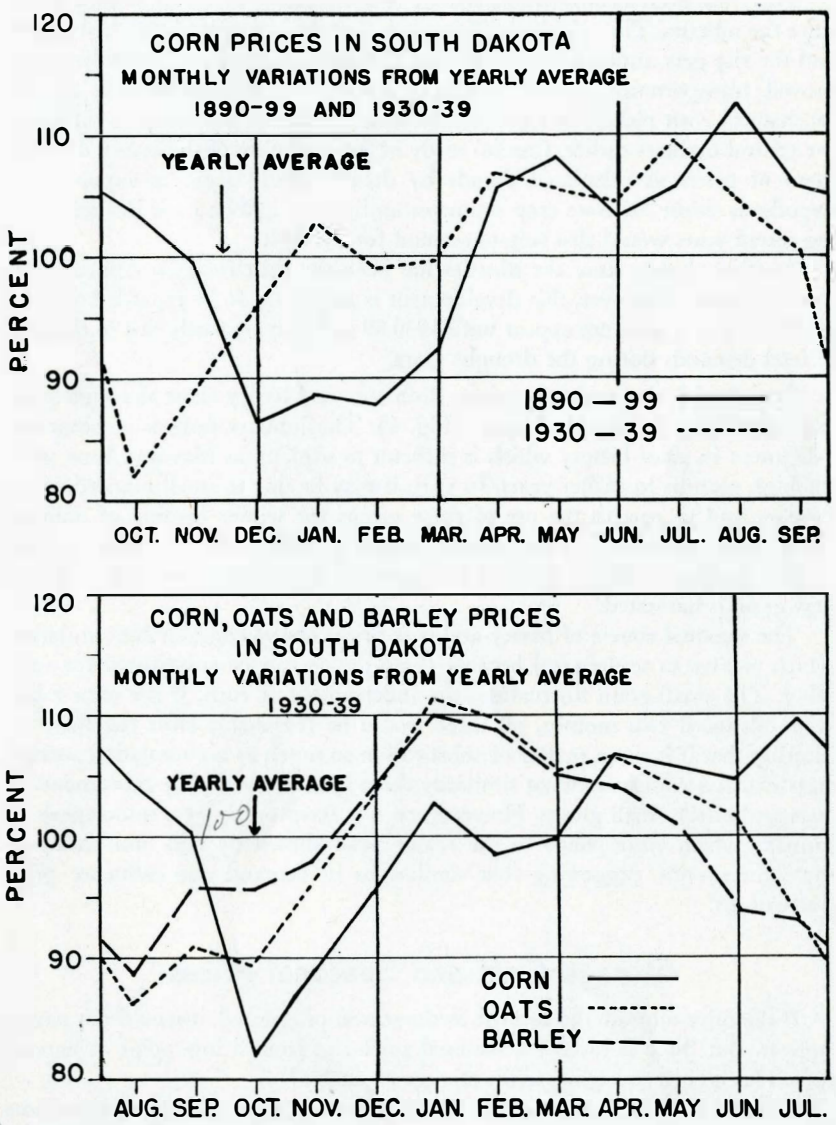

Fig. 4. Price Index of Seasonality for Corn, Barley, and Oats

are also capable of recognizing the influence of abnormal economic and physical conditions which are disturbing to the seasonal pattern.

Pattern of corn prices. An index of seasonality has been calculated for corn from the data for 1930-39 and also for 1890-99. These indexes give the expected price for corn each month as a percentage of the average price for the entire year (Fig. 4).

There has been a considerable change in the seasonal behavior of corn prices since the nineties. The principal difference is that the low point is reached earlier and the rise gets under way sooner. This change is probably due mainly to improved transportation, earlier maturing varieties, and perhaps also to the mechanical corn picker, as these developments help the new crop to influence the central markets earlier. Careful study of the evolution of the seasonal movement of prices as calculated decade by decade would seem to support this hypothesis. More accurate crop estimates and greater public faith in them during recent years would also help to account for the shift.

Another change since the nineties has been the shift from an August peak to a July peak. However, this development is too recent to be regarded as fully established, as it does not appear until 1930-39 and may be partly due to changes in feed demands during the drought years.

Pattern of barley and oats prices. Both oats and barley show the high peak in January and the low in August (Fig. 4). The January peak is a recent development in price history which is difficult to explain, as May and June were the high months in earlier years. In part, it may be due to small marketings in January and in part to the use of these grains for winter feeding of animals which go on pasture with the coming of spring. With oats it is plain that the smaller number of horses reduced the necessity of carrying oats over until the new grain is harvested.

The seasonal course of barley and oats prices shows considerable similarity, which is easy to understand because these grains can be substituted for each other. The small-grain fluctuations are independent of corn. If the corn index were advanced two months, all three would be reasonably close together, indicating that it is not a matter of substitution so much as accumulating storage costs which accounts for what similarity there is in seasonal price movements of corn and of the small grains. However, corn is seen to display a minor peak in January which corresponds to the major peak shown by oats and barley in the same month, suggesting that similarities in demand also influence price fluctuations.

Storage Cost and Seasonal Prices

If the price of grain did not rise as the season progressed, it would not pay to store it. But there is usually a seasonal price rise from a low point at harvest time. Has it been enough to make storage profitable?

It must be remembered first that there are a good many unrelated influences that affect the market. Weather conditions may alter the prospects for the following crop year. Crop conditions in other countries may influence the price

here. War is a tremendously disturbing force. These and other causes may result in random movements away from the expected seasonal price. Therefore, some years storing pays and other years it does not.

To find out whether storage has been profitable it is necessary to compare the selling price after storing with the sum of the price when the grain was put in storage and of the storage cost. Oats and barley of course cost the farmer more to store than does ear corn and so he needs a larger price rise in them than in corn in order to profit by storing.

Estimating Cost of Storage

If the grain is stored in elevators, it is fairly easy to determine storage cost. However, it must be remembered that interest is a cost which will not be included in the elevator charges but which must be allowed for in determining whether the storage venture has paid out. Interest should be reckoned on the cash price available at the time the grain was stored.

The interest rate that should be used varies with the circumstances. If selling for cash would have made it possible to pay off or reduce a bank loan at 8 percent, then 8 percent is a logical interest rate to use. On the other hand, if the money would have been banked, the rate to use should be the rate of interest that would have been paid by the bank, plus an additional rate of 4 to 6 percent which allows for the advantage of being able to buy for cash and thus take advantage of business opportunities at short notice.

If the grain is stored on the farm, estimating the cost is more difficult. A part of the cost depends only on the quantity of grain stored, regardless of how long it is stored. The cost of providing bin space and of loading and unloading, for example, is the same whether the grain is stored one month or ten. On the other hand, interest cost and cost of insurance and shrinkage depend on the period of storage and also on the value of the grain. Insurance should be allowed for as a cost whether the grain is actually insured or not, since the risk is

TABLE 1. COST OF FARM STORAGE OF CORN FROM ONE MONTH TO TWELVE MONTHS AS RELATED TO SELLING PRICE AT HARVEST*

Selling price per bushel at harvest	Storage cost of 100 bushels for—											
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
$ .20	$3.60	$3.70	$3.80	$3.90	$4.00	$4.10	$4.20	$4.30	$4.40	$ 4.50	$ 4.60	$ 4.70
.30	3.65	3.80	3.95	4.10	4.25	4.40	4.55	4.70	4.85	5.00	5.15	5.30
.40	3.70	3.90	4.10	4.30	4.50	4.70	4.90	5.10	5.30	5.50	5.70	5.90
.50	3.75	4.00	4.25	4.50	4.75	5.00	5.25	5.50	5.75	6.00	6.25	6.50
.60	3.80	4.10	4.40	4.70	5.00	5.30	5.60	5.90	6.20	6.50	6.80	7.10
.70	3.85	4.20	4.55	4.90	5.25	5.60	5.95	6.30	6.65	7.00	7.35	7.70
.80	3.90	4.30	4.70	5.10	5.50	5.90	6.30	6.70	7.10	7.50	7.90	8.30
.90	3.95	4.40	4.85	5.30	5.75	6.20	6.65	7.10	7.55	8.00	8.45	8.90
1.00	4.00	4.50	5.00	5.50	6.00	6.50	7.00	7.50	8.00	8.50	9.00	9.50
1.10	4.05	4.60	5.15	5.70	6.25	6.80	7.35	7.90	8.45	9.00	9.55	10.10
1.20	4.10	4.70	5.30	5.90	6.50	7.10	7.70	8.30	8.90	9.50	10.10	10.70
1.30	4.15	4.80	5.45	6.10	6.75	7.40	8.05	8.70	9.35	10.00	10.65	11.30

* Of the storage cost, $2 represents an annual rental charge for farm-storage space.

TABLE 2. COST OF FARM STORAGE OF SMALL GRAIN FROM ONE MONTH TO TWELVE MONTHS AS RELATED TO SELLING PRICE AT HARVEST*

Selling price per bushel at harvest	Storage cost of 100 bushels for—											
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
$ .20	$4.63	$4.77	$4.90	$5.03	$5.17	$5.30	$ 5.43	$ 5.57	$ 5.70	$ 5.83	$ 5.97	$ 6.10
.30	4.70	4.90	5.10	5.30	5.50	5.70	5.90	6.10	6.30	6.50	6.70	6.90
.40	4.77	5.03	5.30	5.57	5.83	6.10	6.37	6.63	6.90	7.17	7.43	7.70
.50	4.83	5.17	5.50	5.83	6.17	6.50	6.83	7.17	7.50	7.83	8.17	8.50
.60	4.90	5.30	5.70	6.10	6.50	6.90	7.30	7.70	8.10	8.50	8.90	9.30
.70	4.97	5.43	5.90	6.37	6.83	7.30	7.77	8.23	8.70	9.17	9.63	10.10
.80	5.03	5.57	6.10	6.63	7.17	7.70	8.23	8.77	9.30	9.83	10.37	10.90
.90	5.10	5.70	6.30	6.90	7.50	8.10	8.70	9.30	9.90	10.50	11.10	11.70
1.00	5.17	5.83	6.50	7.17	7.83	8.50	9.17	9.83	10.50	11.17	11.83	12.50
1.10	5.23	5.97	6.70	7.43	8.17	8.90	9.63	10.37	11.10	11.83	12.57	13.30
1.20	5.30	6.10	6.90	7.70	8.50	9.30	10.10	10.90	11.70	12.50	13.30	14.10
1.30	5.37	6.23	7.10	7.97	8.83	9.70	10.57	11.43	12.30	13.17	14.03	14.90

* Of the storage costs, $3 represents an annual rental charge for farm-storage space.

present and losses over a long period of years will about equal the insurance premium. To estimate the approximate cost of storing grain on the farm in buildings made for storage, see Tables 1 and 2. Where buildings used are not made especially for storage, storing may prove more costly than these tables indicate.

To determine whether it was profitable to store when using existing storage space, not allowing any rental charge for its use, deduct $2 per 100 bushels for corn and $3 per 100 bushels for small grain. It is quite allowable to reckon costs in this way for a short period if the bins are already built and would otherwise be idle.

Another problem arises when the grain is to be stored later than the assessment date, May 1. An allowance must then be made for taxes. Since tax rates vary from year to year and place to place, this cost was not allowed for in Tables 1 and 2. *(See Appendix Table 3 for help in estimating tax costs.)* Many assessors tend to underestimate the amount of grain in a bin and its value. It is necessary to use the quantity and value as used by the assessor in order to get the right tax cost.

Profitability of Storage

Historical evidence of price behavior alone can never take the place of analyses based on current conditions, but it is helpful in determining profitability of storage. Crop adjustment and loan programs of the federal government may be expected to make seasonal fluctuations less extreme than in the past. On the basis of experience, however, there are these facts:

Corn. In 38 of the 50 years studied there was sufficient rise in the corn market after the month of harvest so that farm-storage operations paid for themselves, including a rental charge for the storage space provided. However, in 9 of the 38 years there was only a 2-month period or less during which the corn could have been sold after storage without loss. In 14 years it was profitable to carry corn over into the following crop season.

Oats. In 35 of the 50 years studied there was sufficient rise in the oats market

after the month of harvest so that farm-storage operations would pay for themselves, including the charge for the storage space provided. But, in 5 of the 35 years there was only 1 particular month during which the oats could have been sold with this result, and there were 5 more years in which only 2 months would have been favorable. Furthermore, in 9 years it would have been necessary to hold the grain in storage 9 or more months in order to break even. In determining these figures no allowance was made for taxes on grain carried beyond May 1. In only 8 years would it have been possible to break even carrying oats over into the second season before selling, and in most of these years it would have been still better to sell in the late months of the harvest season.

Barley. In 32 of the 50 years studied there was sufficient rise in the barley market after the month of harvest so that farm storage would pay for itself, including a rental charge for the storage space provided. However, in 6 of these 32 years, there was only 1 month during which the barley could have been sold without loss. Twice this was the last month and once the first month of the crop year, so that even the most skillful market operator would have had difficulty breaking even. Also there were 3 years in which the favorable period was only 2 months long. In 7 of the 36 years it would have been necessary to hold the barley at least 9 months in order to break even. There were 15 years in which it was possible to carry barley over profitably into the following market year, but in 5 of those instances the profit would then have been less than that obtained if the grain had been sold at the previous year's high.

When to Sell and Buy Stored Grain

No selling rule for small grain. With both oats and barley there has been too little consistency in price fluctuations from year to year to permit the formulation of any rule as to which month is the best to sell. In fact, any predetermined rule always to sell in any one month would have led to substantial losses during the period 1890-1939 if followed consistently. It was possible to make money in these grains by storage operations, but wise market judgment would have been needed.

In the case of corn, however, it would have been possible to make money simply by following the rule of always selling in July or August, or less decidedly, in September. Some years this would have resulted in losses, but on the average there would have been substantial gains. It appears, then, that corn is a more profitable crop to store and requires less judgment in following market conditions than do oats and barley.

Some students of price movements declare that with corn the size of the seasonal price change can be predicted from the size of the crop. G. S. Shepherd of Iowa State College recommends storing after average or large corn crops but immediate selling after a small crop (a crop below 95 percent of average).[3] These rules seem at first quite the opposite of common sense, but evidence appears to confirm them. They should not, however, be used as a sole guide.

Buy corn at harvest. In estimating the most profitable time to buy, feeders

[3] G. S. Shepherd. *When Shall We Sell Our Corn,* Iowa Station Circular 113.

can usually reverse the rules appropriate for sellers of cash grain. A reservation must be made, however, since they must have sufficient feed on hand for current needs at all times. Corn in general should be purchased at harvest time. If additional feed is required in the spring, consideration should be given to the possibility of buying barley and oats, remembering that it takes about 2 bushels of oats and 1.4 bushels of barley to equal 1 bushel of corn in feeding value.

In case of drought the further reservation should be made that it might be unsafe for feeders to reverse Shepherd's recommendation to postpone their feed purchases, as this might force them to liquidate their herds for lack of feed.

Feed-Grain Prices as Related to Feeding Values

Demand Relationships

Feed-grain substitutions. Since the feed grains have similar uses, their prices should keep closely in line with each other. A general principle is that when feeders are fully awake to the possibility of substituting a cheaper feed for an expensive one, the prices of feed grains vary with their feeding value. Whenever the price of one grain drops below the price supported by its feeding value, feeders will start buying it in preference to other grains, and this increased buying will bid the price up until it is again as high as the price for other grains. If a grain is overpriced, feeders will stop buying it until the price comes down. The extent to which this principle is true in practice depends largely on the amount of current buying for feeding purposes. However, before feeders already stocked up would find it profitable to sell one grain and buy another, the price differential

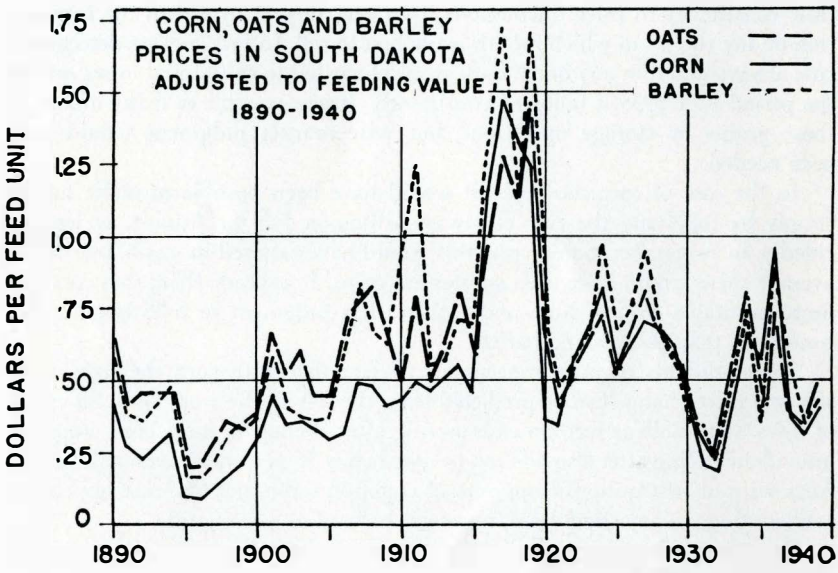

Fig. 5. Feed-Grain Prices Poorly Adjusted to Feeding Value Prior to World War I

would have to be somewhat larger than this principle indicates would be possible. This is true because cost of transportation both ways would have to be considered.

In order to investigate this point, it has been assumed that 2 bushels of oats and 1.4 bushels of barley are equal in feeding value to 1 bushel of corn. The yearly average price of each grain has been multiplied by the appropriate factor and the results are shown in Fig. 5.

The most significant conclusion to be drawn from Fig. 5 is that feed-grain prices were very poorly adjusted to one another as regards relative feeding values in the period up to World War I. There appears to have been a considerable improvement about that time, and since 1928 the relation has been very close. Modern knowledge of animal nutrition has apparently saved farmers considerable money in feed costs in recent years.

Feeding value important. If feeders are to get the most for their money, they must know how to buy feed grains according to their relative feeding values. Even since 1928, price movements within the crop year have resulted in large price discrepancies between equivalent units of corn, oats, and barley. For example, the price of two bushels of oats, which are estimated as equal in feeding value to one bushel of corn, has at times been 45 cents higher than the price of a bushel of corn and at other times 52 cents lower. Barley has been even further out of line with corn prices.

Oats and corn can be interchanged to a high degree in feeding dairy cattle, beef breeding herds, breeding sheep, and horses but to a less extent for fattening hogs, beef cattle, and lambs. Thus the livestock feeder may be justified in paying a premium on corn for a short period in order to obtain quick, economical gains.

Supply Relationships

Farming practices. If grain growers watched the market closely and if they were in position to adjust their acreages to it alone, the net income per acre, after all costs are deducted, would probably be the same for each grain. This practice alone, however, is not advisable because it does not account for crop rotations, changes in crop varieties and cultural practices, suitability of the land for each crop, and the seasonal distribution of the farmer's labor load. Oats and barley can be substituted one for another in crop rotations. However, this does not hold true for substitutions between corn and oats or corn and barley. The limiting factors previously mentioned—crop rotations, changes in crop varieties, cultural practices, and seasonal labor demands—largely determine the acreage planted to both corn and small grain on a farm.

Yields of nutrients. Long-time average yields (1916-40) in five selected counties in southeastern South Dakota show that corn has yielded at least 50 percent more digestible nutrients per acre than has barley or oats (Table 3). These production figures would indicate that corn should be expanded to the maximum in this area. The expansion of hybrid corn and the development and use of new oats and barley varieties has tended to change this relationship somewhat in recent years, but the relative production of nutrients remains about the same. The acreage planted to corn has been greatly increased since the drought

years and is approaching the acreage grown in 1930. It is anticipated that the corn acreage will be expanded to a maximum by 1944 in view of the wartime demands for greater feed production.

Barley yielded about 15 to 25 percent more nutrients per acre than oats during this same period. This would seem to point out that barley was a better crop

TABLE 3. YIELDS, TOTAL DIGESTIBLE NUTRIENTS, AND GROSS VALUE OF CORN, BARLEY, AND OATS IN FIVE COUNTIES OF SOUTHEASTERN SOUTH DAKOTA (1916-40)

County and crop	Yield per acre	TDN* per acre	Gross value per acre
Clay	*bu.*	*lb.*	
Corn	28.1	1,259	$18.55
Barley	24.9	802	13.45
Oats	29.7	683	10.10
Lincoln			
Corn	30.1	1,348	19.87
Barley	25.4	818	13.72
Oats	31.3	720	10.64
Turner			
Corn	24.9	1,116	16.43
Barley	23.0	741	12.42
Oats	27.2	626	9.25
Union	*bu.*	*lb.*	
Corn	31.8	1,425	$20.99
Barley	25.2	811	13.61
Oats	28.7	660	9.76
Yankton			
Corn	25.2	1,129	16.63
Barley	21.9	705	11.83
Oats	26.2	603	8.91

* TDN refers to the pounds of total digestible nutrients obtained per acre. This is a measure of the relative feeding value.

to grow than oats, yet a large acreage was planted to oats. Two factors must be considered in the analysis of this problem. Barley may be planted on the more productive land and oats on the less productive land. This fact would account for some differences in yields of the two crops. Another point to consider is that new oats varieties introduced in the southeastern part of South Dakota are expected in the future to produce a higher nutritive yield per acre than present barley varieties. These oat varieties are Vicland, Boone, Vikota, and Tama.

The yield situation in this part of the state as well as elsewhere is flexible and not static, hence there is need for keeping farmers informed of new developments as they occur. In the production area between the Missouri and James rivers, both barley and oats surpassed corn in yields of total digestible nutrients for the 1916-40 period.[4] In the area west of the Missouri river about the same yield situation occurred.

For the five southeastern counties the gross value of corn per acre was nearly 50 percent higher than the gross value per acre of oats and barley (Table 3). However, a gross income figure obviously cannot be used alone in determining feed crops to be grown. More labor is required in growing an acre of corn than of barley or oats and the labor peaks in production occur at different periods.

Changes in feed-crop acreage. Crop-adjustment programs and drought have had a profound effect on the acreage of corn grown since 1930. The acreage in Clay county, for example, showed an upward trend from 1925 to 1930 and then

[4] C. R. Hoglund. *Farm Management Aspects of Agricultural War Production in South Dakota,* Agricultural Economics Pamphlet 7, June, 1943.

TABEL 4. ACREAGES OF CORN, BARLEY, AND OATS IN FIVE SOUTHEASTERN COUNTIES OF SOUTH DAKOTA (1925-43)

County	1925	1930	1935	1940	1942	1943 (Intentions to plant)
Corn						
Clay	101,900	113,000	90,900	77,800	90,000	102,113
Lincoln	137,400	141,000	129,900	111,000	125,000	132,793
Turner	136,900	145,100	117,200	85,800	102,200	121,448
Union	115,000	116,100	103,400	94,800	105,100	115,488
Yankton	103,400	114,000	88,900	66,400	80,700	95,672
Barley						
Clay	2,600	15,400	38,100	36,300	40,900	26,328
Lincoln	3,300	20,800	48,900	43,300	37,500	16,479
Turner	9,300	35,200	52,300	48,200	44,000	28,934
Union	3,300	14,500	37,700	31,900	26,800	13,353
Yankton	4,500	18,600	34,100	36,300	35,000	27,284
Oats						
Clay	64,600	44,100	34,300	28,600	28,900	38,055
Lincoln	94,300	87,200	72,300	70,400	74,500	84,701
Turner	98,100	81,100	75,100	67,400	78,200	94,832
Union	45,900	36,600	33,200	29,900	33,000	39,029
Yankton	61,100	48,700	45,200	34,700	44,000	53,152

by 1940 dropped to about 75 percent of the 1925 figure (Table 4). The corn acreage has been on an upward trend since the drought years, and prospects are that the 1943 acreage in Clay county will be about the same as the 1925 acreage.[5] About the same conditions hold true for the other four southeastern counties—Lincoln, Turner, Union, and Yankton.

The barley acreage in these same five counties in 1935 was five to twelve times the 1925 acreage, but if farmers' intentions to plant in 1943 were followed, the 1943 acreage will be only about one third to two thirds of the 1935 acreage. A general decline in the barley acreage has occurred in these counties since 1935. The oats acreage in this same area showed a downward trend from 1925 to 1940 but has been increasing since 1940 (Table 4). These changes indicate that farmers adjust feed-crop acreages to such factors as yields, government adjustment programs, climatic conditions, and introduction of new varieties and changes in cultural practices. The changes in feed-crop acreage for the five southeastern counties illustrate how these various conditions affect the acreage. The shifts in other areas have taken somewhat different directions as they have been influenced by vastly different economic, climatic, and physical conditions.[6]

Other feed grains. Wheat and grain sorghums are two other feed grains which contribute to the total feed supply in South Dakota. Although wheat is grown primarily for its cash value as a milling grain, it is used to some extent as feed for poultry and other livestock. Wheat was used quite extensively as a hog feed in 1942 and the early part of 1943. Long-time average yields indicate that wheat produces more livestock feed per acre than any other feed grain produced in Area III.

[5] According to farmers' estimations obtained by the Agricultural Adjustment Administration.
[6] See Appendix Tables 1 and 2 for yields and acreage changes for the three principal feed crops throughout the state.

Grain sorghums have been grown for a relatively short period in the state. This feed crop assumed great importance in the south-central part of South Dakota, particularly in Area V, during and after the drought period. However, corn has tended to replace grain sorghums in recent years, especially in 1942 and 1943.

Summary and Conclusions

The following important points were revealed in this study of the relationships of feed-grain prices in South Dakota during the period 1890-1939:

1. In farm value the feed grains are the most important harvested crops grown in South Dakota, although they are not used generally as a source of direct cash income. Corn, oats, and barley combined produced only two thirds as much cash income as was obtained from wheat during the period of 1924-40 but accounted for three times the farm value of wheat.

2. The price of feed grains has varied more sharply both upward and downward than the general price level.

3. Corn prices are normally low in October and high in July; oats and barley prices are normally low in August and high in January. Barley and oats show a similar pattern of seasonal change in prices. Seasonal fluctuations of barley and oats prices seem to be independent of corn-price fluctuations.

4. The seasonal rise in price of feed grain is not always sufficient to cover cost of storage. Some years it may prove more profitable to sell for a low price at harvest time than for a somewhat higher price later on. In buying feed it is sometimes more profitable to pay somewhat more later in the season and let someone else pay the cost of storage in the meantime.

5. It is easier to make money by holding corn in storage than by holding oats or barley because corn usually shows a greater seasonal advance.

6. In earlier years the prices of the different feed grains were often far out of line with their relative feeding value. In recent years there has been a marked improvement in this situation. There is still room for further improvement, and skilled feeders can profit by considering relative feeding values of various feed grains as well as relative prices.

7. The per-acre yield of total digestible nutrients varies considerably within a county and among various areas of the state. Past history indicates that farmers could possibly have increased nutrient production by making shifts in the acreage of corn, barley, and oats grown. The per-acre-nutrient yield is fluid and not static, as relationships change with the adoption of new crop varieties and cultural methods and as climatic conditions vary.

Appendix

Table 1. Yields of Corn, Oats, and Barley and Total Digestible Nutrients for Seven Production Areas of South Dakota (1916-40)*

County	Bushels per acre			Pounds of TDN per acre†		
	Corn	Barley	Oats	Corn	Barley	Oats
Area I						
Lake	22.5	20.9	28.8	1,008	673	662
Moody	25.8	21.4	29.4	1,156	689	676
Minnehaha	28.3	23.4	32.0	1,268	753	736
Turner	24.9	23.0	27.2	1,116	741	626
Lincoln	30.1	25.4	31.3	1,348	818	720
Yankton	25.2	21.9	26.2	1,129	705	603
Clay	28.1	24.9	29.7	1,259	802	683
Union	31.8	25.2	28.7	1,425	811	660
Area average	27.4	23.3	29.6	1,228	750	681
Area II						
Roberts	21.8	18.4	24.9	977	592	573
Grant	21.4	18.6	26.3	959	599	605
Codington	19.2	16.3	24.5	860	525	564
Hamlin	20.2	17.3	25.4	905	557	584
Deuel	22.2	19.0	28.6	995	612	658
Brookings	23.4	20.3	28.1	1,048	654	646
Area average	21.8	18.6	26.4	977	599	607
Area III						
Brown	18.1	16.5	22.4	811	531	515
Spink	13.7	14.7	19.7	614	473	453
Beadle	14.8	15.4	19.9	663	496	458
Marshall	18.5	16.3	21.7	829	525	499
Day	17.9	16.0	23.1	802	515	531
Clark	16.8	15.7	21.7	753	506	499
Kingsbury	19.4	18.0	25.4	869	580	584
Area average	17.0	16.0	22.3	762	515	513
Area IV						
Sanborn	17.5	18.9	22.6	784	609	520
Davison	16.8	17.1	22.0	753	551	506
Douglas	16.5	19.5	22.7	739	628	522
Miner	17.1	17.6	22.7	766	567	522
Hanson	17.0	17.2	23.6	762	554	543
Hutchinson	19.1	20.2	25.0	856	650	575
McCook	20.8	20.8	26.7	932	670	614
BonHomme	21.2	20.3	25.1	950	654	577
Charles Mix	15.8	18.6	21.6	708	599	497
Area average	18.1	19.1	24.1	811	615	554
Area V						
Lyman	12.4	16.2	18.7	556	522	430
Buffalo	13.4	15.5	18.8	600	499	432
Jerauld	14.1	17.3	20.8	632	557	478
Tripp	14.0	16.8	18.8	627	541	432
Brule	13.1	15.6	17.9	587	502	412
Aurora	14.6	18.0	19.7	654	580	453
Gregory	15.7	18.0	21.7	703	580	499
Area average	14.3	17.0	17.7	641	547	407
Area VI						
Campbell	14.2	13.5	18.2	636	435	419
Walworth	15.2	12.1	16.9	681	390	389
Potter	14.2	14.7	18.4	636	473	423
Sully	12.3	13.9	16.6	551	448	382
Hughes	11.1	14.3	17.7	497	460	407
McPherson	15.8	15.0	20.2	708	483	465
Edmunds	16.1	14.0	18.7	721	451	430
Faulk	14.3	13.6	19.8	641	438	455
Hyde	13.3	14.9	18.3	596	480	421
Hand	13.4	15.1	19.3	600	486	444
Area average	14.1	14.2	18.8	632	457	432
Area VII						
Harding	12.5	14.1	16.5	560	454	380
Butte	19.3	22.7	25.9	865	731	596
Lawrence	20.0	22.1	26.7	896	712	614
Pennington	13.7	17.8	19.3	614	573	444
Custer	13.4	17.2	19.3	600	554	444
Fall River	11.6	15.1	14.7	520	486	338
Perkins	12.9	13.3	16.4	578	428	377
Meade	14.4	15.6	17.5	645	502	403
Washington	8.1	10.1	9.8	363	325	225
Shannon	10.0	10.8	12.5	448	348	288
Corson	13.1	12.8	16.4	587	412	377
Ziebach	10.4	8.8	11.5	466	283	265
Dewey	12.3	12.0	15.8	551	386	363
Haakon	12.7	14.9	18.0	569	480	414
Stanley	12.3	15.8	18.5	551	509	426
Jones	11.6	15.9	18.8	520	512	432
Jackson	11.9	13.7	16.9	533	441	389
Washabaugh	7.3	9.4	11.1	327	303	255
Mellette	12.0	14.3	16.8	538	460	386
Bennett	10.7	12.6	13.4	479	406	308
Todd	10.0	10.7	12.6	448	345	290
Area average	12.8	14.9	17.2	573	480	396
State average	19.6	17.8	24.2	878	573	557

* These seven production areas were designated for the "Agricultural Production Possibility" study in South Dakota in 1942.

Data presented here were obtained from the South Dakota Crop and Livestock Reporting Service.

† "TDN" refers to the pounds of total digestible nutrients obtained per acre. This is a measure of the relative feeding value of different grains.

Table 2. Acres of Corn, Barley, and Oats in Counties of Seven Production Areas of South Dakota (1925-43)

	1925			1930			1935			1940			1942			1943 (Intentions to plant)		
	Corn	Barley	Oats	Corn	Barley	Oats	Corn	Barley	Oats	Corn	Barley	Oats	Corn	Barley	Oats	Corn	Barley	Oats
Area I																		
Lake	101,700	16,700	91,400	101,600	37,600	60,100	91,200	60,900	66,100	81,800	33,200	74,000	84,000	41,800	66,500	102,903	38,069	66,398
Moody	98,000	9,500	91,000	108,800	26,600	71,500	93,100	50,000	70,000	89,600	37,000	64,700	96,600	45,200	57,500	110,545	34,547	54,793
Minnehaha	164,600	7,000	132,500	167,900	32,600	106,800	154,700	61,000	102,200	137,800	35,000	111,500	152,500	41,300	103,500	165,565	28,081	103,589
Turner	136,900	9,300	98,100	141,000	35,200	81,100	117,200	52,300	75,100	86,300	48,000	67,400	102,200	44,000	78,200	121,448	28,934	94,832
Lincoln	137,400	3,300	94,300	145,100	20,800	87,200	129,900	48,900	72,300	111,800	43,000	70,400	125,000	37,500	74,500	132,793	16,479	84,701
Yankton	103,400	4,500	61,100	114,000	18,600	48,700	88,900	34,100	45,200	67,300	36,200	34,700	80,700	35,000	44,000	95,672	27,284	53,152
Clay	101,900	2,600	64,600	113,000	15,400	44,100	90,900	38,100	34,200	78,500	36,000	28,600	90,000	40,900	28,900	102,113	26,328	38,055
Union	115,000	3,300	45,900	116,100	14,500	36,600	103,400	37,700	33,200	95,800	31,900	29,900	105,100	26,800	33,000	115,488	13,353	39,029
Total	958,900	56,200	678,900	1,007,500	201,300	536,100	869,300	383,000	498,300	748,900	300,300	481,200	836,100	312,500	486,100	946,527	213,075	534,549
Area II																		
Roberts	78,300	35,900	80,700	89,100	51,500	62,800	74,000	48,600	76,900	67,800	24,000	83,000	67,000	25,400	88,000	97,999	30,995	99,835
Grant	56,300	15,200	57,100	65,300	27,400	47,300	56,100	27,400	53,600	45,900	20,400	53,600	43,000	27,500	53,800	60,224	28,036	56,003
Codington	45,700	34,800	72,500	41,500	51,500	57,200	34,000	47,400	60,000	39,200	18,000	67,000	46,100	27,000	71,100	46,606	28,799	73,943
Hamlin	56,600	24,100	77,000	60,100	38,800	57,900	46,200	44,100	60,300	45,400	23,700	69,400	48,100	32,500	71,900	60,707	33,367	75,366
Deuel	53,800	13,800	88,700	51,800	37,200	65,800	49,500	43,600	63,600	46,700	27,300	62,800	52,200	33,000	63,800	63,472	28,785	64,267
Brookings	126,200	17,100	138,200	133,200	46,000	97,700	107,000	76,500	96,800	102,700	39,000	110,900	110,500	49,500	100,000	129,443	39,198	99,122
Total	416,900	140,900	514,200	441,000	252,400	388,700	366,800	287,600	411,200	347,700	152,400	446,700	366,900	194,900	448,600	458,451	189,180	468,536
Area III																		
Brown	159,200	60,900	105,600	161,700	111,800	73,500	117,400	144,800	82,900	104,600	85,500	91,000	117,800	126,500	110,000	134,953	178,709	122,497
Spink	142,600	46,700	62,100	144,600	62,400	53,800	97,200	90,700	51,200	79,000	69,900	55,200	56,500	108,000	63,000	87,249	142,624	82,000
Beadle	150,800	33,100	86,800	156,500	43,800	71,000	109,400	56,100	59,500	92,200	53,000	51,000	76,300	74,000	63,200	122,123	85,324	82,505
Marshall	53,000	32,800	39,800	48,700	47,500	32,300	43,400	48,000	37,000	40,700	15,000	45,500	56,000	23,600	50,600	62,742	39,502	60,585
Day	67,700	40,400	61,000	74,600	64,300	48,400	50,600	58,700	62,200	47,200	18,300	80,500	50,200	31,000	90,000	53,257	44,716	95,182
Clark	96,900	66,200	79,700	99,500	89,000	64,000	57,100	70,900	61,300	80,900	33,800	81,200	77,400	49,500	91,400	93,516	70,156	96,877
Kingsbury	116,800	37,600	104,500	124,400	61,500	86,400	82,400	73,800	81,000	76,500	43,800	86,000	79,000	58,500	87,700	108,014	62,803	97,204
Total	787,000	317,700	539,500	810,000	480,300	429,400	557,500	543,000	435,100	521,100	319,300	490,400	513,200	471,100	555,900	661,854	623,834	636,850
Area IV																		
Sanborn	85,100	6,000	53,000	94,300	13,200	38,800	64,900	19,000	31,800	60,500	24,000	23,000	54,000	32,500	26,000	79,031	34,076	31,994
Davison	81,500	5,300	57,700	86,000	13,200	38,300	66,200	24,400	34,100	54,100	37,000	19,700	41,500	37,600	19,800	61,902	40,364	25,115
Douglas	80,000	7,800	37,400	84,000	12,800	31,400	68,800	26,700	28,600	50,700	43,000	16,000	50,000	50,300	16,500	67,655	49,749	19,297
Miner	87,700	15,600	69,800	96,400	30,700	48,800	70,800	40,600	48,500	60,400	39,200	35,000	55,000	46,000	39,200	80,285	45,820	43,168
Hanson	74,600	3,200	54,100	74,600	11,400	35,800	69,300	23,600	33,900	52,400	35,000	20,500	49,300	34,500	23,100	68,470	38,314	29,203
Hutchinson	133,300	14,500	91,000	145,100	28,000	76,700	114,700	45,700	67,400	74,200	66,700	46,400	80,000	77,600	56,800	105,127	81,182	68,221
McCook	108,600	6,700	90,000	114,000	29,200	73,300	95,500	48,800	65,600	83,900	45,200	51,800	86,800	48,700	54,000	104,858	45,508	62,560
Bon Homme	110,600	1,800	72,900	119,200	12,500	58,700	91,900	30,200	47,800	65,700	44,000	28,300	74,500	46,700	32,900	90,738	50,985	41,964
Charles Mix	218,800	10,500	75,400	233,200	26,200	48,500	167,000	50,400	44,200	128,100	79,600	21,200	144,100	108,000	23,000	167,463	122,046	27,049
Total	980,200	71,400	601,300	1,046,800	177,200	450,300	809,100	309,400	401,900	630,000	413,700	261,900	635,200	481,900	291,300	825,529	508,044	348,571

(Concluded on next page)

	1925			1930			1935			1940			1942			1943 (Intentions to plant)		
	Corn	Barley	Oats	Corn	Barley	Oats	Corn	Barley	Oats	Corn	Barley	Oats	Corn	Barley	Oats	Corn	Barley	Oats
Area V																		
Lyman	89,000	21,700	14,500	80,800	45,300	10,200	55,800	40,300	10,900	12,500	53,800	15,000	9,500	62,000	18,000	19,604	72,920	27,447
Buffalo	20,800	4,700	6,100	23,000	12,300	4,300	13,300	10,800	3,000	9,600	9,700	3,800	5,400	8,300	5,400	9,611	8,488	5,310
Jerauld	64,500	7,000	34,000	68,400	16,600	25,500	48,200	24,200	23,500	34,900	20,000	17,900	25,800	29,500	19,000	43,733	30,855	20,982
Tripp	190,200	27,600	34,100	163,800	71,400	28,400	112,700	62,400	24,500	78,400	73,800	21,800	73,800	82,200	25,000	105,366	82,554	39,698
Brule	112,200	10,200	42,500	124,400	19,200	28,200	89,100	31,900	24,600	77,700	38,000	16,400	69,500	51,000	20,300	87,102	53,167	23,761
Aurora	93,000	9,200	50,500	99,500	16,400	34,800	70,300	28,000	31,200	49,200	44,000	15,600	41,400	52,500	17,000	68,131	57,313	20,209
Gregory	136,400	9,900	61,000	132,700	28,600	51,300	90,400	42,100	38,700	84,600	59,600	22,500	95,000	74,400	27,700	121,479	68,684	35,108
Total	706,100	90,300	242,700	692,600	209,800	182,700	479,800	239,700	156,400	346,900	298,900	113,000	320,400	359,900	132,400	455,026	373,981	172,515
Area VI																		
Campbell	29,600	13,000	10,900	34,700	24,500	9,500	26,200	31,000	11,700	22,300	19,000	12,600	22,100	32,000	22,400	26,106	40,493	29,261
Walworth	34,600	15,500	18,200	39,900	29,200	13,700	26,800	35,000	15,300	22,800	21,300	15,500	23,800	34,000	20,500	27,663	47,297	26,696
Potter	57,500	23,000	32,400	72,100	54,100	21,000	38,800	46,000	18,400	33,300	36,000	17,700	34,200	47,400	18,500	44,961	58,704	23,222
Sully	46,300	18,200	20,300	85,000	13,000	51,200	38,800	31,700	13,600	27,300	19,200	12,200	24,300	26,300	12,300	36,900	35,631	21,266
Hughes	30,300	6,200	12,000	31,600	6,400	22,700	18,100	13,800	6,400	12,700	13,800	6,100	8,500	17,400	6,200	13,829	22,003	8,008
McPherson	27,800	31,400	27,700	28,000	44,400	21,000	28,400	47,800	21,400	23,400	34,000	28,200	29,000	55,000	43,500	28,871	70,973	53,454
Edmunds	48,900	41,000	41,500	51,200	64,800	24,600	33,700	63,800	25,500	23,200	47,000	33,000	26,800	71,400	42,500	32,744	97,345	57,963
Faulk	69,700	20,200	42,500	71,500	46,800	27,300	44,000	47,300	26,600	30,500	38,100	27,800	29,800	46,000	30,000	43,654	63,471	39,152
Hyde	33,700	14,700	21,700	35,800	32,400	14,500	20,100	23,200	11,500	14,000	19,100	12,500	8,500	18,700	12,300	15,229	21,063	14,935
Hand	122,100	27,600	68,000	137,900	59,500	48,400	83,600	59,500	45,000	57,200	56,600	39,000	43,800	68,000	48,900	68,255	66,770	58,301
Total	500,500	210,800	295,200	587,700	375,100	253,900	358,500	399,100	195,400	266,700	304,100	204,600	250,800	416,200	257,100	338,212	523,750	332,258
Area VII																		
Harding	10,600	3,400	12,700	13,500	13,000	19,000	13,600	6,700	13,800	5,000	6,700	9,400	7,900	9,600	8,600	11,867	12,071	10,230
Butte	17,000	1,400	9,400	11,400	10,000	11,300	11,200	9,600	8,500	13,100	10,800	6,500	9,100	13,300	6,900	10,584	16,166	8,372
Lawrence	7,600	800	3,700	5,600	4,100	3,700	5,400	2,700	3,200	5,600	4,000	4,500	5,000	6,400	6,000	6,241	10,032	6,554
Pennington	28,800	2,200	12,300	34,200	12,400	14,000	40,300	12,700	18,500	23,000	12,000	15,400	25,000	19,200	18,800	31,499	28,740	22,572
Custer	5,400	900	3,100	9,300	3,500	4,800	7,400	2,300	3,700	4,700	3,100	4,600	3,200	4,100	5,700	3,841	4,728	5,838
Fall River	18,600	2,000	7,100	26,900	10,800	9,000	34,200	6,100	7,200	16,700	6,900	7,400	15,000	9,400	8,200	17,278	12,624	8,998
Perkins	27,100	8,100	23,000	40,900	38,400	32,100	35,000	20,500	27,100	17,000	13,600	22,300	21,500	23,000	21,200	31,210	32,678	23,421
Meade	39,600	3,000	18,400	49,800	12,500	24,000	54,900	10,700	23,900	37,300	15,500	16,000	34,000	24,100	21,900	31,470	22,504	16,606
Washington	2,900	100	....	4,800	2,000	1,200	2,700	200	1,000	1,400	900	600	1,600	2,000	800	.....	459	566
Shannon	2,800	200	1,500	3,900	2,200	2,400	10,800	1,500	3,600	5,000	2,900	2,400	5,400	3,900	2,800	.....	5,653	2,895
Corson	27,200	10,800	21,300	41,500	34,400	28,700	29,000	21,500	24,300	14,800	12,100	14,900	17,800	25,000	17,500	26,209	35,370	23,275
Ziebach	18,500	5,100	11,900	22,300	13,800	11,400	13,200	8,400	11,800	5,700	4,100	5,900	5,600	6,000	5,000	6,544	10,920	7,298
Dewey	28,200	4,100	14,900	24,900	16,800	12,500	16,700	9,700	11,400	8,900	8,000	5,800	8,500	14,700	6,900	13,580	29,550	7,350
Haakon	28,100	5,400	8,700	35,200	19,500	8,000	25,000	16,800	10,000	12,700	14,000	7,100	13,800	20,000	8,400	14,938	22,598	9,299
Stanley	15,200	1,700	3,500	15,500	11,300	3,900	10,000	5,400	5,600	3,900	6,600	5,100	3,100	7,500	4,500	3,562	10,005	6,765
Jones	34,800	6,600	10,700	35,200	22,800	5,400	22,300	19,900	6,700	8,300	25,500	7,200	5,200	30,500	9,000	7,547	31,709	11,031
Jackson	15,900	1,500	4,100	15,500	5,800	3,400	11,200	4,400	4,300	2,700	4,700	2,500	3,000	5,800	3,500	3,151	8,536	3,762
Washabaugh	7,800	800	1,800	14,500	8,700	4,800	13,800	2,900	5,300	3,600	1,200	2,300	4,800	2,600	3,300	7,993	4,710	3,979
Mellette	41,800	4,900	8,100	54,900	25,600	10,300	30,400	11,600	10,000	8,500	13,500	8,800	10,300	11,300	11,800	9,868	18,279	15,109
Bennett	20,800	500	6,900	41,500	14,800	10,700	33,600	5,300	9,100	16,100	13,000	4,700	14,600	11,600	6,800	19,364	15,501	8,091
Todd	16,600	1,200	4,600	59,100	23,400	13,800	48,300	9,300	15,700	35,700	8,200	8,800	32,000	9,500	11,000	37,396	12,799	13,406
Total	415,300	64,700	187,700	560,400	305,800	234,400	469,000	188,200	224,700	249,700	187,300	162,200	246,400	259,500	188,000	294,142	345,632	215,417
State Total	4,765,000	952,000	3,059,000	5,146,000	2,001,900	2,475,500	3,910,000	2,350,000	2,323,000	3,111,000	1,976,000	2,160,000	3,169,000	2,496,000	2,360,000	3,979,741	2,777,496	2,708,696

Table 3. Estimated Tax Costs on Stored Grain as Related to Selected Valuations and Tax Rates

Valuation per 100 bushels	Tax cost per 100 bushels when tax rate in mills is—								
	10	15	20	25	30	35	40	45	50
$ 20	$ .20	$ .30	$ .40	$ .50	$ .60	$ .70	$ .80	$ .90	$1.00
30	.30	.45	.60	.75	.90	1.05	1.20	1.35	1.50
40	.40	.60	.80	1.00	1.20	1.40	1.60	1.80	2.00
50	.50	.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
60	.60	.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00
70	.70	1.05	1.40	1.75	2.10	2.45	2.80	3.15	3.50
80	.80	1.20	1.60	2.00	2.40	2.80	3.20	3.60	4.00
90	.90	1.35	1.80	2.25	2.70	3.15	3.60	4.05	4.50
100	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00
110	1.10	1.65	2.20	2.75	3.30	3.85	4.40	4.95	5.50
120	1.20	1.80	2.40	3.00	3.60	4.20	4.80	5.40	6.00
130	1.30	1.95	2.60	3.25	3.90	4.55	5.20	5.85	6.50
140	1.40	2.10	2.80	3.50	4.20	4.90	5.60	6.30	7.00
150	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50

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