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Economic Comparison of Irrigated and Dryland Farming in Central South Dakota

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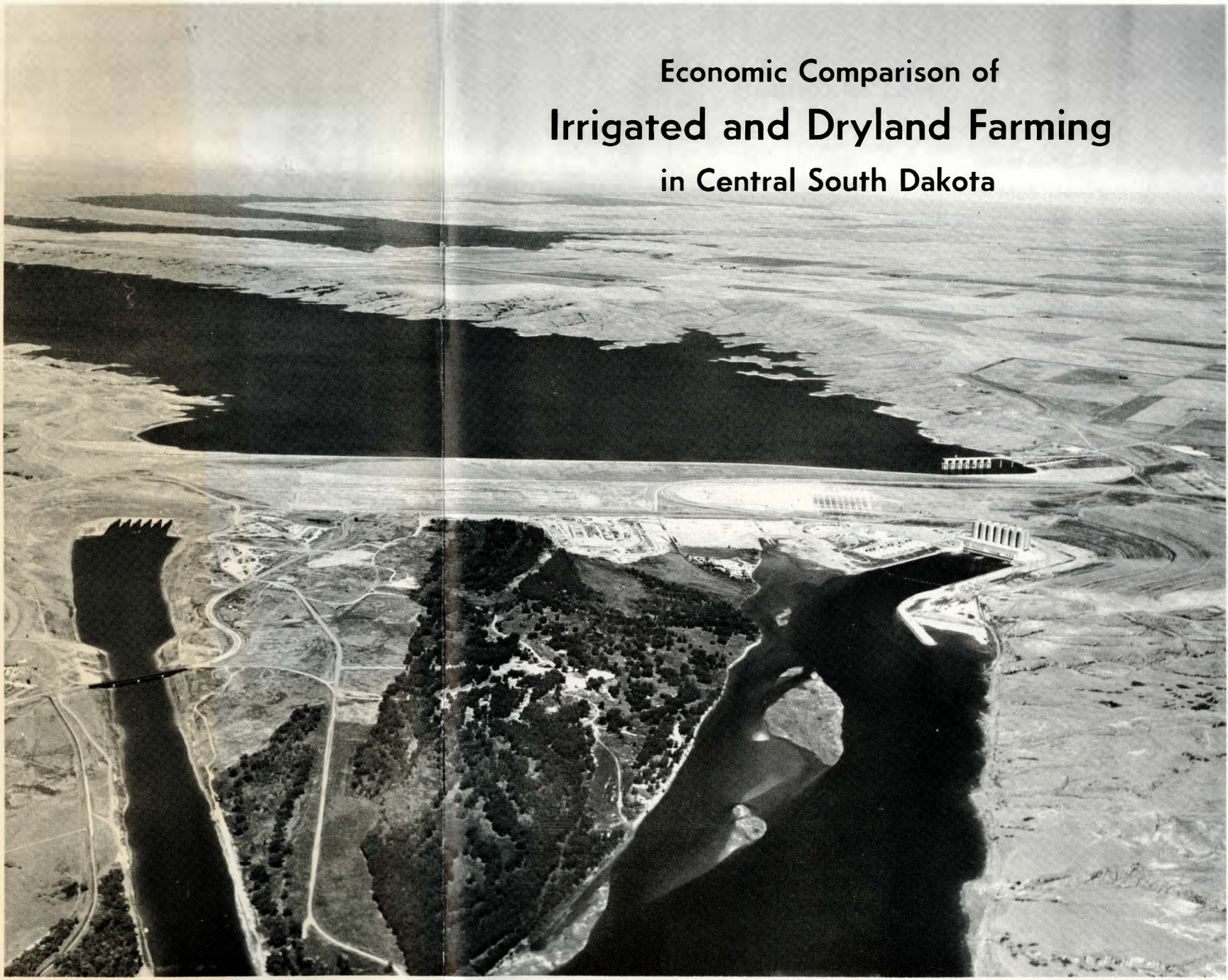

OAHE DAM
The Oahe Dam, 6 miles northwest of Pierre, South Dakota, will eventually form a Reservoir extending 250 miles upstream on the main stem of the Missouri River.

ECONOMICS DEPARTMENT ● AGRICULTURAL EXPERIMENT STATION ● SOUTH DAKOTA STATE UNIVERSITY, BROOKINGS

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Economic Comparison of Irrigated and Dryland Farming in Central South Dakota

by Rex D. Helfinstine, *Professor of Economics*

INTRODUCTION

Completion of Oahe dam across the Missouri river near Pierre, South Dakota, means that landowners in east-central South Dakota must soon decide whether to use or not to use water stored in Oahe reservoir for irrigation. In making this decision landowners and other interested persons want to know if irrigation farming will be more profitable than dryland farming and what problems will be involved in the changeover. Farming in central South Dakota has been a high risk venture because of variations and low level of rainfall. Irrigation is one means of stabilizing and increasing production and incomes from farms in the area.

This study was designed to answer these questions insofar as present knowledge of future conditions permits. Only limited knowledge of production under irrigation in the area is available from experiences of a few farmers with well irrigation and from experimental work on Redfield development farm. Experiences from other irrigated areas of limited comparability are also available. Estimates used in the analysis on future operation and maintenance charges, construction, and costs of developing land for irrigation are furnished by the Bureau of Reclamation.

Farming in the Oahe area, which includes the Lake Plains area of the James river valley and the Missouri Slope area near Pierre, generally involves raising feeder cattle on the native range and pasture and grain production on the cropland. Cattle raising or ranching attains more importance toward the west, particularly in the Missouri Slope area, because of higher proportion of range land

adapted to little else. Spring wheat is the most important cash grain crop produced. Likely introduction of irrigation would mean cattle raising and dryland farming would continue on non-irrigable lands scattered among irrigable lands. Dryland and irrigation farming likely would be combined on most farms.

Objective from the Oahe study with which this report is concerned is that of appraising economic benefits of irrigation from the Oahe reservoir to individual farmers in the proposed Oahe irrigation area in north-central South Dakota. This was done by comparing incomes, capital investment, equipment and labor requirements for typical sizes of dryland farms anticipated by about 1975 with integrated dryland-irrigation farms at the same time.

PROCEDURE USED

Irrigation water from Oahe reservoir is not expected to be available before 1975. Accordingly, this study was based on estimates of farming conditions for about 1975: yields, prices, costs, and practices. Yields were assumed to be higher and practices improved by that time. Prices and costs were assumed to remain at current levels, except those for livestock. Improved livestock feeding efficiency and resulting profitability with current prices appears likely to result in increased production and lower prices. Therefore, it was assumed that livestock prices would decline to levels to maintain profits at present levels.

Opportunities in dryland and irrigated farming were compared for these sizes of farms: 480-acre, 800-acre, and 1280-acre dryland farms in the Lake Plains area and 1280-acre and 2560-acre dryland farms in the Missouri Slope area compared with partly irrigated farms. The smaller sizes were selected in each area as representative of present typical size groups, while the larger size is expected to become more typical as farm sizes increase. Land classification work by the Bureau of Reclamation indicated that 56% of land within the boundaries of the Lake Plains area and 42% within the Missouri Slope area will be irrigable. This irrigable land is scattered throughout the area, so it was assumed that the irrigated farms will be integrated dryland and irrigated units including this proportion of irrigated land.

PRESENT AGRICULTURE

Most of the Oahe irrigation area, known as the Lake Plains area, is in north central South Dakota in the James river valley between Aberdeen and a point north of Huron (see map). A smaller area, known as the Missouri Slope area, is in Sully County, north and east of Pierre. Counties included in the Lake Plains area are: Brown, Spink, and parts of Day and Marshall. Sully County is the only one included in the Missouri Slope area.

Soils

Soil condition frequently determines the crops that may be grown

in a particular field. Characteristics related to soil condition are fertility, texture, depth of topsoil, drainability, and harmful salt concentrations. These characteristics are especially important under irrigated conditions. When near optimum moisture levels can be maintained any one of these soil characteristics may limit the increase in crop yields. It is possible for increased moisture on given soils to reduce yields. For example, poor drainage may not be a critical factor under dryland conditions, but the use of irrigation water could make it critical. The soils with poor internal drainage characteristics are not considered suitable for sustained irrigation farming. The Bureau of Reclamation has excluded such soils from the irrigable classes wherever it was considered practical. Depth of topsoil is important in determining whether a field should be leveled for irrigation. Irrigation may overcome certain unfavorable soil conditions, such as droughty soils arising from sandy soils. However, such sandy soils would have less water holding capacity, thus increasing costs of irrigation because of need for more frequent application. Lack of fertility in such soils could be overcome at added cost by application of commercial fertilizer.

The surface of the Lake Plains area is generally flat, representing the lake bed of glacial Lake Dakota.[1] Glacial tills comprise the bulk of the soil parent materials. Glacial till gives rise to loamy soils, the lake bed materials from silty and in places clayey soils. Outwash is parent material of sandy and gravelly soils and alluvial areas of stream bottoms range in texture from sand to clay. Under dryland conditions, nitrogen fertilizers have given moderate yield responses, unless legumes are included in the rotation. It is expected that under irrigated conditions crops will respond to nitrogen and phosphate fertilizers, particularly nitrogen in the absence of legumes in the rotation.

The topography of the Lake Plains area is generally flat with surface drainage being somewhat inadequate for either dryland or irrigation farming. The Missouri Slope area tends to be more rolling in topography. Both sub-surface and surface drainage are assumed to be required in both areas under irrigation. Plans of the Bureau of Reclamation include provision for necessary drainage works as part of the water distribution works. Costs would become part of the construction costs of the project with only part to be repaid by the farmer.

Land development work required on individual farms, such as leveling, would be undertaken by the individual farmer at his own expense. Such costs are estimated by the Bureau of Reclamation to average $64 per acre.

Land in the Lake Plains and Missouri Slope areas has been clas-

[1]Description of soils prepared by F. C. Westin, Professor of Agronomy, South Dakota State University.

sified by the Bureau of Reclamation for its adaptability to irrigation (table 1). Principal factors considered in making the land classification include soil texture, permeability, salinity, alkalinity, depth to incoherent sand, slope, irrigation pattern, surface leveling, cover, and surface and subsurface drainage.[2]

Class 1 lands may range in texture from sandy loam to a loam or silt loam. The surface soil must be 36 inches or more of free working soil of fine sandy loam to silt loam or 42 inches of sandy loam. The slope must be less than 2% in general gradient; the irrigation pattern must involve a 400-foot minimum run and an 8-acre minimum size. Surface leveling must not exceed 200 cubic yards of excavation per acre nor 0.24 foot average cut and fill. Irrigable land classes 2 and 3 are, respectively, less productive and/or more costly to develop than Class 1 land, but are capable of sustained irrigation farming at a reasonable cost. Land Class 6 is non-irrigable because of costs of land development and/or the soils or drainage conditions are considered unsuitable for sustained irrigation farming.

[2]Source: "Detailed Land Classification Specifications, Missouri River Basin Project, Oahe Unit South Dakota," U. S. Bureau of Reclamation, December 1958.

Climate

Outstanding characteristic of Oahe area climate, as of all the Great Plains, is its undependability for crop production. Periods of extreme cold in winter occur in sharp contrast to periods of extreme heat in summer. Periods of little or no precipitation may be broken by periods of heavy precipitation. During such drought periods strong winds are likely to intensify the adverse effects. Rainfall is deficient on the average for maximum crop growth, and a high probability occurs it will be deficient for any particular year.

For example, at Redfield during the period 1898-1963, total annual

Table 1. Land Classification of Oahe Area for Irrigation*

Class	Lake Plains acres	Lake Plains percent	Missouri Slope acres	Missouri Slope percent
1	169,600	21.4	18,000	15.0
2	191,050	24.1	22,000	18.0
3	84,250	10.7	10,000	8.0
Non-irrigable	347,140	43.8	74,000	59.0
Total	792,040	100	124,000	100

*From information furnished by Bureau of Reclamation, Huron, South Dakota, January 30, 1964, and previously. These figures are subject to revision after more detailed studies. Since obtaining these figures it has been learned that the nonirrigable acreage for Missouri Slope should be increased to 74,000 acres.

precipitation varied from a low of 11.1 inches in 1934 to a high of 30.8 inches in 1900; the average being 17.6 inches (table A-8). Growing season precipitation (April 1 - August 31) at the same station varied from 5.4 inches in 1934 to 20.2 inches in 1957; the average being 12.0 inches. Thus, 68% of total precipitation fell during the growing season, as an average.

Crop yields under dryland conditions have tended to reflect the amount of precipitation. Amount of rainfall is generally the most important limiting factor in yields. This close association is shown by the yields of spring wheat (other than durum), oats and corn and the precipitation records for Brown, Spink, and Sully Counties during the period 1926-1961 (tables A-8, A-9, A-10, A-11). Greatest variations in wheat yields occur in Sully County: from 0.0 in 1933, 1934 and 1936 to 24.4 bushels in 1958; with a coefficient of variation of 73% for the period.[3] Tendency for low and high yields to bunch is indicated by averaging yields of spring wheat by 5-year periods.

	Brown	Spink	Sully
1926-30	8.5	8.2	9.3
1931-35	5.7	4.3	4.5
1936-40	5.8	4.7	2.0
1941-45	14.9	12.8	10.0
1946-50	11.6	10.5	11.8
1951-55	11.1	10.0	10.7
1956-60	14.0	12.8	13.1

Crop production in the Oahe area is subject to other hazards: hail, weeds, insects and diseases. Hail is likely to occur on the hot, sultry days common from June through August. A study of newspaper files in Hand County (adjoining Spink County) showed 93 hailstorms over a period of 53 years.[4] Damage from these hailstorms varied from negligible to very severe, but at least 60 were rated as important. Of these 60 hailstorms, 39 caused moderate damage, because of localization or relatively light damage over a wider area; 16 were severe, involving several townships and causing a high percentage of crop loss; and 5 were outstandingly severe and extensive.

Length of growing season, both its average and its variation, limits crops that can be successfully grown in the Oahe area to relatively short-season crops. For example, weather records for Redfield since 1898 show length of growing season varying from 83 days in 1902 to 176 days in 1948,

[3]The coefficient of variation is a statistical measure of the extent a series of numbers differs from the average, the higher the coefficient the greater the variation. It shows the percentage range on each side of the average within which ⅔ of the items can be expected to fall. Defined statistically it is the square root of the mean of the squared deviations from the arithmetic mean, expressed as a percentage of the arithmetic mean.

[4]Myrick, D. C., "Climate: The Limiting Factor in Hand County Agriculture," U. S. Department of Agriculture, Bureau of Agricultural Economics, Mimeo. F. M. 25, June 1941, p. 31.

and averaging 140 days (table A-8). Growing season is defined as the period between the last 32° F. temperature in spring and the first 32° F. temperature in fall. This length of growing season is near the minimum for profitable corn production. Variability in length means that some years corn will not mature. Corn growing, consequently, is most profitable on farms which include livestock that can utilize immature corn.

TRANSPORTATION AND MARKETS

The Lake Plains part of the Oahe area is served by two transcontinental railroads, three east-

Siphon tubes carry water from the irrigation ditch to fields. Successful operation of an irrigated farm means knowing when and how to irrigate, water requirements of crops, and maintaining pipes or ditches. Corn grain and silage likely would be important in expanding Oahe livestock production. (Bureau of Reclamation Photo.)

west all-weather highways, and two north-south highways. The Missouri Slope area is served by one railroad, two east-west highways, and one north-south highway. Railroad service is primarily for freight. An increasing proportion of farm products is being transported to market by truck because of greater flexibility and convenience.

Market outlets for the Oahe area are limited by great distance to large consuming centers of the East and West. Production of bulky and perishable commodities such as fluid milk, vegetables, and similar products is restricted to an amount that can be consumed locally because of distance to such centers as New York, Chicago and Los Angeles.

PRESENT FARMING

Principal crops grown in the Oahe area are corn, wheat, oats and alfalfa (table 2). Other crops include barley and flax. Considerable land not suited to cultivation is used for native pasture and hay: 22% in Brown County, 23% in Spink and 58% in Sully.

Raising feeder cattle on native pasture and hay is the principal livestock enterprise. When feed grain is available, some cattle may

Table 2. Land Use, South Dakota and Oahe Area Counties, 1959

Item	Average per Farm			
	State	Brown	Spink	Sully
	acres	acres	acres	acres
All corn	74	88	86	97
Corn for grain	(44)	(42)	(30)	(3)
Spring wheat*	25	70	77	99
Winter wheat	7	—	—	23
Oats	36	46	19	7
Barley	8	26	8	2
Rye	2	3	2	1
Flax	10	21	2	2
Alfalfa	37	43	36	35
Other crops	21	19	26	33
Cropland harvested	220	316	256	299
Cropland pasture	21	26	40	64
Crop failure	33	90	143	247
Soil improvement crops	17	33	43	22
Summer fallow	18	17	30	68
Total cropland	309	482	512	700
Native hay	35	31	26	88
Native pasture	432	111	132	907
Other land	29	30	26	33
Total	805	654	696	1,728

Source: U. S. Census of Agriculture, 1959.
*Other than durum.

be grain-fed for marketing as slaughter cattle, or hogs may be raised for market. Some sheep and lambs may be raised. Poultry or dairying are not important enterprises.

Average farm sizes in 1959 in counties of the Oahe area were: 654 acres, Brown; 696 acres, Spink; and 1728 acres, Sully. Average size has been increasing since 1935, so if the same trend continues average sizes by 1975 will be 860 acres in Brown County, 920 acres in Spink County and 2280 acres in Sully County (table 3). Modal size group in Brown and Spink was 500 to 999 acres; in Sully 1000 to 1999 acres (table 4).

PRODUCTION REQUIREMENTS

Description of crops grown and livestock raised as well as input-output data presented in the following section were used in developing budgets for typical farm organizations.

Small Grains

Spring wheat is anticipated to remain the principal cash crop raised in the Oahe area under dryland farming. Wheat is adapted to soils, climate and growing season of the area, while present price-cost relationships make it the most profitable cash crop.

Spring wheat generally follows either a cultivated crop (usually corn), another small grain (oats, barley, or wheat), or fallow (particularly in Sully County). Usual field operations in growing wheat in the

Table 3. Trend in Farm Size, Oahe Area Counties, South Dakota

	South Dakota	Brown	Spink	Sully
	(acres)	(acres)	(acres)	(acres)
1890	—	275	282	254
1900	363	417	559	979
1910	335	460	487	676
1920	464	442	461	1,061
1930	439	441	460	778
1940	545	458	516	1,193
1950	674	525	558	1,388
1959	805	654	696	1,728
1975 projected	1,060	860	920	2,280

Source: Census of Agriculture, U. S. Bureau of Census.

Table 4. Distribution of Farms by Size, South Dakota and Oahe Area Counties*

	State (1959 U.S. census)		Brown and Spink (1959 U.S. census)		Sully (1959 U.S. census)		Lake Plains (1961 survey)		Missouri Slope (1961 survey)	
	No.	%	No.	%	No.	%	No.	%	No.	%
All farms	55,727	100.0	2,972	100.0	381	100.0	75	100.0	39	100.0
Under 139 acres	5,429	9.7	191	6.4	2	0.5	0	0	0	0
140-259 acres	11,427	20.5	251	8.4	18	4.7	7	9.3	1	2.6
260-499 acres	18,137	32.5	843	28.4	39	10.2	15	20.0	4	10.3
500-999 acres	11,219	20.1	1,195	40.2	99	26.0	31	41.3	7	17.9
1,000-1,999 acres	5,434	9.8	427	14.4	137	36.0	21	28.0	13	33.3
Over 2,000 acres	4,081	7.3	65	2.2	85	22.3	1	1.3	13	33.3

*Distribution in survey areas may differ from that in the census because of differences in geographic area involved.

Lake Plains area involve plowing and seeding with a pony press drill, swathing and combining. In the Missouri Slope area of Sully County these operations are changed to disking, harrowing, drilling, swathing, and combining. Land is prepared and the crop seeded as early in spring as field conditions allow (usually in early April). Higher yields generally result from early seeding because of cooler weather and better moisture conditions during growth compared with those for late seeding. Spraying for weed control is becoming a more frequent practice. Harvesting usually occurs in late July and early August.

The 36-year (1926-1961) average yield of spring wheat was 10.3 bushels in Brown County, 9.2 bushels in Spink County, and 9.0 bushels in Sully County (appendix table A-11). Yields for 20-year period (1941-1961), are higher: 13.0 bushels for Brown, 11.7 bushels for Spink, and 11.6 bushels for Sully. Alfalfa is grown on 5% to 10% of cropland in the area and use of commerical fertilizer, particularly nitrogen, is increasing. It is estimated that a long-time average yield of 16 bushels per acre could be maintained by application of 80 pounds of 33-0-0 fertilizer (table 5)[5]. This yield and 80 pound use of fertilizer were assumed in the budgetary analysis.

It is likely wheat growing will become less important with irrigation. This is because yields of longer season crops such as corn and alfalfa are increased proportionately more by irrigation than is wheat. Still some wheat or other small grain may be grown as a companion crop for new stands of alfalfa. Yields are likely to be higher with irrigation: estimated average wheat yields are 36 bushels per acre in the Lake Plains area and 40 bushels in the Missouri Slope area. These yields will require application of 150 pounds of 33-0-0 annually. Number of applications and quantity of water applied will vary with seasonal rainfall. Usually it will not be necessary to irrigate to germinate seed, but a June irrigation may be required. Experience in established irrigation projects suggests that methods of growing wheat under irrigation will be similar to methods under dryland farming except for additional operations —land smoothing, ditching (or use of gated pipe) and irrigating. Land smoothing will become part of seed bed preparation operations. Except with contouring, the usual method is border irrigation, where low ridges are thrown up parallel to the slope so that water turned in at the high side spreads out and flows to the lower side. Seeding rates may be higher under irrigation, perhaps 1½ bushels per acre compared with 1 bushel under dryland farming. Use of fertilizer will be more important with irrigation.

Other small grains—such as oats, barley, rye, or flax—when grown under irrigation should be handled like wheat. Estimated yields under

[5]Fertilizer analysis indicates the percentage of nitrogen (N), phosphate (P_2O_5), and potash (K_2O), respectively.

irrigation and dryland farming are shown in table 5.

Labor and tractor time requirements are expected to be higher with irrigation. Estimated requirements are:

	Units	Dryland	Irrigated
Labor requirements	Man hrs. per A.	1.1	3.9
Tractor requirements	Tr. hrs. per A.	1.0	2.7

Corn

Production of corn is highly important in the area. But there is more risk in growing corn than in growing wheat under dryland conditions because of frost hazards from the short growing season with the possibility of "soft corn" some years. Use of short season hybrids and drying equipment as well as use of the crop for livestock feeding reduces this hazard. Corn may be raised as a cash crop, but it is generally more profitable to use both grain and stalks as silage for cattle feeding, or grain for hog feeding. Usual operations in growing corn in the Lake Plains area include plowing, harrowing, surface planting, cultivating and picking. Others may disc, harrow, list, cultivate, and pick. Operations in the Missouri Slope area include disking, listing, cultivating, and picking. It is becoming more common to spray for weeds and corn borers. Corn ground is usually prepared in May, after small grain seeding, and planted between May 10 and 25.

Average yields of corn for the period 1926-61 have been 17.4 bushels in Brown County, 14.4

Table 5. Estimated Yields by About 1975 of Crops Used for Budget Analysis of Oahe Project, Good Management*

	Unit	Lake Plains Area	Missouri Slope Area
Dryland			
Corn grain	Bu.	27	19
Corn silage	Ton	6	5
Sorghum grain	Bu.	28	18
Barley	Bu.	26	20
Flax	Bu.	8	8
Oats	Bu.	38	30
Rye	Bu.	16	16
Wheat	Bu.	16	28†
Alfalfa hay	Ton	1.6	1.2
Native hay	Ton	.8	.6
Rotation pasture	AUM	2.8	1.8
Native pasture	AUM	1.0	.75
Irrigated‡			
Corn grain	Bu.	82	72
Corn silage	Ton	15.4	13.5
Sorghum grain	Bu.	67	49
Sugar beets	Ton	17.5	17.0
Sugar beet tops§	Ton	1.8	1.7
Potatoes	Bu.	362	400
Soybeans	Bu.	34	30
Barley	Bu.	58	60
Oats	Bu.	80	80
Wheat	Bu.	36	40†
Alfalfa hay	Ton	4.5	4.5
Rotation pasture	AUM	7.9	7.9

*Assumes: 100% replacement of nitrogen removed by crops under dryland farming (27 pounds of N); 100% replacement of nitrogen and phosphate removed by crops under irrigation (80 pounds of N, 45 pounds of P_2O_5); 50% replacement of potash removed by corn silage under irrigation (45 pounds of K_2O); allowance made for fertility returned by manure.

†Assumes winter wheat, after fallow on dryland.

‡Estimated for average of all irrigable land classes.

§Recoverable yields under field conditions.

bushels in Spink and 11.4 bushels in Sully (appendix Table A-11). Yields for the 1941-61 period were 21.0 bushels in Brown, 19.4 bushels in Spink and 15.4 bushels in Sully. Under dryland conditions corn will yield an estimated 27 bushels in the Lake Plains area and 19 bushels in the Missouri Slope area (table 5). These yields assume the use of 80 pounds of 33-0-0 fertilizer annually.

Corn is likely to become a more important crop under irrigation because water increases corn yield relatively more than wheat. Season of greatest growth in July and August is usually the most deficient in moisture under dryland conditions. Yields of corn under irrigation are estimated at 82 bushels per acre for the Lake Plains area and 72 bushels for the Missouri Slope area (table 5). This assumes annual use of 250 pounds of 33-0-0 fertilizer per acre and 100 pounds of 0-44-0 per acre. Additional operations for growing corn under irrigation include land smoothing and application of water. Corn is usually furrow irrigated between rows. Most irrigation takes place in June, July, and August.

Alfalfa

Alfalfa grown for hay is becoming more important under dryland conditions in the Oahe area. High nutrient value and high per acre yields make the crop particlarly adapted to a livestock system of farming. The crop is likely to assume even greater importance under irrigation because of its place in livestock feeding and relatively high yields with added water. Usual practice in seeding alfalfa under dryland conditions is to plow, harrow, and drill seed with a small grain companion crop in the spring. Another way is to disc, harrow, and drill seed with the companion crop. Perhaps seeding rate for small grain may be reduced by one-half. Likely the same practices would be followed in seeding alfalfa under irrigated conditions. However, probability of getting a stand should be much higher under irrigation. Also, fall seeding would be feasible with irrigation.

Usual practice in putting up alfalfa hay has been to mow, rake, and either bale or stack in the field with a tractor-mounted hydraulic stacker. Under irrigation more hay is likely to be baled, and heavier yields will require more time for curing. Average yields under dryland conditions are estimated at 1.6 tons for the Lake Plains area and 1.2 tons for the Missouri Slope (table 5). Irrigation is estimated to increase this to 4.5 tons for both areas, assuming annual application of 100 pounds of 0-44-0 per acre.

Pasture

Cropland pasture has not been important under dryland conditions because few farmers appreciated their need for supplementary pasture. Some have used Sudan or alfalfa to supplement native pasture during the summer. It is expected that under irrigation rotation pastures would increase in im-

portance because of high yields attainable. Gains may be put on cattle grazed on good irrigated pasture at relatively low cost and low labor requirements.

Seeding for an irrigated pasture usually is done in the spring on a well prepared and firm seedbed following the same practices used for seeding alfalfa. Various mixtures of seed are used, usually including both grasses and legumes.

Alternate grazing is recommended for maximum production on irrigated pastures. Pasture should be fenced into at least three fields, to rotate livestock among them. Livestock should be removed from the pasture during and following irrigation in order to prevent damage from tramping. Estimated production from irrigated pasture is 7.9 animal-unit months per acre where adequate fertilizer is applied (table 5). Adequate fertilizer would include 100 pounds of 0-44-0 per acre and 100 to 125 pounds of 33-0-0 fertilizer per acre (amount of nitrogen fertilizer depending upon the proportion of legumes in the seeding).

Cash Crops

Potatoes may be grown under irrigation in this area. Experimental results from the Redfield Development Farm indicate satisfactory yields. These results provide the basis for estimating average yields of 362 bushels per acre on the Lake Plains area and 400 bushels per acre on the Missouri Slope area (table 5). Practices for growing potatoes include: plowing, harrowing, disking, harrowing, smoothing, planting, and harrowing; then cultivating, irrigating, and spraying alternately during the summer (perhaps three times); and rotobeating and harvesting. Market for potatoes is quite sensitive to increases in production so any large volume increase arising from planting on irrigation projects is likely to depress prices below profitable levels. Therefore, profitability of growing potatoes under irrigation will depend upon how much over-all total production is increased.

Another cash crop, sugar beets, is adaptable to growing under irrigation in the Oahe area. Both experimental results from Redfield Development Farm and experiences of farmers in the area using well irrigation indicate the crop is adaptable. Estimated yields are 17.5 tons per acre in the Lake Plains area and 17.0 tons in the Missouri Slope area (table 5).

Usual operations in growing sugar beets under irrigation are: plow, harrow, disk, harrow, smooth, plant, harrow, cultivate, thin (both mechanically and by hand), cultivate, irrigate, cultivate, irrigate (five times), and machine harvest.

Sugar beets in the United States may be grown only under a quota allocated by the Secretary of Agriculture. Production of sugar beets in the Oahe Area, therefore, is contingent upon obtaining a quota. No sugar factories are in the area at present, although application has been made for a permit for construction of one in southeastern South Dakota. Accordingly, it

would be necessary to obtain a large enough quota for farmers in the area to make it economical to build and operate a factory. Freight costs for such a bulky commodity as sugar beets are too high to justify shipment beyond 150 to 200 miles. The Sugar Act of 1948, as amended, provides that growers who comply with production quotas and specified minimum wage standards are eligible for payments from the government. Payments are financed from an excise imposed upon sugar manufactured in the United States and from an import tax levied upon all manufactured sugar imported into the United States.

Livestock

Raising of feeder cattle for sale as calves or yearlings has been the chief livestock enterprise in the Oahe area since it was settled. The Missouri Slope Area has a higher proportion of range pasture and hay than the Lake Plains Area. Such

Sugar beets provide a profitable cash crop where marketing facilities and quotas are available. Special equipment and techniques are required for this crop. Sugar beet tops are used for livestock feed. (Bureau of Reclamation Photo.)

land has little alternative use except for cattle or sheep.

Usual practice is to run the cow herd on fenced native pasture in the summer and fall (May to September) and, following harvest, to turn them into stubble and corn fields to pick up unharvested grain and waste roughage until heavy snows. Then cattle are moved to barn lots or sheltered areas (usually in January) for supplementary feeding of native hay, corn silage and protein cake. It is estimated that 1½ tons of native hay or its equivalent in silage or alfalfa hay are required to carry each mature cow through the winter. Little grain is fed to the cows or calves, but the herd bull is usually fed grain (600 pounds per year). This herd bull generally is separated from the cow herd until the June and July breeding season. If grain is available calves or yearlings raised may be kept through the winter and fed grain for greater winter gains. Otherwise they are marketed as feeders in the fall.

Introduction of irrigation will allow expansion in the cattle enterprise. Irrigated alfalfa hay, pasture, and corn (for silage and grain) will permit an operator to fatten feeders he raises; and also to buy and fatten additional feeders.

Dairying has been of minor importance on most farms in the Oahe area. Some specialized dairy farms have supplied market milk to Aberdeen, Huron, and Redfield. Drying up of native pastures in late summer has handicapped dairying, but the better operators have overcome this by use of supplementary Sudan pasture. Profitable dairying has generally required the production of alfalfa and corn silage for winter roughage.

Irrigation will permit a more profitable dairy enterprise because it promotes higher yielding pastures that will produce during July and August; and also will allow production of a dependable roughage supply for winter use. However, absence of nearby centers of population does not warrant large scale expansion of dairying. Dairying for a manufacturing milk market is possible for the area, but its profitability depends upon continued availability of a market for dried skim milk and butter (presently supported by an agency of the U.S. Government). But, if dairying becomes important the considerable investment in buildings and equipment, and relatively large amounts of labor required could be an opportunity for use of such resources.

A swine enterprise on most farms in the Oahe area has been small or absent. A fluctuating feed grain supply and the specialized care and management required for success have been inhibiting factors preventing expansion. It does appear that a swine enterprise would be profitable on those farms that could provide feed, buildings, and equipment.

Usual feed grains fed to hogs include corn, barley, grain sorghums, and oats supplemented by commercial protein supplement. Alfalfa pasture may be profitably used for spring pigs. Usual practice has been to breed for spring or summer far-

rowing. A few operators breed for an additional fall farrowing. Overhead costs per unit can be reduced through more intensive use of buildings and equipment by farrowing both spring and fall litters. Specialized operators may even farrow up to six times a year. This analysis has assumed that 30 litters at one season are the maximum an operator can raise efficiently. Housing and equipment requirements for hog raising depend upon degree of mechanization. This study assumed a moderate degree.

Both irrigation and an improved dryland farming system would allow considerable expansion in hog raising from larger supplies of feed grain. Irrigation would be particularly valuable in stabilizing the feed grain supply from year to year and in providing adequate alfalfa pasture for low cost gains.

Small scale chicken enterprises are not considered profitable for farms in the Oahe area. A minimum of a 5000-bird laying flock is considered necessary for a profitable enterprise. This type of specialization is not considered in the analysis, since it is equally adaptable to dryland or irrigated conditions.

Canal systems carry irrigation water to smaller ditches for distribution to farms.

OPPORTUNITIES UNDER IRRIGATION

BASIS OF ANALYSIS

Analysis of expected opportunities under irrigation compared with those expected under dryland farming by the year 1975 required several simplifying assumptions. One basic assumption used in this study was that managerial ability would not restrict adoption of any improved practice. Another was that farms were fully owned by the operator with no rent or mortgage interest being paid. However, an interest charge on total investment is made in computing returns to the operator. Likewise, machinery, equipment, and livestock were assumed to be fully owned. All products produced are assumed to be sold, none being used for home consumption. A further assumption was that the operator and his family would supply up to 30 10-hour days of labor per month throughout the year, with any additional labor being hired.

Another basic assumption concerned price level to be used. In this analysis prices received (except for livestock) were assumed to be the average paid to South Dakota farmers for the period 1959 to 1961, rounded to the nearest 10 cents. Livestock prices, because of improved feeding efficiency assumed, were reduced to give profits comparable to the 1959-1961 period.

Prices of various farm products under these assumptions:

Wheat, bu.	$ 1.90
Oats, bu.	0.50
Corn, bu.	0.90
Slaughter steers, choice, cwt.	25.00
Feeder steers, choice cwt.	27.40
Hogs, cwt.	15.00

Determining Most Profitable Farm Organization

The profitability of alternative organizations for an irrigated farm in the Oahe area depends upon size of farm, acreages and proportion of rangeland, cropland, irrigable land, prospective markets, adaptability of various crops, availability and quality of labor, and character of irrigable land. Most farms in the area have a considerable proportion of native pasture and hay. This is shown by 1959 U. S. Census figures: 58% of farm land in Sully County and 22% in Brown and Spink were in native pasture and range.

The budgetary analysis assumed irrigated land was developed on

cropland with the same amount of native pasture and hay remaining. Such native pasture and hay may be utilized most advantageously for beef cattle or sheep raising. Beef cattle raising was assumed in the budgetary analysis, although previous work has indicated sheep raising would be equally profitable. Most farmers and ranchers prefer to use this grass to raise feeder cattle, so this use is continued in the analysis.

Irrigated cropland appears best adapted to growing corn for grain or silage, alfalfa for hay, and sufficient small grain to serve as a companion crop for reseeding alfalfa. Corn grain, corn silage, and alfalfa hay may be utilized best for a livestock feeding program that includes both cattle and hogs. Both sugar beets and potatoes are cash crops adapted to the area, but markets appear uncertain and limited. Present prices, however, would make these crops quite profitable.

Irrigable land generally is interspersed with dryland. Consequently, most farms would develop as a combination of dryland and irrigated farming. Integrated dryland-irrigated farm units were assumed in the analysis, that is with 56% of the land in farms being irrigated in the Lake Plains area and 42% in the Missouri Slope area (according to Bureau of Reclamation estimates).

The budget analysis that follows assumes livestock production is limited by amount of home-grown grain and roughage (only protein supplement is purchased); and that hog production is limited to a maximum of 30 litters during one season because of managerial limitations.

The budget analysis further assumes that irrigable land will be graded and surface irrigation used. Deep cuts from grading may depress crop yields during the development period. However, yields assumed may be expected to prevail after approximately 10 years of irrigation. Shallow soils occurring with uneven topography are classified as non-irrigable by the Bureau. However, some of these soils may be suitable for sprinkler irrigation, which requires limited amounts of land grading. The question of whether surface or sprinkler irrigation will be most profitable must be answered farm by farm.

THE LAKE PLAINS AREA

The Lake Plains area differs markedly from the Missouri Slope area in crop yield potential, proportion of cropland, and proportion of irrigable land. Consequently, it was considered necessary to construct different sets of budgets for each area.

The 1280-Acre Farm

The 1280-acre farm was selected as typical of the larger size group of farms in Lake Plains. This size may become a larger proportion of all farms if the past trend toward fewer, but larger, farms continues. As a dryland farm it would have 947 acres of cropland and 323 acres of native pasture and hay. The same farm under irrigation would have 717 acres of irrigable land; consisting of 273 acres of class 1, 308 acres of class 2 and 136 acres

of class 3. However, Reclamation law limits amount of irrigable land to which water will be delivered to 160 acres under one ownership. One may assume a husband and wife could own 320 acres of irrigable land with the balance sold; or there are enough children among which to divide the ownership and avoid selling any land. We have used both assumptions for illustrative purposes. However, assuming that no land would be sold and 717 acres would be irrigated implies a higher level of managerial ability and a great deal more available capital. The assumption that irrigated land would be limited to 320 acres would reduce this 1280-acre dryland farm to an 883 acre integrated dryland-irrigation farm with 397 acres of the irrigable land sold. This would leave 122 acres of class 1 land, 138 acres of class 2, and 60 acres of class 3. Acres of the various crops were budgeted as follows:

Dryland farm	Non-irrigated acres		Irrigated acres
Corn	410		—
Oats	205		—
Wheat	237		—
Alfalfa	95		—
Total, crops	947		—
Native pasture and hay	323		—
Other	10		—
Irrigated farm		**With 717 acres**	**With 320 acres**
Corn	77	478	214
Wheat	153	53	53
Oats	—	67	—
Alfalfa	—	119	53
Total, crops	230	717	320
Native pasture and hay	323	—	—
Other	10	—	—
	563	717	320

Land smoothing, required for gravity irrigation, is one costly but necessary operation done initially by heavy equipment. Deep cuts will require recommended practices for fertility restoration. Where leveling is not economical, sprinkler irrigation may be used. (Bureau of Reclamation Photo.)

The 323 acres of native pasture and hay on these farms allow a 32 head beef cow herd to be maintained on both dryland and irrigated farms (table 6). On the dryland farm sufficient feed grain and roughage are produced to raise and feed out 60 litters of pigs and to feed out 150 head of yearling steers.[6] Feed supplies on the 883-acre irrigated farm allow 60 litters of pigs and 250 yearling steers to be fed out. Supplies on the 1280-acre irrigated farm would provide feed for 60 litters of pigs and 829 yearling steers.

[6]Some operators would feed heifers, but feeding of steers was assumed in this analysis for simplification.

Total investment in livestock, machinery, and land was:

1280-acre dryland: $176,180
1280-acre irrigated: $336,358
883-acre irrigated: $172,310

Total labor requirements also varied on these farms:

1280-acre dryland: 362 man-days
1280-acre irrigated: 875 man-days
883-acre irrigated: 463 man-days

Production of feed from feed grains, forage crops, and pastures on a total digestible nutrient (TDN) basis was as follows:

1280-acre dryland: 964,567 pounds

Table 6. Comparison of a 1280-Acre Cattle-Hog Dryland Farm with 1280-Acre and 883-Acre Cattle-Hog Integrated Irrigation-Dryland Farms, Lake Plains Area.

Item	Unit	Dryland Farm	Integrated Irrigation-Dryland Farms	
		1280-acres	1280-acres	883-acres
Dry cropland	acres	947	230	230
Irrigated cropland	acres	—	717	320
Native pasture and hay	acres	323	323	323
Other land	acres	10	10	10
Total	acres	1,280	1,280	883
Beef cows	no.	32	32	32
Feeders purchased	no.	150	829	250
Sows farrowing	no.	60	60	60
Labor used operator	days	277	342	282
Labor used, hired	days	85	533	181
Total investment		$176,180	$336,358	$172,310
Total cash receipts		70,205	257,945	99,592
Less cash expenses		41,545	189,296	64,318
Net cash income		28,660	68,649	35,274
Less depreciation		2,684	3,504	2,627
Net farm income		25,976	65,145	32,647
Less interest on investment		10,662	21,192	10,680
Labor and management income		$ 15,314	$ 43,953	$ 21,967

1280-acre irrigated: 2,590,690 pounds
883-acre irrigated: 1,230,830 pounds

Labor and management returns, which allow for depreciation and interest on investment, were:

1280-acre dryland: $15,314
1280-acre irrigated $43,953
883-acre irrigated: $21,967

The 800-Acre Farm

The 800-acre farm is considered representative of the largest modal group in the Lake Plains area. Under dryland conditions this farm has 590 acres of cropland and 200 acres of native pasture and hay. The same farm under irrigation would have 448 acres of irrigable land. As Reclamation law limits the amount of irrigable land under one ownership to 160 acres, two alternative assumptions are made: that 128 acres of irrigable land are sold, leaving 320 acres for husband-wife ownership; or that no irrigable land is sold, leaving the 448 acres of irrigable land for husband-wife-child ownership. This 672-acre dryland and irrigated farm would have 122 acres of class 1, 138 acres of class 2, and 60 acres of class 3 lands. The 800-acre dryland-irrigated farm would have 171 acres of class 1, 192 acres of class 2, and 85 acres of class 3 lands.

The cattle-hog organization was one of the most profitable for this size of farm under either dryland or irrigated conditions. Acres of the various crops were budgeted as follows:

Dryland farm	Non-irrigated acres	Irrigated acres
Corn	225	—
Oats	128	—
Wheat	148	—
Alfalfa	59	—
Total, crops	590	—
Native pasture and hay	200	—
Other	10	—
Total in farm	800	—

Irrigated farms		With 448 acres	With 320 acres
Corn	47	299	214
Wheat	95	53	53
Oats	—	21	—
Alfalfa	—	75	53
Total, crops	142	448	320
Native pasture and hay	200	—	—
Other	10	—	—
	352	—	320

The 200-acres of native pasture and hay plus some cropland pasture allows a breeding cow herd of 20 cows on the dryland farm, and 32 cows on both the irrigated farms (table 7). Feed production also supports 52 litters of pigs on the dryland farm, and 50 litters each on both sizes of irrigated farms. In addition sufficient feed is produced for fattening 65 purchased feeders on the dryland farm, 250 on the 672-acre irrigated farm, and 430 on the 800-acre irrigated farm.

Total investment in livestock, machinery, and land was:

800-acre dryland: $111,375
800-acre irrigated: $209,902
672-acre irrigated: $155,825

Total labor requirements were higher on the irrigated farms:

800-acre dryland: 257 man-days
800-acre irrigated: 541 man-days
672-acre irrigated: 412 man-days

Production of total digestible nutrients from feed grains, forage crops, and pastures show the effects of irrigation:

800-acre dryland: 595,353 pounds
800-acre irrigated: 1,588,557 pounds
672-acre irrigated: 1,151,730 pounds

Labor and management returns, allowing for depreciation and interest on investment, were:

800-acre dryland: $9,102
800-acre irrigated: $25,324
672-acre irrigated: $19,033

A profitable alternative to the previous irrigated crop plan substitutes 60 acres of sugar beets for part of the corn and wheat. Comparison of the two irrigated crop plans with the dryland plan follows:

Dryland farm	Dry farmed	Irrigated
Corn	255	—
Oats	128	—
Wheat	148	—
Alfalfa	59	—
Irrigated farm without sugar beets		
Corn	47	214
Wheat	95	53
Alfalfa	—	53
Irrigated farm with sugar beets		
Corn	47	180
Sugar beets	—	60
Wheat	95	20
Alfalfa	—	60

Table 7. Comparison of an 800-Acre Cattle-Hog Dryland Farm with 800-Acre and 672-Acre Cattle-Hog Integrated Irrigation-Dryland Farms, with and without 60 Acres of Sugar Beets, Lake Plains Area

Item	Unit	Dryland farm	Integrated Dryland-Irrigation Farms		
			Without sugar beets		With sugar beets
		800-acre	800-acre	672-acre	672-acre
Dry cropland	acres	590	142	142	142
Irrigated cropland	acres	—	448	320	320
Native pasture and hay	acres	200	200	200	200
Other land	acres	10	10	10	10
Total	acres	800	800	672	672
Beef cows	no.	20	32	32	36
Feeders purchased	no.	65	430	250	265
Sows farrowing	no.	52	50	50	30
Labor used, operator	days	240	275	256	258
Labor used, hired	days	17	266	156	222
Total investment		$111,375	$209,902	$155,825	$162,535
Total cash receipts		39,478	144,210	94,606	108,325
Less cash expenses		21,376	102,616	63,376	69,124
Net cash income		18,102	41,594	31,230	39,201
Less depreciation		2,247	3,050	2,447	2,689
Net farm income		15,855	38,544	28,783	36,512
Less interest on investment		6,753	13,220	9,750	10,220
Labor and management income		$ 9,102	$ 25,324	$ 19,033	$ 26,292

Production of roughage is higher on the farm with sugar beets because of that supplied by beet tops, but production of feed grain is lower. This requires a shift in the livestock program: from 32 to 36 beef cows, from 250 purchased feeders to 265, and from 50 litters of pigs to 30.

Total investment on the farm raising sugar beets is higher because of the additional specialized beet equipment and more beef cattle, $162,535 compared with $155,825 (table 7).

Labor and management returns are $26,292 on the farm with sugar beets, compared with $19,033 without beets. However, attainment of such returns requires granting of a sugar beet quota by the U. S. Department of Agriculture and construction of a local sugar beet processing plant to provide a market.

The 480-Acre Farm

The 480-acre farm is representative of a modal group of smaller-than-average farms in the Lake Plains area. Such a farm under dryland conditions had 355 acres of cropland and 119 acres of native pasture and hay. The same farm under irrigated conditions would have 269 acres of irrigable land. This is within the 160-acre limitation imposed by Reclamation law, assuming husband and wife ownership. The average proportion of various irrigable land classes applied to this acreage gives 102 acres of class 1, 116 acres of class 2, and 51 acres of class 3 land.

The cattle-hog organization appeared to be one of the most profitable for this farm under dryland or irrigated conditions. Acreages of the various crops as budgeted were:

Dryland farm	Dry farmed	Irrigated
Corn	147	—
Oats	73	—
Wheat	89	—
Alfalfa	46	—
Irrigated farm		
Corn	43	179
Wheat	43	45
Alfalfa	—	45

The 119 acres of native pasture and hay plus 16 acres of cropland pasture on the dryland farm permits carrying of a 12 cow beef breeding herd. The same acreage of native pasture and hay plus 22 acres of irrigated pasture on the irrigated farm allows carrying a 20 cow herd. Feed production on the dryland farm is adequate for feeding out 40 purchased feeder steers and 31 litters of pigs. Additional feed on the irrigated farm allows this to be increased to 200 head of feeder steers and 50 litters of pigs.

Total investment is $56,826 higher on the irrigated than on the dryland farm because of higher investment in livestock, land, and machinery (table 8).

The irrigated farm requires approximately twice the man labor that the dryland farm requires—357 compared with 182 man-days. More labor is needed for the additional livestock and more intensive work on irrigated crops. But the operator on the dryland farm would not be fully employed by his farm work.

Total production of all feed grains, forage crops, and pastures converted to total digestible nutrients (TDN) amounts to 939,120 pounds on the irrigated farm and 356,610 pounds on the dryland farm (1,050,870 vs. 425,560 pounds if wheat is included).

Labor and management returns (allowing for depreciation and interest on investment) are $14,922 on the irrigated farm compared with $5,843 on the dryland farm.

THE MISSOURI SLOPE AREA

The Missouri Slope area differs from the Lake Plains area by having a lower dryland yield potential, a higher proportion of range land and a lower proportion of irrigable land. All these factors have resulted in a much larger average size of farm: 1728 acres in Sully County compared with 696 acres in Spink (1959 U. S. Census figures). Consequently, budgets were worked out for larger size farms: 1280 acres and 2560 acres.

The 1280-Acre Ranch

The 1280-acre ranch was selected as representative of many ranches in the area that are smaller than the average. Such a ranch

Table 8. Comparison of a 480-Acre Cattle-Hog Dryland Farm, with a 480-Acre Cattle-Hog Integrated Irrigation-Dryland Farm, Lake Plains Area

Item	Unit	Dryland Farm	Integrated Irrigation-Dryland Farm
Dry cropland	acres	355	86
Irrigated cropland	acres	—	269
Native pasture and hay	acres	119	119
Other land	acres	6	6
Total	acres	480	480
Beef cows	no.	12	20
Feeders purchased	no.	40	200
Sows farrowing	no.	31	50
Labor used, operator	days	182	248
Labor used, hired	days	—	109
Total investment		$66,825	$123,651
Total cash receipts		23,965	76,404
Less cash expenses		12,742	51,117
Net cash income		11,223	25,287
Less depreciation		1,329	2,394
Net farm income		9,894	22,893
Less interest on investment		4,051	7,971
Labor and management income		$ 5,843	$ 14,922

under dryland conditions has 512 acres of cropland and 753 acres of native range and hayland. If irrigation water were available, it would have 538 acres of irrigable land. Two alternative assumptions regarding the 160 acre limitation were made: that 218 acres of irrigable land are sold, leaving 320 acres for husband-wife ownership; or that no irrigable land is sold, thus leaving 538 acres of irrigable land for husband-wife-child ownership. The assumption that no land is sold must also imply increased capital requirements and managerial ability are available. This 1062-acre integrated dryland-irrigation farm would have 116 acres of class 1, 141 acres of class 2, and 63 acres of class 3 land. The 1280-acre integrated dryland - irrigation farm would have 194-acres of class 1, 237 acres of class 2, and 107 acres of class 3 land.

A cattle-hog organization was budgeted as most profitable for this ranch either as a dryland or irrigated situation. Acres of the various crops were as follows:

Dryland Ranch	Non-irrigated acres	Irrigated acres
Corn	125	—
Oats	65	—
Wheat, spring	90	—
Alfalfa	52	—
Wheat, winter	90	—
Fallow	90	—
Total, cropland	512	—
Native range	753	—
Other	15	—
Total in ranch	1,280	—

Irrigated Ranches		1280-acre	1062-acre
Corn	—	359	214
Wheat, winter	—	89	53
Alfalfa	—	90	53
Total, cropland		538	320
Native range	727	—	—
Other	15	—	—
	742	—	320

The 727 acres of range pasture plus alfalfa and feed grains on the dryland ranch support a 45-head beef cow breeding herd and 11 litters of spring pigs. The 727 acres of range pasture on the irrigated ranches will support 52- and 43-head beef cow breeding herds, respectively, on the 1,280-acre and 1,062-acre units but the additional alfalfa and feed grains would feed out 417 purchased feeders and 55 litters of pigs on the 1,280-acre integrated dryland-irrigation ranch, and 237 feeders and 30 litters of pigs on the 1,062-acre ranch (table 9).

Total investment in livestock, machinery, equipment and land was:

1280-acre dryland: $114,260
1280-acre irrigated: $223,332
1062-acre irrigated: $156,975

Total labor requirements were considerably higher on the integrated dryland-irrigation farms because of additional livestock and more time on irrigated crops.

Requirements were:

1280-acre dryland: 194 man-days
1280-acre irrigated: 639 man-days
1062-acre irrigated: 392 man-days

Production of all feed grains, forage crops, and pasture on a total digestible nutrients basis on the dryland and irrigated ranches were:

1280-acre dryland: 480,207 pounds
1280-acre irrigated: 1,749,876 pounds
1062-acre irrigated: 1,140,111 pounds

Labor and management returns, deducting for depreciation and interest on investment, were:

1280-acre dryland: $4,526
1280-acre irrigated: $26,110
1062-acre irrigated: $15,417

The 2560-Acre Ranch

This 2560-acre ranch was selected as representative of the larger-than-average size ranches in the Missouri Slope area. As a dryland ranch it has 1024 acres of cropland and 1521 acres of native range and hayland. The same ranch with irrigation water available would have 1,075 acres of irrigable land. Alternate assumptions were made because of the 160-acre limitation on irrigated land under one ownership as follows: 755 acres of irrigable land was sold leaving 320 acres for husband and wife ownership or no land was sold leaving

Table 9. Comparison of a 1280-Acre Cattle-Hog Dryland Ranch with 1280-Acre and 1062-Acre Cattle-Hog Integrated Irrigation-Dryland Ranches, Missouri Slope Area

Item	Unit	Dryland Ranch	Integrated Irrigation-Dryland Ranches	
			1280-acre	1062-acre
Dry cropland	acres	512	0	0
Irrigated cropland	acres	—	538	320
Native pasture and hay	acres	753	727	727
Other land	acres	15	15	15
Total	acres	1,280	1,280	1,062
Beef cows	no.	45	52	43
Feeders purchased	no.	—	417	237
Sows farrowing	no.	11	55	30
Labor used, operator	days	194	313	255
Labor used, hired	days	—	326	137
Total investment		$114,260	$223,332	$156,975
Total cash receipts		19,697	146,359	86,775
Less cash expenses		6,028	103,434	59,079
Net cash income		13,669	42,925	27,696
Less depreciation		2,220	2,789	2,427
Net farm income		11,449	40,136	25,269
Less interest on investment		6,923	14,026	9,852
Labor and management income		$ 4,526	$ 26,110	$ 15,417

1,075 acres of irrigable land for husband-wife-children ownership. As before when no land is sold it must be assumed that the greatly increased capital requirements and managerial ability are available. The 1805-acre ranch formed by sale of 755 acres would have 116 acres of class 1, 141 acres of class 2, and 63 acres of class 3 land. The 2560-acre ranch would have 390 acres of class 1, 475 acres of class 2 and 210 acres of class 3 land.

Again the cattle-hog organization budgeted out to be most profitable for this ranch under both dryland and irrigated conditions.

Acreages of the various crops were:

Dryland Ranch	Non-irrigated, acres	Irrigated, acres
Corn	257	—
Oats	128	—
Wheat, spring	179	—
Wheat, winter	179	—
Alfalfa	102	—
Fallow	179	—
Total, cropland	1,024	—
Native range	1,521	—
Other	15	—
Total	2,560	—

Irrigated Ranch	Non-irrigated acres	Irrigated, acres 2560-acre	1805-acre
Corn	—	717	214
Wheat, winter	—	179	53
Alfalfa	—	179	53
Fallow	—	—	—
Total, cropland	—	1,075	320
Native range	1,470	—	—
Other	15	—	—
	1,485	—	320

The 1521 acres of range pasture plus hay and feed grains would support a 92-head beef cow breeding herd on dryland and 100 and 90 on the 2,560- and 1,805-acre irrigated ranches, respectively (table 10). Other feed grown on these ranches would be sufficient for feeding 22 litters of pigs on the dryland ranch; 30 litters of pigs and 1,010 purchased feeders on the 2560-acre integrated dryland-irrigated ranch; and 58 litters of pigs and 125 purchased feeders on the 1,805-acre integrated ranch.

Total investment in livestock, land, machinery and equipment was:

2560-acre dryland: $212,250
2560-acre irrigated: $453,990
1805-acre irrigated: $193,280

Operator and hired labor requirements are higher on the integrated dryland-irrigation farms from additional livestock and more time on irrigated crops. Requirements were:

2560-acre dryland: 331 man-days
2560-acre irrigated: 1,133 man-days
1,805-acre irrigated: 441 man-days

Production of all feed grains, forage crops, and pasture on a total digestible nutrients basis for the dryland and integrated ranches was:

2560-acre dryland: 969,186 pounds
2560-acre irrigated: 3,517,110 pounds
1805-acre irrigated: 1,399,060 pounds

Labor and management returns, which allow for depreciation and interest on investment, were as follows:

2560-acre dryland: $13,136
2560-acre irrigated: $54,009
1805-acre irrigated: $17,344

STABILIZATION EFFECTS OF IRRIGATION

Farm income under dry and irrigated conditions includes two stability elements: of production, and of prices (both prices paid and prices received). Irrigation will affect stability of production with little effect on stability of prices. In years past, however, South Dakota farmers have experienced wide variations in both prices paid for farm inputs and prices received for farm outputs. The extent of these changes is indicated by indices of prices paid and prices received by farmers in South Dakota (table 11). For example, prices paid have fluctuated from an index of 35 in 1933 to 105 in 1962 (1957-59=100). Changes in fixed costs are shown by index of interest and taxes. Interest varied from 48 in 1949 to 244 in 1930. Taxes varied from 31 in 1934 to 118 in 1963. Changes in variable costs are

Table 10. Comparison of a 2,560-Acre Cattle-Hog Dryland Ranch with 2,560-Acre and 1,805-Acre Cattle-Hog Integrated Irrigation-Dryland Ranches, Missouri Slope Area

Item	Unit	Dryland Ranch	Integrated Irrigation-Dryland Ranches	
		2560-acre	2560-acre	1805-acre
Dry cropland	acres	1,024	—	—
Irrigated cropland	acres	—	1,075	320
Native pasture and hay	acres	1,521	1,470	1,470
Other land	acres	15	15	15
Total	acres	2,560	2,560	1,805
Beef cows	no.	92	100	90
Feeders purchased	no.	—	1,010	125
Sows farrowing	no.	22	30	58
Labor used, operator	days	268	358	283
Labor used, hired	days	63	775	158
Total investment		$212,250	$453,990	$193,280
Total cash receipts		40,030	320,685	72,475
Less cash expenses		11,474	234,406	40,499
Net cash income		28,556	86,279	31,976
Less depreciation		2,713	3,704	2,685
Net farm income		25,843	82,575	29,291
Less interest on investment		12,707	28,566	11,947
Labor and management income		$ 13,136	$ 54,009	$ 17,344

indicated by index of prices paid for production items (from 35 in 1933 to 105 in 1962) and the index for wages (from 13 in 1933 to 110 in 1962). Changes in net income are indicated by changes in costs compared with changes in prices received. Prices received have

Table 11. Index of Prices Paid by Farmers, Interest, Taxes, and Wage Rates, and Index of Prices Received by Farmers, South Dakota 1930-63 (1957-59=100)*

Year	Prices paid for production items	Interest payable per acre	Taxes payable per acre	Wage rates for hired farm labor	Prices paid interest, taxes and wage rates	Prices received by farmers
1930	45	244	69	32	52	48
1931	40	213	72	22	45	32
1932	36	204	57	16	40	22
1933	35	182	52	13	37	24
1934	42	163	31	14	41	33
1935	44	149	36	18	43	47
1936	43	128	38	19	42	48
1937	47	110	39	22	44	53
1938	42	96	46	22	42	41
1939	42	84	51	22	40	39
1940	43	76	48	23	41	41
1941	45	73	46	30	43	51
1942	51	72	46	44	49	65
1943	54	69	43	57	53	77
1944	57	69	41	67	57	78
1945	58	66	44	75	59	81
1946	62	59	52	79	64	98
1947	76	54	56	88	77	127
1948	86	49	67	93	83	129
1949	86	48	69	89	82	104
1950	88	51	75	87	84	112
1951	95	55	77	97	91	134
1952	98	60	79	98	93	120
1953	91	64	79	99	90	104
1954	91	69	82	97	91	101
1955	92	74	82	96	92	93
1956	93	83	89	95	94	90
1957	97	91	98	99	98	95
1958	100	99	102	100	100	104
1959	103	110	100	101	102	100
1960	103	122	103	103	103	98
1961	103	137	113	107	105	99
1962	105	155	115	110	108	102
1963	105	164	118	110	108	98

*"South Dakota Agriculture," South Dakota Crop and Livestock Reporting Service, Sioux Falls.

varied from an index of 22 in 1932 to 134 in 1951.

Greater stability of farm income (from more stable production) appears obvious from irrigation development of the Oahe area. This is especially obvious to those familiar with the historical patterns of erratic weather behavior and associated variations in income and production characteristic of dryland farming in the Dakotas.[7]

Degree of stability on dryland farms compared with that on irrigated farms is not obvious. Adequate evaluation of the effect of irrigation requires measuring degree of stability on each. This study does not provide any new measures of stability on dryland and irrigated farms. It is considered that a previous study evaluating irrigation of the Oahe area and the stability effects of irrigation provides an applicable comparison.[8] Highlights of the stability phase of that study will be reviewed.

This earlier study of the Oahe area used a modified budgetary technique to compare stability of dryland farming with irrigated farming, assuming the weather pattern of the period 1926-1952. The study compared yearly income and feed production from 320-acre, 480-acre, and 682-acre partly irrigated farms with that from 320-acre, 480-acre and 800-acre dryland farms. Only results for larger sizes will be presented here. Both the 682-acre irrigation farm and the 800-acre dryland farm were organized as beef cattle-hog farms with additional feeder steers purchased for the irrigated farm.

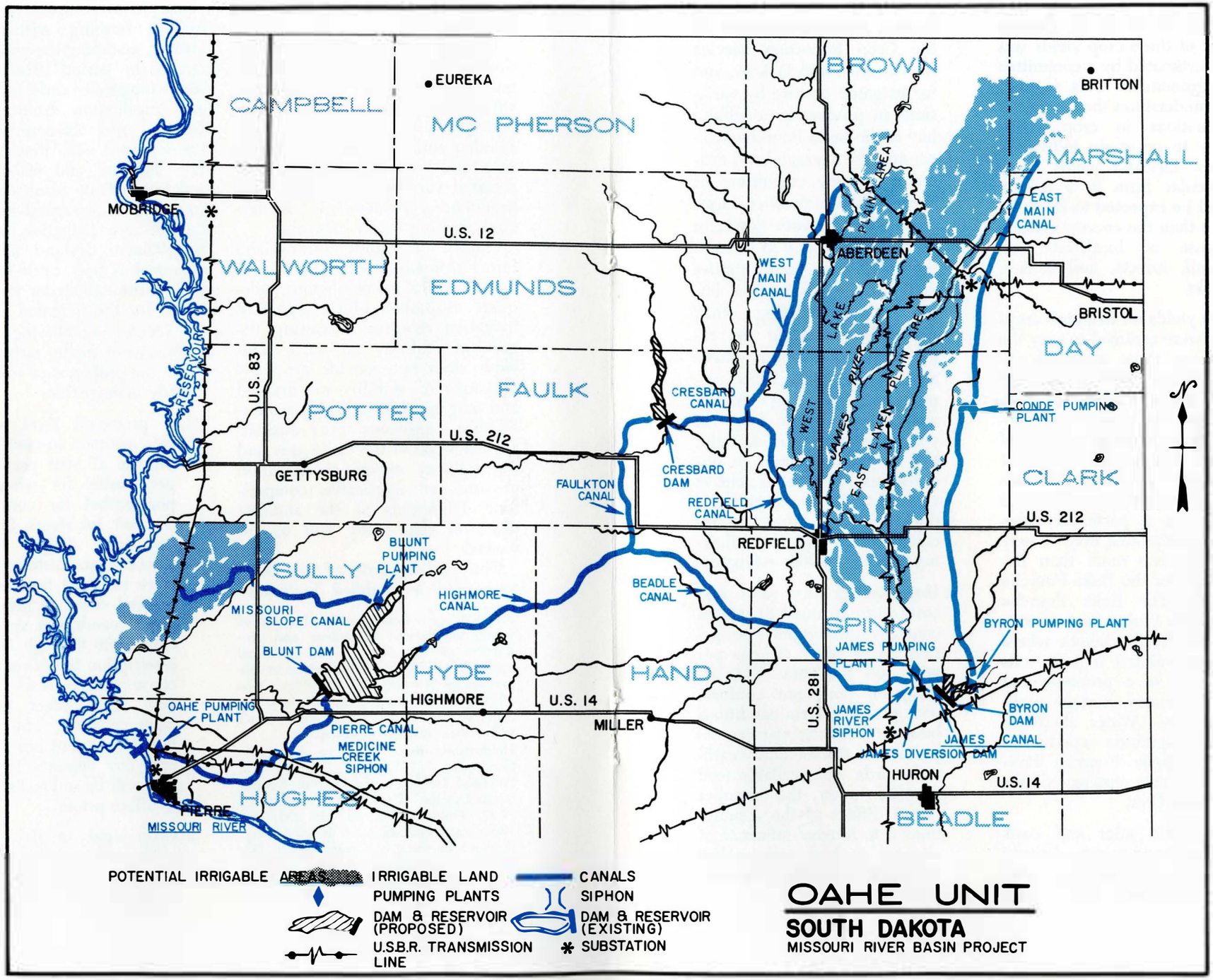
Several simplifying assumptions were made, either to isolate the problems or to keep the study manageable:

1. A projected level of prices was assumed to continue during the 27 year period ($1.55 per bushel for wheat, $1.20 per bushel for corn, $18.15 per cwt. for steers, $16.65 per cwt. for hogs). Constant rather than historical prices were assumed because of the marked effect of general economic conditions upon prices from 1926 through 1952. This assumption is not realistic because widespread drought may itself affect prices of farm products. This assumption of constant prices implies that any changes in production will be so localized as not to affect prices.

2. Crop yields on dry cropland were assumed to vary the same as those reported annually for 1926-52 for Beadle

[7]Stabilization is defined as leveling out of yearly fluctuations in income and production (in this case), or, in statistical terms, as the degree of reduction in dispersion of the observed variables. Coefficient of variation (standard deviation expressed as a percent of the mean) serves as a measure of dispersion.

[8]Helfinstine, Rex. D., "An Economic Comparison of Dryland Farming and Potential Irrigation Farming in Central South Dakota," University of California, Ph.D. Thesis, 1958, pp. 169-206; and "Economic Potentials of Irrigated and Dryland Farming in Central South Dakota", South Dakota Agricultural Experiment Station Bulletin 444, 1955, pp. 37-41.


CAMPBELL
EUREKA
MC PHERSON
BROWN
BRITTON
MARSHALL
MOBRIDGE
U.S. 12
WALWORTH
EDMUNDS
ABERDEEN
WEST MAIN CANAL
EAST MAIN CANAL
LAKE PLAIN AREA
BRISTOL
DAY
POTTER
FAULK
U.S. 83
OAHE RESERVOIR
CRESBARD CANAL
CRESBARD DAM
WEST JAMES RIVER LAKE PLAIN AREA
EAST JAMES RIVER LAKE PLAIN AREA
CONDE PUMPING PLANT
U.S. 212
GETTYSBURG
FAULKTON CANAL
REDFIELD CANAL
CLARK
REDFIELD
U.S. 212
BLUNT PUMPING PLANT
SULLY
OAHE
BEADLE CANAL
HIGHMORE CANAL
MISSOURI SLOPE CANAL
SPINK
BYRON PUMPING PLANT
JAMES PUMPING PLANT
BLUNT DAM
HYDE
HAND
HIGHMORE
U.S. 14
U.S. 281
OAHE PUMPING PLANT
MILLER
JAMES RIVER SIPHON
BYRON DAM
JAMES CANAL
JAMES DIVERSION DAM
PIERRE CANAL
MEDICINE CREEK SIPHON
HURON
U.S. 14
HUGHES
PIERRE
BEADLE
MISSOURI RIVER
POTENTIAL IRRIGABLE AREAS
IRRIGABLE LAND
CANALS
PUMPING PLANTS
SIPHON
DAM & RESERVOIR (PROPOSED)
DAM & RESERVOIR (EXISTING)
U.S.B.R. TRANSMISSION LINE
SUBSTATION
OAHE UNIT
SOUTH DAKOTA
MISSOURI RIVER BASIN PROJECT

County by the Crop Reporting Service. However, the average level of these crop yields was that estimated by a committee of agronomists. This assumption understates the amount of fluctuations in crop yields likely to occur on individual farms. Dryland yields on a particular farm in a county could be expected to fluctuate more than the county average because of localized hail, rainfall, insects, and disease attacks.

3. Crop yields on irrigated cropland were assumed to vary the same as those reported annually for 1926-52 for the Belle Fourche Irrigation Project by the Bureau of Reclamation. Average level of these crop yields was that estimated by the committee of agronomists. Irrigated yields on a particular farm in the Oahe area may or may not fluctuate more than the average for the Belle Fourche Project. The Belle Fourche Irrigation Project is in northwestern South Dakota where average rainfall is less, soils are more of a problem, and periodic water shortage problems arise. Water shortages of the magnitude experienced on the Belle Fourche Project are not anticipated for the Oahe Unit.

4. Beef cattle sales and costs were assumed to vary directly with the previous year's pasture production. For dryland pasture this was shown by pasture condition reported by the Crop Reporting Service for eastern South Dakota; and for irrigated pasture by variations in production of alfalfa hay in the Belle Fourche Project and the average level estimated by the committee of agronomists. In practice, farmers tend to be both slower in reducing herds and in increasing them than feed supplies dictate. The assumption implies that breeding stock would be available for replacement at inventory prices after a drought. Since replacement breeding animals are likely to cost more in years following a drought, this assumption tends to underestimate the co-efficient of variability of net incomes for dryland farms, since net incomes would be lower following a drought than estimated.

5. Hog and poultry sales and costs were assumed to remain constant throughout the period at 30 litters of pigs per year and 100 hens. This assumption does not conform with practical farm conditions because of effects of price expectations, disease and weather hazards, and available feed supplies upon the number raised. Effect of the assumptions is to remove influence of changes in hog and poultry production upon income variability.

6. It was assumed that costs of tractor operations, machinery operation, and hired labor would remain constant throughout the period. This assumption fails to conform with practical conditions, because it is likely that in case of drought there would be a slight decline in cash operating cost arising from less hired labor for the smaller numbers of livestock, less tractor fuel and oil for harvesting smaller production of crops.

Stability of Production

Comparison was made of the stability of feed production from the dryland and the irrigated farm (with 40%, 55%, and 80% of the land irrigated) by converting production from all crops to total digestible nutrients (TDN). Production of all grains, hay, and pasture was included, but production of straw and stover was excluded. The analysis brought out a striking difference in variability: 49% on the dryland compared with 15% to 19% on the irrigated farm (table 12). Stated differently the variation in production on the irrigated farm was only 31% to 39% of that on the dryland farm. This reduction in variability of feed production arising from irrigation appears to be one of the most important advantages of irrigation. An operator whose farm is irrigated would need less capital and feed reserves to carry him through years of adverse weather.

Stability of Earnings

Stabilization of feed production from irrigation must be evaluated from the standpoint of its effect upon stabilization of labor and management income. Irrigation of the Oahe area (under the previous assumptions) would reduce variability of income on an irrigated farm to 33% to 46% of that on a dryland farm (29%, 32%, or 41% compared with 89% on the dryland farm), (table 13). Thus, on the dryland farm there was a cumulative deficit in labor income of $4,574 for the four years 1933 through 1936. There were no years of deficit labor income on the irrigated farm. It is evident that operators with little capital reserve would benefit most from irrigation.

PROBLEMS INTRODUCED BY IRRIGATION

Introduction of irrigation into an area already well established in dryland farming will give rise to numerous problems of adjustment. First, the operator must learn a new technique—irrigated farming differs in many ways from dryland farming. He will want to know the best way to change from dryland to irrigation farming, how much development for irrigation will cost, and what labor and equipment will be required for irrigation. He must recognize the need for learning new managerial skills, especially during initial phases of establishing irrigation.

Additional investment required for irrigation points up the need for increased credit or capital and also where it may be obtained.

Table 12. Feed Production on an 800-Acre Dryland, an 800-Acre (40% Irrigated), a 682-Acre (55% Irrigated), and a 480-Acre (80% Irrigated) Farm, Cattle-Hog Type, Central South Dakota, 1926-1952*

	Total Digestible Nutrients†			
		Partly Irrigated Farms		
Year	Dryland farm 000	40% irrigated 000	55% irrigated 000	80% irrigated 000
1926	333	968	911	844
1927	885	1,074	906	755
1928	475	901	821	731
1929	572	1,033	924	813
1930	650	1,003	883	772
1931	215	586	554	506
1932	465	918	841	747
1933	103	723	716	679
1934	80	735	725	703
1935	435	948	872	783
1936	98	700	692	662
1937	272	848	809	750
1938	469	856	775	688
1939	318	804	752	687
1940	334	992	938	861
1941	446	1,114	1,038	947
1942	844	1,185	1,031	886
1943	476	768	687	589
1944	693	1,009	877	738
1945	904	1,115	936	777
1946	711	1,130	993	864
1947	733	1,124	983	849
1948	968	1,301	1,111	950
1949	509	1,163	1,072	974
1950	666	1,054	927	803
1951	898	1,293	1,115	958
1952	524	1,183	1,091	988
Mean	524	982	888	789
Standard deviation	257	186	144	119
Coefficient of variation	49%	19%	10%	15%

*Helfinstine, Rex D., "An Economic Comparison of Dryland Farming and Potential Irrigation Farming in Central South Dakota," University of California, Ph.D. Thesis, Table 25, p. 183.

†Total digestible nutrients (TDN) includes protein, carbohydrates and fat and is a measure of the energy value of feeds.

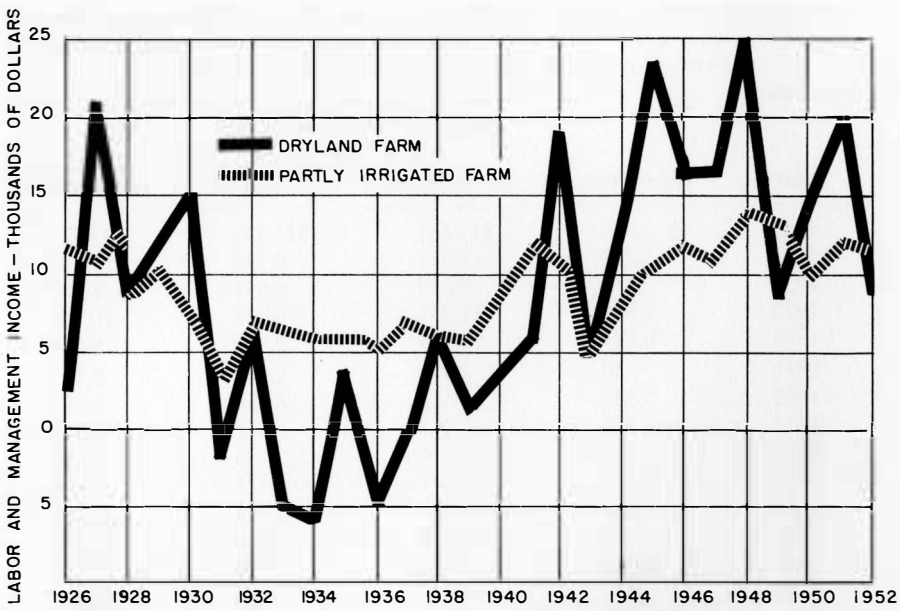
Table 13. Labor and Management Income on an 800-Acre Dryland, an 800-Acre (40% Irrigated), a 682-Acre (55% Irrigated), and a 480-Acre (80% Irrigated) Farm, Cattle-Hog Type, Central South Dakota, 1926-52*

Year	Dryland farm	Labor and management income† Partly irrigated farms‡		
		40% irrigated	55% irrigated	80% irrigated
1926	$ 2,926	$11,141	$11,266	$11,517
1927	15,242	11,983	9,374	8,141
1928	6,439	9,848	8,941	8,582
1929	8,664	12,295	10,927	10,269
1930	10,993	12,308	10,434	9,584
1931	20	2,458	2,907	3,196
1932	5,336	8,662	8,359	8,382
1933	–2,470	5,465	6,612	7,358
1934	–3,705	4,244	6,196	7,518
1935	3,471	6,791	7,372	7,991
1936	–2,870	4,385	5,786	6,716
1937	76	6,855	7,894	8,667
1938	5,446	7,748	7,275	7,175
1939	2,027	6,323	6,628	6,965
1940	2,741	9,994	10,339	10,734
1941	5,021	13,639	13,344	13,409
1942	13,834	14,785	12,463	11,467
1943	4,887	6,087	5,256	4,836
1944	10,372	11,682	9,575	8,338
1945	16,908	15,975	12,172	10,007
1946	12,203	15,982	13,522	12,205
1947	12,184	15,311	12,884	11,570
1948	18,099	18,327	14,915	13,277
1949	6,983	14,620	13,841	13,695
1950	10,406	12,721	10,919	10,020
1951	15,206	17,056	14,331	13,061
1952	6,793	14,363	13,685	13,671
Mean	6,935	10,780	9,897	9,569
Standard deviation	6,149	4,398	3,212	2,754
Coefficient of variation	89%	41%	32%	29%

*Helfinstine, Rex D., "An Economic Comparison of Dryland Farming and Potential Irrigation Farming in Central South Dakota," University of California, Ph.D. Thesis, Table 28, p. 188.

†Labor and management income is defined as the difference between total cash receipts and expenses for the farm business less an allowance for interest on investment and depreciation.

‡Assuming a Bureau of Reclamation estimate of $5 per acre of irrigable land for annual operation and maintenance charge; and $3 per acre for annual construction charge (deferred first 10 years, charged next 40 years).



Labor and management income is stabilized by irrigation as shown in this chart, based on a previous study, comparing a 1,060-acre dryland cattle-hog farm and 480-acre partly irrigated cattle-hog farm.

Farm operators must know adapted types of farm organizations under irrigation in central South Dakota. Finally, a farmer faced with making a decision on whether to irrigate will want to evaluate the two types of farming on the basis of comparative costs and returns from farms requiring comparable investment.

Changing to Irrigation Farming

A dryland farmer or rancher faced with the possibility of obtaining irrigation water likely will want to know what is the most profitable way for him to change from dryland to irrigated farming. He must decide whether sprinkler or surface irrigation is best adapted to his particular farm. Engineering advice is needed to compare amount and cost of land smoothing plus operating costs of surface irrigation with investment and operating cost of a sprinkler system. Usually such engineering advice is available from irrigation specialists at South Dakota State University and from Soil Conservation technicians. After determining type of irrigation system, the farmer must decide how many years he should take to change from dryland to irrigation.[9] Factors tending to lengthen the development

[9]In most cases only a partial irrigation organization, in which both dry and irrigated land are operated together on the same farm, will be feasible in the Oahe Area. This situation results from soil drainage, and topographic deficiencies.

period are time required to learn to irrigate, the large amount of capital required for smoothing and time required for purchasing additional livestock to utilize more feed produced under irrigation. Factors tending to shorten the development period include the assessment of operation and maintenance charges on all irrigable land regardless of whether it is irrigated. Construction charges for irrigation facilities built beyond the farm boundaries by the Bureau of Reclamation are usually postponed for the initial development period of 10 years. Adequate capital or credit may make it profitable for a farmer to develop his irrigable land for irrigation as rapidly as his cropping plans allow. Rapid development allows a farmer to benefit earlier from higher and more dependable yields of crops. Decline in fertility arising from disturbance of the soil surface by smoothing operations may be best restored by using a combination of commercial fertilizer, manure and legumes.

Techniques of Irrigation

Essential techniques of irrigation include learning when and how to irrigate, knowing water requirements of various crops, learning how to maintain ditches and smooth land, and knowing the most economical method of spreading water—surface or sprinkler.[10] A comprehensive Extension educational program to provide technical assistance and advice is needed for beginning irrigation farmers.

Additional Costs of Land Development

Cost of land development for surface irrigation includes cost of grading, constructing laterals, drains, and other structures, clearing, ripping, planing, and rock clearing. These costs (1957–59 average) were estimated by the Bureau of Reclamation to average $62 per acre for the Lake Plains area ($54 for Class 1, $63 for Class 2, and $78 for Class 3, lands). The Bureau estimated average land development costs for the Missouri Slope area at $64 per acre ($54 for Class 1 and $72 for Class 2 lands). These are average costs and the cost of developing individual tracts can be expected to range from minimal costs up to $170 per acre.

Somewhat higher costs for land development were estimated by Soil Conservation Service technicians for a sample of 13 farms in the Oahe area. Land development costs on these 13 farms, on a farm unit basis ranged from $47 to $124 per acre, and averaged $88 per acre.

Additional Labor and Equipment Requirements

More labor per acre is required for crop production under irrigation for cleaning ditches, watering

[10]The budgets constructed for this study have assumed surface irrigation, which involves land smoothing, ditch construction, and maintenance. Sprinkler irrigation systems, however, may be better adapted to those farm situations with rough topography and shallow surface soils. Comparison of costs and returns from the two systems is necessary for determining the most economic system for a particular farm.

crops, leveling land and cultivating smaller fields more intensely. Weed control continues to be an important problem on irrigation projects because of ease with which weed seeds are spread from farm to farm by irrigation water and the stimulus of water on growth. This points up the need for a community weed-control program that includes spraying and other measures at the optimum time. These factors mean two to three times more labor requirements per acre for corn growing under irrigation compared with dryland.

Additional specialized equipment is required for an irrigated compared with a dryland farm if it continues as a cattle-hog farm. For example, additional equipment on the 883-acre irrigated farm, compared with 1280-acre dryland farm, includes a two-way plow costing $900, a land leveler costing $1400, a ditcher costing $320, and other irrigation equipment costing $400. These costs are partly offset by less need for a large combine on the irrigated farm ($6600 needed for a combine on the dryland farm compared to $2900 on the irrigated). Specialty crops such as sugar beets or potatoes would require additional equipment.

Additional Managerial Skills

New managerial skills must be acquired by operators changing from dryland to irrigation. These include: different farming practices, such as learning when and how much to irrigate crops; learning best techniques for controlling weeds, diseases, and insects common to irrigation farming; and acquiring more ability to market a larger volume of products. Perhaps complexities of management may be less under irrigation than under dryland farming after the development period. The more dependable yields and less need for developing plans to meet changing conditions under irrigation may mean less management skill is required.

Suitable Types of Farm Organization

Bureau of Reclamation estimates that only 56% of the Lake Plains area and 43% of the Missouri Slope area will be irrigable, suggests development of an integrated dryland-irrigated organization on most farms. Native pasture likely would be used for raising feeder cattle. Larger supplies of feed grain and hay would be used for raising hogs and fattening feeder cattle raised, as well as for additional purchased feeders. The more stable supply of feed grain and roughage would be particularly advantageous in promoting a more stable livestock program. Larger capital outlays for mechanized equipment would be justified under an irrigation system that assured a more constant use.

Need for Increased Credit

Increased credit is needed under irrigation for developing irrigable land and buying additional machinery and livestock. Development of newly irrigated areas often has been held back by lack of ade-

quate credit facilities. Likely sources of credit for farmers include local banks, Production Credit Association, and Farmers Home Administration. The Farmers Home Administration is a "last resort" available to farmers unable to obtain credit from commercial sources. Costs and returns analysis must indicate a profitable outcome, however, before the Farmers Home Administration will loan money. Greatest need is for an intermediate type of credit to permit a farmer to borrow enough capital to finance additional machinery and livestock and to develop the land, but which would not require repayment until increased returns are realized (perhaps after 3 to 5 years).

One further aspect of need for credit overlooked in this study arises because of the assumption that farm operators own their land. Many farm operators, however, rent part or all of their land. Landlords may not be convinced of the profitability of irrigation or may not be able to provide the development cost of $60 to $70 per acre. Perhaps the tenant in such a situation could undertake the irrigation development under a contract arrangement with the landlord providing for compensation in case of moving.

Dryland Expansion Instead of Irrigation

Farmers confronted with the question of whether to vote for introduction of irrigation into their area may wish to compare net returns to be expected from investing the amount of capital required for irrigation into additional dryland. Well-informed citizens and policymakers concerned with irrigation also may wish to know how returns from an irrigated farm are likely to compare with those from a dryland farm requiring equal investment. Comparisons of irrigated and dryland farms with equal acreages involve substantially higher investment on the irrigated farm.

The previous comparison of the 1280-acre dryland farm with an 883-acre irrigated farm in the Lake Plains area approximates equal total investment: $176,180 for dryland and $172,310 for irrigated farm (table 6). In that comparison labor and management income was $15,314 on dryland and $21,967 on irrigated. Labor requirements were higher on the irrigated farm: 463 days compared with 362 days on dryland.

It appears that the irrigated farm organized as a cattle-hog farm and buying additional feeder cattle for fattening is more profitable than a dryland farm with equal investment. Other factors in addition to income must be considered. These include importance of stabilization effect of irrigation upon income and production and possibility that additional dryland may not be available for purchase at the assumed price. Price of land could be expected to advance with any general attempt by farmers to enlarge their holdings. Furthermore, if a sugar factory is established in the area there would be opportunity for even greater profits from irrigation farming.

SUMMARY

This study was concerned primarily with determining the profitability of irrigation farming compared with dryland farming for the proposed Oahe irrigation area of central South Dakota. Also of concern were the problems likely to arise when irrigation is introduced and any additional factors farmers need to consider in deciding whether or not they want irrigation.

The procedure followed was to make budgetary comparisons of irrigated and dryland farming for three typical sizes of farms in the Lake Plains area (Brown and Spink Counties) and for two typical sizes of ranches in the Missouri Slope area (Sully County). Input-output data were obtained from a personal interview survey of a sample of farm operators in the area and from estimates by research workers in technical fields of the South Dakota Agricultural Experiment Station. Current prices and costs, adjusted for expected trends to about 1975, were assumed.

Irrigation farms were assumed to be integrated dryland-irrigation farms with 56% irrigated land in Lake Plains and 42% in the Missouri Slope. These are the proportions classified as irrigable by the Bureau of Reclamation. Also, irrigable land is interspersed with dryland throughout the two areas.

A livestock organization that includes a beef cow herd to consume native pasture with hogs and additional purchased beef feeder cattle to use the feed grains produced turned out most profitable under both dryland and irrigated conditions in the analysis. Illustrative of the financial results of the budgetary comparison are labor and management incomes from the 480-acre farms in Lake Plains: $5,843 from the dryland and $14,922 from the integrated dryland-irrigation farm. However, total investment on the irrigated farm was nearly double that on the dryland farm: $123,651 compared with $66,825. Total labor requirements also were nearly double: 357 man days compared with 182.

The study emphasized that perhaps the most important factor favoring irrigation comes from stabilizing or leveling out high and low income and production periods. Dryland farm production and income variability is about three times greater than for an irrigated farm.

APPENDIX TABLES

Table A-1. Assumed Prices Received by Farmers for Budgetary Analysis of Oahe Project and Comparisons

Product	Unit	Assumed Price	South Dakota 1956-60 Average*	South Dakota 1951-60 Average
Corn	Bu.	$ 0.90	$ 0.99	$ 1.17
Barley	Bu.	0.80	0.83	0.93
Oats	Bu.	0.50	0.55	0.60
Wheat	Bu.	1.90	1.93	2.02
Sugar beets	Ton	15.00	14.44	14.23
Choice yrlg. slaughter steers, 1,100 lb.	Cwt.	25.00	25.21	26.40
Choice yrlg. slaughter heifers, 1,000 lb.	Cwt.	24.00	23.93	25.09
Cows, commercial grade 1,100 lb.	Cwt.	16.00	16.40	16.94
Hogs, 230 lb. No. 1 and 2	Cwt.	15.00	17.24	18.80
Sows, 400 lb.	Cwt.	13.00	15.03	16.30
Stags	Head	40.00	—	—

*"South Dakota Agriculture," South Dakota Crop and Livestock Reporting Service, and U. S. Department of Agriculture.

Table A-2. Estimated Costs for Operating 2- to 5-Plow Tractors

Annual Use	Unit	Depreciation Interest, Ins.*	Repairs	Fuel	Grease and Oil	Total Cash	Total Total
5-Plow ($4,875)							
1000 hours	hr.	$0.59	$0.23	$0.83	$0.14	$1.20	$1.79
800 hours	hr.	0.64	0.23	0.83	0.14	1.20	1.84
600 hours	hr.	0.86	0.23	0.83	0.14	1.20	2.06
400 hours	hr.	1.28	0.25	0.83	0.16	1.24	2.52
4-Plow ($4,135)							
1000 hours	hr.	0.50	0.20	0.72	0.12	1.04	1.54
800 hours	hr.	0.54	0.20	0.72	0.12	1.04	1.58
600 hours	hr.	0.72	0.20	0.72	0.12	1.04	1.76
400 hours	hr.	1.08	0.22	0.72	0.14	1.08	2.16
3-Plow ($3,190)							
1000 hours	hr.	0.38	0.17	0.51	0.08	0.76	1.08
800 hours	hr.	0.42	0.17	0.51	0.08	0.76	1.18
600 hours	hr.	0.56	0.17	0.51	0.08	0.76	1.32
400 hours	hr.	0.84	0.19	0.51	0.09	0.79	1.63
2-Plow ($2,400)							
1000 hours	hr.	0.29	0.14	0.36	0.05	0.55	0.84
800 hours	hr.	0.32	0.14	0.36	0.05	0.55	0.87
600 hours	hr.	0.42	0.14	0.36	0.05	0.55	0.97
400 hours	hr.	0.63	0.16	0.36	0.06	0.58	1.21

*Assumes 15 year maximum life or 12,000 hours, whichever occurs first: 10% salvage value, 9% of half of new cost for interest on investment, housing, insurance, and taxes.

Table A-3. Estimated Average Expenses Used for Budget Analysis of Oahe Project

Item	Unit	Cost Rate
Labor, regular	Month	$190.00
Labor, seasonal	Day	9.00
Water Charges		
Lake Plains O&M	—	6.38
Missouri Slope, O&M	—	6.38
Lake Plains, construction	—	3.55
Missouri Slope, construction	—	4.25
Depreciation, machinery	—	10% of inventory
Depreciation, buildings	—	3% of inventory
Repairs, machinery	—	4% of inventory
Repairs, buildings	—	3½% of inventory
Real estate taxes, dry or irrigated	—	20 mills on inventory
Personal Property taxes	—	20 mills on inventory
Insurance, property	—	½% of inventory
Interest, real estate	—	5½% of inventory
Interest, short term	—	7% of inventory
Land leveling		
Lake Plains	acre	64.00
Missouri Slope	acre	64.00
Land Values		
Dry cropland: Lake Plains	acre	100.00
Missouri Slope	acre	80.00
Range land: Lake Plains	acre	50.00
Missouri Slope	acre	40.00
Irrigated land: Lake Plains	acre	164.00
Missouri Slope	acre	144.00
Seed Treatment	bu.	0.10
Fertilizer		
16-20-0	cwt.	4.25
0-43-0	cwt.	4.00
33- 0-0	cwt.	4.25
Seed corn, hybrid	bu.	12.40
Alfalfa seed	lb.	0.38
Hog supplement, 30%	cwt.	5.00
Soybean meal, 44%	cwt.	5.00

Table A-4. Estimated Annual Labor and Tractor Time Requirements for Crops with Seasonal Distribution of Labor for Budgetary Analysis of Oahe Project

	Man time per acre	Tractor time per acre	Percent Monthly Distribution of Man-Labor											
	(hours)	(hours)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Dryland Farms														
Small grain	1.1	1.0	—	—	—	15	25	—	10	40	10	—	—	—
Corn	2.2	2.0	—	—	—	—	30	20	10	—	40	—	—	—
Corn silage	6.6	3.6	—	—	—	—	30	20	10	—	40	—	—	—
Alfalfa hay	3.5	2.5	—	—	—	—	—	60	—	40	—	—	—	—
Native hay	1.8	1.3	—	—	—	—	—	—	—	100	—	—	—	—
Irrigated Farms														
Small grain	3.9	2.7	—	—	—	10	10	10	20	40	10	—	—	—
Corn	7.0	3.5	—	—	—	—	30	20	10	—	40	—	—	—
Corn silage	11.0	5.0	—	—	—	—	30	20	10	—	40	—	—	—
Sugar beets	18.2	6.1	—	—	—	—	20	10	10	10	50	—	—	—
Alfalfa	12.2	6.4	—	—	—	—	15	30	25	15	15	—	—	—
Pasture	5.2	1.1	—	—	—	—	20	20	30	10	20	—	—	—

Table A-5. Estimated Annual Labor Requirements and Seasonal Distribution for Livestock as Used in Budgetary Analysis of Oahe Project

	Work hours	Percent Monthly Distribution											
	per head	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Beef Cows													
Under 20	25												
20 to 39	15												
40 to 59	12	16	14	14	14	5	2	1	2	3	4	10	15
60 to 79	10												
80 to 100	7												
Beef Cattle Fattening (drylot), monthly requirements													
Under 20	2.0												
20 to 39	1.0												
40 to 59	.7												
60 to 79	.6												
80 to 99	.5												
100 to 119	.4												
120 to 139	.4												
140 to 159	.4												
160 to 179	.3												
180 to 200	.3												
Hogs: 7 pig spring litters													
Under 10	30												
10 to 19	20	8	7	9	11	9	8	8	8	8	8	8	8
20 to 29	15												
30 to 39	14												

Table A-6. Estimated Amounts of Feed to Fatten Feeder Cattle as Used in Budgetary Analysis of Oahe Project

Kind of Feeders	Initial Weight	Final Weight	Net Gain	No. of Days in Feedlot	Daily Gain	Slaughter Grade	Average Amount of Feed per head			Total Feed per 100 lb. Gain
							Corn lbs.	40% sup. lbs.	Alf.-br. hay, lbs.	
Drylot										
Calves—good to choice*	400	1,000	600	260	2.3	choice	2,576	130	1,750	742
Yearlings—good to choice†	650	1,100	450	180	2.5	choice	2,520	180	900	800
Yearlings—good to choice‡	750	1,200	450	150	3.0	choice	2,632	150	750	785
Pasture										
Calves—good to choice§	400	680	280	200	1.4	—	812	—	2,500	—
Calves—good to choice	400	760	360	200	1.8	—	1,624	—	2,000	—
Yearlings—good to choice‖	680	1,140	460	210	2.2	—	2,240	90	240	—
Yearlings—good to choice#	760	1,125	365	150	2.4	—	2,240	30	—	—

*Ration approximately 50% hay and 50% corn first half of feeding period; reduced to 20-25% hay during last half; protein supplement only fed during last half of feeding period.

†Full-fed ration with approximately 20% hay and 80% concentrates; wintered on roughage with limited grain for gains of about 1.5 lbs. daily; and put on full feed in spring.

‡Roughed over winter, pastured one season and placed on full feed in fall; full-fed ration with about 20% hay and 80% concentrates.

§Winter phase: limited grain feeding.

‖Pasture alone for first 75 days; pasture plus full feed of corn 75 days with 1 lb. supplement last 30 days; 60 days drylot with 4 lbs. hay, 1 lb. supplement and full feed of corn.

#Grain full fed during entire grazing period.

Table A-7. Estimated Amounts of Feed to Fatten a Gilt and Litter of Seven Pigs as Used in Budgetary Analysis of Oahe Project*

	Weight	Corn lbs.	Supplement lbs.	Creep ration lbs.	Legume pasture AUM
Breeding to farrowing	—	560	115	—	—
Farrowing to weaning	0- 35	532	130	200	—
Weaning to market, drylot	35-225	4,508	700	—	—
Total	—	5,600	945	200	—
Breeding to farrowing	—	560	115	—	—
Farrowing to weaning	0- 35	532	130	200	—
Weaning to market, pasture	35-225	4,116	560	—	1.5
Total	—	5,208	805	200	1.5

*"Swine Producer's Guide," *South Dakota Extension Service* F.S. 71

Table A-8. Precipitation and Length of Growing Season, Redfield, 1898-1963.

Year	Total Precipitation	Precipitation Apr. 1-Aug. 31	Length of Growing Season	Last Killing Frost, Spring	First Killing Frost, Fall
1898	13.3	10.2	138	4-25	9-10
1899	19.0	15.5	136	5-13	9-26
1900	30.8	20.6	147	5- 3	9-27
1901	23.7	13.6	103	6- 7	9-18
1902	17.8	13.8	83	6-21	9-12
1903	20.8	15.3	98	6-11	9-17
1904	13.8	10.6	130	5-14	9-21
1905	24.3	18.9	151	5-13	10-11
1906	23.8	17.2	153	5- 9	10- 9
1907	16.5	11.1	124	5-27	9-28
1908	20.4	14.2	142	5- 8	9-27
1909	22.5	15.4	149	5- 6	10-12
1910	12.0	7.8	120	5-12	9- 9
1911	16.0	9.7	153	5- 4	10- 4
1912	18.4	15.9	132	5-16	9-25
1913	12.8	9.9	138	5- 6	9-21
1914	23.5	17.6	150	5-14	10-11
1915	23.8	15.3	139	5-19	10- 5
1916	23.9	17.0	137	5- 1	9-15
1917	15.9	8.5	152	5- 6	10- 5
1918	18.9	12.8	126	5-13	9-16
1919	19.9	12.3	154	5- 9	10-10
1920	22.0	17.0	—	4-28	—
1921	—	11.1	138	5-15	9-30
1922	20.9	10.6	172	4-19	10- 8
1923	16.5	12.4	154	5-12	10-13
1924	21.6	14.0	127	5-25	9-29
1925	16.2	12.4	136	5-18	10- 1
1926	13.0	16.8	129	5-19	9-25
1927	26.8	20.3	167	4-24	10- 8
1928	15.3	11.4	149	4-27	9-23
1929	17.1	6.8	125	5-16	9-18
1930	22.2	12.4	126	5-24	9-27
1931	14.8	7.9	139	5-22	10- 8
1932	16.1	13.0	143	4-27	9-17
1933	14.2	9.8	159	4-27	10- 3
1934	—	5.4	105	5-24	9- 6
1935	18.2	13.9	144	5- 5	9-26
1936	11.8	8.0	151	4-29	9-27
1937	14.9	9.6	151	4-27	9-25
1938	17.5	11.2	151	4-21	9-19
1939	16.8	10.8	158	4-21	9-26
1940	18.7	13.3	147	5- 1	9-25
1941	20.4	12.5	157	4-24	9-28
1942	21.1	14.7	128	4-14	9-19
1943	16.8	12.6	130	4-13	9-20
1944	20.9	15.7	155	5- 6	10- 8
1945	19.3	14.3	137	5-14	9-28
1946	24.8	13.5	149	5-12	10- 8
1947	14.3	8.4	115	5-30	9-22
1948	19.6	16.4	176	4-16	10- 9
1949	14.6	9.1	112	5-25	9-13
1950	14.6	8.5	105	5- 7	8-20
1951	19.8	13.5	134	5-11	9-22
1952	14.6	9.2	143	5-12	10- 2
1953	26.1	20.0	143	5-14	10- 4
1954	16.0	9.6	135	5-10	9-22
1955	16.7	13.5	124	5-10	9-11
1956	19.5	14.4	123	5- 6	9- 6
1957	27.5	20.2	160	5-10	10-17
1958	14.4	10.5	152	5- 1	9-30
1959	12.6	6.7	118	5-15	9-10
1960	19.3	14.3	142	5-11	9-30
1961	17.7	12.5	139	5- 9	9-25
1962	25.0	19.3	127	5- 1	9- 5
1963	15.6	11.8	158	5-22	10-27
Average 1931-60	17.6	12.0	140		

Table A-9. Precipitation and Length of Growing Season, Aberdeen, 1890-1963.

Year	Total Precipitation	Precipitation Apr. 1-Aug. 31	Length of Growing Season	Last Killing Frost, Spring	First Killing Frost, Fall
1890	—	12.1	93	6- 7	9- 8
1891	16.0	9.2	90	5-25	8-23
1892	30.2	26.4	139	5-22	10- 8
1893	22.0	13.9	88	5-24	8-20
1894	22.7	11.8	—	—	9-24
1895	30.2	22.2	109	5-21	9- 7
1896	38.4	20.7	133	4-30	9-10
1897	35.5	16.5	103	6- 6	9-17
1898	16.1	10.9	110	5-22	9- 9
1899	33.9	29.7	136	5-13	9-26
1900	23.1	14.2	137	5- 2	9-16
1901	21.9	14.4	104	6- 7	9-19
1902	26.0	14.1	75	6-21	9- 4
1903	27.5	16.9	128	5-11	9-16
1904	32.1	21.8	132	5-12	9-21
1905	33.3	25.0	152	5-12	10-11
1906	35.1	26.1	139	5-19	10- 5
1907	19.6	11.9	121	5-27	9-25
1908	33.0	21.6	150	5- 2	9-29
1909	25.4	15.2	134	5-13	9-24
1910	15.5	10.2	111	5-21	9- 9
1911	28.8	18.1	158	5-12	10-17
1912	23.5	19.6	132	5-16	9-25
1913	25.4	17.1	139	5- 6	9-22
1914	26.9	20.3	155	5-12	10-14
1915	37.3	23.6	126	5-18	9-21
1916	36.9	24.8	135	5- 3	9-15
1917	18.9	10.5	151	5- 7	10- 5
1918	25.2	18.3	128	5-13	9-18
1919	20.1	14.1	167	5-25	10- 9
1920	22.3	14.5	156	4-27	9-30
1921	24.0	12.8	149	5-15	10-11
1922	20.8	10.2	172	4-19	10- 8
1923	23.8	14.8	154	5-12	10-13
1924	22.5	13.1	127	5-25	9-29
1925	22.1	18.8	137	5-17	10- 1
1926	21.7	13.5	129	5-19	9-25
1927	25.3	16.3	144	5- 5	9-26
1928	18.8	12.6	149	4-27	9-23
1929	20.5	9.6	121	5-20	9-18
1930	21.5	14.5	134	5-17	9-28
1931	18.8	11.5	139	5-22	10- 8
1932	19.6	14.6	155	4-27	9-29
1933	12.7	7.4	163	4-27	10- 7
1934	14.9	8.0	147	4-27	9-21
1935	24.1	17.5	146	5- 4	9-27
1936	13.8	7.4	151	4-29	9-27
1937	25.4	15.9	142	4-28	9-17
1938	16.8	11.5	99	6-11	9-18
1939	22.5	16.9	133	5-15	9-25
1940	16.1	10.5	117	5-16	9-10
1941	21.3	13.6	128	5-23	9-28
1942	27.5	19.5	128	5-14	9-19
1943	21.7	16.2	120	5-13	9-10
1944	28.2	19.3	153	5- 8	10- 8
1945	18.7	11.9	130	5-17	9-24
1946	22.4	12.0	119	6- 2	9-29
1947	19.5	13.5	115	5-30	9-22
1948	15.5	11.7	150	5-12	10- 9
1949	20.3	12.9	113	5-24	9-14
1950	18.1	13.2	126	5-10	9-13
1951	18.7	12.2	134	5-10	9-21
1952	14.1	7.6	130	5-12	9-19
1953	27.7	21.9	129	5-15	9-21
1954	15.3	9.2	126	5-19	9-22
1955	17.0	12.9	124	5-10	9-11
1956	18.4	11.6	125	5- 4	9- 6
1957	22.7	16.7	161	5- 9	10- 7
1958	12.4	8.6	147	5- 6	9-30
1959	15.1	7.5	111	5-22	9-10
1960	14.9	10.2	124	5-11	9-12
1961	15.1	9.6	101	5-26	9- 4
1962	22.4	15.4	127	5- 1	9- 5
1963	17.4	13.6	129	5-23	9-29
Average 1931-60	19.1	12.8	133		

Table A-10. Precipitation and Length of Growing Season, Pierre ,1892-1963.

Year	Total Precipitation	Precipitation Apr. 1-Aug. 31	Length of Growing Season	Last Killing Frost, Spring	First Killing Frost, Fall
1892	18.8	14.4	160	5- 1	10- 8
1893	14.6	8.5	145	5- 2	9-25
1894	7.8	4.2	152	5-21	9-21
1895	16.9	12.9	126	5-19	9-23
1896	17.4	11.0	150	4-21	9-19
1897	18.8	13.0	154	5-14	10-16
1898	10.7	9.1	165	4-25	10- 8
1899	20.0	13.9	160	4-21	9-29
1900	16.8	10.9	161	4-18	9-27
1901	17.0	11.3	128	5-12	9-18
1902	20.0	13.9	141	4-23	9-12
1903	19.5	13.5	189	4-30	11- 5
1904	9.2	6.5	181	4-26	10-25
1905	20.5	16.0	158	5- 5	10-11
1906	22.0	14.7	153	5- 8	10- 9
1907	14.0	9.8	159	5-14	10-11
1908	19.1	12.6	147	5- 2	9-27
1909	13.0	8.6	161	5- 2	10-11
1910	11.0	6.4	179	4-23	10-20
1911	12.7	7.6	171	5- 2	10-21
1912	13.3	10.5	155	4-22	9-25
1913	11.5	8.7	167	5- 3	10-18
1914	20.2	14.8	167	4-29	10-14
1915	23.6	16.0	154	5- 6	10- 8
1916	20.5	16.4	124	5-14	9-15
1917	14.9	10.6	174	4-16	10- 8
1918	17.7	11.6	141	4-30	9-19
1919	21.2	13.4	169	4-24	10-10
1920	22.8	17.5	155	4-27	9-30
1921	19.1	13.2	176	4-17	10-11
1922	19.5	13.6	171	4-19	10- 8
1923	17.9	15.1	172	4-24	10-13
1924	17.5	10.3	161	5-24	11- 2
1925	11.8	8.9	167	5- 1	10-14
1926	15.4	10.0	150	4-28	9-25
1927	19.5	14.9	144	5- 5	9-27
1928	14.0	9.4	151	4-27	9-25
1929	15.8	8.1	161	5-16	10-24
1930	15.7	10.0	191	4- 7	10-15
1931	10.9	5.1	163	5-21	10-31
1932	16.9	13.3	165	4-26	10- 8
1933	16.1	11.4	176	4-15	10- 8
1934	9.3	4.4	152	4-27	9-26
1935	11.2	8.7	162	4-18	9-27
1936	9.4	5.3	167	4-29	10-13
1937	12.9	9.2	164	4-26	10- 7
1938	15.8	10.6	166	5- 9	10-22
1939	13.9	9.2	176	4-21	10-14
1940	8.9	4.7	155	5-15	10-17
1941	21.9	15.9	158	4-23	9-28
1942	20.1	14.7	132	5-14	9-23
1943	16.4	11.9	157	5-13	10-17
1944	23.5	17.8	155	5- 6	10- 9
1945	14.2	9.8	137	5-14	9-28
1946	23.4	15.2	145	5-15	10- 7
1947	10.9	7.7	146	5-30	10-23
1948	17.9	15.5	180	4-12	10- 9
1949	17.1	9.7	148	4-18	9-13
1950	16.2	8.4	148	5- 7	10- 2
1951	23.0	15.4	154	4-23	9-24
1952	13.1	7.3	146	5-11	10- 4
1953	22.5	16.4	146	5-13	10- 6
1954	16.9	11.5	146	5- 9	10- 2
1955	17.6	11.5	159	5- 8	10-14
1956	19.7	12.9	158	5- 4	10- 9
1957	18.7	14.3	172	5- 5	10-24
1958	13.2	9.8	147	5- 6	9-30
1959	17.5	11.2	138	5-15	9-30
1960	19.2	14.7	142	5-11	9-30
1961	11.0	7.4	143	5- 9	9-29
1962	21.3	16.7	191	4-15	10-23
1963	19.3	12.9	159	5-22	10-28
Average 1931-60	16.3	11.1	155		

Table A-11. Yields of Grains per Planted Acre (Non-Irrigated) Brown, Spink, and Sully Counties, 1926-1962*

Year	Brown			Spink			Sully		
	Wheat† bu.	Oats bu.	Corn bu.	Wheat† bu.	Oats bu.	Corn bu.	Wheat† bu.	Oats bu.	Corn bu.
1926	2.6	3.8	13.6	1.9	2.2	10.7	1.1	3.2	8.7
1927	11.0	20.4	24.9	14.0	30.9	27.0	19.5	28.0	27.0
1928	8.6	24.7	20.0	6.9	19.4	11.4	7.5	13.8	10.5
1929	8.1	20.5	19.0	7.7	12.2	11.0	7.5	10.7	7.0
1930	12.3	25.6	14.6	10.4	23.1	11.6	10.9	22.1	12.6
1931	8.5	15.3	8.4	5.5	6.8	3.0	1.7	0.4	0.1
1932	13.3	29.1	17.5	10.3	22.2	6.6	15.9	25.9	6.5
1933	0.2	0.1	5.4	‡	0.1	0.7	‡	‡	0.3
1934	‡	‡	0.2	‡	‡	‡	‡	‡	0.1
1935	6.7	24.0	13.0	5.7	20.4	6.9	4.7	7.7	2.4
1936	0.3	0.2	0.8	0.2	0.1	0.6	‡	‡	0.2
1937	2.7	6.2	6.8	2.1	3.2	3.8	1.0	1.1	2.0
1938	7.6	17.4	7.0	7.9	16.6	6.3	1.9	3.3	1.2
1939	7.2	29.2	17.6	5.5	16.8	6.5	3.6	6.6	3.1
1940	11.2	15.0	16.7	7.6	10.0	4.9	3.6	2.5	6.1
1941	15.4	30.4	12.2	12.5	23.5	1.6	6.5	9.3	0.3
1942	17.2	36.9	23.3	14.6	41.1	21.6	14.6	43.3	20.9
1943	11.2	32.0	20.6	8.0	28.4	17.5	4.0	11.5	4.2
1944	13.4	34.5	27.4	13.3	27.9	27.2	10.4	29.2	21.1
1945	17.1	40.3	19.5	15.7	37.0	20.0	14.5	28.2	15.2
1946	14.2	28.6	24.5	9.4	19.9	24.8	17.0	27.9	23.3
1947	14.5	28.4	16.3	14.1	28.0	13.1	13.2	28.6	10.9
1948	10.7	23.2	26.9	11.7	29.3	27.9	12.8	29.8	21.7
1949	8.3	19.7	17.4	8.1	17.1	12.1	7.9	17.1	9.5
1950	10.3	21.6	22.0	9.2	17.6	21.5	8.2	11.7	15.7
1951	16.8	38.6	18.4	14.8	38.8	16.9	14.8	37.4	17.9
1952	7.7	24.0	16.7	5.7	17.1	17.2	7.4	15.2	15.7
1953	8.8	28.1	30.4	7.3	25.8	28.0	10.7	30.6	28.2
1954	11.4	28.6	21.8	11.9	28.1	19.8	10.3	24.6	16.5
1955	10.8	24.2	21.3	10.3	21.2	14.3	10.5	19.2	9.8
1956	5.4	17.0	24.8	5.5	15.4	25.8	2.3	2.6	17.5
1957	20.3	40.5	32.1	18.8	36.6	28.6	18.4	39.7	31.0
1958	22.4	44.2	22.0	17.9	35.9	18.7	24.4	38.5	15.2
1959	4.0	8.8	7.4	2.6	3.3	6.2	2.7	1.0	1.9
1960	17.9	35.5	17.2	19.4	40.9	22.9	17.9	36.3	11.6
1961	14.4	24.6	18.7	14.4	27.0	22.3	14.8	19.4	14.5
Average									
1926-61	10.3	23.4	17.4	9.2	20.7	14.4	9.0	19.2	11.4
1941-61	13.0	29.0	21.0	11.7	26.7	19.4	11.6	24.9	16.0

*South Dakota Agriculture, South Dakota Crop and Livestock Reporting Service.

†Includes spring wheat other than durum.

‡Less than 0.05.

Table A-12. Summary of 1,280-Acre Dryland Farm Plan, Lake Plains Area

Crop	CROPPING PLAN Acres	Yield	Unit	Production	Farm use	SOLD Amount	Price	Value
Corn	376	27	Bu.	10,152	10,152	—	—	—
Corn silage	34	6	Ton	204	204	—	—	—
Oats	205	38	Bu.	7,790	7,618	172	$0.50	$ 86
Wheat	237	16	Bu.	3,792	237	3,555	1.90	6,754
Alfalfa	49	1.6	Ton	78	78	—	—	—
Rotation pasture	46	2.8	AUM	129	128	—	—	—
Native pasture	323	1.0	AUM	323	323	—	—	—
Other	10	—	—	—	—	—	—	—
Total	1,280	—	—	—	—	—	—	$ 6,840

Item	Grade	No.	Av. wt. per head	Amount	SOLD Price	Value
Cattle, yearling steers	Choice	164	1,100	180,400	$25.00	$45,100
Cattle, yearling heifers	Choice	10	1,000	10,000	24.00	2,400
Cows	Medium	5	1,100	5,500	16.00	880
Hogs		380	225	85,500	15.00	12,825
Sows		40	400	16,000	13.00	2,080
Stags		2	—	—	40.00	80
Total						$63,365

FINANCIAL SUMMARY

Expenses		Receipts		Inventory Value	
Seed	$ 854	Crops	$ 6,840	Land and buildings	$111,350
Fertilizer	935	Livestock	63,365	Buildings and improvements	(11,550)
Feed	4,792	Total	$70,205	Machinery and equipment	23,440
Feeders purchased	26,715	Less cash expense	41,545	Livestock	41,390
Labor	765	Net cash income	$28,660	Total	$176,180
Machinery	2,974	Less depreciation	2,684	**Inventory Numbers**	
Building repairs	397	Net farm income	$25,976	Beef cows	32
Taxes, insurance	3,848	Less interest	10,662	Purchased feeders	150
Other	265	**Labor and management income**	**$15,314**	Sows	60
Cash expense	$41,545			**Labor Requirements**	
Machinery depreciation	2,344			Operator, days	277
Building depreciation	340			Hired, days	85
Interest on investment	10,662			Total	362
Total expense	**$54,891**				

Table A-13. Summary of 1,280-Acre Integrated Dryland-Irrigation Farm Plan, Lake Plains Area

Crop	Acres	CROPPING PLAN Yield	Unit	Production	Farm use	SOLD Amount	Price	Value
Dryland								
Corn	77	27	Bu.	2,079	2,079	—	—	—
Wheat	153	16	Bu.	2,448	153	2,295	$1.90	$ 4,360
Native pasture	323	1.0	AUM	323	317	—	—	—
Other	10	—	—	—	—	—	—	—
Irrigated								
Corn	478	82	Bu.	39,196	39,196	—	—	—
Wheat	53	36	Bu.	1,908	80	1,828	1.90	3,473
Oats	67	80	Bu.	5,360	5,315	45	.50	22
Alfalfa	102	4.5	Ton	459	451	—	—	—
Rotation pasture	17	7.9	AUM	134	134	—	—	—
Total	1,280	—	—	—	—	—	—	$ 7,855

LIVESTOCK PLAN

Item	Grade	No.	Av. wt. per head	Amount	SOLD Price	Value
Cattle, yearling steers	Choice	843	1,100	927,300	$25.00	$231,825
Cattle, yearling heifers	Choice	10	1,000	10,000	24.00	2,400
Cows	Medium	5	1,100	5,500	16.00	880
Hogs		380	225	85,500	15.00	12,825
Sows		40	400	16,000	13.00	2,080
Stags		2	—	—	40.00	80
Total						$250,090

FINANCIAL SUMMARY

Expenses	
Seed	$ 1,218
Fertilizer	1,352
Water charges	7,120
Feed	10,903
Feeders purchased	147,645
Labor	6,801
Machinery	5,718
Building repairs	693
Taxes, insurance	7,623
Other	223
Cash expense	$189,296
Machinery depreciation	2,909
Building depreciation	595
Interest on investment	21,192
Total expense	**$213,992**

Receipts	
Crops	$ 7,855
Livestock	250,090
Total	$257,945
Less cash expense	189,296
Net cash income	$ 68,649
Less depreciation	3,504
Net farm income	$ 65,145
Less interest	21,192
Labor and management income	**$ 43,953**

Inventory Value	
Land and buildings	$157,238
Buildings and improvements	(19,820)
Machinery and equipment	29,090
Livestock	150,030
Total	$336,358
Inventory Numbers	
Beef cows	32
Purchased feeders	829
Sows	60
Labor Requirements	
Operator, days	342
Hired, days	533
Total	875

Table A-14. Summary of 883-Acre Integrated Irrigation-Dryland Farm Plan, Lake Plains Area (for comparison with 1,280-acre dryland farm, table A-12)

Crop	Acres	CROPPING PLAN Yield	Unit	Production	Farm use	Amount	SOLD Price	Value
Dryland								
Corn	77	27	Bu.	2,079	1,086	993	$0.90	$ 894
Wheat	153	16	Bu.	2,448	153	2,295	1.90	4,360
Native pasture	323	1.0	AUM	323	317	—	—	—
Other	10	—	—	—	—	—	—	—
Irrigated								
Corn	208	82	Bu.	17,056	17,056	—	—	—
Corn silage	6	15.4	Ton	92	86	—	—	—
Wheat	53	36	Bu.	1,908	80	1,828	1.90	3,473
Alfalfa	36	4.5	Ton	162	162	—	—	—
Rotation pasture	17	7.9	AUM	134	134	—	—	—
Total	883	—	—	—	—	—	—	$ 8,727

LIVESTOCK PLAN

Item	Grade	No.	Av. wt. per head	Amount	SOLD Price	Value
Cattle, yearling steers	Choice	264	1,100	290,400	$25.00	$72,600
Cattle, yearling heifers	Choice	10	1,000	10,000	24.00	2,400
Cows	Medium	5	1,100	5,500	16.00	880
Hogs		380	225	85,500	15.00	12,825
Sows		40	400	16,000	13.00	2,080
Stags		2	—	—	40.00	80
Total						$90,865

FINANCIAL SUMMARY

Expenses	
Seed	$ 623
Fertilizer	1,224
Water charges	3,178
Feed	5,692
Feeders purchased	44,525
Labor	1,629
Machinery	2,970
Building repairs	470
Taxes, insurance	3,847
Other	223
Cash expense	$64,318
Machinery depreciation	2,279
Building depreciation	348
Interest on investment	10,680
Total expense	**$77,625**

Receipts	
Crops	$ 8,727
Livestock	90,865
Total	$99,592
Less cash expense	64,318
Net cash income	$35,274
Less depreciation	2,627
Net farm income	$32,647
Less interest	10,680
Labor and management income	**$21,967**

Inventory Value	
Land and buildings	$ 92,130
Buildings and improvements	(11,630)
Machinery and equipment	22,790
Livestock	57,390
Total	$172,310

Inventory Numbers	
Beef cows	32
Purchased feeders	250
Sows	60

Labor Requirements	
Operator, days	282
Hired, days	181
Total	463

Table A-15. Summary of 800-Acre Dryland Farm Plan, Lake Plains Area

Crop	CROPPING PLAN Acres	Yield	Unit	Production	Farm use	SOLD Amount	Price	Value
Corn	237	27	Bu.	6,399	6,399	—	—	—
Corn silage	18	6	Ton	108	103	—	—	—
Oats	128	38	Bu.	4,864	4,803	61	$0.50	$ 30
Wheat	148	16	Bu.	2,368	148	2,220	1.90	4,218
Alfalfa	27	1.6	Ton	43	43	—	—	—
Rotation pasture	32	2.8	AUM	90	90	—	—	—
Native pasture	200	1.0	AUM	200	200	—	—	—
Other	10	—	—	—	—	—	—	—
Total	800	—	—	—	—	—	—	$ 4,248

LIVESTOCK PLAN

Item	Grade	No.	Av. wt. per head	Amount	SOLD Price	Value
Cattle, yearling steers	Choice	74	1,100	81,400	$25.00	$20,350
Cattle, yearling heifers	Choice	6	1,000	6,000	24.00	1,440
Cows	Medium	3	1,100	3,300	16.00	528
Hogs		334	225	75,150	15.00	11,272
Sows		30	400	12,000	13.00	1,560
Stags		2	—	—	40.00	80
Total						$35,230

FINANCIAL SUMMARY

Expenses		Receipts		Inventory Value	
Seed	$ 535	Crops	$ 4,248	Land and buildings	$ 69,500
Fertilizer	621	Livestock	35,230	Buildings and improvements	(8,220)
Feed	3,503	Total	$39,478	Machinery and equipment	20,045
Feeders purchased	11,576	Less cash expense	21,376	Livestock	21,830
Labor	153	Net cash income	$18,102	Total	$111,375
Machinery	2,029	Less depreciation	2,247	**Inventory Numbers**	
Building repairs	281	Net farm income	$15,855	Beef cows	20
Taxes, insurance	2,437	Less interest	6,753	Purchased feeders	65
Other	241	**Labor and management income**	**$ 9,102**	Sows	52
Cash expense	$21,376			**Labor Requirements**	
Machinery depreciation	2,005			Operator, days	240
Building depreciation	242			Hired, days	17
Interest on investment	6,753			Total	257
Total expense	**$30,376**				

Table A-16. Summary of 800-Acre Integrated Dryland-Irrigation Farm Plan, Lake Plains Area

Crop	Acres	CROPPING PLAN Yield	Unit	Production	Farm use	SOLD Amount	Price	Value
Dryland								
Corn	47	27	Bu.	1,269	1,269	—	—	—
Wheat	95	16	Bu.	1,520	95	1,425	$1.90	$2,708
Native pasture	200	1.0	AUM	200	200	—	—	—
Other	10	—	—	—	—	—	—	—
Irrigated								
Corn	284	82	Bu.	23,288	23,288	—	—	—
Corn silage	15	15.4	Ton	231	231	—	—	—
Wheat	53	36	Bu.	1,908	80	1,828	1.90	3,473
Oats	21	80	Bu.	1,680	1,262	418	.50	209
Alfalfa	43	4.5	Ton	194	194	—	—	—
Rotation pasture	32	7.9	AUM	253	253	—	—	—
Total	800	—	—	—	—	—	—	$6,390

LIVESTOCK PLAN

Item	Grade	No.	Av. wt. per head	Amount	SOLD Price	Value
Cattle, yearling steers	Choice	444	1,100	488,400	$25.00	$122,100
Cattle, yearling heifers	Choice	10	1,000	10,000	24.00	2,400
Cows	Medium	5	1,100	5,500	16.00	880
Hogs		320	225	72,000	15.00	10,800
Sows		30	400	12,000	13.00	1,560
Stags		2	—	—	40.00	80
Total						$137,820

FINANCIAL SUMMARY

Expenses	
Seed	$ 762
Fertilizer	1,162
Water charges	4,449
Feed	6,739
Feeders purchased	76,583
Labor	3,504
Machinery	3,864
Building repairs	578
Taxes, insurance	4,757
Other	218
Cash expense	$102,616
Machinery depreciation	2,554
Building depreciation	496
Interest on investment	13,220
Total expense	**$118,886**

Receipts	
Crops	$ 6,390
Livestock	137,820
Total	$144,210
Less cash expense	102,616
Net cash income	$ 41,594
Less depreciation	3,050
Net farm income	$ 38,544
Less interest	13,220
Labor and management income	**$ 25,324**

Inventory Value	
Land and buildings	$ 98,172
Buildings and improvements	(16,540)
Machinery and equipment	25,540
Livestock	86,190
Total	$209,902
Inventory Numbers	
Beef cows	32
Purchased feeders	430
Sows	50
Labor Requirements	
Operator, days	275
Hired, days	266
Total	541

Table A-17. Summary of 672-Acre Integrated Irrigation-Dryland Farm Plan, Lake Plains Area (for comparison with 800-acre dryland farm, table A-15)

		CROPPING PLAN					SOLD	
Crop	Acres	Yield	Unit	Production	Farm use	Amount	Price	Value
Dryland								
Corn	47	27	Bu.	1,269	1,152	117	$0.90	$ 105
Wheat	95	16	Bu.	1,520	95	1,425	1.90	2,708
Native pasture	200	1.0	AUM	200	200	—	—	—
Other	10	—	—	—	—	—	—	—
Irrigated								
Corn	195	82	Bu.	15,990	15,990	—	—	—
Corn silage	19	15.4	Ton	293	287	—	—	—
Wheat	53	36	Bu.	1,908	80	1,828	1.90	3,473
Alfalfa	21	4.5	Ton	94	94	—	—	—
Rotation pasture	32	7.9	AUM	253	251	—	—	—
Total	672	—	—	—	—	—	—	$ 6,286

	LIVESTOCK PLAN					
Item	Grade	No.	Av. wt. per head	Amount	SOLD Price	Value
Cattle, yearling steers	Choice	264	1,100	290,400	$25.00	$72,600
Cattle, yearling heifers	Choice	10	1,000	10,000	24.00	2,400
Cows	Medium	5	1,100	5,500	16.00	880
Hogs		320	225	72,000	15.00	10,800
Sows		30	400	112,000	13.00	1,560
Stags		2	—	—	40.00	80
Total						$88,320

FINANCIAL SUMMARY

Expenses	
Seed	$ 574
Fertilizer	1,509
Water charges	3,178
Feed	5,119
Feeders purchased	44,525
Labor	1,404
Machinery	2,965
Building repairs	374
Taxes, insurance	3,510
Other	218
Cash expense	$63,376
Machinery depreciation	2,126
Building depreciation	321
Interest on investment	9,750
Total expense	**$75,573**

Receipts	
Crops	$ 6,286
Livestock	88,320
Total	$94,606
Less cash expense	63,376
Net cash income	$31,230
Less depreciation	2,447
Net farm income	$28,783
Less interest	9,750
Labor and management income	**$19,033**

Inventory Value	
Land and buildings	$ 77,180
Buildings and improvements	(10,680)
Machinery and equipment	21,255
Livestock	57,390
Total	$155,825

Inventory Numbers	
Beef cows	32
Purchased feeders	250
Sows	50

Labor Requirements	
Operator, days	256
Hired, days	156
Total	412

Table A-18. Summary of 672-Acre Integrated Irrigation Dryland Farm Plan With 60 Acres Sugar Beets, Lake Plains Area

Crop	CROPPING PLAN Acres	Yield	Unit	Production	Farm use	SOLD Amount	Price	Value
Dryland								
Corn	47	27	Bu.	1,269	1,147	122	$0.90	$ 110
Wheat	95	16	Bu.	1,520	95	1,425	1.90	2,708
Native pasture	200	1.0	AUM	200	193	—	—	—
Other	10	—	—	—	—	—	—	—
Irrigated								
Corn	180	82	Bu.	14,760	14,760	—	—	—
Sugar Beets	60	17.5	Ton	1,050	—	1,050	15.00	15,750
Beet tops	60	1.8	Ton	108	101	—	—	—
Wheat	20	36	Bu.	720	30	690	1.90	1,311
Alfalfa	22	4.5	Ton	99	99	—	—	—
Rotation pasture	38	7.9	AUM	300	300	—	—	—
Total	672	—	—	—	—	—	—	$19,879

LIVESTOCK PLAN

Item	Grade	No.	Av. wt. per head	Amount	SOLD Price	Value
Cattle, yearling steers	Choice	281	1,100	309,100	$25.00	$77,275
Cattle, yearling heifers	Choice	10	1,000	10,000	24.00	2,400
Cows	Medium	6	1,100	6,600	16.00	1,056
Hogs		180	225	40,500	15.00	6,075
Sows		30	400	12,000	13.00	1,560
Stags		2	—	—	40.00	80
Total						$88,446

FINANCIAL SUMMARY

Expenses	
Seed	$ 748
Fertilizer	1,425
Water charges	3,178
Feed	4,127
Feeders purchased	47,196
Labor	1,728
Contract labor	1,500
Machinery	3,170
Spraying beets	1,800
Building repairs	361
Taxes, insurance	3,678
Other	213
Cash expense	$69,124
Machinery depreciation	2,379
Building depreciation	310
Interest on investment	10,220
Total expense	**$82,033**

Receipts	
Crops	$ 19,879
Livestock	88,446
Total	$108,325
Less cash expense	69,124
Net cash income	$ 39,201
Less depreciation	2,689
Net farm income	$ 36,512
Less interest	10,220
Labor and management income	**$ 26,292**

Inventory Value	
Land and buildings	$ 77,180
Buildings and improvements	(10,320)
Machinery and equipment	23,785
Livestock	61,570
Total	$162,535
Inventory Numbers	
Beef cows	36
Purchased feeders	265
Sows	30
Labor Requirements	
Operator, days	258
Hired, days	222
Total	480

Table A-19. Summary of 480-Acre Dryland Farm Plan, Lake Plains Area

Crop	CROPPING PLAN Acres	Yield	Unit	Production	Farm use	SOLD Amount	Price	Value
Corn	147	27	Bu.	3,969	3,969	—	—	—
Oats	73	38	Bu.	2,774	2,710	64	$0.50	$ 32
Wheat	89	16	Bu.	1,424	89	1,335	1.90	2,536
Alfalfa	30	1.6	Ton	48	48	—	—	—
Rotation pasture	16	3.2	AUM	51	51	—	—	—
Native pasture	119	1.0	AUM	119	118	—	—	—
Other	6	—	—	—	—	—	—	—
Total	480	—	—	—	—	—	—	$ 2,568

Item	Grade	No.	Av. wt. per head	Amount	SOLD Price	Value
Cattle, yearling steers	Choice	45	1,100	49,500	$25.00	$12,375
Cattle, yearling heifers	Choice	4	1,000	4,000	24.00	960
Cows	Medium	2	1,100	2,200	16.00	352
Hogs		198	225	44,550	15.00	6,682
Sows		19	400	7,600	13.00	988
Stags		1	—	—	40.00	40
Total						$21,397

FINANCIAL SUMMARY

Expenses		Receipts		Inventory Value	
Seed	$ 317	Crops	$ 2,568	Land and buildings	$41,750
Fertilizer	331	Livestock	21,397	Buildings and improvements	(5,520)
Feed	2,111	Total	23,965	Machinery and equipment	11,630
Feeders purchased	7,224	Less cash expense	12,742	Livestock	13,445
Machinery	1,080	Net cash income	11,223	Total	$66,825
Building repairs	193	Less depreciation	1,329	**Inventory Numbers**	
Taxes, insurance	1,462	Net farm income	9,894	Beef cows	12
Other	124	Less interest	4,051	Purchased feeders	40
Cash expense	$12,742	**Labor and management income**	**$ 5,843**	Sows	31
Machinery depreciation	1,163			**Labor Requirements**	
Building depreciation	166			Operator, days	182
Interest on investment	4,051				
Total expense	$18,122				

Table A-20. Summary of 480-Acre Integrated Irrigation-Dryland Farm Plan, Lake Plains Area

Crop	Acres	CROPPING PLAN Yield	Unit	Production	Farm use	SOLD Amount	Price	Value
Dryland								
Corn	43	27	Bu.	1,161	777	384	$0.90	$ 346
Wheat	43	16	Bu.	688	43	645	1.90	1,226
Native pasture	119	1.0	AUM	119	116	—	—	—
Other	6	—	—	—	—	—	—	—
Irrigated								
Corn	172	82	Bu.	14,104	14,104	—	—	—
Corn silage	7	15.4	Ton	108	102	—	—	—
Wheat	45	36	Bu.	1,620	68	1,552	1.90	2,949
Alfalfa	23	4.5	Ton	104	104	—	—	—
Rotation pasture	22	7.9	AUM	174	174	—	—	—
Total	480	—	—	—	—	—	—	$ 4,521

LIVESTOCK PLAN

Item	Grade	No.	Av. wt. per head	Amount	SOLD Price	Value
Cattle, yearling steers	Choice	209	1,100	229,900	$25.00	$57,475
Cattle, yearling heifers	Choice	6	1,000	6,000	24.00	1,440
Cows	Medium	3	1,100	3,300	16.00	528
Hogs		320	225	72,000	15.00	10,800
Sows		30	400	12,000	13.00	1,560
Stags		2	—	—	40.00	80
Total						$71,883

FINANCIAL SUMMARY

Expenses		Receipts		Inventory Value	
Seed	$ 482	Crops	$ 4,521	Land and buildings	$ 58,966
Fertilizer	831	Livestock	71,883	Buildings and improvements	(8,940)
Water charges	2,671	Total	$76,404	Machinery and equipment	21,255
Feed	4,588	Less cash expense	51,117	Livestock	43,430
Feeders purchased	35,620	Net cash income	$25,287	Total	$123,651
Labor	981	Less depreciation	2,394	**Inventory Numbers**	
Machinery	2,625	Net farm income	$22,893	Beef cows	20
Building repairs	312	Less interest	7,971	Purchased feeders	200
Taxes, insurance	2,796	**Labor and management income**	**$14,922**	Sows	50
Other	211			**Labor Requirements**	
Cash expense	$51,117			Operator, days	248
Machinery depreciation	2,126			Hired, days	109
Building depreciation	268			Total	357
Interest on investment	7,971				
Total expense	**$61,482**				

Table A-21. Summary of 1,280-Acre Dryland Ranch Plan, Missouri Slope Area

Crop	Acres	CROPPING PLAN Yield	Unit	Production	Farm use	SOLD Amount	Price	Value
Corn	88	19	Bu.	1,672	1,672	—	—	—
Corn silage	37	5	Ton	185	182	—	—	—
Oats	65	30	Bu.	1,950	1,835	115	$0.50	$ 58
Wheat, spring	90	15	Bu.	1,350	90	1,260	1.90	2,394
Wheat, winter	90	28	Bu.	2,520	90	2,430	1.90	4,617
Alfalfa	42	1.2	Ton	50	50	—	—	—
Rotation pasture	10	1.8	AUM	18	18	—	—	—
Fallow	90	—	—	—	—	—	—	—
Native range	753	75	AUM	565	565	—	—	—
Other	15	—	—	—	—	—	—	—
Total	1,280	—	—	—	—	—	—	$ 7,069

LIVESTOCK PLAN

Item	Grade	No.	Av. wt. per head	Amount	SOLD Price	Value
Cattle, yearling steers	Choice	20	1,100	22,000	$25.00	$ 5,500
Cattle, yearling heifers	Choice	12	1,000	12,000	24.00	2,880
Cows	Medium	8	1,100	8,800	16.00	1,408
Hogs		66	225	14,850	15.00	2,228
Sows		11	400	4,400	13.00	572
Stags		1	—	—	40.00	40
Total						$12,628

FINANCIAL SUMMARY

Expenses		Receipts		Inventory Value	
Seed	$ 289	Crops	$ 7,069	Land and buildings	$ 71,680
Fertilizer	168	Livestock	12,628	Buildings and improvements	(7,210)
Feed	841	Total	$19,697	Machinery and equipment	20,045
Labor	—	Less cash expense	6,028	Livestock	22,535
Machinery	1,849	Net cash income	$13,669	Total	$114,260
Building repairs	251	Less depreciation	2,220	**Inventory Numbers**	
Taxes, insurance	2,499	Net farm income	$11,449	Beef cows	45
Other	131	Less interest	6,923	Sows	11
Cash expense	$ 6,028	**Labor and management income**	**$ 4,526**	**Labor Requirements**	
Machinery depreciation	2,005			Operator, days	194
Building depreciation	215				
Interest on investment	6,923				
Total expense	**$15,171**				

Table A-22. Summary of 1,280-Acre Integrated Dryland-Irrigation Ranch Plan, Missouri Slope Area

Crop	Acres	CROPPING PLAN Yield	Unit	Production	Farm use	SOLD Amount	Price	Value
Dryland								
Native pasture	727	.75	AUM	545	545	—	—	—
Other	15	—	—	—	—	—	—	—
Irrigated								
Corn	359	72	Bu.	25,848	25,798	50	$0.90	$ 45
Wheat, winter	89	40	Bu.	3,560	134	3,426	1.90	6,509
Alfalfa	70	4.5	Ton	315	315	—	—	—
Rotation pasture	20	7.9	AUM	158	158	—	—	—
Total	1,280	—	—	—	—	—	—	$ 6,554

LIVESTOCK PLAN

Item	Grade	No.	Av. wt. per head	Amount	SOLD Price	Value
Cattle, yearling steers	Choice	440	1,100	484,000	$25.00	$121,000
Cattle, yearling heifers	Choice	15	1,000	15,000	24.00	3,600
Cows	Medium	9	1,100	9,900	16.00	1,584
Hogs		355	225	79,875	15.00	11,981
Sows		30	400	12,000	13.00	1,560
Stags		2	—	—	40.00	80
Total						$139,805

FINANCIAL SUMMARY

Expenses		Receipts		Inventory Value	
Seed	$ 816	Crops	$ 6,554	Land and buildings	$107,152
Fertilizer	1,467	Livestock	139,805	Buildings and improvements	(18,340)
Water charges	5,719	Total	$146,359	Machinery and equipment	22,390
Feed	7,034	Less cash expense	103,434	Livestock	93,790
Feeders purchased	74,268	Net cash income	$ 42,925	Total	$223,332
Labor	4,008	Less depreciation	2,789	**Inventory Numbers**	
Machinery	4,220	Net farm income	$ 40,136	Beef cows	52
Building repairs	641	Less interest	14,026	Purchased feeders	417
Taxes, insurance	5,048	**Labor and management income**	**$ 26,110**	Sows	55
Other	213			**Labor Requirements**	
Cash expense	$103,434			Operator, days	313
Machinery depreciation	2,239			Hired, days	326
Building depreciation	550			Total	639
Interest on investment	14,026				
Total expense	**$120,249**				

Table A-23. Summary of 1,062-Acre Integrated Irrigation-Dryland Ranch Plan, Missouri Slope Area (for comparison with 1,280-Acre Dryland Ranch, table A-20)

	CROPPING PLAN						SOLD	
Crop	Acres	Yield	Unit	Production	Farm use	Amount	Price	Value
Dryland								
Native pasture	727	.75	AUM	545	545	—	—	—
Other	15	—	—	—	—	—	—	—
Irrigated								
Corn	214	72	Bu.	15,408	14,928	480	$0.90	$ 432
Wheat, winter	53	40	Bu.	2,120	80	2,040	1.90	3,876
Alfalfa	47	4.5	Ton	212	212	—	—	—
Rotation pasture	6	7.9	AUM	47	46	—	—	—
Total	1,062	—	—	—	—	—	—	$ 4,308

	LIVESTOCK PLAN					SOLD	
Item	Grade	No.	Av. wt. per head	Amount	Price	Value
Cattle, yearling steers	Choice	256	1,100	281,600	$25.00	$70,400
Cattle, yearling heifers	Choice	13	1,000	13,000	24.00	3,120
Cows	Medium	7	1,100	7,700	16.00	1,232
Hogs		180	225	40,500	15.00	6,075
Sows		30	400	12,000	13.00	1,560
Stags		2	—	—	40.00	80
Total						$82,467

FINANCIAL SUMMARY

Expenses	
Seed	$ 487
Fertilizer	757
Water charges	3,402
Feed	3,929
Feeders purchased	42,210
Labor	1,233
Machinery	2,853
Building repairs	455
Taxes, insurance	3,545
Other	208
Cash expense	$59,079
Machinery depreciation	2,036
Building depreciation	391
Interest on investment	9,852
Total expense	**$71,358**

Receipts	
Crops	$ 4,308
Livestock	82,467
Total	$86,775
Less cash expense	59,079
Net cash income	$27,696
Less depreciation	2,427
Net farm income	$25,269
Less interest	9,852
Labor and management income	**$15,417**

Inventory Value	
Land and buildings	$ 75,760
Buildings and improvements	(13,250)
Machinery and equipment	20,355
Livestock	60,860
Total	$156,975
Inventory Numbers	
Beef cows	43
Purchased feeders	237
Sows	30
Labor Requirements	
Operator, days	255
Hired, days	137
Total	392

Table A-24. Summary of 2,560-Acre Dryland Ranch Plan, Missouri Slope Area

	CROPPING PLAN					SOLD		
Crop	Acres	Yield	Unit	Production	Farm use	Amount	Price	Value
Corn	181	19	Bu.	3,439	3,439	—	—	—
Corn silage	76	5	Ton	380	377	—	—	—
Oats	128	30	Bu.	3,840	3,816	24	$0.50	$ 12
Wheat, spring	179	15	Bu.	2,685	179	2,506	1.90	4,761
Wheat, winter	179	28	Bu.	5,012	179	4,833	1.90	9,183
Alfalfa	80	1.2	Ton	96	—	—	—	—
Rotation pasture	22	1.8	AUM	40	40	—	—	—
Fallow	179	—	—	—	—	—	—	—
Native range	1,521	.75	AUM	1,141	—	—	—	—
Other	15	—	—	—	—	—	—	—
Total	2,560	—	—	—	—	—	—	$13,956

LIVESTOCK PLAN

Item	Grade	No.	Av. wt. per head	Amount	SOLD Price	Value
Cattle, yearling steers	Choice	41	1,100	45,100	$25.00	$11,275
Cattle, yearling heifers	Choice	27	1,000	27,000	24.00	6,480
Cows	Medium	15	1,100	16,500	16.00	2,640
Hogs		132	225	29,700	15.00	4,455
Sows		22	400	8,800	13.00	1,144
Stags		2	—	—	40.00	80
Total						$26,074

FINANCIAL SUMMARY

Expenses	
Seed	$ 613
Fertilizer	321
Feed	1,718
Labor	567
Machinery	2,974
Building repairs	430
Taxes, insurance	4,589
Other	262
Cash expense	$11,474
Machinery depreciation	2,344
Building depreciation	369
Interest on investment	12,707
Total expense	**$26,894**

Receipts	
Crops	$13,956
Livestock	26,074
Total	$40,030
Less cash expense	$11,474
Net cash income	28,556
Less depreciation	2,713
Net farm income	$25,843
Less interest	12,707
Labor and management income	**$13,136**

Inventory Value	
Land and buildings	$143,360
Buildings and improvements	(12,296)
Machinery and equipment	23,440
Livestock	45,450
Total	$212,250
Inventory Numbers	
Beef cows	92
Sows	22
Labor Requirements	
Operator, days	268
Hired, days	63
Total	331

Table A-25. Summary of 2,560-Acre Integrated Dryland-Irrigation Ranch Plan, Missouri Slope Area

Crop	Acres	CROPPING PLAN Yield	Unit	Production	Farm use	SOLD Amount	Price	Value
Dryland								
Native range	1,470	.75	AUM	1,102	1,102	—	—	—
Other	15	—	—	—	—	—	—	—
Irrigated								
Corn	717	72	Bu.	51,624	51,580	44	$0.90	$ 40
Wheat, winter,	179	40	Bu.	7,160	269	6,891	1.90	13,093
Alfalfa	155	4.5	Ton	698	696	—	—	—
Rotation pasture	24	7.9	AUM	190	189	—	—	—
Total	2,560	—	—	—	—	—	—	$13,133

LIVESTOCK PLAN

Item	Grade	No.	Av. wt. per head	Amount	SOLD Price	Value
Cattle, yearling steers	Choice	1,055	1,100	1,160,500	$25.00	$290,125
Cattle, yearling heifers	Choice	28	1,000	28,000	24.00	6,720
Cows	Medium	17	1,100	18,700	16.00	2,992
Hogs		180	225	40,500	15.00	6,075
Sows		30	400	12,000	13.00	1,560
Stags		2	—	—	40.00	80
Total						$307,552

FINANCIAL SUMMARY

Expenses		Receipts		Inventory Value	
Seed	$ 1,617	Crops	$ 13,133	Land and buildings	$214,200
Fertilizer	2,589	Livestock	307,552	Buildings and improvements	(27,990)
Water charges	11,427	Total	$320,685	Machinery and equipment	28,640
Feed	11,255	Less cash expense	234,406	Livestock	211,150
Feeders purchased	179,881	Net cash income	$ 86,279	Total	$453,990
Labor	8,835	Less depreciation	3,704	**Inventory Numbers**	
Machinery	7,316	Net farm income	$ 82,575	Beef cows	100
Building repairs	980	Less interest	28,566	Purchased feeders	1,010
Taxes, insurance	10,279	**Labor and management income**	**$ 54,009**	Sows	30
Other	227			**Labor Requirements**	
Cash expense	$234,406			Operator, days	358
Machinery depreciation	2,864			Hired, days	775
Building depreciation	840			Total	1,133
Interest on investment	28,566				
Total expense	**$266,676**				

Table A-26. Summary of 1,805-Acre Integrated Irrigation-Dryland Ranch Plan, Missouri Slope Area (for comparison with 2,560-Acre Dryland Ranch, table A-24)

Crop	CROPPING PLAN Acres	Yield	Unit	Production	Farm use	SOLD Amount	Price	Value
Dryland								
Native range	1,470	.75	AUM	1,102	1,102	—	—	—
Other	15	—	—	—	—	—	—	—
Irrigated								
Corn	198	72	Bu.	14,256	14,240	16	$0.90	$ 14
Corn silage	16	13.5	Ton	216	216	—	—	—
Wheat, winter	53	40	Bu.	2,120	80	2,040	1.90	3,876
Alfalfa	45	4.5	Ton	202	202	—	—	—
Rotation pasture	8	7.9	AUM	63	63	—	—	—
Total	1,805	—	—	—	—	—	—	$ 3,890

Item	Grade	LIVESTOCK PLAN No.	Av. wt. per head	Amount	SOLD Price	Value
Cattle, yearling steers	Choice	165	1,100	181,500	$25.00	$45,375
Cattle, yearling heifers	Choice	26	1,000	26,000	24.00	6,240
Cows	Medium	15	1,100	16,500	16.00	2,640
Hogs		376	225	84,600	15.00	12,690
Sows		30	400	12,000	13.00	1,560
Stags		2	—	—	40.00	80
Total						$68,585

FINANCIAL SUMMARY

Expenses		Receipts		Inventory Value	
Seed	$ 487	Crops	$ 3,890	Land and buildings	$105,480
Fertilizer	395	Livestock	68,585	Buildings and improvements	(13,530)
Water charges	3,402	Total	72,475	Machinery and equipment	22,790
Feed	4,830	Less cash expense	40,499	Livestock	65,010
Feeders Purchased	22,262	Net cash income	$31,976	Total	$193,280
Labor	1,422	Less depreciation	2,685	**Inventory Numbers**	
Machinery	2,714	Net farm income	$29,291	Beef cows	90
Building repairs	474	Less interest	11,947	Purchased feeders	125
Taxes, insurance	4,305	**Labor and management income**	**$17,344**	Sows	58
Other	208			**Labor Requirements**	
Cash expense	$40,499			Operator, days	283
Machinery depreciation	2,279			Hired, days	158
Building depreciation	406			Total	441
Interest on investment	11,947				
Total expense	**$55,131**				