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Dryland Farm Organization  
in the Proposed  
Baldhill Area Irrigation Unit  
in North Dakota

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# DRYLAND FARM ORGANIZATION IN THE PROPOSED BALDHILL

## AREA IRRIGATION UNIT IN NORTH DAKOTA<sup>1</sup>

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The Baldhill Area proposed irrigation unit is located principally on the west side of the Baldhill Reservoir in Barnes and Griggs counties. The preliminary work on land classification has not been completed but it is estimated that there will be about 95,000 acres which will have irrigation potentials.

### Purpose of Study

The North Dakota Agricultural College and the Federal agencies involved in the Missouri River Basin development have a direct responsibility in anticipating many agricultural and economic problems that may arise from irrigation development. In order to measure the economic feasibility of irrigation, information is needed for appraising the probable effect of irrigation upon farm income in the proposed irrigation areas of North Dakota. It is essential to know the present income position of dryland farmers and their farm investment and organization in order to assess realistically the changes in farming, capital requirements and tenure arrangements which will come about with irrigation development.

This study of dryland farm organization will be used as a part of the basis for determining the increased capital requirements, changes in farm organization and size, and other changes which are expected to attend the transformation from dryland to irrigation farming.

### Sample Design

Farm schedules were taken in two sample blocks in the proposed irrigation area. These blocks were picked on the basis of soil type, amount of irrigable land, topography and present land use.

A farm schedule was taken in the summer of 1954 of the 1953 dryland operations of the farms in the sample. Forty-eight schedules were obtained. The purpose of this schedule was to obtain the physical organization, input and output relationships and the asset structure of the present dryland farming system.

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<sup>1</sup> This study was carried on under Project ND 704 of the North Dakota Agricultural Experiment Station, in cooperation with the Bureau of Reclamation, Missouri-Souris District, Bismarck, North Dakota.

<sup>2</sup> Assistant Agricultural Economist, North Dakota Agricultural Experiment Station. The author acknowledges most valuable advice and assistance through the course of the study from Mr. Ned Williams and his associates in the Bureau of Reclamation.

Present Agriculture in the Area

The farms in the area are mainly grain farms (82 per cent) and the remainder grain-livestock farms. A farm was classified as a grain farm if at least 60 per cent of its gross income came from the sale of grains. The analysis of the field schedules was not made by type-of-farm, since there were not enough schedules to permit this.

Size of farm - The average size of farm for the 48 farms in the survey was 552 acres. The range in farm size was from 300 to 1,440 acres. Fifty-eight per cent of the farms fell within the 260-499 acre range. The average size of farm for this group was 409 acres (Table 1).

Table 1. Frequency Distribution by Size of Farm and Average Size of Farm, 1953

Farm Size in Acres	Number of Farms	Per Cent of Total	Average Size of Farm (Acres)
300 - 499	28	58	409
500 - 699	10	21	624
700 - 899	8	17	791
900 - 1,099	1	2	999
1,100 - 1,440	1	2	1,440
Total	48	100	552

Land Use and Livestock System - On the average 70 per cent of the total land in the farm was cropland. Wheat is the major crop grown, with 27 per cent of the cropland planted to this crop (Table 2). The other crops grown in the order of their importance are barley, flax and oats. About 18 per cent of the cropland was summer fallowed.

Table 2. Land Use in Average Acres per Farm and in Per Cent of the Total Land and Cropland, 1953

Land Use	Average Acres per Farm	Per Cent of Total Acres	Per Cent of Cropland
Wheat	102	18.6	26.5
Oats	36	6.4	9.2
Barley	65	11.7	16.8
Flax	48	8.7	12.5
Corn	24	4.4	6.3
Idle cropland	3	.6	.8
Fallow	69	12.6	18.0
Tame hay	27	4.9	7.1
Cropland pasture	11	2.0	2.8
Total Cropland	385	69.9	100.0
Permanent pasture	113	20.5	
Wild hay	32	5.8	
Farmstead	9	1.5	
Other	13	2.3	
Total	552	100.0	

Livestock - About 71 per cent of the farms in the survey reported they milked cows, 65 per cent of the farms had some beef cows, 29 per cent reported having hogs, and 23 per cent reported having sheep. Only one of the 48 farms reported having no livestock. Table 3 shows the number of farms reporting the various types of livestock and the low, average and high numbers of livestock of each type found on the farms reporting livestock.

Table 3. Average and Range in Number of Livestock, by Type, for Farms Reporting Livestock

Type of Livestock	Number of Farms Reporting	Number of Livestock		
		Low	Average	High
Milk cows	34	1	6	14
Beef cows	31	2	17	75
Hogs	14	1	4	20
Sheep	11	3	30	70
Horses	37	2	2	4

Table 4 shows the average number of breeding animals for all farms in the survey, and it should be noted that these figures will not be the same as in Table 3. The farms tend to have a higher proportion of beef stock than dairy or the other types of livestock.

The majority of the livestock sold were yearlings or older. The weighted average weight of the heifers and steers sold in the yearling or older group was 859 pounds.

Table 4. Average Number of Breeding Animals per Farm, January 1, 1954

Type of Livestock	Number of Animals
Milk cows	5
Beef cows	11
Sows	1
Ewes	7
Hens	39

Tenure System - The distribution of sample farms by tenure is shown in Table 5. Full owners were the most common group, with 46 per cent of the farms falling in this category.

Table 5. Distribution of Sample Farms by Tenure

Type of Tenure	Number of Farms	Per Cent
Full owner	22	46
Part-owner	17	35
Full tenant	9	19
Total	48	100

On the average, 68 per cent of the land in the sample farms was owned and 32 per cent rented. The part-owners had the larger average size of farm with 587 acres, the owners were second with 524 acres, and the tenants had the smallest with 486 acres.

Farm Income

The income data presented here are estimates based upon production reported by farmers and the Agricultural Marketing Service average farm prices for North Dakota. Most of the expenditure items are also based upon application of standardized factor costs to the quantities reported by farmers. The index of prices received by North Dakota farmers in 1953 was 249, and the United States index of prices paid including interest, taxes and wage rates, was 279. This gives a parity ratio of 89 for the year 1953.

The term net cash farm income as used here is the gross cash farm income minus the cash operating expenditures. The term family labor earnings is the gross cash farm income minus the cash operating expenditures minus an allowance for building and machinery depreciation and interest on investment. The family labor earnings is the amount that would be available to an operator for family living and savings if he had a 100 per cent loan on his land and operating capital, while the net cash farm income would be the family income for an owner entirely free of debt.

Gross Cash Income - The gross cash income is an appropriate measure of the size of business rather than of income available to the farm family. It is a much more accurate measure of size than acreage, since it reflects the productivity of the land and the scale of the livestock enterprise.

The average gross cash income for the 48 farms in the survey was \$7,797 (Table 6). Seventy-five per cent of this income came from the sale of grain. There was considerable variation in gross incomes among the farms studied, the range being from \$2,546 to \$17,176. The most important cause of low incomes was low yields due to grain rust and drought. Since these farms get their income principally from grain, low yields play a major role in accounting for low incomes on many of these farms.

Table 6. Average Gross Farm Income by Source, 1953

Source of Income	Gross Income	Per Cent
Crops	\$5,810	74
Livestock and products	1,918	25
Other	69	1
Total	\$7,797	100

Table 7 shows the frequency distribution of the gross farm income. Twenty-one per cent, or the most frequent group, of the farms had gross incomes which ranged between \$7,500 and \$8,749. Twenty-eight per cent of the farms had gross incomes under \$5,000.

Table 7. Frequency Distribution of the Gross Cash Income, 1953

Gross Income	Number of Farms	Per Cent of Total
\$ 2,500 - 3,749	6	13
3,750 - 4,999	7	15
5,000 - 6,249	7	15
6,250 - 7,499	5	10
7,500 - 8,749	10	21
8,750 - 9,999	1	2
10,000 - 11,249	2	4
11,250 - 12,499	3	6
12,500 - 13,749	1	2
13,750 - 14,999	5	10
15,000 - 16,249	-	-
16,250 - 17,499	1	2
Total farms	48	100

On a per acre basis, the average gross farm income was \$14.14, with a range from \$6.49 to \$34.14. Table 8 shows the frequency distribution of the gross income per acre. Twenty-nine per cent of the farms fell within the \$15.00 to \$19.99 per acre range.

Table 8. Frequency Distribution of the Gross Cash Income per Acre, 1953

Gross Cash Income Per Acre	Number of Farms	Per Cent of Total
\$ 5.00 - 9.99	13	27
10.00 - 14.99	13	27
15.00 - 19.99	14	29
20.00 - 24.99	7	15
25.00 - 29.99	0	0
30.00 - 34.99	1	2
Total farms	48	100

Net Income - A measure of family well-being is the net income. Two net income terms are used to indicate the range within which most of the families actually fall. Since the survey did not include the equity position, debt and rental payments, it can only indicate within what range the net income available for family living, savings and taxes is likely to fall, depending upon debt and rental obligation. The net cash income represents the income which would be available to



the operator if he owned all the land and other assets free of debt; family labor earnings represent the net cash income he would have if all the land and other assets were 100 per cent encumbered (by a 100 per cent loan) and he had paid current interest charges (but no principal) on these assets.

The average net cash income for the 48 farms in the survey was \$3,639 and the range was from a minus \$687 to \$12,555. Three farms had a minus net cash income. The net cash income averaged 47 per cent of the total gross cash income.

The family labor earnings average \$1,225. Family labor earnings is the net cash income minus the non-cash expenditures, such as interest on investment and depreciation. The family labor earnings were 16 per cent of the gross cash income. Seventy-five per cent of the farms had a family labor earnings of less than \$2,500.

Family labor earnings per acre represents a combined index of land productivity and efficiency of capital use. This figure averages \$2.22 for the 48 farms and ranges from a low of minus \$6.57 to a high of \$21.96. Seventy-three per cent of the farms had a per acre family labor earnings of less than \$5.00 per acre.

Table 9. Frequency Distribution of the Per Acre Family Labor Earnings, 1953

Family Labor Earnings Per Acre	Number of Farms	Per Cent
Negative	14	29
0.00 - 4.99	21	44
5.00 - 9.99	11	23
10.00 - 14.99	1	2
15.00 - 19.99	-	-
20.00 - 24.99	1	2
Total farms	48	100

To be realistic, the farm income on most of these farms was in between the net cash income and the family labor earnings. Most of the farmers have some equity in the land and equipment on which they are not paying interest to lenders. It is these interest returns on unencumbered assets on which some of the farmers with very low or negative labor earnings are depending for a living.

Another measure of efficiency which would be more accurate than the family labor earnings per acre would be the family labor earnings per \$100 investment in the farm. This measure would more accurately take into account the livestock enterprises on a farm, especially those which are not so closely related to the farm acreage. The average family labor earnings per \$100 investment was \$3.63 and ranged from a low of minus \$8.61 to a high of \$39.11.

Farm Expenditures

Total farm expenditures per acre, an index of intensity of land use, varied from a low of \$6.84 to a high of \$20.69 per acre. The average was \$11.92. Fifty-six per cent of the farms fell within the \$9.50 to \$12.50 per acre range.

The cash expenditures were 63 per cent of the total farm expenditure (Table 10). The interest on the investment is the largest of the total expense items. This is not a cash expense item; an operator entirely free of debt could use this for family living or reinvest it in the farm. In this analysis it was assumed that the farms were all owner operated. Hence, rent payments and principal repayments on debts were not included in the expenditures. Interest on real estate was charged at 4 per cent and on operating capital (including livestock) at 6 per cent.

Machinery costs, which include fuel, grease, oil, repairs, auto and truck expense, depreciation and interest on investment, were 41 per cent of the total expenditures.

Total farm expenditures in per cent of gross farm income indicates the share of the gross income required to cover the total cost of farming. The average for the 48 farms reporting was 84 per cent.

Table 10. Average Farm Expenditure Per Farm, 1953

Expenditure Item	Average Expenditure Per Farm	Per Cent of Total
Crop	\$ 284	4.3
Fuel, grease and oil	878	13.4
Machine repair	332	5.1
Hired labor	272	4.1
Auto and truck	612	9.3
Insurance	193	2.9
Taxes (real estate and personal property)	546	8.3
Livestock	442	6.7
Custom work	88	1.4
Building repair	263	4.0
Electricity and telephone	50	.8
Miscellaneous	198	3.0
Total Cash Expense	4,158	63.3
Building depreciation	226	3.4
Machinery depreciation	608	9.3
Interest on investment	1,580	24.0
Total Farm Expenditure	\$6,572	100.0

Farm Investment

The farm investment is made up of the value of the real estate, machinery and livestock. The average farm investment was \$34,000 (Table 11). Real estate represented 65 per cent, livestock 13 per cent and machinery 22 per cent of the total investment.

Table 11. Average Farm Investment by Type of Investment, 1953.

Type of Investment	Dollars	Per Cent
Real Estate	21,759	65
Livestock	4,356	13
Machinery	7,594	22
Total Investment	33,709	100
Range in Total Investment		
Low	14,814	
High	104,149	

The average per acre investment, a combined index of land productivity and intensivity of capital inputs, was \$61 and the range was from a low of \$46 to a high of \$82.

Real Estate - The real estate values were based on the 1950 census of agriculture for the counties in which the sample farms were located. The census value per acre was converted to a 1953 value by the use of index numbers for real estate values in North Dakota. The average value per acre for the sample unit was \$39.46.

Machinery - The value of machinery was based on new machinery prices in 1950 and adjusted by the Agricultural Marketing Service index numbers of prices paid for farm machinery. The new price was depreciated according to the age and the expected life of the machine.

The average per acre investment in machinery was \$13.77 with a range from a low of \$5.67 to a high of \$22.84.

Sixty-two per cent of the farms reporting had two tractors, 19 per cent had three, 17 per cent had one and 2 per cent had five tractors. Only five farms or 11 per cent of the 48 farms reporting did not have a combine. Fifty-two per cent of the farms had 12 foot combines, 31 per cent had 6 foot combines, 4 per cent had 9 foot and 2 per cent had 10 foot combines. Twelve farms, or 24 per cent of the farms, did not have a truck. Ten per cent of the farms had 2 ton trucks, 38 per cent had 1 1/2 ton, 6 per cent had 1 ton, 6 per cent had 3/4 ton and 16 per cent had 1/2 ton trucks. Two farms reported having more than one truck.

Livestock - Valuations for livestock were based on the number of animals reported on the farm January 1, 1954. The values were arrived

at by using the North Dakota prices received by farmers for 1953.

The average investment in livestock was \$14,356 and ranged from a low of no investment to a high of \$22,905. Only one farm reported having no livestock. Table 12 shows the frequency distribution of the animal units found on the farms. In order to compare the various kinds of livestock the numbers were reduced to a common denominator and expressed in animal units. An animal unit as used here is equal to: 1 horse, 1 cow, 1 bull, 1 steer or heifer over 1 year of age, 2 head of other cattle, 7 sheep, 14 lambs, 5 hogs, 10 pigs and 100 chickens. There were two ranges in animal units which were the most common, the 10 to 20 and the 20 to 30 animal unit range.

Table 12. Frequency Distribution of Animal Units Per Farm by Number of Farms and Per Cent of Total Farms, January 1, 1954.

Animal Units	Number of Farms	Per Cent
0	1	2
1 - 9.99	1	2
10 - 19.99	12	25
20 - 29.99	12	25
30 - 39.99	8	17
40 - 49.99	4	8
50 - 59.99	3	6
60 - 69.99	5	11
70 - 169.45	2	4
Total farms	48	100

#### Labor

On the average, the farms required 20 man-months of labor. The range was from a low of 7 man-months to a high of 39 man-months of labor. Table 13 shows the distribution of labor by the source. Attention is called to the operator category, as a few farms show over 12 man-months of operator labor. This is due to the fact that there were several partnerships and the operator was charged with 24 man-months of labor if both worked full time. Sixty-five per cent of the labor is contributed by the operator, 27 per cent by the family and 8 per cent is hired. Fifty-two per cent of the farms reported no hired labor. Two farms reported having a hired man the year around.

Table 13. Man-Months of Labor Required for Average Farm  
by Type of Labor, 1953.

Type of Labor	Man-Months of Labor	Per Cent
Operator	12.7 <sup>1/</sup>	65
Family	5.2	27
Hired	1.7	8
Total Labor	19.6	100

<sup>1/</sup> The average is over 12 man-months due to several partnerships where the operator was charged with 24 man-months of labor.

#### Summary

The proposed Baldhill Area irrigation unit is located principally on the west side of the Baldhill Reservoir in Barnes and Griggs counties. It is estimated that there will be about 95,000 acres which will have irrigation potentials.

The farms are principally small grain farms with wheat as the major crop. The livestock system utilizes the land not considered profitable for mall grains. The main type of livestock enterprise is beef cattle. The most frequent size of farm falls within a range of 300 to 499 acres with 409 acres being average for this group.

Seventy-five per cent of the farms had family labor earnings of less than \$2,500. Low farm income in 1953 was due primarily to grain rust and a drought at filling time which lowered yields.

The average farm investment at 1953 prices was \$34,000. Real estate represented 65 per cent, livestock 13 per cent and machinery 22 per cent of the total investment.

Labor for these farms comes principally from the operator and his family. Sixty-five per cent of the labor is contributed by the operator, 27 per cent by unpaid family labor and 8 per cent is hired.

Appendix Table 1. Summary of Labor and Fuel Requirements  
Per Acre by Size of Machine, 1953.

Size and Type of Machine	Number Reporting	Low		Average		High	
		MH/ac $\frac{1}{2}$ (man-hours)	Fuel/ac (gals.)	MH/ac (man-hours)	Fuel/ac (gals.)	MH/ac (man-hours)	Fuel/ac (gals.)
<u>Plow, Moldboard</u>							
3-14 inch	31	.50	1.0	.77	2.2	1.00	3.0
4-14 inch	9	.45	1.0	.50	1.5	.55	2.0
<u>Plow, Pack &amp; Drill</u>							
3-14 inch	5	.62	1.5	.83	2.3	1.00	2.5
4-14 inch	7	.50	1.2	.56	1.6	.67	2.5
<u>One-way Plow</u>							
6 feet	5	.50	1.0	.50	1.5	.50	2.2
<u>Disc, Single</u>							
15 feet	6	.14	.4	.23	.5	.67	1.0
<u>Disc, Tandem</u>							
10 feet	22	.18	.5	.26	.7	.40	1.2
12 feet	6	.17	.3	.21	.6	.25	1.0
<u>Cultivation, Shallow</u>							
10 feet	10	.17	.3	.25	.6	.50	1.0
12 feet	13	.20	.3	.24	.8	.33	1.3
<u>Harrow, Spiketooth</u>							
20 feet	9	.10	.1	.14	.3	.22	.5
25 feet	7	.09	.2	.12	.3	.17	.4
<u>Drill</u>							
10 feet	13	.20	.3	.26	.6	.40	.8
11 feet	7	.21	.4	.29	.6	.36	1.0
12 feet	25	.17	.2	.23	.4	.40	.8
<u>Swather</u>							
12 feet	30	.13	.2	.24	.4	.40	1.0
<u>Combine</u>							
6 feet	12	.40	1.2	.57	1.9	1.00	3.0
12 feet	24	.27	.8	.38	1.7	.80	4.0
<u>Corn Planter</u>							
2-row	24	.25	.3	.45	.6	1.00	1.5

$\frac{1}{2}$  Man-hours per acre.

Appendix Table 1. (Continued)

Size and Type of Machine	Number Reporting	Low		Average		High	
		MH/ac <sup>1/</sup> (man-hrs.)	Fuel/ac (gals.)	MH/ac (man-hrs.)	Fuel/ac (gals.)	MH/ac (man-hrs.)	Fuel/ac (gals.)
<u>Corn, Cultivation</u> 2-row	29	.25	.4	.50	.9	1.33	2.1
<u>Corn Binder</u> 1-row	7	.67	1.0	.91	1.6	2.00	3.3
<u>Corn, Field Cutter</u> 1-row	13	.67	1.2	.91	2.4	1.43	3.8
<u>Mowing Hay</u> 6 feet	5	.40	.5	.59	.7	1.00	1.5
7 feet	32	.20	.3	.38	.6	.77	1.2
<u>Raking Hay</u> 10 feet	21	.25	.2	.37	.5	.67	1.2
12 feet	7	.25	.2	.32	.4	.50	.8

<sup>1/</sup> Man-hours per acre.

Appendix Table 2. Frequency of Gross Income Based on 1951 Prices.

Gross Income	Number of Farms	Per Cent
2,500 - 3,749	5	10.4
3,750 - 4,999	7	14.6
5,000 - 6,249	5	10.4
6,250 - 7,499	6	12.5
7,500 - 8,749	3	6.2
8,750 - 9,999	3	6.2
10,000 - 11,249	9	18.8
11,250 - 12,499	-	--
12,500 - 13,749	1	2.1
13,750 - 14,999	2	4.2
15,000 - 16,249	4	8.3
16,250 - 17,499	-	--
17,500 - 18,749	2	4.2
18,750 - 19,999	1	2.1
Total farms	48	100.0
Average gross income	\$8,852	

Appendix Table 3. Type of Farm Based on 1951 Prices. <sup>1/</sup>

Type of Farm	Number of Farms	Per Cent of Farms
Grain	29	60
Grain-Livestock	18	38
Livestock	1	2
Total	48	100

<sup>1/</sup> A farm was classified as grain or livestock when 60 per cent or more of its gross cash income came from the sale of grains or livestock (including livestock products), respectively.