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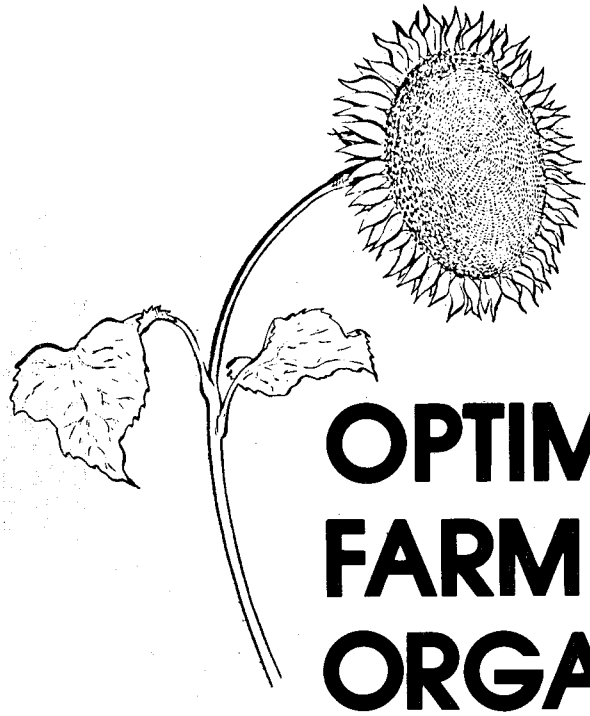
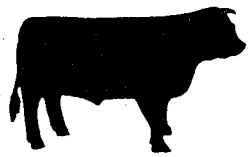


OPTIMUM FARM ENTERPRISE ORGANIZATION in Southeast Central North Dakota

ROGER G. JOHNSON, HARVEY G. VREUGDENHIL, and WENDELL D. HERMAN



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FOREWORD

This study reports on the effects of price changes upon the most profitable enterprise organization of three sizes of farms in the southeast central area of North Dakota. The research for this report was conducted under North Dakota Agricultural Experiment Station Project 1344 "Economics of Crop Production Technology."

The authors wish to extend their appreciation to the plant and animal scientists and agricultural engineers with whom the authors consulted in the formulation of production requirements. The authors also wish to acknowledge the suggestions received from their colleagues in Agricultural Economics, especially LeRoy Schaffner, David Cobia, and Steven Webster.

TABLE OF CONTENTS

Highlights

This study analyzes profit maximizing farm enterprise organization in southeast central North Dakota. Three representative farms were developed to typify small, medium, and large farms in the study area. Above average managerial efficiency was assumed in developing input-output coefficients.

Profit maximizing farm enterprise organizations were obtained through the use of linear programming. Long-run expected prices were extrapolated from 1963-1972 average commodity price relationships. Wheat, fuel, and fertilizer prices were varied to analyze their effects on the most profitable farm plans.

The most common crop and livestock enterprises in the study area were included as alternatives in the model. The crop enterprises considered were durum, wheat, barley, flax, sunflowers, oats, rye, corn silage, alfalfa hay, native hay, tame pasture, and native pasture. A total of eight beef, dairy, sheep, and hog enterprises were considered in the model. The study area farmland was assumed to be 80 percent cropland and 20 percent native hay, native pasture, and wasteland.

The results indicate that if the price of wheat was indexed at 1.00, the price of durum would have to be 1.12 to 1.15, and the price of barley .65 to replace wheat in the crop enterprise organization. Using long-term price relationships, wheat and sunflowers were the most profitable cash crops. Summer fallow was not an economically profitable practice in the study area except at very high prices for nitrogen fertilizer. Barley was more economically produced than oats as a feed for livestock. Hog farrowing was the most profitable livestock enterprise in the study area.

The value of an extra hour of labor for the spring period was very high on the medium and large representative farms. This indicates that most medium and large farmers in the study area could increase profits by overcoming labor shortages during the critical seeding period (April 11-May 30). This could be accomplished by hiring additional labor. The labor shortage could also be overcome by practices which would decrease labor requirements per acre, such as minimum spring tillage, more efficient seed handling systems, or larger machinery. Another alternative may be custom hiring of spring operations.

On typical farms in the study area changes in wheat prices tend to change the most profitable mix of small grains and flax. Wheat price has less effect on the profitability of sunflowers because they do not compete as directly for labor at the same time of the year. At high wheat prices livestock feeding becomes unprofitable but breeding livestock--hogs producing feeders and beef cow herds--remains a profitable use of nontillable land and existing labor and buildings.

Increases in fertilizer prices tend to make flax profitable relative to wheat and reduce fertilizer application rates. Large increases in nitrogen prices make the practice of summer fallowing an economical way of reducing purchased nitrogen. Higher fuel prices have little effect on farm plans but reduce net income.

OPTIMUM FARM ENTERPRISE ORGANIZATION IN SOUTHEAST CENTRAL NORTH DAKOTA

by
Roger G. Johnson, Harvey G. Vreugdenhil, and Wendell D. Herman*

Farm planning has been complicated in recent years by rapidly increasing input prices and highly unstable prices for the farm products produced. Sometimes grain prices have changed as much from day to day as they did during a year prior to 1972. This study examines the effect of changes in prices upon the most profitable farm plan for three sizes of farms in southeast central North Dakota.

The specific objectives of the study were to:

1. Develop input-output coefficients for representative small grain-livestock farms of three sizes in the study area.

2. Construct an analytical model capable of determining profit maximizing farm enterprise organization.

3. Utilize the model to investigate changes in profit maximizing enterprise combinations due to changes in wheat prices and fuel and fertilizer prices.

The Study Area

The study area includes the 11 counties designated in Figure 1. This area comprises the southern portion of the Drift Prairie physiographic region. It is an undulating plain with low-rounded knolls and many closed depressions or potholes. The soils are formed from glacial till and are mostly of loam and clay loam texture.[1]

Small grain and livestock is the characteristic type of farming. Wheat is the principal crop with feed grains and flax as other important crops. In 1973, 20 percent of the cropland was summer fallowed.[2] About one-fifth of the land in farms is not suitable for cultivation and is devoted to pasture and hay for livestock.

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*Johnson is Professor, Vreugdenhil is Research Associate, and Herman is a former graduate student, Department of Agricultural Economics.

[1]Omodt, Hollis W., et al., The Major Soils of North Dakota, Bulletin 472, Department of Soils, Agricultural Experiment Station, North Dakota State University, Fargo, 1962, pp. 3-4.

[2]North Dakota Crop and Livestock Statistics, Annual Summary, Agricultural Statistics No. 29, Statistical Reporting Service, United States Department of Agriculture in cooperation with the Department of Agricultural Economics, North Dakota State University, Fargo, May, 1973.

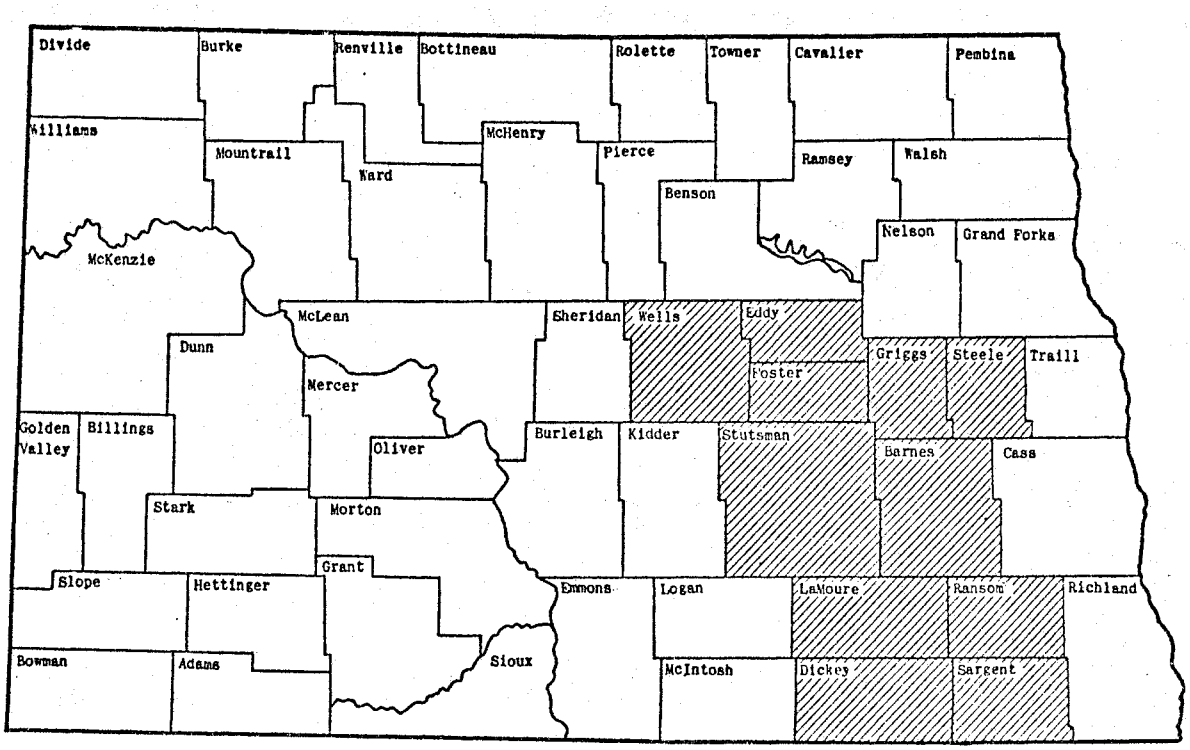

Figure 1. Area of Study, Southeast Central North Dakota

The study area contains 17 percent of the farmland in the state, but accounts for 27 percent of North Dakota's total livestock.[3] Beef cattle is the major class of livestock as reported by 64 percent of the farms. Dairy cows, hogs, and sheep are of lesser importance with 21, 18, and 14 percent, respectively, being reported by farmers.

The average size of farm in 1969 was 803 acres as compared to the state average of 900 acres. In 1969 there were 9,130 farms in the area. The farmers on these farms averaged 48.9 years of age.[4]

Representative Farms

Representative farm situations were set up to typify small, medium, and large size farms in the area. Land acreage, building space available for livestock, and size of farm machinery used were the major factors that differed among the three model farms. The resources available on each farm are summarized in Table 1.

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[3] 1969 Census of Agriculture, "Volume 1, Area Reports Part 18, North Dakota, Section 1, Summary Data," U.S. Government Printing Office, Washington, D.C., 1972.

[4] Ibid.

TABLE 1. RESOURCES AVAILABLE FOR REPRESENTATIVE LARGE, MEDIUM, AND SMALL FARMS, SOUTHEAST CENTRAL NORTH DAKOTA

Resource	Unit	Farm Size		
		Small	Medium	Large
Cropland	acre	446	831	1,656
Native Pasture	acre	58	107	214
Native Hay	acre	17	32	64
Waste	acre	39	70	146
Total Acreage	acre	560	1,040	2,080
Livestock Buildings	sq. ft.	6,050	7,700	9,900
Largest Tractor	h.p.	80	100	120
Grain Drill Width	ft.	14	14	20
Operator Labor	hrs.	3,162	3,162	3,162
Family Labor	hrs.	1,217	1,217	1,217
Hired Labor				
Permanent	hrs.	none	none	2,632
Hourly (summer)		none	644	644

The division of land between cropland, native pasture, native hay, and wasteland is in the proportion reported in the 1969 Census of Agriculture.[5] The proportion of land in each use is the same for each of the three farm sizes. Since land acreage was fixed, the square footage of farm buildings available for livestock was also fixed to keep the analysis in the same perspective for both crops and livestock.

A typical machinery complement was developed for each farm size based upon a survey conducted in 1972.[6] The size of the largest tractor is representative of the relative size of the other equipment on the farms. The equipment complement includes a complete line of small grain equipment, including harvesting equipment plus row crop implements for corn, and hay harvesting equipment.

All three representative farms are family-sized units with the operator willing to contribute a maximum of 3,162 hours of labor and management per year. Each farm operator was willing to work a maximum of 10 hours per day during the spring, summer, and fall and a maximum of eight hours per day in

[5] Ibid.

[6] Held, Larry J., Small Grain Production Costs and Technologies Among Areas of North Dakota, unpublished M.S. thesis, Department of Agricultural Economics, North Dakota State University, Fargo, July, 1973; and Held, Larry J., Roger G. Johnson, and LeRoy W. Schaffner, Small Grain Production Practices and Size and Type of Machinery Used, Southeast Central North Dakota, Statistical Series Issue No. 17, Department of Agricultural Economics, North Dakota State University, Fargo, April, 1973.

the winter. All labor periods assumed a seven-day week; however, all operators were assumed to take 21 days off annually (Table 2). Each operator was assumed to have a school-aged son or other family help who provided 60 hours of labor per month during the fall, winter, and spring and 200 hours per month during the summer for a total of 1,217 hours. The representative small farm was assumed to hire no labor. The representative medium farm was assumed to hire a man as needed during the summer up to a total of 644 hours. The representative large farm had a full-time hired man in addition to the same hourly summer labor available on the medium farm.

An overhead labor requirement was also established to allow for farmstead maintenance and improvement; input purchase; record keeping; management and supervision; farm meetings; and general farm business.[7] Overhead labor requirements were based on a recent South Dakota study.[8] Total overhead labor assumed was 340, 506, and 584 hours per year for the small, medium, and large representative farms, respectively.

The critical labor periods were divided into seven time periods for crop labor (Table 3) and six time periods for total labor (both livestock and crops--Table 2). The additional crop labor period was a result of overlapping spring seeding labor periods. The overlapping periods are the regular seeding period (April 11-May 31) and the late seeding period (May 1-June 10). Together they form the total crop seeding and total spring labor period (April 11-June 10). The crop labor hours shown in Table 3 were reduced for days that it was too wet or cold for field work. The crop and livestock enterprises must both compete for this labor.

The representative farm models assumed a high level of management. Therefore, the physical, technical, and economic coefficients did not reflect average figures for the study area. The input-output coefficients used can be achieved only through the proper use of the presently available technology, including timeliness of operations.

Crop and Livestock Enterprises

Farm plans which gave maximum returns to the resources available were calculated using linear programming. The crop, forage, and pasture enterprises considered were durum, spring wheat, barley, flax, oats, rye, sunflowers, corn silage, alfalfa hay, native hay, tame pasture, and native pasture. Durum, spring wheat, and barley could be planted on summer fallowed land or on nonfallowed land. All other crops were planted on nonfallowed land.

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[7] Pickup labor is often assumed to be included in overhead labor; however, in this study pickup labor was allocated to specific enterprises where possible. Pickup labor is the time spent checking crops, livestock, etc., using the pickup truck.

[8] Aanderud, Wallace G., and Francis Crandall, Planning for More Profitable Use of Resources, EC-652, Cooperative Extension Service, South Dakota State University, Brookings, September, 1966.

TABLE 2. TOTAL HOURS OF LABOR AVAILABLE DURING SPECIFIED PERIODS FOR EACH REPRESENTATIVE FARM, SOUTHEAST CENTRAL NORTH DAKOTA[a]

Season	Dates	Days	Representative Farm: Small — Operator Labor	Small — Operator and Family Labor	Medium — Operator Labor	Medium — Operator, Family, and Hired Labor	Large — Operator Labor	Large — Operator, Family, and Hired Labor[b]
			hours					
Winter	Nov. 16-Apr. 10	146	956	1,262	890	1,196	855	2,161
Spring	Apr. 11-Jun. 10	61	555	683	531	659	519	1,135
Summer	Jun. 11-Jul. 24	44	273	581	243	859	234	1,090
Late Sum.	Jul. 25-Jul. 31	7	64	113	61	159	60	214
Fall	Aug. 1-Sep. 10	41	373	660	357	931	349	1,251
Late Fall	Sep. 11-Nov. 15	66	601	740	574	713	561	1,228
Total		365	2,822	4,039	2,656	4,517	2,578	7,079

[a]Overhead labor and 21 days off have been subtracted from the total operator hours available. (Forty-five percent of the total overhead labor for each representative farm is subtracted from the November 16-April 10 labor period and the remaining 55 percent is discharged proportionally over the remaining labor periods. The farm operator is assumed to take his days off during the November 16-April 10 and June 11-July 24 labor periods.)

[b]Includes a full-time hired man.

TABLE 3. TOTAL HOURS OF LABOR AVAILABLE FOR CROP ENTERPRISE ACTIVITIES DURING SPECIFIED PERIODS FOR EACH REPRESENTATIVE FARM, SOUTHEAST CENTRAL NORTH DAKOTA

Period	Dates	Total Days	X Percent Working Days	= Actual Working Days[a]	Hours Per Day (Operator)	Representative Farm: Small Operator and Family Labor	Medium Operator, Family, and Hired Labor	Large Operator, Family, and Hired Labor[b]
						hours		
Regular Seeding	Apr. 11-May 31	51	50	25.5	13	385.0	385.0	589.0
Late Seeding	May 1-Jun. 10	41	50	20.5	13	309.6	309.6	473.6
Total Seeding	Apr. 11-Jun. 10	61	50	30.5	13	460.6	460.6	704.6
Summer Crop	Jun. 11-Jul. 24	44	80	35.20	10	486.4	732.8	1,014.4
Early Harvest	Jul. 25-Jul. 31	7	65	4.55	12	86.5	118.4	154.8
Regular Harvest	Aug. 1-Sep. 10	41	65	26.65	11	479.8	666.4	879.6
Late Harvest	Sep. 11-Nov. 15	66	60	39.6	9	439.6	439.6	756.4

[a]The actual working days available are predicted at the 90 percent level of probability based on historical weather data. In other words, a farmer would have at least as many actual working days as predicted in 18 out of 20 years.

[b]Includes a full-time hired man.

SOURCE: Eidsvig, D. H., et al., Weather and Profitable Machinery Size, Circular A-534, Department of Agricultural Economics, North Dakota State University, Fargo, August, 1969.

North Dakota Weather-Crop Bulletin, 1960-65, Agricultural Statistics No. 14, Department of Agricultural Economics, North Dakota State University, Fargo, November, 1965.

Sunflowers were limited to 20 percent of total cropland to prevent disease and insect problems associated with more intensive production. The barley and oats could either be sold or used as feed for livestock. Alfalfa and native hay and corn silage were produced only as feed for livestock. Pasture for livestock enterprises was provided by permanent native pasture or alfalfa-brome pasture. Yields, direct costs, and labor requirements for the crops considered are presented in Table 4.

TABLE 4. YIELDS, DIRECT COSTS, AND LABOR REQUIREMENTS FOR CROPS, MEDIUM SIZED FARM, SOUTHEAST CENTRAL NORTH DAKOTA

Crop	Yield Per Acre	Direct Costs	Labor Requirement
			hours
Wheat on Fallow	39.8 bu.	$24.05	2.10
Durum on Fallow	34.3 bu.	24.27	2.10
Barley on Fallow	56.0 bu.	22.49	2.20
Wheat on Nonfallow	32.2 bu.	27.37	1.64
Durum on Nonfallow	27.8 bu.	27.04	1.64
Barley on Nonfallow	50.0 bu.	28.18	1.76
Oats	71.0 bu.	29.61	1.86
Flax	15.0 bu.	18.23	1.39
Rye	40.0 bu.	27.41	1.43
Sunflowers	1,400 lbs.	24.98	1.80
Corn Silage	8 tons	26.83	3.32
Alfalfa Hay[a]	1.84 tons	6.84	1.39
Native Hay--Fert.	1.4 tons	14.08	.58
Native Hay--No Fert.	1.0 tons	2.78	.47
Tame Pasture--Fert.[b]	2.6 AUM's	6.82	.37
Tame Pasture--No Fert.[b]	2.4 AUM's	1.86	.37
Deferred Native Pasture[c]	1.2 AUM's	.42	.10

[a]A five-year rotation using oats as a companion crop. All alfalfa coefficients are based on one-fifth oats and four-fifths alfalfa. Fifty bushels of oats harvested the first year and 2.3 tons of alfalfa the next four years for an adjusted annual yield of 10 bushels of oats and 1.84 tons alfalfa.

[b]One-third alfalfa and two-thirds bromegrass established with oat companion crop in a seven-year rotation. Yield in animal unit months per acre.

[c]Cattle not grazed until July 1. Yield in animal unit months per acre.

The yields used are what can be expected using adequate rates of fertilizer, recommended varieties, and other recommended management practices plus timely operations. Crop and forage yields were approximately 20 percent above average yields for the area. Direct costs included seed, fertilizer, fuel, lubricants, pesticides, machinery repair, crop insurance, custom fertilizer application, and interest on operating capital. The per acre labor

requirements presented in Table 4 for the medium sized farm were slightly greater for the small farm and slightly less for the large farm.

Eight livestock enterprises were considered. It was assumed that farm buildings existed on each representative farm that could be utilized by all livestock. Equipment for beef cattle and hog and sheep finishing was assumed to be available. However, for hog farrowing and dairying, specialized equipment would have to be purchased. The annual costs of this equipment were added to the direct production costs. Production, direct costs, and resource requirements for each class of livestock are summarized in Table 5.

Base Prices

The most profitable farm plan largely depends on the relative product prices. Relative commodity prices in any one year may deviate from their long-term relationship to each other. Long-term average price relationships were used as a base from which to analyze changing prices. Average prices occurring over the 10 years (1963-72) were used for products produced. The base period represents a time of rather stable prices and is long enough not to be unduly influenced by cyclical price patterns. Input prices occurring in 1974 were used for all nonfarm originating inputs.

Base period product prices were increased to account for increased costs and the elimination of most government support payments between the base period and 1974. The increase was calculated so as to generate approximately the same net farm income as occurred during the base period. Increases in prices paid since the base period were accounted for by increasing product prices 53 percent based on the change in the Index of Prices Paid by farmers. Wheat and feed grain payments averaged 16 percent of farm sales during the base period. Product prices were increased another 16 percent to account for the discontinuance of these payments for a total adjustment of 69 percent. Base prices for products used in the analysis are shown in Table 6.

Farm Plans With Base Prices

The farm plan that gives the largest return above variable costs was determined for each farm size. The results shown in Table 7 include optimum enterprise organization resource requirements, as well as two measures of returns.

Variable costs are those costs that change with the farm organization. The fixed costs, such as interest on investment and depreciation of machinery and buildings which do not change with farm organization, are also indicated in Table 7. Return to operator's labor and management is calculated by subtracting the fixed costs from the return above variable costs.

The value of an additional unit of a resource for each farm size is presented in Table 8. Only those resources that are restricting further production would add to net returns. The only resources that were restrictive were land, livestock housing, and labor. The sunflower enterprise could

TABLE 5. PRODUCTION, DIRECT COSTS, AND RESOURCE REQUIREMENTS FOR LIVESTOCK

Livestock	Annual Production	Direct Costs	Resource Requirements				
			Hay Equivalent (tons)	Oat Equivalent (bu.)	Pasture (AUM)	Labor (hrs.)	Housing (sq. ft.)
Beef Cow--Calf Sold	90% calf crop 420 lb. weaning wt.	$ 46.84	2.5	4.7	8.0	9.0	55.0
Beef Cow--Calf Backgrounded	90% calf crop 705 lb. calf sold	56.83	3.0	32.4	8.0	10.8	70.8
Sow--2 Litters, Sell Feeder Pigs	15 - 40 lb. pigs + cull sow	148.00	--	73.5	1.0	28.0	55.0
Sow--2 Litters, Sell Slaughter Hog	14.8 - 225 lb. hogs + cull sow	400.50	--	379.5	1.0	45.9	210.0
Finish Purchased Feeder Pig	221.6 lbs.	40.22	--	22.0	--	2.8	10.0
Background Purchased Calf	707.7 lbs.	179.05	.63	37.5	--	2.4	22.0
Dairy	12,000 lbs. milk 25% culling rate	219.86	5.9	119.2	5.5	59.9	110.0
Ewe - Slaughter Lamb	1.2 lambs/ewe 110 lbs. lambs sold 10 lbs. wool	10.11	.21	8.3	1.8	4.0	20.0

TABLE 6. BASE PRICES USED IN FARM PLANNING ANALYSIS, SOUTHEAST CENTRAL NORTH DAKOTA

Product	Unit	Price
Spring Wheat	bushel	$ 2.70
Durum Wheat	bushel	2.70
All Barley	bushel	1.50
Flax	bushel	4.70
Rye	bushel	1.55
Oats	bushel	.95
Sunflowers	cwt.	7.27
Feeder Steers	cwt.	55.00
Feeder Heifers	cwt.	49.00
Yearling Steers	cwt.	48.00
Yearling Heifers	cwt.	43.50
Slaughter Lambs	cwt.	38.45
Feeder Pigs	head	28.00
Slaughter Hogs	cwt.	35.00
Wool	cwt.	70.00
Milk	cwt.	7.35

also limit returns due to the 20 percent of total cropland acreage limitation placed on it. Therefore, the value of an additional acre of the sunflower enterprise is also presented when it entered at the maximum allowable level. The value of an additional unit of limiting resources is presented in Table 8.

Representative Small Farm

The representative small farm typifies a smaller than average farm in the study area. It consisted of 446 acres of cropland and 114 acres of noncropland. The total labor available on the small representative farm was 4,039 hours per year, which consisted of 2,822 hours of operator labor and 1,217 hours of family labor (Tables 1, 2, and 3). Hiring of additional labor was not allowed because farms of this size generally use only operator and family labor.

Operator labor was 100 percent utilized and family labor was 70 percent utilized in the optimum solution. The return per hour of operator labor and management was $11.17. Livestock generated 64 percent of the total gross farm income, while the remaining 36 percent was generated by crop enterprises.

Sunflowers and wheat on nonfallow were the most profitable crops included in the optimum solution. Sunflowers entered at the maximum level (20 percent of total cropland) allowed by the model. The price of sunflowers would have to fall from $.0727 to $.0634 per pound before sunflowers would be replaced in the optimum solution. The price of wheat would have to fall from $2.70 to $2.64 per bushel before any changes would occur in the

TABLE 7. PROFIT MAXIMUM ENTERPRISE ORGANIZATION, RETURNS AND RESOURCE REQUIREMENTS FOR EACH REPRESENTATIVE FARM, SOUTHEAST CENTRAL NORTH DAKOTA

Item	Unit	Representative Farm		
		Small	Medium	Large
Enterprise Organization				
Wheat Nonfallow	acre	262	457	917
Barley Nonfallow	acre	95	129	146
Rye Nonfallow	acre	--	21	221
Sunflowers Nonfallow	acre	89*	166*	332*
Oats (companion crop)	acre	--	11	8
Alfalfa Hay	acre	--	47	31
Native Hay Unfertilized	acre	--	32*	64*
Native Pasture Unfertilized	acre	--	107*	214*
Cow--Calf--Background Calf	head	--	16	32
Sow--2 Litters, Sell Feeder Pig	sows	101	47	103
Buy Calf--Background	head	--	180	87
Returns				
Return Over Variable Cost	dollar	52,812	70,536	129,809
Fixed Costs	dollar	21,298	30,831	63,223
Return to Operator Labor & Mgmt.	dollar	31,514	39,705	66,586
Resource Requirements				
Total Cropland	acre	446*	831*	1,656*
Livestock Housing	sq. ft.	5,593	7,700*	9,900*
Operating Capital	dollar	23,141	27,382	53,260
Livestock Equipment Capital	dollar	15,254	7,098	15,528
Operator Family & Hired Labor				
Total Winter	hour	1,262*	1,154	1,770
Regular Seeding	hour	212	318	483
Late Seeding	hour	75	142	220
Total Seeding	hour	288	461*	704*
Total Spring	hour	667	659*	1,134*
Summer Crop	hour	48	137	204
Total Summer	hour	531	370	714
Early Harvest	hour	--	50	54
Total Late Summer	hour	78	89	137
Regular Harvest	hour	207	293	602
Total Fall	hour	444	411	617
Late Harvest	hour	215	330	624
Total Late Fall	hour	690	604	1,157
Total Labor	hour	3,672	3,287	5,529

*Resource or enterprise at maximum level.

wheat acreage. Barley (on nonfallow) was produced only for utilization by livestock. No other crop enterprises entered the optimum solutions. The prices (and respective acreages) at which other cash grain enterprises would enter the profit maximizing enterprise organization were: durum, $3.03 (238 acres); flax, $5.03 (130 acres); and barley, $1.77 (238 acres).

TABLE 8. VALUE OF AN ADDITIONAL UNIT OF LIMITING RESOURCES FOR SMALL, MEDIUM, AND LARGE FARMS

Item	Unit	Representative Farm		
		Small	Medium	Large
		- - - - - - dollars - - - - - -		
Cropland	acre	50.85	31.44	31.23
Native Hayland	acre	--	12.26	12.65
Native Pastureland	acre	--	.18	.16
Livestock Housing	sq. ft.	--	.90	.88
Total Winter Labor	hour	17.81	--	--
Total Seeding Labor	hour	--	7.10	16.38
Total Spring Labor	hour	--	43.95	44.39
Sunflowers	acre	12.97	1.23	4.20

Both native pasture and native hay were left unused since no hay or pasture utilizing livestock enterprises were included in the profit maximizing organization. There was not enough native hay or pasture to support a minimum economic beef cow unit which was assumed to be 15 cows.

The livestock enterprises consisted of 102 sows producing feeder pigs for sale. The feeder pig price would have to fall from $28.00 to $27.75 per head before the hog farrowing enterprise would start to be replaced by a farrow and finish hog enterprise. The hog farrowing enterprise would be reduced from 102 to 95 sows at the price of $27.75 per feeder pig.

The marginal value product of cropland of $50.85 per acre was quite high, but would apply only to an additional 29 acres since only 9 percent of the total available labor remained unused.[9] The total winter labor period was the only labor period that was at its limit; however, several other labor periods were very close to their limit. The representative small farm utilized 91 percent of the total available labor.

Representative Medium Farm

The representative medium farm typifies an average sized farm in the study area. It consisted of 831 acres of cropland and 209 acres of noncropland. The total labor available on the representative medium farm was 4,517 hours per year. The total labor available consisted of 2,656 hours of operator labor, 1,217 hours of family labor, and 644 hours of hired labor. Since a charge of $2.30 per hour was made for family labor, it will be considered with hired labor from here on.

[9]The marginal value of product is the increase in the value of the total product associated with each unit of input.

All of the operator's labor plus 631 hours of hired labor was required in the optimum solution. The return per hour of operator labor and management was $14.94. Livestock generated 60 percent of the total gross farm income, while the remaining 40 percent was generated by crop enterprises.

Sunflowers and wheat on nonfallow were the most profitable crops included in the optimum solution. Sunflowers entered at the maximum allowed by the model; however, the price of sunflowers would only have to fall from $.0727 to $.0718 per pound before the sunflower acreage would be reduced in the optimum solution. The price of wheat would have to fall from $2.70 to $2.66 per bushel before any changes in the wheat acreage would occur. Barley was produced only for utilization by livestock. Oats, raised as a companion crop for establishing alfalfa, was also utilized by livestock. Winter rye entered the optimum solution due to restrictions of total spring seeding labor. No other grain crop enterprises entered the optimum solution. The prices (and respective acreages) at which the cash grain enterprises would enter the profit maximizing enterprise organization were durum, $3.03 (456 acres); flax, $5.10 (59 acres); and barley, $1.75 (106 acres).

Native hay and pasture entered the optimum solution at their maximum levels to provide roughage for the beef cow herd. Also, alfalfa hay entered the optimum solution at 47 acres for additional livestock forage.

The livestock enterprises consisted of 47 sows producing feeder pigs, a buy November calf-background activity at 180 head, and 16 beef cows with calves backgrounded. A reduction in the feeder pig price from $28.00 per head to $24.28 would cause the hog farrowing enterprise to fall to 36 sows. The backgrounding enterprise utilized free operator winter labor and was price sensitive. A $.005 per pound reduction in the sell April steer and heifer prices would result in a 84-head reduction in the backgrounding enterprise.

The marginal value product of cropland of $31.44 per acre would apply only to an additional seven acres of cropland. The marginal value product of total seeding labor of $7.10 would only apply to an additional 10 hours of labor. An additional 25 hours of total spring labor could be added at a marginal value product of $43.95 per hour.

Representative Large Farm

The representative large farm typifies a larger than average farm in the study area. It consisted of 1,656 acres of cropland and 424 acres of noncropland. The total labor available was 7,079 hours per year. The total labor available consisted of 2,578 hours of operator labor; 1,217 hours of family labor; and 3,276 hours of hired labor. The hired labor included a full-time hired man. Family labor had a charge of $2.30 per hour so it will be included with hired labor from here on.

A total of 2,578 hours of operator labor and 2,951 hours of hired labor was required in the optimum solutions. The return per hour of operator labor and management was $25.82. The crop enterprises generated 59 percent of the total gross farm income, while the remaining 41 percent was generated by livestock.

Sunflowers and wheat on nonfallow were the most profitable crops included in the optimum solution. Sunflowers entered at the maximum acreage allowed by the model. The price of sunflowers would have to fall from $.0727 to $.0699 per pound before the sunflower acreage would be reduced. The price of wheat would only have to fall from $2.70 to $2.69 per bushel before any changes would occur in the wheat acreage. Barley (on nonfallow and early harvest nonfallow) was produced only for utilization by livestock. Oats, as a companion crop for alfalfa production, was also utilized by livestock. Winter rye entered the optimum solution because the total spring seeding labor supply was used up. No other crop enterprises entered the optimum solution. The prices and respective acreages at which other cash grain enterprises would enter the profit maximizing enterprise organization were: durum, $3.03 (904 acres); flax, $5.16 (103 acres); and barley, $1.76 (819 acres).

The livestock enterprises that entered the optimum solution consisted of a 32-head cow-calf operation (background calf), 103 sows producing feeder pigs, and a buy November calf-background activity that entered at 87 head to utilize available winter labor. The livestock enterprises together utilized all the native hay and pasture and also required 31 acres of alfalfa hay. The hog farrowing operation was the most profitable livestock enterprise. The price of feeder pigs would have to be reduced from $28.00 to $24.12 per head before the hog farrowing enterprise would be affected. Such a price change would cause the number of sows to decrease to 32 head.

The marginal value product of cropland of $32.53 per acre would apply to an additional 25 acres of cropland. The most limiting labor period was the total spring labor period. The marginal value products of total spring labor were $44.39 and would apply to an additional 59 hours of labor. An additional 90 hours of total seeding labor would be added to the optimum solution at a marginal value product of $16.78.

Wheat Price Analysis

The effects of changing prices upon the most profitable farm plan are analyzed in this section.

Both spring wheat and durum prices were varied from $1.95 to $8.70 per bushel (by $.25 increments), while holding all other crop and livestock prices constant. Table 6 presents a listing of all the crop and livestock prices used.

Representative Small Farm

A summary of the results of the wheat price variations for the representative small farm is presented in Table 9. At the highest and lowest prices considered, 90 percent of the total available labor was utilized. The return to operator labor and management varied from $10.97 to $33.03 per hour at the low and high wheat price levels, respectively.

Livestock generated 65 percent of the gross farm income and crops the remaining 35 percent, with wheat at $1.95 per bushel. The situation was

TABLE 9. RESOURCE REQUIREMENTS, ENTERPRISE ORGANIZATION, AND RETURNS FOR VARIATIONS IN WHEAT PRICES, REPRESENTATIVE SMALL FARM, SOUTHEAST CENTRAL NORTH DAKOTA

Item	Unit	Wheat Price						
		1.95-2.20	2.45	2.70	3.20	7.45	7.70	8.70
Return Over Variable Cost[a]	dollar	51,280	51,478	52,847	56,770	100,840	103,437	113,825
Fixed Costs	dollar	20,625	20,625	20,625	20,625	20,625	20,625	20,625
Return to Operator Labor and Management[a]	dollar	30,655	30,853	32,222	37,145	80,215	82,812	93,200
Total Cropland	acre	446*	446*	446*	446*	446*	446*	446*
Livestock Housing	sq. ft.	6,050*	6,050*	6,009	5,856	5,814	5,814	5,814
Operating Capital	dollar	21,454	21,515	22,990	23,113	23,077	23,077	23,077
Livestock Equipment Capital	dollar	14,748	14,814	14,701	14,863	14,836	14,836	14,836
Operator, Family, and Hired Labor:								
Total Winter	hour	1,262*	1,262*	1,262*	1,262*	1,262*	1,262*	1,262*
Regular Seeding	hour	103	108	210	265	265	265	265
Late Seeding	hour	188	182	76	--	--	--	--
Total Seeding	hour	291	289	286	265	265	265	265
Total Spring	hour	671	670	664	642	646	646	646
Summer Crop	hour	62	62	64	70	71	71	71
Total Summer	hour	534	536	534	544	546	546	546
Early Harvest	hour	--	--	--	--	--	--	--
Total Late Summer	hour	77	77	77	77	77	77	77
Regular Harvest	hour	113	114	208	256	256	256	256
Total Fall	hour	347	349	440	490	491	491	491
Late Harvest	hour	271	270	214	162	162	162	162
Total Late Fall	hour	740*	740*	681	631	632	632	632
Total Labor	hour	3,631	3,634	3,658	3,646	3,654	3,654	3,654
Enterprise Organization:								
Wheat Nonfallow	acre	--	85	258	351	353	353	353
Early Harvest Barley Nonfallow	acre	--	--	--	--	--	--	--
Barley Nonfallow	acre	168	95	94	95	93	93	93
Oats (companion crop)	acre	1	1	1	--	--	--	--
Sunflowers Nonfallow	acre	89*	89*	89*	--	--	--	--
Flax Nonfallow	acre	185	173	--	--	--	--	--
Native Hay Unfertilized	acre	17*	17*	17*	17*	17*	17*	17*
Alfalfa Hay	acre	4	4	4	0	0	0	0
Tame Pasture Fertilized	acre	--	--	--	--	--	--	--
Tame Pasture Unfertilized	acre	--	--	--	--	--	--	--
Native Pasture Unfertilized	acre	58*	58*	58*	38	45	45	45
Sow--2 Litters, Sell Feeder Pigs	head	98	99	98	99	99	99	99
Sow--2 Litters, Sell Slaughter Hogs	head	2	--	--	--	--	--	--
Buy Calf--Background	head	--	--	--	--	--	--	--
Cow-Calf--Background Calf	head	9	9	9	6	0	0	0
Livestock Feed:								
Oats	bushel	40	40	40	--	--	--	--
Barley	bushel	4,768	4,759	4,724	4,738	4,632	4,632	4,632

*Resource or enterprise at maximum level.

[a]For lower wheat price.

almost completely reversed at the $8.70 per bushel level. At that wheat price, livestock generated only 34 percent of the total gross farm income, while crops generated 66 percent.

Flax and sunflowers were the most profitable cash crops, with wheat in the $1.95 to $2.20 per bushel range. Barley was produced for livestock feed. At a wheat price of $2.45 per bushel, part of the flax acreage was replaced by wheat. Barley acreage was also reduced causing the backgrounding activity to disappear. Flax was completely replaced by wheat in the optimum enterprise organization at a wheat price of $2.70 per bushel. The livestock enterprises remained unchanged. Wheat replaced sunflowers at a wheat price of $3.20 per bushel, and at a price of $2.45 the hog finishing enterprise was eliminated due to the decreasing barley (for feed) acreage.

It should be noted that even at the highest level of wheat prices of $8.70 per bushel, 93 acres of cropland remained in production of barley for livestock. This indicates that the hog farrowing enterprise was very profitable since crop labor was not limiting. The primary limiting resource on the representative small farm was cropland. The marginal value product per acre of cropland varied from $33.94 to $231.54 at the lowest and highest wheat price levels considered, respectively.

Representative Medium Farm

A summary of the results of the wheat price variation for the representative medium farm is presented in Table 10. At the lowest wheat price considered, 73 percent of the total available labor was utilized compared to a 54 percent utilization of total available labor at the highest wheat price considered. The return to operator labor and management varied from $13.83 to $71.93 per hour at the low and high wheat price levels, respectively.

Livestock generated 63 percent of the gross farm income and crops generated 37 percent, with wheat at $1.95 per bushel. The crop enterprises generated 97 percent of the gross farm income, while the livestock enterprises generated only 3 percent of the highest wheat price considered ($8.70).

Flax, sunflowers, and barley were the most profitable cash crops with the wheat price in the $1.95 to $2.20 per bushel range. About half of the barley production was utilized by livestock and the rest sold. Some of the flax acreage was replaced by wheat at a wheat price of $2.45, but flax was not totally replaced until wheat reached a price of $2.70. At that price wheat became the primary cash crop and all barley production was for livestock feed. Wheat partially replaced sunflowers at a wheat price of $2.95. The livestock enterprises remained relatively stable until wheat reached a price of $4.20 per bushel and then the backgrounding enterprise was substantially reduced. At a $4.70 wheat price, backgrounding was eliminated completely due to the reduction in barley acreage caused by the increased wheat acreage. The total spring labor period was limiting at the lowest wheat price; but, as wheat prices increased, the total seeding and regular seeding labor periods also became limiting. (The most limiting labor period was the regular seeding labor period. The marginal value product of an hour of labor during this period was $333.75 at the highest wheat price considered.)

TABLE 10. RESOURCE REQUIREMENTS, ENTERPRISE ORGANIZATION, AND RETURNS FOR VARIATIONS IN WHEAT PRICES, REPRESENTATIVE MEDIUM FARM, SOUTHEAST CENTRAL NORTH DAKOTA

Item	Unit	Wheat Price						
		1.95-2.20	2.45	2.70	2.95	4.20	4.70	8.70
Return Over Variable Cost[a]	dollar	66,924	67,520	70,537	74,803	97,621	107,653	190,725
Fixed Costs	dollar	30,831	30,831	30,831	30,831	30,831	30,831	30,831
Return to Operator Labor and Management[a]	dollar	36,093	36,689	39,706	43,972	66,790	76,822	159,894
Total Cropland	acre	831*	831*	831*	831*	831*	831*	831*
Livestock Housing	sq. ft.	7,700*	7,700*	7,700*	7,700*	5,025	3,744	2,140
Operating Capital	dollar	25,080	26,151	27,382	28,006	27,048	26,800	23,112
Livestock Equipment Capital	dollar	7,609	8,140	7,099	7,748	7,099	7,099	6,288
Operator, Family, and Hired Labor:								
Total Winter	hour	1,171	1,196*	1,155	1,182	890	763	640
Regular Seeding	hour	138	180	318	385*	385*	385*	385*
Late Seeding	hour	310*	259	143	59	76	76	76
Total Seeding	hour	448	438	461*	444	461*	461*	461*
Total Spring	hour	659*	659*	659*	659*	659*	659*	659*
Summer Crop	hour	130	126	137	149	133	125	136
Total Summer	hour	380	391	371	403	367	359	243
Early Harvest	hour	20	18	51	55	45	38	12
Total Late Summer	hour	61	61	89	96	83	76	29
Regular Harvest	hour	185	224	293	337	327	329	358
Total Fall	hour	311	357	411	465	445	447	425
Late Harvest	hour	425	411	331	273	297	309	293
Total Late Fall	hour	713*	713*	604	564	546	546	423
Total Labor	hour	3,295	3,377	3,289	3,369	2,990	2,850	2,419
Enterprise Organization:								
Wheat Nonfallow	acre	--	197	457	582	636	661	691
Early Harvest Barley Nonfallow	acre	--	--	73	99	75	50	22
Barley Nonfallow	acre	250	131	56	29	--	--	--
Early Harvest Rye Nonfallow	acre	40	35	21	--	7	21	--
Rye Nonfallow	acre	9	33	--	--	--	--	--
Oats (companion crop)	acre	11	10	12	11	5	1	6
Sunflowers Nonfallow	acre	166*	166*	166*	65	89	91	88
Flax Nonfallow	acre	310	217	--	--	--	--	--
Alfalfa Hay	acre	45	42	46	44	19	6	24
Native Hay Unfertilized	acre	32*	32*	32*	32*	32*	32*	32*
Tame Pasture Unfertilized	acre	--	--	--	--	--	--	--
Native Pasture Unfertilized	acre	107*	87	107*	107*	107*	107*	107*
Cow-Calf--Sell Feeder Calf	head	--	--	--	--	--	--	6
Cow-Calf--Background Calf	head	16	13	16	16	16	16	--
Sow--2 Litters, Sell Feeder Pigs	head	51	54	47	52	47	47	4
Buy Calf--Background	head	171	172	180	169	58	--	--
Livestock Feed:								
Oats	bushel	560	522	584	553	237	71	303
Barley	bushel	6,420	6,565	6,448	6,412	3,773	2,493	1,096

*Resource or enterprise at maximum level.

[a]For lower wheat price.

Eighty-three percent of the cropland was producing wheat; 6 percent was for livestock hay, pasture, and feed; and the remaining 11 percent was in sunflowers at the highest wheat price range.

Representative Large Farm

A summary of the results of the variation in wheat prices for the representative large farm is presented in Table 11. Seventy-nine percent of the total available labor was utilized at the lowest wheat prices considered, compared to a 63 percent utilization of total available labor at the highest wheat prices considered. The return to operator labor and management varied from $21.97 to $108.86 per hour at the low and high wheat prices, respectively.

Crop enterprises generated 59 percent of the total gross farm income and livestock the remaining 41 percent with wheat at $1.95 per bushel. With wheat at the highest price considered ($8.70), the crop enterprise generated 91 percent of the total gross farm income, while livestock generated 9 percent.

Flax, sunflowers, and barley were the most profitable cash crops with wheat prices in the $1.95 to $2.20 per bushel range. About one-third of the barley production was utilized as livestock feed and the remainder as seed. Wheat completely replaced flax at a wheat price of $2.95. Wheat became the primary cash crop at this price and all barley production was for livestock feed. Wheat at $2.95 partially replaced sunflowers; but due to spring seeding labor limitations, wheat did not completely replace sunflowers. The livestock enterprises remained stable until a wheat price of $4.20 was reached and then the backgrounding enterprise was reduced. Backgrounding (both buy calf-background and cow-calf--background calf) were eliminated at the highest wheat price. A cow-calf operation replaced them.

Total seeding labor and total spring labor were limiting at all prices of wheat. The regular seeding labor period also became limiting at a wheat price of $2.95 and higher. The regular seeding labor period had a marginal value product of $389.24 per hour at the highest wheat price of $8.70 per bushel.

Increases in Fertilizer and Fuel Prices

Fertilizer and fuel prices were both increased by 10 percent increments up to a 100 percent increase in prices. Fertilizer and fuel prices were both in this section increased simultaneously since they are both tied to energy. The base fertilizer and fuel prices that were increased are: nitrogen, $.18 per pound; phosphate, $.16 per pound; diesel fuel, $.36 per gallon; gas (tax refundable), $.37 per gallon; and gas (nontax refundable), $.48 per gallon.

Representative Small Farm

A summary of the results of the base model parameterizations of fertilizer and fuel prices on the representative small farm is presented

TABLE 11. RESOURCE REQUIREMENTS, ENTERPRISE ORGANIZATION, AND RETURNS FOR VARIATIONS IN WHEAT PRICES, REPRESENTATIVE LARGE FARM, SOUTHEAST CENTRAL NORTH DAKOTA

Item	Unit	Wheat Price					
		1.95-2.20	2.45	2.95	4.20	5.95	8.70
Return Over Variable Cost[a]	dollar	119,874	121,994	136,003	178,204	240,366	342,341
Fixed Costs	dollar	63,223	63,223	63,223	63,223	63,223	63,223
Return to Operator Labor and Management[a]	dollar	56,651	58,771	72,780	114,981	177,143	279,118
Total Cropland	acre	1,656*	1,656*	1,656*	1,656*	1,656*	1,656*
Livestock Housing	sq. ft.	9,900*	9,900*	9,900*	7,977	9,900*	5,543
Operating Capital	dollar	50,153	51,131	53,703	53,311	48,768	41,806
Livestock Equipment Capital	dollar	15,206	15,529	15,529	15,529	13,277	11,614
Operator, Family, & Hired Labor:							
Total Winter	hour	1,840	1,761	1,772	1,580	1,580	1,279
Regular Seeding	hour	268	372	589*	589*	589*	589*
Late Seeding	hour	437	333	116	116	116	116
Total Seeding	hour	705*	705*	705*	705*	705*	705*
Total Spring	hour	1,135*	1,135*	1,135*	1,135*	1,135*	1,135*
Summer Crop	hour	195	202	224	212	249	262
Total Summer	hour	647	712	735	722	712	462
Early Harvest	hour	55	55	55	55	48	13
Total Late Summer	hour	128	137	137	137	123	46
Regular Harvest	hour	405	489	676	669	639	688
Total Fall	hour	638	746	933	925	881	823
Late Harvest	hour	756*	694	533	546	454	455
Total Late Fall	hour	1,228*	1,228*	1,066	1,062	940	716
Total Labor	hour	5,616	5,719	5,778	5,561	5,371	4,459
Enterprise Organization:							
Wheat Nonfallow	acre	--	666	1,453	1,191	1,217	1,284
Early Harvest Barley Nonfallow	acre	103	103	103	103	90	25
Barley Nonfallow	acre	469	43	43	5	--	--
Early Harvest Rye Nonfallow	acre	--	--	--	--	--	--
Rye Nonfallow	acre	248	227	146	167	--	--
Oats (companion crop)	acre	6	8	8	3	32	34
Sunflowers Nonfallow	acre	332*	332*	171	175	150	149
Flax Nonfallow	acre	472	245	--	--	--	--
Alfalfa Hay	acre	25	31	31	11	54	78
Native Hay Unfertilized	acre	64*	64*	64*	64*	64*	64*
Tame Pasture Unfertilized	acre	--	--	--	--	113	87
Native Pasture Unfertilized	acre	214*	214*	214*	214*	214*	214*
Cow-Calf--Sell Feeder Calf	head	--	--	--	--	4	43
Cow-Calf--Background Calf	head	28	32	32	32	68	--
Sow--2 Litters, Sell Feeder Pigs	head	84	104	104	104	89	--
Buy Calf--Background	head	21	87	87	--	--	--
Livestock Feed:							
Oats	bushel	318	392	392	143	1,632	1,712
Barley	bushel	8,173	7,322	7,322	5,399	4,497	1,237

*Resource or enterprise at maximum level.

[a]For lower wheat price.

in Table 12.[10] The return per hour of operator labor and management varied from $11.56 to $10.04 at the 0 and 100 percent increase levels of fuel and fertilizer prices, respectively. The profit maximizing enterprise organization was not affected until the increase in fuel and fertilizer prices reached the 70 percent level. At this level, 127 acres of wheat on nonfallow were replaced by flax on nonfallow due to the lower fertilizer requirements of flax. An additional 46 acres of wheat was replaced by flax at the 80 percent level of increase in fuel and fertilizer prices. The remaining 85 acres of wheat on nonfallow remained in wheat on nonfallow at the 90 percent level, but at a lower rate of nitrogen fertilization--40 pounds of actual nitrogen applied per acre compared to 50 pounds previously.

Representative Medium Farm

A summary of the results of the base model parameterizations of fertilizer and fuel prices on the representative medium farm is presented in Table 13. The return per hour of operator labor and management varied from $14.95 to $12.12 at the 0 and 100 percent increase levels of fuel and fertilizer prices, respectively. The profit maximizing enterprise organization was not affected until fertilizer and fuel prices were increased by 80 percent. The fertilizer and fuel price increases of 80 percent resulted in 174 acres of wheat on nonfallow to be replaced by flax on nonfallow due to the lower fertilizer requirements of flax. All of the wheat on nonfallow (50#N) and rye on nonfallow were diverted into lower fertilization enterprises when fertilizer and fuel prices were increased by 90 percent. This acreage was diverted into wheat on fallow, flax on nonfallow, and the remainder into wheat on nonfallow with 40 pounds of actual nitrogen applied per acre (as compared to 50 pounds of actual nitrogen applied per acre previously).

Representative Large Farm

A summary of the results of the base model parameterizations of fuel and fertilizer prices on the representative large farm is presented in Table 14. The return per hour of operator labor and management varied from $25.83 to $18.85 at the 0 and 100 percent increase levels of fuel and fertilizer prices, respectively. The profit maximizing enterprise organization was not affected until fertilizer and fuel prices were increased by 90 percent. The fertilizer and fuel price increase of 90 percent resulted in 917 acres of wheat on nonfallow (50#N) and 221 acres of rye on nonfallow being replaced by wheat on fallow (304 acres) and flax on nonfallow (530 acres) due to their lower fertilizer requirements.

The major reason for enterprise organization changes occurring at successively higher fertilizer and fuel price increase levels for each increase in farm size (i.e., the enterprise organization changes at the 70, 80, and 90 percent levels of increase in fertilizer and fuel prices for the small, medium, and large representative farms, respectively) was that variable costs and labor requirements were decreasing. Some economies of size were realized from the small to the medium to the large representative farm.

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[10] Parameterizing is varying by increments the price received for a product or an item of production, while holding all other crop and livestock prices constant.

TABLE 12. RESOURCE REQUIREMENTS, ENTERPRISE ORGANIZATION, AND RETURNS FOR INCREASES IN FERTILIZER AND FUEL PRICES, REPRESENTATIVE SMALL FARM, SOUTHEAST CENTRAL NORTH DAKOTA

Item	Unit	Percent Increase in Fertilizer and Fuel Prices			
		0-60%	70%	80%	90%-100%
Return Over Variable Cost[a]	dollar	53,256	49,539	49,116	48,724
Fixed Costs	dollar	20,625	20,625	20,625	20,625
Return to Operator Labor and Management	dollar	32,631	28,914	28,491	28,099
Total Cropland	acre	446*	446*	446*	446*
Livestock Housing	sq. ft.	6,009	6,040	6,050*	6,050*
Operating Capital	dollar	22,990	21,906	21,515	21,280
Livestock Equipment Capital	dollar	14,701	14,784	14,815	14,815
Operator, Family, and Hired Labor:					
Total Winter	hour	1,262*	1,262*	1,262*	1,262*
Regular Seeding	hour	210	135	108	108
Late Seeding	hour	76	154	182	182
Total Seeding	hour	286	289	290	290
Total Spring	hour	664	668	670	670
Summer Crop	hour	64	62	62	62
Total Summer	hour	534	535	536	536
Early Harvest	hour	--	--	--	--
Total Late Summer	hour	76	77	77	77
Regular Harvest	hour	208	139	114	114
Total Fall	hour	440	373	349	349
Late Harvest	hour	214	255	270	270
Total Late Fall	hour	681	724	740*	740*
Total Labor	hour	3,657	3,639	3,634	3,634
Enterprise Organization:					
Wheat Nonfallow (50#N)	acre	258	131	85	--
Wheat Nonfallow (40#N)	acre	--	--	--	85
Barley Nonfallow	acre	94	95	95	95
Oats (companion crop)	acre	1	1	1	1
Sunflowers Nonfallow (20#N)	acre	89*	89*	89*	89*
Flax Nonfallow (10#N)	acre	--	127	173	173
Tame Pasture Unfertilized	acre	--	--	--	--
Native Pasture Unfertilized	acre	58*	58*	58*	58*
Sow--2 Litters, Sell Feeder Pigs	head	98	99	99	99
Sow--2 Litters, Sell Slaughter Hogs	head	--	--	--	--
Livestock Feed:					
Oats	bushel	40	40	40	40
Barley	bushel	4,724	4,750	4,759	4,759

*Resource or enterprise at maximum level.

[a]For lower percentage increase.

TABLE 13. RESOURCE REQUIREMENTS, ENTERPRISE ORGANIZATION, AND RETURNS FOR INCREASES IN FERTILIZER AND FUEL PRICES, REPRESENTATIVE MEDIUM FARM, SOUTHEAST CENTRAL NORTH DAKOTA

Item	Unit	Price Increase in Fertilizer and Fuel Prices		
		0-70%	80%	90%-100%
Return Over Variable Cost[a]	dollar	70,537	62,911	62,149
Fixed Costs	dollar	30,831	30,831	30,831
Return to Operator Labor and Management[a]	dollar	39,706	32,080	31,318
Total Cropland	acre	831*	831*	831*
Livestock Housing	sq. ft.	7,700*	7,700*	7,700*
Operating Capital	dollar	27,382	25,861	23,599
Livestock Equipment Capital	dollar	7,099	7,099	7,099
Operator, Family, and Hired Labor:				
Total Winter	hour	1,155	1,148	1,138
Regular Seeding	hour	318	224	151
Late Seeding	hour	143	237	310*
Total Seeding	hour	461*	461*	461*
Total Spring	hour	659*	659*	659*
Summer Crop	hour	137	135	143
Total Summer	hour	371	369	377
Early Harvest	hour	51	23	1
Total Late Summer	hour	89	61	39
Regular Harvest	hour	293	239	189
Total Fall	hour	411	357	307
Late Harvest	hour	331	378	388
Total Late Fall	hour	604	651	661
Total Labor	hour	3,289	3,245	3,181
Enterprise Organization:				
Summer Fallow	acre	--	--	30
Wheat Nonfallow (20#N)	acre	--	--	28
Wheat Nonfallow (40#N)	acre	--	--	111
Wheat Nonfallow (50#N)	acre	457	283	--
Early Harvest Barley Nonfallow	acre	73	23	--
Barley Nonfallow	acre	56	106	129
Early Harvest Rye Nonfallow (70#N)	acre	21	21	--
Oats (companion crop)	acre	12	12	12
Sunflowers Nonfallow (20#N)	acre	166*	166*	166*
Flax Nonfallow (10#N)	acre	--	174	309
Alfalfa Hay	acre	46	46	46
Native Hay Unfertilized	acre	32*	32*	32*
Native Pasture Unfertilized	acre	107*	107*	107*
Cow-Calf--Background Calf	head	16	16	16
Sow--2 Litters, Sell Feeder Pigs	head	47	47	47
Buy Calf--Background	head	180	180	180
Livestock Feed:				
Oats	bushel	584	584	584
Barley	bushel	6,448	6,448	6,448

*Resource or enterprise at maximum level.

[a]For lower percentage increase.

TABLE 14. RESOURCE REQUIREMENTS, ENTERPRISE ORGANIZATION, AND RETURNS FOR INCREASES IN FERTILIZER AND FUEL PRICES, REPRESENTATIVE LARGE FARM, SOUTHEAST CENTRAL NORTH DAKOTA

Item	Unit	Percent Increase in Fertilizer and Fuel Prices	
		0-80%	90%-100%
Return Over Variable Cost[a]	dollar	129,810	111,806
Fixed Costs	dollar	63,223	63,223
Return to Operator Labor and Management[a]	dollar	66,587	48,583
Total Cropland	acre	1,656*	1,656*
Livestock Housing	sq. ft.	9,900*	9,900*
Operating Capital	dollar	53,260	39,805
Livestock Equipment Capital	dollar	15,529	15,529
Operator, Family, and Hired Labor:			
Total Winter	hour	1,770	1,711
Regular Seeding	hour	484	241
Late Seeding	hour	220	464
Total Seeding	hour	705*	705*
Total Spring	hour	1,135*	1,135*
Summer Crop	hour	205	276
Total Summer	hour	715	786
Early Harvest	hour	132	21
Total Late Summer	hour	214*	104
Regular Harvest	hour	525	293
Total Fall	hour	782	550
Late Harvest	hour	624	565
Total Late Fall	hour	1,158	1,098
Total Labor	hour	5,774	5,384
Enterprise Organization:			
Summer Fallow	acre	--	305
Wheat on Fallow (20#N)	acre	--	304
Wheat Nonfallow (50#N)	acre	917	--
Early Harvest Barley Nonfallow	acre	39	22
Barley Nonfallow	acre	108	124
Early Harvest Rye Nonfallow (70#N)	acre	221	--
Oats (companion crop)	acre	8	8
Sunflowers Nonfallow (20#N)	acre	332*	332*
Flax Nonfallow (10#N)	acre	--	530
Alfalfa Hay	acre	31	31
Native Hay Unfertilized	acre	64*	64*
Native Pasture Unfertilized	acre	214*	214*
Cow-Calf--Sell Feeder Calf	head	--	--
Sow--2 Litters	head	104	104
Buy Calf--Background	head	87	87
Livestock Feed:			
Oats	bushel	392	392
Barley	bushel	7,322	7,322

*Resource or enterprise at maximum level.

[a]For lower percentage increase.