12-1-1969

Effect of Alternative Wheat and Feed Grain Prices on Optimum Farm Plans and Income, Faulk and Potter Counties, South Dakota

E. O. Ulrich

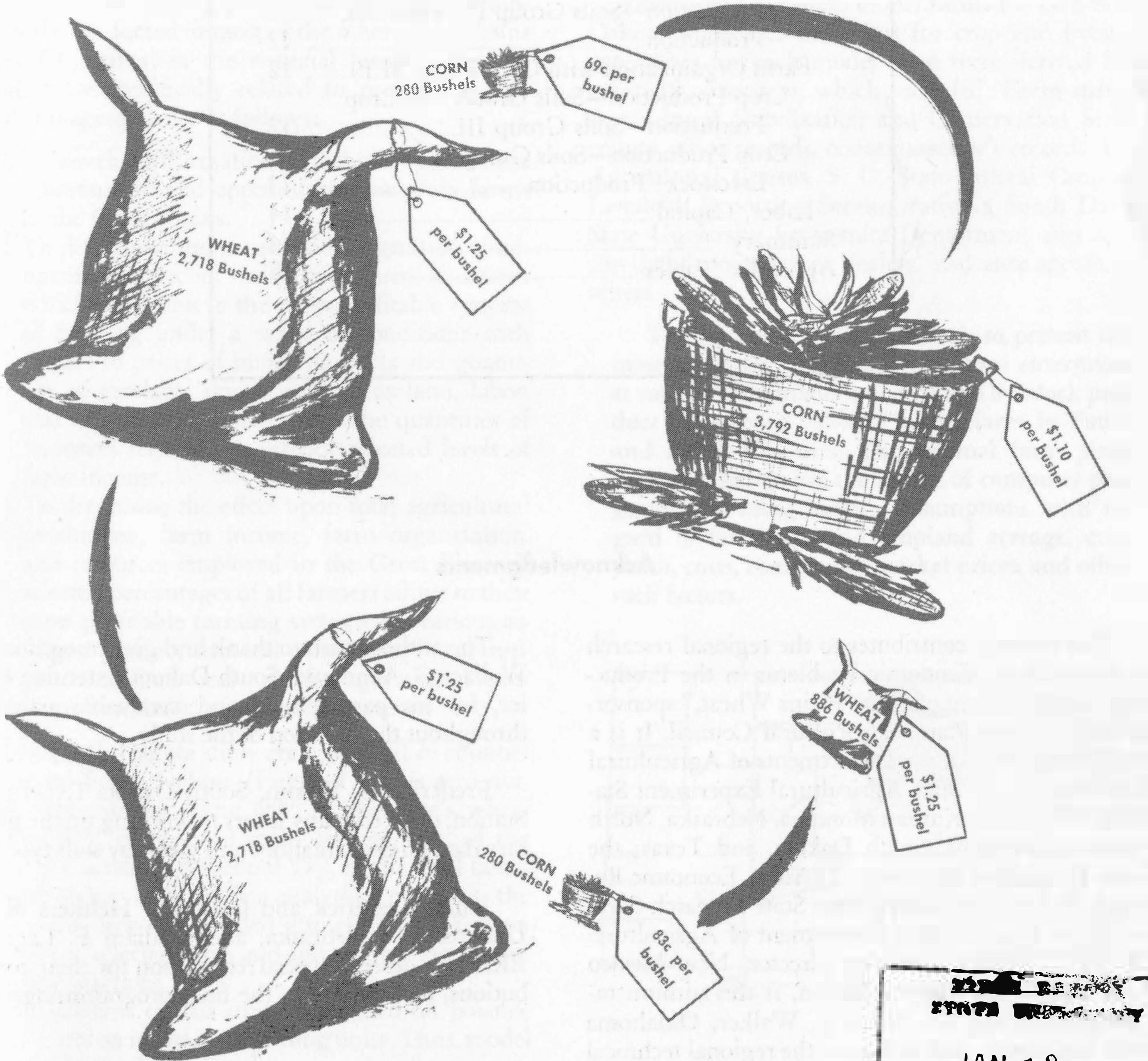
J. T. Sanderson

Experiment Station Bulletin No. 562
December 1969

Effect of Alternative Wheat and Feed Grain Prices on Optimum Farm Plans and Income in North Central South Dakota

Faulk and Potter Counties

Department of Economics in cooperation with
Farm Production Economics Division, Economic Research Service
U.S. Department of Agriculture



SOUTH DAKOTA STATE UNIVERSITY
Agricultural Experiment Station
Brookings, South Dakota

CONTENTS

Acknowledgments

This research contributes to the regional research project—GP-5, "Economic Problems in the Production and Marketing of Great Plains Wheat," sponsored by the Great Plains Agricultural Council. It is a cooperative effort of the Departments of Agricultural Economics in the State Agricultural Experiment Stations of Colorado, Kansas, Montana, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas; the Farm Production Economics Division, Economic Research Service, and Cooperative State Research Service, of the United States Department of Agriculture. Dr. M. L. Wilson, associate director, New Mexico Agricultural Experiment Station, is the administrative adviser, and Dr. Odell L. Walker, Oklahoma State University, is chairman of the regional technical committee.

The authors wish to thank and give recognition t Wallace G. Aanderud, South Dakota Extension Serv ice, for his participation and invaluable assistanc throughout the duration of the study.

Frederick C. Westin, South Dakota Experimer Station, devoted many hours to working up the nece sary data on crop rotations and yields by soils type.

James Kendrick and Glenn A. Helmers of th University of Nebraska, and William F. Lagron ERS, also deserve special recognition for their contri butions, particularly in the final programming.

PREFACE

The purpose of this report is to present some results of a cooperative research project between the South Dakota Agricultural Experiment Station and the Farm Production Economics Division, Economic Research Service, U. S. Department of Agriculture. This research contributes to a larger project—GP-5, "Economic Problems in the Production and Marketing of Great Plains Wheat."

The general objectives of the research undertaken in South Dakota were: (1) To provide economic data needed by farmers to make profitable adjustments in their farming systems and production practices, and (2) To develop a research background for evaluating government farm programs under varying assumptions.

Similar contributing projects to GP-5 were simultaneously conducted in most of the other Great Plains states. Objectives in the regional research project which were specifically related to production and farm management are as follows:

1. To develop information on technical production relationships and opportunities for grain farms in the Great Plains.
2. To determine the nature and magnitude of adjustments needed in specific farm situations which will achieve the most profitable systems of farming under a range of conditions with respect to prices of major products and quantities of available resources, such as land, labor. and capital, and to determine the quantities of resources required to provide selected levels of farm income.
3. To determine the effect upon total agricultural production, farm income, farm organization. and resources employed in the Great Plains if selected percentages of all farmers adjust to their most profitable farming systems for various assumed product demand conditions, factor supply conditions and specific agricultural programs and institutional arrangements.

The South Dakota study area included 26 counties in Central South Dakota (Figure 1). This area normally accounts for about 68% of the state's wheat acreage, 43% of the feed grain acreage, 60% of the state's flax acreage, and about 55% of the total tame- and native-hay acreage. For analytical purposes, the GP-5 study area was divided into eight sub-areas on the basis of selected farm and soil characteristics and cropping practices.

The analysis of this study was based on possible adjustments on individual farming units. Thus, model farms were developed to represent a significant number, group, or segment of farms within a defined geographic area. Model farms were grouped on the basis of similar characteristics, plus similar alternative production opportunities. Determining characteristics for grouping farms into model or typical farms included: Farm size, proportion of cropland to native hay and rangeland, soil characteristics, land use and tillage practices, farm organization and enterprise, labor use and labor availability.

In all, 14 model farms were developed in the eight sub-areas of the 26-county study. Characteristics were so similar in four sub-areas that only one model farm was needed in each, but in the remaining areas there existed enough diversity to require three model farms in each of two sub-areas and two model farms in each of the other two.

Data used to develop model farms for each South Dakota study area and costs for crop and livestock enterprises for each model farm were derived from a variety of sources, which included: Farm surveys, Agricultural Stabilization and Conservation Service county office records, county assessor's records, U. S. Agricultural Census, S. D. State-Federal Crop and Livestock Reporting Service statistics, South Dakota State University Economics Department and actual cost data from machine dealers, insurance agents, and others.

The purpose of this bulletin is to present the most profitable combination of farm enterprises at various combinations of crop and livestock product prices on a 960-acre model farm in Faulk and Potter Counties. The optimal farm plans presented herein are the results of computer programming using specific assumptions with regard to farm size and cropland acreage, crop yields, costs, commodity market prices, and other such factors.

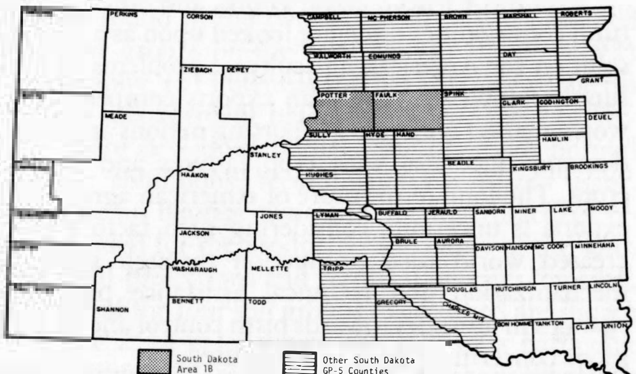


Figure 1. South Dakota GP-5 Study Area.

Effect of Alternative Wheat and Feed Grain Prices on Optimum Farm Plans and Income

Faulk and Potter Counties, South Dakota

By Erwin O. Ullrich Jr. and
John T. Sanderson*

INTRODUCTION

The United States has witnessed rapid technological advances in agricultural production over the past several decades. At the same time, changes in the nature of demand also have occurred. These two phenomena have helped to create or further aggravate an imbalance between supply and demand for specific agricultural commodities. **Stated differently, the nation's productive capacity for wheat greatly exceeds the domestic needs and export demand at satisfactory prices under free market conditions.**

Associated with technological advancement in agriculture is the trend toward fewer and larger farms. In 1967, 31.5% of the nation's farms accounted for 85.1% of the total farm cash receipts.[1]

The upward trend in U. S. per capita income has been associated with a declining per capita consumption of wheat and wheat products; total domestic consumption, however, remains fairly constant. With a continued increase in income, the decline in per capita consumption of wheat can be expected to continue. As income levels rise, dietary changes also occur—usually from lower-priced bulky and starchy foods to those which may be higher in protein as well as higher-priced food items. Thus, there is now a growing tendency for people with rising incomes to view foods, once considered luxuries, as necessities. In addition, convenience foods now command an increasing share of the consumer's food dollar. The future level of total domestic demand depends upon the rate of population growth relative to the rate of increase in per capita income.

Exports of wheat, cereal grains, and other agricultural commodities often are looked upon as a possible solution for American agricultural problems of oversupply. However, American exports compete in the world market with other exporting nations and world demand fluctuates with crop failures and bumper crops. The long-term future of American agricultural exports is uncertain, considering such factors as increased world food production through increased mechanization and technical assistance programs, changes in attitudes towards birth control and in traditions concerning types of foods used.

The problem of farm adjustment thus centers around the changing demand for farm products and the continually changing technology.

The nature of desirable farm adjustment in the Great Plains becomes somewhat complicated by the limited number of feasible alternatives available due to relatively low rainfall and extreme variability of climatic conditions. Considering climatological and other related factors, there exists a comparative advantage in production of small grains (particularly in either hard red spring or winter wheat), depending upon the region of the Great Plains. Wheat, having a comparative advantage over other crops, means that the ratio of costs-to-yield favors wheat. Thus, wheat would be the most profitable crop alternative.

Thorough appraisals of adjustment opportunities on typical farms are needed to evaluate probable effects of farm programs and other external factors and to guide farmers in making adjustment decisions.

TYPE OF AGRICULTURE IN AREA

The average farm size in Faulk County was 1,138 acres, compared with 1,327 acres in Potter County, according to the 1964 Census. Average farm size is increasing annually and this trend is expected to continue. From 1959 to 1964, the U. S. Census of Agriculture shows a 24.7 to 21.1% decline in farms under 500 acres and a 38.1 to 33.2% decline in farms between 500 and 999 acres. In contrast, farms of 1,000 acres or more increased from 37.2 to 47% in the same period.

Twenty-five per cent of the 938 farms in Faulk and Potter Counties were classified as cash-grain and nearly 60% as livestock farms and ranches. General farms, poultry, dairy, and miscellaneous farms made up the remaining 15% of the area's farms. The major cash crops produced in this area are wheat, flax, and rye. The cash sales of corn, barley and oats amounted to about 25% of the total sales in the four counties. Feed grains which were not sold were fed to livestock on the farm.

Table 1 shows the number and percentage of farms in Faulk and Potter Counties that raised and harvested major crops in 1964.

Livestock were found on about 90% of the area's farms. Beef cattle were the most common with most of the herds numbering between 25 and 75 cows. Thirty-two per cent of the farms maintained dairy herds, but according to the 1964 census, only 2 in 3 of these farmers sold dairy products.

*Agricultural economist, Farm Production Economics Division, Economic Research Service, U. S. Department of Agriculture, and assistant professor of economics, respectively, SDSU.

[1]Source: Farm Income Situation, July, 1968.

More than one-third of the farms in the area had farrowed sows in 1964, but most of these farms had fewer than 10 farrowed litters.

Thirty-four per cent of farms in the area maintained a flock of ewes. About 2 in 3 of these farms maintained flocks numbering fewer than 100 ewes. Most of the remaining flocks numbered between 100 and 200 head.

MODEL WHEAT FARM

Description

A farm sample, drawn in 1962, provided the basis for determining the model farms. Farms were stratified on the basis of various characteristics such as farm size, proportion of cropland to native hay and rangeland, land use and farm organization. Farms which differed greatly, such as those which did not have a wheat allotment or those which had either an unusually high or low proportion of cropland to total farmland, were not used to determine the model farm.

The model farm size selected in Faulk and Potter Counties was 960 acres, which consisted of 528 acres of cropland, 386 acres in native hay and pasture, and 46 acres of farmstead, roads, and wasteland. The size of model farm chosen does not represent an arithmetic average—rather it is intended to represent a dominant size of wheat farm which will exist in the 1970's. Although farms are becoming larger, there is a relatively large percentage of farms with fewer than 1,000 acres. Many of these farms will survive and will be enlarged by land rental and purchase. The nature of farm adjustment and farm organization would not differ significantly for farms larger than 960 acres, provided the ratios of farmland, cropland, labor, and capital resources are about the same as for the 960-acre farm.

The crops and crop acreages on the 960-acre representative farm were as follows:

Crop	Acres
Spring Wheat	131
Oats	80
Other Small Grains	25
Corn Grain	87
Corn Silage	27
Summer Fallow	72
Alfalfa	59
Other Tame Hay and Pasture	47
Native Hay	116
Native Pasture	270

Soils

Three major soil associations are found in the Faulk and Potter County area. The Agar-Williams Association, in the western part of the area, occurs in undulating or sloping landscapes. These soils are well-drained with grayish brown silt loam and loam surface layers. The major problems associated with these soils are (1) Maintenance of organic matter and nitrogen, (2) Moisture conservation, and (3) Control of run-off. Livestock and general types of farming are best suited to the Agar-Williams soils area.

Table 1. Number and Percentage of Farms on Which Major Grain Crops Were Raised and Harvested in 1964, Faulk and Potter Counties

Crop	Farms	Percentage of Farms	Acres Harvested Number	Acres Harvested Per Cent
Corn*	714	76.1%	89,525	26.8%
All wheat†	798	85.1	133,211	39.8
Oats	754	80.4	80,394	24.0
Barley	109	11.6	6,173	1.8
Flax	76	8.1	4,086	1.2
Rye	162	17.3	15,573	4.6
Others‡	.....		5,491	1.6

*Includes corn harvested for grain, silage, and other purposes.
†Includes 19,634 acres of winter wheat and 2,833 acres of durum wheat.
‡Includes proso, emmer and speltz, and sorghum.
Source: U. S. Census of Agriculture, 1964.

The Williams-Zahl Association soils, found in the central portion of this area are undulating to steep and are well-to excessively-drained. These soils have grayish-brown loam surfaces. The major management problems are similar to the soils of the Agar-Williams Association soils, namely: (1) Maintenance of organic matter and nitrogen supply, (2) Moisture conservation, and (3) Control of run-off and water erosion. The land use depends mainly upon topography and includes cash grain, livestock, and general farming and ranching.

The Houdek and Bonilla Association soils, classified as Chernozem Soils are found in eastern Faulk County. These soils are undulating to nearly level and are well-to moderately-well-drained. The soils have dark grayish-brown, slightly acid, surface layers. The major problems are maintenance of organic matter and conservation of moisture. The major soil uses are: Cash-grain production, livestock, and general farming.

Each soil series and soil type, within the soil associations found in the two-county area, was classified into four groups on the basis of: (1) Land use, (2) Topography, (3) Potential soil hazards and problems and the management practices needed. Yield projections were developed under assumptions of normal weather conditions, recommended fertilizer usage, and specific management and rotation practices recommended for the productive capability of the soils. The yield projections and fertilization rates, by crop, for each of the four soil groups so classified are shown in Table 2. In cases where the soils of a particular group comprised less than 10% of the area's cropland, the soils of that group were combined with those of a second group and the yields were weighted accordingly.

Table 2. Crop Yields and Fertilizer Usage per Planted Acre by Soil Group, 960-Acre Model Farm, Faulk and Potter Counties

Crop and Rotation	Group I & II Soils Projected Yield Bushels	Fertilizer* Nitrogen Pounds	Fertilizer* P_2O_5 Pounds	Group III Soils Projected Yield Bushels	Fertilizer* Nitrogen Pounds	Fertilizer* P_2O_5 Pounds	Group IV Soils Projected Bushels Bushels	Fertilizer* Nitrogen Pounds	Fertilizer* P_2O_5 Pounds
Spring Wheat on Fallow	23.0		15.0	18.5		12.0	19.8		13.0
Spring Wheat After Corn	18.5	20.5	12.0	15.1	16.5	9.5	16.1	17.5	10.0
Spring Wheat After Small Grain	15.6	17.0	10.0	12.8	14.5	8.5	13.6	15.0	9.0
Oats, Continuous Crop	30.3	12.5	10.0	29.0	12.0	9.5	21.0	9.0	7.0
Barley, Continuous Crop	27.9	17.0	12.0	26.6	16.5	11.5	20.5	12.0	8.5
Rye, Continuous Crop	21.0	10.5	12.0	18.8	10.0	11.0	15.9		10.0
Flax, Continuous Crop	12.1		11.0	10.4		9.0	11.5		10.5
Corn Grain, Continuous Crop	28.1	26.0	9.0	22.9	21.0	6.5	22.9	21.0	6.5
Corn, Silage, Continuous Crop	5.4†	28.5	10.0	4.30†	23.0	7.0	4.30†	23.0	7.0
Alfalfa	1.67†			1.40†			1.10†		
Native Hay‡	.60								

*Actual pounds applied per acre.
†Unit is in tons.
‡Native hay is harvested from noncropland.

A total of 25 crop rotations or sequences, including continuous small grain, were selected for the three soils groups—14 rotations for Soil Group I-II, 16 for Soil Group III, and 11 for Soil Group IV (appendix Table 1). These rotations, chosen from a wide range of alternatives, were within the requirements of the various soils within each group.

The cropland designated as Soils Group I-II amounted to 264 acres, Soils Group III accounted for 174 acres, and 90 acres were classified as Group IV soils.

Crop Alternatives

Cash grains, feed grains, and forage crops were considered as crop alternatives in this two-county area. The small grains included were: Hard spring wheat, flax, rye, barley, and oats. Other crops considered as alternatives included corn-grain, corn-silage, alfalfa and grass, and legume seeding for permanent pasture on cropland.

Flax and rye were grown strictly as cash crops, while corn-grain, spring wheat, oats, and barley could either be used as livestock feed or sold off the farm. The corn-silage and alfalfa which may be produced on these farms would have to be fed to livestock and could not be sold off the farm. Native hay and pasture could either be used by the farm operator for cattle or be left unused.

A cost summary of the crop enterprise budgets considered is shown in Table 3. Costs included in the budgets were: Seed, fertilizer and spray materials, all fixed and variable machine costs, crop hauling to storage, and interest on operating capital. An interest charge on land was not included.

Livestock Alternatives

The livestock activities allowed included: (1) A cow-calf operation, (2) Raising calves to be sold as stockers, and (3) Buying calves to raise and sell as stockers. Fattening activities such as feeding cattle or raising hogs were excluded as enterprise alternatives; these livestock activities are not primarily land based and are somewhat independent of wheat production.

Table 3. Total Man Hours and per Acre Costs for the Crop Alternatives Budgeted for the 960-Acre Model Farm, by Soil Group*

Crop	Total Man-Hours†	Costs per Acre for Soil Group: I-II	III	IV
Summer Fallow	1.14	$ 3.82	$ 3.82	$ 3.82
Spring Wheat/Following Fallow	1.25	10.40	10.12	10.21
Spring Wheat/ Following Corn	1.96	12.38	13.43	13.59
Spring Wheat/Following Small Grain	1.79	13.84	13.41	13.52
Oats	1.79	13.35	13.24	12.67
Barley	1.79	14.12	14.03	13.25
Rye	1.73	15.07	14.92	13.67
Flax	1.79	11.87	11.69	11.83
Corn Grain	2.42	20.22	19.30	19.30
Corn Silage‡	1.76	22.46	21.03	21.03
Alfalfa (2 cuttings—1 baled)	1.39	16.78	16.78	16.78
Native Hay, loose	.82	2.16		

*Excludes a charge for land.
†Excludes hauling and storing.
‡Includes costs for custom harvesting.

Feeding systems which were allowed as alternatives included: (1) A stocker ration with corn-silage, and (2) A stocker ration without corn-silage.

Prices Received

Optimal farm plans were determined for various combinations of crop and livestock product prices. The market prices were held constant for flax at $2.30 per bushel, rye at 78 cents per bushel, feeder calves at $25.28 cwt., and stocker cattle at $23.08 cwt. Wheat prices were varied from zero to over $3 at corn price levels of 69 cents, 83 cents, and $1.10 per bushel. Oat and barley prices were converted to a corn equivalent based on feed value.

The flax, rye, and cattle prices are those which may be expected to occur in 1970 under certain assumed supply and demand conditions. The assumed grain prices are received at local elevators while the livestock prices are those received at the Sioux City Terminal Market.

Labor

The available labor supply was determined from data obtained in several recent farm surveys. Operator and family labor were combined and classified as resident labor. Hired labor, as a category, included regular and part-time help.

The work year was divided into five labor periods, each identified with a season or type of work usually expected to be performed in that period. However. the type of work performed in each period is not as clear-cut as the dates for each period, since there is usually some overlapping of tillage, planting, and harvesting from one labor period to another.

The resident labor used for livestock and field crops could not exceed the number of hours allotted to each period, which is as follows: (1) 1,052 hours, November 16 to March 15; (2) 547 hours, March 16 to April 30; (3) 1,024 hours, May 1 to July 15; (4) 1,053 hours, July 16 to September 30; and (5) 404 hours, October 1 to November 15.

Labor could be hired in any or all periods but was restricted to the average amounts used on sample farms. The hired labor wage rate used was $1.25 per hour.

Table 4. Summary of Budget Items for the Cow-calf Herd and Stocker Calf Alternatives Considered for the 960-Acre Model Farm

Item	Cow-Calf Herd	Stocker Calves Wintered and Grazed with silage	Stocker Calves Wintered and Grazed without silage
Per Cent Calf Crop	92.0%		
Purchase Weight		430 lbs.	430 lbs.
Sales Weight	430 lbs.	700 lbs.	700 lbs.
Purchase Cost		$108.70	$108.70
Pasture	6.5 aum	3.25 aum	3.25 aum
Hay Equivalent	2.60 ton	.40 ton	.64 ton
Corn-Silage		1.20 ton	
Corn-Grain Equivalent	2.70 cwt.		3.60 cwt.
Variable Cash Costs*	$40.87	$ 25.94	$ 25.76
Allocable Fixed Costs†	$11.40	$ 6.90	$ 6.90
Labor per Head	12.00 hrs.	5.3 hrs.	5.3 hrs.

*Includes: Salt and minerals, protein supplement, veterinary and drugs, taxes, insurance marketing, machinery and equipment cash expenses.
†Includes: Depreciation, insurance, taxes, and investment interest on machinery, buildings, and facilities used for enterprise.

OPTIMUM FARM PLANS AT VARYING WHEAT AND FEED GRAIN PRICES

Linear programming is a method of analysis used to determine the farm plans which provides maximum net returns, given input factors such as crop and livestock enterprise costs, amount of available land, amount of the available labor, capital requirements and availability, and product prices. This method of analysis was used to determine wheat and feed grain production which would maximize net income at various price combinations. Because linear programming solutions were obtained for a wide range of wheat prices, a large number of optimum farm organizations resulted. Many of the optimum farm plans indicated insignificant changes in production or net income and will not be presented here.

Tables 5 through 7 show only major changes in crop acreages, crop and livestock production, labor, capital, and net returns at constant feed-grain, flax, and cattle prices with increasing wheat prices.[2] Since minor changes in farm organization were not shown, breaks in the wheat prices are shown in the tables. The wheat prices are shown as a range over which the farm organization, crop and livestock production, and other such factors remain constant.

Farm Plans with Corn Priced at 69 Cents

Results of the linear programming analysis indicate that at this price combination, net returns would be greatest with a farm organization somewhat balanced between a cattle enterprise and cash grain production. Although net returns from livestock production are substantial at all wheat prices, livestock production is more important at lower wheat prices.

[2]The net returns referred to are to land, labor and management.

Table 5. Crop and Livestock Production, Labor, Capital, and Net Returns for the Optimum Farm Plans at Various Levels of Wheat Prices and 69 Cents per Bushel for Corn, 960-Acre Model Farm, Faulk and Potter Counties

Item	Price of Wheat $.60 to $.88	$1 to $1.09	$1.19 to $1.65	$1.81 to $2.10	$2.24 to $3.00	$3.01 to $3.37
Crops (in acres):						
Spring Wheat	62	115	145	319	361	369
Flax	176	149	134	44	8	—
Oats	18	18	18	18	18	18
Summer Fallow		54	83	—	34	70
Corn	150	70	25	25	55	35
Tame Hay or Pasture	123	123	123	123	52	36
Crop Production: (in bushels)						
Spring Wheat	886	2,062	2,718	4,658	5,358	5,592
Flax	1,918	1,614	1,445	420	76	—
Feed Grain (corn equivalent)	2,393	138	280	280	138	138
Corn Silage **(in tons):**	359	359	80	80	231	143
Tame Hay	90	90	171	171	72	50
Native Hay		—	—	—	—	—
Livestock (head):						
Beef Cows		—	58	58	—	—
Stockers sold*	225	225	50	50	166	111
Total Labor Use **(hours)**	2,467	2,324	2,082	2,239	2,114	1,700
Total Capital Used	$54,189	$51,968	$39,724	$42,167	$43,717	$32,895
Net Returns†	$ 5,195	$ 5,580	$ 6,084	$ 7,788	$ 9,829	$13,934

*Includes calves raised and purchased.

†The net returns refer to the lowest wheat price and include returns to land and operator's labor.

Table 6. Crop and Livestock Production, Labor, Capital, and Net Returns for the Optimum Farm Plans at Various Levels of Wheat Prices and 83 Cents per Bushel for Corn, 960-Acre Model Farm, Faulk and Potter Counties

Item	Price of Wheat $.37 to $.80	$1 to $1.15	$1.20 to $1.64	$1.81 to $2.10	$2.24 to $2.99	$3 to $3.37
Crops (in acres):						
Spring Wheat	62	62	145	319	361	369
Flax	176	176	134	44	8	—
Oats	18	18	18	18	18	18
Summer Fallow		—	83	—	34	70
Corn	150	150	25	25	55	35
Tame Hay or Pasture	123	123	123	123	52	36
Crop Production (in bushels):						
Spring Wheat	886*	886	2,718	4,658	5,358	5,592
Flax	1,918	1,918	1,445	420	76	—
Feed Grain (corn equivalent)	4,189	2,393	280	280	138	138
Corn Silage **(in tons):**		359	80	80	231	143
Tame Hay	161	161	161	161	62	40
Native Hay		—	—	—	—	—
Livestock (head):						
Beef Cows	23	—	58	58	—	—
Stockers Sold†	138	225	50	50	166	111
Total Labor Use **(hours)**	2,257	2,467	2,082	2,239	2,114	1,700
Total Capital Used	$46,315	$54,189	$39,724	$42,167	$43,717	$32,895
Net Returns‡	$ 5,729	$ 5,886	$ 6,111	$ 7,788	$ 9,829	$13,934

*Wheat fed to livestock.

†Includes calves raised and purchased.

‡The net returns refer to the lowest wheat prices and include returns to land and operator's labor.

Table 7. Crop and Livestock Production, Labor, Capital, and Net Returns for the Optimum Farm Plans at Various Levels of Wheat Prices and $1.10 per Bushel for Corn, 960-Acre Model Farm, Faulk and Potter Counties

Item	Price of Wheat $.36 to $1.10	$1.23 to $1.80	$1.81 to $2.10	$2.23 to $3	$3.36
Crops (in acres):					
Spring Wheat	33	62	319	363	369
Flax	205	176	44	6	
Oats	18	18	18	18	18
Summer Fallow				30	70
Corn	208	150	25	63	35
Tame Hay or Pasture	65	123	123	48	36
Crop Production (in bushels):					
Spring Wheat	477*	886	4,658	5,370	5,592
Flax	2,197	1,918	1,420	59	
Feed Grain (corn equivalent)	4,831	3,792	280	138	138
Corn Silage (in tons):	128	80	80	266	143
Tame Hay	80	161	161	57	40
Native Hay					
Livestock (head):					
Beef Cows	2	58	58		
Stockers Sold†	162	50	50	166	111
Total Labor Use (hours)	2,120	2,306	2,239	2,137	1,700
Total Capital Used	$45,246	$43,184	$42,167	$44,011	$32,895
Net Returns‡	$ 6,959	$ 7,017	$ 7,788	$ 9,791	$15,884

*Wheat fed to livestock.
†Includes calves raised and purchased.
‡The net returns refer to the lowest wheat price and include returns to land and operator's labor.

In general, wheat acreage and production increased as the wheat price increased. Wheat became increasingly competitive with flax and corn as a cash grain when the wheat price rose while flax and corn prices remained constant. The main adjustment taking place as the wheat price increases is a shift of both flax and corn to wheat. This change occurs at different price ratios on different soil types. The key to this difference is in the relative yields of these crops by soil type. The crop rotations, by soil groups, at the various levels of wheat prices are shown in Table 8.

Crop Production—Soils Group I-II. Spring wheat, barley, oats, flax, corn-grain, corn-silage, alfalfa (including a pasture-type alfalfa), and summer fallow in combinations of 14 crop rotations were the cropping alternatives considered. These soils are somewhat more productive, since all crop yields were higher than on soils of the other two groups. Corn, wheat, and rye yields appear higher in relation to the yields on the other soils groups.

Most profitable, at a wheat price of 88 cents per bushel, was a corn-flax rotation with an average return of $13.69 per acre. Flax, with a price of $2.30 per bushel, was the single most profitable crop enterprise with returns of about $14.22 per acre. Considering the corn yield, production and harvesting costs, 70 cents per bushel was about the break even price for corn. Since continuous flax was not allowed, the best returns were obtained from a corn-flax rotation. With an 88-cent wheat price, continuous wheat (break even price of 95 cents per bushel) produced a loss of 99 cents per acre, a corn-wheat rotation returned a net of $1.25 per acre, wheat-fallow returned $5.14 per acre, and a fallow-wheat-flax rotation produced returns of $6.28 per acre.

Table 8. Crop Rotations by Soil Groups at Various Levels of Wheat Prices and 69 Cents per Bushel for Corn, 960-Acre Model Farm, Faulk and Potter Counties

Crop Rotation	Cropland Acres at the Following Wheat Prices $0.60 to $0.88	$1.00 to $1.09	$1.19 to $1.65	$1.81 to $2.10	$2.24 to $3.00	$3.01 to $3.37
	Acres					
Soil Group I-II						
Corn, Flax	264.0	103.5	14.0			
Summer Fallow, Spring Wheat, Flax		160.5	250.0			
Corn, Spring Wheat				14.0		
Spring Wheat				250.0	264.0	264.0
Soil Group III						
Spring Wheat, Flax, Alfalfa (two years)	174.0	174.0	174.0	174.0	31.6	
Corn, Spring Wheat					73.7	33.6
Summer Fallow, Spring Wheat					68.7	140.4
Soil Group IV						
Spring Wheat, Corn, Oats, Alfalfa (two years)	90.0	90.0	90.0	90.0	90.0	90.0

Increasing the price of wheat from $1 to $1.09 per bushel brought about a shift of 160.5 acres from corn-flax to fallow-wheat-flax which resulted in a net decrease of 80 acres of corn and 26.6 acres of flax. The remaining corn acreage produced silage for the livestock enterprise. Corn-flax remained the most profitable combination, but corn became considerably less profitable in relation to wheat, since wheat rose in price while the corn price remained constant. A corn-wheat rotation returned $3.09 per acre and continuous wheat, $2.07 per acre.

Land use continued to shift from corn-flax to fallow-wheat-flax with a further increase in wheat price, to a range of $1.19 to $1.65 per bushel. Flax production on these soils decreased by 181 bushels, but the increased wheat production of about 666 bushels more than made up for the fewer bushels of flax. Thus, the maximum returns were obtained from 14 acres in a corn-flax rotation and 250 acres in fallow-wheat-flax. The corn acreage produced feed for the livestock enterprise; the wheat and flax production was sold.

Wheat became more profitable than flax, with a further increase in wheat price, $1.81 to $2.10 per bushel. Continuous wheat produced returns of $16.82 per acre, compared with $15.99 for wheat-fallow. Consequently, land use shifted to continuous wheat on nearly all the Group I-II soils. Seven acres of corn was grown for livestock feed.

The corn-silage which was produced on Group I-II soils shifted to Group III soils when the wheat price was increased to $2.24 per bushel and above. This shift left the entire 250 acres of Group I-II soils in continuous wheat, which produced net returns of $18.86, $29.96, and $35.36 per acre at wheat prices of $2.24, $3.00, and $3.37 per bushel, respectively. This is the maximum wheat acreage, and production from continuous wheat would remain unchanged unless feed grain and/or flax prices rose enough to become a competitive factor, assuming no change in the costs of production. The returns from wheat-fallow became less competitive with continuous wheat as the wheat price rose, since production from a wheat-fallow rotation had to be averaged over 2 acres. Net returns from wheat-fallow at a wheat price of $2.24 per bushel were $17.53 per acre and increased to $29.96 per acre with wheat priced at $3.37 per bushel.

Crop Production—Soils Group III. Most of the crop alternatives were the same as on Group I-II soils, Rye was added as an alternative crop, and continuous wheat, barley, or oats were not allowed as on Group I-II soils. Sixteen crop rotations, which varied from 2 to 7 years, were allowed on these soils. These soils were less productive—crop yields were smaller and the costs of producing a bushel of grain were higher.

A wheat-flax-alfalfa (2-years) rotation was the most profitable rotation at wheat prices up to $2.10 per bushel. Cash returns from the rotation were $2.81 per acre with wheat priced at 88 cents per bushel and $7.10 per acre with a wheat price of $2.10 per bushel. This compares with a return of $3.51 per acre for corn-flax at 37 cents per bushel and $11.41 per acre for wheat-fallow at wheat prices of 88 cents and $2.10 per bushel. However, with alfalfa valued at $15 per ton, an additional $2.11 per acre could be added to the 4-year rotation. Thus, the rotation must be judged the most profitable.

A rise in wheat price, to a range of $2.24 to $3, resulted in a shift to 3 rotations, leaving 79 acres in wheat, 37 acres in corn, 34 acres in summer fallow, 16 acres in alfalfa, and about 8 acres in flax. The wheat-flax- alfalfa (2 years) combination produced cash returns of $7.60 per acre at a wheat price of $2.24 per bushel, while the corn-wheat rotation produced cash returns of $9.08 per acre and wheat-fallow returned a net of $12.63 per acre. Corn silage and alfalfa were produced for the livestock enterprise, while flax and wheat were produced for the cash grain market.

The break even price for corn on these soils is 83 cents per bushel, compared with a 70-cent break even price on the Group I-II soils. The break even price for flax is $1.12 per bushel, while for wheat on fallow it is 80 cents and for wheat following a crop it is 95 cents per bushel.

Crop Production—Soils Group IV. These are soils on which productivity would be enhanced by use of longer rotations, preferably with a stand of legume or grass. Continuous cropping is allowable, however, provided proper tillage practices are employed to control erosion. Eleven crop rotations were allowed, most of which contained from 2 to 4 years of alfalfa. One alternative included a permanent seeding of a grass and legume and two rotations allowed 1 year of summer fallow and 4 years of small grain.

Group IV soils comprised only 17% of the cropland and could not figure prominently in cash grain production. Wheat and flax yields were higher than on Group III soils, while barley, oats, and rye yields were lower and the corn yield was equal to that of the Group III soils. Nonetheless, the rotations varied from 5 to 7 years and with most of the rotations containing alfalfa, the relative profitability of producing cash grains on these soils was reduced.

Thus, the most profitable use made of these soils was the production of livestock feed. Wheat was the only cash grain produced in a 5-year rotation of wheat-corn-oats-alfalfa (2 years). Oats, corn silage and alfalfa hay were grown for the livestock enterprise. There was no cropping change on these soils as the wheat price rose from 88 cents to $3.37 per bushel.

Livestock Production. The livestock enterprise in the optimum farm organization was one of raising calves to a weight of 700 pounds. Most of the calves were purchased in the fall and some calves were raised from a stock-cow herd.

The livestock enterprise contributed significantly to the total farm net returns. However, a livestock enterprise would be expected to be included in the optimal plan if it gave any return over variable costs, since some land resources would otherwise remain idle.[3] No provision was made to sell or rent out native hay or range. It is recognized that in most real situations native hay or rangeland probably would be leased out if not used by the farm operator.

With $25.28 and $23.08 cwt. prices used for feeder and stocker calves, respectively, both were profitable, particularly at a corn price of 69 cents. In reality, such a large disparity between grain and livestock prices probably would not remain for long since the demand for corn for livestock feeding would force corn prices to rise. The livestock enterprise was profitable with this combination of crop and livestock prices. However, the size and nature of the livestock enterprise is influenced by the increase in wheat price as cropland shifted to a larger wheat acreage and fewer acres in feed crops. Cropland used for feed production varied from 40% to a low of 31.4% of the total cropland.

The livestock enterprise consisted of 225 fall purchased calves with wheat prices up to $1.10 per bushel. With the wheat price of $1.19 to $2.10 per bushel, the livestock enterprise shifted to a stock-cow herd of 58 head supplemented with five fall-purchased cows. This change in the livestock program resulted from a shift of 45 acres from corn to wheat. A shift back to fall-purchased calves, although fewer in number, when the wheat price continued to rise was due to shifting acreages between corn, wheat and summer fallow on the Group III soils.

Fall-purchased calves fed to a weight of 700 pounds were relatively more profitable than maintaining a herd of stock-cows. In addition, more labor is needed to maintain a stock-cow herd. Also more labor is needed at a time when it competes with spring labor needed for crops. Less short-term capital is required to maintain a stock-cow herd than to purchase feeder calves, but if owned capital or credit is ample, there is no problem.

Feed, other than minerals, feed additives and salt, was homegrown and consisted of hay, corn silage, and a small amount of grain. The kind of grain used for feed depended upon the price of wheat in relation to corn, since the main enterprise was cash grain and crop rotations changed as wheat increased in price.

Farm Plans with Corn Priced at 83 Cents

Very little difference occurred in farm plans when the price of corn was raised to 83 cents. No change occurred in crop rotations, but there was a shift in land use—some tame pasture shifted to tame hay and corn-silage to corn-grain. This change from corn-silage necessitated a shift from purchasing as many feeder calves as in the plans for 69-cent corn. Accompanying the shift to fewer purchased calves was an addition of a stock-cow herd to the livestock enterprise. The wheat, which was produced at prices up to 80 cents, was fed and the corn-grain was sold.

Net returns were somewhat higher for the first three farm plans (shown in Table 6) due mainly to higher corn prices and an increased volume of corn sold. At wheat prices of $1.81 per bushel and up, the net returns were the same as when corn was worth 69 cents per bushel, since no corn was sold.

Crop rotations, by soil groups, at the various levels of wheat prices are shown in Table 9.

Crop Production—Soils Group I-II. The increase of 14 cents in the corn price also increased the profitability of corn-grain, resulting in no change in the corn-flax rotation at wheat prices through $1.15 per bushel. This was in contrast to the shift of 80 acres of corn-grain and 27 acres of flax to wheat and summer fallow at prices of $1 for wheat and 69 cents for corn.

With the increased profitability of corn-grain, the entire corn-grain crop was produced for the cash market at the lowest wheat price range but the relative profitability between corn, wheat, and flax was changed as the wheat price was increased to $1 per bushel.

[3]Returns from a profitable enterprise exceed the variable expenses in the shortrun and fixed costs in the long run.

Table 9. Crop Rotations by Soil Groups at Various Levels of Wheat Prices and 83 Cents per Bushel for Corn, 960-Acre Model Farm, Faulk and Potter Counties

	Cropland Acres at the Following Wheat Prices					
Crop Rotation	$0.37 to $0.80	$1.00 to $1.15	$1.20 to $1.64	$1.81 to $2.10	$2.24 to $2.99	$3.00 to $3.37
Soil Group I-II						
Corn, Flax	264.0	264.0	14.0			
Summer Fallow, Spring Wheat, Flax			250.0			
Corn, Spring Wheat				14.0		
Spring Wheat				250.0	264.0	264.0
Soil Group III						
Spring Wheat, Flax, Alfalfa (2 years)	174.0	174.0	174.0	174.0	31.6	
Corn, Spring Wheat					73.7	33.6
Summer Fallow, Spring Wheat					68.7	140.4
Soil Group IV						
Spring Wheat, Corn, Oats, Alfalfa (2 years)	90.0	90.0	90.0	90.0	90.0	90.0

Although the corn-flax rotation remained unchanged, the production of some corn-grain was shifted to corn-silage. This change in production became necessary as the wheat production from Soil Groups III and IV became more profitable as a cash crop rather than as a feed crop.

With an increase in wheat price, above $1.19 per bushel, the farm plans remained unchanged from the optimal organizations with a 69-cent per bushel corn price.

Crop Production—Soils Group III. The crop rotations on these soils, at all wheat price ranges, were identical to those with corn priced at 69 cents per bushel. The wheat produced was used as livestock feed when priced at 80 cents per bushel and less, but as the price was increased above 80 cents, it was sold as a cash grain.

Crop Production—Soils Group IV. The crop rotations on these soils also were identical to those with corn priced at 69 cents per bushel. The wheat produced, at a price of 80 cents per bushel and less, was used as livestock feed, but as the price was increased above 80 cents per bushel, it was sold as a cash grain.

Livestock Production. The only major change in farm plans, with a 14-cent rise in corn price, was in the livestock enterprise. Essentially, the change was one of raising fewer calves to stocker weights—a stock-cow herd of 23 head was added as an enterprise and the number of calves purchased was reduced by 103 head. This change occurred at a wheat price of about 80 cents per bushel. Wheat was used as livestock feed when it was priced at 80 cents per bushel or less.

Farm Plans with Corn Priced at $1.10

The competitive position of corn was strengthened and its relative profitability was increased with a rise in price from 83 cents to $1.10 per bushel. This forced a rise in the price of wheat necessary for wheat to compete with corn for the use of cropland (as seen in the first two farm plans in Table 10).

The most notable changes, which came as a result of the increased corn price, occurred at wheat prices of $1.10 per bushel and less. First, due to a change in crop rotations on Soils Group III, there was a reduction in wheat and alfalfa acreage and a corresponding increase in corn and flax acreage. Second, with the emphasis on corn and flax production, at the low wheat prices, the livestock enterprise consisted of fall-purchased feeder calves.

Crop rotations, by soil groups, at the various levels of wheat prices are shown in Table 10.

Crop Production—Soils Group I-II. With corn and wheat both priced at $1.10 per bushel, corn-grain returned a net of $10.69 per acre compared with $2.22 for continuous wheat and $4.99 for wheat on summer fallow. Thus, the corn-flax rotation was the most profitable crop combination, with an average return of $12.47 per acre. However, as the market prices for corn and flax remained constant, both corn and flax lost some competitive advantage as the wheat price was raised, and at a wheat price of $1.81 per bushel, the corn-flax rotation shifted to 257 acres of wheat and 7 acres of corn—the same crop acreages as when corn was priced at 83 cents per bushel.

Table 10. Crop Rotations by Soil Groups at Various Levels of Wheat Prices and $1.10 per Bushel for Corn, 960-Acre Model Farm, Faulk and Potter Counties

	Cropland Acres at the Following Wheat Prices				
Crop Rotation	$.36 to $1.10	$1.23 to $1.80	$1.81 to $2.10	$2.23 to $3	$3.36
Soil Group I-II					
Corn, Flax	264.0	264.0			
Corn, Spring Wheat			14.0		
Spring Wheat			250.0	264.0	264.0
Soil Group III					
Corn, Flax	115.8				
Spring Wheat, Flax, Alfalfa (2 years)	58.2	174.0	174.0	24.2	
Corn, Spring Wheat				89.3	33.6
Summer Fallow, Spring Wheat				60.4	140.4
Soil Group IV					
Spring Wheat, Corn, Oats, Alfalfa (2 years)	90.0	90.0	90.0	90.0	90.0

With a further rise in the wheat price, to $2.23 per bushel, the remaining 7 acres of corn also shifted to wheat. Production from the 7 acres of corn was used for livestock feed, but with the entire acreage in wheat, grain for livestock feed was supplied by the oat production from Soils Group IV.

Crop Production—Soils Group III. The increase in the price of corn to $1.10 per bushel brought about a shift of 58 acres to corn and an increase of 29 acres of flax with the corresponding decrease of 58 acres of alfalfa and 29 acres of wheat. The corn-flax rotation returned an average of $8.20 per acre; the wheat-flax-alfalfa (2-years) rotation produced cash returns of $3.15 per acre plus alfalfa hay for the livestock enterprise.

As the wheat price was increased to $1.23 per bushel, the crop rotation shifted back to wheat-flax- alfalfa (2 years), which existed at comparable wheat prices and a corn price of 83 cents per bushel.

The crop combination changed somewhat as the wheat price was increased to $2.23 per bushel with most of the alfalfa and flax acreage shifting to corn, wheat, and summer fallow. In comparing the crop acreages at the lower wheat prices, wheat acreage nearly doubled, corn acreage jumped from zero to almost 45 acres, and summer fallow also went from zero to 30 acres.

A wheat-fallow rotation was slightly more profitable than corn-wheat at a wheat price of $2.23 per bushel, and both were $2.73 to $3.31 per acre more profitable than the wheat-flax-alfalfa (2-year) rotation. But both corn and alfalfa were needed for livestock feed.

With a further increase in the price of wheat, to $3.36 per bushel, an additional shift of crops put wheat acreage to the maximum acreage possible on this group of soils. Wheat production, however, was nearly 4% below the maximum possible production due to the corn acreage which was needed for livestock feed.

Crop Production—Soils Group IV. Crop rotations on Group IV soils did not respond to an increase in either the price of corn or wheat. The wheat-corn-oats-alfalfa (2 years) crop combination remained unchanged at the three corn price levels and all wheat price changes. Wheat production on these soils was slightly less than 45% of the maximum possible. With the exception of wheat, production for these soils was used as livestock feed.

Livestock Production. The livestock enterprise, at wheat prices up to $1.10 per bushel, consisted mainly of fall-purchased feeder calves. The wheat, which was produced at these wheat and corn prices, was used for livestock, since it was worth more as feed than its cash market value. As the wheat price rose, corn grain replaced wheat in the ration.

An increase in the wheat price, to $1.23 per bushel resulted in nearly a complete reversal in the nature of the livestock enterprise—a stock-cow herd replaced most of the fall-purchased feeder calves. Accompanying this change in livestock was an increase in tame hay production and decrease in the corn silage produced.

A further increase in the wheat price resulted in a shift back to fall-purchased feeder calves and an elimination of stock-cows in the livestock enterprise. The numbers of feeder calves purchased were identical to the numbers purchased when corn was priced at 69 and 83 cents per bushel. A small number of the calves were placed on a grain and hay ration.

Labor

Labor was not expected to be a limiting factor. As farms increase either in size or become more intensively farmed, capital substitutes for labor at an increasing rate. In addition, farmers work longer days as well as on Sundays to make up for labor lost due to wet or otherwise inclement weather. Often, some family labor is available, other than the operator himself, if only for emergency needs.

Table 11. Resident Labor Use by Periods for the Optimum Farm Organization at Specified Wheat and Corn Prices, 960-Acre Model Farm, Faulk and Potter Counties

Labor Periods	Corn Price per Bushel	Hours of Labor Available	Resident Labor Use at the Following Ranges of Wheat Prices: $.60 to $.88	$1 to $1.09	$1.19 to $1.65	$1.81 to $2.10	$2.24 to $3	$3.01 to $3.37
					Hours			
Nov. 16 to March 15	69c	1,052	530.0	530.0	481.8	481.8	392.1	261.4
March 16 to April 30	69c	547	374.1	388.5	392.9	488.4	448.9	400.0
May 1 to July 15	69c	1,024	494.5	412.7	468.8	415.7	325.2	258.9
July 16 to Sept. 30	69c	1,053	887.4	919.4	771.8	885.8	914.9	782.4
Oct. 1 to Nov. 15	69c	404	390.6	334.3	290.1	290.1	252.8	172.0
					Hours			
Total Annual		**4,080**	**2,676.6**	**2,584.9**	**2,405.4**	**2,561.8**	**2,333.9**	**1,874.7**
			Resident Labor Use at the Following Ranges of Wheat Prices: $.37 to $.80	**$1 to $1.15**	**$1.20 to $1.64**	**$1.81 to $2.10**	**$2.24 to $2.99**	**$3 to $3.37**
					Hours			
Nov. 16 to March 15	83c	1,052	467.7	530.0	481.8	481.8	392.1	261.4
March 16 to April 30	83c	547	358.9	374.1	392.9	488.4	448.9	400.0
May 1 to July 15	83c	1,024	560.3	494.5	468.8	415.7	325.2	258.9
July 16 to Sept. 30	83c	1,053	634.7	887.4	771.8	885.8	914.9	782.4
Oct. 1 to Nov. 15	83c	404	404.0	390.6	290.1	290.1	252.8	172.0
					Hours			
Total Annual		**4,080**	**2,425.3**	**2,676.6**	**2,405.4**	**2,561.8**	**2,333.9**	**1,874.7**
			Resident Labor Use at the Following Ranges of Wheat Prices: $.36 to $1.10	**$1.23 to $1.80**	**$1.81 to $2.10**	**$2.23 to $3**	**$3.36**	
					Hours			
Nov. 16 to March 15	$1.10	1,052	395.7	481.8	481.8	392.1	261.4	
March 16 to April 30	1.10	547	327.3	370.4	488.4	449.6	400.0	
May 1 to July 15	1.10	1,024	555.2	596.2	415.7	326.8	258.9	
July 16 to Sept. 30	1.10	1,053	664.2	721.8	885.8	937.8	782.4	
Oct. 1 to Nov. 15	1.10	404	404.0	377.9	290.1	247.1	172.0	
					Hours			
Total Annual		**4,080**	**2,346.4**	**2,548.1**	**2,561.8**	**2,353.4**	**1,874.7**	

Results showed that labor needs were neither a crucial nor a limiting factor. In fact, labor was in surplus, since the annual labor requirement in the optimal plans varied from 46 to 66% of its total amount available on an annual basis. The minimum amount of labor used during the planting and harvesting seasons amounted to 53% of the available labor and the maximum labor used amounted to 71%.

Capital

Short-term capital and credit was assumed to be ample and, thus, was not a critical factor. Short-term capital needs varied between $43,489 and $27,398 when corn was priced at 69 cents per bushel, with little change occurring at the other two corn prices. The purchase of feeder calves raised the capital requirements by $5,000 to $25,000, depending upon the numbers purchased.

SUMMARY

The purpose of this publication is to provide some results of a research study in which optimum farm plans were determined for a representative 960-acre wheat farm in Faulk and Potter Counties.

Linear programming techniques were used to determine optimal farm organizations at alternative price combinations of wheat and feed grains. Optimal farm plans were determined at three levels of corn prices ranging from a low of 69 cents to a high of $1.10 per bushel, while wheat prices were varied from zero to $3.36 per bushel.

Results of the programming analysis indicate net returns would be greatest with the model farm oriented toward production of cash-grain, particularly with corn prices of $1.10 and wheat prices of about $1.25 and higher. A cattle enterprise which contributed significantly to the total net returns was maintained.

The three cash crops were corn, flax, and wheat, each having a different break even price, depending upon the yield ratios and production costs on the various soils groups. The break even price is the key in determining which crops are the most profitable at the various price levels.

Given the objective to maximize net returns to land, labor, and management, the strategy is then to shift crops depending upon crop prices. For example, with corn priced at 69 cents, some wheat acreage began to replace corn as a cash grain on Soil Groups I-II when wheat reached a price of $1. As wheat increased to $1.81 per bushel in price, nearly all the corn acreage was replaced by wheat—7 acres of corn remained for livestock feed. Maximum wheat acreage and production was achieved by a shift to continuous wheat at prices of $2.24 per bushel and above.

The crops grown on Soils Group III had a different set of break even prices, as the yields and costs were different. Wheat acreage and production remained constant on Group III soils, even though wheat prices increased from 60 cents to $2.10 per bushel. The livestock enterprise required a considerable amount of hay which was produced on these soils. Crop acreages shifted toward increased wheat production as the wheat price was advanced to $2.24 per bushel. When the price reached $3 per bushel and above, maximum wheat acreage was attained. However, some corn acreage was needed for the production of silage.

The wheat-corn-oats-alfalfa (2-years) rotation which was used on the Group IV soils did not respond to an increase in the price of either corn or wheat. Group IV soils comprised 17% of the total cropland—most of this acreage was used to produce livestock feed.

Corn, as a cash grain, was competitive for cropland at relatively low wheat prices, although the degree of competition depended somewhat upon the price of corn. With corn priced at 69 cents per bushel, corn as a cash grain was produced only until wheat reached $1. When the corn price rose to 83 cents per bushel, cash corn was produced until a wheat price of $1.20 per bushel was reached, but with an increase in corn price to $1.10 per bushel cash corn production was maintained until wheat reached a price of $1.81 per bushel.

Flax, at a price of $2.30 per bushel, was the main competing cash crop as long as wheat was priced below $2.25 per bushel. However, some flax was produced at wheat prices up to $3 per bushel at all three corn price levels.

The maximum wheat acreage allowed was 387 acres, and the maximum production possible was 5,986 bushels; however, neither the maximum wheat acreage nor production was reached in any of the optimum farm plans. At wheat prices of $3 and above, wheat acreage reached 95.3% of the maximum and production, 93.4%. The acreage in wheat represented 70% of the total cropland.

Wheat was produced at all wheat prices, but at the very low prices it was used as livestock feed. Whether corn or wheat is fed depends, of course, on the relative prices. With corn priced at 69 cents per bushel, wheat would be fed rather than sold at a wheat price of 60 cents per bushel or less. With a corn price of 83 cents, wheat would be fed until it reached a market price of

$1 per bushel and with a corn price of $1.10 per bushel the corresponding wheat price is $1.23 per bushel.

Even with maximum wheat acreage, 30% of the cropland was used for the production of livestock feed. The livestock enterprise consisted of raising calves to a weight of 700 pounds. Most of the calves were purchased in the fall, and some calves were raised from a stock-cow herd. The grains used for feed depended upon the price of wheat in relation to corn.

Labor was not a limiting resource since the minimum annual needs amounted to 42% of the labor available and the maximum amounted to 60%. Much of the surplus labor existed during the winter months.

The optimal farm plans presented herein are the results of computer programming, using specific assumptions with regard to farm size and cropland acreage, crop yields, costs, commodity market prices, and other such factors. Consequently, these results cannot be construed as being representative of all or a specific 960-acre farm in this two-county area. The results, however, do present the most profitable farm organizations under the stated assumptions and may serve as a guide for determining profitable farm organizations under a similar cost and price structure.

APPENDIX

Appendix Table 1. Crops and Crop Rotations Allowed as Activities by Soils Group

Rotation	Soils Groups I & II	III	IV
Spring Wheat	X		
Barley	X		
Oats	X		
Flax-Spring Wheat-Barley-Oats-Alfalfa (3 years)	X		
Spring Wheat-Flax-Alfalfa (2 years)	X		
Oats-Alfalfa (3 years)	X		
Corn-Spring Wheat	X	X	
Corn-Barley	X	X	
Corn-Oats	X	X	
Corn-Flax	X	X	
Summer Fallow-Spring Wheat	X	X	
Summer Fallow-Spring Wheat-Flax	X	X	
Summer Fallow-Spring Wheat-Barley-Corn-Corn	X	X	
Corn-Spring Wheat-Corn-Oats-Alfalfa (3 years)	X	X	
Spring Wheat-Corn-Oats-Alfalfa (3 years)		X	
Summer Fallow-Spring Wheat-Corn-Oats-Alfalfa (3 years)		X	X
Spring Wheat-Corn-Flax-Alfalfa (3 years)		X	X
Summer Fallow-Spring Wheat-Barley-Barley-Oats		X	X
Summer Fallow-Spring Wheat-Spring Wheat-Barley-Oats		X	X
Rye-Corn-Oats-Alfalfa (4 years)		X	X
Spring Wheat-Barley-Corn-Oats-Alfalfa (2 years)			X
Spring Wheat-Corn-Oats-Alfalfa (2 years)			X
Spring Wheat-Barley-Corn-Flax-Alfalfa (2 years)			X
Flax-Spring Wheat-Corn-Oats-Alfalfa (2 years)			X
Flax-Barley-Corn-Oats-Alfalfa (2 years)			X
Grass			X

Appendix Table 2. Cropland Use by Soil Groups at Various Levels of Wheat Prices and 69 Cents per Bushel for Corn, 960-Acre Model Farm, Faulk and Potter Counties

	Crop Acres at the Following Wheat Prices					
Crop	$.60 to $.88	$1 to $1.09	$1.19 to $1.65	$1.81 to $2.10	$2.24 to $3	$3.01 to $3.37
Soil Group I-II						
Corn	132.0	51.8	7.0	7.0		
Flax	132.0	105.2	90.4			
Summer Fallow		53.5	83.3			
Spring Wheat		53.5	83.3	257.0	264.0	264.0
Total Acres	**264.0**	**264.0**	**264.0**	**264.0**	**264.0**	**264.0**
Soil Group III						
Spring Wheat	43.5	43.5	43.5	43.5	79.2	87.0
Flax	43.5	43.5	43.5	43.5	7.9	
Alfalfa	87.0	87.0	87.0	87.0	15.8	
Corn					36.8	16.8
Summer Fallow					34.3	70.2
Total Acres	**174.0**	**174.0**	**174.0**	**174.0**	**174.0**	**174.0**
Soil Group IV						
Spring Wheat	18.0	18.0	18.0	18.0	18.0	18.0
Corn	18.0	18.0	18.0	18.0	18.0	18.0
Oats	18.0	18.0	18.0	18.0	18.0	18.0
Alfalfa	36.0	36.0	36.0	36.0	36.0	36.0
Total Acres	**90.0**	**90.0**	**90.0**	**90.0**	**90.0**	**90.0**

Appendix Table 3. Cropland Use by Soil Groups at Various Levels of Wheat Prices and 83 Cents per Bushel for Corn, 960-Acre Model Farm, Faulk and Potter Counties

	Crop Acres at the Following Wheat Prices					
Crop	$.37 to $.80	$1 to $1.15	$1.20 to $1.64	$1.81 to $2.10	$2.24 to $2.99	$3 to $3.37
Soil Group I-II						
Corn	132.0	132.0	7.0	7.0		
Flax	132.0	132.0	90.4			
Summer Fallow			83.3			
Spring Wheat			83.3	257.0	264.0	264.0
Total Acres	**264.0**	**264.0**	**264.0**	**264.0**	**264.0**	**264.0**
Soil Group III						
Spring Wheat	43.5	43.5	43.5	43.5	79.2	87.0
Flax	43.5	43.5	43.5	43.5	7.9	
Alfalfa	87.0	87.0	87.0	87.0	15.8	
Corn					36.8	16.8
Summer Fallow					34.3	70.2
Total Acres	**174.0**	**174.0**	**174.0**	**174.0**	**174.0**	**174.0**
Soil Group IV						
Spring Wheat	18.0	18.0	18.0	18.0	18.0	18.0
Corn	18.0	18.0	18.0	18.0	18.0	18.0
Oats	18.0	18.0	18.0	18.0	18.0	18.0
Alfalfa	36.0	36.0	36.0	36.0	36.0	36.0
Total Acres	**90.0**	**90.0**	**90.0**	**90.0**	**90.0**	**90.0**

Appendix Table 4. Cropland Use by Soil Groups at Various Levels of Wheat Prices and $1.10 per Bushel for Corn, 960-Acre Model Farm, Faulk and Potter Counties

Crop	Crop Acres at the Following Wheat Prices $.36 to $1.10	$1.23 to $1.87	$1.88 to $2.10	$2.23 to $3	$3.36
Soil Group I-II					
Corn	132.0	132.0	7.0		
Flax	132.0	132.0			
Spring Wheat			257.0	264.0	264.0
Total Acres	**264.0**	**264.0**	**264.0**	**264.0**	**264.0**
Soil Group III					
Corn	57.9			44.7	16.8
Flax	72.5	43.5	43.5	6.1	
Spring Wheat	14.5	43.5	43.5	80.9	87.0
Alfalfa	29.1	87.0	87.0	12.1	
Summer Fallow				30.2	70.2
Total Acres	**174.0**	**174.0**	**174.0**	**174.0**	**174.0**
Soil Group IV					
Spring Wheat	18.0	18.0	18.0	18.0	18.0
Corn	18.0	18.0	18.0	18.0	18.0
Oats	18.0	18.0	18.0	18.0	18.0
Alfalfa	36.0	36.0	36.0	36.0	36.0
Total Acres	**90.0**	**90.0**	**90.0**	**90.0**	**90.0**

Appendix Table 5. Crop Rotations on All Soil Groups at Specified Wheat and Corn Prices, 960-Acre Model Farm, Faulk and Potter Counties

Crop Rotation	Corn Price per Bushel	Range of Wheat Prices per Bushel $.60 to $.88	$1 to $1.09	$1.19 to $1.65	$1.81 to $2.10	$2.24 to $3	$3.01 to $3.37
		Acres					
Corn, Flax	69c	264.0	103.5	14.0			
Spring Wheat, Flax, Alfalfa (2 years)	69c	174.0	174.0	174.0	174.0	31.6	
Spring Wheat, Corn, Oats, Alfalfa (2 years)	69c	90.0	90.0	90.0	90.0	90.0	90.0
Summer Fallow, Spring Wheat, Flax	69c		160.5	250.0			
Corn, Spring Wheat	69c				14.0	73.7	33.6
Spring Wheat	69c				250.0	264.0	264.0
Summer Fallow, Spring Wheat	69c					68.7	140.4

Crop Rotation	Corn Price per Bushel	Range of Wheat Prices per Bushel $.80 to $.37	$1.15 to $1	$1.64 to $1.20	$2.10 to $1.81	$2.99 to $2.24	$3.37 to $3
		Acres					
Corn, Flax	83c	264.0	264.0	14.0			
Spring Wheat, Flax, Alfalfa (2 years)	83c	174.0	174.0	174.0	174.0	31.6	
Spring Wheat, Corn, Oats, Alfalfa (2 years)	83c	90.0	90.0	90.0	90.0	90.0	90.0
Summer Fallow, Spring Wheat Flax	83c			250.0			
Corn, Spring Wheat	83c				14.0	73.7	33.6
Spring Wheat	83c				250.0	264.0	264.0
Summer Fallow, Spring Wheat	83c					68.7	140.4

Crop Rotation	Corn Price per Bushel	Range of Wheat Prices per Bushel $.36 to $1.10	$1.23 to $1.87	$1.88 to $2.10	$2.23 to $3	$3.36
		Acres				
Corn, Flax	$1.10	379.8	264.0			
Spring Wheat, Flax, Alfalfa (2 years)	1.10	58.2	174.0	174.0	24.2	
Spring Wheat, Corn, Oats, Alfalfa (2 years)	1.10	90.0	90.0	90.0	90.0	90.0
Corn, Spring Wheat	1.10			14.0	89.3	33.6
Spring Wheat	1.10			250.0	264.0	264.0
Summer Fallow, Spring Wheat	1.10				60.4	140.4