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# Effect of Alternative Wheat and Feed Grain Prices on Optimum Farm Plans and Income in South Cetnral South Dakota: Lyman and Tripp Counties

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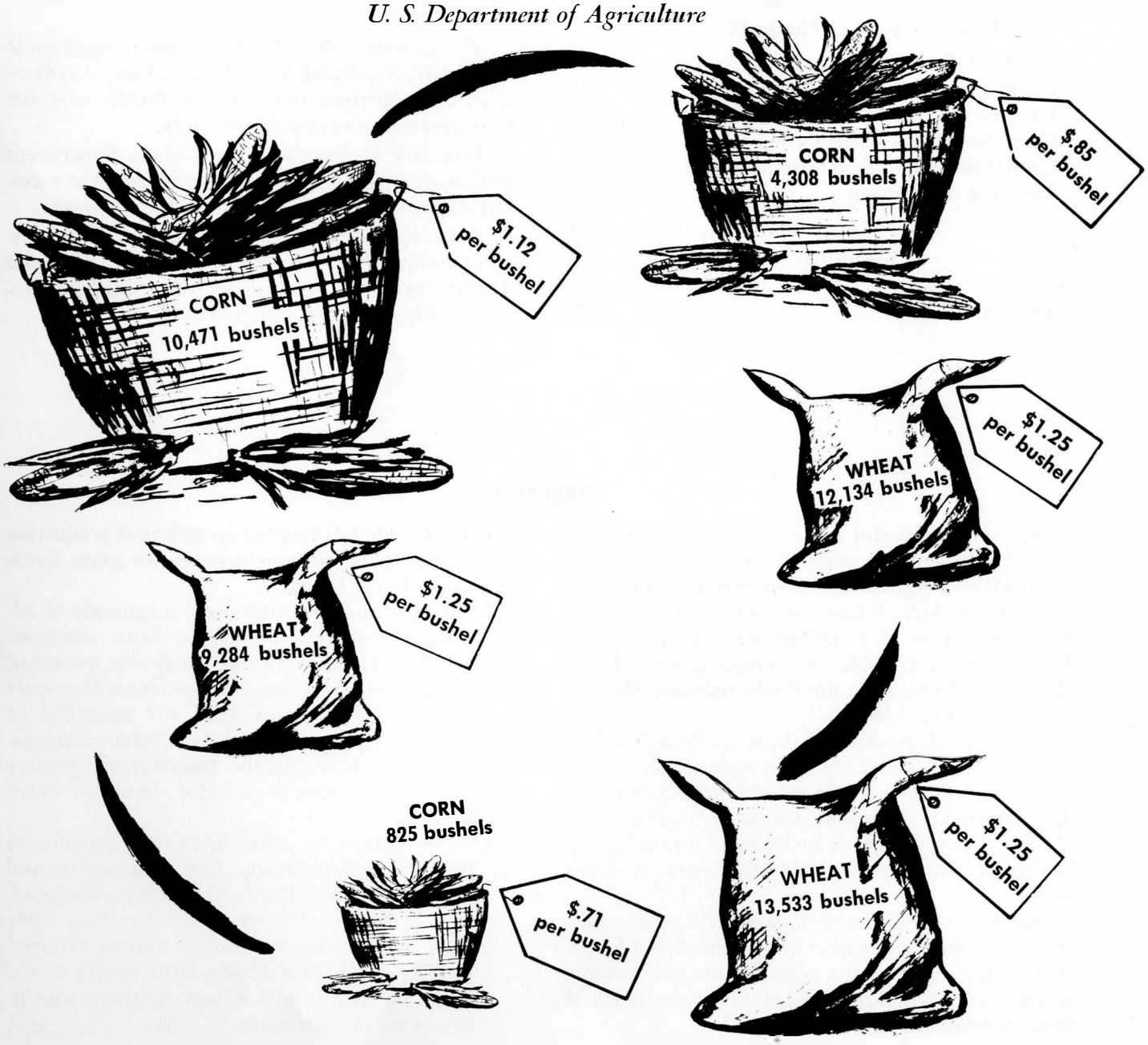
*Lyman and Tripp Counties*

*Department of Economics in cooperation with*

*Production Economics Division, Economic Research Service*

*U. S. Department of Agriculture*

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## 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 three different size model farms in Lyman and Tripp 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.**

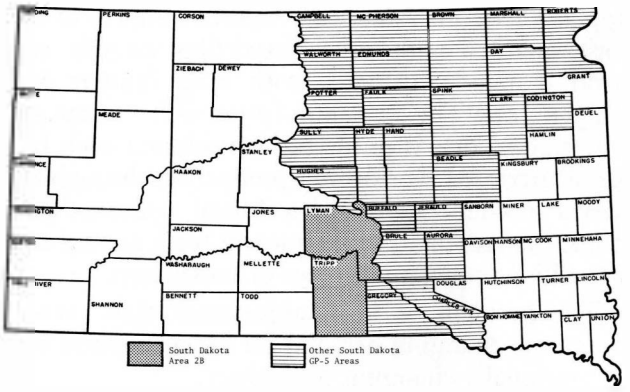


**Fig. 1. South Dakota GP-5 Study Area.**

# Effect of Alternative Wheat and Feed Grain Prices on Optimum Farm Plans and Income in South Central South Dakota Lyman and Tripp Counties

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 consump-

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

tion of wheat and wheat products; total domestic consumption, however, remains fairly constant. With a continued increase in per capita 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 are often 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 grain (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 Lyman County was 1,937 acres, compared with 1,381 acres in Tripp County, according to the 1964 Census. Average farm size is increasing annually and this trend is expected to continue in the future. From 1959 to 1964, the U. S. Census of Agriculture shows a percentage decline in farms under 500 acres, 34.0 to 30.8%, and in farms between 500 and 999 acres, from 35.3 to 33.2%. In contrast, farms of 1,000 acres or more increased from 30.7 to 36% in the same period.

Twenty-four percent of the 1,450 farms in Lyman and Tripp Counties were classified as cash-grain and about 63% as livestock farms and ranches. General farms, poultry, dairy and miscellaneous farms made up the remaining 13% of the area's farms.

The major cash crop produced in this area was winter wheat. However, slightly more than 40% of the oats and nearly all of the rye harvested in 1964 was sold as cash grain; 34.3% of the corn grain produced and 57% of the grain sorghum harvested was sold. Feed grains which were not sold were fed to livestock on the farm.

Table 1 shows the number and percent of farms in Lyman and Tripp Counties on which major grain crops were raised and harvested in 1964.

**Table 1. Number and Percent of Farms on Which Major Grain Crops Were Raised and Harvested in 1964, Lyman and Tripp Counties**

| | No. of Farms | Percentage of Farms | Acres Harvested | |
|---|---|---|---|---|
| | | | Number | Percent |
| Corn* | 786 | 54.2 | 75,103 | 21.0 |
| All Wheat† | 788 | 54.3 | 137,469 | 38.5 |
| Sorghum‡ | 789 | 54.4 | 72,400 | 20.3 |
| Oats | 852 | 58.7 | 60,911 | 17.0 |
| Rye | 78 | 5.4 | 4,795 | 1.3 |
| Other§ | | | 6,668 | 1.9 |

*Includes corn harvested for grain, silage and other purposes.
†Includes 9,883 acres of spring wheat and 767 acres of durum.
‡Includes sorghum harvested for grain, silage and other purposes.
§Includes barley, flax, proso, emmer and speltz, and soybeans.
Source: U. S. Census of Agriculture, 1964.

Livestock were found on about 90% of the area's farms. Beef-cattle were the most common with 50 to 60% of the herds numbering between 30 to 100 cows. The average herd size in Lyman County was about 14% larger than in Tripp County. Cattle feeding enterprises were more common in this area than in other central South Dakota counties. Between 25 and 30% of the farmers sold dairy products, but most dairy herds were fairly small; only a few herds were larger than 20 cows.

Swine enterprises were fairly large on the average, with over half of the enterprises numbering more than 10 sows. Sows were farrowed on less than half of the area's farms in 1964. Hog enterprises were larger in Tripp than in Lyman County.

Sheep and lambs were found on fewer than 14% of the area's farms, some of these were for 4-H projects. Very few flocks had 100 ewes or more—most flocks numbered fewer than 50 head.

## MODEL WHEAT FARMS

### 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 farms.

Three model farms were selected. The first, a 640-acre farm, had 448 acres of cropland, 175 acres in native hay and pasture, and 17 acres of farmstead, roads and wasteland. The second model was a 960-acre farm with 576 acres of cropland, 346 acres in native hay and pastures, and 38 acres of farmstead, roads and wasteland. The third model wheat farm was one of 2,240 acres with 1,156 acres of cropland, 950 acres in native hay and range, and 134 acres in farmstead, roads and wasteland. These sizes of model farms do not represent any arithmetic averages—rather they are intended to represent dominant sizes of wheat farms which will exist in the 1970's. Although farms are becoming larger, there is relatively large percentage of farms with fewer than 1,000 acres. Some of these farms will survive and some will be enlarged by land rental and purchase. The nature of farm adjustment and farm organization would not differ significantly for farms larger than the models, provided the ratios of farmland, cropland, labor and capital resources were about the same as for the model farms.

The crops and crop acreages on the model farms were as follows:

| Crop | Model Farm | | |
|---|---|---|---|
| | 640 | 960 | 2,240 |
| | Acres | | |
| Hard Winter Wheat | 105 | 162 | 275 |
| Oats | 51 | 57 | 120 |
| Other Small Grain | 5 | 16 | 63 |
| Corn Grain | 52 | 57 | 131 |
| Corn Silage | 22 | 20 | 56 |
| Sorghum Grain | 17 | 23 | 72 |
| Sorghum Silage | 10 | 14 | 43 |
| Summer Fallow | 105 | 130 | 235 |
| Alfalfa | 81 | 85 | 136 |
| Other Tame Hay and Pasture | | 12 | 25 |
| Native Hay | 58 | 127 | 342 |
| Native Pasture | 117 | 219 | 608 |

### Soils

The soils of Lyman County are Chestnut and those of Tripp County are Chernozems. The major soil associations found in Lyman County are the Agar-Williams, Williams-Zahl, and the Raber-Eakin. The Tripp County soil associations are the Boyd-Hamill and Holt-Valentine.

The Agar-Williams Association soils occur 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.

The Williams-Zahl Association soils 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 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 Raber-Eakin Association soils are undulating and well-drained. These soils are grayish-brown loams, clay loams and silt loams. The major management problems are: (1) the maintenance of organic matter and nitrogen supply, (2) maintenance of soil fertility, (3) moisture conservation, and (4) control of run-off and water erosion. Cash-grain farming and ranching are best suited to these soils with the specific land use being restricted by topography of the land.

The Boyd-Hamill Association soils are undulating to steep and are well to excessively well drained. These soils are grayish-brown clays. The Holt-Valentine Association soils are also undulating and well drained. These vary from dark grayish-brown to grayish-brown loamy and sand soils. The Holt-Valentine Association are medium to high in natural fertility. The major soil and water management problems of both association soils are: (1) maintenance of organic matter and nitrogen supply, (2) moisture conservation, and (3) control of wind erosion. Livestock and general farming are the major land uses.

Each soil series and soil type, within the soil associations found in the two-county area, was classified into one of four groups on the basis of: (1) land use, (2) topography, (3) potential soil hazards and problems, and (4) management practices needed. Yield projections were developed under assumptions of normal weather conditions, recommended fertilizer usage, and specific management practices recommended for the productive capability of the soils. The yield projections and fertilization rates, by crop, for each soil group 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, 640, 960, and 2,240-Acre Model Farm, Lyman and Tripp Counties

| Crop and Rotation | Group II Soils | | | Group III Soils | | | Group IV Soils | | |
|---|---|---|---|---|---|---|---|---|---|
| | Projected Yield | Fertilizer‡ N | Fertilizer‡ $P_2O_5$ | Projected Yield | Fertilizer‡ N | Fertilizer‡ $P_2O_5$ | Projected Yield | Fertilizer‡ N | Fertilizer‡ $P_2O_5$ |
| | Bu. | Lb. | Lb. | Bu. | Lb. | Lb. | Bu. | Lb. | Lb. |
| Winter wheat on fallow | 30.6 | | | 23.8 | | 15.5 | 25.4 | | 16.0 |
| Spring wheat reseeded on winter killed wheat | 19.5 | | | 13.9 | 15.5 | 9.0 | 14.6 | 16.0 | 9.5 |
| Oats, continuous crop | 31.0 | 12.5 | 10.0 | 20.0 | 8.0 | 6.5 | 20.0 | 8.0 | 6.5 |
| Barley, continuous crop | 28.0 | 17.0 | 12.0 | 20.0 | 12.0 | 8.0 | 23.0 | 13.5 | 9.5 |
| Corn grain, continuous crop | 31.5 | 30.0 | 9.5 | 25.7 | 24.0 | 8.0 | 26.4 | 25.0 | 8.5 |
| Corn silage, continuous crop | 5.90* | 33.0 | 10.5 | 4.85* | 26.5 | 9.0 | 4.95* | 27.5 | 9.5 |
| Grain sorghum, cont. crop | 37.8 | 36.0 | 11.5 | 34.4 | 32.0 | 10.0 | 27.2 | 25.0 | 8.5 |
| Forage sorghum, cont. crop | 7.65* | 39.0 | 12.5 | 7.00* | 35.0 | 11.0 | 5.60* | 27.5 | 9.5 |
| Alfalfa | 1.5* | | | 1.0* | | | 1.1* | | |
| Native hay | .6*† | | | | | | | | |

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

A total of 13 crop rotations or sequences were selected for the three soils groups—9 rotations for Soil Group II, 9 for Soil Group III, and 5 for Soil Group IV (Appendix Table 1). These rotations, chosen from a fairly wide range of alternatives, were within the requirements of the various soils within each group.

The 640-acre farm had 94 acres classified as Group II Soils, 117 acres of Group III Soils, and 237 acres of Group IV Soils. The 960-acre farm had 121, 150, and 305 acres, respectively, classified as Group II, III, and IV soils, The 2,240-acre farm had 243 acres in Group II Soils, 300 acres in Group III Soils, and 613 acres in 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: winter wheat, oats, and barley. Other crops considered as alternatives included corn grain and silage, sorghum grain and silage, alfalfa and grass and legume seeding for permanent pasture on cropland.

All grain crops, including winter wheat, could either be used as livestock feed or sold off the farm. The forage sorghum, corn-silage, and alfalfa that could be produced on these farms had to be fed to livestock and could not be sold off the farm. Native hay and pasture could be used by the farm operator for cattle, or it could be left unused.

A cost summary of the crop enterprise budgets considered for each of the model farms are shown in Table 3, 4, and 5. 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. 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 cattle feeding or raising hogs were excluded as enterprise alternatives; these livestock activities are not primarily land based and are somewhat independent of wheat production.

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

Table 3. Total Man Hours and Per Acre Costs for the Crop Alternatives Budgeted for the 640-Acre Model Farm, by Soil Group,* Lyman and Tripp Counties

| Crop | Total Man Hours† | Costs Per Acre for Soil Group | | |
|---|---|---|---|---|
| | | II | III | IV |
| | | Dollars | | |
| Summer Fallow | 1.17 | 3.14 | 3.14 | 3.14 |
| Winter Wheat after Fallow | 1.40 | 10.04 | 11.51 | 11.55 |
| Spring Wheat Reseeded on Winter Killed Wheat | 1.65 | 11.85 | 14.44 | 14.55 |
| Oats | 2.19 | 14.07 | 13.22 | 13.22 |
| Barley | 2.19 | 14.81 | 13.87 | 14.17 |
| Corn Grain | 3.18 | 20.57 | 19.63 | 19.80 |
| Sorghum Grain | 3.56 | 19.17 | 18.57 | 17.63 |
| Corn Silage | 3.18 | 25.27 | 23.89 | 24.09 |
| Sorghum Silage | 2.44 | 22.78 | 21.69 | 20.73 |
| Alfalfa | 1.55 | 12.86 | 12.52 | 12.58 |
| Native Hay | .96 | 3.09 | 3.09 | 3.09 |

*Excludes a charge for land.
†Excludes hauling and storing.

**Table 4. Total Man Hours and Per Acre Costs for the Crop Alternatives Budgeted for the 960-Acre Model Farm, by Soil Group,* Lyman and Tripp Counties**

| Crop | Total Man Hours† | Costs Per Acre for Soil Group II | III | IV |
|---|---|---|---|---|
| | | Dollars | | |
| Summer Fallow | 1.17 | 3.52 | 3.52 | 3.52 |
| Winter Wheat after Fallow | 1.16 | 8.44 | 9.92 | 9.96 |
| Spring Wheat Reseeded on Winter Killed Wheat | 1.40 | 9.95 | 12.65 | 12.66 |
| Oats | 1.94 | 12.22 | 11.38 | 11.38 |
| Barley | 1.94 | 12.97 | 12.02 | 12.32 |
| Corn Grain | 2.40 | 18.50 | 17.56 | 17.72 |
| Sorghum Grain | 3.20 | 16.25 | 15.64 | 14.69 |
| Corn Silage | 2.01 | 23.20 | 21.82 | 20.90 |
| Sorghum Silage | 1.74 | 20.71 | 19.62 | 18.66 |
| Alfalfa | 1.55 | 13.44 | 12.83 | 12.83 |
| Native Hay | .96 | 2.78 | 2.78 | 2.78 |

*Excludes a charge for land.
†Excludes hauling and storing.

**Table 5. Total Man Hours and Per Acre Costs for the Crop Alternatives Budgeted for the 2,240-Acre Model Farm, by Soil Group,* Lyman and Tripp Counties**

| Crop | Total Man Hours† | Costs Per Acre for Soil Group II | III | IV |
|---|---|---|---|---|
| | | Dollars | | |
| Summer Fallow | 1.17 | 3.03 | 3.03 | 3.03 |
| Winter Wheat after Fallow | 1.14 | 8.83 | 10.30 | 10.35 |
| Spring Wheat Reseeded on Winter Killed Wheat | 1.37 | 8.39 | 10.98 | 11.09 |
| Oats | 1.76 | 10.59 | 9.77 | 9.77 |
| Barley | 1.76 | 11.36 | 10.42 | 10.72 |
| Corn Grain | 3.23 | 18.57 | 17.74 | 17.90 |
| Sorghum Grain | 2.80 | 14.56 | 13.95 | 13.00 |
| Corn Silage | 2.88 | 23.25 | 22.06 | 21.55 |
| Sorghum Silage | 2.75 | 20.76 | 19.86 | 18.19 |
| Alfalfa | 1.48 | 13.48 | 12.81 | 12.94 |
| Native Hay | .91 | 2.45 | 2.45 | 2.45 |

*Excludes a charge for land.
†Excludes hauling and storing.

### Prices Received

Optimal farm plans were determined for various combinations of crop and livestock prices. The market prices were held constant for feeder calves at $25.28 and stocker cattle at $23.08/cwt. Wheat prices were varied from zero to over $3.00 per bushel at corn price levels of 71 cents, 85 cents, and $1.12 per bushel. Oat, barley, and grain sorghum prices were converted to a corn equivalent based on feed value.

Cattle prices were those which could be expected to occur in the future 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. Hours by labor period for each size of farm are as follows:

| | 640 acres | 960 acres | 2,240 acres |
|---|---|---|---|
| | | Hours | |
| November 16 to March 15 | 873 | 1,037 | 1,581 |
| March 16 to April 30 | 464 | 542 | 819 |
| May 1 to July 15 | 938 | 1,096 | 1,612 |
| July 16 to September 30 | 960 | 1,121 | 1,613 |
| October 1 to November 15 | 360 | 420 | 674 |

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

## OPTIMUM FARM ORGANIZATION AT VARYING WHEAT AND FEED GRAIN PRICES

Linear programming is a method of analysis used to determine the farm organization which provides maximum net returns given input factors such as crop and livestock enterprise costs, amount of available land, amount of available labor, capital requirements and availability, and product prices. This method of analysis was used to determine wheat and feed grain production which would optimize 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 7 through 15 show only major changes in crop acreages, crop and livestock production, labor, capital, and net returns[2] at constant feed grain and cattle prices with increasing wheat prices. Since minor changes in farm organization were not shown, breaks in the wheat prices will be 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.

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

**Table 7. Crop and Livestock Production, Capital Needed, and Net Returns for the Optimum Farm Organization at Various Levels of Wheat Prices and 71 Cents per Bushel for Corn, 640-Acre Model Farm, Lyman and Tripp Counties**

| Item | Units | $.36-$.51 | $.74-$.78 | $.88-$1.16 | $1.50-$1.86 | $1.90-$2.53 |
|---|---|---|---|---|---|---|
| **Crops** | | | | | | |
| Winter Wheat | Acres | 15 | 31 | 90 | 198 | 214 |
| Barley | Acres | 19 | 16 | 12 | | |
| Oats | Acres | 33 | 31 | 23 | 6 | 3 |
| Summer Fallow | Acres | 14 | 31 | 90 | 198 | 214 |
| Corn | Acres | 15 | 15 | 11 | 6 | 5 |
| Tame Hay or Pasture | Acres | 352 | 324 | 222 | 40 | 12 |
| **Crop Production** | | | | | | |
| Wheat | Bushels | 337* | 764 | 2,268 | 5,053 | 5,451 |
| Feed Grain (corn equivalent) | Bushels | 1,176 | 1,084 | 808 | 221 | 149 |
| Tame Hay | Tons | 143 | 131 | 98 | 26 | 12 |
| Native Hay | Tons | 35 | 35 | 35 | 35 | 35 |
| **Livestock** | | | | | | |
| Beef Cows | Head | 32 | 31 | 31 | 20 | 15 |
| Stockers Sold† | Head | 145 | 134 | 82 | 15 | 12 |
| Total Labor Use | Hours | 1,770 | 1,711 | 1,485 | 1,056 | 980 |
| Total Capital Used | Dollars | 39,935 | 37,973 | 30,308 | 17,342 | 15,565 |
| Net Returns‡ | Dollars | 2,053 | 2,233 | 2,374 | 5,324 | 8,070 |

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

**Table 8. Crop and Livestock Production, Capital Needed, and Net Returns for the Optimum Farm Organization at Various Levels of Wheat Prices and 71 Cents per Bushel for Corn, 960-Acre Model Farm, Lyman and Tripp Counties**

| Item | Units | $.36-$.48 | $.49-$.68 | $.83-$.91 | $1.36-$2.21 | $2.22-$2.68 |
|---|---|---|---|---|---|---|
| **Crops** | | | | | | |
| Wheat | Acres | 19 | 22 | 148 | 277 | 284 |
| Corn | Acres | 19 | 22 | 12 | 9 | 8 |
| Sorghum | Acres | 44 | 80 | 43 | | |
| Barley | Acres | 15 | 8 | | | |
| Oats | Acres | 34 | 30 | 12 | 2 | |
| Summer Fallow | Acres | 19 | 22 | 148 | 277 | 284 |
| Tame Hay or Pasture | Acres | 426 | 392 | 213 | 11 | |
| **Crop Production** | | | | | | |
| Wheat | Bushels | 432* | 507 | 3,287 | 7,027 | 7,210 |
| Feed Grain (corn equivalent) | Bushels | 2,495 | 3,411 | 1,703 | 276 | 193 |
| Tame Hay | Tons | 144 | 125 | 54 | 11 | |
| Native Hay | Tons | 56 | 60 | 76 | 76 | 62 |
| **Livestock** | | | | | | |
| Beef Cows | Head | | | 3 | 28 | 20 |
| Stockers Sold† | Head | 309 | 289 | 191 | 22 | 15 |
| Total Labor Use | Hours | 2,441 | 2,375 | 1,905 | 1,407 | 1,232 |
| Total Capital Used | Dollars | 59,112 | 55,789 | 42,272 | 24,184 | 20,500 |
| Net Returns‡ | Dollars | 4,439 | 4,470 | 4,587 | 7,129 | 13,215 |

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

**Table 9. Crop and Livestock Production, Capital Needed, and Net Returns for the Optimum Farm Organization at Various Levels of Wheat Prices and 71 Cents per Bushel for Corn, 2,240-Acre Model Farm, Lyman and Tripp Counties**

| Item | Units | $.36-$.75 | $.76-$.77 | $.86-$.89 | $.90-$.96 | $.99-$1.29 | $1.30-$2.59 |
|---|---|---|---|---|---|---|---|
| **Crops** | | | | | | | |
| Wheat | Acres | 18 | 57 | 280 | 487 | 533 | 566 |
| Barley | Acres | 60 | 2 | | | | |
| Oats | Acres | 77 | 59 | 28 | 22 | 13 | |
| Sorghum | Acres | 230 | 232 | 243 | | | |
| Corn | Acres | 18 | 57 | 28 | 27 | 27 | 24 |
| Summer Fallow | Acres | 18 | 57 | 280 | 487 | 532 | 566 |
| Tame Hay or Pasture | Acres | 735 | 692 | 297 | 133 | 51 | |
| **Crop Production** | | | | | | | |
| Wheat | Bushels | 409* | 1,336† | 4,931 | 12,408 | 13,533 | 14,363 |
| Feed Grain (Corn equiv.) | Bushels | 8,935 | 8,898 | 8,160 | 916 | 827 | 628 |
| Tame Hay | Tons | 264 | 244 | 124 | 96 | 56 | |
| Native Hay | Tons | 205 | 205 | 205 | 205 | 205 | 198 |
| **Livestock** | | | | | | | |
| Beef Cows | Head | 79 | 76 | 74 | 96 | 64 | 64 |
| Stockers Sold‡ | Head | 411 | 400 | 213 | 73 | 50 | 50 |
| Total Labor Use | Hours | 4,965 | 4,900 | 3,835 | 3,495 | 3,046 | 2,878 |
| Total Capital Used | Dollars | 107,746 | 104,397 | 74,046 | 58,308 | 44,554 | 45,093 |
| Net Returns§ | Dollars | 8,225 | 8,358 | 8,504 | 8,848 | 8,993 | 14,454 |

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

**Table 10. Crop and Livestock Production, Capital Needed, and Net Returns for the Optimum Farm Organization at Various Levels of Wheat Prices and 85 Cents per Bushel for Corn, 640-Acre Model Farm, Lyman and Tripp Counties**

| Item | Untis | $.36-$.55 | $.59-$.61 | $.79-$.86 | $1.17-$1.23 | $1.90-$2.35 |
|---|---|---|---|---|---|---|
| **Crops** | | | | | | |
| Winter Wheat | Acres | 15 | 22 | 50 | 180 | 214 |
| Barley | Acres | 19 | 9 | 9 | | |
| Oats | Acres | 34 | 30 | 26 | 10 | 3 |
| Summer Fallow | Acres | 15 | 22 | 50 | 180 | 214 |
| Sorghum | Acres | 37 | 48 | 48 | | |
| Corn | Acres | 15 | 21 | 17 | 10 | 5 |
| Tame Hay or Pasture | Acres | 313 | 296 | 248 | 68 | 12 |
| **Crop production** | | | | | | |
| Wheat | Bushels | 337* | 502 | 1,213 | 4,634 | 5,451 |
| Feed Grain (corn equivalent) | Bushels | 2,226 | 2,491 | 2,330 | 331 | 149 |
| Tame Hay | Tons | 136 | 129 | 109 | 39 | 12 |
| Native Hay | Tons | 35 | 35 | 35 | 35 | 35 |
| **Livestock** | | | | | | |
| Beef Cows | Head | 42 | 41 | 36 | 24 | 15 |
| Stockers Sold† | Head | 97 | 90 | 79 | 18 | 12 |
| Total Labor Use | Hours | 1,720 | 1,694 | 1,590 | 1,115 | 980 |
| Total Capital Used | Dollars | 35,279 | 33,698 | 30,848 | 18,743 | 15,565 |
| Net Returns‡ | Dollars | 2,209 | 2,566 | 2,687 | 3,448 | 8,070 |

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

Table 11. Crop and Livestock Production, Capital Needed, and Net Returns for the Optimum Farm Organization at Various Levels of Wheat Prices and 85 Cents per Bushel for Corn, 960-Acre Model Farm, Lyman and Tripp Counties

| Item | Units | $.36-$.63 | $.77-$.90 | $1.03-$1.35 | $1.36-$2.21 | $2.22-$2.67 |
|---|---|---|---|---|---|---|
| **Crops** | | | | | | |
| Wheat | Acres | 19 | 139 | 274 | 277 | 284 |
| Corn | Acres | 19 | 56 | 9 | 10 | 8 |
| Sorghum | Acres | 121 | 121 | | | |
| Oats | Acres | 25 | 5 | 4 | 2 | |
| Barley | Acres | 7 | | | | |
| Summer Fallow | Acres | 19 | 139 | 274 | 277 | 284 |
| Tame Hay or Pasture | Acres | 366 | 116 | 15 | 10 | |
| **Crop production** | | | | | | |
| Wheat | Bushels | 432* | 3,349† | 6,950 | 7,027 | 7,210 |
| Feed Grain (corn equivalent) | Bushels | 4,400 | 5,047 | 292 | 276 | 193 |
| Tame Hay | Tons | 98 | 25 | 17 | 11 | |
| Native Hay | Tons | 76 | 76 | 76 | 76 | 62 |
| **Livestock** | | | | | | |
| Beef Cows | Head | | 4 | 30 | 28 | 20 |
| Stockers Sold‡ | Head | 271 | 141 | 23 | 22 | 15 |
| Total Labor Use | Hours | 2,260 | 1,930 | 1,444 | 1,407 | 1,232 |
| Total Capital Used | Dollars | 52,788 | 35,106 | 24,929 | 24,184 | 20,500 |
| Net Returns§ | Dollars | 4,593 | 4,649 | 4,781 | 7,129 | 13,215 |

*Wheat fed to livestock.
†844 bushels of wheat fed to livestock.
‡Includes calves raised and purchased.
§The net returns refers to the lowest wheat price and includes the returns to land and the operator's labor.
‡The net returns refer to the lowest wheat price and includes the returns to land and the operator's labor.

## Farm Plans with Corn Priced at 71 Cents

Results of the linear programming indicate that at this price combination, net returns would be greatest with a farm organization consisting of cash feed grains and livestock. The cattle enterprise combined a stock-cow herd and purchased feeder calves to raise to stocker cattle weights. As the wheat prices rose, summer fallow and winter wheat acreage increasingly displaced feed crop acreage. Consequently, the large numbers of purchased feeder calves were replaced by a relatively small stock-cow herd on all three model farms.

In general, wheat acreage and production increased as the wheat price increased. The two main sources of income, at the low wheat prices, were derived from the sales of feed grains and stocker cattle.[3] As wheat became increasingly competitive as a cash grain, production gradually shifted from cash feed grains, livestock feed crops and livestock to wheat and summer fallow. The change from feed grains to wheat occurred at different price ratios for each of the model farms, because each farm has a different set of costs for the same crop enterprises. The change in crop rotations by soil group at the various wheat price levels are shown in tables 16 through 18 for each of the model farms.

**Crop Production—Soils Group II.** Winter wheat, barley, oats, corn grain, grain sorghum, corn-silage, forage sorghum, alfalfa (including a pasture-type alfalfa), and summer fallow in 13 rotations were the cropping alternatives considered. Continuous small grain was not allowed, although a continuous row crop (corn and sorghum) was permitted. Corn is the only row crop shown in the crop rotations allowed, although sorghum can be substituted if it is more profitable.

The two most profitable grain crops were grain sorghum and corn when wheat was priced below 75 cents per bushel. Per acre returns for grain sorghum were $2.31 on the 640-acre farm and reached as high as $6.92 on the 2,240-acre farm. Corn returned $1.80 per acre on the 640-acre farm and about $3.80 per acre on each of the other model farms. However, differences in farm plans between the three model farms occurred due to differences in the cost structure. Since both wheat and corn grain prices were relatively low, livestock became an important source of income. Thus, Group II Soils were used to furnish livestock feed in addition to cash feed grain production.

[3]Continuous corn and grain sorghum were allowed as crop enterprise activities. However, to reduce duplicating crop enterprise activities, only corn was used in crop rotations with the assumption that corn would be replaced by grain sorghum if it were the more profitable grain crop.

**Table 12. Crop and Livestock Production, Capital Needed, and Net Returns for the Optimum Farm Organization at Various Levels of Wheat Prices and 85 Cents per Bushel for Corn, 2,240-Acre Model Farm, Lyman and Tripp Counties**

| Item | Units | $.36-$.75 | $.76-$.84 | $.85-$.88 | $.89-$.93 | $.94-$.96 | $1.30-$2.59 |
|---|---|---|---|---|---|---|---|
| **Crops** | | | | | | | |
| Wheat | Acres | 62 | 102 | 230 | 318 | 411 | 566 |
| Sorghum | Acres | 243 | 243 | 243 | 243 | 243 | |
| Corn | Acres | 62 | 102 | 128 | 122 | 27 | 24 |
| Oats | Acres | 56 | 38 | 28 | 22 | 13 | |
| Barley | Acres | 68 | 65 | | | | |
| Summer Fallow | Acres | 62 | 102 | 230 | 318 | 411 | 566 |
| Tame Hay or Pasture | Acres | 603 | 504 | 297 | 133 | 51 | |
| **Crop Production** | | | | | | | |
| Wheat | Bushels | 1,470* | 2,407† | 5,506 | 7,689 | 9,905 | 14,363 |
| Feed Grain (corn equiv.) | Bushels | 10,309 | 11,140 | 10,728 | 10,503 | 7,987 | 628 |
| Tame Hay | Tons | 205 | 165 | 124 | 96 | 56.1 | |
| Native Hay | Tons | 205 | 205 | 205 | 205 | 205 | 198 |
| **Livestock** | | | | | | | |
| Beef Cows | Head | 59 | 49 | 74 | 96 | 84 | 64 |
| Stockers Sold‡ | Head | 399 | 380 | 213 | 73 | 66 | 50 |
| Total Labor Use | Hours | 4,884 | 4,752 | 4,325 | 3,978 | 3,639 | 2,878 |
| Total Capital Used | Dollars | 100,279 | 94,529 | 74,759 | 59,004 | 54,330 | 45,093 |
| Net Returns§ | Dollars | 9,173 | 9,651 | 9,877 | 9,984 | 10,497 | 14,454 |

*Wheat fed to livestock.
†867 bushels of wheat were fed to livestock.
‡Includes calves raised and purchased.
§The net returns refer to the lowest wheat price and includes the returns to land and the operator's labor.

**Table 13. Crop and Livestock Production, Capital Needed, and Net Returns for the Optimum Farm Organization at Various Levels of Wheat Prices and $1.12 per bushel for Corn, 640-Acre Model Farm, Lyman and Tripp Counties**

| Item | Units | $.36-$.61 | $.69-$.89 | $.90-$1.06 | $1.30-$1.33 | $1.47-$1.49 | $1.90-$2.35 |
|---|---|---|---|---|---|---|---|
| **Crops** | | | | | | | |
| Winter Wheat | Acres | 6 | 34 | 41 | 133 | 198 | 214 |
| Barley | Acres | 41 | 27 | 28 | | | |
| Oats | Acres | 34 | 23 | 20 | 10 | 6 | 3 |
| Summer Fallow | Acres | 6 | 34 | 41 | 133 | 198 | 214 |
| Sorghum | Acres | 94 | 94 | 94 | 94 | | |
| Corn | Acres | 6 | 34 | 40 | 10 | 6 | 5 |
| Tame Hay or Pasture | Acres | 261 | 202 | 184 | 68 | 40 | 12 |
| **Crop Production** | | | | | | | |
| Wheat | Bushels | 138* | 809 | 961 | 3,006 | 5,053 | 5,451 |
| Feed Grain (corn equiv.) | Bushels | 3,737 | 4,133 | 4,292 | 3,599 | 221 | 149 |
| Tame Hay | Tons | 108 | 91 | 83 | 39 | 26 | 12 |
| Native Hay | Tons | 35 | 35 | 35 | 35 | 35 | 35 |
| **Livestock** | | | | | | | |
| Beef Cows | Head | 34 | 34 | 32 | 24 | 20 | 15 |
| Stockers Sold† | Head | 86 | 58 | 55 | 18 | 15 | 12 |
| Total Labor Use | Hours | 1,641 | 1,589 | 1,527 | 1,234 | 1,054 | 980 |
| Total Capital Used | Dollars | 31,758 | 27,338 | 26,406 | 18,526 | 17,342 | 15,565 |
| Net Returns‡ | Dollars | 3,120 | 3,151 | 3,330 | 4,375 | 5,174 | 8,070 |

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

**Table 14. Crop and Livestock Production, Capital Needed, and Net Returns for the Optimum Farm Organization at Various Levels of Wheat Prices and $1.12 per Bushel for Corn, 960-Acre Model Farm, Lyman and Tripp Counties**

| Item | Units | $.36-$.59 | $.77-$.88 | $1.04-$1.24 | $1.25-$1.47 | $1.58-$2.67 |
|---|---|---|---|---|---|---|
| **Crops** | | | | | | |
| Wheat | Acres | 38 | 43 | 190 | 203 | 284 |
| Corn | Acres | 37 | 43 | 38 | 50 | 8 |
| Sorghum | Acres | 121 | 121 | 121 | 121 | |
| Barley | Acres | 58 | 58 | 37 | | |
| Oats | Acres | 20 | 26 | | | |
| Summer Fallow | Acres | 38 | 43 | 190 | 202 | 284 |
| Tame Hay or Pasture | Acres | 264 | 242 | | | |
| **Crop production** | | | | | | |
| Wheat | Bushels | 864* | 1,002† | 4,624 | 4,912 | 7,210 |
| Feed Grain (corn equivalent) | Bushels | 5,641 | 5,839 | 5,220 | 4,944 | 193 |
| Tame Hay | Tons | 67 | 92 | | | |
| Native Hay | Tons | 76 | 76 | 62 | 62 | 62 |
| **Livestock** | | | | | | |
| Beef Cows | Head | | 34 | 20 | 20 | 20 |
| Stockers Sold‡ | Head | 225 | 126 | 15 | 15 | 15 |
| Total Labor Use | Hours | 2,201 | 2,189 | 1,457 | 1,437 | 1,232 |
| Total Capital Used | Dollars | 46,899 | 41,472 | 20,552 | 20,147 | 20,500 |
| Net Returns§ | Dollars | 5,771 | 6,029 | 6,426 | 7,055 | 8,684 |

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

**Table 15. Crop and Livestock Production, Capital Needed, and Net Returns for the Optimum Farm Organization at Various Levels of Wheat Prices and $1.12 per Bushel for Corn, 2,240-Acre Model Farm, Lyman and Tripp Counties**

| Item | Units | $.36-$.58 | $.92-$.94 | $.96-$1.00 | $1.08-$1.44 | $1.45-$1.47 | $1.70-$2.71 |
|---|---|---|---|---|---|---|---|
| **Crops** | | | | | | | |
| Wheat | Acres | 75 | 260 | 336 | 395 | 444 | 566 |
| Sorghum | Acres | 243 | 243 | 243 | 243 | 243 | |
| Corn | Acres | 75 | 105 | 93 | 88 | 25 | 24 |
| Barley | Acres | 137 | 75 | 75 | 35 | | |
| Oats | Acres | 62 | 30 | 18 | | | |
| Summer Fallow | Acres | 75 | 260 | 336 | 395 | 444 | 566 |
| Tame Hay or Pasture | Acres | 489 | 183 | 55 | | | |
| **Crop Production** | | | | | | | |
| Wheat | Bushels | 1,728* | 6,284.4*† | 8,158 | 9,284 | 9,860 | 14,363 |
| Feed Grain (corn equiv.) | Bushels | 11,875 | 11,311 | 10,891 | 10,471 | 8,373 | 628 |
| Tame Hay | Tons | 205 | 99 | | | | |
| Native Hay | Tons | 202 | 205 | 205 | 198 | 198 | 198 |
| **Livestock** | | | | | | | |
| Beef Cows | Head | 95 | 86 | 86 | 64 | 64 | 64 |
| Stockers Sold‡ | Head | 253 | 126 | 65 | 50 | 50 | 50 |
| Total Labor Use | Hours | 4,547 | 4,114 | 3,689 | 3,353 | 3,339 | 2,878 |
| Total Capital Used | Dollars | 88,701 | 65,418 | 55,890 | 46,543 | 45,733 | 45,093 |
| Net Returns§ | Dollars | 11,923 | 11,994 | 12,141 | 12,983 | 16,731 | 20,209 |

*Wheat fed to livestock.
†1320 bushels of wheat were fed to livestock.
‡Includes calves raised and purchased.
§The net returns refer to the lowest wheat price and includes the returns to land and the operator's labor.

**Table 16. Crop Rotations on Soil Groups at Various Levels of Wheat Prices and $.71 per Bushel for Corn, 640-Acre Model Farm, Lyman and Tripp Counties**

| Crop Rotation | Range of Wheat Prices per Bushel | | | | |
|---|---|---|---|---|---|
| | $.36-$.51 | $.74-$.78 | $.88-$1.16 | $1.50-$1.86 | $1.90-$2.35 |
| | Acres | | | | |
| **Soil Group II** | | | | | |
| Barley, oats, alfalfa, (3 years) | 94.0 | 81.0 | 60.0 | | |
| Summer fallow, winter wheat | | 13.0 | 34.0 | 94.0 | 94.0 |
| **Soil Group III** | | | | | |
| Summer fallow, winter wheat, corn, oats, alfalfa (4 years) | 117.0 | 117.0 | 86.4 | 51.2 | 23.4 |
| Summer fallow, winter wheat | | | 30.6 | 65.8 | 88.0 |
| Summer fallow, winter wheat, corn | | | | | 5.6 |
| **Soil Group IV** | | | | | |
| Grass | 237.0 | 218.1 | 143.0 | 14.5 | |
| Summer fallow winter wheat | | 18.9 | 94.0 | 222.5 | 237.0 |

**Table 17. Crop Rotations on Soil Groups at Various Levels of Wheat Prices and $.71 per Bushel for Corn, 960-Acre Model Farm, Lyman and Tripp Counties**

| Crop Rotation | Range of Wheat Prices per Bushel | | | | |
|---|---|---|---|---|---|
| | $.36-$.48 | $.49-$.68 | $.83-$.91 | $1.36-$2.21 | $2.22-$2.68 |
| | Acres | | | | |
| **Soil Group II** | | | | | |
| Barley, oats, alfalfa, (3 years) | 77.0 | 40.8 | | | |
| Sorghum | 44.0 | 80.2 | 43.1 | | |
| Summer fallow, winter wheat | | | 77.9 | 121.0 | 121.0 |
| **Soil Group III** | | | | | |
| Summer fallow, winter wheat, corn, oats, alfalfa (4 years) | 150.0 | 150.0 | | | |
| Summer fallow, winter wheat | | | 150.0 | 128.1 | 127.5 |
| Summer fallow, winter wheat, corn | | | | 21.9 | 22.5 |
| **Soil Group IV** | | | | | |
| Grass | 305.0 | 280.8 | 163.0 | | |
| Summer fallow, winter wheat, corn, oats, alfalfa (4 years) | | 24.2 | 98.0 | 20.0 | |
| Summer fallow, winter wheat | | | 44.0 | 285.0 | 305.0 |

**Table 18. Crop Rotations by Soil Groups at Various Levels of Wheat Prices and $.71 per Bushel for Corn, 2,240-Acre Model Farm, Lyman and Tripp Counties**

| Crop Rotation | Range of Wheat Prices per Bushel | | | | | |
|---|---|---|---|---|---|---|
| | $.36-$.75 | $.76-$.77 | $.86-$.89 | $.90-$.96 | $.99-$1.29 | $1.30-$2.59 |
| | Acres | | | | | |
| **Soil Group II** | | | | | | |
| Barley, oats, alfalfa (3 years) | 13.0 | 11.0 | | | | |
| Sorghum | 230.0 | 232.0 | | | | |
| Summer fallow, winter wheat | | | 243.0 | 243.0 | 243.0 | 243.0 |
| **Soil Group III** | | | | | | |
| Barley, oats, alfalfa (3 years) | 158.0 | | | | | |
| Summer fallow, winter wheat, corn, oats, alfalfa (4 years) | 142.0 | 300.0 | | | | |
| Summer fallow, winter wheat | | | 300.0 | 283.4 | 256.1 | 226.6 |
| Summer fallow, winter wheat, corn | | | | 16.6 | 43.9 | 72.4 |
| **Soil Group IV** | | | | | | |
| Barley, oats, alfalfa (3 years) | 129.0 | | | | | |
| Grass | 484.0 | 459.6 | 183.8 | 45.0 | | |
| Summer fallow, winter wheat, corn, oats, alfalfa (4 years) | | 153.4 | 226.0 | 175.0 | 102.0 | |
| Summer fallow, winter wheat | | | 203.2 | 393.0 | 511.0 | 613.0 |

Barley-oats-alfalfa (3 years) was the most profitable rotation on the 640-acre farm with the alfalfa fed to livestock and the grain sold. This rotation occupied the Group II Soils at wheat prices up to 51 cents. As wheat rose to 74 cents, summer fallow-winter wheat returned about 85 cents more per acre than the barley-oats-alfalfa rotation and 9 additional acres shifted to summer fallow and winter wheat. With a further rise in wheat price, to 88 cents, 20 additional acres were shifted to winter wheat and summer fallow which returned $6.55 per acre or about $1.25 more than barley-oats-alfalfa (3 years). At this wheat price, returns from wheat were not as great as from livestock and hence 60 acres was held in the barley-oats-alfalfa rotation. But, at a wheat price of $1.50, all of the Group II Soils were shifted to summer fallow-winter wheat which returned $15.80 per acre.

The cropping system on the two larger-model farms differed from that of the 640-acre model farm on these soils at the lower wheat prices. Considerable acreage was devoted to grain sorghum in addition to the barley, oats, and alfalfa. Alfalfa was needed for the livestock enterprise which was relatively more profitable at these low wheat and corn grain prices.

Wheat became competitive with corn grain and alfalfa at a wheat price of 83 cents on the 960-acre farm and at 86 cents on the 2,240-acre farm. At an 83-cent wheat price, approximately 78 acres shifted from grain sorghum, barley, oats, and alfalfa to summer fallow and winter wheat. At this price, summer fallow-winter wheat returned $6.41 per acre on the 960-acre farm.

On the 2,240-acre farm, 243 acres of sorghum, barley, oats, and alfalfa shifted to summer fallow and winter wheat at a wheat price of 86 cents. Although the returns from grain sorghum and winter wheat were the same, $6.91 per acre, the labor needed for summer fallow-winter wheat was less than half that required by grain sorghum.

**Crop Production—Soils Group III.** These soils were less productive than either the Group II or Group IV Soils. However, most of the crop alternatives on Group III Soils were the same as on Group II Soils with a few exceptions. Continuous corn and sorghum were not allowed on the Group III Soils but 3- and 4-year rotations of summer fallow, winter wheat, other small grains and row crops were allowed. Also several rotations which provided for 3 and 4 years of alfalfa were included as alternatives.

The entire acreage of Group III Soils was devoted to an 8-year rotation of summer fallow-winter wheat-corn-oats-alfalfa (4 years) on the 640- and 960-acre model farms at wheat prices below 50 cents, while a rotation of barley-oats-alfalfa (3 years) occupied about half of the land of these same soils on the 2,240-acre farm. With wheat priced at 36 cents and corn priced at 71 cents, none of the allowable rotations on the 640-acre model farm were profitable and only 3 rotations on the 960-acre farm and 6 on the 2,240-acre farm returned a net profit. At this combination of prices, the rotations which did return a net profit were those which included 3 or 4 years of alfalfa and in which grain sorghum was substituted for corn.

As the wheat price rose to 78 cents, the only rotation on the 640-acre model farm which showed a profit was the 8-year rotation of summer fallow-winter wheat-corn-oats-alfalfa (4 years). Summer fallow-winter wheat became slightly more profitable than the 8-year rotation as wheat rose to 88 cents. About 31 acres of corn, oats, and alfalfa shifted to summer fallow and winter wheat. At this price, summer fallow-winter wheat returned $2.82 per acre compared with $1.45 from the 8-year rotation. Corn, oats, and alfalfa acreage continued to shift to summer fallow and winter wheat as the price of wheat rose — at a price of $1.50, summer fallow-winter wheat returned $9.97 per acre and $15.27 at a price of $1.90. But even at $1.90 wheat price, about 20 acres of the Group III Soils were used for corn, oats, and alfalfa to be used as livestock feed.

The summer fallow-winter wheat-corn-oats-alfalfa (4 years) rotation was used on the 960-acre model farm to provide both livestock feed and cash grain. This rotation shifted to summer fallow and winter wheat at a wheat price of 83 cents. Summer fallow-winter wheat was the most profitable crop combination at this price and would remain so as the wheat prices continued to rise. Thus, nearly all the Group III Soils were devoted to summer fallow and winter wheat at prices of 83 cents or higher. A few acres of corn were planted to be used as livestock feed. With wheat priced at $1.03, $1.36, and $2.21, summer fallow-winter wheat on the 960-acre model farm returned $5.15, $8.96, and $18.75 per acre, respectively.

The Group III Soils on the 2,240-acre model farm were divided between two rotations, barley-oats-alfalfa (3 years) and an 8-year rotation of summer fallow-winter wheat-corn-oats-alfalfa (4 years). This meant that about 12% of the acreage was in summer fallow and winter wheat, 33% in corn grains, and 55% in alfalfa. Both rotations were profitable, at these wheat and corn grain prices, when alfalfa hay was fed to livestock. The wheat grown was fed, in addition to a portion of the corn grain production. As wheat rose to 76 cents, all of the Group III Soil was shifted to the 8-year rotation. Net returns from the 8-year rotation, at this price, was 50% greater than barley-oats-alfalfa (3 years)—several other rotations were more profitable (in terms of cash crops) but feed was needed for the livestock enterprise. Summer fallow-winter wheat became the most profitable crop combination at a wheat price of 86 cents and, thus, the acreage shifted out of corn grains and alfalfa. The size of the livestock enterprise was reduced and alfalfa and corn grain production was shifted to the Group IV Soils. With a continued rise in wheat price, the livestock enterprise was gradually reduced due to increasing wheat production on the Group IV Soils of the 2,240-acre farm. As corn grains, alfalfa hay, and tame pasture gradually shifted to summer fallow-winter wheat on the Group IV Soils, some of the summer fallow-winter wheat acreage on the Group III Soils shifted to corn grain. As wheat reached $1.30 per bushel, approximately 24 acres (about 8%) of the Group III Soils shifted to corn grain which was needed for livestock feed.

**Crop Production—Soils Group IV.** The soils in this group are more productive than those in Soils Group III, when properly managed. Due to the typography of these soils, continuous small grains and row crops were not allowed. A permanent grass and legume seeding was added as a cropping alternative.

The other crop alternatives were the same as on the other soil groups. However, outside of alternate summer fallow and winter wheat, the crop rotations included 3 and 4 years of alfalfa.

On the 640-acre model farm, all of the Group IV Soils were seeded as pasture at wheat prices below 74 cents per bushel. As wheat prices rose, summer fallow-winter wheat became more competitive with the livestock enterprise and feed crops on the Group II and Group IV soils began to shift to winter wheat. With wheat priced at 74 cents, summer fallow-winter wheat returned $1.78 per acre and 19 acres of tame

pasture shifted to summer fallow and winter wheat. With subsequent increases in the wheat price, additional tame pasture acreage shifted to summer fallow and winter wheat until, at a price of $1.90, the entire Group IV Soils was in summer fallow and winter wheat.

The cropping pattern, on the 960-acre farm, was somewhat similar to that of the 640-acre model farm. In general, tame pasture shifted to summer fallow and winter wheat as wheat became more competitive. At the low grain prices, these soils were used for tame pasture, but at a wheat price of 49 cents, 24 acres of pasture shifted to an 8-year crop rotation of summer fallow-winter wheat-corn-oats-alfalfa. With a continued rise in wheat price, to 83 cents per bushel, summer fallow-winter wheat returned a net of $3.49 per acre and acreage continued to shift to summer fallow-winter wheat. The acreage remaining in tame pasture shifted to summer fallow-winter wheat at a wheat price of $1.03 as the returns per acre increased to $5.96—livestock was not competitive at this price.

Most of the Soils Group IV acreage, on the 2,240-acre farm was used for roughage production—mainly for tame pasture and some alfalfa hay. Livestock was the most profitable farm enterprise with the prevailing low wheat and corn prices, although most of the crop rotations returned a small net profit. A shift of tame pasture and barley acreage to summer fallow and winter wheat occurred as wheat rose to a price of 76 cents. The wheat price rise altered the relative profitability of the crop alternatives on each soils group and thus, the livestock enterprise lost some of its competitive advantage. Thus, the Group IV Soils gradually shifted until, at a wheat price of $1.30 per bushel, the entire acreage was in summer fallow and winter wheat. Net returns from summer fallow-winter wheat were $9.33 per acre with wheat priced at $1.30 and $25.23 when wheat was priced at $2.59 per bushel.

**Livestock Production.** The livestock enterprise in the optimum farm plan was primarily one of raising calves to stocker weights (700 pounds). Most of the calves were purchased in the fall but some calves were raised from a stock-cow herd.

The livestock enterprise contributed significantly to total farm income, on all three model farms at the lower wheat prices, but as wheat rose in price the livestock enterprise became supplementary in nature. Without any livestock, some land resources would remain idle. No provisions were made to sell native hay or rent range. It is recognized that in most real situations, native hay or rangeland probably would not remain idle. If not used by the farm operator, it would be leased out.

With the $25.28 and $23.08 prices used for feeder and stocker calves, respectively, both were profitable, particularly at a corn price of 71 cents per bushel. In reality, such a large disparity between grain and livestock prices probably would not occur, or if it did, it would not remain for long, since the demand for corn for livestock feeding would force corn prices to rise.

Fall-purchased calves fed to stocker cattle weights (700 pounds) were relatively more profitable than maintaining a stock-cow herd. In addition, more labor is needed to maintain a stock-cow herd. Also, more of the labor is needed at a time when it competes with 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 and some grain. The grains used for feed depended upon the price of wheat in relation to corn. All the wheat grown was used as feed at prices up to 51 cents on the 640-acre farm, 48 cents on the 960-acre farm, and 75 cents on the 2,240-acre model farm. As the wheat price increased, winter wheat was replaced by oats, barley, corn or grain sorghum as feed.

The percentage of cropland used for feed production on the 640-acre farm varied from about 85% at the low wheat price to 4.5% at the highest programmed price. On the 960-acre farm, the percentage of cropland used for feed production varied from 80.5% at the low wheat price to 1.5% at the high price while, on the 2,240-acre farm, cropland devoted to feed production varied from about 70% to 2% at the high wheat price.

### Farm Plans with Corn Priced at 85 Cents

Differences in farm plans occurred on all model farms at the low wheat prices, when the corn price was raised from 71 cents to 85 cents. Primarily the changes occurred on Soil Groups II and IV and involved a shifting of some tame pasture and alfalfa to barley, oats, and grain sorghum. Fewer feeder calves were purchased but livestock was still an important source of farm income.

Due to the 14-cent increase in corn price and an increased volume of corn grain sold, net returns were higher at the lower wheat prices on all three model farms. The change in crop rotations by soil group at the various wheat price levels are shown in Tables 19 through 21 for each of the model farms.

**Crop Production—Soils Group II.** Crop production on the 640-acre farm was oriented toward feed grain and alfalfa production at wheat prices below $1.17 per bushel. Wheat became competitive with feed grains and alfalfa at a wheat price of $1.17 returning $10.87 per acre, and the entire acreage shifted to winter wheat and summer fallow. The closest competing crop rotations were summer fallow-winter wheat-

corn or grain sorghum each returning about $1.50 per acre less. As the wheat price advanced to $1.90, summer fallow-winter wheat returned $21.77 per acre or $5.08 more than the second most profitable crop rotation.

**Table 19. Crop Rotations by Soil Groups at Various Levels of Wheat Prices and $.85 per Bushel for Corn, 640-Acre Model Farm, Lyman and Tripp Counties**

| Crop Rotation | Range of Wheat Prices per Bushel | | | | |
|---|---|---|---|---|---|
| | $.36-$.55 | $.59-$.61 | $.79-$.86 | $1.17-$1.23 | $1.90-$2.35 |
| | Acres | | | | |
| **Soil Group II** | | | | | |
| Sorghum | 37.4 | 48.2 | 48.2 | | |
| Barley, oats, alfalfa, (3 years) | 56.5 | 45.8 | 45.8 | | |
| Summer fallow, winter wheat | | | | 94.0 | 94.0 |
| **Soil Group III** | | | | | |
| Summer fallow, winter wheat, corn, oats, alfalfa (4 years) | 117.0 | 117.0 | 117.0 | 58.8 | 23.4 |
| Summer fallow, winter wheat | | | | 58.2 | 88.0 |
| Summer fallow, winter wheat, corn | | | | | 5.6 |
| **Soil Group IV** | | | | | |
| Barley, oats, alfalfa, (3 years) | 40.7 | | | | |
| Grass | 196.3 | 183.3 | 153.0 | 30.2 | |
| Summer fallow, winter wheat, corn, oats, alfalfa (4 years) | | 53.7 | 17.3 | 17.3 | |
| Summer fallow, winter wheat | | | 66.7 | 189.5 | 237.0 |

**Table 20. Crop Rotations on Soil Groups at Various Levels of Wheat Prices and $.85 per Bushel for Corn, 960-Acre Model Farm, Lyman and Tripp Counties**

| Crop Rotation | Range of Wheat Prices per Bushel | | | | |
|---|---|---|---|---|---|
| | $.36-$.63 | $.77-$.90 | $1.03-$1.35 | $1.36-$2.21 | $2.22-$2.67 |
| | Acres | | | | |
| **Soil Group II** | | | | | |
| Sorghum | 121.0 | 121.0 | | | |
| Summer fallow, wheat | | | 121.0 | 121.0 | 121.0 |
| **Soil Group III** | | | | | |
| Summer fallow, wheat, corn, oats, alfalfa, (4 years) | 150.0 | | | | |
| Summer fallow, wheat, corn | | 150.0 | 15.8 | 21.9 | 22.5 |
| Summer fallow, wheat | | | 134.2 | 128.1 | 127.5 |
| **Soil Group IV** | | | | | |
| Barley, oats, alfalfa (3 years) | 35.2 | | | | |
| Grass | 269.8 | 93.3 | | | |
| Summer fallow, winter wheat, corn, oats, alfalfa (4 years) | | 44.7 | 30.9 | 20.0 | |
| Summer fallow, wheat | | 167.0 | 274.1 | 285.0 | 305.0 |

**Table 21. Crop Rotations by Soil Groups at Various Levels of Wheat Prices and $.85 per Bushel for Corn, 2,240-Acre Model Farm, Lyman and Tripp Counties**

| Crop Rotation | Range of Wheat Prices per Bushel | | | | | |
|---|---|---|---|---|---|---|
| | $.36-$.75 | $.76-$.84 | $.85-$.88 | $.89-$.93 | $.94-$.96 | $1.30-$2.59 |
| | Acres | | | | | |
| **Soil Group II** | | | | | | |
| Sorghum | 243.0 | 243.0 | 243.0 | 243.0 | 243.0 | |
| Summer fallow, winter wheat | | | | | | 243.0 |
| **Soil Group III** | | | | | | |
| Barley, oats, alfalfa, (3 years) | 153.8 | | | | | |
| Summer fallow, winter wheat, corn, barley | 146.2 | 257.2 | | | | |
| Summer fallow, winter wheat, corn, oats, alfalfa (4 years) | | 42.8 | | | | |
| Summer fallow, winter wheat, corn | | | 300.0 | 300.0 | 43.9 | 73.4 |
| Summer fallow, winter wheat | | | | | 256.1 | 226.6 |
| **Soil Group IV** | | | | | | |
| Grass | 409.0 | 352.6 | 183.8 | 45.0 | | |
| Summer fallow, winter wheat, corn, oats, alfalfa, (4 years) | 204.0 | 260.4 | 226.0 | 175.0 | 102.0 | |
| Summer fallow, winter wheat | | | 203.2 | 393.0 | 511.0 | 613.0 |

The 14-cent rise in the corn price increased net returns from grain sorghum by $4.23, to $9.46 per acre on the 960-acre model farm. Corn returned $8.28 and barley-oats-alfalfa (3 years) was third in profitability. The returns from summer fallow-winter wheat were below that of grain sorghum until wheat reached a price of $1.03. Thus, at that price all the cropland shifted to summer fallow and winter wheat. At a wheat price of $1.36, summer fallow-winter wheat returned a net of $14.32 or $1.60 more than the second most profitable crop rotation. With wheat priced at $2.22, net returns from winter wheat and summer fallow were $34.02 per acre compared with $25.83 from summer fallow-winter wheat-grain sorghum.

Net returns from grain sorghum on the 2,240-acre farm increased by $4.23 per acre with the 14-cent increase in corn price. Although, the net returns from corn more than doubled, corn still returned $2.94 per acre less than grain sorghum. The returns from summer fallow-winter wheat were lower than most crop alternatives until the wheat price rose to over one dollar per bushel. At the $1.30 wheat price, the entire acreage in grain sorghum shifted to summer fallow and winter wheat which returned a net of $13.47 per acre. At this wheat price, winter wheat was the most

profitable cropping alternative. No additional change in cropping patterns could be expected to occur unless a change in corn or cattle prices occurred to reduce the relative profitability of winter wheat. At wheat prices of $1.58 and $2.59, summer fallow and winter wheat returned $17.65 and $32.74 per acre, respectively.

**Crop Production—Soils Group III.** The cropping pattern on the 640-acre model farm was similar whether corn was priced at 85 cents or 71 cents. One hundred and seventeen acres of Group III Soils were devoted to an 8-year rotation of summer fallow-winter wheat-corn-oats-alfalfa at wheat prices up to 86 cents. As wheat rose to $1.17 per bushel, approximately 44 acres of corn, oats, and alfalfa shifted to summer fallow and winter wheat. Summer fallow-winter wheat returned $6.16 per acre at a wheat price of $1.17, compared to the second most profitable rotation of summer fallow-winter wheat-corn which retured $4.85 per acre.

The cropping pattern on the 960-acre farm was also nearly identical to that when corn was priced at 14 cents less. Summer fallow-winter wheat which returned $5.15 per acre, became the most profitable crop rotation at a wheat price of $1.03 followed by summer fallow-winter wheat-corn which returned $4.86 per acre. As the wheat price increased above $1.03, the net return advantage for wheat increased. Thus, at a wheat price of $2.68 the net returns from summer fallow-winter wheat were $24.17 per acre, or $5.48 per acre more than the second most profitable rotation.

Feed grain production became more profitable on the 2,240-acre farm and was increased by shifting alfalfa to summer fallow, winter wheat, barley, and corn. Winter wheat production also increased at the lower wheat prices but it was fed to livestock, making a larger part of the feed grain production available for sale. With wheat priced at 85 cents per bushel, a rotation of summer fallow-winter wheat-corn become slightly more profitable than when barley was included and was $1.42 per acre more profitable than summer fallow-winter wheat-corn-oats-alfalfa (4 years). The acreage in barley, oats, and alfalfa acreage also shifted to summer fallow-winter wheat and corn. As the wheat price was increased to 94 cents, the cropping pattern and crop acreages reverted to that when corn was priced at 71 cents. Net returns for summer fallow-winter wheat were $4.17 per acre compared with $4.15 for a rotation of summer fallow-winter wheat-corn. As the wheat price increased, returns from summer fallow-winter wheat increased faster than rotations with corn grain or alfalfa as the corn and livestock prices remained constant.

**Crop Production—Soils Group IV.** The changes in use of this soils group as a result of the higher corn price occurred primarily because a change also occurred in the cropping patterns on the Group II Soils.

The Group IV Soils, on the 640-acre farm, were used mainly for tame pasture at the low corn price. With an 85-cent corn price, tame pasture remained as the major land use, but some alfalfa hay was now produced to compensate for the loss of hay production on the Group II Soils. Also, feed grains were produced on these soils up through a wheat price of $1.23. The tame hay and pasture acreage shifted, first, to corn, summer fallow, and winter wheat, and then just to summer fallow and winter wheat as the wheat price continued to rise. When wheat reached $1.90 per bushel, the entire acreage of Group IV Soils shifted to summer fallow and winter wheat.

As alfalfa hay was already being produced on the 960-acre model farm Group IV Soils at a corn price of 71 cents, the increase in corn price caused no major change in land use on these soils. Most of the changes which occurred involved only number of acres, although a 5-year rotation of barley, oats, alfalfa (3 years) did come into the cropping pattern at the lowest wheat price. At a wheat price of 77 cents, some land was shifted to summer fallow-winter wheat from tame pasture and barley. With further increases in the wheat price, tame pasture, alfalfa hay, and corn gradually shifted to summer fallow and winter wheat. Thus, at a wheat price of $2.22 the entire 305 acres of Group IV Soils had shifted to summer fallow and winter wheat.

Livestock was more important on the 2,240-acre model farm, at relatively low wheat prices, than either of the other model farms due to the large acreage of native hay and pasture. Consequently, few changes occurred with the increase in corn price and they occurred only below a wheat price of 85 cents. In general, there was a shift from tame pasture and alfalfa hay to corn grain and winter wheat, with the wheat raised for livestock feed. At a wheat price of 85 cents, tame pasture, alfalfa, and corn grain acreage began to shift to summer fallow and winter wheat acreage. The cropping patterns became identical to that which existed at a corn price of 71 cents.

**Livestock Production.** The 14-cent increase in corn price produced only minor changes in the livestock enterprise on all 3 model farms. Corn became more profitable as cash grain and relatively less profitable as feed, and hence, the livestock enterprises were slightly reduced. No change occurred in the kind of feed used.

The change on the 640-acre model farm meant an increase in the number of stock cows with a decrease in the number of purchased calves, while the only change on the 960-acre farm was merely a decrease in the number of purchased calves. With wheat pric-

ed at $1.03 and above, the livestock enterprise became identical to that when corn was priced at 71 cents. With the increase in corn price the number of stock cows and purchased feeder calves were reduced on the 2,240-acre model farm but at wheat prices above 90 cents, the livestock enterprise became identical to that when corn was priced at 71 cents.

### Farm Plans with Corn Priced at $1.12

The competitive position and relative profitability of corn was further enhanced with an increase in price to $1.12 per bushel. This forced a rise in the price of wheat if it were to remain competitive with corn for the use of cropland.

Crop rotations by soil groups at the various levels of wheat prices are shown in Tables 22 through 24 for the three model farms.

**Crop Production—Soils Group II.** With a rise of 27 cents in the corn price, to $1.12 per bushel, wheat was not profitable enough to raise on these soils at wheat prices below $1.47 on any of the model farms. Considering the cost, yield and price relationships, continuous grain sorghum was the most profitable crop with a return of $14.71 per acre on the 640-acre farm, $17.63 on the 960-acre farm, and $19.32 per acre on the 2,240-acre model farm. Continuous corn was second, returning a dollar per acre less than grain sorghum on the 960-acre farm and $2.61 less on the 2,240-acre farm. Barley and oats were poor alternatives on these soils compared with corn and grain sorghum. These soils were more profitably used for cash grain production which left the Group III and IV Soils for feed production.

**Table 22. Crop Rotations by Soil Group at Various Levels of Wheat Prices and $1.12 per Bushel for Corn, 640-Acre Model Farm, Lyman and Tripp Counties**

| Crop Rotation | Range of Wheat Prices Per Bushel | | | | | |
|---|---|---|---|---|---|---|
| | $.36-$.61 | $.69-$.89 | $.90-$1.06 | $1.30-$1.33 | $1.47-$1.49 | $1.90-$2.35 |
| | Acres | | | | | |
| **Soil Group II** | | | | | | |
| Sorghum | 94.0 | 94.0 | 94.0 | 94.0 | | |
| Summer fallow, winter wheat | | | | | 94.0 | 94.0 |
| **Soil Group III** | | | | | | |
| Barley, oats, alfalfa (3 years) | 93.0 | 40.8 | 19.7 | | | |
| Summer fallow, winter wheat, corn, barley | 24.0 | 76.2 | 97.3 | | | |
| Summer fallow, winter wheat, corn, oats, alfalfa, (4 years) | | | | 58.8 | 51.2 | 23.4 |
| Summer fallow, winter wheat, corn | | | | 58.2 | | 5.6 |
| Summer fallow, winter wheat | | | | | 65.8 | 88.0 |
| **Soil Group IV** | | | | | | |
| Barley, oats, alfalfa (3 years) | 79.7 | | | | | |
| Grass | 157.3 | 116.9 | 106.8 | 30.2 | 14.5 | |
| Summer fallow, winter wheat, corn, oats, alfalfa (4 years) | | 120.1 | 130.2 | 17.3 | | |
| Summer fallow, winter wheat | | | | 189.5 | 222.5 | 237.0 |

**Table 23. Crop Rotations on Soil Groups at Various Levels of Wheat Prices and $1.12 per Bushel for Corn, 960-Acre Model Farm, Lyman and Tripp Counties**

| Crop Rotation | Range of Wheat Prices per Bushel | | | | |
|---|---|---|---|---|---|
| | $.36-$.59 | $.77-$.88 | $1.04-$1.24 | $1.25-$1.47 | $1.58-$2.67 |
| | Acres | | | | |
| **Soil Group II** | | | | | |
| Sorghum | 121.0 | 121.0 | 121.0 | 121.0 | |
| Summer fallow, wheat | | | | | 121.0 |
| **Soil Group III** | | | | | |
| Summer fallow, winter wheat, corn, barley | 150.0 | 150.0 | 150.0 | | |
| Summer fallow, winter wheat, corn | | | | 150.0 | 22.5 |
| Summer fallow, winter wheat | | | | | 127.5 |
| **Soil Group IV** | | | | | |
| Grass | 203.3 | 158.5 | | | |
| Barley, oats, alfalfa (3 years) | 101.7 | 101.7 | | | |
| Summer fallow, winter wheat, corn, oats, alfalfa (4 years) | | 44.8 | | | |
| Summer fallow, winter wheat | | | 305.0 | 305.0 | 305.0 |

Wheat became competitive with grain sorghum on the 640-acre model farm at a wheat price of $1.47 and the entire acreage of Group II Soils shifted to summer fallow-winter wheat. Summer fallow-winter wheat returned $15.35 per acre compared with $14.71 from grain sorghum. Grain sorghum shifted to summer fallow-winter wheat on the 960-acre farm at a wheat price of $1.58 and on the 2,240-acre farm at $1.70 per bushel. Summer fallow-winter wheat returned $17.60 and $19.44 per acre, compared with the net returns from grain sorghum of $17.63 and $19.63 on the 960- and 2,240-acre farms, respectively.

**Crop Production—Soils Group III.** The increase in corn price caused a shift from alfalfa hay to wheat and feed grain production on these soils. There were, however, differences in the amount of acreage which shifted on each of the model farms.

With wheat at 36 cents and corn at $1.12, wheat acreage decreased by 9 acres and alfalfa decreased by about 3 acres on the 640-acre farm. In contrast, wheat and feed grain acreage increased while alfalfa acreage decreased to zero on the 2 larger model farms. Although feed grain production was much more profitable than wheat, at this combination of prices, some

**Table 24. Crop Rotations by Soil Groups at Various Levels of Wheat Prices and $1.12 per Bushel for Corn, 2,240-Acre Model Farm, Lyman and Tripp Counties**

| Crop Rotation | Range of Wheat Prices Per Bushel | | | | | |
|---|---|---|---|---|---|---|
| | $.36-$.58 | $.92-$.94 | $.96-$1.00 | $1.08-$1.44 | $1.45-$1.47 | $1.70-$2.71 |
| | Acres | | | | | |
| **Soil Group II** | | | | | | |
| Sorghum | 243.0 | 243.0 | 243.0 | 243.0 | 243.0 | |
| Summer fallow, winter wheat | | | | | | 243.0 |
| **Soil Group III** | | | | | | |
| Summer fallow, winter wheat, corn, barley | 300.0 | 300.0 | 300.0 | 300.0 | | |
| Summer fallow, winter wheat, corn | | | | | 300.0 | 73.4 |
| Summer fallow, winter wheat | | | | | | 226.6 |
| **Soil Group IV** | | | | | | |
| Barley, oats, alfalfa (3 years) | 310.8 | | | | | |
| Grass | 302.2 | 92.7 | | | | |
| Summer fallow, winter wheat, corn, oats, alfalfa (3 years) | | 211.0 | 128.1 | | | |
| Summer fallow, winter wheat | | 309.3 | 484.9 | 613.0 | 613.0 | 613.0 |

of the Group III Soils was needed to produce livestock feed.

As wheat rose in price, the acreage in the barley-oats-alfalfa rotation gradually decreased on the 640-acre farm, with the oats and alfalfa acreage shifting to summer fallow, winter wheat, corn and barley. As wheat rose to $1.30 the returns became greater for crop rotations with a larger proportion of wheat, and land use gradually shifted to increase total wheat production. Cash returns plus value of alfalfa from the summer fallow - winter wheat - corn - oats - alfalfa (4 years) rotation were somewhat comparable to the summer fallow-winter wheat-corn rotation.

The increased wheat price caused a large reduction in tame pasture and hay production on the Group IV Soils as that acreage shifted to summer fallow and winter wheat. Thus, the alfalfa and feed grains produced on the Group III Soils were needed for the livestock enterprise. An increase to $1.47 in wheat price produced an additional shift from feed grain acreage to wheat and summer fallow as well as a slight reduction in alfalfa hay. The summer fallow-winter wheat-corn rotation returned $9.46 per acre compared with $9.62 from summer fallow and winter wheat. When wheat reached $1.90, the crop rotations became identical to those used at a corn price of 85 cents. Approximately 17 acres were used for feed grain and alfalfa production which was needed for livestock since wheat was more profitably grown on the Group II and IV Soils.

A similar shift, from alfalfa to feed grains and wheat, occurred on the 2 larger model farms when corn was raised to $1.12 per bushel. The crop rotations, which included 4 years of alfalfa on the 960-acre farm and 3 years of alfalfa on the 2,240-acre farm at the 85 cent corn price, shifted to a summer fallow-winter wheat-corn-barley rotation on both farms. Below a wheat price of 88 cents on the 960-acre farm and 94 cents on the 2,240-acre farm the wheat that was produced was fed to livestock. A summer fallow-winter wheat-corn-barley rotation returned a net of $6.37 per acre on the 960-acre farm (wheat at 88 cents) and $6.70 per acre (wheat at 94 cents) on the 2,240-acre farm. Summer fallow-winter wheat-corn was the second most profitable of the allowable crop rotations, returning approximately 30 cents per acre less than the summer fallow-winter wheat-corn-barley rotation; rotations which contained alfalfa returned $2 to $3 less.

Barley dropped from the rotation on the 960-acre farm, at a wheat price of $1.25 per bushel. Similarly, barley dropped from the rotation on the 2,240-acre farm as wheat reached a price of $1.45 per bushel.

Summer fallow and winter wheat became the dominant cropping system on both model farms with a continued price rise. As the wheat price was increased to $1.58, summer fallow and winter wheat returned $11.49 per acre compared with $11.40 from a summer fallow-winter wheat-corn rotation on the 960-acre farm. At a price of $1.70, summer fallow-winter wheat returned $12.93 per acre on the 2,240-acre farm compared with $12.31 from summer fallow-winter wheat-corn. Consequently, all the Group III Soils went to summer fallow and winter wheat except a relatively small acreage of corn needed for feed.

**Soils Group IV.** These soils were used to produce mainly alfalfa hay and tame pasture at low wheat prices because cattle were more profitable than cash wheat. With wheat prices ranging from 58 cents on the 2,240-acre farm to 61 cents on the 640-acre farm, winter wheat was the least profitable crop and livestock enterprises were profitable.

Approximately 86% of the Group IV Soils on the 640-acre farm were used to produce pasture and alfalfa hay at a 61-cent wheat price. The barley-oats-alfalfa (3 years) rotation was the most profitable rotation with a $3.06 per acre return; the barley and oats were sold while the wheat was fed to livestock. At a range of 69 to 89 cents, summer fallow-winter wheat-corn-oats-alfalfa (4 years) became slightly more profitable than barley-oats-alfalfa (3 years), returning $3.10 per acre. Tame pasture gradually shifted to summer fallow, winter wheat, corn, and alfalfa at wheat prices of 69 cents to $1.30 until summer fallow-winter wheat occupied 82% of the soils, returning $8.68 per acre compared with $5.13 from the next best

alternative. Tame pasture, alfalfa and feed grains acreage continued to shift to summer fallow and winter wheat at a wheat price of $1.47; summer fallow-winter wheat returned $10.78 per acre, nearly twice the return from the second best alternative. Some tame pasture was needed at the $1.47 wheat price but as the price was increased to $1.90, the cow herd was reduced and the remaining acreage in tame pasture shifted to summer fallow-winter wheat. Summer fallow-winter wheat returned $16.08 per acre, about $9 per acre more than the next best rotation.

Nearly 87% of the Group IV Soils were used for tame pasture and alfalfa hay on the 960-acre farm; barley and oats were sold while wheat produced on the Group III Soils was fed. With wheat priced at 59 cents, summer fallow-winter wheat returned only 53 cents per acre compared with $4.20 from barley-oats-alfalfa (3 years). Winter wheat gradually became more competitive as wheat prices increased and at a price of 77 cents some tame pasture shifted to a 7-year rotation of summer fallow, winter wheat, corn, oats, and alfalfa. As wheat increased to $1.04, the entire acreage shifted to summer fallow-winter wheat as it returned $6.08 per acre or $1.11 more than the second most profitable rotation.

Livestock became supplementary and numbers were reduced on the 960-acre farm to utilize the native hay and range with only enough corn produced (on Group III Soils) to furnish the necessary grain. As wheat rose in price, the competitive position of winter wheat in a 2-year rotation increased at a much faster rate than the other crop rotations allowed on these soils. For example, summer fallow-winter wheat returned $12.47 per acre, at a wheat price of $1.58, compared with $6.87 from the second best rotation.

Farm income on the 2,240-acre farm was derived from livestock and cash feed grain at low wheat prices; thus, about 80% of these soils were devoted to tame pasture and alfalfa hay. But as wheat rose to 92 cents and winter wheat returned a net of $4.68 per acre, it became competitive with tame pasture and alfalfa. The emphasis of land use on the Group IV Soils shifted from roughage production to cash grain. As animal units were reduced the acreage in tame pasture and alfalfa was reduced by about 63%. With wheat at 96 cents, the remaining acreage in tame pasture, some corn, oats, and alfalfa, shifted to summer fallow and winter wheat which returned $5.14 per acre. The remaining corn, oats, and alfalfa then shifted to summer fallow-winter wheat at a price of $1.08

**Table 25. Resident Labor Use by Periods for the Optimum Farm Organization at Specified Wheat and Corn Prices, 640-Acre Model Farm, Lyman and Tripp Counties**

| Labor period | Corn price per bu. | Hours of labor available | Resident Labor Use at the Following Range of Wheat Prices | | | | |
|---|---|---|---|---|---|---|---|
| | | | $.36-$.51 | $.74-$.78 | $.88-$1.16 | $1.50-$1.86 | $1.90-$2.35 |
| | | | Hours | | | | |
| Nov. 16 to March 15 | 71c | 873 | 542.5 | 510.3 | 387.6 | 160.6 | 122.2 |
| March 16 to April 30 | 71c | 464 | 220.7 | 206.7 | 160.0 | 64.1 | 47.6 |
| May 1 to July 15 | 71c | 938 | 411.7 | 403.0 | 368.2 | 290.4 | 270.6 |
| July 16 to Sept. 30 | 71c | 960 | 385.0 | 392.2 | 431.9 | 495.1 | 504.3 |
| Oct. 1 to Nov. 15 | 71c | 360 | 210.0 | 198.4 | 136.9 | 45.4 | 34.9 |
| **Total annual** | **71c** | **3595** | **1769.9** | **1710.6** | **1484.6** | **1055.6** | **979.6** |
| | | | Resident Labor Use at the Following Range of Wheat Prices | | | | |
| | | | $.36-$.55 | $.59-$.61 | $.79-$.86 | $1.17-$1.23 | $1.90-$2.35 |
| | | | Hours | | | | |
| Nov. 16 to March 15 | 85c | 873 | 491.8 | 469.1 | 411.8 | 192.7 | 122.2 |
| March 16 to April 30 | 85c | 464 | 206.5 | 193.1 | 169.6 | 78.0 | 47.6 |
| May 1 to July 15 | 85c | 938 | 449.8 | 465.4 | 439.9 | 305.8 | 270.6 |
| July 16 to Sept. 30 | 85c | 960 | 362.4 | 349.9 | 371.5 | 482.7 | 504.3 |
| Oct. 1 to Nov. 15 | 85c | 360 | 209.4 | 216.9 | 197.5 | 55.8 | 34.9 |
| **Total annual** | **85c** | **3595** | **1719.9** | **1694.4** | **1590.3** | **1115.0** | **979.6** |
| | | | Resident Labor Use at the Following Range of Wheat Prices | | | | |
| | | | $.61 $.61 | $.69-$.89 | $.90-$1.06 | $1.30-$1.33 | $1.47-$1.49 | $1.90-$2.35 |
| | | | Hours | | | | |
| Nov. 16 to March 15 | $1.12 | 873 | 415.8 | 349.7 | 330.1 | 192.7 | 160.6 | 122.2 |
| Mar. 16 to Apr. 30 | 1.12 | 464 | 191.7 | 156.0 | 147.8 | 78.0 | 63.5 | 47.6 |
| May 1 to July 15 | 1.12 | 938 | 465.1 | 535.3 | 505.0 | 407.2 | 289.8 | 270.6 |
| July 16 to Sept. 30 | 1.12 | 960 | 323.5 | 316.0 | 313.2 | 395.5 | 495.1 | 504.3 |
| Oct. 1 to Nov. 15 | 1.12 | 360 | 244.8 | 232.0 | 230.9 | 160.7 | 45.4 | 34.9 |
| **Total annual** | **1.12** | **3595** | **1640.9** | **1589.0** | **1527.0** | **1234.1** | **1054.4** | **979.6** |

per bushel. Since net returns from winter wheat and summer fallow increased more rapidly than the other rotations, a substantial price rise in livestock or feed grain would be needed to shift from wheat production. Summer fallow and winter wheat had a net return of $12.79 per acre at a price of $1.58 and $26.71 per acre at a price of $2.71 which compared with $7.04 and $11.02 for the second most profitable crop rotation at comparable wheat prices.

**Livestock Production.** The effect of an increase in corn price, without an increase in livestock price, is one of reduced net returns on the grain which is fed. Consequently, cash grain production increased and fewer cropland acres were used for feed crops.

A beef-cow herd was maintained on the 640- and the 2,240-acre farm at all wheat prices while purchased calves substituted for a cow herd at the lowest wheat prices on the 960-acre model farm. All calves were marketed at 700-pound weights.

The size of the cow herd on the 640-acre farm declined as the wheat price increased. Cow numbers were reduced from 34 head at wheat prices from 36 to 89 cents to 15 head when wheat was priced at $1.90. The number of purchased feeder calves was also gradually decreased as the price of wheat increased and was discontinued when wheat reached $1.30.

The livestock enterprise, which consisted of only purchased calves on the 960-acre farm at the lowest wheat prices, was gradually reduced in number and replaced by beef cows as the wheat price rose. With herd was reduced to 64 cows at a wheat price of $1.08, and remained at that level with subsequent wheat price increases.

The size of the beef-cow herd and the number of purchased calves on the 2,240-acre farm was greatest at wheat prices below 58 cents. The beef cow numbers and calves purchased decreased as wheat increased. With an increase in the wheat price to 94 cents, the purchasing of calves was discontinued. The beef-cow herd was reduced to 64 cows at a wheat price of $1.08, and remained at that level with subsequent wheat price increases.

No difference occurred in the grains and roughages fed and wheat was still fed at the lower wheat prices.

## Labor

Labor was not expected to be a limiting resource, particularly on the 640-acre and the 960-acre model farms. As farms increase in size and/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

**Table 26. Resident Labor Use by Periods for the Optimum Farm Organization at Specified Wheat and Corn Prices, 960-Acre Model Farm, Lyman and Tripp Counties**

| Labor period | Corn price per bu. | Hours of labor available | Resident Labor Use at the Following Range of Wheat Prices | | | | |
|---|---|---|---|---|---|---|---|
| | | | $.36-$.48 | $.49-$.68 | $.83-$.91 | $1.36-$2.21 | $2.22-$2.68 |
| | | | Hours | | | | |
| Nov. 16 to March 15 | 71c | 1037 | 729.4 | 682.0 | 469.5 | 227.2 | 160.6 |
| March 16 to April 30 | 71c | 542 | 284.4 | 260.1 | 171.3 | 87.2 | 60.4 |
| May 1 to July 15 | 71c | 1096 | 540.2 | 557.9 | 411.3 | 320.3 | 291.2 |
| July 16 to Sept. 30 | 71c | 1121 | 482.7 | 454.6 | 579.0 | 706.3 | 673.3 |
| Oct. 1 to Nov. 15 | 71c | 420 | 404.2 | 420.2 | 274.2 | 66.2 | 46.2 |
| **Total annual** | **71c** | **4216** | **2440.9** | **2374.8** | **1905.3** | **1407.2** | **1231.7** |
| | | | Resident Labor Use at the Following Range of Wheat Prices | | | | |
| | | | $.36-$.63 | $.77-$.90 | $1.03-$1.35 | $1.36-$2.21 | $2.22-$2.67 |
| | | | Hours | | | | |
| Nov. 16 to March 15 | 85c | 1037 | 639.6 | 357.8 | 242.1 | 227.2 | 160.6 |
| March 16 to April 30 | 85c | 542 | 241.8 | 128.1 | 93.9 | 87.2 | 60.4 |
| May 1 to July 15 | 85c | 1096 | 502.7 | 535.5 | 329.9 | 320.3 | 291.2 |
| July 16 to Sept. 30 | 85c | 1121 | 433.3 | 501.5 | 710.0 | 706.3 | 673.3 |
| Oct. 1 to Nov. 15 | 85c | 420 | 420.0 | 406.9 | 68.5 | 66.2 | 46.2 |
| **Total annual** | **85c** | **4216** | **2237.4** | **1929.8** | **1444.4** | **1407.2** | **1231.7** |
| | | | Resident Labor Use at the Following Range of Wheat Prices | | | | |
| | | | $.36-$.59 | $.77-$.88 | $1.04-$1.24 | $1.25-$1.47 | $1.58-$2.67 |
| | | | Hours | | | | |
| Nov. 16 to March 15 | $1.12 | 1037 | 531.0 | 510.2 | 160.6 | 160.6 | 160.6 |
| March 16 to April 30 | 1.12 | 542 | 234.8 | 239.6 | 85.6 | 60.4 | 60.4 |
| May 1 to July 15 | 1.12 | 1096 | 573.5 | 625.1 | 484.4 | 490.4 | 291.2 |
| July 16 to Sept. 30 | 1.12 | 1121 | 453.6 | 472.4 | 524.8 | 517.3 | 673.3 |
| Oct. 1 to Nov. 15 | 1.12 | 420 | 407.8 | 341.1 | 201.5 | 207.8 | 46.2 |
| **Total annual** | **1.12** | **4216** | **2200.7** | **2188.4** | **1456.9** | **1436.5** | **1231.7** |

due to wet or otherwise inclement weather. Often some family labor is available, other than the operator himself, if only for emergency needs.

Results showed that total annual labor needs were neither a crucial nor a limiting factor—total labor was in surplus. The minimum annual labor requirements on the 640-acre farm amounted to 27% of the available supply while the maximum was 49.2%. Both, the minimum and maximum labor requirements, as a percentage of that available, increased as the model farms grew in size. The minimum and maximum requirements on the 960-acre farm varied from 29.2-57.9% while on the 2,240-acre farm, the low and high labor usage varied from 45.7-78.8%.

The labor available during the planting and harvesting seasons was adequate to meet the needs in most cases. The minimum labor needed during these seasons on the 640-acre farm was 31.5% of that available while the maximum was 45.1%. Similarly, the minimum and maximum figures for the 960-acre farm was 33.7-53.8%, and for the 2,240-acre farm, they were 50-74.2%.

Some labor was hired on the 2,240-acre farm during the period of October 1 through November 15 due to a combination of corn harvest and a relatively large cattle enterprise. However, the amount of hired labor varied from less than 1-21.3% of the total labor requirements depending upon the specific farm plan which in turn depended upon the combination of wheat and corn prices.

The hours of labor hired at the various wheat and corn prices are as follows:

| Price of | | Hours of Labor Hired |
|---|---|---|
| Corn | Wheat | |
| 71 cents | 36 to 75 cents | 125.3 |
| 71 cents | 76 to 77 cents | 154.4 |
| 85 cents | 36 to 75 cents | 165.9 |
| 85 cents | 76 to 84 cents | 182.7 |
| 85 cents | 85 to 88 cents | 59.1 |
| $1.12 | 36 to 58 cents | 61.6 |

The utilization of operator and family labor was much higher on the 2,240-acre farm. The two smaller farms could not use all of the available labor without adding land or purchasing feed and additional livestock. Labor use was highest with farm plans which had large livestock enterprises.

Resident labor use by periods for the various wheat and corn price levels for each model farm is shown in Tables 25 through 27.

**Table 27. Resident Labor Use by Periods for the Optimum Farm Organization at Specified Wheat and Corn Prices, 2,240-Acre Model Farm, Lyman and Tripp Counties**

| Labor period | Corn price per bu. | Hours of labor available | Resident Labor Use at the Following Range of Wheat Prices | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | $.36-$.75 | $.76-$.77 | $.86-$.89 | $.90-$.96 | $.99-$1.29 | $1.30-$2.59 |
| | | | Hours | | | | | |
| Nov. 16 to March 15 | 71c | 1581 | 1464.5 | 1419.8 | 965.9 | 773.2 | 518.6 | 518.6 |
| Mar. 16 to April 30 | 71c | 819 | 608.7 | 539.9 | 365.4 | 303.1 | 203.6 | 193.0 |
| May 1 to July 15 | 71c | 1612 | 1141.8 | 1161.4 | 908.2 | 914.6 | 844.2 | 787.6 |
| July 16 to Sept. 30 | 71c | 1613 | 950.5 | 950.2 | 1236.6 | 1277.1 | 1319.4 | 1227.2 |
| Oct. 1 to Nov. 15 | 71c | 674 | 674.0 | 674.0 | 358.6 | 226.9 | 160.5 | 151.8 |
| **Total annual** | **71c** | **6299** | **4839.5** | **4745.3** | **3834.7** | **3494.9** | **3046.3** | **2878.2** |
| | | | Resident Labor Use at the Following Range of Wheat Prices | | | | | |
| | | | $.36-$.75 | $.76-$.84 | $.85-$.88 | $.89-$.93 | $.94-$.96 | $1.30-$2.59 |
| | | | Hours | | | | | |
| Nov. 16 to March 15 | 85c | 1581 | 1311.0 | 1203.5 | 965.9 | 773.2 | 681.6 | 518.6 |
| Mar. 16 to April 30 | 85c | 819 | 543.0 | 490.1 | 365.4 | 303.1 | 261.7 | 193.0 |
| May 1 to July 15 | 85c | 1612 | 1136.4 | 1139.1 | 1165.0 | 1167.3 | 1064.7 | 787.6 |
| July 16 to Sept. 30 | 85c | 1613 | 1054.1 | 1062.6 | 1095.8 | 1138.1 | 1172.1 | 1227.2 |
| Oct. 1 to Nov. 15 | 85c | 674 | 674.0 | 674.0 | 674.0 | 596.3 | 459.3 | 151.8 |
| **Total annual** | **85c** | **6299** | **4718.5** | **4569.3** | **4266.1** | **3978.0** | **3639.4** | **2878.2** |
| | | | Resident Labor Use at the Following Range of Wheat Prices | | | | | |
| | | | $.36-$.58 | $.92-$.94 | $.96-$1.00 | $1.08-$1.44 | $1.45-$1.47 | $1.70-$2.71 |
| | | | Hours | | | | | |
| Nov. 16 to Mar. 15 | $1.12 | 1581 | 1191.8 | 835.7 | 691.8 | 518.6 | 518.6 | 518.6 |
| Mar. 16 to April 30 | 1.12 | 819 | 564.6 | 479.9 | 322.0 | 246.7 | 193.0 | 193.0 |
| May 1 to July 15 | 1.12 | 1612 | 1176.7 | 1140.3 | 1021.6 | 1002.4 | 1026.6 | 787.6 |
| July 16 to Sept. 30 | 1.12 | 1613 | 878.1 | 1034.6 | 1112.7 | 1109.0 | 1093.8 | 1227.2 |
| Oct. 1 to Nov. 15 | 1.12 | 674 | 674.0 | 623.3 | 541.2 | 476.4 | 506.7 | 151.8 |
| **Total annual** | **1.12** | **6299** | **4485.2** | **4113.8** | **3689.3** | **3353.1** | **3338.7** | **2878.2** |

## Capital

Short-term capital and credit were assumed to be ample and, thus, not a critical factor. The annual capital requirements varied between a low of $15,565 and a high of $39,935 on the 640-acre farm when corn was priced at 71 cents. On the 960-acre farm annual capital needs ranged from $20,500 to $59,112 and between $44,554 and $107,746 on the 2,240-acre farm at a corn price of 71 cents. The purchase of feeder calves, at low wheat and feed grain prices increased the annual capital needs by two to three times that needed at high wheat prices.

## Summary


The purpose of this publication is to provide results of a research study in which optimum farm plans were determined for 640-acre, 960-acre, and 2,240-acre model wheat farms in Lyman and Tripp Counties.

Linear programming techniques were used to determine optimal farm plans at three levels of corn prices ranging from 71 cents to $1.12 per bushel, while wheat prices were varied from zero to approximately $2.70 per bushel.

Results of the programming analysis indicate net returns would be greatest with a farm organization somewhat balanced between production of cash grain and livestock at wheat prices below $1 per bushel. At wheat prices above $1 per bushel, the emphasis in production leaned heavily toward wheat and feed grains as cash crops; livestock became a supplementary enterprise.

The main cash crops were winter wheat, barley, oats, corn and grain sorghum, each having a different break-even price, depending upon the yield ratios and production costs on three soils groups and the three farm sizes. Production costs were generally lower on the 960-acre and 2,240-acre farms compared with the 640-acre farm.

Grain sorghum, due to the comparative yield and cost of production, was more profitable than corn on Soils Groups II and III and, thus, had a lower break-even price on these soils.[4] Continuous sorghum could be grown on the Group II Soils, but could only be grown in crop rotations on the Group III and IV Soils. Some grain sorghum was produced on the Group II Soils of the 960-acre and 2,240-acre model farms with the combination of low wheat and feed grain prices. With successive increases in the feed grain price, from 71 cents to 85 cents and then to $1.12, net returns from grain sorghum were raised to levels at which it could successfully compete with the relatively high cattle prices and wheat at medium price levels, even on the 640-acre farm.

While the Group II Soils were used mainly for cash grain production, the Group III and IV Soils were used for both livestock feed and cash grain production. In general, the Group III Soils were used to produce alfalfa hay while the Group IV Soils were used to furnish tame pasture and alfalfa hay. As wheat rose in price, it reached maximum production on the Group IV Soils at lower prices than the Group III Soils since the Group IV Soils were more productive. Wheat never reached the maximum production potential on the Group III Soils as some livestock feed was needed, even at the highest wheat prices.

The maximum wheat acreage is attained in a fallow-winter wheat rotation on 50% of total cropland. The maximum wheat production possible was 5,673 bushels on the 640-acre farm, 7,294 bushels on the 960-acre farm, and 14,640 bushels on the 2,240-acre model farm. About 96% of the potential wheat production was reached on the 640-acre farm at a wheat price of $1.90, while 96% of the maximum wheat production was reached at a wheat price of $1.36 per bushel on the 960-acre farm. Ninety-eight percent of the potential wheat production was realized on the 2,240-acre farm at a wheat price of $1.30 and at corn prices of 71 and 85 cents. The same wheat production was attained at a wheat price of $1.70 when the price of corn was raised to $1.12 per bushel.

Some wheat was produced at all prices, but at the low wheat prices it was fed to livestock. Whether corn, sorghum, other feed grains, or wheat is fed depends upon the relative prices. With corn priced at 71 cents per bushel, the total wheat production was fed to livestock at wheat prices up to 51 cents on the 640-acre farm, 48 cents on the 960-acre farm, and 75 cents on the 2,240-acre farm. Some wheat was fed at slightly higher prices on the 2,240-acre model farm. As the corn price was raised above 71 cents, wheat continued to be used as feed at wheat prices up to 61 cents on the 640-acre farm, 90 cents on the 960-acre farm, and 88 cents on the 2,240-acre farm.

The livestock enterprise consisted of raising calves to 700-pound weights. In addition to the calves raised from a beef-cow herd on the 640-acre and 2,240-acre model farms, 400-pound calves were purchased when wheat prices were below a range of 90 cents to a dollar. Above this price range, the purchase of calves was discontinued. The livestock enterprise on the 960-acre farm consisted of only purchased calves when wheat


[4]Corn only was used in crop rotations to reduce the number of allowable alternatives and, thus, facilitate computer programming. An assumption was made that grain sorghum would substitute for corn in rotations which appeared in the farm plans, provided grain sorghum is the most profitable crop. Grain sorghum returned 50 cents per acre more than corn on the 640-acre farm, $1.50 more than corn on the 960-acre farm, and $3.00 more on the 2,240-acre model farm.

was below 70 cents. As wheat increased above the 70-cent price, a cow herd was added. As the wheat price continued to increase to $1, calf buying was discontinued but the beef-cow herd remained.

Labor was more fully utilized on the 2,240-acre model farm than on either the 640-acre or the 960-acre farm. Annual labor use varied from 27% to 49% of the available labor on the 640-acre farm, from 29% to 58% on the 960-acre farm and from 46% to 79% on the 2,240-acre farm. Hired labor was unnecessary and labor, in no manner, restricted or affected the cropping system.

The optimal farm plans presented herein are the results of computer programming using specific assumptions with regard to farm size, cropland acreage, crop yields, costs, commodity market prices, and other such factors. Consequently, these results cannot be construed as being representative of all 640-acre, 960-acre, and 2,240-acre farms or a specific farm in this two-county area. The results, however, do present the most profitable farm plans under the stated assumptions and may serve as a guide for determining profitable farm plans under a similar cost and price structure.

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

| Rotation | Soils Groups | | |
|---|---|---|---|
| | II | III | IV |
| Corn | X | | |
| Sorghum | X | | |
| Barley-Oats-Alfalfa (Three years) | X | | |
| Summer Fallow-Winter Wheat-Corn | X | X | |
| Summer Fallow-Winter Wheat-Barley | X | X | |
| Summer Fallow-Winter Wheat-Oats | X | X | |
| Summer Fallow-Winter Wheat-Corn-Oats | X | X | |
| Summer Fallow-Winter Wheat-Corn-Barley | X | X | |
| Summer Fallow-Winter Wheat | X | X | X |
| Summer Fallow-Winter Wheat-Corn-Oats-Alfalfa (four years) | | X | X |
| Summer Fallow-Winter Wheat-Corn-Oats-Alfalfa (three years) | | X | X |
| Barley-Oats-Alfalfa (three years) | | X | X |
| Grass | | | X |