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John A. Edwards

The purpose of this study was to investigate factors which may limit linear programming as a predictive tool. It has specifically centered attention on components of linear programming models and characteristics of farm operators which create differences between actual and linear programmed farm organizations.

Twenty farms in Wasco County, Oregon, were selected for the empirical investigation. Data on enterprise costs, technical coefficients, and restraints were obtained from each farmer. Additional information on age, education, farming experience, family size, and income were also obtained for each farmer.

Three programming models were constructed for each farm. Model I represented year-to-year choices among alternative levels of participation in government wheat and feed grain programs. Separate models were developed for each of the years from 1963 to 1966 which represented the program alternatives in these four

years. The purpose of Model I was to calculate profit maximizing solutions for individual farms in this short-run context, to make comparisons with actual decisions of the farmers within the same framework, and to isolate factors which created differences between the actual and programmed solutions.

Model II was constructed to predict individual farm organization where the planning horizon was sufficiently long for changes to occur in resource use patterns and enterprise combinations. Land, family labor, and in some cases operating capital, were treated as fixed resources. The objectives of the Model II analysis were to evaluate the degree of association between the actual and profit maximizing programmed farm organizations and to aid in determining factors which caused differences between the two solutions.

Model III was the same as Model II except that its objective function required the least-cost organization for obtaining a given level of income. Its purpose was to provide an alternative representation of the objectives which guided the farmers in their management decisions.

The Model I analysis indicated that farmers did not make the profit maximizing decisions with respect to choices of government programs. The main factors which hindered them were continual changes in programs and associated incentives and inability to individually assess the economic consequences of alternative program participation. The more educated farmers made the

better decisions while poorer decisions were made on highly productive farms.

The Model II analysis indicated that maximum profit models did not accurately predict the decisions of farmers. However, they did perform better in the short run than in the longer run situations. They also predicted production for major enterprises better than for supplementary enterprises.

Model III with its minimum cost objective described the organization of more than 50 percent of the farmers more completely than the maximum profit model.

Errors in specification of enterprises to include in the models were a major source of differences between actual and programmed organization. Enterprises must not only be physically and economically feasible but also psychologically acceptable to the farmer.

Characteristics such as education, family size, age, and experience were found to be associated with the farmer's management objectives.

An Analysis of Factors Which Contribute To Differences Between Actual and Programmed Optimum Organization On Individual Farm Units

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CHAPTER I

INTRODUCTION

In a dynamic economy such as that of the United States, effective decision making in the agricultural sector, whether at the individual farm level or in the aggregate, is greatly facilitated when economists are able to make reliable predictions [17].

One type of information which has been in wide demand is estimates of aggregate supply response and individual farm adjustments to expected changes in the economic environment [7, p. 3-4].

Analytical tools traditionally used to derive information of this nature have been related to regression procedures. However, these procedures have exhibited weaknesses in terms of methodology and data [1]. Economists working with regression and econometrics have had difficulties incorporating into models conditions such as uncertainty, capital rationing, technological change, and nonmonetary goals, all of which influence the accuracy of the resulting predictions [7, p. 14-24]. Due to limitations in data required for studies at the micro-level, these methods are generally limited to aggregate analyses.

An alternative approach which has found wide acceptance among economists is linear programming. Its main appeal is that it looses the researcher from some of the restrictions under which

he operated when using regression or econometrics [10, p. 470-471].

With linear programming the analysis can be conducted at the farm level and the results aggregated on an area or regional basis. Forces which cause changes in the variables under observation, such as factors of production or enterprise interrelationships, can be studied in detail [16, p. 165]. In making predictions of adjustments, the expected impact of technology, capital rationing, and other factors difficult to account for in traditional methods, can be incorporated into the models [27, p. 11-18].

Because of the apparent advantages of this approach and current pressures for information of a predictive nature, it has provided the framework for a large number of studies concerning supply response and farm adjustments [5, 6, 11, 25, 26].

Linear Programmed Supply Response and Farm Adjustment Analysis

Linear programming is a particularly attractive tool to researchers engaged in supply response and adjustment studies since it allows them to accomplish two objectives at the same time. First, they are able to estimate aggregate commodity supply response, and, second, they gain information on individual farm adjustment potentials [2]. This is achieved by basing the analysis on representative farms. A common procedure followed in these studies is to:

1. Stratify the region into areas based upon type of farming or other relevant characteristics such that the farms within the area might be expected to have similar yield potentials, prices, and costs.

2. Sample each area to provide a basis for sorting farms into homogeneous groups based upon size, soil type, or other relevant factors.

3. Combine data from secondary sources with information obtained from the sample to construct representative farm linear programming models and estimate individual supply functions. [1]

There are three general sources of error in this procedure. First, errors due to aggregation which arise when a limited number of representative farms are used to describe a whole population. This has been designated as "aggregation bias" [4]. The second source of error is in the data. Coefficients are taken from sample surveys and from secondary sources, both of which are subject to error. The third major source of error occurs in the specification of the model and is frequently referred to as "specification error" [19].

Considerable research effort has been expended in developing procedures for measuring and reducing aggregation bias [22] and there are continuous studies for improving the data[1]. Errors

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[1] Many of these studies are organized and coordinated through regional research groups as the W-54, GP-5, and S-42 committees.

which occur as a result of performing the analysis within a linear programming framework have received little explicit attention. This, however, is not due to a lack of awareness of the problem. Some researchers consider this to be a major source of error in using the linear programmed representative farm approach to supply analysis [21, 24].

Purpose of the Study

Like regression and econometrics, linear programming has weaknesses as a tool for making predictions [12, p. 6-9]. The purpose of this study is to center attention on specification error by an investigation of factors which create differences between actual and linear programmed farm organization where individual farms are used as the basic unit for the analysis. The use of a population of individual farms will eliminate one of the principal sources of error associated with this tool, that of aggregation bias.

The remainder of this report will be devoted to a discussion of linear programming as a predictive tool and to an empirical investigation of its usefulness.

CHAPTER II

LINEAR PROGRAMMING AS A PREDICTIVE TOOL

The discussion in this chapter has two objectives: First, to define linear programming and, second, to consider conditions under which it would be an effective tool for prediction.

Linear Programming

Linear programming is a mathematical procedure for maximizing or minimizing a linear function subject to a set of linear inequality or equation constraints [3, p. 9-72; 13, p. 413-445]. The problem is stated as a matrix of simultaneous equations. A maximum or minimum value for the objective function is reached through a series of linear transformations on the matrix. An algebraic statement for a maximizing problem would appear as follows: Find the values of the variables $X_1, \ldots, X_n$ which is a solution to

$$\text{(I)} \qquad \begin{aligned} A_{11} X_1 + A_{12} X_2 + \ldots\ldots + A_{1n} X_n &= b_1 \\ A_{12} X_n + A_{22} X_2 + \ldots\ldots + A_{2n} X_n &= b_2 \\ \text{- -} & \\ A_{m1} X_1 + A_{m2} X_2 + \ldots\ldots + A_{mn} X_n &= b_m \end{aligned}$$

and which maximizes

$$\text{(II)} \qquad Z = C_1 X_1 + C_2 X_2 + \ldots\ldots + C_n X_n$$

where the variables X_j are subject to

(III) $X_j \geq 0$

Each of these relationships has an economic interpretation. For a profit maximizing problem, relationship (II) is the profit function. It relates profit, Z to the sum of prices, C_1, . . . C_n, times the product of enterprises, X_1, . . ., X_n. Relationship (I) specifies the number and magnitude of constraints, b_1, . . . b_m, within which profit from the enterprises, X_j, would be maximized. These constraints would be fixed resources in an individual farm programming problem. The A_{ij}'s, where (i=1, . . .,m) and (j=1, . . ., n) express the technical relationship between the enterprises and the fixed resources. The third relationship (III) merely states that no enterprise, X_j, can be in the farm plan at a negative level. Data requirements for a linear programming problem then, consist of the technical coefficients, A_{ij}, the objective function parameters, C_j, and the restraint coefficients, b_i.

Assumptions

When an economic problem is formulated within a mathematical framework as described above, several assumptions are made about the variables and relationships. (1) All activities must be linear. Each additional unit of a product requires an identical quantity of the variable inputs as any preceding unit. (2) Activities are additive in that no positive or negative interaction

may occur among them. When two or more enterprises are used in combination, their total product will be the sum of their individual products. (3) Resources and products can enter the solution in fractional units. This is the assumption of divisibility. (4) All parameters (prices, resource supplies and technical coefficients) are known with certainty. (5) All pertinent activities and constraints can be included in the model. There is a finite number of activities and constraints which need to be considered [8,p.17-18].

Procedures exist which make it possible to relax most of these assumptions within certain limits, but not all of them are adequately developed as yet [8]. The influence of these assumptions must be considered whenever one seeks to interpret or discuss solutions derived from linear programming.

A Normative Tool

The profession has designated analyses of supply response based on regression or econometric procedures as "positive" since they seek to predict quantitative relationships among variables on the basis of what has historically occurred. On the assumption that historical relationships will continue into the future, these solutions attempt to predict what <u>will</u> happen.

Analyses of supply response based on linear programming have been designated as "normative" in that they predict what <u>ought</u> to happen relative to some norm which in most cases is profit maximization [7, p. 16].

When linear programming is used for prediction of what will happen, the assumption is made that profit maximization is in reality the objective which guides farmers in their management decisions.

A Positive Tool

The purpose of this section is to outline conditions under which a single farm programming model would result in a solution predictive of the decisions a farmer would actually make within the limitations of his farming operation. These conditions are as follows:

1. The model would include b_i's which accurately reflect the restraints within which the farmer operates.
2. The A_{ij}'s in the body of the matrix would accurately relate all physically, economically, and psychologically feasible enterprises to the appropriate restraints.
3. The C_j's in the objective function would accurately reflect the farmer's expected values for these constraints.
4. The objective function in the model would accurately describe the objectives which guide the farmer in his decision-making processes.
5. The farmer would be consistent in adjusting his farm organization in accordance with his objectives and these objectives would not change over time.

The first four conditions require that the model be constructed accurately, while the last condition requires that the farmer be

consistent in choosing his objectives and act in accordance with them. This last condition becomes particularly important as the time horizon becomes longer. If the purpose of the analysis were to predict farm organization in five years under a given set of prices and technology, it would be necessary to assume a particular objective function. If the farmer's objectives should change during this time or he should fail to act in accordance with his objective function, the prediction would be incorrect.

It is possible that all of these conditions could be fulfilled in constructing a programming model and thereby accurately predict a farmer's actions under a given set of circumstances. However, the time factor could become very important. The least amount of error would occur if the objective were to construct a model predictive of a farmer's current actions. All pertinent data could be gathered by direct measurement and through conferences with the farmer.

As the target date for the prediction is pushed into the future changes for error increase. Not only are all coefficients estimates subject to error but expectations and objectives must also be estimated.

This investigation will center attention on the first four of the conditions outlined above. It will assess the extent to which standard profit maximizing linear programming models meet these cconditions. The models will be constructed to predict current

organization, therefore the fifth condition will not be treated explicitly.

CHAPTER III

EMPIRICAL PROCEDURES

The objectives of the empirical investigation were to construct programming models for individual farms which would comply as nearly as possible with the conditions listed in the previous section, to predict the current organization of each farm, and to isolate factors which created differences, if any, between the actual farm organization and those obtained from the linear programming models.

Individual farm operators were taken as the basic unit for the analysis. Physical and economic data were gathered from each participant which would represent as closely as possible his particular management ability and the productivity of his resources in their alternative uses.

The organization of a farm at any point in time is the result of many individual decisions of the operator--decisions which have relatively short-term implications such as choices of government programs each year or whether to sell a calf crop in the fall as weaners or feed them through the winter in hopes of higher prices in the spring. On the other hand, it may have been a decision to buy more land or start a new enterprise, choices which would have a more lasting effect on the total farming operation. These decisions have been conditioned by the nature of the farmer's resources, his own and his family's needs and preferences, and the institutional and economic conditions when the decisions were made.

LINEAR PROGRAMMING MODELS

Linear programming models were developed for two decision-making situations. Model I described year-to-year choices among alternative levels of participation in wheat and feed grain programs. Model II and Model III considered a planning horizon which allowed a re-combination of enterprises and changes in resource allocation.

Model I

The purpose of Model I was to calculate profit maximizing solutions for individual farms in a short-run context, make comparisons with actual decisions of farmers within the same framework, and to isolate factors which contributed to differences which may arise between the actual and programmed organization. Separate models were developed for each of the years 1963 to 1966 to represent alternative choices among wheat and feed grain programs open to the farmers. The general form of all the models and that for 1965 specifically appears in Appendix A.

Restrictions built into the model were land of various levels of productivity available for crops in the particular year, the wheat allotment, and the barley base. A set of institutional restraints were included to limit production in accordance with the program alternatives. Activities were provided which represented all choices in both wheat and feed grain programs. An outline of the main points of these programs for each year is contained in Appendix B.

Participation involved discrete choices which could not be handled by a single programming solution. For example, one choice included production of wheat under the program which would involve reducing the acreage planted and receiving government payments or to stay out of the program, plant the full acreage and receive no payments. Standard linear programs could not take into account these discrete alternatives. This made it necessary to re-run the model for each farm enough times with the appropriate variables excluded to create solutions for each of the discrete choices. From among these solutions the profit maximizing level of participation was established by considering the value of the objective functions. Input data for these models appear in Appendix A. Regression analysis was used to investigate factors which created discrepancies between the actual and programmed participation.

Model II

The general form of Model II is contained in Appendix D. It was constructed to predict the organization on the individual farms within a relatively long-run context and its structure was similar to models used in many supply response and adjustment studies [14, 15, 23, 25].

This model incorporated features to calculate crop rotations on irrigated land, to represent operating capital and credit restraints of the operators, and to accurately reflect labor restrictions.

The procedure for incorporating rotations was patterned after that used in the "National Model" of the U. S. Department of Agriculture [20]. This allowed the optimum rotation to be specified in the solution in a manner that interaction between crops in various sequences was accounted for. Traditionally, several rotations would have been established prior to programming and included in the model as separate activities. This approach would arrive at the most profitable rotation among those constructed but there was no assurance that the optimum rotation would be included in the set of alternatives. The approach used in Model II made the rotation dependent on economic conditions as well as physical and biological interrelationships.

Some farmers were faced with operating capital limitations. Equations and variables included to describe the nature of these restrictions were based on an approach suggested by Rogers [18]. This assumed that the anticipation of production created sufficient credit to cover all cash costs of production for enterprices established on the farm with the exception of feed and livestock purchases for hog operations or cattle feedlots. However, it also assumed that where a farmer could provide feed, credit was available for livestock purchases and operating costs for a feedlot. Alternatively, if the farmer provided the livestock, credit was established for feed purchases and cash operating costs.

Labor restrictions were incorporated to limit quality as well as quantity of each labor restraint. Overhead labor was subtracted in calculating the quantity available for enterprises in each period. For a few farms labor hiring was limited to some maximum level even though plenty of hired labor was available. This helped maintain the proper mix between skilled operator labor and full-time and seasonal hired labor. Most farmers restricted hired labor to field work, feeding the cow herd in the winter and to maintaining equipment, fences, and buildings. Work such as seeding and harvesting crops, calving, or handling a feedlot was done either by the operator himself or under his close supervision; therefore, only limited amounts of hired labor could be used.

Resource restraints in addition to capital and labor were cropland of various qualities, the wheat allotment, a beef cow carrying capacity, and a maximum grain hay production equation. Wheat allotments were averages for 1963 through 1966. A barley base was not included since farms stayed out of the barley program more frequently than they entered it.

Enterprise alternatives included wheat, barley, grain hay, alfalfa hay, and improved pasture on dry cropland, while irrigated land had these alternatives plus corn silage for two farms. Livestock enterprises consisted of beef cows, brood sows, cattle feedlots, and a grass fattening program. Calves produced on the farm could be sold as weaners, wintered and put in the feedlot,

or grass fattened, where irrigated pasture existed. Also, feeder cattle could be purchased as calves or yearlings for the feedlot or for grass fattening. The feedlot was assumed to be fully automated.

The brood sow enterprise was set up on the assumption that two litters would be produced per year and fattening would be done in confinement.

Input data for Model II appears in Appendix E. Enterprise coefficients for dry land wheat, barley, grain hay, and alfalfa were calculated for each farm separately. The same was true for beef cow enterprises. Farm and secondary data were used to construct budgets for the remaining enterprises. Three sets of budgets were included for the feedlot and the brood sow activities to represent three levels of management.

Like the short-run analysis, a step-wise procedure was used to obtain a series of solutions for each farm.

With this procedure the objective function could be evaluated for several enterprise combinations. Comparing objective functions helped explain why discrepancies existed between actual and linear programmed optimum farm organization.

Model III

Model III was identical with Model II except for two equations. The purpose of Model III was to calculate the least-cost plan for maintaining a given level of income. The objective function in

Model II was altered to reflect that of a least-cost model by eliminating all positive coefficients in the equation. An additional equation was added to restrict the solution to the income level desired for the particular farm. With the exception of the right-hand side, which contained the level of income, this equation was identical with the objective function equation in Model II. Since the coefficients in the new objective function were negative, a maximizing routine was used in solving the equations.

The income level for each farm in the least-cost model was defined in the same manner as total net revenue in the maximizing model. Therefore, it was composed of gross revenue minus variable costs of production. The income figures were established through consultation with the individual farmers and represented long-run estimates. The quantities calculated appear in Appendix Table E-1 in the row designated "long-run gross profit."

Procedures for Investigating Causes of Differences Between Actual and Programmed Solutions

Model I

The analysis of factors which created differences between the actual choice of participation in government programs and that specified by linear programming was conducted on the assumption that profit maximization was in reality the objective of the farmers and that there were no other specification errors

in the model. It also assumed that the input data was accurate. Therefore institutional policies and practices and characteristics of the farmers were the only causes of these differences.

Regression procedures were used to assess the relationships among the differences between actual and programmed choices and the characteristics of the farmers.

Model II

The Model II analysis assumed that differences between actual and programmed farm organization could be attributed to errors in specification of the model and to errors in the data. It was hypothesized that major sources of specification error would be in the selection of enterprise alternatives and in the choice of the objective function. Special information was obtained from the farmers relative to their enterprise preferences and management objectives.

Model III was constructed to test the alternative hypothesis that farmers were cost minimizers instead of profit maximizers.

Indices were developed to measure the degree of association between the actual organization and solutions calculated through Model II and Model III.

Regression procedures were again used to establish relationships among characteristics of the farmers and differences between actual and programmed farm organizations.

Sources of Data

Twenty individual farm units were selected for the study. Time requirements for a linear programming analysis and available funds were primary considerations in selecting this number.

All of the farms were located in Wasco County, Oregon, where small grains and livestock are the major farm enterprises. Wheat and barley are the principal crops. Beef cattle constitute the major livestock enterprise. Historically, large numbers of hogs were also produced but in recent years their numbers have declined.

A wide range in productivity occurs due to soil conditions, rainfall, and the presence of irrigation in some localities.

The selection of farmers was made by the extension agents in the county. They acquainted the participants with the purpose of the study, arranged the first appointment and accompanied the enumerator on the first visit.

Farm data collection was achieved in three stages. During the first visit data was gathered for programming models for each farm. This included information for developing technical coefficients and costs for enterprises currently on the farms. Estimates of coefficients for enterprises not found on the farms but which were feasible were also obtained from the operators. Physical and institutional restraints were also specified.

After this data was summarized in budget form for each farm, a second visit was made. At this time these budgets were reviewed

with the farmer and errors were corrected. The objective here was to arrive at coefficients which would be an accurate representation of the individual farm's productive capacity and the farmer's management ability.

Finally, profit maximizing programming models were constructed for each farm and solutions calculated. A third visit was then made to each farm at which time the models and solutions were reviewed. In some cases recommendations were made for changing a model to more accurately represent the farmer's decision-making environment. During this visit additional information was gathered on the historical development of each farm from the time the present operator assumed control up to the present. All major management decisions during this period were noted along with the justification for each action. This was done to provide an insight into the objectives which guided the farmers in their decision-making processes. Personal information was also recorded with regard to age, education, experience, size of family, financial condition, and future plans and goals of each farmer.

Secondary sources of data were the county agricultural stabilization office and the county soil conservation service. Costs of some inputs were verified with local business establishments. Staff members of the Oregon State University Animal Science Department provided information on cattle feedlot and brood sow production and inputs.

Product prices used to represent the expected prices of the farmers were the 10-year averages for each product which included the years from 1956 to 1965 (Appendix E).

CHAPTER IV

DESCRIPTION OF THE FIRMS

The 20 farms were identified in terms of characteristics pertinent to the objectives of the study. The following sections describe these characteristics in some detail.

Physical Description

Land Resources

Land inventories included nonirrigated cropland, irrigated cropland, and range. The 20 farms in the study consisted of 10 with dry cropland, 9 with both dry cropland and irrigated cropland, and one with irrigated cropland only. Nineteen farms had range land. The size of each farm in terms of acreage appears in Table 1.

The geographical location of each farm was particularly significant. Five farms (2, 4, 5, 6 and 16) were located on relatively flat tablelands. The soil was shallow and sometimes rocky. Rainfall varied from 9 to 13 inches per year. On these farms wheel tractors and conventional harvesting equipment were used. The remaining farms, located on hilly land, required heavier crawler tractors and more expensive combines with self-leveling devices.

Land productivity, measured in terms of wheat and barley yields, is contained in Table 2. The highest wheat yield on

Table 1. Land inventory and tenure for the sample farms

Farm number	Land owned			Land rented			Total land		
	Irrigated cropland	Dry cropland	Range	Irrigated cropland	Dry cropland	Range	Irrigated cropland	Dry cropland	Range
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
1	---	1,166	833	---	504	165	---	1,670	998
2	---	1,100	2,910	---	244	480	---	1,344	3,390
3	---	1,625	1,250	---	425	4,650	---	2,050	5,900
4	76	218	1,506	---	---	---	76	218	1,506
5	100	450	850	44	637	250	144	1,087	1,100
6	---	1,270	1,430	---	---	---	---	1,270	1,430
7	35	2,123	584	---	---	---	35	2,123	584
8	55	165	388	---	313	687	55	478	1,075
9	---	---	360	---	1,291	2,190	---	1,291	2,550
10	140	1,860	1,494	---	---	---	140	1,860	1,494
11	16	842	428	43	87	400	59	929	828
12	---	---	---	---	917	568	---	917	568
13	12	1,671	1,150	---	---	---	12	1,671	1,150
14	35	1,365	2,880	---	750	450	35	2,115	2,880
15	---	---	---	6	634	210	6	634	210
16	319	---	---	---	---	---	319	---	---
17	---	---	---	---	1,325	1,450	---	1,325	1,450
18	---	1,593	873	---	---	---	---	1,593	873
19	---	---	---	---	1,180	900	---	1,180	900
20	---	780	340	---	---	---	---	780	340
Total	788	16,228	17,276	93	8,307	12,400	881	24,535	29,226

Table 2 . Average yield of wheat and barley for the sample farm

Farm number	Wheat yield	Barley yield
	Bushels	Bushels
1	42.9*	44
2	28.7*	28
3	35.0*	37
4	34.0	37
5	34.6*	38
6	34.0	37
7	49.8*	57
8	24.0	35
9	36.3*	38
10	37.0	40
11	46.2*	37
12	56.0*	50
13	58.0*	45
14	45.0	37
15	51.0*	43
16	75.0	80
17	51.4*	40
18	52.0*	35
19	52.0*	46
20	40.9*	35
Average	40.9*	35

*Proven yield according to A.S.C.S. requirements.

nonirrigated cropland was 58 bushels per acre, while the poorest land yielded 24 bushels per acre. Farm number 16 with a 75 bushel per acre historical average had all irrigated cropland. Differences in productivity of other crops among the farms were similar to those of wheat and barley. Within farm yield variations for crops can be seen in Appendix E.

No attempt was made to estimate existing range productivity. Instead, an overall carrying capacity was established for each farm which included range, crop stubble, and fallow intermingled with scabland.

Enterprises

Eleven different enterprises were found on the farms at the time of the survey. Crops in production were wheat, barley, grain hay, alfalfa hay, improved pasture, and a combination crop of alfalfa hay and improved pasture. In addition, corn silage could be produced on two farms which had irrigation. Not all of these crops were feasible on each farm. Alfalfa hay and barley could not be grown on two farms due to weather and soil conditions.

Livestock enterprises consisted of cow-calf operations, yearling grass fattening programs, cattle feedlots, and hogs.

Tenure

Farms in the sample included six single owners, three partnerships, and four full tenants. Eight farmers owned part and rented

part of their land. None of the operators were restricted in their management decisions by leasing arrangements. However, all were required to have the landlord's sanction on government program participation each year.

The Farm Operators

Due to the presence of partnerships there were 24 separate operators included in the study. Characteristics of these individuals of interest to the analysis were age, farming experience, education, number of dependents, size of family income, sources of income, attitude toward income level, business financial conditions, historical management decisions, and personal preferences toward enterprises and resource use. A summary of this data appears in Table 3 to Table 8.

Age of Operator

Operators ranged in age from 27 to 70 years. The average age over all operators was about 48 years. A distribution of ages was as follows: 60 years and over, one operator; 50 to 59 years, nine operators; 40 to 49 years, 10 operators; under 40 years, four operators.

Farming Experience

Years of farming experience ranged from 50 years for the oldest farmer to six years for the youngest. The average

Table 3. Personal statistics on farm operators

Farm number	Age of operator	Years farm operator	Years formal education	Dependent children	Family income from farm	Total family income	Attitude toward current level of income
	Number	Number	Number	Number	Dollars	Dollars	
1	42	18	12	2	5,000	5,000	Dissatisfied[1]
	58	30	12		10,500	10,500	Satisfied
2	27	6	12	2	10,500	10,500	Satisfied
3	47	23	13	2	19,500	4/	Satisfied
4	55	30	8	0	3,000	3,000	Satisfied
5	70	50	8	0	10,000	10,000	Satisfied
6	59	31	12	2	8,000	8,000	Satisfied
	50	21	13	0	24,000	4/	Satisfied
7	49	21	13	0	24,000	4/	Satisfied
8	56	41	12	1	4,000	4,000	Dissatisfied[2]
9	42	20	12	5	14,000	4/	Satisfied
10	47	27	12	2	13,000	13,000	Satisfied
	34	8	12	3	5,500	8,500	Satisfied
11	35	8	12	2	5,500	9,500	Satisfied
12	38	16	16	5	7,000	4/	Satisfied
13	50	25	12	1	18,000	4/	Satisfied
14	52	32	13	0	20,000	4/	Satisfied
15	46	20	16	4	8,000	8,000	Dissatisfied[3]
	50	25	12		3,200	3,200	Satisfied
16	48	25	12	0	3,200	3,200	Satisfied
17	46	22	12	3	11,000	11,780	Satisfied
18	53	30	20	0	27,000	4/	Satisfied

Continued

Table 3. Personal statistics on farm operators--Continued

Farm number	Age of Operator	Years farm operator	Years formal education	Dependent children	Family income from farm	Total family income	Attitude toward current level of income
	Number	Number	Number	Number	Dollars	Dollars	
19	46	21	12	3	5,000	5,000	Satisfied
20	44	21	12	3	7,500	9,000	Satisfied
Average	47.7	23.8	12.5	2.7	11,100		

[1]The operator was paying for the farm with funds that would otherwise be family income. The wife expressed some dissatisfaction with this forced level of living.

[2]Farmer felt he and his family were adequately provided with the basic necessities but became disturbed when he compared his standard of living with that of his relatives and friends.

[3]A need for money to put his children through college was the main objection this farmer had with his present income.

[4]No attempt was made to get a detailed account of total income.

Table 4.. Operator real estate and operating capital indebtedness

Farm number	Value of real estate	Real estate debt	Typical annual cash operating capital	Typical amount of annual cash operating capital borrowed[1]	Non-farm financial interests
	Dollars	Dollars	Dollars	Dollars	
1	167,500	86,000	23,000	0	No
2	166,600	38,000	18,500	9,250	No
3	230,000	60,000	25,000	0	Yes[2]
4	68,000	9,000	8,500	8,500	No
5	97,000	0	21,000	0	No
6	185,750	40,000	20,000	10,000	No
7	386,515	0	30,000	0	Yes[2]
8	39,905	0	6,500	1,500	No
9	7,600	0	85,000	80,000	Yes[2]
10	435,940	134,376	90,000	90,000	No
11	152,220	115,000	30,000	30,000	No
12	---	---	12,500	0	Yes[2]
13	349,300	18,000	41,000	0	Yes[3]
14	230,400	50,000	75,000	0	Yes[3]
15	---	---	20,000	20,000	Yes
16	200,000	8,000	27,400	27,400	No
17	---	---	14,500	0	No
18	327,330	81,832	50,000	0	Yes[4]
19	---	---	20,000	20,000	Yes[5]
20	136,000	14,000	17,000	17,000	No
Average	198,754[7]	40,888[7]	31,745	15,682	Yes[6]

Continued

Table 4. Operator real estate and operating capital indebtedness--Continued

[1] All farmers in this study used the local Production Credit Association as the main source of operating capital.

[2] Owned stocks, bonds, or both.

[3] Owned stocks, bonds, and a partnership in a business building in The Dalles.

[4] Owned stocks and an interest in The Dalles Livestock Auction.

[5] Owned stocks, bonds, and an interest in The Dalles Livestock Auction.

[6] Owned stocks, and was the county brand inspector.

[7] Average for the 16 farmers who owned real estate.

Table 5. Historical changes in farm size for sample farms

Farm number	Date of change	Nature of change	Reasons for change[1]
1	1961	Rented 600 acres cropland	A, B
	1964	Bought 650 acres cropland	A, B
2	1948	Bought 600 acres cropland	A, B
	1959	Bought 600 acres range	A, B
	1966	Rented 650 acres cropland	A, B
3	1952	Rented 425 acres cropland	A
4	No change in farm size		
5	1945	Rented 681 acres cropland	C
		250 acres range	C
6	1940	Bought 160 acres pasture	A, B
	1942	Bought 160 acres pasture	A, B
	1947	Bought 260 acres cropland	A, B
		190 acres range	A, B
	1955	Bought 110 acres cropland	A, B
		130 acres range	A, B
	1957	Bought 400 acres cropland	A
		300 acres range	A
7	No change in farm size		
8	1946	Bought 388 acres range	A, B
	1951	Rented 313 acres cropland	A, B
		687 acres range	A, B
9	1952	Bought 360 acres range	A
10	1956	Bought 1,060 acres cropland	D, E
		600 acres range	D, E
11	No change in farm size		
12	No change in farm size		
13	1961	Bought 400 acres cropland	A
14	1951	Bought 1,000 acres cropland	A, B
	1953	Rented 750 acres cropland	A
		450 acres range	A
15	No change in farm size		
16	No change in farm size		
17	No change in farm size		
18	No change in farm size		
19	No change in farm size		
20	No change in farm size		

A - To increase efficiency of operation
B - To increase family income.
C - A favor to relatives.
D - To create an estate.
E - For personal enjoyment.

Table 6. Historical farm enterprise combinations for sample farms

Farm number	Enterprise					
	Wheat	Barley	Beef cows	Seasonal feedlot	Annual feedlot	Hogs
1	C*	C	C			Up to 1950
2	C	I**	C	1957 to present		Up to 1945
3	C	1954 to present	C			Up to 1962
4	C	I	C	1958 only		Up to 1962
5	C	1954 to present	C	C 1946-47		Up to 1947
6	C	C	C	1961-62		Up to 1959
7	C	C	C	C		
8	C	C	C			Up to 1956
9	C	C	C	1957 to present		C
10	C	C	C	1953-62	1962 to present	Up to 1961
11	C	C	C			1964-66
12	C	1954 to present	C	1955 to present		
13	C	C	C			Up to 1957
14	C	C	C		1960-1966	Up to 1947
15	C	1954 to present	C			1960 to present
16	C	Up to 1961	1958 to present			1951-63
17	C	1954 to present	C	1956-57		
18	C	1954 to present	C			Up to 1942
19	C	1954 to present	C			1946-48
20	C	1954 to present	C	1961 to present		Up to 1961

* Continuously.
** Intermittently.

Table 7. Justification for historical changes in farm organization

Farm number	Enterprise	Action	Reasons for action[1]
1	Brood sows	Terminated	A, B
2	Barley	Intermittent	C
	Seasonal feedlot	Started	D
	Brood sows	Terminated	A, B
3	Barley	Started	E
	Brood sows	Terminated	F, G
4	Barley	Intermittent	E
	Seasonal feedlot	1958 only	D, F
	Brood sows	Terminated	F
5	Barley	Started	E
	Brood sows	Terminated	H, G
6	Seasonal feedlot	Intermittent	D, F
	Brood sows	Terminated	H, G
7	No change in farm organization		
8	Brood sows	Terminated	F
9	Seasonal feedlot	Started	D, J
10	Cattle feedlot	Started	I
	Brood sows	Terminated	G
11	Hog feedlot	Intermittent	D, F
12	Barley	Started	E
	Seasonal feedlot	Started	D
13	Brood sows	Terminated	A, B
14	Annual feedlot	Started	D
	Annual feedlot	Terminated	K
	Brood sows	Terminated	H, G
15	Brood sows	Started	J
16	Barley	Terminated	H
	Hogs	Terminated	H
	Beef cows	Started	G, J
17	Barley	Started	E
	Seasonal feedlot	Started	D
	Seasonal feedlot	Terminated	A
18	Barley	Started	E
	Brood sows	Terminated	B
19	Brood sows	Started	J
	Brood sows	Terminated	A
	Barley	Started	E
20	Barley	Started	E
	Brood sows	Terminated	B, G
	Seasonal feedlot	Started	D

Continued

Table 7. Justification for historical changes in farm organization--Continued

A - Inadequate facilities.
B - Personal dislike.
C - Depends on moisture conditions.
D - Provided a good market for cattle and feed grains
E - Due to allotment programs.
F - Stopped due to low prices and returns.
G - More efficient use for labor.
H - Had disease problems.
I - For personal enjoyment.
J - To increase family income.
K - Interfered with crop production.

Table 8. Attitudes of farmers toward brood sow and cattle fattening enterprises

Farm number	Brood sow enterprise			Cattle feedlot enterprise		
	Feasible on farm	Considered starting	Personal dislike	Feasible on farm	Considered starting	Personal dislike
1	yes	no	yes	yes	no	yes
2	yes	yes	yes	1/		
3	yes	no	no	yes	no	yes
4	yes	yes	no	yes	no	no
5	yes	no	yes	1/		
6	yes	yes	yes	yes	yes	no
7	yes	no	yes	1/		
8	yes	no	no	yes	yes	no
9	1/			1/		
10	yes	yes	yes	1/		
11	yes	yes	yes	yes	no	no
12	yes	no	yes	1/		
13	yes	no	yes	yes	yes	yes
14	yes	no	yes	1/		
15	1/			yes	no	no
16	yes	yes	yes	yes	yes	yes
17	yes	no	no	yes	no	no
18	yes	no	yes	yes	yes	yes
19	yes	yes	yes	no	no	no
20	yes	yes	yes	1/		

1/ The enterprise was already on the farm.

experience as a farm operator was about 24 years. Fourteen operators had 20 to 30 years experience inclusive, four had been over 30 years in farming, and five had farmed for less than 20 years.

Formal Education

All the operators had at least an eighth grade education. Twenty-two of the operators graduated from high school, seven had at least one year of college, three were college graduates, and two had schooling beyond the bachelor degree.

Dependent Children

The number of children entirely dependent financially upon the family ranged from zero to five. Seven farmers had no children at home, two farmers had one each, six had two children each, four had three each, one had four children, and two farmers had five children each. Ages of the children ranged from less than a year to 20 years.

Income and Finance

A summary of family income for each operator appears in Table 4. Average farm income for the group was $11,100. However, the range in family income was extreme, varying from $3,000 to $27,000. All operators but three expressed satisfaction with their current level of income. Reasons for dissatisfaction

given by the three appear in footnotes accompanying Table 4. Twelve operators had no off-farm source of income, while seven had nonfarm businesses or investment and four had part-time employment off the farm.

An indication of financial condition was summarized for each farm (Table 4). Since four operators were full tenants they had no real estate investment. Another four were carrying no real estate debt. All except two of the remainder owed less than 50 percent on their real estate. Nine farmers borrowed no operating capital, while seven financed their business totally. The local Production Credit Association was the main source of short-term credit.

Historical Farm Organization

A historical summary of changes in farm size and organization and the operator's reasons for each action was developed (Tables 5 to 7). Nine farms had not changed in acreage while under the present management. Reasons given for this were:

1. There was no opportunity to acquire land within a reasonable distance of the present farm.
2. The operator lacked necessary financial resources.
3. The operator expressed an unwillingness to assume the financial responsibility.
4. The present farm size was satisfactory.

Of those who acquired more land, eight did so by purchasing, and five used a rental arrangement. Increased acreages of cropland ranged from 21 percent to 93 percent. Seven operators bought or leased range. As a result range land acreage was enlarged from between 14 percent and 100 percent on these farms (Table 1). Table 5 presents a summary of reasons given by the farmers for enlarging their farms.

Historical changes in enterprises were largely related to livestock. Only one farm maintained the same enterprise combination continuously. The beef cow enterprise was stable on all farms but No. 16, which was irrigated. Eleven of the 20 farms had a cattle feedlot at some time in their history. However, only six feedlots were in operation in 1966.

Hog enterprises also existed on nearly all farms at some time. In several cases, hogs had been on the farm when the present operator took over. Reasons for starting or dropping various enterprises appear in Table 7.

Additional information was obtained from the operators on hog and cattle feeding (Table 8). All farmers but one indicated that hogs or a cattle feedlot were physically feasible on their farm. The one exception was a tenant. Of those who did not already have these enterprises, eight indicated that they had investigated hogs seriously and five had considered a farm size cattle feedlot. Fourteen expressed a personal preference against hogs, and five had the same attitude toward cattle feeding.

Several farmers objected to working with hogs, while others felt labor requirements were too high. Predominant objections to cattle feeding were the price uncertainties and capital investment requirements, particularly for feedlots where feeder cattle were purchased.

In addition to historical decisions, the operators' current plans for the future were obtained (Table 9). Five individuals expressed no plans for change, seven would buy more land when possible, four planned to retire soon, six were going to make adjustments in livestock enterprises, and two were mainly concerned about substituting capital for hired labor.

The significance of the characteristics outlined above in relation to the objectives of the study will be summarized in the following chapters.

Summary Notes On Farm Operators

The following points of interest were noted with regard to the farmers in this study:

1. Most of the farmers were well off financially. Even those with relatively low cash incomes did not appear to be without the necessities and most of the conveniences enjoyed by the farmers with high incomes.
2. Investment capital did not appear to be a restricting resource when land acquisition was not considered.

Table 9. Current plans for future changes on the sample farms

Farm number	Plans for farm
1	(a) Buy larger equipment and reduce hired labor.
2	(a) Buy more land when possible, (b) Enlarge feedlot, (c) Substitute equipment for labor.
3	(a) Plans to retire and lease out the farm.
4	(a) Plans to retire and let son-in-law run the farm.
5	(a) Retired in 1967. Farm now managed by son-in-law.
6	(a) Plans to change to a purebred cow herd.
7	(a) No plans for change.
8	(a) No plans for change.
9	(a) Will rent or buy land as it becomes available. (b) Would like to enlarge cow herd.
10	(a) May enlarge beef cow herd and plant irrigated land to pasture.
11	(a) No plans for change.
12	(a) Will buy land when available.
13	(a) Will buy land when available.
14	(a) Will buy land when available.
15	(a) Increase number of brood sows.
16	(a) Sell cows and buy calves in fall to grass fatten.
17	(a) Buy land when it becomes available.
18	(a) Will lease to his son in a couple of years.
19	(a) No plans for change
20	(a) No plans for change.

3. Major management concerns were related more to farm size than to enterprise combination and resource allocation.

4. They were at an income level at which personal preferences figured prominently in their management decisions.

5. They appeared to be more interested in improving their income through the acquisition of additional resources than through the optimum allocation of all of their current resources.

CHAPTER V

MODEL I ANALYSIS

Model I was formulated to answer three questions: (1) How accurate were farmers in selecting the optimum participation in wheat and feed grain programs; (2) what factors influenced their ability to pick the optimum participation; and (3) what were the aggregate effects on production and income when optimum participation was not selected? The following discussion considers these questions.

With 20 farms and four years of data for each farm, there was a total of 80 observations to appraise with respect to program choices.

Two levels of choice were considered. First, farmers were required to choose between compliance or noncompliance with wheat and feed grain programs; and, second, if they elected to participate then a choice of level of participation in each program was required. There were four alternative combinations of compliance to consider. They were as follows:

1. Participate in both wheat and feed grain programs.
2. Participate in the wheat program but not in the feed grain program.
3. No participation in either program.
4. Participate in the feed grain program but not in the wheat program.

Possible levels of compliance with wheat and feed grain programs varied over the four years included in the study. In 1963 and 1964 the choice was simply a matter of deciding whether or not to divert additional acres of wheat allotment or barley base. Programs in 1965 and 1966 were more complicated since a substitution of one crop for the other was possible as well as the regular diversion option.

In view of the two general levels of choice, first selecting a combination of wheat and feed grain programs and then choosing a level of participation in the programs selected, there were three possibilities for optimality: First, the optimum combination of programs; second, the optimum level of participation in the optimum combination of programs; and, third, the possibility of choosing the optimum level of participation even though the combination of programs selected was not optimum.

Actual vs. Optimum Program Participation

The solution value of the objective function for alternative program combinations provided the basis for comparing actual with optimum choices. Appendix C contains the programming solutions for Model I and the farmer's actual participation. A summary of these comparisons appears in Table 10. Numbers in the body of the table refer to the alternative program combinations as listed above. Where identical numbers appear in columns headed "Actual" and "Optimum for a given farm number and year, the

Table 10. Summary of actual and optimum levels of participation in wheat and feed grain programs for 1963 to 1966[1]

Farm number	1963		1964		1965		1966	
	Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
1	3*	3	2*	3	1	1	2*	2
2	3*	4	2	2	2	2	2	2
3	4*	3	2	2	2	2	2	2
4	4	2	1	1	2	1	1	1
5	1	4	2	2	2*	2	2	2
6	1	4	2*	1	1	1	1	1
7	2	4	1	1	1	2	2	1
8	4*	3	2*	2	1	2	2*	2
9	3*	3	2*	2	2	1	1	1
10	4	4	2	2	1	2	2*	2
11	3*	4	2*	2	2	1	1*	1
12	3*	3	2*	2	2*	2	1	2
13	3*	1	2*	2	1	1	2*	2
14	3*	4	2	2	1	2	1*	2
15	3	2	2*	2	2*	2	2	1
16	1	3	1	3	1	3	1	1
17	3*	3	2*	2	1	2	1*	1
18	3*	3	2*	2	1	1	1*	1
19	3*	3	2*	2	2	1	2	1
20	3*	4	1*	1	1*	1	1*	1

* The optimum level of participation was selected within the particular program combination.

[1] Numbers in the body of the table represent wheat and feed grain program combinations and have the following interpretation:
(1) Participate in both wheat and feed grain programs.
(2) Participate in the wheat program but not in the feed grain program.
(3) No participation in either program.
(4) Participate in feed grain program but not in the wheat program.

Table 11. Summary of farmer successes in selecting optimum participation in wheat and feed grain programs

Item	Operators made the optimum selection				
	At least one year	At least two years	At least three years	At least four years	Total
	(No.)	(No.)	(No.	(No.)	(No.)
Operators selected:					
Optimum combination of programs	20	17	11	1	49
Optimum level of participation in program combination selected	17	12	8	1	38
Optimum combination of programs and level of participation	13	11	4	0	28

farmer selected the optimum combination of programs for that year. An asterisk indicates an optimum level of participation in the combination of programs indicated by the associated number. Where identical numbers and an asterisk appear simultaneously, the optimum combination of programs and the optimum level of participation were both selected.

Table 11 is a summary of the information in Table 10. In 49 of the 80 observations, the optimum combination of programs was chosen, in 38 cases the best level of participation within programs was selected, and in 28 instances both the optimum combination and level of participation occurred.

Not all farmers were equally adept at selecting the optimum. The optimum combination of programs was selected 61 percent of the time. Eighty-five percent of the farmers were able to pick the optimum combination at least two out of four years, while 55 percent were successful at least three years. The optimum level of participation was chosen by 60 percent of the operators at least two years, and 40 percent were successful for three years. Selecting both optimum combinations and levels of participation was more difficult. This was accomplished 35 percent of the time. Sixty-five percent of the operators picked the optimum combination and optimum level within programs at least one year; however, only 20 percent were successful at least three years.

Factors Influencing Program Choices

Several factors were found to influence the farmers' choices of program participation. Year-to-year changes in the programs and incentives associated with them were of primary importance. Methods of making decisions was another important factor. Finally, characteristics of the farms and operators themselves were investigated as possible factors influencing their ability to choose optimum programs.

Changes In Wheat And Feed Grain Programs

The number of farmers making optimum choices changed from year to year. In 1963 the poorest choices of program combinations were made of the four year period, but the largest number of farmers selected the optimum level of participation. In 1964, choices of optimum program combinations were highest, then declined in 1965, and picked up again in 1966. The numbers of farmers who chose the optimum level of participation declined continuously through 1965, but increased some in 1966.

Much of this variation in optimum choices over time can be attributed to changes in wheat and feed grain programs.

The 1963 program for barley was similar to that in 1962, but the wheat program became optimal for the first time in 1963. The 1962 wheat program stipulated that farmers were free to choose compliance or noncompliance. However, the penalties for

noncompliance were severe enough that most farmers recognized little opportunity for choice. The program for 1963 allowed farmers the option of either planting their full allotments and receiving the regular price support payments or diverting part of their allotments, receiving diversion payments, and obtaining a higher price support rate. Many farmers chose to plant their full allotments without giving sufficient consideration to the alternatives.

Selecting the optimum level of participation within any given combination of programs was easier in 1963 than in subsequent years since there were fewer alternatives for those who chose to participate.

The 1964 wheat program added two new features which multiplied the farmers' choices. These were marketing certificates paid on a percentage of the wheat production and the alternative of noncompliance with any program and planting wheat or barley fence-to-fence. Lower wheat prices in the market also made the choice of diversion more significant. However, the problems of choice created by these additional alternatives were offset in 1965 by a stipulation that farmers could wait till May 15 to commit themselves to a particular level of participation.

The sign-up date for 1963, 1965, and 1966 was March 15. This additional time allowed farmers to more adequately assess their alternatives in the light of expected market prices and productivity on their farms. Therefore, they did much better

as a group in choosing programs than in the preceding year or those that followed.

In 1965 wheat and barley programs were basically the same as in 1964 except that the possibility of substituting one grain for the other was included. This additional alternative made it difficult for farmers to choose either the optimum combination of programs or the optimum level of participation. Only four of the 20 farmers succeeded in selecting the optimum at both levels of choice.

The program for 1966 was only slightly different from 1965. It stipulated that price support payments on barley would be limited to 50 percent of the base acreage, whereas in previous years payments were made on all acres planted under the program. Because of the similarity with the 1965 programs more farmers were successful in choosing the optimum plans.

Sources Of Information For Choosing Programs

Selecting a combination of programs and level of participation was of major concern to farmers in the study. Several sources were consulted before a final decision was made. Those most frequently used were past experience, personal calculations, other farmers, and local Agricultural Stabilization office managers.

An investigation of the data revealed that of 60 possible inter-year comparisons, in 23 cases the combination of programs

selected was the same as that of the previous year (Table 12). In 14 of these 23 selections, the combination chosen was optimum. Alternatively, in 25 cases the program combination chosen was the same as the optimum combination for the previous year. Nineteen of these were also optimum for the current year. These data indicate that farmers were strongly influenced by past experience.

All of the farmers made some effort to calculate arithmetically the results of alternative choices. However, uncertainty about expected yields and prices and the number of alternatives to consider made these estimates tentative.

The choices of certain farmers in the community were frequently noted by others in the area when final sign-up time arrived. Although very little direct contact was made with these individuals, in conferences with the Agricultural Stabilization office personnel, questions arose as to the decisions made by these men.

The Agricultural Stabilization office manager and his staff were relied upon to explain the alternative choices in the programs and possible results arising from a particular decision that might be made.

Characteristics of the Farms and Farmers

To investigate relationships between certain characteristics of the farms and farm operators and actual and optimum program choices a regression analysis was used. The equation for this analysis was as follows:

Table 12. Inter-year comparisons of program participation

Item	Inter-year comparison			
	1963-64	1964-65	1965-66	Total
	(No.)	(No.)	(No.)	(No.)
Farmers' selection of programs for this year was the same as that of last year	1	11	11	23
Farmers' selection of programs this year was the same as last year and was optimum this year	0	6	8	14
Farmers selected last year's optimum programs for this year	1	11	13	25
Farmers' selection of programs this year was optimum last year and also optimum this year	1	7	11	19
If farmers had selected last year's optimum for this year they would have chosen the optimum for this year	2	14	14	30

(Equation I)

$$Y = b_o + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5$$

Where

Y = the four-year average percentage which the difference between the actual and optimum net revenues was of the average optimum net revenues for 1963 to 1966.

X_1 = total cropland acres per farm.

X_2 = long-run average wheat yield per farm.

X_3 = years farming experience of the operator.

X_4 = education of the operator.

X_5 = long-run average family income.

Simple correlation coefficients were estimated showing the degree of relationship between each independent variable and the dependent variable. These appear in Table 13. Only the coefficient for X_2 was significantly different from zero at the .05 level. However, the implications of all the coefficients were interesting.

The negative signs of X_1, X_4, and X_5 indicated that farmers who had larger acreages of cropland, more education, and higher incomes tended to make the better choices of participation in wheat and feed grain programs. On the other hand, those with highly productive land (X_2) had more trouble choosing programs than those where the yields were lower. What little association there was between years of farming experience (X_3) and choices made, indicated that those with more experience made the poorest choices.

Table 13. Simple correlation coefficients showing relation between the dependent variable and each of the independent variables in Equation I

Independent variables	Simple correlation coefficients
X_1	- .34706
X_2	.53833*
X_3	.07229
X_4	- .17953
X_5	- .16686

* Significant at the .05 level.

The least-squares regression procedure was used to estimate the values of the parameters of the equation. The derived equation with all variables included was as follows:

(Equation II)

$$Y = -.55509 - \underset{(.000025)}{.002X_1} + \underset{(.00104)}{.00383X_2} + \underset{(.00132)}{.00188X_3}$$

$$\underset{(.00473)}{-.0073X_4} + \underset{(.000001426)}{.000003X_5}$$

The numbers in parentheses are the standard errors of the respective coefficients. All parameters but that of X_2 were insignificant at both the .05 and .01 level. The coefficient of determination (r^2) was .57 while the coefficient of multiple correlation (r) was .75.

The sign on the coefficient for X_1 indicated that farmers with larger acreages made better decisions than those with smaller farms. A positive relationship occurred between the dependent variable and X_3 and X_5 which indicated that older farmers and those with high incomes tended to make the poorer choices. A negative association between education and the dependent variable was the type which logically would be expected a priori. The positive association between wheat productivity and the dependent variable required closer consideration.

It was found that much of the error occurred in choices of 1965 and 1966 participation, years when the substitution clause was in effect. Some farmers failed to substitute wheat for barley when they should have, while others underestimated the value of barley and substituted wheat for it when this action was not the most profitable. Also, higher wheat yields would make any error in choice appear more obvious when measured by net revenue.

Aggregate Analysis

Preceding sections have presented the results of the Model I analysis in terms of the individual farm units. This section considers the aggregate outcome of the analysis.

The primary question considered here is, what was the overall effect on wheat and barley production and on net revenue when farmers did not choose the optimum wheat and feed grain programs? Table 14 contains a summary of the relevant data. Differences in both acreage and production were relatively small. The average percentage which the difference between actual and optimum acreage and production were of the actual acreage and production came approximately to the following proportions: For wheat acreage three percent and for wheat production two percent, for barley acreage 16 percent and for barley production 13 percent. There was little difference in the percentages relating to wheat over the four years. However, differences in barley acreages and

Table 14. Aggregate actual and optimum wheat and barley production and net revenue for 1963 to 1966

Item	Unit	1963	1964	1965	1966
Wheat acres					
Actual	Acres	8,221.1	7,450.0	8,659.0	7,944.8
Optimum	Acres	8,418.4	7,470.5	8,266.9	8,318.3
Difference	Acres	197.3	20.5	393.1	373.5
Barley acres					
Actual	Acres	3,366.1	2,829.0	2,109.7	2,510.0
Optimum	Acres	3,006.8	3,093.4	2,763.8	2,187.0
Difference	Acres	359.3	264.4	654.1	323.0
Wheat production					
Actual[1]	Bushels	343,069.0	316,211.0	315,312.0	353,565.0
Optimum	Bushels	350,942.0	324,245.0	361,129.0	361,906.0
Difference	Bushels	7,873.0	8,034.0	4,183.0	8,341.0
Barley production[1]					
Actual	Cwt.	59,663.0	50,203.0	38,890.0	39,973.0
Optimum	Cwt.	55,351.0	52,213.0	54,615.0	39,397.0
Difference	Cwt.	4,312.0	2,010.0	15,725.0	576.0
Net revenue					
Actual	Dollars	667,875.0	536,741.0	613,174.0	768,304.0
Optimum	Dollars	679,188.0	547,533.0	646,454.0	784,760.0
Difference	Dollars	11,313.0	10,792.0	33,307.0	16,456.0

[1] Based on long-run average wheat yields multiplied by the crop acreage.

production rose to about 30 percent and 40 percent, respectively, in 1965. In 1964 the difference was down to about nine percent for acreage while in 1966 the percentage related to production was down to about one percent. Barley was more adversely affected than wheat when farmers failed to choose the optimum programs.

The average difference in net revenue over the four years was approximately three percent of actual net revenue. Total income foregone by choosing sub-optimum participation in government programs over the four years amounted to $71,868.00, or an average of $897.60 per farm per year. Most of this loss occurred in 1965 when the substitution alternative was first introduced.

CHAPTER VI

MODEL II ANALYSIS

Model II was constructed for two purposes: First, to evaluate the degree of association between actual and programmed farm organizations; and second, to aid in isolating factors which caused differences between the actual organization and that obtained by linear programming. The results of this analysis are summarized below.

Actual vs. Programmed Organizations

A summary of the historical organization of each farm was discussed in Chapter IV. The current structure of the farms along with two programmed solutions appear in Table 15. A series of profit maximizing plans were calculated for each farm with alternative sets of variables. These are in Appendix F.

The profit maximizing solutions in Table 15 were calculated from the set which contained all of the variables considered physically and economically feasible for the particular farm.

Four comparisons were considered between the actual and this profit maximizing organization. First, an overall comparison of enterprises was made, then they were considered in terms of dry land crops, irrigated crops, and livestock as separate units for comparison.

Table 15. Actual, profit maximizing, and least-cost farm organizations for the individual farms

Enterprise	Unit	Farm number 1 Actual	1 Max. Profit	1 Least cost	2 Actual	2 Max. profit	2 Least cost	3 Actual	3 Max. profit	3 Least cost
Crops, dryland										
Wheat	Acre	517.0	517.0	517.0	410.0	410.0	410.0	650.0	650.0	650.0
Barley	Acre	268.0	288.0	288.0	150.0	109.0	109.0	254.0	282.0	301.0
Grain hay	Acre	8.0	---	3.0	119.0	177.0	177.0	88.0	78.0	78.0
Alfalfa hay	Acre	---	---	---	---	---	---	85.0	---	69.0
Impr. pasture	Acre	20.0	---	---	---	---	---	50.0	108.0	---
Crops irrigated										
Wheat	Acre	---	---	---	---	---	---	---	---	---
Barley	Acre	---	---	---	---	---	---	---	---	---
Pasture	Acre	---	---	---	---	---	---	---	---	---
Alfalfa hay	Acre	---	---	---	---	---	---	---	---	---
Corn silage	Acre	---	---	---	---	---	---	---	---	---
Nurse crop	Acre	---	---	---	---	---	---	---	---	---
Fallow	Acre	---	---	---	---	---	---	---	---	---
Livestock										
Beef cows	Head	25.0	27.0	2.0	100.0	98.0	98.0	100.0	174.0	141.0
Brood sows	Head	---	---	---	---	---	---	---	---	---
Feedlot	Head	---	130.0	---	75.0	133.0	34.0	---	19.0	---
Grass fattening	Head	---	---	---	---	---	---	---	---	---
Gross profit	Dol.	44,296.0	46,635.0	44,296.0	36,991.0	32,752.0	30,991.0	57,365.0	59,061.0	57,365.0

Continued

Table 15. Actual, profit maximizing, and least-cost farm organizations for the individual farms--Cont.

Enterprise	Unit	Farm number 4 Actual	4 Max. Profit	4 Least cost	5 Actual	5 Max. profit	5 Least cost	6 Actual	6 Max. profit	6 Least cost
Crops, dryland	Acre	94.0	94.0	59.0	341.0	289.0	283.0	401.0	401.0	401.0
Wheat	Acre	8.0	9.0	44.0	158.0	233.0	239.0	101.0	109.0	199.0
Barley	Acre	4.0	12.0	3.0	35.0	43.0	33.0	28.0	---	25.0
Grain hay	Acre	---	---	---	---	---	---	19.5	202.0	22.0
Alfalfa hay	Acre	---	---	---	---	---	---	100.0	---	---
Improved pasture	Acre	---	---	---	---	---	---	---	---	---
Crops, irrigated										
Wheat	Acre	---	7.0	42.0	---	74.0	79.0	---	---	---
Barley	Acre	12.0	11.0	5.0	---	---	---	---	---	---
Pasture	Acre	32.0	---	---	---	28.0*	21.0*	---	---	---
Alfalfa hay	Acre	28.0*	42.0*	---	144.0	---	---	---	---	---
Corn silage	Acre	---	6.0	---	---	---	---	---	---	---
Nurse crop	Acre	---	---	---	---	4.0	3.0	---	---	---
Fallow	Acre	---	6.0	24.0	---	38.0	41.0	---	---	---
Livestock										
Beef cows	Head	65.0	72.0	7.0	50.0	68.0	50.0	55.0	52.0	20.0
Brood sows	Head	---	3.0	---	---	5.0	---	---	---	---
Feedlot	Head	---	---	---	62.0	53.0	6.0	---	66.0	
Grass fattening	Head	100.0	56.0	5.0	---	---	34.0	---	---	---
Gross profit	Dol.	10,637.0	15,313.0	10,637.0	34,000.0	34,529.0	34,000.0	28,650.0	30,030.0	28,650.0

* Both pastured and cut for hay.

Continued

Table 15. Actual, profit maximizing, and least-cost farm organizations for the individual farms--Cont.

Enterprise	Unit	Farm number 7 Actual	7 Max. profit	7 Least cost	8 Actual	8 Max. profit	8 Least cost	9 Actual	9 Max. profit	9 Least cost
Crops, dryland										
Wheat	Acre	668.0	668.0	646.0	144.0	119.0	108.0	413.0	413.0	413.0
Barley	Acre	232.0	182.0	375.0	86.0	111.0	122.0	218.0	208.0	208.0
Grain hay	Acre	---	---	---	---	---	---	23.0	50.0	50.0
Alfalfa hay	Acre	30.0	---	---	---	---	---	27.0	---	---
Impr. pasture	Acre	---	342.0	---	---	---	---	---	---	---
Crops, irrigated										
Wheat	Acre	16.0	4.0	26.0	---	25.0	36.0	---	---	---
Barley	Acre	---	---	---	---	---	---	---	---	---
Pasture	Acre	---	---	---	12.0	---	---	---	---	---
Alfalfa hay	Acre	---	29.0	1.0	43.0	22.0	7.0	---	---	---
Corn silage	Acre	---	---	---	---	---	---	---	---	---
Nurse crop	Acre	---	---	---	---	---	---	---	---	---
Fallow	Acre	17.0	---	6.0	---	8.0	12.0	---	---	---
Livestock										
Beef cows	Head	29.0	78.0	4.0	40.0	41.0	23.0	90.0	88.0	88.0
Brood sows	Head	---	---	---	---	---	---	5.0	---	---
Feedlot	Head	25.0	249.0	---	---	41.0	---	136.0	208.0	114.0
Grass fattening	Head	---	---	---	---	---	---	---	---	---
Gross profit	Dol.	72,450.0	77,566.0	72,450.0	14,000.0	15,901.0	14,000.0	39,382.0	41,726.0	39,382.0

Continued

Table 15. Actual, profit maximizing, and least-cost farm organizations for the individual farms --Cont.

Enterprise	Unit	Farm number 10 Actual	10 Max. profit	10 Least cost	11 Actual	11 Max. profit	11 Least cost	12 Actual	12 Max. profit	12 Least cost
Crops, dryland										
Wheat	Acre	815.0	795.0	766.0	319.0	253.0	261.0	280.0	280.0	280.0
Barley	Acre	208.0	86.0	114.0	135.0	194.0	186.0	162.0	162.0	162.0
Grain hay	Acre	17.0	60.0	15.0	10.0	36.0	---	12.0	34.0	30.0
Alfalfa hay	Acre	---	---	---	---	---	---	---	---	---
Improved pasture	Acre	---	---	---	---	---	---	---	---	---
Crops, irrigated										
Wheat	Acre	---	37.0	65.0	---	44.0	36.0	---	---	---
Barley	Acre	---	---	---	---	---	---	---	---	---
Pasture	Acre	---	84.0*	7.0*	---	---	---	---	---	---
Alfalfa hay	Acre	140.0	---	---	59.0	---	11.0*	---	---	---
Corn silage	Acre	---	6.0	---	---	---	---	---	---	---
Nurse crop	Acre	---	15.0	1.0	---	---	---	---	---	---
Fallow	Acre	---	---	63.0	---	15.0	12.0	---	---	---
Livestock										
Beef cows	Head	78.0	140.0	22.0	62.0	63.0	46.0	30.0	22.0	30.0
Brood sows	Head	---	---	---	---	---	---	---	---	---
Feedlot	Head	55.0	98.0	---	---	56.0	---	18.0	154.0	4.0
Grass fattening	Head	---	6.0	17.0	---	---	---	---	---	---
Gross profit	Dol.	63,500.0	74,198.0	63,500.0	34,280.0	36,693.0	34,280.0	42,195.0	43,634.0	42,195.0

* Both pastured and cut for hay.

Continued

Table 15. Actual, profit maximizing, and least-cost farm organizations for the individual farms--Cont.

Enterprise	Unit	Farm number 13 Actual	13 Max. profit	13 Least cost	14 Actual	14 Max. profit	14 Least cost	15 Actual	15 Max. profit	15 Least cost
Crops, dryland										
Wheat	Acre	514.0	514.0	514.0	739.0	739.0	739.0	196.0	196.0	196.0
Barley	Acre	291.0	291.0	291.0	274.0	274.0	274.0	110.0	110.0	110.0
Grain hay	Acre	8.0	19.0	---	34.0	89.0	36.0	14.0	---	---
Alfalfa hay	Acre	---	---	---	---	---	---	---	---	---
Improved pasture	Acre	---	---	---	---	---	---	---	---	---
Crops, irrigated										
Wheat	Acre	---	---	---	---	---	---	---	---	---
Barley	Acre	---	---	---	---	---	---	---	---	---
Pasture	Acre	12.0	---	---	---	---	---	---	---	---
Alfalfa hay	Acre	---	11.0*	12.0	35.0	35.0	35.0	6.0	6.0	6.0
Corn silage	Acre	---	---	---	---	---	---	---	---	---
Nurse crop	Acre	---	---	---	---	---	---	---	---	---
Fallow	Acre	---	---	---	---	---	---	---	---	---
Livestock										
Beef cows	Head	50.0	50.0	50.0	200.0	206.0	201.0	17.0	17.0	17.0
Brood sows	Head	---	---	---	---	---	---	35.0	43.0	33.0
Feedlot	Head	---	154.0	2.0	87.0	182.0	86.0	---	3.0	3.0
Grass fattening	Head	---	---	---	---	---	---	---	---	---
Gross profit	Dol.	65,780.0	68,258.0	65.780.0	78,009.0	82,326.0	78,009.0	15,685.0	16,356.0	15,685.0

*Both pastured and cut for hay.

Continued

Table 15. Actual, profit maximizing, and least-cost farm organizations for the individual farms--Cont.

Enterprise	Unit	Farm number 16 Actual	16 Max. profit	16 Least cost	17 Actual	17 Max. profit	17 Least cost	18 Actual	18 Max. profit	18 Least cost
Crops, dryland										
Wheat	Acre	---	---	---	406.0	406.0	406.0	480.0	480.0	480.0
Barley	Acre	---	---	---	212.0	232.0	232.0	229.0	289.0	289.0
Grain hay	Acre	---	---	---	43.0	21.0	5.0	---	21.0	25.0
Alfalfa hay	Acre	---	---	---	---	---	---	---	---	---
Improved pasture	Acre	---	---	---	42.0	---	---	---	---	---
Crops, irrigated										
Wheat	Acre	50.0	50.0	50.0	---	---	---	---	---	---
Barley	Acre	---	136.0	117.0	---	---	---	---	---	---
Pasture	Acre	125.0	---	---	---	---	---	---	---	---
Alfalfa hay	Acre	90.0	20.0	---	---	---	---	---	---	---
Corn silage	Acre	---	24.0	---	---	---	---	---	---	---
Nurse crop	Acre	---	---	---	---	---	---	---	---	---
Fallow	Acre	---	79.0	149.0	---	---	---	---	---	---
Livestock										
Beef cows	Head	158.0	---	---	70.0	67.0	10.0	50.0	50.0	37.0
Brood sows	Head	---	---	---	---	---	---	---	---	
Feedlot	Head	---	195.0	---	---	216.0	---	---	155.0	---
Grass fattening	Head	---	---	---	---	---	---	---	---	---
Gross profit	Dol.	14,297.0	24,432.0	14,297.0	47,763.0	51,530.0	47,763.0	56,418.0	58,813.0	56,418.0

Continued

Table 15. Actual, profit maximizing, and least-cost farm organizations for the individual farms--Cont.

Enterprise	Unit	Farm number 19 Actual	19 Max. profit	19 Least cost	20 Actual	20 Max. profit	20 Least cost
Crops, dryland							
Wheat	Acre	361.0	361.0	361.0	235.0	235.0	235.0
Barley	Acre	171.0	185.0	185.0	70.0	52.0	98.0
Grain hay	Acre	41.0	43.0	2.0	43.0	---	---
Alfalfa hay	Acre	10.0	15.0	45.0	19.0	95.0	58.0
Improved pasture	Acre	---	---	---	60.0	---	29.0
Crops, irrigated							
Wheat	Acre	---	---	---	---	---	---
Barley	Acre	---	---	---	---	---	---
Pasture	Acre	---	---	---	---	---	---
Alfalfa hay	Acre	---	---	---	---	---	---
Corn silage	Acre	---	---	---	---	---	---
Nurse crop	Acre	---	---	---	---	---	---
Fallow	Acre	---	---	---	---	---	---
Livestock							
Beef cows	Head	70.0	77.0	49.0	45.0	46.0	49.0
Brood sows	Head	---	23.0	---	---	---	---
Feedlot	Head	---	55.0	---	34.0	34.0	---
Grass fattening	Head	---	---	---	---	---	---
Gross profit	Dol.	19,545.0	23,873.0	19,545.0	19,000.0	19,975.0	19,000.0

Overall Comparison

Although all of the solutions were similar due to a limited number of uses for resources, there were some important differences. Only three farms had exactly the same enterprise combination as that obtained from linear programming. Most of the discrepancies were related to irrigated crops and livestock, but there were some differences in the use of dry cropland.

Dry Land Crops

Actual and optimum enterprise combinations on dry cropland were identical in 10 cases. On 14 farms they were the same except for grain hay production. Sixteen had grain hay, while only 14 should have had it. Dry land alfalfa appeared on six farms while the programming analysis included it on only three operations. A similar situation existed with improved pastures. Four farms had improved pasture while it was in the maximizing solution on only three farms.

The best use for dry cropland was, in most cases, a clear-cut decision due to the high productivity of wheat and barley and its limited number of alternative uses.

Grain hay had little influence on land use decisions since it was only grown on land which was otherwise idle due to government programs.

Dry land alfalfa and improved pasture occurred only when it provided inputs for a beef cow enterprise.

Irrigated Crops

Irrigated cropland existed on 10 farms. Only two operators allocated this resource exactly as the maximum profit plan indicated. In nine of the 10 cases, irrigated land was used mainly for hay and pasture. Two farmers sold hay commercially. The rest fed all that was raised. The programming analysis indicated that seven of the 10 farmers should have raised some wheat and barley in addition to forage crops.

There were several reasons why these farmers chose to raise hay on dry land and irrigated land even though they considered wheat and barley to be more profitable. There was not enough hay grown locally, so it would have to be shipped in from distant surplus areas. Hay production in these surplus areas fluctuated enough that adequate supplies were not always available. Hay prices also experienced wide fluctuations. Therefore, raising hay, irrespective of potential returns from small grain crops, was the more desirable plan.

Livestock

The occurrence of livestock on the farms was tied closely to the availability of cheap forage and surplus labor. All 20 farms had beef cows. This enterprise also entered the programmed solutions for 19 of the 20 farms in about the same numbers as actually existed. The one exception was with the farm which had

all irrigated land. Here the whole operation was centered around the beef cow herd. The programming analysis, however, indicated that beef cows were the least profitable enterprise of those adapted to irrigated cropland.

Brood sows and cattle feedlots entered the profit maximizing solutions as users of the residual labor and capital. In most cases some additional labor had to be hired during the summer months in order to make better use of surplus winter labor.

Whether brood sows or a feedlot entered the solution was determined by the availability of surplus labor and capital. Neither of these enterprises were competitive with grain crops or the beef cow herd. A feedlot was much more efficient in the use of labor than brood sows. Therefore, on farms where labor was the more restricting resource, a feedlot entered the solution. On the other hand, brood sows were more efficient in the use of operating capital, particularly where feeder cattle had to be purchased. Under these conditions, brood sows entered the solution. If feeders were raised on the farm, operating capital required was small enough that a fattening program would dominate brood sows.

The analysis indicated that 19 farmers should have had a feedlot where only eight actually had that particular enterprise. It also showed that four operators would have been better off with some brood sows while only two had them.

Reasons given by farmers for not having hogs or a feedlot were discussed previously. There it was indicated that most farmers disliked raising hogs or recognized that they used labor less efficiently than other enterprises. The main objections to a feedlot were price and income uncertainty and investment requirements.

Factors Which Create Differences Between Actual and Programmed Farm Organization

The main concern of this section is to consider why discrepancies between actual and linear programmed farm organizations outlined in the preceding section occurred.

The framework within which the study was conducted makes it possible to limit the investigation to three main causes. The programmed profit maximizing solution for each farm was dependent on the structure of the model used to describe the farm and the related numerical coefficients. Therefore, weaknesses in the model will be considered first, followed by errors in the data, as explanations of differences between programmed and actual farm organization. The third possible cause deals with characteristics of the farm operators and the physical and economic environment within which they function.

The Model

The composition of linear programming models in general and

the associated assumptions were outlined in the introduction. The specific assumptions surrounding the model used in this analysis are as follows:

1. All relationships between resources and products were linear. There were no economies of size.
2. The assumption of additivity was respected for all activities except crop enterprises on irrigated land. Here interaction between small grains and forage crops was introduced.
3. All resources and enterprises were available in fractional units.
4. All parameters were known with certainty.
5. All significant physical and institutional constraints were included in the model.
6. The farm operators were strict profit maximizers within the framework of their individual restraints and alternative activities.
7. All enterprises physically and economically adapted to the farms were acceptable alternatives.

The first assumption did not pose a serious problem in this analysis. Inputs required and returns for all dry land crop enterprises and the beef cow enterprise were based on the current size of each on the individual farms. The solution values were practically the same as those which actually existed.

The feedlot budget assumed an annual capacity of 157 head. Variable costs would be the same irrespective of size. Although fixed costs were found to be similar over the feedlot sizes which

entered the solutions (Appendix E), investment capital was not treated as a restraint in the model. Therefore, any economies which may have existed in terms of investment in facilities would not have altered the solutions.

Whether important economies of size occurred in the use of feedlot labor was also doubtful. The feedlot enterprise was constructed on the basis of an automated feeding system which practically eliminated overhead labor. This included on-farm feed storage, a feed mill, and an automatic feed distribution system. Three farms in the study had this type of operation. The largest farm fed 136 head, the second largest fed 55 head, and the smallest fed 34 head. They reported labor per head at one and eight-tenths, two and one-tenth, and one and one-tenth (1.8, 2.1, and 1.1) hours, respectively. Where total labor requirements per head were reduced to such a low level and overhead labor was extremely small, there was little opportunity for economies of large size to arise in the use of labor.

Brood sows entered the solutions on only four farms. In three cases it was at a level lower than the 35-sow unit which the budget was based on. Also, in each case it was the last activity to enter the solution. In the presence of economies of size, actual input requirements would have been higher for the herd sizes in the solutions than those used. Therefore, they could not have entered at a higher level but would have remained as they are unless their net revenues were zero. In this case,

they would not have entered the solutions at all.

The assumption of additivity was also of minor concern. There was no interaction among dry land crops. The model accounted for possible interaction among crops on irrigated land. Therefore, the assumption did not pose a problem.

A similar situation existed with regard to the divisibility assumption. If there had been some important nonlinear relationships which were not built into the model, then forcing discrete units into the solutions would have improved the results. As it was, the only inconsistency which appeared was livestock entering the solutions in fractional units.

The results of assuming perfect knowledge constituted a major cause for differences between actual and optimum farm organizations. This was the case particularly with feedlots. The reason most frequently given for not having a feedlot was uncertainty with respect to prices and costs. Still, on most of these farms, a feedlot entered the solution.

The constraints in the models did not adversely affect the solutions. However, those related to labor and capital could have been improved. Separate equations for each labor source would have more accurately reflected the problems related to labor quality. For some farms, a larger number of labor periods would have caused the enterprises to be more competitive, as they were in reality on the farms.

The operating capital restraints also over-simplified the real situation. They did not account for intra-year credit transfers nor accurately measure the quantity of credit available to the farmer over the entire year.

The last two assumptions, that the farmers were strict profit maximizers and that all enterprises physically and economically adapted to the area were acceptable alternatives were found to be important causes for differences between actual and programmed farm organizations. Therefore, they will be discussed as separate sections.

The Maximum Profit Criteria

The validity of the assumption that the sample farmers were strict profit maximizers was considered in terms of the objective function used in the model.

There were other objective functions in addition to that of profit maximization which could have been used. For example, to minimize the cost of obtaining a given level of income or to minimize the labor required to reach a certain income level. In determining the objective which guided farmers in their decision-making processes, the minimum cost approach was selected as an alternative to that of maximizing profits. Solutions derived by means of this criteria are also contained in Table 15.

In order to compare the actual and programmed farm organizations within the framework of the two objective functions, two

sets of conformity indices were developed. The first set was calculated to compare the actual organization with each of the two programmed farm plans. The purpose of this comparison was to determine whether the farmers acted more like profit maximizers or cost minimizers in their management decisions. The second set of indices compared the programmed solutions with the actual organization. The purpose of this comparison was to determine which of the models were best for describing what the farmers were actually doing. A detailed explanation of the construction of these indices can be seen in Appendix G.

The first set of indices compared the actual farm organization with those from the programming models in terms of patterns of resource use and enterprise combinations. An overall comparison was made by averaging the indices for each of these items on each farm. These indices appear in Table 16.

The indices for labor and land measure the extent to which the actual allocation of these resources agreed with the programmed solutions. An index of one would indicate perfect association while an index of zero would denote no association.

The enterprise combination indices were based on a weighting system in which each enterprise was weighted by its net revenue.

These indices were imperfect mediums for comparing the actual with the optimum organizations in that they did not allow direct inter-farm nor intra-farm comparisons of the overall farm organizations. No common denominator or common scale was found which would allow this.

Table 16. Indices for comparing actual with programmed resource use and enterprise combinations

Farm No.	Maximum profit				Least cost				Maximum profit[1]	
	Labor	Land	Enterprise	Average	Labor	Land	Enterprise	Average	Labor	Land
1	.72	.98	.94	.88	.82	.99	.99	.93	.97	.97
2	.94	.96	1.00	.97	.88	.96	1.00	.95	.94	.96
3	.89	.95	.89	.91	.97	.96	.99	.97	.91	.95
4	.77	.86	.66	.76	.35	.66	.70	.57	.83	.87
5	.77	.84	.55	.72	.50	.84	.68	.67	.77	.84
6	.87	.85	.91	.88	.77	.92	.95	.88	.95	.88
7	.70	.82	.60	.71	.72	.93	.90	.85	.70	.82
8	.84	.89	.73	.82	.68	.84	.75	.76	.84	.89
9	.91	.97	.65	.84	.89	.97	.65	.84	.91	.97
10	.69	.92	.68	.76	.44	.88	.78	.70	.69	.92
11	.67	.85	.57	.70	.66	.88	.74	.76	.56	.86
12	.77	.98	1.00	.92	.98	.98	1.00	.99	.77	.98
13	.83	.99	.66	.83	.97	.99	.60	.85	.83	.99
14	.94	.97	1.00	.97	.99	1.00	1.00	1.00	.94	.97
15	.89	.99	.97	.92	.94	.99	.97	.97	.89	.99
16	.11	.24	.52	.29	.11	.16	.63	.30	.39	.37
17	.73	.94	.83	.83	.63	.92	.86	.80	.94	.94
18	.79	.95	.88	.87	.93	.95	.92	.93	.93	.94
19	.70	.96	.66	.77	.94	.96	1.00	.97	.96	.97
20	.98	.89	.98	.95	.94	.92	.95	.94	.98	.89
Average	.78	.89	.78	.83	.76	.89	.85	.83	.84	.90

[1] Maximum profit solutions when enterprise alternatives were limited to those which the farmer wanted to consider.

The patterns of labor use on the farms were slightly closer to the maximum profit solution than to that of the least-cost model. Ten farmers favored the maximum profit pattern of allocation while nine tended toward the least-cost approach. However, the average of the indices for those favoring the maximum profit pattern was 82 while the average of the indices of those favoring the least-cost pattern was 92. This indicates that while the maximum profit criteria was adhered to more frequently by the farmers they were not bound very closely to this objective, whereas those patterns which resembled the least-cost allocation would be much more predictable within that framework.

When all the labor indices were averaged for each of the two models the farmers did not compare well in their labor use patterns with either the maximum profit or the least-cost criteria. The average indices were 78 and 76, respectively.

Programmed land use patterns were more closely followed by the farmers. On an average the indices were 89 for both models. However, seven farms conformed more closely to the least-cost pattern of land use while only five were more like that of the maximum profit model. In eight cases the indices were identical for the two models.

The major reason why only a few farmers adhered to the maximum profit pattern of land allocation was centered in the use of irrigated land. Seven farmers with irrigated land failed to favor the maximum profit land use pattern.

Enterprise combinations selected by the farmers were, on an average, closer to those of the least-cost models. The average of

the indices was off by 15 units from a perfect association. With the maximum profit models a 22-point difference occurred.

There were 13 farms which adhered more closely to the least-cost approach while only two resembled closely the maximum profit enterprise combination. In five cases there was no difference in indices between the two models.

When the three indices were combined for each farm, the resulting average indices indicated that 11 farmers were closer to the least-cost solutions, seven favored the maximum profit approach, while with three farmers the average indices for the two models were identical.

This analysis indicates that there are objectives other than profit maximization which the operators emphasized when planning their farm organizations. It also points out that farmers' objectives may be different with regard to various resources. Land may be allocated in a way that will maximize profits, while the labor resource is allocated more like the least-cost approach. Why some farmers acted as profit maximizers and others did not will be investigated in later sections.

Table 17 contains the indices which were used to compare the programmed solutions with the actual farm organization. These indices are different from those above in that they measure the weighted differences between the actual and programmed organizations. An index of zero indicates no difference in organization. There is no common maximum difference which the indices can approach.

Table 17. Indices for comparing programmed with actual farm organization

Farm No.	Maximum profit	Least cost
1	.05	.04
2	.08	.09
3	.22	.05
4	.34	.96
5	.63	1.41
6	.11	.13
7	.21	.11
8	.42	.66
9	.06	.04
10	.26	.40
11	.49	.42
12	.08	.02
13	.05	.02
14	.03	.00
15	.03	.01
16	1.16	1.08
17	.17	.20
18	.07	.06
19	.13	.10
20	.13	.12
Average	.24	.30

In 13 of the 20 cases, the least-cost model came closer to describing the actual farm organization than the maximum profit model. Here again is an indication that maximizing profits was not the principal objective of all farmers.

Enterprise Alternatives

The assumption that physically and economically feasible enterprises were acceptable alternatives did not prove to be correct for every farmer. This was particularly true of feedlots and brood sow enterprises. Farmer attitudes toward those enterprises were discussed in Chapter III.

When profit maximizing solutions were calculated for each farm using just those enterprises which the individual farmer desired, the actual organization came closer to the calculated solution. This can be seen in the last two columns of Table 16. Here the pattern of labor allocation index on an average was five points higher than the average where all feasible enterprises were included in the model. The average land use index was one point higher.

By including enterprise alternatives which were not acceptable to the farmers, greater differences arose between the actual and profit maximizing organizations.

The Input Data

The input-output coefficients were derived from three sources--individual farmers, extension specialists, and commercial business establishments.

All coefficients relating to dry land grain crops, grain hay, and cow herds were based on farm records and estimates of the individual farmer. Labor requirements for all other dry land crops and livestock enterprises were also drawn from this source.

It was assumed that all data obtained from the farm operators accurately reflected the individual situations.

Input requirements for all irrigated crops, improved dry land pasture, the cattle feedlot, and the brood sow enterprise were calculated from secondary sources. In some instances farmer estimates were used to corroborate these calculations.

Production estimates for each of these enterprises were obtained from the farmers except for those related to the feedlot and brood sows. For each of these two enterprises, animal husbandry specialists helped to set up three alternative sets of input-output coefficients (Appendix E) which represented three levels of management ability. Programming solutions were calculated for the individual farms with each of these levels of management (Appendix F). Where a farmer had previous experience in cattle feeding a level of management was assigned to him which reflected this experience. In all other cases it was assumed that the farmer had average management ability.

Whether this procedure resulted in an adequate representation of each farmer's ability cannot be determined. However, within the bounds of the coefficients used, the effect on the solution of using each level of management was ascertained. This is summarized in Table 18. Changing feedlot and brood sow coefficients over the range specified had little effect on the number of farms with cattle feedlots. The average size, however, was affected much more by changes in the level of efficiency.

The principal reason for stability in the number of cattle feedlots was the presence of cow herds which furnished the necessary feeders. Even at low levels of management, it was more profitable to fatten calves raised on the farm than to sell them as weaners. The fluctuation in fat cattle numbers occurred mainly in that part of the total which were purchased off the farm.

Using data obtained from secondary sources to construct coefficients representative of the individual farmer's management ability was probably a major weakness in the data.

The Farm Operators

Several characteristics of the farm operators were considered as possible factors contributing to differences between the actual and programmed farm organizations. These factors were: Years of farming experience, particularly experience on the farm currently

Table 18. The effect on occurrence and size of cattle feedlot and brood sow enterprises of different levels of management ability

Management level		No. of farms with brood sows	No. of farms with feedlots	Total brood sows	Total fat cattle	Average brood sows per farm	Average far cattle per farm
Brood sow	Cattle feedlot						
Average	Average	4	18	35	2,140	9	119
Average	Above average	3	20	64	2,930	22	147
Average	Below average	15	18	173	880	12	49
Above average	Average	9	17	126	1,889	14	111
Below average	Average	1	18	2	2,304	2	128

operated; the number of years of formal education; the number of children which received either part or all of their support from the family income; the size of the annual family income from the farm, and the age of the operator.

The hypothesis was advanced a priori that years of farming experience, years of formal education, and the number of dependent children would be negatively associated with the magnitude of the differences between actual and programmed organizations.

Past farming experience could either entrench the farm operator in a set of habits which would cause him to resist change when necessary or it could serve as a training process through which he would profit and thereby make more knowledgeable decisions. This analysis assumed the latter type of reaction. Farmers with more experience would tend to approach the optimum organization.

Whether or not years of formal education would necessarily have any influence on a farmer's ability to choose the optimum organization is also subject to debate. It might be argued that farming is a trade and that those who succeed are the individuals who acquaint themselves with skills and practices unique to the particular area in which they are farming. This could be accomplished to some extent through formal institutions. However, most information of this type would have to be gained through observation and personal experience. On the other hand, an education, particularly if it is in the field of agriculture

would make a person more aware of latest developments in the field and cause him to be more sensitive to needed changes in his farm organization. He would tend to be more critical of his current and historical decisions and would be more proficient with the tools of farm management analysis. The supposition that farmers with higher educations would tend to approach the profit maximizing farm organization was based on these arguments.

The assumed negative relationship between the number of dependents and the amount of error between the actual and programmed organizations was based on the assumption that the burden of providing for children would force the farmers to make the optimum use of their limited resources.

Old age and high incomes were expected to be associated with below optimum farm organizations.

As farmers advance in age, changes occur in their objectives and in the quality of their labor input. Leisure may become more important, income requirements moderate, and individual capability for strenuous activity decrease. When this occurs adjustments are made in the enterprise mix and resource allocation in accordance with the new conditions. It was hypothesized that these adjustments would be incompatible with the type of organization specified by linear programming.

High incomes were expected to inbue the farmers with objectives other than profit maximization. After farmers had acquired the normal comforts, they would rather spend their time in social, civic, or educational activities than in increasing their income.

Interrelationships among these characteristics of the farmers were investigated through a simple correlation analysis (Table 19). Here the degree and direction of association was calculated.

Farming experience was negatively correlated with years of formal education, family income, and the number of dependent children. The relationship was statistically significant with respect to the number of dependent children. This close relationship is to be expected since greater experience would be closely associated with older farmers who would have fewer children at home. The high correlation between age and experience verified this as did also the high negative coefficient relating age and dependent children.

Years of education were positively correlated with income and negatively correlated with age, although not statistically significant in either case. Farmers with more education tended to have higher incomes. The older farmers were raised during a period of time when college training was unusual. Most of those over 40 years old had either an eighth grade or a high school education.

There was hardly any correlation between family income and age of operator. Income was negatively correlated with the number of dependents, indicating that farmers with higher incomes had fewer children at home.

There were several means by which discrepancies between actual and programmed farm organizations could be expressed. Those selected for analysis were differences in net revenue, difference

in patterns of land and labor use, and differences in enterprise combinations.

Simple correlation coefficients were calculated relating the characteristics of the farm operators outlined above with these measures of enterprise compatibility (Table 20).

The difference in net income between the actual and programmed organizations was expressed as a percentage of the programmed net income. This index was positively associated with farming experience and age of the operators. However, the magnitude of the coefficients was extremely small. This positive relationship indicated that as farmers grew older and had more experience their farm organization become more divergent with the programming solution. This was probably due to the influence of age in both cases and not to experience. It is possible, however, that the a priori hypothesis that experience would exhibit a negative influence was incorrect and that greater experience tended to establish farmers in a set program of operation.

Simple correlation coefficients for education, family income, and number of dependent children were negative. This relationship was expected for education and dependent children. A negative correlation between family income and the index of net revenue differences was not anticipated. This may be accounted for partly by the fact that a definite positive association existed between family income and the denominator of the index. Also, wheat and

Table 19. Simple correlation coefficients showing relationships among the characteristics of the farm operators

Variables		Variables				
		X_1	X_2	X_3	X_4	X_5
Farming experience	X_1	1.00	- .31	-.04	.90*	- .67*
Formal education	X_2		1.00	.33	- .32	.18
Family income	X_3			1.00	.02	- .33
Age of operator	X_4				1.00	- .72*
Dependent children	X_5					1.00

*Significant at the .05 level.

Table 20. Simple correlation coefficients relating characteristics of farm operators with measured differences between actual and profit maximizing farm organizations

Independent variables		Dependent variables[1]			
		Y_1	Y_2	Y_3	Y_4
Farming experience	X_1	.028	.126	-.070	-.117
Formal education	X_2	-.315	.095	.204	.485*
Family income	X_3	-.318	.116	.085	-.043
Age of operator	X_4	.066	.026	-.140	-.257
Dependent children	X_5	-.322	.229	.352	.215

*Significant at the .05 level.

[1] Y_1 - Differences between actual and maximum profit programmed net revenues expressed as a percentage of the maximum profit programmed net revenue.
Y_2 - Maximum profit labor conformity index (Table 16).
Y_3 - Maximum profit land conformity index (Table 16).
Y_4 - Maximum profit enterprise conformity index (Table 16).

barley were the most profitable among the various enterprises. On large farms these crops constituted a large proportion of the net revenue. Differences in organization on the farms in most cases did not arise from discrepancies in wheat and barley acreages. Therefore, although the large farmers may have been off in their selection of other enterprises, these differences would not greatly affect the total net revenue for the farm.

The correlation coefficients for the labor conformity index and characteristics of the farmers were positive in every case. The magnitude of the coefficients was extremely small indicating that none of the characteristics were very closely related to errors in patterns of labor use.

Land use indices were negatively correlated with farming experience and age of the operators and positively correlated with education, income, and number of dependent children. This indicated that older farmers deviated from the programmed land use pattern to a greater extent than those who were younger while those with more education and larger number of dependents tended to favor this pattern of land use. Income levels had only a slight association with this variable.

The simple correlation coefficients indicated that farmers with more education and more children tended to have the same combination of enterprises as the programmed solutions. Older farmers and those with higher incomes deviated from the programmed combination. A review of the farm organizations suggested that

the presence or absence of hogs and cattle feedlots were the major factors which influenced the sign of the correlation coefficient. A summary of all the relationships considered in the simple correlation analysis suggested that the farmers who came closest to the profit maximizing farm organization were those with the most education and the largest number of dependent children. To a more limited degree these farmers had higher incomes and were younger. Years of farming experience did not appear to have a consistent influence in either direction.

Multiple regression analysis was used to estimate the cumulative association which existed between these characteristics of the farmers and the differences which occurred between the actual and programmed farm organization (Table 21). The general form of the equation used was as follows:

(Equation III)

$$Y_i = b_o + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5$$

Where i = 1 to 4

and where

Y_1 = Difference between the actual and maximum profit net revenues expressed as a percentage of the maximum profit net revenue.

Y_2 = Maximum profit labor conformity index.

Y_3 = Maximum profit land conformity index.

Y_4 = Maximum profit enterprise conformity index.

Table 21. Regression coefficients relating characteristics of farm operators to measured differences between actual and profit maximizing farm organization

Independent variables		Dependent variables[1]			
		Y_1	Y_2	Y_3	Y_4
Farming experience	X_1	-.0054311	.0155029	.088383	.0122259
Formal education	X_2	-.0070679	.0019088	.0072635	.0468588*
Family income	X_3	-.0000058*	.0000071	.0000049	-.0000101
Age of operator	X_4	-.0034183	-.0018371	-.0000060	-.0131330
Dependent children	X_5	-.0570854*	.0840469*	.0698317*	.0140162
r		.73*	.57*	.54*	.63*
r^2		.54	.33	.29	.40

* Significant at the .05 level.

[1] See footnote 1, Table 20.

X_1 = Years of farming experience.

X_2 = Years of formal education.

X_3 = Family income.

X_4 = Age of the operator.

X_5 = Number of dependent children.

The coefficient relating characteristics of the farm operators to differences in actual and profit maximizing net revenues, Y_1, were negative in all cases. This indicated that as the numerical value of each characteristic increased the index of net revenue differences decreased. Only two coefficients tested significantly different from zero. This analysis revealed that 54 percent of the total variation in Y_1 among the farms was accounted for by the association between this variable and the characteristics of the farmers.

The coefficients for the labor, Y_2, and the land, Y_3, resource equations were all positive except for those associated with age of operator. These variables accounted for a relatively small proportion of the total variation in Y_2 and Y_3. The coefficients of determination, r^2 were .33 and .29, respectively.

Differences in enterprise combinations as reflected by the enterprise conformity indices, Y_4, were positively correlated with all of the characteristics except family income and age of operator. The proportion of the total variation in Y_4 explained by all these characteristics amounted to .40.

The following conclusions were reached with respect to the influence of the selected characteristics of the farmers on differences between the actual and programmed farm organizations. The number of dependent children had a major influence on whether or not the farmers approached the profit maximizing plan. Farmers with the largest number of dependents came closest to this organization. Education was another factor of significance. Those individuals with more years of formal education were closer to the profit maximizing solution than those who did not have this additional training. Older farmers tended to have motives other than profit maximization although the tendency was not a strong one. There was also a slight tendency for the more experienced farmers to deviate from the programmed solution. High incomes appeared to be associated with individuals who had approached the programmed organization. However, this relationship was questionable due to the close association between family income and the denominator of the net revenue index.

Aggregate Analysis

Production for each enterprise was summed over all of the farms to obtain an indication of the aggregate differences between the actual (aggregates) and programmed farm organizations (Table 15). The programming solutions were aggregated on four different bases: First, all maximum profit solutions involving the set of all physically and economically feasible enterprises were summed (aggregate B); second, the least-cost solutions were summed (aggregate C); third, the maximum profit solutions were summed where the solutions were based on the set of activities which the farmer felt were acceptable (aggregate D); and fourth, a combination of the profit maximizing solutions and least-cost solutions (aggregate E) where the solution for each farm was selected which most closely described the actual organization on the basis of the indices relating the programmed solutions to the actual solution (Table 22).

The discrepancies between the actual and programmed production are attributable to errors in specification of the models and errors in the data. There was no aggregation bias since individual farms and not representative farms were used.

The three major enterprises on the farms were wheat, barley, and beef cows. Aggregate E came closest to the actual wheat acres and beef cow numbers while aggregate B represented barley production more closely.

Table 22. Aggregate production for actual and alternative programmed farm organizations

	Unit	Aggregate A	Aggregate B	Aggregate C	Aggregate D	Aggregate E
		Actual organization	Maximum profit organization	Least-cost organization	Reduced enterprise maximum profit organization	Combination of least-cost and maximum profit organization
Dry land crops:						
Wheat	acre	7,969.0	7,818.0	7,725.0	7,806.0	7,822.0
Barley	acre	3,337.0	3,405.0	3,826.0	3,655.0	3,481.0
Grain hay	acre	530.0	683.0	482.0	537.0	762.0
Alfalfa hay	acre	191.0	342.0	194.0	374.0	285.0
Improved pasture	acre	272.0	450.0	29.0	29.0	342.0
Irrigated crops:						
Wheat	acre	68.0	243.0	334.0	255.0	243.0
Barley	acre	12.0	147.0	122.0	128.0	134.0
Pasture	acre	289.0	112.0	28.0	112.0	98.0
Alfalfa hay	acre	545.0	166.0	72.0	129.0	116.0
Corn silage	acre	0	30.0	0	6.0	6.0
Fallow	acre	21.0	146.0	307.0	219.0	156.0
Livestock:						
Beef cows	head	1,434.0	1,230.0	944.0	1,203.0	1,445.0
Brood sows	head	40.0	74.0	33.0	41.0	49.0
Fat cattle, feedlot	head	507.0	2,201.0	249.0	816.0	1,110.0
Fat cattle, grass	head	100.0	56.0	39.0	56.0	62.0

Actual brood sow and fat cattle numbers were represented quite well by both aggregate C and aggregate D. Also aggregate E did better than aggregate B in predicting these quantities.

The actual production of irrigated crops was not well represented by any of the programmed solutions.

The aggregate analysis indicated that no single model did well at predicting all of the quantities of interest. The size of major enterprises were predicted with more accuracy than supplementary enterprises. Stratifying farms on a basis of the objective function brought better results than any single objective function. Supplementary enterprise quantities were predicted more closely by the least-cost and reduced enterprise maximum profit models. All of the models predicted the actual size of enterprises on dry land which had a limited number of alternative uses better than for irrigated land where more alternatives were available.

CHAPTER VII

IMPLICATIONS OF THE STUDY

The objectives of this study were meant to be suggestive and not definitive. They were to center attention on errors which can arise in supply response and adjustment studies based on the linear programming approach due to specification error. Researchers using this approach have recognized the presence of this type of error but have not been able to assess its magnitude or specific steps which could be taken to reduce or eliminate it. No empirical studies on this problem have been published up to the present time. The results of this investigation suggest that the predictive value of the linear programming technique could be improved through a continuation of this type of analysis. It could help isolate conditions under which large amounts of specification error might be expected and thereby provide a basis for evaluating the usefulness of the tool for specific situations. It could also provide the basis for stratifying a population so that models could be constructed for each strata which would minimize the specification error.

The procedures used in this investigation suggest an additional use for linear programming. It has historically been applied in studies where the objective was to specify the optimum way of attaining a given objective or to predict farm production. In this study it was used to investigate factors which caused differences to arise between the actual and normative solutions.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

Linear programming has become widely accepted as an analytical tool in studies of supply response and agricultural adjustments. One of the primary objectives of these studies has been to provide information on what farmers would do in terms of production under given sets of conditions.

The traditional use of linear programming has been to answer normative questions of what ought to happen under given conditions or what should be done to obtain a given objective. When this method of analysis has been applied to questions requiring positive answers the researcher has assumed that all of the relevant variables could be incorporated into the model. It has also been assumed that the simplifying assumptions required by this approach would not introduce serious errors into the resulting solutions.

The purpose of this study was to investigate factors which may limit linear programming as a predictive tool. It has specifically centered attention on components of linear programming models and characteristics of farm operators which create differences between actual and linear programmed farm organizations.

The basic unit for the analysis was the individual farm. Twenty farms in Wasco County, Oregon, were selected for the empirical investigation. Data on enterprise costs, technical coefficients, and restraints were obtained from each farmer.

All of the data gathered was reviewed by the farmers for accuracy before it was used in the analysis. The objective in the collection of data was to arrive at coefficients which would accurately reflect conditions on the individual farms. Additional information was gathered on each farmer which included age, education, farming experience, income, facility size, financial conditions, and historical farming decisions.

Three programming models were constructed for each farm. Model I represented year-to-year choices among alternative levels of participation in government wheat and feed grain programs. Separate models were developed for each of the years from 1963 to 1966 which represented the program alternatives in these four years. The purpose of Model I was to calculate profit maximizing solutions for individual farms in this short-run context, to make comparisons with actual decisions of the farmers within the same framework, and to isolate factors which created differences between the actual and programmed solutions.

Model II was constructed to predict individual farm organization where the planning horizon was sufficiently long for changes to occur in resource use patterns and enterprise combinations. Land, family labor, and in some cases operating capital, were treated as fixed resources. The objectives of the Model II analysis were to evaluate the degree of association between the actual and profit maximizing programmed farm organizations and to aid in determining factors which caused differences between the two solutions.

Model III was the same as Model II except that its objective function required the least-cost organization for obtaining a given level of income. Its purpose was to provide an alternative representation of the objectives which guided the farmers in their management decisions.

The Model I analysis indicated that farmers did not make the profit maximizing decisions with respect to choices among government programs. None of the operators chose the optimum participation in all four years and only 13 were successful at least one year.

Several factors hindered farmers from making optimum choices. One of the most important was continued changes in the programs and incentives associated with them. The analysis indicated that the farmers' decisions improved as they gained experience in dealing with a program. Another factor which restricted farmers was their inability to individually assess the economic consequences of alternative levels of participation in the program. Past experience, personal calculations, choices of other farmers, and Agricultural Stabilization office personnel were drawn upon for information to guide their decisions. The analysis indicated that the farmers relied heavily upon last year's experience in formulating this year's decisions.

A regression analysis was performed which attempted to account for differences in actual and programmed choices of participation among farms by differences in cropland acreage, land productivity,

and the operator's farming experience, formal education and income. This indicated that farmers with more education made the better decisions and that on highly productive farms there was a tendency for poorer decisions. It was more difficult for the farmer to assess the value of compliance or noncompliance with wheat and feed grain programs on the more productive farms.

The aggregate effect of the farmers selecting less than optimum participation was evaluated. The difference in wheat acreage between actual and programmed production was three percent of the actual acreage while the difference in barley acreage came to 16 percent of the actual barley acreage. Total income foregone by choosing sub-optimum levels of participation came to $71,868.00 over the four years, or an average of $897.60 per farm per year. Most of this loss occurred in 1965.

The Model II analysis indicated that differences which occurred between actual and programmed farm organization were generally related to the use of irrigated cropland and to the selection of livestock enterprises. There was no organizational difference in use of dry cropland on 10 farms and on four additional farms actual and programmed organizations were the same except for grain hay production.

Causes of differences between actual and profit maximizing programmed farm organizations were traced to specification errors in the models.

Specification error arose in the choice of activities to include in the models and in the selection of the objective function. The activities included in the models were selected on the assumption that all physically and economically feasible enterprises were acceptable alternatives. This proved to be an incorrect assumption if the models were to predict what farmers would actually do. For example, the model specified that cattle feedlots would appear on 19 of the 20 farms and that brood sows would be included on four farms. In reality, only eight farms had feedlots and two had hogs. During interviews, 19 of the 20 farmers indicated that both hogs and cattle feedlots were feasible on their farms. However, 14 expressed a personal dislike for hogs and five disliked cattle feedlots. Ten farmers had never contemplated a hog enterprise for their farm, while seven had never considered a feedlot. Yet when questioned all of these individuals felt that both hogs and cattle feeding would be physically and economically acceptable on their farms. Personal preference was an important factor in the selection of enterprises.

The profit maximizing objective was selected to describe the motivating force which guided the farmers in their farm decisions. An alternative objective of obtaining a given income with the least cost was also considered. The analysis indicated that in 13 of the 20 cases, the least-cost model came closer to describing the actual farm organization than did the maximum profit model.

Resource use patterns and enterprise combinations were also investigated. It was found that 10 farmers favored the maximum profit pattern of labor allocation, while nine tended toward the least-cost approach. Land use patterns were different in that seven farms conformed more closely to the least-cost pattern of land use where only five were more like that of the maximum profit solution. Farmers came much closer to following programmed land use patterns than they did to patterns of labor allocation.

Enterprise combinations selected by the farmers were, on the average, close to the least-cost combination. Thirteen farms adhered more closely to the least-cost approach, while only two followed the maximum profit combination.

Characteristics of the farm operators were considered as possible factors contributing to differences between actual and optimum farm organization. It was found that farmers with more dependent children and higher educations tended to approach the profit maximizing farm organization. Younger farmers and those newer in the business also tended to follow the profit maximizing motive.

As a result of this study the following conclusions were made:

1 - The maximum profit programming models used in this study did not accurately predict all of the decisions of the farmer's related enterprise selection and resource use.

2 - The profit maximizing models performed better in the short-run context than in the longer-run situation.

3 - The models predicted the production for major farm enterprises better than production for supplementary enterprises.

4 - Errors in specification of enterprises in the models were a major factor which created differences between actual and programmed farm organization. Enterprises must not only be physically and economically feasible but also psychologically acceptable to the farmer.

5 - Profit maximization was not the exclusive objective of the farmers. They acted as profit maximizers in making some decisions and not in others. The minimum cost objective described the objectives of more farmers in this study better than did the maximum profit objective.

6 - Certain characteristics of the farmers may provide a means for establishing their objectives. Education and the number of dependents were found to be the most significant in this study. Age and experience could also be important.

7 - A continuation of this type of analysis would prove fruitful in establishing procedures to reduce discrepancies between actual and programmed solutions which arise due to errors in specification of the model.

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APPENDICES

APPENDIX A

EXPLANATION OF MODEL I AND

INPUT DATA FOR MODEL I

Table 23. The general form of Model I

Equation number		Unit	B_i		Support wheat A	Support wheat B	Wheat A	Wheat B	Subst. wheat for barley	Divert wheat	Divert barley
1	$ cost	Dol.	0	=	$-P_1$	$-P_2$	$-P_3$	$-P_4$	$-P_5$	$-P_6$	$-P_7$
2	Cropland A	Acre	B_1	≤	1		1				
3	Cropland B	Acre	B_2	≤	.139	1.139		1	1.25	1	1
4	Wheat allotment	Acre	B_3	≤	1	1	1	1		1	
5	Max. wheat diversion	Acre	B_4	≤						1	
6	Barley base	Acre	B_5	≤					1		1
7	Max. barley diver.	Acre	B_6	≤							1
8	Actual wheat diver.	Acre	B_7	≤						-1	
9	Actual barley diver.	Acre	B_8	≤							-1
10	Max wheat with pay	Acre	B_9	≤	1	1					
11	Wheat account	Bu.	0	≤	-A	-A	-A	-A	-A		
12	Barley account	Cwt.	0	≤							

Continued

Table 23. The general form of Model I--Continued

Equation number	Support barley A	Support barley B	Subst. barley for wheat	No prog. wheat A	No prog. wheat B	No prog. barley A	No prog. barley B	Sell wheat	Sell barley
1	$-P_8$	$-P_9$	$-P_{10}$	$-P_{11}$	$-P_{12}$	$-P_{13}$	$-P_{14}$	$-P_{15}$	$-P_{16}$
2	1			1		1			
3		1	1		1		1		
4		1							
5									
6	1	1							
7									
8									
9									
10									
11				-A	-A			1	
12	-A	-A	-A			-A	-A		1

Interpretation of Model I

Restraints

B_1 and B_2 - cropland of different qualities available for crops in the particular year. They do not include summer fallow.

B_3 - Total farm wheat allotment. In 1963 there were two wheat allotment restraints. The first restricted production to the total allotted acres for the farm if the producer chose to stay out of the wheat program, while the second limited production to 20 percent less than the total farm allotment which was a requirement for those who complied with the wheat program for that year.

B_4 - Maximum acres of wheat allotment which could be diverted for payment. This is the amount beyond the minimum required for participation in the wheat program.

B_5 - Total farm barley base.

B_6 - Maximum acres of barley base which could be diverted for payment.

B_7 - An accounting row for wheat diversion. It initially contained the minimum diverted acres required for participation in the program.

B_8 - An accounting row for barley diversion. It initially contained the minimum diverted acreage required for participation in the program.

B_9 - The maximum acres of wheat which could receive price support payments. This restraint was absent from the 1963 models since price support payments were made on all acres seeded under the wheat program. In 1966 a similar equation was included for barley, since that was the only year that support payments were provided on less than 100 percent of the acres seeded under the feed grain program.

Activities

P_1 and P_2 - Allowed for wheat production with price support payments on land of various qualities. Under the wheat program a minimum diversion was required by all participants. The amount of this requirement is the initial restraint level in B_7. To deduct this acreage from the total cropland restraint when these activities entered the solution, the land use coefficients were set at a level which would accomplish this. Since diversion generally took place on least productive land, this requirement was built into the model. The cost coefficients were established by subtracting the price support payment per acre from the variable costs of production.

P_3 and P_4 - Allowed for production of wheat under the program which would not receive price support payments. Cost coefficients in this case were simply variable costs of production.

P_5 - Took into account the possibility of substituting wheat for barley when both programs were entered. The explanation of the land coefficient is the same as the land coefficients of P_1 and P_2. In this case, however, the initial diversion requirement for entering the program was higher. The activity is restrained by the barley base since substitution could not exceed this quantity. The cost coefficient was the same as that for P_3 and P_4.

P_6 - Was the activity which allowed additional wheat diversion within the program. It drew from the least productive land, the wheat allotment, and the maximum wheat diversion restraints.

P_7 - Was the same as P_6 except it applied to additional barley diversion.

P_8 and P_9 - Were activities which allowed barley production under the barley program. The explanation of the land coefficients are the same as for those in P_1 and P_2. In 1966 these activities were restricted to 50 percent of the barley base since that acreage was eligible for price support payments. Additional activities similar to P_3 and P_4 were added for barley to allow for

production under the program which would not receive price supports. Cost coefficients were calculated in the same manner as those in P_1 and P_2.

P_{10} - Allowed for the substitution of barley for wheat under the programs and drew from the wheat allotment restraint. The cost coefficient was the variable cost per acre of producing barley.

P_{11} to P_{14} - Represented production of wheat and barley when there was no participation in the wheat or feed grain programs. Costs were simply variable costs of production per acre.

P_{15} and P_{16} - Were wheat and barley selling activities.

Programming Procedures

The solution to the model involved discrete choices among the activities. Since standard programming procedures were unable to solve this type of problem an indirect approach was used. There were four alternative combinations of programs represented by an equal number of sets of activities. Solutions were calculated for each of these sets. The optimum solution was found by comparing the objective functions. The activities included in each of these sub-models were as follows:

A - Participate in both wheat and feed grain programs;

P_1, P_2, P_3, P_4, P_5, P_6, P_7, P_8, P_9, P_{10}, P_{15}, P_{16}.

B - Participation in wheat program only;

P_1, P_2, P_3, P_4, P_6, P_{13}, P_{14}, P_{15}, P_{16}.

C - Participation in neither wheat nor feed grain programs;

P_{11}, P_{12}, P_{13}, P_{14}, P_{15}, P_{16}.

D - Participation in barley program only;

P_7, P_8, P_9, P_{11}, P_{12}, P_{15}, P_{16}.

Table 24. Individual farm restraints for Model I analysis, 1963-66

Restraint number		Unit	Farm number 1				Farm number 2			
			1963	1964	1965	1966	1963	1964	1965	1966
1	Cropland A	Acre	---	---	---	---	441.9	349.0	494.9	369.8
2	Cropland B	Acre	421.0	507.0	774.7	838.4	56.9	37.0	52.5	41.3
3	Cropland C	Acre	---	---	---	---	180.8	142.8	202.5	159.5
4	Wheat allot. AI	Acre	351.0	337.1	478.6	524.7	500.8	344.6	457.5	337.4
5	Wheat allot. AII	Acre	180.7	---	---	---	400.6	---	---	---
6	Max. wheat diver. A	Acre	171.7	67.4	95.7	262.3	150.2	68.9	91.5	168.7
7	Max. wheat diver. B	Acre	---	---	---	---	---	---	---	---
8	Barley base A	Acre	138.4	106.0	243.0	188.0	158.0	59.2	157.6	57.6
9	Barley base B	Acre	---	---	---	---	---	---	---	---
10	Max. barley diver. A	Acre	34.6	39.7	72.9	70.5	39.0	22.2	59.1	21.6
11	Max. barley diver. B	Acre	---	---	---	---	---	---	---	---
12	Actual wheat diversion	Acre	78.5	37.4	53.1	78.7	100.2	38.3	50.8	50.6
13	Actual barley diver.	Acre	14.0	26.5	48.6	47.0	39.0	14.8	39.4	14.4
14	Max. wheat with pay A	Acre	---	303.4	382.9	236.1	---	310.1	366.0	151.8
15	Max. barley with pay B	Acre	---	---	---	117.5	---	---	---	36.0
16	Wheat account	Bu.	---	---	---	---	---	---	---	---
17	Barley account	Cwt.	---	---	---	---	---	---	---	---

Continued

Table 24. Individual farm restraints for Model I analysis, 1963-66-- Continued

Restraint number	Farm number 3				Farm number 4				Farm number 5			
	1963	1964	1965	1966	1963	1964	1965	1966	1963	1964	1965	1966
1	403.2	469.0	407.7	471.4	197.7	113.4	173.2	117.0	456.2	515.4	462.0	298.5
2	468.4	544.9	473.7	547.7	---	---	---	---	---	---	---	---
3	---	---	---	---	---	---	---	---	---	---	---	---
4	649.6	684.8	593.5	670.5	133.9	75.4	122.3	73.8	396.2	354.0	362.0	201.3
5	519.7	---	---	---	107.1	---	---	---	317.0	---	---	---
6	194.9	342.4	296.8	335.3	40.2	15.1	24.5	36.9	118.9	70.8	72.4	100.6
7	---	---	---	---	---	---	---	---	---	---	---	---
8	---	202.4	177.6	198.4	29.6	29.6	29.6	28.8	48.0	43.2	48.0	53.6
9	---	---	---	---	---	---	---	---	---	---	---	---
10	---	75.9	66.6	74.4	7.4	17.6	11.1	10.8	12.0	16.2	18.0	20.1
11	---	---	---	---	---	---	---	---	---	---	---	---
12	129.9	76.1	65.9	100.6	26.8	8.4	13.6	11.1	79.2	39.4	40.2	30.2
13	44.4	50.6	44.4	49.6	7.4	7.4	7.4	7.2	12.0	10.8	12.0	13.4
14	---	308.2	267.1	301.7	---	67.9	97.8	33.2	---	318.6	289.6	90.6
15	---	---	---	124.0	---	---	---	18.0	---	---	---	33.5
16	---	---	---	---	---	---	---	---	---	---	---	---
17	---	---	---	---	---	---	---	---	---	---	---	---

Continued

Table 24. Individual farm restraints for Model I analysis, 1963-66--Continued

Restraint number	Farm number 6				Farm number 7				Farm number 8			
	1963	1964	1965	1966	1963	1964	1965	1966	1963	1964	1965	1966
1	431.4	395.1	436.5	434.0	530.9	492.0	521.9	495.1	50.0	50.0	50.0	50.0
2	159.6	146.2	167.6	152.0	223.0	205.0	219.2	206.4	142.4	108.6	191.4	106.7
3	---	---	---	---	305.0	285.2	219.2	286.4	52.7	40.2	146.2	39.5
4	430.1	394.5	399.4	386.2	742.7	639.6	678.5	626.0	146.1	123.4	185.6	120.8
5	344.1	---	---	---	594.2	---	---	---	116.9	---	---	---
6	129.0	78.9	78.6	193.1	222.8	127.9	135.7	313.0	43.8	24.7	37.1	60.4
7	---	---	---	---	---	---	---	---	---	---	---	---
8	160.8	86.4	128.8	114.4	246.4	276.0	246.4	214.4	45.6	---	44.8	---
9	---	---	---	---	---	---	---	---	---	---	---	---
10	40.2	32.4	34.8	42.9	61.6	82.8	92.4	80.4	11.4	---	16.8	---
11	---	---	---	---	---	---	---	---	---	---	---	---
12	86.0	43.8	43.7	57.9	148.5	71.0	75.4	93.9	29.2	13.7	20.6	18.1
13	40.2	21.6	32.2	28.6	61.6	55.2	61.6	53.6	11.4	---	11.2	---
14	---	355.1	314.4	173.8	---	575.4	542.8	281.7	---	111.1	148.5	54.4
15	---	---	---	71.5	---	---	---	134.0	---	---	---	---
16	---	---	---	---	---	---	---	---	---	---	---	---
17	---	---	---	---	---	---	---	---	---	---	---	---

Continued

Table 24. Individual farm restraints for Model I analysis, 1963-66--Continued

Restraint	Farm number 9				Farm number 10				Farm number 11			
number	1963	1964	1965	1966	1963	1964	1965	1966	1963	1964	1965	1966
1	359.7	361.8	343.5	337.1	347.8	304.4	351.7	308.4	290.6	228.7	228.7	---
2	418.9	297.0	304.7	298.9	902.9	790.0	913.1	800.6	197.6	155.4	155.4	---
3	---	---	---	---	---	---	---	---	---	---	---	---
4	447.8	342.0	409.1	334.9	921.7	790.5	842.2	773.9	352.7	253.0	253.3	---
5	358.2	---	---	---	737.4	---	---	---	282.2	---	---	---
6	134.3	68.4	81.8	167.5	276.5	158.1	421.1	387.0	105.8	51.8	126.7	---
7	---	---	---	---	---	---	---	---	---	---	---	---
8	176.8	221.3	176.8	204.8	263.2	180.8	263.2	175.2	132.8	82.4	80.0	---
9	---	---	---	---	---	---	---	---	---	---	---	---
10	---	79.2	66.3	76.8	65.8	67.8	98.7	65.7	33.2	30.9	30.0	---
11	44.2	---	---	---	---	---	---	---	---	---	---	---
12	89.6	42.7	51.1	50.2	184.3	77.9	93.6	116.1	70.5	28.1	34.6	---
13	44.2	52.8	44.2	51.2	65.8	45.2	65.8	43.8	33.2	20.6	20.0	---
14	---	307.8	327.3	150.7	---	711.5	379.0	348.3	---	207.4	---	---
15	---	---	---	128.0	---	---	---	109.5	---	---	---	---
16	---	---	---	---	---	---	---	---	---	---	---	---
17	---	---	---	---	---	---	---	---	---	---	---	---

Continued

Table 24. Individual farm restraints for Model I analysis, 1963-66--Continued

Restraint number	Farm number 12				Farm number 13				Farm number 14			
	1963	1964	1965	1966	1963	1964	1965	1966	1963	1964	1965	1966
1	348.0	322.2	350.1	324.2	460.3	531.7	493.6	533.6	266.7	182.5	250.7	617.4
2	122.0	109.7	123.0	110.4	80.8	93.3	86.6	93.6	457.2	312.8	429.7	111.3
3	---	---	---	---	216.7	250.4	232.4	251.3	546.1	373.7	513.3	308.4
4	308;9	265.4	284.8	259.9	537.5	519.7	492.8	506.5	852.0	494.7	732.5	611.3
5	247.1	---	---	---	430.0	---	---	---	681.6	---	---	---
6	92.7	53.1	57.0	129.9	161.3	103.9	98.6	253.3	217.8	98.9	146.5	305.6
7	---	---	---	---	---	---	---	---	---	---	---	---
8	120.8	109.6	120.8	106.4	212.0	238.4	212.0	236.8	418.0	237.6	418.0	267.2
9	---	---	---	---	---	---	---	---	---	---	---	---
10	30.2	41.1	45.3	39.9	53.0	89.4	79.5	88.8	83.6	89.1	125.4	100.2
11	---	---	---	---	---	---	---	---	---	---	---	---
12	61.8	29.5	31.6	39.0	107.5	57.7	54.8	76.0	170.4	55.0	86.5	91.7
13	30.2	27.4	30.2	26.6	53.0	59.6	53.0	59.2	83.6	59.4	85.6	66.8
14	---	238.9	227.8	117.0	---	467.7	394.2	227.9	---	445.2	622.7	275.1
15	---	---	---	66.5	---	---	---	148.0	---	---	---	167.0
16	---	---	---	---	---	---	---	---	---	---	---	---
17	---	---	---	---	---	---	---	---	---	---	---	---

Continued

Table 24. Individual farm restraints for Model I analysis, 1963-66--Continued

Restraint number	Farm number 15				Farm number 16				Farm number 17			
	1963	1964	1965	1966	1963	1964	1965	1966	1963	1964	1965	1966
1	175.0	234.0	172.0	232.4	94.0	93.6	94.8	93.2	649.6	470.7	548.1	449.0
2	90.0	121.0	86.0	119.7	---	---	---	---	142.6	132.8	154.7	123.2
3	---	---	---	---	---	---	---	---	---	---	---	---
4	185.5	217.5	169.5	212.9	51.0	45.5	46.6	44.5	475.6	361.4	434.6	353.8
5	148.4	---	---	---	40.8	---	---	---	380.1	---	---	---
6	55.6	43.5	33.9	106.4	15.3	9.1	9.3	22.2	142.7	72.3	86.9	176.9
7	---	---	---	---	---	---	---	---	---	---	---	---
8	62.4	88.8	62.4	86.4	34.4	34.4	34.4	33.6	176.8	134.4	176.8	137.0
9	---	---	---	---	---	---	---	---	---	---	---	---
10	15.6	33.3	23.4	32.4	8.6	24.1	25.1	12.6	44.2	50.4	66.3	49.8
11	---	---	---	---	---	---	---	---	---	---	---	---
12	37.1	24.2	18.8	31.9	10.2	5.1	5.2	6.7	95.1	40.2	48.3	53.1
13	15.6	22.2	15.6	21.6	8.6	8.6	8.6	8.4	44.2	33.6	44.2	29.0
14	---	195.7	135.6	95.8	---	40.9	37.3	20.0	---	325.3	347.7	159.2
15	---	---	---	54.0	---	---	---	21.0	---	---	---	83.0
16	---	---	---	---	---	---	---	---	---	---	---	---
17	---	---	---	---	---	---	---	---	---	---	---	---

Continued

Table 24. Individual farm restraints for Model I analysis, 1963-66--Continued

Restraint number	Farm number 18				Farm number 19				Farm number 20			
	1963	1964	1965	1966	1963	1964	1965	1966	1963	1964	1965	1966
1	346.9	281.9	364.5	280.4	555.6	667.8	559.3	610.2	113.2	172.2	123.8	173.1
2	479.1	389.3	503.4	387.1	---	---	---	---	161.0	207.4	134.0	206.1
3	---	---	---	---	---	---	---	---	41.7	60.5	39.1	60.1
4	576.2	410.0	526.4	401.4	364.9	377.6	333.4	369.7	203.8	277.3	186.2	271.5
5	461.0	---	---	---	291.9	---	---	---	163.0	---	---	---
6	172.9	82.0	105.3	200.7	109.5	75.5	66.7	184.9	61.1	55.5	37.2	135.7
7	---	---	---	---	---	---	---	---	---	---	---	---
8	226.4	175.2	283.0	169.6	148.8	152.8	148.8	148.0	72.0	105.6	72.0	102.4
9	---	---	---	---	---	---	---	---	---	---	---	---
10	56.6	65.7	84.9	63.6	37.2	57.3	56.3	55.5	18.0	39.6	27.0	38.4
11	---	---	---	---	---	---	---	---	---	---	---	---
12	115.2	45.6	58.5	60.2	73.0	41.9	37.0	55.5	40.8	30.8	20.7	40.7
13	56.6	43.8	56.6	42.4	37.2	38.2	37.2	37.0	18.0	26.4	18.0	25.6
14	---	369.0	421.1	180.6	---	339.8	266.7	166.4	---	249.6	149.0	122.2
15	---	---	---	106.0	---	---	---	92.5	---	---	---	64.0
16	---	---	---	---	---	---	---	---	---	---	---	---
17	---	---	---	---	---	---	---	---	---	---	---	---

Costs, Prices, and Technical Coefficients For Model I

The costs and technical coefficients for each farm were the same as those used in Model II. They appear in Appendix E. Prices for each year were average market prices for the months from August of the year in which the crop was harvested to the following May. Prices used were as follows:

Year	Unit	Wheat (per bushel)	Barley (per cwt.)
1963	dollar	2.03	2.14
1964	dollar	1.43	2.24
1965	dollar	1.45	2.43
1966	dollar	1.71	2.46

Government payments* were different for each year. Diversion payments were calculated as follows:

Wheat

1963 - The payment rate per acre was 50 percent of the base rate ($1.89) times the normal yield.

1964 - The payment rate per acre was 20 percent of the loan rate ($1.37) times the normal yield.

1965 - The payment rate per acre was 50 percent of the loan rate ($1.31) times the normal yield.

1966 - The payment rate per acre was 40 percent of the loan rate ($1.33) times the normal yield.

* All wheat and feed grain program payment rates were provided by the Wasco County Agricultural Stabilization office.

Barley

1963 - The payment rate per acre was 50 percent of the price support rate ($1.10) times the normal yield.

1964 - The payment rate per acre was 50 percent of the price support rate ($1.10) times the normal yield.

1965 - The payment rate per acre was 50 percent of the price support rate ($1.10) times the normal yield.

1966 - The payment rate per acre was 50 percent of the price support rate ($1.14) times the normal yield.

Wheat subsidy payments were as follows:

Year	Dollars/bushel
1963	1.890
1964	.475
1965	.553
1966	1.320

Barley price support payments were as follows:

Year	Dollars/bushel
1963	.14
1964	.12
1965	.16
1966	.20

APPENDIX B

SPECIAL FEATURES OF THE WHEAT AND FEED GRAIN PROGRAMS, 1963-1966

Wheat Program*

1963

1 - Stay out of the program by complying only with the farm acreage allotment and receive regular price supports.

2 - Comply with the program by diverting a minimum of 20 percent of the farm allotment to conserving uses and receive an additional 18 cents payment per bushel above the regular price support.

3 - Diversion payments could be earned by diverting to consuming uses a minimum of 20 percent and not more than 50 percent of the farm allotment.

1964

1 - Stay out of the program completely by ignoring the farm allotment, plant all the wheat desired, and receive as a result only the market price for wheat.

2 - Comply with the program by diverting at least 11.11 percent of the farm allotment to conserving uses and receive a price support in the form of marketing certificates. These certificates were issued on 90 percent of the normal production. Forty-five percent were in the form of domestic marketing certificates while the remainder were issued as export certificates.

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* Information on wheat and feed grain programs was provided by the Wasco County Agricultural Stabilization office.

3 - Diversion payments could be earned by diverting a minimum of 11.11 percent and no more than 20 percent of the farm allotments.

1965

1 - Stay out of the program completely by ignoring the farm allotment, plant all the wheat desired, and receive as a result only the market price for wheat.

2 - Comply with the program by diverting at least 10 percent of the year's allotment to conserving uses and receive a price support payment in the form of domestic and export marketing certificates on 80 percent of the normal production.

3 - Comply with provisions of both wheat and feed grain programs and substitute one grain crop for the other. No price supports would be paid on this additional production.

4 - Diversion payments could be earned by diverting allotment in addition to the minimum required. A maximum of 20 percent of the year's allotment could be diverted for payment.

1966

1 - Stay out of the program completely by ignoring the farm allotment, plant all the wheat desired, and receive as a result only the market price for wheat.

2 - Comply with the program by diverting a minimum of 15 percent of the year's allotment to conserving uses and receive a price support payment in the form of domestic marketing certificates on 45 percent of the normal production.

3 - Comply with provisions of both wheat and feed grain programs and substitute one grain crop for the other. No price supports would be paid on this additional production.

4 - Diversion payments could be earned by diverting allotment in addition to the minimum required. A maximum of 50 percent of the year's allotment could be diverted for payment.

Feed Grain Program

1963

1 - Stay out of the program completely and plant all the barley desired.

2 - Comply with the program by diverting a minimum of 20 percent of the year's feed grain base to conserving uses and receive price support payments on all feed grains produced under the program.

3 - Diversion payments could be earned on the minimum

diversion requirement for participation and any additional diversion up to 40 percent of the year's base acreage.

1964

1 - The feed grain program alternatives for 1964 were identical with those in 1963 except that the maximum diversion was increased to 50 percent.

1965

1 - The 1965 feed grain program alternatives were identical with those in 1964 except for the addition of the substitution clause as described in the wheat program for 1965.

1966

1 - The 1966 feed grain program alternatives were identical with those in 1965 except that price support payments were limited to 50 percent of the feed grain base for the year.

APPENDIX C

ACTUAL FARMER PARTICIPATION AND PROGRAMMED PARTICIPATION IN WHEAT AND FEED GRAIN PROGRAMS, 1963-1966

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 1.

Item	Unit	1963 participation		1964 participation		1965 participation		1966 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	351.0	351.0	337.1	507.0	478.6	478.6	524.7	524.7
Barley acres	Acre	70.0	70.0	132.3	---	154.5	---	235.8	235.8
Sub. wheat for barley	Acre	---	---	---	---	5.3	194.3	---	---
Additional wheat diversion	Acre	---	---	---	---	---	---	---	---
Additional barley diversion	Acre	---	---	---	---	34.6	---	---	---
Wheat production[1]	Bu.	15,093.0	15,093.0	16,181.0	24,336.0	23,227.2	32,299.0	25,186.0	25,186.0
Barley production[1]	Cwt.	1,400.0	1,400.0	2,646.0	---	3,090.0	---	4,716.0	4,716.0
Net revenue	Dol.	27,526.0	27,526.0	24,505.0	27,317.0	41,522.8	46,694.0	57,212.0	57,212.0
Index of program combination[2]		3	3	2	3	1	1	2	2

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations having the following interpretation:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 2.

Item	Unit	1963 participation		1964 participation		1965 participation		1966 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	500.8	500.8	344.6	344.6	457.7	366.0	315.0	337.4
Barley acres	Acre	178.8	111.8	74.0	145.7	192.0	241.5	154.0	183.7
Sub. wheat for barley	Acre	---	---	---	---	---	---	---	---
Additional wheat diversion	Acre	---	---	---	---	---	91.5	---	---
Additional barley diversion	Acre	---	39.0	---	---	---	---	---	---
Wheat production[1]	Bu.	13,977.1	13,977.1	9,993.4	9,993.4	13,273.0	10,614.0	9,135.0	9,784.1
Barley production[1]	Cwt.	1,341.0	838.8	947.0	1,322.1	25,757.0	3,362.9	1,909.0	1,900.4
Net revenue	Dol.	24,176.6	24,780.0	16,362.0	24,844.0	24,844.4	23,549.6	24,362.5	
Index of program combinations[2]		3	4	2	2	2	2	2	2

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations having the following interpretation:
(1) Participate in both wheat and barley programs
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 3.

Item	Unit	1963 participation		1964 participation		1965 participation		1966 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	649.6	649.6	684.5	469.0	587.9	267.1	670.2	471.4
Barley acres	Acre	177.6	222.0	291.0	506.7	218.9	577.2	248.4	447.2
Sub. wheat for barley	Acre	---	---	---	---	---	---	---	---
Additional wheat diversion	Acre	---	---	---	---	---	---	---	---
Additional barley diversion	Acre	---	---	---	---	---	---	---	---
Wheat production[1]	Bu.	20,272.0	20,272.0	21,802.0	16,415.0	18,774.0	9,348.0	21,469.0	16,449.0
Barley production[1]	Cwt.	2,664.0	3,330.0	5,238.0	9,120.0	3,940.0	10,811.0	4,471.0	8,050.0
Net revenue	Dol.	36,278.4	36,284.0	34,535.0	35,940.0	30,746.0	33,967.0	48,846.1	49,531.9
Index of program combinations[2]		4	3	2	2	2	2	2	2

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations have the following interpretation:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 4.

Item	Unit	1963 participation		1964 participation		1965 participation		1966 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	132.8	66.9	72.0	72.3	122.1	97.8	73.8	73.8
Barley acres	Acre	20.0	73.9	7.8	12.0	37.5	29.6	18.0	18.0
Sub. wheat for barley	Acre	---	---	---	---	---	---	---	---
Additional wheat diversion	Acre	---	40.2	---	---	---	24.5	---	---
Additional barley diversion	Acre	---	---	25.0	17.6	---	---	10.0	10.8
Wheat production[1]	Bu.	2,656.0	1,338.0	1,448.0	1,447.6	2,442.0	1,956.0	1,476.0	1,476.0
Barley production[1]	Cwt.	250.0	923.4	312.5	150.0	468.7	370.0	225.0	225.0
Net revenue	Dol.	3,825.4	4,380.1	2,597.5	2,630.9	4,225.1	4,449.6	3,470.2	3,470.3
Index of program combinations[2]		4	2	1	1	2	1	1	1

[1]Production with actual participation using long-run average yields.

[2]Indices of program combinations have the following interpretation:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 5.

Item	Unit	1963 participation		1964 participation		1965 participation		1966 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	313.8	396.2	354.6	354.6	354.6	354.6	199.9	201.3
Barley acres	Acre	60.0	48.0	54.0	117.5	58.4	58.4	30.3	67.0
Sub. wheat for barley	Acre	---	---	---	---	---	---	---	---
Additional wheat diversion	Acre	30.6	---	---	---	---	---	---	---
Additional barley diversion	Acre	---	---	---	---	---	---	---	---
Wheat production[1]	Bu.	9,727.8	12,282.2	9,992.6	10,974.0	11,222.0	11,222.0	6,196.9	6,240.3
Barley production[1]	Cwt.	1,170.0	936.0	1,053.0	2,291.3	1,138.8	1,138.8	590.8	1,306.5
Net revenue	Dol.	19,481.9	20,065.6	16,653.3	18,380.8	17,885.5	17,885.5	12,414.7	13,632.1
Index of program combinations[2]		1	4	2	2	2	2	2	2

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations have the following interpretation:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 6.

Item	Unit	1963 participation		1964 participation		1965 participation		1966 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	344.1	430.1	394.0	394.5	320.8	320.8	385.2	386.2
Barley acres	Acre	105.3	96.6	103.3	54.0	---	115.7	91.2	23.7
Sub. wheat for barley	Acre	---	---	---	---	111.2	---	---	47.8
Additional wheat diversion	Acre	39.0	---	---	---	---	---	---	---
Additional barley diversion	Acre	78.6	40.2	---	32.4	---	---	28.6	42.9
Wheat production[1]	Bu.	12,043.5	15,053.5	13,807.5	13,807.5	14,120.0	11,228.0	13,482.0	15,190.0
Barley production[1]	Cwt.	1,926.0	978.6	1,033.7	546.0	---	2,314.0	1,390.0	237.0
Net revenue	Dol.	24,380.4	25,091.7	19,521.2	19,995.9	20,261.8	21,041.5	27,335.3	27,563.2
Index of program combinations[2]		1	4	2	1	1	1	1	1

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations have the following interpretation:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 7.

Item	Unit	1963 participation		1964 participation		1965 participation		1966 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	593.8	742.7	635.5	627.5	569.9	542.8	624.0	626.0
Barley acres	Acre	319.1	184.8	220.5	151.0	154.0	206.0	233.7	---
Sub. wheat for barley	Acre	---	---	---	---	---	---	---	134.0
Additional wheat diversion	Acre	148.5	---	---	11.8	108.6	135.7	---	---
Additional barley diversion	Acre	---	61.6	---	82.8	92.4	---	---	80.4
Wheat production[1]	Bu.	31,200.6	37,140.6	32,308.0	31,988.0	30,102.6	26,242.4	31,891.0	36,153.9
Barley production[1]	Cwt.	4,788.5	1,960.0	2,777.0	2,205.0	5,263.4	6,029.5	3,112.0	---
Net revenue	Dol.	64,885.1	67,521.5	53,922.9	54,722.5	60,119.2	61,983.3	69,726.9	73,620.6
Index of program combinations[2]		2	4	1	1	1	2	2	1

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations have the following interpretation:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 8.

Item	Unit	1963 participation		1964 participation		1965 participation		1966 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	146.1	146.1	123.4	123.4	235.1	235.1	200.0	200.0
Barley acres	Acre	45.6	99.0	61.6	61.6	44.8	65.2	23.0	23.0
Sub. wheat for barley	Acre	---	---	---	---	---	---	---	---
Additional wheat diversion	Acre	---	---	---	---	---	---	---	---
Additional barley diversion	Acre	---	---	---	---	---	---	---	---
Wheat production[1]	Bu.	6,651.8	6,651.8	5,789.2	5,789.2	10,033.8	10,033.8	9,100.0	9,100.0
Barley production[1]	Cwt.	1,368.0	2,179.5	1,452.0	1,452.0	1,344.0	1,650.0	690.0	690.0
Net revenue	Dol.	13,195.2	13,907.5	9,729.7	9,729.7	14,186.5	14,371.1	16,134.1	16,134.1
Index of program combinations[2]		4	3	2	2	1	2	2	2

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations have the following interpretation:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 9.

Item	Unit	1963 participation		1964 participation		1965 participation		1966 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	447.8	447.8	341.7	342.0	409.2	409.1	333.6	334.9
Barley acres	Acre	231.0	230.8	253.0	278.6	193.6	67.2	205.4	---
Sub. wheat for barley	Acre	---	---	---	---	---	109.6	---	200.7
Additional wheat diversion	---	---	---	---	---	---	---	---	---	---
Additional barley diversion	---	---	---	---	---	---	---	---	---	---
Wheat production[1]	Bu.	17,031.0	17,031.0	13,668.0	13,680.0	15,708.0	18,995.4	13,396.0	19,440.0
Barley production[1]	Cwt.	3,462.0	3,462.0	3,894.0	4,278.5	2,904.1	1,008.3	3,091.0	---
Net revenue	Dol.	33,254.5	33,254.5	25,931.1	26,527.0	28,690.8	29,231.6	31,865.4	33,258.3
Index of program combinations[2]		3	3	2	2	2	1	1	1

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations have the following interpretation:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 10.

Item	Unit	1963 participation		1964 participation		1965 participation		1964 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	921.7	921.7	767.5	790.5	842.2	842.2	762.9	762.9
Barley acres	Acre	224.0	263.2	82.5	215.7	39.1	369.9	345.6	345.6
Sub. wheat for barley	Acre	---	---	---	---	125.4	---	---	---
Additional wheat diversion	Acre	---	---	---	---	---	---	---	---
Additional barley diversion	Acre	44.8	---	---	---	98.5	---	---	---
Wheat production[1]	Bu.	31,129.0	31,129.0	26,069.0	26,759.0	32,545.0	28,783.0	25,971.0	25,971.0
Barley production[1]	Cwt.	3,360.0	3,948.0	3,235.5	3,235.1	586.5	5,548.8	5,184.0	5,184.0
Net revenue	Dol.	58,399.1	58,439.0	45,049.8	45,784.8	46,353.7	48,083.3	52,795.0	52,795.0
Index of program combinations[2]		4	4	2	2	1	2	2	2

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations have the following interpretations:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 11.

Item	Unit	1963 participation		1964 participation		1965 participation		1966 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	352.7	352.7	253.0	253.0	319.9	322.2	253.3	253.3
Barley acres	Acre	135.5	81.8	105.3	105.3	165.7	---	---	---
Sub. wheat for barley	Acre	---	---	---	---	---	132.8	74.3	74.3
Additional wheat diversion	Acre	---	---	---	---	---	---	---	---
Additional barley diversion	Acre	---	33.2	---	---	---	---	---	---
Wheat production[1]	Bu.	15,250.5	15,250.5	11,142.0	11,142.0	14,315.5	19,043.0	13,751.9	13,751.9
Barley production[1]	Cwt.	2,032.5	1,227.6	1,580.7	1,580.7	2,485.5	---	---	---
Net revenue	Dol.	28,514.9	28,626.0	18,596.5	18,596.5	25,974.8	27,273.9	25,277.0	25,277.0
Index of program combinations[2]		3	4	2	2	2	1	1	1

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations have the following interpretations:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 12.

Item	Unit	1963 participation		1964 participation		1965 participation		1966 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	308.9	308.9	265.3	265.3	284.8	284.8	259.9	259.9
Barley acres	Acre	161.0	161.1	127.0	127.0	146.0	146.0	---	135.7
Sub. wheat for barley	Acre	---	---	---	---	---	---	99.1	---
Additional wheat diversion	Acre	---	---	---	---	---	---	---	---
Additional barley diversion	Acre	---	---	---	---	---	---	---	---
Wheat production[1]	Bu.	18,534.0	18,534.0	15,918.0	15,918.0	17,088.0	17,088.0	20,973.0	15,594.0
Barley production[1]	Cwt.	2,897.0	2,897.0	2,189.5	2,189.5	2,516.5	2,516.5	---	2,715.2
Net revenue	Dol.	31,171.3	31,171.3	27,087.9	27,087.9	30,375.0	30,375.0	33,263.6	34,421.2
Index of program combinations[2]		3	3	2	2	2	2	1	2

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations have the following interpretation:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 13.

Item	Unit	1963 participation		1964 participation		1965 participation		1966 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	460.0	430.0	519.8	519.7	492.8	394.2	506.0	506.5
Barley acres	Acre	297.5	159.0	355.7	355.7	---	26.0	372.0	372.0
Sub. wheat for barley	Acre	---	---	---	---	209.4	186.0	---	---
Additional wheat diversion	Acre	---	---	---	---	---	98.6	---	---
Additional barley diversion	Acre	---	53.0	---	---	---	---	---	---
Wheat production[1]	Bu.	25,776.8	24,080.0	29,103.2	29,103.2	33,516.8	31,105.6	28,364.0	28,364.0
Barley production[1]	Cwt.	3,783.0	3,004.0	5,982.0	5,982.0	---	390.0	6,454.5	6,454.5
Net revenue	Dol.	47,287.2	49,845.1	51,017.1	51,017.1	47,654.9	50,987.9	88,981.3	88,981.3
Index of program combinations[2]		3	1	2	2	1	1	2	2

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations have the following interpretation:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 14.

Item	Unit	1963 participation		1964 participation		1965 participation		1966 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	852.0	852.0	668.2	668.2	732.5	622.7	611.3	611.3
Barley acres	Acre	418.0	267.5	163.0	163.0	256.2	484.4	261.1	334.2
Sub. wheat for barley	Acre	---	---	---	---	78.3	---	6.1	---
Additional wheat diversion	Acre	---	---	---	---	---	---	---	---
Additional barley diversion	Acre	---	83.6	---	---	---	---	---	---
Wheat production[1]	Bu.	36,852.0	36,852.0	26,920.0	26,920.0	34,838.0	29,922.0	37,044.0	36,678.0
Barley production[1]	Cwt.	6,270.0	4,012.8	3,260.0	3,260.0	5,124.0	10,265.9	6,355.0	7,918.8
Net revenue	Dol.	70,627.0	70,844.4	43,172.1	43,172.1	64,657.4	67,806.1	84,381.0	85,423.1
Index of program combinations[2]		3	4	2	2	1	2	1	2

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations have the following interpretation:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 15.

Item	Unit	1963 participation		1964 participation		1965 participation		1966 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	185.5	148.4	217.5	217.5	169.4	169.5	212.9	212.9
Barley acres	Acre	79.5	79.5	113.2	113.2	69.6	69.7	107.4	---
Sub. wheat for barley	Acre	---	---	---	---	---	---	---	85.8
Additional wheat diversion	Acre	---	---	---	---	---	---	---	---
Additional barley diversion	Acre	---	---	---	---	---	---	---	---
Wheat production[1]	Bu.	8,715.0	7,123.2	10,440.0	10,440.0	8,136.0	8,136.0	10,219.2	13,145.4
Barley production[1]	Cwt.	1,192.5	1,458.5	1,863.5	1,863.5	1,069.8	1,069.8	1,804.5	---
Net revenue	Dol.	16,597.1	16,638.6	18,671.7	18,671.7	14,375.8	14,375.8	23,965.8	24,500.8
Index of program combinations[2]		3	2	2	2	2	2	2	1

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations have the following interpretation:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 16.

Item	Unit	1963 participation		1964 participation		1965 participation		1966 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	38.0	51.0	44.0	93.6	47.0	94.8	45.8	44.5
Barley acres	Acre	13.0	43.0	---	---	---	---	---	---
Sub. wheat for barley	Acre	---	---	---	---	---	---	---	33.6
Additional wheat diversion	Acre	10.2	---	---	---	---	---	---	---
Additional barley diversion	Acre	30.0	---	34.4	---	34.4	---	33.6	---
Wheat production[1]	Bu.	2,850.0	3,825.0	3,300.0	7,202.0	3,300.0	7,110.0	3,435.0	5,857.5
Barley production[1]	Cwt.	520.0	1,720.0	---	---	---	---	---	---
Net revenue	Dol.	6,034.88	8,076.2	4,388.8	6,402.2	4,495.8	6,626.0	6,583.8	8,724.5
Index of program combinations[2]		1	3	1	3	1	3	1	1

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations have the following interpretation:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain program, 1963 to 1966 for farm number 17.

Item	Unit	1963 participation		1964 participation		1965 participation		1966 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	475.6	475.6	361.3	361.3	434.7	347.7	353.8	353.8
Barley acres	Acre	316.6	316.6	211.7	211.7	---	306.8	---	---
Sub. wheat for barley	Acre	---	---	---	---	151.5	---	132.3	132.3
Additional wheat diversion	Acre	---	---	---	---	---	---	---	---
Additional barley diversion	Acre	---	---	---	---	---	---	---	---
Wheat production[1]	Bu.	23,780.0	23,780.0	18,070.0	18,070.0	29,083.5	17,385.0	23,748.8	23,748.8
Barley production[1]	Cwt.	8,072.0	8,072.0	5,128.3	5,128.3	---	8,139.4	---	---
Net revenue	Dol.	54,853.9	54,853.9	32,050.7	37,050.7	43,183.5	45,348.9	45,871.1	45,871.1
Index of program combinations[2]		3	3	2	2	1	2	1	1

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations have the following interpretation:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 18.

Item	Unit	1963 participation		1964 participation		1965 participation		1966 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	575.9	576.2	410.0	410.0	526.4	526.4	401.4	401.4
Barley acres	Acre	249.8	249.8	215.0	215.0	221.4	---	---	---
Sub. wheat for barley	Acre	---	---	---	---	---	226.4	164.8	164.8
Additional wheat diversion	Acre	---	---	---	---	---	---	---	---
Additional barley diversion	Acre	---	---	---	---	---	---	---	---
Wheat production[1]	Bu.	27,385.5	27,385.5	22,678.5	22,678.5	29,155.5	39,342.3	29,683.6	29,683.6
Barley production[1]	Cwt.	8,743.0	8,743.0	3,225.0	3,225.0	3,321.0	---	---	---
Net revenue	Dol.	62,092.9	62,092.9	40,054.5	40,054.5	52,480.5	57,404.0	54,787.7	54,787.7
Index of program combinations[2]		3	3	2	2	1	1	1	1

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations have the following interpretation:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 19.

Item	Unit	1963 participation		1964 participation		1965 participation		1966 participation	
		Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	364.9	364.9	377.6	377.6	333.4	333.4	369.5	369.7
Barley acres	Acre	190.7	190.7	191.0	191.0	157.0	---	185.0	---
Sub. wheat for barley	Acre	---	---	---	---	---	148.8	---	148.0
Additional wheat diversion	Acre	---	---	---	---	---	---	---	---
Additional barley diversion	Acre	---	---	---	---	---	---	---	---
Wheat production[1]	Bu.	16,785.4	16,785.4	17,369.6	17,369.6	15,336.4	22,181.2	23,814.2	23,814.2
Barley production[1]	Cwt.	3,718.7	3,718.7	3,724.5	3,724.5	3,061.5	---	---	---
Net revenue	Dol.	32,738.4	32,738.4	31,030.6	31,030.6	28,223.5	30,812.0	40,062.4	43,413.2
Index of program combinations[2]		3	3	2	2	2	1	2	1

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations have the following interpretations:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

Table 25. Actual and programmed optimum level of participation in wheat and feed grain programs, 1963 to 1966 for farm number 20.

		1963 participation		1964 participation		1965 participation		1966 participation	
Item	Unit	Actual	Optimum	Actual	Optimum	Actual	Optimum	Actual	Optimum
Wheat acres	Acre	203.0	203.8	277.3	277.3	186.2	185.8	271.5	271.5
Barley acres	Acre	70.0	54.0	66.0	66.0	---	---	---	---
Sub. wheat for barley	Acre	---	---	---	---	72.0	72.0	92.2	92.2
Additional wheat diversion	Acre	---	---	---	---	---	---	---	---
Additional barley diversion	Acre	---	18.0	39.6	39.6	---	---	---	---
Wheat production[1]	Bu.	7,359.2	7,359.2	10,213.2	10,213.2	9,095.8	9,095.8	11,594.1	11,594.1
Barley production[1]	Cwt.	704.0	540.0	660.0	660.0	---	---	---	---
Net revenue	Dol.	12,557.6	13,054.2	17,058.3	17,058.3	12,895.5	12,895.5	21,782.2	21,782.2
Index of program combinations[2]		3	4	1	1	1	1	1	1

[1] Production with actual participation using long-run average yields.

[2] Indices of program combinations have the following interpretations:
(1) Participate in both wheat and barley programs.
(2) Participate in the wheat program but not in the barley program.
(3) No participation in either program.
(4) Participate in the barley program but not in the wheat program.

APPENDIX D

DESCRIPTION OF MODEL II

Table 26. The general form of Model II

Equation number		Unit	B_i		Nurse crop	Alfalfa 5 years	Pasture 5 years	Wheat after G.M.	Corn after G.M.	Wheat after grain	Wheat I	Fallow I
1	$ cost	Dol.	0	=	-P	-P	-P	-P	-P	-P	-P	-P
2	Irrigated land	Acres	B_1	=	1	5	5	1	1	1	1	1
3	Dryland	Acres	B_2	=				.12		.12	.12	
4	Wheat allotment	Acres	B_3	=				1		1	1	
5	Nurse crop acct.	Acres	0	≤	-1	1	1					
6	Green manure acct.	Acres	0	≤		-1	-1	1	1			
7	Grain to grain	Acres	0	≤				-1	-1	1		
8	Fallow to grain	Acres	0	≤							1	-1
9	Max. grain hay	Acres	0	≤				-A		-A	-A	
10	Wheat acct.	Bushels	0	≤				-A		-A	-A	
11	Barley acct.	Cwt.	0	≤								
12	Corn silage acct.	Tons	0	≤					-A			
13	Pasture acct.	AUM	0	≤			-A					
14	Range acct.	AUM	B_{13}	≤								
15	Hog acct.	Cwt.	0	≤								
16	Calf acct.	Cwt.	0	≤								
17	Yearling acct.	Cwt.	0	≤								
18	Cull cow acct.	Cwt.	0	≤								
19	Grass fat acct.	Cwt.	0	≤								
20	Labor period I	Hours	B_{19}	≥	A	A	A	A	A	A	A	A
21	Max. labor hire period I	Hours	B_{20}	≥								
22	Feed hay	AUM	0	≥								
23	Feed barley	Cwt.	0	≥								
24	Purchased yearlings	Cwt.	0	≥								

Continued

Table 26. The general form of Model II--Continued

Equation number		Unit	B_i		Nurse crop	Alfalfa 5 years	Pasture 5 years	Wheat after G.M.	Corn after G.M.	Wheat after grain	Wheat I	Fallow I
25	Operating capital	$100.00	0	≥	A	A	A	A	A	A	A	A
26	Investment capital	$100.00	0	≥								
27	Fixed cash reqd.	$100.00	B_{26}	=								
28	Cash on hand	$100.00	B_{27}	≥								
29	Credit	$100.00	0	≥	-A	-A	-A	-A	-A	-A	-A	-A
30	Credit K	$100.00	0	≥								
31	Credit F	$100.00	0	≥								
32	Credit G	$100.00	0	≥								
33												
34	Hay acct.	AUM	0	≥								
35	Fat cattle acct.	Cwt.	0	≥								
36	K_1 credit	$100.00	0	≥	1							
37	K_2 credit	$100.00	0	≥		1						
38	K_3 credit	$100.00	0	≥			1					
39	K_4 credit	$100.00	0	≥				1				
40	K_5 credit	$100.00	0	≥					1			
41	K_6 credit	$100.00	0	≥						1		
42	K_7 credit	$100.00	0	≥							1	
43	K_8 credit	$100.00	0	≥								1
44	K_9 credit	$100.00	0	≥								
45	K_{10} credit	$100.00	0	≥								
46	K_{11} credit	$100.00	0	≥								
47	K_{12} credit	$100.00	0	≥								
48	K_{13} credit	$100.00	0	≥								
49	K_{14} credit	$100.00	0	≥								
50	K_{15} credit	$100.00	0	≥								
51	K_{16} credit	$100.00	0	≥								

Continued

Table 26. The general form of Model II--Continued

Equation number		Unit	B_i	Nurse crop	Alfalfa 5 years	Pasture 5 years	Wheat after G.M.	Corn after G.M.	Wheat after grain	Wheat I	Fallow I
52	K_{17} credit	$100.00	0	≤							
53	K_{18} credit	$100.00	0	≤							
54	K_{19} credit	$100.00	0	≤							
55	K_{20} credit	$100.00	0	≤							
56	K_{21} credit	$100.00	0	≤							

Table 26. The general form of Model II--Continued

Equation number	Wheat	Barley	Grain hay	Dryland alfalfa	Improved pasture	Cow-calf range	Cow-calf pasture	Brood sow	Calf to yrlg.	Feed-lot A	Feed-lot B	Grass fatten	Hay transfer
1	-P	-P	-P	-P	-P	-P	-P	-P	-P	-P	-P	-P	0
2													
3	2.12	2		1	1								
4	1												
5													
6													
7													
8													
9	-A		1										
10	-A												
11		-A						A	A	A	A		
12											A		
13							A					A	
14					-A	A							
15								-A					
16						-A	-A		A				
17									-A	A		A	
18						-A	-A						
19												-A	
20	A	A	A	A	A	A	A	A	A	A	A	A	
21													
22			-A	-A		A	A		A				-1
23								A		A	A		
24											A		
25	A	A	A	A	A	A	A	A	A	A	A	A	
26						A	A	A		A	A		

Continued

Table 26. The general form of Model II--Continued

Equation number	Wheat	Barley	Grain hay	Dryland alfalfa	Improved pasture	Cow-calf range	Cow-calf pasture	Brood sow	Calf to yrlg.	Feed-lot A	Feed-lot B	Grass fatten	Hay transfer
27													
28													
29	-A	-A	-A	-A	-A	-A	-A	-A	-A	-A	-A	-A	
30								-A		-A	-A	-A	
31	-A	-A				-A	-A		A				
32													
33													
34													1
35								-A		-A	-A		
36													
37													
38													
39													
40													
41													
42													
43													
44	1												
45		1											
46			1										
47				1									
48					1								
49						1							
50							1						
51								1					
52										1			
53											1		

Continued

Table 26. The general form of Model II--Continued

Equation number	Wheat	Barley	Grain hay	Dryland alfalfa	Improved pasture	Cow-calf range	Cow-calf pasture	Brood sow	Calf to yrlg.	Feed-lot A	Feed-lot B	Grass fatten	Hay transfer
54												1	
55													
56													

Table 26. The general form of Model II--Continued

Equation number	Barley transfer	Hire labor Period I	Buy barley	Buy hay	Buy calf	Buy yrlg.	Buy operating capital	Buy investment capital	Buy cash	Transfer credit F	Transfer credit K	Spend cash	Invest cash
1	0	-P	-P	-P	-P	-P	-P	0	-P	-P	-P	0	0
2													
3													
4													
5													
6													
7													
8													
9													
10													
11	1												
12													
13													
14													
15													
16					-1								
17													
18													
19													
20		-9											
21		9											
22				-1									
23	-1		-1										
24						-1							
25		A		A			-1					-1	
26								-1					

Continued

Table 26. The general form of Model II--Continued

Equation number	Barley transfer	Hire labor Period I	Buy barley	Buy hay	Buy calf	Buy yrlg.	Buy operating capital	Buy investment capital	Buy cash	Transfer credit F	Transfer credit K	Spend cash	Invest cash
27										-1	-1	-1	
28									1			1	1
29							1						
30													
31	A									1			
32			A		A	A			-1				
33											1		
34													
35													
36													
37													
38													
39													
40													
41													
42													
43													
44													
45													
46													
47													
48													
49													
50													
51													
52													
53													

Continued

Table 26. The general form of Model II--Continued

Equation number	Barley transfer	Hire labor Period I	Buy barley	Buy Hay	Buy calf	Buy yrlg.	Buy operating capital	Buy investment capital	Buy cash	Transfer credit F	Transfer credit	Spend K cash	Invest cash
54													
55		1											
56				1									

Table 26. The general form of Model II--Continued

Equation number	Sell hogs	Sell hay	Sell calves	Sell grass fat	Sell fat cattle	Sell cull cows	Sell wheat	Sell barley
1	P	P	P	P	P	P	P	P
2								
3								
4								
5								
6								
7								
8								
9								
10							1	
11								1
12								
13								
14								
15	1							
16			1					
17								
18						1		
19				1				
20								
21								
22								
23								
24								
25								
26								

Continued

Table 26. The general form of Model II--Continued

Equation number	Sell hogs	Sell hay	Sell calves	Sell grass fat	Sell fat cattle	Sell cull cows	Sell wheat	Sell barley
27								
28								
29								
30								
31								
32								
33								
34		1						
35					1			

Continued

Table 26. The general form of Model II--Continued

Equation number	K_1 transfer	K_2 transfer	K_3 transfer	K_4 transfer	K_5 transfer	K_6 transfer	K_7 transfer	K_8 transfer	K_9 transfer	K_{10} transfer	K_{11} transfer	K_{12} transfer	K_{13} transfer
36	-1												
37		-1											
38			-1										
39				-1									
40					-1								
41						-1							
42							-1						
43								-1					
44									-1				
45										-1			
46											-1		
47												-1	
48													-1
49													
50													
51													
52													
53													
54													
55													
56													
29	-A	-A	-A	-A	-A	-A	-A	-A	-A	-A	-A	-A	-A

Continued

Table 26. The general form of Model II--Continued

Equation number	K_{14} transfer	K_{15} transfer	K_{16} transfer	K_{17} transfer	K_{18} transfer	K_{19} transfer	K_{20} transfer	K_{21} transfer
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
49	-1							
50		-1						
51			-1					
52				-1				
53					-1			
54						-1		
55							-1	
56								-1
29	-A	-A	-A	-A	-A	-A	-A	-A

Interpretation of Model II

The Objective Function

Equation I contains the maximum profit objective function. Negative P values indicate costs, while positive P values indicate product prices.

Irrigated Crop Rotation Activities

The first eight activities in Table 26 deal with irrigated crop production. From these activities 19 different rotation programs are possible. Some of these are as follows:

1 - Nurse crop, alfalfa

2 - Nurse crop, pasture

3 - Nurse crop, alfalfa, pasture

4 - Nurse crop, alfalfa, wheat

5 - Nurse crop, alfalfa, wheat, wheat

6 - Nurse crop, alfalfa, corn

7 - Nurse crop, alfalfa, corn, wheat

8 - Nurse crop, pasture, wheat

9 - Nurse crop, pasture, wheat, wheat

10 - Nurse crop, pasture, corn

11 - Nurse crop, pasture, corn, wheat

12 - Nurse crop, alfalfa, pasture, wheat, wheat, corn

The alfalfa and pasture in these rotations each cover a five-year period. In this model the differences in yield which occur when a crop assumes a particular position in the rotation is illustrated by the two activities "wheat after G.M." (green manure)"and wheat after grain. Different inputs are required to obtain a given yield when wheat follows a green manure crop than when it follows another grain crop. These differences are accounted for in the cost and technical coefficients. The two activities are placed in the model so that the first enters the solution only after a green manure crop which in this case was either alfalfa hay or pasture while the second must be preceded by either corn or wheat.

The rotation activities included in Model II are for purposes of illustration and represent only a part of the alternatives used in the actual farm models.

Dry land Crop Production Activities

Wheat, barley, grain hay, alfalfa, and improved pasture constituted the alternative uses for dry cropland. Wheat production was restricted by the farm allotment. There was no limitation on barley production since much of the time farmers did not participate in the feed grain program. Grain hay production was limited to acreages diverted from wheat. There were no restrictions on dry land alfalfa or improved pasture. Grain hay and dry land alfalfa did not feed into the hay account (Equation 34)

since it was assumed that both products were fed on the farm. Therefore, they entered directly into the hay feeding equation (Equation 22).

Each of the irrigated and dry land crop enterprises required operating capital to the extent of their variable costs of production (Equation 25). Each of them also generated credit equal to this variable cost of production (Equations 36 to 52, and Equation 29).

Dry land wheat and barley also added to credit Equation 31 value equal to the difference between the gross revenue and variable costs of production. The significance of Equation 31 will be discussed in the credit section.

Cow-calf Activities

Two cow-calf activities were constructed. One represented production under range conditions and the other production on irrigated pasture. Forage, hay, and labor were the main physical inputs. Production included calves and cull cows (Equations 16 and 18). Capital requirements included both operating and investment capital. Operating costs included all fixed and variable costs of production. However, operating capital required was limited to the cash input. Investment capital covered only that required for the breeding herd.

The same explanation of credit applies here as was presented in the crop enterprise discussion.

Brood Sow Enterprise

The brood sow enterprise assumed two litters per year and that fattening would be done in confinement. Inputs and production for the hog enterprise appear in Appendix E.

The brood sow enterprise uses operating capital and investment capital. It creates sufficient credit to cover its cost of production and credit equal to the difference between its gross venue and cost of production which goes into Equation 33.

Cow to Yearling Enterprise

This was an intermediate activity which transformed home-grown or purchased calves into yearling feeders for the feedlot or for grass fattening.

Feedlot Enterprises

The two feedlot enterprises represent cattle fed a high barley ration and cattle fed a ration based on corn silage. The model also indicates that feedlot B was restricted to fattening purchased yearlings. In the actual models there were additional feedlot activities which allowed purchased feeders to be fattened on high barley rations and cattle raised on the farm to be fattened on a silage ration. A fully automated feeding system was assumed in both cases. Enterprise budgets for these activities appear in Appendix E. The feedlot activities required both operating and investment capital. They

contributed to credit Equation 30.

Grass Fattening Enterprise

This activity was limited to farms which had irrigated land. It requires operating capital and contributes to credit Equation 30. Inputs and production for this activity also appear in Appendix E.

Hay and Barley Transfer Activities

These activities simply transfer the related products from the product accounts to the feeding accounts. This makes it possible to purchase feeds for consumption and avoid the possibility of having them re-sold in the programming analysis.

Labor Hiring Activity

Labor could be hired from March through September in nine hour units. During some months there was a maximum which the farmer could adequately supervise. For this reason the activity draws from Equation 21 which is the hiring limit for the particular labor period.

Commodity Purchase Activities

Barley, hay, calves, and yearlings could be purchased for on-farm use. The hay purchasing activity drew from the operating capital equation since it was assumed that enterprises using this

resource created sufficient credit for its purchase. Barley, calf, and yearling purchases drew from credit Equation 32. The reason for this will be discussed in the credit section.

Capital and Credit Activities

Cash was required for four purposes: First, to provide for operating capital (Equation 25); second, to furnish investment resources for the cow-calf, brood sow, and feedlot enterprises (Equation 26); third, to purchase feed and livestock off the farm; and, fourth, to meet the fixed cash requirements of the family and farming operation (Equation 27).

Sources of cash to meet these needs came first from cash on hand (Equation 28). This money could be used for fixed cash requirements by way of the "spend cash" activity, for operating capital by way of the "invest cash" activity, or for purchases of barley or livestock by means of the "buy cash" activity. The second source of cash was from credit created in the production of crops and livestock (Equation 29). This credit was used by the "buy operating capital" activity which provided operating capital (Equation 25). The third source of cash came from additional credit created in the production of dry land grain crops and from the cow-calf enterprise which fed into Equation 31. It should be noted that the "barley transfer" and the "calf to yearling" activities draw from Equation 31. This is on the

assumption that if these products are used on the farm they do not serve as credit since they no longer exist in their original form. Credit from Equation 31 could be used to provide for fixed cash required (Equation 27) by means of the "transfer credit F" activity. The fourth source of cash came from credit created by the "brood sow," "feedlot," and "grass fatten" activities which fed into Equation 30. This credit could be used only for fixed cash required (Equation 27) and was transferred by the "transfer credit K" activity.

Selling Activities

These activities disposed of products grown on the farms. The prices used are contained in Appendix E.

Resource Restraints

Resources assumed to be limiting in the model were cropland, range land, the wheat allotment, and family and full-time hired labor. Equations were included for land of different productivity. The wheat allotment was the average for the years from 1963 to 1966. The labor restraints were uniform for all farms. The year was divided into five labor periods:

November - February

March - May

June

July - August

September - October

On farms where capital was limiting the "cash on hand" restraint consisted of cash available at the beginning of the year.

APPENDIX E

INPUT DATA FOR MODEL II AND MODEL III

Table 27. Individual farm restraint levels for model II and model III

Item	Unit	Farm number							
		1	2	3	4	5	6	7	8
Wheat allotment	Acres	510.0	410.0	650.0	101.3	361.9	401.0	672.0	144.0
Land I	Acres	---	---	---	76.0	144.0	---	35.0	55.0
Land A	Acres	555.0	990.0	1,350.0	218.0	1,087.0	1,020.0	1,200.0	378.0
Land B	Acres	1,115.0	98.0	700.0	---	---	250.0	500.0	100.0
Land C	Acres	---	256.0	---	---	---	---	423.0	---
Forage	AUM	376.3	1,190.0	1,966.0	833.3	641.0	575.5	439.0	481.8
Labor, N-F	Hours	492.0	1,056.0	509.0	330.0	330.0	544.0	1,055.0	529.0
Labor, M-M	Hours	585.0	1,168.0	743.0	526.0	585.0	1,080.0	1,673.0	585.0
Labor, J	Hours	315.0	412.0	400.0	195.0	195.0	312.0	581.0	195.0
Labor, J-A	Hours	639.0	825.0	825.0	315.0	315.0	522.0	1,213.0	444.0
Labor, S-O	Hours	327.0	380.0	350.0	272.0	250.0	220.0	543.0	300.0
Max. labor hire M-M	Hours	---	---	15.0	---	---	---	---	---
Max. labor hire S-O	Hours	---	---	---	---	---	---	---	---
Fixed cash required	$100.00	---	319.9	---	---	---	---	---	63.6
Cash on hand	$100.00	---	92.5	---	---	---	---	---	93.8
Long-run gross profit	Dollars	44,296.0	30,991.0	57,365.0	10,637.0	34,000.0	28,650.0	72,450.0	14,000.0

Continued

Table 27. Individual farm restraint levels for model II and model III--continued

Item	Unit	Farm number 9	10	11	12	13	14	15	16
Wheat allotment	Acres	413.0	832.0	297.0	28.0	514.0	739.0	196.0	50.0
Land 1	Acres	---	140.0	59.0	---	12.0	35.0	---	---
Land A	Acres	712.0	730.0	651.0	677.0	1,253.0	600.0	423.0	*189.0
Land B	Acres	579.0	1,130.0	278.0	240.0	220.0	1,015.0	211.0	* 50.0
Land C	Acres	---	---	---	---	198.0	500.0	---	* 80.0
Forage	AUM	1,128.8	850.5	867.9	384.4	752.0	2,429.0	212.5	---
Labor, N-F	Hours	694.0	909.0	763.0	255.0	905.0	1,300.0	528.0	1,000.0
Labor, M-M	Hours	793.0	1,288.0	877.0	654.0	800.0	799.0	656.0	1,080.0
Labor, J	Hours	600.0	429.0	293.0	325.0	324.0	585.0	178.0	360.0
Labor, J-A	Hours	836.0	936.0	594.0	437.0	711.0	821.0	375.0	720.0
Labor, S-O	Hours	353.0	748.0	380.0	360.0	308.0	720.0	459.0	552.0
Max. labor hire M-M	Hours	---	---	---	---	13.0	55.0	---	---
Max. labor hire S-O	Hours	---	---	---	---	13.0	20.0	---	---
Fixed cash required	$100.00	---	---	---	---	---	55.0	---	---
Cash on hand	$100.00	---	---	---	---	---	---	136.0	---
Long-run gross profit	Dollars	39,382.0	63,500.0	34,280.0	42,195.0	65,780.0	78,009.0	15,685.0	14,297.0

Continued

Table 27. Individual farm restraint levels for model II and model III--continued

Item	Unit	Farm number 17	18	19	20
Wheat allotment	Acres	406.0	479.0	361.0	235.0
Land I	Acres	---	---	---	---
Land A	Acres	1,108.0	713.0	1,180.0	409.0
Land B	Acres	217.0	880.0	---	314.0
Land C	Acres	---	---	---	57.0
Forage	AUM	1,003.0	675.6	965.0	569.0
Labor, N-F	Hours	640.0	907.0	781.0	341.0
Labor, M-M	Hours	772.0	520.0	1,117.0	302.0
Labor, J	Hours	238.0	240.0	375.0	155.0
Labor, J-A	Hours	476.0	858.0	570.0	260.0
Labor, S-O	Hours	336.0	300.0	370.0	173.0
Max. labor hire M-M	Hours	---	---	---	---
Max. labor hire S-O	Hours	---	---	---	---
Fixed cash required	$100.00	---	---	---	---
Cash on hand	$100.00	---	---	162.2	173.0
Long-run gross profit	Dollars	47,763.0	56,418.0	19,545.0	19,000.0

* Irrigated land.

Table 28. Yields for irrigated crops on the individual farms

Farm number	Wheat	Barley	Alfalfa hay	Pasture	Corn silage
	Bushel	Cwt.	AUM	AUM	Ton
1	---	---	---	---	---
2	---	---	---	---	---
3	---	---	---	---	---
4	70.0	40.0	15.0	13.3	---
5	70.0	40.0	15.0	13.3	---
6	---	---	---	---	---
7	70.0	---	15.0	10.0	---
8	60.0	---	15.0	10.0	---
9	---	---	---	---	---
10	70.0	---	15.0	13.3	18.0
11	70.0	---	16.6	---	---
12	---	---	---	---	---
13	---	---	16.6	---	---
14	60.0	---	16.6	---	---
15	---	---	20.0	---	---
16	75.0	40.0	15.0	13.3	23.0
17	---	---	---	---	---
18	---	---	---	---	---
19	---	---	---	---	---
20	---	---	---	---	---

Table 29. Dryland improved pasture enterprise inputs and production for each farm

Farm number	Variable costs	Forage yield	Labor Mar.-May	Operating capital	Investment capital
	Dollar	AUM	Hour	$100.00	$100.00
1	1.89	1.60	.10	.0189	.1636
2	.98	1.60	.10	.0098	.1636
	.98	1.20	.10	.0098	.1636
3	1.89	1.80	.10	.0189	.1636
4	---	---	---	---	---
5	---	---	---	---	---
6	.189	1.46	.10	.0189	.1636
7	2.58	2.50	.10	.0258	.2332
	1.89	1.80	.10	.0189	.1636
8	1.89	1.80	.10	.0189	.1636
9	2.58	2.00	.10	.0258	.2332
10	---	---	---	---	---
11	---	---	---	---	---
12	---	---	---	---	---
13	1.89	1.60	.10	.0189	.1636
14	1.89	1.60	.10	.0189	.1636
15	---	---	---	---	---
16	---	---	---	---	---
17	2.58	2.20	.10	.0258	.2332
18	2.58	2.70	.10	.0258	.2332
19	2.58	2.80	.10	.0258	.2332
20	1.89	1.60	.10	.0189	.1636

Table 30. Dryland grain hay enterprise inputs and production per acre for each farm

Farm number	Variable costs	Hay yield	Labor March-May	Labor June	Labor July-Aug.	Labor Sept.-Oct.	Total labor	Operating capital
	Dollars	AUMs	Hours	Hours	Hours	Hours	Hours	$100.00
1	9.26	1.56	.03	1.68	---	.18	1.89	.0926
2	4.56	2.33	.04	1.89	---	.18	2.11	.0456
3	7.61	3.90	.51	2.38	---	.12	3.01	.0761
4	9.25	4.67	.08	2.01	---	.21	2.30	.0925
5	9.25	4.67	.03	2.04	---	.19	2.26	.0925
6	7.74	2.33	.15	2.73	---	.35	3.23	.0774
7	12.95	1.56	.05	2.78	---	.15	2.98	.1295
8	12.85	2.11	1.11	---	2.69	.50	4.30	.1285
9	13.16	3.11	.64	3.66	---	.24	4.54	.1316
10	9.25	3.33	.03	2.04	---	.19	2.26	.0925
11	8.95	4.67	.20	3.35	---	.15	3.70	.0895
12	12.87	4.66	.10	1.07	---	.23	1.40	.1287
13	12.53	5.11	.03	3.29	---	.17	3.49	.1253
14	11.41	5.22	.02	3.29	---	.14	3.45	.1141
15	11.87	1.56	.40	4.00	---	.30	4.70	.1187
16*								
17	10.69	3.89	.09	3.92	---	.17	4.18	.1069
18	8.50	4.67	---	3.00	---	.12	3.12	.0850
19	12.51	5.44	.03	3.84	---	.22	4.09	.1251
20	9.12	1.56	.08	.53	---	.13	.74	.0912
Average	10.23	3.49	.20	2.64	2.69	.21	3.04	.1023

* All irrigated land.

Table 31. Dryland wheat enterprise inputs and production per acre for each farm

Farm number	Variable costs	Wheat yield	Labor March-May	Labor June	Labor July-August	Labor Sept.-Oct.	Total labor	Operating capital
	Dollars	Bushels	Hours	Hours	Hours	Hours	Hours	$100.00
1	12.21	48.0	.72	.21	.88	.31	2.12	.1221
	6.09	25.0	.72	---	.88	.31	1.91	.0609
2	7.42	29.0	1.04	.20	1.04	.39	2.67	.0742
3	12.77	35.0	.56	---	1.38	.12	2.06	.1277
	9.26	25.0	.56	---	1.31	.12	1.99	.0926
4	10.32	34.0	.79	.19	1.25	.38	2.61	.1032
5	10.32	31.0	.79	.19	1.25	.38	2.61	.1032
6	11.79	35.0	.77	.14	1.90	.35	3.16	.1179
7	13.64	54.0	.49	.10	1.34	.35	2.28	.1364
	13.64	40.0	.49	.10	1.34	.35	2.28	.1364
8	13.85	31.0	1.11	---	.90	.50	2.51	.1385
9	11.01	40.0	.64	.10	1.50	.24	2.48	.1101
	10.54	30.0	.64	.10	1.50	.24	2.48	.1054
10	12.54	41.0	1.13	.19	.83	.38	2.53	.1254
	12.54	37.0	.23	.19	.83	.38	1.63	.1254
11	10.59	45.0	.54	.09	.88	.47	1.98	.1059
12	13.80	60.0	.50	.16	1.47	.48	2.61	.1380
13	16.04	59.0	.84	.19	1.44	.37	2.84	.1604
14	13.33	60.0	.62	.21	.98	.26	2.07	.1333
	13.33	40.0	.62	.21	.98	.26	2.07	.1333
15	15.22	50.0	1.01	.18	1.12	.80	3.11	.1522
16*								

Continued

Table 31. Dryland wheat enterprise inputs and production per acre for each farm--Continued

Farm number	Variable costs	Wheat yield	Labor March-May	Labor June	Labor July-August	Labor Sept.-Oct.	Total labor	Operating capital
	Dollars	Bushels	Hours	Hours	Hours	Hours	Hours	$100.00
17	12.13	50.0	.54	.08	1.10	.26	1.98	.1213
18	13.63	60.0	.49	.18	.93	.22	1.82	.1363
	13.63	45.0	.49	.18	.93	.22	1.82	.1363
19	14.99	40.0	.64	.10	.98	.32	2.04	.1499
20	13.25	41.0	.57	---	.95	.34	1.86	.1325
	10.90	30.0	.57	---	.95	.34	1.86	.1090
Average	12.18	41.3	.67	.16	1.14	.34	2.27	.1218

* All irrigated land.

Table 32. Dryland barley enterprise inputs and production per acre for each farm

Farm number	Variable costs	Barley yield	Labor March-May	Labor June	Labor July-August	Labor Sept.-Oct.	Total labor	Operating capital
	Dollars	Cwt.	Hours	Hours	Hours	Hours	Hours	$100.00
1	5.92	18.0	.68	---	.88	.30	1.86	.0592
2	6,03	17.5	.87	.18	1.06	.37	2.48	.0603
	6.00	12.5	.87	.18	1.00	.37	2.42	.0600
	5.89	7.5	.87	.18	.97	.37	2.39	.0589
3	12.78	22.0	.52	---	1.37	.12	2.01	.1278
	7.11	18.0	.52	---	1.30	.12	1.94	.0711
4	8.15	15.0	1.05	.17	1.25	.36	2.83	.0815
5	8.15	15.0	1.05	.17	1.25	.36	2.83	.0815
6	11.49	20.0	.79	.14	1.90	.35	3.18	.1149
	7.22	10.0	.79	.14	1.90	.35	3.18	.0722
7	11.37	20.0	.51	.10	1.34	.35	2.30	.1137
	8.50	10.0	.51	.10	1.00	.35	1.96	.0850
8	13.68	20.0	1.16	---	.90	.50	2.56	.1368
	8.28	15.0	1.07	---	.90	.50	2.47	.0828
9	8.54	20.0	.66	.10	1.50	.24	2.50	.0854
	8.54	15.0	.66	.10	1.50	.24	2.50	.0854
10	12.58	20.0	1.05	.17	.84	.36	2.42	.1258
11	11.21	20.0	.55	.08	.88	.44	1.95	.1121
	11.21	15.0	.55	.08	.88	.44	1.95	.1121
12	13.46	40.0	.49	.14	.47	.45	1.55	.1346
	13.46	30.0	.49	.14	.47	.45	1.55	.1346
13	14.08	30.0	.88	.17	1.42	.17	2.64	.1408
	14.08	20.0	.88	.17	1.42	.17	2.64	.1408
14	13.20	15.0	.57	.19	.97	.25	1.98	.1320
	13.20	15.0	.57	.19	.97	.25	1.98	.1320

Continued

Table 32. Dryland barley enterprise inputs and production per acre for each farm--Continued

Farm number	Variable costs	Barley yield	Labor March-May	Labor June	Labor July-August	Labor Sept.-Oct.	Total labor	Operating capital
	Dollars	Cwt.	Hours	Hours	Hours	Hours	Hours	$100.00
15	11.38	21.0	.80	.16	1.12	.70	2.78	.1138
	11.38	21.0	.80	.16	1.12	.70	2.78	.1138
16*								
17	11.43	30.0	.54	.07	1.09	.26	1.96	.1143
	11.43	20.0	.54	.07	1.09	.26	1.96	.1143
18	11.17	15.0	.47	.16	.92	.21	1.76	.1117
19	13.86	21.0	.70	.09	.97	.31	2.07	.1386
20	10.47	10.0	.52	---	.94	.30	1.76	.1047
Average	10.59	18.4	.72	.14	1.12	.34	2.29	.1035

* All irrigated land.

Table 33. Dryland alfalfa enterprise inputs and production per acre for each farm

Farm number	Variable costs	Hay production	Labor March-May	Labor June	Total labor	Operating capital
	Dollars	AUMs	Hours	Hours	Hours	$100.00
1[1]	---	---	---	---	---	---
2	---	---	---	---	---	---
3	4.68	3.33	---	2.73	2.73	.0468
4	---	---	---	---	---	---
5	---	---	---	---	---	---
6	5.27	2.33	---	2.34	2.34	.0527
7	4.68	2.50	---	2.73	2.73	.0468
8	---	---	---	---	---	---
9	8.68	1.56	---	4.79	4.79	.0868
10	---	---	---	---	---	---
11	---	---	---	---	---	---
12	---	---	---	---	---	---
13	---	---	---	---	---	---
14	---	---	---	---	---	---
15	---	---	---	---	---	---
16						
17	---	---	---	---	---	---
18	---	---	---	---	---	---
19	5.81	3.33	---	2.70	2.70	.0581
20	7.79	3.33	.10	.70	.80	.0779
Average	6.15	2.73	.10	2.66	2.68	.0615

[1] Investment capital requirements in $100 units were as follows for each farm: No. 3, .1675; No. 6, .2336; No. 7, .2336; No. 9, .2336; No. 19, .2336; No. 20, .1778. The average investment capital requirement was .2133.

Table 34. Cow-calf enterprise inputs and production per cow for each farm

Farm number	Variable costs	Forage	Hay	Labor Nov.-Feb.	Labor March-May	Labor June	Labor July-Aug.	Labor Sept.-Oct.	Total labor	Calf production	Cull cows	Operating capital	Investment capital
	Dollars	AUMs	AUMs	Hours	Hours	Hours	Hours	Hours	Hours	Cwt.	Cwt.	$100.00	$100.00
1	30.48	13.76	2.48	5.60	2.40	.40	.80	.80	10.00	3.44	1.16	.1734	2.19
2	26.17	12.15	3.47	3.60	2.80	.20	.40	.75	7.75	3.40	1.36	.1590	2.27
3	25.84	11.30	3.80	2.83	1.79	.27	.60	.41	5.90	3.98	.97	.1258	2.21
4	31.15	12.82	4.37	2.61	2.60	.60	.95	2.20	8.96	3.37	1.53	.1290	2.42
5	34.71	12.37	4.12	3.92	3.66	.30	.62	.62	9.12	3.28	1.58	.2277	1.99
6	31.93	11.14	4.70	6.33	5.37	.07	1.60	.07	13.44	3.44	1.23	.1663	2.55
7	26.81	13.60	2.50	3.80	2.15	.10	.20	1.15	7.40	3.56	1.67	.1477	2.01
8	27.83	11.70	4.95	3.50	3.15	.25	1.10	1.85	9.85	3.58	1.21	.1621	1.93
9	27.58	12.90	2.10	4.70	1.39	.92	.66	1.06	8.73	3.55	1.20	.1366	2.31
10	31.41	10.50	5.20	3.97	2.19	.27	.55	.73	7.71	3.30	1.58	.1689	2.42
11	29.31	13.88	3.92	2.40	1.56	.55	.71	.52	5.74	4.11	1.56	.1642	2.15
12	33.33	13.00	4.20	4.30	4.20	.50	1.00	2.80	12.80	3.44	1.29	.1977	2.26
13	37.84	15.00	2.49	4.68	1.80	.20	.40	.72	7.80	3.61	1.36	.2224	2.60
14	35.90	11.80	3.82	3.80	2.15	.10	.20	1.15	7.40	3.33	1.46	.1892	2.66
15	31.30	12.50	4.70	3.68	1.86	.24	.47	.47	6.72	3.82	1.71	.2010	1.85
16	30.26	11.56	5.21	2.87	2.75	.41	.20	.20	6.43	3.35	1.54	.1182	2.81
17	31.33	12.70	5.75	5.30	1.61	.93	.43	.96	9.23	3.30	1.39	.1736	2.33
18	30.90	13.51	3.15	2.66	1.64	.25	.60	1.16	6.31	3.35	1.36	.1663	2.38
19	28.73	12.60	3.20	4.23	1.66	.07	.14	.47	6.57	3.19	1.11	.1573	2.20
20	30.52	12.26	3.93	1.74	2.03	.14	.29	.43	4.63	3.27	1.66	.1708	2.24
Average	30.67	12.55	3.90	3.83	2.44	.34	.60	.93	8.12	3.48	1.40	.1733	2.29

Table 35. Estimated production and inputs for a 430-pound good-to-choice calf, fed to a 643-pound feeder (alfalfa ration)

Item	Unit	Amount	Value/ unit	Total value
				(dollars)
Production:				
Yearling feeder	lb.	643.0		
Cash expenses:				
Salt and mineral	lb.	12.0	2.95/cwt.	.35
Veterinary	dol.			.65
Utilities	dol.			.77
Machine use[1]	dol.			1.83
Repairs on facilities	dol.			.28
Total				3.88
Feed:				
Alfalfa hay	lb.	2,324.0		
	AUM	3.87		
Labor:				
Total labor	hr.	3.6		
Labor/day	hr.	.024		
Calf[2]:	lb.	434.0		
Feeding program:				
Beginning weight	lb.	430.0		
Ending weight	lb.	643.0		
Gain in weight	lb.	213.0		
Gain/day	lb.	1.28		
Days on feed	no.	167.0		

[1] Based on the following machine use:

Pickup	18 mi. @ $ .05/ mi. =	$ .90
Tractor	.5 hr. @ $1.85/hr. =	.93
Total		$1.83

[2] Pounds of calf required to produce a 643-pound feeder include an allowance for a one percent death loss.

Table 36. Estimated production and inputs for a 430-pound good-to-choice calf, fed to a 643-pound feeder, (silage ration)

Item	Unit	Amount	Value/ unit	Total value
				(dollars)
Production:				
Yearling feeder	lb.	643.0		
Cash expenses:				
Total[1]	dol.			3.88
Feed:				
Corn silage	lb.	4,509.0		
Alfalfa hay	lb.	835.0		
	AUM	1.39		
Labor[1]:	hr.			
Calf[1]:	lb.			
Feeding program[1]:				

[1] See Table 35.

Table 37. Estimated production and inputs for a 643-pound yearling feeder, fed to a 1,018-pound choice grade with average management* (high concentrate ration)

Item	Unit	Amount	Value/ unit	Total value
				(Dollars)
Production:				
Choice slaughter cattle[1]	lb.	1,018.0		
Cash expenses:				
Stilbestrol	mg.	18.0	.08/12 mg.	.12
Veterinary	dol.			1.00
Salt and mineral	lb.	30.0	$2.95/cwt.	.89
Vitamin A supplement	lb.	.6	.25	.15
Utilities	dol.			.42
Repair on facilities[2]	dol.			1.12
Machine use[3]	dol.			3.85
Marketing charge	dol.			2.80
Hay	lb.	190.0	$12.00/T.	1.14
Concentrate	lb.	253.0	$97.00/T.	12.27
Beet pulp	lb.	365.0	$50.00/T.	9.12
Total				32.88
Feed:				
Barley	lb.	1,916.0		
Labor:				
Total hours	hr.	2.7		
Hours/day	hr.	.019		
Yearling feeder[4]	lb.	662.0		
Facilities:				
Feedlot (annual operation)	dol.			37.23
Amortization[5]	dol.			3.72
Feedlot (seasonal)	dol.			96.84
Amortization[5]	dol.			8.07
Feeding program:				
Beginning weight	lb.	643.0		
Ending weight	lb.	1,072.0		
Gain in weight	lb.	429.0		
Gain/day	lb.	3.0		
Days on feed	no.	143.0		
Feed conversion	lb.	6.34		

Continued

Table 37. Estimated production and inputs for a 643-pound yearling feeder, fed to a 1,018-pound choice grade with average management* (high concentrate ration) --Continued

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[1] Assumed a five percent shrink in marketing.

[2] Estimated at three percent of investment in facilities for annual operation and one percent for seasonal operation.

[3] Based on the following machine use:

Pickup	20 mi. @ $	.05/mi. =	$1.00
Truck	23 mi. @ $	.10/mi. =	2.30
Tractor	.3 hr. @ $	1.85/hr. =	.55
Total			$3.85

[4] Pounds of yearling feeder required was increased from 643 pounds to 662 pounds to allow for a three percent death loss.

[5] The amortization rates were 10 years and 12 years for annual and seasonal feedlots, respectively.

* It was assumed that with average management, gain per day based on the shrunk market weight would be 2.62 pounds.

Table 38. Estimated production and inputs for a 643-pound yearling feeder, fed to a 1,042-pound choice grade, with above average management* (high concentrate ration)

Item	Unit	Amount	Value/ unit	Total value
				(dollars)
Production:				
Choice slaughter cattle[1]	lb.	1,042.0		
Cash expenses:				
All except feed[2]	dol.			10.35
Hay	lb.	190.0	$12.00/T.	1.14
Concentrate	lb.	253.0	$97.00/T.	12.27
Beet pulp	lb.	365.0	$50.00/T.	9.12
Total				32.88
Feed:				
Barley	lb.	1,916.0		
Labor[2]				
Yearling feeder[2]				
Facilities[2]				
Feeding program:				
Beginning weight	lb.	643.0		
Ending weight	lb.	1,101.0		
Gain in weight	lb.	458.0		
Gain/day	lb.	3.2		
Days on feed	no.	143.0		
Feed conversion	lb.	5.95		

[1] See footnote 1, Table 37.

[2] See Table 37.

* It was assumed that with above average management, gain per day based on the shrunk market weight would be 2.79 pounds.

Table 39. Estimated production and inputs for a 643-pound yearling feeder, fed to a 978-pound choice grade, with below average management* (high concentrate ration)

Item	Unit	Amount	Value/ unit	Total value
				(dollars)
Production:				
Choice slaughter cattle[1]	lb.	978.0		
Cash expenses:				
Total[2]				32.88
Feed[2]				
Labor[2]				
Yearling feeder[2]				
Facilities[2]				
Feeding program:				
Beginning weight	lb.	643.0		
Ending weight	lb.	1,020.0		
Gain in weight	lb.	386.0		
Gain/day	lb.	2.7		
Days on feed	no.	143.0		
Feed conversion	lb.	7.06		

[1]See footnote 1, Table 37.

[2]See Table 37.

*It was assumed that with below average management, gain per day based on the shrunk market weight would be 2.34 pounds.

Table 40. Estimated production and inputs for a 643-pound yearling feeder, fed to a 1,018-pound choice grade (silage ration)

Item	Unit	Amount	Value/ unit	Total value
				(dollars)
Production:				
Choice slaughter cattle[1]	lb.	1,018.0		
Cash expenses:				
Total except feed[2]	dol.			10.08
Cottonseed meal	lb.	125.0	$97.00/T.	6.06
Total				16.14
Feed:				
Corn silage	lb.	2,355.0		
Alfalfa hay	lb.	471.0		
Barley	lb.	1,628.0		
Labor:				
Total hours	hr.	6.28		
Hours/day	hr.	.04		
Yearling feeder[2]:	lb.			
Facilities[2]:	dol.			
Feeding program:				
Beginning weight	lb.	643.0		
Ending weight	lb.	1,052.0		
Gain in weight	lb.	409.0		
Gain/day	lb.	2.6		
Days on feed	no.	157.0		

[1]See footnote 1, Table 37.

[2]See Table 37.

Table 41. Estimated production and inputs for an 890-pound feeder fed to a 1,093-pound choice slaughter grade (high concentrate ration)

Item	Unit	Amount	Value/ unit	Total value
				(dollars)
Production:				
Choice fat cattle[1]	lb.	1,093.0		
Cash expenses:				
Veterinary	dol.			.50
Salt and mineral	lb.	21.0	$2.95/cwt.	.62
Vitamin A supplement	lb.	.6	.25	.15
Utilities	dol.			.30
Repair on facilities[2]	dol.			1.12
Machine use[3]	dol.			3.85
Marketing	dol.			2.80
Hay, grain	lb.	190.0	$12.00/T.	1.14
Concentrate	lb.	185.0	$97.00/T.	8.97
Beet pulp	lb.	297.0	$50.00/T.	7.43
Total				26.87
Feed:				
Barley	lb.	1,407.0		
Labor:				
Total hours	hr.	2.79		
Hours/day	hr.	.03		
Feeder steer[4]	lb.	918.0		
Facilities:				
Feedlot	dol.			96.84
Amortization of investment in feedlot[5]	dol.			8.07
Feeding program:				
Beginning weight	lb.	890.0		
Ending weight	lb.	1,150.0		
Gain in weight	lb.	260.0		
Gain/day	lb.	2.8		
Days on feed	no.	93.0		
Feed conversion	lb.	7.99		

[1] Assumes a five percent shrink in marketing.

[2] Estimated at one percent of investment in facilities.

[3] Based on the following machine use:

Continued

Table 41. Estimated production and inputs for an 890-pound feeder fed to a 1,903-pound choice slaughter grade (high concentrate ration) --Continued

Pickup	15 mi. @ $ .05/mi. =	$ .75
Truck	25 mi. @ $ .10/mi. =	$2.50
Tractor	.2 hr. @ $1.85/hr. =	.37
Total		$3.62

[4] Pounds of feeder steer required was increased from 890 to 918 pounds to allow for a three percent death loss.

[5] A 12-year amortization period was used.

Table 42. Estimated production and inputs for an 890-pound feeder, fed to a 1,098-pound choice slaughter grade (silage ration)

Item	Unit	Amount	Value/ unit	Total value
				(dollars)
Production:				
Choice fat cattle[1]	lb.	1,093.0		
Cash expenses:				
Total except feed[2]	dol.			9.33
Cottonseed meal	lb.	150.0	$97.00/T	7.28
Total				16.61
Feed:				
Corn silage	lb.	1,700.0		
Alfalfa hay	lb.	200.0		
Barley	lb.	1,356.0		
Labor:				
Total hours	hr.	4.32		
Hours/day	hr.	.04		
Facilities[2]:	dol.			
Feeding program:				
Beginning weight	lb.	890.0		
Ending weight	lb.	1,150.0		
Gain in weight	lb.	260.0		
Gain/day	lb.	2.4		
Days on feed	no.	108.0		

[1] See footnote 1, Table 41.

[2] See Table 41.

Table 43. Estimated production and inputs for an 890-pound grass fat yearling sold September 15

Item	Unit	Amount	Value/ unit	Total value
				(dollars)
Production:				
Grass fat yearling[1]	lb.	890.0		
Cash expenses:				
Stilbestrol	mg.	16.0	.08/12 mg.	.11
Veterinary	dol.			.50
Salt and mineral	lb.	10.0	$2.95/cwt.	.30
Machine use[2]	dol.			3.62
Marketing	dol.			2.80
Repairs on facilities	dol.			2.00
Total				9.33
Feed:				
Pasture	AUM	4.95		
Labor:				
Total hours	hr.	4.23		
Labor/day	hr.	.025		
Yearling feeder[3]	lb.	663.0		
Feeding program:				
Beginning weight	lb.	643.0		
Ending weight	lb.	947.0		
Gain in weight	lb.	304.0		
Gain/day	lb.	1.8		
Days on feed	no.	169.0		

[1] Assumes a six percent shrink in marketing.

[2] Based on the following machine use:

Pickup	15 mi. @ $ .05/mi. =	$ .75
Truck	25 mi. @ $ .10/mi. =	2.50
Tractor	.2 hr. @ $1.85/hr. =	.37
Total		$3.62

[3] Assumes 663 pounds of yearling feeder is required to produce an 890-pound grass fat yearling. This provides for a three percent death loss during the feeding period.

Table 44. High concentrate and corn silage rations used in cattle feeding programs

Item					
High concentrate ration:		Step #1	Step #2	Step #3	Step #4[1]
Barley	lb.	1,100.0	1,200.0	1,400.0	1,600.0
Hay, grain	lb.	-------Free choice--------			None
Concentrate[2]	lb.	200.0	200.0	200.0	200.0
Beet pulp, dried	lb.	600.0	500.0	400.0	200.0
Salt	lb.	100.0	50.0	None	None
Days	No.	7.0	7.0	7.0	
Corn silage ration:			Yearlings		2-year olds
Corn silage	avg.lb./day		15.0		17.0
Alfalfa hay	avg.lb./day		3.0		2.0
Barley	avg.lb./day		10.4		14.0
Cottonseed meal	avg.lb./day		.8		1.5

[1] Step #4 ration is 77.7 percent TDN and 9.31 percent digestible protein.

[2] Purina 32 percent protein concentrate.

Table 45. Estimated investment requirements for an annual feedlot operation, 25-head unit[1]

Item	Value
Slat and chain self-feeder, 20 ft. with 3/4 hp. motor	$ 550.00
Feed bunks with cover	240.00
Concrete walk	98.00
Mill, 1/2 hp. motor	600.00
Augers	180.00
Grain storage	655.00
Concentrate storage	350.00
Fences	148.00
Total	$2,821.00
Investment per head[2]	$ 43.40
Amortization rate per head[3]	$ 4.34

[1] Investment requirements are for a fully automated feeding system. Labor costs were not included.

[2] It was assumed that the feedlot had an annual capacity of 65 head.

[3] Based on a 10-year repayment period.

Table 46. Estimated investment requirements for an annual feedlot operation, 60-head unit[1]

Item	Value
Floor-mounted auger, 60', 1 hp. motor	$1,115.00
Mill, 1 hp. motor	600.00
Grain storage, 180 T.	1,665.00
Concentrate storage, 2 T.	350.00
Feed bunks, cover, concrete walk	1,014.00
Augers	300.00
Switches for automatic feeding	150.00
Waterers	300.00
Fencing	314.00
Total	$5,808.00
Investment per head[2]	$ 37.23
Amortization rate per head[3]	$ 3.72

[1] Investment requirements are for a fully automated feeding system. Labor costs were not included.

[2] It was assumed that the feedlot had an annual capacity of 157 head.

[3] Based on a 10-year repayment period.

Table 47. Estimated investment requirements for an annual feedlot operation, 120-head unit[1]

Item	Value
Auger, 3 hp. motor	$2,285.00
Bunks, cover, walks	2,028.00
Mill, 3 hp. motor, 100 bu./hr. capacity	650.00
Grain storage	4,079.00
Concentrate bins	400.00
Augers	300.00
Switches for automatic feeding	150.00
Waterers	600.00
Corrals	518.00
Total	$11,010.00
Investment per head[2]	$ 35.29
Amortization rate per head[3]	3.53

[1] Investment requirements are for a fully automated feeding system. Labor costs were not included.

[2] It was assumed that the feedlot had an annual capacity of 312 head.

[3] Based on a 10-year repayment period.

Table 48. Estimated annual production and inputs for a brood sow and two litters with a confinement operation and average management*

Item	Unit	Amount	Value/ unit	Total value
				(dollars)
Production:				
Fat hogs[1]	hd.	15.5		
	cwt.	30.32		
Cash expenses:				
Taxes[2]	dol.			7.36
Repair on facilities[3]	dol.			8.22
Marketing	hd.	14.0	1.46	20.44
Utilities	dol.			8.00
Veterinary	dol.			15.20
Machine -				
Tractor	hr.	.53	1.85	.98
Truck	mi.	80.0	.10	8.00
Boar charge[4]	dol.			3.33
Concentrate, 18% pre-starter	lb.	72.5	.079	5.73
Concentrate, 18% starter	lb.	362.5	.053	19.03
Concentrate, 35%	lb.	514.5	.057	29.33
Concentrate, 40%	lb.	699.3	.062	43.36
Sow concentrate, 30%	lb.	867.0	.037	33.81
Herd death loss[5]	dol.			2.20
Total				204.99
Feed:				
Barley	cwt.	119.46		
Labor:				
Total labor	hr.	30.0		
Investment:				
Facilities	dol.			350.00
Breeding herd	dol.			110.00
Amortization on investment in facilities[6]	dol.			35.00

[1] Assumes two percent death loss after weaning and shrink of 2.2 percent in marketing.

[2] Based on an investment of $460.00, an assessed value of $115.00, and a tax levy of 64.5 mills.

Continued

Table 48. Estimated annual production and inputs for a brood sow and two litters with a confinement operation and average management* --Continued

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[3] Figured at 2.35 percent of investment in facilities.

[4] Based on a boar value of $150.00 and a useful life of two years.

[5] Assumed a two percent death loss on the breeding herd.

[6] Allowed a 10-year amortization period.

* With average management, 15.5 fat hogs averaging 200 pounds could be marketed per year and 350 pounds of feed would be required for each 100 pounds of gain in weight.

Table 49. Estimated annual production and inputs for a brood sow and two litters with a confinement operation and above average management*

Item	Unit	Amount	Value/ unit	Total value
				(dollars)
Production:				
Fat hogs[1]	hd.	17.0		
	cwt.	33.25		
Cash expenses:				
Taxes[1]	dol.			7.36
Repair on facilities[1]	dol.			8.22
Marketing	hd.	16.0	1.46	23.36
Utilities	dol.			8.00
Veterinary	dol.			15.20
Machine -				
Tractor	hr.	.53	1.85	.85
Truck	mi.	80.0	.10	8.00
Boar charge[1]	dol.			3.33
Concentrate, 18% pre-starter	lb.	82.9	.079	6.55
Concentrate, 18% starter	lb.	414.4	.053	21.96
Concentrate, 35%	lb.	629.8	.057	35.90
Concentrate, 40%	lb.	861.9	.062	53.44
Sow concentrate, 30%	lb.	867.0	.037	33.81
Herd death loss[1]	dol.			2.20
Total				228.31
Feed:				
Barley	cwt.	118.68		
Labor:	hr.	2/		
Investment:	dol.	2/		

[1] See footnotes, Table 48.

[2] See Table 48.

* With above average management, 17 fat hogs averaging 200 pounds could be marketed and 325 pounds of feed would be required for each 100 pounds of gain in weight.

Table 50. Estimated annual production and inputs for a brood sow and two litters with a confinement operation and below average management*

Item	Unit	Amount	Value/ unit	Total value
				(dollars)
Production:				
Fat hogs[1]	hd.	15.0		
	cwt.	29.34		
Cash costs:				
Total except feed for fattening[2]	dol.			132.30
Concentrate, 35%	lb.	588.0	.057	33.52
Concentrate, 40%	lb.	799.2	.062	49.55
Total				215.37
Feed:				
Barley	lb.	129.23		
Labor:[2]	hr.			
Investment:[2]	dol.			

[1]See footnote 1, Table 48.

[2]See Table 48.

*With below average management 15.0 fat hogs averaging 200 pounds could be marketed and 400 pounds of feed would be required for each 100 pounds of gain in weight.

Table 51. Estimated annual per acre cost of producing corn silage on land under sprinkler irrigation

Item				Cost
				(dollars)
Expenses:				
Fertilizer, 224# ammonium nitrate @ $55.15/T.				6.27
Machine				27.33
Herbicide (custom application)				11.00
Seed, 26 lb. @ $.20/lb.				5.20
Irrigation, 5 lines @ $1.05/line				5.25
Total				55.05[1]
Labor:				
March	2.13 hrs.	June	.27 hrs.	
April	.85 hrs.	July	.54 hrs.	
May	.33 hrs.	August	6.00 hrs.	
Expenses:				
With 448# ammonium nitrate				61.13[2]
With 522# ammonium nitrate				63.20[3]

[1] Expenses when corn follows a green manure crop.

[2] Expenses when corn follows small grain crops first year after green manure.

[3] Expenses when corn follows small grain crops second year after green manure.

Table 52. Estimated annual inputs per acre for producing corn silage on land under surface irrigation

Item				Cost
				(dollars)
Expenses:				
Fertilizer, 224# ammonium nitrate @ $55.15/T.				6.27
Machine				27.33
Herbicide (custom application)				11.00
Seed, 26# @ $.20/1b.				5.20
Total				49.80[1]
Labor:				
March	2.13 hrs.	June	1.05 hrs.	
April	.85 hrs.	July	2.12 hrs.	
May	1.16 hrs.	August	6.70 hrs.	
Expense:				
With 448# ammonium nitrate				57.88[2]
With 522# ammonium nitrate				47.92[3]

[1] See footnote 1, Table 51.

[2] See footnote 2, Table 51.

[3] See footnote 3, Table 51.

Table 53. Estimated annual per-acre cost of production for alfalfa-grass hay with sprinkler irrigation

Item			Cost
			(dollars)
Expenses:			
Fertilizer, 136# superphosphate @ $102.00/T.			6.94
Crop insurance			1.05
Machine[1]			4.14
Irrigation, 6 lines @ $1.05/line			6.30
Miscellaneous[2]			4.69
Annual establishment cost			4.98
Total			28.10
Total minus establishment costs			23.12
Labor:			
March	1.48 hrs.	August	2.6 hrs.
June	2.6 hrs.	October	1.27 hrs.
Expenses:			
Amortizing establishment cost over five years			30.09
Amortizing establishment cost over three years			34.75

[1] Includes all power and equipment cost except supplies for baling.

[2] Supplies for baling.

Table 54. Estimated annual cost of production for alfalfa-grass hay with surface irrigation

Item			Cost
			(dollars)
Expenses:			
Fertilizer, 136# superphosphate @ $102.00/T			6.94
Crop insurance			1.05
Machine[1]			4.14
Miscellaneous[2]			4.98
Annual establishment cost			5.18
Total			22.29
Total minus establishment costs			17.11
Labor:			
April	1.35 hr.	August 3.63 hr.	
May	1.00 hr.	September .83 hr.	
June	3.60 hr.	October .90 hr.	
July	1.01 hr.		
Expenses:			
Amortizing establishment cost over five years			24.36
Amortizing establishment cost over three years			29.19

[1] Includes all power and equipment costs except supplies for baling.

[2] Supplies for baling.

Table 55. Estimated annual inputs per acre for producing pasture on land under surface irrigation

Item				Cost
				(dollars)
Expenses:				
Fertilizer, 179# ammonium nitrate @ $55.15/T.				4.94
Machine				.43
Amortization of establishment cost (seven year life)				4.69
Total				10.06
Total minus establishment costs				5.37
Labor:				
March	.35 hrs.	July	1.01 hrs.	
April	.93 hrs.	August	.83 hrs.	
May	1.96 hrs.	September	.23 hrs.	
June	.95 hrs.	October	.23 hrs.	
Expenses:				
Amortizing establishment cost over five years				12.21
Amortizing establishment cost over three years				16.78

Table 56. Estimated annual inputs per acre for producing pasture on land under sprinkler irrigation

Item	Cost
	(dollars)
Expenses:	
Fertilizer, 179# ammonium nitrate @ $55.15/T.	4.94
Machine	.43
Irrigation, 8 lines @ $1.05/line	8.40
Annual establishment cost (seven year life)	4.69
Total	18.46
Total minus establishment costs	13.77
Labor:	
March .35 hrs.	
April .93 hrs	
July .35 hrs.	
Expenses:	
Amortizing establishment cost over five years	20.34
Amortizing establishment cost over three years	24.71

Table 57. Estimated per acre cost of establishing a stand of alfalfa-grass hay with sprinkler irrigation

Item	Cost
	(dollars)
Fertilizer, 188# ammonium sulfate @ $55.65/T.	5.23
Seed -	
Alfalfa, 8# @ $.61/lb.	4.88
Orchard grass, 5# @ $.57/lb.	2.85
Machine costs[1]	2.55
Labor, 3.01 hrs. @ $1.50/hr.	4.52
Irrigating, 3 lines @ $.80/line	2.40
Electricity, 3 lines @ $.25/line	.75
Taxes[2]	5.64
Interest on investment, $350.00 @ 5%	17.50
Interest on operating capital, $39.08 @ .0325%	1.27
Harvest cost (first year crop for hay)	
Machine[3]	6.61
Labor, 2.43 hrs. @ $1.50/hr.	3.65
Total establishment cost	57.85
Hay credit (1.0 ton @ $23.00/ton)	23.00
Net establishment cost	34.85
Annual cost of establishment (seven year life)	4.98
Annual cost of establishment (three year life)	11.62

[1] Includes cost of repairs, lubricants, oil, and fuel for tractor and equipment.

[2] Based on a land value of $350.00 and a tax levy of 64.5 mills.

[3] Includes costs related to equipment and tractor as in footnote 1 plus baling costs.

Table 58. Estimated per acre cost of establishing a stand of alfalfa-grass hay with surface irrigation

Item	Cost
	(dollars)
Fertilizer, 188# ammonium sulfate @ $55.65/T.	5.23
Seed -	
Alfalfa, 8# @ $.61/lb.	4.88
Orchard grass, 5# @ $.57/lb.	2.85
Machine costs[1]	2.55
Labor, 3.01 hrs. @ $1.50/hr.	4.52
Irrigating, 3.0 hrs. @ $1.50/hr.	4.50
Taxes[2]	5.64
Interest on investment, $350.00 @ 5%	17.50
Interest on operating capital, $40.43 @ .0325%	1.31
Harvest cost (first year crop for hay)	
Machine[3]	6.61
Labor, 2.43 hr. @ $1.50/hr.	3.65
Total establishment cost	59.24
Hay credit (1.0 ton @ $23.00/T.)	23.00
Net establishment cost	36.24
Annual cost of establishment (seven year life)	5.18
Annual cost of establishment (five year life)	7.25
Annual cost of establishment (three year life)	12.08

[1] Includes cost of repairs, lubricants, oil, and fuel for tractor equipment.

[2] Based on a land value of $350.00 and a tax levy of 64.5 mills.

[3] Includes costs related to equipment and tractor as in footnote 1 plus baling costs.

Table 59. Estimated per-acre cost of establishing pasture on land with surface irrigation

Item	Cost
	(dollars)
Fertilizer, 188# ammonium sulfate @ $55.65/ton	5.23
Seed -	
Alfalfa, 2# @ $ .61/lb.	1.21
Orchard grass, 8# @ $ .57/lb.	4.56
Machine costs[1]	2.55
Labor, 3.01 hrs. @ $1.50/hr.	4.52
Irrigating, 3.0 hrs. @ $1.50/hr.	4.50
Taxes[2]	5.64
Interest on investment, $350.00 @ 5%	17.50
Interest on operating capital, $38.47 @ .0325%	1.25
Harvest cost (first year crop for hay)	
Machine[3]	6.61
Labor, 2.43 hr. @ $1.50/hr.	3.65
Total establishment cost	57.22
Hay credit (1.0 ton @ $23.00/ton)	23.00
Net establishment cost (without labor $21.55)	34.22
Annual cost of establishment (seven year life)	4.89
Annual cost of establishment (five year life)	6.84
Annual cost of establishment (three year life)	11.41

[1] Includes cost of repairs, lubricants, oil, and fuel for tractor equipment.

[2] Based on a land value of $350.00 and a tax levy of 64.5 mills.

[3] Includes costs related to equipment and tractor as in footnote 1 plus baling costs.

Table 60. Estimated per-acre cost of establishing pasture on land with sprinkler irrigation

Item	Cost
	(dollars)
Fertilizer, 188# ammonium sulfate @ $55.65/ton	5.23
Seed -	
Alfalfa 2# @ $ .61/lb.	1.21
Orchard grass, 8# @ $ .57/lb.	4.56
Machine costs[1]	2.55
Labor, 3.01 hrs. @ $1.50/hr.	4.52
Irrigating, 3 lines @ $ .80/line	2.40
Electricity, 3 lines @ $ .25/line	.75
Taxes[2]	5.64
Interest on investment $350.00 @ 5%	17.50
Interest on operating capital $37.12 @ .0325%	1.21
Harvest cost (first year crop for hay)	
Machine[3]	6.61
Labor, 2.43 hrs. @ $1.50/hr.	3.65
Total establishment cost	55.83
Hay credit (1.0 ton @ $23.00/ton)	23.00
Net establishment cost	32.83
Annual cost of establishment (seven year life)	4.69
Annual cost of establishment (five year life)	6.57
Annual cost of establishment (three year life)	10.94

[1] Includes cost of repairs, lubricants, oil and fuel for tractor and equipment.

[2] Based on a land value of $350.00 and a tax levy of 64.5 mills.

[3] Includes costs related to equipment and tractor as in footnote 1 plus baling costs.

Table 61. Estimated per-acre cost of establishing permanent improved pasture on dry land yielding over 25 bushels of wheat per acre

Item	Times over	Repairs ($)	Fuel (gal.)	Labor (hr.)	Cost (dollars)
Establishment costs:					
Land preparation:					
Plow	1	.399	1.73	.363	
Springtooth	2	.054	.46	.124	
Harrow	2	.032	.35	.106	
Rodweed	1	.048	.32	.083	
Packing[1]	1	---	.32	.083	1.00
Fertilize[2]	1	---	.41	.097	
Drill	1	.271	.46	.150	
Total		.80	4.05	1.01	
Seed:					
Alfalfa, 2#/acre @ $ .61/lb.					1.22
Crested wheat, 6#/acre @ $. 46/lb					2.76
Fertilizer[2] 30#/acre @ $ .095/acre					2.85
Taxes, land value $130/acre					2.10
Interest on land @ 5%					6.50
Fencing					1.00
Repairs					.80
Power[3]					2.12
Truck					.45
Labor, 1.01 hr./A. @ $1.50/hr.					1.52
Total					22.32
Annual cost:					
Amortization of establishment cost, 10 year period					2.23
Fencing					.35
Total					2.58

[1] Rental charge on packer was $1.00/acre.

[2] Includes rental of applicator and delivery of fertilizer to the farm.

[3] Includes cost of fuel, oil, lubricants and repairs on the tractor.

Table 62. Estimated per-acre cost of establishing permanent pasture on dry land yielding under 25 bushels of wheat per acre

Item	Times over	Repairs ($)	Fuel (gal.)	Labor (hr.)	Cost (dollars)
Establishment costs:					
Land preparation:					
Plow	1	.399	1.73	.363	
Springtooth	1	.027	.23	.062	
Harrow	1	.016	.17	.053	
Rodweed	1	.048	.32	.083	
Packing[1]	1	---	.32	.083	1.00
Drill	1	.271	.46	.150	
Total		.761	3.23	.794	
Seed:					
Crested wheat 6#, alfalfa 2#					3.98
Taxes, land value $80/acre					1.29
Interest on land @ 5%					4.00
Repairs					.76
Power[2]					1.69
Labor, .794 hrs. @ $1.50/hr.					1.19
Truck					.45
Fencing					1.00
Total					15.36
Annual cost:					
Amortization of establishment cost, ten year period					1.54
Fencing					.35
Total					1.89

[1] Rental charge on packer was $1.00/acre.

[2] Includes cost of fuel, oil, lubricants and repairs on tractor.

Table 63. Product and input prices used in Model II

Item	Unit	Price[1]
		(Dollars)
Weaner calves sold in the fall (450#)	Cwt.	23.53
Weaner calves purchased (450#)	Cwt.	24.42
Yearling feeders (650#)	Cwt.	22.07
Cull cows	Cwt.	14.69
Choice fat cattle (1,050#)	Cwt.	24.04
Choice fat cattle (1,100#)	Cwt.	23.27
Grass fat yearlings	Cwt.	20.65
Fat hogs (200#)	Cwt.	19.74
Alfalfa hay purchased or sold	Ton	25.00
Barley sold	Cwt.	2.41
Barley purchased	Cwt.	2.43
Wheat sold[2]	Bushel	2.00

[1] All prices are 10-year average (1955-66) market prices.

[2] Includes the value of government payments.

APPENDIX F

MODEL II PROGRAMMING SOLUTIONS

Model II Programming Solution

The following tables contain solutions for each farm based on the Model II analysis. Except those for farms Nos. 10 and 16, each solution was based on the following enterprise alternatives:

Solution number	Enterprises
1	Crops
2	Crops, cow-calf
3	Crops, cow-calf, brood sow (average management)
4	Crops, cow-calf, feedlot (average management)
5	Crops, cow-calf, feedlot (average management), brood sow (average management)
6	Crops, cow-calf, feedlot (above average management), brood sow (average management)
7	Crops, cow-calf, feedlot (below average management), brood sow (average management)
8	Crops, cow-calf, feedlot (average management), brood sow (above average management)
9	Crops, cow-calf, feedlot (average management), brood sow (below average management)

Solutions for farm No. 10 were the same as those outlined above except that solution 4 included grass fattening and brood sow enterprises, solution 5 considered grass fattening as the only livestock alternative, and solutions 6, 7, 8, and 9 also considered grass fattening.

Solutions for farm No. 16 included the following enterprise alternatives:

Solution number	Enterprises
1	Crops, cow-calf
2	Crops, cow-calf, grass fattening
3	Crops, grass fattening
4	Crops, brood sow (average management)
5	Crops, cow-calf, grass fattening, brood sow (average management), feedlot (average management)
6	The same as Solution 5 except that the fallow activity was excluded
7	The same as Solution 5 but with above average feedlot management
8	The same as Solution 5 but with below average feedlot management

Table 64. Summary of programmed optimum solutions for farm No. 1

Item	Unit	Solution number								
		1	2	3	4	5	6	7	8	9
Enterprise										
Dry land:										
Wheat	acre	516	516	516	516	516	516	516	516	516
Barley	acre	288	288	288	288	288	288	288	288	288
Grain hay	acre	---	43	43	---	---	---	62	---	---
Fallow	acre	865	822	822	865	865	865	803	865	865
Livestock:										
Beef cows	head	---	27	27	27	27	27	27	27	27
Cattle feedlot	head	---	---	---	130	130	130	21	130	130
Brood sows	head	---	---	10	---	---	---	7	---	---
Seasonal labor	day	8	16	30	34	34	34	28	34	34
Total labor	hour	1,511	1,796	1,974	1,951	1,951	1,951	2,027	1,951	1,951
Operating capital	dol.	6,649	7,632	9,911	29,413	29,413	29,413	10,536	29,413	29,413
Investment capital	dol.	---	5,989	10,674	10,812	10,812	10,812	9,840	10,812	10,812
Gross profit	dol.	44,195	45,500	45,970	46,635	46,635	47,383	46,037	46,635	46,635

Table 64. Summary of programmed optimum solutions for farm No. 2

Item	Unit	Solution number								
		1	2	3	4	5	6	7	8	9
Enterprise										
Dry land:										
Wheat	acre	410	410	410	410	410	410	410	410	410
Barley	acre	237	141	141	148	126	109	126	109	148
Grain hay	acre	---	146	146	138	160	177	160	177	138
Fallow	acre	697	648	648	648	648	648	648	648	648
Livestock:										
Beef cows	head	---	98	98	98	98	98	98	98	98
Cattle feedlot	head	---	---	---	114	75	132	75	75	114
Brood sows	head	---	---	14	---	4	---	4	5	---
Seasonal labor	day	---	---	3	---	4	8	4	8	---
Total labor	hour	1,670	2,506	2,892	3,014	2,983	2,981	2,983	2,967	3,014
Operating capital	dol.	4,450	7,363	10,658	20,664	13,470	25,004	13,470	11,459	20,664
Investment capital	dol.	---	22,233	26,564	26,494	26,311	27,165	26,311	26,514	26,494
Gross profit	dol.	25,080	30,368	31,210	32,069	32,123	32,752	31,406	32,354	32,069

Table 64. Summary of programmed optimum solutions for farm No. 3

Item	Unit	Solution number								
		1	2	3	4	5	6	7	8	9
Enterprise										
Dry land:										
Wheat	acre	650	650	650	650	650	650	650	650	650
Barley	acre	336	282	282	282	282	282	282	282	282
Grain hay	acre	---	78	78	78	78	78	78	78	78
Alfalfa hay	acre	---	107	107	108	108	108	107	107	108
Fallow	acre	1,064	933	933	932	932	932	933	933	932
Livestock:										
Beef cows	head	---	174	174	174	174	174	174	174	174
Cattle feedlot	head	---	---	---	19	19	19	---	---	19
Brood sows	head	---	---	2	---	---	---	---	---	---
Seasonal labor	day	57	88	90	91	91	91	91	91	91
Total labor	hour	1,482	2,653	2,678	2,677	2,677	2,677	2,678	2,678	2,677
Operating capital	dol.	11,597	18,422	18,801	22,841	22,841	22,841	18,801	18,801	22,841
Investment capital	dol.	---	38,450	39,215	39,166	39,166	39,166	39,215	39,215	39,166
Gross profit	dol.	48,343	58,940	59,010	59,061	59,061	59,172	59,010	59,071	59,061

Table 64. Summary of programmed optimum solutions for farm No. 4

Item	Unit	Solution number 1	2	3	4	5	6	7	8	9
Enterprise										
Dry land:										
Wheat	acre	56	101	101	101	97	94	101	94	94
Barley	acre	47	2	2	2	6	9	2	9	8
Grain	acre	---	---	---	---	12	12	12	12	12
Fallow	acre	115	115	115	115	103	103	103	103	104
Irrigated land:										
Wheat	acre	46	---	---	7	5	7	---	7	7
Barley	acre	---	---	---	11	19	11	18	11	12
Alfalfa pasture	acre	---	43	43	42	50	45	35	45	44
Pasture	acre	---	12	12	---	---	---	---	---	---
Alfalfa hay	acre	---	---	---	---	---	---	10	---	1
Nurse crop	acre	---	8	8	8	7	6	6	6	6
Fallow	acre	30	12	12	12	5	6	6	6	6
Livestock:										
Beef cows	head	---	105	105	72	79	72	79	72	71
Cattle feedlot	head	---	---	---	---	16	---	40	---	---
Grass fattening	head	---	---	---	56	45	56	21	56	55
Brood sows	head	---	---	---	---	---	3	---	3	3
Seasonal labor	day	---	---	---	---	4	3	5	3	3
Total labor	hour	574	1,271	1,215	1,354	1,369	1,396	1,369	1,374	1,354
Operating capital	dol.	2,108	3,915	3,915	4,871	5,053	5,108	5,884	5,108	5,234
Investment capital	dol.	---	25,652	25,652	25,652	19,859	18,908	20,752	18,908	18,872
Gross profit	dol.	9,717	12,142	12,142	15,289	15,303	15,313	15,470	15,313	15,443

Table 64. Summary of programmed optimum solutions for farm No. 5

Item	Unit	Solution number 1	2	3	4	5	6	7	8	9
Enterprise										
Dry land:										
Wheat	acre	266	266	266	289	289	289	279	279	289
Barley	acre	256	256	256	233	233	233	243	243	233
Grain hay	acre	---	43	43	43	43	43	43	43	43
Fallow	acre	565	522	522	522	522	522	522	522	522
Irrigated land:										
Wheat	acre	96	96	96	73	73	73	83	83	73
Alfalfa pasture	acre	---	---	---	28	28	28	16	16	28
Nurse crop	acre	---	---	---	4	4	4	2	2	4
Fallow	acre	48	48	48	39	39	39	42	42	39
Livestock:										
Beef cows	head	---	46	46	68	68	68	50	50	68
Cattle feedlot	head	---	---	---	53	53	53	13	13	53
Grass fattening	head	---	---	---	---	---	---	26	26	---
Brood sows	head	---	---	21	---	5	5	12	12	---
Seasonal labor	day	86	108	154	134	144	144	145	145	134
Total labor	hour	1,240	1,466	1,675	1,629	1,675	1,675	1,675	1,675	1,675
Operating capital	dol.	8,373	9,949	15,555	12,785	14,025	14,025	14,221	14,501	12,785
Investment capital	dol.	---	11,231	20,839	18,466	20,590	20,590	18,199	18,199	18,466
Gross profit	dol.	30,531	33,106	33,701	34,407	34,539	38,842	34,387	35,001	34,407

Table 64. Summary of programmed optimum solutions for farm No. 6

Item	Unit	Solution No. 1	2	3	4	5	6	7	8	9
Enterprise										
Dry land:										
Wheat	acre	401	401	401	401	401	401	401	401	401
Barley	acre	210	170	170	109	109	109	170	109	109
Grain hay	acre	---	47	47	---	---	---	47	---	---
Alfalfa hay	acre	---	80	80	202	202	202	80	202	202
Fallow	acre	659	572	572	558	558	558	570	558	558
Livestock:										
Beef cows	head	---	52	52	52	52	52	52	52	52
Cattle feedlot	head	---	---	---	66	66	66	---	66	66
Seasonal labor	day	71	81	81	90	90	90	81	90	90
Total labor	hour	1,296	2,109	2,109	2,258	2,258	2,258	2,109	2,258	2,258
Operating capital	dol.	7,667	9,954	9,954	16,775	16,775	16,775	9,954	16,775	16,775
Investment capital	dol.	---	15,034	15,034	20,363	20,363	20,363	15,034	20,365	20,363
Gross profit	dol.	27,840	29,634	29,634	30,030	30,030	30,414	29,634	30,030	30,030

Table 64. Summary of programmed optimum solutions for farm No. 7

Item	Unit	Solution number								
		1	2	3	4	5	6	7	8	9
Enterprise										
Dry land:										
Wheat	acre	646	650	655	668	668	672	668	668	668
Barley	acre	375	371	195	182	182	178	182	182	182
Impr. pasture	acre	---	---	342	342	342	342	342	342	342
Fallow	acre	1,102	1,102	1,031	1,031	1,031	1,031	1,031	1,031	1,031
Irrigated land:										
Wheat	acre	26	22	17	4	4	---	4	4	4
Fallow	acre	9	8	4	2	2	---	2	2	2
Pasture	acre	---	---	---	---	---	4	---	---	---
Alfalfa hay	acre	---	5	13	29	29	31	29	29	29
Livestock:										
Beef cows	head	---	32	78	78	78	81	78	78	78
Cattle feedlot	head	---	---	---	249	249	251	62	249	249
Brood sows	head	---	---	22	---	---	---	15	---	---
Seasonal labor	day	16	18	13	16	16	16	16	16	16
Total labor	hour	2,089	2,537	3,299	3,532	3,532	3,570	3,490	3,532	3,532
Operating capital	dol.	13,477	14,388	19,224	54,412	54,412	56,134	20,297	54,412	54,412
Investment capital	dol.	---	6,676	31,654	31,489	31,489	32,620	31,581	31,489	31,489
Gross profit	dol.	72,198	74,315	75,517	77,566	77,566	79,043	76,250	77,566	77,566

Table 64. Summary of programmed optimum solutions for farm No. 8

Item	Unit	Solution number								
		1	2	3	4	5	6	7	8	9
Enterprise										
Dry land:										
Wheat	acre	103	113	113	119	119	112	119	119	119
Barley	acre	128	117	117	111	111	119	111	111	111
Fallow	acre	248	248	248	248	248	248	248	248	248
Irrigated land:										
Wheat	acre	41	31	31	25	25	32	25	25	25
Fallow	acre	14	10	10	8	8	11	8	8	8
Alfalfa hay	acre	---	14	14	22	22	12	22	22	22
Livestock:										
Beef cows	head	---	---	---	41	41	133	33	41	41
Cattle feedlot	head	---	---	---	41	41	133	33	41	41
Brood sows	head	---	---	5	---	---	---	1	---	---
Total labor	day	831	1,295	1,440	1,531	1,531	15,057	1,529	1,531	1,531
Operating capital	dol.	10,357	11,579	10,827	9,375	9,375	27,540	9,375	14,522	14,522
Investment capital	dol.	---	8,452	9,889	10,299	10,299	9,648	10,204	10,299	10,299
Gross profit	dol.	12,955	14,846	15,158	15,901	15,901	16,358	15,545	15,901	15,901

Table 64. Summary of programmed optimum solutions for farm No. 9

Item	Unit	Solution number								
		1	2	3	4	5	6	7	8	9
Enterprise										
Dry land:										
Wheat	acre	413	413	413	413	413	413	413	413	413
Barley	acre	208	208	208	208	208	208	208	208	208
Grain hay	acre	---	50	50	50	50	50	50	50	50
Fallow	acre	670	620	620	620	620	620	620	620	620
Livestock:										
Beef cows	head	---	88	88	88	88	88	88	88	88
Cattle feedlot	head	---	---	---	208	208	208	53	208	208
Brood sows	head	---	---	20	---	---	---	13	---	---
Seasonal labor	day	11	17	28	27	27	27	27	27	27
Total labor	hour	1,449	2,380	2,877	2,990	2,990	2,990	2,958	2,990	2,990
Operating capital	dol.	6,437	1,812	14,035	44,330	44,330	44,330	16,101	44,330	44,330
Investment capital	dol.	---	20,235	29,378	27,987	27,987	28,987	28,039	27,987	27,987
Gross profit	dol.	32,763	38,131	39,278	40,525	40,525	41,726	39,417	40,525	40,525

Table 64. Summary of programmed optimum solutions for farm No. 10

Item	Unit	Solution number								
		1	2	3	4	5	6	7	8	9
Enterprise										
Dry land:										
Wheat	acre	767	797	800	795	762	795	795	800	795
Barley	acre	118	83	80	85	118	85	85	81	85
Grain hay	acre	---	100	---	60	---	60	55	---	60
Fallow	acre	980	880	980	970	980	920	925	---	920
Irrigated land:										
Wheat	acre	70	35	32	37	70	37	37	32	37
Corn	acre	---	---	---	6	---	6	6	1	6
Pasture	acre	---	50	15	---	---	---	---	---	---
Alfalfa hay	acre	---	37	77	71	---	71	86	91	71
Nurse crop	acre	---	18	16	15	---	15	15	16	15
Fallow	acre	70	1	---	---	70	---	4	---	---
Livestock:										
Beef cows	head	---	173	159	140	---	140	138	118	140
Cattle feedlot	head	---	---	---	98	---	98	92	20	98
Grass fattening	head	---	---	---	6	---	6	10	69	6
Seasonal labor	day	---	9	14	24	---	24	24	21	24
Total labor	hour	2,342	3,797	4,286	4,249	2,342	4,249	4,249	4,251	4,249
Operating capital	dol.	12,848	17,408	27,973	19,500	12,848	19,500	19,752	26,475	19,500
Investment capital	dol.	---	42,422	51,759	34,358	---	34,358	34,745	39,624	34,358
Gross profit	dol.	61,534	67,686	70,198	74,198	61,534	74,787	73,217	74,377	74,198

Table 64. Summary of programmed optimum solutions for farm No. 11

Item	Unit	Solution number								
		1	2	3	4	5	6	7	8	9
Enterprise										
Dry land:										
Wheat	acre	253	256	256	253	253	271	256	253	253
Barley	acre	194	190	191	194	194	176	190	194	194
Grain hay	acre	---	36	36	36	36	36	36	36	36
Fallow	acre	482	447	446	446	446	446	447	446	446
Irrigated land:										
Wheat	acre	44	41	41	44	44	26	41	44	44
Alfalfa hay	acre	---	5	4	---	---	---	5	---	---
Fallow	acre	15	13	14	15	15	33	13	15	15
Livestock:										
Beef cows	head	---	63	63	63	63	63	63	63	63
Cattle feedlot	head	---	---	---	56	56	152	37	56	56
Brood sows	head	---	---	6	---	---	---	---	---	---
Total labor	hour	1,229	1,773	1,931	2,017	2,017	2,141	1,974	2,017	2,017
Operating capital	dol.	5,763	7,887	9,159	12,234	12,234	29,433	10,305	12,234	12,234
Investment capital	dol.	---	13,599	16,160	15,518	15,518	19,109	14,984	15,518	15,518
Gross profit	dol.	30,890	35,828	36,141	36,693	36,693	37,171	36,260	36,693	36,693

Table 64. Summary of programmed optimum solutions for farm No. 12

Item	Unit	Solution number								
		1	2	3	4	5	6	7	8	9
Enterprise										
Dry land:										
Wheat	acre	280	280	280	280	280	280	280	280	280
Barley	acre	162	162	162	162	162	162	162	162	162
Grain hay	acre	---	27	27	34	34	---	34	34	34
Fallow	acre	475	448	448	441	441	475	441	441	441
Livestock:										
Beef cows	head	---	30	30	22	22	---	30	22	22
Cattle feedlot	head	---	---	---	154	154	307	8	154	154
Brood sows	head	---	---	13	---	---	---	10	---	---
Total labor	hour	701	1,117	1,501	1,483	1,483	1,531	1,482	1,483	1,483
Operating capital	dol.	6,040	7,369	9,989	33,088	33,088	63,812	9,892	33,088	33,088
Investment capital	dol.	---	6,683	10,735	10,589	10,589	11,438	10,283	10,589	10,589
Gross profit	dol.	40,464	42,046	42,883	43,634	43,634	45,219	42,967	43,634	43,634

Table 64. Summary of programmed optimum solutions for farm No. 13

Item	Unit	Solution number								
		1	2	3	4	5	6	7	8	9
Enterprise										
Dry land:										
Wheat	acre	514	514	514	514	514	514	514	514	514
Barley	acre	291	291	291	291	291	291	291	291	291
Grain hay	acre	---	---	24	19	19	56	17	56	19
Fallow	acre	866	866	842	847	847	810	849	810	847
Irrigated land:										
Alfalfa hay	acre	12	12	12	12	12	12	12	12	12
Livestock:										
Beef cows	head	---	50	50	50	50	50	50	50	50
Cattle feedlot	head	---	---	---	154	154	169	41	41	154
Brood sows	head	---	---	20	---	---	---	12	14	---
Seasonal labor	day	49	56	84	88	88	83	93	88	88
Total labor	hour	1,771	2,231	2,545	2,591	2,591	2,603	2,621	2,639	2,591
Operating capital	dol.	12,510	13,879	37,133	37,133	40,138	18,742	19,278	37,133	18,375
Investment capital	dol.	---	13,296	19,166	19,166	19,339	20,694	21,102	19,166	22,288
Gross profit	dol.	62,774	65,838	68,258	68,258	69,226	67,518	68,371	68,258	67,616

Table 64. Summary of programmed optimum solutions for farm No. 14

Item	Unit	Solution number								
		1	2	3	4	5	6	7	8	9
Enterprise										
Dry land:										
Wheat	acre	704	724	724	739	739	739	739	739	739
Barley	acre	309	289	289	274	274	274	274	274	274
Grain hay	acre	---	87	87	89	89	89	89	89	89
Fallow	acre	1,102	---	1,015	1,015	1,015	1,015	1,015	1,015	1,015
Irrigated land:										
Wheat	acre	35	15	15	---	---	---	---	---	---
Alfalfa hay	acre	---	20	20	35	35	35	35	35	35
Livestock:										
Beef cows	head	---	206	206	206	206	195	206	206	206
Cattle feedlot	head	---	---	---	182	182	215	153	153	182
Brood sows	head	---	---	25	---	---	---	3	3	---
Seasonal labor	day	29	83	128	136	136	137	136	136	136
Total labor	hour	2,085	3,614	3,959	4,181	4,181	4,147	4,189	4,189	4,181
Operating capital	dol.	21,055	22,756	28,536	34,233	34,233	40,631	29,549	29,549	34,233
Investment capital	dol.	---	55,494	67,082	62,780	62,780	60,954	63,177	63,177	62,780
Gross profit	dol.	68,436	78,506	79,519	82,326	82,326	83,384	80,760	82,352	82,326

Table 64. Summary of programmed optimum solutions for farm No. 15

Item	Unit	Solution number								
		1*	2*	3	4*	5	6	7	8*	9*
Enterprise										
Dry land:										
Wheat	acre	---	---	196	---	196	196	196	---	---
Barley	acre	---	---	109	---	109	109	109	---	---
Fallow	acre	---	---	329	---	329	329	329	---	---
Irrigated land:										
Alfalfa	acre	---	---	6	---	6	6	6	---	---
Livestock:										
Beef cows	head	---	---	17	---	17	17	17	---	---
Cattle feedlot	head	---	---	---	---	3	3	3	---	---
Brood sows	head	---	---	44	---	43	43	43	---	---
Seasonal labor	day	---	---	21	---	21	21	21	---	---
Total labor	hour	---	---	2,178	---	2,142	2,142	2,142	---	---
Operating capital	dol.	---	---	26,236	---	26,184	26,184	26,184	---	---
Investment capital	dol.	---	---	16,955	---	16,881	16,881	16,881	---	---
Gross profit	dol.	---	---	16,249	---	16,357	16,376	16,325	---	---

* Solutions were infeasible.

Table 64. Summary of programmed optimum solutions for farm No. 16

Item	Unit	Solution No. 1	2	3	4	5	6	7	8	9
Enterprise										
Irrigated land:										
Wheat	acre	50	50	50	50	50	50	50	50	---
Barley	acre	159	54	123	160	136	18	134	93	---
Corn	acre	---	22	---	---	24	27	26	24	---
Pasture	acre	---	125	55	---	---	130	---	50	---
Alfalfa hay	acre	---	15	---	---	20	47	25	30	---
Nurse crop	acre	---	20	11	---	4	42	5	16	---
Fallow	acre	105	26	80	109	79	---	79	56	---
Livestock:										
Beef cows	head	---	104	---	---	---	13	---	---	---
Cattle feedlot	head	---	---	---	---	195	---	254	95	---
Grass fattening	head	---	78	135	---	---	324	---	136	---
Brood sows	head	---	---	---	40	---	---	---	---	---
Seasonal labor	day	---	3	---	---	12	67	14	25	---
Total labor	hours	1,790	2,966	2,995	2,989	3,447	3,431	3,600	3,393	---
Operating capital	dol.	4,125	9,931	24,978	13,567	33,905	46,795	44,389	36,003	---
Investment capital	dol.	---	29,299	---	12,680	7,260	3,654	9,456	3,537	---
Gross profit	dol.	17,770	18,905	18,154	22,056	24,432	22,045	25,831	23,184	---

Table 64. Summary of programmed optimum solutions for farm No. 17

Item	Unit	Solution number								
		1	2	3	4	5	6	7	8	9
Enterprise										
Dry land:										
Wheat	acre	406	406	406	406	406	406	406	406	406
Barley	acre	232	232	232	232	232	232	232	232	232
Grain hay	acre	---	30	18	21	21	27	19	21	21
Fallow	acre	767	737	749	746	746	740	748	746	746
Livestock:										
Beef cows	head	---	79	79	67	67	12	79	67	67
Cattle feedlot	head	---	---	---	216	216	370	25	216	216
Brood sows	head	---	---	18	---	---	---	15	---	---
Seasonal labor	day	25	29	39	38	38	43	38	38	38
Total labor	hour	1,035	1,854	2,261	2,338	2,338	2,115	2,302	2,338	2,338
Operating capital	dol.	7,914	12,198	16,290	45,817	45,817	78,034	17,233	45,817	45,817
Investment capital	dol.	---	18,394	26,786	23,705	23,705	16,554	26,146	23,705	23,705
Gross profit	dol.	47,190	49,408	50,240	51,530	51,530	53,483	50,320	51,530	51,530

Table 64. Summary of programmed optimum solutions for farm No. 18

Item	Unit	Solution number								
		1	2	3	4	5	6	7	8	9
Enterprise										
Dry land:										
Wheat	acre	479	479	479	479	479	479	479	479	479
Barley	acre	289	289	289	289	289	289	289	289	289
Grain hay	acre	---	32	19	21	21	21	21	21	21
Fallow	acre	825	783	806	804	804	804	804	804	804
Livestock:										
Beef cows	head	---	50	50	50	50	50	50	50	50
Cattle feedlot	head	---	---	---	155	155	155	37	155	155
Total labor	hour	1,380	1,798	2,200	2,281	2,281	2,281	2,252	2,281	2,281
Operating capital	dol.	9,754	11,640	14,985	36,018	36,018	36,018	16,396	36,018	36,018
Investment capital	dol.	---	11,892	18,667	17,646	17,646	17,646	17,706	17,646	17,646
Gross profit	dol.	54,172	57,166	57,794	58,813	58,813	59,705	57,923	58,813	58,813

Table 64. Summary of programmed optimum solutions for farm No. 19

Item	Unit	Solution number								
		1	2	3	4	5	6	7	8	9
Enterprise										
Dry land:										
Wheat	acre	301	361	361	361	361	361	361	361	361
Barley	acre	207	206	206	185	185	185	185	185	185
Grain hay	acre	---	43	43	43	43	43	43	43	43
Alfalfa hay	acre	---	3	3	45	45	45	45	45	45
Fallow	acre	612	547	547	456	456	456	456	456	456
Livestock:										
Beef cows	head	---	77	77	77	77	77	77	77	77
Cattle feedlot	head	---	---	---	143	55	117	55	55	143
Brood sows	head	---	---	29	---	23	18	23	23	---
Seasonal labor	day	---	---	15	4	17	17	17	17	4
Total labor	hour	1,166	1,851	2,575	2,416	2,749	2,763	2,749	2,749	2,416
Operating capital	dol.	8,377	11,208	21,464	45,273	25,908	48,649	25,908	13,974	45,273
Investment capital	dol.	---	16,915	26,116	23,231	27,191	27,886	27,191	27,191	23,231
Gross profit	dol.	17,190	21,307	22,847	23,189	23,873	24,407	23,347	25,095	23,189

Table 64. Summary of programmed optimum solutions for farm No. 20

Item	Unit	Solution number								
		1	2	3	4	5	6	7	8	9
Enterprise										
Dry land:										
Wheat	acre	---	235	235	235	235	235	235	235	235
Barley	acre	---	97	97	52	52	52	59	52	52
Impr. pasture	acre	---	29	29	---	---	---	---	---	---
Alfalfa hay	acre	---	59	59	95	95	95	92	95	95
Fallow	acre	---	370	370	408	408	408	404	408	408
Livestock:										
Beef cows	head	---	50	50	46	46	46	46	46	46
Cattle feedlot	head	---	---	---	34	34	34	31	34	34
Brood sows	head	---	---	1	---	---	---	---	---	---
Seasonal labor	day	---	8	8	4	4	4	5	4	4
Total labor	hour	---	821	845	961	961	961	949	961	961
Operating capital	dol.	---	6,117	6,347	7,459	7,459	7,459	7,066	7,459	7,459
Investment capital	dol.	---	12,762	13,059	13,357	13,357	13,357	13,177	13,357	13,357
Gross profit	dol.	---	19,050	19,103	19,734	19,734	19,930	19,409	19,734	19,734

APPENDIX G

EXPLANATION OF CONFORMITY INDICES

Conformity Indices Relating Actual and Programmed Solutions On a Basis Of Resource Allocation Patterns and Enterprise Combinations

These indices were developed on the basis that direct comparisons of fixed resource allocation patterns and enterprise combinations were possible since a common denominator existed in each case. For land and fixed labor it was the total units of each available. For enterprises it was the weighted value of the alternative enterprises. There were the same enterprise alternatives in each model for a given farm. The following formulas were used:

For labor and land allocation patterns

$$I = \frac{\sum X_{i1} \leq X_{i2}}{\sum X_{i2}}$$

where

I = The conformity index for land or labor.

X_{i1} = The quantity of land or labor actually allocated to the ith enterprise.

X_{i2} = The quantity of land or labor allocated to the ith enterprise in the programmed solution.

For enterprise combinations

$$I = \frac{\sum X_{i3}}{\sum X_{i4}}$$

where

I = the conformity index for land.

X_{i3} = The weighted value of each enterprise in the actual solution that was correctly selected when compared to the programmed solution. Excluding an enterprise which should not have been on the farm as well as choosing those which should have been included was considered as a correct selection.

X_{i4} = The sum of the weighted values of all of the enterprise alternatives in the programming model.

Conformity Indices Comparing Programmed Organizations With the Actual Farm Organization

This index used the weighted values of all enterprises in the solutions multiplied by the number of physical units in each enterprise. The formula was as follows:

$$I = \frac{\sum |(X_{i5} - X_{i6})|}{\sum X_{i5}}$$

where

I = The conformity index relating the programmed organization to the actual organization.

X_{i5} = The weighted size of the ith enterprise in the actual organization.

X_{i6} = The weighted value of the ith enterprise in the programmed organization.