AN ECONOMIC ANALYSIS OF BEEF CATTLE PRODUCTION AND GRAIN OPERATIONS IN WEST CENTRAL MANITOBA

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INTRODUCTION

Beef production is big business. Over 300,000 Canadian farmers have cattle on their farms (3). In 1967 net marketings were over 3,600,000 head with sales valued at about $850,000,000 (22). At the same time beef and veal consumption in Canada averaged 88 pounds per capita (8). This figure reflects an increase of over one pound per person per year during the last 30 years. Coupled with expected population increases, this trend indicates that an 8 to 10 per cent increase in cattle slaughterings will be required during the next three years.

Several economists have made projections concerning future increases in livestock production. These have been based on projected needs, on estimates of population growth, and on the assumption that continuous prosperity will result in more meat consumption per capita. In a comparison with 1965, Professor H. Van Vliet (27) indicates that total beef production in Canada is expected to increase by 60 per cent by 1980 and by 180 per cent by the year 2,000. Compared with the base period of 1955-58, Shefrin and Menzies (23) predict that the population will increase 63 per cent by 1980 and that the per capita consumption of beef will increase by 25 per cent.

At the provincial level the Report of the Committee on Manitoba's Economic Future (17), covering the period 1962-75, expects a similar growth in demand for livestock products and estimates that Manitoba could readily double its beef output by 1975. Census statistics (4) reveal that between 1951 and 1966 total cattle numbers rose from 671,183 to 1,151,179. Thus, during this period, total cattle numbers increased by 72 per cent. Only 12 per cent of this increase, however, occurred from 1961 to 1966. Realization of the prediction that beef production can be doubled by 1975 depends on extensive programs to facilitate expansion of the livestock industry and on a basic change in the attitude of farmers to the raising and finishing of beef cattle.

In 1966, 40 per cent of all farm cash receipts in Manitoba came from livestock (7). The income from field crops was 54 per cent. The relative position of the livestock industry with respect to income is therefore important to Manitoba farmers. Periods of ready markets for grain, of course, tend to discourage livestock production. Grain markets for the future, however, are not assured whereas market demand for beef is expanding.

A.M. Runciman, President of the United Grain Growers, has warned the Western Canadian agricultural community that the wheat grower is on the brink of the greatest readjustment period he has faced since the 1930's (16). He predicted that unless something unforeseen happens the 1968-69 wheat quotas will not exceed five bushels per seeded acre; hardly enough to cover operating expenses. The basic problem is lack

of sales in an over-supplied world market. This predicament could continue for some time.

With the above basic considerations in mind, it becomes imperative to study some of the factors involved in beef production if expected requirements are to be met.

A. FARMER'S CONCERN

Specifically, the farmer is interested in knowing the conditions under which a beef cattle operation is profitable. The farm operator is asking many questions concerning the benefits of a beef cattle enterprise to the overall farm business. Is the beef cow herd profitable if it is necessary to pay market prices for all resources? Is labor a restricting factor during the cropping season? Is the beef cow herd able to compete for resources in situations where the farm operator has a relatively small amount of capital available for use in his farm business? Is the beef herd able to profitably compete for farm resources with average, less than average or above average beef prices? Is there a substitution of livestock for grain enterprise at average or below average grain prices? With quota restrictions on grain deliveries but given the opportunity to sell unlimited amounts of grain for feed at lower prices, is a beef cow herd profitable? What is the least cost ration for the beef cow herd? Given certain alternative cattle management systems which one is the most profitable? Which combination of livestock - grain operation is the most suitable? These are some of the questions that concern the farm operator.

To answer the questions outlined above it is first necessary to collect data on costs, returns and resource requirements for beef cattle herds. With this information it may be possible to answer some of the questions concerning the conditions that affect the profitability of a beef cattle enterprise.

B. THE PROBLEM

Despite the importance of the beef cattle enterprise many professional agriculturalists as well as some farm operators believe that this enterprise is poorly managed and provides relatively low returns. There are five main obstacles that hinder greater beef production:

(1) Low weaning percentage and low weaning weight.

(2) Feeding programs. Many farmers overfeed stock, or rations are not balanced to meet animal requirements; hence costs increase.

(3) Low pasture carrying capacity. This may mean that the pasture land is low in yield and/or in quality or that a considerable amount of waste land cannot be used at all in its present form.

(4) Relatively poor breeding stock.

(5) Many farmers lack operating capital, are unable to obtain credit or are unwilling to borrow capital.

Some of these problems are functions of management. Management factors and costs of production have frequently been cited for their importance in determining profits. Most livestock men are aware of their

significance but find it difficult to improve on them. To the extent that this is so, there exists an opportunity for increasing income through improved management practices.

C. STUDY OBJECTIVE

This study presents and analyzes information pertaining to beef-grain operations in West Central Manitoba. It will provide some data on production practices, costs and associated returns that presently prevail on farms in this area.

If farmers are to make the most profitable use of their resources, they must evaluate in a systematic way the profits resulting from different production alternatives. With rapidly changing technology and fluctuations in economic conditions, this evaluation process must be continuous. Farmers who fail to adjust to new circumstances find it increasingly difficult to achieve profitable farm operations.

The main objective of this paper is to make an economic evaluation of beef cattle production in West Central Manitoba. This will be accomplished in the following ways:

(1) By outlining the present organization of beef cattle enterprises.

(2) By describing the present practices that farmers follow in managing their beef cow herds and by determining whether various practices cause differences in returns over costs.

(3) By providing input-output information on feed requirements, labor, machinery and other costs.

(4) By determining which system of beef cattle management may be most profitable.

This paper is directed to those operators presently in the cattle business. Operators who have liquidated their herds are not likely to return to cattle production even though prices become more favourable. The time and costs involved in rebuilding a herd is a major impediment to re-entry.

D. METHODOLOGY

Forty farmers in West Central Manitoba were interviewed on their beef cattle operations covering the 1964-1966 period. These farm operators had previously participated or were presently members of the Manitoba Farm Business Group Program 1/. At the time of visitation the farm account book was checked for accuracy and information on physical inputs were obtained. Due to the fact that uniform and complete data on all production costs were lacking, some costs had to be synthesized from other studies and research reports. In a later section, some of the cost data pertaining to the production coefficients will be described.

The analysis also includes an economic evaluation of some of the improved production practices that are usually recommended to cattlemen.

1/ The Manitoba Farm Business Group Program is a three year project in which farmers keep records of their whole farm operation as well as additional feed and labor records which enable them to analyze each enterprise on their farm. The program is continuous in nature in that a new group is set up when one graduates. In addition to record keeping, regular meetings are held to discuss such topics as farm management, agricultural engineering, soils, crops and livestock with instructors from the respective branches of the Manitoba Department of Agriculture.

Given certain resources linear programming will be used to select the most profitable combination of enterprises. This information should enable farm operators to evaluate the potential adjustments and the benefits of a beef cattle enterprise in their farm operations.

The data presented herein do not represent any particular sample farm because each farm is unique and differs in certain respects from other farms. Modifications may, however, be incorporated to fit individual circumstances. The information could thus be used as a framework and reference tool for use in individual farm planning.

E. STUDY AREA

The information presented in this study applies to the Newdale-Birtle-Russel area in West Central Manitoba (Figure 1). The clay loam soils are relatively fertile Northern Black Earths developed on glacial till (11). The undulating topography is characterized by numerous small potholes and undrained depressions. Grain and forage crops grown are those common to the Prairies. In this area the high percentage of unimproved land, good water supply and abundance of feed grain favors the operation of beef cattle enterprises.

More generally, the data of this study could be applicable to the parkland area of Manitoba, Saskatchewan and Alberta. Some adjustments may be needed in yield relationships, prices and input requirements because of the differences in climate, distance to market and other factors, but these adjustments would be minor.

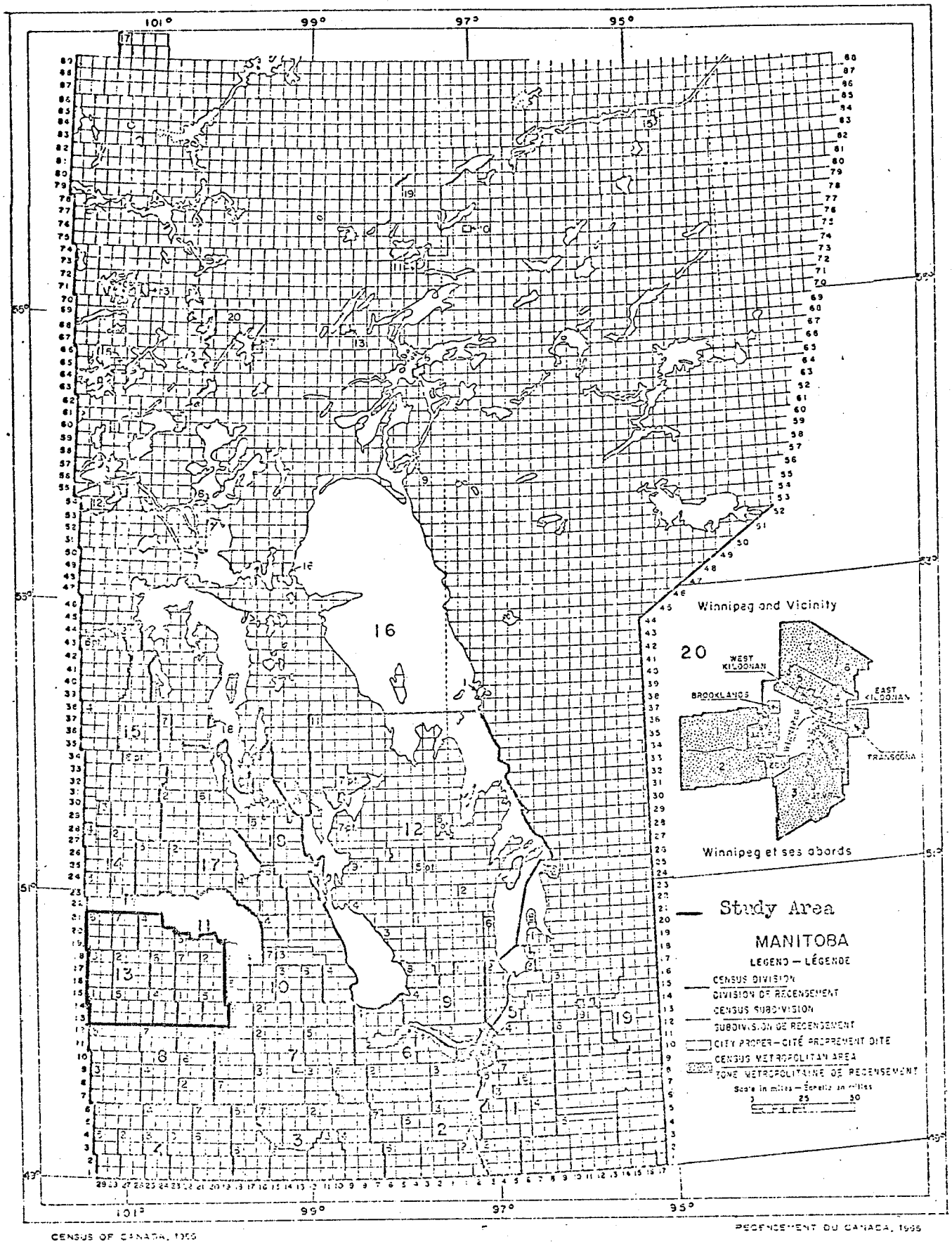

Figure 1. Census Division of Manitoba

Census Divisions 11 and 13 are representative of the area selected for study. Table 1 shows farms in these divisions classified by size-group. In 1966 the average size of farm was 578 acres of which 63 per cent was improved. Generally the farms analyzed in this study were larger than average. Most sample farms fall in the ranges over 560 acres and in most instances represent the top 40 per cent of all census farms.

Cattle numbers increased by about 10 per cent between 1961 and 1966 in Census Divisions 11 and 13. Since the number of farms with cattle declined from 3,088 to 2,594 during this period, the number of head per farm correspondingly increased from 32 to 42. Several factors are responsible for these changes.

TABLE 1

CENSUS FARMS CLASSIFIED BY SIZE OF FARM, CENSUS DIVISIONS 11 AND 13, MANITOBA, 1966

Size range	Number	Per cent
Under 399 acres	1,248	37
400-559 acres	710	21
560-759 acres	635	19
760-1,119 acres	510	15
1,120-1,599 acres	200	6
Over 1,599 acres	74	2
Total	3,377	100

Source: Census of Canada, Agriculture, Manitoba, 1966.

Firstly, some farm operators with small cattle herds possibly found that the costs associated with livestock, equipment, machinery, buildings, wells and fences, etc. exceeded returns. These operators have either expanded their livestock operations to spread overhead costs or sold their herds. Some of the operators in this latter category have perhaps found off-farm employment.

Secondly, some operators have found that their labor can be more fully utilized throughout the year by expanding their cattle enterprise.

Thirdly, livestock prices in the mid - 1960's were somewhat more favourable than in the late 1950's or early 1960's. Furthermore the unstable market for grain in recent years has meant that grain supplies in excess of market quotas could be sold in the form of beef.

CHAPTER II

THEORETICAL BACKGROUND

Economics as a process of inquiry generally uses the scientific method of investigation. There is no such thing, however, as one scientific method because it changes from one field to another. The technique may vary from one research worker to another within a field and even from investigation by a single worker. Virtually all scientific research, however, will follow a common pattern that consists of essentially four steps:

1. The formation of hypothesis or hypotheses; that is, the formation of a system of general propositions to explain the behaviour of the facts.
2. The assembly of facts or existing information.
3. The prediction, which is an explanation obtained by deducing from the hypothesis certain specific conclusions not already known from the mere collection of facts.
4. The testing of the prediction by reference again to observed facts.

When actually engaged in research, it is not necessary to follow a neat four - step pattern. There is continual interaction among the four steps. Hypotheses help to explain facts. But additional facts or new interpretations of existing facts may cause scientists to revise their hypotheses.

In general, steps one and three are called theory and comprises the procedure called model construction. It follows then that economic theory is a set of hypotheses and predictions about economic phenomena. The theorist's main concern is that the reasoning follow a logical order so that the predictions can be deduced from the assumptions. The theorist may also be exploring new inferences from given assumptions. But in the end the theory must be tested against the facts. Granted that the logic is correct, the criterion of a good theory is that it be successful as a predictor.

THE PRODUCTION FUNCTION

The economic theory which is relevant to attaining the optimum allocation of resources is the concept of the production function and the law of diminishing returns 1/. The production function expresses the relationship between resource inputs and the resulting output (s). This relationship is valid only for a given state of technology. Samuelson (24) defines the production function as, "the technical relationship telling the amount of output capable of being produced by each and every set of specified inputs or factors of production". Mathematically, a general production function can be expressed as $Y = F(X_1 \ldots Xn)$ where $X_1 \ldots Xn$ are the inputs and Y is the total output.

1/ All Economic Principles presented here will assume perfectly competitive farms in accordance with the general nature of the agricultural industry.

In general, the production function is assumed to conform to the "law of diminishing returns", sometimes called the "law of variable proportions". This is a basic generalization of the relationship between the rate of input of productive services and the rate of output of product. The law of diminishing returns states that the addition of a variable input to fixed inputs results first in total physical product which increases at an increasing rate, second in total physical product which increases at a constant rate, third in total physical product which increases at a decreasing rate, and fourth in total physical product which decreases with increases in the variable factor. The range over which returns increase at an increasing rate is based on the universal experience that proportions are important in the production process; that is, returns from the variable input increase until some optimum proportion is approached and then decrease as the optimum proportion of the variable input to the fixed input is exceeded.

This law is valid under the following conditions: First, the state of technology is given. Second, it is necessary that there be productive services whose quantity is held constant. The law does not apply when all inputs are harmoniously varied; this is a problem of economy of scale. Third, the law premises the possibility of varying the proportions in which the various productive services combine. Obviously, if two productive services must be used in rigidly fixed proportions, an increase in one without proportionate increase of the other will lead to no increase of product (marginal product will be zero, and not diminishing). For the law to be relevant, it is necessary that

the proportions in which productive services combine, generally be variable.

Another concept of importance is that of marginal product. The marginal physical product (MPP) is the addition to or increment in total production resulting from an increment in the variable input. When total physical product (TPP) increases at an increasing rate, the marginal physical product is increasing. When total physical product increases at a constant rate marginal physical product is constant. When total physical product is increasing at a decreasing rate, marginal physical product is decreasing. When total physical product is decreasing with increases in the variable factor, the marginal physical product is less than zero. The average physical (APP) product of an input is that proportion of total physical product produced by the variable input divided by the amount of the variable input used.

One can designate the total amount of Y produced as physical product. The line indicating the relationship between an output Y and an input X_1 is the total physical product (TPP). The line showing how the marginal physical product depends on X_1 is shown as the marginal physical product line (MPP). The line showing how average physical product depends on X_1 is designated as the average physical product line (APP). These are shown in Figure 2.

The elasticity of production (E_p) is the ratio formed by dividing the percentage change in total product by the percentage change in total amount of the variable factor. The elasticity of production indicates

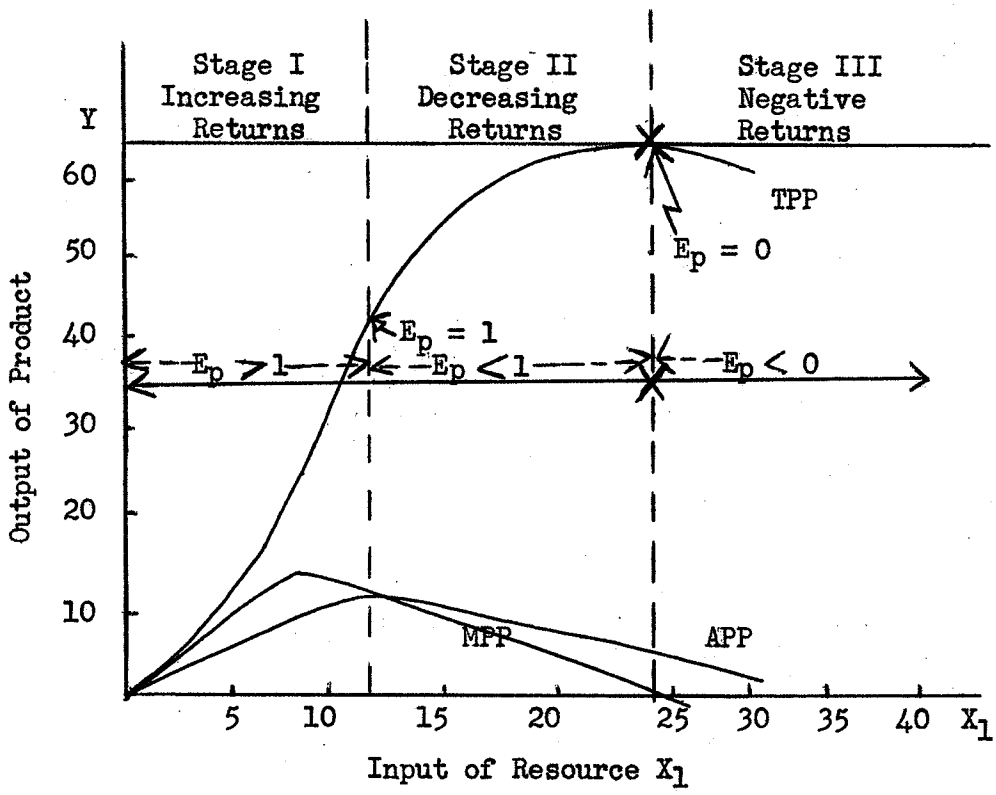

Figure 2. An input-output relationship showing average, marginal and total physical productivity in Stages I, II, and III.

the nature of the returns to scale for the business as a whole. The returns to scale are diminishing if the E_p is less than one and greater than zero, increasing if greater than one and constant if equal to one.

Figure 2 is divided into three stages. In Stage 1 the marginal physical product is always greater than the average physical product and extends to the input level which results in a maximum average productivity of the variable factor; the maximum point on the average physical product defines the end of Stage 1. Stage II extends from the input level denoting a maximum average product to the one defining the maximum total product. Stage III indicates all levels of output for which a negative marginal product exists and extends over the entire range of

declining total output. A production function showing increasing marginal returns alone would have only Stage I. One characterized by decreasing marginal returns from the outset might have Stage I and could include both Stages II and III.

Any level of resource use falling into Stage I is irrational since the average productivity of all previous inputs of the variable resource increases continuously as additional amounts of the variable resource services are added. If it is known that it pays to produce any quantity, it follows that it pays to produce at least the maximum amount which can be produced in Stage I. Hence one can recommend without reference to prices to drive the process to the edge of Stage I or into Stage II. However, in the extreme short run, it may be necessary to operate in Stage I. If this is the case, the marginal productivity of the fixed factor(s) is actually negative.

Stage III is also an irrational area of production since the marginal product is negative and hence additional inputs decrease output. However, now the variable factor rather than the fixed resource is withdrawn from use. Here also the physical scientist can flatly state that it does not pay a competitive business to use quantities of X_1 which would carry the process into Stage III. Some farmers may operate in this stage, however, due to lack of knowledge.

Stage II is the only rational range in which to produce. The rate at which variable factors are applied to fixed factors can never fall outside of this stage if economic returns are to be maximized.

However, the exact economic intensity of production cannot be stipulated within Stage II until prices and costs are specified. Physical relationships alone are not sufficient to indicate the optimum rate of production.

The economic question is, at what point does the value of the marginal physical product become equal to the cost of the input used to secure it? Obviously, as long as the production process pays more per additional unit of input than the additional unit of input costs, it pays to expand production. Equally obvious is that it does not pay to expand production beyond the point at which the value of marginal product is equal to the cost of the input because here additional expenditures for the input, produce a quantity of product having a smaller value than the increment of output. The relevant principles and computation procedures involved in profit maximization are now considered.

CRITERIA FOR EFFICIENT RESOURCE ALLOCATION

In Stage II, any management recommendations as to the optimum amount of X_1 to use in the production of Y must depend on the price of Y and the price of X_1, as well as on physical relationships. Also, any recommendations concerning optimum rates of input made under one set of price conditions are automatically wrong under a different set of price conditions. This reveals a fundamental condition for the optimum use of the variable X_1.

If the total output is to be maximized, a resource must be allocated among technical units (acres, cows, etc.) in a manner such that its marginal productivity is equal in all cases; this condition must hold for all resources. With resources given and limited, maximum efficiency is attained only as it becomes impossible to reshuffle variable resources without decreasing total product.

The physical relationships of production may be converted to value relationships simply by multiplying total, average and marginal physical products by the price of the product. These values correspond to the total, average and marginal value products under conditions of perfect competition and knowledge. Then in order to ascertain the optimum use of X_1, it is necessary that the marginal value product of X_1 ($MVPx_1$) must be equal to the price of X_1 (Px_1). In equation form this can be stated as 1/:

$$MVP = Px_1 \quad \text{or} \quad \frac{MVP}{Px_1} = 1 \qquad (2)$$

or as $\frac{\Delta Y}{\Delta X_1} = \frac{Px_1}{PY}$ where $\frac{\Delta Y}{\Delta X_1}$ is the marginal value productivity 2/ of X_1 and the terms Px_1 and Py are the prices of the resource and product output, respectively. Cross multiplying, this equation becomes $(\Delta Y)(Py) = \Delta X_1 (Px_1)$ where the term $(\Delta Y)(Py)$ may be regarded as the marginal value product of the resource, while $(\Delta X_1)(Px_1)$ may be regarded as the marginal factor cost. Since $X_1 = 1$, it follows that $(\Delta Y)(Py) = Px_1$.

1/ Only under conditions of "perfect competition".

2/ The notation Δ means "change in".

These equations imply that (1) if the last unit of X_1 does not pay for itself, less of X_1 should be used, (2) if the last unit of X_1 more than pays for itself, more of X_1 should be used, and (3) that use of X_1 should be stopped at the point at which X_1 just pays for itself.

When several resources are considered from the standpoint of one enterprise, $Y = f\ (x_1, x_2, \ldots Xn)$, the optimum combination of the resource occurs where the following equation holds:

$$\frac{MVPx_1Y}{Px_1} = \frac{MVPx_2Y}{PX_2} = \ldots\ldots = \frac{MVPxnY}{PXn}$$

where $MVPx_i$ is the marginal value productivity of resource X_i and where Px_i is its cost.

When several resources are being utilized in several alternative enterprises, the criterion of efficient resource use must be considered in terms of the marginal value productivity of the resources:

$$\frac{MVPx_1\ Y_1}{Px_1} = \frac{MVPx_1\ Y_2}{Px_1} --- = \frac{MVPx_2Y_1}{Px_2} = \frac{MVPx_2Y_2}{Px_2} ----$$

$$--- \frac{MVPx_3Y_1}{Px_3} = \frac{MVPx_3Y_2}{Px_3} = --- \frac{MVPXnYm}{PXn}.$$

The term $\frac{MVPXnYm}{PXn}$ is the marginal value productivity of resource Xn in enterprise Ym, and Pxn is the price of the respective resource inputs X_1 --- Xn.

The general condition for efficient resource allocation is that the ratios must be equal and greater than 1.0 if capital is limited. This condition implies that the scarce resources should be allocated in

such a manner that the marginal value productivity of each of the resources should be proportional to their prices. If capital is unlimited the ratios must equal 1.0 and each resource just equals its marginal value productivity.

LINEAR PROGRAMMING

In this study the possible tools considered for investigating economic adjustments were budgeting and linear programming. Because of the number of solutions considered it was decided that linear programming would be more appropriate in this analysis. It would also provide for an optimum allocation of the available resources.

A farm budget is a written plan for future action plus the anticipated results. Basically a budget converges on two figures for a given period. One of these figures is total revenue for the period or situation under consideration. The other figure is total expenses for the same period. The difference between these two figures is called net profit or net return or net loss, depending on whether net revenues are greater than or less than expenses. A budget can be detailed or general - it can be complete, covering an entire farm (both home and business), or partial, covering only the business aspect of the farm or only a portion thereof, such as one enterprise (13).

Linear programming is an empirical tool developed during World War II for determining the best method of allocating scarce resources (14). Since then, the method has become highly refined and is being used by a large number of private firms and research organizations. It has been

used by agricultural economists to specify the optimum organization of resources and enterprises on farms, to suggest desirable adjustments, to determine least-cost rations, to indicate optimum interregional patterns of resource use and product specialization in agriculture, and to solve related types of problems.

Linear programming has been defined as the maximization or minimization of a linear function subject to specific linear equalities or inequalities. The significance of most problems is the fact that a group of limited resources must be shared among a number of competing demands, and all decisions are interlocking because they all have to be made under a common set of fixed limits.

Linear programming cannot answer all things. One should not discredit the tool itself, however, but it should be put in its proper perspective. Dorfman has said "No mathematical model simple enough to be manageable can reflect adequately the intricate blundering decision making process of the real economic world (9)." Probably one should be satisfied with the conclusion of Henderson and Schlaifer that, "Mathematical programming cannot replace judgment, but it can supply some of the factual information that management needs in order to make judgments" (15).

Several assumptions are necessary for linear programming: (a) linearity, (b) divisibility, (c) additivity, and (d) finiteness. Together with these assumptions is the idea of a process. Technically a process involves one or more functional relationships in which all

the inputs and outputs enter as dependent variables and there is only one independent variable, the level of the process. Each process requires a different bundle of production factors. Variations in each of these processes, if occurring, can be treated as additional processes. It departs from our traditional way of thinking of absolute divisibility and substitution of individual factors of production one for the other.

Linearity means that input factors combine in fixed proportions at all levels of output. Also, output will vary in fixed proportions with any given input, and thus, we have neither economies nor diseconomies of scale in the use of a given process. Actually these assumptions need not restrict the researcher. Linear approximations of appropriate sections of curvilinear production functions are adequate for most answers for which data are available. There is, however, the problem that factor or product prices may vary with quantities bought and sold. Quantity discounts for fuel, spray, fertilizers, etc. are common. Variable price contracts for such products as fluid milk and broilers occur frequently. This, however, can be overcome if each linear segment is properly defined and each applicable approximation is handled simply as a new process. In any case linear assumptions are not unique to this tool of analysis.

The assumption of divisibility also may pose problems for inputs purchased in bulk, machinery and equipment, consulting services, etc. Additivity merely says that processes can be added. Two activities carried out simultaneously is simply the sum of these activities if they are carried out singly. The assumption of finiteness means that there

is a limit to the number of alternative activities and to the resource restrictions which need be considered. This is practical because most farmers do not have an unlimited number of alternatives or resources.

Budgeting is the same general technique as linear programming. Both use the assumption of linearity, constant input-output ratios, price and cost coefficients, divisibility, independence, specification of physical and economic restrictions on alternatives. They require essentially the same information and have about the same limitations.

There are some differences, however, in these methods. Budgeting is seldom used to find the one unique production alternative which gives maximum profits. Ordinarily, it is used to determine which one of two producing methods are best. The many other alternative organizations are not examined. Budgeting can be used, to determine which one of a hundred programs gives greatest returns but it is too time consuming and costly. Linear programming can handle large scale problems and can specify the optimum program in a fraction of the time when a electronic computer is utilized. Budgeting cannot or it contains less obvious guides for knowing when an optimum allocation is achieved.

Of particular interest to the economist are the computational by-products obtained with linear programming. Reference is made to the marginal value productivities of those resources which are limiting. Their major value is as an indicator of how much the net cash revenue would be increased by the addition of one unit of the restrictive resource (or vice-versa). A simple comparison of this value with the

cost of obtaining the additional unit indicates whether or not this adjustment is desirable. The addition of one unit is not likely, but this information can be used as a guide in considering what changes in the fixed resources should be considered.

In linear programming some resources are fixed and some are variable. Fixed resources are resources such as land and labor that are available only in fixed amounts. Variable resources would be resources such as fertilizer and feed that can be purchased until capital is exhausted. In linear programming, the costs of the variable resources needed to produce a certain product may be deducted from the price of the product. Thus linear programming maximizes net return to a fixed bundle of resources. Maximum profits accrue when the marginal value product for the last unit of the fixed resource employed in producing any product is equal for all products.

The preceding discussion provides the theoretical framework for determining conditions that are conducive to maintaining a beef cattle operation. The factor inputs, production coefficients, and price used in this study are presented in a subsequent chapter.

CHAPTER III

APPROACHES TO THE PROBLEM

The problem of selecting farms to be included in the study was approached in two different ways. The first approach considered was to select beef cattle farms on the basis of a random sampling procedure. This approach involved numbering all the farms in the study area from which a random sample would then be drawn from the total population. The advantages of this sampling procedure was that it would be possible to make some statistical generalization about the entire beef cow cattle numbers.

One disadvantage of this approach was the possibility that the sample selected would not contain herd sizes or the management system which this study proposed to analyze. Some farms do not have any cattle in this area and many have only a few head, thus it would be difficult to locate the beef cattle herds needed for this study. A second disadvantage to random sampling approach was that it would require more time and resources to collect the necessary information. On the basis of the additional resources required and the possibility of not having beef herds of sufficient size, the random sampling approach was eliminated.

The second approach considered and the one used was to obtain a list of farm operators who had participated in the Manitoba Farm Business Group Program. Therefore, one knew beforehand the structure and organizational set-up of these farms, size of beef herd, beef management

system followed and their location. Also some input-output data were available since these operators had a fairly accurate account of their farm business transactions for several years.

Initially, a letter explaining the nature of the project was mailed to each farmer who had been selected for study. They were asked about their willingness to submit the required information and to participate in the study. All farm operators contacted were willing to co-operate in the project. Selection of farms was made largely on the basis of size of cattle herd, the management system followed (feeder, cow-calf, or stocker operation), and geographic location. The criteria of herd size was a minimum of 20 cows and a maximum of 100. The geographic location was a rather arbitrary decision, but West Central Manitoba was chosen on the basis that the area has a relatively large number of beef-grain type of farm operations which this study proposed to analyze. The project was not set up to examine ranch type operations.

The next step was to visit each of the selected farms to complete a survey schedule which would supplement information already obtained from the operators farm account book. This visitation offered an opportunity to inspect the farm and beef herd and provide insight into the operation beyond the information from the questionnaire. Before taking the schedule, the farmer being interviewed was given further information about the nature of the research being conducted and the general type of questions he would be expected to answer. The cooperating farmers were then asked a specific set of questions about their farms and particularly their beef cattle operations (See Appendix A).

Collecting data by a farm survey method results in a certain amount of error. However, reliability of answers could be verified by cross-check questions and observations; also, wherever possible, with the operator's farm account book. Yearly production of crops was used as a cross-check on amounts of feed fed to the beef cattle, sales, seed used and beginning and end of year inventories.

CHARACTERISTICS OF THE SAMPLE

Data were obtained from 40 farm operators with beef cattle herds in West Central Manitoba for the period 1964-1966. For purposes of analysis farms were classified into three livestock management systems: cow-calf, feeder and stocker.

The cow-calf system is defined as one where most of the calves are sold in October or November as feeder calves. These calves are born in February or March and nursed until they are weaned and sold. They are then finished on other farms or feedlots. This operation is most suitable to farms that have large amounts of roughages, pasture and limited quantities of grain.

The feeder system is defined as one in which the calves are sold as finished animals. Most of the calves are farm produced but some may also be purchased. Management of the cow herd is usually the same as it is for the cow-calf system. After weaning, calves may be drylot fed until they are ready for sale as finished beef. Alternatively some farmers may feed their calves a growing ration through the winter and then provide a light grain feed on pasture until midsummer. Thereafter the cattle are

given a full grain feed before being offered for sale in the fall of the year. More grain and a smaller amount of forage is converted to saleable beef with the feeder system than with the cow-calf system.

The stocker system is defined as one in which market animals are sold as long yearlings. Usually the cow-herd is managed in the same manner as it is in the cow-calf system. After the calves are weaned, the farmer feeds the animal through the winter for growth and development rather than for fattening. In the spring the stockers are placed on pasture until the following fall when they are sold. These are then probably finished in a feedlot. To a large extent a good stocker program depends on an ample supply of inexpensive roughage for the winter and low cost pasture for the summer.

Every attempt was made to select farms which followed one livestock management system, i.e., cow-calf, feeder or stocker. All farm operators, however, did not rigidly adhere to one system. Some calves might be sold at weaning time as feeders and others might be winterfed and sold as finished beef in the spring. Each farm in this study was placed in the group closest to the particular system followed.

FARM ORGANIZATION

Land Use by Management System. The study farms with cow-calf systems averaged 1,504 acres, feeder systems, 1,012 acres, and stocker systems, 708 acres (Table 2). As the average census farm size in this area was 578 acres in 1966, the study farms were considerably above average in size.

Cow-calf farms averaged 756 acres of cropland or 50 per cent of the total farm area. Feeder cattle farms averaged 726 acres of cropland or 72 per cent of the total farm area and stocker farms averaged 479 acres of cropland or 67 per cent of the total farm area. Tame hay and pasture occupied 22 per cent of the cropland for cow-calf systems with 17 and 11 being the respective percentages for the stocker and feeder systems of operation. This indicates the somewhat higher pasture and forage requirements of the cow-calf and stocker systems. The percentage of cropland in cereal crops and small grains was 10 per cent higher for the feeder system than for the other two systems.

Machinery Investment. Table 3 shows the machinery and equipment investment by system of livestock operation. Cow-calf systems were larger in acreage and had considerably higher investments than the feeder or stocker systems. Investment per cropland acre was $29.54, $25.47 and $21.28 for the cow-calf, feeder and stocker systems, respectively.

TABLE 2

AVERAGE LAND USE PER FARM BY SYSTEM OF BEEF HERD MANAGEMENT, 40 FARMS, WEST CENTRAL MANITOBA

Land Use	System		
	Cow-calf	Feeder	Stocker
Number of farms	13	14	13
	- acres per farm -		
Cropland:			
Wheat	272	214	147
Oats	37	75	43
Barley	33	85	57
Flax	21	41	-
Mixed grain	6	3	6
Rapeseed	7	12	7
Silage	2	-	6
Grass and legume hay	112	44	48
Other	44	49	18
Improved pasture	50	33	28
New breaking	32	7	4
Summerfallow	140	163	115
Total improved	756	726	479
Native land:			
Hay	64	48	14
Pasture	398	119	55
Woods and waste	277	109	151
Total unimproved	739	276	220
Farmstead	9	10	9
Total farm area	1,504	1,012	708

TABLE 3

MACHINERY AND EQUIPMENT INVESTMENT BY SYSTEM OF BEEF HERD MANAGEMENT, 40 FARMS, WEST CENTRAL MANITOBA

Item	System		
	Cow-calf	Feeder	Stocker
Number of farms	13	14	13
	- dollars per farm -		
Cars	2,660	1,968	917
Trucks	1,423	1,052	668
Tractors	5,714	5,355	3,504
Total power	9,797	8,376	5,273
Combines	3,986	3,174	1,006
Swathers	883	80	149
Other general crop machinery	3,910	3,481	1,847
Haying equipment	2,203	1,844	1,338
Other	23	-	39
General livestock equipment	595	1,101	319
Miscellaneous equipment	936	434	406
Total machinery investment a/	22,333	18,490	10,193

a/ Value or investment at the beginning of the year.

Building Investment. Table 4 shows investment in buildings by system of beef herd management. Investment in barns, fences, wells and dugouts amounted to $5,564, $3,816 and $2,141 for the cow-calf, feeder and stocker operations respectively, or $8.59, $6.55 and $4.72 on a per animal unit basis.

TABLE 4

INVENTORY OF BUILDINGS BY SYSTEM OF BEEF HERD MANAGEMENT, 40 FARMS, WEST CENTRAL MANITOBA

Item	System		
	Cow-calf	Feeder	Stocker
Number of farms	13	14	13
	- dollars per farm -		
Main barn, feedlots, etc.	3,180	2,827	1,476
Machine shed, garage, etc.	1,319	1,286	449
Granaries	2,371	1,896	1,081
Fences, wells, dugouts	2,384	989	665
Other buildings	285	94	198
Total farm buildings	9,539	7,092	3,869
Houses	7,113	4,843	2,299
Total all buildings a/	16,652	11,935	6,168

a/ Value or investment at the beginning of the year.

Value of Production. Gross value of production by system of herd management is shown in Table 5. Miscellaneous income includes rentals, patronage payments, off-farm work, etc. Since patronage payments are included in the miscellaneous category, the value of crop production would be somewhat higher than the amount shown. The feeder cattle system of management purchased considerably more grain, feed and livestock than did the other two systems of management. Gross value of production per cropland acre amounted to $26.29, $30.86 and $27.70 for the cow-calf, feeder and stocker operations in the order given.

TABLE 5

GROSS VALUE OF PRODUCTION BY SYSTEM OF BEEF HERD MANAGEMENT, 40 FARMS, WEST CENTRAL MANITOBA

Item	System		
	Cow-calf	Feeder	Stocker
Number of farms	13	14	13
	- dollars per farm -		
Crop	9,614	11,070	7,163
Livestock	4,811	8,677	3,842
Milk and cream	134	109	119
Eggs	20	5	3
Miscellaneous	3,693	2,903	1,887
Total operating receipts	18,272	22,764	13,014
Change in livestock	15	343	349
Change in grain	2,112	941	493
Home used	112	261	247
Sub-total	20,511	24,309	14,103
Grain and feed purchased	385	705	388
Livestock purchased	253	1,196	445
Gross value	19,873	22,408	13,270

Expenses. Table 6 shows a summary of farm operating expenses by system of management. Livestock expenses include supplements, minerals, veterinary and medicine and other direct outlays. Grain, roughage or livestock purchased are not included since these were deducted from gross profit in Table 5. Farm overhead includes land taxes, fire insurance, hydro, telephone and miscellaneous items such as newspapers, bank charges, box rent, etc. Depreciation on farm buildings, machinery and equipment was a significant cost on all farms. Although depreciation is not an out-of-pocket expense in any given year, it nevertheless represents a true cost since it must be paid in the long run.

The gross expense ratio is a measure of efficiency which indicates the portion of gross income taken up by total costs. The respective ratios for the cow-calf, feeder and stocker systems of operation were 55 per cent, 50 per cent and 48 per cent.

Net Income. Net income is a measure of the profitability of the farm operation. In this study it was the return to operator for capital, labor and management. Net income per farm amounted to $8,872, $11,256 and $6,862 on cow-calf, feeder and stocker systems, respectively, or $11.74, $15.50 and $14.33 per cropland acre.

TABLE 6

SUMMARY OF EXPENSES BY SYSTEM OF BEEF HERD MANAGEMENT, 40 FARMS, WEST CENTRAL MANITOBA

Item	System		
	Cow-calf	Feeder	Stocker
Number of farms	13	14	13
	- dollars per farm -		
Crop	1,607	1,858	1,009
Livestock	278	529	208
Machinery and equipment	2,513	2,200	1,619
Buildings	431	381	99
Farm overhead	1,160	1,160	723
Small tools	81	170	97
Rent	318	1,172	731
Hired labor	619	433	368
Sub-total	7,007	7,903	4,854
Depreciation:			
Farm buildings	470	307	175
Machinery and equipment	3,524	2,942	1,379
Sub-total	3,994	3,249	1,554
Total farm expenses a/	11,001	11,152	6,408

a/ Does not include interest on investment.

Net Worth. Operating net worth measures the financial status at the end of the year (Table 7). It is the farm and personal assets minus the farm and personal liabilities. The operating net worth as calculated, will differ from "sell out" net worth by the amount that the estimated value of land and buildings differs from actual market value.

The value of real estate averaged $33.81, $46.97 and $38.92 per total acre and $67.26, $65.48 and $58.26 per cropland acre for the cow-calf, feeder and stocker systems of operation in that order. Operating net worth averaged $123.58, $116.97 and $111.07 respectively per cropland acre for the cow-calf, feeder and stocker operations.

Capital Turnover. Capital turnover is an efficiency measure which indicates the ratio of total farm investment to gross profit and is expressed as a percentage. Capital turnover is a measurement of productivity relative to investment; hence a high turnover ratio is usually associated with a profitable farm operation. The capital turnover was 21 per cent on the cow-calf systems and 25 per cent on both feeder and stocker systems. This shows that these systems turned over their total farm assets every four to five years on the average.

TABLE 7

NET WORTH STATEMENT BY SYSTEM OF BEEF HERD MANAGEMENT, 40 FARMS, WEST CENTRAL MANITOBA

Item	System		
	Cow-calf	Feeder	Stocker
Number of farms	13	14	13
	- dollars per farm -		
Real estate	50,849	47,537	27,906
Machinery and equipment	22,334	18,477	10,191
Livestock	12,060	11,924	8,838
Grain and feed	10,758	9,960	5,344
Supplies	458	369	338
Farm accounts receivable	106	147	38
Cash	213	158	503
Total farm assets	96,777	88,572	53,158
Farm liabilities	19,313	13,729	6,005
Total farm equity	77,464	74,843	47,153
Personal assets	15,960	10,074	6,051
Total net worth a/	93,424	84,917	53,204

a/ Value at beginning of the year.

CHAPTER IV

THE BEEF CATTLE ENTERPRISE

The purpose of this chapter is to describe the beef cattle enterprise prevailing on the sample farms. The description is intended to provide a better understanding of the problems encountered in maintaining a beef cattle herd in West Central Manitoba. Beef was the major livestock enterprise on all farms. Other livestock consisted of hogs, dairy cattle, and horses but these were all minor in importance.

Livestock Numbers. Cow-calf farm systems averaged 52.4 cows; feeder systems, 34.0 cows; and stocker system, 30.0 cows (Table 8). Basically, there were only breeding animals on hand for the cow-calf systems when the inventory was taken at the beginning and the end of the year. As the calves had not been dropped at these times, only late or early calves were found on the farms. On the other systems, calves were being held over the winter and were part of the inventory. Most farms had some heifers for replacing cull cows which averaged six head for all farms. The replacement rate ranged from a low of 12 per cent to a high of 20 per cent.

On the cow-calf systems the value of the cows averaged $164 and bulls $476; on the feeder systems cows averaged $162 and bulls $342; and on the stocker systems cows averaged $172 and bulls $364. These values were estimates made by the farmers at the time the inventories were taken and were based on their knowledge of market prices.

TABLE 8

INVENTORY OF LIVESTOCK BY SYSTEM OF BEEF HERD MANAGEMENT, 40 FARMS, WEST CENTRAL MANITOBA

Type	System					
	Cow-calf		Feeder		Stocker	
	No.	Value	No.	Value	No.	Value
		$		$		$
Number of farms	13		14		13	
Cows	52.4	8,612	34.0	5,520	30.0	5,156
Heifers (replacement)	6.4	851	5.7	824	6.7	865
Feeder calves	1.2	216	45.7	4,550	4.1	471
Stocker calves	-	-	.1	14	22.9	2,050
Calves	14.8	1,440	-	-	-	-
Bulls	1.6	761	1.4	479	.8	291
Total cattle a/	76.4	11,880	86.9	11,387	64.5	8,833

a/ Numbers and values are the average of the beginning and end of year inventory.

Feed and Other Current Costs. Table 9 shows the feed, pasture and other current costs per farm by system of beef herd management. Including replacement heifers the average total cost for these items on a per cow basis amounted to $62.53, $102.47 and $73.13 for the respective cow-calf, feeder and stocker systems of operation. The high operating costs per cow for the feeder operations resulted from a relatively large expense for feed grain.

TABLE 9

FEED AND PASTURE COSTS, VETERINARY AND MEDICINE EXPENSES FOR CATTLE ENTERPRISE BY SYSTEM OF BEEF HERD MANAGEMENT, 40 FARMS, WEST CENTRAL MANITOBA

Item	System		
	Cow-calf	Feeder	Stocker
Number of farms	13	14	13
	- dollars per farm -		
Wheat	-	162	18
Oats	612	1,253	569
Barley	16	363	166
Mixed grain	16	81	30
Screenings	3	31	13
Tame hay	1,490	1,148	741
Silage	19	12	115
Native hay	339	127	265
Straw	246	179	156
Other	62	5	61
Minerals and supplements	80	153	49
Sub-total feed	2,883	3,514	2,183
Veterinary and medicine	73	101	54
Other current costs	102	33	61
Pasture costs	619	420	386
Total operating costs	3,677	4,068	2,684

Building and Other Joint Costs. Building and other joint costs to the cattle operation are presented in Table 10. These costs were estimated by farmers at the time of visitation and represented that portion of total cost to be allocated to the livestock enterprise. On a per cow basis joint costs averaged $16.55, $20.91 and $15.31 for the cow-calf, feeder and stocker systems, respectively.

TABLE 10

BUILDINGS AND OTHER JOINT COSTS TO THE CATTLE OPERATION BY SYSTEMS OF BEEF HERD MANAGEMENT, 40 FARMS, WEST CENTRAL MANITOBA

Item	System		
	Cow-calf	Feeder	Stocker
Number of farms	13	14	13
	- dollars per farm -		
Livestock buildings	60	64	18
Granaries	8	4	1
Fences, wells, dugouts	104	54	51
Car	46	52	35
Truck	82	98	56
Tractor	85	64	70
General equipment	44	58	25
Fire insurance dues	85	33	19
Hydro and telephone	79	77	69
Depreciation:			
Building	184	116	94
Machinery and equipment	196	210	124
Total joint costs	973	830	562

Gross Returns to Cattle Operations. Returns from items sold were valued at the actual prices received (Table 11). In most cases these values reflect returns after deducting market and transportation costs. In some instances the farmer transported his own cattle to market in which case the farmer's time or costs were not considered in this table. Transporation charges would be included, however, with truck charges in Table 10.

Animals slaughtered and milk or cream consumed by the family were priced at market value. Manure nutrients were not evaluated in this study. The cost of purchased livestock was deducted from gross sales to arrive at gross returns to the livestock enterprise. On a per cow basis livestock returns, adjusted for change in inventory, averaged $79.47, $162.92 and $104.72 for the cow-calf, feeder and stocker systems of management, respectively. Only the feeder systems had any significant outlay for livestock purchases. This averaged $1,058 per farm.

TABLE 11

GROSS RETURNS PER FARM TO THE CATTLE OPERATIONS BY SYSTEMS OF BEEF HERD MANAGEMENT, 40 FARMS, WEST CENTRAL MANITOBA

Type of livestock	System					
	Cow-calf		Feeder		Stocker	
	No.	Value	No.	Value	No.	Value
		$		$		$
Number of farms	13		14		13	
Bulls	.5	132	.8	255	.3	73
Cows	6.2	654	3.9	634	5.4	722
Heifers	.5	40	4.3	682	1.2	143
Feeders	.3	45	25.7	5,146	-	-
Stockers		-		-	16.8	2,408
Calves	42.4	3,643	2.2	213	3.3	260
Sub-total	49.9	4,514	36.9	6,930	27.0	3,606
Cream and milk sales		134		109		113
Home consumed		136		155		159
Inventory change		41		332		368
Sub-total		4,825		7,526		4,246
Value of livestock purchased		152		1,058		403
Gross returns to livestock		4,673		6,468		3,843

Cost and Returns per Beef Cow. Production costs can be divided into variable or out-of-pocket and fixed or overhead costs. Farmers are usually more aware of variable costs because they must be paid during the production cycle. Market prices paid for these inputs were used in this study. These are presented together with returns on a per cow basis by system of management in Table 12.

TABLE 12

COSTS AND RETURNS PER BEEF COW BY SYSTEMS OF MANAGEMENT, 40 FARMS, WEST CENTRAL MANITOBA

Item	System		
	Cow-calf	Feeder	Stocker
Number of farms	13	14	13
		- dollars per cow -	
Costs (variable)			
Grain, supplements	11.00	47.61	21.69
Hay, silage, straw, etc.	38.03	40.91	37.79
Total feed	49.03	88.52	59.48
Interest a/	12.02	17.51	14.01
Insurance, dues, etc.	1.44	0.83	0.52
Veterinary, medicine	1.24	2.54	1.47
Hydro, telephone	1.34	1.94	1.88
Machinery and equipment	4.37	6.85	5.07
Buildings, fences, wells, etc.	2.93	3.07	1.91
Other costs	1.73	0.83	1.66
Total cash costs	74.10	122.09	86.00
Costs (fixed)			
Pasture	10.53	10.58	10.52
Buildings	7.87	7.03	5.72
Machinery and equipment	4.76	7.55	4.77
Total fixed costs b/	23.16	25.16	21.01
Total all costs	97.26	147.25	107.01
Returns			
Beef sales	76.77	174.55	98.26
Cream and milk sales	2.28	2.75	3.08
Home consumed	2.31	3.90	4.33
Livestock purchased	2.59	26.64	10.98
Total return	78.77	154.57	94.69
Inventory change	+ 0.70	+ 8.36	+10.03
Returns over all costs c/	-17.79	+ 15.68	- 2.29
Returns over cash costs	+ 5.37	+ 40.84	+18.72

a/ Interest on livestock inventory and farm stored hay and grain.

b/ Interest and depreciation on buildings and machinery are included as part of fixed costs.

c/ Adjusted for inventory change.

Fixed costs as determined in this study represent costs for pasture, buildings, machinery, and equipment. The fact that some operators did not meet total costs of production does not mean they would be forced out of production. Production could and would continue as long as the fixed assets are available for use or are replaceable with assets of satisfactory utility at a lower cost. As an example, some farmers used building space which they could not afford to replace with structures of similar design at current prices. It might also be possible for operators to handle the beef enterprise with less shelter than was actually used or to construct satisfactory shelter at a lower cost.

The average farmer using the cow-calf or stocker system of management failed to meet all costs. On the average the feeder operator was able to meet all expenses and provide some return to labor. All farm operators, regardless of management system, however, did receive a net return over cash costs on the average.

Considerable variation in production costs was found among the three systems. The feeder system used more resource inputs per cow but received the highest gross income. The cow-calf system had both lower costs and lower cash returns and also received a smaller return over cash costs per cow than the feeder or stocker systems. Pasture costs on a per cow basis were about the same for all systems of management. Feed inputs, however, were quite different. Grain and supplements, for instance, made up 22, 54 and 36 per cent of the costs for the ration in the cow-calf, feeder and stocker systems of operation respectively, whereas roughage amounted to 78, 46 and 64 per cent.

Returns over cash costs for the entire beef enterprise may be more meaningful to farm operators than the costs per cow or total costs of production. The beef enterprise may be economically desirable on the farm even though the total costs of labor, pasture and buildings are not fully covered. Based on the costs and returns in this study, 48 per cent of the farmers met all production costs including pasture and buildings and also received some returns to labor. Eighty-two per cent of the farm operators were able to meet their variable costs of production and then had some cash available for fixed costs. All farms managed to cover the cost of roughages, feed grains and supplements.

Labor Use. Table 13 shows the total hours of labor and hours per animal unit expended on the cattle enterprise according to system of management. Considerably less total labor and less labor per animal unit was used in operating the feeder system than in the other two systems of management. The difference in hours of labor used between the feeder and stocker systems may be due to the fact that the stockers were kept on farms over a longer period of time. The feeder systems also averaged 58.3 animal units compared with 45.4 animal units for the stocker system and may have resulted in economies of scale which could have reduced labor requirements per animal unit. The greater efficiency in labor use of the feeder systems compared with the cow-calf systems could be due to the fact that cow-calf systems at calving time require an additional amount of work on account of the greater average number of cows.

TABLE 13

HOURS OF LABOR USED FOR THE CATTLE ENTERPRISE BY MONTH AND SEASON ACCORDING TO SYSTEM OF BEEF HERD MANAGEMENT, 40 FARMS, WEST CENTRAL MANITOBA

Item	System					
	Cow-calf		Feeder		Stocker	
	Total hours	Hours per A.U.	Total hours	Hours per A.U.	Total hours	Hours per A.U.
Number of farms	13		14		13	
Number of animal units	64.8		58.3		45.4	
November	121.8	1.9	84.6	1.4	119.0	2.6
December	130.8	2.0	88.4	1.5	126.4	2.8
January	135.7	2.1	100.0	1.7	136.0	3.0
February	133.4	2.1	96.6	1.6	134.1	2.9
March	143.5	2.2	101.5	1.7	144.9	3.2
April	120.1	1.9	105.9	1.8	131.0	2.8
Total winter	785.3	12.2	577.0	9.7	791.4	17.3
May	74.0	1.1	51.6	.9	71.2	1.6
June	34.1	.5	36.8	.6	54.2	1.2
Total spring	108.1	1.6	88.4	1.5	125.4	2.8
July	45.6	.7	37.1	.6	35.2	.8
August	47.3	.7	30.3	.5	30.6	.7
Total summer	92.9	1.4	67.4	1.1	65.8	1.5
September	45.8	.7	33.7	.6	37.9	.8
October	61.5	1.0	43.9	.8	58.1	1.3
Total fall	107.3	1.7	77.6	1.4	96.0	2.1
Total labor use a/	1,093.6	16.9	810.4	13.7	1,078.6	23.7

a/ Labor use as estimated by the farm operator.

If all returns above cash costs were credited to labor, the cow-calf, feeder and stocker farm operators would have received $0.29, $2.00 and $0.64 per hour respectively. The feeder type of management system was, therefore, economically more advantageous than the cow-calf or stocker systems. The low labor returns in the latter systems can be attributed both to lower returns over cash costs and to higher labor requirements.

CHAPTER V

PROFITABLE BEEF CATTLE ENTERPRISES

The results of the previous chapter show that except for the feeder system of operation the beef cattle enterprise is unprofitable when paying market prices for all inputs. This brings forth the question, "Under what conditions is a beef cow herd profitable?" In this chapter several hypothetical farms with different input-output coefficients are examined and discussed. Linear programming is used to determine the combination of inputs that maximize returns to the fixed resources.

This section will analyze the profitability of beef cattle systems when the full market price is not paid for all resource inputs. Perhaps some farms have resources available such as pasture, buildings, fences, etc. for which there is no alternative use and hence is of little market value. A beef cattle operation might be profitable on these farms as long as it pays all the cash costs associated with the enterprise. The enterprise that should, however, be maintained depends on the kinds and amounts of resources, the enterprises competing for these resources and the relative prices of the products produced.

Following is a brief description of the resources available on the hypothetical farms that were developed, crop and livestock alternatives that were considered, and a list of the factor and product prices that were assumed.

Resources Available. It was assumed that all hypothetical farms had the following resource structure: 740 acres of cropland, 100 acres of native hayland, 300 acres of native pasture, sufficient tractors and machinery for farming existing land, and sufficient grain storage capacity for harvested grain. The level of resources available for use on the hypothetical farms was not selected to correspond to the level of resources for any specific farm. The reason for this was that one of the assumptions underlying linear programming is that of constant proportions or linearity. Providing linearity holds a doubling or tripling of resources results in the same proportionate increase in output. Thus, once an optimum farm plan is established for a hypothetical farm with a given level of resources, this same plan is optimal for a second farm that has twice the level of resources, except output in the second plan is double that of the first plan. Thus, if ten beef cows are found in the optimum farm plan for the first farm, twenty beef cows would be found in the optimum farm plan for the second farm.

Three labor supplies were assumed available for use on these hypothetical farms. A full time labor supply was assumed to be 2,640 hours per year or the amount of labor a farm operator working full time on the farm would have available for farm work. On most of these hypothetical farms the operator hired labor for six months of the year (May to October inclusive) but on some he hired labor for the full year. In addition to this, the operator could hire casual labor during May for spring field operations at $1.25 per hour and during the harvest season in September at $1.60 per hour. In some cases the operator was

not allowed to hire any labor to find what effect this had on the farm operations. It was also assumed that the operator had no family labor because there was very little of this type of labor used or available on the study farms.

In developing these hypothetical farms it was assumed the operator could buy hay up to a maximum of 50 tons at $15 per ton and rent pasture (community or other) up to a maximum of 20 animal units at eight dollars per unit per season. In addition to this the farmer could buy any required amount of oats and barley for feed at $0.65 and $1.00 per bushel, respectively. This price was slightly higher than what the farmer could sell oats or barley to take account of handling costs.

Three assumptions were made about capital availability (Table 14). The operator was assumed to have three sources of capital, namely: (1) personal, (2) trade, and (3) bank capital. Personal capital was cash available to the farm business from the farm operator's previous earnings. Trade capital was credit available from a variety of sources such as machinery dealers, feed and oil companies, fertilizer manufacturers, etc. Bank capital was a source of credit from any financial institution including provincial and federal governments. From each of these sources there were three levels of capital made available. Some of the hypothetical farms had access to personal, trade and bank credit up to a maximum of $2,500, $2,500 and $5,000, respectively. Others had access to $5,000, $5,000 and $10,000 from personal, trade and bank sources in that order. A third situation was where the operator had access to an unlimited supply of capital from each of these

TABLE 14

AVAILABILITY OF CAPITAL ON HYPOTHETICAL FARMS

Type of Capital	Capital Level		
	One	Two	Three
		- dollars -	
Personal	2,500	5,000	unlimited
Trade	2,500	5,000	unlimited
Bank	5,000	10,000	unlimited

categories. Unlimited capital availability was used to determine the amount of capital needed to establish the optimum farm plan. Limited access to capital was used to determine the effect of capital rationing on the crop activities and the beef enterprise.

An interest charge of six per cent per annum was assumed for trade capital. The operator was allowed this type of credit only for the cropping enterprise, hence was only required for about eight months out of the year. Therefore, the effective rate was four per cent on trade capital. Bank credit was charged a six per cent interest rate and could only be used for the livestock enterprise. It was assumed this type of credit was used throughout the year. Personal credit was assumed available at an effective rate of two per cent for both livestock and crop production.

The availability of building space for the livestock enterprise on the hypothetical farms was assumed to be 1,890 square feet for the feeder or stocker enterprise and 2,500 square feet for the cow-calf

enterprise. These figures were used because this was approximately the amount of space available on the study farms.

Production Alternatives. Production alternatives considered were those most likely to be serious competitors for resources available on farms in West Central Manitoba. The input-output relationships used for crop and livestock enterprises might reflect levels of efficiency and managerial ability somewhat above average in some instances. Farmers co-operating in the Manitoba Farm Business Groups are probably somewhat above average in managerial capacity because they are participating in this program. They also operate larger units and have more resources available to operate the farm business.

Crop resource requirements and yields were estimated on the basis of the study data, together with information obtained from agronomists, soil scientists, farm management reports and other miscellaneous publications 1/. Estimates on yield response to fertilizers were obtained from the Manitoba Crop Insurance Corporation and other fertilizer trial data. Similarly, livestock yields and resource requirements were based on information obtained from animal scientists and specialists, farm

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1/ General sources of information used to estimate resource requirements were the 1964, 1965 and 1966 annual reports and records of the Manitoba Farm Business Groups (5), the 1964, 1965, 1966 annual reports of the Western Manitoba Farm Business Association (1), Principles and Practises of Commercial Farming (26), Sanford Evans Statistical Services (25), Yearbook of Manitoba Agriculture (21), Frontiers in Animal Nutrition (12), and Canadian Farm Building Plan Services (6).

management service reports, and other miscellaneous publications 1/. Information on size of machinery, sequence of field operations and other cultural practises was obtained from farmers that participated in this study.

Crop Production Alternatives and Crop Yields. Soil and climatic conditions are primary factors in determining crop production alternatives. The growing season in West Central Manitoba is relatively short, 82 days being the normal frost free period (19). Grain yields, however, are somewhat higher relative to other areas in Manitoba.

The hypothetical farms were given the opportunity to grow wheat, oats, barley, flaxseed and tame hay. In this study, no particular rotation was specified. The rotation that evolved on these farms was determined by the program model which specified the acreages of each crop to be grown in the various farm plans that would maximize returns to the fixed factors. Two restrictions, however, were placed on the rotation, namely: (1) each farm plan must have at least 15 per cent of the cropland in summerfallow, and (2) no more than 25 per cent of the cropland could be used for growing flaxseed. A grain marketing quota of six and ten bushels per cultivated acre plus the unit quota

1/ Data on costs and time requirements for field operations were obtained from, Economic Aspects of Farm Machinery Use in Crop Production, M.J. Dubois, (10). Information on size of farm machinery, sequence of operations and time over for field operations and other cultural practises was obtained from farm operators that co-operated in the study.

was imposed on the hypothetical farms. Some of the farms were allowed to sell unlimited quantities of cereal grain to study the quota effect on farm income. No marketing restrictions were placed on the sale of flaxseed. On some farms the operator was given the opportunity to sell unlimited amounts of grain for livestock feed in addition to the Canadian Wheat Board quota, but at lower prices (Table 15). In this study a 10-year average price (1956-65) was used for grain sold to the Canadian Wheat Board with adjustments for freight rates and handling charges. Non-quota feed grain prices were estimated by the farmer and were about 20 to 30 per cent lower than the regular quota prices.

It was assumed that the cereal grains and flaxseed could either be left unfertilized or fertilized according to whichever was most profitable. The yields used in this study (18) are 20-year average yields (1946-66) adjusted for fertilizer use (Table 16). The Manitoba Crop Insurance Corporation supplied information on yield response to fertilizers; supplemented by data from the study farms. Tame hay could be seeded on the cropland but had to compete for land with the cereal grains. Native hay acreage could either be cut and fed to the livestock or left unused. The native pasture could be used by the livestock enterprise or left idle.

A full line of power equipment and associated machinery (including tractors, tillage and harvesting equipment) was assumed for all the hypothetical farms. The resources required for crop production and the associated costs are shown in Table 17. It was assumed there was

TABLE 15

PRICE ASSUMPTIONS FOR CEREAL GRAINS AND FLAXSEED

Item	Grade	Price
		- dollars per bushel -
Wheat (quota)	No. 3 Northern	1.60
Wheat (non-quota)	No. 3 Northern	1.35
Barley (quota)	No. 1 Feed	.96
Barley (non-quota)	No. 1 Feed	.75
Oats (quota)	No. 1 Feed	.60
Oats (non-quota)	No. 1 Feed	.48
Flaxseed	No. 1	2.83

TABLE 16

YIELD ASSUMPTIONS FOR CEREAL GRAINS AND FLAX, FERTILIZED AND UNFERTILIZED

Item	Yield of Grain a/ Fertilized	Unfertilized
	- bushels per acre -	
Wheat on summerfallow	30.0	25.0
Wheat on first year stubble	24.0	20.0
Wheat on second year stubble	23.0	19.0
Wheat, continuous	22.0	-
Oats on summerfallow	61.0	52.0
Oats on first year stubble	50.0	40.0
Oats on second year stubble	48.0	38.0
Barley on summerfallow	43.0	35.0
Barley on first year stubble	32.0	24.0
Barley on second year stubble	31.0	23.0
Flax on first year stubble	11.5	9.5
Flax on second year stubble	11.0	9.0

a/ These are 20-year average yields 1946-66 adjusted for fertilizer and non-fertilizer use.

no hired custom work because this was of minor importance on the survey farms.

Livestock Production Alternatives. Several livestock alternatives were considered for the hypothetical farms. These were cow-calf enterprise, feeder enterprise (purchased and/or reared on the farm) and stocker enterprise (purchased and/or reared on the farm).

The cow-calf enterprise was included for two reasons. First, this enterprise can make use of large amounts of roughages and pasture relative to grain, hence adapts to the land use system in West Central Manitoba. Second, it can make use of the operator's labor during the winter months when it otherwise has no alternative use.

The feeder and stocker enterprises were selected to provide an alternative to selling weanling calves. These enterprises would have the advantage of requiring less capital when the calves were raised on the farm than if purchased. A description of the livestock enterprises considered as production alternatives follows.

The Cow-Calf Enterprise. A 90 per cent calf crop was assumed for the beef cow-calf operation in most cases. For some situations this was reduced to 75 per cent. It was assumed that one replacement heifer was kept per year for each seven cows in the herd. Annual saleable products for the 90 per cent calf crop assumption were thus 75.3 per cent of a 400 pound calf and 14.3 per cent of a 1,000 pound cull cow. In the model the calves could be sold in the fall about the first of

TABLE 17

RESOURCES USED AND COSTS FOR CEREAL CROP, FLAXSEED AND HAY PRODUCTION

Item	Machine Costs a/	Weed Control	Fertilizer Costs	Seed Costs	Cleaning and Treatment	Crop Insurance b/	Total Cost
	- dollars per acre -						
Summerfallow	3.65						3.65
Wheat on fallow	5.39	.30	2.50	3.17	.14	1.00	12.50
Wheat on stubble	6.03	.30	2.70	3.17	.14	1.00	13.34
Oats on fallow	5.39	.30	2.50	2.70	.23	.96	12.08
Oats on stubble	6.03	.30	2.70	2.70	.23	.96	12.92
Barley on fallow	5.39	.30	2.50	2.69	.15	1.06	12.09
Barley on stubble	6.03	.30	2.70	2.69	.15	1.06	12.93
Flax on stubble	6.17	.30	2.70	2.72	.06	.99	12.94
Tame hay							10.26
Native hay							9.00

a/ Includes costs for fuel, oil, grease, repairs, depreciation and interest.

b/ Manitoba Crop Insurance Corporation Rates.

November and/or they could become a part of the feeder and/or stocker enterprises at this time.

Since available building space was assumed to be 2,500 square feet and each cow-calf unit required 45 square feet, the maximum number that could be had on these farms was 55 head. No consideration was given in this study to expanding these facilities.

A minimum cost ration for the beef cow herd was determined by the use of linear programming from the potentially available feeds, namely; wheat, oats, barley, tame hay and wild hay. In addition, urea, tallow and molasses could be purchased when they could be economically included in the ration. Beef produced and feed input requirements for the cow herd are summarized in Table 18. Data for cash expenses, pasture requirements and labor use were based primarily on information collected from farmers that cooperated in the study.

Net energy for maintenance on a per cow basis was assumed to be about 9.0 megacalories per day for a seven month feeding period or a total of 1,894 megacalories (12). Total weight of the winter feed requirements was estimated at 4,220 pounds per cow. The ration must contain at least eight per cent protein and not more than 70 per cent roughage.

TABLE 18

SUMMARY OF BEEF PRODUCED AND RESOURCES REQUIRED FOR THE COW-CALF ENTERPRISE

Item	Unit	Amount
		- per cow -
Calf crop raised	per cent	90
Weaning weight of calf	pound	400
Sale of beef produced:		
Cow beef	pound	143
Calf beef	pound	303
Total		446
Cash expenses a/	dollar	15.40
Space	sq. ft.	45.00
Labor	hour	16.89
Feed and nutrient requirements:		
Net energy maintenance	megcal.	≥ 1,894 b/
Protein	per cent	≥ 8.0 b/
Maximum roughage	per cent	≤ 70.0 c/
Weight of feed	cwt.	= 42.20 d/
Permanent pasture	acre	7.00

a/ Includes veterinary expenses, mineral supplements, sire services, power, repairs and upkeep of buildings.

b/ ≥ means "greater than or equal to".

c/ ≤ means "less than or equal to".

d/ = means "equal to".

Feeder Cattle Enterprises. The cattle feeding enterprise assumed that a 400 pound calf was put in the feed lot about November 1, fed throughout the winter and sold about eight months later at 1,000 pounds. These calves could have been purchased or they might have been calves that were raised on the farm. If purchased, the market value of the calf, handling and other miscellaneous cash costs were charged as an expense of acquiring and raising the feeder. If the calf was raised on the farm, only the miscellaneous cash costs were charged as an expense (Table 19).

Labor requirements and miscellaneous cash costs were primarily based on information collected from the study farms. Building requirements were based on data taken from Canadian Farm Plan Services Catalogues of Plans with some minor adjustments (6).

Net energy requirements for maintenance and production for feeder cattle were obtained from Frontiers in Nutrition Supplement (12). The total weight of feed required to bring the feeder calf to market weight (1,000 pounds) was estimated to be 4,566 pounds or about 7.5 pounds of feed per pound of gain. The minimum amount of protein and maximum amounts of tallow, molasses, urea and roughages to be included in the ration is shown in Table 19.

The Stocker Enterprise. The stocker operations assumed that the 400 pound calf which was weaned about November 1, was fed throughout the winter for growth and development (rather than fattening) and in the succeeding spring was placed on pasture. The stocker was sold in

TABLE 19

SUMMARY OF BEEF PRODUCED AND RESOURCES REQUIRED FOR THE FEEDER CATTLE ENTERPRISES

Item	Unit		Amount
			- per feeder -
Sale of feeder	pound		1,000
Cash expenses:			
Purchase cost of calf a/	dollar		109.50
Miscellaneous cash costs b/	dollar		8.30
Total	dollar		117.80
Space	sq. ft.		30.00
Labor	hour		13.94
Feed and nutrient requirements:			
Net energy for maintenance	megcal.	≥	1,363.0 c/
Net energy for production	megcal.	≥	1,227.0 c/
Protein	per cent	≥	10.4 c/
Tallow	per cent	≤	5.0 d/
Molasses	per cent	≤	10.0 d/
Maximum urea	per cent	≤	1.0 d/
Maximum roughage	per cent	≤	24.0 d/
Weight of feed	cwt.	=	45.66 e/

a/ Includes buying costs.
b/ Includes veterinary expenses, repair and upkeep of buildings, minerals and other miscellaneous expenses.
c/ ≥ means "greater than or equal to".
d/ ≤ means "less than or equal to".
e/ = means "equal to".

the fall at about 1,000 pounds. As with the feeder enterprise, the calf could be purchased or raised on the farm. If purchased, all costs were included, but if raised on the farm only the miscellaneous cash costs made up the expenses for the stocker. Sources of information for feed and other resource requirements were the same as for the feeder enterprise. All the resource requirements for the stocker operation are shown in Table 20.

Price Assumptions. Table 21 shows livestock prices used in this analysis (Appendix B). They are 10-year average prices (1957-66 inclusive) as reported from the Winnipeg Stockyards (20). The feeder prices shown are the average for Choice grade steers and heifers delivered to the yards. Stocker prices are the average for Good grade stocker steers and heifers. In calculating these prices, 60 per cent of these cattle were assumed to be males. Calf prices are an average for Choice and Good grade calves and the cow price is an average for Good grade cows. An alternative price was also used for stockers, feeders and calves. This price was about 10 per cent higher than the 10-year average and was used to show the effect of changes in beef prices on the optimum farm organization. Costs for resource inputs were not varied because beef prices are probably subject to more fluctuations and are more cyclical in nature than the value of these inputs.

Prices used for feed, hay and pasture were obtained from farm management service reports, farm planning prices published by the University of Manitoba, Prairie Farm Rehabilitation Administration and farmers who co-operated in this study.

TABLE 20

SUMMARY OF BEEF PRODUCED AND RESOURCES REQUIRED FOR THE STOCKER ENTERPRISE

Item	Unit	Amount
		- per stocker -
Sale of stocker	pound	1,000
Cash expenses:		
Purchase of calf a/	dollar	109.50
Miscellaneous cash costs b/	dollar	8.61
Total		118.11
Labor	hour	21.06
Space	sq. ft.	30.00
Feed and nutrient requirements:		
Net energy (maintenance)	megcal.	≥ 599.00 c/
Net energy (production)	megcal.	≥ 518.00 c/
Protein	per cent	≥ 10.00 c/
Maximum roughage	per cent	≤ 65.00 d/
Weight of feed	cwt.	= 31.74 e/
Pasture	acre	5.00

a/ Includes buying costs.
b/ Includes veterinary expenses, repairs and upkeep of buildings, minerals, and other miscellaneous costs.
c/ ≥ means "greater than or equal to".
d/ ≤ means "less than or equal to".
e/ = means "equal to".

TABLE 21

FACTOR AND PRODUCT PRICES

Factor or Product	Unit	Price
		- dollars -
Hay purchased	ton	15.00
Rented pasture (per season)	A.U.	8.00
Feed Prices:		
Urea	cwt.	5.00
Molasses	cwt.	1.70
Tallow	cwt.	6.00
Purchased oats	bus.	.65
Purchased barley	bus.	1.00
Livestock Prices:		
Calves a/	cwt.	27.00
Feeders a/	cwt.	22.50
Stockers a/	cwt.	22.30
Cull cows a/	cwt.	16.00

a/ Ten-year average prices (1957-66 inclusive).

LINEAR PROGRAMMING RESULTS

The purpose of this section is to determine the conditions that are conducive to maintaining a beef cattle enterprise. Some of the livestock resource inputs are not charged the full market price in the following presentation. In the analysis it was assumed there was no alternative use for native pasture other than for beef cattle, hence there was no charge for this resource. Costs of tame or native hay included only the expenses of putting up hay. For some of the hypothetical farms feed grain for the livestock enterprise was valued below Canadian Wheat Board prices after the operator had filled his quota. The livestock enterprise, however, must be competitive since the operator was also given the opportunity to sell this grain. Land taxes are not included as a cost to the beef enterprise nor is there a charge for interest on investment in land or livestock except for purchased feeder or stocker cattle. Interest on investment and depreciation on machinery is included as an expense. With these assumptions in mind this section will attempt to describe situations in which the beef cattle enterprise might be profitably maintained.

1. THE EFFECT OF ALTERNATIVE BEEF AND FEED WHEAT PRICES ON FARM ORGANIZATION AND RETURNS TO FIXED FACTORS

Many farmers have questions concerning the effect that changes in beef prices and sales of non-quota feed grain have on maintaining a beef cattle enterprise. To determine the effect of these changes, three hypothetical farms were programmed. These farms and the optimum organization for each is shown in Table 22.

TABLE 22

OPTIMAL ORGANIZATION OF THREE HYPOTHETICAL FARMS WITH MEDIUM LEVELS OF CAPITAL, SIX BUSHEL QUOTA, AND ALTERNATIVE BEEF AND FEED WHEAT PRICES

Farm number		1	2	3
Capital levels		Medium	Medium	Medium
Quota		6	6	6
Livestock prices		Average	Average	High
Price feed wheat		$0.00	$1.35	$0.00
	Unit			
Return to fixed factors	dollar	15,715	16,659	17,382
Land Use:				
Wheat	acre	149	453	149
Oats	acre	142	112	142
Barley	acre	98	25	98
Flax	acre	185	-	185
Summerfallow	acre	166	150	166
Native hay	acre	76	68	76
Native pasture	acre	300	300	300
Labor Use:				
Winter	hour	1,320	1,320	1,320
Spring: Operator	hour	440	440	440
Hired	hour	298	289	298
Summer: Operator	hour	419	415	419
Hired	hour	74	45	74
Fall: Operator	hour	437	440	437
Hired	hour	126	58	126
Grain Sales:				
Wheat: Quota	bus.	3,729	4,839	3,729
Feed	bus.	-	6,465	-
Barley: Feed	bus.	3,265	-	3,265
Flax	bus.	2,118	-	2,118
Livestock Operations:				
Cow-calf (own)	head	55.6	48.8	55.6
Feeder (own)	head	39.6	37.0	39.6
Feeder (buy)	head	20.9	6.4	20.9
Stocker (own)	head	2.5	-	2.5
Stocker (buy)	head	-	19.6	-
Sell: Feeder	head	60.5	43.4	60.5
Stocker	head	2.5	19.6	2.5
Cull cows	head	7.9	7.0	7.9
Capital:	dollar	12,548	13,544	12,800
Other Activities and Resources:				
Rent pasture	A.U. 1/	14.5	20.0	14.5
Buy hay	ton	4.2	14.3	4.2

1/ Animal unit.

All three farms have the same basic resources and production alternatives except that beef and non-quota feed wheat prices were changed. The maximum capital available for use on these farms is $5,000 of trade capital, $5,000 of personal and $10,000 of bank capital. Hereafter this will be referred to as a medium level of capital availability. This, however, does not mean all this credit is required to operate these farms at the optimal level. The total credit actually used is shown in Table 22. A six bushel quota, plus the initial unit is imposed on all three farms.

The results show that all the farm plans included a beef enterprise where the calves raised were either sold as finished feeders in the spring or roughed through the winter, put on pasture the following spring and sold the following fall.

The organization of both farm numbers one and three was similar. Land and labor use, grain sales and livestock numbers were identical, as well as the use of pasture and purchased hay. Slightly more capital, however, was used on farm number three because the purchase price of livestock was somewhat higher. For the same reason the returns to fixed factors were $1,667 more on farm number three as compared to farm number one. Livestock space was used to the maximum initially assumed on these farms, and hence restricted further expansion of the beef enterprise.

The organization on farm number two was considerably different from farm numbers one and three due to the assumption that non-quota wheat could be sold as feed. Flax was not included in the rotation for

this plan. Only enough oats and barley were seeded to feed livestock. Summerfallow decreased somewhat and wheat acreage was tripled. All of the Canadian Wheat Board quota was filled with wheat sales and the balance of the wheat sold as feed.

The livestock operation on farm number two also changed considerably. Whereas farm numbers one and three sold most of the livestock as finished feeder cattle in the spring, farm number two had a stocker as well as a feeder operation. Also, fewer cows were kept on farm number two because it was more profitable to buy stockers to make use of the available pasture and winter labor supply.

These summaries indicate that farm plan three had the highest return to fixed factors of production. They show that the farm operator is financially better off with high livestock prices alone than when he had the opportunity to sell feed wheat at $1.35 per bushel with average livestock prices. It also indicates that a reorganization of the farm structure is necessary when non-quota feed wheat can be sold.

The marginal value products of selected limiting resources for plans one, two and three presented in Table 22 are shown in Table 23. Each value indicates the amount by which income would be increased with an additional unit of the respective resource. For example, an additional acre of land in plan one and three increased income by $12.85, in plan two by $17.02. Each additional bushel of wheat, oats and barley in plan one would increase income by $1.09, $0.51 and $0.75, respectively. Each hour of increase in the winter labor supply for plans one, two

TABLE 23

MARGINAL VALUE PRODUCTS OF SELECTED RESOURCES IN THE OPTIMUM FARM ORGANIZATION OF PLANS ONE, TWO AND THREE

Resource	Unit	Marginal Value Product		
		Plan One	Plan Two	Plan Three
		- dollars -		
Land 1/	acre	12.85	17.02	12.85
Wheat supply	bus.	1.09	1.35	1.09
Oats supply	bus.	.51	.64	.51
Barley supply	bus.	.75	.93	.75
Flax supply	bus.	2.83	2.91	2.83
Feeder cattle	feeder	224.88	224.88	255.88
Stocker cattle	stocker	222.88	222.88	245.88
Calves	calf	116.07	116.07	128.79
Cull cows	cow	155.84	158.23	157.50
Winter labor	hours	4.04	1.64	2.38
Feeder and stocker space	sq. ft.	.10	.37	1.26
Cow-calf space	sq. ft.	.17	-	.84
Quota	bus.	.51	.25	.51
Rent pasture	A.U. 2/	-	32.52	-

1/ Cropland only
2/ Equals one animal unit of grazing for the pasture season.

and three would increase income by $4.04, $1.64 and $2.38 in that order. An increase of one animal unit of grazing (renting pasture) would increase income by $32.52. These marginal values, however, are valid only over certain ranges which are often very short. For instance, the marginal value of winter labor in plan one is valid only with 12 less or 27 hours more of labor use. The marginal value of an acre of land would remain the same at $12.85 an acre with 76 fewer or 57 additional acres.

2. THE EFFECT OF ALTERNATIVE QUOTA LEVELS, BEEF AND FEED WHEAT PRICES ON FARM ORGANIZATION AND RETURNS TO FIXED FACTORS

Farmers establishing beef cattle enterprises are interested in the effect of alternative quota levels, beef and feed wheat prices on the cattle enterprise in their optimum farm plan. They are concerned about the stability of the enterprise because of adjustment problems that might arise. To determine the effect that quota levels and beef prices have on the optimum farm organization three hypothetical farms were programmed. The resources available on these farms and the optimum organization is presented in Table 24.

An equal number of beef cows was included in all farm plans. The only difference was that in plan four (with high livestock prices and non-quota feed wheat sales) a stocker operation was included with the cow-calf feeder enterprise; whereas, in plans one and five the livestock enterprises consisted almost wholly of a cow-calf feeder operation.

TABLE 24

OPTIMAL ORGANIZATION FOR THREE HYPOTHETICAL FARMS WITH MEDIUM LEVELS OF CAPITAL, ALTERNATIVE QUOTA LEVELS, BEEF AND FEED WHEAT PRICES

Farm number		1	4	5
Capital levels		Medium	Medium	Medium
Quota		6	6	10
Livestock prices		Average	High	Average
Price feed wheat		$0.00	$1.35	$0.00
	Unit			
Return to fixed factors	dollar	15,715	18,154	16,849
Land Use:				
Wheat	acre	149	438	223
Oats	acre	142	118	142
Barley	acre	-	28	24
Flax	acre	185	-	185
Summerfallow	acre	166	156	166
Native hay	acre	76	74	76
Native pasture	acre	300	300	300
Labor Use:				
Winter	hour	1,320	1,320	1,320
Spring: Operator	hour	440	440	440
Hired	hour	298	286	298
Summer: Operator	hour	419	417	419
Hired	hour	74	58	74
Fall: Operator	hour	437	440	437
Hired	hour	126	135	126
Grain Sales:				
Wheat: Quota	bus.	3,729	4,839	5,950
Feed	bus.	-	6,156	-
Barley: Feed	bus.	3,265	-	82
Flax	bus.	2,118	-	2,118
Livestock Operations:				
Cow-calf (own)	head	55.6	55.6	55.6
Feeder (own)	head	39.6	31.8	42.0
Feeder (buy)	head	20.9	17.2	18.5
Stocker (own)	head	2.5	10.2	-
Stocker (buy)	head	-	-	2.5
Sell: Feeder	head	60.5	49.0	60.5
Stocker	head	2.5	10.2	2.5
Cull cows	head	7.9	7.9	7.9
Capital:	dollar	12,548	12,713	12,569
Other Activities and Resources:				
Rent pasture	A.U. 1/	14.5	20.0	14.5
Buy hay	ton	4.2	8.9	4.2

1/ Animal unit.

In farm plan four no flax was included in the rotation. This suggests that it was more profitable to sell non-quota wheat at $1.35 per bushel than to grow flax. Labor and capital requirements were about the same for all three farm plans.

Plan four shows the highest return to fixed factors at $18,154. This indicates that under the assumed conditions, the farmer was better off with a six bushel quota, high livestock prices and non-quota wheat sales than with a 10 bushel quota, average livestock prices and no non-quota wheat sales.

The marginal value products of selected resources for plans one, four and five are shown in Table 25. The marginal values for plans one and five were identical except for land. The value of land increased possibly because of higher quota limitations in plan five. The marginal value for land was highest in plan four and could be due to high livestock prices and/or non-quota feed wheat sales. An additional hour of winter labor would have increased returns by more than four dollars in all these plans. This would indicate a good return for labor expended on the livestock enterprise.

3. THE EFFECT OF ALTERNATIVE CALVING RATES AND NO FEEDER OR STOCK ENTERPRISES ON THE OPTIMUM FARM ORGANIZATION

Farmers with beef cattle operations are interested in knowing the effect of alternative calving rates on the optimal farm organization. Two hypothetical farms with different calving rates were programmed

TABLE 25

MARGINAL VALUE PRODUCTS OF SELECTED RESOURCES IN THE OPTIMUM FARM ORGANIZATION OF PLANS ONE, FOUR AND FIVE

Resource	Unit	Marginal Value Products		
		Plan One	Plan Four	Plan Five
		- dollars -		
Land 1/	acre	12.85	17.02	14.89
Summerfallow	acre	40.12	21.15	40.12
First stubble land	acre	30.53	9.47	30.53
Second stubble land	acre	28.03	6.77	28.03
Third stubble land	acre	26.95	5.43	26.95
Wheat supply	bus.	1.09	1.35	1.09
Flax supply	bus.	2.83	2.91	2.83
Native pasture	acre	-	1.42	1.21
Winter labor	hour	4.04	4.59	4.04
Cow-calf space	sq. ft.	.17	.10	.17
Feeder and stocker space	sq. ft.	.10	-	.10
Quota	bus.	.51	.25	.51

1/ Cropland only.

to determine this effect. A third farm plan was established with no feeder or stocker enterprises. This forced the operator into a cow-calf operation if livestock were to be maintained on the farm. All farms were assumed to have the same basic resources but plan one assumed a 90 per cent calving rate and plan 49 a 75 per cent calving rate. The possibility of feeder or stocker operations were not considered in plan 168. A 90 per cent calving rate was assumed for the cow-calf enterprise. These farm plans and the optimum organizations are shown in Table 26.

Farm plan 49 had fewer cows and feeders than plan one. Because of the lower calving rate in plan 49, it was more profitable to keep fewer cows and to instead have more stockers to make use of all the available pasture. Land and labor use were about the same for each of these plans. Capital requirements, however, were $1,620 higher on plan 49 than plan 1 due to more feeder cattle being purchased.

The returns to fixed factors was $903 more in plan one as compared to plan 49. The higher returns can be attributed to higher calving rates in plan one, this being the only difference between these two farm organizations.

Plan 168 with no stocker or feeder enterprises permitted, had the lowest return to fixed factors. Farm plans one and 49 with the 75 and 90 per cent calving rates increased returns over plan 168 by $2,247 and $3,150, respectively. This was due to the fact that these farms fed the farm raised calves and sold them as finished beef. However, farm plan

TABLE 26

OPTIMAL ORGANIZATION OF THREE HYPOTHETICAL FARMS WITH MEDIUM LEVELS OF CAPITAL, SIX BUSHELS QUOTA, ALTERNATIVE CALVING RATES, AND NO FEEDER AND STOCKER ENTERPRISES

Farm number		1	49	168
Capital levels		Medium	Medium	Medium
Quota		6	6	6
Livestock prices		Average	Average	Average
Price feed wheat		$0.00	$0.00	$0.00
	Unit			
Return to fixed factors	dollar	15,715	14,812	12,565
Land Use:				
Wheat	acre	149	163	164
Oats	acre	142	116	43
Barley	acre	98	126	174
Flax	acre	185	185	185
Summerfallow	acre	166	150	174
Native hay	acre	76	68	53
Native pasture	acre	300	300	300
Labor Use:				
Winter	hour	1,320	1,320	682
Spring: Operator	hour	440	440	440
Hired	hour	298	304	153
Summer: Operator	hour	419	415	375
Hired	hour	74	45	-
Fall: Operator	hour	437	440	395
Hired	hour	126	164	75
Grain Sales:				
Wheat: Quota	bus.	3,729	3,729	3,729
Barley: Feed	bus.	3,265	4,550	7,478
Flax	bus.	2,118	2,110	2,122
Livestock Operations:				
Cow-calf (own)	head	55.6	48.8	55.6
Feeder (own)	head	39.6	10.0	-
Feeder (buy)	head	20.9	33.4	-
Stocker (own)	head	2.5	19.6	-
Sell: Calves	head	-	-	42.0
Feeder	head	60.5	43.4	-
Stocker	head	2.5	19.6	-
Cull cows	head	7.9	6.9	7.9
Capital:	dollar	12,548	14,168	9,443
Other Activities and Resources:				
Rent pasture	A.U. 1/	14.5	20.0	12.7
Buy hay	ton	4.2	14.3	2.8

1/ Animal unit.

168 required less capital and labor than either plan one or 49, hence a farm operator might consider a cow-calf operation if these resources were limiting or because of personal preferences.

The results in Table 26 indicate that if a farmer were concerned with profits alone he would view the cow-calf operation by itself as unfavourable. A cow-calf enterprise with a 90 per cent calf crop yields lower returns than an operation with only a 75 per cent calf crop where the farmer sells the cattle as finished animals. These results show that a feeder or stocker system of management provides higher returns to the farm operator than a cow-calf system of operation.

4. THE EFFECT OF ALTERNATIVE CAPITAL LEVELS ON THE OPTIMUM FARM ORGANIZATION

Many farmers are limited in the amount of capital they have available for use in their farm operation. Farmers in this situation want to use their capital for the enterprise that will provide them with the greatest net return to the fixed factors they control. The purpose of this section is to determine if a livestock operation can compete with crop production under these conditions. This objective was accomplished by programming a hypothetical farm with three levels of capital to determine the effect of capital on the beef cattle enterprise in the optimum farm organization. All other resource inputs were assumed equal for each capital level. The resources used on the hypothetical farm and the optimum organization for the different levels of capital are presented in Table 27.

TABLE 27

OPTIMAL ORGANIZATION OF THREE HYPOTHETICAL FARMS WITH AVERAGE LIVESTOCK PRICES, SIX BUSHEL QUOTA AND ALTERNATIVE CAPITAL LEVELS

Farm number		1	9	17
Capital levels		Medium	Unlimited	Low
Quota		6	6	6
Livestock prices		Average	Average	Average
Price feed wheat		$0.00	$0.00	$0.00
	Unit			
Return to fixed factors	dollar	15,715	15,850	10,799
Land Use:				
Wheat	acre	149	149	124
Oats	acre	142	142	127 1/
Barley	acre	98	98	18
Flax	acre	185	185	-
Summerfallow	acre	166	166	268
Native hay	acre	76	76	72
Native pasture	acre	300	300	300
Labor Use:				
Winter	hour	1,320	1,320	1,320
Spring: Operator	hour	440	440	440
Hired	hour	298	298	71
Summer: Operator	hour	419	419	402
Hired	hour	74	74	135
Fall: Operator	hour	437	437	372
Hired	hour	126	126	15
Grain Sales:				
Wheat: Quota	bus.	3,729	3,729	3,619
Barley: Feed	bus.	3,265	3,265	-
Flax	bus.	2,118	2,118	
Livestock Operations:				
Cow-calf (own)	head	55.6	55.6	51.0
Feeder (own)	head	39.6	39.6	38.6
Feeder (buy)	head	20.9	20.9	10.3
Stocker (own)	head	2.5	2.5	-
Stocker (buy)	head	-	-	14.1
Sell: Feeder	head	60.5	60.5	48.9
Stocker	head	2.5	2.5	14.1
Cull cows	head	7.9	7.9	7.3
Capital:	dollar	12,548	12,548	8,684
Other Activities and Resources:				
Rent pasture	A.U. 2/	14.5	14.5	18.2
Buy hay	ton	4.2	4.2	-

1/ Unfertilized
2/ Animal unit.

Farm plans numbers one and nine were identical except for returns to fixed factors. The returns being slightly higher in plan nine because with an unlimited supply of capital, the lower cost trade credit was substituted for personal or bank capital wherever possible.

As a result of capital rationing, returns to fixed factors decreased by $4,916 between plans one and 17. This loss in returns was due mainly to the fact that 203 acres of land were left idle. Farm plan 17 followed a two year rotation (one crop and summerfallow), whereas plan one used a four year rotation. This probably indicates that a longer rotation may be followed when more capital is available. The oats acreage was left unfertilized in plan 17 due to the lack of credit, but all the crop was fertilized in plan one.

The livestock organization changed somewhat between plans 1 and 17. Plan 17 indicated that fewer cows and feeders but more stockers would maximize profits as compared to plan one. It would appear that more stockers came into the livestock operation to make use of pasture to the limit of space available for stockers and feeders. Because of capital rationing less credit was used in plan 17. However, there was some bank capital left unused. It should be emphasized that only certain types of capital could be used for certain enterprises. In this analysis it was assumed the personal capital could be used for either the crop or livestock enterprises, but trade capital could only be used for crops and bank capital only for livestock. What has actually happened in all likelihood is that all the personal and trade capital

available were used for the crop enterprise; this was short of requirements, therefore, some land was left idle. The livestock enterprise probably used bank capital, exclusively; up to the limit of its requirements, leaving some left over. It might have been preferable to let capital flow more freely between enterprises, however it was assumed in this study that banks would not finance such everyday expenses such as fuel, oil, grease, repairs, etc., whereas trade capital (oil companies, machinery dealers) would extend credit of this type. These creditors and perhaps the farmer themselves probably think of this type of credit more as a business convenience than as an actual loan.

In plans one and nine the marginal values of land were $12.85 and $13.40 per acre, respectively. It was somewhat higher in plan nine due to the unlimited supply of capital. Because of the severe capital restriction in plan 17 some land was left idle and consequently the marginal value of land dropped to zero.

5. THE EFFECT OF CANADIAN WHEAT BOARD QUOTA LEVELS ON THE OPTIMUM FARM ORGANIZATION

Many farm operators would like to know what type of farm organization to follow when grain sales are restricted by Canadian Wheat Board quotas. Also, they are concerned about the adjustment problems that might arise when market quotas are placed on grain sales. If the farmer were in the position to know a year or two in advance what his grain quota level would be, generally his adjustment decisions

could be made on a sounder basis. The farmer, however, is seldom in this position, but he does have knowledge of previous years' marketings and estimated carryover of grains, thus he might conceivably estimate within a certain range what quota level could be expected.

To determine the effect of alternative quota levels on the grain and cattle enterprises in the optimum farm organization a hypothetical farm was programmed with a six bushel, ten bushel and unlimited quotas. The farm programmed and the optimum organization for these quota levels are shown in Table 28.

Farm plans nine and thirteen indicate that the farm organization should remain about the same when quota levels change from six to ten bushels per specified acre 1/. The only difference was that acreage seeded to barley should be substituted with wheat up to the maximum for the ten bushel quota under the less restricting market conditions.

The farm organization in plan 34 with unlimited grain sales is considerably changed from both plans nine and 13. All the cropland available in plan 34 was seeded to wheat with only the minimum allowable used for summerfallow. This indicates that wheat is the most profitable crop when marketing restrictions are relaxed. The livestock operation in plan 34 also changed. Whereas in plans nine and 13, 55 cows were included, only seventeen were specified for plan 34. Plan 34

1/ The specified acreage includes all improved land except land seeded to flax.

TABLE 28

OPTIMAL ORGANIZATION OF THREE HYPOTHETICAL FARMS WITH UNLIMITED LEVELS OF CAPITAL, AVERAGE LIVESTOCK PRICES, ZERO PRICE FOR NON-QUOTA WHEAT AND ALTERNATIVE QUOTA LEVELS

Farm number		9	13	34
Capital levels		Unlimited	Unlimited	Unlimited
Quota		6	10	Unlimited
Livestock prices		Average	Average	Average
Price feed wheat		$0.00	$0.00	-
	Unit			
Return to fixed factors	dollar	15,850	16,985	19,097
Land Use:				
Wheat	acre	149	223	629
Oats	acre	142	142	-
Barley	acre	98	24	-
Flax	acre	185	185	-
Summerfallow	acre	166	166	111
Native hay	acre	76	75	35
Native pasture	acre	300	300	300
Labor Use:				
Winter	hour	1,320	1,320	1,148
Spring: Operator	hour	440	440	440
Hired	hour	298	298	275
Summer: Operator	hour	419	419	343
Hired	hour	74	74	-
Fall: Operator	hour	437	437	440
Hired	hour	126	126	231
Grain Sales:				
Wheat: Quota	bus.	3,729	5,950	15,059
Barley: Feed	bus.	3,265	82	-
Flax	bus.	2,118	2,118	-
Livestock Operations:				
Cow-calf (own)	head	55.6	55.6	17.9
Feeder (own)	head	39.6	42.0	-
Feeder (buy)	head	20.9	18.5	-
Stocker (own)	head	2.5	-	13.5
Stocker (buy)	head	-	2.5	49.5
Sell: Feeder	head	60.5	60.5	-
Stocker	head	2.5	2.5	63.0
Cull cows	head	7.9	7.9	2.6
Capital:	dollar	12,548	12,569	18,246
Other Activities and Resources:				
Rent pasture	A.U. 1/	14.5	14.5	20.0
Buy hay	ton	4.2	4.2	39.0
Buy oats	bus.	-	-	2,727

1/ Animal unit.

changed to a stocker system of operation from a feeder system in plans nine and thirteen. The stocker system was expanded to the maximum or to the point where all the pasture and space assumed initially available on the farm was fully utilized. Most of these stockers were purchased in plan 34 because farm raised calves were not available due to the unprofitability of the cow-calf operation under these conditions. Oats were purchased in plan 34 because higher returns were realized when the cropland was seeded to wheat.

Capital requirements were about $5,700 higher in plan 34 than in plans nine and thirteen mainly because most of the stockers had to be purchased. When the quota level changed from six to ten bushels per acre, returns to fixed factors increased by $1,135. With unlimited grain sales, returns increased by $3,247 over the farm plan with the six bushel quota.

The results in Table 28 show that quota levels do effect the optimum farm organization. When quota levels are 10 bushels or less, a cow-calf-feeder system of operation should be followed and the majority of these feeder calves should be farm raised. With unlimited grain sales a cow-calf-stocker system is more profitable and most of these stockers should be purchased.

The marginal value products for selected limiting resources are presented in Table 29 for plans nine, 13 and 34. Plan 34 had the highest marginal value product for land due to the fact that grain quotas were unlimited. Some cow-calf space as well as winter labor were left

TABLE 29

MARGINAL VALUE PRODUCT OF SELECTED RESOURCES IN THE OPTIMUM FARM ORGANIZATION OF PLANS NINE, THIRTEEN AND THIRTY FOUR

Resource	Unit	Marginal Value Product		
		Plan 9	Plan 13	Plan 34
		- dollars -		
Land 1/	acre	13.40	15.44	21.58
Feeder and stocker space	sq. ft.	0.10	0.10	0.81
Cow-calf space	sq. ft.	0.10	0.10	-
Winter labor	hour	4.25	4.25	-
Rent pasture 2/	A.U.	-	-	50.96

1/ Cropland only.
2/ Equals one animal unit of grazing per season.

over so the marginal value of these resources was zero. Because of the limitations of feeder and stocker space and rented pasture, the marginal value products of these resources was much higher in plan 34 than in either plans nine or thirteen. In fact, these plans could have rented more pasture hence the marginal value for rented pasture was zero in plans nine and thirteen.

6. THE EFFECT OF HIRED LABOR ON THE BEEF AND CROP ENTERPRISES IN THE OPTIMUM FARM ORGANIZATION

Many farmers have questions concerning the effect of alternative availabilities of hired labor on their farm organization. They would like to find those labor situations that are conducive to maintaining profitable beef or crop enterprises. To determine those situations, a hypothetical farm was programmed with several different hired labor supplies and evaluated for the effect that labor had on the beef or crop enterprise. The farm operator was assumed to work full time on all these farms. In one instance the operator was given the opportunity to hire labor for six months during the cropping season plus casual labor for spring seeding and harvest. In another the operator employed a full time hired man and in a third instance no hired labor was specified. Farms programmed and the optimum organization for these alternative labor supplies are shown in Table 30.

Farm plans two and 74 had the same resources except that in the former plan it was assumed that six months of labor was hired (May to October inclusive), whereas in plan 74 there was no hired labor. Farm

TABLE 30

OPTIMAL ORGANIZATION OF HYPOTHETICAL FARMS WITH VARIATIONS IN THE AMOUNT OF HIRED LABOR

Farm number		2	74	98	99
Capital levels		Medium	Medium	Medium	Unlimited
Quota		6	6	6	6
Livestock prices		Average	Average	Average	Average
Price feed wheat		$1.35	$1.35	$1.35	$0.00
	Unit				
Return to fixed factors	dollar	16,659	12,028	11,216	14,808
Land Use:					
Wheat	acre	453	365	456	155
Oats	acre	112	33	-	133
Barley	acre	25	-	-	108
Flax	acre	-	-	-	185
Summerfallow	acre	150	216	284	159
Native hay	acre	68	42	-	75
Native pasture	acre	300	300	-	300
Labor Use:					
Winter	hour	1,320	542	-	1,357 1/
Spring: Operator	hour	440	436	395	440
Hired	hour	289	-	-	307
Summer: Operator	hour	415	366	339	419
Hired	hour	45	-	-	66
Fall: Operator	hour	440	341	288	440
Hired	hour	58	-	-	141
Grain Sales:					
Wheat: Quota	bus.	4,839	4,081	4,839	3,729
Feed	bus.	6,465	5,969	7,813	-
Barley: Feed	bus.	-	-	-	3,762
Flax	bus.	-	-	-	2,115
Livestock Operations:					
Cow-calf (own)	head	48.8	44.2	-	55.5
Feeder (own)	head	37.0	-	-	31.8
Feeder (buy)	head	6.4	-	-	21.0
Stocker (own)	head	-	-	-	10.2
Stocker (buy)	head	19.6	-	-	-
Sell: Calves	head	-	33.5	-	-
Feeder	head	43.4	-	-	52.8
Stocker	head	19.6	-	-	10.2
Cull cows	head	7.0	6.3	-	7.9
Capital:	dollar	13,544	7,096	7,263	12,745
Other Activities and Resources:					
Rent pasture	A.U. 2/	20.0	1.3	-	20.0
Buy hay	ton	14.3	2.2	-	8.9

1/ Includes 37 hours of hired labor.

2/ Animal unit.

plan 98 was restricted to an operation with no livestock or hired labor. Plan 99 had a full year's supply of hired labor, unlimited capital but a zero price on non-quota feed wheat.

The optimum organization for plan two with six months of hired labor included a beef enterprise where the calves raised were finished on the farm. In addition feeders and stockers were purchased to make use of all the available building space and pasture. In plan 74 with no hired labor the organization of the farm changed to a cow-calf enterprise. There were 126 acres of land which became idle in this plan; spring labor being the limiting factor. This reduced returns to fixed factors by $4,631 as compared to plan two.

In plan 98 it was assumed that the farmer kept no livestock and had no option to hire labor. There was no idle land in this plan which would indicate that in plan 74, the cow-calf operation was successfully competing with land for the available spring labor supply, because all the land came into production in plan 98. Since plan 98 had no livestock or hired labor and plan 74 had no labor with a considerable portion of the land lying idle, capital requirements were much lower for both plans as were the returns to fixed factors.

In plan 99 a full time hired man was included in the labor supply. Capital availability was unlimited, a six bushel quota was specified together with average livestock prices and sales of non-quota feed wheat were not allowed. Only 37 hours of the hired winter labor was actually required. Returns to fixed factors were $1,851 lower in this plan as

compared to plan two due to the extra cost of a full time hired man. Plan 99, however, with the full year's supply of hired labor had returns which were considerably higher than in either plan 74 or 98 where no labor was hired.

These summaries indicate that the labor supply is important to maintaining a beef cattle enterprise. The highest returns accrued when labor could be hired on a six month basis. However, if this were not possible, it was more profitable to hire a man for the full year than to hire no labor.

The marginal value products of selected limiting resources for plans two, 74, 98 and 99 are presented in Table 31. For plans two, 98 and 99 the marginal value of land was $17.02, $2.51 and $13.40 per acre, respectively. The marginal value of land for plan 98 was low because September labor was severely restricted with a marginal value of $41.65 per hour. There was no marginal value for land in plan 74 because some land was left idle due to the labor shortage during the cropping season. The marginal values for labor during the months of May, July and September were $11.62, $5.91 and $34.60, per hour, respectively. For the month of May this value was valid only in the range of one fewer hour and eight additional hours of labor. The range for the other months was similar which illustrates once again that marginal values at any one point may be valid only over very short ranges.

TABLE 31

MARGINAL VALUE PRODUCTS OF SELECTED RESOURCES IN THE OPTIMUM FARM ORGANIZATION OF PLANS TWO, 74, 98 AND 99

Resource	Unit	Plan 2	Plan 74	Plan 98	Plan 99
			- dollars -		
Land 1/	acre	17.02	-	2.51	13.40
Wheat supply	bus.	1.35	1.35	1.35	1.09
Oats supply	bus.	.64	.64	.64	.51
Barley supply	bus.	.93	.93	.90	.75
Flax supply	bus.	2.91	2.83	2.83	2.83
Feeder cattle	head	224.88	221.96	-	224.96
Stocker cattle	head	222.88	205.61	-	222.96
Calves	head	116.07	107.95	-	113.88
Cull cows	head	158.23	159.92	-	159.96
Winter labor	hour	1.64	-	-	-
May labor	hour	-	11.62	-	-
July labor	hour	-	5.91	-	-
September labor	hour	-	34.60	41.65	-
Feeder and stocker space	sq. ft.	.37	-	-	1.51
Cow-calf space	sq. ft.	-	-	-	.62
Quota	bus.	.25	.25	.25	.51
Rent pasture	A.U. 2/	32.52	-	-	28.60

1/ Cropland only.
2/ Equals one animal unit of grazing per season.

7. THE EFFECT OF ALTERNATIVE LIVESTOCK SYSTEMS AND QUOTA LEVELS ON RETURNS TO FIXED FACTORS

Many farmers raise questions concerning the effect of the type of livestock system followed, calving rates, grain quotas on the returns to fixed factors. Perhaps some question the profitability of any type of livestock operation. To determine what effect these situations had on returns, hypothetical farms with alternative quota levels, calving percentages and different livestock systems were developed and evaluated. The farms programmed and the optimum organization are presented in Table 32.

Farm plan 154 was programmed with no livestock and a six bushel quota. Farm plan 173 and 169 were programmed with a six and 10 bushel grain quota, respectively, both allowing a cow-calf system of operation with a 90 per cent calving rate. In plan 54 any type of livestock system was permitted (cow-calf, feeder or stocker) but the calving rate was lowered to 75 per cent. All of these farms were given the opportunity to sell non-quota feed wheat.

Farm plans 154 and 169 had identical resources except that in plan 154 no livestock could be kept. The result was that in plan 169 with a cow-calf operation, returns to fixed factors were about $3,000 higher than in plan 154. Concomitantly, more labor and capital were employed in plan 169. Summerfallow was at the specified minimum in both of these plans. Only enough oats were grown for livestock feed and wheat was the only grain sold.

TABLE 32

OPTIMAL ORGANIZATION OF HYPOTHETICAL FARMS WITH MEDIUM LEVELS OF CAPITAL, SIX AND TEN BUSHEL QUOTAS, AVERAGE LIVESTOCK PRICES, NON-QUOTA WHEAT SALES AND ALTERNATIVE LIVESTOCK SYSTEMS

Farm number		154	173	169	54
Capital levels		Medium	Medium	Medium	Medium
Quota		6	10	6	10
Livestock prices		-	Average	Average	Average
Price feed wheat		$1.35	$1.35	$1.35	$1.35
	Unit				
Return to fixed factors	dollar	11,370	15,076	14,336	16,711
Land Use:					
Wheat	acre	629	586	586	546
Oats	acre	-	43	43	57
Barley	acre	-	-	-	-
Flax	acre	-	-	-	-
Summerfallow	acre	111	111	111	137
Native hay	acre	-	53	53	35
Native pasture	acre	-	300	300	300
Labor Use:					
Winter	hour	-	682	682	1,128
Spring: Operator	hour	427	440	440	440
Hired	hour	67	173	173	262
Summer: Operator	hour	196	323	323	355
Hired	hour	-	-	-	-
Fall: Operator	hour	341	415	415	440
Hired	hour	55	95	95	218
Grain Sales:					
Wheat: Quota	bus.	4,839	7,800	4,839	7,800
Feed	bus.	10,219	6,268	9,229	5,669
Livestock Operations:					
Cow-calf (own)	head	-	55.6	55.6	17.9
Stocker (own)	head	-	-	-	10.8
Stocker (buy)	head	-	-	-	52.2
Sell: Calves	head	-	42.0	42.0	-
Stocker	head	-	-	-	63.0
Cull cows	head	-	7.9	7.9	2.6
Capital:	dollar	9,154	10,322	10,322	16,424
Other Activities and Resources:					
Rent pasture	A.U. 1/	-	12.7	12.7	20.0
Buy hay	ton	-	2.8	2.8	39.0

1/ Animal unit.

In plan 54 all livestock systems were possible but with a 75 per cent calving rate. Only 17 cows were specified in the optimal solution and the farm raised calves were sold as finished animals. Another 52 stockers were purchased to the limit of the available pasture and building space. Compared to plan 173, plan 54 had returns to fixed factors that were $1,635 higher. Considerably more labor was used in this plan and about $6,000 more of capital.

These summaries indicate that a cow-calf system of livestock operation will increase the returns to fixed factors under the specified assumptions. Also, it indicates that returns can be increased still further if a practice of feeding out farm raised calves were followed, together with a stocker operation to make use of available pasture.

8. THE EFFECT OF ALTERNATIVE LIVESTOCK AND NON-QUOTA WHEAT PRICES ON THE OPTIMUM FARM ORGANIZATION

Farmers would like to know the optimum organization of the farm with different levels of livestock and non-quota grain prices. To determine this organization hypothetical farms were developed with average and high livestock prices, with and without non-quota feed wheat sales. The optimal farm organizations corresponding to these assumptions are shown in Table 33.

In both plans five and six average livestock prices were assumed but in the latter plan non-quota feed wheat could be sold at $1.35 per bushel. This resulted in a return to fixed factors of $17,399 compared

TABLE 33

OPTIMAL ORGANIZATION OF HYPOTHETICAL FARMS WITH MEDIUM CAPITAL LEVELS, TEN BUSHEL QUOTA WITH ALTERNATIVE LIVESTOCK AND NON-QUOTA WHEAT PRICES

Farm number		5	6	7	8
Capital levels		Medium	Medium	Medium	Medium
Quota		10	10	10	10
Livestock prices		Average	Average	High	High
Price feed wheat		$0.00	$1.35	$0.00	$1.35
	Unit				
Return to fixed factors	dollar	16,849	17,399	18,516	18,894
Land Use:					
Wheat	acre	223	453	223	438
Oats	acre	142	112	142	118
Barley	acre	24	-	24	28
Flax	acre	185	-	185	-
Summerfallow	acre	166	150	166	156
Native hay	acre	76	68	76	74
Native pasture	acre	300	300	300	300
Labor Use:					
Winter	hour	1,320	1,320	1,320	1,320
Spring: Operator	hour	440	440	440	440
Hired	hour	298	289	298	286
Summer: Operator	hour	419	415	419	417
Hired	hour	74	45	74	58
Fall: Operator	hour	437	440	437	440
Hired	hour	126	158	126	135
Grain Sales:					
Wheat: Quota	bus.	5,950	7,800	5,950	7,800
Feed	bus.	-	3,504	-	3,195
Barley: Feed	bus.	82	-	82	-
Flax	bus.	2,118	-	2,118	-
Livestock Operations:					
Cow-calf (own)	head	55.6	48.8	55.6	55.6
Feeder (own)	head	42.0	37.0	39.6	31.8
Feeder (buy)	head	18.5	6.4	20.9	17.2
Stocker (own)	head	-	-	2.5	10.2
Stocker (buy)	head	2.5	19.6	-	-
Sell: Feeder	head	60.5	43.4	60.5	49.0
Stocker	head	2.5	19.6	2.5	10.2
Cull cows	head	7.9	7.0	7.9	7.9
Capital:	dollar	12,569	13,544	12,820	12,713
Other Activities and Resources:					
Rent pasture	A.U. 1/	14.5	20.0	14.5	20.0
Buy hay	ton	4.2	14.3	4.2	8.9

1/ Animal unit.

to $16,849 in plan five. Land use changed considerably; whereas in plan five flax acreage was increased to the maximum initially assumed, there was no flax grown in plan six. This would indicate that wheat was more profitable than flax despite the fact that it was sold for $1.35 per bushel. Slightly fewer cows were specified for plan six than for plan five but the stocker operation was expanded so that all the available pasture was used.

Farm plans seven and eight assumed high livestock prices, but non-quota wheat sales were allowed in plan eight only. Returns to fixed factors were $378 higher in plan eight as compared to plan seven. The land use and livestock organization followed about the same pattern as in plans five and six.

These summaries indicate high livestock prices are conducive to maintaining a beef enterprise. Returns in plan seven with high livestock prices were $1,670 more than in plan five with low livestock prices. There was a negligible amount of non-quota feed grain sold on any of these farms which might suggest that non-quota grain sales are unimportant when the farmer has a 10-bushel quota for grain sales.

9. THE EFFECT OF ALTERNATIVE PASTURE COSTS ON RETURNS AND ON THE OPTIMUM FARM ORGANIZATION

Farmers interested in maintaining a beef cattle enterprise have two main concerns about pasture situations. One, they would like to know if the beef cattle enterprise can compete with other enterprises

for farm resources when pasture is available free of costs, and secondly, whether the beef cattle enterprise can compete with other enterprises when there is an imputed cost for the pasture. To answer these questions, four hypothetical farms were programmed, two with and two without pasture costs to determine the effect of pasture cost on the beef cattle enterprise in the optimum farm organization. These farms and the optimum organization are presented in Table 34.

Beef cattle were included in the optimum organization for all four hypothetical farms. Farm plans one and 216 were assumed to have identical resources except that in plan 216 there was an imputed cost of eight dollars per animal unit of pasture per season; whereas in plan one 300 acres of pasture free of charge (equivalent to 43 animal unit of grazing per season) plus the opportunity of renting 20 animal units of grazing at eight dollars per animal unit were assumed. The organization of these two farm plans was very similar. The number of stockers increased by eight head in the plan where all the pasture had an imputed cost, the capital requirements increased by $116 and returns to fixed factors decreased by $343.

Both plans two and 217 were permitted to sell non-quota feed wheat at $1.35 per bushel. All resources were identical in these plans except that plan two had 300 acres of pasture at no cost. Despite the fact that this owned pasture was free of charge there was no significant difference in the farm organization of these two plans. Returns to fixed factors, however, were somewhat higher when there was no charge for the use of owned pasture.

TABLE 34

OPTIMAL ORGANIZATION OF HYPOTHETICAL FARMS WITH MEDIUM LEVELS OF CAPITAL, SIX BUSHEL QUOTA, AVERAGE LIVESTOCK PRICES WITH ALTERNATIVE NON-QUOTA WHEAT PRICES AND PASTURE CHARGES

Farm number		1	216	2	217
Capital levels		Medium	Medium	Medium	Medium
Quota		6	6	6	6
Livestock prices		Average	Average	Average	Average
Price feed wheat		$0.00	$0.00	$1.35	$1.35
	Unit				
Return to fixed factors	dollar	15,715	15,372	16,659	16,345
Land Use:					
Wheat	acre	149	158	453	450
Oats	acre	142	126	112	120
Barley	acre	98	116	25	15
Flax	acre	185	185	-	-
Summerfallow	acre	166	155	150	155
Native hay	acre	76	74	68	68
Native pasture	acre	300	-	300	-
Labor Use:					
Winter	hour	1,320	1,320	1,320	1,320
Spring: Operator	hour	440	440	440	440
Hired	hour	298	301	289	287
Summer: Operator	hour	419	437	415	415
Hired	hour	74	58	45	48
Fall: Operator	hour	437	440	440	440
Hired	hour	126	136	58	156
Grain Sales:					
Wheat: Quota	bus.	3,729	3,729	4,839	4,839
Feed	bus.	-	-	6,465	6,437
Barley: Feed	bus.	3,265	4,110	-	-
Flax	bus.	2,118	2,113		
Livestock Operations:					
Cow-calf (own)	head	55.6	55.6	48.8	48.7
Feeder (own)	head	39.6	42.0	37.0	36.8
Feeder (buy)	head	20.9	6.7	6.4	6.1
Stocker (own)	head	2.5	-	-	-
Stocker (buy)	head	-	10.4	19.6	20.1
Sell: Feeder	head	60.5	48.7	43.4	42.9
Stocker	head	2.5	10.4	19.6	20.1
Cull cows	head	7.9	8.1	7.0	7.0
Capital:	dollar	12,548	12,664	13,544	13,858
Other Activities and Resources:					
Rent pasture	A.U. 1/	14.5	63.0	20.0	63.0
Buy hay	ton	4.2	9.1	14.3	14.6

1/ Animal unit.

The results show that the livestock enterprise can pay the cost of permanent pasture and still compete successfully for other resources. Permanent pasture at no cost is conducive to maintaining a beef cattle operation but it is not a necessary factor.

SUMMARY OF HYPOTHETICAL FARMS

For the hypothetical farms considered in this study, it was found that labor hiring, available permanent pasture, high calving percentage, medium to high levels of capital and high livestock prices were all conducive to maintaining a beef cattle enterprise. All of these factors, however, may not be required simultaneously for a successful livestock operation. For instance, beef cattle might be profitable with only average livestock prices but with a high calving percentage.

The availability of capital was particularly important to the crop enterprises which indirectly affected the beef enterprise through supplying potential feed. Available building space was held constant on all the farms and in the majority of plans was used to the maximum initially assumed. Reduced labor supplies had the effect of changing the livestock operations from a cow-calf-feeder-stocker system 1/, to a straight cow-calf system. Availability of permanent pasture at no cost increased the returns to fixed factors of production but this was not a necessary factor for a successful livestock operation.

1/ Farm raised calves were sold as finished beef or as stockers off-the-grass the following fall.

All of the factors mentioned above will not necessarily affect the beef cattle enterprise on all farms in the same manner as they affected it on these hypothetical farms. However, the beef cattle enterprise in the optimum organization for farms with resources, prices and alternatives similar to those used in this analysis are likely to be affected in much the same manner as the beef cattle operation was in the optimum organizations for the programmed hypothetical farms.

A COMPARISON OF THE STUDY SAMPLE FARMS AND HYPOTHETICAL FARMS

A comparison of the average costs and returns per animal unit for the sample survey farms and three hypothetical farms is presented in Table 35. An animal unit is defined as 1.0 mature cow. Feeders or stockers make 0.7 of an animal unit and calves 0.3.

Although the comparison is shown on a per animal unit basis there are problems that arise when comparing an average for a sample of farms with a hypothetically developed farm. For instance, the resources available or technology assumed are not the same for the hypothetical and study farms. In any case the hypothetical farms are developed mainly to show how the sample farms could perhaps improve their income position given a certain bundle of resources together with superior levels of management and technical know-how.

It will be noted that there were some wide variations in the costs and returns between the hypothetical and the study sample farms. These differences may be attributed to several factors. First, the study farm

TABLE 35

AVERAGE COSTS AND RETURNS PER ANIMAL UNIT FOR THE STUDY FARMS AND THREE HYPOTHETICAL FARMS BY LIVESTOCK MANAGEMENT SYSTEM

Item	Cow-Calf		Feeder		Stocker	
	Plan 168	Study Farm	Plan 1	Study Farm	Plan 34	Study Farm
Number of animal units	68.2	64.8	99.7	58.3	62.0	45.4
	- dollars per animal unit -					
Costs (variable)						
Grain	18.20	9.98	51.73	32.42	28.56	17.53
Hay	11.07	34.51	10.87	27.86	15.42	30.55
Total feed	29.27	44.49	62.60	60.28	43.98	48.08
Interest @ 6%	9.83	10.91	9.67	11.93	12.02	11.33
Other	11.84	11.84	10.94	10.94	10.11	10.11
Total cash costs	50.94	67.24	83.21	83.15	66.11	69.52
Cost (fixed)						
Pasture	6.53	9.55	4.61	7.20	8.13	8.50
Machinery and buildings	11.46	11.46	9.93	9.93	8.48	8.48
Total fixed costs	17.99	21.01	14.54	17.13	16.61	16.98
Total all costs	68.93	88.25	97.75	100.28	82.72	86.50
Total returns	85.14	74.46	154.80	129.08	233.17	93.53
Livestock purchases	-	2.35	22.96	18.14	87.42	8.88
Gross returns	85.14	72.11	131.84	110.94	145.75	84.65
Returns over all costs	16.21	-16.14	34.09	10.66	63.03	-1.85
Returns over cash costs	34.20	4.87	48.63	27.79	79.64	15.13
Returns per hour	.96	-.96	2.49	.78	2.66	- .08

represents an average for a sample of farms which differ somewhat in size, soil quality, capital investment and other methods of operation together with differences in the farmers managerial ability; whereas the hypothetical farms represent a single operation. Therefore, similar returns could not be expected. However, it should be pointed out that although the average returns to livestock for the study farms were lower, some study farms had returns comparable to the hypothetical farms. Secondly, the quality, weight, or the price received per pound for the market animals was not enumerated in this study. Only the total value of the animal sold was recorded. Differences in these factors could have a significant influence on the returns between the observed and hypothetical results. Thirdly, it might be mentioned as a partial explanation that the observed systems were not purely cow-calf, feeder or stocker operations. There were elements of all categories in many of the actual operations. Thus, a cow-calf system sold some finished feeders and stockers and some of the feeder and stocker systems sold some calves at weaning time. Fourthly, calving rates assumed for the hypothical farms were higher than for the study farms which obviously would increase returns on the hypothetical farms. Also, additional labor could be hired on the hypothetical farms which may or may not have been the case on the study farms. These factors and perhaps others would make the comparison between the hypothetical and the actual situation less meaningful. However, with the above considerations in mind a brief comparison of the farms shown in Table 35 follows.

Feed costs were significantly lower on the hypothetical farm as compared to the sample farms for the cow-calf system of management. These were also somewhat lower for the stocker system but slightly higher for the feeder system of operation. For all hypothetical management systems, considerably more grain and less hay was fed per animal unit than on the study farms. It would appear that the study farms were experiencing rather high feed conversion ratios (pounds of feed per pound of gain) and considerable improvement could take place in managing livestock feeding operations.

Interest on investment was about the same on the hypothetical and study farms. Other cash costs included insurance, veterinary and medicines, hydro, telephone, machine, building and fence costs. These other costs and depreciation on building and machinery were assumed to be the same for both sets of farms.

Total costs were about $20 lower per animal unit on the hypothetical cow-calf system as compared to the study farms. For the hypothetical feeder and stocker system total costs were not significantly different from the study farms. Total returns per animal unit were higher for all the hypothetical farms. The only explanation that can be given is that the study farms perhaps sold livestock at lower weights and of lower quality. The calving percentage was also somewhat lower on the study farms than the 90 per cent assumed for the hypothetical farms. This would have obviously a detrimental effect on net returns. The large expense for purchased livestock on the stocker enterprise was due to the fact that 50 of the 63 stockers were purchased.

Returns over all costs for the hypothetical cow-calf, feeder and stocker enterprises were $16.21, $34.09 and $63.03 respectively compared to -$16.24, $10.66 and -$1.85, respectively on the study farms. Labor use per animal unit was assumed to be the same for the hypothetical and the study farms, hence labor returns per hour was also considerably lower on the study farms.

In general, it would appear that the cow-calf system of operation was unprofitable on the study farms because of high operating costs per animal unit and lower total returns. Total operating costs for the feeder and stocker systems of operation do not appear unduly high for the study farms, but they are in all likelihood not getting as much gain in weight per $1.00 of feed as the hypothetical farms. Since the study farms had considerably lower total returns, they also had lower returns above all costs.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The main objective of this study was to evaluate the economics of beef cattle production in West Central Manitoba. More specifically, the objectives were: (1) to obtain a description of the present organization of the beef cattle enterprise, (2) to describe the management practices followed and to determine whether various practices cause difference in returns, (3) to obtain input-output information, including feed requirements, labor and other costs of beef cattle operations, (4) to determine those conditions conducive to maintaining a beef enterprise, and (5) to determine whether the livestock enterprise will successfully compete with the grain enterprise in the overall farm organization.

Data were obtained by personal interview with 40 farmers associated with the Manitoba Farm Business Group Program and through the use of their farm account books. The sample was selective in that only farm operators in this area who had beef cattle were included. Information on feed requirements, labor, costs and returns was obtained from the farm account books supplemented by a personal visit to each farm operator. Farms were classified by three livestock management systems, namely; (1) cow-calf, (2) feeder and (3) stocker.

Beef cattle were the major livestock species on the farms in this study. Other livestock enterprises consisted of hogs, some dairy cattle and horses but these were kept mainly for home use.

Farm inventories and estimates of values were made by the farmer and were based on the operator's knowledge of market prices and the production potential of the resources available for the farm business. In general, the farms included in this study were possibly somewhat above average in size, net income, net worth and because of the fact that they had participated in the farm business program, some were perhaps superior managers.

Costs, returns and resource requirements were calculated for cow-calf, feeder and stocker systems of beef cattle operations. Value produced per cow was significantly different for each of these systems. Using actual prices received, value produced per cow was $79, $155 and $95 for the cow-calf, feeder and stocker systems of management, respectively.

Value produced per cow and per stocker was not high enough to pay market prices for all resources. The feeder system of operation was able to provide a return above resource costs. On the average the cow-calf system was about $18 per unit short of paying all costs and the stocker system about two dollars. Although value produced was not sufficient to cover all costs, it was more than sufficient to cover the variable costs of production. This indicates that a beef cattle operation will provide some return to the fixed resources. However, with the cost structure and organization that presently exists in the study area, the cow-calf and stocker systems are likely to be unprofitable if they have to pay market prices for all resources.

Most of the feed requirement for the beef cattle were farm produced. The rations consisted of native hay together with some seeded forage, grain and some supplements.

Labor used per head varied by system of management. The greatest economies were realized with the feeder system which averaged about 14 hours of labor per animal. The cow-calf system averaged about 17 hours and the stocker system about 24 hours of labor per unit.

Some form of shelter for the winter period was provided on all these farms. Pole sheds and corrals were often used in the feeder or stocker operations and enclosed barns were generally provided for the cows.

On the average, investment in buildings, fences, wells and dug-outs amounted to about $85 on a per cow basis for all study farms 1/. Investment in livestock was $237 per cow and other general and miscellaneous livestock equipment cost about $14 per cow. Hence, on the average total investment would be about $336 per cow for all farm systems included in this study. This does not include investment in haying equipment or the livestock share of tractors, truck or car costs.

As was previously mentioned, except for the feeder system a beef cattle enterprise was unprofitable when it had to pay market prices for all resources. However, it was found that if the beef cow herd could be managed at higher levels of efficiency, or if the herd was

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1/ Per cow as used here includes replacement heifers.

not expected to pay market prices for all resources, it could be profitably maintained.

The level of efficiency that a farmer needs to cover all costs associated with the beef enterprise depends on four factors, namely: (1) percentage calf crop weaned, (2) weight of calf at weaning time, (3) annual maintenance costs of the beef operation, and (4) price received for beef produced. The level of efficiency achieved for one of these factors influences the level needed by other factors to break even. When better than average efficiency is achieved for one or two of these factors, average efficiency for the other factors may be sufficient for the beef cow herd to pay market prices for all the resources used.

To determine the conditions suitable for maintaining a beef cattle herd when it was not necessary for the beef enterprise to pay market prices for all resources, hypothetical farms with different resource bases were programmed. The results showed that hired labor, permanent pasture, medium to high levels of capital and high livestock prices were conducive to maintaining a beef cattle operation.

Canadian Wheat Board quotas less than or equal to 10 bushels per crop acre did not affect the livestock organization to any large extent. However, when quotas were unlimited the livestock system changed; fewer cows were kept and farm raised calves were finished on the farm, with the livestock program centred on a purchased stocker system of operation. With a 10 bushel quota or less most of the calves were farm raised instead of purchased.

Permanent pasture at no cost was conducive to maintaining a beef cattle herd but not a necessity. Beef cow herds can increase profits on farms where there is no permanent pasture as long as sufficient hay and feed grain is produced on the farm for the winter feeding period and sufficient pasture can be rented for the summer grazing season. On farms with no pasture the size of the beef cow enterprise will depend on the availability of rented pasture.

The level of capital available for use in the farm operation greatly affected the returns to factors of production. Crop returns were particularly influenced since at low levels of capital some cropland became idle and more stockers were purchased to round out the livestock operation.

Adequate supplies of labor were important to the farm organizations. With no hired labor a cow-calf system of livestock operation was most profitable but some cropland became idle. With six months of hired labor a cow-calf-feeding system together with a purchased stocker operation yielded the best returns. With a full year's supply of hired labor the livestock operation was much the same as with six months of hired labor but returns to fixed factors decreased due to the costs of the additional labor. The optimum organization and the highest returns accrued with six months of hired labor.

Beef price changes incorporated in this study did not affect the organization of the beef enterprise for the hypothetical farms considered. The size and type of livestock system followed was about the

same for both levels of beef prices. High beef prices, however, increased returns to fixed factors. It is possible that at low beef prices the organization of the beef enterprise would change or perhaps force the livestock farmer out of business.

In conclusion, for the hypothetical farms programmed in this study, beef cattle were able to compete successfully with the crop enterprise for farm resources with the facilities assumed available. The ability to utilize resources efficiently was important in handling the beef cattle enterprise. Profits can be realized by farm operators who achieve a high production of beef per cow while keeping down feed, labor and other costs. Generally the results of this study show that livestock returns were maximized with a cow-calf-feeder and/or stocker system of operation. Since each farm is unique, however, and differs in certain respects from other farms, the final decision must be made by operators depending on his particular circumstances.

SUGGESTIONS FOR FUTURE RESEARCH

A beef cow herd study might be conducted in other areas of the prairies to obtain information similar to that obtained for beef cow herds in West Central Manitoba. However, a different approach might be used in collecting the desired information. Although the data from the farm accounts supplemented by one personal visit was generally good, it could possibly be improved by using monthly mail-in sheets. Information, such as labor, feed consumption, etc., could be recorded and mailed in each month. Labor for one week might be considered representative of the entire month when no changes occurred. Other less routine information, such as purchases, sales and cash costs could be recorded throughout the year on a form provided by the researcher. These records could then be checked for accuracy and completeness as the study progresses and when the researcher visits the farm operator at the end of the year. Collecting information in this manner might increase its accuracy and reliability.

Research should be conducted on the feasibility of confinement feeding of beef cows and calves. Presently there is only a limited amount of information available on drylot beef cow production (21). As land prices, taxes and other costs rise, confinement feeding will become more practical. A study of this nature might be applicable for farms on the prairies having very little non-tillable land but other under-utilized resources which could be used for beef cattle production.

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APPENDIX

APPENDIX A - QUESTIONNAIRE

ECONOMIC ANALYSIS OF FARM BEEF OPERATIONS
MANITOBA

714.4E.R.
1967

Operator _____ P.O. Address _____

Group _____ Type _____ Record No. _____

Legal Description (Home Quarter) Q _____ S _____ T _____ R _____

(1) Livestock Sales	As Reported			Adjustment After Visit		
	A.U.'s	No.	Value	A.U.'s	No.	Value
Bulls						
Dairy Cows						
Beef Cows						
Heifers						
Steers						
Calves						
Stockers						
Feeders						
Assoc. Cattle						
TOTAL		XX			XX	

	As Reported		Adjustment After Visit	
(2) Cream & Milk Sales	$		$	
(3) Livestock Products Consumed (Meat, Milk, Cream)	$		$	
(4) Inventory Change	$		$	
Livestock Purchased (specify type)	No.	Value	No.	Value
TOTAL				
Gross Returns (1 & 2 & 3 & 4)-c				
Expenditure for hired labor	$		$	

. Feed Consumption	Homegrown		Purchased	
	Amt.	Value	Amt.	Value
1) Wheat				
Oats				
Barley				
Mixed grain				
Screenings				
Tame Hay				
Wild Hay				
Silage				
Straw				
Minerals & Supplements				
TOTAL				

2) Pasture

	No. of Acre		Value	
	Imp.	Unimp.	Imp.	Unimp.
Own pasture				
Rented pasture				

3) Pasture Carrying Capacity	Acres per A.U.	Period
Tame or seeded pasture		
Wild pasture		
Other, summerfallow, stubble		

Gain per day for: Heifers _____ Steers _____ Calves _____

4) Vet. & Medicine $ _____

5) Community pasture _____ animals for _____ days _____ $ _____

6) Other current expenses $ _____

Total Operating Expenses (D & E) $ _____

. Returns above feed and current costs $ _____

Joint Costs	Total Value	Livestock Per cent	Livestock Value
(1) Buildings and Improvements			
Main barn			
Other barns			
Granaries			
(2) Machinery & Equipment operating			
(3) Misc. (hydro, telephone, etc.)			
Total Joint Costs			

Return above Operating Expenses _____

Depreciation

(1) Buildings $ _____

(2) Machinery and equipment $ _____

Net Income to Labor and Capital $ _____

Interest

(1) Buildings $ _____

(2) Livestock Inventory $ _____

(3) Machinery $ _____

(4) Grain, hay, supplies $ _____

Labor Returns from Enterprise $ _____

Labor Use:	Hired	Operator		Family	Other	Total
January						
February						
March						
April						
May						
June						
July						
August						
September						
October						
November						
December						
Total						

Labor returns per hour _____

(1) Breeding females (No.) _____

(2) Cows in Calf (No.) _____

(3) Calves: Born (No.) _____

Live births (No.) _____

Weaned (No.) _____

(4) Calving Percentage (%) _____

(5) Weaning: Weight (lbs.) _____

Age (days) _____

(6) Calving period (date calving starts and ends) _____

Livestock Investment	Beg. Year	End Year	Average
Bulls			
Dairy Cows			
Beef Cows			
Heifers			
Steers			
Calves			
Stockers			
Feeders			
Association Cattle			
Total Cattle			

Building	Size	Total Investment	Per cent Livestock	Value Livestock
1. Main barn				
Other barns				
Corrals				
Other (specify)				
2. Granaries				
Total Buildings			XXX	

1. Machinery & Equipment

Item	Number	Size	Total Investment	Per cent Livestock	Value of Livestock
1st Tractor					
Other					
Combine					
Swather					
Baler					
Mower					
Rake					
Moldboard plow					
Oneway					
Discer					
Drill					
Sp. tooth harrow					
Drag harrow					
Deep Tiller					
Cultivator					
Other					
TOTAL	XXX	XXX		XXX	

2. Total enterprise investment (O&P&Q) $ _____ Annual Investment Cost $_____

3. Nature of Beef enterprise: Primary _____ Secondary _____

I. Marketing Pattern

Types of Animals	Month of Sale	Prices	Weights

J. Labor Supply Available

Month	Operator	Family	Other	Total
January				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				
TOTAL				

Comments on Labor Supply _____

_____

_____

_____

'. Usual Rotation _____

Others _____

_____

_____

_____

I. <u>Sequence of Operations</u>

(1) Summerfallow _____

(2) Wheat on fallow _____

Wheat on stubble _____

(3) Oats on fallow _____

Oats on stubble _____

(4) Barley on fallow _____

Barley on stubble _____

(5) Flax on fallow _____

Flax on stubble _____

(6) Other _____

APPENDIX B

LIVESTOCK PRICES, WINNIPEG STOCKYARDS, 1957-1966

CATTLE	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	10 Year Average
Steers:											
Choice	18.88	22.93	24.57	22.60	22.00	25.70	23.85	22.65	24.25	25.60	23.30
Good	17.79	21.95	23.85	21.70	21.40	24.85	23.00	21.85	23.25	25.15	22.48
Heifers:											
Choice	17.68	21.43	23.32	21.31	20.70	23.97	23.03	20.67	22.15	24.20	21.85
Good	16.55	20.42	22.26	20.22	19.85	22.75	21.64	19.74	20.55	23.40	20.74
Cows:											
Good	11.90	16.60	17.05	15.50	15.50	17.20	17.10	15.40	14.80	18.85	15.99
Medium	10.61	15.40	15.83	14.32	14.52	15.88	15.92	14.33	13.67	17.70	14.82
Calves:											
Choice & Good	23.65	28.45	31.75	30.45	30.35	33.35	32.45	30.70	29.80	34.35	30.53
Medium & Common	16.98	22.46	25.63	24.05	24.23	26.67	25.36	23.06	23.00	26.65	23.81
All Calves:	18.25	25.02	25.41	23.56	24.35	27.60	24.55	21.05	21.35	26.00	23.71

Source: Livestock Market Review, (1957-66).