# ECONOMIC ANALYSES OF THE EFFECTS OF CALVING SEASON ON BEEF COW-CALF-FORAGE SYSTEMS

by

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# CHAPTER I

# INTRODUCTION

## Background

In Virginia, cattle production is the third largest agricultural industry and the fastest growing of the livestock industries. The number of sheep and dairy cattle has been declining, while the number of beef cattle has increased each year since 1965. Thus, by 1975, Virginia had 1,750,000 head of cattle, a figure which represents a 38 percent increase from 1965. Of this number, 159,000 are milk cows, 621,000 are beef cows, 140,000 are beef cow replacements and 86,000 are heifers over 500 pounds. Also, there are 239,000 steers and bulls over 500 pounds and an additional 474,000 steers, bulls and heifers under 500 pounds, while only 31,000 are presently being fed for slaughter.[1/]

In the Middle Atlantic Region (Virginia, Maryland, Delaware and Washington, D.C.) beef consumption is projected to increase from 1,716,000 beef carcasses in 1970 to 2,308,000 in 1980. At present, less than 20 percent of the beef consumption in the area is purchased from local slaughter. Although the number of cattle marketed in Virginia has increased by over 60,000 head since 1964, the number of

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[1/] Virginia Crops and Livestock, Crop Reporting Service, U.S. Department of Agriculture, Virginia Department of Agriculture and Commerce, Vol. 47, No. 2, February 1975, page 2.

cattle slaughtered has decreased by over 70,000 head.[1/] Meat packing plants in Virginia have imported carcass beef from outside the area because a regular supply of high quality Virginia beef carcasses has not been available throughout the year.[2/]

Farm records and economic analyses indicate that for many beef farms in Virginia the sale of weaned calves has been less profitable than keeping weaned calves a longer period and feeding the calves to heavy feeder or slaughter weights.[3/] If Virginia farmers can competitively supply to Virginia slaughter plants a regular supply of finished beef, then Virginia farmers, and also meat packing operators may benefit by higher returns, and consumers may benefit from lower costs.

## Problem

There are several ways of providing Virginia meat packing plants with a uniform constant supply of beef throughout the year. One way is to vary the length of feeding and another way is to adjust the season of calving. A more even seasonal distribution of finished cattle may be attained by varying the length of feeding period (rate of daily

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1/ Livestock Slaughter, U.S. Department of Agriculture, Statistical Reporting Service, September 1975.

2/ Virginia Division of Industrial Development, Virginia Department of Agriculture and Commerce, and Virginia Agricultural Extension Service, Virginia Polytechnic Institute and State University, The Feasibility of Cattle Finishing and Cattle Slaughter Facilities in Virginia, July 1972.

3/ Kline, R. G. and Charles H. Cameron, The Beef Industry in the Appalachian Area of Virginia, Research Bulletin 99, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, April 1975.

gains) for weaned calves, but under many circumstances, a long feeding period increases the cost per hundredweight gain of producing high quality of beef carcasses.[1/]

Another method to facilitate a regular supply of finished beef is to adjust the seasonal pattern of calving so that a more even distribution of calves may occur throughout the year. This is the problem to which the present research is directed. According to a recent survey of beef farmers in Virginia the calving season has been mainly from December to May.[2/] The calving dates reported in 1969 for the three areas with 90 percent of state's brood cows were as follows:

| | Percent of the farms | | | |
|---|---|---|---|---|
| Area | Dec.-Feb. | March-May | June-Aug. | Sept.-Nov. |
| Appalachian | 54 | 41 | 3 | 2 |
| Northern Virginia | 64 | 32 | 1 | 3 |
| Piedmont | 53 | 44 | 3 | 0 |

This calving pattern directly creates the uneven seasonal marketing pattern of Virginia fed cattle which is shown in Table 1-1. As the table reveals, each of the months February through June shows a large deviaiton above equal sales in every year since 1972. Furthermore, approximately 60 percent of the slaughter cattle sold are sold during these five months.

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[1/] Ibid.

[2/] Butler, Charles, Economic and Operational Characteristics of the Southern Beef Cattle Industry, Southern Cooperative Series Bulletin 176, October 1972 (Virginia data by Kline and Cameron).

Table 1-1. Marketing Pattern of Slaughter Cattle Sales in Virginia

| Month | Equal percent sales | Percent of Annual Sales 1971[1/] | 1972[2/] | 1973[2/] | 1974[2/] |
|---|---|---|---|---|---|
| January | 8.33 | 11 | 1 | 11 | 8 |
| February | 8.33 | 13 | 14 | 20 | 11 |
| March | 8.33 | 13 | 11 | 12 | 9 |
| April | 8.33 | 12 | 15 | 11 | 16 |
| May | 8.33 | 10 | 9 | 14 | 12 |
| June | 8.33 | 8 | 12 | 9 | 11 |
| July | 8.33 | 7 | 5 | 4 | 6 |
| August | 8.33 | 5 | 1 | 1 | 6 |
| September | 8.33 | 5 | 6 | 1 | 7 |
| October | 8.33 | 4 | 3 | 5 | 2 |
| November | 8.33 | 5 | 5 | 10 | 7 |
| December | 8.33 | 7 | 18 | 2 | 5 |
| Average wt. | | | | | |
| Steers | | | 1013 | 1053 | 1068 |
| Heifers | | | 857 | 851 | 890 |

[1/] Holder, D. L., The Feasibility of Cattle Finishing and Cattle Slaughtering Facilities in Virginia, July 1, 1972, Table 4.8, page 4-4.

[2/] Summarized from Virginia slaughter sales records by Animal Science Department, VPI & SU.

The following questions relate to the effects of season of calving. Why do Virginia farmers predominantly plan for beef cows to calve during the months of December to June? Is there a relationship between calving season and the initial weight and daily gains of calves? Are prices of weaned calves more favorable during specified seasons of the year? What is an economical beef forage feed system for calves born during spring, summer and fall?

## Review of Literature

An experiment is being conducted at the Forage Research Station, Middleburg, Virginia, to study the effects of forage-feed system and season of calving, fall and spring, on calf performance (two years reported).[1/] Three systems of forage are being used: (1) bluegrass-white clover pasture and alfalfa-orchardgrass hay, (2) bluegrass-white clover pasture and fescue-red clover pasture, and (3) fescue-white clover pasture and fescue-red clover pasture. Spring born calves have had a slightly higher daily gain and weaning weight than fall calves -- average daily gains of spring calves was 1.88 pounds, and for fall calves was 1.72 pounds. Neither the spring nor fall calves performed well on the all fescue-clover system, averaging 40 to 60 pounds less than when cows and calves were grazed on bluegrass-clover and fescue-red clover or alfalfa-orchardgrass pastures. Fescue-clover has produced enough fall growth (two tons hay equivalent) for spring calving

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[1/] Hammes, Jr., Roy C., "Beef Cow and Calf Performance on Year-Round Grazing Systems," Northern Virginia Forage Conference Proceedings, March 11, 1976. This experiment is still in progress. Results are based on two years of data.

lots but heavy stocked (1.66 A/cow and calf) fall calving lots have needed some hay.

Research at the Ohio Research Center indicates that fall calving is a good complement to spring calving if the beef producer has good quality feed available for wintering his beef cow herd.[1/] Two fall calving herds were wintered fall 1974, one on improved tall fescue-alfalfa, the other on unimproved pasture. Both herds had access to hay in large bales which had been cut from the pastures during early summer. From birth (April 4) average daily gains for calves on improved and unimproved pastures respectively were 3.05 pounds and 2.52 pounds. During early summer pasture season both groups of calves gained similarly. Calves were weaned June 23 averaging 596 pounds and 530 pounds or 1.80 pounds and 1.57 pounds gain per day for herds on improved and unimproved pastures respectively. Neither group of calves were creepfed.

Research conducted by the Animal Science Department, Virginia Polytechnic Institute and State University 1957 through 1962 using 28,957 records of data collected from 193 herds participating in the Virginia Beef Cattle Improvement Association (BCIA) performance

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1/ Parker, Charles F. and R. W. Van Deuren, "Fall Calving Valuable for Ohio Beef Herds," Ohio Report on Research and Development, Ohio Agricultural Research and Development Center, Wooster Ohio, Vol. 60, November-December 1975, pages 96-98.

testing program indicates that the month of birth affects the rate of growth of beef calves.[1/] Calves born during February through May gained about four percent faster than January and June calves, 12 percent faster than July through October calves and six percent faster than November and December calves.[2/]

## Objectives

The overall objective of this study is to determine the economic effects season of calving will have on cow-calf farm systems where beef calves are sold at weaning weight, and crops such as corn and hay may be fed or sold. The specific objectives of this study are to determine for beef cow-calf farms the effects of season of calving on: (1) farm income, (2) the optimum combination of beef animals, forage feed crops and crops for cash sale, (3) the cost per hundredweight of weaned calf produced for each season of calving and (4) the beef prices at which non-competitive seasonal calving systems will become competitive.

## Area of Study

An area in Northern Virginia including the Northern Shenandoah Valley and Northern Piedmont of Virginia was chosen for the study

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[1/] Marlowe, T. J., C. C. Mast and R. R. Schalles, "Some Non-Genetic Influences on Calf Performance," Journal of Animal Science, Vol. 24, No. 2, May 1965, p. 495.

[2/] Ibid.

because it is an important beef producing area in the state.[1/] Experiments relating to beef cow-calf performance with spring and fall calving are being conducted at the Northern Virginia Forage Research Station. Results from studies at these research stations provide data for the inputs of this present study. Although, yields of crops and pastures may vary somewhat for other areas of Virginia with adjustments for these differences in yields, the results of this study should be adaptable to beef cow-calf operations in other areas of Virginia.

## Thesis Organization

The remainder of this thesis is divided into five chapters. In chapter II, the relevant theoretical concepts of the theory of farm production are presented. In chapter III, the procedure used in constructing budgets for the various crop and livestock enterprises and in setting up linear programming models to analyze alternatives for beef cow-calf farmers. In chapter IV, the results of the linear programming analyses are presented. In chapter V, there is a disucssion of the results, a statement of why the chosen enterprises are optimal combinations, a statement of the implications of the results and a statement for the need for further research. In chapter VI, there is a summary of the study.

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[1/] The combined Shenandoah Valley and Northern Piedmont Counties has a national classification of economic area 12 (Shenandoah Valley - See Appendix H for counties included).

# CHAPTER II

# THEORY

## Short Run Production and Cost Relationships

The revelant theory for the present study is that of production in perfect competition. More specifically it can be viewed in the short run where some resources remain fixed during the time frame of the production. By holding all other inputs constant while allowing only one to vary, a total product curve, with its associated average product and marginal product curves can be drawn (Figure 1). This represents, for the firm, the technical relationship between the different levels of input and associated output. The stages of production are defined as follows: Stage I displays output increasing at an increasing rate, Stage II displays output increasing at a decreasing rate until marginal product equals zero. That is additional quantities of input produce no additional output. Stage II is shown graphically to be the region between the intersection of the marginal product curve and the average product curve and the interesection of the marginal product curve and the horizontal axis, i.e., where marginal product equals zero. Stage III displays declining output .

Using the production relationships shown in Figure 1 together with prices of inputs, cost curves can be established (Figure 2). From these cost curves, the profit maximizing level of output is established by the intersection of the marginal cost curve and the marginal revenue curve (price line). This will occur in stage II of the production

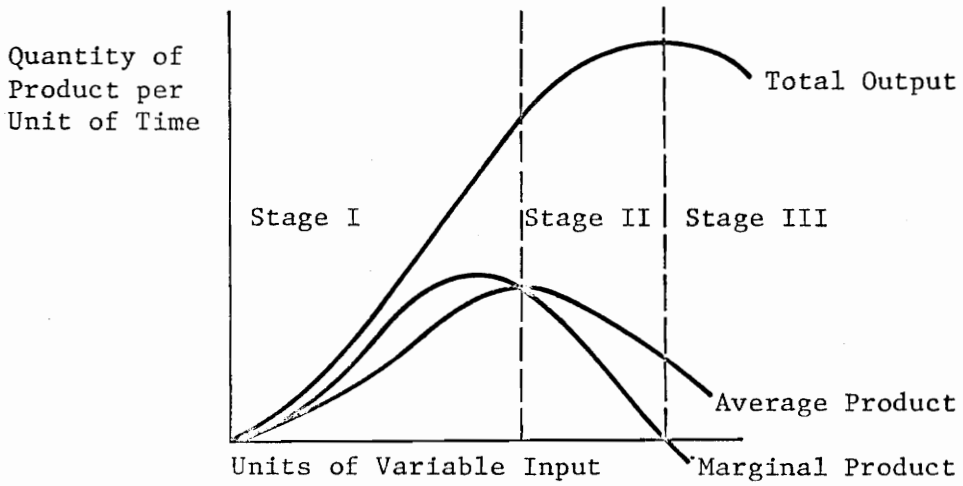
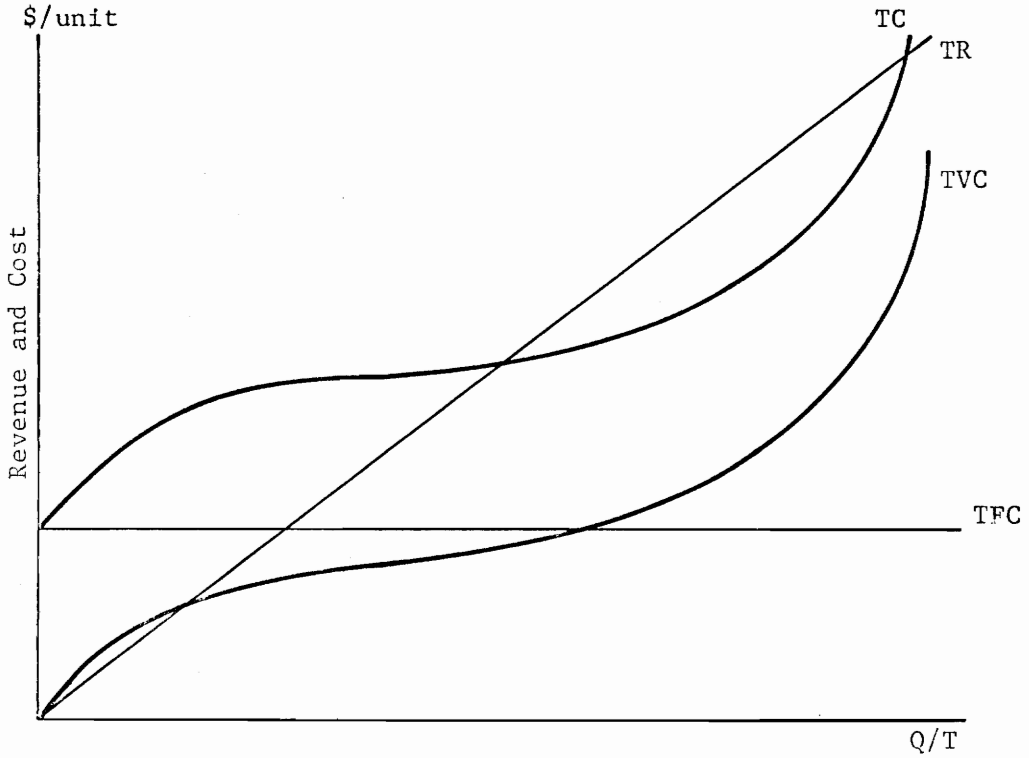



Figure 1. Stages of Production Illustrated Using the Classical Production Function and Associated Average and Marginal Curves.



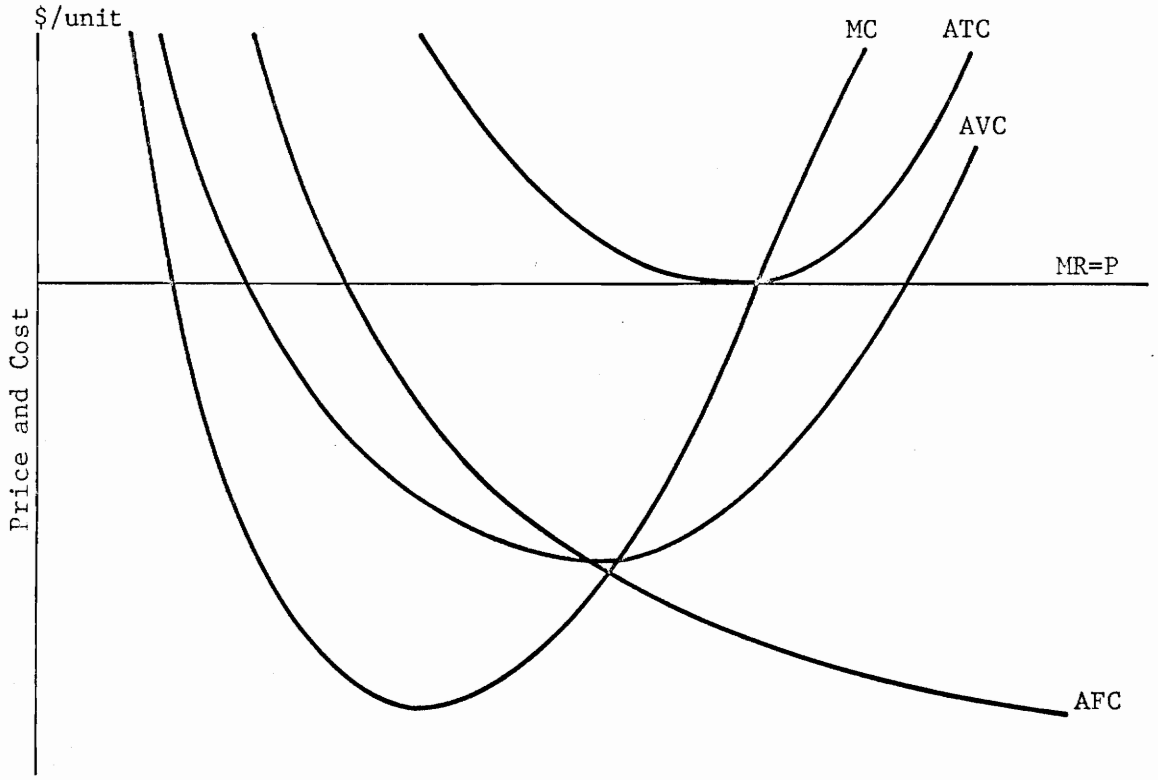




Figure 2. Revenue and Cost Curves.

function, that is between the maximum point of the average product curve and the point at which marginal product equals zero.

## Linear Programming (L.P.) Theory of the Firm

A process ray diagram is used to portray the L.P. model of a single product firm with two effective constraints, cropland and pastureland (Figure 3). The processes $P_1$, $P_2$, and $P_3$, indicate alternative methods of producing beef using specified proportions of the constraining resources, cropland and pastureland. Three processes using different proportions of the two inputs, cropland and pastureland are illustrated graphically.[1/] Viewing from the origin, the production indifference curves (isoquants) ABCDE, JKLM and WXY each shows a level of output with the level of output increasing for isoquants further from the origin. While all three processes in figure 3 are expressed as linear relationships designating constant returns to scale, the assumptions of L.P. do not imply constant marginal returns.[2/] To illustrate this concept, when the amount of cropland is fixed at 80 acres (line JN), and the amount of pasture to produce 50,000 lb. beef (NC) is less than that to produce the second 50,000 lbs. of beef (CK). That is, it takes larger increases in the amount of pastureland to achieve the same increase in the amount of beef produced. Levels of equal cost (isocost)

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[1/] Baumol, W. J., Economic Theory and Operations Analysis, Second Edition, Prentice Hall, Inc., Engleweed Cliffs, New Jersey, 1965, pp. 270-294.

[2/] Swanson, E. R., Programming Optimal Farm Plans, Farm Size and Output Research; a study in Research Methods, Southern Cooperative Series Bulletin No. 56, June 1958, pp. 48 and 49.

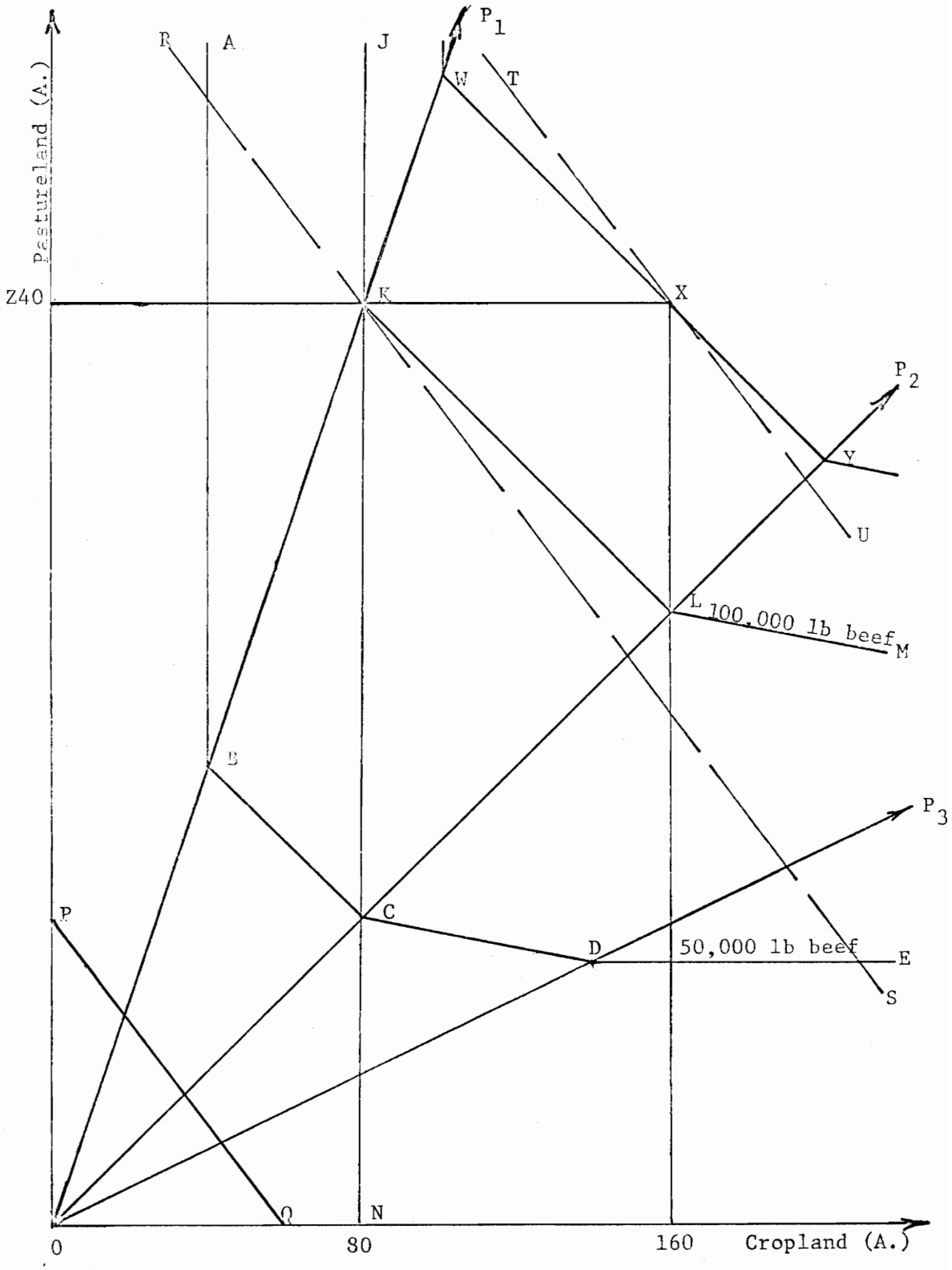


Figure 3. L. P. Ray Diagram of a Single Product Firm.

of pastureland and cropland are also illustrated in figure 3, lines PQ and RS. The isocost line that is tangent to the highest possible isoquant determines the optimal process for that specified output. The resource restrictions of the farm firm, 160 acres of cropland and 240 acres of pastureland determine the least cost level of output for 125,000 lbs. of beef (point x). As point x lies between processes $P_1$ and $P_2$, the optimum output is achieved by using WX:WY of process $P_1$ and XY:WY of process $P_2$.

## L.P. Model for Multiple Product Firm

While the usual marginal analysis model of production proceeds by maximization of a profit function subject to a production function, the L.P. model provides for maximization of an objective function subject to a set of constraints, equations or inequalities. The additional special postulates of L.P. are linearity, divisibility, additivity and finitiness.[1/] This L.P. problem for multiple product firms can be expressed mathematically as follows:

$$\text{Maximize: } f = c_1x_1 + c_2x_2 + \dots c_nx_n \tag{1}$$

$$\text{Subject to: } a_{11}x_1 + a_{12}x_2 + \dots a_{1n}x_n \leq b_1 \tag{2}$$

$$a_{21}x_1 + a_{22}x_2 + \dots a_{2n}x_n \leq b_2 \tag{3}$$

$$\vdots \qquad \vdots \qquad \vdots \qquad \vdots$$

$$a_{m1}x_1 + a_{m2}x_2 + \dots a_{mn}x_n \leq b_m \tag{4}$$

$$x_i \geq 0 \quad (i = 1, \dots, n) \tag{5}$$

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[1/] Ibid., p. 47.

Where equation (1) represents the objective to be maximized; inequalities (2), (3), and (4) represent the constraining rows; and each column containing an $x_i$ represents a productive process. Statement (5) restricts the levels of the processes to nonnegative values. The c, a, and b values represent respectively the amount of profit for a process, the level of inputs represented by a process, and the restriction placed on a model.

The theory of production for multiple product firm is illustrated graphically in Figure 4. The restriction of pastureland, cropland, labor and capital form the production transformation curve illustrated by the linear segmented curve ABCDE. The slope of the isorevenue XY or YZ determines the optimum combination of corn and beef to be sold. When the ratio of the prices of cattle to corn is such that segment PQ is the revelant isorevenue line (which is parallel to YX) then the optimal combination is point D. The isorevenue curve is tangent to the transformation curve at a point permitting the highest possible returns. If that price ratio changes such that segment RS is revelant isorevenue line (which is parallel to YZ) then point C defines the optimal combination.

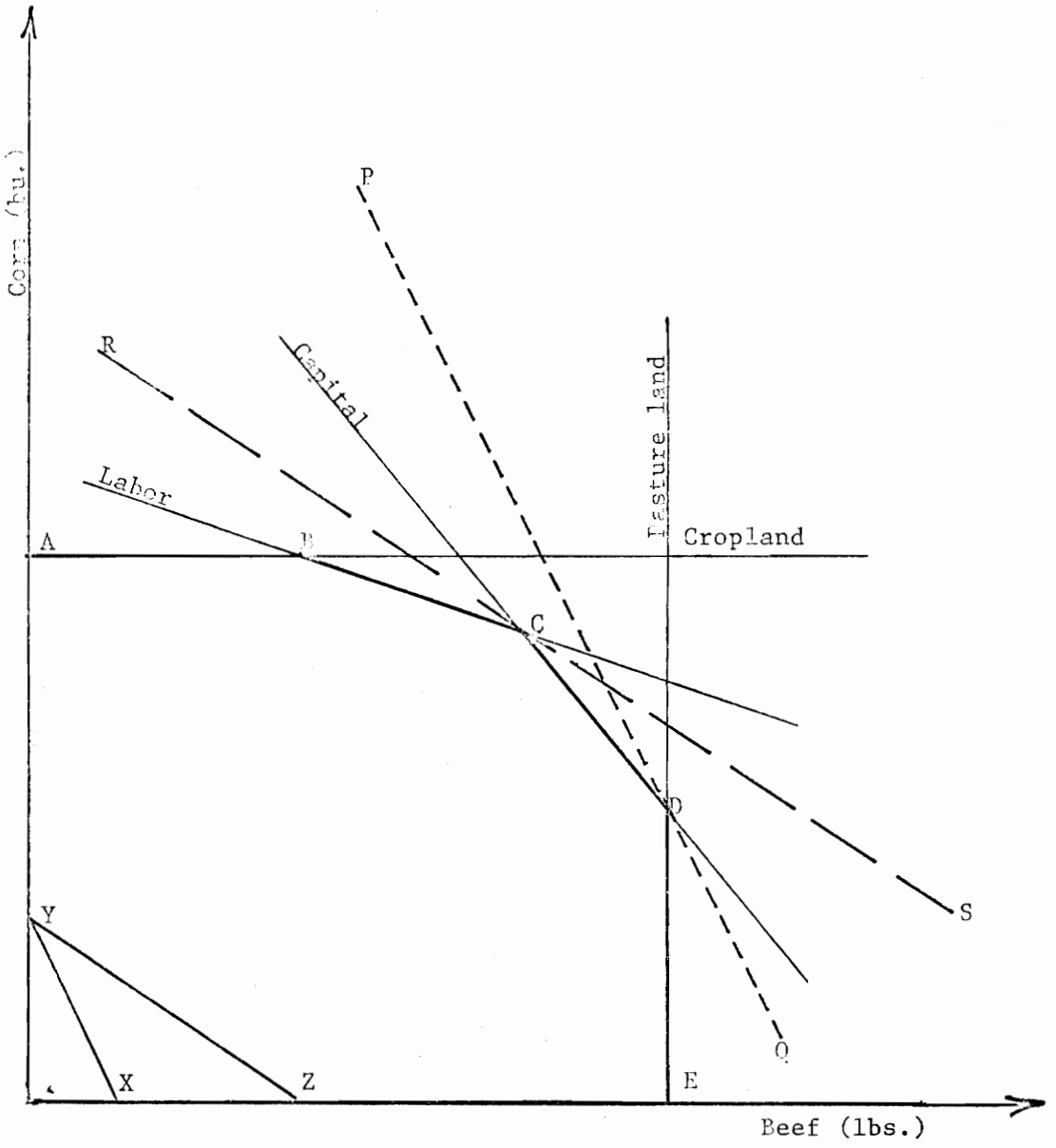


Figure 4. Graphical Analysis of Linear Programming.

# CHAPTER III

## PROCEDURES

To satisfy the objectives set forth in Chapter I, twelve crop and forage budgets and three livestock budgets will be constructed. Then data from these budgets together with the limited resources available to the representative farms will be used to set up the linear programming farm planning model to address the other objectives listed in Chapter I.

### Crop and Livestock Budgets Developed Using the Budget Generator

Crop budgets:

To construct a crop budget using the Virginia Polytechnic Institute and State University's Version of the Oklahoma State University Crop and Livestock Budget Generator, for each crop the quantity and price of each input and output, and the month of the year that is feasible to plant, to cultivate, to spray, and to harvest are stipulated. Also, the type and size of the equipment needed for each operation is stipulated as well as the crop, yield and type of land. This information is coded on a crop enterprise input form and is punched on computer cards. These cards are combined with proper job cards and read into the computer. A budget is created, and stored for future use as an input to the L.P. model.

The major forage crops for the Northern Virginia Area are native pasture consisting of Kentucky bluegrass and white clover, and established pastures of orchardgrass with alfalfa and fescue with red clover. Winter feeds include stockpiled fescue, corn silage and hay cut from the established pastures, in order to utilize the surplus spring growth. Corn grain, a cash crop, will be considered in this study as an alternative to corn grown for silage. All forages production is in terms of total digestible nutrients (TDN) and expressed in animal unit months (AUM's)[1/] for the production period produced. Hay and corn silage are transferred to be fed in any of the four periods. The yield for corn silage will be on an as-fed basis, considering storage and feeding losses of 13%. Production data from the extension publications of the Agronomy Department of V.P.I. & S.U. was reviewed. With advice from extension specialists from the same department, crop yields and rates of fertilization are developed.

Because of seasonal variation of forage output the yields are listed for the four production periods:

Period 1, April 16 - June 15 (61 days),

Period 2, June 16 - August 31 (77 days),

Period 3, September 1 - November 30 (91 days), and

Period 4, December 1 - April 15 (136 days).

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[1/] An animal unit month is the amount of feed nutrients necessary to sustain a 1,000 pound animal (an animal unit) for a month. In calculation, one AUM is equivalent to 400 pounds TDN utilized.

These periods correspond directly to the season of growth of most pastures: spring with the most pasture growth, summer with little growth, fall with good growth and winter with essentially no growth.

For each crop a charge was included, when appropriate, for harvesting, storing and feeding. For the pasture crops, the charge was for fence repair and any temporary fencing needed for proper management. For harvested crops such as corn, grain, corn silage and hay, the harvesting of crops were charged at custom rates (see Appendix A). This allowed for flexibility to reflect the changes in the farm organization as cattle prices were varied, holding the other prices constant. Also, corn silage was charged $4.28/ton to cover all costs of storage and feeding from a tranch silo. All other equipment was considered as being on the farm and, therefore, a fixed asset for the duration of these analyses. A list of this equipment complement is found in Appendix A.

Beef budgets:

As consideration of season of calving is the main thrust of this study, three beef cow-calf budgets are developed using a similar process as outlined above for crops. The three seasons of calving are spring, summer and fall with calving dates centered on March 1, July 15, and October 1, respectively. The performance of beef cows and calves for the spring and fall system is based on the current Middleburg study, while the performance of beef cows and calves of the summer system is

simulated for similar conditions using the Marlowe study.[1/] The amount of feed required for each season of calving varies directly with the average rates of gain of the steers and heifers (Table 3-1) using Middleburg rates of gain data. Feed requirements for the cattle are listed for the same four production periods as used for crops. In pounds of total digestible nutrients, the feed required by season of calving is 5,447 for spring, 5,369 for summer, and 5,282 for fall. The average daily rate of gain of steer calves in pounds per day is 1.93 for spring, 1.80 for summer and 1.70 for fall. Weights and average daily rates of gain (adjusted for 260 days) from the Hammes' study,[2/] and summer average daily rates of gain were calculated from this study using Marlowe's study.[3/] As forage production is measured in animal unit months, feed requirements measured in TDN is converted to AUM's (1 AUM is equivalent to 400 pounds TDN utilized). Also included in Table 3-1, by season of calving, are: the feed requirements in AUM's by period of forage growth (production period) and the total feed required on a per cow basis; the birth weights of the calves; and the sale weights of steers, heifers and replacement heifers, which together make up the primary source of livestock revenue. A unit of

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[1/] Marlowe, T. J., C. C. Mast and R. R. Schalles, "Some Non-Genetic Influences on Calf Performance," Journal of Animal Science, Vol. 24, No. 2, May 1965, p. 495.

[2/] Hammes, Jr., Roy C., "Beef Cow and Calf Performance on Year-Round Grazing Systems," Northern Virginia Forage Conference Proceedings, March 11, 1976.

[3/] Marlowe, p. 495.

Table 3-1. Feed Requirements in Total Digestible Nutrients for a Thirty-three Head Beef Cow-Calf Herd for Three Seasons of Calving. Total by Class of Livestock and by Production Period

| Livestock class[1/] | Pounds of total digestible nutrients | | |
|---|---|---|---|
| | Spring | Summer | Fall |
| Steers | 60,111 | 59,621 | 57,282 |
| Heifers | 16,742 | 16,177 | 14,152 |
| Cows | 73,262 | 72,694 | 73,884 |
| Cow and calf subtotal | 150,115 | 148,492 | 145,318 |
| Replacement heifers | 24,896 | 23,947 | 24,262 |
| Bull | 4,745 | 4,745 | 4,745 |
| Herd total | 179,756 | 177,184 | 174,325 |
| Total (lbs./brood cow) | 5,447 | 5,369 | 5,282 |
| Total (AUM's/brood cow) | 13.62 | 13.42 | 13.21 |

By periods of forage growth on a per cow basis as animal unit months:

| Period | Dates | Spring | Summer | Fall |
|---|---|---|---|---|
| 1 | Apr. 16-June 15 | 2.10 | 1.81 | 2.76 |
| 2 | June 16-Aug. 31 | 3.23 | 2.51 | 2.31 |
| 3 | Sept. 1-Nov. 30 | 4.00 | 3.29 | 2.98 |
| 4 | Dec. 1-Apr. 15 | 4.29 | 5.81 | 5.16 |
| Total (AUM's/brood cow) | | 13.62 | 13.42 | 13.21 |

Birth weights of calves in pounds

| Sex | Spring | Summer | Fall |
|---|---|---|---|
| Steers | 84 | 78 | 72 |
| Heifers | 80 | 74 | 68 |

Average daily rates of gain in pounds per day adjusted for 260 days[1/]

| Sex | Spring | Summer | Fall |
|---|---|---|---|
| Steers | 1.93 | 1.80 | 1.70 |
| Heifers | 1.81 | 1.68 | 1.58 |

Sale weights of cattle in pounds

| Sex | Spring | Summer | Fall |
|---|---|---|---|
| Steers | 585 | 545 | 515 |
| Heifers | 550 | 510 | 480 |
| Replacements | 960 | 920 | 912 |

SOURCES: (1) Number 4, Nutrient Requirements of Beef Cattle (fifth revised edition), 1976 National Academy of Sciences.
(2) Hammes, Jr., Roy C., "Beef Cow and Calf Performance on Year-Round Grazing Systems, Northern Virginia Forage Conference Proceedings, March 11, 1976.
(3) Marlowe, T. J., C. C. Mast and R. R. Schalles, "Some Non-genetic Influences on Calf Performance," Journal of Animal Science, Vol. 24, No. 2, May 1965, p. 495.

[1/] Based on two years of data. See page 5 for actual rate of gain.

cattle, for this study, consists of one brood cow, 0.15 of a replacement heifer and 0.03 of a herd bull. A 90 percent calf crop of 0.45 of a steer and 0.45 of a heifer will be assumed, while marketing 0.45 of a steer calf, 0.30 of a heifer calf, 0.12 of a cull cow and 0.03 of a cull yearling heifer and 0.01 of a cull bull annually. In addition to the livestock receipts a beef cow is credited for fifty percent of the manure produced (Appendix B, Table 4). As cattle will be on pasture the year around no charge will be made for spreading manure.

## Prices

Prices of inputs and products used in this study are average prices of 1967 to 1975 prices adjusted to 1976 dollars. The prices of calves were obtained from "Results, Virginia Feeder Calf Sales" for the weight and month sold for the past ten years. These prices are deflated to 1967 dollars using the consumer price index and inflated to 1976 dollars using the index for livestock products sold. All prices of inputs and products are found in Appendix A.

## L.P. Model Construction

The main focus of this study is to determine the potential returns from beef cow-calf systems with alternative calving dates, when management practives are assumed to be similar to practices usually used by better beef farmers in the area.

The construction of the Linear Programming (L.P.) model is a vital part of this study. The validity of solutions and their potential

use relies on the ability of the model to provide information related to the major objectives. By using an L.P. model an optimum combination of resources and products is obtained for specific situations from the alternatives considered. The model contains an objective function, three categories of activities--production, marketing and resource supplying--and two types of constraints--real and accounting. The objective function, the activities and the constraints are described in the following sections. Appendix F shows the complete L.P. matrix with a description of each activity and constraint used in the model.

Objective function:

The objective function of the L.P. model is to maximize net returns to fixed resources subject to the constraints included. Objective 1 (Variable Cost) is specified as maximization of net returns to fixed resources for the short run. The model also includes a count row that calculates the net returns after the annual costs for fixed factors other than land and labor have been deducted.

Activities:

The production activities considered consist of four groups - the beef cow-calf budgets, the crop budgets, the buying activities and the selling activities. The first two groups, viz. the beef cow-calf budgets and the crop budgets, have been fully discussed earlier; therefore, the latter two groups are explained in this section.

Buying activities included hiring labor and buying feed. Labor is divided into the four quarters of the year. The periods are January-

March, April-June, July-September and October-December. Labor can be hired in any of these four periods at $2.75 per hour if additions to operator labor are needed and profitable. A TDN balance activity and a buy corn silage activity are necessary to effect a transfer of feed (as TDN) to any of the four production periods.

The crop selling activities include hay and corn grain. All the revenue from sales of livestock is included in the cow production activity and reported as "Other Livestock Income".

The hay enterprise was charged for custom baling and the removal of the large 1,000 pound round bales from the field where it was stored until fed. Another charge was included for moving these bales back to the field for feeding. Hay for sale was charged for custom baling in small (40 lb.) rectangular bales and moving bales when sold. The corn grain enterprise was charged for drying the corn, and is considered sold at the farm when harvested, so no charge is made for storage.

Constraints:

The constraints associated with the representative farm used in this study include land, labor and feed. The average amount of open-land for a beef cow-calf operation in the Northern Virginia Area is 320 acres.[1/] The land use classifications and amount for the average beef operation are: (1) land suitable for continuous row crops using conventional tillage, 90 acres designated land A; (2) land suitable for reduced tillage and for rotational crops using conventional tillage, 58

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[1/] 1969 survey of beef farm in Virginia Department of Agriucltural Economics.

acres designated land B; (3) land suitable for estalbished pastures and hay, 22 acres designated land C; (4) land suitable for improved native pasture only, 115 acres designated land D; and (5) land suitable for unimproved native pasture only, 35 acres designated land E.

Labor furnished by the farm manager is assumed to be 2,200 hours per year: January-March, 500 hours; April-June, 600 hours; July-September, 600 hours; October-December, 500 hours.

The only feed restriction is that the feed must be produced on the farm. This restriction is included in the L.P. model by placing a prohibitive high cost on purchasing corn silage and hay.

## L.P. Farm Program

The L.P. matrix was set up using the Virginia Polytechnic Institute and State University's Version of the Oklahoma State University L.P. Farm Program. This was accomplished by using the computer cards punched by the Budget Generator mentioned earlier in this chapter. These two programs are compatable and can be so set up that cards punched from the Budget Generator can be directly used as the input (data) cards for the L.P. Farm Program.

# CHAPTER IV

## RESULTS OF THE LINEAR PROGRAMMING ANALYSES

In this chapter the results of the linear programming analyses are presented. Maximization of net returns to fixed resources is used as a farm operator's objective in selecting his optimum farm organization. These results are presented in the order of the objectives as stated in Chapter I.

### Basic Calf Prices

Returns:

Beef cow-calf farms with spring calving has the greatest net returns to land, labor, and management, $30,696, followed closely by fall calving with $30,257, and the least profitable returns are for summer calving, $27,750 (Table 4-1). The number of head of brood cows for spring, fall and summer calving are 215, 164 and 120, respectively. The percent of gross farm receipts from livestock is 81.9 percent for spring calving, 64.5 percent for fall calving and 53.8 percent for summer calving.

Enterprises:

For the spring calving system crops grown on land A are corn silage 46.3 acres, corn grain 12.5 acres, and fescue with red clover for hay, summer pasture and winter (stockpiled) pasture 31.2 acres. The total of available land classes B and C, 80 acres, is utilized as

Table 4-1. The Effect of Season of Calving on Farm Income, Basic Cattle Prices

| Item | Season of calving [1] | | |
|---|---|---|---|
| | Spring | Summer | Fall |
| | $ | $ | $ |
| Gross Income | | | |
| Crop sales | | | |
| Hay | 10,750 | 7,393 | 9,625 |
| Corn | 3,317 | 21,477 | 15,562 |
| Subtotal | 14,067 | 28,870 | 25,187 |
| Livestock sales [2] | | | |
| Calves | 40,450 | 20,747 | 28,181 |
| Cull livestock | 9,753 | 5,369 | 7,610 |
| Manure credit | 13,577 | 7,441 | 9,958 |
| Subtotal | 63,780 | 33,557 | 45,749 |
| Total | 77,847 | 62,427 | 70,936 |
| Operating Expenses | | | |
| Interest | 10,947 | 6,471 | 8,559 |
| Seed cost | 4,840 | 2,411 | 2,499 |
| Fertilizer, lime, minerals and salt | 19,578 | 16,122 | 19,415 |
| Machine hiring expense | 5,235 | 4,699 | 4,461 |
| Machine operating expense | 713 | 640 | 699 |
| Veterinary and medicine expense | 2,385 | 1,333 | 1,815 |
| Trucking and marketing expense | 520 | 291 | 396 |
| Livestock commission | 492 | 256 | 352 |
| Total | 44,711 | 32,223 | 38,195 |
| Net Return to Fixed Resources | 33,136 | 30,204 | 32,740 |
| Overhead Expenses | 2,440 | 2,454 | 2,483 |
| Net Return to Land, Labor and Management | 30,696 | 27,750 | 30,257 |

[1] Calving dates: Spring-March 1; Summer-July 15; Fall-October 1.

[2] Number of cattle spring 215 head, summer 120 head, fall 164 head.

fescue with red clover. Bluegrass with white clover is grown on all the available land classes D and E, 150 acres. The bluegrass on land D receives a high level of fertilization.

Crops grown for the fall and summer calving systems are basically the same as they are for the spring calving system except that different amounts of corn silage and corn grain are grown. Summer and fall calving systems use only about 20 percent as much land A, 9.3 acres and 10.8 acres respectively, for corn silage as does spring calving. About 6½ times as much corn grain is grown on land A for the summer calving system and 4 2/3 times as much corn grain for the fall system when compared with spring calving. With the summer calving system the bluegrass-white clover grown on land D receives a low level of fertilization, and 7.9 AUM's of pasture are not utilized during the spring growing season, April to June.

Sensitivity analyses:

Beef farm operators do not have perfect information concerning prices or technical coefficients of production when making decisions. Likewise, constraining resources, such as the acres of the various types of land, vary from farm to farm. In order to take into consideration these variations, sensitivity analyses are made.

The results of the enterprise combination presented previously in Table 4-2 are on the basis of the resources assumed to be available on the farm, certain prices and technical coefficients. The sensitivity analysis presented in Table 4-3 shows the extent to which income would be increased or decreased if more (or less) of a specified resource

Table 4-2. The Optimum Combination of Crops and Beef Cows for a Beef Cow-Calf Farm by Seasons of Calving, Basic Beef Prices

| Item | Unit | Spring | Summer | Fall |
|---|---|---|---|---|
| Land Use | | | | |
| Forage-feed crop | | | | |
| Bluegrass/white clover pasture, land E | Acre | 35.0 | 35.0 | 35.0 |
| Bluegrass/white clover pasture, land D, low fertilizer | Acre | | 115.0 | |
| Bluegrass/white clover pasture, land D, medium fertilizer | Acre | | | |
| Bluegrass/white clover pasture, land D, high fertilizer | Acre | 115.0 | | 115.0 |
| Fescue/red clover, hay, summer pasture and winter pasture, land C | Acre | 22.0 | 22.0 | 22.0 |
| Fescue/red clover, hay, summer pasture and winter pasture, land B | Acre | 58.0 | 58.0 | 58.0 |
| Fescue/red clover, hay, summer pasture and winter pasture, land A | Acre | 31.2 | | 20.7 |
| Corn for silage with rye cover, land B | Acre | | | |
| Corn for silage with rye cover, land A | Acre | 46.3 | 9.3 | 10.8 |
| Other crops | | | | |
| Corn for grain with rye cover, land B | Acre | | | |
| Corn for grain with rye cover, land A | Acre | 12.5 | 80.7 | 58.5 |
| Crop sales | | | | |
| Hay | Ton | 199.8 | 137.4 | 178.9 |
| Corn | Bu. | 1,246.9 | 8,074.0 | 5,850.2 |
| Excess pasture (Apr.-June) | AUM | | 7.9 | |
| Crop feeds | | | | |
| Hay | Ton | | | |
| Silage | Ton | 746.1 | 149.1 | 173.3 |
| Livestock Enterprises | | | | |
| Beef cow-calf | Head | 215.0 | 120.0 | 164.0 |
| Steers calves | Head | 97.0 | 54.0 | 74.0 |
| Heifers calves | Head | 65.0 | 36.0 | 49.0 |
| Cull cows | Head | 26.0 | 14.0 | 20.0 |
| Cull heifer | Head | 6.0 | 4.0 | 5.0 |
| Cull bulls | Head | 3.0 | 1.0 | 2.0 |
| Returns to Fixed Resources | $ | 33,136.0 | 30,204.0 | 32,740.0 |

were available. This imputed value of a resource is indicated in Table 4-3, column headed "MVP". The range over which the imputed value will hold is indicated under the columns "Range-Low, High". For example, in Table 4-3, a one acre change of land A for spring calving, holding everything else constant, would change the returns to fixed resources by $180.42. The representative farm had 90 acres of land A and the imputed value $180.42 per acre, would hold if acreage available was as low as 80.9 acres or as high as 127.7 acres. For acreage of land A less than 80.9 the expected MVP value would be somewhat greater than $180.42 per acre.

The MVP's of lands A, B and C are each about the same for optimum plans with the three seasons of calving, but MVP's differs for lands D and E. While the MVP for land D for fall calving differs from spring calving by about $3, that for summer calving differs by about $21, from the spring calving system. Whereas, the MVP of land E for fall calving is about the same as for spring calving, summer calving is only about 50 percent of that for spring calving.

Sensitivity analyses for stability of activities, both those that are and those that are not included in the optimum farm plan, are shown in Table 4-4. For activities included the optimum farm plan Table 4-4 column "Cost" indicates the cost (+) or returns (-) for a unit of the activity specified in the row. The columns headed "Level" indicate the level of the activity in an optimum plan; and "Range-High, Low" indicates, with costs (returns) of all other activities constant, the range over which a cost (returns) of a specified activity can vary without a change in the level of the optimum enterprise combination.

Table 4-3. The Value of an Additional Unit of Limited Resources,[1/] With the Applicable Range for Which these Values Will Hold, Basic Beef Prices

| Resource | Unit | Amount | MVP | Low | High |
|---|---|---|---|---|---|
| | | | $ | | |
| Spring Calving | | | | | |
| Land A | Acre | 90.0 | 180.42 | 80.9 | 127.7 |
| Land B | Acre | 58.0 | 162.29 | 47.8 | 87.2 |
| Land C | Acre | 22.0 | 133.88 | 10.0 | 56.4 |
| Land D | Acre | 115.0 | 32.55 | 84.3 | 122.9 |
| Land E | Acre | 35.0 | 22.71 | 0 | 54.3 |
| Labor | Hours | 2,200.0 | | | |
| Summer Calving | | | | | |
| Land A | Acre | 90.0 | 180.31 | 15.7 | 108.4 |
| Land B | Acre | 58.0 | 161.72 | 44.8 | 61.5 |
| Land C | Acre | 22.0 | 133.39 | 6.4 | 26.1 |
| Land D | Acre | 115.0 | 11.28 | 109.8 | 227.9 |
| Land E | Acre | 35.0 | 10.36 | 29.3 | 159.5 |
| Labor | Hours | 2,200.0 | | | |
| Fall Calving | | | | | |
| Land A | Acre | 90.0 | 180.42 | 47.3 | 118.2 |
| Land B | Acre | 58.0 | 162.29 | 10.1 | 77.4 |
| Land C | Acre | 22.0 | 133.88 | | 44.8 |
| Land D | Acre | 115.0 | 29.48 | 95.4 | 162.7 |
| Land E | Acre | 35.0 | 21.47 | | 151.5 |
| Labor | Hours | 2,200.0 | | | |

[1/] The amount of unused labor was 838 hours for spring, 1386 hours for summer and 1198 hours for fall calving. The amount of capital used was $121,636 for spring, $71,897 for summer and $95,098 for fall. These are the main restrictive resources, others are listed in Appendix F.

Table 4-4. Cost Ranges for the Optimal Combination of Crops and Livestock for a Beef Cow-Calf Farm in the Shenandoah Area, Virginia by Seasons of Calving, Basic Cattle Prices[a/]

| Activity | Unit | Cost | Spring calving | | | | Summer calving | | | | Fall calving | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Incoming range | | | | Incoming range | | | | Incoming range | | |
| | | | Level | Cost | Low | High | Level | Cost | Low | High | Level | Cost | Low | High |
| | | ($) | | ($) | ($) | ($) | | ($) | ($) | ($) | | ($) | ($) | ($) |
| Bluegrass/white clover pasture, land E | Acre | 3 | 35 | | | 26 | 35 | | | 14 | 35 | | | 25 |
| Bluegrass/white clover pasture, land D, low fertilization | Acre | 4 | | - 4 | | | 115 | | | 8 | | - 2 | | |
| Bluegrass/white clover pasture, land D, medium fertilization | Acre | 23 | | 19 | | | | 19 | | | | 20 | | |
| Bluegrass/white clover pasture, land D, high fertilization | Acre | 39 | 115 | | | 43 | | 30 | | | 115 | | | 42 |
| Orchardgrass/alfalfa pasture, land C | Acre | 91 | | 43 | | | | 44 | | | | 43 | | |
| Orchardgrass/alfalfa pasture, land B | Acre | 100 | | 46 | | | | 47 | | | | 46 | | |
| Orchardgrass/alfalfa pasture, land A | Acre | 114 | | 58 | | | | 58 | | | | 58 | | |
| Fescue/red clover pasture, land C | Acre | 84 | 22 | | | 132 | 22 | | | 131 | 22 | | | 132 |
| Fescue/red clover pasture, land B | Acre | 95 | 58 | | | 102 | 58 | | | 102 | 58 | | | 102 |
| Fescue/red clover pasture, land A | Acre | 107 | 31 | | | 108 | | 107 | | | 21 | | | 108 |
| Corn silage pasture, land B | Acre | 251 | | 242 | | | | 242 | | | | 242 | | |
| Corn silage pasture, land A | Acre | 268 | 46 | | 265 | 278 | 9 | | 267 | 275 | 11 | | 265 | 278 |
| Corn grain pasture, land B | Acre | 155 | | 147 | | | | 148 | | | | 147 | | |
| Corn grain pasture, land A | Acre | 163 | 13 | | 162 | 171 | 81 | | 156 | 163 | 59 | | | |
| Sell hay | Ton | - 54 | 200 | | - 58 | - 53 | 137 | | | | 180 | | - 58 | - 53 |
| Sell corn | Bu. | - 3 | 1,247 | | - 3 | - 2 | 8,074 | | - 3 | - 3 | 5,850 | | - 3 | - 2 |

Table 4-4. Continued

| Activity | Unit | Cost | Spring calving | | | | Summer calving | | | | Fall calving | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Incoming range | | | | Incoming range | | | | Incoming range | | | |
| | | | Level | Cost | Low | High | Level | Cost | Low | High | Level | Cost | Low | High |
| | | ($) | | ($) | ($) | ($) | | ($) | ($) | ($) | | ($) | ($) | ($) |
| Beef cow-calf | | | | | | | | | | | | | | |
| Spring | Head | -278 | 215 | | -299 | -271 | | | | | | | | |
| Summer | Head | -261 | | | | | 120 | | -261 | -255 | | | | |
| Fall | Head | -261 | | | | | | | | | 164 | | -291 | -255 |
| Excess pasture | | | | | | | | | | | | | | |
| April 16-June 15 | AUM | | | | | | 8 | | 4 | 1 | | | | |
| Net returns | $ | | 33,136 | | | | 30,204 | | | | 32,740 | | | |

a/ Figures have been rounded to the nearest whole number.

For example, for the spring calving system, corn silage with rye cover crop with a production cost of $268 per acre is included in the optimum farm plan at a level of 46 acres. In an optimum farm plan, corn silage acreage as well as the level of all other activities will remain unchanged unless the cost per acre of producing corn silage on land A is less than $265 or more than $278. Compared to spring calving the stability of corn silage is similar for the fall calving system and less stable for the summer calving system.

Corn for silage on land A is moderately stable for costs higher and less stable for costs lower than the $268 per acre budgeted production costs. For spring, summer and fall calving systems respectively, per acre cost increases greater than $10, $7 and $10 would be required before acreage of corn silage in an optimum farm plan would be decreased. However decreases in corn silage production costs per acre greater than $3, $1, and $3 for spring, summer and fall calving systems, respectively would result in increased acreage of corn silage on land A.

Since corn for grain and corn for silage are competitive for the use of land A and B, the stability of the sell corn activity is closely associated with the stability of the corn silage activity. The budgeted sale price of corn is $2.66 per bushel. An increase in returns per bushel of corn of greater than $0.01 for spring and fall calving systems, and less than $0.01 for the summer calving system would cause the sale of corn to increase. Whereas the sale of corn would decrease only if the returns per bushel were decreased more than $0.19, $0.25,

and $0.05 per bushel for spring, fall and summer calving systems respectively.

For spring, summer and fall calving systems, respectively, the returns per cow to fixed resources and feed are $278, $261, and $261. The numbers of brood cows included in optimum programs is 215, 120 and 164 for spring, summer and fall calving, respectively. The beef enterprise for spring and fall calving is moderately unstable with respect to lower returns but quite stable with respect to higher returns. The number of beef cows included in an optimum plan would be less if returns were reduced by more than $7 and $6 per cow (approximately $1.19 and $1.12 per hundredweight of beef produced) respectively for spring and fall calving systems. For spring and fall calving respectively the numberof beef cows would not increase unless returns were increased more than $21 and $30 per cow (approximately $3.56 and $5.61 per hundredweight of beef produced). However, for summer calving, some increase in the level of brood cows would occur with an increase in returns per brood cow of a little more than $0.07 but would decrease only if the returns were decreased by more than $6 per brood cow.

The sensitivity analyses can be extended to other enterprises that are not in the optimum farm plan. This analysis Table 4-4 shows the penality (reduction in returns per unit of fixed resources) that would occur if the specified activity were forced into the farm plan. This is shown in Table 4-4 in the column headed "Incoming Costs". This imputed figure is alos the amount by which it is necessary to increase the net returns to fixed resources (reduce costs) before the specified

enterprise would enter an optimal plan. For example the cost of growing one acre of orchardgrass with alfalfa on land A is $114.32. If an acre of orchardgrass is forced into the optimum combination of enterprises, net returns to fixed resources would be reduced by $58.30. Or, in order for orchardgrass to be a competitive user of land A the production cost per acre would have to be reduced by $58.30. The sensitivity analyses of other enterprises shown in Table 4-4 may be interpreted in a similar manner.

The above sensitivity analyses greatly aided the evaluation of the optimal combination of crops and the numberof brood cows for the basic price level of cattle. To analyze the effects of season of calving on the farm organization under different beef/corn price ratios, all beef receipts are first increased 32 percent and then decreased 32 percent.[1/]

Steer prices for the basic price situations are $47.30 per cwt, $46.73 per cwt and $49.29 per cwt for spring, summer and fall calving respectively. The equivalent steer prices (constant value of manure produced) at the higher price level is $62.34 per cwt, $61.82 per cwt and $65.16 per cwt.

High Calf Prices

Returns:

The net returns to land, labor, and management with a 32 percent price increase for beef was $50,530 for spring, $46,492 for fall and

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[1/] The income per beef cow was increased (decreased) 25%, however this included manure credit. However when this is adjusted for beef sales only it amounts to approximately 32 percent.

the least profitable is again the summer system with $44,577 (Table 4-5). This represents an increase in net returns to land, labor and management of about 60 percent above returns with basic cattle prices (see Table 4-1, page 27). Livestock receipts make up all of the gross receipts as all crops are fed, leaving none for sale.

Enterprises:

The effect of high cattle prices on enterprise combinations is that all feed produced is fed to cattle (Table 4-6). No corn grain is grown as all of land A and B is used for producing corn silage, all land C is utilized for fescue pasture and hay for feed and no hay is sold. The bluegrass on land D receives the high level of fertilization to help produce the pasture needed for 329 head for spring, 333 for summer and 339 for fall calving systems.

Sensitivity analyses:

The MVP's of the limited resources increases when the price of cattle is increased, for example the MVP for land A increases 58 percent and the MVP for land E increases 93 percent (Table 1, Appendix I). Labor is restrictive during the calving period in each of the three systems as well as the harvest season for the spring and fall systems. Labor is an imputed value of $2.87 per hour.

The cost ranging analysis for high cattle prices indicates that the level of beef cattle included in an optimum plan would remain the same even if returns are reduced by $21, $5 and $6 per cow (approximately $3.57, $0.89, $1.12 per hundredweight of beef produced)

Table 4-5. The Effect of Season of Calving on Farm Income, High Cattle Prices

| Item | Season of calving | | |
|---|---|---|---|
| | Spring | Summer | Fall |
| | $ | $ | $ |
| Gross Income | | | |
| Crop sales | | | |
| Hay | | | |
| Corn | | | |
| Subtotal | | | |
| Livestock sales[1/] | | | |
| Calves | 81,495 | 76,197 | 77,235 |
| Cull livestock | 19,649 | 19,719 | 20,857 |
| Manure credit | 20,775 | 20,552 | 20,363 |
| Subtotal | 121,919 | 116,468 | 118,455 |
| Total | 121,919 | 116,468 | 118,455 |
| Operating expenses | | | |
| Hire labor | 1,236 | 1,435 | 1,223 |
| Interest | 16,390 | 16,646 | 16,816 |
| Seed cost | 12,392 | 12,392 | 12,392 |
| Fertilizer, lime, minerals & salt | 24,278 | 24,291 | 24,305 |
| Machine hiring expense | 8,899 | 8,899 | 8,899 |
| Machine operating expense | 459 | 460 | 460 |
| Veterinary and machine expense | 3,647 | 3,701 | 3,760 |
| Trucking and marketing expense | 795 | 807 | 820 |
| Livestock commission | 752 | 710 | 728 |
| Total | 68,850 | 69,342 | 69,404 |
| Net returns to fixed resources | 53,070 | 47,126 | 49,050 |
| Overhead expenses | 2,540 | 2,549 | 2,558 |
| Net returns to land labor & management | 50,530 | 44,577 | 46,492 |

[1/] Number of head of brood cows for spring calving, 329; for summer calving, 333; for fall calving, 339.

Table 4-6. The Optimum Combination of Crops and Beef Cows for a Beef Cow-Calf Farm by Seasons of Calving, High Beef Prices

| Item | Unit | Spring | Summer | Fall |
|---|---|---|---|---|
| Land Use | | | | |
| Forage-feed crop | | | | |
| Bluegrass/white clover pasture, land E | Acre | 35.0 | 35.0 | 35.0 |
| Bluegrass/white clover pasture, land D, low fertilizer | Acre | | | |
| Bluegrass/white clover pasture, land D, medium fertilizer | Acre | | | |
| Bluegrass/white clover pasture, land D, high fertilizer | Acre | 115.0 | 115.0 | 115.0 |
| Fescue/red clover, hay, summer and winter pasture, land C | Acre | 22.0 | 22.0 | 22.0 |
| Fescue/red clover, hay, summer and winter pasture, land B | Acre | | | |
| Fescue/red clover, hay, summer and winter pasture, land A | Acre | | | |
| Corn for silage with rye cover land B | Acre | 58.0 | 58.0 | 58.0 |
| Corn for silage with rye cover land A | Acre | 90.0 | 90.0 | 90.0 |
| Other crops | | | | |
| Corn for grain with rye cover land B | Acre | | | |
| Corn for grain with rye cover land A | Acre | | | |
| Crop sales | | | | |
| Hay | Ton | | | |
| Corn | Ton | | | |
| Crop feeds | | | | |
| Hay | Ton | 33.0 | 33.0 | 33.0 |
| Silage | Ton | 2,290.0 | 2,290.0 | 2,290.0 |
| Livestock Enterprises | | | | |
| Beef cow-calf | Head | 329.0 | 333.0 | 339.0 |
| Steer calves | HEad | 148.0 | 150.0 | 153.0 |
| Heifers calves | Head | 99.0 | 100.0 | 102.0 |
| Cull cows | Head | 39.0 | 40.0 | 41.0 |
| Cull heifers | Head | 10.0 | 10.0 | 10.0 |
| Cull bulls | Head | 3.0 | 3.0 | 3.0 |
| Returns to Fixed Resources | $ | 53,070.0 | 49,050.0 | 47,126.0 |

respectively for spring, summer and fall calving (Table 2, Appendix I). However, the number of beef cows associated with high beef prices would not be increased unless returns per cow were increased more than $1, $17 and $15 (approximately $0.17, $3.05 and $2.80 per hundredweight of beef produced).

When comparing returns per cow with returns attained at basic cattle prices, an increase of $54 for spring, $65 for summer and $64 for the fall calving system would be necessary to have the same farm organization as the optimal organization for high cattle prices. When these increases in returns per cow are prorated for the amount of beef produced as compared to basic prices an increase per hundredweight for the price of steers of $10.93 for spring, $14.01 for summer and $14.39 for fall is necessary to have this same farm organization.[1/]

## Low Calf Prices

Returns:

With a 32 percent price decrease for beef, net returns to land, labor, and management is $21,380 for the spring, $20,389 for the fall

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1/

Comparison of Necessary Prices with Basic Prices for Each Season of Calving

| Livestock Class | Spring | | Summer | | Fall | |
|---|---|---|---|---|---|---|
| Prices ($/cwt) | Basic | Necessary | Basic | Necessary | Basic | Necessary |
| Steer calves | 47.30 | 58.23 | 46.73 | 60.74 | 49.29 | 63.68 |
| Heifer calves | 38.63 | 47.55 | 36.17 | 49.62 | 40.26 | 52.02 |
| Cull cows | 26.36 | 32.45 | 26.04 | 33.85 | 27.47 | 35.49 |
| Cull heifers | 35.00 | 43.08 | 34.58 | 44.95 | 36.47 | 47.12 |
| Cull bulls | 31.23 | 38.44 | 30.85 | 40.10 | 32.54 | 42.04 |

and $19,947 for the summer calving system (Table 4-7). This represents a decrease in net returns to land, labor and management of about $9,316 below that of the basic cattle price level for the spring system. The percent of gross receipts from livestock is 41.6 percent for the spring, 49.3 percent for the fall and 42.8 percent for the summer systems.

Enterprises:

This price decrease has a dramatic effect on the optimum farm organization. For the spring system, nearly all of the permanent pasture of bluegrass with white clover on land D is utilized with the lowest application of fertilizer (Table 4-8). Also, when compared to the basic price level of cattle, only a third as much fescue is grown on land B and none on land A. Some of land A, 11.2 acres, is used instead for corn silage with the majority of it used to grow corn grain, as is most of land B. As in the basic price situation, some hay is sold, 67.5 tons. Corn grain production increases to 13,730.9 bushels for sale from 117.6 acres of land A and B. The 32 percent decrease in beef prices results in a shift from cattle sales to more sales of corn grain.

Sensitivity analyses:

The price reduction of beef causes the acreage in corn for silage to be greatly reduced. Still it is economical to feed some corn silage to brood cows even though at the low beef prices the returns per beef cow to land, labor and management is $204, $191, $191 for spring, summer and fall calving systems respectively. The optimum farm organization

Table 4-7. The Effect of Season of Calving on Farm Income, Low Cattle Price

| Item | Season of calving | | |
|---|---|---|---|
| | Spring | Summer | Fall |
| | $ | $ | $ |
| Gross income | | | |
| Crop sales | | | |
| Hay | 3,633 | 6,516 | 7,550 |
| Corn | 30,247 | 24,530 | 22,168 |
| Subtotal | 33,880 | 31,046 | 29,718 |
| Livestock sales[1/] | | | |
| Calves | 13,928 | 12,935 | 16,056 |
| Cull livestock | 3,358 | 3,347 | 4,336 |
| Manure credit | 6,857 | 6,908 | 8,477 |
| Subtotal | 24,143 | 23,190 | 28,869 |
| Total | 58,023 | 54,237 | 58,587 |
| Operating expenses | | | |
| Interest | 5,980 | 6,046 | 7,344 |
| Seed cost | 2,959 | 2,278 | 2,256 |
| Fertilizer, lime, minerals & salt | 17,526 | 16,380 | 18,723 |
| Machine hiring expense | 5,382 | 4,761 | 4,575 |
| Machine operating expense | 550 | 620 | 648 |
| Veterinary and machine expense | 1,204 | 1,228 | 1,527 |
| Turcking and marketing expense | 262 | 268 | 333 |
| Livestock commission | 248 | 236 | 296 |
| Total | 34,111 | 31,817 | 35,703 |
| Net returns to fixed resources | 23,912 | 22,420 | 22,884 |
| Overhead expenses | 2,532 | 2,473 | 2,495 |
| Net returns to land, labor & management | 21,380 | 19,947 | 20,389 |

[1/] Number of head of brood cows for spring calving, 108; for summer calving, 111; for fall calving, 138.

Table 4-8. The Optimum Combination of Crops and Beef Cows for a Beef Cow-Calf Farm by Seasons of Calving, Low Beef Prices

| Item | Unit | Spring | Summer | Fall |
|---|---|---|---|---|
| Land Use | | | | |
| Forage-feed crop | | | | |
| Bluegrass/white clover pasture, land E | Acre | 35.0 | 35.0 | 35.0 |
| Bluegrass/white clover pasture, land D, low fertilizer | Acre | 112.5 | 115.0 | 36.4 |
| Bluegrass/white clover pasture, land D, medium fertilizer | Acre | 2.5 | | |
| Bluegrass/white clover pasture, land D, high fertilizer | Acre | | | 78.6 |
| Fescue/red clover, hay, summer and winter pasture, land C | Acre | 22.0 | 22.0 | 22.0 |
| Fescue/red clover, hay, summer and winter pasture, land B | Acre | 19.2 | 48.9 | 58.0 |
| Fescue/red clover, hay, summer and winter pasture, land A | Acre | | | 1.5 |
| Corn for silage with rye cover pasture, land B | Acre | | | |
| Corn for silage with rye cover pasture, land A | Acre | 11.2 | 5.9 | 5.2 |
| Other crops | | | | |
| Corn for grain with rye cover pasture, land B | Acre | 38.8 | 9.1 | |
| Corn for grain with rye cover pasture, land A | Acre | 78.8 | 84.1 | 83.3 |
| Crop sales | | | | |
| Hay | Ton | 67.5 | 121.1 | 140.3 |
| Corn | Bu. | 11,370.9 | 9,222.0 | 8,333.7 |
| Excess pasture (Apr.-June) | AUM | | 25.0 | |
| Crop feeds | | | | |
| Hay | Ton | | | |
| Corn silage | Ton | 180.8 | 95.0 | 83.8 |
| Livestock Enterprises | | | | |
| Beef brood cow | Head | 108.0 | 111.0 | 138.0 |
| Steer calves | Head | 49.0 | 50.0 | 62.0 |
| Heifer calves | Head | 32.0 | 33.0 | 41.0 |
| Cull cows | Head | 13.0 | 13.0 | 17.0 |
| Cull heifers | Head | 3.0 | 3.0 | 4.0 |
| Cull bulls | Head | 1.0 | 1.0 | 1.0 |
| Returns to fixed resources | $ | 23,912.0 | 22,420.0 | 22,884.0 |

(Table 4-8), including the acreage of silage fed would remain unchanged even if the returns per cow were as low as $204 for spring calving, $140 for summer calving and $178 for fall calving (Appendix I, Table 4).

These returns are equivalent to steer prices of $32.73 per cwt, $20.56 per cwt and $30.26 per cwt for spring, summer and fall calving, respectively based on the projected prices for steers of $47.30 per cwt for spring, $49.29 per cwt for summer and $46.73 per cwt for fall calving.[1/] Cost (return) ranging for other activities can be observed in Appendix I, Table 4. As expected, when the price of cattle decreases the MVP of the limited resources also decreases. For example, the MVP of land A decreases 25 percent and that of land E decreases 14 percent (Table 3, Appendix I).

## Production Cost Per Hundredweight of Calf

The costs of producing calves are calculated for the three systems of calving. Costs per hundredweight of calf produced are $36.02 for the spring system, $24.58 for the summer system and $32.33 for the fall system (Table 4-9). The weight of calf produced per cow

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1/ Comparison of Necessary Prices with Basic Prices for Each Season of Calving

| Livestock Class | Spring | | Summer | | Fall | |
|---|---|---|---|---|---|---|
| Prices ($/cwt) | Basic | Necessary | Basic | Necessary | Basic | Necessary |
| Steer calves | 47.30 | 32.73 | 46.73 | 20.56 | 49.29 | 30.26 |
| Heifer calves | 38.63 | 26.73 | 38.17 | 16.79 | 40.26 | 24.72 |
| Bull cows | 26.36 | 18.24 | 26.04 | 11.46 | 27.47 | 16.86 |
| Cull heifers | 35.00 | 24.22 | 34.58 | 15.21 | 36.47 | 22.39 |
| Cull bulls | 31.23 | 21.61 | 30.85 | 13.57 | 32.54 | 19.98 |

Table 4-9. Cost of Producing Calves by Season of Calving, Basic Cattle Price

| Item | Unit | Season of calving | | |
|---|---|---|---|---|
| | | Spring | Summer | Fall |
| Production costs per cow | | | | |
| Non-feed costs | $ | 18.54 | 18.37 | 18.39 |
| Corn silage costs | $ | 57.59 | 20.63 | 17.68 |
| Pasture from hay production | $ | 32.22 | 39.75 | 37.90 |
| Permanent pasture | $ | 21.61 | 4.21 | 28.31 |
| Total production costs | $ | 129.96 | 88.70 | 102.28 |
| Interest costs per cow | $ | 49.64 | 48.13 | 48.76 |
| Overhead costs per cow | $ | 8.42 | 8.24 | 7.61 |
| Total var. costs (ex. land, labor and management) per cow | $ | 188.02 | 145.07 | 158.65 |
| Less value of cull animals | $ | 45.36 | 44.74 | 46.40 |
| Less value of manure | $ | 63.18 | 61.96 | 60.90 |
| Net variable costs to calves | $ | 79.48 | 38.37 | 51.35 |
| Labor costs ($3/hour) | $ | 18.30 | 16.55 | 16.13 |
| Land costs[1/] | $ | 56.40 | 42.90 | 53.75 |
| Net total cost to calves | $ | 154.18 | 97.82 | 121.23 |
| Hundredweight of calf produced per cow | Cwt | 4.28 | 3.98 | 3.75 |
| Net variable costs per hundredweight of calf | $/Cwt | 18.57 | 9.64 | 13.43 |
| Net total costs per hundredweight of calf | $/Cwt | 36.02 | 24.58 | 32.33 |

[1/] Opportunity costs of land A and B is corn for grain, land C is alfalfa hay and land D and E is rented a five dollars per AUM.

is 428 pounds for spring, 398 pounds for summer and 375 pounds for fall calving.

## Competitive Beef Calving Systems

In order to consider the three beef systems on a farm, it is necessary to have an L.P. analysis with simultaneous activities of spring, summer and fall calving. Beef prices at which the non-competitive (summer and fall) beef-calving systems will become competitive with the spring system are $277.33 per cow for summer and $263.83 per cow for fall calving (Table 4-10). If these returns are prorated for the amount of beef produced per cow, then the prices for steer calves are $50.23 per cwt for summer and $49.92 per cwt for fall calving. This, for example, means that steer calves prices would need to be increased by $3.50 per cwt ($50.23 - $46.73) for summer calves and $0.63 per cwt for fall calves to be competitive with spring calves.

Table 4-10. Beef Prices at Which Non-Competitive Beef Calving Systems Will Become Competitive

| Item (per cow) | Unit | Season of calving: Spring Current | Spring Necessary | Summer Current | Summer Necessary | Fall Current | Fall Necessary |
|---|---|---|---|---|---|---|---|
| Net returns to feed and fixed resources | $ | 278.27 | | 261.03 | 277.33 | 261.41 | 263.83 |
| Value of manure | $ | 63.18 | | 61.96 | 61.96 | 60.90 | 60.90 |
| Less non-feed variable costs | $ | 18.54 | | 18.37 | 18.37 | 18.39 | 18.39 |
| Steer calves[1/] | $/cwt | 47.30 | | 46.73 | 50.23 | 49.29 | 49.92 |
| Heifer calves | $/cwt | 38.63 | | 38.17 | 41.03 | 40.26 | 40.79 |
| Cull cows | $/cwt | 26.36 | | 26.04 | 27.99 | 27.47 | 27.82 |
| Cull heifers | $/cwt | 35.00 | | 34.58 | 37.17 | 36.47 | 36.93 |
| Cull bulls | $/cwt | 31.23 | | 30.85 | 33.16 | 32.54 | 32.96 |
| Beef cows | Head | 215.00 | | 0 | | 0 | |
| Date of livestock sale | | Nov. 15 | | Apr. 4 | | June 15 | |

[1/] Amount of Beef Produced Per Cow:

| | Amt/cow | Cwt | Lbs. prod. | Cwt | Lbs. prod. | Cwt | Lbs. prod. |
|---|---|---|---|---|---|---|---|
| Steer calves | .45 | 585 | 263 | 545 | 245 | 515 | 231 |
| Heifer calves | .30 | 550 | 165 | 510 | 153 | 480 | 144 |
| Cull cows | .12 | 950 | 114 | 950 | 114 | 950 | 114 |
| Cull heifers | .03 | 960 | 29 | 920 | 28 | 910 | 28 |
| Cull bulls | .01 | 1800 | 18 | 1800 | 18 | 1800 | 18 |
| | | | 589 | | 558 | | 535 |

# CHAPTER V

## DISCUSSION AND IMPLICATIONS

Results of L.P. analyses for a 320 acre beef cow-calf farm in Northern Virginia indicate that in terms of returns to fixed resources, profits are highest for a farm with the spring calving system, slightly lower for the fall calving and lowest for the summer calving (Table 5-1). Spring calving is the most profitable when the price of weaned calves ranges from approximately 32 percent lower to approximately 32 percent higher than the projected (basic) prices per hundredweight for steer and heifer calves. The unprofitability of summer calving may explain the small number of calves born during the summer period for present beef farms in Virginia. The December-February period may be different from fall calving used in this study (See page 3).

The higher returns for the spring calving system is partially explained by differences in daily gain of calves (weaned weight) and projected prices for weaned calves as listed above (spring vs summer). Weaning weights for steer and heifer calves respectively are spring calves 585 pounds and 550 pounds; summer calves 545 pounds and 510 pounds; and fall calves 515 and 480 pounds.

With farm sale price of corn at $2.66 per bushel and hay at $53 per ton, with the projected (basic) prices the number of brood cows and percent of gross income from livestock is the greatest for the spring calving system and the least for summer calving. However, when the price of weaned calves is reduced approximately 32 percent, a farm

Table 5.1. Summary of Returns, Crops Grown, Crops Fed, Crop Sales and Brood Cows for Spring, Summer and Fall Calving with Low, Basic, and High Weaned Calf Prices.

| | SPRING | | | SUMMER | | | FALL | | |
|---|---|---|---|---|---|---|---|---|---|
| | Low | Basic | High | Low | Basic | High | Low | Basic | High |
| Net Returns | 21,380 | 33,140 | 50,530 | 19,950 | 30,200 | 47,126 | 20,390 | 32,740 | 49,050 |
| Crops | | | | | | | | | |
| Perm. Pastime*(AC) | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| Hay & Pasture (AC) | 41 | 111 | 22 | 71 | 80 | 22 | 82 | 101 | 22 |
| Corn Silage (AC) | 11 | 46 | 148 | 6 | 9 | 148 | 5 | 11 | 148 |
| Corn Grain (AC) | 118 | 13 | | 93 | 81 | | 83 | 58 | |
| Crop Sales | | | | | | | | | |
| Hay (Ton) | 68 | 200 | | 121 | 140 | | 140 | 180 | |
| Corn (Ton) | 11,371 | 1,250 | | 9,222 | 8,070 | | 8,334 | 5,850 | |
| Excess Pasture (AUM) | | | | 25 | 8 | | | | |
| Crop Feeds | | | | | | | | | |
| Hay (Ton) | | | 33 | | | 33 | | | 33 |
| Silage (Ton) | 181 | 745 | 2,290 | 95 | 150 | 2,290 | 84 | 170 | 2,290 |
| Brood Cows (HD) | 108 | 215 | 329 | 111 | 120 | 333 | 138 | 164 | 339 |

*Fertilization rate varied on land D, see tables 4-2, 4-6, 4-8

with the spring calving system has the least number of brood cows and the highest crop sales. With low beef prices, as compared to a farm with spring calves, a farm with fall calves has more beef cows, higher livestock sales, and slightly higher total sales, however, net returns are less. For high beef prices, approximately 32 percent above projected prices for spring, summer and fall calving, all crops are fed (no corn for grain sold) and bluegrass pastures are fertilized at a relatively high rate. For each situation slightly more than one cow is kept per acre of land. Since the crop organization is identical for the three calving systems, the number of brood cows is inversely related to weight of weaned calves, 329 spring calving, 333 for summer calving and 339 for fall calving. That is the system with heaviest calves requires more feed per cow.

The weaned weight advantage of spring produced calves is greater than the price advantage of fall produced calves for each of the weaned calf price levels considered. At low beef prices, a farm with fall rather than spring calves has slightly higher receipts but the greater expenses associated with larger livestock numbers are greater than the added receipts. At high beef prices, a farm with fall calves has both lower receipts and higher expenses than a farm with spring calves.

Although the present study indicates that a farm with spring calving is slightly more profitable than a farm with fall calving, it does not refute the results of an Ohio study[1/] (See page 6). Authors of

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[1/] Parker, Charles F. and R. W. Van Deuren, "Fall Calving Valuable for Ohio Beef Herds," Ohio Report on Research and Development, Ohio Agricultural Research and Development Center, Wooster Ohio, Vol. 60, November-December 1975, pages 96-98.

the Ohio study concluded that fall calving is a good complement to spring calving if the beef producer has good quality feed available for wintering his beef cow herd. Of course if some brood cows did not settle during the primary breeding season, then an alternate breeding season might be feasible. Breeding for fall calving does seem to be a feasible alternative when viewed in light of this study, however, a dual calving system with the appropriate increase in the number of calves dropped was not evaluated in the present study.

An important implication of this study is that in order to have a more uniform seasonal distribution of weaned calves grown in Virginia, summer calving for some producers would be necessary. Yet for summer calving to be competitive, higher prices for summer born calves are necessary. Some method of transferring income to producers of summer calves would need to be devised.

With the opportunity of producing either corn for grain or corn silage on land type A and B, with the farm sale price of corn at $2.66 per bushel and the projected prices of weaned steers calves at $47.30, $46.73 and $49.29 per hundredweight respectively[1/] for spring, summer and fall calves it is profitable to feed 3.5 tons, 1.2 tons and 1.1 tons of corn silage per brood cow for systems of spring, summer and fall calving respectively. If the price of weaned steer calves are

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[1/] This is a weaned steer-corn price ratio of 17.78, 17.58 and 18.53 for spring, summer and fall respectively. The weaned steer-corn price ratio is the bushels of corn to equal the sale value of 100 pounds of weaned steer calf (Liveweight).

as low as $32.23, $20.56 and $30.26 respectively for spring, summer and fall born calves, it would be profitable to feed annually 1.7 tons, 0.9 of a ton, and an 0.6 of a ton of corn silage per cow for spring, summer and fall born calves respectively. That is, the above amounts of corn silage would attain the beef production indicated at a lower cost than other feed alternatives considered. When corn is $2.66 per bushel and weaned steer calf prices for spring, summer and fall calving, respectively are as high as $58.23, $60.74 and $63.64 (weaned steer-corn ratios of 21.89, 22.83 and 23.94) returns would be decreased if corn were sold. Highest profits would be achieved by feeding annually approximately seven tons of corn silage per cow.

For spring calving, the most profitable calving system, the weaned steer calf-corn ratio is 21.89 with high calf prices, $58.23 per hundredweight. For eight years in the past 20, the weaned steer calf-corn ratio was less than 21.89, therefore it would not have been profitable for eight years in 20 to feed as much as seven tons of corn silage per cow. For the spring calving system with low weaned calf prices $32.23 per hundredweight the weaned steer calf-corn ratio was 12.11. For 19 years in the past 20 the weaned steer calf-corn ratio was

greater than 12.11. Therefore it would have been profitable in 19 years in 20 to feed annually at least 1.7 tons of corn silage per cow.[1/]

Some scientists indicate that it is unnecessary to feed corn silage to beef cow-calf herds.[2/] Results of the present study qualify this statement by showing that operator's returns may be increased by feeding small amounts of corn silage even when steer calf-corn ratio is quite low. This does not contradict the statement that corn silage may provide more nutrients than is needed for the brood cow. This present study does indicate that it is not profitable to grow corn silage for beef brood cows when adequate pasture is available from land not suitable for corn production. In the spring and in fall and winter, with stockpiled fescue available, this study indicates no corn silage is fed. Yet when the pasture is short during the summer months, corn silage provides feed at the lowest cost. While corn silage may provide more than adequate nutrition, when used as the basic feed there are times that corn silage may be a profitable supplement to pasture, i.e. when adequate high quality pasture is unavailable at a reasonable cost. This has wide implications for those beef cow-calf farmers who

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[1/] Weaned steer calf-corn ratio for steers born in spring:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1956 | 16.39 | 1961 | 24.39 | 1966 | 19.97 | 1971 | 34.19 |
| 1957 | 18.85 | 1962 | 27.25 | 1967 | 20.04 | 1972 | 34.70 |
| ;958 | 27.19 | 1963 | 21.22 | 1968 | 27.30 | 1973 | 25.78 |
| 1959 | 26.72 | 1964 | 16.57 | 1969 | 26.73 | 1974 | 10.21 |
| 1960 | 24.16 | 1965 | 24.55 | 1970 | 24.17 | 1975 | 16.52 |

[2/] Blaser, R. E., "Match Forage Supply and Quality with Animal Requirements," Northern Virginia Forage Conference Proceedings, March 11, 1976.

may tend to limit the size of the brood cow herd to the number that can be carried on pasture and non-corn forage.

It is not inconsistent with theory that even though cost per pound of calf produced is more costly, the spring calving system is more profitable than the fall calving system when evaluating the whole farm for growing calves to be sold at weaning age. Calves from the summer calving system are sold at the lower price. Weaned calves from the fall calving system had a net variable per hundredweight cost of $13.43 as compared to $18.57 for calves grown with the spring calving system. The price of fall born calves were slightly higher than the price of spring born calves, however the fall produced calves did not enter an optimum solution when both calving systems were considered simultaneously. The spring calving system is more profitable since per 100 pounds of calf sold, the spring calving system requires less feed than the fall calving system. The cost per 100 pound of calf sold is higher for the spring calving system because the feed requirement per 100 pounds gain is less than the requirement for the fall calving system during the period of maximum pasture growth (April 15 to June 15) and more than the fall calving system during period of lowest pasture availability, (June 16 to August 16). During this period of low pasture availability the spring calving system uses more corn silage than does the fall calving system.

The results of this study indicate the need for additional research relative to other forage systems to provide feed for summer and

winter. Some other forage-feed systems worthy of additional research include sudax-sorghum for hay and silage, a grain-on-grass system, corn silage with chicken litter for feed, grazing Bermuda grass for summer pasture, grazing small grain for winter pasture, and using small grain as a double crop on the above forage systems where applicable.

Also, feeding the calves to heavier weights as an alternative to selling weaned calves is worthy of further research, since it may permit higher returns to the farmers' resources than is possible when calves are sold at weaning. An optimal feeding system for each weight of animal to be produced should be evaluated at different prices of cattle and for different rates of gain. This would enable cattle producers to select the most profitable feeding program that would produce cattle at a specified weight for the time of year it was optimal to sell.

## CHAPTER VI

## SUMMARY

In Virginia, over 95 percent of all calves are born during five consecutive months of the year. This calving pattern contributes to the uneven seasonal marketing pattern of Virginia fed cattle, and this uneven marketing, in turn, is a barrier to efficient use of Virginia cattle by the slaughter plants.[1/]

The results of this study to determine the economic effects of calving season, indicate that spring and fall calving generate about the same income - $96 per acre and $95 per acre respectively, while summer calving generates returns of $87 per acre.[2/] The farm organization for the spring and fall systems is about the same except that 31 percent more brood cows are included with the spring system. Furthermore, the spring system uses more than three times as much corn silage as the fall system when evaluated on a per cow basis. The summer system includes the least number of cattle and requires the least amount of corn silage and fescue pasture. When cattle prices

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[1/] Holder, D. L., The Feasibility of Cattle Finishing and Cattle Slaughtering Facilities in Virginia, July 1, 1972, Table 4-8, page 4-4.

[2/] This research is based on two years results of a study now in progress at the Northern Virginia Research Stateion, Middleburg, Virginia. Tests were not made of statistical significance for differences in calf weights and gains.

are increased or decreased 32 percent, the spring calving system remains more profitable than the fall and the summer systems.

The cost of producing calves was calculated for the three calving systems. The variable costs per hundredweight of calf produced were the highest for the spring system - $18.57 per hundredweight, $9.64 per hundredweight for summer and $13.43 per hundredweight for fall system.

The approximate prices of cattle to enable the three systems to yield the same net returns were also determined. Based on the price of steers for the spring system of $47.30 per hundredweight, the steer price of the fall system would need to be increased $0.63 per hundredweight. However, the steer price for the summer system would need to be increased $3.50 per hundredweight.

An important implication of this study is that in order to have a more uniform seasonal distribution of weaned calves grown in Virginia, summer calving for some producers would be necessary. This implies that some method of increasing income to producers of summer calves would need to be devised.

Another implication of the study is that it may be profitable to feed corn silage to beef cow-calf herds. The results of this study point out that it may increase farm returns by feeding small amounts of corn silage rather than growing additional pasture even when the weaned steer calf-corn ratio is quite low. This has wide implications for those beef producers who may tend to limit the size of the brood cow herd to the number that can be carried on pasture and non-corn forage.

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# APPENDIX A

## Prices and Investment Costs

Table 1. Input Prices Used in Budgets and in Linear Programs [a/]

| Item | Unit | Price ($) |
|---|---|---|
| Corn Seed | Lb. | .50 |
| Rye Seed | Bu. | 5.95 |
| Orchard grass | Lb. | .60 |
| Fescue | Lb. | .45 |
| Alfalfa | Lb. | 1.36 |
| Red clover | Lb. | 1.03 |
| Ladino clover | Lb. | 2.13 |
| Nitrogen | Lb. | .27 |
| Phosphate | Lb. | .27 |
| Potash | Lb. | .10 |
| Boron | Lb. | .23 |
| Limestone | Ton | 13.50 |
| Atrazine | Lb. | 3.50 |
| Paraquat | Pt. | 7.00 |
| Furadan | Lb. | .67 |
| Sevin | Lb. | 1.50 |
| 2, 4, D | Lb. | 2.24 |
| Labor | Hr. | 2.75 |
| Gasoline | Gal. | .50 |
| Diesel fuel | Gal. | .34 |
| Interest | % | 9.0 |

[a/] Prices represent a price level for early 1976.

Table 2. Product Prices Used in Budgets and in Linear Programs [a/]

| Item | Unit | Price |
|---|---|---|
| Corn Grain | Bu | 2.66 |
| Mixed Hay (40 lb bale) | Ton | 53.81 |
| Cattle | | |
| -spring calving (Nov. sale) | | |
| steer calf | cwt | 47.30 |
| heifer calf | cwt | 38.63 |
| cull cow | cwt | 26.36 |
| cull heifer | cwt | 35.00 |
| cull bull | cwt | 31.23 |
| -summer calving (Apr. sale) | | |
| steer calf | cwt | 46.73 |
| heifer calf | cwt | 38.17 |
| cull cow | cwt | 26.04 |
| cull heifer | cwt | 34.58 |
| cull bull | cwt | 30.85 |
| -fall calving (June sale) | | |
| steer calf | cwt | 49.29 |
| heifer calf | cwt | 40.26 |
| cull cow | cwt | 27.47 |
| cull heifer | cwt | 36.47 |
| cull bull | cwt | 32.54 |

[a/] Prices represent a price level for early 1976.

Table 3 Investment Costs of Crop System Machinery and Equipment[a/]

| Name of Machine | Purchase Price |
|---|---|
| Tractor, Deisel (35 H.P.) | 6,600 |
| Tractor, Deisel (50 H.P.) | 9,680 |
| Plow, M. B. 2-16" | 870 |
| Disc, Tandem 8' | 1,650 |
| Cultipaker | 1,300 |
| Grain Drill w/o Fertilizer Attachment | 2,000 |
| Grain Drill w/ Fertilizer Attachment | 2,090 |
| Mower Conditioner | 4,365 |
| Rake, Side Delivery | 1,300 |
| Bale Mover, Large | 125 |
| Rotary Mower | 950 |
| Wagon | 550 |
| Corral and Chutes (100 cows) | 1,500 |
| Small Equipment (100 cows) | 100 |

a/ Prices represent a price level for early 1976.

# APPENDIX B

## Beef Cow-Calf Budgets

BEEF COW-CALF:SPRING CALVING NORTHERN VIRGINIA AREA 1976-1980
TABLE 1 ESTIMATED NON-FEED COST, FEED NUTRIENT, LABOR, AND FIXED REQUIREMENTS FOR A 33 COW HERD (PER COW)

| LIVESTOCK INVESTMENT | UNITS | SIZE | NUMBER | VALUE/UNIT | VALUE |
|---|---|---|---|---|---|
| BEEF COW | HD. | 1.00 | 1.00 | 413.000 | 413.00 |
| BEEF BULL | HD. | 1.00 | 0.03 | 525.000 | 15.75 |
| BEEF HEIFER | HD. | 1.00 | 0.15 | 370.000 | 55.50 |
| TOTAL LIVESTOCK INVESTMENT | | | | | 484.25 |

| PRODUCTION | UNITS | QUANITY | WEIGHT | PRICE | VALUE/UNIT | VALUE |
|---|---|---|---|---|---|---|
| STEER CALVES | CWT. | 0.45 | 5.85 | 47.300 | 276.70 | 124.52 |
| HEIFER CALVES | CWT. | 0.30 | 5.50 | 38.630 | 212.46 | 63.74 |
| COWS | CWT. | 0.12 | 9.50 | 26.360 | 250.42 | 30.05 |
| HEIFERS | CWT. | 0.03 | 9.60 | 35.000 | 336.00 | 10.08 |
| AGED BULL | CWT. | 0.01 | 18.00 | 31.230 | 562.14 | 5.62 |
| 2.0 PERCENT DEATH LOSS | DOL. | | | | | 4.68 |
| TOTAL RECEIPTS | | | | | | 229.33 |

| OPERATING INPUTS | UNITS | RATE PER UNIT | NUMBER OF UNITS | TOTAL UNITS | PRICE | VALUE |
|---|---|---|---|---|---|---|
| SALT | CWT. | 0.18 | 1.00 | 0.180 | 3.05 | 0.55 |
| SALT & MIN. | CWT. | 0.32 | 1.00 | 0.320 | 6.49 | 2.08 |
| VET SUPPLIES | DOL. | 1.00 | 1.00 | 1.000 | 6.10 | 6.10 |
| SUPPLIES & MISC. | HD. | 1.17 | 1.00 | 1.170 | 1.00 | 1.17 |
| VET MEDICINE | DOL. | 8.50 | 0.90 | 7.650 | 0.50 | 3.82 |
| SALES COMM. | DOL. | 0.01 | 1.00 | 0.010 | 229.30 | 2.29 |
| HAULING | HD. | 0.91 | 1.00 | 0.910 | 2.66 | 2.42 |
| TON.1* | AUMS | 2.10 | 1.00 | 2.100 | 0.0 | 0.0 |
| TON.2 | AUMS | 3.23 | 1.00 | 3.230 | 0.0 | 0.0 |
| TON.3 | AUMS | 4.00 | 1.00 | 4.000 | 0.0 | 0.0 |
| TON.4 | AUMS | 4.29 | 1.00 | 4.290 | 0.0 | 0.0 |
| EQUIPMENT REPAIR | | | | | | 0.11 |
| TOTAL OPERATING COST | | | | | | 18.54 |

| | |
|---|---|
| RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT | 210.78 |

| CAPITAL COST | PRICE | AMOUNT | VALUE |
|---|---|---|---|
| ANNUAL OPERATING CAPITAL | 0.090 | 7.587 | 0.68 |
| EQUIPMENT INVESTMENT | 0.090 | 11.759 | 1.06 |
| LIVESTOCK INVESTMENT | 0.090 | 485.563 | 43.70 |
| TOTAL INTEREST CHARGE | | | 45.44 |

| | |
|---|---|
| RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT | 165.34 |

| OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE) | | |
|---|---|---|
| EQUIPMENT | DOL. | 0.70 |
| LIVESTOCK | DOL. | 4.85 |
| TOTAL OWNERSHIP COST | | 5.55 |

| | |
|---|---|
| RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT | 159.79 |

| LABOR COSTS | PRICE | HOURS | |
|---|---|---|---|
| EQUIPMENT LABOR | 2.750 | 0.011 | 0.03 |
| LIVESTOCK LABOR | 2.750 | 4.550 | 12.51 |
| TOTAL LABOR COST | | | 12.54 |

| | |
|---|---|
| RETURNS TO LAND, OVERHEAD RISK AND MANAGEMENT | 147.25 |

CALVES BORN MAR.1, 90% (30) WEANED IN 8.5 MONTHS & SOLD. AT NOV. SALE: 15 STEERS 505 LBS; 10 HEIFERS 550 LBS; 4 CULL YEARLING HEIFERS 960LBS. 5 HEIFERS (15%) KEPT FOR REPLACEMENTS.

ANDY DRABRAND AG ECON VPI&SU JUNE 1976

BEEF COW-CALF:SUMMER CALVING NORTHERN VIRGINIA AREA 1976-1980
TABLE 2 ESTIMATED NON-FEED COST,FEED NUTRIENT,LABOR,AND FIXED REQUIREMENTS FOR A 33 COW HERD (PER COW)

| LIVESTOCK INVESTMENT | UNITS | SIZE | NUMBER | VALUE/UNIT | VALUE |
|---|---|---|---|---|---|
| BEEF COW | HD. | 1.00 | 1.00 | 413.000 | 413.00 |
| BEEF BULL | HD. | 1.00 | 0.03 | 525.000 | 15.75 |
| BEEF HEIFER | HD. | 1.00 | 0.15 | 370.000 | 55.50 |
| TOTAL LIVESTOCK INVESTMENT | | | | | 484.25 |

| PRODUCTION | UNITS | QUANITY | WEIGHT | PRICE | VALUE/UNIT | VALUE |
|---|---|---|---|---|---|---|
| STEER CALVES | CWT. | 0.45 | 5.45 | 46.730 | 254.68 | 114.61 |
| HEIFER CALVES | CWT. | 0.30 | 5.10 | 38.170 | 194.67 | 58.40 |
| COWS | CWT. | 0.12 | 9.50 | 26.040 | 247.38 | 29.69 |
| HEIFERS | CWT. | 0.03 | 9.20 | 34.580 | 318.14 | 9.54 |
| AGED BULL | CWT. | 0.01 | 18.00 | 30.850 | 555.30 | 5.55 |
| 2.0 PERCENT DEATH LOSS | DOL. | | | | | - 4.36 |
| TOTAL RECEIPTS | | | | | | 213.43 |

| OPERATING INPUTS | UNITS | RATE PER UNIT | NUMBER OF UNITS | TOTAL UNITS | PRICE | VALUE |
|---|---|---|---|---|---|---|
| SALT | CWT. | 0.18 | 1.00 | 0.180 | 3.05 | 0.55 |
| SALT & MIN. | CWT. | 0.32 | 1.00 | 0.320 | 6.49 | 2.08 |
| VET SUPPLIES | DOL. | 1.00 | 1.00 | 1.000 | 6.10 | 6.10 |
| SUPPLIES & MISC. | HD. | 1.17 | 1.00 | 1.170 | 1.00 | 1.17 |
| VET MEDICINE | DOL. | 8.50 | 0.90 | 7.650 | 0.50 | 3.82 |
| SALES COMM. | DOL. | 0.01 | 1.00 | 0.010 | 213.40 | 2.13 |
| HAULING | HD. | 0.91 | 1.00 | 0.910 | 2.66 | 2.42 |
| TDN.1* | AUMS | 1.81 | 1.00 | 1.810 | 0.0 | 0.0 |
| TDN.2 | AUMS | 2.51 | 1.00 | 2.510 | 0.0 | 0.0 |
| TDN.3 | AUMS | 3.29 | 1.00 | 3.290 | 0.0 | 0.0 |
| TDN.4 | AUMS | 5.81 | 1.00 | 5.810 | 0.0 | 0.0 |
| EQUIPMENT REPAIR | | | | | | 0.11 |
| TOTAL OPERATING COST | | | | | | 18.39 |

| | |
|---|---|
| RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT | 195.05 |

| CAPITAL COST | PRICE | AMOUNT | VALUE |
|---|---|---|---|
| ANNUAL OPERATING CAPITAL | 0.090 | 8.514 | 0.77 |
| EQUIPMENT INVESTMENT | 0.090 | 11.759 | 1.06 |
| LIVESTOCK INVESTMENT | 0.090 | 485.563 | 43.70 |
| TOTAL INTEREST CHARGE | | | 45.53 |

| | |
|---|---|
| RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT | 149.52 |

| OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE) | | |
|---|---|---|
| EQUIPMENT | DOL. | 0.70 |
| LIVESTOCK | DOL. | 4.85 |
| TOTAL OWNERSHIP COST | | 5.55 |

| | |
|---|---|
| RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT | 143.97 |

| LABOR COSTS | PRICE | HOURS | |
|---|---|---|---|
| EQUIPMENT LABOR | 2.750 | 0.011 | 0.03 |
| LIVESTOCK LABOR | 2.750 | 4.550 | 12.51 |
| TOTAL LABOR COST | | | 12.54 |

| | |
|---|---|
| RETURNS TO LAND, OVERHEAD RISK AND MANAGEMENT | 131.43 |

CALVES BORN JUL.15,90% (30) WEANED IN 8.5 MONTHS & SOLD. AT APR. SALE: 15 STEERS 545 LBS; 10 HEIFERS 510 LBS; 4 CULL YEARLING HEIFERS 920LBS. 5 HEIFERS (15%) KEPT FOR REPLACEMENTS. ANDY BRABRAND AG ECON VPI&SU JUNE 1976

BEEF COW-CALF: FALL CALVING NORTHERN VIRGINIA AREA 1976-1980
ESTIMATED NON-FEED COST, FEED NUTRIENT, LABOR, AND
TABLE 3 FIXED REQUIREMENTS FOR A 33 COW HERD (PER COW)

| LIVESTOCK INVESTMENT | UNITS | SIZE | NUMBER | VALUE/UNIT | VALUE |
|---|---|---|---|---|---|
| BEEF COW | HD. | 1.00 | 1.00 | 413.000 | 413.00 |
| BEEF BULL | HD. | 1.00 | 0.03 | 525.000 | 15.75 |
| BEEF HEIFER | HD. | 1.00 | 0.15 | 370.000 | 55.50 |
| TOTAL LIVESTOCK INVESTMENT | | | | | 484.25 |

| PRODUCTION | UNITS | QUANITY | WEIGHT | PRICE | VALUE/UNIT | VALUE |
|---|---|---|---|---|---|---|
| STEER CALVES | CWT. | 0.45 | 5.15 | 49.290 | 253.84 | 114.23 |
| HEIFER CALVES | CWT. | 0.30 | 4.80 | 40.260 | 193.25 | 57.97 |
| COWS | CWT. | 0.12 | 9.50 | 27.470 | 260.96 | 31.32 |
| HEIFERS | CWT. | 0.03 | 9.10 | 36.670 | 331.80 | 9.96 |
| AGED BULL | CWT. | 0.01 | 18.00 | 32.540 | 585.72 | 5.86 |
| 2.0 PERCENT DEATH LOSS | DOL. | | | | | -4.39 |
| TOTAL RECEIPTS | | | | | | 214.95 |

| OPERATING INPUTS | UNITS | RATE PER UNIT | NUMBER OF UNITS | TOTAL UNITS | PRICE | VALUE |
|---|---|---|---|---|---|---|
| SALT | CWT. | 0.18 | 1.00 | 0.180 | 3.05 | 0.55 |
| SALT & MIN. | CWT. | 0.32 | 1.00 | 0.320 | 6.49 | 2.08 |
| VET SUPPLIES | DOL. | 1.00 | 1.00 | 1.000 | 6.10 | 6.10 |
| SUPPLIES & MISC. | HD. | 1.17 | 1.00 | 1.170 | 1.00 | 1.17 |
| VET MEDICINE | DOL. | 8.50 | 0.90 | 7.650 | 0.50 | 3.82 |
| SALES COMM. | DOL. | 0.01 | 1.00 | 0.010 | 215.00 | 2.15 |
| HAULING | HD. | 0.91 | 1.00 | 0.910 | 2.66 | 2.42 |
| TDN.1* | AUMS | 2.76 | 1.00 | 2.760 | 0.0 | 0.0 |
| TDN.2 | AUMS | 2.31 | 1.00 | 2.310 | 0.0 | 0.0 |
| TDN.3 | AUMS | 2.98 | 1.00 | 2.980 | 0.0 | 0.0 |
| TDN.4 | AUMS | 5.16 | 1.00 | 5.160 | 0.0 | 0.0 |
| EQUIPMENT REPAIR | | | | | | 0.11 |
| TOTAL OPERATING COST | | | | | | 18.40 |

| | |
|---|---|
| RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT | 196.55 |

| CAPITAL COST | PRICE | AMOUNT | VALUE |
|---|---|---|---|
| ANNUAL OPERATING CAPITAL | 0.090 | 6.618 | 0.60 |
| EQUIPMENT INVESTMENT | 0.090 | 11.759 | 1.06 |
| LIVESTOCK INVESTMENT | 0.090 | 485.563 | 43.70 |
| TOTAL INTEREST CHARGE | | | 45.35 |

| | |
|---|---|
| RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT | 151.19 |

| OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE) | | |
|---|---|---|
| EQUIPMENT | DOL. | 0.70 |
| LIVESTOCK | DOL. | 4.85 |
| TOTAL OWNERSHIP COST | | 5.55 |

| | |
|---|---|
| RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT | 145.64 |

| LABOR COSTS | PRICE | HOURS | |
|---|---|---|---|
| EQUIPMENT LABOR | 2.750 | 0.011 | 0.03 |
| LIVESTOCK LABOR | 2.750 | 4.550 | 12.51 |
| TOTAL LABOR COST | | | 12.54 |

| | |
|---|---|
| RETURNS TO LAND, OVERHEAD RISK AND MANAGEMENT | 133.10 |

CALVES BORN OCT.1, 90% (30) WEANED IN 8.5 MONTHS & SOLD. AT JUNE SALE: 15 STEERS 515 LBS; 10 HEIFERS 480 LBS; 4 CULL YEARLING HEIFERS 910LBS. 5 HEIFERS (15%) KEPT FOR REPLACEMENTS.

ANDY BRABRAND AG ECON VPI&SU JUNE 1976

Table 4. Manure Credit Calculations and Value of Manure Credit[1/]

| | Lbs/T[2/] | T/A.U. | A.U./ brood cow | Conversion Factors[3/] | Percent utilized | Lbs/ brood cow | Price/ lb. | Value/ brood cow |
|---|---|---|---|---|---|---|---|---|
| Spring calving herd | | | | | | | | |
| Nitrogen | 14.0 | 11 | 1.57 | 1 | 50 | 120.9 | .27 | 32.49 |
| Phosphate | 4.0 | 11 | 1.57 | 2.29 | 50 | 79.1 | .27 | 21.36 |
| Potassium | 9.0 | 11 | 1.57 | 1.2 | 50 | 93.3 | .10 | 9.33 |
| TOTAL | | | | | | | | 63.33 |
| Summer calving herd | | | | | | | | |
| Nitrogen | 14.0 | 11 | 1.54 | 1 | 50 | 118.0 | .27 | 31.86 |
| Phosphate | 4.0 | 11 | 1.54 | 2.29 | 50 | 77.6 | .27 | 20.95 |
| Potassium | 9.0 | 11 | 1.54 | 1.2 | 50 | 91.5 | .10 | 9.15 |
| TOTAL | | | | | | | | 61.96 |
| Fall calving herd | | | | | | | | |
| Nitrogen | 14.0 | 11 | 1.51 | 1 | 50 | 116.3 | .27 | 31.39 |
| Phosphate | 4.0 | 11 | 1.51 | 2.29 | 50 | 76.1 | .27 | 20.54 |
| Potassium | 9.0 | 11 | 1.51 | 1.2 | 50 | 89.7 | .10 | 8.97 |
| TOTAL | | | | | | | | 60.90 |

[1/] Virginia Polytechnic Institute and State University, A Handbook of Agronomy, Publication 600, Extension Division, Revised January 1974, p. 30.

[2/] Nitrogen, phosphorus, potassium.

[3/] To convert P into $P_2O_5$ multiply by 2.29; to convert K into $K_2O$ multiply by 1.2.

# APPENDIX C

## Feed Nutrient Requirements for 33 Brood Cows and Replacement

Table 1. Beef Cow Calf: Spring Calving
Feed Nutrient Requirement for 33 Brood Cows and Replacements

| Period | | | | Total digest nutrients | |
|---|---|---|---|---|---|
| Months | Days | Livestock group | Head | lb/da/hd | lbs. |
| PERIOD 1 | | | | | |
| Apr. 16 - June 15 | 61 | Cow and calf | 33 | 11.7 | 23,552 |
| | Subtotal | | | | -- |
| | 61 | Herd bull | 1 | 13.0 | 793 |
| | 61 | Repl. heifer | 5 | 11.2 | 3,416 |
| | Total | | | | 27,761 |
| | Total (Per Cow) | | | | 841 |
| PERIOD 2 | | | | | |
| June 16 - Aug. 31 | 77 | Cow only | 33 | 8.6 | 21,853 |
| | 77 | Calves, steer | 15 | 6.8 | 7,854 |
| | 77 | Calves, heifer | 15 | 6.5 | 7,508 |
| | Subtotal | Cow and calf | | | 37,215 |
| | 77 | Herd bull | 1 | 13.0 | 1,001 |
| | 77 | 1 ½ yr. old heifer | 5 | 11.5 | 4,428 |
| | Total | | | | 42,644 |
| | Total (Per Cow) | | | | 1,292 |
| PERIOD 3 | | | | | |
| Sept. 1 - Nov. 30 | 91 | Cow only | 29 | 8.6 | 22,695 |
| Sept. 1 - Nov. 15 | 76 | Cull cow only | 4 | 8.6 | 2,614 |
| Sept. 1 - Nov. 15 | 76 | Calves, steer | 15 | 9.6 | 10,944 |
| | 76 | Calves, heifer | 15 | 8.1 | 9,234 |
| | Subtotal | Cow and calf | | | 45,487 |
| | 91 | Herd bull | 1 | 13.0 | 1,183 |
| Sept. 1 - Nov. 15 | 76 | 2 yr. repl. heifer | 1 | 12.5 | 950 |
| Sept. 1 - Nov. 30 | 91 | 2 yr. repl. heifer | 1 | 12.5 | 4,550 |
| Nov. 15 - Nov. 30 | 15 | Calves, heifer | 5 | 8.1 | 608 |
| | Total | | | | 52,778 |
| | Total (Per Cow) | | | | 1,599 |
| PERIOD 4 | | | | | |
| Dec. 1 - Feb. 28 | 90 | 2 yr. repl. heifer | 4 | 11.7 | 4,212 |
| | 90 | Cow only | 29 | 10.0 | 26,100 |
| March 1 - Apr. 15 | 46 | Cow and calf | 33 | 11.7 | 17,761 |
| | Subtotal | Cow and calf | | | 48,073 |
| Dec. 1 - Apr. 15 | 136 | Herd bull | 1 | 13.0 | 1,768 |
| | 136 | 1 yr. repl. heifer | 5 | 9.9 | 6,732 |
| | Total | | | | 56,573 |
| | Total (Per Cow) | | | | 1,714 |
| | Year Total | | | | 179,756 |
| | Year Total (Per Cow) | | | | 5,447 |

SOURCE: Number 4, Nutrient Requirements of Beef Cattle (fifth revised edition, 1976), National Academy of Science. Feed for unweaned cattle is included with beef-cow requirement for 3½ month and calculated separately from 3½ to 8½ months.

Table 2. Beef Cow Calf: Summer Calving
Feed Nutrient Requirements for 33 Brood Cows and Replacements

| Period | | | | Total digest nutrients | |
|---|---|---|---|---|---|
| Months | Days | Livestock group | Head | lb/da/hd | lbs. |
| PERIOD 1 | | | | | |
| Apr. 16 - June 15 | 61 | Cow only | 29 | 10.0 | 17,690 |
| | 61 | Calves, heifer | 5 | 8.6 | 2,623 |
| | Subtotal | | | | 20,313 |
| | 61 | Herd bull | 1 | 13.0 | 793 |
| | 61 | Repl. heifer | 4 | 11.7 | 2,855 |
| | Total | | | | 23,961 |
| | Total (Per Cow) | | | | 726 |
| PERIOD 2 | | | | | |
| June 16 - July 14 | 29 | 2 yr. repl. heifer | 4 | 11.7 | 1,357 |
| | 29 | Cow only | 29 | 10.0 | 8,410 |
| July 15 - Aug. 31 | 48 | Cow and calf | 33 | 11.7 | 18,533 |
| | Subtotal | Cow and calf | | | 28,300 |
| June 16 - Aug. 31 | 77 | Herd bull | 1 | 13.0 | 1,001 |
| | 77 | Repl. heifer | 5 | 9.9 | 3,812 |
| | Total | | | | 33,113 |
| | Total (Per Cow) | | | | 1,003 |
| PERIOD 3 | | | | | |
| Sept. 1 - Oct. 31 | 61 | Cow and calf | 33 | 11.7 | 23,552 |
| Nov. 1 - Nov. 30 | 30 | Cow only | 33 | 8.6 | 8,514 |
| Nov. 1 - Nov. 30 | 30 | Calves, steer | 15 | 6.3 | 2,835 |
| | 30 | Calves, heifer | 15 | 5.7 | 2,565 |
| | Subtotal | Cow and calf | | | 37,466 |
| Sept. 1 - Nov. 30 | 91 | Herd bull | 1 | 13.0 | 1,183 |
| | 91 | Repl. heifer | 5 | 10.5 | 4,778 |
| | Total | | | | 43,427 |
| | Total (Per Cow) | | | | 1,316 |
| PERIOD 4 | | | | | |
| Dec. 1 - Apr. 15 | 136 | Cow only | 29 | 8.6 | 33,918 |
| Dec. 1 - Mar. 31 | 121 | Cull cow only | 4 | 8.6 | 4,162 |
| Dec. 1 - Mar. 31 | 121 | Calves, steer | 15 | 8.1 | 14,701 |
| Dec. 1 - Mar. 31 | 121 | Calves, heifer | 15 | 7.5 | 13,612 |
| | Subtotal | | | | 66,393 |
| Dec. 1 - Apr. 15 | 136 | Herd bull | 1 | 13.0 | 1,768 |
| | 136 | Repl. kept | 4 | 11.9 | 6,474 |
| Dec. 1 - Mar. 31 | 121 | Repl., 1 sold | 1 | 11.9 | 1,440 |
| Apr. 1 - Apr. 15 | 15 | Calves, heifer | 5 | 8.1 | 608 |
| | Total | | | | 76,683 |
| | Total (Per Cow) | | | | 2,324 |
| Year Total | | | | | 177,184 |
| Year Total (Per Cow) | | | | | 5,369 |

SOURCE: Number 4, Nutrient Requirements of Beef Cattle (fifth revised edition, 1976), National Academy of Science. Feed for unweaned cattle is included with beef-cow requirements for 3½ month and claculated separately from 3½ to 8½ months.

Table 3. Beef Cow Calf: Fall Calving
Feed Nutrient Requirement for 33 Brood Cows and Replacements

| Period | | | | Total digest nutrients | |
|---|---|---|---|---|---|
| Months | Days | Livestock group | Head | lb/da/hd | lbs. |
| PERIOD 1 | | | | | |
| Apr. 16 - June 15 | 61 | Cow only | 33 | 8.6 | 17,312 |
| | 61 | Calves, steer | 15 | 8.6 | 7,869 |
| | 61 | Calves, heifer | 15 | 7.5 | 6,862 |
| | Subtotal | Cow and calf | | | 32,043 |
| | 61 | Herd bull | 1 | 13.0 | 793 |
| | 61 | 1 yr. heifer | 5 | 11.9 | 3,630 |
| | Total | | | | 36,466 |
| | Total (Per Cow) | | | | 1,105 |
| PERIOD 2 | | | | | |
| June 16 - Aug. 31 | 77 | Cow only | 29 | 10.0 | 22,330 |
| | 77 | Calves, heifer | 5 | 9.1 | 3,504 |
| | Subtotal | Cow and calf | | | 25,834 |
| | 77 | Herd bull | 1 | 13.0 | 1,001 |
| | 77 | Repl. heifer | 4 | 11.7 | 3,604 |
| | Total | | | | 30,439 |
| | Total (Per Cow) | | | | 922 |
| PERIOD 3 | | | | | |
| Sept. 1 - Sept. 30 | 30 | 2 yr. repl. heifer | 4 | 11.7 | 1,404 |
| | 30 | Cow only | 29 | 10.0 | 8,700 |
| Oct. 1 - Nov. 30 | 61 | Cow and calf | 33 | 11.7 | 23,552 |
| | Subtotal | Cow and calf | | | 33,656 |
| | 91 | Herd bull | 1 | 13.0 | 1,123 |
| Sept. 1 - Nov. 30 | 91 | Repl. heifer | 5 | 9.9 | 4,504 |
| | Total | | | | 39,343 |
| | Total (Per Cow) | | | | 1,192 |
| PERIOD 4 | | | | | |
| Dec. 1 - Jan. 15 | 46 | Cow and calf | 33 | 11.7 | 17,761 |
| Jan. 16 - Apr. 15 | 90 | Calves, steer | 15 | 6.0 | 8,100 |
| | 90 | Calves, heifer | 15 | 5.4 | 7,290 |
| | 90 | Dry cow, only | 33 | 8.6 | 25,542 |
| | Subtotal | Cow and calf | | | 58,542 |
| Dec. 1 - Apr. | 136 | Bull | 1 | 13.0 | 1,768 |
| | 136 | Bred. repl. heifer | 5 | 11.2 | 7,616 |
| | Total | | | | 68,077 |
| | Total (Per Cow) | | | | 2,063 |
| Year Total | | | | | 174,325 |
| Year Total (Per Cow) | | | | | 5,283 |

SOURCE: Number 4, Nutrient Requirements of Beef Cattle (fifth revised edition, 1976), National Academy of Science. Feed for unweaned cattle is included with beef-cow requirements for 3½ month and calculated separately from 3½ to 8½ months.

# APPENDIX D

## Enterprise Budgets for Specific Crops

TABLE 1 BLUEGRASS/WHITE CLOVER PASTURE
NORTHERN VIRGINIA AREA
2.2 A.U.M. PER ACRE

LAND E
NATIVE PASTURE
MIDDLEBURG

| CATEGORY | UNITS | PRICE | QUANTITY | VALUE |
|---|---|---|---|---|
| PRODUCTION: | | | | |
| TDN.1* | AUMS | 0.0 | 1.414 | 0.0 |
| TDN.2 | AUMS | 0.0 | 0.218 | 0.0 |
| TDN.3 | AUMS | 0.0 | 0.478 | 0.0 |
| TDN.4 | AUMS | 0.0 | 0.065 | 0.0 |
| TOTAL RECEIPTS | | | | 0.0 |
| OPERATING INPUTS: | | | | |
| PHOSPHATE | LBS. | 0.270 | 10.000 | 2.70 |
| POTASH | LBS. | 0.100 | 5.000 | 0.50 |
| FENCE REPAIR | ACRE | 0.100 | 1.000 | 0.10 |
| TOTAL OPERATING COST | | | | 3.30 |
| RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT | | | | -3.30 |
| CAPITAL COST: | | | | |
| ANNUAL OPERATING CAPITAL | | 0.090 | 1.900 | 0.17 |
| TRACTOR INVESTMENT | | 0.090 | 0.0 | 0.0 |
| EQUIPMENT INVESTMENT | | 0.090 | 0.0 | 0.0 |
| TOTAL INTEREST CHARGE | | | | 0.17 |
| RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT | | | | -3.47 |
| OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE) | | | | |
| TRACTOR | DOL. | | | 0.0 |
| EQUIPMENT | DOL. | | | 0.0 |
| TOTAL OWNERSHIP COST | | | | 0.0 |
| RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT | | | | -3.47 |
| LABOR COST: | | | | |
| MACHINERY LABOR | HR. | 2.750 | 0.0 | 0.0 |
| OTHER LABOR | HR. | 2.750 | 0.050 | 0.14 |
| TOTAL LABOR COST | | | | 0.14 |
| RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT | | | | -3.61 |

*/ A.U.M. MEANS ANIMAL UNIT MONTH AND IS EQUIVALENT TO 400 LBS T.D.N. UTILIZED
NOTE 1 BUDGET PREPARED FOR COW-CALF / FORAGE SUBSYSTEMS RESEARCH FOR M.S. DEGREE IN AGRICULTURAL ECONOMICS BY ANDY BRABRAND.

ENTERPRISE: 89 REGION: 2 MACH. COMP ID: 1
SUBCODE: 156 COUNTY: 15 LAND GROUP: 3
CAPITAL MONTH: 6 USER ID: 78 DATE PRINTED: 11/01/76

TABLE 2 BLUEGRASS/WHITE CLOVER PASTURE
NORTHERN VIRGINIA AREA
4.2 A.U.M. PER ACRE PER YEAR

LAND D
IMPROVED PASTURE
MIDDLEBURG

| CATEGORY | UNITS | PRICE | QUANTITY | VALUE |
|---|---|---|---|---|
| PRODUCTION: | | | | |
| TDN.1* | AUMS | 0.0 | 2.510 | 0.0 |
| TDN.2 | AUMS | 0.0 | 0.540 | 0.0 |
| TDN.3 | AUMS | 0.0 | 1.050 | 0.0 |
| TDN.4 | AUMS | 0.0 | 0.080 | 0.0 |
| TOTAL RECEIPTS | | | | 0.0 |
| OPERATING INPUTS: | | | | |
| PHOSPHATE | LBS. | 0.270 | 40.000 | 10.80 |
| POTASH | LBS. | 0.100 | 40.000 | 4.00 |
| LIME | TONS | 13.500 | 0.500 | 6.75 |
| CLOVER SEED,WHTE | LBS. | 2.130 | 0.333 | 0.71 |
| FENCE REPAIR | ACRE | 0.100 | 1.000 | 0.10 |
| TRACTOR FUEL COST | ACRE | | | 0.10 |
| TRACT REPAIR COST | ACRE | | | 0.07 |
| TRACTOR LUBE COST | ACRE | | | 0.01 |
| EQUIP REPAIR COST | ACRE | | | 0.08 |
| TOTAL OPERATING COST | | | | 22.62 |
| RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT | | | | -22.62 |
| CAPITAL COST: | | | | |
| ANNUAL OPERATING CAPITAL | | 0.090 | 13.256 | 1.19 |
| TRACTOR INVESTMENT | | 0.090 | 1.343 | 0.12 |
| EQUIPMENT INVESTMENT | | 0.090 | 1.967 | 0.18 |
| TOTAL INTEREST CHARGE | | | | 1.49 |
| RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT | | | | -24.11 |
| OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE) | | | | |
| TRACTOR | DOL. | | | 0.17 |
| EQUIPMENT | DOL. | | | 0.31 |
| TOTAL OWNERSHIP COST | | | | 0.48 |
| RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT | | | | -24.59 |
| LABOR COST: | | | | |
| MACHINERY LABOR | HR. | 2.750 | 0.063 | 0.17 |
| OTHER LABOR | HR. | 2.750 | 0.050 | 0.14 |
| TOTAL LABOR COST | | | | 0.31 |
| RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT | | | | -24.91 |

NOTE 2 FERTILIZE AT THE RATE OF 120 LB OF EACH, P2O5 AND K2O EVERY THREE YEARS,AND SEED 3 LBS CLOVER SEED AT THE SAME TIME. CLIP PASTURE EVERY 2 YEARS.

ENTERPRISE: 89 REGION: 2 MACH. COMP ID: 1
SUBCODE: 156 COUNTY: 6 LAND GROUP: 3
CAPITAL MONTH: 6 USER ID: 78 DATE PRINTED: 11/01/76

TABLE 3 ORCHARD GRASS/ALFALFA HAY AND PASTURE LAND C
NORTHERN VIRGINIA AREA
2.3 TONS HAY AND 3.0 AUM PASTURE PER ACRE* MIDDLEBURG

| CATEGORY | UNITS | PRICE | QUANTITY | VALUE |
|---|---|---|---|---|
| PRODUCTION: | | | | |
| HAY | TONS | 53.810 | 2.300 | 123.76 |
| TON.3 | AUMS | 0.0 | 3.000 | 0.0 |
| TOTAL RECEIPTS | | | | 123.76 |
| OPERATING INPUTS: | | | | |
| GRASS SEED | LBS. | 0.600 | 2.500 | 1.50 |
| ALFALFA SEED | LBS. | 1.360 | 3.000 | 4.08 |
| NITROGEN | LBS. | 0.270 | 2.000 | 0.54 |
| PHOSPHATE | LBS. | 0.270 | 95.000 | 25.65 |
| POTASH | LBS. | 0.100 | 176.000 | 17.60 |
| LIME | TONS | 13.500 | 0.500 | 6.75 |
| BORON | LBS. | 0.200 | 5.000 | 1.00 |
| PARAQUAT | PT. | 7.000 | 0.400 | 2.80 |
| CUSTOM BALE | TONS | 10.000 | 2.300 | 23.00 |
| FENCE REPAIR | ACRE | 0.100 | 1.000 | 0.10 |
| TRACTOR FUEL COST | ACRE | | | 2.76 |
| TRACT REPAIR COST | ACRE | | | 2.12 |
| TRACTOR LUBE COST | ACRE | | | 0.41 |
| EQUIP REPAIR COST | ACRE | | | 3.12 |
| TOTAL OPERATING COST | | | | 91.44 |
| RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT | | | | 32.33 |
| CAPITAL COST: | | | | |
| ANNUAL OPERATING CAPITAL | | 0.090 | 31.565 | 2.84 |
| TRACTOR INVESTMENT | | 0.090 | 39.259 | 3.53 |
| EQUIPMENT INVESTMENT | | 0.090 | 55.079 | 4.96 |
| TOTAL INTEREST CHARGE | | | | 11.33 |
| RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT | | | | 20.99 |
| OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE) | | | | |
| TRACTOR | DOL. | | | 5.09 |
| EQUIPMENT | DOL. | | | 8.67 |
| TOTAL OWNERSHIP COST | | | | 13.76 |
| RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT | | | | 7.23 |
| LABOR COST: | | | | |
| MACHINERY LABOR | HR. | 2.750 | 1.361 | 3.74 |
| OTHER LABOR | HR. | 2.750 | 0.050 | 0.14 |
| TOTAL LABOR COST | | | | 3.88 |
| RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT | | | | 3.35 |

FOOTNOTE: THE FIRST TWO GROWTHS ARE CUT FOR HAY, THE OTHER GROWTHS ARE FOR GRAZING. * ESTABLISHING COSTS PRORATED OVER 5 YEARS,FOLLOWING S.GRAIN
TOTAL YIELD = 3.94 TON HAY EQUIVALENT = 9.0 AUM

TABLE 4 ORCHARD GRASS/ALFALFA HAY AND PASTURE — LAND B
NORTHERN VIRGINIA AREA
2.7 TONS HAY AND 3.5 AUM PASTURE PER ACRE* — MIDDLEBURG

| CATEGORY | UNITS | PRICE | QUANTITY | VALUE |
|---|---|---|---|---|
| PRODUCTION: | | | | |
| HAY | TONS | 53.810 | 2.710 | 145.83 |
| TDN.3 | AUMS | 0.0 | 3.510 | 0.0 |
| TOTAL RECEIPTS | | | | 145.83 |
| OPERATING INPUTS: | | | | |
| GRASS SEED | LBS. | 0.600 | 2.500 | 1.50 |
| ALFALFA SEED | LBS. | 1.360 | 3.000 | 4.08 |
| NITROGEN | LBS. | 0.270 | 2.000 | 0.54 |
| PHOSPHATE | LBS. | 0.270 | 110.000 | 29.70 |
| POTASH | LBS. | 0.100 | 201.000 | 20.10 |
| LIME | TONS | 13.500 | 0.500 | 6.75 |
| BORON | LBS. | 0.200 | 5.000 | 1.00 |
| CUSTOM BALE | TONS | 10.000 | 2.710 | 27.10 |
| FENCE REPAIR | ACRE | 0.100 | 1.000 | 0.10 |
| TRACTOR FUEL COST | ACRE | | | 3.19 |
| TRACT REPAIR COST | ACRE | | | 2.45 |
| TRACTOR LUBE COST | ACRE | | | 0.48 |
| EQUIP REPAIR COST | ACRE | | | 3.27 |
| TOTAL OPERATING COST | | | | 100.27 |
| RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT | | | | 45.56 |
| CAPITAL COST: | | | | |
| ANNUAL OPERATING CAPITAL | | 0.090 | 30.813 | 2.77 |
| TRACTOR INVESTMENT | | 0.090 | 45.409 | 4.09 |
| EQUIPMENT INVESTMENT | | 0.090 | 56.415 | 5.08 |
| TOTAL INTEREST CHARGE | | | | 11.94 |
| RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT | | | | 33.62 |
| OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE) | | | | |
| TRACTOR | DOL. | | | 5.89 |
| EQUIPMENT | DOL. | | | 8.87 |
| TOTAL OWNERSHIP COST | | | | 14.76 |
| RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT | | | | 18.86 |
| LABOR COST: | | | | |
| MACHINERY LABOR | HR. | 2.750 | 1.554 | 4.27 |
| OTHER LABOR | HR. | 2.750 | 0.050 | 0.14 |
| TOTAL LABOR COST | | | | 4.41 |
| RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT | | | | 14.45 |

FOOTNOTE: THE FIRST TWO GROWTHS ARE CUT FOR HAY, THE OTHER GROWTHS ARE FOR GRAZING. * ESTABLISHING COSTS PRORATED OVER 5 YEARS
TOTAL YIELD = 4.64 TON HAY EQUIVALENT=10.54 AUM

TABLE 5 ORCHARD GRASS/ALFALFA HAY AND PASTURE — LAND A
NORTHERN VIRGINIA AREA
3.1 TONS HAY AND 4.0 AUM PASTURE PER ACRE* — MIDDLEBURG

| CATEGORY | UNITS | PRICE | QUANTITY | VALUE |
|---|---|---|---|---|
| PRODUCTION: | | | | |
| HAY | TONS | 53.810 | 3.100 | 166.81 |
| TDN.3 | AUMS | 0.0 | 4.000 | 0.0 |
| TOTAL RECEIPTS | | | | 166.81 |
| OPERATING INPUTS: | | | | |
| GRASS SEED | LBS. | 0.600 | 2.500 | 1.50 |
| ALFALFA SEED | LBS. | 1.360 | 3.000 | 4.08 |
| NITROGEN | LBS. | 0.270 | 3.000 | 0.81 |
| PHOSPHATE | LBS. | 0.270 | 130.000 | 35.10 |
| POTASH | LBS. | 0.100 | 220.000 | 22.00 |
| LIME | TONS | 13.500 | 0.500 | 6.75 |
| BORON | LBS. | 0.200 | 5.000 | 1.00 |
| CUSTOM BALE | TONS | 10.000 | 3.200 | 32.00 |
| FENCE REPAIR | ACRE | 0.100 | 1.000 | 0.10 |
| TRACTOR FUEL COST | ACRE | | | 3.49 |
| TRACT REPAIR COST | ACRE | | | 2.68 |
| TRACTOR LUBE COST | ACRE | | | 0.52 |
| EQUIP REPAIR COST | ACRE | | | 3.28 |
| TOTAL OPERATING COST | | | | 113.32 |
| RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT | | | | 53.49 |
| CAPITAL COST: | | | | |
| ANNUAL OPERATING CAPITAL | | 0.090 | 32.701 | 2.94 |
| TRACTOR INVESTMENT | | 0.090 | 49.655 | 4.47 |
| EQUIPMENT INVESTMENT | | 0.090 | 56.758 | 5.11 |
| TOTAL INTEREST CHARGE | | | | 12.52 |
| RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT | | | | 40.97 |
| OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE) | | | | |
| TRACTOR | DOL. | | | 6.44 |
| EQUIPMENT | DOL. | | | 8.91 |
| TOTAL OWNERSHIP COST | | | | 15.35 |
| RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT | | | | 25.62 |
| LABOR COST: | | | | |
| MACHINERY LABOR | HR. | 2.750 | 1.691 | 4.65 |
| OTHER LABOR | HR. | 2.750 | 0.050 | 0.14 |
| TOTAL LABOR COST | | | | 4.79 |
| RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT | | | | 20.83 |

FOOTNOTE: THE FIRST TWO GROWTHS ARE CUT FOR HAY, THE OTHER GROWTHS ARE FOR GRAZING. * ESTABLISHING COSTS PRORATED OVER 5 YEARS
TOTAL YIELD = 5.2 TON HAY EQUIVALENT=12.1 AUM

TABLE 6 FESCUE/RED CLOVER HAY,SUMMER GRAZING,AND STOCKPILING FOR WINTER GRAZING NORTHERN VIRGINIA AREA LAND C
1.5 T HAY & 1.4 AUMS SUMMER GRAZING & 6.2 AUMS STOCKPILE GRAZING

| CATEGORY | UNITS | PRICE | QUANTITY | VALUE |
|---|---|---|---|---|
| PRODUCTION: | | | | |
| HAY | TONS | 53.810 | 1.500 | 80.71 |
| TDN.1* | AUMS | 0.0 | 4.000 | 0.0 |
| TDN.2 | AUMS | 0.0 | 1.400 | 0.0 |
| TDN.4 | AUMS | 0.0 | 6.200 | 0.0 |
| TOTAL RECEIPTS | | | | 80.71 |
| OPERATING INPUTS: | | | | |
| GRASS SEED | LBS. | 0.450 | 1.500 | 0.67 |
| CLOVER SEED,RED | LBS. | 1.030 | 3.800 | 3.91 |
| NITROGEN | LBS. | 0.270 | 84.000 | 22.68 |
| PHOSPHATE | LBS. | 0.270 | 78.000 | 21.06 |
| POTASH | LBS. | 0.100 | 88.000 | 8.80 |
| LIME | TONS | 13.500 | 0.500 | 6.75 |
| ELECTRIC FENCE | ACRE | 0.200 | 1.000 | 0.20 |
| CUSTOM BALE | TONS | 10.000 | 1.500 | 15.00 |
| FENCE REPAIR | ACRE | 0.100 | 1.000 | 0.10 |
| TRACTOR FUEL COST | ACRE | | | 1.51 |
| TRACT REPAIR COST | ACRE | | | 1.16 |
| TRACTOR LUBE COST | ACRE | | | 0.23 |
| EQUIP REPAIR COST | ACRE | | | 1.54 |
| TOTAL OPERATING COST | | | | 83.61 |
| RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT | | | | -2.90 |
| CAPITAL COST: | | | | |
| ANNUAL OPERATING CAPITAL | | 0.090 | 53.164 | 4.78 |
| TRACTOR INVESTMENT | | 0.090 | 21.490 | 1.93 |
| EQUIPMENT INVESTMENT | | 0.090 | 25.018 | 2.25 |
| TOTAL INTEREST CHARGE | | | | 8.97 |
| RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT | | | | -11.87 |
| OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE) | | | | |
| TRACTOR | DOL. | | | 2.79 |
| EQUIPMENT | DOL. | | | 3.94 |
| TOTAL OWNERSHIP COST | | | | 6.73 |
| RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT | | | | -18.59 |
| LABOR COST: | | | | |
| MACHINERY LABOR | HR. | 2.750 | 0.721 | 1.98 |
| OTHER LABOR | HR. | 2.750 | 1.100 | 3.02 |
| TOTAL LABOR COST | | | | 5.01 |
| RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT | | | | -23.60 |

HAY CUT ON MAY 15 FOR LARGE (1000LB) BALES (REMOVED) AND PASTURE SUMMER GRAZED THROUGH JULY,THEN ALLOWED TO STOCKPILE UNTIL WINTER,DEC.1-APR.15
TOTAL YIELD = 4.3 TONS HAY EQUIVALENT = 11.6 AU

TABLE 7 FESCUE/RED CLOVER HAY, SUMMER GRAZING, AND STOCKPILING FOR WINTER GRAZING NORTHERN VIRGINIA AREA LAND B
1.8 T HAY & 1.6 AUMS SUMMER GRAZING & 7.3 AUMS STOCKPILE GRAZING

| CATEGORY | UNITS | PRICE | QUANTITY | VALUE |
|---|---|---|---|---|
| PRODUCTION: | | | | |
| HAY | TONS | 53.810 | 1.800 | 96.86 |
| TDN.1* | AUMS | 0.0 | 4.900 | 0.0 |
| TDN.2 | AUMS | 0.0 | 1.600 | 0.0 |
| TDN.4 | AUMS | 0.0 | 7.300 | 0.0 |
| TOTAL RECEIPTS | | | | 96.86 |
| OPERATING INPUTS: | | | | |
| GRASS SEED | LBS. | 0.450 | 1.500 | 0.67 |
| CLOVER SEED,RED | LBS. | 1.030 | 3.800 | 3.91 |
| NITROGEN | LBS. | 0.270 | 97.000 | 26.19 |
| PHOSPHATE | LBS. | 0.270 | 90.000 | 24.30 |
| POTASH | LBS. | 0.100 | 100.000 | 10.00 |
| LIME | TONS | 13.500 | 0.500 | 6.75 |
| ELECTRIC FENCE | ACRE | 0.200 | 1.000 | 0.20 |
| CUSTOM BALE | TONS | 10.000 | 1.800 | 18.00 |
| FENCE REPAIR | ACRE | 0.100 | 1.000 | 0.10 |
| TRACTOR FUEL COST | ACRE | | | 1.69 |
| TRACT REPAIR COST | ACRE | | | 1.30 |
| TRACTOR LUBE COST | ACRE | | | 0.25 |
| EQUIP REPAIR COST | ACRE | | | 1.54 |
| TOTAL OPERATING COST | | | | 94.92 |
| RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT | | | | 1.94 |
| CAPITAL COST: | | | | |
| ANNUAL OPERATING CAPITAL | | 0.090 | 60.143 | 5.41 |
| TRACTOR INVESTMENT | | 0.090 | 24.090 | 2.17 |
| EQUIPMENT INVESTMENT | | 0.090 | 25.229 | 2.27 |
| TOTAL INTEREST CHARGE | | | | 9.85 |
| RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT | | | | -7.91 |
| OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE) | | | | |
| TRACTOR | DOL. | | | 3.12 |
| EQUIPMENT | DOL. | | | 3.96 |
| TOTAL OWNERSHIP COST | | | | 7.09 |
| RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT | | | | -15.00 |
| LABOR COST: | | | | |
| MACHINERY LABOR | HR. | 2.750 | 0.805 | 2.21 |
| OTHER LABOR | HR. | 2.750 | 1.100 | 3.02 |
| TOTAL LABOR COST | | | | 5.24 |
| RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT | | | | -20.24 |

HAY CUT ON MAY 15 FOR LARGE (1000LB) BALES (REMOVED) AND PASTURE SUMMER GRAZED THROUGH JULY, THEN ALLOWED TO STOCKPILE UNTIL WINTER, DEC.1-APR.15
TOTAL YIELD = 5.1 TONS HAY EQUIVALENT = 13.8 AU

TABLE 8 FESCUE/RED CLOVER HAY, SUMMER GRAZING, AND STOCKPILING FOR WINTER GRAZING NORTHERN VIRGINIA AREA LAND A
2.0 T HAY & 1.8 AUMS SUMMER GRAZING & 8.2 AUMS STOCKPILE GRAZING

| CATEGORY | UNITS | PRICE | QUANTITY | VALUE |
|---|---|---|---|---|
| PRODUCTION: | | | | |
| HAY | TONS | 53.810 | 2.100 | 113.00 |
| TDN.1* | AUMS | 0.0 | 5.700 | 0.0 |
| TDN.2 | AUMS | 0.0 | 1.900 | 0.0 |
| TDN.4 | AUMS | 0.0 | 8.600 | 0.0 |
| TOTAL RECEIPTS | | | | 113.00 |
| OPERATING INPUTS: | | | | |
| GRASS SEED | LBS. | 0.450 | 1.500 | 0.67 |
| CLOVER SEED,RED | LBS. | 1.030 | 3.800 | 3.91 |
| NITROGEN | LBS. | 0.270 | 110.000 | 29.70 |
| PHOSPHATE | LBS. | 0.270 | 105.000 | 28.35 |
| POTASH | LBS. | 0.100 | 115.000 | 11.50 |
| LIME | TONS | 13.500 | 0.500 | 6.75 |
| ELECTRIC FENCE | ACRE | 0.200 | 1.000 | 0.20 |
| CUSTOM BALE | TONS | 10.000 | 2.100 | 21.00 |
| FENCE REPAIR | ACRE | 0.100 | 1.000 | 0.10 |
| TRACTOR FUEL COST | ACRE | | | 1.87 |
| TRACT REPAIR COST | ACRE | | | 1.44 |
| TRACTOR LUBE COST | ACRE | | | 0.28 |
| EQUIP REPAIR COST | ACRE | | | 1.55 |
| TOTAL OPERATING COST | | | | 107.34 |
| RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT | | | | 5.66 |
| CAPITAL COST: | | | | |
| ANNUAL OPERATING CAPITAL | | 0.090 | 68.048 | 6.12 |
| TRACTOR INVESTMENT | | 0.090 | 26.689 | 2.40 |
| EQUIPMENT INVESTMENT | | 0.090 | 25.439 | 2.29 |
| TOTAL INTEREST CHARGE | | | | 10.82 |
| RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT | | | | -5.15 |
| OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE) | | | | |
| TRACTOR | DOL. | | | 3.46 |
| EQUIPMENT | DOL. | | | 3.99 |
| TOTAL OWNERSHIP COST | | | | 7.45 |
| RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT | | | | -12.60 |
| LABOR COST: | | | | |
| MACHINERY LABOR | HR. | 2.750 | 0.888 | 2.44 |
| OTHER LABOR | HR. | 2.750 | 1.100 | 3.02 |
| TOTAL LABOR COST | | | | 5.47 |
| RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT | | | | -18.07 |

HAY CUT ON MAY 15 FOR LARGE (1000LB) BALES (REMOVED) AND PASTURE SUMMER GRAZED THROUGH JULY, THEN ALLOWED TO STOCKPILE UNTIL WINTER, DEC.1-APR.15
TOTAL YIELD = 5.7 TONS HAY EQUIVALENT = 15.5 AU

TABLE 9 CORN FOR SILAGE WITH RYE COVER, NO-TILL LAND B
NORTHERN VIRGINIA AREA CUSTOM PLANT,FERTILIZE, AND HARVEST
16.7 TONS SILAGE WITH 1.7 AUM PASTURE

| CATEGORY | UNITS | PRICE | QUANTITY | VALUE |
|---|---|---|---|---|
| PRODUCTION: | | | | |
| CORN SILAGE | TONS | 0.0 | 14.500 | 0.0 |
| TDN.2 | AUMS | 0.0 | 20.340 | 0.0 |
| TDN.3 | AUMS | 0.0 | 0.250 | 0.0 |
| TDN.4 | AUMS | 0.0 | 1.500 | 0.0 |
| TOTAL RECEIPTS | | | | 0.0 |
| OPERATING INPUTS: | | | | |
| CORN SEED | LBS. | 0.500 | 12.500 | 6.25 |
| RYE SEED | BU. | 5.950 | 1.500 | 8.92 |
| NITROGEN | LBS. | 0.270 | 170.000 | 45.90 |
| PHOSPHATE | LBS. | 0.270 | 85.000 | 22.95 |
| POTASH | LBS. | 0.100 | 140.000 | 14.00 |
| LIME | TONS | 13.500 | 0.500 | 6.75 |
| PARAQUAT | PT. | 7.000 | 1.000 | 7.00 |
| ATRAZINE | LBS. | 3.500 | 3.000 | 10.50 |
| FURADAN | LBS. | 0.670 | 10.000 | 6.70 |
| SEVIN | LBS. | 1.500 | 0.500 | 0.75 |
| 2-4-D | LBS. | 2.240 | 1.000 | 2.24 |
| CUSTOM PLANT | ACRE | 8.800 | 1.000 | 8.80 |
| CUST HAR SIL | TONS | 2.750 | 16.700 | 45.92 |
| TRENCH SILO* | TONS | 4.280 | 14.500 | 62.06 |
| TRACTOR FUEL COST | ACRE | | | 0.55 |
| TRACT REPAIR COST | ACRE | | | 0.41 |
| TRACTOR LUBE COST | ACRE | | | 0.08 |
| EQUIP REPAIR COST | ACRE | | | 0.96 |
| TOTAL OPERATING COST | | | | 250.76 |
| RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT | | | | -250.76 |
| CAPITAL COST: | | | | |
| ANNUAL OPERATING CAPITAL | | 0.090 | 95.535 | 8.60 |
| TRACTOR INVESTMENT | | 0.090 | 7.638 | 0.69 |
| EQUIPMENT INVESTMENT | | 0.090 | 44.793 | 4.03 |
| TOTAL INTEREST CHARGE | | | | 13.32 |
| RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT | | | | -264.07 |
| OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE) | | | | |
| TRACTOR | DOL. | | | 0.99 |
| EQUIPMENT | DOL. | | | 5.35 |
| TOTAL OWNERSHIP COST | | | | 6.34 |
| RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT | | | | -270.42 |
| LABOR COST: | | | | |
| MACHINERY LABOR | HR. | 2.750 | 0.360 | 0.99 |
| OTHER LABOR | HR. | 2.750 | 4.970 | 13.67 |
| TOTAL LABOR COST | | | | 14.66 |
| RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT | | | | -285.07 |

*/ INCLUDES STORAGE AND FEEDING COSTS

TABLE 10 CORN FOR SILAGE WITH RYE COVER, NO-TILL LAND A
NORTHERN VIRGINIA AREA CUSTOM PLANT,FERTILIZE, AND HARVEST
18.6 TONS SILAGE WITH 1.9 AUM PASTURE

| CATEGORY | UNITS | PRICE | QUANTITY | VALUE |
|---|---|---|---|---|
| PRODUCTION: | | | | |
| CORN SILAGE | TONS | 0.0 | 16.100 | 0.0 |
| TDN.2 | AUMS | 0.0 | 22.600 | 0.0 |
| TDN.3 | AUMS | 0.0 | 0.300 | 0.0 |
| TDN.4 | AUMS | 0.0 | 1.600 | 0.0 |
| TOTAL RECEIPTS | | | | 0.0 |
| OPERATING INPUTS: | | | | |
| CORN SEED | LBS. | 0.500 | 12.500 | 6.25 |
| RYE SEED | BU. | 5.950 | 1.500 | 8.92 |
| NITROGEN | LBS. | 0.270 | 180.000 | 48.60 |
| PHOSPHATE | LBS. | 0.270 | 90.000 | 24.30 |
| POTASH | LBS. | 0.100 | 150.000 | 15.00 |
| LIME | TONS | 13.500 | 0.500 | 6.75 |
| PARAQUAT | PT. | 7.000 | 1.000 | 7.00 |
| ATRAZINE | LBS. | 3.500 | 3.000 | 10.50 |
| FURADAN | LBS. | 0.670 | 10.000 | 6.70 |
| SEVIN | LBS. | 1.500 | 0.500 | 0.75 |
| 2-4-D | LBS. | 2.240 | 1.000 | 2.24 |
| CUSTOM PLANT | ACRE | 8.800 | 1.000 | 8.80 |
| CUST HAR SIL | TONS | 2.750 | 18.600 | 51.15 |
| TRENCH SILO* | TONS | 4.280 | 16.100 | 68.91 |
| TRACTOR FUEL COST | ACRE | | | 0.55 |
| TRACT REPAIR COST | ACRE | | | 0.41 |
| TRACTOR LUBE COST | ACRE | | | 0.08 |
| EQUIP REPAIR COST | ACRE | | | 0.96 |
| TOTAL OPERATING COST | | | | 267.88 |
| RETURNS TO LAND,LABOR,CAPITAL,MACHINERY, OVERHEAD,RISK,AND MANAGEMENT | | | | -267.88 |
| CAPITAL COST: | | | | |
| ANNUAL OPERATING CAPITAL | | 0.090 | 100.073 | 9.01 |
| TRACTOR INVESTMENT | | 0.090 | 7.638 | 0.69 |
| EQUIPMENT INVESTMENT | | 0.090 | 44.793 | 4.03 |
| TOTAL INTEREST CHARGE | | | | 13.73 |
| RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT | | | | -281.60 |
| OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE) | | | | |
| TRACTOR | DOL. | | | 0.99 |
| EQUIPMENT | DOL. | | | 5.35 |
| TOTAL OWNERSHIP COST | | | | 6.34 |
| RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT | | | | -287.95 |
| LABOR COST: | | | | |
| MACHINERY LABOR | HR. | 2.750 | 0.360 | 0.99 |
| OTHER LABOR | HR. | 2.750 | 4.970 | 13.67 |
| TOTAL LABOR COST | | | | 14.66 |
| RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT | | | | -302.60 |

*/ INCLUDES STORAGE AND FEEDING COSTS

TABLE 11 CORN FOR GRAIN WITH RYE COVER, NO-TILL LAND B
NORTHERN VIRGINIA AREA CUSTOM PLANT, FERTILIZE, AND HARVEST
90. BU. PER ACRE

| CATEGORY | UNITS | PRICE | QUANTITY | VALUE |
|---|---|---|---|---|
| PRODUCTION: | | | | |
| CORN | BU. | 2.660 | 90.000 | 239.40 |
| TDN.3 | AUMS | 0.0 | 2.800 | 0.0 |
| TDN.4 | AUMS | 0.0 | 1.300 | 0.0 |
| TOTAL RECEIPTS | | | | 239.40 |
| OPERATING INPUTS: | | | | |
| CORN SEED | LBS. | 0.500 | 12.500 | 6.25 |
| RYE SEED | BU. | 5.950 | 1.500 | 8.92 |
| NITROGEN | LBS. | 0.270 | 160.000 | 43.20 |
| PHOSPHATE | LBS. | 0.270 | 70.000 | 18.90 |
| POTASH | LBS. | 0.100 | 90.000 | 9.00 |
| LIME | TONS | 13.500 | 0.500 | 6.75 |
| PARAQUAT | PT. | 7.000 | 1.000 | 7.00 |
| ATRAZINE | LBS. | 3.500 | 3.000 | 10.50 |
| FURADAN | LBS. | 0.670 | 10.000 | 6.70 |
| SEVIN | LBS. | 1.500 | 0.500 | 0.75 |
| 2-4-D | LBS. | 2.240 | 1.000 | 2.24 |
| CUSTOM PLANT | ACRE | 8.800 | 1.000 | 8.80 |
| CUSTOM COMBINE | ACRE | 16.500 | 1.000 | 16.50 |
| DRYING | BU. | 0.100 | 90.000 | 9.00 |
| TRACTOR FUEL COST | ACRE | | | 0.74 |
| TRACT REPAIR COST | ACRE | | | 0.56 |
| TRACTOR LUBE COST | ACRE | | | 0.11 |
| EQUIP REPAIR COST | ACRE | | | 1.11 |
| TOTAL OPERATING COST | | | | 157.04 |
| RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT | | | | 82.36 |
| CAPITAL COST: | | | | |
| ANNUAL OPERATING CAPITAL | | 0.090 | 71.703 | 6.45 |
| TRACTOR INVESTMENT | | 0.090 | 10.346 | 0.93 |
| EQUIPMENT INVESTMENT | | 0.090 | 55.905 | 5.03 |
| TOTAL INTEREST CHARGE | | | | 12.42 |
| RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT | | | | 69.94 |
| OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE) | | | | |
| TRACTOR | DOL. | | | 1.34 |
| EQUIPMENT | DOL. | | | 6.91 |
| TOTAL OWNERSHIP COST | | | | 8.25 |
| RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT | | | | 61.69 |
| LABOR COST: | | | | |
| MACHINERY LABOR | HR. | 2.750 | 0.488 | 1.34 |
| OTHER LABOR | HR. | 2.750 | 1.100 | 3.02 |
| TOTAL LABOR COST | | | | 4.37 |
| RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT | | | | 57.32 |

TABLE 12 CORN FOR GRAIN WITH RYE COVER, NO-TILL LAND A
NORTHERN VIRGINIA AREA CUSTOM PLANT, FERTILIZE, AND HARVEST
100. BU. PER ACRE

| CATEGORY | UNITS | PRICE | QUANTITY | VALUE |
|---|---|---|---|---|
| PRODUCTION: | | | | |
| CORN | BU. | 2.660 | 100.000 | 266.00 |
| TDN.3 | AUMS | 0.0 | 3.100 | 0.0 |
| TDN.4 | AUMS | 0.0 | 1.400 | 0.0 |
| TOTAL RECEIPTS | | | | 266.00 |
| OPERATING INPUTS: | | | | |
| CORN SEED | LBS. | 0.500 | 12.500 | 6.25 |
| RYE SEED | BU. | 5.950 | 1.500 | 8.92 |
| NITROGEN | LBS. | 0.270 | 175.000 | 47.25 |
| PHOSPHATE | LBS. | 0.270 | 75.000 | 20.25 |
| POTASH | LBS. | 0.100 | 95.000 | 9.50 |
| LIME | TONS | 13.500 | 0.500 | 6.75 |
| PARAQUAT | PT. | 7.000 | 1.000 | 7.00 |
| ATRAZINE | LBS. | 3.500 | 3.000 | 10.50 |
| FURADAN | LBS. | 0.670 | 10.000 | 6.70 |
| SEVIN | LBS. | 1.500 | 0.500 | 0.75 |
| 2-4-D | LBS. | 2.240 | 1.000 | 2.24 |
| CUSTOM PLANT | ACRE | 8.800 | 1.000 | 8.80 |
| CUSTOM COMBINE | ACRE | 16.500 | 1.000 | 16.50 |
| DRYING | BU. | 0.100 | 90.000 | 9.00 |
| TRACTOR FUEL COST | ACRE | | | 0.74 |
| TRACT REPAIR COST | ACRE | | | 0.56 |
| TRACTOR LUBE COST | ACRE | | | 0.11 |
| EQUIP REPAIR COST | ACRE | | | 1.11 |
| TOTAL OPERATING COST | | | | 162.94 |
| RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT | | | | 103.06 |
| CAPITAL COST: | | | | |
| ANNUAL OPERATING CAPITAL | | 0.090 | 74.653 | 6.72 |
| TRACTOR INVESTMENT | | 0.090 | 10.346 | 0.93 |
| EQUIPMENT INVESTMENT | | 0.090 | 55.905 | 5.03 |
| TOTAL INTEREST CHARGE | | | | 12.68 |
| RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT | | | | 90.38 |
| OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE) | | | | |
| TRACTOR | DOL. | | | 1.34 |
| EQUIPMENT | DOL. | | | 6.91 |
| TOTAL OWNERSHIP COST | | | | 8.25 |
| RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT | | | | 82.12 |
| LABOR COST: | | | | |
| MACHINERY LABOR | HR. | 2.750 | 0.488 | 1.34 |
| OTHER LABOR | HR. | 2.750 | 1.100 | 3.02 |
| TOTAL LABOR COST | | | | 4.37 |
| RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT | | | | 77.76 |

# APPENDIX E

## Summary of Partial Budgets for Crop and Pasture Production

Table 1. Crop and Pasture Production Inputs and Outputs

| Activity name | Land class | N | $P_2O_5$ | $K_2O$ | Output/acre Item | TDN (AUM's)[1] | Amount |
|---|---|---|---|---|---|---|---|
| Bluegrass pasture | E | 0 | 10 | 5 | Pasture | 2.15 | .9 Tons[2] |
| | D | 0 | 10 | 5 | Pasture | 2.38 | 1.0 Tons |
| | D | 0 | 40 | 40 | Pasture | 4.18 | 1.8 Tons |
| | D | 0 | 70 | 70 | Pasture | 5.80 | 2.5 Tons |
| Orchard/alfalfa | C | 2 | 95 | 176 | Hay | 6.00 | 2.3 Tons |
| | | | | | Pasture | 3.00 | 1.6 Tons |
| | B | 2 | 110 | 200 | Hay | 7.10 | 2.7 Tons |
| | | | | | Pasture | 3.50 | 1.9 Tons |
| | A | 3 | 125 | 230 | Hay | 8.30 | 3.2 Tons |
| | | | | | Pasture | 4.20 | 2.2 Tons |
| Fescue/red clover | C | 84 | 78 | 88 | Hay | 4.00 | 1.5 Tons |
| | | | | | Smr. past. | 1.40 | .5 Tons |
| | | | | | Wtr. past. | 6.20 | 2.3 Tons |
| | B | 97 | 90 | 100 | Hay | 4.90 | 1.8 Tons |
| | | | | | Smr. past. | 1.60 | .6 Tons |
| | | | | | Wtr. past. | 7.30 | 2.7 Tons |
| | A | 110 | 105 | 115 | Hay | 5.70 | 2.1 Tons |
| | | | | | Smr. past. | 1.90 | .7 Tons |
| | | | | | Wtr. past. | 8.60 | 3.2 Tons |
| Corn silage | B | 170 | 85 | 140 | Corn silage | 20.30 | 14.5 Tons[3] |
| | | | | | Rye pasture | 1.75 | |
| | A | 180 | 90 | 150 | Corn silage | 22.60 | 16.1 Tons |
| | | | | | Rye pasture | 1.90 | |
| Corn grain | B | 160 | 70 | 90 | Corn grain | -- | 90.0 Bu. |
| | | | | | Rye pasture | 1.60 | |
| | | | | | Stover | 2.50 | |
| | A | 170 | 75 | 95 | Corn grain | -- | 100.0 Bu. |
| | | | | | Rye pasture | 1.75 | |
| | | | | | Stover | 2.75 | |

[1] An animal unit month (AUM) is equivalent to 400 pounds of total digestible nutrients (TDN) utilized.

[2] Pasture expressed in tons of hay equivalent.

[3] Silage in tons as fed.

# APPENDIX F

## The Linear Programming TABLEAU

| COST AND REVENUE COMPONENTS | 37030081 | 86880000 | 38030001 | 38030002 | 38030003 | 38030004 |
|---|---|---|---|---|---|---|
| OTHER LIVESTOCK INCOME | | | | | | |
| MISC. CROP INCOME/ACRE | | | | | | |
| SEED COST | | | | | | |
| FERTILIZER&LIME COST | | | | | | |
| MACHINE HIRING EXPENSE | | | | | | |
| MACH.OPERATING EXPENSE | | | | | | |
| TAXES (LIVESTOCK) | | | | | | |
| VET-MED EXPENSE | | | | | | |
| TRUCK"G & MKTG EXPENSE | | | | | | |
| MISC. EXPENSE | | | | | | |
| OBJECTIVE 1 (VARIABLE COST) | | 35.00 | | | | |
| FIXED COST/UNIT | | | | | | |
| OBJECTIVE 2 (TOTAL COST) | | 35.00 | | | | |
| CONSTRAINTS | | | | | | |
| + 00010000 LABOR JAN - MAR | | | | | | |
| + 00020000 LABOR APRIL - JUNE | | | | | | |
| + 00030000 LABOR JULY - SEPT | | | | | | |
| + 00040000 LABOR OCT-DEC | | | | | | |
| ÷ 00050000 TDN BALANCE | -1.40 | | 1.00 | 1.00 | 1.00 | 1.00 |
| + 00060000 TOTAL CAPITAL | | | | | | |
| + 00070000 ANNUAL CAPITAL | | | | | | |
| + 00080000 AUM'S JUNE 16 - AUG 31 | | | | -1.00 | | |
| + 00090000 AUM'S SEPT 1 - NOV 30 | | | | | -1.00 | |
| + 00100000 AUM'S APRIL 16 - JUNE 15 | | | -1.00 | | | |
| + 00110000 AUM'S DEC 1 - APRIL 15 | | | | | | -1.00 |
| - 00120000 CONSERVING ACRES | | | | | | |
| - 00130000 ACRES FALLOWED | | | | | | |
| + 00140000 SMALL GRN GRAZE-OUT | | | | | | |
| - 80000000 HAY & FORAGE | | | | | | |
| - 86000000 SILAGE | -1.00 | 1.00 | | | | |
| - 72000000 CORN | | | | | | |
| + 09000001 GROUP 1 LAND | | | | | | |
| + 09000002 GROUP 2 LAND | | | | | | |
| + 09000003 GROUP 3 LAND | | | | | | |
| + 09000004 GROUP 4 LAND | | | | | | |
| + 09000005 GROUP 5 LAND | | | | | | |
| + 09000000 TOTAL LAND | | | | | | |
| + 09881000 HIRE LABOR TDN BALAN | | | | | | |

| COST AND REVENUE COMPONENTS | 85156215 | 85156104 | 85156204 | 85156304 | 80153303 | 80990000 | 80153302 | 80153301 | 80158303 | 80158202 | 80158101 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OTHER LIVESTOCK INCOME | | | | | | | | | | | |
| MISC. CROP INCOME/ACRE | | | | | | | | | | | |
| SEED COST | | .36 | .71 | 2.13 | 5.58 | | 5.58 | 5.58 | 4.58 | 4.58 | 4.58 |
| FERTILIZER&LIME COST | 3.30 | 3.30 | 21.65 | 37.00 | 54.44 | | 58.19 | 65.76 | 59.59 | 67.54 | 76.60 |
| MACHINE HIRING EXPENSE | | | | | 23.00 | | 27.10 | 32.00 | 15.00 | 18.00 | 21.00 |
| MACH.OPERATING EXPENSE | | .26 | .26 | .26 | 8.41 | | 9.39 | 9.98 | 4.43 | 4.79 | 5.14 |
| TAXES (LIVESTOCK) | | | | | | | | | | | |
| VET-MED EXPENSE | | | | | | | | | | | |
| TRUCK"G & MKTG EXPENSE | | | | | | | | | | | |
| MISC. EXPENSE | | | | | | | | | | | |
| OBJECTIVE 1 (VARIABLE COST) | 3.30 | 3.92 | 22.62 | 39.39 | 91.43 | -53.81 | 100.26 | 113.32 | 83.60 | 94.91 | 107.32 |
| FIXED COST/UNIT | | .74 | .74 | .74 | 22.25 | | 23.92 | 24.93 | 10.91 | 11.52 | 12.14 |
| OBJECTIVE 2 (TOTAL COST) | 3.30 | 4.66 | 23.36 | 40.13 | 113.68 | -53.81 | 124.18 | 138.25 | 94.51 | 106.43 | 119.46 |
| CONSTRAINTS | | | | | | | | | | | |
| + 00010000 LABOR JAN - MAR | .05 | .05 | .05 | .05 | .05 | | .05 | .05 | | | |
| + 00020000 LABOR APRIL - JUNE | | | | | .78 | | .84 | .91 | .44 | .48 | .52 |
| + 00030000 LABOR JULY - SEPT | | .18 | .18 | .18 | .26 | | .34 | .34 | .07 | .07 | .07 |
| + 00040000 LABOR OCT-DEC | | | | | .32 | | .38 | .45 | .21 | .25 | .29 |
| + 00050000 TDN BALANCE | | | | | | | | | | | |
| + 00060000 TOTAL CAPITAL | 3.30 | 6.86 | 27.35 | 40.56 | 185.77 | | 202.09 | 220.73 | 130.12 | 144.23 | 159.46 |
| + 00070000 ANNUAL CAPITAL | 1.90 | 3.53 | 14.08 | 20.89 | 31.56 | | 30.81 | 32.86 | 53.16 | 60.14 | 68.04 |
| + 00080000 AUM'S JUNE 16 - AUG 31 | -.21 | -.24 | -.54 | -.74 | | | | | -1.40 | -1.60 | -1.80 |
| + 00090000 AUM'S SEPT 1 - NOV 30 | -.47 | -.52 | -1.05 | -1.46 | -3.00 | | -3.51 | -4.00 | | | |
| + 00100000 AUM'S APRIL 16 - JUNE 15 | -1.41 | -1.56 | -2.51 | -3.49 | | | | | | | |
| + 00110000 AUM'S DEC 1 - APRIL 15 | -.06 | -.07 | -.08 | -.11 | | | | | -6.20 | -7.30 | -8.20 |
| - 00120000 CONSERVING ACRES | | | | | | | | | | | |
| - 00130000 ACRES FALLOWED | | | | | | | | | | | |
| + 00140000 SMALL GRN GRAZE-OUT | | | | | | | | | | | |
| - 80000000 HAY & FORAGE | | | | | 2.30 | -1.00 | 2.71 | 3.10 | 1.50 | 1.80 | 2.00 |
| - 86000000 SILAGE | | | | | | | | | | | |
| - 72000000 CORN | | | | | | | | | | | |
| + 09000001 GROUP 1 LAND | | | | | | | | 1.00 | | | 1.00 |
| + 09000002 GROUP 2 LAND | | | | | | | 1.00 | | | 1.00 | |
| + 09000003 GROUP 3 LAND | | | | | 1.00 | | | | 1.00 | | |
| + 09000004 GROUP 4 LAND | | 1.00 | 1.00 | 1.00 | | | | | | | |
| + 09000005 GROUP 5 LAND | 1.00 | | | | | | | | | | |
| + 09000000 TOTAL LAND | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| + 09881005 HIRE LABOR TDN BALAN | | | | | | | | | | | |

| COST AND REVENUE COMPONENTS | 86161152 | 86990000 | 86161151 | 72167152 | 72990000 | 72167151 | 11030118 | 11020118 | 11010118 | 37030011 | 80880000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OTHER LIVESTOCK INCOME | | | | | | | 296.80 | 279.80 | 279.40 | | |
| MISC. CROP INCOME/ACRE | | | | | | | | | | | |
| SEED COST | 77.23 | | 84.08 | 15.17 | | 15.17 | | | | | |
| FERTILIZER&LIME COST | 116.79 | | 121.84 | 105.04 | | 110.94 | 2.61 | 2.61 | 2.61 | | |
| MACHINE HIRING EXPENSE | 54.72 | | 59.95 | 34.30 | | 34.30 | | | | | |
| MACH.OPERATING EXPENSE | 2.00 | | 2.00 | 2.52 | | 2.52 | .11 | .11 | .11 | | |
| TAXES (LIVESTOCK) | | | | | | | | | | | |
| VET-MED EXPENSE | | | | | | | 11.10 | 11.10 | 11.10 | | |
| TRUCK"G & MKTG EXPENSE | | | | | | | 2.42 | 2.42 | 2.42 | | |
| MISC. EXPENSE | | | | | | | 2.29 | 2.15 | 2.13 | | |
| OBJECTIVE 1 (VARIABLE COST) | 250.74 | | 267.87 | 157.03 | -2.66 | 162.93 | -278.26 | -261.40 | -261.02 | | 58.00 |
| FIXED COST/UNIT | 11.06 | | 11.06 | 14.21 | | 14.21 | 1.76 | 1.76 | 1.76 | | |
| OBJECTIVE 2 (TOTAL COST) | 261.80 | | 278.93 | 171.24 | -2.66 | 177.14 | -276.50 | -259.64 | -259.26 | | 58.00 |
| CONSTRAINTS | | | | | | | | | | | |
| + 00010000 LABOR JAN - MAR | 1.16 | | 1.16 | 1.16 | | 1.16 | 1.73 | .78 | .93 | | |
| + 00020000 LABOR APRIL - JUNE | .06 | | .06 | .06 | | .06 | 1.26 | 1.08 | 1.11 | | |
| + 00030000 LABOR JULY - SEPT | 3.87 | | 3.87 | | | | .63 | .96 | 1.58 | | |
| + 00040000 LABOR OCT-DEC | .23 | | .23 | .36 | | .36 | .93 | 1.73 | .93 | | |
| + 00050000 TDN BALANCE | | | | | | | | | | -2.61 | |
| + 00060000 TOTAL CAPITAL | 303.18 | | 320.31 | 220.99 | | 229.19 | 508.04 | 507.90 | 507.88 | | |
| + 00070000 ANNUAL CAPITAL | 95.53 | | 100.07 | 69.60 | | 74.65 | 497.08 | 496.11 | 498.01 | | |
| + 00080000 AUM'S JUNE 16 - AUG 31 | | | | | | | 3.23 | 2.31 | 2.51 | | |
| + 00090000 AUM'S SEPT 1 - NOV 30 | -.25 | | -.30 | -2.80 | | -3.10 | 4.00 | 2.98 | 3.29 | | |
| + 00100000 AUM'S APRIL 16 - JUNE 15 | | | | | | | 2.10 | 2.76 | 1.81 | | |
| + 00110000 AUM'S DEC 1 - APRIL 15 | -1.50 | | -1.60 | -1.30 | | -1.40 | 4.29 | 5.16 | 5.81 | | |
| - 00120000 CONSERVING ACRES | | | | | | | | | | | |
| - 00130000 ACRES FALLOWED | | | | | | | | | | | |
| + 00140000 SMALL GRN GRAZE-OUT | | | | | | | | | | | |
| - 60000000 HAY & FORAGE | | | | | | | | | | -1.00 | 1.00 |
| - 86000000 SILAGE | 14.50 | -1.00 | 16.10 | | | | | | | | |
| - 72000000 CORN | | | | 90.00 | -1.00 | 100.00 | | | | | |
| + 09000001 GROUP 1 LAND | | | 1.00 | | | 1.00 | | | | | |
| + 09000002 GROUP 2 LAND | 1.00 | | | 1.00 | | | | | | | |
| + 09000003 GROUP 3 LAND | | | | | | | | | | | |
| + 09000004 GROUP 4 LAND | | | | | | | | | | | |
| + 09000005 GROUP 5 LAND | | | | | | | | | | | |
| + 09000000 TOTAL LAND | 1.00 | | 1.00 | 1.00 | | 1.00 | | | | | |
| + 09881005 HIRE LABOR TDN BALAN | | | | | | | | | | | |

| COST AND REVENUE COMPONENTS | 09950003 | 09940004 | 00880001 | 09881001 | 09881002 | 09881003 | 09881004 | 09881005 | 09880001 | 09880002 | 00880002 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OTHER LIVESTOCK INCOME | | | | | | | | | | | |
| MISC. CROP INCOME/ACRE | | | | | | | | | | | |
| SEED COST | | | | | | | | | | | |
| FERTILIZER&LIME COST | | | | | | | | | | | |
| MACHINE HIRING EXPENSE | | | | | | | | | | | |
| MACH.OPERATING EXPENSE | | | | | | | | | | | |
| TAXES (LIVESTOCK) | | | | | | | | | | | |
| VET-MED EXPENSE | | | | | | | | | | | |
| TRUCKING & MKTG EXPENSE | | | | | | | | | | | |
| MISC. EXPENSE | | | | | | | | | | | |
| OBJECTIVE 1 (VARIABLE COST) | | | | 2.75 | 2.75 | 2.75 | 2.75 | 11.50 | .09 | | |
| FIXED COST/UNIT | | | | | | | | | | | |
| OBJECTIVE 2 (TOTAL COST) | | | | 2.75 | 2.75 | 2.75 | 2.75 | 11.50 | .09 | | |
| CONSTRAINTS | | | | | | | | | | | |
| + 00010000 LABOR JAN - MAR | | | | -1.00 | | | | | | | |
| + 00020000 LABOR APRIL - JUNE | | | | | -1.00 | | | | | | |
| + 00030000 LABOR JULY - SEPT | | | | | | -1.00 | | | | | |
| + 00040000 LABOR OCT-DEC | | | | | | | -1.00 | | | | |
| + 00050000 TDN BALANCE | | | | | | | | -1.00 | | | |
| + 00060000 TOTAL CAPITAL | | | | 2.75 | 2.75 | 2.75 | 2.75 | 11.50 | | -1.00 | |
| + 00070000 ANNUAL CAPITAL | | | | 1.37 | 1.37 | 1.37 | 1.37 | 5.75 | -1.00 | | |
| + 00080000 AUM'S JUNE 16 - AUG 31 | | | | | | | | | | | |
| + 00090000 AUM'S SEPT 1 - NOV 30 | | 1.00 | | | | | | | | | |
| + 00100000 AUM'S APRIL 16 - JUNE 15 | 1.00 | | | | | | | | | | |
| + 00110000 AUM'S DEC 1 - APRIL 15 | | | | | | | | | | | |
| - 00120000 CONSERVING ACRES | | | 1.00 | | | | | | | | -1.00 |
| - 00130000 ACRES FALLOWED | | | | | | | | | | | 1.00 |
| + 00140000 SMALL GRN GRAZE-OUT | | | -1.00 | | | | | | | | 1.00 |
| - 80000000 HAY & FORAGE | | | | | | | | | | | |
| - 86000000 SILAGE | | | | | | | | | | | |
| - 72000000 CORN | | | | | | | | | | | |
| + 09000001 GROUP 1 LAND | | | | | | | | | | | |
| + 09000002 GROUP 2 LAND | | | | | | | | | | | |
| + 09000003 GROUP 3 LAND | | | | | | | | | | | |
| + 09000004 GROUP 4 LAND | | | | | | | | | | | |
| + 09000005 GROUP 5 LAND | | | | | | | | | | | |
| + 09000000 TOTAL LAND | | | 1.00 | | | | | | | | |
| + 09881005 HIRE LABOR TDN BALAN | | | | | | | | 1.00 | | | |

# APPENDIX G

Complete Solution Results
for the Three Calving Seasons (Basic Price)

| | ACTIVITY | COST | LEVEL | INCOMING COST | COST RANGES | |
|---|---|---|---|---|---|---|
| 09950003 | RENTOUT MAR-MAY PAST. (AUM"S) | 0.00 | | -8.75 | | |
| 09940004 | RENTOUT OCT-FEB PAST. (AUM"S) | 0.00 | | -18.72 | | |
| 00880001 | FALLOW LAND | 0.00 | | 0.00 | | |
| 09881001 | HIRE LABOR LABOR JAN - MAR | 2.75 | | -0.12 | | |
| 09881002 | HIRE LABOR LABOR APRIL - JUNE | 2.75 | | -0.12 | | |
| 09881003 | HIRE LABOR LABOR JULY - SEPT | 2.75 | | -0.12 | | |
| 09881004 | HIRE LABOR LABOR OCT-DEC | 2.75 | | -0.12 | | |
| 09881005 | HIRE LABOR TDN BALANCE | 11.50 | 0.00 | | -INFINITY | 18.20 |
| 09880001 | ANNUAL CAPITAL | 0.09 | 121635.81 | | 0.05 | 0.10 |
| 09880002 | TOTAL CAPITAL | 0.00 | 147857.25 | | -0.01 | 0.01 |
| 00880002 | DIVERSION TRANSFER | 0.00 | | 0.00 | | |
| 85156215 | LAND E BLUEGRASS/WHITE CLOVE | 3.30 | 35.00 | | -INFINITY | 26.02 |
| 85156104 | L LAND D BLUEGRASS/WHITE CLOVE | 3.92 | | -3.95 | | |
| 85156204 | M LAND D BLUEGRASS/WHITE CLOVE | 22.62 | | 19.40 | | |
| 85156304 | H LAND D BLUEGRASS/WHITE CLOVE | 39.39 | 115.00 | | -INFINITY | 42.61 |
| 80153303 | LAND C ORCHARD GRASS/ALFALFA | 91.43 | | 43.20 | | |
| 80990000 | SELL HAY & FORAGE | -53.81 | 199.77 | | -58.00 | -53.42 |
| 80153302 | LAND B ORCHARD GRASS/ALFALFA | 100.26 | | 46.46 | | |
| 80153301 | LAND A ORCHARD GRASS/ALFALFA | 113.32 | | 58.30 | | |
| 80158303 | LAND C FESCUE/RED CLOVER HAY | 83.60 | 22.00 | | -INFINITY | 131.83 |
| 80158202 | LAND B FESCUE/RED CLOVER HAY | 94.91 | 58.00 | | -INFINITY | 103.97 |
| 80158101 | LAND A FESCUE/RED CLOVER HAY | 107.32 | 31.19 | | 97.02 | 108.09 |
| 86161152 | LAND B CORN FOR SILAGE WITH | 250.74 | | 241.68 | | |
| 86990000 | SELL SILAGE | 0.00 | | -26.21 | | |
| 86161151 | LAND A CORN FOR SILAGE WITH | 267.87 | 46.34 | | 265.07 | 277.91 |
| 72167152 | LAND B CORN FOR GRAIN WITH R | 157.03 | | 147.44 | | |
| 72990000 | SELL CORN | -2.66 | 1246.95 | | -2.67 | -2.47 |
| 72167151 | LAND A CORN FOR GRAIN WITH R | 162.93 | 12.47 | | 161.86 | 173.83 |
| 11030118 | BEEF COW-CALF:SPRING CALVING | -278.27 | 214.89 | | -299.20 | -276.43 |
| 11020118 | BEEF COW-CALF: FALL CALVING | -261.41 | | -263.83 | | |
| 11010118 | BEEF COW-CALF:SUMMER CALVING | -261.03 | | -277.33 | | |
| 37030011 | HAY TRANSFER TO TDN ACTIVITY | 0.00 | | -4.95 | | |
| 80880000 | BUY HAY & FORAGE | 58.00 | | 53.81 | | |
| 37030081 | C SIL TRANSFER TO TDN ACTIVITY | 0.00 | 746.13 | | -0.17 | 0.69 |
| 86880000 | BUY SILAGE | 35.00 | | 26.21 | | |
| 38030001 | TDN USING ACTIVITY | 0.00 | | -9.96 | | |
| 38030002 | TDN USING ACTIVITY | 0.00 | 421.92 | | -0.43 | 1.33 |
| 38030003 | TDN USING ACTIVITY | 0.00 | 622.66 | | -2.85 | 0.33 |
| 38030004 | TDN USING ACTIVITY | 0.00 | | -0.11 | | |

ESTIMATED NET PROFIT FOR THIS ALTERNATIVE IS 33135.65

| | RHS NAME | | RHS LEVEL REACHED | | P(I) | RHS RANGES | |
|---|---|---|---|---|---|---|---|
| 00010000 | LABOR JAN - MAR | | 500.00 | 447.48 | | | |
| 00020000 | LABOR APRIL - JUNE | | 600.00 | 328.03 | | | |
| 00030000 | LABOR JULY - SEPT | | 600.00 | 343.21 | | | |
| 00040000 | LABOR OCT-DEC | | 500.00 | 243.16 | | | |
| 00050000 | TDN BALANCE | | | | 18.71 | -254.10 | 916.59 |
| 00060000 | TOTAL CAPITAL | | | | | -INFINITY | 147857.25 |
| 00070000 | ANNUAL CAPITAL | | | | .08 | -INFINITY | 121635.81 |
| 00080000 | AUM"S JUN-SEP PAST. | | | | 18.71 | -254.10 | 420.79 |
| 00090000 | AUM"S OCT-FEB PAST. | | | | 18.71 | -254.10 | 547.66 |
| 00100000 | AUM"S MAR-MAY PAST. | | | | 8.75 | -105.82 | 25.52 |
| 00110000 | AUM"S NATIVE PASTURE | | | | 18.60 | -79.71 | 212.48 |
| 00120000 | CONSERVING ACRES | | | | | -INFINITY | 1000.00 |
| 00130000 | ACRES FALLOWED | | | | | -INFINITY | 1000.00 |
| 00140000 | SMALL GRN GRAZE-OUT | | | | | -INFINITY | INFINITY |
| 80000000 | HAY & FORAGE | | | | -53.80 | -INFINITY | 199.77 |
| 86000000 | SILAGE | | | | -26.20 | -654.71 | 181.50 |
| 72000000 | CORN | | | | -2.65 | -INFINITY | 1246.95 |
| 09000001 | GROUP 1 | LAND | 90.00 | 90.00 | 180.42 | 80.91 | 127.70 |
| 09000002 | GROUP 2 | LAND | 58.00 | 58.00 | 162.29 | 47.78 | 87.17 |
| 09000003 | GROUP 3 | LAND | 22.00 | 22.00 | 133.88 | 9.99 | 56.35 |
| 09000004 | GROUP 4 | LAND | 115.00 | 115.00 | 32.55 | 84.34 | 122.88 |
| 09000005 | GROUP 5 | LAND | 35.00 | 35.00 | 22.71 | 0.00 | 54.30 |
| 09000000 | TOTAL LAND | | 1320.00 | 320.00 | | | |
| 09881005 | HIRE LABOR TDN BALAN | | .00 | .00 | 6.70 | 0.00 | 916.59 |

# APPENDIX H

## List of Counties in this Study

Counties Included in the Shenandoah Area, Virginia's Subregion in the Southern Regional Beef Study[1/]

| | |
|---|---|
| Albemarle | Louisa |
| Augusta | Madison |
| Clarke | Orange |
| Culpeper | Page |
| Fairfax | Prince William |
| Fauquier | Rappahannock |
| Fluvanna | Rockingham |
| Frederick | Shenandoah |
| Goochland | Spotsylvania |
| Greene | Stafford |
| Loudoun | Warren |

[1/] The subregions included in the regional research project S-67 were identified by state representatives on the technical committee conducting that study. Dr. Ralph G. Kline is a member from Virginia.

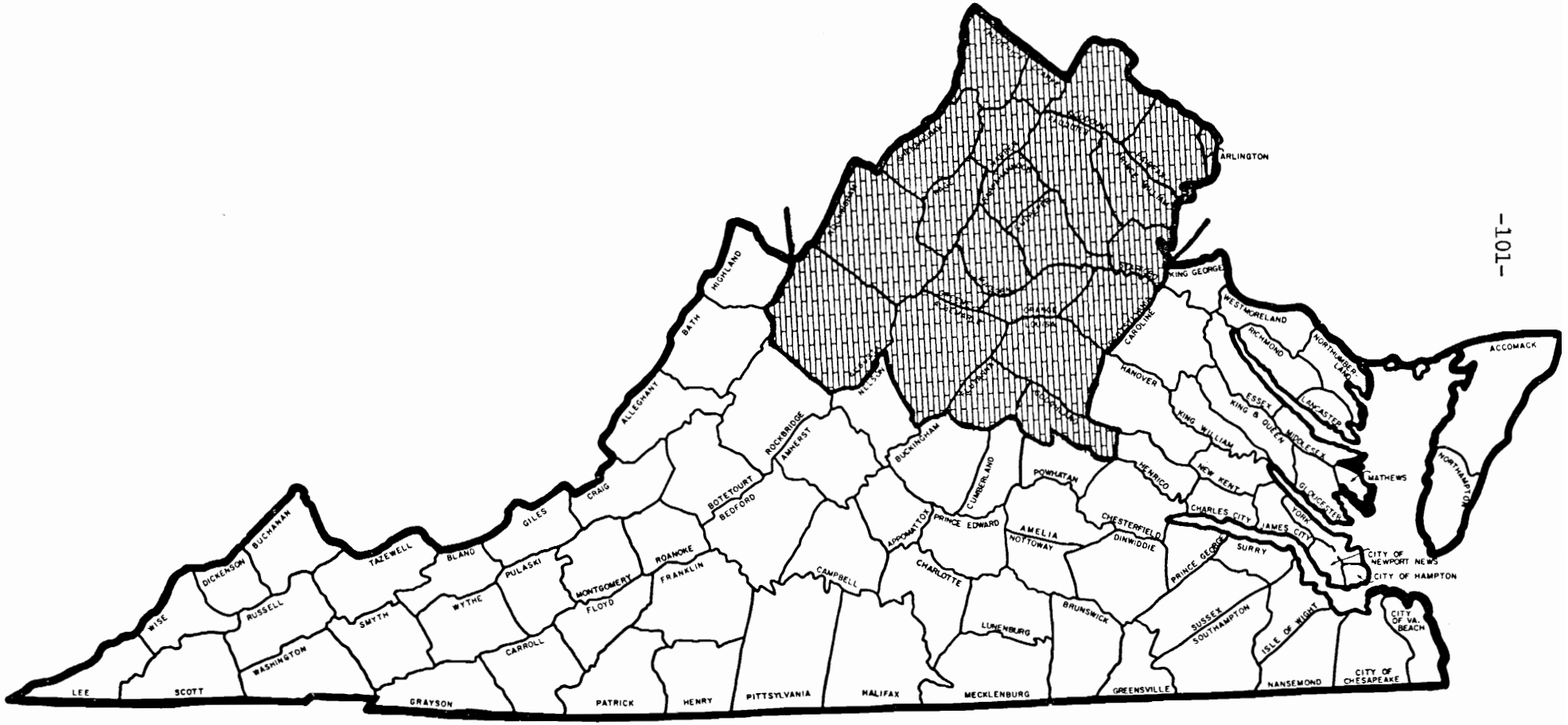


Figure 1. Area of Study - Northern Area of Virginia

# APPENDIX I

## Marginal and Cost Ranging Analyses

Table 1. The Value of An Additional Unit of Limited Resources[1/] with the Applicable Range for Which These Values Will Hold, High Beef Prices

| Resources | Unit | Amount | MVP | Range | |
|---|---|---|---|---|---|
| | | | | Low | High |
| Spring calving | | | | | |
| Land A | Acre | 90.0 | 248.87 | 49.6 | 162.2 |
| Land B | Acre | 58.0 | 213.59 | 16.7 | 137.8 |
| Land C | Acre | 22.0 | 165.93 | | 133.3 |
| Land D | Acre | 115.0 | 86.37 | | 206.8 |
| Land E | Acre | 35.0 | 43.90 | | 256.3 |
| Labor (Jan.-March) | Hours | 500.0 | 2.87 | | 747.5 |
| (July-Sept.) | Hours | 600.0 | 2.87 | | 802.0 |
| Summer calving | | | | | |
| Land A | Acre | 90.0 | 227.39 | 53.7 | 111.7 |
| Land B | Acre | 58.0 | 194.46 | 18.0 | 81.0 |
| Land C | Acre | 22.0 | 153.95 | | 105.3 |
| Land D | Acre | 115.0 | 80.78 | | 259.1 |
| Land E | Acre | 35.0 | 41.92 | | 354.9 |
| Labor (July-Sept.) | Hours | 600.0 | 2.87 | | 920.2 |
| (Oct.-Dec.) | Hours | 500.0 | 2.87 | | 624.7 |
| Fall calving | | | | | |
| Land A | Acre | 90.0 | 224.78 | 43.8 | 93.8 |
| Land B | Acre | 58.0 | 192.17 | 6.8 | 62.0 |
| Land C | Acre | 22.0 | 153.01 | | 35.4 |
| Land D | Acre | 115.0 | 80.00 | | 138.7 |
| Land E | Acre | 35.0 | 41.63 | | 88.9 |
| Labor (July-Sept.) | Hours | 600.0 | 2.87 | | 1,121.8 |

[1/] The amount of capital was 182,112 dollars for spring, 186,846 dollars for summer calving and 184,955 dollars for fall calving season.

Table 2. Cost Ranges for the Optimum Combination of Crops and Livestock for a Beef Cow-Calf Farm by Seasons of Calving, High Cattle Prices[a/]

| Activity | Unit | Cost | Spring calving | | | | Summer calving | | | | Fall caoving | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Incoming range | | | | Incoming range | | | | Incoming range | | | |
| | | | Level | Cost | Low | High | Level | Cost | Low | High | Level | Cost | Low | High |
| | | ($) | | ($) | ($) | ($) | | ($) | ($) | ($) | | ($) | ($) | ($) |
| Bluegrass/white clover pasture, land E | Acre | 3 | 35 | | | 47 | 35 | | | 45 | 35 | | | 45 |
| Bluegrass/white clover pasture, land D, low fertilization | Acre | 4 | | - 35 | | | | - 31 | | | | - 32 | | |
| Bluegrass/white clover pasture, land D, medium fertilization | Acre | 23 | | 4 | | | | 6 | | | | 6 | | |
| Bluegrass/white clover pasture, land D, high fertilization | Acre | 40 | 115 | | | 58 | 115 | | | 56 | 115 | | | 56 |
| Orchardgrass/alfalfa pasture, land C | Acre | 91 | | 29 | | | | 32 | | | | 32 | | |
| Orchardgrass/alfalfa pasture, land B | Acre | 100 | | 16 | | | | 26 | | | | 24 | | |
| Orchardgrass/alfalfa pasture, land A | Acre | 114 | | 14 | | | | 25 | | | | 23 | | |
| Fescue/red clover pasture, land C | Acre | 84 | 22 | | | 146 | 22 | | | 143 | 22 | | | 143 |
| Fescue/red clover pasture, land B | Acre | 95 | | 81 | | | | 88 | | | | 86 | | |
| Fescue/red clover pasture, land A | Acre | 107 | | 81 | | | | 88 | | | | 87 | | |
| Corn silage pasture, land B | Acre | 251 | 58 | | 248 | 264 | 58 | | 248 | 258 | 58 | | 248 | 259 |
| Corn silage pasture, land A | Acre | 268 | 90 | | | 271 | 90 | | | 271 | 90 | | | 271 |
| Corn grain pasture, land B | Acre | 155 | | 155 | | | | 155 | | | | 155 | | |
| Corn grain pasture, land A | Acre | 163 | | 160 | | | | 160 | | | | 160 | | |
| Sell hay | Ton | - 54 | | - 58 | | | | - 55 | | | | - 55 | | |
| Sell corn | Bu. | - 3 | | - 3 | | | | - 3 | | | | - 3 | | |

Table 2. Continued

| Activity | Unit | Cost | Spring calving | | | | Summer calving | | | | Fall calving | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Incoming range | | | | Incoming range | | | | Incoming range | | | |
| | | | Level | Cost | Low | High | Level | Cost | Low | High | Level | Cost | Low | High |
| | | ($) | | ($) | ($) | ($) | | ($) | ($) | ($) | | ($) | ($) | ($) |
| Beef cow-calf | | | | | | | | | | | | | | |
| Spring | Head | -353 | 329 | | -354 | -332 | | | | | | | | |
| Summer | Head | -331 | | | | | 333 | | -348 | -326 | | | | |
| Fall | Head | -331 | | | | | | | | | 339 | | | |
| Net returns | $ | | 53,059 | | | | 47,126 | | | | 49,050 | | | |

a/ Figures have been rounded to the nearest whole number.

Table 3. The Value of An Additional Unit of Limited Resources[1/] with the Applicable Range for Which These Values Will Hold, Low Beef Prices

| Resource | Unit | Amount | MVP | Range | |
|---|---|---|---|---|---|
| | | | | Low | High |
| Spring calving | | | | | |
| Land A | Acre | 90.0 | 135.18 | 88.4 | 161.2 |
| Land B | Acre | 58.0 | 113.91 | 56.2 | 135.0 |
| Land C | Acre | 22.0 | 92.73 | 19.9 | 52.4 |
| Land D | Acre | 115.0 | 21.00 | 73.2 | 116.5 |
| Land E | Acre | 35.0 | 19.48 | | 36.6 |
| Summer calving | | | | | |
| Land A | Acre | 90.0 | 140.40 | 2.2 | 112.8 |
| Land B | Acre | 58.0 | 118.65 | 44.8 | 83.2 |
| Land C | Acre | 22.0 | 96.76 | 6.4 | 51.6 |
| Land D | Acre | 115.0 | 5.22 | 96.6 | 227.9 |
| Land E | Acre | 35.0 | 4.91 | 15.1 | 159.5 |
| Fall calving | | | | | |
| Land A | Acre | 90.0 | 124.00 | 87.0 | 118.2 |
| Land B | Acre | 58.0 | 112.07 | | 61.2 |
| Land C | Acre | 22.0 | 91.15 | | 25.7 |
| Land D | Acre | 115.0 | 21.81 | 95.4 | 146.8 |
| Land E | Acre | 35.0 | 20.26 | | 68.2 |

[1/] The amount of unused labor was 1402 hours for spring, 1435 hours for summer and 1323 hours for fall calving. The amount of capital used was 66,441 dollars for spring, 67184 dollars for summer and 81,602 dollars for fall calving.

Table 4. Cost Ranges for the Opitmal Combination of Crops and Livestock for a Beef Cow-Calf Farm by Seasons of Calving, Low Cattle Prices

| Activity | Unit | Cost | Spring calving | | | | Summer calving | | | | Fall calving | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Incoming range | | | | Incoming range | | | | Incoming range | | |
| | | | Level | Cost | Low | High | Level | Cost | Low | High | Level | Cost | Low | High |
| | | ($) | | ($) | ($) | ($) | | ($) | ($) | ($) | | ($) | ($) | ($) |
| Bluegrass/white clover pasture, land E | Acre | 3 | 35 | | | 23 | 35 | | | 8 | 35 | | | 24 |
| Bluegrass/white clover pasture, land D, low fertilization | Acre | 4 | 113 | | 4 | 12 | 115 | | | 9 | 36 | | - 2 | 4 |
| Bluegrass/white clover pasture, land D, medium fertilization | Acre | 23 | 3 | | 14 | 23 | | 13 | | | | 22 | | |
| Bluegrass/white clover pasture, land D, high fertilization | Acre | 40 | | 39 | | | | 20 | | | 79 | | 21 | 40 |
| Orchardgrass/alfalfa pasture, land C | Acre | 91 | | 49 | | | | 49 | | | | 40 | | |
| Orchardgrass/alfalfa pasture, land B | Acre | 100 | | 54 | | | | 54 | | | | 43 | | |
| Orchardgrass/alfalfa pasture, land A | Acre | 114 | | 57 | | | | 57 | | | | 54 | | |
| Fescue/red clover pasture, land C | Acre | 84 | 22 | | | 126 | 22 | | | 126 | 22 | | | 135 |
| Fescue/red clover pasture, land B | Acre | 95 | 19 | | 55 | 95 | 49 | | 55 | 103 | 58 | | | 103 |
| Fescue/red clover pasture, land A | Acre | 107 | | 98 | | | | 98 | | | 2 | | 98 | 126 |
| Corn silage pasture, land B | Acre | 251 | | 249 | | | | 249 | | | | 241 | | |
| Corn silage pasture, land A | Acre | 268 | 11 | | 267 | 270 | 6 | | 189 | 270 | 5 | | 189 | 279 |
| Corn grain pasture, land B | Acre | 155 | 39 | | 155 | 156 | 9 | | 147 | 156 | | 146 | | |
| Corn grain pasture, land A | Acre | 163 | 79 | | 161 | 164 | 84 | | 161 | 172 | 83 | | 145 | 172 |
| Sell hay | Ton | - 54 | 68 | | - 58 | - 54 | 121 | | | | 140 | | - 58 | - 45 |
| Sell corn | Bu. | - 3 | 11,371 | | 161 | 164 | 9,222 | | - 3 | - 2 | 8,334 | | - 3 | - 2 |

Important implications of the study are: beef cow-calf production is competitive over a wide range of beef prices and it may increase farm returns to feed small amounts of corn silage rather than grow additional pasture even when the weaned steer calf-corn ratio is quite low.