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The Economic Feasibility of Confinement Feedlots and the Analysis of Seasonal Marketing Variations for Feeder Cattle in South Dakota

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THE ECONOMIC FEASIBILITY OF CONFINEMENT FEEDLOTS AND THE

ANALYSIS OF SEASONAL MARKETING VARIATIONS

FOR FEEDER CATTLE IN SOUTH DAKOTA

by

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This thesis is approved as a creditable and independent investigation by a candidate for the degree, Master of Science, and is acceptable as meeting the thesis requirements for this degree. Acceptance of this thesis does not imply that the conclusions reached by the candidate are necessarily the conclusions of the major department.

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CHAPTER I

INTRODUCTION

Livestock production is an important sector of South Dakota's dominant industry of agriculture. South Dakota farmers and ranchers received cash receipts from livestock and livestock products in 1973 amounting to $1,230.9 million for livestock and livestock products.[1]

About two thirds of South Dakota livestock production results from raising beef cattle and feeding beef cattle for slaughter. Raising beef cattle encompasses the management of beef cow herds and the production of feeder cattle. This section of South Dakota's beef industry is booming. Beef cows and heifers, numbering 2,058,000 head, are at record levels on South Dakota farms. This makes the state the 5th largest producer of beef cows and heifers in the United States.[2] It is also the 6th largest producer of feeder cattle and, in a ten year period from 1964 to 1973, the number of feeder cattle made available for feedlots by South Dakota increased from 915,000 to 1,314,000 for a 30.4 per cent increase.[3] These production expansions are attributed to better utilization of land for the larger beef cow herds, less

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[1]South Dakota Crop and Livestock Reporting Service, South Dakota Agriculture-1973 (Sioux Falls, South Dakota: May, 1973), p. 35.

[2]Ibid., p. 36.

[3]Figures on feeder cattle available equal the number of feeder cattle to South Dakota feedlots plus net South Dakota outshipment of feeder cattle in Table I-1 on page 3.

calving morbidity, and a shift from dairy to beef cow operations.[4]

The second activity, as delineated above, is feeding cattle for slaughter. South Dakota is also a major producer of fat cattle. In the last two years it has ranked 10th in fat cattle production in the United States.[5] However, in 1964 it was the 9th largest producer and in the 10 year period from 1964 to 1973, cattle placed on feed in South Dakota had decreased 4.7 per cent from 590,000 head in 1964 to 562,000 head in 1973 (Table I-1).

Even with over half a million cattle placed on feed in 1973, conditions exist which have raised concern about South Dakota beef cattle production, specifically the states' production potential. In 1968, Valentine Heier acknowledged that South Dakota is both an exporter of feeder cattle and feed grains, and he provided information to develop the cattle feeding potential by making a special analysis for optimal combination of feed grains and feeder cattle in South Dakota.[6] In a 1970 bulletin, Ray Gaarder also recognized the undeveloped potential for feeding cattle since both feed grains and feeder cattle leave the state. Gaarder stated that, if the 591,000 head

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[4]Raymond O. Gaarder, South Dakota's Beef Industry, Bulletin 385 (Revised) (Brookings, South Dakota: South Dakota State University, Economics Department, December, 1971), pp. 13-18.

[5]South Dakota Crop and Livestock Reporting Service, op. cit., p. 46.

[6]Valentine M. Heier, "Optimum Movement of Feeder Calves and Feed Grains Within South Dakota With Implications for Slaughter Plant Locations" (unpublished Master's dissertation, South Dakota State University, June, 1968), p. 1.

Table I-1: Beef Cows and Heifers, Beef Calves Born and Estimated Net Disposition of South Dakota's Feeder Cattle

	Beef Cows and Heifers On Farms, S.D., Jan. 1			Beef Calves Born Previous Year	Estimated Net Disposition of Feeder Cattle Within South Dakota					Net S.D. Outshipment of Feeder Cattle
							Herd Replacements			
Year	Cows and Heifers That Have Calved[1]	Cow Replacements 500 lbs. and Over	Total		To S.D. Feedlots	Deaths and S.D. Slaughter Off Grass	Heifers[2]	Bulls	Total	
					(1,000 Head)					
1960	1,150	157	1,307	1,124	362	112	184	16	674	450
1961	1,186	158	1,344	1,150	464	115	190	17	786	364
1962	1,220	184	1,404	1,186	451	119	195	18	783	403
1963	1,288	208	1,496	1,220	450	122	206	19	797	423
1964	1,400	233	1,633	1,288	590	129	224	20	963	325
1965	1,512	239	1,751	1,400	564	140	242	22	968	325
1966	1,482	236	1,718	1,512	563	151	237	21	972	540
1967	1,522	242	1,764	1,482	618	148	244	22	1,032	450
1968	1,556	241	1,797	1,522	660	152	249	22	1,083	439
1969	1,602	234	1,836	1,556	551	156	256	23	986	570
1970	1,719	238	1,957	1,602	552	160	275	24	1,011	591
1971	1,731	251	1,982	1,719	602	172	277	25	1,076	643
1972	1,829	291	2,120	1,731	561	173	293	27	1,054	677
1973	1,906	292	2,198	1,829	562	183	305	27	1,077	752

Source: Figures and procedure derived from South Dakota Agriculture, South Dakota Crop and Livestock Service, and R. O. Gaarder, South Dakota's Beef Industry.

1-Adjusted Beef cows and heifers that calved (1960-1969)

2-Adjusted Beef cow replacement heifers 500 lbs. and over (1960-1969) that left South Dakota in 1970 were all fed in South Dakota, cattle feeding could double in the state without importing a single calf from other states. He also concludes that the state has a maximum potential of tripling its cattle feeding to create over $100 million potential in value added in South Dakota.[7] Yet, an extension of Gaarder's calculations shows that a record 750,000 feeder cattle may have been shipped out of the state in 1973 (Table I-1) and provides the motivation to do further research on the factors which may affect cattle feeding in the state. The areas of particular interest are in feedlot operations and feeder cattle marketings in the state.

THE PROBLEMS

South Dakota apparently produces an adequate quantity of feeders and feed grains to substantially increase slaughter cattle production. Furthermore, South Dakota prices for feed grain, roughage, and feeder cattle are equal to, or less than, the prices for these inputs in other areas where cattle feeding has flourished in recent years.[8] Therefore, a general problem is determining why such an unused potential is present in the state. It should also be determined how South Dakota farmers might increase fat cattle production.

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[7]Gaarder, op. cit., p. 26.

[8]Robert E. Olson, "Trends in and Opportunities for Cattle Feeding in South Dakota", Economics Newsletter, No. 15 (Brookings, South Dakota: South Dakota State University, Economics Department, February 22, 1973), p. 2.

Therefore, in an attempt to explain South Dakota's slow cattle feeding growth and possibly help farmers in South Dakota and neighboring areas develop the cattle feeding industry, the following problems were researched.

First, this area experiences long and cold winters which can reduce cattle gains and feed efficiency. Also, the winter provides a harsh environment for a man to labor in. To alleviate the problems imposed by the state's climate, it was hypothesized that total confinement feedlots may be a feasible alternative for South Dakota farmers interested in feeding cattle. The total confinement feedlots considered were cold-slatted barns and will be more completely described in later sections. A secondary issue to be considered was to determine what sizes of confinement feedlots are more economical to operate. Also, in past research in other states, the economic feasibility of operating confinement facilities instead of open lots was determined under particular assumptions. This study considered the effect of varying two assumptions which could change the feasibility of using total confinement for feeding cattle. The assumptions are: (1) wage rate for feedlot operators and (2) differences in feed efficiency or feed costs between open lots and total confinement cattle feeding barns.

In trying to answer the question of why feeding could be depressed in South Dakota, another specific problem concerning feeder cattle marketing within the state was investigated. The investigation such marketings could provide information which could lead to another incentive to feed more cattle in South Dakota.

To maximize profits or minimize losses, many feedlot operators purchase feeder cattle more than once a year. If feeders are available during only one period of the year in South Dakota, cattle feeders would consider it a disadvantage to feeding in South Dakota and the condition could have a dampening effect on the beef industry in the state. With increases in transportation costs, the problem of seasonal availability of feeder cattle could be an even greater problem to feeders than that of climate or environment. However, if cattle were available in large quantities throughout the year another incentive to feed in South Dakota would exist.

The following pages will provide information relative to the two problem topics previously mentioned, which are: (1) confinement feeding for South Dakota and (2) marketing of South Dakota feeder cattle.

OBJECTIVES

The objectives of the study were:

1. To compare the return to management and/or ownership from various sizes of open lot and confinement feedlots, given certain prices for feeder cattle, feed grain, labor, and other inputs.
2. To compare the return to management and/or ownership from different sizes of open lot and confinement feedlots when variations in the inputs of wage rates and feed efficiency are considered.

3. To analyze the marketing intentions of feeder cattle producers within the state to evaluate supplies of feeder cattle available to cattle feedlots.

SKETCH OF STUDY

The study involved, first, a review of literature. This was a selected review of literature, since many documents exist on the subject of beef cattle production, and if literature is not selected carefully a researcher could spend excessive time reviewing material. Brief comments were made of literature on the nations agriculture economy for feeding cattle, general cattle feeding characteristics and requirements, characteristics of feeding cattle in South Dakota, and finally, material on confinement or environmental feedlots are reviewed.

In Chapter III, the methodology for analysis is described and the various basic assumptions are presented. The methodology required the development of a budget model to provide a systematic procedure to evaluate the feedlot alternatives. Assumptions on such items as costs, labor requirements, and equipment needs are set forth along with other numerous assumptions that must be considered and determined to complete an analytical study of various feedlot operations.

The next chapter, Chapter IV, presents the empirical results of the budget analysis of the feedlot structures considered. Analysis is made with regard to sizes of feedlots and types. This chapter embraces much of the original knowledge for which the research was initiated.

In Chapter V, the budget model developed is used to test the effect of variations in wage rates and feed efficiency on feedlot financial statements. Such a study helps determine the sensitivity of feedlot profitability to the variations of the two assumptions. The variables represent two important elements to consider in regard to feasibility of open lot or confinement facilities for cattle feeding.

Chapter IV encompasses an analysis and investigation on South Dakota feeder cattle marketing. Most of the material presented is derived from the results of a mail survey of farmers in South Dakota. Secondary results of the survey on farmer's cattle operations are also elaborated on and the author makes implications for cattle feeding and beef operations for the state from information that was obtained.

The manuscript is consummated with a chapter of summary, conclusions, and implications derived from the research. The purpose and incentives for the research are summarized, conclusions on cattle feeding in South Dakota are determined from results of the study, and finally, implications and suggestions derived from or implied by the research are offered. The chapter represents the condensed prosaic results of the authors research.

CHAPTER II

REVIEW OF LITERATURE

INTRODUCTION

The purpose of this chapter is to provide background information on cattle feeding to serve as a source of information for the analysis of characteristics of the business of feeding cattle. The topics reviewed and reported here include: (1) general agriculture conditions in the United States and the world which affect cattle feeders, (2) cattle feeding characteristics and requirements, (3) cattle feeding in South Dakota, and (4) the status of confinement feeding. Because of the great breadth of literature on most of these topics, only a small number of sources most relevant to the study were selected out of the total of possible source material.

GENERAL AGRICULTURE CONDITIONS--DOMESTIC AND INTERNATIONAL

Agriculture in the United States has recently acquired infrequent characteristics of shortages versus surpluses. This is of special importance to cattle feeders who must compete with other farmers and consumers for some of the agricultural products in short supply. This section should help explain the unusual agriculture condition for farmers, especially livestock producers. The condition of surpluses or excess capacity, which have been the general rule for 30 years, are gone and some of the current shortages add new dimensions to feeding cattle.

agriculture. The rate of exodus of farm labor has declined as farm labor has slowly approached a balance with the normal requirements for feed production. This change has had a more noticeable effect on livestock production, which is more labor intensive than field crops, in that it apparently caused restraints on livestock production.[2]

At any rate, growth in livestock production decelerated from a 1.7 per cent increase in 1960-1965 to only a .9 per cent increase for 1970-1973. What the changed status of agricultural labor means to a livestock producer is that, if new capital equipment or other technological innovations are not able to replace manpower, then the producer will have to provide labor higher returns and compete with the non-farm sectors for workers.[3]

Cattle feeders have also noticed considerable increases in feed costs. This has happened for two major reasons. First, there is more competition for the feedstuffs from various sectors of the economy. Second, there has occurred a decrease in supply of feedstuffs due to the great increases in prices for various cash crops that can be grown on the same fields. These conditions may lead to added emphasis on livestock feed efficiency research with the use of public funds.[4]

Economists believe the immediate reason for the new pressures on agriculture production, increased prices, and shifts toward cash crop production stem from growing world demand for our agricultural

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[2]Ibid., p. 130

[3]Ibid., p. 131.

[4]Ibid.

products. The increase in demand, which was shown in increased exports, was large. Projections had suggested tha annual export of United States agricultural products by 1980 would reach $10 billion. Actual foreign purchases for fiscal 1973 were $12.9 billion and for calendar 1973 agricultural exports reached $17.5 billion. Most of the increase (60 per cent) came from increased volume, the remainder from higher prices. The increased exports had significant implications on livestock producers. It raised the price and decreased availability of feedstuffs, which decreased profit margins. The overall effect was a reduction in incentives to produce. It also helped raise the price of beef, but the price rise was not in as great as the rise in feed costs due to greater demand by foreigners for crops other than meat and a domestic price freeze on live beef.[5]

The third general topic concerning agriculture is a brief and cautious analysis of the future. Agricultural conditions in the future will be greatly influenced by recent legislation, specifically the Agriculture and Consumer Protection Act of 1973. The principal innovation of this act is a system of target prices for wheat, feed grains, and cotton. This legislation would keep the Government from accumulating stockpiles unless market prices fall to commodity loan rates or floor prices set by the Government which are far below target prices. For market prices above floor prices, but below target prices, the Government will make "deficiency payments" to farmers for the difference between market prices and target prices. When market prices

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[5]Ibid., p. 132.

are above target prices, farmers will receive no Government "deficiency payments".[6] The act's principal relevance to livestock producers is that it provides a part of the environment from which feedstuff prices will be determined.

Another aspect of the act will be of importance to livestock producers. The legislation should improve overall market information for agriculture producers. The act mandates the provision of market information to the private sector so decisions can be made in the private sector with the fullest possible knowledge about market conditions and trends. Hopefully, increased and improved information will improve agricultural efficiency. The fullest possible knowledge criterion initiates action in three specific areas. First, export demand information has shown deficiencies in the past. To alleviate this condition, steps have been made to improve the flow of world-wide economic intelligence on agricultural demands and conditions in other countries. Second, a new reporting system has been initiated to forward information on export sales of agriculture goods to the farm sector. The third section of the mandate on providing fullest possible knowledge will be to improve farm and food forecasting and planning. The need for such improvements was not pressed as much when agricultural conditions of stockpiles and idle acres existed. Presently, there has arisen a high priority for proper planning to ensure adequate supplies at adequate prices.[7]

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[6]Ibid., p. 134.

[7]Ibid.

Thus, agriculture's past important role in the American and world economies has taken on a new more important role. The author thinks that, in the future, conditions of past surpluses will exist only during short periods of time, if at all. The new environment adds more significance to this research on a small segment of the farm sector--cattle feeding, where efficiency in operations will be required at a much higher level than in the past.

CATTLE FEEDING CHARACTERISTICS AND REQUIREMENTS

Cattle Feeding--Characteristics

Some characteristics of cattle feeding include high investment requirements relative to sales, fluctuating input and product prices, long time intervals between commitment of input and output, dependence on weather, shifts in feeder cattle supplies, death losses, and small fluctuating profit margins. Recent low fat cattle prices have created extreme hardships for cattle feeders and prompted action in both executive and legislative branches of the Federal Government to improve the industry's situation.

A cattle feeder may experience operational and financial difficulties when faced with certain situations. He is particularly vulnerable to financial loss from a market that fluctuates downward during his feeding cycle, because he has to sell his product within a short time period. This stems from the fact that after fat cattle reach their normal market weight they become quasiperishable, in that, added days on feed raise the value of the cattle slower than costs increase and later their value may actually decline. Also, a feeder must buy within a short period of time to use feedstocks on hand and maximize returns to fixed capital of feeding cattle. This vulnerability to market fluctuations is the likely cause of recent growth in contract feeding agreements in which cattle are owned by packers, retailers, private individuals or companies.[8]

All feedlot operators have faced the problems of what and how long to feed. It takes only a short period of time to determine that there are a great number of opinions on what to feed, and each ration may be right, depending on feedlot locations and availability of various feedstuffs.[9] Rations, furthermore, are significant in determining how long to feed, and the combination of what, and how long to feed affects selling price and costs, which determine profitability. The ability to feed just the right level is very important since margins are often so small that an animal profit or loss can be determined in the last few days of feeding.[10]

More specifically, the variations in net returns or profits are due to variations in three elements: gross margins, feed costs, and

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[8] U. S. Department of Agriculture, Feasibility of a Physical Distribution System Model for Evaluating Improvements in the Cattle and Fresh Beef Industry, ARS 52-36 (Chicago: A. T. Kearner and Company, Inc., November, 1969), p. 12.

[9] Paul R. Hasbargen, Controlling Feed Costs in Cattle Feeding, pamphlet (St. Paul: University of Minnesota Press), p. 2.

[10] U. S. Department of Agriculture, op. cit., p. 13.

nonfeed costs.[11]

Gross margins (GM) are usually figured on a per hundred weight gain, though a per head basis is acceptable. It is calculated by subtracting the average laid-in purchase cost (PC) from the average net sales value (NSV) of a finished animal, and dividing by the average hundred weight of gain added (GA) to each animal sold. A gross margins equation would be as follows:

$$GM = (NSV - PC) \div GA$$

where,

PC = Average price paid x average weight of feeders

NSV = Average sales weight x (hundred weight price - hundred weight marketing costs)

GA = Average selling weight - average buying weight

Gross margins represents the "price received" for each one hundred pounds of beef produced in the feedlot. This measure fluctuates with timing of purchase and sales since the product price varies with time.[12]

Cattle Feeding--Feed Costs and Requirements

Feed cost represents the largest portion of total feedlot costs--generally about 65 to 70 per cent. Feed costs vary for many reasons. Two general factors are, variations in feed conversion efficiency and feed prices.[13]

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[11]Paul R. Hasbargen, Farmer Costs and Returns in Cattle Feeding and Comparisons with Research Results, pamphlet (St. Paul: University of Minnesota Press), p. 3.

[12]Ibid.

[13]Ibid., p. 4.

Variations in feed conversion efficiency originate from many factors, but the scope of this review of literature has been limited to three regions of variability. They are types and/or quality of rations, cattle, and environment. As with most factors of cattle feeding, they are highly interrelated.

Much literature has been presented on feeding rations for various sizes and types of cattle, with other determinates being the price and quality of feed, and rate of gain desired. Principal requirements for feedlot cattle that must be met, however, are those of net energy. Donald Gill, Extension Nutritionist at Oklahoma State University, has published information on the net energy maintenance and gain system of ration evaluation developed by Drs. Lofgreen and Garrett at the University of Califormia. Gill states that their system is the most satisfactory means of predicting feedlot performance on rations to date.[14]

Net energy (NE) evaluations differ from past evaluations' standard of total digestible nutrients (TDN) in one principle area. Gill's report stresses that energy in feeds is used for two purposes in feedlot cattle, maintenance and gain. The area of difference between NE and TDN evaluation, hence, stems from the fact that the NE system allows for the condition that feeds used for maintenance have a higher energy value then when the same feed is used to produce gain. Total

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[14]Donald Gill, "Net Energy Requirements of Feedlot Cattle," South Dakota Beef Cattle Handbook (Brookings, South Dakota: Cooperative Extension Service, South Dakota State University, December, 1972, p. 1001.1.

digestible nutrients makes no such distinguishment.[15] Of course, for the NE system of evaluation of feedlot rations to work, the rations must be balanced. Other requirements to be met are those of protein, vitamins, minerals, and water. The South Dakota Beef Cattle Handbook supplies information on these requirements in articles by Danny Fox, Jim Matsushima, and O. E. Olson.[16]

The above requirements can be placed under a single category of nutrients, and a cattle feeder should try to maximize nutrient use. The Beef Cattle Handbook, furthermore, presents a procedure by which a ration can be formulated to maximize the use of all the nutrients fed.[17]

Cattle Feeding--Alternative Types of Cattle

Literature pertaining to the quality and/or type of cattle fed is extensive. Again, feedlot practices vary significantly. A feedlot operator has a great choice of breeds of livestock, such as, dairy, exotics, crossbreeds, Okies, and standard beef breeds. When variations in quality, size, condition, origin, and sex are added to these choices, the alternatives are numerous. Two publications that do provide

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[15] Ibid.

[16] Danny Fox, "Protein Requirements for Growing and Finishing Beef," South Dakota Beef Cattle Handbook (Brookings, South Dakota: Cooperative Extension Service, South Dakota State University, December, 1972), pp. 1100.1-1100.5; also Danny Fox, "Vitamin Requirements of Beef Cattle," ibid., pp. 1200.1-1200.2; also J. K. Matsushima, "Mineral Requirements for Feedlot Cattle," ibid., pp. 1300.1-1300.4; also Danny Fox and O. E. Olson, "Water Requirements for Beef Cattle, " ibid., pp. 1400.1-1400.2.

[17] Danny Fox, "Guideline Finishing Ration," ibid., p. 1600c.1-1600c.9.

extensive information on cattle are, Alvin L. Neumann and Roscoe R. Snapp's Beef Cattle[18] and Hilton M. Brigg's Modern Breeds of Livestock.[19] This study was limited to the use of 650 lb. choice feeder steers that will grade mostly choice when sold.

Cattle Feeding--The Effect of the Feeding Environment

Environment of a feedlot adds a third general determinant of gain on feedlot cattle, however, knowledge of the various environmental aspects of the feedlot and their effect on gain is not universal. H. L. Self stresses that the role, effect, and mode of action of environmental factors on gain are not understood.[20] Self has done research on environmental factors, mainly in the area of the economics related to shelter versus open lot and he raises some problems in this area and cites some pertinent literature.[21] A. J. F. Webster of Canada has studied the effect of cold weather on beef cattle and his work is of importance to South Dakota feeders, who also experience severe winters.[22] South Dakota's infinite variety of weather also produces

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18Alvin L. Neuman and Roscoe R. Snapp, Beef Cattle (New York: Wiley, 1969).

19Hilton M. Briggs, Modern Breeds of Livestock (New York: Macmillan, 1969).

20H. L. Self, "Environmental Implications in Economy of Gain in Feedlot Cattle," Journal of Animal Science, XXXV, No. 1 (July, 1972), 148.

21Ibid., p. 152.

22A. J. F. Webster, "Direct Effects of Cold Weather on the Energetic Efficiency of Beef Production in Different Regions of Canada," Canadian Journal of Animal Science, L, No. 3 (December, 1970), 563.

periods of extreme heat which diminishes gain in feedlot cattle, however, the periods of extreme high temperatures are not a significant problem for South Dakota feeders, as they are for southern and southwestern feeders in the United States.

CATTLE FEEDING IN SOUTH DAKOTA

Many of the factors of cattle feeding in South Dakota have already been cited, and pertinent literature has been recognized. The reason for this is that many of the factors are generally inherent to cattle feeding, regardless of geographical or state boundaries. One characteristic that is a problem or condition for cattle feeding in the northern plains is climate. Literature in this area has already been cited.

Yet, South Dakota cattle feeding does possess some specific characteristics which were the principal motivation for this study. Data presented by both Gaarder[23] and Heier[24] emphasize the point that the state exports both feeder cattle and feed grain. Gaarder's publication gives a good overall view of South Dakota's beef industry conditions, with subject contents ranging from U. S. demand[25] to South Dakota production[26] to a section on South Dakota feedlot competitors

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[23]Gaarder, op. cit., p. 11.

[24]Heier, op. cit., p. 1.

[25]Gaarder, op. cit., pp. 6-7.

[26]Ibid., pp. 11-19.

in Texas.[27] Heier's thesis objective was to promote beef production by determining least-cost patterns for shipping of feeder cattle and feed grain, mainly within the state. He also included information about slaughtering plant operations.[28]

CONFINEMENT FEEDING

Technology

Much of the technological information as well as economic literature on confinement feeding is provided by research publications from Minnesota and Iowa. The only type of confinement facility considered in this study was cold-slotted confinement barns. This type was considered because economists who have studied confinement systems think it is the most feasible type to use. Also, some technical data are available on cold-slotted barns. The West Central Minnesota Experiment Station at Morris operates such a system, as well as total confinement facilities referred to as a warm-slotted barn and a manure-scrape barn.[29] Iowa State University also operates a cold-slot barn at its Allee Research Farm.[30] A private firm, Iowa Beef Processor's (IBP)

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[27]Ibid., pp. 30-31.

[28]Heier, op. cit., pp. 47-56.

[29]R. E. Smith and others, A Comparison of Five Housing Systems for Feedlot Cattle, Research Report B-170 (St. Paul: University of Minnesota Press, 1972), p. 3.

[30]H. L. Self and M. P. Hoffman, "Feeding Yearling Steers in Confinement," Annual Progress Report--1973, Allee Experimental Farm, OEF 73-31 (Ames: Iowa State University Press, June, 1973), pp. 10-15.

supplies research reports and technical information on its similar type barn in Denison, Iowa.[31] Further engineering guidance can be, and was obtained from private firms.[32]

Economic and Cattle Performance Reviews

The literature cited in the previous section was the principal source of information used in the study on the economic and cattle performance elements of total confinement, as well as open lot operations. Minnesota's three-year data showed confinement to be advantageous to open lots on the basis of return to management and labor, and cattle feeding efficiency.[33] Iowa Beef Processor's research showed results of increased profits and greater feed efficiencies for confinement over three years of testing involving over 10,000 head of cattle.[34] The Iowa State University research was more limited than either Minnesota or IBP's but, again, confinement showed an advantage in feed efficiency. Profits and returns to labor and management were not considered in the Iowa research.[35] As a general rule, rates of

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[31]Gerald Frankl and W. R. Masch, IBP's Cattle Feeding Research Progress Report No. 2 (Dakota City, Nebraska: Iowa Beef Processor's, Inc., June, 1973).

[32]The author consulted with Tom Teigen, Teigen Construction, Aberdeen, South Dakota; Mert Oden, Oden Enterprises, Inc., Wahoo, Nebraska; and Ken Schoendyke, Confinement Builders, Emmetsburg, Iowa.

[33]Smith and others, op. cit., p. 12.

[34]Frankl and Masch, op,. cit., p. 8.

[35]Self and Hoffman, op. cit., p. 13.

gain had not been significantly different when comparing confined cattle to cattle in open lots.

Many more items can be considered besides profits, management returns, and feeding efficiencies when considering confinement versus open lot cattle feeding operations. Self lists the following as alternative factors to be weighed when considering cattle feedlot structures of confinement or open lot. These are: (1) bedding needs, (2) length of feeding period, (fixed costs are reduced when feeding length is shortened); (3) mud problems; (4) pollution control; (5) degree of environmental control desired; (6) labor requirements; (7) influence on carcass quality and value; (8) land requirements; (9) effects on performance predictability which, if increased, permits more efficient buying and selling; (10) working conditions desired; (11) attractiveness of the cattle to packer buyers; and (12) beneficial uses of manure.[36]

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[36]Self, op. cit., p. 152.

CHAPTER III

METHODOLOGY OF ANALYSIS AND BASIC FEEDLOT SYSTEMS ASSUMPTIONS FOR PRODUCTION REQUIREMENTS AND EXPENSES

INTRODUCTION

The study of South Dakota feedlot systems was limited to eight categories of farm feedlots. The hypothetical feedlots were specified by size and type. The sizes considered were 100, 300, 500, and 1,000-animal-units capacity at one time and an open lot and confinement structure were considered for each size.

A prerequisite for analysis of the feedlot systems involved three steps. First, a systematic method was established to generate data to be analyzed. A computerized synthetic budget model was created as a tool for the analysis. Next, assumptions were established regarding the production requirements of the feedlot systems. The third and final step consisted of estimating expenses in the operation of the feedlot systems. The last two steps were in some cases combined in execution because some production requirements and expenses are directly and intently interrelated.

METHODOLOGY OF ANALYSIS

An analytical format was established to evaluate the feasibility of operating the feedlots considered in the research. It was decided that a synthetic budget model adapted to a computer would provide an efficient method for the analysis of the problems and possibilities of the feedlot operations.

The process of developing the model involved a series of steps. First, the basic data had to be collected; secondly, the proper assumptions had to be established. The data and assumptions are designated in the following portions of this chapter. Next, mathematical equations or identities were determined to depict relationships by which costs, sales, expenses, and relationships had to be conformed into an acceptable computer program which provided empirical results in an understandable format.[1] A copy of the computerized synthetic budget program used for the study can be found in Appendix A.

The model served in analyzing the different types and sizes of open and confinement feedlot operation's profitability. Furthermore, the computerization of the budget procedure could allow more extended analysis of feedlot operations by varying certain original assumptions. Computer iterations can be executed to test the impact of alternative wage rates, depreciation rates, cattle prices, feed costs, and feeding efficiencies on economic profits or losses feedlots may incur.

In taking advantage of the program's flexible nature, the original assumptions on two of the feedlot production factors were varied. The production factors altered were wage rates and confinement feed efficiency improvements. They represented two elements where variations which could occur would produce a distinct relative impact on the

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[1]Robert E. Olson, Associate Professor of Economics, South Dakota State University; provided assistance in the final step of writing the computer program.

economic feasibility of all types and sizes of feedlots considered. The results of the changes and further information on the justification and the procedure used will appear in Chapter V.

An operation would also be sensitive to changes in cattle prices, feed prices, and interest rates but such changes would affect the alternative lot's profits or losses in an absolute or uniform amount and would not help in determining the acceptable use of either an open lot or a confinement lot feeding operation for a farm.

ASSUMPTIONS FOR PRODUCTION REQUIREMENTS AND EXPENSES

Assumptions were specified on the two types of livestock relevant to this study; feeder cattle put on feed and fat cattle produced. Both types of cattle were assumed identical for all systems.

The feeder cattle were 650 pound choice steers and were valued at $.4925 a pound for a per head value of $320.12. The value was based on Sioux Falls market price as of February 1, 1974. No assumptions were made as to the breeds of the cattle.

Slaughter cattle were assumed to be sold at $.4900 a pound at a weight of 1,050 pounds for a gross sale of $514.50 per head. The price was a futures price of live beef cattle for delivery in June of 1974 and the price was quoted as of February 1, 1974 at the Chicago Merchantile Exchange.

All cattle were assumed to gain 400 pounds at a rate of 2.75 pounds per day and thus be on feed for about 145 to 150 days depending on shrink loss in getting feeder cattle from point of purchase to the feedlot. The time on feed allowed two ltos of cattle to be fed per year. A uniform rate of gain was assumed because no evidence in the literature reviewed by the author showed that cattle in either an open lot or environmental barn gain at significantly different rates. Although cattle fed in total confinement have shown to be significantly more efficient in feed conversion in tests at Morris, Minnesota;[2] Denison, Iowa;[3] and Newell, Iowa,[4] this fact was accounted for in feed costs in a later section of the study.

Gross margins for the livestock were calculated after allowing for shipping expenses and marketing expenses. Marketing costs of slaughter cattle were set at $3.30 per head which was determined by area interviews to be an acceptable South Dakota rate. Shipping costs to deliver feeder cattle to feedlots and slaughter cattle to market were determined from South Dakota Class B Motor Carriers Tariff No. 48.[5]

Specifically, a linear regression equation was estimated from the rates for motor carriers with a minimum weight of 20,000 pounds. The two variables for the equation being the distance shipped in miles

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[2]Smith and others, op. cit., p. 11.

[3]Frankl and Masch, op. cit., pp. 3-8.

[4]Self and Hoffman, op. cit., pp. 10-15.

[5]South Dakota Public Utilities Commission, South Dakota Class B Motor Carriers Tariff Bulletin No. 48 (Pierre, South Dakota, February 1974), p. 2.

(independent variable) and the rate per pound of shipment (dependent variable).

The shipping cost equation is shown below:

$$Y = 15.50008 + 0.17883 X$$

$$R^2 = .987980$$

where,

Y = estimated rate in cents per cwt. shipped

X = miles shipped

Gross margins could then be calculated from the following equation:

$$GM = ASCW\ (ASCP + 15.50008 + 0.17883\ X_1) -$$

$$AFCW\ (AFCP + 15.50008 + 0.17883\ X_2)$$

where,

GW = gross margins per animal unit

ASCW = Average slaughter cattle weight

AFCW = Average feeder cattle weight

X_1 = Average miles slaughter cattle shipped

X_2 = Average miles feeder cattle shipped

For the specific analysis, distance shipped for both feeder cattle and slaughter cattle was assumed equal to 50 miles. The gross margin for all systems was constant and equal to $187.21 per animal unit.

Feed

The systems all used a high concentrate ration of corn equivalents, silage equivalents, and supplement. However, a distinction between confinement and open lot feed requirements was made on the basis of an investigation of various upper Midwest experiments and studies. The average feed costs for confinement fed cattle in 12 different experiments and studies was 7 per cent less and the cost differences ranged from 42 per cent less to 1 per cent more for confinement versus open lots. For the study of basic feedlots, confinement feed costs were set at 5 per cent less than open lot costs.

For the open lot, each steer was fed 42 bushels of corn equivalents at $2.00 per bushel, one ton of corn silage equivalents at $15.00 per ton, and 200 pounds of supplement at $180.00 per ton. This ration was developed from literature on feedlot operations.[6] The concern of feed requirements was for acceptability and not optimum conditions.

Feedlot—Open Lot

The open lot(s) considered in the study were structured to allow 500 square feet (.0114 A.) per animal unit,[7] and the land was valued at $300 an acre. Each system was given lots of 100-animal-unit capacity, therefore, a 500-animal-unit feedlot would be formed by five 100-animal-unit lots. Each of the 100-animal-unit lots, 165' x 250', was allocated the following resources with respective investment costs:

1. 150 feet of windbreak; $3.10 per linear foot

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[6]Fox, op. cit., p. 1600c.1-1600c.9; see also Doane Agriculture Service, Inc., Doane's Agricultural Report Reference Vol. (St. Louis, 1972), pp. 265-266.

[7]Two hundred and fifty square feet per animal unit would be acceptable for areas that receive 20 inches of rain or less annually.

2. 100 feet of precast concrete fenceline bunks; $7.50 per linear foot

3. A 10' long gate; $40 per gate

4. Remaining area enclosed by a 5 cable fence with posts 9' apart; $1.40 per linear foot

5. A waterer with pipe and trenching; $275.00

6. Cement work-aprons for waterers and bunks--500 cubic yards; $21.00 per cubic yard.

In order to meet proposed effluent guidelines each open lot system included a waste treatment pit or a lagoon. The type of lagoon and construction costs were assumed to be identical to the conditions used by the Environmental Protection Agency (E.P.A.).[8] Each lagoon would presumably hold 100 per cent of the run-off from a ten year--24 hour storm for eastern South Dakota.

Feedlot--Confinement

Each confinement or environmental barn allocated 16 square feet per animal unit or 800 pounds of live weight. Such an allocation on a weight basis gives the cattle a more constant area, relative to size, than a per head allocation. More explanation of this procedure will evolve in Chapter IV.

An environment feedlot facility consisted of the following investments and requirements. The respective cost coefficients are also

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[8]Milton L. David, Richard E. Seltzer, and William D. Eickhoff, Economic Analysis of Proposed Effluent Guidelines--Feedlots Industry, Prepared for the Environmental Protection Agency (Washington: August 1973), pp. XII-1-11.

listed with the required feedlot investments.

1. .056 A. of land per 100 A. U.'s; $300 per acre

2. A clear-span pole building 40 feet wide with an enclosed 16 feet wide drive-way, length equals two thirds times A. U. capacity of barn; $80 per linear foot of barn

3. Concrete pit 8 feet x 24 feet x length of building including dirt excavation, concrete (1 cubic yard per foot length of barn), steel re-rod, forming materials, and labor; approximately $50 per animal unit

4. A concrete approach; $168 per feedlot

5. Slatted concrete floors; $1.25 per square foot x 24 feet wide x length of building

6. Waterers--1 per 100 A. U.; $150 per waterer

7. Bunks the length of the building; $7.50 per linear foot

8. Fence and gates; $5 per foot x length of barn

Supplementary equipment required for an environmental barn included a pump to periodically extract liquid from the pit. A liquid manure wagon is necessary to receive the extraction which can be spread on farm land as a fertilizer supplement or substitute.

Feed Facilities

An environmental barn system may require the use of less feed due to an increase in feed efficiency and decreased losses attributable to weather. Therefore, less feed facility requirements may be plausible. However, for this study the difference was not felt to be significant and each system of the same size also had the same feed facilities. Also estimations of feed storage capacity vary with different conditions of feedstuffs stored.

Feed storage consisted mainly of bunker silos. The exception being the 100 A. U. size which utilized an upright concrete stave silo for corn storage. Literature states that for small capacities, corn is more feasibly kept in such a silo. The principal reasons given are to cut down on spoilage losses and reduce management responsibilities of loading and feeding of corn.[9] A bunker silo was used for storage of silage in the 100 A. U. lot.

The bunker and stave silo capacities and prices were obtained from South Dakota salesmen for companies constructing these facilities. For a description of facilities used in the study please refer to Table III-1.

No allowances were made for storage of supplement in the 100, 300, or 500 A. U. operations. The exception was that, at these levels the operator would buy his supplement bagged and make use of space already available on the farm; a space which would be difficult to set a cost on and would vary from farm to farm. The 1,000 A. U. systems were allocated a 3,300 bushel bin at a cost of $2,500.00 for storage of bulk feed supplements.

Feed handling facilities and costs were determined from an Iowa State University study.[10] Some slight modifications were made from consultation with implement dealers.

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[9]C. R. Hoglund, The Economic Appraisal of Concrete Tower, Sealed Storage and Bunker Silo Systems (East Lansing: Michigan State University Press 1970), pp. 4-5.

[10]William Zmolek and others, An Evaluation of Iowa Beef Cattle Systems (Ames: Iowa State University Press, November 1973), p. 24.

Table III-1: Feed Storage and Handling Requirements, and Costs for Open Lots and Confinement Systems

	Lot Size in Animal Units			
	100	300	500	1,000
Storage				
Stave Silo-Corn-Capacity-bu.	10,000	---	---	---
Size-dia. x ht. (ft.)	20 x 40	---	---	---
Price-Dollars	$6,300	---	---	---
Bunker Silo-Corn-Capacity-bu.	---	30,000	50,000	100,000
Size	---	12 x 37½ x 87½	12 x 37½ x 150	12 x 50 x 212½ (ft.)
Price-Dollars	---	$6,000	$9,940	$13,810
Bunker Silo-Silage Capacity-T.	200 T.	600 T.	1,000 T.	2,000 T.
Size x w x l in feet	12 , 16 , 37½	12 x 25 x 67½	12 x 37½ x 75	12 x 37½ x 150
Price-Dollars	$2,684	$4,500	$5,522	$ 9 ,940
Supplement Storage Cost	---	---	---	$ 2,500
Handling Costs				
Loader and Tractor (New)	$5,000	$8,000	$8,000	$12,000
Used Tractor-for Feed Wagon	1,500	2,000	2,600	---
Mixing Wagon	3,200	3,200	3,200	---
Feed Wagon	---	2,400	3,000	---
Scales	---	---	800	---
Truck, Mixing Box, Scales	---	---	---	11,000

Again, each system of the same size was allotted similar feeding equipment. The various equipment had to provide a means of gathering from storage, mixing, distributing, and in some cases, weighing the ration. In 100 A. U. lots mixing and distributing was done with a single mixing wagon. A scale was provided for in only the 500 and 1,000 A. U. lots, as such operations may be considered as more complex and more demanding of management controls. Specific equipment used is also portrayed in Table III-1. No allowances were made for ration treatment such as roasting, steaming, or cracking, except for ingredient mixing.

Waste Treatment and Handling

In the confinement systems the only equipment required was a pump, a liquid manure wagon, and a tractor to pull the wagon to the points of distribution.

Open lots required additional equipment to clean manure build-up out of pens, plus equipment to maintain a proper level of liquid in the feedlot lagoon.

For manure collection, each open lot was consigned one or two manure spreaders of varying capacity, a used loader and tractor, and an additional used tractor to supplement the manure spreaders. Liquid handling from the lagoon was accomplished, according to E.P.A. estimated requirements, and consisted of either a pump-liquid manure wagon combination or a type of irrigation system. The irrigation systems included a pump.[11]

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[11] David, Seltzer, and Eickhoff, loc. cit.

Table III-2: Waste Treatment and Handling Requirements, and Costs for Open Lots and Confinement Systems

	Lot Size in Animal Units			
	100	300	500	1,000
Confinement				
Liquid Manure Wagon-Size (gal.)	1,000	2,250	2,250	2,250
Number	1	1	1	2
Cost	$2,000	$4,025	$4,025	$8,050
Used Tractor Cost	$1,200	$1,200	$2,500	$2,500
Pump Cost	$ 500	$1,000	$2,000	$3,000
Open Lot				
Manure Spreader-Number	1	1	1	2
Size	3 T.	3 T.	4 T.	4 T.
Cost	$1,400	$1,400	$1,700	$3,400
Used Tractor Cost	$1,200	$1,200	$2,500	$2,500
Used Loader and Tractor Cost	$2,750	$3,500	$4,000	$5,250
Lagoon	$1,550	$1,550	$1,550	$2,100
Pump For Lagoon	$ 500	---	---	---
Liquid Manure Wagon-Number	1	---	---	---
Size-Gal.	1,000	---	---	---
Cost	$2,000	---	---	---
Traveling Gun Irrigation Cost	---	$3,000	$3,000	$6,000

Also, any lot that included a liquid manure wagon was also assigned a used tractor to pull the spreader. The cost and sizes of the waste treatment and handling equipment is shown in Table III-2.

Labor

Labor requirements for labor vary with size and type of feedlot structure. It is an important element in determining the advantages of one system over another.

The man-hour requirements for the various systems were estimated from an evaluation of feedlot systems by Iowa State University.[12] The sizes did not allow specific use of their data, but interpolation from data presented in Figure III-1 was used to derive the requirements. The requirements are shown in Table III-3 on an animal unit, yearly, and daily basis.

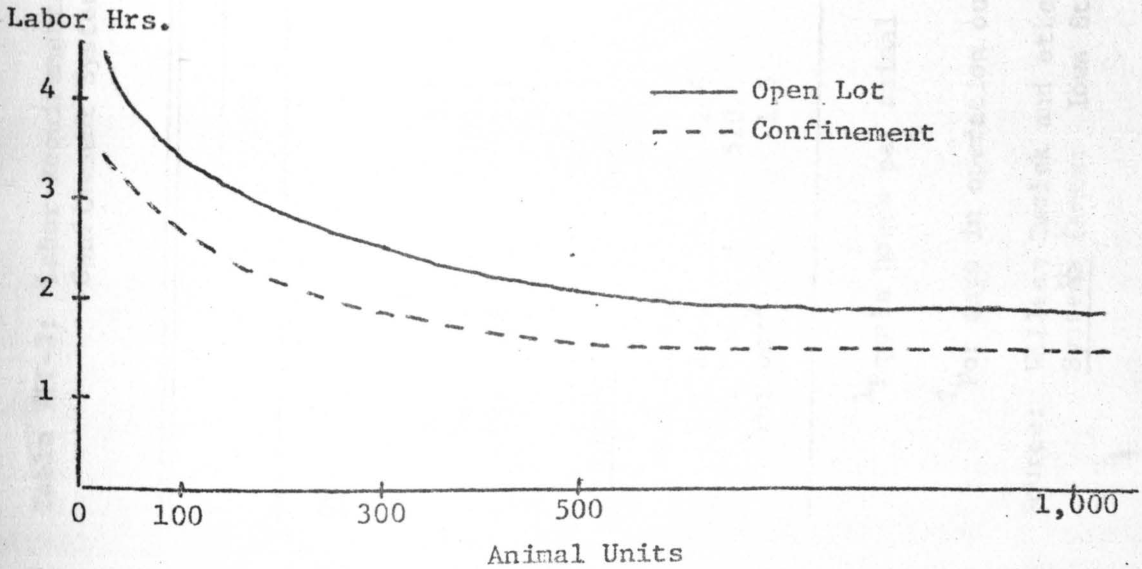

Figure III-1: Animal Unit Labor Requirements for Open Lot and Confinement Facilities

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[12] Zmolek and others, op. cit., pp. 10-12.

Table III-3: Labor Requirements of Feedlot Facilities for Open Lots and Confinement Systems

	Size of Lot in Animal Units			
	100	300	500	1,000
Open Lot				
Labor (Hrs.)				
Per A.U.	3.5	2.3	2.0	1.7
Per Year[1]	700.0	1,380.0	2,000.0	3,400.0
Per Day[2]	2.1	4.1	5.9	10.0
Confinement				
Labor (Hrs.)				
Per A.U.	2.6	1.8	1.6	1.3
Per Year[1]	520.0	1,080.0	1,600.0	2,600.0
Per Day[2]	1.5	3.2	4.7	7.6

[1] Equals hours per animal unit*size*turn-over rate.

[2] For days in operation out of a year which has 340 days.

Source: William Zmolek and others, An Evaluation of Iowa Beef Cattle Systems (Ames: Iowa State University Press, November, 1973), pp. 10-12.

Labor costs for 1973 were estimated to cover wage and social security payments, retirement allowances, and health and disability insurance. The hourly labor cost was attained by the following formula:

$$L.C. = ASDW * (1 + S.S.) * (1 + RA) * (1 + HDI) * (1 + PIA)$$

where,

L.C. = Labor Costs

ASDW = Average South Dakota hourly wage rate in 1972 = $1.80

S.S. = Social Security tax rate for self employed = .07 or 7 per cent

RA = Retirement Allowance = .15 or 15 per cent

HDI = Health and Disability Insurance = .05 or 5 per cent

PIA = Price Inflation Allowance = .10 or 10 per cent

The Price Inflation Allowance was estimated by dividing the 1973 all items price index for farmers by the 1972 all items price index for farms.

Death Loss

The death loss was given a constant figure for all lots. The grounds for such a procedure being that no data available showed that either size or type of lot per se affects the morbidity of feedlot cattle.

In the study, the death loss percentage applied was one (1) per cent of the animals on feed. This is similar to figures reported from other studies. The monetary loss was determined per animal sold and allowances were made for the value feed and labor lost due to the death of an animal. The animals were assumed to die in the middle of the feeding program. The formula for the death loss per animal sold is:

$$DL = DL\% * (PCFC - \frac{1}{2}FED - \frac{1}{2}LABR)$$

where,

DL = Death loss (dollars per animal sold)

DL% = Death loss Percentage

PCFC = Purchase Cost of Feeder Cattle

FED = Feed Cost per Animal Unit

LABOR = Labor Cost per Animal Unit

No credit was assumed for salvage value of the dead animals.

Veterinary Health

Veterinary and health charges were given a standard value of $3.30 per head. This figure is an average of allowances reported in other research literature.[13] The charge is assumed to cover medicines and veterinary services and not the labor involved in handling the cattle for vaccination or treatment.

Depreciation

In all depreciation for this research, the straight line depreciating method was used. For the study's purpose of determining the better system or size rather than an optimum condition, the straight line method was appropriate.

The depreciable life of the confinement barn was assumed to be

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[13] Smith and others, op. cit., pp. 11-13.

ten years. Regular farm buildings are depreciated over 25 years, but they serve multi-purposes. The justification for a life shorter than for farm buildings in general, originated from the specialization that the confinement building exhibits. A cold-slatted barn for beef cattle has a life more like a confinement hog barn which is depreciated over ten years giving it the same status as equipment.

All structures, machinery, and equipment included in the study, except land and some used equipment, were depreciated by a 10-year straight-line depreciation method. The used equipment was depreciated at a 6-year life rate and the land had no depreciation.

Repairs and Fuel

Repair and fuel expenses were determined by a process similar to depreciation expenses. A set percentage was applied to the original value of the equipment and machinery.

The percentage was computed from tax permittable procedures. The Internal Revenue Service allows a farmer to annually deduct 11 per cent on machinery and 3 per cent on equipment. An overall percentage of 6 per cent per year or 3 per cent per animal unit was used reflecting the much lower proportion of machinery than stationary equipment in the systems. Three per cent per animal unit allows for a turnover rate of two groups of cattle fed per year.

Interest

Interest on operational investment was determined by applying the estimated interest rate to the amount of the investment that was assumed financed by banking or financial institutions. The relevant interest rate was assumed as being 8 per cent. Fifty per cent of the feedlot investment was assumed to be financed. This procedure has been used as a method in other studies of this type.[14] Thus, in the computation of interest, four per cent was used which is the multiple of the previously mentioned percentages. The 4 per cent figure was multiplied times all capital required for producing slaughter cattle, excluding feed, but including feeder cattle.

Taxes

Taxes considered in the study were limited to property taxes. Projected profits for various feedlot systems were considered as pre-income tax profits.

Property taxes were levied against feeder cattle, land, machinery, and equipment. To determine an appropriate figure to estimate tax costs it was necessary to use an acceptable assessment rate and mill levy. For the study, an assessment rate of 50 per cent was used and the mill levy was set at 40 mills for agricultural property. Thus a multiple of the mill levy and assessment rate (2 per cent)[15] was used as a cost coefficient determinant and was multiplied times the original investment of feeder cattle, land, machinery, and equipment.

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[14] Darwin K. Johnson, "An Economic Analysis of Selected Beef Enterprise Systems for Southeast South Dakota", (unpublished Master's thesis, South Dakota State University, 1973), p. 167.

[15] Mill Levy x Assessment Rate = .04 x .5 = .02.

CHAPTER IV

ANALYSIS AND COMPARISON OF BASIC FEEDLOT SYSTEMS

INTRODUCTION

In Chapter III the methodology, model, and assumptions for the basic data were developed to assist the actual analysis to take place in Chapter IV based on the previous material. The analytical procedure for the feedlot systems involved comparison of the alternative feedlots operating statements. Most of the terminology used will be straight forward or self explanatory, however; two terms, "animal unit" and "return to management and/or ownership", were arbitrarily assigned specific definitions for the purpose of this analysis.

An animal unit terminology based on weight was adopted because of the limited space of the confinement operations. An 800 pound animal equals an animal unit. An animal unit could be substituted for a head of cattle figure in the open lot but in confinement feeding weight for a given area is more relevent as opposed to head for a given area. For confinement feeding, the concept of 800 pounds for 16 square feet gives cattle a relatively constant ratio of size per space. Specifically, it allows for the fact that a 600 pound feeder needs less space than a 1,000 pound feeder and eliminates misuse of space for light feeders and crowding of heavy cattle that a per head allotment will produce.

Return to management and/or ownership is the nomenclature used to measure the economic incentives to operate the feedlots. It was chosen in lieu of such terms as profits, return to capital and management, and return to entrepreneur. Return to management and/or ownership stresses that a farm feedlot operator not only accepts the responsibilities and risks of management but also ownership. Any loss or profit should be jointly attributable to both factors of production because of the impracticability of separating them. Return to labor is treated as an expense of production and may tend to deflate returns more than some actual feedlot operators budgets show who do not allow themselves a labor charge.

ANALYSIS OF OPEN LOT CATTLE FEEDING SYSTEMS

The details on the information that is presented in this section on open lots are available in numerical form in Table IV-1. The discussion of the open lot systems will cover three general parts of the table: sales, expenses, and return to management and/or ownership.

Sales

There is little evidence that the size or even the type of lot will affect the value of slaughter cattle sold and differences that do occur are more attributable to effective cattle buying and selling; or differences in feeding. Because the purpose of the research was to compare confinement and open lot systems and not the efficiency of other feedlot practices or marketing skills of specific operators, the sales price of cattle was assumed to be equal for all lots analyzed.

The sales value of $508.93 per head is a net value which

Table IV-1: Operating Statements for Various Sizes of Open Lot Feeding Facilities Per Animal Unit

Item	100 A.U.	300 A.U.	500 A.U.	1,000 A.U.
SALES				
Livestock Sales Minus Shipping And Marketing Costs	508.93	508.93	508.93	508.93
EXPENSES				
Livestock, at the Farm	321.72	321.72	321.72	321.72
Feed	117.00	117.00	117.00	117.00
Labor	8.95	6.14	5.12	4.35
Vet, Health	3.30	3.30	3.30	3.30
Depreciation	18.90	8.66	6.83	5.31
Death Loss	2.59	2.60	2.61	2.61
Interest on				
Equipment	7.30	3.40	2.66	2.09
Land, Cattle	12.94	12.94	12.94	12.94
Taxes on				
Equipment	7.39	3.40	2.66	2.09
Land, Cattle	6.47	6.47	6.47	6.47
Repairs, Fuel	11.08	5.11	3.99	3.13
TOTAL EXPENSE	517.73	490.74	485.30	481.01
Return to Management and/or Ownership	-8.80	18.19	23.63	27.92
Annual Return to Management and/or Ownership	-1,760.	10,915.	23,631.	55,843.
Annual Return to Management and/or Ownership as a Percentage of Total Investment Required	-4.72	20.95	34.61	51.75

represents gross sales minus shipping costs for 50 miles and marketing costs of $3.30 per head. The computer program employed allows flexibility in both marketing costs and shipping distances should changes in these values be desired for subsequent analyses.

Expenses

The expenses determined for the four sizes of open feedlots resulted from use of methodology, data, and assumptions set forth in Chapter III. A systematic listing of the component expenses and a summation of the components are listed in numerical form in Table IV-1 by lot size. The table will be the main source of quantitative descriptives for the analysis of expenses.

The four conventional or open lot feedlots exhibit economies of scale, a characteristic that has been generally accepted in feedlot operations in the past. The animal unit expenses diminished significantly as the size of the lots increased. The 100 A. U. open lot possessed animal unit expenses of $517.24 compared to $490.74, $485.30, and $481.01 for the 300 A. U., 500 A. U., and 1,000 A. U. lots, respectively. The differences stem from variations in the non-feed expenses derived from equipment and labor.

The variable non-feed expenses included depreciation, interest, taxes, repairs, fuel, and labor. They equal $53.71, $26.71, $21.26, and $16.97 for the 100, 300, 500, and 1,000-capacity sizes. For the basic feedlots considered in the study, an operator of a 100 A. U. feedlot could cut such expenses by 50.3 per cent if a 300 A. U. lot was utilized, 60.4 per cent if a 500 A. U. lot was operated, and 68.4

per cent if a 1,000 A. U. open lot was implemented using the assumptions of the study. The incremental non-feed expenses do not differ as significantly between the large sizes but substantial economies do exist. The variable non-feed animal unit expenses of the 300 A. U. open lot are 20.4 per cent and 36.5 per cent more than the comparable expenses for the 500-unit lot and 1,000-unit lot. The 500 A. U. lot with varying non-feed expenses or equipment and labor costs of $21.26 are 20.2 per cent more than the similar expenses of $16.97 for the largest lot considered.

The explanation of the differences evolved from the assumptions made for the hypothetical feedlot operations and actual differences in the animal unit investment requirements for the different sized operations. Assumptions that created differences were related to feed storage, labor requirements, and pollution control allowances.

The feed storage system partially explains the high costs of the 100 A. U. lot. For this lot alone, corn was hypothetically stored in an upright concrete silo which costs $2,800 more than a comparable bunker silo. As previously mentioned, chances of corn spoilage are much lower for the upright silo which offset the lower initial investment requirement of a small bunker silo. The decrease in equipment related expenses of the other lots derived from savings obtained from the use of larger equipment and facilities which themselves exhibit economies of scale.

Another expense which affects size is the charge for labor. Table IV-1 indicates labor charges equal $8.95, $6.14, $5.12, and

$4.35 for the respective lots going from the smallest to the largest. The small lot is 31.4 per cent more labor intensive than the 300 A. U. lot, 42.8 per cent more than the 500-unit open lot, and 51.4 per cent more labor intensive than the largest lot using labor expenses as a basis. Like equipment expenses, the average labor unit differences diminish when comparing the larger sizes. The 300 A. U. lot's animal unit labor expenses are 16.6 per cent more than the 500 A. U. lot and 29.2 per cent more than the large lot, also the large lot's animal unit labor expenses are 15.0 per cent less than the 500 A. U. lot's similar expense.

The decreasing average unit expenses depict the condition that the larger lots allow for more efficient uses of labor resources. The lower unit labor costs originate from possible lower requirements in feed distribution, waste treatment, and handling of cattle.

The other expenses considered were not assumed to be affected by the size of the lots. Although different sizes may be able to procure feeder cattle more economically, feed more efficiently, and possibly make more effective use of tax laws, the purpose of this study did not require such differences and also establishing a reliable quantification of such factors was beyond the scope of the work undertaken for this analysis.

Return to Management and/or Ownership

The four hypothetical farm open lot feedlots portrayed large differences in monetary reward to management and/or ownership with absolute values ranging from $8.80 loss per A. U. for the small lot to a $27.92 gain for the largest lot. Intermediate lots of the 300 and 500-unit size showed gains of $18.19 and $23.63 per animal unit.

The absolute value of the returns is largely affected by the gross margins within which the cattle feeder has to operate. The gross margin is independent of the size in this case and equals $187.21 ($508.93 minus $321.72) for all lots. The feed and non-feed expenses must be less than $187.21 if the hypothetical lots are to be profitable. The total feed and non-feed expenses are equal to the sum of all expenses except livestock expenses in Table IV-1.

The significant feature was the relative differences in the return to management and/or ownership amounts in considering sizes of open lots' economic feasibility. There were large differences calculated and they originate from the large differences in the expenses which vary with the size. For the study, the 100-unit feedlots $8.80 A. U. loss was $26.99 less than the next sizes positive return of $18.19. If cattle had been purchased in such a manner as to show zero return to the small lot, the 300 A. U. lot would have shown a $26.99 return per animal unit which is identical to the differences in expenses for the two lots. Similarly, the 500 and 1,000 A. U. lots returns per animal unit are $32.43 and $36.72 more than the small lot.

In summary, the size of open lot can have large effects on the differences between expenses incurred in operating a feedlot which affect the value of a gross margin a feedlot operator can profitably produce within. Still, marketing and purchasing of cattle which set the gross margin will set the actual return a cattle feeder can expect. In the open lots considered, a feeder would need the following margins in order to break even in his operations. For the 100 A. U. lot the critical margin value is about $196.01, the difference between livestock expenses and total expenses. Likewise, the critical gross margin values for the 300, 500, and 1,000-unit lots are $169.02, $163.58, and $159.29. These values could vary slightly because of taxes and interest on different valued feeder cattle.

ANALYSIS OF CONFINEMENT CATTLE FEEDING SYSTEMS

The analysis of confinement facilities was done on the same basis as the open lot facilities. Again only certain economic indicators were analyzed in evaluating the various sizes of confinement barns or facilities. They came under the general topics of sales, expenses, and returns to management and/or ownership.

Sales

As with the open lots, all confinement barns produced equal valued cattle calculated at $508.93 each. It is possible that the confinement cattle could have been valued higher than open lot fed cattle. It has been argued that confinement fed cattle have a better marketing appearance due to clean feedlot conditions which could cause them to sell better. Also, confinement fed cattle could shrink less during shipping because they are more used to close quarters and are more adjusted to human presence, which could lower animal stress during marketing period. However, such allowances were not considered in the study.

Expenses

The confinement facilities exhibited economies of scale with respect to expenses produced in operations. The expenses per animal unit decreased from $511.50 to $495.02 to $491.31 to $488.13 for the lots from 100-unit capacity to 300 to 500 to finally the low expense for the 1,000-unit capacity barn.

The differences are dependent upon the variations in costs of labor and equipment outlays for the alternative lots. These values equal $50.57 for the small facility, $34.08 for the 300-unit barn, $30.36 for the 500-unit barn, and $27.18 for the large lot and represent the sum of labor, depreciation, interest on equipment, taxes on equipment, repairs, and fuel for equipment. If the values of $50.57, $34.08, $30.36, and $27.18 are subtracted from the appropriate total expenses for the lots, a constant subsidiary expense of about $460.95 is derived for each lot. It was this amount of expenses that did not change when the size of the lot was changed.

Of the expenses that varied with size, those tied to equipment were largest and the sum of the four equipment related values were $45.45, $29.48, $26.52, and $23.85 for the lots from smallest to largest in size. The expenses were determined by subtracting labor expenses from the total variable expenses considered in the previous paragraph. These animal unit expenses diminish with size because the animal unit investment in storage equipment, feed handling equipment, and waste treatment diminishes with increased size of confinement operation.

Table IV-2: Operating Statements for Various Sizes of Confinement Facilities Per Animal Unit

Item	100 A.U.	300 A.U.	500 A.U.	1,000 A.U.
SALES				
Livestock Sales Minus Shipping And Marketing Costs	508.93	508.93	508.93	508.93
EXPENSES				
Livestock, at the Farm	321.72	321.72	321.72	321.72
Feed	111.15	111.15	111.15	111.15
Labor	5.12	4.60	3.84	3.33
Vet, Health	3.30	3.30	3.30	3.30
Depreciation	19.19	12.37	11.15	0.00
Death Loss	2.64	2.64	2.64	2.64
Interest on				
Equipment	7.50	4.89	4.39	3.96
Land, Cattle	12.81	12.81	12.81	12.81
Taxes on				
Equipment	7.50	4.89	4.39	3.96
Land, Cattle	6.41	6.41	6.41	6.41
Repairs, Fuel	11.25	7.33	6.59	5.94
TOTAL EXPENSE	508.59	492.11	488.39	485.21
Return to Management and/or Ownership	0.34	16.82	20.54	23.72
Annual Return to Management and/or Ownership	68.	10,093.	20,541.	47,442.
Annual Return to Management and/or Ownership as a Percentage of Total Investment Required	0.18	13.75	18.70	23.94

Labor expenses also diminish with size as shown in Table IV-2. The explanation of the decrease of labor expenses from $5.12 to $4.60 to $3.84 to $3.33 for the four confinement barns is, that labor is more readily substituted by technology as size increases.

Return to Management and/or Ownership

The absolute value of returns, profits, or revenues are determined by the assumptions made about the purchasing and marketing of cattle in the study completed for the report. The values of returns, whether positive or negative, were determined by the gross margin in the study which was $187.21 for all sizes of lot. At this gross margin, the four confinement facilities showed animal unit returns of -$2.57, $13.91, $17.62, and $20.80.

~~The relative~~ differences between the returns are significant when feeding 650 pound steers up to a weight of 1,050. Under this type of operation, the smallest lot returns $16.48 less to management and/or ownership per A. U. than the 300 A. U. barn, $20.19 less than the 500 A. U. barn, and $23.37 less than the 1,000 A. U. barn. These figures are identical to the amount expenses are cut by the increase in size of feedlots.

ECONOMIC COMPARISON OF THE ALTERNATIVE TYPES OF CATTLE FEEDLOT SYSTEMS

One of the basic objectives of the research considered in this document was to determine whether confinement feedlots are a feasible alternative to conventional open lots for South Dakota feeders. Some of the following findings will provide some knowledge on the feasibility of confinement feeding as an alternative.

Much of the information has been presented previously in the discussion of the separate sizes of open lots and confinement or environmental barns. Now, however, the alternative types of feedlots will be considered together by means of analysis--primarily of the expenses derived in the operation of the possible types. Sales, as has been cited, are constant for all lots, and since gross margins are also constant for all lots, revenues are a direct result of the level of expenses for each lot. The analysis will be divided by size of lots and expenses were the key economic indicators of feasibility.

<u>100-Animal-Unit Feedlots</u>

As the results in Table IV-3 indicate, a 100 A. U. confinement barn is more feasible to operate than a similar sized open lot. Although for the assumptions and conditions set in the study both show losses, the 100 A. U. confinement lot is \$6.23 less expensive per A. U. to operate than the open lot. If the gross margin were increased by \$8.80, the size of animal unit loss of open lot, the identical sized confinement barn would return \$6.23 per A. U. while the open lot would just break even on expenses and show no return to management and/or ownership.

The small confinement lot is more economical to operate for three reasons. First, as with all the other confinement-open lot alternatives, the confinement's feed costs are five per cent less because cattle feed efficiency is assumed to be five per cent better in confinement facilities. For the assumed feed costs and requirements it amounts to a $2.92 savings per A. U., which could fluctuate as feed prices and requirements change.

The second factor is the smaller labor costs incurred by the confinement barn and is a part of the non-feed costs in Table IV-3. A reference back to Tables IV-1 and IV-2 show that the open lot's labor expenses are $8.95 per A. U. compared to $5.12 for the environmental (ENVR) or confinement barn for a $3.83 savings per A. U. In actual time required, the environmental facility takes about 42.8 per cent less hours per head.

The final factor in causing the confinement lot to be more economical is also contained within the non-feed costs. It is a cost related to the meeting of environmental control standards which cause the open lot equipment related costs to be only slightly larger than the confinement costs. The open lot equipment related costs equal $44.76 while the confinement equipment costs equal $45.45. If small feedlot operators meet environmental standards they would be better off, economically, to use a confinement system which does not require a lagoon construction and waste dispersion equipment for sewage in the lagoon. The E.P.A. requirements produce substantial A. U. investment increases for small lots.

Regardless of profits, the large investment requirements may be a substantial deterant to operation of the small lot. The figures in Table IV-4 show that for $14,591 more a 300 A. U. open lot could be built instead of the most profitable of two 100 A. U. lots. For the conditions assumed this investment would also yield $5,457 per 300 head of cattle sold instead of a $257 loss per 100 head of cattle sold from the confinement barn. Assuming two lots of feeders are fed per year, an annual return of $10,914 dollars could be made instead of a $514 loss for a net annual gain of $11,428 dollars for investing an additional $14,591 in a larger lot.

300-Animal=Unit Feedlots

Further observation of Table IV-3 would indicate that the 300 A. U. open lot is more economical than the same sized environmental barn. The $7.20 advantage in non-feed costs of the open lot offsets the $2.92 feed cost advantage of the ENVR system to give the open lot a $4.28 advantage in return to management and/or ownership per animal unit.

The explanation for the open lot advantage was that the labor costs per A. U. become more uniform, $6.14-open and $4.60 ENVR and cannot, along with feed cost savings, offset the equipment related costs of depreciation, taxes, interest, repairs, and fuel. These costs are $20.57 per A. U. for the open lot and $29.48 per A. U. for the ENVR system.

500-Animal-Unit Feedlots

As with the 300 animal unit lots, and as can be observed with the 1,000 A. U. lots in Table IV-3, the comparible open lot facility shows an economic advantage over the 500 A. U. ENVR barn. The reasons are similar. The equipment and investment cost figures outweigh the

Table IV-3: Economic Calculations for Both Size and Type of Feedlot Structures Per Animal Unit

Item	100 A.U.		300 A.U.		500 A.U.		1,000 A.U.	
	Open	Envr	Open	Envr	Open	Envr	Open	Envr
Feeder Costs Minus Shipping	321.72	321.72	321.72	321.72	321.72	321.72	321.72	321.72
Feed Costs	117.00	111.15	117.00	111.15	117.00	111.15	117.00	111.15
Nonfeed Costs	79.01	75.72	52.02	59.24	46.58	55.52	42.29	52.34
Total Costs	517.73	508.59	490.74	492.11	485.30	488.39	481.01	485.21
Sales Minus Shipping and Marketing	508.93	508.93	508.93	508.93	508.93	508.93	508.93	508.93
Return to Management and/ or Ownership	-8.80	0.34	18.10	16.82	23.63	20.54	27.92	23.72
Total Investment Required	372.79	375.16	173.69	244.66	136.55	219.69	107.91	198.15

ENVR's advantages in labor requirements and feed efficiency. For the study's assumptions, the open lot showed a $6.01 monetary advantage per A. U. over the ENVR lot.

1,000-Animal-Unit Feedlots

The largest feed lots considered in the study did show economies of scale existing for both types. Still, the unit expenses were diminishing faster for the open lot than the ENVR barn and, therefore, the 1,000 A. U. open lot showed the highest advantage in return over the comparable confined system--$7.12 more return per animal unit for the open lot. Labor cost per A. U. near equality, $4.35-open and $3.33-ENVR (see Tables IV-1 and IV-2), and the small effect of E.P.A. compliance represent the basic reasons for the open lot advantages. However, both lots show large returns per animal unit of $27.92-open and $20.80-ENVR system for the conditions set by the researcher.

Summary

In comparing similar sizes of open and environmental feed lots, the open lots show an economic advantage. In the single case where economic advantage was shown by the confinement barn, sound business would tend to motivate operations at least to a 300 A. U. open lot.

It should be noted that for the two larger confinement facilities, it would have been more feasible to produce at a size smaller of open lot. For instance, the 300 A. U. open lot expenses were $490.74 per A. U. and investment totaled $52,107 (see Table IV-4) while the

Table IV-4: Economic Calculations for Both Size and Type of Feed Lot Structures for One Turnover

Item	100 A.U. Open	100 A.U. Envr	300 A.U. Open	300 A.U. Envr	500 A.U. Open	500 A.U. Envr	1,000 A.U. Open	1,000 A.U. Envr.
Feeder Cost Minus Shipping	32,172.	32,172.	96,516.	96,516.	160,860.	160,860.	321,719.	321,719.
Feed Costs	11,700.	11,115.	35,100.	33,345.	58,500.	55,575.	117,000.	111,150.
Nonfeed Costs	7,901.	7,572.	15,606.	17,772.	23,289.	27,759.	42,289.	52,339.
Total Costs	51,773.	50,859.	147,221.	157,632.	242,649.	244,194.	481,008.	485,208.
Sales Minus Shipping and Marketing	50,893.	50,893.	152,679.	152,679.	254,465.	254,465.	508,929.	508,929.
Return to Management and/ or Ownership	-880.	34.	5,457.	5,046.	11,816.	10,271.	27,921.	23,721.
Total Investment Required	37,279.	37,516.	52,107.	73,397.	68,275.	109,843.	107,910.	198,148.

500 A. U. ENVR barn expenses were $491.31 per A. U. and investments totaled $109,843.

Basically, lower investment and greater animal unit returns are experienced for the smaller 300 A. U. open lot in comparison to the ENVR facility. Analysis of similar 500-capacity open lot and 1,000-capacity ENVR lots shows the environmental A. U. returns and total investment are $20.80 per animal unit and $198,148, respectively, while the 500 A. U. open lot's animal unit returns are $23.63 and total investment required is only $68,275. Again, the smaller open lot is advantageous to the next larger confinement facility.

All the economic analysis presented are dependent upon the acceptability of the assumptions and conditions set for the feedlots and, therefore, variations in the feasibility of alternative operations are susceptible to change. Two assumptions which prominently affect the possibility of confinement feedlot implementation are feed efficiency and wage rate. For the previous investigation they were set at five percent, i.e. confinement fed cattle feed five percent more efficiently or economically, and the wage rate equaled $1.80. In the next chapter the effect of changing these two assumptions will be considered.

CHAPTER V

THE EFFECT OF ALTERATIONS OF WAGE RATES AND CONFINEMENT FEED EFFICIENCIES ON RELATIVE ECONOMIC ADVANTAGES OF OPEN AND CONFINEMENT FEED LOT OPERATIONS

INTRODUCTION

The initial results of the analysis of alternative types and sizes of feedlots described in Chapter IV rest upon a single set of assumptions. The practicality of standard assumptions on such items as feed prices, feeder prices, feed storage requirements, and sales for all lots was determined by the initial purposes and objectives of the study. That was to determine primarily if confinement systems are a competitive alternative to open feedlots for South Dakota farmers. Essentially, the feedlot size or type has little effect on many of the assumptions or expenses and revenues related to cattle feeding.

When considering the economics of sizes and types of feedlots, two assumptions in particular were considered likely to vary under different circumstances. Logic exists for the allowance of alternative values for wage rates and feed efficiency improvements. The alternative values for these two cattle feeding elements, when combined with the unchanged assumptions of the feedlot operations of Chapter III, will provide the material for analysis in Chapter V.

The wage rate a feeder considers appropriate will depend on how valuable a South Dakota feeder considers his time and his value of his labor would possibly change the acceptability of an open lot or environmental system. Many farmers would not pay themselves the average South Dakota wage rate of $1.80. Some with few or no opportunities for additional employment might accept less, and others with good alternatives might demand more. Therefore, alternative wage rates for feedlot operators were considered.

Also research has shown that feed efficiency improvement for cattle in confinement can exceed or fall short of five per cent as assumed in Chapter III and IV. Iowa Beef Processor's of Dakota City, Nebraska experienced feed efficiency improvement as high as 14 per cent for confinement fed cattle and costs per pound of gain were 42 per cent less for confinement cattle in one study period.[1] Iowa State University experiments at Newell, Iowa also showed a savings of as high as 15 per cent for feed costs in total confinement over an open lot group of cattle.[2] Feed cost savings and feed efficiencies have also been less than five per cent at these locations and at Morris, Minnesota research trials.[3] Therefore, other possible feed efficiency figures should be considered.

The computerized synthetic budget model which was developed made it possible to perform analysis of alternatives at a low cost and with an acceptable amount of additional work by the researcher.

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[1]Frankl and Masch, op. cit., p. 3.

[2]Self and Hoffman, op. cit., p. 12.

[3]Smith and others, op. cit., p. 11.

Also, many further iterations on other alternatives in assumptions are feasible but were considered unnecessary when considering the scope of the study.

This section of the research involved formulation of alternative assumptions for wage rates for all lots and feed efficiency improvements for confinement lots. Next, a method for analysis of the alternatives was devised and finally the actual investigation of the results was presented.

Procedure for Analysis

The alternatives for feedlot wage rates and feed efficiency improvements were limited to six each. One of the alternatives in each case was the same as the assumptions set in Chapter III and analyzed in Chapter IV. It should be stressed that the change in feed efficiency improvements affects only the feed costs of the environmental barns and not the feed costs of the open lots since it is used as the basis for the change and is constant for all open lots. The wage rate changes influence both sizes and types of lots' non-feed costs and, therefore, revenues.

The different wage rates considered were $1.70, $1.80, $1.90, $2.00, $2.25, and $2.50 per hour. The hourly labor expenses are then multiples of each wage rate, and a constant coefficient to allow for social security, retirement allowances, health and disability coverage, and inflation—1.421. (See page 38 for labor costs estimations.) The hour requirements for the lots are the same as those set in the initial assumptions.

The six alternative feed efficiency improvements were set at 2.5, 5, 7.5, 10, 12.5, and 15 per cent for the confinement lot operations. The various confinement feed costs would then equal one, minus the feed efficiency improvement, times the open lots' feed costs of $117.00 per animal unit. For example, at a 2.5 per cent improvement the confinement lot feed costs would be (1 - .025) x $117.00 or $114.08 per animal unit.

With the twelve alternatives in feed efficiency improvements and wage rates, along with two types and four different sizes of feedlots, a large number of distinctive results are possible. These amount to 24 different calculations for the open lots since feed efficiency changes did not affect the cardinal results of the operations and only the relative position in comparison to environmental barns. Distinctive results on confinement barns number 144 for a total 168 different alternatives for open lot and confinement feedlots.

Not all the results will appear in the text due to the large number of possibilities for analysis. However, all the results are listed in the appendix should further information be desired in general or in regard to statements that will follow in the text.

The documentary method used to discuss the effects of some of the alternatives involved the following procedure. First, the results were discussed within the appropriate sizes of feedlots. Then under the general heading of feedlot sizes, some of the alternative economic results and consequences were discussed with respect to open and confined feedlots.

PARTIAL ANALYSIS OF ALTERNATIVE WAGE RATES AND FEED EFFICIENCIES' EFFECT ON FEEDLOT ECONOMICS

The wage rate and feed efficiency changes' effect on the total feed and non-feed costs, return to management and/or ownership per animal unit and per year, and return on investment were the primary relationships considered in the following section. Although the analysis rests on the data in Appendix B, it should not be necessary to constantly refer to them during the discussions.

As was expected, the feedlot returns and expenses were highly sensitive to both wage rate and feed efficiency changes. Furthermore, there were large changes in the relative profitability of open lots and confined feeding facilities when these changes were considered.

100-Animal-Unit Feedlots

The 100-animal-unit lots were normally not profitable operations when the changes were made within the ranges considered. This is especially true when considering the 100-animal-unit open lots. Even with the wage rate at $1.70 the lot showed a loss of $8.31 per head, and when wage rates were set at $2.50 the losses climbed to $12.27 per A. U..

The 100-animal-unit confinement lots did show positive returns on 27 of the 36 possible wage rate-feed efficiency combinations. Unless wage rates below $2.00 per hour are considered, the environmental facility would have to promote cattle to fatten greater than five per cent more economically than open lots to show a positive return to the manager or owner. However, for the basic assumptions of the study, a wage rate at $1.70 per hour and feed efficiency improvement of 15 per cent, the lot showed an annual return on total investment of 6.5 per cent for $2,454 annual return. These are the results of the optimum conditions considered.

300-Animal-Unit Feedlots

For this size of lot all the facilities exhibited expenses within the value of the assumed gross margins. Thus positive returns were developed. In general, the open lots exhibited higher returns on investments, but the value of absolute costs, i.e. returns, were competitive between open lots and confinement feeding.

The consequences of the different open lot operating wage rates provided a decrease of over $1,600 in annual return when considering wage rate increases from $1.70 to $2.50. The rates yielded annual incomes of $11,119 and $9,487, respectively, for a 15 per cent decrease in annual return as a result of the 47 per cent increase in wages. The incremental effect of a 10 cent increase in wages were: (1) an approximate decrease of $200 in annual income, (2) four tenths of one per cent decrease of annual return on total investment, and (3) an increase of $.34 in A. U. non-feed costs. To further indicate the sensitivity of operations to the $.10 wage rate change, the $.34 fluctuation in labor expenses (non-feed costs) was 5.5 per cent of the original $6.14 labor expenses of basic 300-animal-unit lot in the previous chapter.

The confinement operation's additional changes to the wage rate, feed efficiency improvement percentages, provides 36 different profitable possibilities, and of these only some of the alternatives were considered. With the criteria of animal unit expenses and revenues, the operations of any 300 A. U. open lot were equaled by confinement feedlot operations at all levels of feed efficiency greater than or equal to 7.5 per cent except at 7.5 per cent feed efficiency and $2.25 and $2.50 wage rates.

However, no confinement systems developed as high a return on investment as comparable wage rate open lots until feed efficiency improvements reached 15 per cent. Near equality was attained at 12.5 per cent feed efficiency improvement.

The economic sensitivity of the confinement operations to changes in feed efficiencies was illustrated by the following facts. Each 2.5 per cent increase in feed efficiency caused a $2.93 ($117.00 x .025) decrease in feed costs and total costs per animal unit, a $1,746 increase in annual returns and a 2.4 per cent increase in annual return on investment for the same wage rate. The annual return increase of $1,746 represents 17.3 per cent of the $10,093 return produced by the original environmental barn described in Chapter IV.

The economic responses to wage rate changes for environmental barns was, like the open lots, dependent on the labor requirements and cost coefficients set in previous material. A $.10 increase in wage rates only increased animal unit labor charges $.26 as compared to $.34 for the 300 A. U. open lot since labor requirements are not as great for cattle fed inside. The $.26 changed annual income by about $250 for the 300 A. U. barns.

The $250 change in income from wage rate changes, when combined with the feed efficiency monetary change of $1,746 per 2.5 per cent increase in feed use by animals, yields an annual return net increase of $1,496. The approximate $1,500 increase for each $.10 increase of wages and 2.5 per cent increase of feed efficiency explains why the confinement facilities become competitive with open lots if feed efficiencies are increased while wages are increased. When wages are increased the only effect on open lots is to lower returns through increased expenses.

500-Animal-Unit Feedlots

The economic implications on 500-animal-unit open lots, when wage rates are changed, are diminished from those of the 300 A. U. lots. The labor requirements are lessened; therefore, the effect on animal unit figures were lessened. However, the multiple effect of more cattle did create larger changes in annual revenues. For the 500-capacity open lots, the $.10 wage rate increment did modify animal unit total and labor expenses by $.28. The change decreased annual returns by about $280 and varied annual return on investment by four tenths of one per cent. The $280 variation in annual return is 1.2 per cent of the annual return of the $1.80 wage rate feed lot, the $.28 change in labor costs is 5.5 per cent of the similar lots labor costs.

Under some of the alternatives considered, the open lots again were less profitable or more expensive than the confinement systems. At conditions less expensive than a $2.00 wage rate and a 7.5 per cent improvement in feed utilization, the confinement lots show greater production incentives of lower expenses, thus greater returns. However, per cent return on investment was not equated under any conditions considered.

The wage rate impact on animal unit expenses and revenues was less than those on smaller, previously mentioned confinement lots. The animal unit expenses were changed by about $.21 for the 500-capacity barn, only .1 of one per cent of the total feed and non-feed animal unit costs at $1.80-5 per cent wage rate-feed efficiency combination. That small percentage changed annual revenues about $210 and return on investment by .2 of a per cent. Economies of scale lessened the impact of the modifications in wage rates.

The response to feed efficiency changes in confinement operations were the same as in previous analysis on a per animal basis. Each 2.5 per cent change reduced animal unit feed costs, aggregate costs, and revenues by $2.93. Yet, the annual revenue was inflated by about $2,900 because of the additional cattle marketed each year. This is 14 per cent of the annual return for the fundamental 500-capacity feedlot—the type analyzed in Chapter IV.

Since economies of scale with regard to labor requirements exist, the combined effect of increased feed efficiency and wage rates yields a higher annual unit increase in revenues than previous confinement fed cattle. Hence, the confinement facilities of 500-animal-units were more sensitive to feed efficiency changes in relation to wage changes than smaller confinement operations.

1,000-Animal-Unit Feedlots

The fundamental 1,000-capacity open lot considered in the previous chapter showed the highest return on investment and animal unit return of any system. The former is still true regardless of the wage rate, although exceptions exist for the latter. A $.10 wage rate variance did result in a $.24 animal unit change in expenses which modified annual return by about $480. The $.24 is only .15 of one per cent of animal unit costs for the basic 1,000 capacity open lot and the $480 is only .85 of one per cent of the annual return. At these conditions farmers could pay labor higher rates for feedlot work than they could in smaller lots and not have a large effect on unit costs.

The $.10 wage rate change influenced A. U. labor costs and, therefore, expenses were about $.19 for the confinement barn, which changed annual revenues by about $380. The amounts are 5.7, .1, and .9 per cent of respective categories. The sensitivity is diminished because of declining labor requirements per animal unit of production.

Again certain combinations of wage rates and feed efficiencies promoted confinement feeding to a level of competitiveness with open lots on the basis of expenses. The total non-feed and feed costs are equal or less for cattle fed inside when feed efficiency improvement equals 10 per cent or more. This is the highest feed efficiency requirement needed so far to equate the operating expenses between open lot and confinement feeding. Open lots have either increased or maintained their advantage as size increases and the latter fact is the reason for the high feed use improvement needed to bring about equality.

Concluding Remarks

The wage rate caused decreasing amounts of $.49, $.34, $.28, and $.24 influence on labor, non-feed, and total expenses for the four sizes of open lots of 100, 300, 500, and 1,000-animal-unit capacity--a condition attributable to the economy of labor requirements with increased sizes. Also the decreased impact caused annual returns to vary 5.6, 1.9, 1.2, and .9 per cent and indicated that small lots which face smaller profit margins could more rapidly change from productive to non-productive operations as labor rates fluctuated than could the larger lots operating under the same margins.

For confinement the $.10 wage rate change varied labor, non-feed, and total expenses by $.28, $.26, $.22, and $.19 since they are not as labor intensive as open lots. The annual revenues were changed $56, $216, $220, and $380 which are 82.3, 2.1, 1.1, and 0.8 per cent of the base lots' annual return to management and/or ownership.

Alternatives were experienced at all levels of production where confinement produced as great as returns as open lots, but at the 1,000 unit level no alternatives matched the open lots' return on investment. At higher wage rates the confinement facilities were more competitive because of their lower wage requirements.

If the reader who would like exact values for various alternatives he may refer to Appendix B. Also, all the previous figures and comments resulted from the Appendix tables or the base feedlot operations which are discussed in the previous chapter. Some of the base feedlot values appear in the Appendix tables. The open lots with $1.80 wage rate and the confinement figures at this wage rate and 5 per cent feed efficiency are base conditions.

CHAPTER VI

ANALYSIS OF FEEDER CATTLE MARKETING BY SOUTH DAKOTA BEEF CATTLE PRODUCERS

INTRODUCTION

When a cattle feeder is maintaining an operation at full capacity he usually purchases feeder cattle more than once a year, while feedstuffs need only be harvested or bought once a year or during one season. If a feeder buys his cattle in an area where feeder cattle are available in large numbers only once a year, he experiences difficulties in maintaining full capacity operations at a profitable level of production throughout the year.

It was hypothesized that South Dakota's feeder cattle may be available unevenly during the year and that large numbers are sold during the fall marketing season. If so, the hypothesis could help explain the undeveloped potential for cattle feeding in the state. If not so, there would be an added incentive to produce more slaughter cattle in South Dakota as far as feeder cattle supplies are concerned.

To test the hypothesis it then became necessary to collect and analyze data on feeder cattle marketing for the state. Since historical data were not available in time series, accepted statistical methods of linear regression or curve fitting could not be used to determine trends of feeder cattle marketing in the state. The lack of feeder cattle marketing data arises from characteristics of the marketing environment. A farmer has three alternative means of marketing available to him. He can sell privately, at local livestock auctions, or at public stockyards. The first two alternatives can not or do not lend themselves easily to complete record keeping and reporting of marketings. The third alternative, public stockyards, represents the smallest means of feeder cattle marketings for South Dakota. Should public stockyard data be used, the fact that the only South Dakota public stockyard is in Sioux Falls may add a location bias to marketing implications for the state. Therefore, an independent procedure was developed and data were collected which elucidated the characteristics of feeder cattle marketing in the state.

PROCEDURE OF DATA COLLECTION

It was decided, given the amount of resources available for the research, the best alternative for acquiring the data desired on cattle operations in South Dakota would be a mail survey of farmers. The survey completed met the requirements set forth by John B. Lansing and James N. Morgan. Their requirements are that a survey could produce some important benefits, could be completed at a reasonable cost, and had some chance of being financed.[1]

The survey sample consisted of randomly selected farmers in nine counties throughout the state, one county from each crop reporting

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[1] John B. Lansing and James N. Morgan, Economic Survey Methods (Ann Arbor: University of Michigan Press, 1971), p. 11.

district in the state.[2] Most of the counties were centrally located within each district, however, three exceptions existed. The exceptions were: Corson in District I, Stanley in District 4, and Bennett in District 7; originated from the method of obtaining the mailing addresses of farmers in the counties. The addresses were procured from the county directories. In Districts 1 and 4, the directories were published only for the counties of Corson and Stanley, respectively. In District 7 no directories were available and a mailing list was procured from the Bennett county agent, Gary Nies. Bennett County was chosen because the other counties in District 7 consisted mainly of Indian reservations or national forests.

The survey questionnaires were mailed to every eighth addressee in the respective county directories, or 12.5 per cent of the sample county's farmers and ranchers. The sample size was selected on the basis of a projected cold-list[3] return of between 15 and 20 per cent. The size of the sample which actually returned questionnaires was projected to be about 2 per cent of the sample county population. A questionnaire, cover letter, and return envelope were mailed to 733 rural residents out of a total number of about 5,800 farm residents in the nine counties.

The questionnaire, along with a copy of the cover letter, appear in Appendix C. The questionnaire was devised to include only feeder

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[2]South Dakota Crop and Livestock Reporting Service, South Dakota Agriculture-1972, May 1973, preface.

[3]A cold-list is a mailing list that has never been tested before.

cattle and cattle on feed as of November 1, 1973. Cattle on feed for slaughter were included in the questionnaire to make classification of the farmers' inventories more complete and to allow a current analysis of farmers' feeding operations in South Dakota. Farmers were requested to exclude dairy cattle for milking purposes, beef cows and replacements, bulls and bull replacements, and calves raised for breeding purposes. They were requested to include steers of dairy breeding and crosses.

The main elements of the questionnaire were feeder and fat cattle inventories, sources, and intended distributions. The three elements were, furthermore, categorized by types of cattle; calves 0 to 400 pounds, 400 to 750 pound feeders, feeders weighing more than 750 pounds, cattle on feed for slaughter below 750 pounds and over 750 pounds. Cattle sources were subdivided into cattle raised and bought while intended distributions were classified by predicted selling period, selling type, and method of feeding for fat cattle as the appendix figure shows.

INTERPRETATION OF SURVEY DATA

Four weeks after the questionnaires were mailed, the data from the returned questionnaires were compiled and analyzed. There were 152 acceptable returns for a return of 21 per cent. No follow-up on the survey was undertaken. The survey responses provided data on 13,571 head of feeder cattle and cattle on feed for slaughter.

For a pictorial depiction of the counties and crop reporting districts surveyed, refer to Figure VI-1 on page 78. The figure also shows seasonal feeder cattle marketing for the sampled crop reporting districts and counties of the state.

Survey Results--State

The 13,571 head of livestock were classified under the three categories of the survey: present inventory, source, and intended distribution.

The present inventories were composed mainly of feeder cattle as would be predicted in a state that is a feeder cattle exporter. The total inventories included 10,931 feeder cattle or 80.5 per cent of the total inventory. Of the feeder cattle, 74 per cent (actual number, 8,095) were calves 400 pounds or less. Of the total inventory, 59.6 per cent were calves. Feeders 400 to 750 pounds numbered 2,646, which was 24.2 per cent of the feeder cattle on hand and 19.5 per cent of the total inventory. A very small amount of heavy feeders were recorded, 1.8 per cent of feeders weighed over 750 pounds. The figure supports the trend of feeder raisers or speculators not holding a great number of heavy feeders. The fat cattle surveyed included only 2,640 head, 19.5 per cent of the total inventory. There were about as many light cattle on feed (45.1 per cent) as heavy cattle over 750 pounds on feed (54.9 per cent).

Most of the bovines sampled had been raised by the survey respondents. Farmers surveyed raised 74.9 per cent of the total inventory. Farmers in South Dakota purchase few feeder cattle, as the November survey showed 87.6 per cent of the feeder cattle on the sampled farms were raised. However, only 23.3 per cent of the fat cattle were raised.

The most important category of the survey was the listing of intended cattle distributions by the cattle owners. There were also six sub-divisions of the intended distribution category: 1973 sale of calves, 1973 sale of yearlings, 1974 winter or spring sale of 600 to 750 pound feeders, 1974 sale of yearlings, fat cattle fed on own farm, and fat cattle custom fed.

The winter or spring sale of 600 to 750 pound feeders was included to measure the trend of backgrounded cattle being marketed. Cattle backgrounding involves weaned calves kept through most, if not all, of the winter months that gain between 1.5 to 2.0 pounds per day and are sold at a weight of between 600 to 750 pounds. Backgrounding, compared to wintering, includes higher gains, winter or spring sale versus fall sale and backgrounding generally prepares cattle for feedlots instead of summer pasturing.[4]

The marketing operations of cattle producers could be analyzed with the samples acquired. For the state, the survey respondents stated they intended to sell 10,132 feeder cattle. Of the number, 53.9 per cent were to be sold in the 1974 winter or spring. The remaining 46.1 per cent would be sold in the fall, with 18.4 per cent sold as calves in the fall of 1973, 7.5 per cent were marketed as yearlings in 1973, and the remaining 19.9 per cent would be sold as yearlings in the

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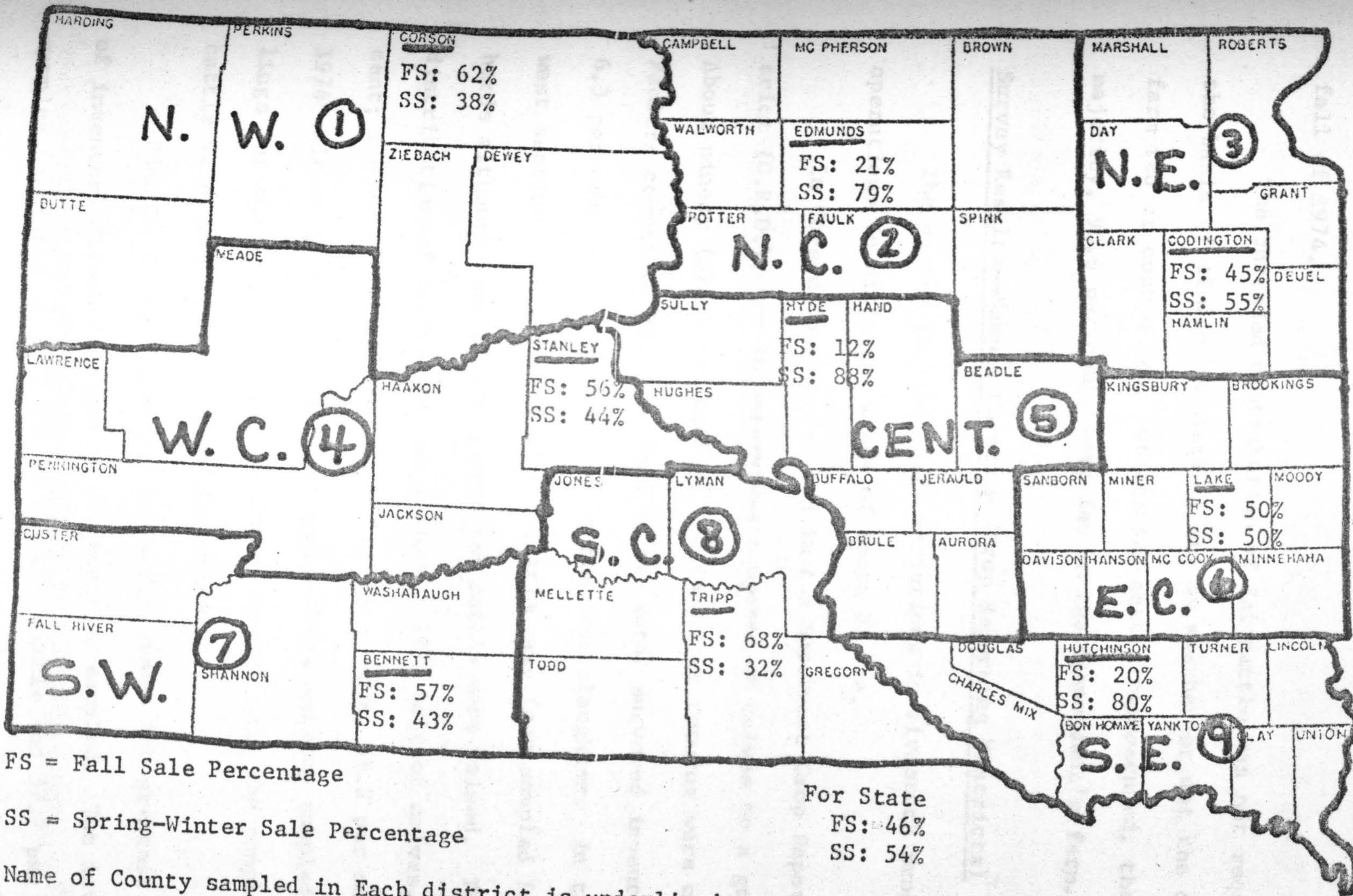
[4]Statement by Dr. Wallace Aanderud, South Dakota State University Extension Economist, personal interview, Brookings, South Dakota, October 2, 1973.



FS = Fall Sale Percentage

SS = Spring-Winter Sale Percentage

Name of County sampled in Each district is underlined

For State
FS: 46%
SS: 54%

Figure VI-1: Seasonal Marketings for Feeder Cattle in the Sampled Crop Reporting Districts and Counties of South Dakota fall of 1974.

The intended distribution of fat cattle was not requested on the basis of time of marketing, but on whether or not the cattle were farm fed or custom fed. Of the fat cattle represented, the vast majority, 90.6 per cent, were fed on the respondent's farm.

Survey Results--Sample Counties (Crop Reporting Districts)

The survey implied large variations in livestock producer's operations in different areas of South Dakota.

In Corson County, located in the Northwest Crop Reporting District (C.R.D.), the inventory was composed of calves to a great extent. About ninety (87.8) per cent of the inventory returns were calves. Feeders comprised 93.7 per cent of the total surveyed inventory and 6.3 per cent of the cattle were on feed for slaughter. In this northwest section 93.4 per cent of the cattle came from sampled farmers' cow herds although none of the sample fat cattle were raised. The intended distribution of feeders was as follows: 1973 sale of calves, 30.4 per cent; winter or spring sale at 600 to 750 pounds, 38.2 per cent; and 1974 sale of yearlings, 31.4 per cent. There were no sampled yearlings for the 1973 fall sale in Corson County. All the sampled fat cattle were farm fed as opposed to custom fed.

Edmunds County livestock producers showed the greatest amount of inventory diversification of the counties sampled. The inventory samples consisted of 62.3 per cent feeder cattle and 37.7 per cent fat cattle. Most (97.6 per cent) of the cattle on feed as of the November

1, 1973 survey in Edmonds County were below 750 pounds. The predominant source of the sample cattle was again the respondents farm cow herds. However, there was a strong trend to purchase feedlot cattle as shown by the fact that 90.4 per cent of the cattle on feed were purchased. The intended feeder cattle distribution of the sample in the North Central C.R.D. showed 79.2 per cent of the feeders would be sold in the 1974 winter or spring. Again, all the sampled fat cattle were being fed on the sampled farms.

Feeders accounted for 98.6 per cent of the sample cattle inventory in the northeast South Dakota area of Codington County, and 65 per cent were calves. Of the inventory, 61.2 per cent were bought. Intended feeder cattle marketings portrayed the following relative weights: 1973 sale of calves, 13.2 per cent; 1973 sale of yearlings, 18.5 per cent; winter or spring sale, 54.6 per cent; and 1974 sale of yearlings, 13.4 per cent.

The Stanley County sample inventory included 83.3 per cent feeder cattle, 52.3 per cent calves, and 30.9 per cent feeders between 400 and 750 pounds. In the county, most of the cattle, (63.9 per cent), were raised by the current sampled owner. The comparative importance of intended feeder cattle distribution was: 1973 fall sale of calves, 12.6 per cent; 1973 fall sale of yearlings, 21.8 per cent; 1974 winter or spring sale, 44.4 per cent; and 1974 fall sale of yearlings, 21.1 per cent. Cattle on feed accounted for 16.7 per cent of the sampled inventory and all of them were bought and custom fed.

The sample inventory of Hyde County (Central C.R.D.) was entirely feeder cattle of two classes. Calves made up 79.9 per cent and feeders 400 pounds to 750 pounds formed the remaining 20.1 per cent. Of these feeders, 88.3 per cent were projected for 1974 spring and winter sale, the remainder being sold as calves in 1973.

In the East Central C.R.D. sample 71.3 per cent of the inventory were cattle on feed. Lake County inventory showed the highest percentage of fat cattle feeding of the counties surveyed. The feeders were distributed between all three categories; 19.3 per cent calves, 4.2 per cent 400 t0 750 pounders, and 5.2 per cent heavy feeders. A large proportion (75.4 per cent) of cattle were purchased by the sampled farmers in the district. Of the 360 feeders inventory sampled, 49.7 per cent were again destined for winter or spring sale at 600 to 750 pounds; 8.0 per cent, 1973 fall sale of calves; 24.4 per cent, 1973 fall sale of yearlings; and 11.9 per cent, fall sale of yearlings in 1974. The predominant trend of feeding on the farm was evident in Lake County, as all of the relevant cattle were fed by this method.

Bennett County results indicated 99.4 per cent of the pertinent cattle in possession were feeder cattle and 70.8 per cent were calves. About 93 per cent of the feeders were raised by the current owners. The distributions of feeder cattle were projected as follows: 1973 fall sale of calves, 20.0 per cent; 1974 winter and spring sale, 42.5 per cent; and 1974 fall sale of yearlings, 37.5 per cent. No cattle were being custom fed in the Southwest C.R.D. sample.

In Tripp County 59.6 per cent of the cattle were calves, 13.8

per cent were feeders 400 to 750 pounds, and 5.2 per cent were heavy feeders over 750 pounds, or in summation 78.6 per cent of the cattle sampled were feeders. Also, 21.4 per cent of the cattle were fat cattle and mainly cattle over 750 pounds. Current owner raised cattle represented 82.1 per cent of the sample. In the South Central region, 32.1 per cent of the farmers were undecided as to their feeder cattle distribution. This was shown by their having no definite distribution projection. The remaining feeder cattle distributions were: 36.0 per cent, 1973 fall sale of calves; 15.0 per cent, 1973 fall sale of yearlings; 31.8 per cent, 1974 winter or spring sale; and 17.0 per cent, 1974 fall sale of yearlings.

In the ninth county surveyed, Hutchinson in the Southeast C.R.D., 75.1 per cent of the inventories were feeder cattle. Of the feeder cattle, calves consisted of 85.4 per cent. Cattle on feed made up 24.9 per cent of the relative inventory. In Hutchinson, 92.3 per cent of the cattle were raised by the current proprietor. The intended distributions of the feeder cattle were: 1973 fall sale of calves, 17.9 per cent; 1973 fall sale of yearlings, 1.9 per cent; and 1974 winter or spring sale, 80.0 per cent.

The sample counties (i.e. districts) showed a high variability of operations on farms in the state. Many of these were logical and/or predictable and they provided for informative interpretation and analysis.

IMPLICATIONS OF SURVEY

The survey yielded a total number of 10,132 cattle to be sold as feeders. Of these, 53.9 per cent were to be sold in the winter or spring at 600 to 750 pounds, and 46.1 per cent were to be sold in the fall either as calves or yearlings. This, along with previous research, implies that under present conditions a feeder could purchase feeder cattle in substantial numbers and purchase them at more than one time in the year. Assuming both the spring-winter sale period and the fall sale period run about three months each, the feeder can secure cattle during two three-month periods of the year. This should be a flexible enough market for farmers or operators of feedlots who, on the average, market two lots of cattle a year and do not continually sell and purchase cattle for their feeding operations.

It has been contended by some that cattle feeding may not be most farmers "bag". The thought is that commercial feedlots may represent the coming means of development for feeding in South Dakota.[5] This farmer survey would support such a contention. In the sample, almost 80 per cent of the cattle inventories were to leave the farm as feeders to be fed, presumably, by someone else. Some of the feeders were bought by fellow farmers to be sold as heavy feeders or fat cattle, but farmers surveyed, at the most, bought only an amount equal to 17 per cent of the feeders sold. The remaining 83 per cent of the

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[5]Ron Ross, "South Dakota. . .Long on Feed and Cattle; Short on Experience," The Farmer, North Dakota-South Dakota edition, November 3, 1973, p. 10.

feeders sold, then, were either fed by commercial feedlots or fed out-of-state. Assuming 50 per cent of the feeders leave the state, and farmers buy and feed out 17 per cent, then South Dakota commercial feedlots may buy 33 per cent of the feeders sold by South Dakota farmers. In other words, not only will commercial feedlots possibly provide developments for livestock feeding in the future, they could be the principal feeders in the state now feeding two-thirds of the South Dakota feeders sold and fed in South Dakota.

Some rather predictable results are also indicated by the survey. First, most of the feeding of fat cattle by South Dakota farmers is done in the eastern and southern sections of the state where feed grains are more prevalent. Secondly, South Dakota farmers do very little buying of feeder cattle to re-sell as heavier feeder cattle as shown by the fact that 87 per cent of the feeder cattle of this sample were raised by present owners. Finally, farmers have very few of their own cattle custom fed as 91 per cent of the cattle on feed were being fed on the farmers own farms.

CHAPTER VII

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

SUMMARY

South Dakota, as a whole is an exporter of two important inputs for feeding cattle, feed grains and feeder cattle. If these two exports could be combined to produce more slaughter cattle within the state, it would mean a substantial increase in income for the state. The general stimulant for this study was to help provide some coordinated knowledge to stimulate more cattle feeding within the state, or at least help explain why the seemingly added potential for feeding cattle exists, and whether it might be exploited.

The study has emphasized that there are additional factors involved in feeding cattle other than the amounts of feed and feeder cattle in an area. Two of these additional factors provided the specific research topics in which new knowledge and information could be advantageous to South Dakota. The two factors are the feedlot systems or environment and the seasonality of feeder cattle supply for the state.

Study of the first factor, feedlot system or environment, focussed on a particular problem of determining whether total confinement feedlots can provide an economically feasible alternative for farm feedlots. Such systems could help farmers maintain steady gains through the winter months and periods of intense summer heat.

Consequently, the problem of what size, if any, would confinement feedlots be feasible also required investigation.

To determine the feasibility of confinement operations, basic requirements and assumptions were made on running both open lot and confinement cattle feedlots for the four sizes of farm feedlots. Then a synthetic computerized budget model was created to test the validity of confinement feeding alternatives. This process provided flexibility which was utilized to test the impact of various wage rates and feed efficiency improvements on open lots and confinement lots and, hence, comparative advantages and disadvantages of various types and sizes of feedlots.

Related to the seasonal availability of feeder cattle, the second specific problem was to determine the degree to which types of feeder cattle marketing practices exist within the state. It was hypothesized that a season marketing of feeder cattle could partially explain the lack of growth of cattle feeding in the state or provide another incentive for the business.

To investigate marketing practices followed by feeder cattle producers in the state, a mail survey of farmers in the state was initiated. Statements produced on South Dakota marketing of feeder cattle were a result of the returns and data obtained from the survey.

CONCLUSIONS

With regard to feedlot types and sizes, and the basic assumptions of Chapter III it was concluded that open lot operations generally have an advantage over environmental barns. For the 100-animal-unit size, the confinement facility did produce economic advantages for the sole exception to the general statement. The criteria for this conclusion were feedlot expenses, return to management and/or ownership, and return on investment.

In Chapter V, alternative assumptions on wage rate and feed efficiency improvements were analyzed within the budget model. The results of the optional assumptions showed the initial findings were sensitive to the variables. The impact of the six alternative wage rates and feed efficiency improvements was stressed by the fact that, under combinations of the assumptions with higher wage rates or greater feeding efficiency the confinement lots frequently did become competitive, based on the expenses and returns of the lots.

The conclusion arrived at on marketing of feeder cattle in South Dakota was that, feeder cattle producers do distribute feeder cattle annually during a large number of months at significant numbers. Of the feeder cattle surveyed, 54 per cent were to be marketed in the early spring and late winter and 46 per cent in the fall. Therefore, the seasonal availability of feeder cattle should not be a major deterent to feeding cattle in South Dakota.

IMPLICATIONS

Implications of the Research

The completed research has found the considered feedlot operations consistent with a characteristic thought to exist for such activities, specifically, that larger feedlots are more efficient. More efficient means that average total costs of production decrease as the size of the feedlot is increased. The condition is referred to as economies of scale or increasing returns to scale.[1] The considered synthetic feedlots all exhibited the condition.

From a theoretical point of view, the previous condition implies that a feedlot operator should expand production. Furthermore, the operator should at least expand production until average total costs are minimized. Meeting this requirement will put the producer at the minimum level of production for his normal short-run profit range,[2] if the price of beef cattle is above his average total cost. If the price is below his average total cost, he can produce for a short period of time but will not be covering fixed costs and he should consider terminating production if a price increase is not foreseen in the near future.

Decreasing average total costs of the research conducted, suggests that cattle feeding by farmers with lots of 1,000-animal-units or head capacity is not the most efficient means of producing slaughter cattle in South Dakota. It also suggests that, although farmers may experience per head profits, larger lots would yield larger per head profits and in periods of losses, larger lots would experience smaller per head losses.

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[1]Joan Robinson, The Economics of Imperfect Competition, 2nd edition (New York: St. Martin's, 1969), pp. 333-335.

[2]Richard A. Bilas, Microeconomic Theory: A Graphical Analysis, (New York: McGraw-Hill, 1967), pp. 160-165.

Furthermore, the analysis suggests that production cost conditions provide a stimulant for the development of commercial feedlots in South Dakota or explain why some new or revamped feedlots in South Dakota are of a size greater than 1,000-animal units.

The survey conducted by the author indicates that commercial, not farm feedlots, are the prominent cattle feeders in the state. Decreasing costs provide some further logic to support the implication made earlier in the text that, two-thirds of the cattle fed in South Dakota may be fed in commercial lots.

Yet, feeding cattle in small farm lots is still an acceptable practice if certain conditions exist, such as: (1) excess feedstuffs are in storage or available at the farm, (2) a farmer raises his own feeder cattle, (3) cattle feeding is experiencing a general profitable period, and (4) seasonal periods of decreased labor requirements for other enterprise exist which might allow cattle feeding during the winter months.

Implications for Further Research

The synthetic budget method developed to research the problems of the study is flexible and, therefore, applicable to other problems. First, budget iterations can be made to determine the sensitivity to such items as feed costs, feeder costs, depreciation, and investment requirements to determine profitability levels for the various sizes and types of lots. Second, the possibility of adapting this budget to an extension program to assist cattle feeders in determining costs and revenues would be a possibility for more study.

Some study needs to be initiated to evaluate the secondary benefits of feeding cattle in confinement. The possible benefits include better working conditions, better cattle appearance for marketing, and more predictable rate of gain. An economic procedure to evaluate the significance of the secondary benefits could provide more justification for confinement feeding in South Dakota if they prove to be substantial.

Also, it is possible that a feeder could use a mixture of open lots and environmental barns for an efficient feeding system, especially if light feeder cattle are put on feed. The cattle could be fed up to about 800 pounds and put in confinement for finishing. Such a system might create management problems in the allocation of cattle to lots, marketing of the fat cattle, and purchasing the proper weight and type of feeder cattle at the proper time.

Finally, biological and physical sciences should initiate more research in determining feasible uses of animal waste. About the only practical use now is a fertilizer substitute. One possible use is as a roughage replacement to feed to cattle. Some research has been accomplished in this area but few of the results or procedures are applicable to feedlot situations in South Dakota.

BIBLIOGRAPHY

BIBLIOGRAPHY

Aanderud, Wallace. Personal interview. Brookings, South Dakota, October 2, 1973.

Bilas, Richard A. Microeconomic Theory: A Graphical Analysis. New York: McGraw-Hill, 1967.

Briggs, Hilton M. Modern Breeds of Livestock. New York: Macmillan, 1969.

David, Milton L., Richard E. Seltzer, and William D. Eickhoff. Economic Analysis of Proposed Effluent Guidelines--Feedlots Industry. Prepared for the Environmental Protection Agency. Washington, August, 1973.

Doane Agriculture Service, Inc. Doane's Agricultural Research. Reference Vol. St. Louis, 1972.

Frankl, Gerald, and W. R. Masch. IBP's Cattle Feeding Research Progress Report No. 2. Dakota City, Nebraska: Iowa Beef Processor's, Inc., June, 1973.

Gaarder, Raymond O. South Dakota's Beef Industry. Bulletin 385 (Revised). Brookings: South Dakota State University Press, December, 1971.

Hasbargen, Paul R. Controlling Feed Costs in Cattle Feeding. pamphlet. St. Paul: University of Minnesota Press.

______. Farmer Costs and Returns in Cattle Feeding and Comparisons with Research Results. pamphlet. St. Paul: University of Minnesota Press.

Heier, Valentine M. "Optimum Movement of Feeder Calves and Feed Grains Within South Dakota With Implications for Slaughter Plant Locations." Unpublished Master's thesis, South Dakota State University, 1968.

Hoglund, C. R. The Economic Appraisal of Concrete Tower, Sealed Storage and Bunker Silo Systems. East Lansing: Michigan State University Press. 1970.

Johnson, Darwin K. "An Economic Analysis of Selected Beef Enterprise Systems for Southeast South Dakota." Unpublished Master's thesis, South Dakota State University, 1973.

Lansing, John B., and James N. Morgan. Economic Survey Methods. Ann Arbor: University of Michigan Press, 1971.

Neuman, Alvin L., and Roscoe R. Snapp. Beef Cattle. New York: Wiley, 1969.

Olson, Robert E. "Trends in and Opportunities for Cattle Feeding in South Dakota," Economics Newsletter. No. 15. Brookings: South Dakota State University Press, February 22, 1973.

Robinson, Joan. The Economics of Imperfect Competition. 2nd Edition, New York: St. Martin's, 1967.

Ross, Ron. "South Dakota...Long on Feed and Cattle; Short on Experience," The Farmer. North Dakota-South Dakota Edition, November 3, 1973, 10-13.

Self, H. L. "Environmental Implications in Economy of Gain in Feedlot Cattle," Journal of Animal Science. XXXV, No. 1 (July, 1972), 147-152.

________, and M. P. Hoffman. "Feeding Yearling Steers in Confinement," Annual Progress Report--1973, Allee Experimental Farm. OEF 73-31. Ames: Iowa State University Press, June, 1973, 10-15.

Smith, R. E., and others. A Comparison of Five Housing Systems for Feedlot Cattle. Research Report B-170. St. Paul: University of Minnesota Press, 1972.

South Dakota Crop and Livestock Reporting Service. South Dakota Agriculture-1973. Sioux Falls, South Dakota: May, 1973.

South Dakota Public Utilities Commission. South Dakota Class B Motor Carriers Tariff Bulletin No. 48. Pierre, February, 1974.

South Dakota State University. South Dakota Beef Cattle Handbook. Brookings, South Dakota: Cooperative Extension Service, December, 1971.

Stein, Herbert, William J. Fellner, and Gary L. Seevers. "Annual Report of the Council of Economic Advisers," Economic Report of the President. Transmitted to the Congress February, 1974. Washington: Government Printing Office, 1974.

U. S. Department of Agriculture. Feasibility of a Physical Distribution System Model for Evaluating Improvements in the Cattle and Fresh Beef Industry. ARS 52-36. Chicago: A. T. Kearner and Company, Inc., November, 1969.

Webster, A. J. F. "Direct Effects of Cold Weather on the Energetic Efficiency of Beef Production in Different Regions of Canada," Canadian Journal of Animal Science, L, No. 1 (December, 1970) 562-567.

Neuman, Alvin L., and Roscoe R. Snapp. Beef Cattle. New York: Wiley, 1969.

Olson, Robert E. "Trends in and Opportunities for Cattle Feeding in South Dakota," Economics Newsletter. No. 15. Brookings: South Dakota State University Press, February 22, 1973.

Robinson, Joan. The Economics of Imperfect Competition. 2nd Edition, New York: St. Martin's, 1967.

Ross, Ron. "South Dakota...Long on Feed and Cattle; Short on Experience," The Farmer. North Dakota-South Dakota Edition, November 3, 1973, 10-13.

Self, H. L. "Environmental Implications in Economy of Gain in Feedlot Cattle," Journal of Animal Science. XXXV, No. 1 (July, 1972), 147-152.

________, and M. P. Hoffman. "Feeding Yearling Steers in Confinement," Annual Progress Report--1973, Allee Experimental Farm. OEF 73-31. Ames: Iowa State University Press, June, 1973, 10-15.

Smith, R. E., and others. A Comparison of Five Housing Systems for Feedlot Cattle. Research Report B-170. St. Paul: University of Minnesota Press, 1972.

South Dakota Crop and Livestock Reporting Service. South Dakota Agriculture-1973. Sioux Falls, South Dakota: May, 1973.

South Dakota Public Utilities Commission. South Dakota Class B Motor Carriers Tarriff Bulletin No. 48. Pierre, February, 1974.

South Dakota State University. South Dakota Beef Cattle Handbook. Brookings, South Dakota: Cooperative Extension Service, December, 1971.

Stein, Herbert, William J. Fellner, and Gary L. Seevers. "Annual Report of the Council of Economic Advisers," Economic Report of the President. Transmitted to the Congress February, 1974. Washington: Government Printing Office, 1974.

U. S. Department of Agriculture. Feasibility of a Physical Distribution System Model for Evaluating Improvements in the Cattle and Fresh Beef Industry. ARS 52-36. Chicago: A. T. Kearner and Company, Inc., November, 1969.

Webster, A. J. F. "Direct Effects of Cold Weather on the Energetic Efficiency of Beef Production in Different Regions of Canada," Canadian Journal of Animal Science, L, No. 1 (December, 1970) 562-567.

Zmolek, William, and others. An Evaluation of Iowa Beef Cattle Systems. Ames: Iowa State University Press, November, 1973.

APPENDIX A

COMPUTERIZED SYNTHETIC BUDGET PROGRAM

```
C DANF7107          71072638,'OLSON',MSGLEVEL=1
      DIMENSION X(2,4,16),ICAP(4)
C
    1 FORMAT('1',24X,I4,1X,'ANIMAL UNIT FEEDLOT')
    5 FORMAT('0',32X,'OPEN LOT')
    6 FORMAT('0',31X,'CONFINEMENT')
    7 FORMAT(' ',F12.2,F12.3,F12.2,2F12.0,F12.1)
    8 FORMAT('0',2X,'*RETURN ON TOTAL INVESTMENT PER YEAR')
    9 FORMAT(' ',' ')
   10 FORMAT('1')
   11 FORMAT('0','FEED EFFICIENCY IMPROVEMENT=',F6.3)
   12 FORMAT('0','INITIAL WAGE RATE=',F5.2)
   13 FORMAT('0','CORN PRICE=',F5.2)
   14 FORMAT('0','FEEDER CATTLE PRICE=',F6.2)
   15 FORMAT('0','EQUIPMENT COST RATIO=',F5.2)
C
C     INITIAL ASSUMPTIONS
C
      CORN=2.00
      DER=1
      FE=.050
      FEEDP=CORN/2.00
      DATA ICAP/100,300,500,1000/
      NT=1
      PRFR=.4925
      WR=1.80
      CALL DF7107( WR,DER,FE,FEEDP,ICAP,PRFR,X,NT,KW)
C
C
      STOP
      END
```

****

```
C DANF7107          71072638,'OLSON',MSGLEVEL=1
      DIMENSION X(2,4,16),ICAP(4)
C
    1 FORMAT('1',24X,I4,1X,'ANIMAL UNIT FEEDLOT')
    5 FORMAT('C',32X,'OPEN LOT')
    6 FORMAT('0',31X,'CONFINEMENT')
    7 FORMAT(' ',F12.2,F12.3,F12.2,2F12.C,F12.1)
    8 FORMAT('0',2X,'*RETURN ON TOTAL INVESTMENT PER YEAR')
    9 FORMAT(' ',' ')
   10 FORMAT('1')
   11 FORMAT('0','FEED EFFICIENCY=',F6.3)
   12 FORMAT('0','INITIAL WAGE RATE=',F5.2)
   13 FORMAT('C','CORN PRICE=',F5.2)
   14 FORMAT('C','FEEDER CATTLE PRICE=',F6.2)
   15 FORMAT('0','EQUIPMENT COST RATIO=',F5.2)
C
C     INITIAL ASSUMPTIONS
C
      CORN=2.00
      DER=1
      FE=.05
      FEEDP=CORN/2.00
      DATA ICAP/100,300,500,1000/
      NT=1
      WR=1.80
      AWR=WR
      KW=3
      DO 101 L=1,6
      FE=L*.025
      DO 101 I=1,4
      WRITE(12,1)ICAP(I)
      WRITE(12,9)
      WRITE(12,11)FE
      AWR=WR-.10
      WRITE(12,12)AWR
      AWR=AWR-.10
      AWRX=AWR
      CP=FEEDP*CORN
      WRITE(12,13)CP
      PF=PRFR*1E2
      WRITE(12,14)PF
      WRITE(12,15)DER
      DO 101 J=1,2
      AWR=AWRX
      DO 101 K=1,6
      DAWR=.10
      IF(K.GT.4)DAWR=.25
      AWR=AWR+DAWR
      CALL DF7107(AWR,DER,FE,FEEDP,ICAP,PRFR,X,NT,KW)
      IF(J*K.EQ.1)WRITE(12,9)
      IF(J*K.EQ.1)CALL HD7107
      IF(J*K.EQ.1)WRITE(12,5)
      IF((J.EQ.2).AND.(K.EQ.1))WRITE(12,6)
      XJ=X(J,I,15)*.5
      F=FE
      IF(J.EQ.1)F=0.0
      WRITE(12,7)AWR,F ,X(J,I,14),XJ,X(J,I,15),X(J,I,16)
      IF (J*K.EQ.12)WRITE(12,9)
      IF (J*K.EQ.12)WRITE(12,8)
  101 CONTINUE
```

```
      SUBROUTINE HD7107
    2 FORMAT(' ','----------------------------------------------------
     1---------------------')
    3 FORMAT(' ',8X,'WAGE',8X,'FEED',5X,'RETURN TO MANAGEMENT AND OWNERS
     1HIP',3X,'PER CENT')
    4 FORMAT(' ',8X,'RATE',5X,'EFFICIENCY',3X,'PER A.U.',3X,
     1'PER FEEDLOT',2X,'PER YEAR',6X,'ROI*')
   11 FORMAT(' ',29X,'------------------------------------')
      WRITE(12,2)
      WRITE(12,3)
      WRITE(12,11)
      WRITE(12,4)
      WRITE(12,2)
      RETURN
      END
```

****

```
      SUBROUTINE DF7107(AWR,DER,FE,FEEDP,ICAP,PRFR,X,NT,KW)
C
      DIMENSION A(20),S(80)
      DIMENSION IX(4),IY(8),JY(8)
      DIMENSION X(2,4,16),Y(2,7,8)
      DIMENSION SALES(2,4),C(2,4,11)
      DIMENSION PMWG(4),              ICAP(4),HRSH(8),SLI(4)
      DIMENSION TERA(2,4),EQUIP(2,4),TVST(2,4)
C
    1  FORMAT(20A1)
    2 FORMAT('1')
    5 FORMAT(' ',5X,'TABLE',1X,'IV','-',I3,'.',1X,61A1)
    8 FORMAT('+',80X,40A1)
    9 FORMAT(80A1)
   10 FORMAT(' ',80A1)
   11 FORMAT(20A1)
   12 FORMAT(' ',20A1)
   13 FORMAT(' ',20A1,4F10.2)
   14 FORMAT(' ',20A1,8F9.2)
   23 FORMAT(' ',20A1,4F10.0)
   24 FORMAT(' ',20A1,8F9.0)
C
      DO 90 K=1,2
      DO 90 I=1,4
      EQUIP(K,I)=0
      TVST(K,I)=0
      SALES(K,I)=0
      DO 89 L=1,11
   89 C(K,I,L)=0
      DO 90 J=1,16
   90 X(K,I,J)=0
      DO 91 J=1,8
      DO 91 K=1,2
      DO 91 I=1,7
   91 Y(K,I,J)=0
C
C     SALES
C
      ASCW=1050
      DIST=50
      SPSC=.49
      TRRT=.001555+.0000178 8*DIST
      MKTC=3.00
      CM=ASCW*TRRT+MKTC
      DO 95 K=1,2
      DO 95 I=1,4
   95 SALES(K,I)=ASCW*SPSC-CM
C
C     C MATRIX (K)  1- OPEN LOT 2- CONFINEMENT
C     (I) 1-100 HEAD 2-300 3-500 4-1000
C
C
C
C     1- FEEDER COST
C
      AFRW=650
      DIST=50
      TRRT=.001555+.00001788*DIST
      DO 110 K=1,2
```

```
      DO 110 I=1,4
  110 C(K,I,1)=AFRW*(PRFR+TRRT)
C
C     2- FEED
C
      CORN=2.00*FEEDP
      SIL=15.00*FEEDP
      SUP=180.00*FEEDP
      DO 112 I=1,4
      C(1,I,2)=CORN*42+SIL*1+SUP*.1
  112 C(2,I,2)=(1.0-FE)*C(1,I,2)
C
C     3- LABOR
C
      DATA HRSH/3.5,2.4,2.,1.7,2.,1.8,1.5,1.3/
      SS=1.07
      RA=1.15
      HC=1.05
      FIF=1.10
      VC=3.3
      DO 140 K=1,2
      DO 140 I=1,4
      XX=HRSH(I)
      IF(K.EQ.2)XX=HRSH(I+4)
      C(K,I,3)=XX*AWR*SS*RA*HC*FIF
C
C     4- VETERINARY
C
  140 C(K,I,4)=VC
C
C     5- DEPRECIATION
C
      BUNK=100
      CFEN=1.40
      CSTB=7.50
      CSTW=7.50
      EFEN=165
      FENC=505
      GATE=40
      PRLD=300
      WIND=150
      WTRS=150
      DATA SLI/7850.,9400.,10200.,16750./
      DATA PMWG/2500.,5025.,6025.,11050./
      DO 350 I=1,4
      SIZE=ICAP(I)
      DO 350 K=1,2
      TERA(K,I)=.0115
      IF(K.EQ.2)TERA(K,I)=.0006
      TERA(K,I)=TERA(K,I)*SIZE*PRLD
      GO TO(301,302,303,304),I
  301 C(K,I,5)=.05*(8980+11000)+.085*1250
      EQUIP(K,I)=8980+11000+1250
      GO TO 305
```

```
302 C(K,I,5)=.05*(10500+15600)+.C85*1250
    ECLIP(K,I)=105C0+15600+125C
    GC TC 305
303 C(K,I,5)=.05*(15460+176CC)+.C85*25CO
    ECUIF(K,I)=15460+17600+2500
    GC TC 305
304 C(K,I,5)=.05*(2525C+23CCC)+.C85*25CC
    ECUIP(K,I)=25250+23CC0+2500
305 CCNTINUE
    IF(K-1)321,321,323
321 CKI5    =.05*((SIZE/1CO)*(WIND*CSTW+BUNK*CSTB+GATE+WTRS+FENC*CFEN))
   1+EFEN*CFEN*(1+(SIZE/1CCO))+.C5*SLI(I)
    ECUIF(K,I)=EQUIP(K,I)+CKI5*2C
    C(K,I,5)=CKI5+C(K,I,5)
    GC TC 35C
323 CQ=168+(SIZE/100)*136C0+PMWG(I)
    C(K,I,5)=.05*CQ+C(K,I,5)
    ECUIP(K,I)=EQUIP(K,I)+CQ
350 C(K,I,5)=C(K,I,5)/ICAP(I)
    DC 351 K=1,2
    DC 351 I=1,4
    ECUIP(K,I)=DER*EQUIP(K,I)
351 C(K,I,5)=C(K,I,5)*DER

    RI=.08
    RI=RI*.25
    RL=RI*2
    RR=.03
    DLPC=.01
    DC 399 I=1,4
    SIZE=ICAP(I)
    DC 399 K=1,2

    6-DEATH LCSS
    C(K,I,6) =DLPC*(C(K,I,1)-.5*C(K,I,2)-.5*C(K,I,3))

    7-8 INTEREST CN ECUPMENT ANC LAND
    C(K,I,7)=(EQUIP(K,I)*RI)/ICAP(I)
    C(K,I,8)=((RL*TERA(K,I))/ICAP(I))+PRFR*AFRW*RL

    9-10 TAXES ON LANC AND EQUIPMENT

    C(K,I,9)=(ECUIP(K,I)*.C2)/ICAP(I)
    C(K,I,10)=((TERA(K,I)*.02)/ICAP(I))+PRFR*AFRW*.02




    11 - REPAIRS
    C(K,I,11)=(RR*ECUIP(K,I))/ICAP(I)

    TCTAL INVESTMENT
399 TVST(K,I)=EQUIP(K,I)+TERA(K,I)

    ASSIGN X MATRIX

    DC 502 I=1,4
    DC 5C2 K=1,2
    X(K,I,1)=SALES(K,I)
```

```
      CC 501 J=1,11
  501 X(K,I,J+1)=C(K,I,J)
      CC 503 J=1,12
      XK=X(K,I,J)
      KX=XK*1E2
      X(K,I,J)=KX*.01
  503 IF(XK-X(K,I,J).GE..CC5)X(K,I,J)=X(K,I,J)+.01
      CC 504 J=2,12
  504 X(K,I,13)=X(K,I,13)+X(K,I,J)
      X(K,I,14)=X(K,I,1)-X(K,I,13)
      X(K,I,15)=X(K,I,14)*ICAP(I)*2
      X(K,I,16)=X(K,I,15)/TVST(K,I)
  502 X(K,I,16)=X(K,I,16)*1C0
C
C     ASSIGN Y MATRIX
C
      CO 510 L=1,8
      K=1
      IF((L/2)*2.EQ.L) K=2
      I=(L+1)/2
      Y(1,1,L)=X(K,I,2)
      Y(1,2,L)=X(K,I,3)
      Y(1,3,L)=X(K,I,13)-X(K,I,2)-X(K,I,3)
      Y(1,4,L)=Y(1,1,L)+Y(1,2,L)+Y(1,3,L)
      Y(1,5,L)=X(K,I,1)
      Y(1,6,L)=X(K,I,14)
  510 Y(1,7,L)=TVST(K,I)/ICAP(I)
      CC 545 K=1,8
      M=(K+1)/2
      CC 545 J=1,7
  545 Y(2,J,K)=Y(1,J,K)*ICAP(M)
C
      IF(KW.EC.3)CC TO 99
      REWINC 10
      IF(KW.EC.1)GO TC 98
C
C     WRITE CPERATING STATEMENTS
C
      CC 840 L=1,2
      WRITE(12,2)
      READ(10,9)S
      WRITE(12,5)NT,(S(I),I=1,43)
      CC 801 J=1,11
      REAC(10,9)S
  801 WRITE(12,10)S
      K=1
      REAC(10,1,END=99)A
      WRITE(12,13)A,(X(L,J,K),J=1,4)
      K=K+1
      CC 803 J=1,4
      REAC(10,1,END=99)A
  803 WRITE(12,12)A
      CC 805 I=1,15
      IF(I.EC.14)GO TO 806
      REAC(10,1,END=99)A
      IF((I.EC.7).CR.(I.EC.10))GC TO 804
```

```
      WRITE(12,13)A,(X(L,J,K),J=1,4)
      K=K+1
      GC TC 805
  804 WRITE(12,12)A
      GC TC 805
  806 REAC(10,9)S
      WRITE(12,10)S
  805 CCNTINUE
      CC 810 I=1,15
      REAC(10,1,ENC=99)A
      IF((I.EC.4).OR.(I.EQ.8))GO TO 808
      IF(I.EC.15)GO TO 8C8
      WRITE(12,12)A
      GO TC 810
  808 CONTINUE
      IF(K.EC.15)GO TO 8C9
      WRITE(12,13)A,(X(L,J,K),J=1,4)
      GC TC 812
  809 WRITE(12,23)A,(X(L,J,K),J=1,4)
  812 CCNTINUE
      K=K+1
  810 CCNTINUE
      REAC(10,9)S
      WRITE(12,10)S
      NT=NT+1
  840 CONTINUE
   98 CCNTINUE
      IF(KW.EC.2)GO TO 99
C
C     WRITE ECCNCMIC CALCULATICNS
C
      CC 890 L=1,2
      WRITE(12,2)
      REAC(10,9)S
      WRITE(12,5)NT,(S(I),I=1,61)
      REAC(10,9)S
      WRITE(12,8)(S(I),I=1,40)
      REAC(10,9)S
      WRITE(12,10)S
      REAC(10,9)S
      WRITE(12,8)(S(I),I=1,40)
      CO 850 I=1,9
      REAC(10,9)S
      WRITE(12,10)S
      REAC(10,9)S
  850 WRITE(12,8)(S(J),J=1,40)
      K=1
      CC 860 I=1,12
      REAC(10,1,ENC=99)A
      IF((I.EC.8).OR.(I.EQ.9))GO TO 856
      IF((I.EC.5).OR.(I.EC.6))GO TO 856
      IF(I.EC.11)GC TC 856
      IF(L-2)851,852,852
  851 WRITE(12,14)A,(Y(L,K,J),J=1,8)
      GC TC 855
  852 CCNTINUE
      WRITE(12,24)A,(Y(L,K,J),J=1,8)
  855 CCNTINUE
      K=K+1
      REAC(10,9)S
```

```
      WRITE(12,10)S
      GC TC 86C
  856 WRITE(12,12)A
  860 CONTINUE
      READ(10,9)S
      WRITE(12,10)S
      READ(10,9)S
      WRITE(12,8)(S(I),I=1,40)
      NT=NT+1
  890 CCNTINUE
   99 CCNTINUE
      RETURN
      END
/*
//GC.SYSIN CC *
CPERATING STATEMENTS FOR VARIOUS SIZES OF
                    OPENLCT FEECING FACILITIES PER ANIMAL UNIT


-------------------------------------------------------------------
       ITEM           10C A.U.   30C A.U.   5CO A.U.   1CCO A.U.
-------------------------------------------------------------------

 SALES
    LIVESTCCK SALES
     MINUS SHIPPING
     ANC MARKETING
     CCSTS

 EXPENSES

    LIVESTCCK, AT-
     THE-FARM
    FEEC
    LABCR
    VET,HEALTH
    CEPRECIATICN
    CEATH LCSS
    INTEREST ON-
     EGUIPMENT
     LANC,CATTLE
    TAXES CN-
     EGUIPMENT
     LANC,CATTLE
    REPAIRS,FUEL
                          ----------------------------------------
 TCTAL EXPENSE

    RETURN TC MANAGE-
    MENT AND/CR
    CWNERSHIP

    ANNUAL RETURN TO
    MANAGEMENT AND/
    CR CWNERSHIP

    ANNUAL RETURN TO
    MANAGEMENT AND/
    CR CWNERSHIP AS
```

A PERCENTAGE OF
TOTAL INVESTMENT
REQUIRED

OPERATING STATEMENTS FOR VARIOUS SIZES OF
CONFINEMENT FACILITIES PER ANIMAL UNIT

ITEM	100 A.U.	300 A.U.	500 A.U.	1000 A.U.
SALES				
LIVESTOCK SALES MINUS SHIPPING AND MARKETING COSTS				
EXPENSES				
LIVESTOCK, AT-THE-FARM				
FEED				
LABOR				
VET, HEALTH				
DEPRECIATION				
DEATH LOSS				
INTEREST ON-				
EQUIPMENT				
LAND, CATTLE				
TAXES ON-				
EQUIPMENT				
LAND, CATTLE				
REPAIRS, FUEL				
TOTAL EXPENSE				
RETURN TO MANAGEMENT AND/OR OWNERSHIP				
ANNUAL RETURN TO MANAGEMENT AND/OR OWNERSHIP				
ANNUAL RETURN TO MANAGEMENT AND/OR OWNERSHIP AS A PERCENTAGE OF TOTAL INVESTMENT REQUIRED				

ECONOMIC CALCULATIONS FOR BOTH SIZE AND TYPE OF FEED LOT STRU
CTURES
PER ANIMAL UNIT

ITEM	100 A.U.		300 A.U.		500 A.U.		1000 A.U.	
	OPEN	ENVR	OPEN	ENVR	OPEN	ENVR	OPEN	ENVR
FEEDER COST								
MINUS								
SHIPPING								
FEED COSTS								
NONFEED COSTS								
TOTAL COSTS								
SALES MINUS SHIPPING AND MARKETING								
RETURN TO MANAGEMENT AND OWNERSHIP								
TOTAL INVEST-MENT REQUIRED								

ECONOMIC CALCULATIONS FOR BOTH SIZE AND TYPE OF FEED LOT STRUCTURES
PER FEED LOT FACILITY

ITEM	100 A.U.		300 A.U.		500 A.U.		1000 A.U.	
	OPEN	ENVR	OPEN	ENVR	OPEN	ENVR	OPEN	ENVR
FEEDER COST								
MINUS								
SHIPPING								

```
FEED COSTS

NONFEED COSTS

TOTAL COSTS

SALES MINUS
 SHIPPING AND
 MARKETING

RETURN TO
 MANAGEMENT AND
 OWNERSHIP

TOTAL INVEST-
 MENT REQUIRED

------------------------------------------------------------------------------------------------
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/*
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APPENDIX B

IMPACT OF ALTERNATIVE ASSUMPTIONS ON FEEDLOTS

Table B-1: Economic Effects of Alternative Wage Rates and Feed Efficiency Improvements on 100-Animal-Unit Open Lot and Confinement Feedlot Facilities

Wage Rate ($/hr)	Feed Efficiency Improvement[1] (Per Cent)	Total Feed and Non-Feed Costs (Per A.U.)	Return to Management and/or Ownership		Return on Investment[2] (Per Cent)
			Per A.U.	Per Year	
		OPEN LOT			
1.70	0.0	195.52	-8.31	-1,662	-4.5
1.80	0.0	196.01	-8.80	-1,760	-4.7
1.90	0.0	196.50	-9.29	-1,858	-5.0
2.00	0.0	197.00	-9.79	-1,958	-5.3
2.25	0.0	198.24	-11.03	-2,206	-5.9
2.50	0.0	199.48	-12.27	-2,454	-6.6
		CONFINEMENT			
1.70	2.5	189.49	-2.28	-456	-1.2
1.80	2.5	189.78	-2.57	-514	-1.4
1.90	2.5	190.06	-2.85	-570	-1.5
2.00	2.5	190.34	-3.13	-626	-1.7
2.25	2.5	191.05	-3.84	-768	-2.0
2.50	2.5	191.76	-4.55	-910	-2.4
1.70	5.0	186.58	0.63	126	0.3
1.80	5.0	186.87	0.34	68	0.2
1.90	5.0	187.14	0.07	14	0.0
2.00	5.0	187.42	-0.21	-42	-0.1
2.25	5.0	188.14	-0.93	-186	-0.5
2.50	5.0	188.85	-1.64	-328	-0.9
1.70	7.5	183.67	3.54	708	1.9
1.80	7.5	183.96	3.25	650	1.7
1.90	7.5	184.24	2.97	594	1.6
2.00	7.5	184.52	2.69	538	1.4
2.25	7.5	185.23	1.98	396	1.1
2.50	7.5	185.94	1.27	254	0.7
1.70	10.0	180.76	6.45	1,290	3.4
1.80	10.0	181.05	6.16	1,232	3.3
1.90	10.0	181.32	5.89	1,178	3.1
2.00	10.0	181.60	5.61	1,122	3.0
2.25	10.0	182.32	4.89	978	2.6
2.50	10.0	183.03	4.18	836	2.2

Table B-1 (continued)

Wage Rate ($/hr)	Feed Efficiency Improvement[1] (Per Cent)	Total Feed and Non-Feed Costs (Per A.U.)	Return to Management and/or Ownership Per A.U.	Return to Management and/or Ownership Per Year	Return on Investment[2] (Per Cent)
		CONFINEMENT			
1.70	12.5	177.85	9.36	1,872	5.0
1.80	12.5	178.14	9.07	1,814	4.8
1.90	12.5	178.42	8.79	1,758	4.7
2.00	12.5	178.70	8.51	1,702	4.5
2.25	12.5	179.41	7.80	1,560	4.2
2.50	12.5	180.12	7.09	1,418	3.8
1.70	15.0	174.94	12.27	2,454	6.5
1.80	15.0	175.22	11.99	2,398	6.4
1.90	15.0	175.50	11.71	2,342	6.2
2.00	15.0	175.78	11.43	2,286	6.1
2.25	15.0	176.50	10.71	2,142	5.7
2.50	15.0	177.20	10.01	2,002	5.3

[1]Per cent feed efficiency improvement of confinement using the conventional open lot as the base for the improvement.

[2]Annual return divided by total investment required.

Table B-2: Economic Effects of Alternative Wage Rates and Feed Efficiency Improvements on 300-Animal-Unit Open Lot and Confinement Feedlot Facilities

Wage Rate ($/hr)	Feed Efficiency Improvement[1] (Per Cent)	Total Feed and Non-Feed Costs (Per A.U.)	Return to Management and/or Ownership		Return on Investment[2] (Per Cent)
			Per A.U.	Per Year	
		OPEN LOT			
1.70	0.0	168.68	18.53	11,119	21.3
1.80	0.0	169.02	18.19	10,915	20.9
1.90	0.0	169.36	17.85	10,711	20.6
2.00	0.0	169.70	17.51	10,507	20.2
2.25	0.0	170.54	16.67	10,003	19.2
2.50	0.0	171.40	15.81	9,487	18.2
		CONFINEMENT			
1.70	2.5	173.06	14.15	8,491	11.6
1.80	2.5	173.30	13.91	8,347	11.4
1.90	2.5	173.56	13.65	8,191	11.2
2.00	2.5	173.82	13.39	8,035	10.9
2.25	2.5	174.46	12.75	7,651	10.4
2.50	2.5	175.09	12.12	7,273	9.9
1.70	5.0	170.14	17.07	10,243	14.0
1.80	5.0	170.39	16.82	10,093	13.8
1.90	5.0	170.65	16.56	9,937	13.5
2.00	5.0	170.91	16.30	9,781	13.3
2.25	5.0	171.54	15.67	9,403	12.8
2.50	5.0	172.18	15.03	9,019	12.3
1.70	7.5	167.23	19.98	11,989	16.3
1.80	7.5	167.48	19.73	11,839	16.1
1.90	7.5	167.74	19.47	11,683	15.9
2.00	7.5	168.00	19.21	11,527	15.7
2.25	7.5	168.64	18.57	11,143	15.2
2.50	7.5	169.27	17.94	10,765	14.7
1.70	10.0	164.32	22.89	13,735	18.7
1.80	10.0	164.57	22.64	13,585	18.5
1.90	10.0	164.83	22.38	13,429	18.3
2.00	10.0	165.09	22.12	13,273	18.1
2.25	10.0	165.72	21.49	12,895	17.6
2.50	10.0	166.36	20.85	12,511	17.0

Table B-2 (continued)

Wage Rate ($/hr)	Feed Efficiency Improvement[1] (Per Cent)	Total Feed and Non-Feed Costs (Per A.U.)	Return to Management and/or Ownership Per A.U.	Per Year	Return on Investment[2] (Per Cent)
		CONFINEMENT			
1.70	12.5	161.41	25.80	15,481	21.1
1.80	12.5	161.66	25.55	15,331	20.9
1.90	12.5	161.92	25.29	15,175	20.7
2.00	12.5	162.18	25.03	15,019	20.5
2.25	12.5	162.82	24.39	14,635	19.9
2.50	12.5	163.45	23.76	14,257	19.4
1.70	15.0	158.50	28.71	17,227	23.5
1.80	15.0	158.75	28.46	17,077	23.2
1.90	15.0	159.01	28.20	16,921	23.1
2.00	15.0	159.26	27.95	16,771	22.8
2.25	15.0	159.90	27.31	16,387	22.3
2.50	15.0	160.54	26.67	16,003	21.8

[1]Per cent feed efficiency improvement of confinement using the conventional open lot as the base for the improvement.

[2]Annual return divided by total investment required.

Table B-3: Economic Effects of Alternative Wage Rates and Feed Efficiency Improvements on 500-Animal-Unit Open Lot and Confinement Feedlot Facilities

Wage Rate ($/hr)	Feed Efficiency Improvement[1] (Per Cent)	Total Feed and Non-Feed Costs (Per A.U.)	Return to Management and/or Ownership Per A.U.	Return to Management and/or Ownership Per Year	Return on Investment[2] (Per Cent)
		OPEN LOT			
1.70	0.0	163.29	23.92	23,921	35.0
1.80	0.0	163.58	23.63	23,631	34.6
1.90	0.0	163.86	23.35	23,351	34.2
2.00	0.0	164.13	23.08	23,081	33.8
2.25	0.0	164.85	22.36	21,361	32.8
2.50	0.0	165.56	21.65	21,651	31.7
		CONFINEMENT			
1.70	2.5	169.37	17.84	17,841	16.2
1.80	2.5	169.59	17.62	17,621	16.0
1.90	2.5	169.80	17.41	17,411	15.9
2.00	2.5	170.01	17.20	17,201	15.7
2.25	2.5	170.54	16.67	16,671	15.2
2.50	2.5	171.07	16.14	16,141	14.7
1.70	5.0	166.45	20.76	20,761	18.9
1.80	5.0	166.67	20.54	20,541	18.7
1.90	5.0	166.88	20.33	20,311	18.5
2.00	5.0	167.09	20.12	20,121	18.3
2.25	5.0	168.15	19.58	19,581	17.8
2.50	5.0	168.15	19.06	19,061	17.4
1.70	7.5	163.55	23.66	23,661	21.5
1.80	7.5	163.77	23.44	23,441	21.3
1.90	7.5	163.98	23.23	23,231	21.1
2.00	7.5	164.18	23.03	23,031	21.0
2.25	7.5	164.72	22.49	22,491	20.5
2.50	7.5	165.25	21.96	21,961	20.0
1.70	10.0	160.63	26.58	26,581	24.2
1.80	10.0	160.85	26.36	26,361	24.0
1.90	10.0	161.06	26.15	26,151	23.8
2.00	10.0	161.27	25.94	25,941	23.6
2.25	10.0	161.81	25.40	25,401	23.1
2.50	10.0	162.33	24.88	24,881	22.7

Table B-3 (continued)

Wage Rate ($/hr)	Feed Efficiency Improvement[1] (Per Cent)	Total Feed and Non-Feed Cost (Per A.U.)	Return to Management and/or Ownership Per A.U.	Return to Management and/or Ownership Per Year	Return on Investment[2] (Per Cent)
		CONFINEMENT			
1.70	12.5	157.73	29.48	29,481	26.8
1.80	12.5	157.95	29.26	29,261	26.6
1.90	12.5	158.16	29.05	29,051	26.4
2.00	12.5	158.36	28.85	28,851	26.3
2.25	12.5	158.90	28.31	28,311	25.8
2.50	12.5	159.43	27.78	27,781	25.3
1.70	15.0	154.81	32.40	32,401	29.5
1.80	15.0	155.03	32.18	32,181	29.3
1.90	15.0	155.24	31.97	31,971	29.1
2.00	15.0	155.45	31.76	31,761	28.9
2.25	15.0	155.99	31.22	31,221	28.4
2.50	15.0	156.61	30.70	30,701	28.0

[1]Per cent feed efficiency improvement of confinement using the conventional open lot as the base for the improvement.

[2]Annual return divided by total investment required.

Table B-4: Economic Effects of Alternative Wage Rates and Feed Efficiency Improvements on 1,000-Animal-Unit Open Lot and Confinement Feedlot Facilities

Wage Rate ($/hr)	Feed Efficiency Improvement[1] (Per Cent)	Total Feed and Non-Feed Costs (Per A.U.)	Return to Management and/or Ownership Per A.U.	Return to Management and/or Ownership Per Year	Return on Investment[2] (Per Cent)
		OPEN LOT			
1.70	0.0	159.05	28.16	56,323	52.2
1.80	0.0	159.29	27.92	55,843	51.7
1.90	0.0	159.53	27.68	55,363	51.3
2.00	0.0	159.77	27.44	54,883	50.9
2.25	0.0	160.37	26.84	53,683	49.7
2.50	0.0	160.97	26.24	52,483	48.6
		CONFINEMENT			
1.70	2.5	166.22	20.99	41,982	21.2
1.80	2.5	166.41	20.80	41,602	21.0
1.90	2.5	166.59	20.62	41,242	20.8
2.00	2.5	166.78	20.43	40,862	20.6
2.25	2.5	167.42	19.97	39,942	20.2
2.50	2.5	167.69	19.52	39,042	19.7
1.70	5.0	163.31	23.90	47,802	24.1
1.80	5.0	163.49	23.72	47,442	23.9
1.90	5.0	163.67	23.54	47,082	23.8
2.00	5.0	163.86	23.35	46,702	23.6
2.25	5.0	164.32	22.89	45,782	23.1
2.50	5.0	164.78	22.43	44,862	22.6
1.70	7.5	160.40	26.81	53,622	27.1
1.80	7.5	160.59	26.62	53,242	26.9
1.90	7.5	160.77	26.44	52,882	26.7
2.00	7.5	160.96	26.25	52,502	26.5
2.25	7.5	161.42	25.79	51,582	26.0
2.50	7.5	161.87	25.34	50,682	25.6
1.70	10.0	157.48	29.73	59,462	30.0
1.80	10.0	157.67	29.54	59,082	29.8
1.90	10.0	157.85	29.36	58,722	29.6
2.00	10.0	158.04	29.17	58,342	29.4
2.25	10.0	158.50	28.71	57,422	29.0
2.50	10.0	159.96	28.25	56,502	28.5

Table B-4: (continued)

Wage Rate ($/hr)	Feed Efficiency Improvement[1] (Per Cent)	Total Feed and Non-Feed Costs (Per A.U.)	Return to Management and/or Ownership Per A.U.	Per Year	Return on Investment[2] (Per Cent)
		CONFINEMENT			
1.70	12.5	154.58	32.63	65,262	32.9
1.80	12.5	154.77	32.44	64,882	32.7
1.90	12.5	154.95	32.26	64,522	32.6
2.00	12.5	155.14	32.07	64,142	32.4
2.25	12.5	155.59	31.62	63,242	31.9
2.50	12.5	155.59	31.16	62,322	31.5
1.70	15.0	151.66	35.55	71,102	35.9
1.80	15.0	151.66	35.55	71,102	35.7
1.90	15.0	152.03	35.18	70,362	35.5
2.00	15.0	152.22	34.99	69,981	35.3
2.25	15.0	152.68	34.53	69,062	34.9
2.50	15.0	153.14	34.07	68,142	34.4

[1]Per cent feed efficiency improvement of confinement using the conventional open lot as the base for the improvement.

[2]Annual return divided by total investment required.

APPENDIX C

QUESTIONNAIRE AND COVER LETTER USED TO SAMPLE BEEF CATTLE PRODUCERS

South Dakota State University
Questionnaire No. ______
(Confidential)

In the following tables include only feeder cattle and cattle on feed as of November 1, 1973. Animals to be excluded would be dairy cattle for milking purposes, beef cows and replacements, bulls and bull replacements, calves raised for breeding purposes. Include steers of dairy breeding and crosses.

Type of Cattle		Present Inventory	SOURCE			
				Bought as:		
			Raised	Calves 0-400#	Feeders 400-750#	Feeders 750-over
Calves 0-400#						
Feeders 400-750#						
Feeders 750# & over						
Cattle on Feed for Slaughter	Below 750#					
	750# & over					

Type of Cattle		Present Inventory (same as above)	INTENDED DISTRIBUTION					
			1973 Fall Sale as Calves	1973 Fall Sale as Yearlings	Winter or Spring Sale at 600-750#	1974 Fall Sale as Yearlings	Cattle on feed for slaughter	
							Fed on own farm	Custom Fed
Calves 0-400#								
Feeders 400-750#								
Feeders 750# & over								
Cattle on Feed for Slaughter	Below 750#							
	750#-over							

/____/ Check if you would like a copy of the report which will make use of this survey.

COLLEGE OF AGRICULTURE AND BIOLOGICAL SCIENCES

SOUTH DAKOTA STATE UNIVERSITY . Brookings, South Dakota 57006

ECONOMICS DEPARTMENT

Area Code 605, Phone 688-4141

October 26, 1973

Dear Sir:

Your help is greatly needed!

Concern has been shown by farmers, ranchers, slaughter plant operators, legislators and other interested parties about cattle feeding practices in South Dakota. This survey seeks your help in providing information on source and intended distribution of feeder cattle and cattle on feed. Specific concern is for "backgrounding" or wintering operations being used by feeder cattle producers.

You were selected as part of a sample of producers in nine counties of the state to provide basic facts. Your cooperation in completing this questionnaire will be greatly appreciated even if your present operations include no feeder cattle production or cattle feeding. The results of this survey will be made available to you if you so desire.

The information you provide will be kept confidential.

Sincerely,

Robert E. Olson

Robert E. Olson
Research Economist

REO:br
Enc.