ECONOMICS OF FEED STORAGE FOR COWHERDS DURING DROUGHT PERIODS FOR WESTERN KANSAS

by

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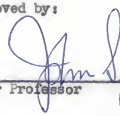

Major Professor

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CHAPTER I

INTRODUCTION

Livestock have contributed a large amount to Kansas farm income. During 1956-60, 51 per cent of the Kansas cash farm income came from the sale of livestock and livestock products. Of this, income from cattle and calves comprised 34 per cent and other livestock products 17 per cent (Table 1).

TABLE 1

PERCENTAGE DISTRIBUTION OF KANSAS CASH FARM INCOME FROM MARKETINGS AND GOVERNMENT PAYMENTS, 1956-60

Item	Year					
	1956	1957	1958	1959	1960	1956-60 Average
	%	%	%	%	%	%
Total Crops	42.7	34.9	50.7	45.9	48.7	44.6
Cattle and Calves	36.2	30.9	31.4	37.8	35.5	34.4
Other Livestock and Livestock Products	19.2	22.1	15.0	14.0	13.5	16.7
Government Payment	1.9	12.1	2.9	2.3	2.3	4.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Farm Income Situation, United States Department of Agriculture, Agricultural Marketing Services, 1957-61.

Although farm income from cattle in Western Kansas[1] may not be as important as in other parts of Kansas, it nevertheless is an important part of agriculture in that area (Figure 1). Comparing cattle and wheat production tends to indicate the importance of cattle in Western Kansas. For the five-year period 1956-60, the yearly value of cattle (dairy excluded) averaged $83,484,260; annual wheat production for the same period was $136,286,160.[2] Various reasons may be given for the importance of cattle in this area. Cattle are able to utilize feed crops, native pasture,[3] wheat pasture and aftermath in the fields. Recent farm programs have increased feed grain production; this, of course, encourages cattle production. Crop production is seasonal, and certain cattle programs are able to utilize non-crop seasonal labor.

The Problem

Various methods of cattle production are carried on in Western Kansas. Cattle may be purchased in the spring, pastured during the summer, and sold in the fall. Sometimes cattle are bought to utilize aftermath in fields and wheat pasture during the fall and winter. They may be wintered and sold in the spring, or placed on grass in the spring and sold in the fall. Some farmers buy cattle to feed out on grain. Over a quarter-million

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[1] In this study Western Kansas comprises the Northwest, West Central, and Southwest crop reporting districts as designated by the Kansas State Board of Agriculture.

[2] *Farm Facts*, 1956-60, Kansas State Board of Agriculture.

[3] 1959 U. S. Census data reports that 32% of the land in Western Kansas is in pasture, 66% in cultivation and 2% other land.

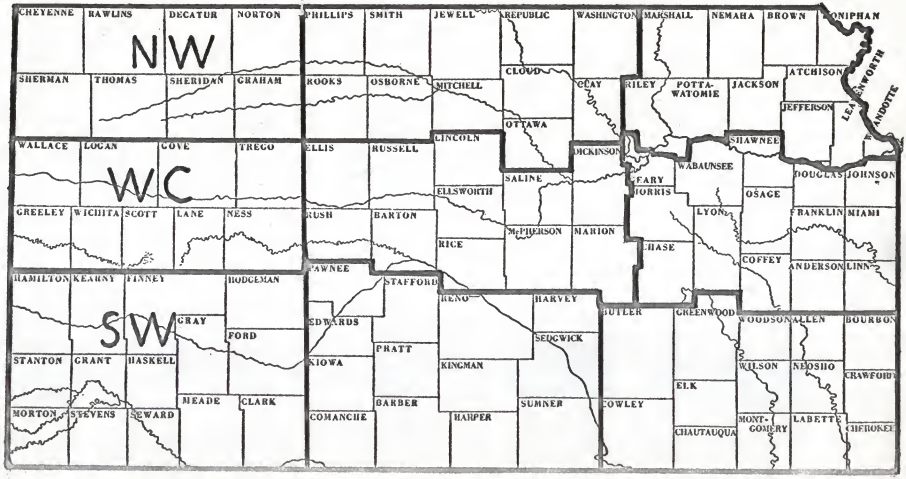

Fig. 1. Crop reporting districts in Kansas, Farm Facts, Kansas State Board of Agriculture, 1959-60, p. 2.

beef cows are found in Western Kansas.[1] Cattlemen may manage their herds to calve in the spring and sell the calves in the fall, or handle the calves in a different manner. Of the many cattle programs available to farmers, this study is concerned with the farmers who have cowherds which calve in the spring and are sold in the fall.

Many problems are involved in maintaining a cowherd in Western Kansas. A survey was made of cattle production in 1957 in ten Western Kansas counties.[2] Data on cattle production covered the period from 1952-1957. This study showed the major problems involved in cattle production were: maintaining a stable feed supply, price risk, production problems, labor supply, obtaining credit, and buying cattle.[3]

Buller stated in his study that:

> To the farmer in the cowherd group, the major problem was maintaining a stable feed supply. The ability to maintain a stable quantity of feed produced was essential to maintaining the investment in the cowherd.[4]

The problem of maintaining a stable supply of feed for cowherds in the Great Plains has also been recognized by others. For example Charles W. Nauheim stated:[5]

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[1] 1959 U. S. Census data reports that, excluding dairy cows, there are 238,759 cows in Western Kansas.

[2] 173 farmers were interviewed in Clark, Comanche, Finney, Ford, Gove, Hodgeman, Lane, Ness, Scott, and Thomas counties.

[3] The Effects of the Drought on the Beef Enterprise in Western Kansas, 1952-57, unpublished thesis by Orlan Buller, Kansas State University, 1959.

[4] Ibid.

[5] Charles W. Nauheim, Economic Research Service, U. S. Department of Agriculture, Kansas State University, Manhattan, Kansas.

Grass and feed production on farms and ranches in the Great Plains fluctuates from year to year. Frequently, a series of good years is followed by a series of bad years. Production of grass may vary with rainfall as much as 50 per cent on either side of the mean. Since 1950, annual yields of forage sorghum in selected counties in Western Kansas have fluctuated from 37 per cent above to 66 per cent below the 10 year average. In 1952 the average yield was 47 per cent below that of 1951. In 1956, it was 54 per cent less than the below-average of 1955. But in 1957, the average yield of forage sorghum was 244 per cent above the 1956 yield.

The effects of drought on cattle enterprises are often slow to develop, but they tend to 'snowball' as dry weather continues. Contributing to this snowballing effect is the ranchers' and farmers' continual hope for rain and their reluctance to make quick and effective adjustments to counter the drought. Grass and feed reserves are exhausted, and large numbers of cattle in poor condition are forced on the market, where they depress prices, particularly, in the drought area.[1]

Warren Bailey of the U. S. Department of Agriculture gives a similar statement by these remarks:

Another, more dramatic feature of the Plains climate is its seasonal variability, particularly with respect to rainfall. Good seasons and bad, singly or in bunches seemingly fall in random disorder. Crop yield may double the average or may fail completely. Neither creates surprise; either elation or despair follows.[2]

The problem of maintaining a stable feed supply through the use of roughage reserves is a relatively new area of study in reducing income variability of beef cattle enterprises. Howard W. Ottoson of the University of Nebraska stated:

There has been much discussion but little analysis on the possibilities of feed reserves as a means of alleviating the effects of the uncertain economic climate in which Plains farmers operate. The notion of reserves is not new in the Plains; no doubt nearly every Plains farmer uses this stratagem in some degree in his business.[3]

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[1]Great Plains Council Publication No. 19, Management Strategies in Great Plains Farming, Nebraska Agricultural Experiment Station Bulletin MP, 1961, p. 81.

[2]Ibid., p. 6.

[3]Ibid., p. 61.

Ottoson goes on to define a feed reserve as "A stock of feed held on the farm but not consumed during the period ensuing from one harvest period to another."[1]

The yearly variation in precipitation over a rather large geographical area causes large variations in the total stocks of feeds in these areas over time. Figure 2 shows deviation from the mean annual precipitation from 1911 to 1961 for Leoti, located in Wichita County which is in the West-Central region of Kansas. From this it can be seen that years of below normal precipitation seem to fall in clusters. For example 1931 to 1941 was a period of consistently below normal precipitation as were the years 1952 to 1956. These two periods created the droughts of the thirties and the fifties respectively.[2]

The problem of this study was that uncertain precipitation in Western Kansas results in an unstable feed supply. Frequent droughts of several years duration cause pasture shortage to develop, feed reserves are used up and the farmer is faced with several alternatives: (a) should he sell his cattle on what may be a depressed market; (b) should he buy feed to maintain his stock on a market inflated due to lack of available feed in the area plus the cost of transporting feed from other areas; or, (c) can he economically store enough roughage during years of high rainfall and large crop production which can be used during drought years.

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[1] Ibid.

[2] "Climatological Data," U. S. Department of Commerce, Weather Bureau Annual Summary, 1911-1961, vol. XXV-LXXV.

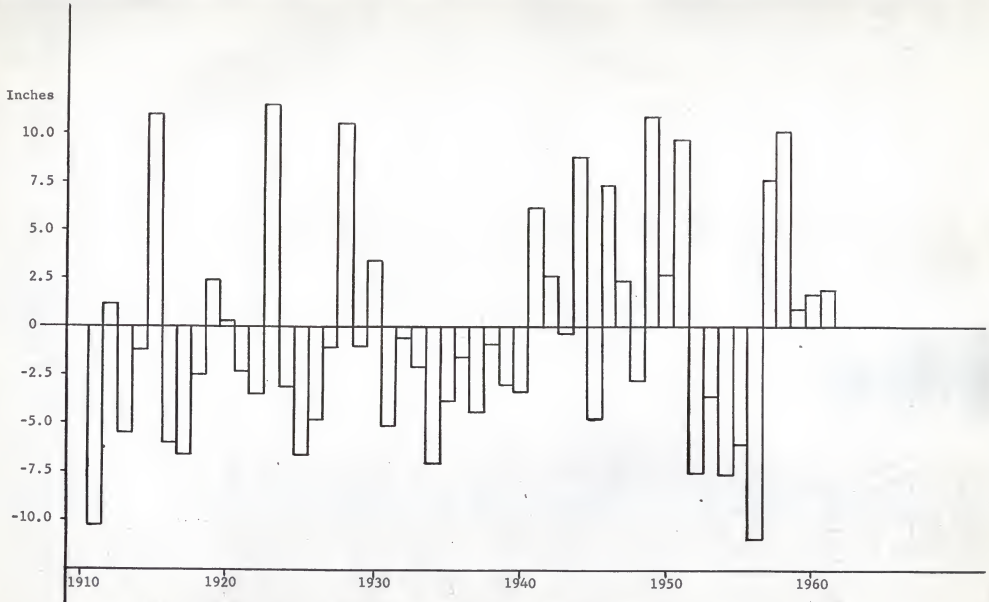

Fig. 2. Deviation from mean annual precipitation. (Based on 1911-1961 period.) Source: U.S. Department of Commerce, Climatological Data, Weather Bureau Annual Summary, 1911-1961, vol. XXV-LXXV.

Objectives

Specifically, the objectives of this study were:

1. Evaluate roughages which can be stored, especially sorghum silage.

2. Appraise the different types of storage facilities.

3. Compute costs for storing feed, including cost of feed as well as the cost of storage facilities.

4. Develop and compare budgets showing incomes of various size cowherds during drought periods when feed reserves have been provided and cowherds maintained.

The general hypothesis of this study was that feed stored during periods of high yields would be an economical and effective method of maintaining cowherds during drought periods. The reasoning here was that farm income would be more stable than without feed reserves, but not necessarily equal each year. The farmer would not be faced with the alternatives of the direct and immediate cash outlay to purchase feed to maintain his herd; or be forced to liquidate his herd at possible low prices and buy back at the end of the drought at possible high prices.

Adjustment to Risk and Uncertainty

The maximization of profits over the anticipated life of the farm firm is not necessarily the most important goal of the farm operator. This could be especially true concerning the farmer with limited capital. This concept is well stated by Heady.

> The entrepreneur may be influenced not only by the mean or most probable value of future income but also by the time distribution of income....large losses in early years can bring the opportunity to make decisions to a halt by causing liquidation of the firm. If early losses make continuation of the firm impossible, the value of the future income stream, even if it is

> expected to be extremely high in later years, then falls to zero. Survival of the firm in the short-run is a means to maximization of returns over a period covering a greater number of years..... The manager's apparent irrationality (his failure to adopt the specialist's recommendations) may actually be a manifestation of this highly rational concern for the long-run standing of his firm.
>
> While survival as an end may be competitive with maximum profits as an end in the short-run, short-run survival is complementary with profit and utility maximization in the long-run.[1]

It is to this end that sorghum silage storage in years of high production, reducing income in those years, may be a sound management decision for the farm operator if it will make possible the survival of the firm and the minimization of losses in years of less favorable production. Feed storage may be less appealing to farmers with large capital reserves or with high risk preference. Short-run survival would not be a major concern to the entrepreneur with large capital reserves since he could purchase feed, even at great cost, to tide his herd over drought periods.

Rational management decisions aimed at reducing uncertainty need not be the same for each farm firm. Each entrepreneur is operating with a different combination of resources and may also have different ends to maximize. This is summarized by Heady. "Given an uncertainty setting, the optimum plan for any individual depends on his psychological makeup, his capital position, and the ends to be maximized."[2]

Physical Description of the Study Area

Soil

The land in Western Kansas is rather homogenous from the standpoint of soil type. Soils are mostly undulating to nearly level with silt

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[1] Earl O. Heady, Economics of Agricultural Production and Resource Use, (New Jersey: Prentice-Hall, Inc., 1960), pp. 504-505.

[2] Ibid., p. 501.

loam being the most prevalent soil type. Also occurring, especially in the southern portion of this area, are fine sandy loam and clay loam soils. These soils are well adapted to wheat and sorghum production and the nearly level areas are well adapted to irrigation. Sorghum chlorosis may be expected to occur on the more sloping soils as they are often high in lime content.[1]

Portions of this area are composed of moderately steep to very steep land which is usually composed of gravelly loam and silt loam soils. Unless the divides are sufficiently broad for cultivation, the soils of these areas should be devoted to native grasses.[2]

There are also various other less prevalent soil types in this area. However, two additional soil types comprise large enough areas to merit consideration. These are the dune sands which are located south of the Arkansas River Valley and the depressional soils of Scott and Finney counties.[3]

The dune sands "occur on undulating to steeply rolling relief. These soils are excessively drained and are suitable only for grazing. Erosion by wind is a severe hazard on these soils."[4] The depressional soils are located in what is:

> . . . commonly called the Scott-Finney depression, in which the depressional soils are dark grayish brown silty clay loams to clays. The areas between depressions . . . tend to be light grayish brown, silt loams. The relief of the area is dominantly nearly level to

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[1] O. W. Bidwell, Major Soils of Kansas, Kansas Agricultural Experiment Station, Circular 336, July 1956, p. 11.

[2] Ibid.

[3] Ibid., p. 12.

[4] Ibid., p. 12.

> slightly undulating with numerous undrained depressions. The depressional soils are poorly drained and are of a solonized nature. They frequently pond water during the months of highest rainfall. The areas between the depressions are well drained and are well adapted to wheat and sorghum production.[1]

It should be mentioned that Western Kansas is highly vulnerable to wind erosion due to the low annual precipitation.

Climate

The climate of Western Kansas is semi-arid and suitable only for certain crops under dryland conditions. These crops are mainly wheat, native pasture, and sorghums. These crops yield well in years of favorable precipitation. Figure 3 showed the average annual precipitation which varied from 20 inches on the eastern border to 16 inches near the western edge in the center of this area. Figure 4 showed average annual precipitation by months at Colby, located in Thomas County, Kansas. This 50-year period showed increasing precipitation in spring until June, then steadily declining precipitation the rest of the year. This moisture distribution showed that 14.27 inches out of 18.46 inches annual rainfall had been received during the April 1 to October 1 growing season, which suggested favorable moisture conditions during the spring and summer for crops such as wheat, spring pasture, and early summer pasture. The conditions are nearly as favorable for fall harvested crops such as grain and forage sorghums. However, August is often hot and dry causing lowered yields among fall harvested crops. Average monthly moisture distribution is very important in Western Kansas. Since the average annual rainfall is marginal to consistent crop production, moisture conserving practices must

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[1] Ibid., p. 11.

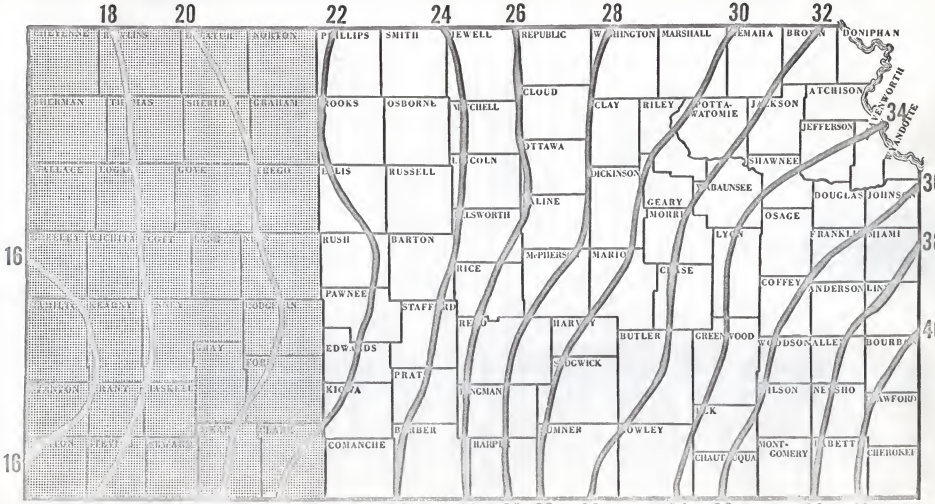

Fig. 3. Average annual Kansas precipitation. (Based on 1898-1942 period.) Source: O. W. Bidwell, Major Soils of Kansas, Kansas Agricultural Experiment Station Circular 336, July 1956, p. 4.

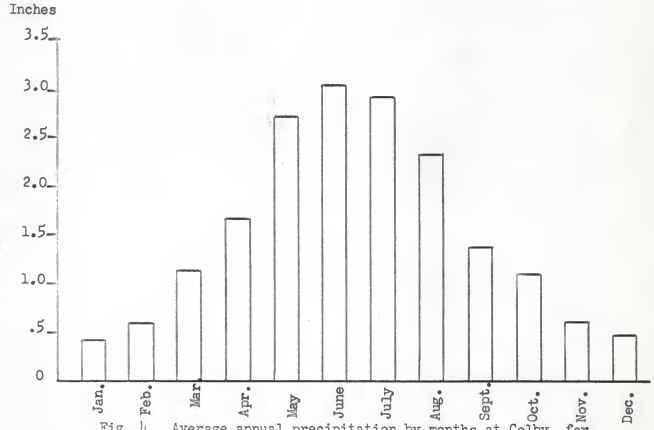

Fig. 4. Average annual precipitation by months at Colby, for the years 1914-1963. (In the files of the Colby Branch Experiment Station, Colby, Kansas.)

be followed and crops must be grown that take maximum advantage of these favorable moisture months. This chart indicated the largest amounts of moisture are received when wheat and sorghum need moisture the most.

CHAPTER II

GENERAL PROCEDURES

The Budget

Budget techniques and analysis were employed in the study. Heady and Jensen define a budget as,

> A formal or informal device for setting down the different crops or livestock which can be produced and in deciding which alternative is most profitable . . . . The farm plan or budget is to the farmer what the blueprint or architect's specifications are to the building contractor. It shows what is to be done and how to do it. In setting up a budget or plan, we set down the prospective acres of each crop and the numbers of each livestock; we evaluate farming practices and estimate the yields and production; income and costs are computed and finally an estimate of net income is made. If we make up budgets for several systems of farming, we predict which one will be most profitable. Every good businessman makes up a plan of this sort; he budgets his use of capital and labor.[1]

Thus budgeting is a technique for assembling and organizing information in order to facilitate decisions with respect to the management of farm resources.

Kansas State Board of Agricultural biennial reports, data from leading United States Agricultural Experiment Stations, U. S. Department of Agriculture data, farm management records, and other sources of information were used in developing crop production yields, storage costs and livestock budgets. The advice of agricultural specialists, who were frequently consulted, was also used in the study.

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[1]Earl O. Heady and Harold R. Jensen, Farm Management Economics, (New Jersey: Prentice-Hall, Inc., 1957), p. 91.

Feed production costs on a primarily cash grain farm were first developed. Then dry matter losses occurring in the storage of sorghum silage were determined so storage costs for various lengths of time could be calculated. Three different size cowherd units were adopted. Budgets were developed for the three cowherd units for each of the three districts in the study area comparing average income effects of carrying one-year's feed supply, three-year's feed supply, and five-year's feed supply. Costs in the budgets for a given size cowherd were held constant among districts with the exception of the cost of sorghum silage, which was varied according to calculated cost of production in the various districts. No comparison was made between districts since it was believed that other costs may also vary under actual field conditions.

General Assumptions

Above average managerial ability was probably the most important basic assumption of the study. This assumption facilitated the adoption of crop yields, storage costs, and beef production commensurate with the quality of management assumed. For example, crop yields were adopted from a time period of relatively favorable production, silage storage losses assumed the operator covered the filled silo immediately and adequately, and an average calf crop rate under good management was adopted.

The assumption was made that the farms were owner-operated, and that the operator did not have alternative employment for his labor. This assumption facilitated the full utilization of his labor in the farming enterprise so his labor was handled as a fixed cost, and labor was hired only when requirements were such as to require the service of additional men.

The last general assumption was a qualification of the limitations of the study. The study was conducted on the assumption that irrigation was not an alternative available to the farm operator. Therefore, average crop yields were based on dryland conditions. Other assumptions were of a specific nature and were outlined when applicable.

Selection of Farm Size

A study utilizing budgeting technique requires the selection of a model or specified farm size on which analytical budgeting techniques can be applied to test various alternatives. A model need not be average for the area being studied; however, it should be so selected that the conclusions drawn within this specified framework of assumptions does have practical application. A model has been defined as a farm that does not exist and never did, but is typical of farms of this size and organization in the area.[1] Based on this qualification three model size farms were selected. This study was divided into two major parts (1) determination of cost of production and storage of roughage type feeds, and (2) determination of the effects of feed storage as a method of combating the financial risk associated with beef cattle production during drought periods. The model farms selected had the same amount of land under cultivation while pastureland acreage was varied according to size of the cowherd unit. Through the aid of farm management reports, the 1954 and 1959 Census of

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[1] Willard W. Cochrane and William T. Buts, "Output Responses of Farm Firms," Journal of Farm Economics, XXXIII (November, 1951), Part I.

Agriculture[1] and the recommendations of agricultural specialists at Kansas State University;[2] the three models selected consisted of 1663 acres, 2718 acres and 3772 acres. Each model was assumed to be composed of 960 acres farmland of which 940 acres were under cultivation and 20 acres were composed of farmstead, roads, and waste. Pastureland acreage for each model was determined as that acreage sufficient to carry a cow-herd of 50, 125 or 200 cows on a pasture improvement basis. That is, pasture acreage requirements were determined on the basis that the range was now in fair to good condition and by following the adopted rate of grazing the range could be gradually improved.

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[1]An analysis of farm size in 1954 and 1959 indicated an apparent trend towards fewer and larger farms in Western Kansas. This can be seen by showing the percentage change in farm numbers of different sizes from 1954 to 1959: 0-260 acres, -21%; 260-499 acres, -19.1%; 500-999 acres, -10.2%; and 1000 or more acres, +7.8% during this period total farm numbers in this area declined 9%.

[2]Specialists consulted in selection of farm size include: C. F. Bortfeld, Associate Professor of Farm Management; Kling L. Anderson, Professor of Agronomy; Edgar F. Smith, Professor of Animal Husbandry; and C. W. Nauheim, Economic Research Service, U. S. Department of Agriculture.

CHAPTER III

SORGHUM SILAGE PRODUCTION

Only the cropland was considered in determining feed production costs. Pastureland was not considered in the study until the cowherds were developed. Feed costs were related to the number of acres under cultivation and not to the total number of acres in the farm. That part of fixed costs composed of annual machinery costs were related only to the total number of cultivated acres, therefore only the 940 acres of cultivated land was considered in arriving at the costs of producing feeds.

Real Estate Investment

Real estate investment consisted of the cropland, the buildings, other than the farm dwelling and the improvements. Typical buildings and improvements for a 960 acre primarily cash grain farm were determined in a survey conducted of the study area in 1958.[1] Building and improvements valuations were also determined in this survey. Cropland values were estimated at $105 per cultivated acre.[2] This study, as previously mentioned, considered 940 acres cultivated. Total real estate investment in all three districts for the cash grain portion of the model farm was

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[1]Unpublished survey conducted by Charles W. Nauheim, Economic Research Service, U. S. Department of Agriculture, Kansas State University.

[2]Estimated by author, based on unpublished estimates made by J. E. Pallesen, State Statistician, and farm management fieldmen in the area.

estimated at $107,986 (see Appendix Table 10).

Machinery and Equipment

The machinery and equipment inventory for a 960 acre cash grain farm was also determined by the 1958 survey.[1] Unless otherwise stated valuation was based on 60 percent of new cost except when the machine was indicated as having been purchased used, in which case valuation was based on 60 percent of the purchase price. Total machinery and equipment investment as determined by districts was: Northwest, $14,398; West Central, $14,047; and Southwest, $14,509, (see Appendix Table 11).

Fixed Costs

Fixed costs may be defined as costs fixed, regardless of the level of output.[2] Fixed costs are incurred regardless if the investment is used for productive purposes or left idle. Included in fixed costs are interest on investment, taxes, depreciation, and insurance.

Interest on Investment

The study defined interest on investment as an opportunity cost. While the money was invested in farm operations such as real estate, machinery and equipment, the farm operator was foregoing alternative receipts had the money been invested in other assets. This cost must be deducted from gross farm income in determining the operators returns to labor and management. Interest on investment was calculated at five percent on the real estate investment and at six percent on the machinery

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[1] Nauheim, loc. cit.

[2] Paul A. Samuelson, Economics an Introductory Analysis, 5th ed., New York: McGraw-Hill Book Company, Inc., 1961, p. 523.

and equipment investment.

Taxes

Property taxes paid will vary according to the valuation or appraised value of the property and the tax levy. Tax valuations vary somewhat between communities, and to a much greater extent among states. However, in Western Kansas appraised valuation of farm real estate tends to be rather stable among various communities.[1] Machinery valuations should be uniform for a given machine of a given age anywhere in Kansas. "In Kansas assessors are instructed to use the 'Kansas Personal Property Assessment Schedule' prepared annually by the County Clerks' Association. This schedule uses one-third of blue book[2] value."[3] Since tax levies do vary greatly between communities, it was decided to calculate taxes as one percent of inventory value on both real estate and personal property. G. H. Larson, et al., suggested a similar method for use on machinery.

> Over the normal full life of a machine, property taxes in Kansas average slightly less than one percent per year of original cost of the machine. A 2 1/2 percent sales tax when distributed over the entire life of a machine amounts to 0.1 to 0.3 percent each year, depending on the length of life of the machine . . . . Added to the property tax this makes about one percent annually for taxes.[4]

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[1] Real Estate Assessment Ratio Study, Kansas Property Valuation Department, 1959.

[2] Blue book refers to the National Farm Tractor and Implement Blue Book for 1959.

[3] G. H. Larson, G. E. Fairbanks, and F. C. Fenton, What it Costs to Use Farm Machinery, Kansas Agricultural Experiment Station Bulletin No. 417, April 1960, p. 22.

[4] Ibid.

The distinction should be made that while the above quotation suggested one percent per year tax on the original cost of the machine, this study used one percent of the inventory value throughout the entire study.

Depreciation

Depreciation is a fixed cost which is a capital allowance for obsolescence and wear resulting to capital equipment due to time and use. Depreciation allowances were charged for permanent improvements and machinery and equipment. The family automobile was assumed to be used 50 percent for business, so 50 percent of its depreciation was included with machinery. Depreciation was calculated as follows. Buildings and improvements were assumed a remaining expected useful life of 20 years so they were depreciated at the rate of 5 percent annually. Machinery and equipment were depreciated on the basis of 10 years useful life remaining, or at 10 percent annually. All depreciation charges were based on inventory value.

Insurance

Insurance on buildings was computed as a fixed cost at the rate of $9.80 per $1,000 building valuation.[1] Total insurance on buildings amounted to $77 for all districts.

Total annual fixed costs were a summation of the fixed costs discussed and were computed by districts as Northwest, $9,468; West Central, $9,409; and Southwest, $9,487. Annual fixed costs per crop acre were determined by dividing total annual fixed costs by 940, or the total number of cultivated acres. Annual fixed costs per acre by districts

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[1] Nauheim, loc. cit.

were: Northwest, $10.07; West Central, $10.01; and Southwest, $10.09 (Table 2).

TABLE 2

INVESTMENT AND FIXED COSTS FOR A 960 ACRE FARM FOR VARIOUS DISTRICTS IN KANSAS

Item	Districts		
	Northwest	West Central	Southwest
Investment			
Real estate	$107,986	$107,986	$107,986
Machinery and equipment	14,398	14,047	14,509
Total Investment	122,384	122,033	122,495
Items of fixed expense			
Interest on investment			
Real estate @ 5%	5,399	5,399	5,399
Machinery and equipment @ 6%	864	843	871
Taxes			
Real estate @ 1%	1,080	1,080	1,080
Personal Property @ 1%	144	141	145
Depreciation			
Buildings and improvements, except dwelling @ 5%	464	464	464
Machinery and equipment @ 10%	1,440	1,405	1,451
Insurance on buildings @ $9.80/$1,000	77	77	77
Total Annual Fixed Costs	9,468	9,409	9,487
Fixed Costs per Crop Acre[1]	10.07	10.01	10.09

[1] 940 acres under cultivation

Variable Costs

Variable costs were defined as the costs resulting from operation of a business that would not have been incurred had that business not been operated. In the study, variable costs included costs incurred in seed bed preparation, seeding, cultivating and harvesting the forage sorghum.

Pre-harvest Cost

Tillage operated varied according to the area under study and also varied greatly within an area. Topography, field size, rainfall, and soil type greatly affect tillage operations. Tillage operations also varied slightly for the model farms in the different areas. Tillage operations and time requirements as well as repairs, fuel and lubrication for the tractors and machines used were based on a study of the area.[1]

Since the study assumed the operator did not have alternative uses for his labor, his labor was a fixed cost of production. Therefore, labor became a variable cost only when the operations required labor other than that provided by the operator.

Variable costs involved before harvest in the Northwest area accounted for 34 percent; in the West Central area, 27 percent; and in the Southwest area, 33 percent of total variable costs of producing sorghum silage. Pre-harvest costs comprised a smaller percent of total variable costs in West Central Kansas than in the other two areas. This was due to the adaptability of large planting and cultivating equipment which made possible the completion of these operations with less fuel and repairs. All pre-harvest costs were computed on a planted acre basis.

Harvest Costs

Costs involved in harvesting were computed on a per-ton-basis. It was determined in the study that an average of 85 percent of the acres planted would be harvested.[2] Yields were determined on a harvested-acre-basis.

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[1]Based on an unpublished study conducted in the area in 1958 by Charles W. Nauheim, Economic Research Service, U. S. Department of Agriculture, Kansas State University.

[2]Records from the Kansas State A.S.C.S. office for the years 1951-1961 for the study area indicate that 85 percent of the acres planted would be harvested.

However, yields were then adjusted to a planted acre basis by multiplying the determined yields by 0.85.[1] Harvesting required equipment the operator did not furnish and additional hired labor. One man was hired at the cost of $1.20 per hour. A custom operator with his truck was employed to haul one-half of the forage to the silo at a cost of $0.91 per ton.[2] It was assumed the farm operator would haul the other one-half. The forage sorghum was chopped by a custom operator.[3] This charge accounted for the following percentages of total variable costs of production by areas: Northwest, 42 percent; West Central, 52 percent, and Southwest, 48 per cent (see Appendix Tables 12, 13, and 14).

Total Cost of Production

Total cost of producing sorghum silage per acre and ton for various areas of Kansas was presented in Table 3. Production costs were the summation of fixed and variable costs per acre. Production costs were then computed on a per ton of production basis by dividing total cost per acre by the yield per acre. Cost of production per ton by area was determined to be: Northwest, $4.00; West Central, $3.90; and Southwest, $4.34. Fixed costs composed a high percentage of total cost of production. By areas

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[1]Yields are often reported on a harvested acre basis. Yields in tons per harvested acre for forage sorghum following wheat were by area: Northwest, 6.4; West Central, 6.8; and Southwest, 6.4. These yields were calculated from records made available by the Kansas State Agricultural Stabilization and Conservation Office, U. S. Department of Agriculture, for the years 1957-1961.

[2]Rates for Custom Farm Operations, 1960, Kansas Crop and Livestock Reporting Service.

[3]Rates by area per ton: Northwest, $1.00; West Central, $1.14; Southwest, $1.21. (Ibid).

fixed costs comprised the following percentages of total cost of production: Northwest, 47 percent; West Central, 44 percent; and Southwest, 43 percent.

TABLE 3

TOTAL COST PER PLANTED ACRE AND TON OF PRODUCING SORGHUM SILAGE FOR VARIOUS AREAS IN KANSAS

Item	Area		
	Northwest	West Central	Southwest
Fixed cost per cropland acre[a]	$10.07	$10.01	$10.09
Variable cost per acre[b]	11.55	12.63	13.35
Total cost per planted acre	21.62	22.64	23.44
Total cost per ton[c]	4.00	3.90	4.34

[a]See Table 2.

[b]See Tables 12, 13, and 14.

[c]Yields per harvested acre: Northwest 6.4 tons; West Central 6.8 tons; Southwest 6.4 tons. Assuming 85 percent of planted acreage was harvested, yields adjusted to a planted acre basis would be: Northwest 5.4 tons; West Central 5.8 tons; Southwest 5.4 tons. Calculated weighted average for sorghum silage produced under dryland conditions 1957-1960 (Letter from J. E. Pallesen, State Statistician, Topeka, Kansas).

CHAPTER IV

SORGHUM SILAGE STORAGE

Silo Structures

Estimated construction costs of various type silos were presented in Appendix Table 15. Cost of constructing various type silo structures were estimated by Leo Wendling, Extension Engineer for the Kansas Agricultural Experiment Station. These estimates showed decreasing costs per ton storage capacity on structures up to 1,000 tons capacity. His estimates showed near constant costs per ton on larger structures. It was interesting to note the large difference on a per ton basis of erecting different types silo. The earth trench silo would be the most economical form of long-term storage.

Losses Incurred in Storage

Dry matter recovered and lost during the first year of storage as a percentage of dry matter ensiled in sorghum silage by type of silo was summarized and presented in Table 4. In compiling this table a review of available literature was made and letters were sent to the major Agricultural Experiment Stations of the United States. It was found that little accurate data were available on losses occurring in storage. However, two important factors became evident. The first factor was that an opaque type sheet plastic cover free of holes, properly applied to the surface of the silage immediately after the filling and packing operations were completed, will greatly reduce storage losses. The cover must form

TABLE 4

DRY MATTER RECOVERED AND LOST DURING THE FIRST YEAR OF STORAGE AS A PERCENTAGE OF DRY MATTER ENSILED IN SORGHUM SILAGE BY TYPE OF SILO[a]

Item	Type of Silo					
	Gas Tight	Concrete Stave Upright		Lined Trench or Bunker		Earth Trench
		Covered	Uncovered	Covered	Uncovered	Covered
	%	%	%	%	%	%
Recovered	92	88	80	84	72	82
Lost	8	12	20	16	28	18

[a]Silage loss determination based on the following:

*Martin Decker, Filling and Covering Silos, Kansas Agricultural Experiment Station Bulletin 1959, No. 410, p. 6.

*A. W. Halverson, W. C. McCune, and O. E. Olson, "Preserving Nutrients in Corn Silage," South Dakota Farm and Home Research, May 1959, 10:20-23.

*L. A. Moore, "Plastics Reduce Spoilage," Hoards Dairyman, September 25, 1960, 105:948-9.

*F. R. Murdock, Plastics Protect Silage, Washington Extension Circular 1959, No. 307.

*"Bunker Silo Covers Save Feed," Agricultural Research, U. S. Department of Agriculture, May 1961, p. 5.

*C. H. Gordon, letter to author, Dec. 21, 1961, Research worker for Economic Research Service, U. S. Department of Agriculture, Beltsville, Maryland.

an air-tight seal and should be at least 6 mm in thickness to be effective. It is recommended that the cover be applied immediately after filling is completed and be covered with about three inches of dirt or sawdust so if a puncture occurs it will not let air into a large area.[1]

The second important factor was made evident by a two-year experiment conducted by the U. S. Department of Agriculture in which they found three main types of losses occur in silage storage. This study indicated visible spoilage in sealed and unsealed bunker silos actually accounted for only about one-seventh of the total dry matter loss. The rest occurred as gaseous and seepage loss. These two types of losses were reduced about fifty percent by proper covering.[2] Gaseous loss resulted as a by-product of decomposition; seepage was due partially to precipitation filtering through the silage leaching away nutrients and providing a favorable environment for decomposition bacteria to become active. Information was not available concerning further losses after one year of storage. However, most researchers interviewed felt that silage properly covered would not undergo major losses after the first year of storage. Therefore, for the purposes of this study it was considered that losses did not occur after the first year of storage.

Fixed Costs

Annual fixed costs of storing sorghum silage per ton by size and type of silo were presented in Appendix Table 16. Fixed costs include

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[1] F. R. Murdock, et al., Plastics Protect Silage, Washington Extension Circular No. 307, (November 1959).

[2] "Bunker Silo Covers Save Feed," Agricultural Research, U. S. Department of Agriculture, (May 1961), p. 5.

depreciation which was calculated for a structural life of 30 years for the gas tight silo, 20 years for the concrete stave, lined trench and bunker silos, and ten years for the earth trench silo; and interest, taxes, repairs and insurance which was calculated at seven percent of original investment.[1]

Storage-Variable Costs

Variable costs of storing sorghum silage per ton, by type of silo for various areas in Kansas were presented in Table 5. Variable costs included an additional filling charge of twenty-five cents per ton for filling upright type silos. This charge was levied for the use of a blower in filling these type silos. A charge of two cents per estimated square foot of surface area was charged for covering the silo with a plastic type cover. Reduced loss when a plastic cover was used in comparison to its costs, suggests that it is an essential item in silage storage. Also included was a charge for silage losses during the storage period. This was calculated by multiplying percent lost presented in Table 4, by cost of producing sorghum silage presented in Table 3. Cost of storing sorghum silage for one year was presented in Appendix Tables 17, 18, and 19 for various areas in Kansas.

Cost of Storing Sorghum Silage for Three Years

Cost of stored sorghum silage per ton for three years by type and size of silo were presented in Appendix Tables 20, 21, and 22 for the various areas of Western Kansas. Fixed costs were those computed in

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[1]Suggested by Leo Wendling, Extension Agricultural Engineer, Kansas Agricultural Experiment Station.

TABLE 5

VARIABLE COSTS OF STORING SORGHUM SILAGE PER TON, BY TYPE OF SILO FOR VARIOUS AREAS IN KANSAS

Item	Type of Silo					
	Gas Tight	Concrete Stave Upright		Lined Trench or Bunker		Earth Trench
		Covered	Uncovered	Covered	Uncovered	Covered
Northwest Kansas						
Filling charge[a]	$ .25	$ .25	$ .25			
Cover cost[b]		.02		$ .12		$ .12
Losses	.32	.48	.80	.64	$1.12	.72
Total Variable Cost	$ .57	$ .75	$1.08	$ .76	$1.12	$ .84
West Central Kansas						
Filling charge	.25	.25	.25			
Cover Cost		.02		.12		.12
Losses	.31	.47	.78	.62	1.09	.70
Total Variable Cost	$ .56	$ .75	$1.03	$ .74	$1.09	$ .82
Southwest Kansas						
Filling charge	.25	.25	.25			
Cover cost		.02		.12		.12
Losses	.35	.52	.87	.69	1.22	.78
Total Variable Cost	$ .60	$ .79	$1.12	$ .81	$1.22	$ .90

[a]Additional filling charge of 25 cents per ton for upright silos.

[b]Cover cost figured @ 2 cents per square foot of surface area.

Table 2 multiplied by three for the three year period. Variable costs were those costs computed in Table 5.

Cost of Storing Sorghum Silage for Five Years

Cost of stored sorghum silage per ton for five years by type and size of silo were presented in Appendix Tables 23, 24, and 25 for the areas of Western Kansas. Fixed costs were those computed in Table 2 multiplied by five for the five-year period. Variable costs were those computed in Table 5. Fixed costs occur every year regardless of use of the structure or how it is used, so they must be computed on a yearly base and summed for the length of the storage period. Variable costs, however, were incurred only once for each time the silo is filled. Therefore, they would remain the same for the five-year period as they were in the one-year period. Fixed costs and variable costs of storage were the same for all areas. Also included in storage costs were feed costs and interest charges. Feed costs were presented in Table 3. This was the actual calculated cost of producing sorghum silage in the various areas. Interest charges were computed on the cost of producing the feed and on the variable costs. Interest charge was computed at six percent per year for five years for a total interest charge of thirty percent of the combined variable costs and feed costs. It may be noted that the cost of sorghum silage over a five-year storage period was directly related to the cost of constructing the silo structure. The earth trench silo which costs the least to construct also provides the least expensive long-term storage. Since the earth trench did provide the least expensive method of storage it was chosen as the most desirable structure to be used throughout the remainder of this study.

CHAPTER V

ANALYSIS OF THE BUDGET

The Budget

In the utilization of budgeting techniques the selection of models, or specified enterprise sizes were required. A budget can only be a tool in farm management if the standards that become the foundation of the budget were carefully and accurately selected. Specialists[1] were consulted in the preparation and selection of these standards. However, the validity of each budget was limited to the models selected and were not applicable to any one particular livestock enterprise. Model beef cowherd enterprises of the following cowherd sizes were selected to test one variable, that was the effect of long-term sorghum silage storage on income stability.[2] Models selected were: (1) a 50 cowherd unit; (2) a 125 cowherd unit; (3) a 200 cowherd unit. Budgeting techniques were used to study the effect on income stability of varying the quantity of sorghum silage stored.

The first condition tested was used as the control. It consisted of maintaining only the current year's feed supply. This study did not

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[1]Specialists consulted in the selection of standards include: the late C. F. Bortfeld, Associate Professor of Farm Management; Kling Anderson, Professor of Agronomy; Edgar F. Smith, Professor of Animal Husbandry; and C. W. Nauheim, Economic Research Service, U. S. Department of Agriculture.

[2]Long-term in this case refers to a period of time greater than one year.

take into consideration long-term income effects of maintaining only a current year's feed supply or the possibility of being faced with a crop failure necessitating the purchase of feeds or the liquidation of all or part of the herd. This may well serve as the problem of a future study. Budget requirements were developed to maintain on a long-term basis the size cowherds selected when wintered on a ration consisting of sorghum silage, soybean oil meal, and low-grade roughage such as wheat stubble or dry grass. There were a total of twenty-seven budgets prepared. These budgets showed the effects of: (1) Sorghum silage production costs on net income, (2) Enterprise size, or scale of production, on net income, and (3) Length of feed storage on net income. Since the methods used in preparation were the same for all budgets, most of the standards were the same. Therefore, all budgets were discussed together, and differences enumerated when it was deemed necessary.

Real Estate Investment

Real estate investment, consisting of the pasture land and holding facilities, was presented in Appendix Table 26. It was necessary to determine the carrying capacity of pasture land in Western Kansas. Above average management was an assumption of the study, therefore, it was possible to assume that the range land was in good condition and also that the operator would maintain this range land in good condition in the future. This assumption allowed the adoption of a high grazing rate commensurate with the quality of range involved, but it also limited the stocking rate by the desire to maintain the range on a long term improvement basis. The

grazing rate adopted was 10 acres[1] of native grass for each animal unit.[2]

Existing pastureland was judged to be fenced and have serviceable stock wells and tanks. They were assumed to be included in the inventory value of the land. Holding, sorting, and loading facilities were located at one central location. These facilities were judged to be lacking on many livestock farms necessitating their construction which became part of the real estate investment. Holding facilities were inventoried at 50 percent of their construction cost.

Working Capital

Working capital consisted of the investment in livestock; the investment in equipment including bunks for feeding silage, water tanks, and small miscellaneous equipment such as hand forks; the investment in silage and soybean oil meal; and for the 125 and 200 cowherd units the investment in a tractor front-end loader valued at $250 for loading silage. Equipment needed and its cost was determined by the author based upon recommendations made by Leo Wendling.[3] All equipment items were valued at 50 percent of original cost. Estimated unit and capital requirements for various size cowherds were summarized and presented in Table 6.

Livestock Inventory

The livestock inventory for the 50, 125, and 200 cowherd units was

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[1]Table 6. "Estimated Unit and Capital Requirements for Various Size Cowherds."

[2]One animal unit equals one cow or mature bull; 1 1/2 yearling cattle, or two weaned calves. (Doane Agricultural Digest, p. 533)

[3]Leo Wendeling, loc. cit.

TABLE 6

ESTIMATED UNIT AND CAPITAL REQUIREMENTS
FOR VARIOUS SIZE COWHERDS

Size of Cowherd	Feed Bunks		Water Tanks		Silage Loader	Total Investment
	Linear Feet[a]	Investment	No.	Investment[b]	Investment	
50	58	$ 290	4	$ 272	—	$ 562
125	146	730	9	612	$500	1,842
200	234	1,170	15	1,020	500	2,690

[a]Doane Agricultural Digest (St. Louis: Doane Agricultural Service, 1956), p. 525.

[b]Construction Cost of $5 per linear foot. (Interview with Wendling, loc. cit.).

presented in Appendix Table 27. Calves were assumed to be born in early spring and sold in October. Cull bulls were sold in August after the breeding season was completed. Cull cows were sold in October with the calves. Animals inventoried comprised the next season's breeding herd or were heifer calves kept for replacements to be bred for calving when two years old.

Edgar F. Smith[1] suggested 40 per cent of the heifer calves (assume 50 percent are heifers) be kept for replacements each year. This should allow for better replacement selections and the opportunity to maintain a relatively young and productive herd. Dr. Smith also emphasized the need for maintaining an adequate number of bulls and replacing them every four years so replacement heifers would not need to be inbred.

[1]Dr. Edgar F. Smith, Professor of Animal Husbandry, Kansas State University, Manhattan, Kansas. Interview with author, July, 1962.

Feed Requirements

Feed requirements for wintering various size cowherds for 180 days were presented in Table 7. The ration, consisting of sorghum silage

TABLE 7

FEED REQUIREMENTS FOR WINTERING COWHERD FOR 180 DAYS[a]

Item	Yearly Rations per Head	50 Cowherd	125 Cowherd	200 Cowherd
	Units[b]	tons	tons	tons
Silage				
Cows	3 tons	174	435	696
Bulls	7 tons	14	35	56
Total Silage		188	470	752
S.O.M.				
Cows	270#	7.83	19.58	31.32
Bulls	450#	.45	1.13	1.80
Total S.O.M.		8.28	20.71	33.12
Total Salt	25#[c]	12.5 cwt	31.3 cwt	50 cwt

[a]Cowherd includes bulls and replacements.

[b]When cattle have access to low quality roughage, such as wheat stubble or dry grass, this ration will meet nutrient requirements as determined by the Committee on Animal Nutrition, National Research Council, December, 1950.

[c]Frank B. Morrison, Feeds and Feeding, (22nd ed.; Ithaca, N. Y.: Morrison Publishing Company, 1957). p. 699.

and soybean oil meal was designed to meet all nutritional needs of the breeding herd and supply enough nutrients for a one-pound average daily gain which was judged sufficient to keep the herd in thrifty breeding condition provided they had access to low quality roughage such as wheat stubble, milo stubble, or dry grass. This ration would allow a daily intake per cow of 33 1/3 pounds sorghum silage and 1.5 pounds soybean oil meal.

Less sorghum silage was inventoried for current year's use than was required for the feeding season since it was assumed that only two-thirds of the feeding season remained after the January 1 inventory date. Budgets allowing for three-year's feed storage had inventoried silage needed for the remainder of the current feeding period plus the feed required for two additional seasons. Budgets allowing for five-year's feed storage, had inventoried sorghum silage for the remainder of the current feeding period plus the feed required for four additional feeding seasons. Additional soybean oil meal for future years was not inventoried as it was assumed to be available each year and deterioration of soybean oil meal in storage was not part of the study. Feed required for wintering various cowherds for 180, 540, and 900 days are presented in Appendix Table 28.

Cash Receipts From Marketing Beef Cattle

Annual cash receipts from beef cattle marketing per head and by herd size were presented in Appendix Table 29. The study assumed that cows calved beginning in February. Cows were bred in May and June allowing cull bulls to be sold in August. Cull cows and those calves not being kept for herd replacements were sold in October.

Annual Expense

Annual expense consisted of fixed costs; including interest on fixed capital, plus variable costs incurred in one-year's operation of the livestock enterprise. Annual expense was broken down into parts and each item discussed separately.

Interest

Interest charges consisted of interest on fixed and working capital. An interest rate of five percent was levied against fixed capital, which consisted of the real estate investment, and six percent on working capital. Simple interest rates were used throughout the entire study.

Interest on working capital was computed on the total inventory value of the working capital. Working capital consisted of the breeding herd, (including replacements), feeding and handling equipment, and the amount of feed inventoried under the various budgets.

Feed Requirements

Feed requirements for one year for various size cowherdswere presented in Table 7. Sorghum silage requirements included only current year's requirements for all budgets. Sorghum silage stored for a longer period of time was not an annual expense, but it was part of working capital and the interest charge on all working capital was an annual expense.

Soybean oil meal was assumed to be purchased at a cost of $3.85 per hundred pounds, which would be $77.00 per ton.[1]

Salt was consumed at the rate of 25 pounds per cow per year. Salt

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[1]Kansas State Board of Agriculture, "Prices Paid by Farmers," Farm Facts, 1957-61.

was assumed to be purchased at a cost of $1.60 per hundred pounds.[1]

Veterinarian and Medical Expense

Veterinarian charges on a per cow basis were presented in Table 8. It was judged by the veterinarians interviewed that charges for various operations per head would be similar for cowherds consisting of 50 cows or more. Operations listed and prices charged were believed to be typical for cowherds in Western Kansas.

TABLE 8

TYPICAL VETERINARIAN CHARGES PER HEAD FOR COWHERDS CONSISTING OF 50 COWS OR LARGER FOR WESTERN KANSAS[a]

Item	Operation	Cost Per Head	Age at Time of Operation
Calves	Blackleg and malignant edema vaccination	$ .25	3 mo.
Calves	Dehorning	.75	3 mo.
Calves	Castration	.50	3 mo.
Replacement heifers	Brucellosis vaccination	1.00	6-12 mo.
Cows	Pregnancy testing[b]	1.00	Oct.-Nov.
Cows	Incidentals	1.00	
Total Expense per Cow		$3.30	

[a]Interview with J. E. Mosier, D.V.M., and F. W. Oehme, D.V.M., Kansas State University, Manhattan, Kansas, June 21, 1962.

[b]Expect to cull three to five percent of cows as infertile females.

[1]Local feed dealer prices, Manhattan, Kansas. July, 1962.

Bull Depreciation

Bulls were assumed to be purchased at a cost of $492.00 per head.[1] Purebred bulls were used exclusively to help maintain a high quality herd. One bull was used to service twenty-five cows. Each bull was sold at the end of four breeding seasons, so even in the fifty cowherd it was not necessary to inbreed replacement heifers, if adequate records were kept and good management practices followed. Bulls were sold for $279.20 per head. Therefore, bull depreciation was computed by subtracting the bull's selling price from his purchase price, ($212.80), divided by four for four-years' service and multiplying the annual depreciation per bull by the number of bulls in the herd.

Hauling Charges

Hauling charges consisted of costs involved in the transportation of cattle to market by a custom trucker. Cattle were assumed to be transported a distance of fifteen miles to a local livestock auction.[2] Bulls were marketed in August and calves and cull cows marketed in October.

Marketing Costs

Marketing costs consisted of charges involved in the selling of cattle at the local livestock auction. Marketing charges were estimated at $2.50 per head.[3]

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[1]"Strong Demand for Bulls at Dodge City," The Kansas Stockman, March, 1962, p. 44.

[2]Using a 40-foot trailer, 50-55 head of 450 pound calves could be hauled in one load. This was assumed to cost $10 per load. (Umsheid Trucking Company, Manhattan, Kansas), Interview with author, July, 1962.

[3]Marketing charges determined by interview with various local livestock auctions in the study area, July, 1962.

Taxes

All taxes were levied at the rate of one percent on inventory value. Real estate taxes were calculated as one percent of real estate inventory value. Personal property taxes were calculated as one percent of inventoried working capital.

Feed Distribution Equipment Costs

Feed distribution equipment costs consisted of costs, (other than labor) involved in transporting feed from the storage structure to the feed bunks. For the 50 cowherd feed distribution costs were estimated at $1.00 per day for the feeding season. Silage was loaded by hand onto the farm truck and unloaded by hand at the feed bunks.

For the 125 and 200 head cowherds silage was loaded onto the farm truck by means of a tractor front-end-loader, transported to the feed bunks and unloaded by hand. Feed distribution costs were estimated at $1.51 per day for the 125 head cowherd and at $2.10 for the 200 head cowherd.

Fence Repair

It was assumed that pastures were adequately fenced, making allowance for new fencing in the budget unnecessary. However, a charge of ten cents per acre was levied as an annual expense for fence repair.

Equipment Repair

The annual cost of owning and using livestock equipment for various size cowherds was presented in Appendix Table 30. However, there were two items that merit discussion. Feed bunks refer to permanent type feed bunks that feed from both sides. Costs involved were computed on a linear foot of feed bunk basis. Miscellaneous expense referred to small hand tools such as hand forks, scoops and brooms which may easily be broken, lost or worn out,

which allowed for the high annual cost of 50 percent of estimated initial cost.

CHAPTER VI

SUMMARY AND CONCLUSIONS

In the introduction of this thesis the problem was stated that uncertain precipitation in Western Kansas results in an unstable feed supply. It was pointed out that the livestock man is often faced with several alternatives: (a) should he sell his cattle on what may be a depressed market, (b) should he buy feed to maintain his stock on a market inflated due to the lack of available feed in the area plus the cost of transporting feed from other areas; or (c) can he economically store enough roughage during years of high rainfall and large crop production which can be used during drought years.

The objectives of this study were to:

1. Evaluate roughages which can be stored, especially sorghum silage.

2. Appraise the different types of storage facilities.

3. Compute costs for storing feed, including feed as well as storage facilities.

4. Develop and compare budgets showing incomes of various size cowherds during drought periods when feed reserves have been provided and cowherds maintained.

The hypothesis of this study was: feed stored during periods of high yields would be an economical and effective method of maintaining cowherds during drought periods. Sorghum silage was the roughage chosen

for evaluation. Criterion for evaluating storage facilities, in general, were those that would provide the lowest cost sorghum silage storage for a period of time of one or more years.

Budgeting techniques were employed as a method of analyzing and comparing various alternatives. Costs of producing sorghum silage in the three Western Kansas crop reporting districts were determined as a basis from which dollar losses resulting in sorghum silage storage and feed costs in maintaining cowherds could be determined.

A study of this nature has definite limitations of scope and applicability to real world situations. Inferences made and conclusions drawn were directly applicable only to the models which they described, based on the standards which were selected in the development of the budgets. With these limitations in mind the findings presented in this thesis have practical application of definite value; especially in the recommendation of types of silage storage structures and their uses in providing economical sorghum silage storage, the recommendation of long term sorghum silage storage, and the recommendation to farmers of establishing new beef cowherd enterprises in Western Kansas.

This study found crop production costs to be greatly influenced by fixed costs. Therefore, costs of producing sorghum silage as determined in this study were greatly affected by cropland values and interest on investment. Cropland was valued at $105 per acre, pastureland at $45 per acre, interest on fixed capital at five per cent, and interest on working capital at six per cent for all areas.

The use of an opaque plastic cover, properly installed, at least 6 mm in thickness was found to be a very important factor in reducing loss

in storage of sorghum silage. It was found that visible spoilage only comprised a small part of the total loss in sorghum silage storage. The earth trench silo was selected for use in this study as it provided the most economical form of storage.

Table 9 presented a summary of operator's returns to labor and management as determined by the various budgets. The data presented in this table indicated the operator could show a profit under all budgets when only one year's feed stock was provided and no provisions were made for long term storage. This table does not, however, allow for adverse economic conditions resulting from drought periods in which the operator would not produce enough roughage type feed to maintain his cowherd. During droughts, with no long term storage, the operator must either buy feed which may need to be imported from areas not affected by the drought or sell all or part of his herd due to lack of available feed. Therefore, the income from one year's feed supply does not present a true long-term picture of real world conditions where uncertain crop production is a reality.

Operator's returns to labor and management showed a profit for the operator from eight out of the nine budgets when a three year's feed stock had been provided. This condition represents some stability for the cowherd operator. The operator could withstand two complete sorghum crop failures and maintain his entire herd without the purchase of additional feed. This condition more accurately described the real world situation. With short-run income stability as the criterion for testing the hypothesis, the statement can be made that sorghum silage storage for a three-year period substantiated the hypothesis. The budgets representing

TABLE 9

SUMMARY OF OPERATOR'S RETURNS TO LABOR AND MANAGEMENT FOR VARIOUS BUDGETS

Item	Cowherd Size		
	50	125	200
Northwest Kansas			
One-year feed supply[a]	$222.55	$813.77	$1,463.93
Three-year feed supply	83.32	472.24	912.26
Five-year feed supply	-53.25	130.78	371.09
West Central Kansas			
One-year feed supply	246.16	872.83	1,558.37
Three-year feed supply	110.08	539.21	1,019.37
Five-year feed supply	-23.34	205.59	490.80
Southwest Kansas			
One-year feed supply	143.85	617.02	1,149.06
Three-year feed supply	-5.88	249.17	555.25
Five-year feed supply	-153.02	-118.61	-27.99

[a]Also referred to as No Long Term Storage.

the one-year and five-year storage periods did not prove the hypothesis. The one-year feed storage period was not applicable to the real world situation. Sorghum silage storage for the five-year period showed losses occurring in five out of the nine cases tested, therefore it would not be an acceptable strategem. In order for a firm to exist in the long-run it must make a profit.

This study considered that the operator had no alternative use for his labor. Therefore, his labor was not considered as a cost in this study. According to economic theory a firm would operate in the short run as long as the price of its product exceeds its average variable cost.[1] In the long run both fixed and variable costs must be covered

[1]Richard H. Leftwich, The Price System and Resource Allocation, (New York: Holt, Rinehart and Winston, 1960), p. 368.

plus a small profit allowance.

> In the long run those resources which were fixed in the short run become variable.... As they become variable, it becomes possible for individual firms to change scale of plant, for firms to exit from those industries in which losses occur, and for firms to enter those industries which make profits.[1]

The low returns to labor and management for the cowherd operator, under all budgets, may suggest a welfare problem meriting further consideration in the desirability of recommending cowherd enterprises in Western Kansas.

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[1] Ibid., p. 370.

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APPENDIX

TABLE 10

REAL ESTATE INVESTMENT FOR 960 ACRE CASH GRAIN FARM FOR VARIOUS AREAS IN KANSAS[a]

Item	Area		
	Northwest	West Central	Southwest
Quonset, General Purpose (40'x100')	$ 7,128.00	$ 7,128.00	$ 7,128.00
Steel Grain Bins (Two 1000 bu)	557.00	557.00	557.00
Poultry House	162.00	162.00	162.00
Fence, Wire	648.00	648.00	648.00
Water System	791.00	791.00	791.00
Cropland and Farmland (940 acres at $105 per acre)	98,700.00	98,700.00	98,700.00
Total Real Estate Investment	$107,986.00	$107,986.00	$107,986.00

[a]Unpublished survey of buildings and improvements in Western Kansas conducted by Charles W. Nauheim, Economic Research Service, U. S. Department of Agriculture, Kansas State University, Manhattan, Kansas.

TABLE 11

MACHINERY AND EQUIPMENT FOR TYPICAL 960 ACRE CASH GRAIN FARM FOR VARIOUS AREAS IN KANSAS[a]

Machine or Equipment	Size	Area		
		Northwest	West Central	Southwest
Tractor, New	4 plow	$ 2,388	$ 2,388	$ 2,388
Tractor, Used	3 plow	1,174	1,174	1,174
Plow, Oneway	15'	609	609	609
Field Cultivator	15'	396	396	396
Rod Weeder	12'	192	192	192
Drill, Grain	16 10	513	513	513
Combine	14' SP	3,972	3,972	3,972
Elevator, Grain Auger	6" auger	252	252	252
Gasoline Storage		120	120	120
Truck, Used	1 1/2 ton	1,107	1,107	1,107
Pick-up, New	3/4 ton	1,254	1,254	1,254
Lister-Planter	4 row	417		417
Row Cultivator	4 row	363		363
Rotary-Hoe	21'		429	
Shop Tools		417	417	417
Tractor Mower	7'	222	222	222
Spike Harrow	24'			111
Auto, New (Farm share = 50%)		1,002	1,002	1,002
Total Machinery and Equipment		$14,398	$14,047	$14,509

[a]Valuation based on 60% of new cost (Nauheim, op. cit.).

TABLE 12

VARIABLE COSTS PER ACRE FOR PRODUCING SORGHUM SILAGE IN NORTHWEST KANSAS

Field Operation	Size Implement	Times Over No.	Cost per Acre: Tractor and Machine Repairs	Tractor and Machine Fuel and Lubrication	Tractor and Machine Labor Hours	Total Cost
Pre-harvest[a]						
Field cultivator	15 ft.	1.0	$ .07	$ .15	.21	
Oneway plow	15 ft.	1.0	.08	.12	.17	
Rod weeder	12 ft.	1.0	.05	.11	.26	
Lister planter	4 R	1.5	.23	.23	.39	
Row cultivator	4 R	2.0	.16	.24	.53	
Seed						$ .90
Total Pre-harvest Machine Cost			$ .59	$ .85	1.56	$1.44
Harvest[b]						
Trucks	1 1/2 T	1.0	.15	.24	.52	
Tractors[c]	3	1.0	.07	.27	.52	.62
Custom charge						
Field cutter[d]						5.40
Truck[e]						2.46
Total Harvest Machine Cost			$ .22	$ .51	1.04	$ .73
Total Variable Costs Per Acre						11.55

[a]Calculated from data obtained from Charles W. Nauheim, Economic Research Service, U. S. Department of Agriculture, Kansas State University, Manhattan, Kansas.

[b]Harvest requirements calculated on 85 percent of planted acreage, allowing for 15 percent of planted acreage as loss.

[c]Hired labor calculated @ $1.20 per hour.

[d]Forage harvester @ cost of $1.00 per ton for a yield of 5.4 tons per planted acre, if calculated on harvested acreage basis use yield of 6.4 tons per acre and 85 percent of planted acreage.

[e]Charge of having one-half of silage hauled by custom trucker. Estimated cost of $ .91 per ton, "Rates for Custom Farm Operation, 1960," Kansas Crop & Livestock Reporting Service. (Mimeographed)

TABLE 13

VARIABLE COSTS PER ACRE FOR PRODUCING SORGHUM SILAGE IN WEST CENTRAL KANSAS[a]

Field Operation	Size Implement	Times Over No.	Cost per Acre: Tractor and Machine Repairs	Tractor and Machine Fuel and Lubrication	Labor Hours	Total Cost
Pre-harvest						
Field cultivator	15 ft.	3.0	$ .08	$ .45	.63	
Oneway plow	15 ft.	1.0	.04	.12	.17	
Drill	16-10	1.3	.04	.12	.22	
Rotary hoe	21 ft.	2.0	.02	.12	.33	
Seed						$ 1.04
Total Pre-harvest Machine Cost			$ .18	$ .81	1.35	$ .99
Harvest						
Trucks	1 1/2 T	1.0	.15	.24	.52	
Tractor	3 P	1.0	.07	.27	.52	.62
Custom charge						
Field cutter[b]						6.61
Truck						2.64
Total Harvest Machine Cost			$ .22	$ .51	1.04	$ .73
Total Variable Costs Per Acre						12.63

[a] See footnotes Table 12.

[b] Forage harvester @ cost of $1.14 per ton for a yield of 5.8 tons per planted acre, if calculated on harvested acreage basis use yield of 6.8 tons per acre and 85 percent of planted acreage.

TABLE 14

VARIABLE COSTS PER ACRE FOR PRODUCING SORGHUM SILAGE IN SOUTHWEST KANSAS[a]

Field Operation	Size Implement	Times Over No.	Cost per Acre			
			Tractor and Machine		Labor Hours	Total Cost
			Repairs	Fuel and Lubrication		
Pre-harvest						
Field cultivator	15 ft.	2.0	$ .14	$ .30	.43	
Spike Harrow	24 ft.	1.0	.02	.05	.13	
Blank list	4 R	1.0	.15	.15	.26	
Lister planter	4 R	2.0	.30	.30	.52	
Row cultivator	4 R	2.0	.16	.24	.52	
Seed						$ 1.20
Total Pre-harvest Machine Cost			$ .77	$1.04	1.86	$ 1.81
Harvest						
Trucks	1 1/2 T	1.0	.15	.24	.52	
Tractor	3	1.0	.07	.27	.52	.62
Custom charge						
Field cutter[b]						6.53
Truck						2.46
Total Harvest Machine Cost			$ .22	$ .51	1.04	$ .73
Total Variable Costs Per Acre						13.35

[a] See footnotes Table 12.

[b] Forage harvester @ cost of $1.21 per ton for a yield of 5.4 tons per planted acre, if calculated on harvested acreage basis use yield of 6.4 tons per acre and 85 percent of planted acreage.

TABLE 15

ESTIMATED CONSTRUCTION COST OF VARIOUS TYPE SILOS[a]

Type of Silo	Silo Capacity in Tons					
	200	400	600	800	1000	1200
Gas Tight Silo[b]	$7,000	$12,000	$16,800	$21,200	$25,000	$30,000
Concrete Stave Upright	2,200	3,600	4,500	5,200	6,000	6,600
Lined Trench or Bunker	1,300	2,400	3,000	3,600	4,000	4,800
Earth Trench	120	220	300	360	400	480

[a]Leo Wendling, Unpublished Material, Extension Engineer Kansas Agricultural Experiment Station.

[b]Estimate includes silo-unloader.

TABLE 16

ANNUAL FIXED COSTS OF STORING SORGHUM SILAGE PER TON
BY SIZE AND TYPE OF SILO IN KANSAS

Item	Capacity of Silo in Tons					
	200	400	600	800	1000	1200
Gas Tight Silo						
Depreciation[a]	$233.00	$400.00	$559.00	$706.00	$833.00	$999.00
Interest[b]	490.00	840.00	1176.00	1484.00	1750.00	2100.00
Annual Fixed costs	723.00	1240.00	1735.00	2190.00	2583.00	3099.00
Annual cost per ton	3.62	3.10	2.89	2.74	2.58	2.58
Concrete Stave Upright Silo						
Depreciation	110.00	180.00	225.00	260.00	300.00	330.00
Interest	154.00	252.00	315.00	364.00	420.00	462.00
Annual fixed costs	264.00	432.00	540.00	624.00	720.00	792.00
Annual cost per ton	1.32	1.08	.90	.78	.72	.66
Lined Trench or Bunker Silo						
Depreciation	65.00	120.00	150.00	180.00	200.00	240.00
Interest	91.00	168.00	210.00	252.00	280.00	336.00
Annual fixed costs	156.00	288.00	360.00	432.00	480.00	576.00
Annual cost per ton	.78	.72	.60	.54	.48	.48
Earth Trench Silo						
Depreciation	12.00	22.00	30.00	36.00	40.00	48.00
Interest	8.00	15.00	21.00	25.00	28.00	34.00
Annual fixed costs	20.00	37.00	51.00	61.00	68.00	82.00
Annual cost per ton	.10	.09	.09	.08	.07	.07

[a]Life of silos: Gas Tight, 30 years; Concrete Stave, 20 years; Lined Trench or Bunker, 20 years; Earth Trench, 10 years (Wendling, op. cit.).

[b]Includes: Interest, Taxes, Repairs and Insurance. Calculated as seven percent of original cost. (Wendling, op. cit.).

TABLE 17

COST OF SORGHUM SILAGE PER TON, WHEN FED FIRST YEAR BY TYPE AND SIZE OF SILO NORTHWEST KANSAS

Item	Capacity of Silo in Tons					
	200	400	600	800	1000	1200
Gas Tight Silo						
Fixed Costs[a] (10.3% of Original Cost)	3.62	3.10	2.89	2.74	2.58	2.58
Feed Costs[b]	4.57	4.57	4.57	4.57	4.57	4.57
Total Cost	8.19	7.67	7.46	7.31	7.15	7.15
Concrete Stave Upright						
Fixed Costs (12% of Original Cost)	1.32	1.08	.90	.78	.72	.66
Feed Costs	4.75	4.75	4.75	4.75	4.75	4.75
Total Cost	6.07	5.83	5.65	5.53	5.47	5.41
Lined Trench or Bunker						
Fixed Costs (12% of Original Cost)	.78	.72	.60	.54	.48	4.8
Feed Costs	4.76	4.76	4.76	4.76	4.76	4.76
Total Cost	5.54	5.48	5.36	5.30	5.24	5.24
Earth Trench						
Fixed Costs (16.7% of Original Cost)	.10	.09	.09	.08	.07	.07
Feed Costs	4.84	4.84	4.84	4.84	4.84	4.84
Total Costs	4.94	4.93	4.93	4.92	4.91	4.91

[a] Includes: Depreciation, Interest, Taxes, Repairs, and Insurance.

[b] Includes: Cost of producing and harvesting feed ($4.00), losses, filling silo, and cover for all except gas tight silo.

TABLE 18

COST OF SORGHUM SILAGE PER TON, WHEN FED FIRST YEAR BY TYPE AND SIZE OF SILO WEST CENTRAL KANSAS

Item	Capacity of Silo in Tons					
	200	400	600	800	1000	1200
Gas Tight Silo						
Fixed Costs[a] (10.3% of Original Cost)	3.62	3.10	2.89	2.74	2.58	2.58
Feed Costs[b]	4.46	4.46	4.46	4.46	4.46	4.46
Total Cost	8.08	7.56	7.35	7.20	7.04	7.04
Concrete Stave Upright						
Fixed Costs (12% of Original Cost)	1.32	1.08	.90	.78	.72	.66
Feed Costs	4.64	4.64	4.64	4.64	4.64	4.64
Total Costs	5.96	5.72	5.54	5.42	5.36	5.30
Lined Trench or Bunker						
Fixed Costs (12% of Original Cost)	.78	.72	.60	.54	.48	.48
Feed Costs	4.64	4.64	4.64	4.64	4.64	4.64
Total Cost	5.42	5.36	5.24	5.18	5.12	5.12
Earth Trench						
Fixed Costs (16.7% of Original Cost)	.10	.09	.09	.08	.07	.07
Feed Costs	4.72	4.72	4.72	4.72	4.72	4.72
Total Cost	4.82	4.81	4.81	4.80	4.79	4.79

[a]Includes: Depreciation, Interest, Taxes, Repairs, and Insurance.

[b]Includes: Cost of producing and harvesting feed ($3.90) losses, filling silo, and cover cost for all except gas tight silo.

TABLE 19

COST OF SORGHUM SILAGE PER TON, WHEN FED FIRST YEAR BY TYPE AND SIZE OF SILO, SOUTHWEST KANSAS

Item	Capacity of Silo in Tons					
	200	400	600	800	1000	1200
Gas Tight Silo						
Fixed Costs[a] (10.3% of Original Cost)	3.62	3.10	2.89	2.74	2.58	2.58
Feed Costs[b]	4.94	4.94	4.94	4.94	4.94	4.94
Total Cost	8.56	8.04	7.83	7.68	7.52	7.52
Concrete Stave Upright						
Fixed Costs (12% of Original Cost)	1.32	1.08	.90	.78	.72	.66
Feed Costs	5.13	5.13	5.13	5.13	5.13	5.13
Total Cost	6.45	6.21	6.03	5.91	5.85	5.79
Lined Trench or Bunker						
Fixed Costs (12% of Original Cost)	.78	.72	.60	.54	.48	.48
Feed Costs	5.15	5.15	5.15	5.15	5.15	5.15
Total Cost	5.93	5.87	5.75	5.69	5.63	5.63
Earth Trench						
Fixed Cost (16.7% of Original Cost)	.10	.09	.09	.08	.07	.07
Feed Cost	5.25	5.24	5.24	5.24	5.24	5.24
Total Cost	5.34	5.33	5.33	5.32	5.31	5.31

[a]Includes: Depreciation, Interest, Taxes, Repairs, and Insurance.

[b]Includes: Cost of producing and harvesting feed ($4.34) losses, filling silo, and cover cost for all except gas tight silo.

TABLE 20

COST OF SORGHUM SILAGE PER TON, WHEN STORED THREE YEARS BY TYPE AND SIZE OF SILO, NORTHWEST KANSAS

Item	Capacity of Silo in Tons					
	200	400	600	800	1000	1200
Gas Tight Silo						
Fixed Costs[a]	10.86	9.30	8.67	8.22	7.74	7.74
Feed Costs[b]	5.39	5.39	5.39	5.39	5.39	5.39
Total Cost	16.25	14.69	14.06	13.61	13.13	13.13
Concrete Stave Upright						
Fixed Costs	3.96	3.24	2.70	2.34	2.16	1.98
Feed Costs	5.61	5.61	5.61	5.61	5.61	5.61
Total Cost	9.57	8.85	8.31	7.95	7.77	7.59
Lined Trench or Bunker						
Fixed Costs	2.34	2.16	1.80	1.62	1.44	1.44
Feed Costs	5.62	5.62	5.62	5.62	5.62	5.62
Total Cost	7.96	7.78	7.42	7.24	7.06	7.06
Earth Trench						
Fixed Costs	.30	.27	.27	.24	.21	.21
Feed Costs	5.71	5.71	5.71	5.71	5.71	5.71
Total Cost	6.01	5.98	5.98	5.95	5.92	5.92

[a]Includes: Depreciation, Interest, Taxes, Repairs, and Insurance.

[b]Includes: Cost of producing and harvesting feed ($4.00), losses, filling silo, interest on feed costs, and cover for all except gas tight silo.

TABLE 21

COST OF SORGHUM SILAGE PER TON, WHEN STORED THREE YEARS BY TYPE AND SIZE OF SILO WEST CENTRAL KANSAS

Item	Capacity of Silo in Tons					
	200	400	600	800	1000	1200
Gas Tight Silo						
Fixed Costs[a]	10.86	9.30	8.67	8.22	7.74	7.74
Feed Costs[b]	5.26	5.26	5.26	5.26	5.26	5.26
Total Cost	16.12	14.56	13.93	13.48	13.00	13.00
Concrete Stave Upright						
Fixed Costs	3.96	3.24	2.70	2.34	2.16	1.98
Feed Costs	5.48	5.48	5.48	5.48	5.48	5.48
Total Cost	9.44	8.72	8.18	7.82	7.64	7.46
Lined Trench or Bunker						
Fixed Costs	2.34	2.16	1.80	1.62	1.44	1.44
Feed Costs	5.48	5.48	5.48	5.48	5.48	5.48
Total Cost	7.82	7.64	7.28	7.10	6.92	6.92
Earth Trench						
Fixed Costs	.30	.27	.27	.24	.21	.21
Feed Costs	5.57	5.57	5.57	5.57	5.57	5.57
Total Cost	5.87	5.84	5.84	5.81	5.78	5.78

[a]Includes: Depreciation, Interest, Taxes, Repairs, and Insurance.

[b]Includes: Cost of producing and harvesting feed ($3.90), losses, filling silo, interest on feed costs, and cover for all except gas tight silo.

TABLE 22

COST OF SORGHUM SILAGE PER TON, WHEN STORED THREE YEARS BY TYPE AND SIZE OF SILO, SOUTHWEST KANSAS

Item	Capacity of Silo in Tons					
	200	400	600	800	1000	1200
Gas Tight Silo						
Fixed Costs[a]	10.86	9.30	8.67	8.22	7.74	7.74
Feed Costs[b]	5.83	5.83	5.83	5.83	5.83	5.83
Total Cost	16.69	15.13	14.50	14.05	13.57	13.57
Concrete Stave Upright						
Fixed Costs	3.96	3.24	2.70	2.34	2.16	1.98
Feed Costs	6.05	6.05	6.05	6.05	6.05	6.05
Total Cost	10.01	9.29	8.75	8.39	8.21	8.03
Lined Trench or Bunker						
Fixed Costs	2.34	2.16	1.80	1.62	1.44	1.44
Feed Costs	6.08	6.08	6.08	6.08	6.08	6.08
Total Cost	8.42	8.24	7.88	7.70	7.52	7.52
Earth Trench						
Fixed Costs	.30	.27	..27	.24	.21	.21
Feed Costs	6.18	6.18	6.18	6.18	6.18	6.18
Total Cost	6.48	6.45	6.45	6.42	6.39	6.39

[a]Includes: Depreciation, Interest, Taxes, Repairs, and Insurance.

[b]Includes: Cost of producing and harvesting feed ($4.34) losses, filling silo, interest on feed costs, and cover for all except gas tight silo.

TABLE 23

COST OF SORGHUM SILAGE PER TON, WHEN STORED FIVE YEARS BY TYPE AND SIZE OF SILO, NORTHWEST KANSAS

Item	Capacity of Silo in Tons					
	200	400	600	800	1000	1200
Gas Tight Silo						
Fixed Costs[a]	18.10	15.50	14.45	13.70	12.90	12.90
Feed Costs[b]	5.94	5.94	5.94	5.94	5.94	5.94
Total Cost	24.04	21.44	20.39	19.64	18.84	18.84
Concrete Stave Upright						
Fixed Costs	6.60	5.40	4.50	3.90	3.60	3.30
Feed Costs	6.18	6.18	6.18	6.18	6.18	6.18
Total Cost	12.78	11.58	10.68	10.08	9.78	9.48
Lined Trench or Bunker						
Fixed Costs	3.90	3.60	3.00	2.70	2.40	2.40
Feed Costs	6.19	6.19	6.19	6.19	6.19	6.19
Total Cost	10.09	9.79	9.19	8.89	8.59	8.59
Earth Trench						
Fixed Costs	.50	.45	.45	.40	.35	.35
Feed Costs	6.29	6.29	6.29	6.29	6.29	6.29
Total Cost	6.79	6.74	6.74	6.69	6.64	6.64

[a]Includes: Depreciation, Interest, Taxes, Repairs, and Insurance.

[b]Includes: Cost of producing and harvesting feed ($4.00) losses, filling silo, interest on feed costs, and cover for all except gas tight silo.

TABLE 24

COST OF SORGHUM SILAGE PER TON, WHEN STORED FIVE YEARS BY TYPE AND SIZE OF SILO, WEST CENTRAL KANSAS

Item	Capacity of Silo in Tons					
	200	400	600	800	1000	1200
Gas Tight Silo						
Fixed Costs[a]	18.10	15.50	14.45	13.70	12.90	12.90
Feed Costs[b]	5.80	5.80	5.80	5.80	5.80	5.80
Total Costs	23.90	21.30	20.25	19.50	18.70	18.70
Concrete Stave Upright						
Fixed Costs	6.60	5.40	4.50	3.90	3.60	3.30
Feed Costs	6.03	6.03	6.03	6.03	6.03	6.03
Total Costs	12.53	11.43	10.53	9.93	9.63	9.33
Lined Trench or Bunker						
Fixed Costs	3.90	3.60	3.00	2.70	2.40	2.40
Feed Costs	6.03	6.03	6.03	6.03	6.03	6.03
Total Cost	9.93	9.63	9.03	8.73	8.43	8.43
Earth Trench						
Fixed Costs	.50	.45	.45	.40	.35	.35
Feed Costs	6.14	6.14	6.14	6.14	6.14	6.14
Total Cost	6.64	6.59	6.59	6.54	6.49	6.49

[a]Includes: Depreciation, Interest, Taxes, Repairs, and Insurance.

[b]Includes: Cost of producing and harvesting feed ($3.90) losses, filling silo, interest on feed costs, and cover for all except gas tight silo.

TABLE 25

COST OF SORGHUM SILAGE PER TON, WHEN STORED FIVE YEARS BY TYPE AND SIZE OF SILO, SOUTHWEST KANSAS

Item	Capacity of Silo in Tons					
	200	400	600	800	1000	1200
Gas Tight Silo						
Fixed Costs[a]	18.10	15.50	14.45	13.70	12.90	12.90
Feed Costs[b]	6.42	6.42	6.42	6.42	6.42	6.42
Total Cost	24.52	21.92	20.87	20.12	19.32	19.32
Concrete Stave Upright						
Fixed Costs	6.60	5.40	4.50	3.90	3.60	3.30
Feed Costs	6.67	6.67	6.67	6.67	6.67	6.67
Total Cost	13.27	12.07	11.17	10.57	10.27	9.97
Lined Trench or Bunker						
Fixed Costs	3.90	3.60	3.00	2.70	2.40	2.40
Feed Costs	6.70	6.70	6.70	6.70	6.70	6.70
Total Cost	10.60	10.30	9.70	9.40	9.10	9.10
Earth Trench						
Fixed Costs	.50	.45	.45	.40	.35	.35
Feed Costs	6.81	6.81	6.81	6.81	6.81	6.81
Total Cost	7.31	7.26	7.26	7.21	7.16	7.16

[a]Includes: Depreciation, Interest, Taxes, Repairs, and Insurance.

[b]Includes: Cost of producing and harvesting feed ($4.34), losses filling silo, interest on feed costs, and cover for all except gas tight silo.

TABLE 26

REAL ESTATE INVESTMENT FOR VARIOUS SIZE COWHERDS FOR WESTERN KANSAS

Size of Cowherd	Total No. Animal Units	Pastureland			Holding Facilities	Total Real Estate Investment
		Acres Required[a]	Value Per Acre	Estimated Investment	Estimated Investment	
50	70.3	703	$45	$ 31,635	$315	$ 31,950
125	175.8	1,758	45	79,110	375	79,485
200	281.2	2,812	45	126,540	375	126,915

[a] With average annual rainfall of 15-19 inches, one acre of good quality native pasture will furnish enough grass for 0.6 months animal units pasture; which would require ten acres pasture per animal unit for a six month grazing season. (Agricultural Conservation Program et al., Conservation Technical Standards and Specifications for Northwest Kansas, March 1957 and Soil and Water Conservation and Technical Standards and Specifications for Southwest Kansas, January 1957.)

TABLE 27

LIVESTOCK INVENTORY FOR VARIOUS SIZE COWHERDS
IN WESTERN KANSAS

Item	No.	Weight	Total Weight	Value Per Head	Total Value
50 Cowherd					
Brood cows	42	1,000	42,000	$160.00	$ 6,720.00
Pregnant heifers	8	900	7,200	160.00	1,280.00
Heifers-10 mo. of age	8	450	3,600	110.00	880.00
Bulls	2	1,600	3,200	400.00	800.00
Total Value	60		56,000		$ 9,680.00
125 Cowherd					
Brood cows	105	1,000	105,000	$160.00	$16,800.00
Pregnant heifers	20	900	18,000	160.00	3,200.00
Heifers-10 mo. of age	20	450	9,000	110.00	2,200.00
Bulls	5	1,600	8,000	400.00	2,000.00
Total Value	150		140,000		$24,200.00
200 Cowherd					
Brood cows	168	1,000	168,000	$160.00	26,880.00
Pregnant heifers	32	900	28,800	160.00	5,120.00
Heifers-10 mo. of age	32	450	14,400	110.00	3,520.00
Bulls	8	1,600	12,800	400.00	3,200.00
Total Value	240		224,000		$38,720.00

TABLE 28

SORGHUM SILAGE REQUIREMENTS FOR WINTERING VARIOUS COWHERDS FOR 180, 540, and 900 DAYS BY SIZE OF SILO[a]

Silo Capacity in Tons	50 Cowherd			125 Cowherd			200 Cowherd		
	Time in Days								
	180	540	900	180	540	900	180	540	900
	Tons								
200	188	188	188						
400		376							
600				470	470	470			
800			752				752	752	752
1,000					940	1,880		1,504	3,008
Total	188	564	940	470	1,410	2,350	752	2,256	3,760

[a]180 days equals one feeding year.

TABLE 29

ANNUAL CASH RECEIPTS FROM MARKETING BEEF CATTLE[a]

Item	Weight Per Head (lbs)	Selling Price Per Cwt.	Receipts Per Head	50 Cowherd No.	50 Cowherd Total Receipts	125 Cowherd No.	125 Cowherd Total Receipts	200 Cowherd No.	200 Cowherd Total Receipts
Steer calves[b]	450	$26.90	$121.05	22.5	$2,723.63	56.25	$ 6,809.06	90.0	$10,894.50
Heifer calves	425	23.50	99.88	14.5	1,448.26	36.25	3,620.65	58.0	5,793.04
Cull cows[c]	1,000	12.20	122.00	7.8	951.60	19.55	2,385.10	31.3	3,818.60
Bulls	1,600	17.45	279.20	0.5	139.60	1.25	349.00	2.0	558.40
Total Receipts					$5,263.09		$13,163.81		$21,064.54

[a]Based on average monthly price at Kansas City during August for bulls and during October for other types of cattle, for the five-year period from 1956-1960. (Kansas City Daily Drovers Telegram, 1956-1960).

[b]Number of calves sold is based on a 90% calf crop as deemed possible under good management and when pregnancy tested. (Interview with J. E. Mosier, D.V.M., and F. M. Oehme, D.V.M., Kansas State University, Manhattan, Kansas, June 21, 1962.)

[c]Number of cows sold and their value reduced by 2.27 percent to allow for annual death loss of mature animals. (Journal of Animal Science, 1944, III, 82.)

TABLE 30

ANNUAL COST OF OWNING LIVESTOCK EQUIPMENT
FOR VARIOUS SIZE COWHERDS[a]

Item	Cost Per Unit	Rate Percent	No. of Units	Estimated Investment	Annual Cost
50 Cowherd					
Feed bunks	$ 5.00 /ft	13	58	$ 290.00	$ 37.70
Tanks	68.00	12	4	272.00	32.64
Silage loader					
Holding facilities		8[b]	1	630.00	50.40
Miscellaneous		50		25.00	12.50
Total Annual Cost					$133.24
125 Cowherd					
Feed Bunks	$ 5.00 /ft	13	146	$ 730.00	94.90
Tanks	68.00	12	9	612.00	73.44
Silage loader		10.55[c]	1	500.00	52.75
Holding facilities		8	1	750.00	60.00
Miscellaneous		50		25.00	12.50
Total Annual Cost					$293.59
200 Cowherd					
Feed bunks	$ 5.00 /ft	13	234	$1,170.00	152.10
Tanks	68.00	12	15	1,020.00	122.40
Silage loader		10.55	1	500.00	52.75
Holding facilities		8	1	750.00	60.00
Miscellaneous		50		25.00	12.50
Total Annual Cost					$399.75

[a]Depreciation rates, unless otherwise stated, are from interview with Wendling (loc. cit.).

[b]O. H. Larson, O. E. Fairbanks, and F. C. Fenton, What It Costs To Use Farm Machinery, Kansas Agricultural Experiment Station Bulletin No. 417, p. 24.

[c]Estimated by the author.

TABLE 31

BUDGET FOR 50 COWHERD NORTHWEST DISTRICT

Item	No.*	Estimated Unit Value	Feed Supply Total Value 1 year	3 year	5 year
Investment					
Real Estate					
Pasture land	703 A	$ 45.00	$31,635.00	$31,635.00	$31,635.00
Holding facilities			315.00	315.00	315.00
Total Investment			31,950.00	31,950.00	31,950.00
Working Capital					
Brood cows	42	160.00	6,720.00	6,720.00	6,720.00
Pregnant heifers	8	160.00	1,280.00	1,280.00	1,280.00
Heifers--10 mo.	8	110.00	880.00	880.00	880.00
Bulls	2	400.00	800.00	800.00	800.00
Equipment					
Bunks	58 lf		145.00	145.00	145.00
Tanks	4		136.00	136.00	136.00
Miscellaneous			13.00	13.00	13.00
Feed--current year					
Sorghum silage	125.3 T	4.94	619.00	619.00	619.00
S.O.M.	28 cwt	3.85	108.00	108.00	108.00
Feed--stored	[a]	[b]		1,989.00	1,989.00
Total Working Capital			10,701.00	12,690.00	14,641.00
Total Investment			42,651.00	44,640.00	46,591.00

Item	No.	RECEIPTS Weight	Price/Cwt	Value Each	Total Value
Steer calves	22.5	450	$26.90	$121.05	$2,723.63
Heifer calves	14.5	425	23.50	99.88	1,448.26
Bulls	.5	1,600	17.45	279.20	139.60
Cull cows	7.8	1,000	12.20	122.00	951.60
Total Receipts					5,263.09

Table 31 (continued)

Item	Unit	Cost Per Unit	Feed Supply: 1 year Total Units	1 year Total Cost	3 year Total Units	3 year Total Cost	5 year Total Units	5 year Total Cost
Annual Expenses								
Int. on fixed cap.	dol.	$ .05	31,950	$1,597.50	31,950	$1,597.50	31,950	$1,597.50
Int. on working cap.	dol.	.06	10,701	642.06	12,690	761.40	14,641	878.46
Sorghum silage	ton	4.94	188	928.72	188	928.72	188	928.72
S.O.M.	cwt.	3.85	165.6	637.56	165.6	637.56	165.6	637.56
Salt	cwt.	1.60	12.5	20.00	12.5	20.00	12.5	20.00
Vet. & Med. Expenses	cow	3.30	50	165.00	50	165.00	50	165.00
Bull depreciation	head	53.20	2	106.40	2	106.40	2	106.40
Hauling charges	load	10.00	2	20.00	2	20.00	2	20.00
Marketing costs	head	2.50	45.3	113.25	45.3	113.25	45.3	113.25
Real estate taxes	dol.	.01	31,950	319.50	31,950	319.50	31,950	319.50
Personal Prop. taxes	dol.	.01	10,701	107.01	12,690	126.90	14,641	146.41
Feed Distr. (equip.)	day	1.00	180	180.00	180	180.00	180	180.00
Fence repair	acre	.10	703	70.30	703	70.30	703	70.30
Equipment repair	dol.			133.24		133.24		133.24
Total Annual Cost				5,040.54		5,179.77		5,316.34
Operator's return to labor and management				222.55		83.32		-53.25

[a]For 3 years feed supply, 376 tons, for 5 years feed supply, 752 tons.

[b]For 3 years feed supply, $5.29, for 5 years feed supply, $5.24.

*A = acres
lf = linear feet
T = tons
cwt = 100 pounds

TABLE 32

BUDGET FOR 125 COWHERD NORTHWEST DISTRICT

Item	No.*	Estimated Unit Value	Feed Supply Total Value 1 year	3 year	5 year
Investment					
Real Estate					
Pasture land	1,758 A	$ 45.00	$79,110.00	$79,110.00	$79,110.00
Holding facilities			375.00	375.00	375.00
Total Investment			79,485.00	79,485.00	79,485.00
Working Capital					
Brood cows	105	160.00	16,800.00	16,800.00	16,800.00
Pregnant Heifers	20	160.00	3,200.00	3,200.00	3,200.00
Heifers—10 mo.	20	110.00	2,200.00	2,200.00	2,200.00
Bulls	5	400.00	2,000.00	2,000.00	2,000.00
Equipment					
Bunks	146 lf		365.00	365.00	365.00
Tanks	9		306.00	306.00	306.00
Silage loader	1		250.00	250.00	250.00
Miscellaneous			13.00	13.00	13.00
Feed—current year					
Sorghum silage	313.3 T	4.93	1,545.00	1,545.00	1,545.00
S.O.M.	69 cwt	3.85	266.00	266.00	266.00
Feed—stored	—a	—b		4,879.00	9,757.00
Total Working Capital			26,945.00	31,824.00	36,702.00
Total Investment			106,430.00	111,309.00	116,187.00

RECEIPTS

Item	No.	Weight	Price/Cwt	Value Each	Total Value
Steer calves	56.25	450	$26.90	$121.05	$ 6,809.06
Heifer calves	36.25	425	23.50	99.88	3,620.65
Bulls	1.25	1,600	17.45	279.20	349.00
Cull cows	19.55	1,000	12.20	122.00	2,385.10
Total Receipts					13,163.81

Table 32 (continued)

Item	Unit	Cost Per Unit	Feed Supply: 1 year Total Units	1 year Total Cost	3 year Total Units	3 year Total Cost	5 year Total Units	5 year Total Cost
Annual Expenses								
Int. on fixed cap.	dol.	$ .05	79,485	$3,974.25	79,485	$3,974.25	79,485	$3,974.25
Int. on working cap.	dol.	.06	26,945	1,616.70	31,824	1,909.44	36,702	2,202.12
Sorghum silage	ton	4.93	470	2,317.10	470	2,317.10	470	2,317.10
S.O.M.	cwt.	3.85	414.2	1,594.67	414.2	1,594.67	414.2	1,594.67
Salt	cwt.	1.60	31.3	50.08	31.3	50.08	31.3	50.08
Vet. and Med.Expense	cow	3.30	125	412.50	125	412.50	125	412.50
Bull depreciation	head	53.20	5	266.00	5	266.00	5	266.00
Hauling charges	load	10.00	3	30.00	3	30.00	3	30.00
Marketing costs	head	2.50	113.3	283.25	113.3	283.25	113.3	283.25
Read estate taxes	dol.	.01	79,485	794.85	79,485	794.85	79,485	794.85
Personal Prop. taxes	dol.	.01	26,945	269.45	31,824	318.24	36,702	367.02
Feed Distr. (equip.)	day	1.51	180	271.80	180	271.80	180	271.80
Fence repair	acre	.10	1,758	175.80	1,758	175.80	1,758	175.80
Equipment repair	dol.			293.59		293.59		293.59
Total Annual Cost				12,350.04		12,691.57		13,033.03
Operator's return to labor and management				813.77		472.24		130.78

[a]For 3 years feed supply, 940 tons, for 5 years feed supply, 1,880 tons.

[b]For 3 years feed supply, $5.19, for 5 years feed supply, $5.19.

*A = acres
lf = linear feet
T = tons
cwt = 100 pounds

TABLE 33

BUDGET FOR 200 COWHERD NORTHWEST DISTRICT

Item	No.*	Estimated Unit Value	Feed Supply 1 year	Total Value 3 year	Total Value 5 year
Investment					
Real Estate					
Pasture land	2,812 A	$ 45.00	$126,540.00	$126,540.00	$126,540.00
Holding facilities			375.00	375.00	375.00
Total Investment			126,915.00	126,915.00	126,915.00
Working Capital					
Brood cows	168	160.00	26,880.00	26,880.00	26,880.00
Pregnant heifers	32	160.00	5,120.00	5,120.00	5,120.00
Heifers--10 mo.	32	110.00	3,520.00	3,520.00	3,520.00
Bulls	8	400.00	3,200.00	3,200.00	3,200.00
Equipment					
Bunks	234 lf		585.00	585.00	585.00
Tanks	15		510.00	510.00	510.00
Silage loader	1		250.00	250.00	250.00
Miscellaneous			13.00	13.00	13.00
Feed--current year					
Sorghum silage	501.3 T	4.92	2,466.00	2,466.00	2,466.00
S.O.M.	110.4 cwt	3.85	425.00	425.00	425.00
Feed-stored	[a]	[b]		7,881.00	15,612.00
Total Working Capital			42,969.00	50,850.00	58,581.00
Total Investment			169,884.00	177,765.00	185,496.00

RECEIPTS

Item	No.	Weight	Price/Cwt	Value Each	Total Value
Steer calves	90	450	$26.90	$121.05	$10,894.50
Heifer calves	58	425	23.50	99.88	5,793.04
Bulls	2	1,600	17.45	279.20	558.40
Cull cows	31.3	1,000	12.20	122.00	3,818.60
Total Receipts					21,064.54

Table 33 (continued)

Item	Unit	Cost Per Unit	Feed Supply: 1 year Total Units	1 year Total Cost	3 year Total Units	3 year Total Cost	5 year Total Units	5 year Total Cost
Annual Expenses								
Int. on fixed cap.	dol.	$ .05	126,915	$ 6,345.75	126,915	$ 6,345.75	126,915	$6,345.75
Int. on working cap.	dol.	.06	42,969	2,578.14	50,850	3,051.00	58,581	3,514.86
Sorghum silage	ton	4.92	752	3,699.84	752	3,699.84	752	3,699.84
S.O.M.	cwt.	3.85	662.4	2,550.24	662.4	2,550.24	662.4	2,550.24
Salt	cwt.	1.60	50	80.00	50	80.00	50	80.00
Vet. & Med. expenses	cow	3.30	200	660.00	200	660.00	200	660.00
Bull depreciation	head	53.20	8	425.60	8	425.60	8	425.60
Hauling charges	load	10.00	5	50.00	5	50.00	5	50.00
Marketing costs	head	2.50	181.3	453.25	181.3	453.25	181.3	453.25
Real estate taxes	dol.	.01	126,915	1,269.15	126,915	1,269.15	126,915	1,269.15
Personal Prop. taxes	dol.	.01	42,969	429.69	50,850	508.50	58,581	585.81
Feed distribution(eq.)	day	2.10	180	378.00	180	378.00	180	378.00
Fence repair	acre	.10	2,812	281.20	2,812	281.20	2,812	281.20
Equipment repair	dol.			399.75		399.75		399.75
Total Annual Cost				19,600.61		20,152.28		20,693.45
Operator's return to labor and management				1,463.93		912.26		371.09

[a]For 3 years feed supply, 1,504 tons, for 5 years feed supply, 3,008 tons.

[b]For 3 years feed supply, $5.24, for 5 years feed supply, $5.19.

*A = acres
lf = linear feet
T = tons
cwt = 100 pounds

TABLE 34

BUDGET FOR 50 COWHERD WEST CENTRAL DISTRICT

Item	No.*	Estimated Unit Value	Feed Supply Total Value 1 year	3 year	5 year
Investment					
Real Estate					
Pasture land	703 A	$ 45.00	$31,635.00	$31,635.00	$31,635.00
Holding facilities			315.00	315.00	315.00
Total Investment			31,950.00	31,950.00	31,950.00
Working Capital					
Brood cows	42	160.00	6,720.00	6,720.00	6,720.00
Pregnant heifers	8	160.00	1,280.00	1,280.00	1,280.00
Heifers--10 mo.	8	110.00	880.00	880.00	880.00
Bulls	2	400.00	800.00	800.00	800.00
Equipment					
Bunks	58 lf		145.00	145.00	145.00
Tanks	4		136.00	136.00	136.00
Miscellaneous			13.00	13.00	13.00
Feed--current year					
Sorghum silage	125.3 T	4.82	604.00	604.00	604.00
S.O.M.	28 cwt	3.85	108.00	108.00	108.00
Feed--stored	[a]	[b]		1,944.00	3,850.00
Total Working Capital			10,686.00	12,630.00	14,536.00
Total Investment			42,636.00	44,580.00	46,486.00

Item	No.	RECEIPTS Weight	Price/Cwt	Value Each	Total Value
Steer calves	22.5	450	$26.90	$121.05	$2,723.63
Heifer calves	14.5	425	23.50	99.88	1,448.26
Bulls	.5	1,600	17.45	279.20	139.60
Cull cows	7.8	1,000	12.20	122.00	951.60
Total Receipts					5,263.09

Table 34 (continued)

Item	Unit	Cost Per Unit	Feed Supply: 1 year Total Units	1 year Total Cost	3 year Total Units	3 year Total Cost	5 year Total Units	5 year Total Cost
Annual Expenses								
Int. on fixed cap.	dol.	$ .05	31,950	$1,597.50	31,950	$1,597.50	31,950	$1,597.50
Int. on working cap.	dol.	.06	10,686	641.16	12,630	757.80	14,536	872.16
Sorghum silage	ton	4.82	188	906.16	188	906.16	188	906.16
S.O.M.	cwt.	3.85	165.6	637.56	165.6	637.56	165.6	637.56
Salt	cwt.	1.60	12.5	20.00	12.5	20.00	12.5	20.00
Vet. & Med. expenses	cow	3.30	50	165.00	50	165.00	50	165.00
Bull depreciation	head	53.20	2	106.40	2	106.40	2	106.40
Hauling charges	load	10.00	2	20.00	2	20.00	2	20.00
Marketing costs	head	2.50	45.3	113.25	45.3	113.25	45.3	113.25
Real estate taxes	dol.	.01	31,950	319.50	31,950	319.50	31,950	319.50
Personal Prop. taxes	dol.	.01	10,686	106.86	12,630	126.30	14,536	145.36
Feed distr. (equip.)	day	1.00	180	180.00	180	180.00	180	180.00
Fence repair	acre	.10	703	70.30	703	70.30	703	70.30
Equipment repair	dol.			133.24		133.24		133.24
Total Annual Cost				5,016.93		5,153.01		5,286.43
Operator's return to labor and management				246.16		110.08		-23.34

[a]For 3 years feed supply, 376 tons, for 5 years feed supply, 752 tons.

[b]For 3 years feed supply, $5.17, for 5 years feed supply, $5.12.

*A = acres
lf = linear feet
T = tons
cwt = 100 pounds

TABLE 35

BUDGET FOR 125 COWHERD WEST CENTRAL DISTRICT

Item	No.*	Estimated Unit Value	Feed Supply Total Value 1 year	3 year	5 year
Investment					
Real Estate					
Pasture land	1,758 A	$ 45.00	$ 79,110.00	$ 79,110.00	$ 79,110.00
Holding facilities			375.00	375.00	375.00
Total Investment			79,485.00	79,485.00	79,485.00
Working Capital					
Brood cows	105	160.00	16,800.00	16,800.00	16,800.00
Pregnant heifers	20	160.00	3,200.00	3,200.00	3,200.00
Heifers--10 mo.	20	110.00	2,200.00	2,200.00	2,200.00
Bulls	5	400.00	2,000.00	2,000.00	2,000.00
Equipment					
Bunks	146 lf		365.00	365.00	365.00
Tanks	9		306.00	306.00	306.00
Silage loader	1		250.00	250.00	250.00
Miscellaneous			13.00	13.00	13.00
Feed--current year					
Sorghum silage	313.3 T	4.81	1,507.00	1,507.00	1,507.00
S.O.M.	69 cwt	3.85	266.00	266.00	266.00
Feed--stored	—a	—b		4,766.00	9,532.00
Total Working Capital			26,907.00	31,673.00	36,439.00
Total Investment			106,392.00	111,158.00	115,924.00

RECEIPTS

Item	No.	Weight	Price/Cwt	Value Each	Total Value
Steer calves	56.25	450	$26.90	$121.05	$ 6,809.06
Heifer calves	36.25	425	23.50	99.88	3,620.65
Bulls	1.25	1,600	17.45	279.20	349.00
Cull cows	19.55	1,000	12.20	122.00	2,385.10
Total Receipts					13,163.81

Table 35 (continued)

Item	Unit	Cost Per Unit	Feed Supply: 1 year Total Units	1 year Total Cost	3 year Total Units	3 year Total Cost	5 year Total Units	5 year Total Cost
Annual Expenses								
Int. on fixed cap.	dol.	$ .05	79,485	$ 3,974.25	79,485	$ 3,974.25	79,485	$ 3,974.25
Int. on working cap.	dol.	.06	26,907	1,614.42	31,673	1,900.38	36,439	2,186.34
Sorghum silage	ton	4.81	470	2,260.70	470	2,260.70	470	2,260.70
S.O.M.	cwt.	3.85	414.2	1,594.67	414.2	1,594.67	414.2	1,594.67
Salt	cwt.	1.60	31.3	50.08	31.3	50.08	31.3	50.08
Vet. & Med. expenses	cow	3.30	125	412.50	125	412.50	125	412.50
Bull depreciation	head	53.20	5	266.00	5	266.00	5	266.00
Hauling charges	load	10.00	3	30.00	3	30.00	3	30.00
Marketing costs	head	2.50	113.3	283.25	113.3	283.25	113.3	283.25
Real estate taxes	dol.	.01	79,485	794.85	79,485	794.85	79,485	794.85
Personal Prop. taxes	dol.	.01	26,907	269.07	31,673	316.73	36,439	364.39
Feed distri (equip)	day	1.51	180	271.80	180	271.80	180	271.80
Fence repair	acre	.10	1,758	175.80	1,758	175.80	1,758	175.80
Equipment repair	dol.			293.59		293.59		293.59
Total Annual Cost				12,290.98		12,624.60		12,958.22
Operator's return to labor and management				872.83		539.21		205.59

[a]For 3 years feed supply, 940 tons, for 5 years feed supply 1,880 tons.

[b]For 3 years feed supply, $5.07, for 5 years feed supply $5.07.

*A = acres
lf = linear feed
T = tons
cwt = 100 pounds

TABLE 36

BUDGET FOR 200 COWHERD WEST CENTRAL DISTRICT

Item	No.*	Estimated Unit Value	Feed Supply 1 year	Total Value 3 year	5 year
Investment					
Real Estate					
Pasture land	2,812 A	$ 45.00	$126,540.00	$126,540.00	$126,540.00
Holding facilities			375.00	375.00	375.00
Total Investment			126,915.00	126,915.00	126,915.00
Working Capital					
Brood cows	168	160.00	26,880.00	26,880.00	26,880.00
Pregnant heifers	32	160.00	5,120.00	5,120.00	5,120.00
Heifers--10 mo.	32	110.00	3,520.00	3,520.00	3,520.00
Bulls	8	400.00	3,200.00	3,200.00	3,200.00
Equipment					
Bunks	234 lf		585.00	585.00	585.00
Tanks	15		510.00	510.00	510.00
Silage loader	1		250.00	250.00	250.00
Miscellaneous			13.00	13.00	13.00
Feed--current year					
Sorghum silage	501.3 T	4.80	2,406.00	2,406.00	2,406.00
S.O.M.	110.4 cwt	3.85	425.00	425.00	425.00
Feed--stored	[a]	[b]		7,700.00	15,251.00
Total Working Capital			42,909.00	50,609.00	58,160.00
Total Investment			169,824.00	177,524.00	185,075.00

RECEIPTS

Item	No.	Weight	Price/Cwt	Value Each	Total Value
Steer calves	90	450	$26.90	$121.05	$10,894.50
Heifer calves	58	425	23.50	99.88	5,793.04
Bulls	2	1,600	17.45	279.20	558.40
Cull cows	31.3	1,000	12.20	122.00	3,818.60
Total Receipts					$21,064.54

Table 36 (continued)

Item	Unit	Cost Per Unit	Feed Supply: 1 year Total Units	1 year Total Cost	3 year Total Units	3 year Total Cost	5 year Total Units	5 year Total Cost
Annual Expenses								
Int. on fixed cap.	dol.	$ .05	126,915	$ 6,345.75	126,915	$ 6,345.75	126,915	$ 6,345.75
Int. on working cap.	dol.	.06	42,909	2,574.54	50,609	3,036.54	58,160	3,489.60
Sorghum silage	ton	4.80	752	3,609.60	752	3,609.60	752	3,609.60
S.O.M.	cwt.	3.85	662.4	2,550.24	662.4	2,550.24	662.4	2,550.24
Salt	cwt.	1.60	50	80.00	50	80.00	50	80.00
Vet. & Med. expenses	cow	3.30	200	660.00	200	660.00	200	660.00
Bull depreciation	head	53.20	8	425.00	8	425.60	8	425.60
Hauling charges	load	10.00	5	50.00	5	50.00	5	50.00
Marketing costs	head	2.50	181.3	453.25	181.3	453.25	181.3	453.25
Real estate taxes	dol.	.01	126,915	1,269.15	126,915	1,269.15	126,915	1,269.15
Personal Prop. taxes	dol.	.01	42,909	429.09	50,609	506.09	58,160	581.60
Feed distr. (equip.)	day	2.10	180	378.00	180	378.00	180	378.00
Fence repair	acre	.10	2,812	281.20	2,812	281.20	2,812	281.20
Equipment repair	dol.			399.75		399.75		399.75
Total Annual Cost				19,506.17		20,045.17		20,573.74
Operator's return to labor and management				1,558.37		1,019.37		490.80

[a]For 3 years feed supply, 1,504 tons, for five years feed supply, 3,008 tons.

[b]For 3 years feed supply, $5.12, for 5 years feed supply, $5.07.

*A = acres
lf = linear feet
T = tons
cwt = 100 pounds

TABLE 37

BUDGET FOR 50 COWHERD SOUTHWEST DISTRICT

Item	No.*	Estimated Unit Value	Feed Supply 1 year	Total Value 3 year	5 year
Investment					
Real Estate					
Pasture land	703 A	$ 45.00	$31,635.00	$31,635.00	$31,635.00
Holding facilities			315.00	315.00	315.00
Total Investment			31,950.00	31,950.00	31,950.00
Working Capital					
Brood cows	42	160.00	6,720.00	6,720.00	6,720.00
Pregnant heifers	8	160.00	1,280.00	1,280.00	1,280.00
Heifers--10 mo.	8	110.00	880.00	880.00	880.00
Bulls	2	400.00	800.00	800.00	800.00
Equipment					
Bunks	58 lf		145.00	145.00	145.00
Tanks	4		136.00	136.00	136.00
Miscellaneous	4		13.00	13.00	13.00
Feed--current year					
Sorghum silage	125.3 T	5.34	669.00	669.00	669.00
S.O.M.	28 cwt	3.85	108.00	108.00	108.00
Feed--stored	—a	—b		2,139.00	4,241.00
Total Working Capital			10,751.00	12,890.00	14,992.00
Total Investment			42,701.00	44,840.00	46,942.00

RECEIPTS

Item	No.	Weight	Price/Cwt	Value Each	Total Value
Steer calves	22.5	450	$26.90	$121.05	$2,723.63
Heifer calves	14.5	425	23.50	99.88	1,448.26
Bulls	.5	1,600	17.45	279.20	139.60
Cull cows	7.8	1,000	12.20	122.00	951.60
Total Receipts					5,263.09

Table 37 (continued)

Item	Unit	Cost Per Unit	Feed Supply: 1 year Total Units	1 year Total Cost	3 year Total Units	3 year Total Cost	5 year Total Units	5 year Total Cost
Annual Expenses								
Int. on fixed cap.	dol.	$ .05	31,950	$1,597.50	31,950	$1,597.50	31,950	$1,597.50
Int. on working cap.	dol.	.06	10,751	645.06	12,890	773.40	14,992	899.52
Sorghum silage	ton	5.34	188	1,003.92	188	1,003.92	188	1,003.92
S.O.M.	cwt.	3.85	165.6	637.56	165.6	637.56	165.6	637.56
Salt	cwt.	1.60	12.5	20.00	12.5	20.00	12.5	20.00
Vet. & Med. expenses	cow	3.30	50	165.00	50	165.00	50	165.00
Bull depreciation	head	53.20	2	106.40	2	106.40	2	106.40
Hauling charges	load	10.00	2	20.00	2	20.00	2	20.00
Marketing costs	head	2.50	45.3	113.25	45.3	113.25	45.3	113.25
Real estate taxes	dol.	.01	31,950	319.50	31,950	319.50	31,950	319.50
Personal Prop. taxes	dol.	.01	10,751	107.51	12,890	128.90	14,992	149.92
Feed distr. (equip.)	day	1.00	180	180.00	180	180.00	180	180.00
Fence repair	acre	.10	703	70.30	703	70.30	703	70.30
Equipment repair	dol.			133.24		133.24		133.24
Total Annual Cost				5,119.24		5,268.97		5,416.11
Operator's return to labor and management				143.85		-5.88		-153.02

[a]For 3 years feed supply, 376 tons, for 5 year feed supply, 752 tons.

[b]For 3 years feed supply, $5.69, for 5 years feed supply, $5.64.

*A = acres
lf = linear feet
T = tons
cwt = 100 pounds

TABLE 38

BUDGET FOR 125 COWHERD SOUTHWEST DISTRICT

Item	No.*	Estimated Unit Value	Feed Supply Total Value 1 year	3 year	5 year
Investment					
Real Estate					
Pasture land	1,758 A	$ 45.00	$79,110.00	$79,110.00	$79,110.00
Holding facilities			375.00	375.00	375.00
Total Investment			79,485.00	79,485.00	79,485.00
Working Capital					
Brood cows	105	160.00	16,800.00	16,800.00	16,800.00
Pregnant heifers	20	160.00	3,200.00	3,200.00	3,200.00
Heifers—10 mo.	20	110.00	2,200.00	2,200.00	2,200.00
Bulls	5	400.00	2,000.00	2,000.00	2,000.00
Equipment					
Bunks	146 lf		365.00	365.00	365.00
Tanks	9		306.00	306.00	306.00
Silage loader	1		250.00	250.00	250.00
Miscellaneous			13.00	13.00	13.00
Feed--current year					
Sorghum silage	313.3 T	5.33	1,670.00	1,670.00	1,670.00
S.O.M.	69 cwt	3.85	266.00	266.00	266.00
Feed--stored	—a	—b		5,255.00	10,509.00
Total Working Capital			27,070.00	32,325.00	37,579.00
Total Investment			106,555.00	111,810.00	117,064.00

Item	No.	RECEIPTS Weight	Price/Cwt	Value Each	Total Value
Steer calves	56.25	450	$26.90	$121.05	$ 6,809.06
Heifer calves	36.25	425	23.50	99.88	3,620.65
Bulls	1.25	1,600	17.45	279.20	349.00
Cull cows	19.55	1,000	12.20	122.00	2,385.10
Total Receipts					13,163.81

Table 38 (continued)

Item	Unit	Cost Per Unit	Feed Supply: 1 year Total Units	1 year Total Cost	3 year Total Units	3 year Total Cost	5 year Total Units	5 year Total Cost
Annual Expenses								
Int. on fixed cap.	dol.	$ .05	79,485	$3,974.25	79,485	$3,974.25	79,485	$3,974.25
Int. on working cap.	dol.	.06	27,070	1,624.20	32,325	1,939.50	37,579	2,254.74
Sorghum silage	ton	5.33	470	2,505.10	470	2,505.10	470	2,505.10
S.O.M.	cwt.	3.85	414.2	1,594.67	414.2	1,594.67	414.2	1,594.67
Salt	cwt.	1.60	31.3	50.08	31.3	50.08	31.3	50.08
Vet. & Med. expenses	cow	3.30	125	412.50	125	412.50	125	412.50
Bull depreciation	head	53.20	5	266.00	5	266.00	5	266.00
Hauling charges	load	10.00	3	30.00	3	30.00	3	30.00
Marketing costs	head	2.50	113.3	283.25	113.3	283.25	113.3	283.25
Real estate taxes	dol.	.01	79,485	794.85	79,485	794.85	79,485	794.85
Personal Prop. taxes	dol.	.01	27,070	270.70	32,325	323.25	37,579	375.79
Feed distr. (equip.)	day	1.51	180	271.80	180	271.80	180	271.80
Fence repair	acre	.10	1,758	175.80	1,758	175.80	1,758	175.80
Equipment repair	dol.			293.59		293.59		293.59
Total Annual Cost				12,546.79		12,914.64		13,282.42
Operator's return to labor and management				617.02		249.17		-118.61

[a]For 3 years feed supply, 940 tons, for five years feed supply, 1,880 tons.

[b]For 3 years feed supply, $5.59, for 5 years feed supply, $5.59.

*A = acres
lf = linear feet
T = Ton
cwt = 100 pounds

TABLE 39

BUDGET FOR 200 COWHERD SOUTHWEST DISTRICT

Item	No.*	Estimated Unit Value	Feed Supply 1 year	Total Value 3 year	Total Value 5 year
Investment					
Real Estate					
Pasture land	2,812 A	$ 45.00	$126,540.00	$126,540.00	$126,540.00
Holding facilities			375.00	375.00	375.00
Total Investment			126,915.00	126,915.00	126,915.00
Working Capital					
Brood cows	168	160.00	26,880.00	26,880.00	26,880.00
Pregnant heifers	32	160.00	5,120.00	5,120.00	5,120.00
Heifers--10 mo.	32	110.00	3,520.00	3,520.00	3,520.00
Bulls	8	400.00	3,200.00	3,200.00	3,200.00
Equipment					
Bunks	234 lf		585.00	585.00	585.00
Tanks	15		510.00	510.00	510.00
Silage loader	1		250.00	250.00	250.00
Miscellaneous			13.00	13.00	13.00
Feed--current year					
Sorghum silage	501.3 T	5.32	2,667.00	2,667.00	2,667.00
S.O.M.	110.4 cwt	3.85	425.00	425.00	425.00
Feed--stored	[a]	[b]		8,483.00	16,815.00
Total Working Capital			43,170.00	51,653.00	59,985.00
Total Investment			170,085.00	178,568.00	186,900.00

RECEIPTS

Item	No.	Weight	Price/Cwt	Value Each	Total Value
Steer calves	90	450	$26.90	$121.05	$10,894.50
Heifer calves	58	425	23.50	99.88	5,793.04
Bulls	2	1,600	17.45	279.20	558.40
Cull cows	31.3	1,000	12.20	122.00	3,818.60
Total Receipts					21,064.54

Table 39 (continued)

Item	Unit	Cost Per Unit	Feed Supply: 1 year Total Units	1 year Total Cost	3 year Total Units	3 year Total Cost	5 year Total Units	5 year Total Cost
Annual Expenses								
Int. on fixed cap.	dol.	$ .05	126,915	$6,345.75	126,915	$6,345.75	126,915	$6,345.75
Int. on working cap.	dol.	.06	43,170	2,590.20	51,653	3,099.18	59,985	3,599.10
Sorghum silage	ton	5.32	752	4,000.64	752	4,000.64	752	4,000.64
S.O.M.	cwt.	3.85	662.4	2,550.24	662.4	2,550.24	662.4	2,550.24
Salt	cwt.	1.60	50	80.00	50	80.00	50	80.00
Vet. & Med. expenses	cow	3.30	200	660.00	200	660.00	200	660.00
Bull depreciation	head	53.20	8	425.60	8	425.60	8	425.60
Hauling charges	load	10.00	5	50.00	5	50.00	5	50.00
Marketing costs	head	2.50	181.3	453.25	181.3	453.25	181.3	453.25
Real estate taxes	dol.	.01	126,915	1,269.15	126,915	1,269.15	126,915	1,269.15
Personal Prop. taxes	dol.	.01	43,170	431.70	51,653	516.53	59,985	599.85
Feed distr. (equip.)	day	2.10	180	378.00	180	378.00	180	378.00
Fence repair	acre	.10	2,812	281.20	2,812	281.20	2,812	281.20
Equipment repair	dol.			399.75		399.75		399.75
Total Annual Cost				19,915.48		20,509.29		21,092.53
Operator's return to labor and management				1,149.06		555.25		-27.99

[a] For 3 years feed supply, 1,504 tons, for 5 years feed supply, 3,008 tons.

[b] For 3 years feed supply, $5.64, for 5 years feed supply, $5.59.

*A = acres
lf = linear feet
T = Ton
cwt = 100 pounds

ECONOMICS OF FEED STORAGE FOR COWHERDS DURING DROUGHT PERIODS FOR WESTERN KANSAS

by

DUANE ANTHONY UNGER

B. S., Kansas State University, 1960

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Economics and Sociology

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1964

This study was concerned with the desirability of storing sorghum silage in order to maintain cowherds during drought periods of three or five years duration. The problem of this study was: uncertain precipitation in Western Kansas results in an unstable feed supply. This study attempted to determine if a livestock farmer can economically store enough roughage during years of high rainfall and large crop production which can be used during drought years to maintain the cowherd. The objectives were to compute costs of producing and storing sorghum silage; and to compare the incomes of various size cowherds during drought periods when feed reserves have been provided and cowherds maintained.

The budget was employed as the tool of analysis for the study. Considerable effort and detail were involved in the development of the budget standards. Western Kansas was divided according to the three crop reporting districts to facilitate the development of more accurate and representative budget standards. Trends in farm and cowherd size provided basis for selecting the 960 acre cash grain unit with 50, 125, and 200 cowherd units. The cash grain unit was first developed. Costs of producing sorghum silage in each district were determined. Second, silos were analyzed to determine the most economical method of storing sorghum silage over three or five year periods. Dry matter loses incurred during storage and cost per ton of sorghum silage at the end of the various storage periods were determined. Third, partial budgets were developed to analyze the effects on average net income and income stability by maintaining one, three, or five year feeds stocks. Pasture acreage was varied to meet the needs of each size cowherd.

The hypothesis of this study was: feed stored during periods of high yields would be an economical and effective method of maintaining cowherds during drought periods. Table 1 presents a summary of operator's returns to labor and management. This table indicates the operator could show a profit when only one-years feed stock was provided. This does not present a true long-term picture where drought periods are a reality. Eight of the nine budgets indicate a profit for the operator when a three-years feed stock was provided. This condition represents some stability, as the operator could withstand two complete sorghum crop failures and maintain his herd without purchasing feed. Sorghum silage storage for the five-year period showed losses occurring in five of the nine cases tested; therefore, it would not be an acceptable strategem. Short-run income stability was the criterion for testing the hypothesis. Sorghum silage storage for a three-year period substantiated the hypothesis. The budgets representing the one-year and five-year storage periods did not prove the hypothesis.

It was the intention of this thesis that the material which has been developed will be used by farm management personnel, farmers, and other workers in farm planning.

TABLE 1

SUMMARY OF OPERATOR'S RETURNS TO LABOR AND MANAGEMENT FOR VARIOUS BUDGETS

Item	Cowherd Size		
	50	125	200
Northwest Kansas			
One-year feed supply[a]	$222.55	$813.77	$1,463.93
Three-year feed supply	83.32	472.24	912.26
Five-year feed supply	-53.25	130.78	371.09
West Central Kansas			
One-year feed supply	246.16	872.83	1,558.37
Three-year feed supply	110.08	539.21	1,019.37
Five-year feed supply	-23.34	205.59	490.80
Southwest Kansas			
One-year feed supply	143.85	617.02	1,149.06
Three-year feed supply	-5.88	249.17	555.25
Five-year feed supply	-153.02	-118.61	-27.99

[a]Also referred to as No Long Term Storage.