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Optimum Enterprise Combinations for Representative Farms in Seven Counties of Southwestern Utah, 1967

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OPTIMUM ENTERPRISE COMBINATIONS FOR REPRESENTATIVE FARMS IN SEVEN COUNTIES OF SOUTHWESTERN UTAH, 1967

by

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ABSTRACT

Optimum Enterprise Combinations for Representative Farms

in Seven Counties of Southwestern Utah, 1967

by

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Utah State University, 1971

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Resources available for agricultural production were ascertained and trends in their use were studied for seven counties of southwestern Utah. Special consideration was given to cropland, irrigation water, and operating capital as resource restrictions for a linear programming model. Budget data were obtained for crop and livestock enterprises by interviewing farmers and ranchers in the area. Budgets for four representative farm types representing climatic and irrigation differences were made to study crop possibilities. Acreage minimums or maximums for selected crops were established as conservation measures. Budgets were prepared for farm livestock enterprises to use with crop budgets for each representative farm. Results provided profit maximizing enterprise combinations for each representative farm.

(73 pages)

INTRODUCTION

Agriculture in seven counties of southwestern Utah faces several problems. Like other arid areas, irrigation is necessary for most types of crop production. Irrigation water, in most of the area, comes directly from rivers and creeks without seasonal storage. During the late summer months, flow decreases and the availability of irrigation water restricts the type of crops which can profitably be produced.

In some parts of southwestern Utah, most irrigation water comes from pump irrigation and irrigation problems are quite different. Late summer water is limited by the pumping facilities of each individual farmer and a yearly maximum of 4 acre feet per acre that has been imposed by the state.

Irrigated cropland makes up less than 1 percent of the total land area in southwestern Utah. Federal and state-owned lands make up the greater portion of the area. Grazing permits on these lands are held by local farmers and ranchers for grazing cattle and sheep.

The cost-price squeeze in agriculture encourages a change toward larger farms and greater efficiency of operation. Although many agricultural resources are quite limiting, agriculture remains the most important source of income to residents of the area.

Most agricultural resources can be used for several kinds of crop and livestock enterprises. Each enterprise requires resources of different times and in varying quantities during the year. Some resources are available in very limited quantities during certain periods and go unused during other times of the year. With a fixed supply of some resources and a varying supply of others, the problem of selecting an optimum enterprise combination to maximize farm income becomes complex.

This study, using linear programming techniques, has been made in an effort to ascertain optimum enterprise combinations under several types of conditions. Increased efficiency of resource use would improve the area. Crop and livestock enterprise studies were made in the counties of Beaver, Iron, Washington, Kane, Garfield, Piute and Wayne. Due to extreme differences in climate and available late summer water, the region was divided into four areas for study of crop farming, Table 1. Further reference will be made to the areas as follows:

1. High Elevation area - Areas of crop land above 6,000 feet elevation.
2. Intermediate Elevation area - Areas of crop land between 5,000 and 6,000 feet elevation under stream flow irrigation.
3. Southwest Pump area - Areas of crop land irrigated in part or total by pump irrigation between 5,000 and 6,000 feet elevation.
4. Utah's Dixie area - Areas of crop land located at less than 4,000 feet elevation.

Table 1. Location and climate factors that affect crop production in representative areas of southwestern Utah

Location	County	Elevation feet	Frost free days	Developmental heat units
I. High Elevation Area:				
Panguitch	Garfield	6720	83	2743
Loa	Wayne	7045	85	2946
Average				
II. Intermediate Elevation Area:				
Beaver	Beaver	5860	104	3734
Kanab	Kane	5010	151	5537
Escalante	Garfield	5750	134	4551
Average				
III. Southwestern Pump Area:				
Milford	Beaver	5028	126	4623
Cedar City	Iron	5680	150	5065
Parowan	Iron	5974	123	4470
Modena	Iron	5460	138	4597
Enterprise	Washington		118	4242
Average				
IV. Utah's Dixie:				
St. George	Washington	2700	196	7798

OBJECTIVES

Objectives of this study were:

1. To ascertain resources available for agricultural production in the seven county area and to identify trends in their use.
2. Ascertain farm and ranch organization patterns that use resources efficiently and result in optimum income.
3. Estimate the effects that these organizational patterns would have on the agricultural economy of the area.

REVIEW OF LITERATURE

In 1964, an optimum enterprise combinations study for Piute County was completed by Langford (6). His study is the only work completed on optimum enterprise combinations in the study area of this report. Other areas of Utah have been studied with recommendations for maximum profit combinations using available resources. Master's theses by Mitts (7) in Sevier County and Sumsion (8) in West Millard County have determined optimum enterprise combinations for representative farms. Each of the three mentioned studies used budgeting and linear programming techniques similar to those used in this study.

SOURCES OF DATA AND METHODS OF PROCEDURE

Data for this study were obtained by personal interviews with 94 farmers and ranchers who live in seven counties of southwestern Utah, Table 2. A form was used to aid in obtaining useful and complete data from each interview. Interviews were made on an enterprise basis rather than by complete farm or ranch. An interview with an individual farmer often resulted in information for one livestock and two or three crop enterprises.

In addition to survey information, data were used from several secondary sources. Consumptive use of irrigation water for crops was obtained from a study made in Milford Valley (1). Additional supplementary information on farming in Milford Valley was obtained from a thesis published in 1966 (2). Time series data by county on livestock numbers, acreages, farms and crop yields were obtained from agriculture census data (3). Land controlled by state and federal agencies, livestock grazed and animal unit months of grazing were obtained from an Experiment Station report (4).

Available Resources

In the seven-county study area, there are 131,000 acres of irrigated crop land, 24,000 acres of dry farm land and 1,420,000 acres of

Table 2. Crop enterprise interviews in four cropping areas and livestock enterprise interviews in seven counties of southwestern Utah, 1967

Enterprise	Interviews
Crops:	
High elevation area	
Alfalfa	43
Barley	15
Potatoes	11
Oat hay	4
Intermediate elevation area	
Alfalfa	15
Barley	4
Southwest pump area	
Alfalfa	10
Barley	6
Silage	6
Potatoes	4
Utah's Dixie area	
Alfalfa	6
Barley	4
Silage	6
Barley-milo	3
Livestock:	
Range cow-calf	41
Range ewe-lamb	13
A grade dairy	10
B grade dairy	7
Feeder beef warm-up	8
Farm flock sheep	9

privately-owned grazing land. The remaining 11,780,000 acres are owned by state and federal government agencies. The Bureau of Land Management and the National Forest Service control 9,560,000 acres which have grazing privileges used by permittees who run cattle and sheep. Because carrying capacities vary and boundaries of Bureau of Land Management and National Forest Service lands do not correspond exactly with boundaries of the seven county study area, exact figures for the number of livestock permitted on lands in the area were not available. Estimates were made on the assumption that acres per AUM were equal throughout the area for the total acreage, Table 3.

All of Kanab and Cedar City Bureau of Land Management Districts are inside the study area. Approximately 88 percent of the Richfield District and 24 percent of the Fillmore District are inside the study area. All of Dixie National Forest and 28 percent of Fish Lake National Forest are inside the study area.

Cattle and sheep grazed on federal lands during 1964 consumed about 416,500 AUM's of feed which is 27 percent of the feed requirement for 111,000 head of cattle and 80,000 head of sheep which were in the area. The remaining 73 percent was obtained from private grazing land, farm feeding and grazing rights owned outside of the study area which are mostly "winter" ranges.

Table 3. Estimated animal units of grazing and number of permitted livestock on Bureau of Land Management and National Forests in seven counties of southwestern Utah, 1964.

District or Forest	Cattle Permits	Cattle AUM's	Sheep Permits	Sheep AUM's
	Number of Head	Number	Number of Head	Number
Bureau of Land Management				
Cedar City	16,808	61,435	77,950	18,208
Kanab	19,349	104,570	24.094	4,445
Richfield	14,067	49,501	72,223	23,796[a]
Fillmore	5,154	25,400	58,203	40,745[a]
District Total	55,378	244,178	232,470	88,446
National Forests				
Dixie	18,875	73,434	49,198	16,784
Fish Lake	5,779	24,555	13,122	5,930[a]
National Forest Total	24,654	97,989	62,620	22,714
Totals	80,032	342,167	295,090	111,160[b]

[a] Figures shown represent only a percentage of the totals, as only part of the district or forest is inside study area: Richfield - 88%, Fillmore - 24% and Fish Lake - 28%.

[b] Total numbers don't compare with study area totals because livestock often graze on several districts or forests during the year.

Changes in Resource Use

During the 30-year period from 1935 to 1964, many changes in the use of agricultural resources have taken place, Table 4. The trend has been to larger farms, fewer farmers and greater production per unit. There has been a major change-over from sheep to cattle production. Sheep numbers have decreased by 85 percent while cattle numbers have increased by 89 percent. The net change has resulted in a reduction of 24,425 animal units or 293,000 AUM/s of feed per year. State averages for Forest Service permits during the 30-year period show a 38 percent decline in animal units while Bureau of Land Management permits have decreased by 48 percent.

Dairy cattle numbers have not exhibited much change but location and herd size has undergone extensive adjustment. Production per cow has increased considerably and movement of the product into outside markets has taken place.

Changes have occurred very gradually in most enterprises over the 30-year period and trends appear, in most cases, to be continuing to move in the same direction.

Budget Preparation

Budget data were prepared for each enterprise in each area to find average costs and returns per unit of production, appendix Table 5-18. Fixed costs including investment in land, improvements, grazing permits,

Table 4. Comparative data and percent change of resource use for seven counties of southwestern Utah, 1935 and 1964

Resource	1935	1964	% change[a]
Irrigated land/farm	54	81	+50
Average no. of farms/co.	363	262	-28
Cattle	58,523	110,634	+89
Sheep	460,966	80,284	-83
Dairy cows	9,233	7,085	-23
Forest Service AUM's[b]	211,739	130,703	-38
B. L. M. AUM's	573,829[c]	295,788	-48
Alfalfa yield per acre	1.7 ton	3.1 ton	+82
Barley yield per acre	31.4 bu.	51.1 bu.	+63
Corn silage yield per acre	7.7 ton	13.2 ton	+71
Potatoes yield per acre	106 cwt.	202 cwt.	+90

[a] Figures shown are percent change from 1935 to 1964 average figures.
[b] Estimated for average conditions in Utah.
[c] Based on state averages of 1940 figures. Data for 1935 are not complete because administered areas were too small at that time.

buildings and machinery were obtained at current value for the complete farming unit and allocated to the various enterprises according to farmers' estimates of their use. Investment cost of 6 percent was used as an opportunity cost on fixed investment. Depreciation of buildings, machinery and other depreciating improvements were based upon initial cost and expected useful life. Tax rates were calculated from a listing of assessed valuations and mill levies supplied by county assessors for each of the counties. Variable costs of seed, fertilizer, water, labor and power were considered to be of greater importance. Values used were prices most often paid by farmers interviewed in that cropping area. Interest on operating money was set at 6 percent annually, with charges being made for the portion of the year that money was in use. Labor requirements for each of the enterprises were obtained by listing all operations performed and time required to perform each operation.

Alfalfa hay was produced in all areas. Budgets for alfalfa do not include an establishment cost except for a pro-rated cost for seed. A companion crop is grown with alfalfa during the establishment year. Farmers indicate that costs for alfalfa establishment are seed and additional summer water above normal requirements for the companion crop. Using water late in the season produces hay or fall grazing to offset the extra cost. Seed cost is pro-rated over a 5-year period, the usual alfalfa stand life.

Other crops studied are annual, and costs occur within a year of harvest.

Prices and costs

Prices used for budget preparation were averages of those received or paid in 1967 by farmers in the survey. Additional price data for 1968 and 1969 were gathered on prices received by the farmer for livestock, milk, potatoes and alfalfa hay. The price used for potatoes is the average of prices received for field-run potatoes for the three year period. Some farmers are selling sorted and graded potatoes at a price considerably higher than field-run prices. Although storage and grading was usually profitable, it was not considered as a production activity for this study.

The model value for wages paid was $1.50 per hour. This price for labor was used for both family and hired labor.

Labor

Interviews taken from this study show that some hired labor was used by most operators. However, data were not available to show supply of labor or average hours of hired labor used. Farmers indicated that migrant labor was available for harvesting potatoes but some difficulty was experienced in obtaining labor at a time to best fit their needs.

It was assumed, for this study, that labor needs can be met by family or hired labor to produce crop and livestock enterprises that bring optimum income.

Water

Water was one of the most limiting resources to crop farming in the area. Often a farmer would let part of his land lie idle to have additional

water for a smaller acreage of a more profitable crop with a high water requirement. Another common solution to short, late season water was to irrigate alfalfa when stream flow was high and let it go dormant in late summer when irrigation demands for other crops were highest and water was lowest. This practice usually produces two good cuttings and some regrowth for pasture.

In the southwest pump area where pump output was metered and closely checked by the state, figures on crop consumptive use requirements and available water per acre were readily available. In the other three cropping areas where irrigation water comes from surface flow without seasonal storage facilities, information was more difficult to obtain. Data were calculated from farmers' estimates, averages from the southwest pump area and irrigation water consumptive use for crops, 1. Consumptive use figures used for budget preparation appear in Table 19. Stream flow varies considerably from year to year. Several other factors affect water requirement needs for crop production. The type of water distribution facilities used by the farmer and the type of soil on his farm influence irrigation efficiency. Water distribution in concrete ditches is much more efficient than in unlined ditches. When the soil is gravelly or sandy, water requirement per irrigation and irrigation frequency are both increased if optimum moisture conditions for plant growth are maintained.

In the southwest pump area, there is no limitation per month except by the capacity of each farmer's pumping facilities. However, there is a

limit put on by the Utah State Division of Water Rights of 4 acre feet per acre each year. This limitation is often sufficiently limiting that a farmer will leave part of his land idle that he might have a more adequate supply of irrigation water for his remaining acres. Power cost for pumping irrigation water is several times more expensive than distribution costs for surface flow irrigation water. Indications of this study are that the added cost of pumping is offset by making water available in adequate quantities during periods of high use requirements for crops which return greater profits.

There are a few areas where seasonal storage facilities are available but special study of these areas was not made.

Alfalfa and potato restrictions

Alfalfa minimum acreage was set at one-fourth of total cropland as a rotation and conservation measure. In all areas except the high elevation area, alfalfa entered the optimum enterprise combination at a level higher than the minimum acreage set.

A maximum of one-third of total cropland was set for potatoe acreage. Farmers indicate that in order to maintain soil fertility through rotation, this is a good upper limit for potato production. Potato scab and other problems affecting potato quality increase as percentage of total acres in potato production increases.

The Linear Programming Model

Crop enterprise budgets were prepared by area as listed in Tables 5 to 18. Average production, costs, returns to fixed inputs and net returns were computed on a per unit basis. Activities for the linear programming model were crops adapted to the representative area, farm livestock enterprises, a buying activity for grain and selling activities for crop and livestock products. Restrictions for the model include land, water available by months for irrigation and two levels of operating capital. On alfalfa hay minimum of twenty-five percent and a potato maximum of thirty-three percent of total farm acres also served as a restriction as conservation measures. Coefficients for enterprise production were net returns to fixed factors, water consumptive use by months, and operating capital requirements. The linear programming model was set up to maximize income to the representative farms.

Available capital was very limited to some farmers but other farmers were able to obtain capital when it appeared profitable to do so. Operating capital of $100 per acre and unrestricted operating capital were used to obtain two sets of enterprise combinations for each of the four cropping areas. Representative farm size for High Elevation, Intermediate Elevation and Utah's Dixie areas was set at 100 acres. Farms in these areas are typically smaller than the Southwest Pump area where the representative farm size selected was 200 acres.

Size of enterprise does not affect enterprise combination because the function is linear. In other words, increased efficiencies due to optimum enterprise size are not reflected by this model. The selection of a typical representative farm size for each area makes the linear programming result match the production possibilities of local farmers more closely. Because income and expense data are taken from farms reflecting average local conditions, this also makes the linear programming solution more applicable.

Choice between the three livestock enterprises when capital is limited has little effect upon income. This appears unusual when comparing net return figures. Both farm flock sheep and grade B dairy show negative net returns, while feeder beef shows a positive net return.

When capital is not restricted, feeder beef enters the program in preference to either farm flock sheep or grade B dairy. This is because feeder beef requires more capital outlay to purchase the livestock and has a greater return for an equal amount of feed. However, the risk factor is greater because a drop in price after feeders are purchased can remove the profit margin and cause a substantial loss. A drop in price for sheep or dairy is distributed over the total production phase so the effect is reduced.

Livestock enterprises are tied closely to crop enterprises by making no allowance for purchase of roughage. However, there is a marginal value product listing for each livestock feed which is the maximum price which could be paid for feed and still break even.

Risk is much higher for producing some crops than others. Potatoes and corn silage are more susceptible to frost damage than are alfalfa and barley. Potato quality is also adversely affected by an interruption in irrigation water or by potato scab. Both corn silage and potatoes have specialized labor demands which must be met where timing is important to produce a quality product. For these reasons, returns to fixed factors for potatoes and corn silage were reduced by 20 percent before entering them into the linear programming model. Utah's Dixie area does not have a frost problem during the silage producing season; so, a reduction in returns to fixed factors was not made.

DESCRIPTION OF AGRICULTURAL PRODUCTION

Crop Enterprises

High Elevation area

Areas above 6,000 feet elevation have an average frost free season of 84 days. This short growing season with an accompanying low level of developmental heat units limits cropping possibilities. The danger of a killing late spring or early fall frost makes corn a high risk enterprise. As a result corn was not commonly produced. Barley and potatoes often failed to mature in some localities but suffered only occasional damage in others.

Alfalfa hay was produced more than any other crop. Production was limited by the short season to two cuttings per year but average yields of 3.7 tons per acre made it a valuable crop. Alfalfa required water throughout the growing season and low late summer water restricted the acreage most farmers produced.

Potatoes were grown in some high elevation localities with good results. Average field run prices received brought a higher return to potatoes than any other crop. Some farmers developed a market for seed potatoes at a price near twice that received for commerical market potatoes. There was very little loss during sorting because most field run potatoes meet the minimum standard for seed. Sprinkler irrigation was sometimes used on potatoes to increase irrigation efficiency and relieve the last summer water

shortage. Potatoes irrigated by sprinklers have a greater percentage of green ends because of eroding away of soil around the plants and exposing tubers to sunlight. Green ends which are culls under other grading standards are suitable for seed potatoes.

Barley was produced in some localities but not in others because the growing season is often too short for maturity. It was the most profitable grain crop studied and the crop most commonly used as a companion crop for establishing alfalfa.

Oats were grown for both grain and hay and are good as a companion crop for alfalfa establishment. Oats for grain showed a negative net return and the lowest return to fixed factors of any crop in the study. Oat hay grows well in high elevations and produces good feed but is not equal in quality to alfalfa hay. Oats need spring and early summer water but don't require water when it is in greatest demand for potatoes and alfalfa in the late summer.

Intermediate Elevation area

Locations in the Intermediate Elevation have an average of 129 frost free days. Variation in average frost free days range from 104 days in Beaver to 151 days in Kanab. This variation is large enough that it could have a significant effect upon cropping possibilities. Crops most commonly produced were alfalfa and barley. Low late summer water and livestock oriented agriculture limits production of the higher income crops even though climatic conditions were favorable.

Many of the farms in this area like parts of other areas are in small plots scattered along creeks. This restricts the size and efficiency of equipment which can be used. In locations where corn or potatoes could profitably be grown, equipment investment often rules it out.

Alfalfa is grown on most of the cropland and produces three cuttings per year. Yields vary widely with average yield at 4.7 tons per acre. Many farmers keep cropland in alfalfa as much as possible, producing just enough barley as a nurse crop to maintain a good alfalfa stand.

Barley was grown throughout the intermediate elevation area. Its requirement for irrigation water does not extend into the late summer which relieves the short water problem.

Farmers usually try to produce the feed required by their livestock enterprise and a combination of alfalfa hay and barley usually meets this need.

Southwest Pump area

In the Southwest Pump area, alfalfa, barley, corn silage and potatoes were the crops most commonly produced. Farms are usually larger and late season irrigation water is more adequate than in other areas. Length of growing season is similar to the intermediate elevation area but farm size and irrigation water differences make cropping practices quite dissimilar. Some farms are crop oriented with alfalfa, potatoes and barley produced as cash crops. Many farms have a livestock enterprise, a corn silage enterprise and sell only potatoes as a cash crop.

Utah's Dixie area

In Utah's Dixie area, there are an average of 196 frost free days per year. It is the only part of the study area which has a climate suitable for double cropping. Barley is planted in the autumn and harvested in the spring. Milo is planted within a few days after the barley harvest and harvested in the fall. This cropping procedure is listed as barley-milo. Barley and milo sell for the same price. When the double cropping system was used, fixed costs were divided equally between the two crops. Producing barley without a summer crop has the same effect in conserving summer water as leaving the land idle and reduces the problem of low summer water. The growing season for barley is about the same for double or single cropping.

Alfalfa had a high yield with an average of five cuttings and 6. 5 tons per acre. Corn for silage was usually planted with sorghum and makes an excellent quality of ensilage.

Farm Livestock Operations

Grade A dairy

Grade A and grade B dairy enterprise budgets are shown as Tables 20 and 21. Market for grade A milk is limited and the price of base seems high. Several dairymen selling grade B milk indicated the high cost of base more than off-set higher prices received for grade A milk. Budgets prepared from 17 interviews did not bear this out. Average production costs for two grades of milk were so similar that they were averaged together. Investment

for grade A dairies averaged $354.00 more per cow than did grade B dairies. These additional costs were in base and better milk handling facilities to meet grade A requirements. Additional interest cost for this investment amounts to $21.24 per year at 6 percent. Price premium to grade A producers was $1.41 per hundredweight. On the annual average production per cow of 12,398 pounds of milk, an additional $174.81 per cow was received by the grade A producer.

Grade B dairy

Average net return per cow on grade A dairy farms was $148.84. Grade B dairies showed a negative net return of $4.73. A negative net return, however, does not mean that the dairyman should sell his cows. He is receiving $1.50 per hour for his labor and $42.90 per cow for fixed investment. Unless he can dispose of his fixed investment at near investment value or convert it to grade A, remaining in grade B milk production could be the most profitable livestock enterprise for him.

Farm flock sheep

The farm flock sheep enterprise was a ewe-lamb operation. Lambs were born in sheds during the late winter or early spring. Farm hay, grain and pasture were used to feed the ewes and fatten the lambs. Ewes were pastured an average of four months per year. When foothill pasture was available for six or seven months or more per year, feed costs were reduced significantly. However, investment in grazing land was often so high that a

6 percent opportunity cost on investment was greater than feed costs for feeding sheep hay and grain.

Net return to the farm flock sheep enterprise per ewe is a negative $2.48, Table 22. A negative net return does not necessarily mean that the enterprise was losing money for the farmer. He received $1.50 per hour for his time and $1.25 per ewe return to fixed investment. Labor requirement was high during lambing when most other demands for labor on the farm were at a minimum. Providing a market for farm labor during slack seasons is often a means of increasing returns to the farming operation. Another benefit unique to farm flock sheep was their ability to graze ditchbanks, hillsides and other areas which would have no value for other farm animals.

The most profitable operations were those which concentrated extra effort to get a good lambing percentage. Records indicate that it was unprofitable to feed sheep for 12 months to market 1.2 lambs per ewe.

Feeder beef

The feeder beef enterprise was a warm-up operation to prepare weaner calves to enter fattening feed lots. Weaner calves averaged 353 pounds when purchased and were sold at an average weight of 734 pounds, Table 23. Many farmers pastured calves several months as part of the feeding operation. The ration was mostly roughage in all cases during the entire feeding period.

The most important factor in making a profit is the price spread between purchase price of calves and sale price. Average purchase price was 2 1/2 cents per pound above sale price. When sale price becomes higher per pound, a greater negative price spread can occur and still maintain the same profit position. Also, the greater the number of pounds put on each calf, the greater the negative price spread can be and maintain profitability. When prices go down after weaner calves have been purchased, the drop in value per pound of purchase weight must be absorbed by the growth weight of the calf.

Operating capital requirement was high because of investment for calves.

Where hay is available, the warm-up feeder beef enterprise fits in well with many operations as a means to market farm grown feed at a profit and use farm labor during the slack season without a labor requirement during the crop season.

Range Livestock Operations

Beef cow-calf

Range cow-calf and range sheep operations were not closely tied to crop farming so they were considered separate from other livestock enterprises. Budgets for these two enterprises appear as Tables 24 and 25.

Cost data for range cow-calf enterprises in several small areas were much above average. This higher cost was due to winter feeding of hay.

In all enterprises where beef cows were fed hay for four months or longer, a net profit was not realized. Because these enterprises represented less than 10 percent of the enterprise interviews, they were not included in budget averages. Where cattle were on BLM and Forest permits most of the year, feed costs were very low; but an increase in fixed costs in the form of interest on the investment in permits made overall costs about average.

Range sheep

Range sheep numbers decreased very rapidly until recent years. There has been a leveling off of the trend. Sheep ranchers indicated that much of the range area was too rough for good utilization by cattle. Sheep are better adapted to steep terrain where most of the feed is from browse. Labor costs for sheep were high compared to cattle. As more of the range land was fenced, the opportunity to reduce labor requirements by changing from sheep to cattle become more feasible. Most of the area which was best adapted to cattle grazing was being used for cattle. This probably accounts for the stability in sheep numbers in recent years.

RESULTS OF THE ANALYSIS

After the crop and livestock budgets were prepared, linear programming was used to ascertain which combination of enterprises would produce the highest income without depleting the soil. With the aid of the computer, the optimum combination of enterprises was selected. Maximum income from available resources of the representative farm was the criteria used to decide what was optimum. The computer calculated the marginal value of each resource. Also an income penalty figure was calculated which indicates the amount income would be reduced if an enterprise combination other than the one selected as optimum was produced.

Crops used in the linear programming study were those most commonly produced in each cropping area which could be either fed to livestock or sold. The size of the livestock operation was limited by the amount of forage which could be produced on the farm. Grains could be purchased when profitable.

Grade A dairy was the most profitable farm livestock enterprise studied. However, because of the limited market for grade A milk, grade A dairy was not included in the linear programming model.

In order to study the effect of operating capital on optimum enterprise combinations, the level of operating capital was assumed to be $100 per acre in one solution of the model and unlimited in a second solution.

Enterprise Combinations

High Elevation area

A. Capital restricted to $100 per acre.

The optimum solution included the production of alfalfa, oat hay, barley and potatoes, Table 26. Livestock production was involved in the form of a beef feeding enterprise. Eight acres of land was left idle.

July water was the most limiting resource with a marginal value product of $127.05 per acre foot. In actual practice, alfalfa would probably be grown on the eight acres left idle; and all alfalfa would go without sufficient water for optimum production while water demand for potatoes is high and barley and oat hay still have a water requirement.

All available feed goes to feeder beef. If sheep brought an additional return of $2.04 per ewe and grade B dairy $3.08 per cow, both would enter the program. If feeder beef decreased in profitability by $1.52 per head with other livestock enterprises at average levels, it would start to leave the optimum farm enterprise combination.

Capital had a marginal value product of 12.5 percent up to $12,190. This amount was in addition to 6 percent already entered into the budgets for operating capital.

With the optimum combination of enterprises shown in Table 26, alfalfa hay had a marginal value product of $27.85 per ton and oat hay a marginal value product of $25.94 per ton for feeding livestock.

B. Capital level unrestricted.

Increasing the capital level in the High Elevation area did not affect other resource use. Crop enterprises remained the same except seven acres of oat hay were substituted for the seven acres of barley. Since roughage was limited to what could be grown on the farm and operating capital was available, the number of feeder beef which could be fed increased by 17 head and the profit by $261.22

Intermediate Elevation area

A. Capital restricted to $100.00 per acre

On a 100-acre representative farm, crops grown were alfalfa and barley, Table 27. In this area, climate is similar to the southwest pump area; but irrigation water in late summer was very limiting. August water was a limiting resource with a marginal value produce of $17.63 per acre foot. If higher return crop alternatives were included in the program, August water would have a higher marginal value product.

In the absence of a cash crop, operating capital was very limiting with a marginal value product of 12 percent.

Income penalty for changing from feeder beef to farm flock sheep was $.04 per breeding ewe and $1.61 per cow for grade B dairy. Sensitivity to change for feeder beef was $.20 per feeder calf.

With the limited level of capital, both alfalfa hay and barley were sold.

B. Unrestricted capital.

When operating capital was unlimited, alfalfa hay was fed to additional feeder beef and barley sales were reduced. August water was sufficiently limiting to prevent a change from barley to more alfalfa hay. Marginal value product was $82.01 per acre foot for August water. With average water requirement of around four acre feet per acre, water was much more limiting than land which has a marginal value product of $33.61 per acre.

Additional operating capital increased the feeder beef enterprise from 117 to 235 head. Income penalty for changing from feeder beef to farm flock sheep was $4.61 per ewe and $36.84 per cow for changing to grade B dairy. Alfalfa hay had a marginal value product of $36.45 for feeding to feeder beef.

Southwest Pump area

A. Capital restricted to $100 per acre.

On a representative farm of 200 acres, all the land was used, with $83.45 as its marginal value product, Table 28. Alfalfa, corn silage and potatoes formed the optimum crop enterprise combination. Feeder beef cattle and farm flock sheep were also included in the farm plan. If all other resources were left the same, $82.45 would be added per acre for 11 more acres of land. At this point, marginal value product decreased; but the new range was not given. Farm flock sheep of 864 head and feeder beef of 148 head entered the program. Grade B dairy would have entered the

program at 96 head had the return per cow been $2.34 higher. The choice between the three livestock enterprises when capital was limited had little effect upon income. Producing barley would have caused a $31.37 income penalty per acre. Barley had the lowest return per acre to fixed factors of the crop enterprises. It also was the only livestock feed which would be purchased. For these reasons, land was not used for the production of barley. Alfalfa hay had a marginal value product of $33.12 and corn silage $10.33. This means that a greater profit would have been realized if alfalfa hay or corn silage were purchased at less than these amounts and fed to livestock in the ratios shown by the optimum enterprise combination.

Captial had a marginal value product of 11 percent in addition to 6 percent already entered into the budgets for operating money.

B. Unrestricting capital.

Removing the capital restriction did not affect the use of other resources significantly. Changes in the enterprise combination was a substitution of 10 acres of alfalfa for 10 acres of silage, and the farm flock sheep enterprise was dropped and replaced by feeder beef. As more capital became available, both farm flock sheep and grade B dairy became less attractive. Return per dollar invested in operating capital was higher for the latter two enterprises, but return to other resource inputs was greater for feeder beef. Income penalty per cow for grade B dairy was now $32.24 and farm flock sheep per breeding ewe was $3.91. Marginal value product for alfalfa was $42.68 per ton and $12.85 per ton for silage.

Utah's Dixie area

A. Capital restricted to $100.00 per acre.

In the Dixie area, alfalfa, barley, corn silage and barley-milo double cropping all entered the optimum farm plan. Farm flock sheep were again a part of the optimum combination when capital was limited. This plan called for selling 475 and 192 hundredweight of barley and barley-milo combination respectively. August water was the most restricting resource with a marginal value product of $46.96 per acre foot. If land were increased without changing other resources, it would have returned only $40.54 per acre. Since about four acre feet of water per acre were required to produce a crop, water was much more restricting than land. One hundred dollars per acre of operating capital was very restricting to income with a marginal value product of 12.3 percent. The capital restriction also had a decided effect upon livestock enterprises. Farm flock sheep was the only livestock enterprise included in the optimum enterprise combination. Income penalty for changing to feeder beef was $.25 per calf and to grade B dairy was $1.29 per cow. Sensitivity for changing from farm flock sheep was only $.04 per breeding ewe.

Marginal value product for alfalfa hay was $29.33 per ton and silage was $10.91 per ton for feeding livestock.

B. Unrestricted capital.

Increasing operating capital increases income by $3,859 but also increased risk. To get the additional income required $32,090 additional

investment capital. The only livestock enterprise in the optimum enterprise combination was feeder beef. Income penalty for changing from feeder beef to farm flock sheep was $3.58 per breeding ewe and $55.97 per cow for grade B dairy.

Alfalfa hay had a marginal value product of $36.33 per ton and marginal value product for silage was $13.13 per ton.

SUMMARY

This study was conducted to provide information to farm operators concerning optimum enterprise combinations in the counties of Beaver, Iron, Washington, Kane, Garfield, Piute and Wayne in Southwestern Utah. Special consideration was given to the scarce resources of water, land and capital.

Surveys were made of crop and livestock operations in the area. From these surveys and from secondary information, budgets were prepared. Because climatic conditions and available late summer water varied so greatly, the area was subdivided for crop budget preparation into (1) High Elevation, (2) Intermediate Elevation, (3) Southwest Pump and (4) Utah's Dixie. Livestock budgets represent the entire area.

Linear programming was used to determine optimum enterprise combinations for each of the four representative areas.

Capital was considered at two levels: (1) $100 per acre and (2) unlimited. Land was sometimes all used but some land was often left idle because of limited water.

Representative farm size was selected at 100 acres except the Southwest Pump area where 200 acres per farm was chosen. A minimum of 25 percent of total farm acreage for alfalfa production was used for soil conservation purposes. An acreage maximum of 34 percent for potato production was selected for the same reason.

Four farm livestock operation alternatives were studied including A grade dairy, B grade dairy, farm flock sheep and feeder beef. Range cow-calf and range sheep were not considered as part of the farm operation but were studied for profitability.

Alfalfa entered every optimum program above minimum level except the High Elevation area where water was short because of high demands from potato production. Potato acreage entered optimum programs at maximum levels in both areas where potatoes were produced.

When capital was restricted, farm flock sheep entered optimum programs in two of the four areas but did not enter optimum programs when capital was unlimited. Feeder beef entered three optimum programs with limited capital and all optimum programs with unlimited capital. B grade dairy did not enter an optimum program but was close in profitability to farm flock sheep and feeder beef.

CONCLUSIONS

Conclusions as a result of this study are:

Livestock

1. When capital was limited to $100 per acre, there was no significant difference in profitability of farm flock sheep, grade B dairy and feeder beef. Variation within each enterprise was greater than variation between enterprises.

2. As capital was increased, feeder beef becomes more profitable than farm flock sheep or grade B dairy; however, risk due to price changes also increased.

3. Grade A dairy, under all conditions of the study, was the most profitable farm livestock enterprise studied. Possibilities for additional markets for grade A milk should be investigated.

4. Range operations of cattle and sheep provide a substantial return to agriculture in the study area. On an animal unit basis of five sheep are equal to one cow, sheep returned $14.09 more per animal unit to fixed factors than cattle.

Crops

1. Alfalfa was the most commonly produced crop. In all areas, alfalfa entered the optimum enterprise combination at a level higher than the minimum for crop rotation and conservation purposes except the High Elevation area. Here, late summer water was in great demand for potato production. When water is available, alfalfa hay should replace oat hay to increase profits.

2. Potatoes are the most profitable crops produced in the study area. Uncertainty is high due to price fluctuations and production hazards. With a reduction of 20 percent to offset uncertainty potatoes still remained the most profitable crop. When livestock is not emphasized and a suitable rotation to maintain soil fertility can be worked out, it is desirable to increase potato acreage in the Southwest Pump area where late season water is not a major problem.

3. When livestock is raised on the farm and sufficient acreage can be produced to avoid excessive equipment costs, silage should be produced. It is the most productive livestock feed of the study in areas which have a growing season long enough for maturity.

4. Barley was more profitable than oats but less profitable than other crops of the study.

5. Oat hay requires little late season water and should be produced only when water is too limiting for alfalfa or as a "catch-crop" for additional hay. It was most profitable in the High Elevation area.

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APPENDIX

Table 5. Average receipts, costs, return to fixed factors and net return per acre from alfalfa production, High Elevation area, 1967

Item	Units	Quantity	Price per unit dollars	Value or cost dollars
Receipts:				
Alfalfa hay	ton	3.7	25.00	92.50
Grazing	AUM	.3	4.50	1.35
Total Receipts				93.85
Costs:				
Labor and power:				
Labor	hrs.	6.76	1.50	10.14
Tractor power	hrs.	3.38	2.00	6.76
Machine hire				5.31
Fuel				1.14
Total labor and power				23.35
Materials:				
Phosphate fertilizer	lbs.	28	4.42	1.24
Seed (prorata)	lbs.	2	.54	1.08
Water	acre ft.	3.8	1.13	4.29
Insecticides				.16
Wire	bales	157	.02	3.14
Total materials				9.91
Overhead:				
Interest on money in crop				.62
Interest on capital investment				24.51
Depreciation				9.48
Other				
Taxes				3.18
Total overhead				37.79
Total Costs				71.05
Return to Fixed Factors				59.97
Net Return				22.80

Table 6. Average receipts, costs, return to fixed factors and net return per acre from barley production, High Elevation area, 1967

Item	Units	Quantity	Price per unit dollars	Value or cost dollars
Receipts:				
Barley	cwt.	34	2.50	85.00
Straw	ton	.75	10.00	7.50
Total Receipts				92.50
Costs:				
Labor and power:				
Labor	hrs.	6.04	1.50	9.06
Tractor Power	hrs.	4.1	2.00	8.20
Machine Hire				8.41
Fuel				.94
Total labor and power				26.61
Materials:				
Nitrogen fertilizer				.48
Seed				4.86
Water	acre ft.	3.2	1.13	3.61
Insecticides				
Wire				
Total materials				8.95
Overhead:				
Interest on money in crop				.79
Interest on capital investment				27.20
Depreciation				11.99
Other				
Taxes				3.46
Total Overhead				43.44
Total costs				79.00
Return to fixed factors				56.15
Net return				15.47

Table 7. Average receipts, costs, return to fixed factors and net return per acre from oat hay production, High Elevation area, 1967

Item	Unit	Quantity	Price per unit dollars	Value or cost dollars
Receipts:				
Oat hay	ton	3.6	22.00	79.20
Grazing	AUM	.5	4.50	2.25
Total receipts				81.45
Costs:				
Labor and power				
Labor	hrs.	7.5	1.50	11.40
Tractor power	hrs.	4.28	2.00	8.56
Machine hire				3.12
Fuel				1.99
Total labor and power				25.07
Materials:				
Nitrogen fertilizer	lbs.	38	4.40	1.67
Seed	lbs.	100	4.75	4.75
Water	acre ft.	2.7	1.13	3.08
Wire	bales	120	.02	2.40
Total materials				11.90
Overhead:				
Interest on money in crop				.46
Interest on capital investment		389.04	.06	23.34
Depreciation				9.16
Taxes				3.31
Total overhead				36.27
Total costs				70.84
Return to fixed factors				55.87
Net return				20.06

Table 8. Average receipts, costs, return to fixed factors and net return per acre from potato production, High Elevation area, 1967

Item	Unit	Quantity	Price per unit dollars	Value or cost dollars
Receipts:				
Potatoes	cwt.	186	1.55	288.30
Total receipts				288.30
Costs:				
Labor and power				
Labor	hrs.	13.26	1.50	19.89
Tractor power	hrs.	6.18	2.00	12.36
Machine hire				65.65
Fuel				2.72
Total labor and power				100.62
Materials:				
Phosphate & Nitrogen	lbs.	198	4.42	8.75
Seed	lbs.	12.40	4.03	49.97
Water	acre ft.	3.4	1.13	3.84
Total materials				62.56
Overhead:				
Interest on money in crop				2.45
Interest on capital investment		491.14	.06	29.46
Depreciation				21.18
Taxes			.0628	4.96
Total overhead				58.05
Total costs				221.23
Return to fixed factors				122.67
Net return				67.07

Table 9. Average receipts, costs, return to fixed factors and net return per acre from alfalfa production, Intermediate Elevation area, 1967

Item	Unit	Quantity	Price per unit dollars	Value or cost dollars
Receipts:				
Alfalfa hay	ton	4.7	25.00	117.50
Grazing	AUM	.3	5.00	1.50
Total receipts				119.00
Costs:				
Labor and power				
Labor	hrs.	9.16	1.50	13.74
Tractor power	hrs.	3.8	2.00	7.60
Machine hire				7.29
Fuel				1.50
Total labor and power				30.13
Materials				
Phosphate fertilizer	lbs.	87	4.00	3.48
Seed (prorata)	lbs.	2	.54	1.08
Water	acre ft.	4.1	1.90	7.79
Insecticides				1.05
Wire	bale	134	.02	2.68
Total materials				16.08
Overhead:				
Interest on money in crop				.71
Interest on capital investment		455	.06	27.30
Depreciation				7.76
Taxes				3.16
Total overhead				38.93
Total costs				82.14
Return to fixed factors				75.79
Net return				36.86

Table 10. Average receipts, costs, return to fixed factors and net return per acre from barley production, Intermediate Elevation area, 1967

Item	Unit	Quantity	Price per unit dollars	Value or cost dollars
Receipts:				
Barley	bu	76	1.18	89.68
Straw	ton	.75	10.00	7.50
Total receipts				97.18
Costs:				
Labor and power				
Labor	hrs.	7.1	1.50	10.65
Tractor power	hrs.	4.2	2.00	8.40
Machine hire				5.13
Fuel				2.04
Total labor and power				26.22
Materials:				
Nitrogen fertilizer	lbs.	60	4.08	2.45
Seed	cwt.	1	3.75	3.75
Water	acre ft.	3.5	1.90	6.64
Total materials				12.84
Overhead:				
Interest on money in crop			.03	.48
Interest on capital investment		467.51	.06	28.04
Depreciation				7.48
Taxes				2.82
Total overhead				38.82
Total costs				77.88
Return to fixed factors				39.06
Net return				19.30

Table 11. Average receipts, costs, return to fixed factors and net return per acre from alfalfa production, Southwest Pump area, 1967

Item	Units	Quantity	Price per unit dollars	Value or cost dollars
Receipts:				
Hay	ton	4.7	25.00	117.50
Grazing	AUM	.3	5.00	1.50
Total receipts				119.00
Costs:				
Labor and power				
Labor	hrs.	6.2	1.50	9.30
Tractor power	hrs.	3.9	2.00	7.80
Machine hire				12.26
Fuel				1.08
Total labor and power				30.44
Materials:				
Phosphate fertilizer				
Seed (prorata)	lbs.	2	.54	1.08
Water	acre ft.	4.58	3.50	16.03
Insecticides				.50
Wire	bales	134	.02	2.68
Total materials				20.29
Overhead:				
Interest on money in crop				.68
Interest on capital investment		431.85	.06	25.91
Depreciation				7.90
Taxes				4.14
Total overhead				38.63
Total costs				89.36
Return to fixed factors				67.59
Net return				29.64

Table 12. Average receipts, costs, return to fixed factors and net return per acre from barley production, Southwest Pump area, 1967

Item	Units	Quantity	Price per unit dollars	Value or cost dollars
Receipts:				
Barley	bu.	87	1.18	102.66
Straw	ton	.75	10.00	7.50
Total receipts				110.16
Costs:				
Labor and power				
Labor	hrs.	3.9	1.50	5.85
Tractor power	hrs.	2.2	2.00	4.40
Machine hire				6.19
Fuel				1.06
Total labor and power				17.50
Materials:				
Nitrogen fertilizer	lbs.	283	.0385	10.90
Seed	bu.	2.2	2.25	4.95
Water	acre ft.	3.85	3.50	13.47
Total materials				29.32
Overhead:				
Interest on money in crop				.81
Interest on capital investment				25.81
Depreciation				10.97
Taxes				4.04
Total overhead				41.63
Total costs				88.45
Return to fixed factors				62.53
Net return				21.71

Table 13. Average receipts, costs, return to fixed factors and net return per acre from corn silage production, Southwest Pump area, 1967

Item	Units	Quantity	Price per unit dollars	Value or cost dollars
Receipts:				
Ensilage	ton	17.5	10.00	175.00
Total receipts				175.00
Costs:				
Labor and power				
Labor	hrs.	7.1	1.50	10.65
Tractor power	hrs.	4.7	2.00	9.40
Machine hire				.36
Fuel				2.26
Total labor and power				22.67
Materials:				
Nitrogen fertilizer	cwt.	4.75	3.56	16.60
Seed	lbs.	15.5	.26	4.03
Water	acre ft.	3.95	3.50	13.83
Wire				2.05
Total materials				36.51
Overhead:				
Interest on money in crop				1.04
Interest on capital investment				26.46
Depreciation				8.05
Taxes				4.67
Total overhead				40.22
Total costs				99.40
Return to fixed factors				114.78
Net return				75.60

Table 14. Average receipts, costs, return to fixed factors and net return per acre from potato production, Southwest Pump area, 1967

Item	Units	Quantity	Price per unit dollars	Value or cost dollars
Receipts:				
Potatoes	cwt.	242	1.55	375.10
Total receipts				375.10
Costs:				
Labor and power				
Labor	hrs.	9.1	1.50	13.65
Tractor power	hrs.	4.8	2.00	9.60
Machine hire				98.90
Fuel				2.24
Total labor and power				124.39
Materials:				
Phosphate & nitrogen	cwt.	6	3.87	23.22
Seed	cwt.	19	2.74	54.06
Water	acre ft.	3.8	3.50	13.30
Total materials				88.58
Overhead:				
Interest on money in crop				4.86
Interest on capital investment				27.77
Depreciation				13.14
Taxes				7.40
Total overhead				53.17
Total costs				266.14
Return to fixed factors				157.27
Net return				108.96

Table 15. Average receipts, costs, return to fixed factors and net return per acre from alfalfa production, Utah's Dixie, 1967

Item	Units	Quantity	Price per unit dollars	Value or cost dollars
Receipts:				
Alfalfa hay	ton	6.5	25.00	162.50
Grazing	AUM	.3	5.00	1.50
Total receipts				163.00
Costs				
Labor and power				
Labor	hrs.	8.5	1.50	12.75
Tractor power	hrs.	5.2	2.00	10.40
Machine hire				5.34
Fuel				2.22
Total labor and power				30.71
Materials:				
Phosphate fertilizer	lbs.	215	4.25	9.14
Seed	lbs.	3.5	.65	2.28
Water	acre ft.	4.8	1.84	8.82
Wire	bales	182	.02	3.64
Total materials				23.88
Overhead:				
Interest on money in crop				1.20
Interest on capital investment	$	890	.06	53.40
Depreciation				11.03
Taxes				6.37
Total overhead				72.00
Total costs				126.59
Return to fixed factors				107.21
Net return				36.41

Table 16. Average receipts, costs, return to fixed factors and net return per acre from barley production, Utah's Dixie, 1967

Item	Units	Quantity	Price per unit dollars	Value or cost dollars
Receipts:				
Barley	cwt.	32.6	2.50	81.50
Straw	ton	.75	10.00	7.50
Total receipts				89.00
Costs:				
Labor and power				
Labor	hrs.	5.2	1.50	7.80
Tractor power	hrs.	3.1	2.00	6.20
Machine hire				6.13
Fuel				1.35
Total labor and power				21.48
Materials:				
Nitrogen fertilizer	lbs.	216	3.95	8.53
Seed	lbs.	100	5.16	5.16
Water	acre ft.	1.2	1.84	2.21
Total materials				15.90
Overhead:				
Interest on money in crop				.68
Interest on capital investment	$	872.25	.06	52.32
Depreciation				8.59
Taxes				6.88
Total overhead				68.47
Total costs				105.85
Return to fixed factors				46.75
Net return				(16.85)

Table 17. Average receipts, costs, return to fixed factors and net return per acre from silage (corn or sorgham) production, Utah's Dixie, 1967

Item	Units	Quantity	Price per unit dollars	Value or cost dollars
Receipts:				
Silage	ton	22	10.00	220.00
Total receipts				220.00
Costs:				
Labor and power				
Labor	hrs.	9.26	1.50	13.89
Tractor power	hrs.	4.2	2.00	8.40
Machine hire				28.00
Fuel				2.08
Total labor and power				52.37
Materials:				
Nitrogen fertilizer	lbs.	254	4.09	10.39
Seed	lbs.	18	.22	3.96
Water	acre ft.	3.8	1.84	6.99
Total materials				21.34
Overhead:				
Interest on money in crop				1.41
Interest on capital investment	$	890	.06	53.40
Depreciation				12.53
Taxes				6.77
Total overhead				74.11
Total costs				147.82
Return to fixed factors				144.88
Net return				72.18

Table 18. Average receipts, costs, return to fixed factors and net return per acre from milo production, Utah's Dixie, 1967

Item	Units	Quantity	Price per unit dollars	Value or cost dollars
Receipts:				
Milo	cwt.	32	2.50	80.00
Total receipts				80.00
Costs:				
Labor and power				
Labor	hrs.	6.8	1.50	10.20
Tractor power				6.32
Machine hire				6.26
Fuel				1.48
Total labor and power				24.26
Materials:				
Nitrogen fertilizen	lbs.	200	3.95	7.90
Seed	lbs.	20	.25	5.00
Water	acre ft.	4.2	1.84	7.73
Total materials				20.63
Overhead:				
Interest on money in crop				.97
Interest on capital investment		485	.06	29.10
Depreciation				9.20
Taxes				3.19
Total overhead				42.46
Total costs				87.35
Return to fixed factors				34.57
Net return				(7.35)

Table 19. Available irrigation water in acre feet per acre and water consumptive use requirements for representative crops by months in 4 areas of southwestern Utah

Water available	Consumptive use requirements, acre ft.				
I. High Elevation area:					
	acre feet	alfalfa	barley	potatoes	oat hay
May	1	.8	1.4	.6	1.4
June	1	.8	1.0	1.2	1.0
July	.8	.8	.6	1.2	.6
August	.6	.8		.3	
September	.6	.8			
Total	4.0	4.0	3.0	3.3	3.0
II. Intermediate Elevation area:					
	acre feet	alfalfa	barley		
May	1	.8	1.4		
June	1	.8	1.0		
July	.8	.8	.6		
August	.6	.8			
September	.6	.8			
Total	4.0	4.0	3.0		
III. Southwest Pump area:					
	acre feet	alfalfa	barley	potatoes	corn silage
April	1.2	.8	1.4	.7	.55
May	1.2	.8	1.0	1.4	1.1
June	1.2	.8	1.0	1.4	1.1
July	1.2	.8			.55
August	1.2	.8			
September	1.2	.8			
Total	4.0	4.8	3.0	3.5	3.3
IV. Utah's Dixie area:					
	acre feet	alfalfa	barley	silage	barley-milo
May	1	.8	.6	.6	.6
June	1	.8		1	1.2
July	.8	.8		1	1
August	.8	.8		1	1
September	.8	.8			.6
Total	4.4	4.0		3.6	4.4

Table 20. A grade dairy income-expense record per cow, 1967

Item	Number	lbs/head	Unit value	Value
Receipts:				
Milk	1	12,398	.0513	636.02
Heifer calves	.46		52.22	24.02
Bull calves	.47		36.00	16.92
Cull cows	.22		190.00	41.80
Total receipts				718.76
Costs:				
Item	Unit cost		Amount	Cost
Variable costs:				
Hay	.0125		14,895	186.19
Grain	.0291		3,557	103.51
Salt and mineral	.015		72	1.08
Breeding				6.86
Vet. supplies				3.09
Transportation				43.79
Heifers				47.39
Barn supplies				12.54
Bedding				5.00
Gasoline and oil				5.63
Operating interest				11.40
Labor				74.57
Total variable costs				501.05
Fixed Costs:				
Interest on investment	.06		842.00	50.52
Depreciation				12.20
Taxes				6.15
Total fixed costs				68.87
Total costs				569.92
Return to fixed factors				217.71
Net return				148.84

Table 21. Grade B dairy income-expense record per cow, 1967

Item	Number	lbs/head	Unit value	Value
Receipts:				
Milk	1	12,398	.0372	461.21
Heifer calves	.46		52.22	24.02
Bull calves	.47		36.00	16.92
Cull cows	.22		190.00	41.80
Total receipts				543.95
Costs:				
Item	Unit cost		Amount	Cost
Variable costs:				
Hay	.0125		14,895	186.19
Grain	.0291		3,557	103.51
Salt and mineral				1.08
Breeding				6.86
Vet. supplies				3.09
Transportation				43.79
Heifers				47.39
Power and barn supplies				12.54
Bedding				5.00
Gasoline and oil				5.63
Operating interest				11.40
Labor				74.57
Total variable costs				501.05
Fixed costs:				
Interest on investment	.06		488	29.28
Depreciation				12.20
Taxes				6.15
Total fixed costs				47.63
Total costs				557.68
Return to fixed factors				42.90
Net return				(4.73)

Table 22. Farm flock sheep income-expense record per breeding ewe, 1967

Item	Number	lbs/head	Price	Value
Receipts:				
Lamb	1.2	105	.24	30.24
Old ewes	.04		8.00	.32
Wool	1	10	.44	4.40
Gov't payment		10	.19	1.90
Total receipts				36.86
Costs:				
Cost item	Unit cost		Amount	Cost per head
Variable costs:				
Hay	.0125		1345	16.81
Grain	.025		130	3.25
Pasture (aum)	5.00		.8	4.00
Salt	.01		6	.06
Rams	192.00		.025	.48
Vet supplies				.20
Replacement ewes	17.00		.2	3.40
Transportation				.48
Shearing				.76
Gas, oil, and supplies				.78
Labor				4.35
Operating interest	.03		34.57	1.04
Total variable costs				35.61
Fixed costs:				
Interest on investment	.06		42.00	2.52
Depreciation				.59
Taxes				.62
Total fixed costs				3.73
Total costs				39.34
Return to fixed factors				1.25
Net return				(2.48)

Table 23. Feeder beef income-expense record per feeder calf, 1967

Item	Number	lbs./head	Price/lb.	Value
Receipts:				
Calf	1	734	.235	172.49
Costs:				
Item	Unit cost		Amount	Cost
Variable costs:				
Hay	.0125		2970	37.13
Grain	.025		316	7.90
Pasture (aum)	8.00		.81	6.48
Salt	.015		24	.36
Calf	.26		353	89.03
Gas and oil				.42
Transportation				.71
Death loss	.26		.03 x 353	2.75
Materials and supplies				.46
Labor	1.50		5.18	7.78
Operating interest	.02		142.49	2.85
Total variable costs				154.95
Fixed costs:				
Interest on investment	.06		38.33	2.30
Depreciation				2.20
Taxes				1.16
Total fixed costs				5.66
Total costs				160.61
Return to fixed factors				17.54
Net return				11.88

Table 24. Beef cow-calf income-expense record per cow, 1967

Item	Number	lbs/head	Price	Value
Receipts:				
Calves	.84	423	26.43	93.91
Cull cows	.07		138.00	9.66
Cull bulls	.01		242.00	2.42
Total receipts				105.99
Costs:				
Item	Unit cost		Amount	Cost
Variable costs:				
Hay	.0125		1884 lbs.	23.55
Grain	.025		38 lbs.	.95
Pasture	5.00		2 aum	10.00
Permits	.44		8 aum	3.52
Mineral and salt	.015		22 lbs.	.33
Bulls				3.90
Vet. supplies				.71
Transportation				3.71
Gasoline and oil				2.68
Labor				11.35
Operating interest	.03		48.35	.48
Total variable costs				61.18
Fixed costs:				
Investment interest	.06		495.50	29.73
Depreciation				3.54
Taxes				4.41
Total fixed cost				37.68
Total costs				97.86
Return to fixed factors				44.81
Net return				8.13

Table 25. Range sheep income-expense record per breeding ewe, 1967

Item	Unit	Quantity	Price/unit	Cost or value
Receipts:				
Lambs 86%	lbs.	80.6/hd.	22.72	15.75
Wool	lbs.	9.9/hd.	.4667	4.62
Old ewes 3.8%	head	3.8%	9.11	.35
Wool payment		9.9	.19	1.88
Total				22.60
Costs:				
Hay	lbs.	106	.0125	1.32
Grain	lbs.	20	.025	.50
Pasture				.46
Permits				.42
Salt	lbs.	7.2	.0125	.09
Bucks 44%	head	77	74.00	.34
Vet supplies				.04
Labor	hrs.	3.17	1.50	4.75
Shearing	head	1	.63	.63
Inv. decrease		2%	15.00	.30
Transportation				.37
Gas and oil		3.2	.30	.96
Operating interest		10.18	.03	.31
Taxes assessed value		22.81	.062	1.41
Repair				.18
Camp & camp supplies				.44
Other				.02
Depreciation				.87
Investment interest		96.56	.06	5.79
Total				19.20
Net return per head				3.40

Table 26. Linear programming results from a 100 acre representative farm with two levels of capital. High Elevation area

Activity	Unit	Level
I. Restricted Capital ($100 per acre). Income to fixed resources $10,490.83		
Alfalfa	acres	25
barley	acres	7
potatoes	acres	33
oat hay	acres	27
sell potatoes	cwt	6138
buy barley	cwt	142
feeder beef	1 calf	122
farm sheep	1 ewe	0
grade B dairy	1 cow	0
II. Unrestricted Capital. Income to fixed resources $10,752.05		
Alfalfa	acres	25
barley	acres	0
potatoes	acres	33
oat hay	acres	34
sell potatoes	cwt	6138
buy barley	cwt	438
feeder beef	1 calf	139
farm sheep	1 ewe	0
grade B dairy	1 cow	0

Table 27. Linear programming results from a 100 acre representative farm with two levels of capital. Intermediate Elevation area

Activity	Unit	Level
I. Restricted Capital ($100 per acre). Income to fixed factors $6,160.79		
Alfalfa	acres	75
Barley	acres	25
Sell alfalfa	ton	177
Sell barley	cwt.	542
Feeder beef	1 calf	117
Farm sheep	1 ewe	0
Grade B dairy	1 cow	0
II. Unrestricted Capital. Income to fixed factors $8,211.70		
Alfalfa	acres	75
Barley	acres	25
Sell alfalfa	ton	0
Sell barley	cwt.	170
Feeder beef	1 calf	235
Farm sheep	1 ewe	0
Grade B dairy	1 cow	0

Table 28. Linear programming results from a 200 acre representative farm with two levels of capital. Southwest Pump area

Activity	Unit	Level
I. Restricted Capital ($100 per acre). Income to fixed factors $39,372.12		
Alfalfa	acres	56
Barley	acres	0
Silage	acres	77
Potatoes	acres	67
Sell potatoes	cwt.	16214
Buy barley	cwt	987
Feeder beef	1 calf	148
Farm sheep	1 ewe	864
Grade B dairy	1 cow	0
II. Unrestricted Capital. Income to fixed factors $42,753.36		
Alfalfa	acres	66
Barley	acres	0
Silage	acres	67
Potatoes	acres	67
Sell potatoes	cwt.	16214
Buy barley	cwt	1640
Feeder beef	1 calf	519
Farm sheep	1 ewe	0
Grade B dairy	1 cow	0

Table 29. Linear programming results from a 100 acre representative farm with two levels of capital. Utah's Dixie area

Activity	Unit	Level
I. Restricted Capital ($100 per acre). Income to fixed factors $9,041.45		
Alfalfa	acres	27
Barley	acres	15
Silage	acres	47
Barley-milo	acres	11
Sell barley	cwt.	475
Sell barley-milo	cwt.	192
Feeder beef	1 calf	0
Farm sheep	1 ewe	880
Grade B dairy	1 cow	0
II. Unrestricted Capital. Income to fixed factors $12,895.00		
Alfalfa	acres	35
Barley	acres	13
Silage	acres	39
Barley-milo	acres	12
Sell barley	cwt.	0
Sell barley-milo	cwt.	0
Feeder beef	1 calf	384
Farm sheep	1 ewe	0
Grade B dairy	1 cow	0

VITA

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