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Estimated Response of Sugar Beet Production to Possible Changes in Relative Profitability, Utah, 1969

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ESTIMATED RESPONSE OF SUGAR BEET PRODUCTION TO POSSIBLE CHANGES

IN RELATIVE PROFITABILITY, UTAH, 1969

by

Darwin C. Allred

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

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UTAH STATE UNIVERSITY
Logan, Utah

1970

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Estimated Response of Sugar Beet Production to Possible

Changes in Relative Profitability, Utah, 1969

by

Darwin C. Allred, Master of Science

Utah State University, 1970

Major Professor: Dr. Lynn H. Davis
Department: Agricultural Economics

This study was designed to determine the relative profitability of
sugar beet production relative to other enterprises competing with
sugar beets for limited resources and to estimate a production response
of sugar beet growers in the beet producing areas of Utah.

Sugar beet producing areas in Utah were delineated. Representa-
tive farm units for beef-crop, dairy-crop, and all-crop farms were
synthesized. Enterprise budgets were formulated and analysed to
ascertain the relative profitableness of sugar beets compared to
competing enterprises in each production area.

Linear programming was used to develop the supply response
portion of this study. An aggregated supply curve was derived
showing the acreage response of sugar beet producers at varying sugar
beet prices. Rotation for nematode control restricted annual sugar
beet production to 25 percent of available sugar beet land. The price
range over which it would be profitable to include sugar beets in the
optimum combinations was $9.98 per ton to $14.19 per ton.

(117 pages)

Sugar is a commodity of international interest. It is traded in major markets throughout the world. As a food, sugar is increasing in importance, especially in lower income countries.

The International Sugar Council reports that wide variation in per capita consumption exists among nations. Per capita consumption of sugar is highest in North America and lowest in Asia and Africa.

In the USA, sugar is considered a necessity and its consumption is relatively stable at 97 pounds per capita (18). This fact is substantiated by the low price and income elasticities of -.28 and .27, reported by Viton and Pignalosa (19). These indices indicate consumers use about the same amount of sugar regardless of price or amount of income.

Historically, the United States has not produced enough sugar to meet consumer needs and has relied heavily on imports because foreign production of sugar is more economical. Nearly half of our supply of sugar is imported. Dependence upon imported sugar in case of war or other emergency tends to encourage more development than would be necessary for peace time when transportation of sugar is not a problem.

The sugar program is federally sponsored and has been closely administered by the Federal Government. Since the Cuban crisis in 1962, increased attention has been given to the development of domestic sugar production. Sugar beet acreage allotments were removed during the 1960-1964 period and from 1967-1969. Allotments are to be in effect again in 1970. Continued emphasis, however, is being placed on the feasibility

of increasing domestic production.

Domestic beet sugar is produced under highly variable conditions. Forty-ton beet yields per acre are produced in the semi-tropical Imperial Valley of California, where soils are alkaline, the crop is irrigated, and temperatures may reach 120° F. Compared with this is the ten-ton yields in the Red River Valley of the northern central states, where soils are prairie, very little rainfall is the only moisture source, and the frost-free period is short.

Sugar beets have traditionally been a labor-intensive, high-cost crop requiring relatively large amounts of water, good management, large amounts of capital, and a highly productive soil for profitable growth conditions. Field labor has been one of the most important costs of production. Wage rates have increased faster than the reduction of labor requirements in all areas except Hawaii (18).

Limited information about infectious pests keeps the sugar industry constantly in a position of defense. This fact causes an ever increasing need for better herbicides, insecticides, nematocides, and sugar beet varieties.

The sugar beet industry has played an important role in the economy of Utah. Sugar beets have proven to be a profitable crop relative to other crops such as alfalfa, corn, and wheat. Beets have been a successful source of cash income for small diversified crop and livestock farms in selected irrigated valleys in Utah. Total acres devoted to sugar beet production in Utah reached a peak in 1920 when 113,000 acres were harvested. Since 1920 the acreage of sugar beets has decreased but remained relatively constant at approximately 30,000 acres from 1948 to 1968 with only a slight downward trend as illustrated

in Figure 1. During this same time, there was an upward trend for the United States as illustrated by Figure 2.

In Utah the yield of sugar beets has shown a constant improvement over this period with an increase from 12.2 tons per acre in 1948 to 16.3 tons per acre in 1965. The average size of sugar beet enterprises in Utah has increased from 10 acres in 1948 to 33 acres in 1968 (1). Presently there are twenty states in which sugar beets are produced, of which Utah ranks fourteenth. Even though Utah contributes a small amount of the total United States supply, the production and processing are still an important part of the Utah economy. An estimated value of eleven million dollars is derived from this industry in Utah (13).

Sugar beets are produced in 11 Utah counties (Figure 3). The major producing counties are Box Elder, Utah, Davis, Salt Lake, and Weber. Eighty percent of the beets in Utah come from these counties. There are three factories in Utah, located in Box Elder, Cache, and Salt Lake counties. It has been estimated by sugar company officials that factory capacity would not become a restriction to a stable sugar beet expansion (13). Sugar beets grown in Carbon County are transported out of Utah to Delta, Colorado, and processed by Great Western Sugar Company. Sugar beets from southern Idaho are brought into Utah and are processed at the Garland factory in Box Elder County and the Lewiston factory in Cache County. The sugar factory at Lewiston is operated by Amalgamated Sugar Company. Beets processed by this plant are grown in Cache and Weber counties. With the exception of Carbon County, the remaining portion of beets produced in the state are processed by Utah-Idaho Sugar Company at Garland and West Jordan. The West Jordan factory is located in Salt Lake County (Figure 3).

Thousand acres
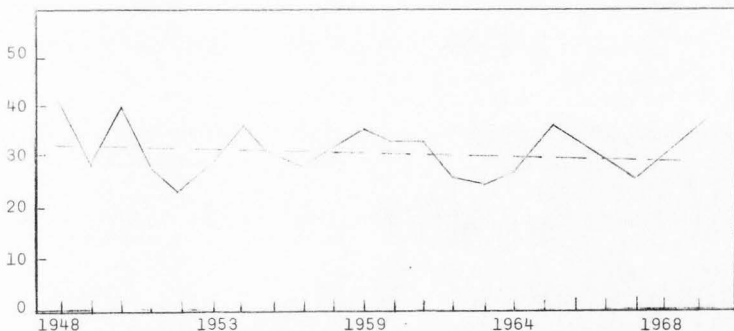
Figure 1.   Trends of sugar beet acreage, Utah, 1948-1968.

Source: Agricultural Stabilization and Conservation Service
Annual reports for Utah and United States.

Ten thousand acres
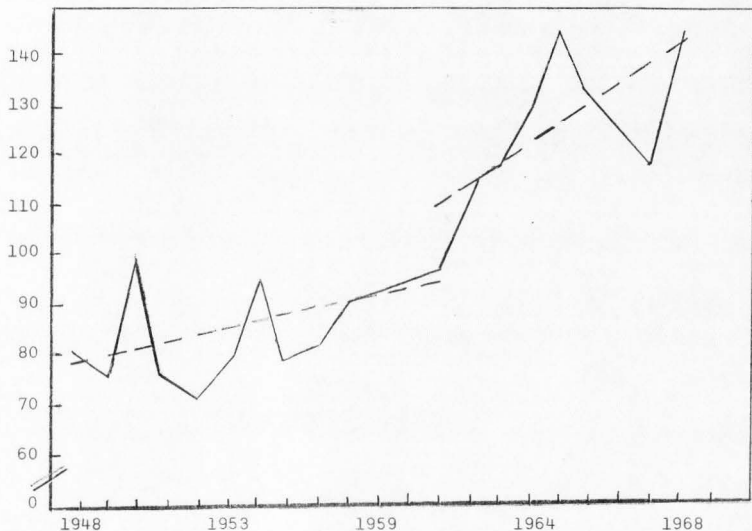
Figure 2.   Trends of sugar beet acreage, United States, 1948-1968.

Source: Agricultural Stabilization and Conservation Service
Annual reports for Utah and United States.
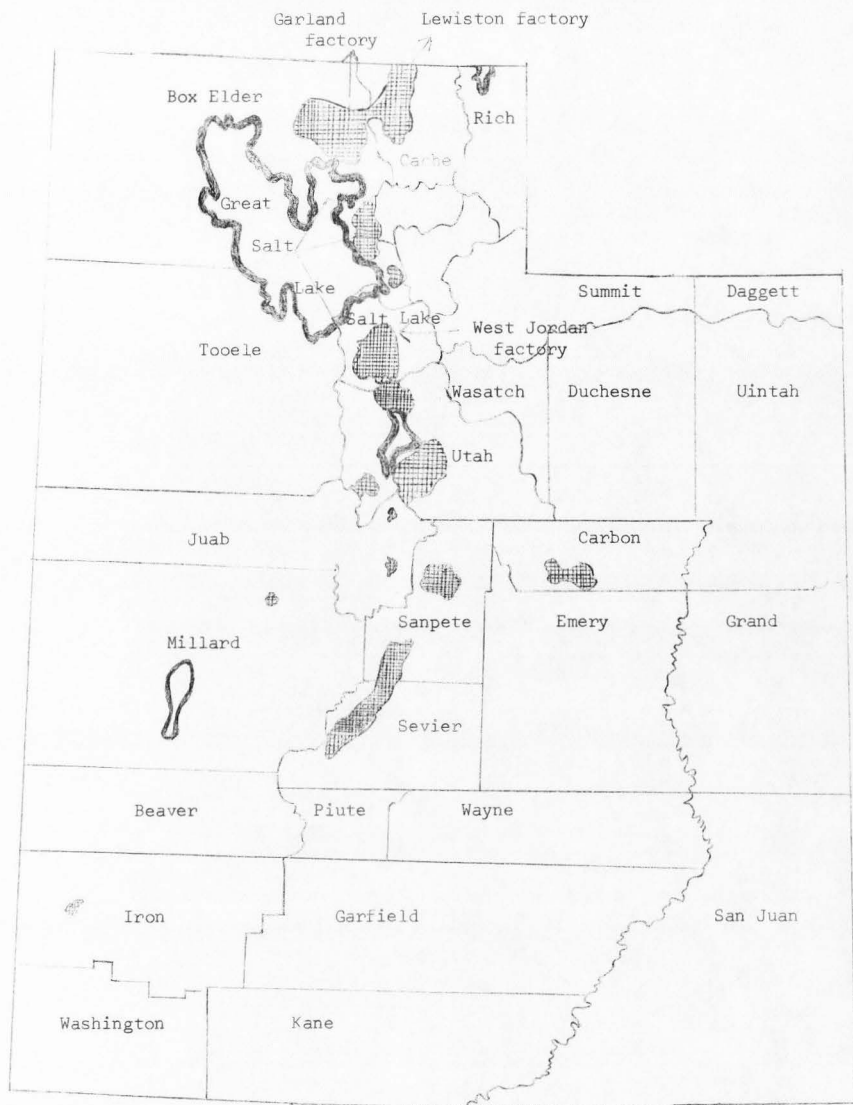
Figure 3. Map illustrating present areas of sugar beet production and factory locations in Utah, 1969.

Large amounts of capital have been committed to the sugar beet industry in Utah. This includes both processing and production. Because the industry is a major income producer in the state, an assessment of production potential of the state is important.

Knowledge concerning the relative profitableness of sugar beets as compared to other competing enterprises and the supply response of sugar beet production to changing profitability are necessary if an assessment of potential expansion is to be made.

In 1968 there were approximately 30,000 acres of beets harvested. This study encompassed areas throughout Utah in which beets are presently being produced, and was designed to provide information helpful in assessing potential expansion of sugar beet production.

OBJECTIVES

1. To ascertain relative profitableness of sugar beet production and other crops in sugar beet producing areas of Utah.

2. To estimate a supply response curve for sugar beet production as affected by changing profitability of sugar beets relative to competing enterprises.

REVIEW OF LITERATURE

Four major areas of reference were considered in reviewing litera-
ture pertinent to this study. First, studies were considered dealing
with economic factors that would influence sugar beet production in
Utah. Second, studies concerning cost and returns of sugar beet produc-
tion were considered. Emphasis was on studies affecting sugar beet
production in Utah. The third area of interest concerned studies using
linear programming as an approach to determining optimum enterprise
combinations. The final area of concern involved studies using linear
programming in supply response analysis. Also included, were studies
illustrating various macro-supply-aggregation techniques that would
pertain to this study.

Economic studies affecting sugar beet production

Studies conducted by Johnson, Jensen, and Boisvert (9) in Minnesota
reported a decrease in sugar beet acreage in that state. They stated
two basic reasons for the decrease. (a) There were relatively small
differences in net income per acre among corn, soybean, and sugar beets.
(b) Sufficient supplies of labor were not always available. Repre-
sentative farm budgets were developed for each sugar beet producing
area within the state. Linear programming techniques were used to
ascertain the optimum profit combination for each area, with varying
production conditions. They concluded that an increase of mechanical
technology would increase production of beets. This study was signif-
icant in view of the decreasing trend of sugar beet production in
various parts of Utah.

Sidhu (16) conducted a study of factors influencing decisions to produce sugar beets in Utah. This study included a regression analysis of variables thought to be important. Two variables were found to be consistently significant. These were man hours of available family labor and lack of suitable land for growing sugar beets. Other factors restricting expansion of sugar beets were rotation, nematode, equipment, and water. He concluded future price increases accompanied by free allotments will be favorable for expansion of sugar beet acreage in Utah.

Cost and return studies

Yaggie and Loftsgard (20) conducted a study to identify and analyze production practices and costs for sugar beets in the Red River Valley. Objectives of the study were (a) to determine characteristics and budgets associated with sugar beet producing farms, and (b) to provide information for a complementary study of the aggregate supply response potential of sugar beets to various demand situations.

It was concluded that economies of size do exist in sugar beet production and that these economies are associated largely with machine ownership. They found that each enterprise should be a minimum of 90 acres to justify economic ownership of all specialized beet equipment. Cost per unit of output for larger acreages remained about the same.

Morrison (14) conducted a study of the cost and returns of sugar beet enterprises in Utah. The 1963 study included 67 farms in Box Elder, Cache, Davis, Weber, and Utah counties. A survey was made as to the size of sugar beet enterprises and yields associated with each size. For each enterprise, total costs were subtracted from gross receipts to provide a net return value. Average net return from sugar beets was

$74.74 per acre. This study reflected yield difference as related to cost and returns of beet production.

In 1952, Larsen (12) analyzed production of sugar beets in Utah County. Simple correlation analysis of cost per ton to yields indicated a correlation coefficient of -.73. This coefficient indicated that lower costs per ton are associated with greater yields per acre and there are definitely economies associated with higher yields.

Linear programming studies

Spaulding (17) estimated a supply response of sugar beet production in Box Elder and Cache counties. Enterprise budgets and representative farm units were developed according to size, type, and production level. Optimum combinations were selected by linear programming. The price of sugar beets was varied parametrically to show the optimal combination of enterprises at each price change. He concluded that with an increased profitability of sugar beets, there would be an increase in the number of acres of beets produced by farmers. The sugar beet response ranged from 0 to 27,997 acres at respective prices of $11.70 to $16.70.

Hettinger (8) projected the response of sugar beet production in Colorado to the year 1975. Seven geographical areas in which sugar beets were produced were delineated. For each area a model farm operation was derived. Seventy acres of beets per operator was assumed necessary to approach economies of scale and achieve optimum profit conditions. Factors considered were: relative operating costs per acre for sugar beets and competing crops, prices, operator and hired labor available, labor costs, rotational restrictions, and available irrigated acres for producing sugar beets. Various conditions were conjectured using different combinations of crop prices and costs.

Linear programming was used to arrive at an optimum profit combination
for each of the various combinations of prices and costs. Either
decreased costs or increased prices produced a positive supply response.
He concluded that future expansion of sugar beets in Colorado will
depend on the extent of the underground water resource being developed.

Supply and aggregation studies

Johnson, Jensen, and Boisvert (9) have projected a supply response
to varying sugar beet prices in southern Minnesota to the year 1975.
The primary objective of this study was to assess the likely sugar supply
in response to various price and demand situations. Two geographical
beet producing areas were examined. Two different technologies were then
used for each area representing present and 1975. The 1975 technology
was completely mechanical and more efficient. Budgets for major
competing crops were ascertained. Linear programming was then used to
arrive at optimum enterprise combinations for each county. These were
then aggregated by adding each county supply to arrive at an estimated
total supply.

Young (21) conducted a very comprehensive economic analysis of
producing, processing, and marketing sugar beets in the Eastern region
of the United States. The purpose of this study was to examine and
measure the effects of changes in economic, technical, and institutional
factors influencing future prospects for the industry. One of the
primary objectives was to estimate the production response of sugar
beet production in the region. Linear programming techniques were used.
Four representative farm situations were developed. Solutions at various
prices were computed for sugar beets, beans, and corn. In summarizing
the results of the analysis, it was predicted that there would be a

positive shift in the supply curve for sugar beets in the Eastern region.

METHOD OF PROCEDURE AND SOURCES OF DATA

The purpose of this section is to discuss the sources of data and methods of analysis used in this study. In addition, basic assumptions and limitations concerning both methodology and production variables are discribed.

Statistical data were used to determine the counties in Utah that produce sugar beets of which nine counties were important. The analysis was made using county boundary lines except in two cases where production factors were similar. Davis County was combined with Weber County and Sanpete County with Sevier County for analysis purposes in conducting this study. This provided seven areas of sugar beet production. For each of the areas, selected enterprise budgets were formulated (Appendix B). Crops that were considered of major importance were: sugar beets, corn silage, alfalfa, irrigated barley, irrigated wheat, and tomatoes. Other crops are produced, however these are not used in this study because they do not compete with sugar beets for land, and are not produced in significant amounts. The livestock enterprises used in this study were beef and dairy. Input requirements, costs, and returns for each of these enterprises were obtained from earlier studies conducted by the Agricultural Economics Department at Utah State University. These were updated with information obtained from interviews with farmers and agricultural officials throughout the state. The data from each enterprise budget were then used to compare relative profitableness within various production areas. The enterprise budgets were also the source of data for linear programming. Within each area, three farm types were

formulated. These three farm types were beef-crop, dairy-crop, and all crop units.

Yield relationships

Sugar beet yields were the base for comparing competing enterprises. Sugar beet yields were derived from statistical data for each county (2). The years 1954, 1959, and 1963 through 1968 were used. This provided an average of an eight-year production period (Table 1). In comparing yields and relative profitableness of competing enterprises, the same quality of land must be available for each enterprise. Because statistical data does not take into account the different production levels on varying qualities of land, it was necessary to establish comparative yield relationships. Land used to produce the average yield of beets will produce the comparable yield of competing crops. A study completed by Professor E. M. Morrison and interviews with the Plant Science Department at Utah State University provided the comparative yields for each county (Table 2). In all cases the comparative yield was equal to or greater than the county average as reported by the Agriculture Census. More productive land is apparently used for sugar beets and less productive land is used for other crops. It was assumed that land used to produce present beet yields would produce the comparative yield of competing crops.

Product prices

Prices for sugar beet enterprises were calculated by a weighted average of county prices paid Utah farmers for the years 1963-1968 (5). Weighting was accomplished by giving the price of the 1963 year the weight of one, the year 1964 the weight of two, and so on up, giving

Table 1. Average yields per acre of selected crops for sugar beet
producing counties in Utah, 1969

County	Sugar beets	Alfalfa	Wheat	Barley	Corn silage	Tomatoes
	tons	tons	bu	bu	tons	tons
Box Elder	18.3	3.4	53	41	15.3	12.0
Cache	15.7	3.3	51	40	14.7	NA
Carbon	14.7	2.4	39	32	13.0	NA
Davis/Weber	19.7	3.6	48	43	15.0	12.5
Salt Lake	18.3	3.6	44	41	15.0	12.0
Sevier/Sanpete	14.5	3.2	59	53	14.3	NA
Utah	17.3	306.0	53	37	15.0	NA

Table 2. Comparative yields per acre of selected crops for sugar beet
producing counties in Utah, 1969

County	Sugar beets	Alfalfa	Wheat	Barley	Corn silage	Tomatoes
	tons	tons	bu	bu	tons	tons
Box Elder	18.3	4.9	76	85	18.1	17.1
Cache	15.7	4.2	65	75	15.5	NA
Carbon	14.7	3.9	61	69	14.5	NA
Davis/Weber	19.7	5.2	81	92	19.4	18.3
Salt Lake	18.3	4.9	76	85	18.1	17.1
Sevier/Sanpete	14.5	3.9	60	68	14.3	NA
Utah	17.3	4.6	71	81	17.0	NA

1968 the weight of six. This gave greatest emphasis to the most recent years without ignoring previous years. With sugar beets the average production area price was adjusted by the ratio of sugar content per area compared to the state average. The price of tomatoes was estimated by officials of the largest tomato processing company, which process over 90 percent of the tomatoes grown in Utah. Prices used for alfalfa and barley were calculated from primary data, gathered in 1969, by the Utah State University Agricultural Economics Department. The price of wheat was calculated from state averages and then adjusted in the same portion as barley prices. Corn silage was valued equal to one-third the value of alfalfa.

Representative size

Farm size in Utah varies greatly. Sugar company officials have indicated that "more progressive" farmers operate farms of 100-200 acres and over. A larger number of acres in Utah was capable of growing sugar beets in the farm size group of 160 acres than any other farm size. The size of the representative farm unit considered was 160 acres. United States census records, supplemented by personal survey data, indicated the 160 acre unit to be a common size in all counties.

Beef and dairy enterprises are of commercial importance in Utah, but were considered as supplementary to the crops. A maximum of 30 dairy cows and 60 head of beef were permitted in the linear programming analysis. The optimum number of livestock per farm size was calculated from estimates by the Extension Department at Utah State University.

Assumptions concerning production variables

It was assumed that water resources were of a flow nature. This means that water can only be used once on a given farm and must be used when it is available. Irrigation requirements for various crops within each county were calculated from estimates given by Christensen, et al. (4) of the Utah Agricultural Experiment Station. Irrigation efficiency was assumed to be 50 percent. Available water supplies were calculated from previous studies conducted by the Agricultural Experiment Station at Utah State University (15).

It was assumed that the operator was able to provide 200 hours of labor per month during April to June, time period I. Other family labor consisted of 50 hours per month during this same period. In time period II, from June to September, the operator would provide 225 hours per month and other family labor would consist of 160 hours per month. In time period III, September to November 15, the operator provided 200 hours per month and 50 hours of family labor was provided. This totaled 500 hours in period I, 1155 hours in period II, and 625 hours in period III.

In addition to family labor, hired labor was available at the rate of $1.50 per hour in amounts corresponding to the needs of the optimum solution for all enterprises except dairy. Because of the non-seasonal nature of dairying, labor was charged at a higher rate of $1.95 per hour.

Capital was assumed to be unlimited.

For the representative farms, including beef or dairy, feed inputs were assumed available as the optimum solution required.

Agronomic considerations

Production practices in Utah indicate proper rotation and conser-
vation are necessary to maintain optimum long-run soil conditions.
Sugar beet acreage was restricted to 25 percent of the cropland. This
was for purposes of nematode and disease control.

A minimum of 12.5 percent of the land was required to be in
alfalfa for conservation purposes. Due to allotments and rotation
practices, wheat and barley were each limited to 40 acres.

In areas where tomatoes were produced, a maximum of 10 acres was
allowed in the solution because of the high labor requirements and
uncertainty involved in producing tomatoes.

Analytical procedure of relative profitabilities

Several tests were applied to data in the enterprise budgets to
determine the relative profitability of sugar beet production as
compared to enterprises competing for limiting resources.

Net return per acre was calculated for each enterprise in each
area. To ascertain this, all costs of production were subtracted from
gross returns. Return to fixed investment and management was derived
for each enterprise by adding to the net return the charge for interest
on fixed investment. Return to labor and management for the respective
enterprises was obtained by adding back to the net return the charge
made for labor. Return per hour on the representative enterprises was
derived by dividing the total return to family labor and management
by the number of hours required. These calculations were performed
for each of the enterprises.

Analytical procedures for linear programming

Linear programming was used as the primary analytical technique in this study. Linear programming is a mathematical technique which can be used to solve a set of simultaneous equations for the purpose of maximizing (or minimizing) an objective function. In this study the objective was to maximize returns to fixed factors within the framework of earlier assumptions. With any method, there are certain fundamental assumptions and limitations (7). For linear programming these are:

1. The objective of the entrepreneur is to maximize profits within the framework of production possibilities.

2. All relationships among resource supplies and use are linear.

3. The alternatives contain the characteristics of independence, divisibility, complete mobility, and finiteness.

To develop an aggregate supply curve, first a micro-supply relationship was needed. Information derived from representative farm budgets was subjected to linear programming analysis.

Parametric programming is a method within the linear programming which was used to develop the supply response relationship for each farm unit. The price of beets was first assumed to be low enough to keep beets from being produced. The price per ton was then increased by increments of $.20 until the entire permitted acreage of sugar beets entered the solution. This procedure calculated the optimum combination of enterprises and the maximum return that can be derived at varying prices.

By using parametric programming, a series of solutions were obtained for each representative farm unit. This indicated the number

of acres or units of each enterprise that would enter into the optimum solution at various prices for sugar beets. Since the price of sugar beets was varied, this gave a supply response relationship to changing profitability of sugar beets.

A complete interpretation of a farm plan developed through linear programming requires investigation of the stability of the plan. Sensitivity analysis is a part of linear programming which helps answer questions as the following: First, how great is the advantage of activities which entered the plan over those which did not? Second, how would increasing or decreasing one or more resources affect the optimum mix of activities and the value of the program? Third, how would changes in price relationships affect the solution (3)? This analysis was concerned mainly with how the changes in price relationships affect the solution. The sensitivity analysis provided an estimate of the range over which a shadow price is revelant. This will indicate the range at which the return to labor and management per acre of each enterprise could vary without causing a change in the original number of acres in the solution.

Aggregation of supply-response quantities were made in four steps. First, a micro-supply response for each 160 acre representative unit of beef-crop, dairy-crop, and all-crop was derived. Second, the beet average for the representative farm units were combined and then averaged giving each the same weight.

The third step, then, was to derive a total supply response for each county, based on the average of the representative farm units.

The fourth step horizontally summed the total of each county. This provided a supply response for the state.

ANALYSIS OF RELATIVE PROFITABLENESS

The purpose of this section is to discuss the relative profita-
bility of sugar beet production as compared to competing enterprises.

Relative profitability of sugar beets

An analysis was made of the costs and returns of sugar beet
production and enterprises that compete with sugar beets for limited
resources, Tables 3 through 9.

Gross returns per acre for each crop were calculated for each
representative farm unit in each production area. From the gross
returns all costs were deducted to calculate net return. The interest
on fixed capital and land was calculated at 6 percent and added to
the net return, providing a net return to fixed investment and manage-
ment.

To derive the return to labor and management, charges made for
labor in the enterprise budgets were added to net return. Return to
labor and management was divided by the total number of man hours
required for each enterprise to calculate return per hour to labor
and management.

Different measures of net returns for each of the enterprises
provided a basis to compare production areas. In Box Elder County
tomatoes were the most profitable in terms of net return, return to
fixed investment and management, and return to labor and management.
The beef enterprise indicated the greatest return to labor and manage-
ment per hour. Comparing only the cropping enterprises, sugar beets
led in all returns, except the return per hour to labor and management,

Table 3. Relative profitableness of selected crop and livestock enterprise in terms of returns to limiting resources, Box Elder County, Utah, 1969

Item	Unit	Sugar beets	Irrigated alfalfa	Irrigated barley	Irrigated wheat	Corn silage	Tomatoes	Beef	Grade A dairy
		acre	acre	acre	acre	acre	acre	acre	head
Yield		18.3 T	4.9 T	85 Bu	76 Bu	18.1 T	17.1 T	990 lb	10,400 lb
Price per unit	dol	15.63	22.00	.96	1.30	7.33	31.90	.262	.46
By-product	dol	18.30	3.00	12.00	11.50	1.00	4.00	10.00	36.20
Gross returns	dol	304.33	110.80	93.60	110.30	133.67	491.68	112.38	514.60
Total expenses	dol	224.47	96.84	86.60	88.89	121.04	385.75	100.53	461.62
Net return	dol	79.86	13.96	7.00	21.41	12.63	105.93	11.85	52.98
Return to fixed investment and management	dol	115.86	49.36	41.92	56.33	47.19	143.13	28.05	108.06
Return to labor and management	dol	148.86	31.96	23.50	37.91	36.63	308.43	20.85	124.98
Hours required	hrs	46	12	11	11	16	135	6	80
Return to labor and management per hour	dol	3.23	2.66	2.14	3.45	2.29	2.28	3.48	1.56

Table 4. Relative profitableness of selected crop and livestock enterprise in terms of returns to limiting resources, Cache County, Utah, 1969

Item	Unit	Sugar beets	Irrigated alfalfa	Irrigated barley	Irrigated wheat	Corn silage	Beef	Grade A dairy
		acre	acre	acre	acre	acre	head	head
Yield		15.7 T	4.2 T	76 bu	65 bu	15.5 T	990 lb	10,400 lb
Price per unit	dol	15.43	22.00	.96	1.30	7.33	.262	.46
By-product	dol	15.70	2.50	11.00	10.00	1.00	10.00	36.20
Gross return	dol	257.95	94.90	83.96	94.50	114.62	112.38	514.60
Total expenses	dol	216.06	91.96	83.05	85.24	114.03	100.53	451.62
Net return	dol	41.89	2.94	.91	9.26	.59	11.85	62.98
Return to fixed investment and management	dol	77.89	38.34	35.83	44.18	35.15	28.05	118.06
Return to labor and management	dol	107.89	19.44	15.91	24.26	23.09	20.85	134.98
Hours required	hrs	44	11	10	10	15	6	80
Return to labor and management per hour	dol	2.45	1.77	1.59	2.43	1.54	3.48	1.69

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Table 5. Relative profitableness of selected crop and livestock enterprise in terms of returns to limiting resources, Carbon County, Utah, 1969

Item	Unit	Sugar beets	Irrigated alfalfa	Irrigated barley	Irrigated wheat	Corn silage	Beef	Grade A dairy
		acre	acre	acre	acre	acre	head	head
Yield		14.7 T	3.9 T	69 bu	61 bu	14.7 T	990 lb	10,400 lb
Price per unit	dol	16.15	23.00	1.06	1.43	7.67	.262	.46
By-product	dol	14.70	2.50	9.50	9.00	1.00	10.00	36.20
Gross return	dol	252.10	92.20	82.64	96.23	113.75	112.38	514.60
Total expenses	dol	207.25	83.65	75.77	78.35	101.96	103.17	462.75
Net return	dol	44.85	8.55	6.87	17.88	11.79	9.21	31.85
Return to fixed investment and management	dol	74.85	37.95	35.79	46.80	40.35	25.41	86.93
Return to labor and management	dol	110.85	25.05	21.87	32.88	32.79	18.21	103.85
Hours required	hrs	44	11	10	10	14	6	80
Return to labor and management per hour	dol	2.52	2.28	2.19	3.29	2.34	3.04	1.29

Table 6. Relative profitableness of selected crop and livestock enterprise in terms of returns to limiting resources, Davis/Weber Counties, Utah, 1969

Item	Unit	Sugar beets	Irrigated alfalfa	Irrigated barley	Irrigated wheat	Corn silage	Tomatoes	Beef	Grade A dairy
		acre	acre	acre	acre	acre	acre	head	head
Yield		19.7 T	5.2 T	92 Bu	81 Bu	19.4 T	18.3 T	990 lb	10,400 lb
Price per unit	dol	15.41	26.00	1.10	1.49	8.67	31.90	.262	.46
By-product	dol	19.70	3.00	12.50	12.00	1.00	4.00	10.00	36.20
Gross return	dol	323.28	138.20	113.70	132.69	169.20	525.94	112.38	514.60
Total expenses	dol	235.09	105.12	95.56	97.81	129.22	404.61	105.94	483.06
Net return	dol	88.19	33.08	18.14	34.88	39.98	121.33	6.44	31.54
Return to fixed investment and management	dol	130.19	74.48	59.06	75.80	80.54	164.53	22.64	86.62
Return to labor and management	dol	158.69	51.08	36.14	52.88	63.98	332.83	15.44	103.54
Hours required	hrs	47	12	12	12	16	141	6	80
Return to labor and management per hour	dol	3.38	4.26	3.01	4.40	4.00	2.36	2.57	1.29

Table 7. Relative profitableness of selected crop and livestock enterprise in terms of returns to limiting resources, Salt Lake County, Utah, 1969

Item	Unit	Sugar beets	Irrigated alfalfa	Irrigated barley	Irrigated wheat	Corn silage	Tomatoes	Beef	Grade A dairy
		acre	acre	acre	acre	acre	acre	head	head
Yield		18.3 T	4.9 T	85 Bu	76 Bu	18.1 T	17.1 T	990 lb	10,400 lb
Price per unit	dol	15.41	26.00	1.10	1.49	8.67	31.90	.262	.46
By-product	dol	18.30	3.00	12.00	11.50	1.00	4.00	10.00	36.20
Gross return	dol	301.84	130.40	105.50	124.74	157.93	491.68	112.38	514.60
Total expenses	dol	226.92	98.79	88.05	90.34	123.79	306.65	105.94	483.06
Net return	dol	73.38	31.61	17.45	34.40	34.14	104.98	6.44	31.54
Return to fixed investment and management	dol	109.38	67.01	52.37	69.32	68.70	142.18	22.64	86.62
Return to labor and management	dol	142.38	49.61	33.90	50.90	58.14	307.48	15.44	103.54
Hours required	hrs	46	12	11	11	16	135	6	80
Return to labor and management per hour	dol	3.10	4.13	3.09	4.63	3.63	2.28	2.57	1.29

Table 8. Relative profitableness of selected crop and livestock enterprise in terms of returns to limiting resources, Sevier/Sanpete Counties, Utah, 1969

Item	Unit	Sugar beets	Irrigated alfalfa	Irrigated barley	Irrigated wheat	Corn silage	Beef	Grade A dairy
		acre	acre	acre	acre	acre	head	head
Yield		14.5 T	3.9 T	82 bu	60 bu	14.3 T	990 lb	10,400 lb
Price per unit	dol	15.63	23.00	1.06	1.43	7.67	.262	.46
By-product	dol	14.50	2.50	11.50	9.00	1.00	10.00	36.20
Gross return	dol	241.14	91.20	98.42	94.80	110.68	112.38	514.60
Total expenses	dol	209.62	85.65	79.41	79.48	105.28	103.17	462.75
Net return	dol	31.52	6.55	19.01	15.32	5.40	9.21	31.85
Return to fixed investment and management	dol	61.52	35.95	47.93	30.32	33.96	25.41	86.93
Return to labor and management	dol	97.52	23.05	35.51	44.24	26.00	18.21	103.85
Hours required	hrs	44	11	11	10	14	6	80
Return to labor and management per hour	dol	2.22	2.10	3.25	4.42	1.89	3.04	1.29

Table 9. Relative profitableness of selected crop and livestock enterprise in terms of returns to limiting resources, Utah County, Utah, 1969

Item	Unit	Sugar beets	Irrigated alfalfa	Irrigated barley	Irrigated wheat	Corn silage	Beef	Grade A dairy
		acre	acre	acre	acre	acre	head	head
Yield		17.3 T	4.6 T	81 bu	71 bu	17.0 T	990 lb	10,400 lb
Price per unit	dol	15.18	23.50	1.06	1.43	7.67	.262	.46
By-product	dol	17.30	2.75	11.00	10.50	1.00	10.00	36.20
Gross return	dol	279.91	110.85	96.86	112.03	131.39	112.38	514.60
Total expenses	dol	222.49	95.39	87.28	89.55	117.74	103.32	465.05
Net return	dol	57.42	15.46	9.58	22.48	13.65	9.06	49.55
Return to fixed investment and management	dol	93.42	50.86	44.50	57.40	48.21	25.26	104.63
Return to labor and management	dol	124.92	31.96	26.08	38.98	36.15	18.06	121.55
Hours required	hrs	45	11	11	11	15	6	80
Return to labor and management per hour	dol	2.77	2.91	2.37	3.54	2.41	3.01	1.52

of which wheat had the greatest profit.

Of the cropping enterprises, sugar beets had the greatest net return in the production areas of Cache, Carbon, Sevier/Sanpete, and Utah counties. With the exception of tomatoes, sugar beets had the greatest net return of the crops in every production area within this study.

In the production areas of Box Elder, Salt Lake, and Davis/Weber, tomatoes yielded the largest return to labor, capital and management. Only these three production areas produced tomatoes.

Wheat was found to have the largest return per hour to labor and management in all production areas except Box Elder and Cache counties, where beef had the greatest hourly return.

Of the livestock enterprises, the dairy enterprise in Cache County indicated the greatest returns to labor, capital, and management.

ANALYSIS OF MICRO-SUPPLY RESPONSE

This section presents results of the linear programming for representative farm units in each production area. Results of the sensitivity analysis are also presented.

Results of linear programming

Representative farm units provided a basis for analyzing the supply response. These units were analyzed within the framework of assumptions and restrictions as previously discussed. A series of two to six linear programming solutions at varying sugar beet prices were derived for each representative farm unit. Each solution provided an optimum combination of enterprises at a specified price for sugar beets.

A complete presentation of the solution for each county is given in Appendix A, Tables 15 through 21. Each table consists of various optimum enterprise combinations corresponding to specified sugar beet prices for each county. The tables are actually in three sections. The top section of each optimum enterprise combination table designates price per ton of sugar beets. The price per ton was assumed to be a variable factor. Corresponding to each price per ton is the net return to labor and management per acre of sugar beets produced.

The second section indicates the optimum combination of enterprises. Cache County beef-crop illustration table shows the optimum to be 40 acres of beets, 20 acres of alfalfa, 15.8 acres of barley, 40 acres of wheat, 23.3 acres of corn silage, and 20.9 acres of unused land. Also included was 60 head of beef and 719 hours of hired labor.

In the representative farm units containing livestock enterprises,
the alfalfa, barley, and corn silage was fed to the livestock, or sold,
depending on which was the most profitable. Also the livestock enter-
prises were able to purchase additional feeds whenever it became
profitable to do so. The first solution represents a price per ton
at which it would not be profitable to produce sugar beets. The last
solution in each representative farm unit is the price per ton as
calculated in the budgets. As previously discussed, the maximum
acreage permitted in sugar beets was limited to 25 percent of the
available land. Since maximum production was attained at budget price,
increasing price would not increase production.

The example of the Cache County beef-crop representative farm
unit illustrated a change in combination of enterprises when price
per ton increased to $12.92. At $12.92 per ton, maximum profits to
the farm could be obtained by producing 30.5 acres of beets. As the
price of sugar beets was increased, holding all other costs and prices
constant, the combination of enterprises changed. At each change
there was an increase in the acreage of sugar beets. At a price per
ton over $12.92, maximum profits to the farm could be obtained by
producing 40 acres of beets. The Cache County beef-crop unit illus-
trates that sugar beets should be produced below a price per ton of
$10.13.

The third section of the table indicates the net return to family
labor and management. Two thousand eighty hours of family labor were
considered fixed and could be used on the farm without using capital,
but hiring labor cost $1.50 per hour and was charged to the capital
limitations. The number of hours of family labor utilized within the

solution was divided into the net profit to derive a return to family labor and management per hour. In the example of the Cache County beef-crop unit, the $4,373 profit was divided by the 2,280 hours to arrive at a return per hour of $2.36.

A decrease in the acreage of beets decreased net return to fixed factors in all of the farm units. Because of varying costs between counties, corresponding prices per ton of beets in the different counties did not yield the same net return. The sensitivity analysis, Table 10, indicates the range of net return to labor and management values per acre in which the marginal value of the product would remain constant. The Cache County beef-crop unit illustrates that forty acres of beets should be produced at a price per ton of $12.92. Table 16 in Appendix A indicates a maximum profit combination for Cache County with 40 acres of beets, 20 acres of alfalfa, 15.8 of barley, 40 of wheat, 23.3 acres of corn silage and 60 head of beef. The sensitivity analysis illustrates the range of net return to labor and management values per acre, in which no change in the combination of enterprises would occur. Comparison of the net return to labor and management as calculated in the budgets, with the range of values in the sensitivity analysis, indicated the stability of the optimal profit-solution.

In Box Elder County, the response was primarily an all or none situation. The maximum permitted acreage of sugar beets was included in the optimum solution above a price of $12.03 per ton. Any price below $11.67 per ton should cause sugar beets to drop completely out of the solution.

In Cache County, smaller and more incremental changes occurred in

Table 10. Sensitivity analysis of net returns to labor and management, 160 acre farms, in selected Utah counties, 1969

Enterprise	Net return to labor and management per acre	Range of values of which no change would occur in basic optimum solution		
		Farm organization		
		Beef-crop	Dairy-crop	All-crop
		Box Elder		
Beets	148.86	82.96-infinity	82.96-infinity	82.96-infinity
Alfalfa	31.96	0.0 -39.41	0.0 -35.1	30.34-39.41
Barley	23.50	0.0 -30.46	0.0 -30.46	0.0 -30.46
Wheat	37.91	30.46-infinity	30.46-infinity	30.46-infinity
Corn silage	36.63	0.0 -37.96	0.0 -37.96	0.0 -37.96
Tomatoes	308.43	216.46-infinity	216.46-infinity	216.46-infinity
Beef	20.85	15.72-infinity	--	--
Dairy	124.98	--	129.35-infinity	--
		Cache		
Beets	107.89	69.26-infinity	69.26-infinity	69.26-infinity
Alfalfa	19.44	0.0 -33.75	18.70-38.61	18.70-25.59
Barley	15.91	0.0 -19.00	0.0 -19.00	0.0 -19.00
Wheat	224.24	19.00-infinity	19.00-infinity	19.00-infinity
Corn silage	23.09	0.0 -32.78	0.0 -24.81	0.0 -24.81
Beef	20.85	17.47-infinity	--	--
Dairy	134.98	--	113.00-infinity	--

Table 10. Continued

Enterprise	Net return to labor and management per acre	Range of values of which no change would occur in basic optimum solution		
		Farm organization		
		Beef-crop	Dairy-crop	All-crop
			Carbon	
Beets	110.85	75.93-infinity	75.93-infinity	75.93-infinity
Alfalfa	25.05	0.0 -25.18	0.0 -25.18	22.56-25.18
Barley	21.78	0.0 -22.45	0.0 -22.41	0.0 -22.41
Wheat	32.88	22.45-infinity	22.41-infinity	22.41-infinity
Corn silage	32.79	32.60-44.92	32.60-33.74	32.60-39.35
Beef	18.21	15.16-infinity	--	--
Dairy	103.85	--	127.07-infinity	--
			Davis/Weber	
Beets	158.74	110.42-infinity	110.42-infinity	110.42-infinity
Alfalfa	51.08	0.0 -57.97	0.0 -58.58	46.76-58.58
Barley	36.14	0.0 -46.51	0.0 -46.51	0.0 -46.51
Wheat	52.88	46.51-infinity	46.51-infinity	46.51-infinity
Corn silage	63.98	5.95-69.63	5.95-69.63	0.0 -infinity
Tomatoes	332.83	251.42-infinity	251.42-infinity	251.42-infinity
Beef	15.44	0.0 -18.58	--	--
Dairy	103.54	--	0.0 -151.59	--

Table 10. Continued

Enterprise	Net return to labor and management per acre	Range of values of which no change would occur in basic optimum solution		
		Farm organization		
		Beef-crop	Dairy-crop	All-crop

		Salt Lake		
Beets	142.38	103.14-infinity	103.14-infinity	103.14-infinity
Alfalfa	49.61	2.48-52.14	2.48-52.14	0.0 -52.14
Barley	33.90	19.92-50.64	0.0 -50.64	0.0 -50.64
Wheat	52.98	50.64-infinity	50.64-infinity	50.64-infinity
Corn silage	58.14	0.0 -60.48	0.0 -60.48	55.66-60.48
Tomatoes	307.18	236.64-infinity	236.64-infinity	236.64-infinity
Beef	15.44	0.0 -18.64	--	--
Dairy	103.54	--	0.0 -152.78	--

		Sevier/Sanpete		
Beets	97.52	71.41-infinity	71.41-infinity	71.41-infinity
Alfalfa	23.05	0.0 -34.37	0.0 -34.37	20.50-34.37
Barley	35.51	0.0 -41.47	0.0 -86.91	19.32-infinity
Wheat	30.32	19.32-infinity	19.32-infinity	19.32-infinity
Corn silage	26.00	0.0 -27.32	0.0 -27.32	0.0 -27.32
Beef	18.21	16.82-infinity	--	--
Dairy	103.85	--	0.0 -127.96	--

Table 10. Continued

Enterprise	Net return to labor and management per acre	Range of values of which no change would occur in basic optimum solution		
		Farm organization		
		Beef-crop	Dairy-crop	All-crop
		Utah		
Beets	124.92	85.76-infinity	85.76-infinity	85.76-infinity
Alfalfa	31.96	0.0 -37.31	0.0 -44.65	31.85-44.65
Barley	26.08	0.0 -28.12	0.0 -28.12	0.0 -28.17
Wheat	38.98	21.12-infinity	28.12-infinity	28.12-infinity
Corn silage	36.15	0.0 -44.18	0.0 -44.18	0.0 -44.25
Beef	18.06	16.12-infinity	--	--
Dairy	121.55	--	0.0 -132.97	--

the series of optimum solutions. The maximum sugar beet acreage per-
mitted entered the optimum solution above a price of $12.92 per ton.
Beets left the solution at $9.97.

A wide range of response prices occurred in Carbon County. The
maximum acreage of beets entered the solution at $14.19 per ton. The
price of $9.97 caused sugar beets to completely leave the solution.

The supply response for Davis/Weber area indicated the maximum
acreage of beets would be produced at $12.96 per ton. Sugar beets
were not included in the optimum combination of enterprises at a
price per ton below $12.39.

The supply response for Salt Lake County was identical for all
three representative farm types. Sugar beets were included in the
optimum solution above $12.67 per ton. At any price below $12.67
per ton sugar beets completely left the solution.

In Sevier County the maximum acres permitted to enter the solution
occurred at a price of $13.38 per ton. The linear programming solutions
indicated sugar beets would not be produced below a price per ton of
$10.50.

Linear programming solutions in Utah County illustrated a wide
range of response prices. The maximum beet acreage entered the solution
above a price of $12.92 per ton. Sugar beets completely left the
optimum solution at a price per ton of $10.15.

The lowest price per ton at which sugar beets would be produced
in any production area was $9.98 per ton. This occurred in Cache
County. The linear programming solutions indicated a maximum produc-
tion of sugar beets for the state of Utah at the price of $14.19 per
ton.

It should be observed that a high price per ton does not necessarily mean a high net return per acre, Appendix A, Tables 15 through 25.

None of the linear programming solutions used the entire amount of water available, therefore, the marginal value of water was zero. Only the solutions in Box Elder and Salt Lake Counties used the entire amount of land provided. The marginal value of land in Box Elder was $13.96. In Salt Lake the marginal value of land was $34.14. In all other production areas, the optimum combination of enterprises included unused land.

The return to family labor and management was greatest in all solutions which contained the maximum allowable acres of beets. In every situation of the budgeted solution it was profitable to hire labor to supplement the family labor.

UPPER LIMITS OF SUGAR BEET PRODUCTION

The purpose of this section is to discuss restrictions to sugar beet production associated with nematode control, mechanization, and acreage limits, as they affect potential beet production.

Nematodes and nematicides

The sugar beet nematode ranks as one of the major problems of the sugar beet industry. This pest has limited beet production in Europe since the mid-1800's and was discovered in Utah fields around 1900. Since then known infested areas have increased in size and number. The sugar beet nematode is now found in all beet growing areas of Utah. Sidhu (16) found that in most areas of Utah, nematode was considered by most farmers to be the most important factor limiting sugar beet production. Nematodes are a detriment to efficient and maximum production, not only because of damage caused to the growing crop, but also because rotation with non-susceptible host crops or fumigation of the soil becomes a necessity. Long rotations reduce the potential acreage for growing sugar beets. Even with good soil management practices, a four to five year rotation is necessary to reduce nematode population sufficiently to produce a profitable crop of beets. However, if host plants, including weeds, are present then the rotation is often ineffective.

Some management practices that help control the nematode include (a) not spreading dump dirt back on the land or carrying soil from infected fields, (b) proper rotations, (c) planting early, and (d) maintaining high soil fertility.

Long rotations limit the portion of the potential acreage on which sugar beets can be grown to 20 or 30 percent of the potential acreage. Nematicides kill enough nematodes to allow a satisfactory crop of beets to be grown year after year. However, the high cost of fumigants and application limits this practice. Jorgenson and Griffin (11) showed that an application of 20-25 gallons of either of three common soil fumigants will control the nematode at a cost of approximately $30-$40 per acre. E. C. Jorgenson, Nematologist of the United States Department of Agriculture has indicated that there are new lower cost nematicides ready to be marketed (10). Many of these are proven to be effective in controlling nematodes but have not yet been cleared by the government for use on sugar beets. At recommended rates of application, the probable cost of the treatments with the new fumigants would be near $15.00 instead of the present $30.00. Studies by Jorgenson have shown that in comparison to non-fumigation, the use of nematicides result in increased yields on infested land. This is true, not only for land with heavy nematode infestations, but also for land with moderate or low nematode infestions.

With increased yields and closer rotation due to less costly fumigants, the profitability of sugar beets is even more attractive.

Mechanization

Sugar company officials predict the sugar beet industry will continue to undergo change in the next few years. Great strides toward mechanization of several operations formerly performed by hand have been made in recent years. Limited hand labor for irrigation and operating the mechanized equipment will probably always be needed. No hand

labor will be directly involved in thinning, hoeing, or harvesting in mechanized beet production of the future.

Chemicals for weed control in sugar beets are increasing in use and importance. Presently there are 39 registered chemicals for weed control in sugar beets (6).

The cost of producing sugar beets by mechanization and chemical weed control is usually equal or less than with labor, Tables 11 and 12.

Potential sugar beet acreage

It was necessary to establish upper limits on the number of acres in each county which can be devoted to sugar beet production in any one year. To establish these figures, maps were provided sugar company officials who outlined the areas presently producing sugar beets and in rotation with beets the last six years. From these maps a potential acreage was calculated. According to the Bureau of Reclamation reports, 4 to 5 percent of the acreage is used for roads, farmsteads, fences, and canals. To check potential acreage calculated from the maps, an analysis was completed using statistical data from the Utah census records. The acreage for sugar beets and each competing irrigated crop was tabulated. The two methods indicated very similar results. An average of the two figures was calculated to provide an estimated potential sugar beet acreage in each county, Table 13.

With continuous annual fumigation, sugar beets can be grown consecutively, year after year. This practice occurs on some farms, but in view of the previous discussion on the cost and problems associated with continuous growing of sugar beets, it was assumed

Table 11. Estimated cost and returns per acre for sugar beet
production, present technology, Box Elder County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	18.3	15.63	286.03
By-product (tops)	ton	18.3	1.00	18.30
Total receipts				304.33
Expenses:				
Labor	hrs	46.0	1.50	69.00
Power				
tractor	hrs	14.0	2.00	28.00
truck	hrs	10.0	1.50	15.00
Machine hire	ton	18.3	.90	16.47
Materials:				
Fertilizer-Nitrogen	lbs avail	100	.0925	16.25
Phosphate	lbs avail	80	.00875	
Barnyard	tons	4	1.50	6.00
Seed	lbs	5	.60	3.00
Water	share	1.5	3.00	4.50
Herbicides	lbs	1.75	4.00	7.00
Total materials				36.75
Overhead:				
Interest on operating				
capital	dollars	115	.03	3.45
Capital repairs	dollars			12.00
Interest on land* and				
fixed capital	dollars	600	.06	36.00
Taxes	acre	1	7.80	7.80
Total overhead				59.25
Total expenses				224.47
Net return				79.86

* Land @ 500/ac.

Table 12. Estimated cost and returns per acre for sugar beet
production, future technology, Box Elder County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	tons	18.3	15.63	286.03
By-product (tops)	tons	18.3	1.00	18.30
Total receipts				304.33
Expenses:				
Labor	hrs	22.0	1.50	33.00
Power				
tractor	hrs	18.0	2.00	36.00
truck	hrs	10.0	1.50	15.00
Machine hire	ton	18.3	1.00	18.30
Materials:				
Fertilizer-Nitrogen	lbs avail	100	.0925	16.25
Phosphate	lbs avail	80	.0875	
Barnyard	ton	4	1.50	6.00
Seed	lbs	5	.60	3.00
Water	share	1.5	3.00	4.50
Herbicides-pre-emergent	acre	1	7.00	7.00
post-emergent	acre	1	13.00	13.00
special treatment	acre	1	4.25	4.25
Total materials				54.00
Overhead:				
Interest on operating capital	dollars	115	.03	3.45
Capital repairs	dollars			15.00
Interest on land* and fixed capital	dollars	650	.06	39.00
Taxes	acre	1	7.80	7.80
Total overhead				65.25
Total expenses				221.55
Net return				82.78

*Land @ 500/ac.

beets would be grown on the same land once in every four years. There-
fore, the maximum acres of sugar beets produced in one year is limited
to 25 percent of the total.

It is assumed that fertility could be maintained by a proper
rotation when some manure and commercial fertilizer was applied.
Proper weed control would not make fumigation necessary.

Table 13. Estimated acreage of cropland capable of growing sugar beets
in Utah, 1969

County	Total potential acreage	Land available in one year
Box Elder	52,000	13,000
Cache	40,000	10,000
Carbon	4,400	1,100
Davis/Weber	40,000	10,000
Salt Lake	22,000	5,500
Sevier/Sanpete	44,000	11,000
Utah	32,000	8,000
State	234,400	58,600

ESTIMATED SUPPLY RESPONSE AGGREGATION

The procedure used thus far in this study consisted of three steps. They were (a) define farms within a production area, (b) prepare budgets for representative farms for three types, and (c) use linear programming to derive a sugar beet response schedule for each farm type.

To derive a combined response schedule, individual response schedules for the farm types were aggregated. An initial problem in aggregating the individual sugar beet response schedules was to determine how many farms of each type were in the production areas. An associated problem was the need to ascertain whether there was a significant difference in the response of sugar beet production by farm size and farm type.

One approach in deriving an aggregate response schedule was to estimate the number of farms of each type within each production area to use as weights in deriving an aggregate response schedule. Data were insufficient to provide adequate estimates of the number of farms of each type. Therefore, it was assumed that the number of farms in each type was equal. Farm types were given equal weight in calculating an average sugar beet response. The average sugar beet response expressed as a proportion of the number of acres in the farm was multiplied by the number of acres of available sugar beet land. From these results was obtained the estimated sugar beet response for each production area, Table 14.

The sugar beet response schedules of each production area were added together to arrive at an estimated sugar beet response schedule

Table 14. Sugar beet production response summary for selected counties, Utah, 1969-1980

Price	Counties							
	Box Elder	Cache	Carbon	Davis/Weber	Salt Lake	Sevier/Sanpete	Utah	Combined
per ton	acres							
14.40	13,000	10,000	1,100	10,000	5,500	11,000	8,000	58,600
14.20	13,000	10,000	1,100	10,000	5,500	11,000	8,000	58,600
14.00	13,000	10,000	559	10,000	5,500	11,000	8,000	58,059
13.80	13,000	10,000	559	10,000	5,500	9,808	8,000	56,867
13.60	13,000	10,000	559	10,000	5,500	6,417	8,000	53,476
13.40	13,000	10,000	559	10,000	5,500	6,417	8,000	53,476
13.20	13,000	10,000	339	10,000	5,500	6,417	8,000	53,256
13.00	13,000	8,000	339	1,750	5,500	2,658	5,333	38,580
12.80	13,000	8,000	339	--	5,500	2,658	5,333	34,830
12.60	13,000	7,750	339	--	--	2,658	5,333	29,080
12.40	13,000	7,750	312	--	--	2,658	3,533	27,253
12.20	13,000	7,750	312	--	--	2,658	2,333	26,053
12.00	542	7,750	275	--	--	2,658	2,333	13,308
11.80	542	3,333	275	--	--	2,658	2,333	9,141
11.60	--	3,333	275	--	--	1,558	2,333	7,499
11.40	--	3,333	275	--	--	1,558	2,333	7,499
11.20	--	3,333	275	--	--	1,558	2,333	7,499
11.00	--	3,333	248	--	--	1,558	1,800	6,939
10.80	--	3,333	248	--	--	1,558	1,800	6,939
10.60	--	2,833	248	--	--	--	1,800	4,881
10.40	--	2,250	248	--	--	--	1,800	4,298
10.20	--	1,500	248	--	--	--	733	2,481
10.00	--	--	--	--	--	--	--	--

for the state of Utah, Table 14. Results of the aggregation produced a stair-step effect. Each of the vertical portions of the supply response schedule, Figure 4, indicate that quantities would remain constant even as price changes over the range indicated by the vertical line.

It has been estimated that approximately ten thousand acres of beets annually are needed to maintain a processing factory in Utah. Assuming sugar beets must be processed within the state, the figures in the estimated response schedule indicate it would be unrealistic to consider the production response below a price per ton of $11.80. Therefore, it is estimated the range of sugar beet production would occur between 13,000 and 58,000 acres.
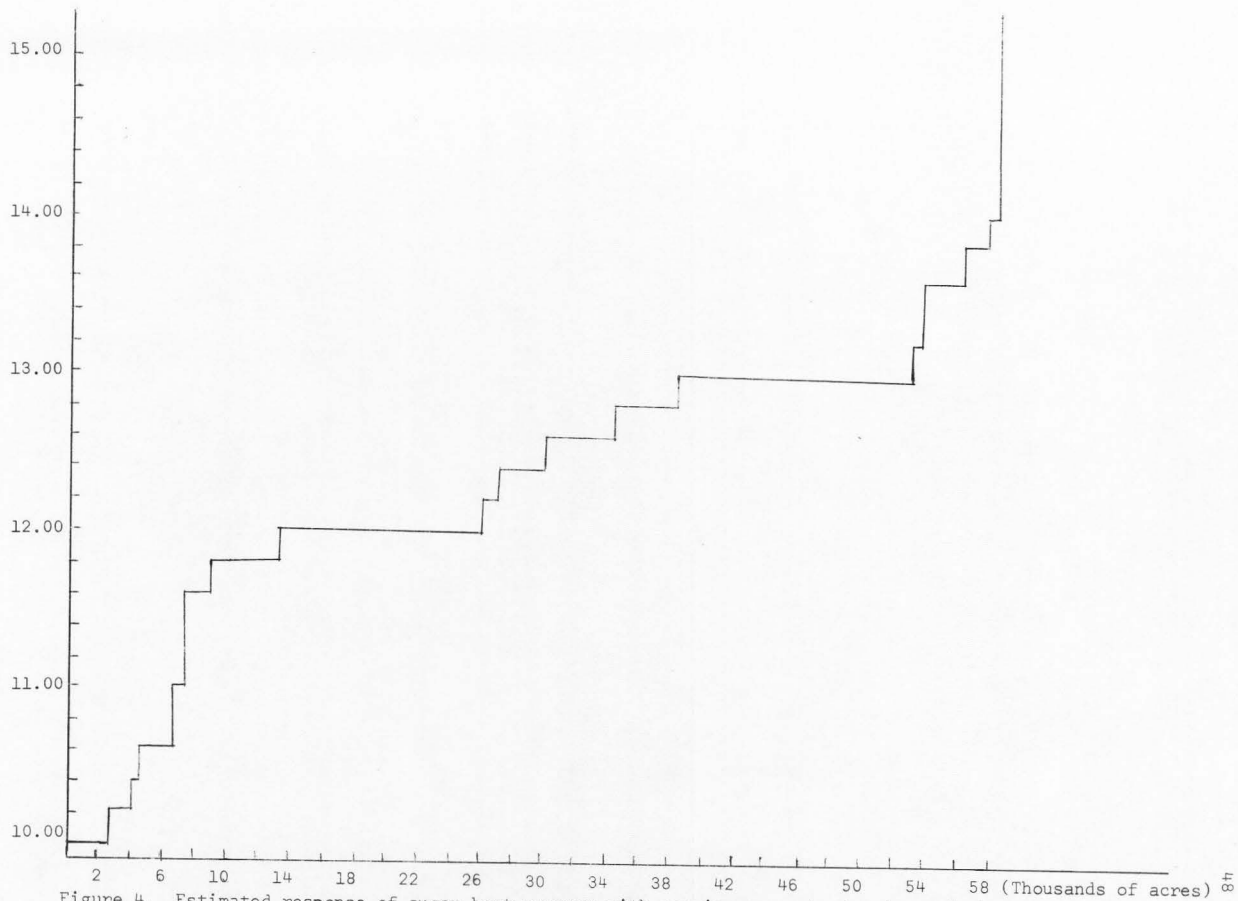
Figure 4. Estimated response of sugar beet growers with varying sugar beet prices, Utah, 1969.

SUMMARY

Sugar is a commodity which has international interest. In the United States, production of sugar from sugar beets is approximately 3 million tons and from cane approximately 2 million tons. Sugar beets are grown under a wide variety of conditions. Utah has been a leading producer of sugar beets. Since 1920 production has continued to decline. The last few years, however, indicated a leveling out of this trend. Currently, national circumstances suggest there may be need for increased domestic sugar production. As Utah has been an important domestic sugar producing state, an assessment of the production potential of the Utah sugar beet industry is important.

This study was designed to determine the profitability of sugar beet production relative to other enterprises competing for scarce resources. It was desired to estimate a supply curve for beet production. The analysis included the counties of Box Elder, Cache, Carbon, Davis, Salt Lake, Sanpete, Sevier, Utah, and Weber. These counties produce 97 percent of the beets in Utah.

Enterprise budgets were formulated from studies conducted by the Agricultural Economics Department at Utah State University. The input coefficients were updated from both primary and secondary sources.

An analysis was made of the enterprise budgets to ascertain the relative profitableness of sugar beets compared to other competing enterprises in each production area. Gross return and total expenses were calculated for each enterprise. Returns to various factors of production were calculated.

Tomatoes were the most profitable crop in the four counties where they were produced. Excluding tomatoes, sugar beets proved to be most profitable in Box Elder, Davis/Weber, Salt Lake, and Utah counties. The dairy enterprise showed a greater net return in Cache County, with sugar beets second. Considering only cropping enterprises, sugar beets had the second largest return, next to tomatoes, and were number one in the counties not producing tomatoes. Tomatoes were restricted to a limited number of acres because of high labor requirements and uncertainties involved in their production. Therefore, sugar beets were the most profitable enterprise in relation to the entire farming unit. The three farm types in five production areas indicated wheat to have the greatest return per hour of labor and management. This may be an important consideration in view of limited family labor.

The supply response portion of this study was accomplished through use of representative farm units. These representative units were developed with beef-crop, dairy-crop, and all-crop situations. A 160 acre farm size was used for each unit. The average yield of sugar beets in each was used as a base from which to compare all competitive enterprises. It was assumed than an acre of land which would produce 18.3 tons of beets, would also produce 4.9 tons of alfalfa, 85 bushels of barley, 76 bushels of wheat, or 18.1 tons of corn silage. This permitted the assumption that each enterprise had at its disposal an acre of land equal in production capacity.

Each of the farm units were subjected to certain restrictions in the analysis. It was required that a minimum of 12.5 percent of the available land be devoted to alfalfa. Because of diseases associated with continued sugar beet production, sugar beets were restricted

to 25 percent of the total acreage. Tomatoes were restricted to slightly more than 6 percent of the acreage. The beef fattening operation was restricted to 60 head of beef and the Grade A dairy operation was limited to 30 cows.

Linear programming was used to derive a micro-supply response relationship for each representative farm unit. Linear programming is a mathematical technique which simultaneously considers various production coefficients and resource supplies which will maximize returns to fixed factors. Parametric linear programming was used to facilitate price variation of sugar beets. Parametric programming is a part of basic linear programming which permits variable price programming. This technique provided an optimal profit solution for each price per ton of sugar beets. The price of sugar beets was increased to a level which caused a change in the original optimum enterprise combination. This procedure continued for each farm unit until the price of sugar beets was high enough to cause maximum production. By this process a price-quantity relationship was obtained. This not only provided a supply response relationship of sugar beets, but also indicated the change of the competing enterprise.

Sensitivity analysis is a part of linear programming which indicates stability of the optimal solution. This produced a price range for each enterprise at which no change in the combination of units would occur.

Estimates of the land available for sugar beet production were made for each of the production areas in this study.

The average response for the three representative farm units provided a micro-response schedule. From this schedule was calculated

the macro-supply response for each county.

The final supply curve for the state of Utah was then estimated by horizontally summing the county response schedules.

CONCLUSIONS

Tomatoes were the most profitable crop in terms of net return, return to labor and management, and return to fixed investment and management. However, tomatoes can only be produced in limited areas of the state. Excluding tomatoes, sugar beets were the most profitable crop. Wheat had the largest net return per hour to labor and management. The Grade A dairy enterprise was the most profitable enterprise in Cache County, except for return to labor and management per hour. Because of the different measures of profitability, no one enterprise was considered most profitable. Sugar beets and tomatoes are the most profitable crops in the situation where family labor and management is relatively plentiful or where capital could be substituted for labor. If management and labor are limited, or hired labor is expensive, the less labor intensive enterprise such as wheat should be produced.

Sugar beet production was responsive to changes in relative profitability. The price per ton at which no beets would be produced are below $9.98. The prices per ton above $14.19 would allow the total land acreage capable of growing sugar beets (25 percent maximum permitted), to be devoted to sugar beet production on all production areas.

With present prices of sugar beets and with rotation restrictions, farmers would maximize returns by producing the maximum acres of sugar beets possible. Linear programming results indicate it would not be necessary to increase sugar beet prices to obtain maximum production.

In comparing the estimated number of acres at corresponding prices with the actual quantities of acres devoted to sugar beets, it will be noted that the model overstated the acreage at the existing prices.

There are several explanations that account for the difference between the model and existing acres. A considerable number of farmers are part time, or are older, and prefer not to grow sugar beets because they are unwilling to invest the time and capital necessary to gain optimum returns. Sugar beets require more management than many alternative crops. Growers may hesitate producing beets due to lack of available family labor. Subjective factors such as personal preference and other factors not completely accounted for in this study would account for this difference.

Government control in the form of allotments would definitely curtail expansion of sugar beet production.

Increased sugar beet prices should bring about an increase in sugar beet acreage. A major factor to increasing the acreage of sugar beets will be the change in technology to the degree of eliminating hand labor from thinning and hoeing.

As farmers recognize the value and proper use of modern technology, sugar beets can continue to have an economic advantage in Utah.

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APPENDIXES

Appendix A

Optimum Enterprise Plans

Table 15. Optimum enterprise combinations at varying sugar beet prices for selected 160 acre farm types, Box Elder County, Utah, 1969

| | | Farm type | | | | | | |
| | | Beef crop Solution | | Dairy crop Solution | | All crop Solution | | |
		first	second	first	second	first	second	third
Net return to labor and management/acre	dol	82.95	148.86	82.95	148.86	76.48	82.95	148.86
Comparable price/ton	dol	12.02	15.53*	12.03	15.63*	11.67	12.03	15.63*
Enterprise plans								
Sugar beets	acre	--	40.0	--	40.0	--	5	40
Alfalfa hay	acre	92.6	52.5	84.9	44.9	90	105	70
Barley	acre	14.1	14.1	17.6	17.6	--	--	--
Irr. wheat	acre	40.0	40.0	40.0	40.0	40	40	40
Tomatoes	acre	10.0	10.0	10.0	10.0	10	10	10
Corn silage	acre	3.3	3.3	7.5	7.5	20	--	--
Unused land	acre	--	--	--	--	--	--	--
Livestock	head	60.0	60.0	30.0	30.0	--	--	--
Hired labor I	hour	41.0	360.0	442.0	762.0	--	40	280
Hired labor II	hour	432.0	832.0	890.0	1,289.0	365	576	825
Hired labor III	hour	536.0	11.75	950.0	1,590.0	545	821	1,085
Return to family labor and management	dol	7,179	9,815	7,040	9,676	6,838	6,871	9,501
Return per hour to family labor and management	dol	3.15	4.30	3.09	4.24	3.00	3.01	4.17
Family labor used	hour	2,280	2,280	2,280	2,280	2,280	2,380	2,380

*Prices used in budgets.

Table 16. Optimum enterprise combinations at varying sugar beet prices for selected 160 acre farm types, Cache County, Utah, 1969

		Beef crop Solution					Dairy crop Solution		All crop Solution					
	Unit	first	second	third	fourth	fifth	first	second	first	second	third	fourth	fifth	sixth
Net return to labor and management/acre	dol	24.64	31.89	49.37	68.44	107.89	69.25	107.89	21.66	27.47	55.00	63.96	69.26	107.89
Comparable price/ton	dol	10.13	10.59	11.70	12.96	15.43*	12.96	15.43*	9.97	10.31	12.07	12.64	12.97	15.43*
Enterprise plans														
Sugar beets	acre	--	10.0	13.4	18.3	40.0	--	40.0	--	17.3	21.5	24.7	27.7	40
Alfalfa hay	acre	29.7	78.5	74.2	69.3	45.2	80.0	35.6	142	123.0	106.0	93.1	111.4	97.8
Barley	acre	15.7	15.7	15.7	15.7	15.7	19.7	19.7	--	--	--	--	--	--
Irr. wheat	acre	40.0	40.0	40.0	40.0	40.0	40.0	40.0	--	--	--	--	--	--
Corn silage	acre	3.8	3.8	3.8	3.8	3.8	8.7	8.7	--	--	9.5	16.7	--	--
Unused land	acre	10.6	11.7	12.0	12.6	15.4	11.5	15.9	18	19.7	23.0	25.4	20.8	22.2
Livestock	head	60.0	60.0	60.0	60.0	60.0	30.0	30.0	--	--	--	--	--	--
Hired labor I	hour	--	--	26.0	65.0	233.0	324.0	635.0	--	--	--	--	--	96.0
Hired labor II	hour	--	--	--	--	199.0	287.0	656.0	--	--	--	--	96.0	209.0
Hired labor III	hour	--	--	--	71.0	392.0	207.0	798.0	--	--	--	65.0	69.0	250.0
Return per hour to family management	dol	4,651	4,823	4,980	5,120	6,094	4,707	6,251	2,764	2,866	3,450	3,691	4,000	5,383
Return per hour to family labor and management	dol	2.15	2.15	2.18	2.24	2.67	2.07	2.74	1.74	1.36	1.54	1.62	1.75	2.36
Family labor used	dol	2,148	2,236	2,280	2,280	2,280	2,280	2,280	1,584	2,113	2,245	2,280	2,280	2,280

*Prices used in budgets.

Table 17. Optimum enterprise combinations at varying sugar beet prices for selected 160 acre farm types, Carbon County, Utah, 1969

| | | Farm type | | | | | | | | | | | | | | |
| | | Beef crop Solution | | | | | | Dairy crop Solution | | | All crop Solution | | | | | |
		first	second	third	fourth	fifth	sixth	first	second	third	first	second	third	fourth	fifth	sixth
Net return to labor and management/acre	dol	28.62	30.43	62.27	75.40	75.91	104.85	73.48	75.39	104.85	28.62	43.79	50.70	62.27	75.39	104.85
Comparable price/ton	dol	9.97	11.09	13.25	14.15	14.19	16.15*	14.02	14.14	16.15	9.97	12.00	12.47	13.25	14.19	16.15*
Enterprise plans																
Sugar beets	acre	--	11.3	14.1	29.8	37.2	40.0	--	30.5	40.0	--	15.9	20.3	22.6	30.5	40.0
Alfalfa hay	acre	63.0	69.6	66.3	48.0	20.0	20.0	84.5	63.5	31.5	68.6	50.4	79.6	77.0	67.9	31.5
Barley	acre	40.0	17.0	17.4	17.4	17.4	17.4	13.1	7.5	--	40.0	40.0	--	--	--	--
Irr. wheat	acre	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
Corn silage	acre	4.1	4.1	4.1	4.1	18.8	16.4	5.5	16.2	18.8	--	--	--	--	--	18.9
Unused land	acre	12.9	17.7	18.1	20.4	17.8	26.0	17.2	23.3	29.6	11.4	13.7	20.1	20.3	21.6	29.6
Livestock	head	60.0	60.0	60.0	60.0	60.0	60.0	18.0	--	--	--	--	--	--	--	--
Hired labor I	hour	--	--	23.0	143.0	218.0	238.0	121.0	132.0	158.0	--	--	--	--	51.0	158.0
Hired labor II	hour	--	--	--	--	--	36.0	--	--	--	--	--	--	--	--	--
Hired labor III	hour	--	--	--	230.0	373.0	409.0	3.0	221.0	332.0	--	--	--	33.0	150.0	332.0
Return to family labor and management	dol	4,363	4,376	4,797	5,189	5,208	6,365	4,944	5,003	6,181	3,904	4,145	4,341	4,602	5,003	6,181
Return per hour to family labor and management	dol	1.91	2.11	2.24	2.28	2.28	2.79	2.17	2.19	2.71	2.51	2.02	1.99	2.08	2.19	2.71
Family labor used	hour	2,280	2,071	2,138	2,280	2,280	2,280	2,280	2,280	2,280	1,554	2,054	2,171	2,208	2,280	2,280

*Prices used in budgets.

Table 18. Optimum enterprise combinations at varying sugar beet prices for selected 160 acre farm types, Davis/Weber Counties, Utah, 1969

	Unit	Beef crop Solution			Dairy crop Solution			All crop Solution		
		first	second	third	first	second	third	first	second	third
Net return to labor and management/acre	dol	99.03	110.41	158.74	99.03	110.41	158.74	99.03	110.41	158.74
Comparable price/ton	dol	12.38	12.96	15.41*	12.38	12.96	15.41*	12,38	12.96	15.41*
Enterprise plans										
Sugar beets	acre	--	7.3	40.0	--	7.3	40.0	--	7.3	40.0
Alfalfa hay	acre	102.0	93.6	54.2	102.0	93.6	54.2	102.0	93.6	54.2
Irr. wheat	acre	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
Tomatoes	acre	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Unused land	acre	7.6	9.0	15.9	7.6	9.0	15.9	7.6	9.0	15.9
Hired labor I	hour	--	--	248.0	--	--	248.0	--	--	248.0
Hired labor II	hour	364.0	425.0	698.0	364.0	425.0	698.0	364.0	425.0	698.0
Hired labor III	hour	530.0	650.0	1193.0	530.0	650.0	1193.0	530.0	650.0	1194.0
Return to family labor and management	dol	9,337	9,419	11,352	9,337	9,419	11,352	9,337	9,419	11,352
Return per hour to family labor and management	dol	4.10	4.13	4.97	4.10	4.13	4.97	4.10	4.13	4.97
Family labor used	hour	2,280	2,280	2,280	2,280	2,280	2,280	2,280	2,280	2,280

*Prices used in budgets.

Table 19. Optimum enterprise combinations at varying sugar beet prices for selected 160 acre farm types, Salt Lake County, Utah, 1969

| | Unit | Farm type | | | | | |
| | | Beef crop Solution | | Dairy crop Solution | | All crop Solution | |
		first	second	first	second	first	second
Net return to labor and management/acre	dol	103.14	145.42	103.14	145.42	103.14	145.42
Comparable price/ton	dol	12.67	15.14*	12.67	15.41*	12.67	15.41*
Enterprise plans							
Sugar beets	acre	--	40.0	--	40.0	--	40.0
Alfalfa hay	acre	20.0	20.0	20.0	20.0	20.0	20.0
Irr. wheat	acre	40.0	40.0	40.0	40.0	40.0	40.0
Tomatoes	acre	10.0	10.0	10.0	10.0	10.0	10.0
Corn silage	acre	90.0	50.0	90.0	50.0	90.0	50.0
Unused land	acre	--	--	--	--	--	--
Hired labor I	hour	140.0	380.0	140.0	380.0	140.0	380.0
Hired labor II	hour	155.0	675.0	155.0	675.0	155.0	675.0
Hired labor III	hour	895.0	1335.0	895.0	1335.0	895.0	1335.0
Return to family labor and management	dol	9,631	11,323	9,631	11,323	9,631	11,323
Return per hour to family labor and management	dol	4.22	4.96	4.22	4.96	4.22	4.96
Family labor used	hour	2,280	2,280	2,280	2,280	2,280	2,280

*Prices used in budgets.

Table 20. Optimum enterprise combinations at varying sugar beet prices for selected 160 acre farm types, Sevier/Sanpete Counties, Utah, 1969

		Beef crop Solution				Dairy crop Solution			All crop Solution			
	Unit	first	second	third	fourth	first	second	third	first	second	third	fourth
Net return to labor and management/acre	dol	34.87	57.16	71.41	97.52	69.08 ·	71.41	97.52	23.09	57.16	71.41	97.52
Comparable price/ton	dol	11.62	13.05	13.83	15.63*	13.67	13.83	15.63*	10.50	13.05	13.83	15.63*
Enterprise plans												
Sugar beets	acre	--	11.9	32.7	40.0	--	37.4	40.0	--	16.7	37.4	40.0
Alfalfa hay	acre	63.3	50.5	28.2	20.4	60.2	28.5	25.7	68.6	50.6	28.5	25.7
Barley	acre	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
Irr. wheat	acre	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
Corn silage	acre	4.3	4.3	4.3	4.3	6.7	--	--	--	--	--	--
Unused land	acre	12.5	13.3	14.8	15.3	13.1	14.1	14.3	--	--	14.0	14.2
Livestock	head	60.0	60.0	60.0	60.0	21.0	--	--	--	--	--	--
Hired labor I	hour	--	37.0	200.7	257.8	204.0	171.0	191.0	--	9.0	170.0	191.0
Hired labor II	hour	--	--	--	69.0	--	--	25.0	--	--	--	25.0
Hired labor III	hour	--	--	309.1	417.0	85.0	307.0	346.0	--	--	307.0	346.0
Return to family labor and management	dol	4,562	4,837	5,294	6,338	5,123	5,211	6,255	4,122	4,678	5,211	6,255
Return per hour to family labor and management	dol	2.00	2.12	2.32	2.78	2.25	2.29	2.74	2.65	2.86	2.29	2.74
Family labor used	hour	2,280	2,280	2,280	2,280	2,280	2,280	2,280	1,554	1,633	2,280	2,280

*Prices used in budgets.

Table 21. Optimum enterprise combinations at varying sugar beet prices for selected 160 acre farm types, Utah County, Utah, 1969

		Beef crop Solution					Dairy crop Solution			All crop Solution				
	Unit	first	second	third	fourth	fifth	first	second	third	first	second	third	fourth	fifth
Net return to labor and management/acre	dol	37.81	49.26	72.70	85.75	124.92	76.59	85.75	124.92	37.88	48.18	72.77	85.82	124.92
Comparable price/ton	dol	10.14	10.81	12.16	12.92	15.18*	12.39	12.92	15.18*	10.15	10.71	12.17	12.92	15.18*
Enterprise plans														
Sugar beets	acre	--	10.5	12.7	25.8	40.0	--	27.3	40.0	--	15.6	21.5	27.3	40.0
Alfalfa hay	acre	69.1	78.0	75.5	60.0	43.2	84.9	75.7	60.7	74.1	60.4	82.7	75.7	60.7
Barley	acre	40.0	14.8	14.8	14.8	14.8	20.0	--	--	40.0	34.3	--	--	--
Irr. wheat	acre	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
Corn silage	acre	3.5	3.5	3.5	3.5	3.5	4.4	--	--	--	--	--	--	--
Unused land	acre	7.4	13.0	13.4	15.8	18.5	10.7	44.9	19.3	5.9	9.6	15.8	16.9	19.3
Livestock	head	--	60.0	60.0	60.0	60.0	17.0	--	--	--	--	--	--	--
Hired labor I	hour	--	--	17.0	116.0	224.0	116.0	45.0	141.0	--	--	--	45.0	141.0
Hired labor II	hour	--	--	--	--	123.0	--	--	110.0	--	--	--	--	110.0
Hired labor III	hour	--	--	--	204.0	426.0	--	139.0	336.0	--	--	47.0	138.0	336.0
Return to family labor and management	dol	5,430	5,528	5,826	6,162	7,728	5,855	6,045	7,612	5,050	5,210	5,693	6,051	7,615
Return per hour to family labor and management	dol	3.03	2.62	2.69	2.70	3.39	2.57	2.65	3.34	3.13	2.47	2.55	2.65	3.34
Family labor used	hour	1,792	2,113	2,177	2,280	2,280	2,280	2,280	2,280	1,615	2,111	2,229	2,280	2,280

*Prices used in budgets.

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Appendix B

Crop and Livestock Budgets

Table 22. Estimated costs and returns per acre for sugar beet
production, Box Elder County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	18.3	15.63	286.03
By-product	ton	18.3	1.00	18.30
Total receipts				304.33
Expenses:				
Labor	hrs	46	1.50	69.00
Power				
tractor	hrs	14	2.00	28.00
truck	hrs	10	1.50	15.00
Machine hire	ton	18.3	.90	16.47
Materials:				
Fertilizer-Nitrogen	lbs avail	100	.0925	9.25
Phosphate	lbs avail	80	.0875	7.00
Barnyard	tons	4	1.50	6.00
Seed	lbs	5	.60	3.00
Water	share	1.5	3.00	4.50
Herbicides	lbs	1.75	4.00	7.00
Total materials				36.75
Overhead:				
Interest on operating				
capital	dollars	115	.03	3.45
Capital repairs	collars			12.00
Interest on land* and				
fixed capital	dollars	600	.06	36.00
Taxes	acre	1	7.80	7.80
Total overhead				59.25
Total expenses				224.47
Net return				79.86

*Land @ 500/ac.

Table 23.   Estimated costs and returns per acre for sugar beet
production, Cache County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	15.7	15.43	242.25
By-product	ton	15.7	1.00	15.70
Total receipts				257.95
Expenses:				
Labor	hrs	44	1.50	66.00
Power				
tractor	hrs	14	2.00	28.00
truck	hrs	9	1.50	13.50
Machine hire		15.7	.90	14.13
Materials:				
Fertilizer-Nitrogen	lbs avail	90	.0925	8.33
Phosphate	lbs avail	80	.0875	7.00
Barnyard	ton	4	1.50	6.00
Seed	lbs	5	.60	3.00
Water	share	1.5	4.00	6.00
Herbicides	lbs	1.75	4.00	7.00
Total materials				37.33
Overhead:				
Interest on operating				
capital	dollars	115	.03	3.45
Capital repairs	dollars			12.00
Interest on land* and				
fixed capital	dollars	600	.06	16.00
Taxes	acre	1	5.65	5.56
Total overhead				57.10
Total expenses				216.06
Net return				41.89

*Land @ 500/ac.

Table 24. Estimated costs and returns per acre for sugar beet
production, Carbon County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	14.7	16.15	237.40
By-product	ton	14.7	1.00	14.70
Total receipts				252.10
Expenses:				
Labor	hrs	44	1.50	66.00
Power				
tractor	hrs	14	2.00	28.00
truck	hrs	9	1.50	13.50
Machine hire	tons	14.7	.90	13.23
Materials:				
Fertilizer-Nitrogen	lbs avail	90	.0925	8.32
Phosphate	lbs avail	80	.0875	7.00
Barnyard	ton	4	1.50	6.00
Seed	lbs	5	.60	3.00
Water	share	1.5	3.00	4.50
Herbicides	lbs	1.75	4.00	7.00
Total materials				35.82
Overhead:				
Interest on operating capital	dollars	115	.03	3.45
Capital repairs	dollars			12.00
Interest on land* and fixed capital	dollars	500	.06	30.00
Taxes	acre	1	5.25	5.25
Total overhead				50.70
Total expenses				207.25
Net return				44.85

*Land @ 400/ac.

Table 25. Estimated costs and returns per acre for sugar beet
production, Davis/Weber Counties, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	19.7	15.41	303.58
By-product	ton	19.7	1.00	19.70
Total receipts				323.28
Expenses:				
Labor	hrs	47	1.50	70.50
Power				
tractor	hrs	14	2.00	28.00
truck	hrs	10	1.50	15.00
Machine hire	ton	19.7	.90	17.73
Materials:				
Fertilizer–Nitrogen	lbs avail	100	.0925	9.25
Phosphate	lbs avail	80	.0875	7.00
Barnyard	ton	4	1.50	6.00
Seed	lbs	5	.60	3.00
Water	share	1.5	4.00	6.00
Herbicides	lbs	1.75	4.00	7.00
Total materials				
Overhead:				
Interest on operating				
capital	dollars	115	.03	3.45
Capital repairs	dollars			12.00
Interest on land* and				
fixed capital	dollars	700	.06	42.00
Taxes	acres	1	8.16	8.16
Total overhead				65.61
Total expenses				235.09
Net return				88.19

*Land @ 600/ac.

Table 26. Estimated costs and returns per acre for sugar beet
production, Salt Lake County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	18.3	15.41	282.00
By-product	ton	18.3	1.00	18.30
Total receipts				300.30
Expenses:				
Labor	hrs	46	1.50	69.00
Power				
tractor	hrs	14	2.00	28.00
truck	hrs	10	1.50	15.00
Machine hire	ton	18.3	.90	16.47
Materials:				
Fertilizer-Nitrogen	lbs avail	100	.0925	9.25
Phosphate	lbs avail	80	.0875	7.00
Barnyard	ton	4	1.50	6.00
Seed	lbs	5	.60	3.00
Water	share	1.5	4.00	6.00
Herbicides	lbs	1.75	4.00	7.00
Total materials				38.25
Overhead:				
Interest on operating				
capital	dollars	115	.03	3.45
Capital repairs	dollars			12.00
Interest on land* and				
fixed capital	dollars	600	.06	36.00
Taxes	acre	1	8.75	8.79
Total overhead				60.20
Total expenses				226.92
Net return				73.38

*Land @ 500/ac.

Table 27. Estimated costs and returns per acre for sugar beet
          production, Sevier/Sanpete Counties, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	14.5	15.63	226.64
By-product	ton	14.5	1.00	14.50
Total receipts				241.14
Expenses:				
Labor	hrs	44	1.50	66.00
Power				
tractor	hrs	14	2.00	28.00
truck	hrs	9	1.50	13.50
Machine hire	ton	14.5	.90	13.05
Materials:				
Fertilizer–Nitrogen	lbs avail	90	.0925	8.32
Phosphate	lbs avail	70	.0875	6.13
Barnyard	ton	4	1.50	6.00
Seed	lbs	5	.60	3.00
Water	shares	1.5	5.00	7.50
Herbicides	lbs	1.75	4.00	7.00
Total materials				37.95
Overhead:				
Interest on operating capital	dollars	115	.03	3.45
Capital repairs	dollars			12.00
Interest on land* and fixed capital				
Taxes	acre	1	5.67	5.67
Total overhead				51.12
Total expenses				209.62
Net return				31.52

*Land @ 400/ac.

Table 28. Estimated costs and returns per acre for sugar beet
production, Utah County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	17.3	15.18	262.61
By-product	ton	17.3	1.00	17.30
Total receipts				279.91
Expenses:				
Labor	hrs	45	1.50	67.50
Power				
tractor	hrs	14	2.00	28.00
truck	hrs	10	1.50	15.00
Machine hire	ton	17.3	.90	15.57
Materials:				
Fertilizer-Nitrogen	lbs avail	90	.0925	8.32
Phosphate	lbs avail	80	.0875	7.00
Barnyard	ton	4	1.50	6.00
Seed	lbs	5	.60	3.00
Water	shares	1.5	3.50	5.25
Herbicides	lbs	1.75	4.00	7.00
Total materials				36.57
Overhead:				
Interest on operating				
capital	dollars	115	.03	3.45
Capital repairs	dollars			12.00
Interest on land* and				
fixed capital	dollars	600	.06	36.00
Taxes	acre	1	8.40	8.40
Total overhead				59.85
Total expenses				222.49
Net return				57.42

*Land @ 500/ac.

Table 29. Estimated costs and returns per acre for irrigated alfalfa
production, Box Elder County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	4.9	22.00	107.80
By-product	acre			3.00
Total receipts				110.80
Expenses:				
Labor	hrs	12	1.50	18.00
Power				
tractor	hrs	6	2.00	12.00
truck	hrs	2.1	1.50	3.15
Machine hire	ton	4.9	.50	2.45
Materials:				
Fertilizer-Phosphate	lbs avail	.55	.0875	4.81
Seed	lbs	4	.56	2.24
Water	share	1	1	3.00
Insecticides	acre	1	1.00	1.00
Other (Twine)	ton	4.9	.58	2.84
Total materials				13.89
Overhead:				
Interest on operating capital	dollars	30	.005	.15
Capital repairs	dollars			4.00
Interest on land* and fixed capital	dollars	590	.06	35.40
Taxes	acre	1	7.80	7.80
Total overhead				47.35
Total expenses				96.84
Net return				13.96

*Land @ 500/ac.

Table 30. Estimated costs and returns per acre for irrigated alfalfa
production, Cache County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	4.2	22.00	92.40
By-product	acre			2.50
Total receipts				94.90
Expenses:				
Labor	hrs	11	1.50	16.50
Power				
tractor	hrs	6	2.00	12.00
truck	hrs	1.7	1.50	2.55
Machine hire	ton	4.2	.50	2.10
Materials:				
Fertilizer-Phosphate	lbs avail	40	.875	2.29
Barnyard	ton	0		
Seed	lbs	4	.56	2.24
Water	share	1	4.00	1.00
Insecticides	acre	1	5.65	5.65
Other (Twine)	ton	4.2	.58	2.43
Total materials				13.61
Overhead:				
Interest on operating				
capital	dollars	30	.005	.15
Capital repairs	dollars			4.00
Interest on land* and				
fixed capital	dollars	590	.06	35.40
Taxes	acre	1	5.65	5.65
Total overhead				42.20
Total expenses				91.96
Net return				2.94

*Land @ 500/ac.

Table 31. Estimated costs and returns per acre for irrigated alfalfa
production, Carbon County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	3.9	23.00	39.70
By-product	acre			2.50
Total receipts				92.20
Expenses:				
Labor	hrs	11	1.50	16.50
Power				
tractor	hrs	6	2.00	12.00
truck	hrs	1.6	1.50	2.40
Machine hire	ton	3.9	.50	1.95
Materials:				
Fertilizer-Phosphate	lbs avail	40	.0875	3.50
Seed	lbs	4	.56	2.24
Water	share	1	3.00	3.00
Insecticides	acre	1	1.00	1.00
Other (Twine)	ton	3.9	.58	2.26
Total materials				12.00
Overhead:				
Interest on operating				
capital	dollars	30	.005	.15
Capital repairs	dollars			4.00
Interest on land* and				
fixed capital	dollars	490	.06	29.40
Taxes	acre	1	5.25	5.25
Total overhead				38.80
Total expenses				83.65
Net return				8.55

*Land @ 400/ac.

Table 32. Estimated costs and returns per acre for irrigated alfalfa
production, Davis/Weber Counties, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	5.1	26.00	135.20
By-product	acre			3.00
Total receipts				138.20
Expenses:				
Labor	hrs	12	1.50	18.00
Power				
tractor	hrs	6	2.00	12.00
truck	hrs	2.2	1.50	3.30
Machine hire	ton	5.2	.50	2.60
Materials:				
Fertilizer-Phosphate	lbs avail	60	.0875	5.25
Seed	lbs	4	.56	2.24
Water	share	1	4.00	4.00
Insecticides	acre			1.00
Other (Twine)	ton	5.2	.58	3.02
Total materials				15.51
Overhead:				
Interest on operating capital	dollars	30	.005	.15
Capital repairs	dollars			4.00
Interest on land* and fixed capital	dollars	690	.06	41.40
Taxes	acre	1	8.16	8.16
Total overhead				53.71
Total expenses				105.12
Net return				33.08

*Land @ 600/ac.

Table 33. Estimated costs and returns per acre for irrigated alfalfa
production, Salt Lake County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	4.9	26.00	127.40
By-product	acre			3.00
Total receipts				130.40
Expenses:				
Labor	hrs	12	1.50	18.00
Power				
tractor	hrs	6	2.00	12.00
truck	hrs	2.1	1.50	3.15
Machine hire	ton	4.9	.50	2.45
Materials:				
Fertilizer-Phosphate	lbs avail	55	.0875	4.81
Seed	lbs	4	.56	2.24
Water	share	1	4.00	4.00
Insecticides	acre	1	1.00	1.00
Other (Twine)	ton	4.9	.58	2.84
Total materials				14.89
Overhead:				
Interest on operating				
capital	dollars	30	.005	.15
Capital repairs	dollars			4.00
Interest on land* and				
fixed capital	dollars	590	.06	35.40
Taxes	acre	1	8.75	8.75
Total overhead				48.30
Total expenses				98.79
Net return				31.61

*Land @ 500/ac.

Table 34. Estimated costs and returns per acre for irrigated alfalfa
production, Sevier/Sanpete Counties, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	3.9	23.00	89.70
By-product	acre			2.50
Total receipts				92.20
Expenses:				
Labor	hrs	11	1.50	16.50
Power				
tractor	hrs	6	2.00	12.00
truck	hrs	1.6	1.50	2.40
Machine hire	ton	3.9	.50	1.95
Materials:				
Fertilizer-Phosphate	lbs avail	40	.0875	3.50
Seed	lbs	4	.56	2.24
Water	share	1	5.00	5.00
Insecticides	acre	1	1.00	1.00
Other (Twine)	ton	3.9	.58	2.26
Total materials				14.00
Overhead:				
Interest on operating capital	dollars	30	.005	.15
Capital repairs	dollars			4.00
Interest on land* and fixed capital	dollars	490	.06	29.40
Taxes	acre	1	5.25	5.25
Total overhead				38.80
Total expenses				85.65
Net return				6.55

*Land @ 400/ac.

Table 35. Estimated costs and returns per acre for irrigated alfalfa
production, Utah County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	4.6	23.50	108.10
By-product	acre			2.75
Total receipts				110.85
Expenses:				
Labor	hrs	11	1.50	16.50
Power				
tractor	hrs	6	2.00	12.00
truck	hrs	1.9	1.50	2.85
Machine hire	ton	4.6	.50	2.30
Materials:				
Fertilizer-Phosphate	lbs avail	50	.0875	4.38
Seed	lbs	4	.56	3.50
Insecticides	acre	1	1.00	1.00
Other (Twine)	ton	4.6	.58	2.67
Total materials				13.79
Overhead:				
Interest on operating capital	dollars	30	.005	.15
Capital repairs	dollars			4.00
Interest on land* and fixed capital	dollars	590	.06	35.40
Taxes	acre	1	8.40	8.40
Total overhead				47.95
Total expenses				95.39
Net return				15.46

*Land @ 500/ac.

Table 36. Estimated costs and returns per acre for corn silage
           production, Box Elder County; Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	18.1	7.33	132.67
By product	acre			1.00
Total receipts				133.67
Expenses:				
Labor	hrs	16	1.50	24.00
Power				
tractor	hrs	6	2.00	12.00
truck	hrs	4	1.50	6.00
Machine hire	ton	18.1	.25	4.53
Materials:				
Fertilizer--Nitrogen	lbs avail	80	.0925	7.40
Phosphate	lbs avail	60	.0875	5.25
Barnyard	ton	3	1.50	4.50
Seed	lbs	15	.20	3.00
Water	share	.5	3.00	4.50
Herbicides	acre	1	2.50	2.50
Total materials				27.15
Overhead:				
Interest on operating				
capital	dollars	50	.030	1.50
Capital repairs	dollars			3.50
Interest on land* and				
fixed capital	dollars	576	.06	4.56
Taxes	acre	1	7.80	7.80
Total overhead				47.36
Total expenses				121.04
Net return				12.63

*Land @ 500/ac.

Table 37. Estimated costs and returns per acre for corn silage
production, Cache County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	15.5	7.33	113.62
By-product	acre			1.00
Total receipts				114.62
Expenses:				
Labor	hrs	15	1.50	22.50
Power				
tractor	hrs	5	2.00	10.00
truck	hrs	4	1.50	6.00
Machine hire	ton	15.5	.25	3.88
Materials:				
Fertilizer-Nitrogen	lbs avail	75	.0925	6.94
Phosphate	lbs avail	40	.0875	3.50
Barnyard	ton	3	1.50	4.50
Seed	lbs	15	.20	3.00
Water	share	1.5	4.00	6.00
Herbicides	acre	1	2.50	2.50
Total materials				26.44
Overhead:				
Interest on operating capital	dollars	50	.03	1.50
Capital repairs	dollars			3.50
Interest on land* and fixed capital	dollars	576	.06	34.56
Taxes	acre	1	5.65	5.65
Total overhead				45.21
Total expenses				114.03
Net return				.59

*Land @ 500/ac.

Table 38. Estimated costs and returns per acre for corn silage
production, Carbon County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	14.7	7.67	112.75
By-product	acre			1.00
Total receipts				113.75
Expenses:				
Labor	hrs	14	1.50	21.00
Power				
tractor	hrs	4	2.00	8.00
truck	hrs	4	1.50	6.00
Machine hire	ton	14.7	.25	3.67
Materials:				
Fertilizer-Nitrogen	lbs avail	70	.0925	6.48
Phosphate	lbs avail	40	.0875	3.50
Barnyard	ton	3	1.50	4.50
Seed	lbs	15	.20	3.00
Water	share	1.5	3.00	4.50
Herbicides	acre	1	2.50	2.50
Total materials				24.48
Overhead:				
Interest on operating capital	dollars	50	.03	1.50
Capital repairs	dollars			3.50
Interest on land* and fixed capital	dollars	476	.06	28.56
Taxes	acre	1	5.25	5.25
Total overhead				38.81
Total expenses				101.96
Net return				11.79

*Land @ 400/ac.

Table 39. Estimated costs and returns per acre for corn silage
production, Davis/Weber Counties, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	19.4	8.67	168.00
By-product	acre			1.00
Total receipts				169.00
Expenses:				
Labor	hrs	16	1.50	24.00
Power				
tractor	hrs	6	2.00	12.00
truck	hrs	4	1.50	6.00
Machine hire	ton	19.4	.25	4.85
Materials:				
Fertilizer-Nitrogen	lbs avail	80	.0925	7.40
Phosphate	lbs avail	60	.0875	5.25
Barnyard	ton	3	1.50	4.50
Seed	lbs	15	.20	3.00
Water	share	1.5	4.00	6.00
Herbicides	acre	1	2.50	2.50
Total materials				28.65
Overhead:				
Interest on operating capital	dollars	50	.03	1.50
Capital repairs	dollars			3.50
Interest on land* and fixed capital	dollars	676	.06	40.56
Taxes	acre	1	8.16	8.16
Total overhead				53.72
Total expenses				129.22
Net return				39.98

*Land @ 600/ac.

Table 40. Estimated costs and returns per acre for corn silage
production, Salt Lake County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	18.1	8.67	156.93
By-product	acre			1.00
Total receipts				157.93
Expenses:				
Labor	hrs	16	1.50	24.00
Power				
tractor	hrs	6	2.00	12.00
truck	hrs	4	1.50	6.00
Machine hire	ton	18.1	.25	4.53
Materials:				
Fertilizer-Nitrogen	lbs avail	80	.0925	7.40
Phosphate	lbs avail	60	.0875	5.25
Barnyard	ton	3	1.50	4.50
Seed	lbs	15	.20	3.00
Water	share	1.5	4.00	6.00
Herbicides	acre	1	2.50	2.50
Total materials				28.95
Overhead:				
Interest on operating capital	dollars	50	.03	1.50
Capital repairs	dollars			3.50
Interest on land* and fixed capital	dollars	576	.06	34.56
Taxes	acre	1	8.75	8.75
Total overhead				48.31
Total expenses				123.79
Net return				34.14

*Land @ 500/ac.

Table 41. Estimated costs and returns per acre for corn silage
production, Sevier/Sanpete Counties, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	14.3	7.67	109.68
By-product	acre			1.00
Total receipts				110.68
Expenses:				
Labor	hrs	14	1.50	21.00
Power				
tractor	hrs	4	2.00	8.00
truck	hrs	4	1.50	6.00
Machine hire	ton	14.3	.25	3.57
Materials:				
Fertilizer-Nitrogen	lbs avail	70	.0925	6.48
Phosphate	lbs avail	40	.0875	3.50
Barnyard	ton	3	1.50	4.50
Seed	lbs	15	.20	3.00
Water	shares	1.5	5.00	7.50
Herbicides	acre	1	2.50	2.50
Total materials				27.48
Overhead:				
Interest on operating				
capital	dollars	50	.03	1.50
Capital repairs	dollars			3.50
Interest on land* and				
fixed capital	dollars	476	.06	28.56
Taxes	acre	1	5.67	5.67
Total overhead				39.23
Total expenses				105.28
Net return				5.40

*Land @ 400/ac.

Table 42. Estimated costs and returns per acre for corn silage
production, Utah County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	17.0	7.67	130.39
By-product	acre			1.00
Total receipts				131.39
Expenses:				
Labor	hrs	15	1.50	22.50
Power				
tractor	hrs	5	2.00	10.00
truck	hrs	4	1.50	6.00
Machine hire	ton	17	.25	4.25
Materials:				
Fertilizer-Nitrogen	lbs avail	80	.0925	7.40
Phosphate	lbs avail	51	.0875	4.38
Barnyard	ton	3	1.50	4.50
Seed	lbs	15	.20	3.00
Water	share	1.5	3.50	5.25
Herbicedes	acre	1	2.50	2.50
Total materials				27.03
Overhead:				
Interest on operating				
capital	dollars	50	.03	1.50
Capital repairs	dollars			3.50
Interest on land* and				
fixed capital	dollars	576	.06	34.56
Taxes	acre	1	8.40	8.40
Total overhead				47.96
Total expenses				117.74
Net return				13.65

*Land @ 500/ac.

Table 43. Estimated costs and returns per acre for irrigated wheat
production, Box Elder County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	bu	76	1.30	98.80
By-product	ton	2.3	5.00	11.50
Total receipts				110.30
Expenses:				
Labor	hrs	11	1.50	16.50
Power				
tractor	hrs	4	2.00	8.00
truck	hrs	1	1.50	1.50
Machine hire	bu	76	.02	1.52
Materials:				
Fertilizer-Nitrogen	lbs avail	45	.0925	4.16
Phosphate	lbs avail	10	.0875	.88
Barnyard	ton	2	1.50	3.00
Seed	lbs	95	.0475	4.51
Water	share	.5	3.00	1.50
Herbicides	acre	1	1.00	1.00
Total materials				15.05
Overhead:				
Interest on operating				
capital	dollars	40	.015	.60
Capital repairs	dollars			3.00
Interest on land* and				
fixed capital	dollars	582	.06	34.92
Taxes	acre	1	7.80	7.80
Total overhead				46.32
Total expenses				88.89
Net return				21.41

*Land @ 500/ac.

Table 44. Estimated costs and returns per acre for irrigated wheat
production, Cache County, Utah, 1969

	Units	Quality	Price	Amount
			dollars	dollars
Receipts:				
Primary product	bu	65	1.30	84.50
By-product	ton	2.0	5.00	10.00
Total receipts				94.50
Expenses:				
Labor	hrs	10	1.50	15.00
Power				
tractor	hrs	4	2.00	8.00
truck	hrs	1	1.50	1.50
Machine hire	bu	65	.02	1.30
Materials:				
Fertilizer-Nitrogen	lbs avail	42	.0925	3.88
Phosphate	lbs avail	10	.0875	.88
Barnyard	ton	2	1.50	3.00
Seed	lbs	95	.0475	4.51
Water	share	.5	4.00	2.00
Herbicides	acre	1	1.00	1.00
Total materials				15.27
Overhead:				
Interest on operating				
capital	dollars	40	.015	.60
Capital repairs	dollars			3.00
Interest on land* and				
fixed capital	dollars	582	.06	34.92
Taxes	acre	1	5.65	5.65
Total overhead				44.17
Total expenses				85.24
Net return				9.25

*Land @ 500/ac.

Table 45. Estimated costs and returns per acre for irrigated wheat
production, Carbon County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	bu	61	1.43	87.23
By-product	ton	1.8	5.00	9.00
Total receipts				96.23
Expenses:				
Labor	hrs	10	1.50	15.00
tractor	hrs	4	2.00	8.00
truck	hrs	1	1.50	1.50
Machine hire	bu	61	.02	1.22
Materials:				
Fertilizer-Nitrogen	lbs avail	40	.0925	3.70
Phosphate	lbs avail	10	.0875	.88
Barnyard	ton	2	1.50	3.00
Seed	lbs	95	.0475	4.51
Water	share	.5	3.00	1.50
Herbicides	acre	1	1.00	1.00
Total materials				14.86
Overhead:				
Interest on operating capital	dollars	40	.015	.60
Capital repairs	dollars			3.00
Interest on land* and fixed capital	dollars	482	.06	28.92
Taxes	acre	1	5.25	5.25
Total overhead				37.77
Total expenses				78.35
Net return				17.88

*Land @ 400/ac.

Table 46. Estimated costs and returns per acre for irrigated wheat
production, Davis/Weber Counties, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	bu	81	1.49	120.69
By product	ton	2.4	‚ 5.00	12.00
Total receipts				132.69
Expenses:				
Labor	hrs	12	1.50	18.00
Power				
tractor	hrs	4	2.00	8.00
truck	hrs	1	1.50	1.50
Machine hire	bu	81	.02	1.62
Materials:				
Fertilizer-Nitrogen	lbs avail	50	.0925	4.62
Phosphate	lbs avail	10	.0875	.88
Barnyard	ton	2	1.50	3.00
Seed	lbs	95	.0475	4.50
Water	share	.5	4.00	2.00
Herbicides	acre	1	1.00	1.00
Total materials				16.01
Overhead:				
Interest on operating capital	dollars	40	.015	.60
Capital repairs	dollars			3.00
Interest on land* and fixed capital	dollars	682	.06	40.92
Taxes	acre	1	8.16	8.16
Total overhead				52.68
Total expenses				97.81
Net return				34.88

*Land @ 600/ac.

Table 47. Estimated costs and returns per acre for irrigated wheat
production, Salt Lake County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	bu	76	1.49	113.24
By-product	ton	2.3	5.00	11.50
Total receipts				124.74
Expenses:				
Labor	hrs	11	1.50	16.50
Power				
tractor	hrs	4	2.00	8.00
truck	hrs	1	1.50	1.50
Machine hire	bu	76	.02	1.52
Materials:				
Fertilizer-Nitrogen	lbs avail	45	.0925	4.16
Phosphate	lbs avail	10	.0875	.88
Barnyard	ton	2	1.50	3.00
Seed	lbs	95	.0475	4.51
Water	share	.5	4.00	2.00
Herbicides	acre	1	1.00	1.00
Total materials				15.55
Overhead:				
Interest on operating capital	dollars	40	.015	.60
Capital repairs	dollars			3.00
Interest on land* and fixed capital	dollars	582	.06	34.92
Taxes	acre	1	8.75	8.75
Total overhead				47.27
Total expenses				90.34
Net return				34.40

*Land @ 500/ac.

Table 48. Estimated costs and returns per acre for irrigated wheat
production, Sevier/Sanpete Counties, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	bu	60	1.43	85.80
By-product	ton	1.8	5.00	9.00
Total receipts				
Expenses:				
Labor	hrs	10	1.50	15.00
Power				
tractor	hrs	4	2.00	8.00
truck	hrs	1	1.50	1.50
Machine hire	bu	60	.02	1.20
Materials:				
Fertilizer-Nitrogen	lbs avail	40	.0925	3.70
Phosphate	lbs avail	10	.0875	.88
Barnyard	ton	2	1.50	3.00
Seed	lbs	95	.0475	4.51
Water	share	.5	5.00	2.50
Herbicides	acre	1	1.00	1.00
Total materials				15.59
Overhead:				
Interest on operating capital	dollars	40	.015	.60
Capital repairs	dollars			3.00
Interest on land* and fixed capital	dollars	482	.06	28.92
Taxes	acre	1	5.67	5.67
Total overhead				38.19
Total expenses				79.48
Net return				15.32

*Land @ 400/ac.

Table 49. Estimated costs and returns per acre for irrigated wheat
           production, Utah County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	bu	71	1.43	101.53
By-product	ton	2.1	5.00	10.50
Total receipts				112.03
Expenses:				
Labor	hrs	11	1.50	16.50
Power				
tractor	hrs	4	2.00	8.00
truck	hrs	1	1.50	1.50
Machine hire	bu	71	.02	1.42
Materials:				
Fertilizer-Nitrogen	lbs avail	44	.0925	4.07
Phosphate	lbs avail	10	.0875	.88
Barnyard	ton	2	1.50	3.00
Seed	lbs	95	.0475	4.51
Water	share	.5	3.50	1.75
Herbicides	acre	1	1.00	1.00
Total materials				15.21
Overhead:				
Interest on operating				
capital	dollars	40	.015	.60
Capital repairs	dollars			3.00
Interest on land* and				
fixed capital	dollars	582	.06	34.92
Taxes	acre	1	8.40	8.40
Total overhead				46.92
Total expenses				89.55
Net return				22.98

*Land @ 500/ac.

Table 50. Estimated costs and returns per acre for irrigated barley
production, Box Elder County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	bu	85	.96	81.60
By-product	ton	2.4	5.00	12.00
Total receipts				
Expenses:				
Labor	hrs	11	1.50	16.50
Power				
tractor	hrs	4	2.00	8.00
truck	hrs	1	1.50	1.50
Machine hire	bu	85	.02	1.70
Materials:				
Fertilizer-Nitrogen	lbs avail	40	.0925	3.70
Phosphate	lbs avail	10	.0875	.88
Barnyard	ton	2	1.50	3.00
Seed	lbs	75	.0466	3.50
Water	share	.5	3.00	1.50
Total materials				12.58
Overhead:				
Interest on operating capital	dollars	40	.015	.60
Capital repairs	dollars			3.00
Interest on land* and fixed capital	dollars	582	.06	34.92
Taxes	acre	1	7.80	7.80
Total overhead				46.32
Total expenses				86.60
Net return				7.00

*Land @ 500/ac.

Table 51. Estimated costs and returns per acre for irrigated barley
production, Cache County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	bu	76	.96	72.96
By-product	ton	2.2	5.00	11.00
Total receipts				83.96
Expenses:				
Labor	hrs	10	1.50	15.00
Power				
tractor	hrs	4	2.00	8.00
truck	hrs	1	1.50	1.50
Machine hire	bu	76	.02	1.52
Materials:				
Fertilizer-Nitrogen	lbs avail	38	.0925	3.48
Phosphate	lbs avail	10	.0875	.88
Barnyard	ton	2	1.50	3.00
Seed	lbs	75	.0466	3.50
Water	share	.5	4.0	2.00
Total materials				12.86
Overhead:				
Interest on operating				
capital	dollars	40	.015	.60
Capital repairs	dollars			3.00
Interest on land* and				
fixed capital	dollars	582	.06	34.92
Taxes	acre	1	5.65	5.65
Total overhead				44.17
Total expenses				83.05
Net return				.91

*Land @ 500/ac.

Table 52. Estimated costs and returns per acre for irrigated barley
production, Carbon County, Utah, 1969

	Units	Quantity	Price	Amount
Receipts:				
Primary product	bu	69	1.06	73.14
By-product	ton	1.9	5.00	9.50
Total receipts				82.64
Expenses:				
Labor	hr	10	1.50	15.00
tractor	hr	4	2.00	8.00
truck	hr	1	1.50	1.50
Machine hire	bu	69	.02	1.38
Materials:				
Fertilizer-Nitrogen	lbs avail	35	.0925	3.24
Phosphate	lbs avail	10	.0875	.88
Barnyard	ton	2	1.50	3.00
Seed	lbs	75	.0466	3.50
Water	share	.5	3.00	1.50
Total materials				12.12
Overhead:				
Interest on operating capital	dollars	40	.015	.60
Capital repairs	dollars			3.00
Interest on land* and fixed capital	dollars	482	.06	28.92
Taxes	acre	1	5.25	5.25
Total overhead				37.77
Total expenses				75.77
Net return				6.87

*Land @ 400/ac.

Table 53. Estimated costs and returns per acre for irrigated barley
production, Davis/Weber Counties, Utah, 1969

	Units	Qualtity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	bu	92	1.10	101.20
By-product	ton	2.5	5.00	12.50
Total receipts				113.70
Expenses:				
Labor	hrs	12	1.50	18.00
Power				
tractor	hrs	4	2.00	8.00
truck	hrs	1	1.50	1.50
Machine hire	bu	92	.02	1.84
Materials:				
Fertilizer-Nitrogen	lbs avail	45	.0925	4.16
Phosphate	lbs avail	10	.0875	.88
Barnyard	ton	2	1.50	3.00
Seed	lbs	75	.0466	3.50
Water	share	.5	4.00	2.00
Total materials				13.54
Overhead				
Interest on operating				
capital	dollars	40	.015	.60
Capital repairs	dollars			3.00
Interest on land* and				
fixed capital	dollars	682	.06	40.92
Taxes	acre	1	8.16	8.16
Total overhead				52.68
Total expenses				95.56
Net return				18.14

*Land @ 600/ac.

Table 54. Estimated costs and returns per acre for irrigated barley
production, Salt Lake County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	bu	85	1.10	93.50
By-product	ton	2.4	5.00	12.00
Total receipts				105.50
Expenses:				
Labor	hrs	11	1.50	16.50
Power				
tractor	hrs	4	2.00	8.00
truck	hrs	1	1.50	1.50
Machine hire	bu	85	.02	1.70
Materials:				
Fertilizer-Nitrogen	lbs avail	40	.0925	3.70
Phosphate	lbs avail	10	.0875	.88
Barnyard	ton	2	1.50	3.00
Seed	lbs	75	.0466	3.50
Water	share	.5	4.00	3.00
Total materials				13.08
Overhead:				
Interest on operating				
capital	dollars	40	.015	.60
Capital repairs	dollars			3.00
Interest on land* and				
fixed capital	dollars	582	.06	34.92
Taxes	acre	1	8.75	8.75
Total overhead				47.27
Total expenses				88.05
Net return				17.45

*Land @ 500/ac.

Table 55. Estimated costs and returns per acre for irrigated barley
production, Sevier/Sanpete Counties, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	bu	82	1.06	86.92
By-product	ton	2.3	5.00	11.50
Total receipts				98.42
Expenses:				
Labor	hrs	11	1.50	16.50
tractor	hrs	4	2.50	8.00
truck	hrs	1	1.50	1.50
Machine hire	bu	82	.02	1.64
Materials:				
Fertilizer-Nitrogen	lbs avail	40	.0925	3.70
Phosphate	lbs avail	10	.0875	.88
Barnyard	ton	2	1.50	3.00
Seed	lbs	75	.0466	3.50
Water	share	.5	5.00	2.50
Total materials				13.58
Overhead:				
Interest on operating capital	dollars	40	.015	.60
Capital repairs	dollars			3.00
Interest on land* and fixed capital	dollars	482	.06	28.92
Taxes	acre	1	5.67	5.67
Total overhead				38.19
Total expenses				79.41
Net return				19.01

*Land @ 400/ac.

Table 56. Estimated costs and returns per acre for irrigated barley
production, Utah County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	bu	81	1.06	85.86
By-product	ton	2.2	5.00	11.00
Total receipts				96.86
Expenses:				
Labor	hrs	11	1.50	16.50
Power				
tractor	hrs	4	2.00	8.00
truck	hrs	1	1.50	1.50
Machine hire	bu	81	.02	1.62
Materials:				
Fertilizer-Nitrogen	lbs avail	39	.0925	3.61
Phosphate	lbs avail	10	.0875	.88
Barnyard	ton	2	1.50	3.00
Seed	lbs	75	.0466	3.50
Water	share	.5	3.50	1.75
Total materials				12.74
Overhead:				
Interest on operating				
capital	dollars	40	.015	.60
Capital repairs	dollars			3.00
Interest on land* and				
fixed capital	dollars	582	.06	34.92
Taxes	acre	1	8.40	8.40
Total overhead				46.92
Total expenses				87.28
Net return				9.58

*Land @ 500/ac.

Table 57. Estimated costs and returns per acre for tomato production,
Box Elder County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	13.68	31.90	436.38
By-product	ton	3.42	15.00	51.30
Miscellaneous	acre			4.00
Total receipts				491.68
Expenses:				
Labor	hrs	135	1.50	202.50
Power				
tractor	hrs	12	2.00	24.00
truck	hrs	12	1.50	18.00
Materials:				
Fertilizer-Phosphate	lbs avail	100	.0875	8.75
Barnyard	ton	4	1.50	6.00
Seed	plants	8,000	.0075	60.00
Water	share	1.5	3.00	4.50
Other (box rent)	acre			5.00
Total materials				84.25
Overhead:				
Interest on operating				
capital	dollars	240	.025	6.00
Capital repairs	dollars			6.00
Interest on land* and				
fixed capital	dollars	620	.06	37.20
Taxes	dollars			7.80
Total overhead				57.00
Total expenses				385.75
Net return				105.93

*Land @ 500/ac.

Table 58. Estimated costs and returns per acre for tomato production,
           Davis/Weber Counties, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	14.64	31.90	467.02
By-product	ton	3.66	15.00	54.90
Miscellaneous	acre			4.00
Total receipts				525.92
Expenses:				
Labor	hrs	141	1.50	211.50
Power				
tractor	hrs	13	2.00	26.00
truck	hrs	12	1.50	18.00
Materials:				
Fertilizer--Phosphate	lbs	100	.0875	8.75
Barnyard	ton	4	1.50	6.00
Seed	plants	8,000	.0075	60.00
Water	share	1.5	4.00	6.00
Other (box rent)	acre		5.00	5.00
Total materials				85.75
Overhead:				
Interest on operating				
capital	dollars	240	.025	6.00
Capital repairs	dollars			6.00
Interest on land* and				
fixed capital	dollars	720	.06	43.70
Taxes	dollars	1	8.14	8.14
Total overhead				63.34
Total expenses				404.59
Net return				121.33

*Land @ 600/ac.

Table 59. Estimated costs and returns per acre for tomato production,
Salt Lake County, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	ton	13.68	31.90	436.38
By-product	ton	13.68	15.00	51.30
Miscellaneous	acre	3.42		4.00
Total receipts				491.68
Expenses:				
Labor	hrs	135	1.50	202.50
Power				
tractor	hrs	12	2.00	24.00
truck	hrs	12	1.50	18.00
Materials:				
Fertilizer-Phosphate	lbs	100	.0875	8.75
Barnyard	ton	4	1.50	6.00
Seed	plants	8,000	.0075	60.00
Water	share	1	4.50	4.50
Other (box rent)	acre			5.00
Total materials				84.25
Overhead:				
Interest on operating				
capital	dollars	240	.025	6.00
Capital repairs	dollars			6.00
Interest on land* and				
fixed capital	dollars	620	.06	37.20
Taxes	dollars		8.80	8.80
Total overhead				58.00
Total expenses				386.70
Net return				104.98

*Land @ 500/ac.

Table 60. Estimated costs and returns for beef production, Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary products sold	lbs	1000	.262	262.00
less 1% loss	dollars			- 2.62
less 600 lbs	lbs	600	.245	-147.00
Total receipts				112.38
Expenses:				
Feed-beet tops		value		*
barley	bu	20		*
alfalfa	ton	.3		*
corn silage	ton	1		*
mineral & supplement	head	1	6.00	6.00
Labor	hrs	6	1.50	9.00
Bedding	lbs	200	.25	5.00
Veterinary & medicine				3.00
Electricity & utilities				2.50
Truck	hrs	1.5	1.50	2.25
Tractor & machinery	hrs	1	2.00	2.00
Interest on fixed capital	dollars	270	.06	16.20
Interest on operating money	dollars	20	.04	.80
Capital repairs and depreciation	dollars			1.40
Stock water	dollars			2.00
Miscellaneous	dollars			.50
Taxes on livestock	dollars			1.75
Total expenses				*
Net return				*

*These values were subject to individual production area costs for each production area.

Table 61. Estimated cost and returns for Grade A dairy production,
Utah, 1969

	Units	Quantity	Price	Amount
			dollars	dollars
Receipts:				
Primary product	lbs	10,400	.046	478.40
By-product value	calf	1	18.00	18.00
Miscellaneous	ton	13	1.40	18.20
Total receipts				514.60
Expenses:				
Feed-alfalfa	ton	4.6		٭
corn silage	ton	4.5		٭
barley	bu	50		٭
minerals & supplements	cow	1		4.60
Labor	hrs	80	1.50	120.00
Bedding	ton	1	5.00	5.00
Veterinary & medicine	dollars			7.00
Electricity & utilities	dollars			7.50
Truck	hrs	2	1.50	3.50
Tractor & machinery	hrs	6	2.00	12.00
Interest on fixed capital	dollars	918	.06	55.08
Interest on operating money	dollars	189	.04	7.56
Capital repairs & depreciation	dollars			15.00
Stock water	dollars			.50
Miscellaneous	dollars			24.00
Taxes on livestock	dollars			7.70
Total expenses				٭
Net return				٭

٭These values were subject to individual production area costs for each
production area.

VITA

Darwin C. Allred

Candidate for the Degree of

Master of Science

Thesis: Estimated Response of Sugar Beet Production to Possible
Changes in Relative Profitabilities, Utah, 1969

Major Field: Agricultural Economics

Biographical Information:

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