5-1970

Alternatives in Machinery Management on Juab County, Utah, Dry-Farms

W. Jay Dalley
Utah State University

ALTERNATIVES IN MACHINERY MANAGEMENT ON JUAB COUNTY, UTAH, DRY-FARMS

by

W. Jay Dalley

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

of

MASTER OF SCIENCE

in

Agricultural Education

Approved:

Major Professor

Committee Member

Committee Member

Dean of Graduate Studies

UTAH STATE UNIVERSITY
Logan, Utah

1970

ACKNOWLEDGMENTS

I express my sincere appreciation to all of those who helped me in any way to complete this thesis.

To the two men who at alternate times have served as chairman, I give special thanks. Professor Stanley S. Richardson was very helpful in setting up the plan, giving encouragement, and getting the final work completed. Dr. Von Jarrett gave me encouragement, help, and push at a time when it was most needed.

I express thanks to Dr. Eldon Drake and Dr. Paul Christensen for their suggestions and criticism. It was a pleasure to have them on my committee.

Finally, to my wife Della, for her patience, support, and help, I extend my deepest gratitude.

W. Jay Dalley

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (Continued)

ABSTRACT

Alternatives in Machinery Management on

Juab County, Utah, Dry-farms

by

W. Jay Dalley, Master of Science

Utah State University, 1970

Major Professor: Von H. Jarrett
Department: Agricultural Education

Data were collected from 25 dry farmers living in East-Juab County farming a minimum of 100 acres of land. The data includes the use of tractors, plows, weeders, drills, and combines. A comparison was made between the costs of operation for nine farms between the range of 100 and 500 acres, with an average of 302 acres, producing an average of 83 acres of grain; eleven farms in the range of 501 to 1,000 acres, with an average of 729 acres, producing an average of 243 acres of grain; and five farms in the range of 1,001 to the largest of 2,600 acres , having an average of 1,871 acres, producing an average of 769 acres of grain. Machinery costs were prorated for other crops grown. The calculations include costs of depreciation, interest, taxes, and repairs.

Machinery costs per acre of grain produced for the smallest acreage group were $10.99. Costs for the medium acreage group were $5.66, and the largest acreage group were $3.21. The total costs with estimated fuel and labor amounted to $16.27 for the smallest acreage group, $10.25 for the medium acreage group, and $7.13 for the largest acreage group.

A comparison was then made between the costs of four operations with custom hiring, cooperative-owned equipment, rental equipment, and the costs of the survey data for one acre of land. The costs are as follows: the smallest acreage group, $11.07; custom hiring, $9.50; rental equipment $7.57; medium acreage group, $6.89; cooperative-owned equipment $5.37; and the largest acreage group, $4.95.

(62 pages)

sentimental values. Under these conditions it decreases the possibility of purchasing some of the land for expansion of smaller units.

In the present trend of rising real estate values, much of the land is being purchased by non-farmers investing for future price increases. Present government programs also give an incentive for owners to receive government payments instead of selling the land. An example of this was stated by the Juab Agricultural Stabilization and Conservation Service. It brought out the fact that over 40 percent of the land in Juab County was placed in the conservation reserve in 1958. Some of the contracts were for 5 years and some of them were for 10 years. Most 10-year contracts paid enough to give the farmer interest on the investment and the value of the land over the period of the contract. In view of these facts, it is not always possible for a farmer to expand the size of his operation.

Need for study

The author recently had an advanced class of high school agricultural students carry out a survey to consider this general problem. The conclusion of the students was that farms in the area considered were not large enough to support the machinery required for diversified farming, and that even under specialization, most of the farms would be better off to have some of the work custom hired (assuming custom operators were available), instead of purchasing certain kinds of machinery. There was enough evidence from the preliminary survey to justify a more comprehensive study in Juab County.

Objective

The objective of this study was to investigate two pertinant

questions:

1. On the dry-farms in Juab County, is there a relationship between acres farmed and ownership costs (investment per acre, operating expenses, etc.) of farm machinery?
2. Assuming that ownership of machinery is a problem on the dry-farms, are there alternatives to machine ownership which are acceptable to Juab County dry farmers?

Limitation

The study was limited to farmers living in East-Juab County who farm a minimum of 100 acres of land that is predominantly dry-land. It is also limited to the four main items of equipment used on a dry-farm--tractor, plow, drill, and combine.

Definition of terms

Dry farmer. A farmer who does not use any irrigation water to supplement the moisture received from rain and snow.

Predominantly dry farmer. A farmer who may have some irrigation water occasionally to irrigate a small portion of his land.

Summer fallow. Land that is cultivated but unplanted and does not produce a crop during the year of fallow. The land may be planted to winter wheat in the fall for harvest the following year. Clean cultivation is used to control weeds and conserve the moisture.

Small unit. Farms in the acreage range of 100-500 acres.

Medium unit. Farms in the acreage range of 501-1000 acres.

Large unit. Farms in the acreage range of from 1001-2600 acres.

Major tractor horsepower. The tractor that does, or tractors that do, the majority of the farm work.

East-Juab County. The area that is adjoining Highway 91 and for approximately 10 miles west. It also includes that area from Levan and south on Highway 28 to the Sanpete County line.

Agricultural characteristics of Juab County

Juab County is a diversified farming area. The eastern portion of the county produces a variety of field crops and livestock. The western area produces an abundance of feed for livestock and is used for wintering sheep and cattle. There are areas in the western portion of the county where irrigation produces a variety of field crops.

Juab County has also been noted for its mining in the Tintic area. It is widely known for its beryllium mines.

The oldest dry-land experimental farm in America still in operation is located in the heart of the Juab County dry-land area south of Nephi.

Livestock sold is the highest single income source from agriculture in Juab County, with a total of $1,166,000 in 1964. The value of crops sold was $306,000 the same year. The value of crops fed to livestock is not known but crops fed to livestock play a large part in making the livestock industry so valuable.

The Juab County Mill is one of the few flour mills still in operation in the state. Gem brand flour has been a favorite for many years. The mill is now making many brands of flour for Western and Pacific coast markets. The quality of wheat produced on the Juab County dry-farms has been one of the main factors in the success of the mill.

Industry has increased in recent years in the Nephi area. H. K. Porter Co., producer of rubber hose and belts, is the chief

employer in the area with Rancho Trailer Co. increasing in size each year. Within the last year two smaller industries have located in the city. Rocking O Trailer Co. and the Jeneal Clothing Plant are now in full production and are employing local help. All of these industries aid many small farmers in the total family income.

Method used in sampling procedure

The data were collected from dry farmers living in East Juab County who are farming a minimum of 100 acres of land. The research was limited to the number of farms available, making it possible to use all farmers instead of just a random sample. Seventy-one percent completed the questionnaire or provided the information at the time of the interview with the author. Wherever possible the author filled out the questionnaire from the answers supplied by the farmer. A copy of the survey form is included in the appendix.

Method of designing the information survey

The actual survey form was changed three times. The original form included irrigated land and equipment as well as use of fuel and oil. After the problem was limited to dry-land, the form was adapted to dry-land conditions. A pilot survey was then made and it was found that some of the equipment was not used to any extent on dry-farms. The equipment was then limited to the four main items used, namely, tractors, plows, drills, and combines. The records on fuel and oil were not available making it necessary to eliminate these items from the survey.

Tables 1 and 2 give additional background information on Juab County.

Table 1. Agriculture in Juab County, 1964 (Richards and Christensen, 22)

Number of farms	253
Acres of land in farms	262,024
Average size of farms	1,035.7 acres
Irrigated farms	202
Average value of land and buildings per farm	$36,622.00

Value of agricultural products sold, 1964, $,472,000.00 (about 40 percent was soil bank in 1964)

Crops		Livestock	
Hay	23,382 tons	Cattle and calves	11,701
Winter wheat	196,308 bushels	Number sold in 1964	5,328
Spring wheat	8,228 bushels	Sheep and lambs	18,307
Barley	63,758 bushels	Number sold in 1964	14,174
Oats	6,566 bushels	Hogs	677
Sugar beets	1,530 tons	Dairy cows	356
Potatoes (100 lb.)	694 bags	Whole milk sold, lbs.	1,752,503,000
Alfalfa seed	131,042 lbs.	Chickens	8,114
Corn silage	5,241 tons	Eggs sold, dozen	100,000
Apples	22,700 lbs.	Wool, lbs.	170,408
Peaches	21,060 lbs.		
Pears	46 bushels		
Apricots	1,590 lbs.		

Total value of crops sold,	$306,000.00
Total value of livestock and livestock products sold	$1,166,000.00

Table 2. Assessed valuation of Juab County (Esplin, 9)

	Total	Commercial and Industrial	Agriculture
Real Estate			
Residential	$ 272,870	Includes farmers lot's	
Commercial and Industrial	83,770	$ 83,770	
Agricultural	1,780,825		$1,780,825
Buildings			
Residential	974,040	Includes farm homes	
Commercial and Industrial	706,830	706,830	
Agricultural	108,335		108,335
Personal Property			
Motor vehicles (Including farm trucks)	512,015	Includes farm trucks	
Merchandise and fixtures	189,535	189,535	
Commercial and Industrial machinery	280,130	280,130	
Agricultural machinery	126,860		126,860
Other property	36,440		
Range cattle	165,780		165,780
Other cattle	32,995		32,995
Horses	15,010		15,010
Sheep	130,735		130,735
Other animals (pigs, etc.)	1,250		1,250
Poultry	765		675
Total	$5,418,340	$1,260,265	$2,362,465*
Public Utilities and Mines			
Power and Light, Railroad, Telephone, Mines, Freight Lines, Passenger Service, Car companies	4,020,767		
	$9,439,107	$1,260,265	$2,362,465

*Does not include farm trucks, farmer's homes and lots.

capacity to be optimum when weather variations are considered.

Berge (5) states that the average investment in machinery on Wisconsin farms for the year 1960 was $9,562. The only way this can be justified is by reducing labor expense or increasing income by quality of product. An example listed for this was the hay conditioner.

Long (18) analyzed the problem with the theory that as the size of the implement gets larger, the point of diminishing returns catches up. Labor costs decrease per actual operation, but other items enter in which reduce the actual time saved in proportion to the size of tractor. Examples of this would be increased service time and time lost in filling planting equipment. These could be somewhat offset by better planning, increased capacity for the equipment being pulled with a tractor, etc. He also suggests arranging work the long way of the field to reduce time. This would not be desirable, however, where conservation is a problem, or irrigation principles conflict.

Berry (6) used a formula which included interest, depreciation, housing, taxes, and labor for both owner and hired help. This averaged $6,000 per year. For 100 acres this amounts to $60 per acre. Two hundred acres cuts it in half, or $30 per acre, and 400 acres reduces this figure to $15.

The January 15 issue of the Farmers Bulletin shows figures where costs are getting higher each year. Kansas Farm Business Association farms average approximately $29,000 yearly expenses as compared to $10,000 to $12,000 a decade earlier (1).

The general trend for farm machinery to get bigger is increasing the investment. Some tractors now sell for $10,000 for one unit. One

Iowa farmer states that you can't justify the expense of the tractor he and his brother own with a pencil and paper, but other values such as saving time for an increase in their livestock setup would help to justify the expense. In the same county in Iowa, three farmers bought a large tractor together. They say they cannot afford to own the unit alone, but the three of them together can afford it, and it will do the work so rapidly that there will be no conflict in getting all of the work done. A labor shortage helped them to make the decision (12).

Everett Stoneberg, Agricultural Economist at Iowa State University, comments,

> . . . they may pay their way if you can use them enough during the year. It depends on how much value farm operators put on spare time, and how critical timing on the job actually is. (12, p. 42)

If labor is critical, this may be a good way of substituting capital for labor.

Hull (12), Agricultural Engineer at Iowa State University, estimates 400 acres of plowing are necessary to justify the tractor. Eighteen percent of initial cost is used for the annual cost. The tractors are over 100 horsepower and where they cost $10,000 or more the annual cost would amount to $1,800 per year.

Davis and Phillips (8) found that when machinery was used for seed-bed preparation and planting, costs averaged $11.44 per acre. The machinery investment per acre amounted to an average of $36 per acre. There was considerable variation in this figure. The 25 percent of the farmers who had the larger investments showed an average of $65 per acre. The 25 percent with the smaller investments showed $17 per acre. Some of the farmers in this study traded labor,

borrowed machinery, and/or exchanged machinery to cut the costs.

Hunt (14, p. 9) in his instruction in machinery management wrote, "The greatest single factor affecting the machinery cost of doing a unit of farm work is the number of days the machinery is used per year." He found that the average use per year of most farm implements was 20 days. This is characteristic of farm machinery due largely to the seasonal nature of farm work. Many farm machines perform only one job.

Hunt (14) also found that if farm machines were not manufactured rather cheaply, the farmers' overhead costs would rise unreasonably. He states,

> Some of the best known features of design for durability have not been used because of the cost, the limited use, and the likelihood of the machines being discarded due to obsolescence before they wear out. (14, p. 9)

Merrill (19), in a study of Minidoka County in Idaho, is convinced a farmer could afford to own a baler with 40 acres of hay and an annual average of five tons of hay per acre. This was figuring 10 years of use for the machine.

It appears that the trend in some areas is toward custom work. Lindsey (17) found that 93 percent of the farmers contacted in the 1959 survey in Delta Valley, Mississippi, hired some work done. Custom work is not new in the valley, but in this area cotton was the chief crop produced for a number of years. When government acreage controls prevented the production of cotton on some of the land, it was necessary to produce other crops. This meant added machinery adapted to the new crops. According to Lindsey (17), farmers are taking a closer look at custom work as a possible solution to their machinery and equipment problems. Many farmers have used custom

services for certain jobs, and many others are seeking facts to better enable them to make the decision between machine ownership and custom work. The facts recommended to consider in arriving at the ownership versus custom work are listed as:

1. Price of custom work.
2. Fixed and variable costs of ownership.
3. Value of labor job performance.

The average farmer in the Delta Valley pays $1,067 for custom work. This amounts to eighteen million dollars annually. Fifty percent of the small grains are custom harvested.

According to Davis and Phillips (8), custom work in the area studied in Utah was not common enough to establish custom rates. This could show lack of need for custom work, or the possibility that farmers have not investigated the advantages, or that custom operators have not been available. This could be because of lack of sufficient work to justify the business.

There seems to be a difference in prices charged for custom work in various areas, as shown by Ritchie (23). Information taken from the 1963 U. S. survey showed the Mountain States to have the following average rates for custom work:

Harvesting:

1. Small grains, $4 an acre.
2. Sugar beets, $2 a ton.

Plowing and cultivating:

1. Moldboard plow, $3.85 an acre.
2. Disk plow, $3 an acre.
3. One way, $1.85 an acre.

4. Disking tandem, $1.50 an acre.

5. Offset, $1.50 an acre.

6. Springtooth harrow, $1.10 an acre.

7. Spiketooth harrow, $ .80 an acre.

Wallace's Farmer (3), February 2, 1963, reports the following rates:

Moldboard plow	Per hr.	Per acre	Tractor only per acre
Two bottom tractor and plow	$1.85	$2.00	$1.00
Three bottom plow	2.40	1.85	1.10
Four bottom plow	3.35	1.85	1.30
Five bottom plow	3.85	1.60	1.40

From this, it would appear that there was little extra expense for the ownership of the large tractor over the small one.

Leasing of machinery is also gaining polularity in some areas. Lindsey (17) indicates that machinery dealers feel the high price of machinery may lead to renting. The National Farm Equipment Association (17) shows rental figures as 1 percent of retail for a 10-hour day. Five percent is charged for one week, 15 percent for one month, 25 percent for two months, and 33 1/3 percent for three months. This would be high for tractors, but for special equipment such as harvesting equipment, it would be satisfactory.

Ritchie (23) shows wheel-type tractor rental rates at the following basis:

3 bottom or more, $3.45 an hour.

2 bottom, 2.74 an hour.

This is considerably higher than figures shown in the Wallace's Farmer (3).

Ritchie (23) shows the cost of renting a self-propelled combine is $10 per hour, as compared to Lindsey (17) who quotes $7.98 per hour.

For a longer term lease, Pollard (21) lists prices on tractors from Greater Iowa Leasing Corporation of Boone, Iowa, on a different basis. The leasing corporation pays all expenses but fuel, labor, and property tax. The cost for an 80 horsepower diesel tractor would be as follows: $21.75 a week plus $.55 an hour for every hour of tractor use, where the contract base is 728 hours a year. This figures $2.10 an hour. At 1400 hours base, the cost would be $1.90 an hour. Few farmers would use a tractor over the 728-hour base. Under high income conditions, the gross cost is more, but the net cost is less than for owning because of the difference in income tax structure.

O'Brien (20) feels it pays to rent machinery because of the following:

1. It relieves guess work in costs.
2. You can use the machinery you need and turn the other back.
3. There is no purchase option.
4. You renew your lease year by year.

Diesel tractors seem to be gaining in percentage of use. Hoglund and Orbegoso (13) state that tractor sales in Michigan have increased by 20 percent in the last 10 years, and 43 percent of the total were diesel.

The increase in size of tractors may have an influence on hours of use but in a national survey by the Ethyl Logs (13), it was shown that only 20 percent of the tractors with hour meters operated as much as 1,000 hours or more per year. Sixty percent were operated less than

400 hours annually. These figures were included in Hoglund and Orbegoso's (13) report. By comparison, in Michigan they found that of 397 tractors used on 163 farms that the number of hours used was as follows:

1. 31 percent, less than 400 hours.
2. 53 percent, 400 to 799 hours or more.
3. 16 percent, as much as 800 hours or more.
4. Over 60 percent of the tractors with 45 or more horsepower were used less than 800 hours.

When determining differences between gasoline and diesel, they suggested that the following factors be considered:

1. The differences in initial investments which effect lifetime depreciation.
2. The number of hours of use.
3. The cost of repairs and maintenance.
4. The economy in use of fuel.
5. The differences in cost per gallon between gasoline and diesel fuel.

The better lugging power of a diesel tractor is a difficult factor to measure.

Wallace's Farmer (2) shows a record and test by the University of Illinois engineers. Records were kept on 25 farm tractors. April, May, June, and October were peak months in hours of use. The total hours for the year averaged 334 hours.

The engineers rigged up a test tractor that measured average load. During the year the average load was only 54 percent of the tractor's horsepower. If a tractor is designed to be most efficient at full

load, it would not be the best for general work.

Study has been limited on cooperative use of farm machinery, but there is some indication of cooperative use and possibly of more use. Lindsey (17) indicates that cooperative ownership has not been very satisfactory in the Delta. Variable weather conditions, and farm crops with a high degree of seasonability seem to be the main problems. Complete independence is also desired by most farmers. Cooperative ownership was found among operators of small farms. Swapping work has resulted in the same conditions in general as cooperative ownership.

Comstock (7, p. 18), speaking of mergers of cooperatives, considers the human problem as part of the trouble. This could also be applied to cooperative ownership of equipment. One main reason was "the affinity for what is ours, not much, but it's mine." He also states that farmers should realize that becoming a member of a new cooperative is not like taking a new wife.

Jarrett (16) found some favorable reports for joint ownership of harvesting equipment where considerable savings have been realized. He states,

> Generally the farms must be in close proximity and an agreement in writing with definite understanding of responsibility as to who will operate, care for, maintain, and house the equipment. (16, p. 22)

Jarrett also found success where farmers each own equipment and trade use as well as where they share in the title of the equipment.

The late President Kennedy (4) felt cooperatives could solve some of the problem as voiced in a national meeting:

> The theme of your meeting, "Power in Partnerships," reflects the spirit in farm cooperatives, for it is only through unity that your rights to do business cooperatively are fully recognized and protected by law; it is only in unity that cooperatives can help

> shape the changing face of agriculture so that rural communities can survive and prosper. (4, p. 3)

In the same meeting (4), Raymond W. Miller expressed his feelings.

> . . . for the cooperative is as much a discovery in the area of human survival and in improving the lot of the individual as the jet propelled rocket. (4, p. 4)

It is a recognized fact that cooperatives have a place in the successful operation of farms in the United States. The November 1963 issue of the News for Farmer Cooperatives (4, p. 4) reported in full the policy of the United States Department of Agriculture in regards to cooperatives. In the November 1963 issue, John A. Baker, Assistant Secretary of the United States Department of Agriculture, states that in general it provides the following points:

1. Through its various agencies USDA will provide research, educational, and advisory services to help strengthen cooperatives.
2. USDA accepts fully its responsibility to encourage the growth of cooperatives.
3. The head of each agency is expected to insure full support to the policy through his agency. (4, p. 4)

With this information, it appears the United States Department of Agriculture is in favor of cooperatives to solve some of the problems confronting farmers.

Many farmers feel that a cooperative is actually owned by each member of the cooperative. With this type of thinking, a cooperative machinery rental business might be successful in some areas where private rental would not work.

The high ownership cost of machinery seems to be a general problem in most areas of the United States. There seems to be some conflict in figures that should be more closely correlated, but the general trend seems to be in the direction of need for a solution.

There is a definite limit to the number of acres that can profitably support the ownership of equipment, and also a limit to the number of acres a certain size unit can profitably care for.

Merrill (19) showed where ownership could be justified by a limited number of acres for a baler. He did not show the capacity of the baler. It would be worthwhile to use his figures and compare the capacity of the baler to see how much more work it could do and thus cut expense per unit of baling done. Jarrett (15) suggests that joint ownership has been successful on many farms. It is entirely possible that several people could use the baler listed. This could enable them to use it to full capacity. Hunt (14) states that the only way machinery can be used more profitably is to increase the number of hours used thus getting value of capacity before the equipment becomes obsolete. Custom work and machinery rental can also be considered as an alternative in many areas where they are available.

Equipment seems to be getting larger in order to save labor time. Joint ownership was cited as a way to use a large unit to cut labor time on each farm and thus cut the expense of a large unit for one farmer.

Machinery must pay for its use either by decreasing labor or by improving the quality to give more returns. It is apparently necessary for each farmer to take a critical look at his farming business and choose the best solution.

FINDINGS

Questionnaire information

The first page of the survey form included a list of yes or no questions related to use of equipment, custom work, time spent, and cooperative ownership. The information is shown in Table 3. The responses of the farmers indicate the following: sixty-four percent of the farmers do farm work at least 44 hours a week or spend full time. Seventy-two percent of the farmers felt that they could farm more land with present equipment if experienced labor could be hired. Only 28 percent plan to expand within the next three years. It appears that the most limiting factor is the lack of experienced labor for expansion of land. In spite of answering "yes" to the question of farming more acres with present equipment, 68 percent plan to purchase equipment within three years, and 16 of the 17 said they would purchase larger equipment. This is, of course, understandable if labor is a problem and larger equipment could save time.

Hiring work done by custom operators is common. Seventy-two percent of the farm owners or operators hire some work done by custom operators now, and 36 percent said that they would hire more done by custom operators if they were available at optimum time. Only one in four felt that he could get custom operators at an optimum time. Thirty-five percent said they could get work done in an acceptable time, but two out of five felt that custom operators were available only at an undesirable time.

The data indicate that there is interest in cooperative ownership

Table 3. Response of 25 Juab County dry farmers to questionnaire

		Yes	%	No	%
1.	Do you farm full time or at least 44 hours a week?	16	64	9	34
2.	Could you adequately farm more acres with your present available time?	6	24	19	76
3.	Could you farm more acres if you could hire experienced labor?	19	76	6	24
4.	Time permitting, could you farm more acres with your equipment?	18	72	7	28
5.	Do you plan on expanding within the next 3 years?	7	28	18	72
6.	Have you expanded within the last 3 years?	8	32	17	68
7.	Do you plan to replace any of your equipment within 3 years?	17	68	8	32
8.	Will you buy larger equipment when you buy?	16	73	6	27
9.	Do you lend your equipment?	10	40	15	60
10.	Do you borrow any equipment?	9	36	16	64
11.	Do you hire any work done by custom operators?	18	72	7	28
12.	Would you hire more if it were available at optimum time?	9	36	16	64
13.	Which of the following best describes the time custom work is available?				
	a. Optimum time	5	25		
	b. Acceptable time	7	35		
	c. Undesirable time	8	40		
14.	Have you ever owned any equipment in cooperation with anyone else?	11	44	14	56
15.	If so, did each individual operate the equipment on his own farm?	9	82		
16.	Did one individual operate the equipment?	2	18		
17.	Would you consider owning equipment with someone else under any of the following conditions? If so, answer the next three.	13	52	12	48
	a. One individual be in charge with several people operating the machine.	6	46		
	b. Each individual operate the machine on his own farm.	4	31		
	c. One individual only to operate the machine.	3	23		

and that some of the farmers may be able to benefit from that system. Forty percent have owned machinery in cooperation with someone else in the past, and 52 percent would consider owning with someone else now. Nearly half of those interested felt that one person should be in charge of the machine with several people operating it. Thirty-one percent wanted each individual to operate the machinery on his own farm. Thenty-three percent felt that only one person should operate the machine on all farms.

Cropland uses

Cropland uses are quite limited on the dry-farms in Juab County. Wheat is the main crop with a few acres of barley grown occasionally. On the farms surveyed, as shown in Table 4, grain is grown on 36 percent of the cropland. Most of the farmers have a wheat allotment equal to about one-third of the cropland. Some farmers in the community have set aside some land for hay, and others have taken part of the land out of production for wheat and are using it for pasture only. The land surveyed showed that they have an average of 10 percent in hay or pasture and 54 percent in summer fallow. It is necessary to summer fallow the land at least one year in order to produce a profitable crop of dry land grain. The government allotment program makes it necessary to produce other crops or summer fallow two years to each year of cropping. Some farmers feel that this is the most profitable system under unrestricted planting. Yields on the double fallow system are about one-tenth higher than those on the single system at the Nephi Field Station (24). Eighteen percent of the land in this study is summer fallowed for two years. With about one-third in grain

Table 4. Use of cultivated cropland on 25 dry-farms in Juab County

Range in acres	Number of farms	Total acres	Average	Grain	Average	Fallow	Average	Hay and Pasture	Average
100-500	9	2715	302	749	83	1021	113	945	105
501-1000	11	8020	729	2728	248	4323	393	969	88
1001-2600	5	9354	1871	3843	769	5411	1082	100	20

each year, this means that half of the grain raised is under the double fallow system. The owners of the larger farms seem to be in favor of specialized crops because most of the land is used for wheat production.

Tractor horsepower

There is a great variation in number of horsepower per acre. These figures are shown in Table 5. The larger size farms have 11.48 acres per horsepower with the medium units showing only 6.94, and the small units a low 3.78 acres per horsepower.

Some of the tractors are small, and many are old and of little value. The major tractor horsepower, or the larger unit or units that do the majority of work, were calculated separately and shown in Table 6. Using this basis, the relationship runs in the same direction from 17.72 acres per horsepower on the larger units, down to 5.12 on the smaller units.

Costs of investment per acre were smaller on the larger acreage. The largest acreage group shows an average investment of $2.83 per acre. The medium unit has $8.15 invested per acre and the smallest unit, $13.28.

In order to compare the data with the costs of owning a new tractor, the costs of ownership for three different tractor sizes were calculated and are shown in Table 7. It is difficult to calculate an exact price for a tractor because of the variation in attachments, tire size, etc. An approximate cost was used for tractors sold in the Nephi area. The scrap value was estimated at 5 percent and the remaining value was depreciated by the straight line method over a

Table 5. Tractor horsepower and acreage cultivated as reported by 25 Juab County farmers

Total acres	Total h.p.	Acres per h.p.	Total h.p. cost	Investment per acre	Major tractor h.p.	Acres per major h.p.	Major tractor h.p. cost	Investment per acre
2600	213	12.21	$16,800	$ 6.46	133	19.55	$10,800	$ 4.15
2014	190	10.60	7,500	3.72	150	13.43	5,000	2.48
1910	157	12.17	8,500	4.45	94	20.32	6,700	3.51
1560	108	14.44	3,000	1.92	108	14.44	3,000	1.92
1270	148	8.58	6,895	5.43	53	23.96	1,000	.79
900	88	10.22	2,075	2.31	88	10.22	2,075	2.31
900	183	4.92	12,300	13.67	133	6.77	10,800	12.00
900	103	8.74	2,200	2.44	103	8.74	2,200	2.44
885	127	6.97	8,400	9.49	63	14.04	5,500	6.21
764	122	6.26	10,000	13.09	70	10.91	7,200	9.42
703	142	4.95	9,100	12.94	94	7.48	7,500	10.67
675	114	5.92	7,800	11.56	70	9.64	6,000	8.89
640	68	9.41	5,000	7.81	68	9.41	5,000	7.81
600	53	11.32	3,500	5.83	53	11.32	3,500	5.83
540	53	10.19	5,000	9.26	53	10.19	5,000	9.26
513	101	5.08	10,600	20.66	101	5.08	10,600	20.66
500	52	9.62	4,800	9.60	52	9.62	4,800	9.60
450	93	4.84	4,600	10.22	54	8.33	3,000	6.67
438	94	4.66	10,100	23.06	67	6.54	7,200	16.44
303	129	2.35	10,160	33.53	94	3.22	7,500	24.75
262	92	2.85	1,900	7.25	92	2.85	1,900	7.25
242	81	2.99	6,200	25.62	52	4.65	5,400	22.31
240	83	2.89	2,700	11.25	51	4.71	1,800	7.50
160	72	2.22	3,050	19.06	45	3.56	2,500	15.63
120	27	4.44	2,000	16.67	27	4.44	2,000	16.67

Table 6. Acreage cultivated as related to tractor horsepower

Range in acres	No. of farms	Acres	H.p.	Acres per h.p.	H.p. cost	Investment per acre	Major h.p.	Acres per major h.p.	Major h.p. cost	Investment per acre
1001-2600	5	1,871	163	11.48	$8,539	$ 4.56	108	17.32	5,300	$ 2.83
501-1000	11	729	105	6.94	6,907	9.47	81	9.0	5,943	8.15
100-500	9	302	80	3.78	5,057	16.75	59	5.12	4,011	13.28

Table 7. Yearly ownership costs for three different tractor sizes

Tractor h.p. size	Cost	Scrap value	Life years	Depreciation	Taxes	Repairs	Interest	Total
125-140	$11,500	$575	15	$728	$86	$403	$288	$1,505
90-100	8,500	425	15	538	63	298	213	1,112
65-75	6,000	300	15	380	45	210	150	785

fifteen year period. The straight line method uses an equal amount of depreciation for each year of the estimated life of the tractor. Tax schedules were taken from the Juab County Assessors Office and the tax calculated on the approximate mill levy of sixty mills. Repairs were calculated on a basis of 3.5 percent of the purchase price per year. This is the recommendation suggested by Jarrett (16) in his book, Farm Machinery Decision Making. Interest was calculated on a basis of 5 percent of the average investment per year. The average investment would be 50 percent of the purchase price. On this basis, the $11,500 tractor would cost $1,505 per year to own. These figures do not include fuel, oil, or lubrication. The $8,500 tractor would cost $1,112 per year to own and the $6,000 tractor would cost $785 per year. On this basis of figuring, the annual cost would be $13.08 per $100 of purchase price or 13.08 percent of the purchase price. The annual cost of ownership can be used for any priced tractor figured by the 13.08 basis.

The cost per acre of ownership of a tractor changes drastically up to 600 acres as shown in Table 8. The $8,500 tractor would cost $5.56 per acre per year for 200 acres. The cost drops to $2.78 per acre for 400 acres and $1.85 to use on 600 acres. A 2,000 acre unit would reduce the cost to $.56 per acre. The other two tractors have the same correlation in relation to acreage

Plows

The investment for the plow that is most used ranges from $.84 per acre on the larger acreage group to $3.34 on the small units. Table 9 is a summary of data. The average plow cost for the smaller

Table 8. Cost of ownership per acre per year for three different tractor sizes

Acres	$11,500 tractor[a] 125-140 h.p.	$8,500 tractor[b] 90-100 h.p.	$6,000 tractor[c] 65-75 h.p.
200	$7.53	$5.56	$3.93
400	3.76	2.78	1.96
600	2.51	1.85	1.31
800	1.88	1.39	.98
1000	1.50	1.11	.79
1200	1.25	.93	.65
1400	1.08	.79	.56
1600	.94	.70	.49
1800	.84	.62	.44
2000	.75	.56	.39

[a]$1,505, [b]$1,112, [c]$785.
Yearly costs taken from Table 5.

Table 9. Average plow costs for three different acreage ranges in Juab County

Range	Number of farms	Acreage	Plow cost	Cost per acre	Age
1000-2600	5	1,871	1,570	.84	11.4
501-1000	11	729	870	1.19	10.8
100-500	8	302	1,009	3.34	7.6

farms was $1,009 as compared with $890 for the medium and $1500 for the larger farms.

Combines

All of the farmers in the survey do not own combines. Only 64 percent, or 16 out of 25 own a combine. The investment per harvested acre on the larger acreages is $10.01 as compared with $13.64 on the medium acreage and $12.92 on the smaller acreage. The purchase of used combines cut the investment per acre as shown by the cost per acre of all combines using the original new purchase price. This makes an average of $14.36 investment per acre harvested. The used combines grouped together show an investment of $10.25 for a low average acreage of 240 acres. The combines purchased new cut an average of 526 acres per year and have an investment of $12.51 per acre. Custom acreage helps to decrease the investment per acre. An average of 22 percent of the acres cut is custom cut. Table 10 shows the date on average investment per acre.

The average yearly cost of the new and used combines was determined and shown in Table 11. To determine the depreciation on the new combines, the average age was calculated at the time of purchase and the remaining life to 15 years was divided into the purchase price. The average age at time of purchase was 6.5 leaving a figure of 8.5 to use for a depreciation basis. Repairs were calculated on a basis of 3.4 percent of the original cost. This figure is taken from Jarrett (16). Interest was calculated on the basis of 5 percent on the average investment and the taxes on the basis of current rates in Juab County. Using this basis of determining costs, the used combines cost

Table 10. Summary of averages of self-propelled combines in Juab County

Description	Number of combines	Original cost	Average age	Average acres harvested	Average acres custom harvested	Average percent custom harvested	Average investment per acre harvested
Farm size 1001-2600	4	$7,025	9.0	702	188	27	$10.01
Farm size 501-1000	9	5,444	12.0	399	74	19	13.64
Farm size 100-500	3	2,533	14.7	196	43	22	12.92
Original cost all combines	16	6,275	11.8	437	97	22	14.36
Combines purchased new	11	6,582	10.9	526	114	22	12.51
Combines purchased used	5	2,460	13.6	240	60	25	10.25

Table 11. Average yearly costs of sixteen combines in Juab County

Description	Number	Average years of life remaining	Average depre-ciation	Average repairs	Average interest	Average taxes	Total	Average cost per acre cut
Used purchases	5	8.5	$289	$190	$190	$20	$561	$2.34
New purchases	11	15.0	439	224	165	43	871	1.98

$2.34 per acre cut as against $1.98 per acre for the new machines.

The cost of ownership of the two new self-propelled combines was calculated and shown in Table 12. This information gives a comparison on new costs with those listed from data gathered. The cost per acre can be determined by dividing the acres to be harvested into the cost of each combine. Both 10-year and 15-year figures were used for depreciation life in order to make a comparison.

The life of a combine can vary with the acreage cut and the operator who runs the equipment. A good operator can lengthen the life of the machine by proper lubrication and maintenance. Even though the years of life can be shortened by a longer period of use each year, combines will last a long time if repairs are made when needed. The combine, in the survey, that cuts the most acreage has cut more than 6,000 acres in the first five years of life. The next most used combine has run for 12 years. The combine cut over 1,500 acres the first year it was used and is currently cutting an average of 800 acres yearly. The life of this machine is not certain, but it may last for 20 years. Of the 16 combines shown in the survey, five have been used for 20 years or more. All five have been on low acreage use in recent years.

The present prices are considerably higher than the average prices paid for new machines by the farmers surveyed. The comparable figures are $871 yearly costs for older combines as against $1,387 for a new machine purchased in 1969.

Grain drills

Only 12 farms reporting had information related to the purchase

Table 12. Comparative cost of ownership of two self-propelled combines

Cost	Scrap value	Life years	Depreciation	Taxes	Repairs	Interest	Total
$ 8,500	$425	15	$538	$63	$289	$213	$1,103
8,500	425	10	808	77	289	213	1,387
10,500	525	15	665	72	357	525	1,619
10,500	525	10	998	96	357	525	1,976

price of grain drills. The average acreage planted was 381 acres with an average investment of $1,210 per unit or $3.18 invested per acre. The lowest investment figure was $.82 per acre and the highest $26.47.

Calculating an average cost per acre for all drills, the depreciation was based on 15 years using 5 percent scrap value, making a balance of $1,160. This makes $77 depreciation, taxes $7, interest $3, and repairs $38 for a total of $215 or a cost of $.56 per acre planted.

Average yearly costs

In order to give an account of cost per acre for annual use, the machinery was calculated in three farm size categories. Table 13 shows the costs for the major horsepower tractors. Even though the annual average cost for the group of larger farms is $1,116 as compared with $600 for the group of smaller farms, the cost per acre is only $.60 on the larger farms as compared with $219 on the smaller farms.

Figures for plows, as shown in Table 14, indicate that the cost varies from $.14 to $.55 per acre. The total investment per unit is higher on the smaller acreage group than on the medium acreage group.

Yearly expenses for grain drills are at least doubled as the unit gets smaller. The lowest cost is $.07 per acre, the medium cost is $.22 and the highest $.44. The data are found in Table 15.

The average cost per acre harvested for combines, as shown in Table 16, is $1.30 on the largest units, $1.88 on the medium units, and $2.14 on the smallest units. These figures are similar to the ones found by Fehr and Stevens in their study in Wyoming. Their costs were an average of $1.98 per acre for 331 acres harvested per combine.

Table 13. Average yearly expenses and cost per acre for major tractors reported in Juab County

Range in acres	Number of farms	Average acres	Average taxes	Average depreciation	Average interest	Average repairs	Total	Average cost per acre
1001-2600	5	1,871	$63	$541	$213	$299	$1,116	$ .60
501-1000	11	729	51	437	173	242	903	1.24
100-500	9	302	37	320	126	177	660	2.19

Table 14. Average yearly expenses and cost per acre for plows reported in Juab County

Range in acres	Number of farms	Average acreage	Average depre-ciation	Average interest	Average taxes	Average repairs	Total	Average cost per acre
1001-2600	5	1,871	$99	$39	$11	$110	$259	$.14
501-100	11	729	55	22	6	61	144	.20
100-500	9	302	64	25	7	71	167	.55

Table 15. Average yearly expenses and cost per acre for grain drills reported in Juab County

Range in acres	Number of drills	Average acreage	Average depre-ciation	Average interest	Average taxes	Average repairs	Total	Average cost per acre
1001-2600	4	1,871	$72	$28	$ 8	$17	$125	$.07
501-1000	5	729	92	36	11	22	161	.22
100-500	3	302	75	30	9	18	132	.44

Table 16. Average yearly expenses and cost per acre for combines reported in Juab County

Range in acres	Number of farms	Average acres harvested	Average depre-ciation	Average interest	Average taxes	Average repairs	Total	Average cost per acre harvested
1001-2600	4	702	$445	$176	$52	$239	$912	$1.30
501-1000	9	399	345	136	48	220	749	1.88
100-500	3	196	160	63	35	161	419	2.14

The average yearly costs per acre of grain was determined on each of the four types of machinery. Figures are shown in Table 17. As would be expected, the costs are much greater on the smallest unit. The table does not allow for the use of the tractors on other crops. It was found that the other crop use for the smallest acreage unit was 34 percent, the medium unit 30 percent, and the largest acreage unit was 3 percent. The total corrected figures of $10.99, $5.66, and $3.25 are shown in the notes to the table as proof that increased acreage definitely cuts the costs of machinery on the farms surveyed.

The estimated time as shown in Table 18 was calculated on the basis of a 100 horsepower tractor ability and using the fraction of the 100 horsepower unit for the average horsepower in each acreage range. The information was used to give the basis for giving costs per hour for machinery and labor. Using the total hours on the table and dividing by the acreage, the hours per acre of grain produced is 2 hours on the smallest acreage, 1.79 on the medium acreage, and 1.49 on the largest acreage. This is a reduction of 25.5 percent in labor costs between the top and bottom which is a significant reduction.

Total cost of machinery, fuel, and labor are shown in Table 19. Fuel costs are on the basis of .044 gallon per horsepower hour as taken from Jarrett (16) and $.16 per gallon. These were totaled and divided by the acres of grain produced to give the total cost per acre of grain. The largest acreage unit cost $7.13 per acre, the medium acreage unit $10.25, and the smallest acreage unit $16.27. This means that for the total cost, the largest unit will produce an acre of wheat for 44 percent of the cost of the smallest unit and 70 percent of the cost of the medium unit.

Table 17. Average yearly machinery costs per acre of grain produced on farms reported in Juab County

Range in acres	Average acres of grain	Average tractor cost per acre	Average plow cost per acre	Average combine cost per acre	Average drill cost per acre	Average total cost per acre
1001-2600	769	$1.45	$ .34	$1.30	$ .16	$ 3.25
501-1000	248	3.64	.58	1.88	.65	6.75
100-500	83	7.95	2.01	2.14	1.59	13.69

Note: This table does not allow for the use of the tractors for hay production. Assuming that the tractor is used equal time for the hay, the following figures should be used:

1. Smallest acreage, 34 percent use for hay, reduced tractor costs to $5.25, and total costs to $10.99.
2. Medium acreage, 30 percent use for hay, reducing tractor costs to $2.55 for a total of $5.66.
3. Largest acreage, 3 percent use for hay, reducing tractor costs to $1.41 for a total of $3.21.

Table 18. Estimated hours for specific operations on farms reported in Juab County

Range in acres	Number of farms	Number of tractors used	Hours for 2 plowings of fallow	Hours to weed fallow one time	Hours to drill grain	Total tractor hours	Hours to combine grain	Total hours
1001-2600	5	7	555	235	167	957	192	1,149
501-1000	11	13	255	96	61	382	62	444
100-500	9	10	84	35	26	145	21	166

Note: Figures are based on 5 acres plowed per hour for 100 h.p., 6 acres weeded, and 6 acres drilled. Combining was figured at 4 acres per hour.

Table 19. Summary of costs per acre of grain for specific operations, fuel, and labor on farms reported in Juab County

Range in acres	Acres of grain	Machinery costs per acre	Tractor fuel per acre	Combine fuel per acre	Labor costs per acre	Total cost per acre of grain
1001-2600	769	$ 3.21	$ .67	$.26	$2.99	$ 7.13
501-100	248	5.66	.75	.26	3.58	10.25
100-500	83	10.99	1.02	.26	4.00	16.27

Comparison with alternatives

The difference in the costs per acre are compared with alternatives in Table 20. The costs with and without labor are included. The cooperative equipment is on the basis of a new 100 horsepower tractor, costing $9,000, assumed to perform the same operations as the survey tractors. Total time was figured and divided into the annual cost in order to get the cost per hour. The acreage assumed for the cooperative tractor and equipment is 1,800 acres with 1,200 being fallow and 600 grain.

The rental tractor is a 94 horsepower tractor with one unit of equipment. Rental costs are $6.00 per hour without labor and $8.00 per hour with labor. The rental combine is a 14-foot combine of the size listed in the survey. Fuel and all expenses with and without labor are included.

Custom rates are based on the accepted fee for Juab County. There is some variation according to the conditions, but the listed figures are used most of the time.

Labor is calculated on the basis of $2.00 per hour for each operation. As the size of equipment goes up, the cost per acre for labor goes down. The difference between the low of $.40 per acre and the high of $.74 per acre is in favor of a large horsepower tractor where acreage warrants it. This could cut labor costs by 46 percent for the plowing operation.

The lowest total cost per acre for the four operations was $3.06 without labor and $4.95 with labor for the largest acreage group. The cooperative equipment purchased today will increase costs over equipment purchased in past years. Total costs for the cooperative unit

Table 20. Comparison of data and alternatives on a cost per acre basis

	Range 1001-2600[c]		Range 501-1000[d]		Range 100-500[e]		Cooperative[f] equipment		Rental equipment		Custom hiring
	a	b	a	b	a	b	a	b	a	b	
Plow	$ .55	$1.06	$ .79	$1.36	$2.00	$2.74	$ .54	$ .94	$1.28	$1.71	$2.50
Weed*	.42	.86	.65	1.15	1.52	2.15	.41	.74	1.07	1.43	1.50
Drill	.53	.97	1.24	1.74	2.65	3.28	.76	1.09	1.07	1.43	1.50
Combine	1.56	2.06	2.14	2.64	2.40	2.90	2.10	2.60	2.50	3.00	4.00

*Figures were not available from farmers. The figures used are for a new unit, weeder.

Note: a. These figures are cost of machinery and fuel per acre only.
b. These figures include labor with cost of machinery and fuel per acre.
c. Average acres, 1,871
d. Average acres, 729
e. Average acres, 302
f. The costs were figured on a basis of 1,800 acres.

was only 49 percent of the cost of the smallest unit. Custom hiring would be less than the cost of the smallest acreage unit.

Variables

The total costs or individual costs listed cannot be the only basis to make conclusions. The type of land area and working conditions may limit the use of fast and large equipment. The depth of plowing can greatly vary the amount of work accomplished. Sampson et al. (24) found than eight-inch plowing gave 8 percent higher yields than five inch plowing. The increased yield may not be enough to offset the difference in the cost of plowing.

The time of plowing and weather conditions can also influence the work done. In 1967 many acres were too wet to plow until late in May and the land was dry before it could all be plowed. Sampson et al. (24) also found that the yields were not reduced if plowed within two weeks of the time the plow would scour. Plowing beyond these periods greatly reduced yields. The plowing could be planned so that some of the land could be plowed in the fall, thus leaving a longer period before cultivating in the spring. Some farmers shallow plow in the fall to increase germination of rye and other weeds. A later period for deep spring plowing is then allowed before the moisture is gone.

Custom work, cooperative ownership and machinery rental would be limited by the area provided. Some farmers are somewhat isolated but they may have success by using the alternatives for some equipment. Modern equipment with faster road speeds, and hydraulic controls help to eliminate the disadvantage of isolation.

The effect that machinery may have on yields cannot be readily

determined but it cannot be eliminated as a factor to consider. The information on yields from the farmers was not secured. Information from the United States Agriculture Stabilization and Conservation Service (ASCS) (25) was available however. There are 307 established wheat yields in all of Juab County with an average yield of 26 bushels per acre on a total of 17,939.5 acres of allotment for the 1969 year.

A breakdown of yields shows that there are 194 non-irrigated farms with a total of 14,828.7 acres of allotment averaging 21.79 bushels per acre. The range is from 14 to 29 bushels to the acre. Thirty-four farms have a blended yield, or a combination of irrigated and dry-land acres acres, averaging 31.79 bushels to the acre on 2,083 acres of allotment. The range is from 30 to 41 bushels to the acre. Seventy-nine farms are listed as irrigated with an average yield of 52.36 and an allotment of 1,027.8 acres. The yield range is from 42 to 72 bushels to the acre.

The yields on the three acreage groups surveyed are 22.24 on the largest acreage groups, 24.97 on the medium acreage group, and 28.19 on the smallest acreage group. Apparently several of the surveyed farms have a water right that is used in some years. The medium size farms have two out of eleven blended yields and the smallest units have three out of nine blended yields. Without including the blended units, the medium units averaged 23.78 bushels per acre and the smallest units averaged 24.15 bushels per acre. The higher yields on the small units may be due to better farming because of more horsepower and machinery per acre, but it may also be because of the location of the land. The largest single farm surveyed had the lowest yield per acre, 20 bushels, but it is located in a low yield area. The lowest yield in a small

farm unit was 20 bushels per acre and it is also located in the low yield area. Yields are closely related to the area where the farm is located. In the heart of the main dry-farm area the ASCS yields listed for the farms surveyed varies from 24 to 26 bushels per acre. The highest yield for the strictly dry-farm acreage was 28 bushels per acre.

Conclusions

The data are conclusive that the larger the acreage covered with machinery, the greater the number of hours of use, and the use of larger equipment all cut down the cost per acre of production. Labor costs alone can be cut more than 50 percent by the use of larger equipment. Small equipment on small farms does not seem to be the answer because of increased fuel and labor costs. Sixty-seven percent of the farmers in the group of small farms farm full time or at least 44 hours a week. Most of the farmers in the group of small farms run cattle. Some of the farmers in the group of large farms also run cattle.

Further studies may be helpful but from the data found in the Review of Literature it appears that the economic trend is in the direction of larger farms and larger equipment. A study could be made to see what the acreage limit would be for the larger equipment sizes. A study on actual yields may also be helpful.

Where costs per acre can be reduced to approximately 33 percent by increased acreage, it would justify each farmer to secure help from some reliable source to assist him in figuring alternatives on his particular unit. A group of farmers may profit by figuring their units together and owning machinery under a cooperative basis. There has

been some success in cooperative ownership in the past. Custom operation is being used on many farms and may solve some of the problems. Twenty-two percent of the grain harvested by the combines owned by those in the survey is custom harvested. Rental equipment is starting to show promise.

There can be no choice that is best for every farm. Each farmer has a situation that is different from other farmers. Many variables such as location of land, type of soil, weather conditions, etc. can influence the decision made by a farmer. There doesn't seem to be enough difference in yield to say that one system is better than another. Total net income is the most important item to consider and if production is enough to offset the alternatives a farmer is better off. It must be remembered that many farmers admittedly have chosen that occupation for the enjoyment derived and pride of ownership. Many decisions are made with that in mind.

SUMMARY

The survey was taken from farmers who live in Juab County, Utah, and farm more than 100 acres of land that is predominantly dry-land. Twenty-five farmers or 75 percent of those in the above category were interviewed by the author.

The data show that 64 percent of the farmers farm full time or at least 44 hours per week. Sixty-two percent felt that they could farm more acres with present equipment if experienced labor could be hired. Sixty-eight percent plan to purchase new equipment within 3 years and 94 percent said they would hire more done if they could get it done at an optimum time. Only 25 percent felt that they could get custom operators at an optimum time although an additional 35 percent felt that it is available at an acceptable time. Fifty-two percent indicated interest in cooperative ownership with someone else.

The major crop produced is wheat and 36 percent of the land produces grain that is mostly wheat. Government allotments limit the wheat acreage to about one-third of the cropland. Hay or pasture is produced on 10 percent of the land. Fifty-four percent of the land is in summer fallow with about 18 percent being in fallow two years before planting.

The farms were grouped into three groups according to acreage. The smallest acreage is from 100 to 500 acres, with nine farms. The medium group is 501 to 1,000 acres, with 11 farms. The largest group is 1,001 acres and above, with five farms. The average acreages were 302, 729, and 1,871 acres, respectively.

Investment per acre for four machines on the largest acreage unit is: major tractor, $2.83; plow, $.84; grain drill, $.60; and combine, $3.75 for a total of $8.02. Investment per acre on the medium acreage unit is: tractor, $8.15; plow, $1.19; grain drill, $1.99; and combine, $7.47 for a total of $18.80. Investment per acre for the smallest acreage unit is: tractor, $13.28; plow, $3.34; grain drill, $3.92; and combine, $8.39 for a total of $28.93. The medium unit has 65 percent as much investment per acre as the smallest unit and the largest unit has 28 percent. The largest unit has 43 percent as much investment per acre as the medium unit.

Total yearly ownership costs for the four pieces of machinery is as follows: largest acreage unit, $1.30 per acre; medium unit, $2.69 per acre; and smallest unit, $4.57 per acre. Percentage relationship is very similar to ownership costs. The cost per acre for the medium unit is 59 percent of the cost for the smallest unit. The largest unit is 28 percent of the cost of the smallest unit and 49 percent of the cost of the medium unit.

Costs per acre were also calculated on the basis of acres of grain produced. The largest acreage group showed a machinery cost of $3.21; tractor fuel, $.67; combine fuel, $.26; and labor costs, $2.99; for a total of $7.13. The medium sized group had machinery costs of $5.66; tractor fuel, $.75; combine fuel, $.26; and labor costs, $3.58; for a total of $10.25. The smallest acreage group had machinery costs of $10.99; tractor fuel, $1.02; combine fuel, $.26; and labor costs of $4.00; for a total of $16.99. The medium sized acreage group produces an acre of grain for 60 percent of the cost of the smallest group. The largest acreage group produces an acre for 33 percent of the cost

of the smallest group and 55 percent of the cost of the medium group.

The variation in costs is so great that other alternatives were calculated in order to see if the two smaller acreage groups could find a way to cut costs. The costs were calculated for cooperative owned equipment farming 1,800 acres with 600 acres in crops. Rental units were calculated at the rate of $8.00 per hour for tractor and equipment and $12.00 per hour for combine. Custom rates were calculated on the basis of $2.50 an acre for plowing, $1.50 per acre for weeding and drilling, and $4.00 per acre for combining.

On the basis of the above, the total costs per acre for four operations including labor at the rate of $2.00 per hour are as follows: the large acreage unit where the equipment was owned was $4.95 per acre. When cooperative equipment was calculated on the basis of 1,800 acres the cost per acre was $5.37. The medium sized farms where the equipment was owned cost $6.89 per acre. Rental equipment cost $7.57 per acre regardless of the size of farm and custom hiring cost $9.50. The smallest farms where the equipment was owned cost $11.07 per acre.

Many variables such as location of land, type of land, plowing depth, crop yield, etc. may enter into the cost per acre. The data are conclusive, however, that the costs per acre are less as the acreage increases. There is also a definite possibility that farmers can use other alternatives to decrease the machinery costs per acre.

LITERATURE CITED

1. Anonymous. Cut the costs that cut your farm profits. Farmers Bulletin 2108:1-15. 1963.

2. Anonymous. How much for custom work? Wallace's Farmer 88:48. February 2, 1963.

3. Anonymous. How much do you use your tractor? Wallace's Farmer 89:45. February 1, 1964.

4. Bailey, A. Partnership in action. News for Farmer Cooperatives. November 1963.

5. Berge, O. I. Make machinery pay its way. Hoard's Dairyman 108-494. April 25, 1963.

6. Berry, R. L. More acres can cut fixed costs. Farm Quarterly 17:82-83. Fall 1962.

7. Comstock, J. P. Human problems: Why some mergers fail. News Farmers Coops 30:17-18. May 1963.

8. Davis, Lynn H., and Clynn Phillips. Cost of operating machines for seedbed preparation and planting on irrigated farms in Utah, 1960. Utah Resource Series, Agricultural Experiment Station, Utah State University, Logan, Utah. June 1962.

9. Esplin, Lynn. Juab County Valuation. County Agent's Office, Nephi, Utah. 1957. (Mimeographed)

10. Fehr, Allen H., Jr., and Delwin M. Stevens. Cost of owning and operating farm power and machinery on dry land farms in Wyoming. Agriculture Experiment Station Bulletin 442, University of Wyoming, Laramie, Wyoming. June 1964.

11. Heady, E. O., and R. D. Krenz. Farm size and cost relationships in relation to recent machine technology. Iowa Agricultural Experiment Research Bulletin 504:444-466. 1962.

12. Hofmyer, K. Farm tractors are getting bigger. Wallace's Farmer 88:42-43. May 18, 1963.

13. Hoglund, C. R., and E. G. Orbegoso. Investments and operating costs for gasoline and diesel operated farm tractors. Michigan Agricultural Quarterly Bulletin 45:679-690. May 1963.

14. Hunt, Donnell. Farm power and machines management. Laboratory manual and workbook, 2nd edition. Iowa State College Press, Ames, Iowa. 1960.

15. Jarrett, Von H. Farm machinery management. Report for special problems in machinery, AE 400. University of Missouri. Fall 1963.

16. Jarrett, Von H. Farm machinery decision making. Teaching Unit, Department of Agricultural Education, Utah State University, Logan, Utah. 1965.

17. Lindsey, M. M. Economic analysis of custom work on farms in the Delta. Mississippi Agricultural Experiment Farm Research 26:2-3. June 1963.

18. Long, M. E. Larger machines may increase costs. Hoard's Dairyman 107:1283. December 10, 1962.

19. Merrill, Keith. Farm management--cost analysis 1960. Agricultural Education Department, Utah State University, Logan, Utah. 1960.

20. O'Brien, D. K. It pays to use lease machinery. Farm Journal 87:50. December 1963.

21. Pollard, M. E. Can you lease machinery for less? Farm Quarterly 18:84-85. Summer 1963.

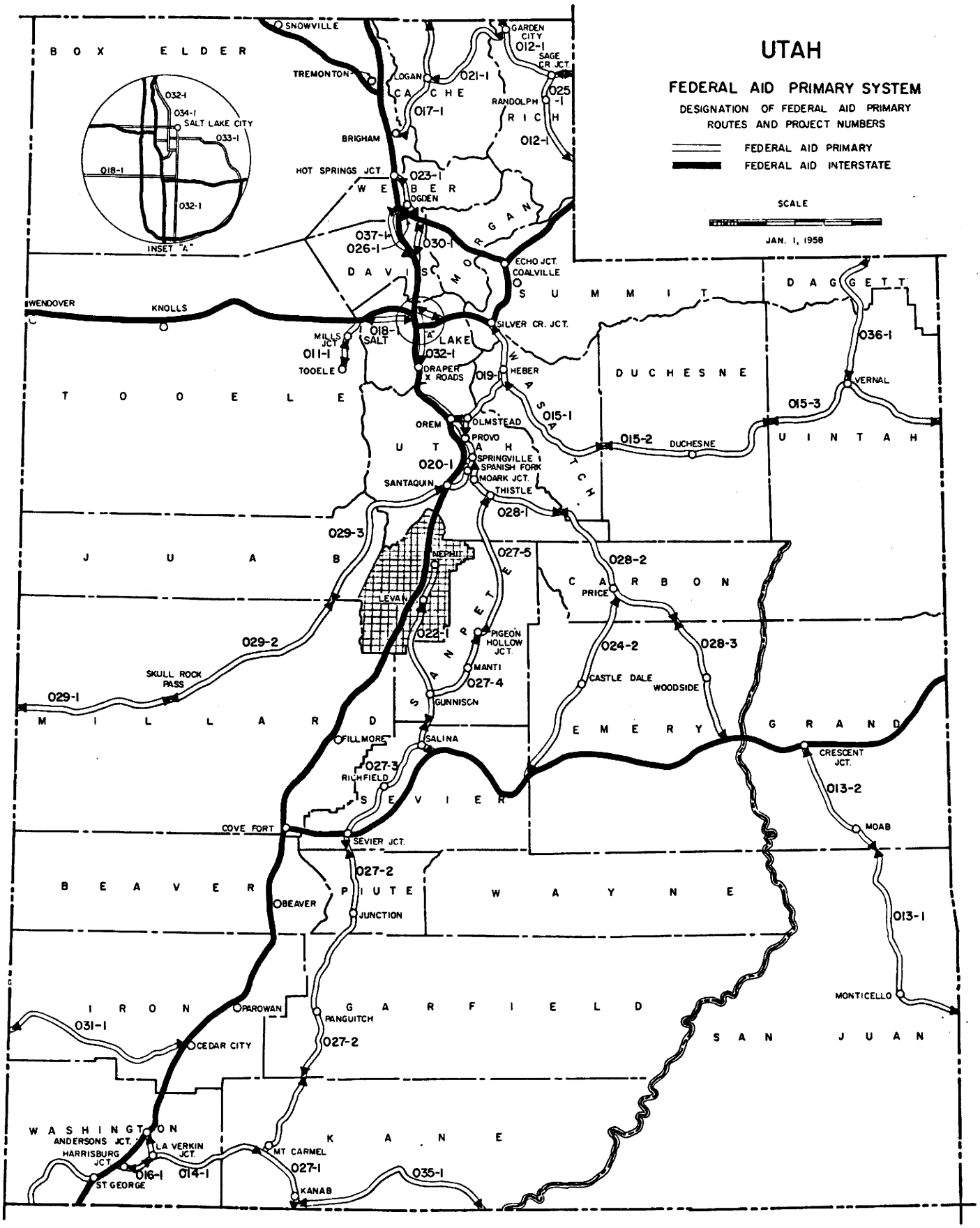
22. Richards, Stuart H., and Rondo A. Christensen. Utah agricultural statistics. Utah State University, Logan, Utah. 1967.

23. Ritchie, W. Custom rates for 1963. Hoard's Dairyman. 108:578-579. May 10, 1963.

24. Sampson, I. G., H. B. Peterson, D. R. McAllister, D. C. Tingey, D. W. Pittman, and W. H. Bennett. Fifty years of dry land research. Agricultural Experiment Station Bulletin 371. Utah State University, Logan, Utah. October 1954.

25. United States Agricultural Stabilization and Conservation Service. 1969. Juab County Office, Nephi, Utah. (Mimeographed sheet)

APPENDIX



REVISED: JUNE 16 1966
RESEARCH SECTION

Name_____ Address_____

Acres in farm_____ Acres cultivated_____

Land use	Acres	Land use	Acres

1. Yes____ No____ Do you farm full time or at least 44 hours a week?
2. Yes____ No____ Could you adequately farm more acres with your present available time?
3. Yes____ No____ Could you farm more acres if you could hire experienced labor?
4. Yes____ No____ Time permitting, could you farm more acres with your equipment?
5. Yes____ No____ Do you plan on expanding within the next 3 years?
6. Yes____ No____ Have you expanded in the last 3 years?
7. Yes____ No____ Do you plan on replacing any of your equipment within the next 3 years?
8. Yes____ No____ Will you buy larger equipment when you buy?
9. Yes____ No____ Do you lend your equipment?
10. Yes____ No____ Do you borrow any equipment?
11. Yes____ No____ Do you hire any work done by custom operators?
12. Yes____ No____ Would you hire more if it were available at optimum time?
13. Which of the following best describes the time custom work is available?
    a. Optimum time___ b. Acceptable time___ c. Undesirable time___
14. Yes____ No____ Have you ever owned any equipment in cooperation with anyone else?
15. Yes____ No____ If so, did each individual operate the equipment on his own farm?
16. Yes____ No____ Did one individual operate the equipment?
17. Would you consider owning equipment with someone else under any of following conditions? If so, answer the next three.
    a. One individual be in charge with several people operating the machine.
    b. Each individual operate the machine on his own farm.
    c. One individual only to operate the machine.

Item	Make	Model	Year	Year purchased	Original cost	Purchase price	Serial No.
Tractor							
Plow							
Weeder							
Drill							
Combine							

VITA

William Jay Dalley

Candidate for the Degree of

Master of Science

Thesis: Alternatives in Machinery Management on Juab County, Utah, Dry-farms

Major Field: Agricultural Education

Biographical Information:

Personal Data: Born at Beaver, Utah, March 18, 1926, son of William S. and Violet Willden Dalley; married Della Rasmussen March 28, 1946; four children--Ronald, Brent, Merilyn, and Terilee.

Education: Attended elementary schools in Beaver and Gunnison, Utah; graduated from Gunnison Valley High School in 1944; received the Bachelor of Science degree from Utah State University in 1958; completed requirements for the Master of Science degree at Utah State University in 1970.

Professional Experience: Teacher of Vocational Agriculture at Juab High School, Nephi, Utah, since 1957.