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POTATO PRODUCTION, UTAH, 1953

An Economic Analysis . . . . . .

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Summary

- Potatoes were produced in every county in Utah in 1949. They have accounted for about 2.5 percent of the total cash farm income and around 10 percent of the cash farm income from crop sales over the past several years. Gross value of the crop has averaged about 4 million dollars per year. During peacetime, production has fluctuated between 11,000 and 15,000 acres. Yields have increased steadily from 96 hundredweight per acre in 1939 to 152 hundredweight in 1954.

- A total of 130 records from farms in 10 counties was included in a survey to determine costs and physical factors required for the production of potatoes. The potato acreage ranged from 1 to 35 acres, and averaged 9.1 acres. Yields averaged 169 hundredweight per acre. The farms averaged 98 acres of cultivated land and 144 acres of cultivated, pasture, and wasteland. Most of the farms had some livestock.

- The total cost of producing potatoes in Utah in 1949 was $186.16 per acre, or $1.10 per hundredweight. On a percentage basis total costs were: labor — 35.1 percent; power — 18.6 percent; overhead — 14.9 percent; and material costs — 31.3 percent.

- An average of 63 man-hours of labor was required to produce an acre of potatoes on the 130 survey farms. Land preparation, planting and growing, and harvesting operations accounted for 13.4, 35.4, and 51.2 percent of total labor, respectively. Hired labor, most of which was used in harvesting, accounted for 47 percent of total used.

- Tractor use averaged 13.6 hours per acre for the survey farms. Truck use averaged 3.0 hours per acre. Horses were also used to some extent on some farms.

- Combine potato harvesters were used on 13 of the 130 survey farms. Their use resulted in average savings per acre of 6.0 man hours, .5 tractor hour, and 1.7 truck hours, over enterprises using conventional harvesting methods. Average harvesting costs were $45.17 per acre and $.24 per hundredweight for farms using combine harvesters, and $56.37 per acre and $.29 per hundredweight for comparable enterprises using conventional harvesting methods.

- Seven different varieties of potatoes were produced. In the five southern counties an overwhelming preference was shown for the Russet variety. In five northern counties Pontiac and Bliss varieties were the most popular.

- The labor and power cost for preharvest operations amounted to approximately 30 percent of the total cost of producing potatoes. Use of man labor for preharvest operations ranged from 9.4 to 97 man hours per acre. As use of man labor increased yield per acre increased; however, cost of production increased at a faster rate.

Apparently judicious and effective use of man labor in preharvest operations is important in achieving efficient production.

- Yields ranged from 12 to 300 hundredweight per acre. Average yield was 169 hundredweight. High average yield per acre appears to be important in achieving low cost production per hundredweight.

- As acres per enterprise increased, man labor per acre and cost of production per hundredweight decreased. Generally speaking, larger size enterprises were more efficient.

- On land which had produced leguminous crops during preceding years, moderate applications of manure and commercial fertilizer appeared to be most economical. Slightly larger applications seemed to be advantageous where non-leguminous crops had been grown.

- Apparently it was more economical to have a leguminous crop rather than a non-leguminous crop preceding potatoes in the rotation.

- Efficient performance of all the practices involved in producing potatoes is superior to high efficiency in one or a few and low efficiency in others. Larger than average yields, less than average use of preharvest labor, and larger than average size appear to be the factors most conducive to efficient low cost production.

Introduction

THE potato enterprise is important in providing a cash crop and a means of diversifying and intensifying the operations on many of Utah's irrigated farms. It is particularly important in those areas where, because of short growing season or inadequate markets, other intensive crops cannot be produced economically.

Potatoes have accounted for around 2.5 percent of the total cash farm income and around 10 percent of the cash farm income from crop sales over the past several years. The gross value of the crop has been between four and five million dollars in 8 of the last 12 years from 1943 to 1954, inclusive. It fell below four million dollars in 1950, 1953, and 1954 and reached a high of 5.5 million dollars in 1952.

Except for a period during World War II, the acreage in Utah has fluctuated between 11,000 and 15,000. Neither an increasing or decreasing longtime trend exists. There has been a marked increase in yields per acre, however. They have increased rather steadily from 96 hundredweight in 1939 to 152 hundredweight in 1954 (table 1).

In 1949, the most recent year for which data are available on a county basis, potatoes were produced in all 29 counties in Utah. Less than 100 acres were produced in each of twelve counties. Five counties — Weber, Davis, Iron, Sevier, and Piute—reported production in excess of 1,000 acres each. Other counties with important amounts of potatoes in 1949 were Cache, Box Elder, Salt Lake, Utah, Millard, Beaver, Washington, and Garfield (table 2).

Table 1. *Potato production, prices, and value, Utah 1930-1954*

Year	Acres (000)	Production (000)	Yield per acre	Price per bushel	Total value (000)	Indexes 1935-39 = 100	
						Acres harvested	Yield per acre
		bu	*bu*	*dol*	*dol*	*no.*	*no.*
1930	12.0	2160	180	.60	1,296	92	114
1931	15.0	1950	130	.40	780	116	82
1932	15.0	2250	150	.20	450	116	95
1933	14.0	2100	150	.49	1,029	108	95
1934	13.0	1040	80	.53	551	100	51
1935	13.6	2040	150	.60	1,224	105	95
1936	12.2	1830	150	.95	1,738	94	95
1937	12.9	2128	165	.43	915	99	104
1938	13.6	2244	165	.43	965	105	104
1939	12.6	2016	160	.55	1,109	97	101
1940	12.9	2193	170	.46	1,009	99	108
1941	11.2	1904	170	.76	1,447	86	108
1942	12.5	2312	185	1.18	2,728	96	117
1943	19.6	3430	175	1.27	4,356	151	111
1944	17.5	2765	158	1.52	4,203	135	100
1945	18.0	3240	180	1.32	4,277	138	114
1946	18.0	3330	185	1.28	4,262	138	117
1947	13.5	2498	185	1.97	4,921	104	117
1948	15.1	3171	210	1.57	4,978	116	133
1949	15.4	3388	220	1.37	4,642	118	139
1950	13.5	3308	245	1.05	3,473	104	155
1951	10.8	2214	205	1.98	4,384	83	130
1952	12.4	3162	255	1.75	5,534	95	161
1953	14.0	3430	245	.85	2,916	108	155
1954	13.0	3381	260	1.05	3,549	100	164

Source: U.S.D.A. Agricultural Statistics. Annual publication.
U.S.D.A. Utah Annual Crop Report.

Purpose of the Study

THE primary objectives of the study were twofold: (1) to determine the costs of producing potatoes, and the nature and amounts of the physical factors required; and (2) to ascertain the association of various production practices to the success of the enterprise.

Method of Study

TEN counties were included in the study: Cache, Box Elder, Weber, Davis, Utah, Millard, Iron, Sevier, Piute, and Garfield. They were selected for their importance in potato production and because they would encompass most of the different

Table 2. *Irish potatoes harvested for home use and for sale by counties, Utah 1949*

County	Farms reporting	Total acres*	Acres per farm	Yield per acre	Total production	Harvested value
	number	*number*	*number*	*cwt*	*cwt*	*dollars*
Beaver	56	834	14.9	273	227,554	568,885
Box Elder	187	782	4.2	145	113,726	227,452
Cache	241	655	2.7	165	107,822	215,644
Carbon	115	84	.7	92	7,755	19,388
Daggett	17	23	1.4	78	1,800	4,500
Davis	260	1025	3.9	142	145,677	291,354
Duchesne	350	145	.4	100	14,563	36,408
Emery	231	75	.3	104	7,808	19,520
Garfield	94	721	7.7	102	73,278	183,195
Grand	7	1	.1	229	229	572
Iron	103	1614	15.7	170	274,286	685,715
Juab	33	32	1.0	91	2,900	6,525
Kane	43	17	.4	89	1,519	3,798
Millard	63	450	7.1	182	81,747	183,931
Morgan	54	160	3.0	147	23,497	50,988
Piute	136	1215	8.9	113	137,365	295,335
Rich	24	15	.6	79	1,186	2,574
Salt Lake	295	308	1.0	124	38,071	82,614
San Juan	76	112	1.5	39	4,338	10,845
Sanpete	260	80	.3	94	7,503	16,882
Sevier	240	1701	7.1	139	236,116	507,649
Summit	22	9	.4	49	439	1,098
Tooele	95	42	.4	109	4,589	9,958
Uintah	404	96	.2	109	10,446	26,115
Utah	659	845	1.3	122	103,149	232,085
Wasatch	69	36	.5	110	3,962	9,905
Washington	96	998	10.4	134	134,072	335,180
Wayne	83	204	2.5	130	26,568	66,420
Weber	406	1376	3.4	126	173,265	375,985
Total	4719	13,655	2.9	144	1,965,230	4,470,520

Source: U. S. Census of Agriculture, 1950. Vol. I Part 31.
*Does not include acreage for farms with less than 10 bags harvested.

types of farm organization and growing conditions which might have a bearing on the production of potatoes.

Information was obtained from producers by trained enumerators on a personal interview basis. Specially prepared questionnaires were used by enumerators to guide the interview and to record data. In obtaining potato cost data from individual farmers no basis of selection was used other than selecting areas of greatest concentration of potato producers within the various counties and obtaining data from those commercial producers available and willing to cooperate. Farm garden type enterprises were not included in the survey; for that reason the average size enterprise reported in this study is somewhat larger than that reported by the census.

An effort was made to have each county in the sample represented roughly in proportion to its relative importance in potato production.

Preliminary analysis of the data on a county basis revealed a degree of similarity in size of enterprise, yields, costs, cultural practices, and other factors, among certain of the counties. Based on similarity and to facilitate the analysis and presentation of data, Cache and Box Elder Counties were grouped together; Weber, Davis, and Utah Counties were grouped together; and five southern counties, Millard, Iron, Sevier, Piute, and Garfield Counties were grouped together. The presentation that follows is based upon analysis of potato enterprises grouped in this manner.

Inasmuch as potatoes are stored on the farm and marketings are spread over a period of several months, complete data on sales were not available at the time the survey was made. For that reason net returns for 1953 are not measured in this study. Yields per acre and cost of production per hundredweight are the principal measures of efficiency and success.

Description of the Enterprise

MOST of the potatoes in Utah are produced on family enterprise type operations of diversified irrigated farms (table 3). Enterprises included in this survey ranged from 1 to 35 acres. Average size was 9.1 acres with yields averaged at 169 hundredweight per acre. Of 130 farms included in the survey, 94, or 72 percent grew 10 or less acres of potatoes. The farms included in the survey had an average of 89 acres of other cultivated land, and a total acreage of 144 acres including potato acreage, other cultivated land, pasture, and wasteland. Acreages of other cultivated land ranged from 12.5 to 600 acres. One hundred, or 77 percent of the farms, had 100 acres or less of other cultivated land. Total acreages ranged

Table 3. *Inventories of land and livestock on potato survey farms, Utah 1953*

Item	Cache and Box Elder Counties		Five southern counties*		Weber, Davis, Utah Counties		Total	
	Acres	Value	Acres	Value	Acres	Value	Acres	Value
	acres	*dol*	*acres*	*dol*	*acres*	*dol*	*acres*	*dol*
LAND								
Acres in potatoes	9.2	3797	13.1	3413	4.8	2448	9.1	3156
Other cultivated	78.8	31465	117.4	24614	63.6	32365	88.8	29050
Pasture and waste	32.6	4538	76.5	5135	20.2	2765	45.7	4135
Total farm	120.6	39800	207.0	33162	88.6	37577	143.6	36341
LIVESTOCK	*number*		*number*		*number*		*number*	
Beef cattle	21		42		58		43	
Dairy cattle	17		7		7		10	
Poultry	4		7		148		57	
Sheep	....		85		30		45	
Horses	....		1		1		1	
Hogs	2		3		1		2	

*Five counties are Garfield, Iron, Millard, Piute, and Sevier.

from 24 to 1000, and 111 of the 130 farms reported total acreage of 200 or less. Approximately 9 percent of the total cultivated acreage on survey farms was devoted to potatoes. This percentage varied slightly in different areas.

Livestock inventories on farms included in this survey averaged 43 beef cattle, 10 dairy cattle, 57 poultry, 45 sheep, 2 hogs, and 1 horse per farm. Seventeen farms had no livestock of any kind. Beef cattle were reported on 81 farms, dairy cattle on 71 farms, horses on 42 farms, poultry on 26 farms, and hogs on 24 farms.

Generally speaking, potatoes in Utah are produced on fairly good quality land under irrigation. They are planted in rows in the spring, after the risk of killing frosts has diminished. The potatoes are cultivated, hoed or hand weeded to control weeds, and irrigated as frequently as necessary to maintain favorable moisture conditions in the soil. It is quite often necessary in southern counties to irrigate prior to planting also, in order to insure a good start for the crop. Most producers in Utah are able to perform a majority of planting and growing operations with their own and family labor.

Potatoes are harvested in late summer and fall. In lower valleys vines are killed by defoliant sprays or mechanical beaters. In valleys at higher elevations early frosts kill the vines. The potatoes are then harvested before they can be damaged by later frosts.

Harvesting operations in the past have involved digging or lifting the potatoes out of the ground with some type of digger or plow, hand picking, putting them into sacks, then hauling them to storage or to market. Recently use of mechanical harvesters has been adopted. These dig and elevate the potatoes, free them of dirt, vines, and other foreign materials as well as possible, and sack them for loading on trucks, or dump them loose into the truck boxes for hauling to market or storage. Harvest operations usually involve large amounts of hired labor.

Requirements For Physical Factors of Production

COSTS in general are the physical quantity of an item times price per unit. Physical quantities of various items used in producing potatoes change only when practices and methods of production are changed, while price fluctuates with ever-changing economic situation. For that reason it is important that physical quantities of cost items be known so that changes in production practices and prices can be taken into account in estimating costs of production in subsequent years.

Labor Requirements

An average of 63 man hours of labor was used on surveyed farms to produce an acre of potatoes during 1953. This amount of labor was used in connection with enterprises averaging 9.1 acres of potatoes and having yields of 169 hundredweight per acre. Harvesting operations accounted for 51.3 percent of the total labor; planting and growing operations 35.4 percent, and land preparation operations 13.4 percent of the total. Within these groupings principal requirements for labor were for bagging, loading and hauling, irrigating, seed cutting, cultivating, hoeing, and hauling manure.

As reported more completely later in this bulletin, total labor required in producing potatoes varies with size of enterprise; and labor required for harvesting

Table 4. *Man hours of labor requirements in potato production, Utah 1953*

Item	Cache and Box Elder Counties	Five* southern counties	Weber, Davis, Utah Counties	Total	
	hours	*hours*	*hours*	*hours*	*percent*
Land preparation					
Manuring	2.8	2.3	4.8	2.9	4.6
Fertilizing	.1	**	.3	.1	.1
Plowing	1.8	2.1	1.8	1.9	3.1
Disking and harrowing	1.7	1.1	1.5	1.3	2.1
Listing or furrowing	....	.4	.1	.2	.4
Ditching	.5	.7	.6	.6	1.0
Leveling	.4	.2	.3	.3	.5
Irrigating	....	1.2	....	.7	1.1
Miscellaneous	.5	.2	.4	.3	.5
Total preparation	7.8	8.2	9.8	8.3	13.4
Planting and growing					
Seed procurement	.3	.3	.4	.3	.5
Seed treatment	....	.1	**	.1	.1
Seed cutting	4.5	3.1	9.0	4.6	7.3
Planting	2.8	2.1	3.6	2.6	4.1
Fertilizing	....	.1	....	....	.1
Cultivating	3.5	2.9	4.5	3.4	5.4
Hoeing	2.1	2.3	6.4	3.0	4.9
Irrigating	7.3	8.1	9.1	8.1	12.9
Spraying	....	....	.1	....	....
Harrowing	.1	....	.1	.1	.1
Miscellaneous	....	....	....	....	....
Total planting and growing	20.7	19.0	33.3	22.2	35.4
Harvesting					
Vine killing	.7	.4	.6	.5	.8
Digging	2.5	2.3	2.9	2.5	4.0
Bagging	24.2	16.4	21.0	19.1	30.5
Loading and hauling	8.1	8.8	9.5	8.7	14.0
Mechanical harvesting	1.8	.1	4.0	1.3	2.0
Total harvesting	37.3	28.0	38.0	32.1	51.3
TOTAL HOURS	65.8	55.2	81.1	62.6	100.0

*Five counties are: Millard, Iron, Sevier, Piute, Garfield
**Less than .05

operations varies with yields. Total labor decreased from about 86 man hours to about 55 man hours per acre as average size of enterprise increased from 2.6 to 19.2 acres (table 4).

Hours of labor per acre for harvesting operations increased consistently as yields increased; however, time required per hundredweight in harvesting operations decreased from .22 man hours to .16 man hours as average yields increased from 101 to 273 hundredweight per acre.

Total man labor requirements by areas were: Weber, Davis, and Utah Counties, 81.1 hours; Cache and Box Elder Counties, 65.8 hours; and the five southern counties, 55.2 hours. Differences between the areas in man labor used probably

Table 5. *Percent total labor that was hired in producing potatoes, Utah 1953*

Item	Cache and Box Elder Counties	Five* southern counties	Weber, Davis, Utah Counties	Total
	percent	*percent*	*percent*	*percent*
Land preparation	3.3	1.5	2.1	2.0
Planting and growing	10.7	16.2	13.8	14.3
Harvesting	82.3	83.8	74.7	81.4
Total labor	50.4	48.4	40.9	47.1

*Five counties are Garifeld, Iron, Millard, Piute, and Sevier.

result from differences in average size of enterprise and yields per acre.

Hired labor accounted for 47.1 percent of the total used in producing potatoes during 1953. Evidently operators were unable to spread the peak labor demand for harvesting over any appreciable length of time, and as a result hired labor ac-

Table 6. *Power requirements and costs per acre in producing potatoes, Utah 1953*

Item	Tractor		Truck		Horse		Total	
	Amt.	Value	Amt.	Value	Amt.	Value	Value	Percent
	hrs	*dol*	*hrs*	*dol*	*hrs*	*dol*	*dol*	*percent*
Land preparation								
Manuring	2.2	3.75	.2	.47	.2	.19	4.41	12.7
Fertilizing	.1	.17	....	....	....	....	.17	.5
Plowing	1.9	4.21	....	....	....	....	4.21	12.1
Disking and harrowing	1.3	2.36	....	....	.1	.05	2.41	6.9
Listing or furrowing	.2	.41	....	....	*	.01	.42	1.2
Ditching	.3	.56	....	....	*	.01	.57	1.6
Leveling	.3	.54	....	....	*	.01	.55	1.6
Miscellaneous	.3	.89	....	....	....	....	.89	2.6
Total preparation	6.6	12.89	.2	.47	.3	.27	13.63	39.3
Planting and growing								
Seed procurement	*	.02	.2	.49	....	....	.51	1.4
Planting	1.3	2.70	....	....	.2	.11	2.81	8.1
Fertilizing	*	.06	....	....	....	....	.06	.2
Cultivating	2.9	5.38	....	....	.5	.36	5.74	16.5
Spraying	*	.03	....	....	....	....	.03	.1
Harrowing	*	.06	....	....	*	.04	.10	.3
Miscellaneous	*	.04	*	.02	....	....	.06	.2
Total planting and growing	4.3	8.29	.2	.51	.7	.51	9.31	26.8
Harvesting								
Vine killing	.5	1.17	....	....	....	....	1.17	3.4
Digging	2.0	4.55	....	....	*	.03	4.58	13.2
Loading and hauling	*	.03	2.6	5.64	....	....	5.67	16.3
Mechanical harvesting	.2	.36	....	....	....	....	.36	1.0
Total harvesting	2.7	6.11	2.6	5.64	*	.03	11.78	33.9
TOTAL HOURS	13.6	27.29	3.0	6.62	1.0	.81	34.72	100.0

*Less than .05

counted for 81.4 percent of the total labor for harvesting.

Hired labor also accounted for 14.3 percent of total hours in planting and growing operations, and 2.0 percent of land preparation operations (table 5).

There were slight variations between operations and areas in average cost rate placed on labor. Cost rate averaged $1.04 per hour for all operations.

Power Requirements

Principle power for potato production in 1953 was supplied by tractors. Tractor use averaged 13.6 hours per acre for all farms studied. Principle uses were for manuring, plowing, harrowing, planting, cultivating, and digging. Trucks were used for an average of 3.0 hours per acre, of which 2.6 hours were for hauling potatoes at harvest time. Horses were also used to some extent on some farms (table 6).

Land preparation operations accounted for 39.3 percent of total power cost, harvesting operations 33.9 percent, and planting and growing operations 26.8 percent.

The average cost rate was $2.01 per hour for tractor use and $2.21 per hour for truck.

Costs of Producing Potatoes

THE total cost of producing potatoes on the farms studied in 1953 was $186.16 per acre, or $1.10 per hundredweight. These costs include costs of labor, machinery, materials, and overhead (table 7).

Cost of Man Labor

Man labor constituted the largest single cost item and accounted for 35.1 percent of total. This item included cost of labor hired plus value of labor performed by the operator and his family. Operator and family labor was valued in terms of alternative earning power in similar employment. Since the average cost rate was about $1.04 per hour for all areas, variation in labor costs between areas resulted from differences in amount of labor used.

Power Cost

Power cost includes cost of tractor, truck, and horse power used in producing potatoes. It comprised 18.6 percent of total cost. Charges for use of power equipment were made on the basis of prevailing custom rates for hiring work done, regardless of whether machinery was owned by the operator or hired. Farmers reported custom rates per acre for various jobs, and their estimate was converted to an hourly rate depending upon amount of work the equipment could do in an hour. Charges for tractor power also covered tractor equipment and attachments. Charges for horse labor were set by the operators' estimate of cost per hour of hiring a team. Charges for horse drawn equipment are not included in the cost of horse power but are part of costs included in overhead. About 94 percent of the power used was supplied by the operator.

Overhead Cost

Overhead costs constituted 14.9 percent of total cost of producing potatoes in 1953. They included interest on money invested in the crop, interest on capital, building and equipment repairs and depreciation, and taxes on land, water, and drainage. Interest on capital was the largest item of overhead cost, accounting for 9.4 percent of the total cost of production. Taxes on land, water, and drain-

Table 7. *Cost per acre of producing potatoes, Utah 1953*

Item	Cost per acre				
	Cache and Box Elder Counties	Five southern counties*	Weber, Davis, Utah Counties	State	
				Total	Percent of total
	dollars	*dollars*	*dollars*	*dollars*	*percent*
Labor					
Family labor	35.80	29.85	50.86	35.27	18.9
Hired labor	33.13	27.61	33.79	30.12	16.2
Total labor	68.93	57.46	84.65	65.39	35.1
Power					
Operator	36.62	28.50	39.62	32.55	17.5
Hired	1.45	2.87	.80	2.13	1.1
Total power	38.07	31.37	40.42	34.68	18.6
Overhead costs					
Interest on money in crop	2.83	2.11	3.00	2.45	1.3
Interest on capital invest.	20.90	13.15	26.34	17.51	9.4
Building repairs	.....	.....	.13	.03	†
Building depreciation	.17	.03	.52	.16	.1
Equipment repairs	.....	.02	.41	.09	†
Equipment depreciation	.04	.08	.50	.15	.1
Taxes, land	3.44	1.94	5.47	2.97	1.6
Taxes, drainage	.41	.07	.18	.17	.1
Taxes, water	1.66	5.08	4.95	4.24	2.3
Total overhead costs	29.45	22.48	41.50	27.77	14.9
Materials					
Commercial fertilizer	7.41	5.62	6.73	6.26	3.4
Manure 1953	6.01	4.03	5.96	4.87	2.6
Manure 1952	2.44	.74	2.54	1.49	.8
Manure 1951	.65	.15	1.26	.48	.3
Chemicals	.05	.02	.35	.09	†
Field sacks	4.08	3.37	3.53	3.57	1.9
Seed potatoes	55.33	35.77	41.06	41.44	22.3
Fees	.....	.02	.....	.01	†
Miscellaneous	.....	.18	.....	.11	†
Total materials	75.97	49.90	61.43	58.32	31.3
GRAND TOTAL	212.42	161.21	228.00	186.16	100.0

*Five counties are Garfield, Iron, Millard, Piute, and Sevier.
†Less than .05 percent.

age together were 4.0 percent of the total cost.

Interest at 5 percent per year was charged on average investment in land, buildings, and horse drawn equipment used in connection with the potato enterprise. The interest charge thus represents a cost to the enterprise for use of fixed capital. In the case of machinery and buildings, a proportionate part of the value was prorated to the potato enterprise according to use.

Interest at 5 percent was also charged on working capital or money invested in

the crop, from the time the expenses were incurred until payment was received. Items on which interest was charged and the amount of time for which charges were made were: land preparation, 5 months; planting and growing operations, 3 months; manure costs, 1 year; commercial fertilizers and seed, 6 months; chemicals, 4 months; and sacks, 2 months.

Tax cost on land was determined by assigning a proportionate part of the total taxes of the farm land to the potato enterprise, provided all the land was taxed at about the same rate. If different tax rates were applied, the potato land was assigned a proportionate part of the total cost for land in the same class. Water assessments were charged in proportion to the amount of water used on potatoes compared to the total used by the farm.

The expense of depreciation and repair was calculated on all horse-drawn machinery and buildings used to house potato machinery. After consideration was given to repairs made, a rate of about 10 percent of the ending inventory value was applied in calculating depreciation on machinery; and about 5 percent was used for buildings. Depreciation and cost of repairs were charged against the potato enterprise in proportion to use made of the machinery and buildings for the enterprise.

Material Cost

Material cost includes the cost of fertilizer, manure, seed potatoes, sacks, chemicals, fees, and miscellaneous materials. Cost of applying these items was included in costs for labor and machinery. Material costs constituted 31.3 percent of total cost of producing potatoes. Cost of seed potatoes was the largest material cost, accounting for 22.3 percent of the total cost. Manure and fertilizer costs together accounted for 7.1 percent of the total (table 8).

Approximately 50 percent of the value of the manure was estimated as available for plant growth the first year after it was applied, approximately 30 percent the second year, and 20 percent the third year. Accordingly, the potato enterprise was charged with 50 percent of the cost of manure applied in 1953, 30 percent of that applied in 1952, and 20 percent of that applied in 1951. Manure was valued at $1.40 per ton at the barn or corral. Cost of hauling and spreading was included in labor and machinery costs.

There is some question as to the amount of available plant nutrients that remain in the soil for use by crops in succeeding years from the application of commercial fertilizers. Most authorities agree that residual value depends to a

Table 8. *Materials used per acre for potato production, Utah 1953*

Item	Units	Cache and Box Elder Counties	Five southern counties*	Weber, Davis, Utah Counties	Total
Comm'l fertilizer	lbs.	208	146	221	175
Manure 1953	tons	8.60	5.76	8.50	6.96
Manure 1952	tons	5.82	1.77	6.09	3.56
Manure 1951	tons	2.33	.53	4.49	1.71
Seed potatoes	lbs.	1147	1257	1119	1204

*Five counties are Garfield, Iron, Millard, Piute, and Sevier.

great extent on the fertilizer used, and the method and time of application. In this study the entire cost of commercial fertilizer applied in 1953 was charged against the potato enterprise.

Cost of seed was the actual cash cost to the operator if seed was purchased, or approximate average cost in the community for comparable seed if the seed was grown on the farm.

Other material costs such as chemicals, sacks, fees, and miscellaneous, represented actual cash costs.

Mechanized Harvesting

IN years past potatoes have been harvested by digging out of the ground with a digger or plow, picking up and putting them in sacks, and then loading them on trucks and hauling them to storage or market. This method of harvesting involved large amounts of man labor. Combine potato harvesters are being used extensively in some other states. These harvesters dig the potatoes, elevate them, and free them of dirt, vines and other foreign material, and sack them or dump them loose into a truck box. They have not been widely used in Utah as yet, however, they were used in 13 of 130 enterprises included in this study.

Data collected in this survey were analyzed to see what advantages there may be in using combine harvesters instead of harvesting by the old methods. Thirteen enterprises on which combine harvesters were used ranged from 1 to 10 acres in size, and from 100 to 300 hundredweight per acre in yield. Average size was 5.2 acres and average yield was 185 hundredweight. Twelve of these thirteen enterprises were in Cache, Box Elder, Weber, Davis, and Utah Counties. In order to make comparisons that would be most valid between the two methods of harvesting, 30 enterprises in the five northern counties were selected for study. Enterprises selected also ranged in size from 1 to 10 acres, in yields from 100 to 300 hundredweight per acre, and were devoid of unusual characteristics. The average size of enterprises used for comparison was 5.4 acres, and average yield was 192 hundredweight per acre (table 9).

Comparison of 13 enterprises where combine harvesters were used with 30 comparable enterprises using other har-

Table 9. *Comparison of mechanical harvesting with other methods of harvesting potatoes, Utah 1953*

Item	Method of harvesting	
	Mechanical	Other*
Acres per enterprise	5.2	5.4
Yield per acre (cwt.)	185	192
Man labor	*Hours per acre*	
Vine killing	1.0	.5
Digging and bagging	25.3	29.9
Loading and hauling	6.9	8.8
Total man labor	33.2	39.2
Tractor hours		
Vine killing	.6	.5
Digging	2.8	3.3
Total tractor hours	3.4	3.8
Truck hours		
Loading and hauling	1.8	3.5
	dollars	
Cost of man labor	32.62	40.56
Cost of tractor use	7.88	9.25
Cost of truck use	4.67	6.56
Total cost per acre	45.17	56.37
Cost per cwt.	.24	.29

*Thirty selected enterprises

vesting methods showed that more complete mechanization resulted in average savings of 6.0 man hours of labor, .5 tractor hours, and 1.7 truck hours per acre. Enterprises where combine harvesters were used had total harvesting costs of $45.17 per acre compared to $56.37 for the 30 enterprises with other harvesting methods. Costs were $.24 and $.29 per hundredweight, respectively. Cost rates per hour for man labor and machinery were charged as explained previously. Rates did not differ much for different types of equipment.

It might be expected that as new methods of harvesting become more commonly accepted and as farmers learn more about them and become more skilled in their use, additional savings in labor might be affected.

Factors Associated With Success

A METHOD of sorting the records into groups on the basis of some selected factor was used in order to note the association of other factors with the particular factor being studied.

Variety of Potato Grown

Growers included in this study reported growing seven different varieties of potatoes. Varieties by number of enterprises on which they were grown were: Mesabi, 1; White Rose, 2; Kennebec, 4; Cobbler, 5; Bliss, 27; Pontiac, 33; and Russets, 58.

In the five southern counties 49 of 52 enterprises surveyed produced Russets. The other three produced White Rose, Kennebec, and Pontiac. In Cache, Box Elder, Weber, Davis, and Utah Counties a definite preference for Bliss and Pontiac was shown. In the Cache and Box Elder County area Bliss was produced on 17 enterprises, Pontiac on 8, Russets on 5, and Kennebec on 1. In the Weber, Davis, and Utah County area Bliss was produced on 10 enterprises, Pontiacs on 24, Russets on 4, Cobblers on 5, Kennebec on 2, Mesabi 1, and White Rose 1.

Table 10. *Relation of variety of potato to various factors, Utah 1953*

Area and variety	No. of records	Acres per enterprise	Per acre				Cost per cwt.
			Yield	Comm'l fert.	Manure	Total cost	
	no.	*acres*	*cwt*	*lbs*	*tons*	*dol*	*dol*
Cache-Box Elder area							
Bliss	17	8.6	223	234	10.4	222.19	1.00
Kennebec	1	35.0	300	300	2.5	288.38	.96
Pontiac	8	4.2	195	57	5.0	208.09	1.07
Russet	5	12.0	202	208	1.1	178.63	.88
Utah-Weber-Davis area							
Bliss	10	4.3	164	245	6.9	235.10	1.43
Cobbler	5	3.6	139	67	13.5	231.66	1.67
Pontiac	24	5.9	168	227	5.5	220.00	1.31
Russet	4	3.1	153	214	6.9	237.20	1.55
All others	4	2.9	196	307	15.5	286.09	1.46
All farms	130	9.1	169	175	4.9	185.25	1.10

Table 11. *Relation of potato yields per acre to various factors, Utah, 1953*

Yields per acre			Acres per enter-	Man labor/acre		Comm'l fert. per	Manure appl. per	Cost per
Interval	Avg.	Records	prise	Pre-harvest	Harvest	acre	acre	cwt.
cwt	*cwt*	*no*	*acres*	*hrs*	*hrs*	*lbs*	*tons*	*dol*
0 -114	101	25	10.6	27.4	21.9	77.9	2.2	1.45
115-154	136	35	8.3	34.1	30.6	235.0	4.3	1.39
155-194	173	24	11.6	26.4	31.9	142.0	4.3	.98
195-234	205	26	7.8	35.7	36.9	148.0	7.3	1.04
235-300	273	20	9.4	29.2	44.0	293.0	7.9	.83
All farms	169	130	9.1	30.6	32.1	175.0	4.9	1.10

The records were grouped according to area and sub-sorted according to variety in order to note associations between variety and various factors. Since the five southern counties produced Russets predominately, that area was not included in this sub-sort (table 10).

There was no significant difference in average yields in each area among the three principal varieties, Bliss, Pontiac, and Russet. Among those three the variety that was grown on the largest total acreage in each area also was the highest yielding, and the variety grown on the least total acreage was the lowest yielding in each area. This suggests that perhaps producers have discovered which variety is best adapted to growing conditions on their respective farms, and tend to concentrate on that variety.

Comparing average situations, corresponding varieties in the Cache-Box Elder area produced greater yields per acre. Costs per hundredweight averaged lower and acres per enterprise averaged higher than in the Utah-Weber-Davis area.

Yield Per Acre

Yields of potatoes ranged from 12 to 300 hundredweight per acre. Average yield was 169 hundredweight. In order to note associations between yields and various factors the records were sorted on the basis of yields per acre (table 11). The records were divided into five groups as follows: yields less than 115 hundredweight, 115 to 154 hundredweight, 155 to 194 hundredweight, 195 to 234 hundredweight, and 235 to 300 hundredweight per acre. Average yields for each group were 101, 136, 173, 205, and 273 hundredweight per acre, respectively.

Apparently no association exists between yield per acre and man hours used in pre-harvest operations. As yields increased, however, man hours required for harvesting also increased. There seemed to be a fairly consistent association between yields and commercial fertilizer and manure applied. With one exception, quantities of those items applied increased as yields increased. Cost of production per hundredweight decreased rather consistently from $1.45 to $.83 as average yields increased from 101 to 273 hundredweight per acre. This indicated that although total costs of obtaining higher yields per acre were increased they increased at a slower rate than yields.

Man Labor Used in Preharvest Operations

Labor used in preharvest operations is a principal cost item that can be varied independently of other factors as the operator desires. Since power is used in

conjunction with labor, power required is dependent to a large extent upon amount of labor used. Both labor and power used in harvesting operations are dependent to a great extent upon yields. Overhead costs were largely fixed in nature, and the cost of seed, which was the largest material cost, was also quite fixed.

Labor and power cost for preharvest operations accounted for approximately 30 percent of the total cost of producing potatoes.

Inasmuch as use of man labor in preharvest operations is under control of the operator, data were analyzed to see what associations might exist between man labor and various other factors. The records were divided into four groups on the basis of hours of man labor used in preharvest operations (table 12). Use of man labor for these operations ranged from 9.4 to 24.9 man hours for the first group, 25.0 to 34.9 man hours for the second group, 35.0 to 44.9 man hours for the third group, and from 45.0 to 97.0 man hours for the fourth group. Average number of man hours for preharvest operations in each group was 19.9, 28.8, 39.5, and 59.2, respectively. The average for all enterprises was 30.5.

There seemed to be rather consistent associations between man hours of labor used in preharvest operations and several other factors. As the amount of labor for those operations increased total man hours and machinery costs also increased consistently. Quantities of commercial fertilizers and manure applied increased markedly for the two groups using the most labor. Size of enterprise decreased consistently as man hours used in preharvest operations increased. Yields per acre increased rather consistently through the first three groups as man hours per acre increased. The increased yield was not sufficient to offset rising costs, however; and costs per hundredweight increased from $.96 for the group using the least man labor to $1.12 and $1.13 for the second and third groups, and to $1.44 for the group using the most man labor.

Apparently judicious and effective use of man labor in preharvest operations is important to the success of the enterprise. As total preharvest hours of man labor increased preharvest hours of man labor per hundredweight also increased indicating that greater inputs of labor were not accompanied with proportionate increases in yield.

Man Hours Per Acre

In order to note associations between man hours and various factors the records were sorted on the basis of total man hours used per acre. The records were divided into four groups as follows: those

Table 12. *Preharvest man hours per acre related to various factors in potato production, Utah 1953*

Preharvest man hours				Acres per enterprise	Yield per acre	Total man hours per acre	Cost per cwt.
Interval per acre	Average per acre	Average per cwt.	Records				
			no.	*acres*	*cwt*	*hrs*	*dol*
0 to 24.9	19.9	.12	34	14.6	160	47.5	.96
25 to 34.9	28.8	.17	33	10.7	170	63.1	1.12
35 to 44.9	39.5	.21	33	6.0	185	74.6	1.13
45 and over	59.2	.34	30	4.7	177	97.9	1.44
All farms	30.5	.18	130	9.1	169	63.0	1.10

requiring 28 to 54.9 man hours per acre, 55 to 69.9, 70 to 89.9, and 90 man hours or more per acre. Average number required in each of these groups was 45, 62, 79, and 101, respectively (table 13).

There seemed to be a fairly consistent inverse relation between man hours per acre and size of enterprise. As average use of labor increased from 45 to 79 man hours, the size of enterprise decreased from 15.0 to 5.4 acres. A further increase to 101 man hours per acre was accompanied by a slight increase in size to 6.1 acres. This slight reversal was rather insignificant compared to the relation in the first three groupings. This relation tends to confirm that shown when the records were sorted on size of enterprise.

There was a consistent positive relation between total man hours used per acre and several factors. Yield, commercial fertilizer and manure applied, and total cost per acre all increased consistently as man hours per acre increased. An increase of 17 man hours from the first group to the second group was accompanied by an increase of 45 hundredweight per acre. A further increase of 39 man hours from the second group to the fourth group was accompanied by an increase of only 31 hundredweight per acre.

Costs per hundredweight decreased from $1.06 for the first group to $1.03 for the group using 62 man hours per acre, and then increased to $1.26 per hundredweight for the group using the most labor. This indicates that those producers using about an average amount of labor achieved the greatest degree of efficiency.

Size of Enterprise

In most types of agricultural production, size of enterprise has an effect upon efficiency and success. In order to note associations between size of enterprise and other factors, records were sorted on the basis of acres of potatoes grown. Enterprises included in this study ranged from 1 to 35 acres in size and were divided into four groups: less than 3.5 acres, those with 3.6 to 6.5 acres, those with 6.6 to 10.5 acres, and those with 10.6 acres or more (table 14). Average size of enterprise in these groups was 2.6, 5.0, 8.7, and 19.2 acres of potatoes, respectively (table 14). As size of enterprise increased man labor per acre and all costs on a per acre basis decreased consistently. Cost of production per hundredweight decreased from $1.37 per acre for the smallest enterprises to $1.01 per hundredweight for the largest enterprises. There does not seem to be any association between size of enterprise and yields per acre.

Table 13. *Relation of man hours per acre to various factors in potato production, Utah, 1953*

Man hours per acre		Records	Acres per enterprise	Yield per acre	Total cost per acre	Cost per cwt.
Interval	Average					
hrs	*hrs*	*no*	*acres*	*cwt*	*dollars*	*dollars*
28 - 54.9	45	32	15.0	138	146.76	1.06
55 - 69.9	62	39	9.6	183	188.29	1.03
70 - 89.9	79	34	5.4	186	217.16	1.16
90 and over	101	25	6.1	214	268.31	1.26
All farms	63	130	9.1	169	186.18	1.10

Table 14. *Relation of size of potato enterprise to various factors, Utah 1953*

Acres per enterprise		Records	Yield per acre	Man labor cost per acre	Total cost per acre	Cost per cwt.
Interval	Average					
acres	*acres*	*no*	*cwt*	*dol*	*dol*	*dol*
0 - 3.5	2.63	35	175	85.60	238.83	1.37
3.6 - 6.5	5.02	27	176	74.16	212.21	1.21
6.6 - 10.5	8.74	33	165	68.12	191.98	1.16
10.6 and over	19.20	35	169	54.86	171.25	1.01
All farms	9.15	130	169	62.68	186.25	1.10

Relations shown suggest that production was more efficient on larger enterprises or that many unnecessary costs were incurred on smaller ones.

Cropping Practices

Type and natural fertility of soils, types of crops grown previously, and amounts and kinds of fertilizers used are all factors which may have an effect on yield of potatoes and cost of production. An attempt was made to analyze these factors, and their associations with yields and costs.

It is recognized that complete information about these factors is not available. Initial levels of fertility, specific plant food deficiencies, degree to which manure and fertilizers satisfy deficiencies in the soil, soil depletion attributed to potato production, and the level of fertility remaining in the soil after the potatoes were harvested are some of the factors about which data are lacking. The interpretation of data is limited by these deficiencies. The conclusions to be drawn from this analysis must be considered suggestive.

In order to facilitate the analysis, manure and commercial fertilizers have been converted to a comparable basis of elemental nitrogen and phosphate. It was assumed that manure contained 10 pounds of nitrogen and 5 pounds of phosphate per ton. Commercial fertilizers were converted to pounds of nitrogen and phosphate depending on their analysis. Fertilizer elements of the manure and commercial fertilizers were added directly. The analysis of manure may vary somewhat from the standard values used, and possible beneficial effects from organic matter in the manure are not valued.

Since most soils in Utah contain ample supplies of potassium, it was not considered in this analysis.

It is generally conceded that the type of crop grown on the land has an effect on the fertility and friability of the soil. Leguminous crops are considered beneficial to the soil; non-leguminous crops are considered detrimental. Consequently, the records were sorted on the basis of the number of non-leguminous crops that had been produced since the last leguminous crop was grown. The records were divided into four groups depending on whether the land had been broken out of alfalfa or one, two, or three or more non-leguminous crops had been grown in preceding years (table 15). In addition, three other groups were provided to include enterprises on which non-leguminous crops had been produced on part of the acreage during one or more of the preceding three years, and enterprises for which complete data were not available. The group with mixed cropping was more characteristic of all alfalfa cropping than any of the other groups.

Table 15. *Relation of previous cropping practices to various factors in potato production, Utah 1953*

Cropping practice	Records	Acres per enterprise	Per acre					Cost per cwt.
			Yield	Man labor	Comm'l fertilizer	Manure	Total cost	
	no	*acres*	*cwt*	*hrs*	*lbs*	*tons*	*dol*	*dol*
Alfalfa three preceding years	48	9.5	165	56	140	3.2	164.84	1.00
Acreage mixed between alfalfa and other crop one or more of preceding three years	23	13.6	180	67	156	4.7	192.15	1.07
One other crop grown since alfalfa	14	8.6	155	66	167	6.5	189.85	1.23
Two other crops grown since alfalfa	10	3.5	142	79	207	8.6	222.73	1.56
Three or more other crops grown since alfalfa	17	6.8	202	66	374	10.6	224.64	1.11
Two other crops and previous cropping unknown	15	8.8	157	66	188	4.2	198.55	1.26
One other crop and previous cropping unknown	3	5.7	113	56	.....	1.9	186.88	1.65
All farms	130	9.1	169	63	175	4.9	186.16	1.10

There does not seem to be any association between crops grown previously and size of enterprise or man labor per acre. There was a fairly consistent association between crops grown previously and the use of manure and commercial fertilizers. As the number of years non-leguminous crops were grown since alfalfa increased, quantities of manure and fertilizers used also increased. Apparently it was possible through increased use of manure and fertilizer to prevent drastic decreases in yields, or perhaps even to increase yields on soils where non-leguminous crops have been grown, however, cost of production per hundredweight increased. Producing potatoes on land that has just been broken out of alfalfa appeared to be the most economical. Although yields for this group were not as high as for two other groups, combinations of yields and costs made the lowest cost of production.

Use of Fertilizer According to Previous Cropping Practices

It is assumed that fertilizer requirements vary depending on types of crops grown previously. In order to determine which combinations of cropping practices and fertilizer practices might be most economical the records were sorted on the basis of cropping practices and subsorted on the basis of quantities of nitrogen and phosphate applied per acre (table 16). The records were divided into three groups. The first group included enterprises where alfalfa had been produced each of the preceding three years. In the

Table 16. *Cropping practices and fertilizer use related to yields and cost per hundredweight*

Fertilizer intensity	Records	Acres per enterprise	Per acre			
			Comm'l fert.	Manure applied	Yield	Cost per cwt.
	no	*acres*	*lbs.*	*tons*	*cwt*	*dol*
			Alfalfa three years			
Over 100 lbs. of both P_2O_5 and N	4	7.6	526	8.5	180	1.35
Over 100 lbs. either P_2O_5 or N, 0 to 100 lbs. of other	4	3.4	179	11.0	199	1.18
0 to 100 lbs. of both P_2O_5 and N	23	11.8	144	3.8	174	.93
0 of either P_2O_5 or N 0 to 100 lbs. of other	4	8.8	183	.....	147	1.06
0 lbs. of both P_2O_5 and N	13	8.1	.....	.....	139	1.05
			Acreage mixed between alfalfa and other crops one or more of previous three years			
Over 100 lbs. of both P_2O_5 and N	1	10.0	300	12.9	200	1.26
Over 100 lbs. either P_2O_5 or N, 0 to 100 lbs. of other	5	10.6	316	4.4	150	1.15
0 to 100 lbs. both P_2O_5 and N	16	15.2	115	4.6	189	1.04
0 of either P_2O_5 or N, 0 to 100 lbs. of other	1	7.0	157	.....	71	1.46
			Non leguminous crop one or more of previous three years			
Over 100 lbs. both P_2O_5 and N	16	7.0	328	15.7	203	1.16
Over 100 lbs. P_2O_5 or N, 0 to 100 of other	15	5.6	447	6.6	182	1.24
0 to 100 lbs. both P_2O_5 and N	22	7.3	90	3.6	146	1.29
0 either P_2O_5 or N, 0 to 100 of other	3	8.8	264	.....	160	1.38
0 lbs. both P_2O_5 and N	3	12.7	.....	.....	111	1.12
All farms	130	9.1	175	4.9	169	1.10

second group non-leguminous crops had been produced on part of the acreage during one or more of the preceding three years. In the third group non-leguminous crops had been produced on all the acreage during one or more of the preceding three years. These three groups were then subsorted according to the intensity of application of nitrogen and phosphate.

In each group yields increased rather consistently as the applications of phosphate and nitrogen increased. The most economical combination of factors, however, is not necessarily the one giving the highest yields. On land which has been in alfalfa three preceding years, the most economical combination appears to occur with moderate applications of manure and commercial fertilizers rather than with extremely heavy or light application. The same is true of the group on which acreage was mixed between alfalfa and other crops during one or more of the previous three years. On land where non-leguminous crops have been grown during one or more of the preceding three years, heavy applications of manure

and fertilizer appear to be more economical than moderate or light applications.

Source and Intensity in Fertilizer Application

The data were further analyzed to note any association that might exist between source of fertilizer elements and intensity of use, and other factors. Records were sorted into four groups (table 17). The first group included enterprises where only manure was used. In the second group fertilizer elements were combined in such a manner as to provide a fairly substantial application of both phosphate and nitrogen. In the third and fourth groups fertilizer applications were heavily weighted with one element. Heavy applications of phosphate were the third group and heavy applications of nitrogen were the fourth group. The first two groups were subsorted according to intensity of application.

In the second fertilizer group farmers added some phosphate to manure and reduced the ratio of nitrogen to phosphate below 2 to 1. On many enterprises manure was supplemented by both phosphate and nitrogen. On a few enterprises both phosphate and nitrogen commercial fertilizers were used without any manure at all. Use of a combination of fertilizers appeared to be decidedly superior to emphasizing either fertilizer element alone or use of manure only. Use of combination fertilizers in the lightest intensity group, 20 pounds of commercial fertilizer and 3.1 tons of manure, produced higher yields than the heaviest application, 15.3 tons of manure alone. Large applications of phosphate alone were accompanied by yields somewhat below the state average yield. Large applications of nitrogen alone produced high yields, but costs on

Table 17. *Relation of type and intensity of manure and fertilizer application to various factors in potato production, Utah 1953*

Type of fertilization and intensity	Records	Acres per enterprise	Comm'l fert. per acre	Manure appl. per acre	Yield per acre	Cost per cwt.
	no	*acres*	*lbs*	*tons*	*cwt*	*dol*
Manure only						
9.0 tons and over	16	4.9	....	15.3	172	1.22
5.1 to 8.9 tons/acre	17	9.8	....	7.1	168	1.02
0 to 5.0 tons/acre	18	11.7	....	2.9	155	1.04
Combined fertilizer (phosphate and nitrogen)						
Over 300 lbs. total	12	7.8	463	14.5	196	1.19
150 to 300 lbs. total	15	7.8	394	5.3	209	.98
0 to 150 lbs. total	12	10.3	237	3.2	181	1.09
Unbalanced fertilizers						
Heavy application phosphate	13	10.1	352	1.6	142	1.31
Heavy application nitrogen	11	11.2	350	1.8	198	1.31
No manure or commercial fertilizer	16	9.0	....	....	131	1.07
All farms	130	9.1	175	4.9	169	1.10

a per hundredweight basis were also high.

Apparently most economical operations were attained with moderate applications of commercial fertilizers and manure together. Moderate applications of manure alone also were accompanied by low cost of production per hundredweight.

Number of Factors Better Than Average

It is generally accepted that all around efficiency is superior to high efficiency in one or two areas and low efficiency in others. Three factors that seem to be most closely associated with costs of production per hundredweight are yields, labor efficiency as measured by man hours used in preharvest operations, and acres per enterprise. The records were sorted and subsorted into groups depending upon whether performance was better or poorer than average in each of these three factors (table 18). More than average yields, larger than average size, and less than average use of man labor were considered desirable. The records, sorted in this manner, were then placed in four groups as follows; first, all factors below

Table 18. *Relation of number of factors better than average to success of the potato enterprise, Utah 1953*

Class interval	Records	Acres per enterprise	Yield per acre	Man labor per acre		Comm'l fert. per acre	Manure per acre	Cost per acre
				Preharvest	Total			
	no	*acres*	*cwt*	*hrs*	*hrs*	*lbs*	*tons*	*dol*
All below average	29	4.1	118	48.7	80.4	143	7.2	1.90
			Average and Better Size:					
Below average other two	6	13.2	122	41.6	71.6	251	4.3	1.51
Above average labor efficiency	24*	16.5	127	23.5	49.1	172	2.3	1.20
Above avg. yields	6*	11.2	221	44.5	83.4	125	10.8	1.08
Above average both other	14†	20.1	224	21.6	58.5	192	6.0	.85
Total	50	16.5	167	26.3	57.2	183	4.1	1.05
			Average and Better Labor Efficiency:					
Below average other two	8	4.8	118	21.4	45.6	42	1.9	1.17
Above avg. size	24*	16.5	127	23.5	49.1	172	2.3	1.20
Above avg. yields	10*	5.5	205	24.7	62.6	151	5.9	.98
Above average both other	14†	20.1	224	21.6	58.5	192	6.0	.85
Total	56	13.8	167	22.8	53.3	171	3.9	1.01
			Average and Better Yields:					
Below average other two	33	4.6	221	43.6	82.4	202	8.2	1.00
Above avg. size	6*	11.2	221	44.5	83.4	125	10.8	1.08
Above average labor efficiency	10*	5.5	205	24.7	62.6	151	5.9	.98
Above average both other	14†	20.1	224	21.6	58.5	192	6.0	.85
Total	63	8.8	221	30.7	68.4	183	7.2	.93

*Each item appears twice in table
†This item appears three times in table

average; second, size of enterprise average or better; third, labor efficiency average or better, and fourth, yields average or better. The second, third and fourth groups were then subsorted according to which of the other two factors were above or below average. Subsorting the second, third, and fourth groups in this manner resulted in several groups appearing in two places in the table.

Twenty-nine enterprises were below average in all three factors. These enterprises averaged 4.1 acres of potatoes, had yields of 118 hundredweight per acre, and required 48.7 man hours of labor for the land preparation, planting, and growing operations. Average costs of production for this group was $1.90 per hundredweight. Fourteen enterprises were better than average in all factors. That group averaged 20.1 acres of potatoes, had yields of 224 hundredweight, and required 21.6 man hours of labor per acre for preharvest operations. Average cost of production for this group was $.85 per hundredweight. The 14 enterprises above average compared with the 29 enterprises below average were about 5 times as large, had yields almost twice as great, and costs of production less than half as much per hundredweight.

The three groups which were average and better in size, average and better in labor efficiency, and average and better in yields, had costs of production of $1.05, $1.01, and $.93 per hundredweight, respectively. Within each of these groups the records were subsorted in four groups depending upon whether both other factors were below average, whether one or the other was above average, or whether both were above average. Within these groups highest cost of production occurred when both other factors were below average, or when size was above average. Above average labor efficiency resulted in somewhat lower costs and above average yields resulted in still lower costs of production per hundredweight. Lowest cost of production was achieved when both other factors were better than average.

Better than average yields appeared to be the most important consideration in achieving efficient production, with effective use of labor second, and size of enterprise next in importance.

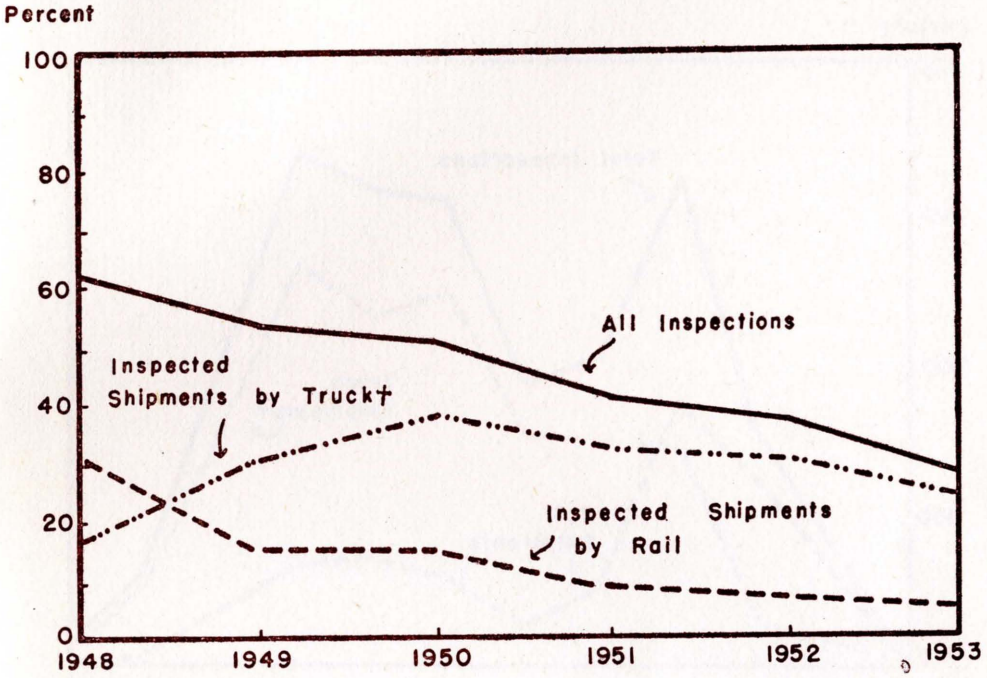
Marketing of Utah Potatoes

FOR many years Utah farmers have produced potatoes for markets outside the state. Production has usually been from 2 to 4 times as great as domestic consumption. While the exact in and out of state movements are not known, potatoes produced in other areas are marketed in Utah to satisfy demand for certain types and qualities that are not produced here. The Utah markets handle, also, some new potatoes at times when they are not available from local production. It is probable that year after year, 50 to 75 percent of all potatoes produced in Utah are marketed in other states.

During the period from 1947 through 1953, 64 percent of all potatoes shipped from Utah by rail were unloaded at 62 principal cities in 31 different states throughout the United States. The remaining 36 percent of rail shipments were unloaded at unspecified cities. California markets received the largest number of carlots, accounting for 68 percent of the unloads at principal cities. Texas markets received about 15 percent of the

shipments, and Missouri and Oklahoma markets were next in importance. Other midwestern markets, and markets in the southern states were of lesser importance. Few Utah potatoes were shipped to eastern seaboard states.

The state of Utah and the United States government cooperate in providing in-



Source: from state inspection reports

† In carlots equivalent of 360 hundredweight

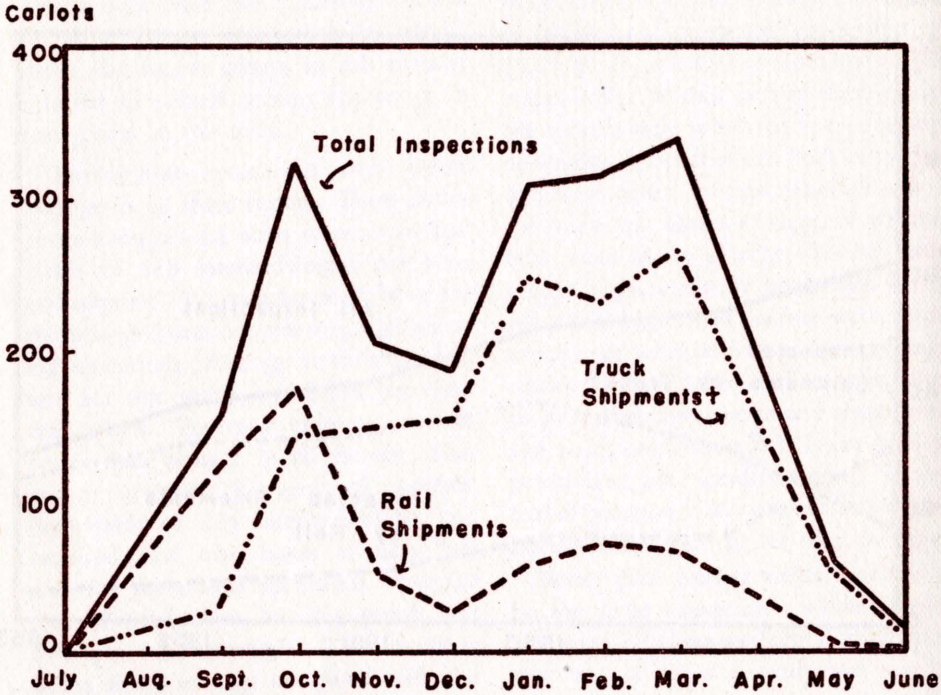
Fig. 1. Inspected shipments of Utah potatoes as a percentage of total production, 1948 through 1953 crop years (July 1 to June 30)

spection services for producers or handlers of agricultural products in Utah. Inspection of potatoes is not compulsory except on sales to the government, but is performed upon requests of producers or handlers of potatoes. Volume of potato inspections expressed as a percentage of total production decreased consistently from the 1948 crop year through the 1953 crop year (fig. 1). Volume of inspected rail shipments also decreased from about 32 percent of production in 1948 to 4 percent in 1953. Over that period carlot inspections have averaged about 75 percent of total rail carlot shipments as reported by the Agricultural Marketing Service.

Volume of inspected truck shipments as a percent of total production increased rapidly from 1948 to 1950, and has decreased slightly since 1950 (fig. 2). Inspected truck shipments were about 50 percent of inspected rail shipments in 1948, and increased to about 700 percent

of inspected rail shipments in 1953, indicating a rapid shift from rail to truck transportation.

Data available (from the inspectors office) seem to indicate that most of inspected truck shipments moving out of Utah are destined for southern California markets. A considerable volume of truck shipments also goes to Oklahoma, Texas, New Mexico, and Arizona, with lesser



Source: from state inspection reports

† In carlots equivalent of 360 hundredweight

Fig. 2. Average monthly inspected shipments of Utah potatoes for human consumption, 1948 through 1953 crop years (July 1 to June 30)

amounts going to other states in the Rocky Mountain area.

Complete and accurate data are not available to indicate volume or direction of movement of uninspected truck shipments. It is probable, however, that these shipments would equal or exceed inspected shipments and would move into the same market areas as the inspected shipments.

The marketing season for the Utah crop begins in July with the shipment of early potatoes. Rail shipments predominate in marketings during July, August, and September. Fall marketings reach a peak during October. Volume of marketings decreases during November and December, increases to peak levels during January, February, and March, and decrease rapidly through April, May, and June. Truck shipments are almost equal to rail shipments in October and from November through June the volume of truck shipments exceeds rail shipments by a wide margin.