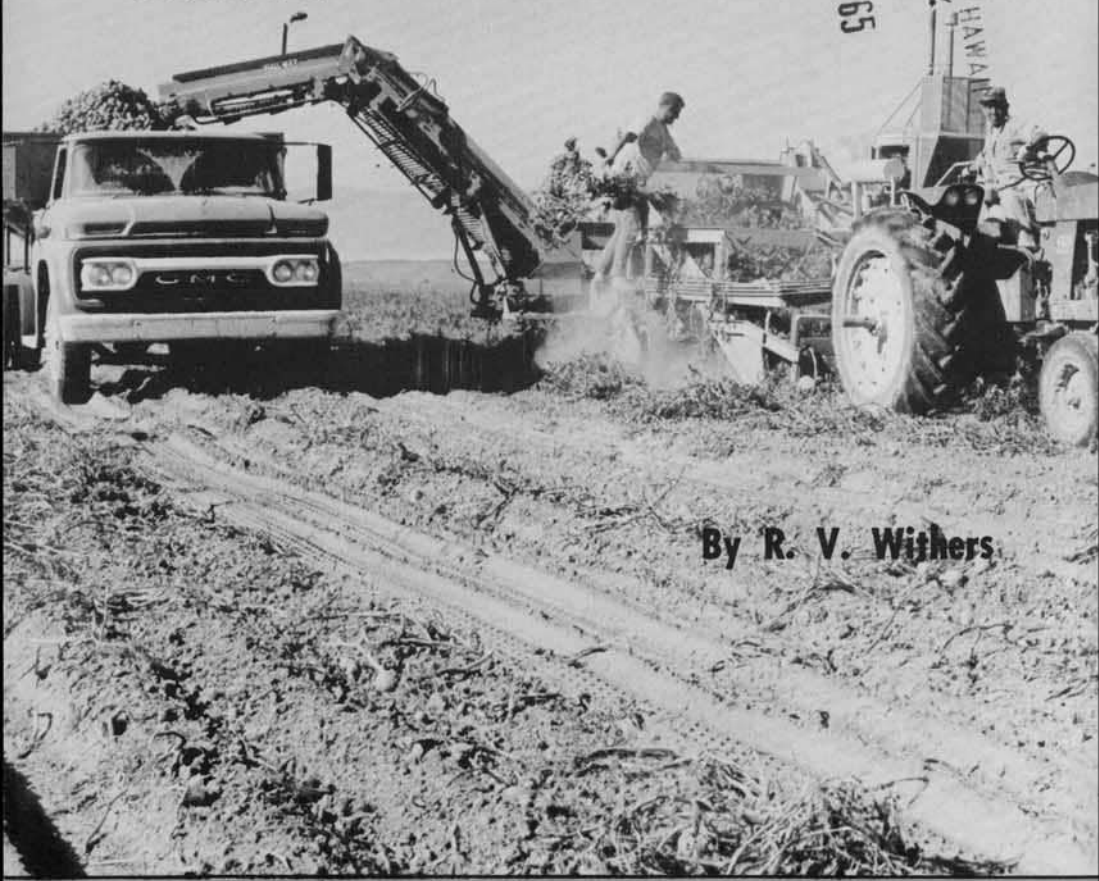
UNIVERSITY OF IDAHO
College of Agriculture

POTATO PRODUCTION COSTS



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THE STUDY

This bulletin is the result of a series of studies concerning the cost of producing potatoes in Idaho. This project was carried on by the Agricultural Economics Department of the University of Idaho. Several members of that department have worked on the various phases of the project since its beginning in 1956. The first phase was a study of production costs on farms in the upper Snake River Valley. Two Idaho Agricultural Research Progress Reports were written in 1959 on this phase of the study. The first, No. 33, reported on production costs on potato farms and the second, No. 34, gave details to help farmers figure individual costs.

A second phase was a study of enterprise combinations on irrigated farms in southwestern Idaho. A third phase was a study of potato production costs as related to size on moderately large potato enterprises in southcentral Idaho. Progress Report No. 82 summarized this work.

This bulletin combines work from the first and third phases of the project. The third phase is emphasized because it was the most recent.

ACKNOWLEDGMENT

The author wishes to acknowledge the work carried on by his predecessors in the project and especially to Kurt Moller and Elwood Jones, who collected and analyzed much of the data. Dr. W. E. Folz also gave assistance and many helpful suggestions.

Special appreciation goes to those farmers and others who have given the information which made this study possible. Thanks also to the Idaho Potato Producers Association for financial assistance on the project.

SUMMARY

Potato acreage in Idaho has more than tripled since 1920 and has doubled since 1940. Thirteen percent of all farm receipts was for potatoes in 1962.

There have been rapid changes in potato production technology, particularly in machinery. Much of the labor in raising potatoes previously done by hand is now performed by expensive equipment. With these changes have come many changes in factors of potato production cost. Some significant factors in production cost are related to yields, machine use, labor efficiency or the efficiency with which land, labor and capital are combined to produce potatoes.

The efficiency of an enterprise is also related to size. Machine costs become prohibitive for small enterprises. Recent studies indicate a range of estimated potato production costs from $.90 per hundredweight for a 300-acre potato enterprise to $1.20 per hundredweight for a 20-acre enterprise. These costs were figured on the basis of constant yields and a typical set of production practices in southcentral and southeastern Idaho. The most obvious reason for the lower estimated costs on larger enterprises was that fixed machinery costs such as depreciation and interest on investment were spread over more acres of the crop. In actual practice some people have been able to narrow this difference by working with neighbors, making use of used rather than new machinery or by hiring considerable work on a custom basis.

The most significant result or conclusion which can be drawn from the study is that size of enterprise is an important factor in the efficiency of potato production. When all other factors were held equal, farmers with 200 to 300 acres of potatoes had lower costs than those with small acreages due to more efficient use of

equipment. Since potato prices are so highly variable, farmers must keep costs down in order to improve the possibility of a satisfactory income year after year.

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Potato production has become increasingly significant in Idaho during the past few years. Potato acreage has been expanding quite rapidly with yields increasing simultaneously. Changes in acreage and yield are illustrated in Table 1.

Average potato acreage in Idaho increased from 77,100 in the 1920 to 1929 period up to 254,000 for 1960 to 1963. At the same time average yields increased from 115 hundredweight per acre in the early period to 200 hundredweight in the more recent period. During 1961, Idaho farmers received over $64 million for the sale of potatoes or about 15.6 percent of all farm receipts. Farmers received $62 million or 13.6 percent of all farm receipts for potatoes sold in 1963.

The increase in yield and acreage has largely resulted from technological advances in agriculture. Potato production has changed from largely a hand operation to almost complete mechanization. Improvements in pumping and irrigation facilities have made it possible to develop large areas of land which were previously too dry for anything but grazing and some dryland farming. Much of this new land has been nearly ideal for potatoes.

The development of potato processing plants has helped to expand the market to keep pace with rising production. Over 40 percent of the potatoes produced in Idaho was processed in 1960 as compared to almost none before 1950, when practically all of the crop was placed on the fresh market.

Table 1—Average Potato Acreage and Average Yield Per Acre, Idaho, 1920-1963

Years	Potato acreage	Yield per acre
		(cwt.)
1920-29	77,100	115
1930-39	117,200	130
1940-49	155,200	146
1950-59	171,300	190
1960-63	254,000	200

Source: USDA, Statistical Reporting Service, Idaho Crop Summaries, Boise, Idaho

All of these factors have had an effect on the potato grower. The expansion of potato production has not meant that the grower could easily make a profit. On the contrary, the extra production helped keep prices down so that the margin between prices received and production costs has been narrow and often negative for some individual.

How can a farmer cope with the so-called "cost-price squeeze"? Although potato prices tend to fluctuate quite widely over the marketing period, there is little the individual grower can do to affect the price, except perhaps, improve the quality of his product. Marketing could also be more effective in many instances. One area, however, where much can be done is in controlling costs on individual farms. The farmers who are able to stay in business are those successful in keeping production costs low.

POTATO PRODUCTION COSTS

Farmers are constantly seeking ways to improve production efficiency and reduce costs per unit produced. This is not easy since there are so many factors which go into potato production, all of which have an effect on cost. These factors may be classed into three main categories.

Physical factors with which the potato grower must work will be mentioned first. Costs are related to soil conditions, availability and source of irrigation water, location of the farm with respect to markets, topography of the fields and climatic factors. All of these items differ from one area to another and even between farms. Unpredictable weather complicates the problem.

A second area may include methods and practices followed by the potato producer. His costs per hundredweight of potatoes are directly related to how well he manages available resources. Such items as how he prepares his land, whether or not he gets his work done on time, fertilization practices, disease and pest control and system of irrigation are all important so far as production costs are concerned. This area may also include the operator's choice of machinery and how well he maintains it. Over mechanization or careless machine operation can quickly overcome possibilities of profit.

A third area is related to the second in that it is an element of management. This area has to do with the choice and combination of enterprises and the size of the enterprise. How many acres of potatoes must a farmer operate to gain efficiencies of size? Because of high machinery costs along with increased mechanization it has become increasingly important to adjust machinery and acreage to a balanced combination.

Two economic studies have been made to determine the effects of potato enterprise size on costs of production. The first study was made in the upper Snake River Valley for the 1957 crop year. The second was made in southcentral Idaho in 1962.

Although both of these areas are basically similar there are some differences in physical characteristics. The growing season

(frost free days) at Blackfoot is about 118 days based on long time averages.[1] This rather short growing season limits the types of crops which can be grown. Potatoes and sugar beets are the only cultivated crops of any importance. Hay and grain are the most common crops of the area. Counties in the upper Snake River Valley harvesting more than 10,000 acres of potatoes in 1963 were Bingham, 50,900 acres; Bonneville, 25,000 acres; Jefferson, 18,000 acres; Fremont, 12,900 acres and Madison, 11,100 acres. For greater detail see Figure 1.

Southcentral Idaho has a slightly longer growing season than the upper Snake River Valley. The average number of continuous frost free days at Rupert is 131 days. Counties in southcentral Idaho in which more than 10,000 acres of potatoes were harvested in 1963 were Minidoka, 34,200 acres; Cassia, 28,000 acres; and Jerome, 12,000 acres.[2]

Nature of Studies Conducted

The upper Snake River Valley study was completed in 1958.[3] Data for this study were collected on 68 farms. These farms were

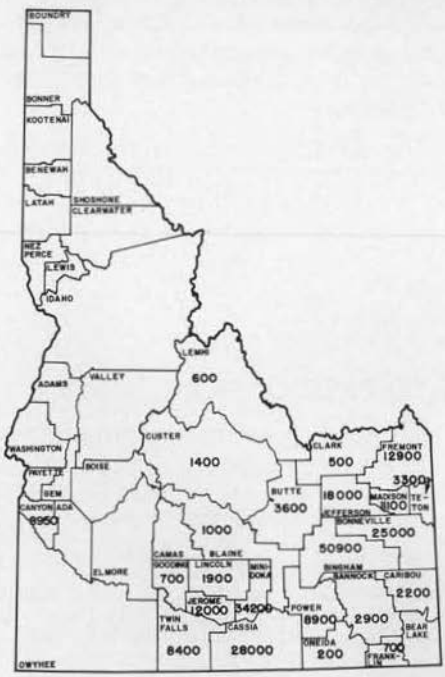

Figure 1. Potato acreage harvested in selected counties, 1963. (USDA, "Idaho Potatoes by Selected Counties," Statistical Reporting Service, Boise, Idaho.)

[1] Department of Commerce. **Climatological Data**, Annual Summary, Washington, D.C.

[2] Ibid.

[3] Weber, Jack and Elwood Jones, **Analysis of Production Costs on Potato Farms in Southeastern Idaho**, Idaho Agricultural Research Progress Report No. 33, Department of Agricultural Economics, University of Idaho, November, 1959.

typical of the area in size and cropping pattern, but management was probably somewhat better than average. A 6-year rotation was common and consisted of 2 years of potatoes, 1 year in wheat, 1 year in a cereal nurse crop and 2 years in alfalfa. Information was obtained by personal visits with the farm operators.

In the analysis of the obtained information costs were calculated for 4 farm sizes: 80, 160, 240 and 320 acres. Potato acreages on these farms were 20, 42, 65 and 100 acres respectively. As was typical of the area, some livestock were kept on nearly all farms.[1] For this publication cost data have been adjusted to 1962 prices so that a better comparison with the southcentral Idaho study could be made.

Information for the southcentral Idaho study was collected the fall of 1961 and during the 1962 season. This study was confined to farms with rather large potato acreages in Minidoka and Cassia counties. All of the farms studied were in pump irrigated areas. Some 20 farms in the area contributed information concerning production costs on their own farms. This information was used as a basis for budgeting costs on 9 sizes of potato enterprise ranging from 140 up to 300 acres of potatoes. Total farm acreage ranged from 600 to 838 acres. The potato enterprise was studied and analyzed in detail while the remaining farm enterprises were not considered except as related to potatoes.

Although some maintain that the alfalfa in a rotation benefits potatoes and therefore some of the alfalfa costs should be charged to potatoes, no attempt was made to do this in this study. It was hoped that by studying only large potato enterprises this project would supplement data obtained for the upper Snake River Valley study on smaller enterprises.[2]

RELATION OF ACREAGE TO PRODUCTION COSTS

Both of the studies indicated that production costs per hundredweight of potatoes tended to decline as the size of enterprise, or acreage in this case, increased within the range studied. Figure 2 illustrates the estimated cost per hundredweight for various sizes

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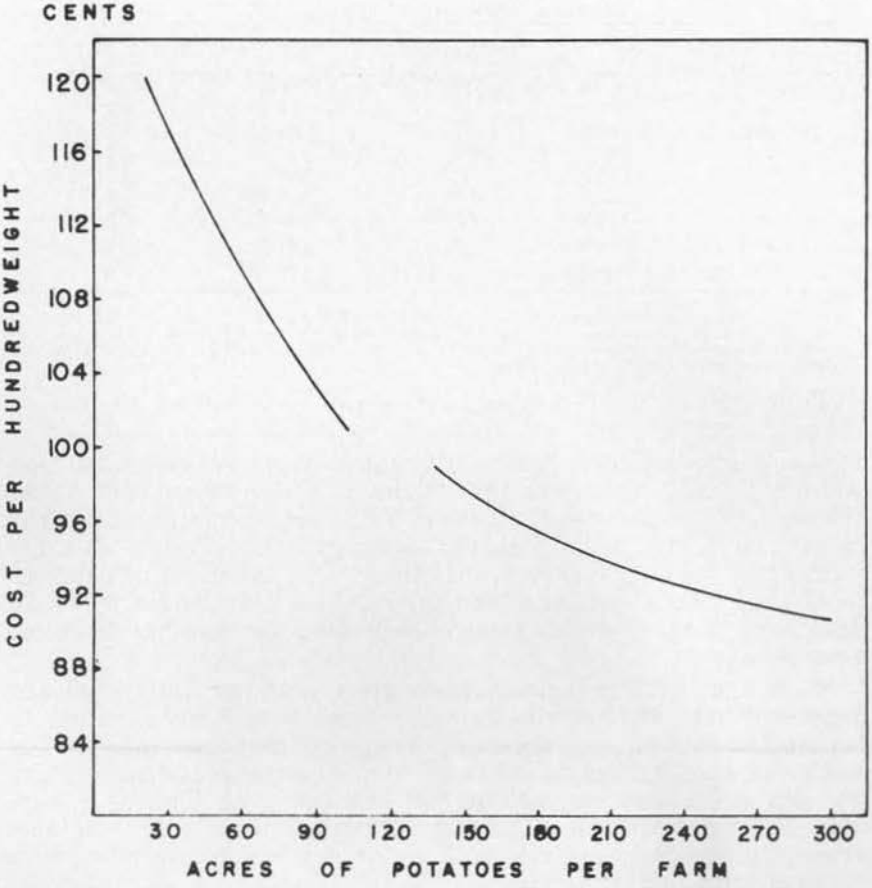
[1] Jones, Elwood Crawford, **The Relationship of Farm Size to Costs and Returns for Alternative Crop and Livestock Systems on Irrigated Potato Farms in the Upper Snake River Valley of Idaho**, unpublished masters thesis, Agricultural Economics Department, University of Idaho, 1958.

[2] Moller, Kurt Lewis, **Cost Economies Associated with an Increase in Size of Potato Enterprise on Pump Irrigated Farms in Southcentral Idaho**, unpublished masters thesis, Agricultural Economics Department, University of Idaho, 1963.

Figure 2. Cost of producing potatoes on varying acreages, Idaho, 1962.



of potato enterprise. These curves were constructed using estimated costs derived from the two preceding studies. The open space between the two curves represents an area for which complete cost data were not available.

These estimated curves assume a constant yield of 200 hundredweight of potatoes per acre for the upper curve and 211 hundredweight for the lower curve. These yields represent average yields for the 2 areas studied. The assumption was also made that typical or ordinary production practices were used. If larger or smaller yields were achieved or if significantly different practices were used, the curves would need to be adjusted but the same type of relationships of decreasing unit cost with increasing size could still be expected.

One might argue that decreasing costs or increasing output affects the relationship between large and small acreages. The shape of the curve, however, should not change appreciably since in-

Table 2—Estimated Per Acre Fixed and Variable Costs for Nine Potato Acreages. Southcentral Idaho, 1962

Acres of potatoes	Fixed costs	Variable costs[1]	Total costs	Cost per cwt
140	$55.48	153.51	$208.99	$.99
160	51.19	"	204.70	.97
180	47.91	"	201.42	.95
200	45.25	"	198.76	.94
220	43.13	"	196.64	.93
240	41.19	"	194.70	.92
260	39.67	"	193.18	.92
280	38.33	"	191.84	.91
300	37.18	"	190.69	.90

1 Under the assumptions made, variable costs were the same for each acreage studied from 140 up to 300 acres. In real life, differences in management and farm circumstances would cause some variability in these. This analysis assumed constant inputs and yields for various sizes.

creasing output or decreasing costs could be achieved regardless of the size of the potato enterprise.

Another assumption was made which appeared generally true but not always. That was that farmers having from 140 up to 300 acres of potatoes tended to have a full set of equipment so that potato machinery investment was essentially the same on all these farms. It is feasible, however, that those with 140 acres of potatoes could get by on a somewhat smaller machine investment by using machinery longer, working with neighbors or purchasing some used equipment.

Note that with the assumptions given cost per hundredweight decreased from $1.20 on the 20 acre enterprise to $.90 in the neighborhood of 300 acres of potatoes. Assuming average yields of 200 sacks per acre, estimated costs on the larger acreage were some 30¢ less per hundredweight or $60 less per acre. This is a sizeable difference. If the difference in reality were only half this great it would still be significant. A further breakdown of costs is given in the following tables.

Table 2 gives the breakdown between fixed and variable costs for various sizes of enterprise. Fixed costs were considered to be those not related directly to output such as machine depreciation, insurance, property taxes, interest on investment and operator labor. Variable costs were such items as seed, fertilizer, seasonal labor, machine repairs, tractor fuel and other items of cost directly related to production. Under the assumption of a constant yield of 211 hundredweight of potatoes and equal inputs for the various sizes, variable costs per acre were similar for all sizes. The same kind of machinery, equal amounts of seed and fertilizer and the same practices were assumed for each size.

Fixed costs per acre on the other hand varied in relation to the number of acres in the potato enterprise. Estimated fixed costs ranged from $55.48 per acre on the 140-acre enterprise to $37.18 on the 300-acre enterprise. The difference was due primarily to the fact that fixed costs for the larger enterprises were spread over a greater number of units.

Table 3—Estimated per Acre Fixed and Variable Costs by Operation for Three Sizes of Potato Enterprise, Southcentral Idaho, 1962

Operation	Variable Cost	Fixed Cost		
		140 acres	220 acres	300 acres
Pre-irrigation corrugation	$ .63	$ .77	$ .50	$ .37
Fertilizing	28.28	--	--	--
Plowing	1.91	2.40	1.54	1.14
Disking and harrowing	.68	1.06	.70	.52
Seed purchase and cutting	51.46	1.11	.70	.51
Trucking seed to planter	.28	.77	.55	.42
Planting	3.03	3.01	1.94	1.42
Harrowing	.40	.27	.24	.25
Three cultivations	2.74	3.39	2.20	1.63
Spraying for beetles	2.75	--	--	--
Ten irrigations[1]	14.69	4.91	4.69	4.57
Ditching	.07	.14	.11	.09
Burning and spraying ditches	.62	--	--	--
Rolling	.44	.58	.45	.41
Vine elimination	1.78	2.12	1.37	1.02
Harvesting[2]	10.97	10.16	6.60	4.79
Hauling to cellar	12.70	4.59	3.39	2.85
Piling in cellar	4.00	1.60	1.02	.74
Scraping dirt from cellar	.05	.52	.38	.31
Storage services	10.55	--	--	--
Transportation for manager	.49	2.11	1.48	1.19
Equipment repair shop	--	1.23	.78	.57
Shop tools	--	.68	.43	.32
Withholding tax on wages	.91	--	--	--
Interest on working capital	4.08	--	--	--
Interest and taxes on land	--	14.06	14.06	14.06
Total fixed cost per acre		55.48	43.13	37.18
Total variable cost per acre	$153.51	$153.51	$153.51	$153.51
Total cost per acre		$208.99	$196.64	$190.69
Total cost per hundredweight[3]		.99	.93	.90

[1] One of the 10 irrigations was a preplanting irrigation. The other 9 were during the growing season.

[2] Method of harvest calculated was direct with digging and loading accomplished in one operation.

[3] Cost assuming normal practices and 211 hundredweight of potatoes produced per acre
Source: Cost data obtained from thesis of Kurt Moller, op, cit.

A breakdown of fixed and variable costs for 3 enterprise sizes for each operation is given in Table 3. Note that seed was the most expensive single item of cost with fertilizer second.

Table 4—Per Acre Costs of Producing Potatoes on Various Sizes of Enterprise, Upper Snake River Valley, 1962

Item	20 Acres	42 Acres	65 Acres	100 Acres
Labor	$ 30.45[1]	$ 49.80	$ 37.80	$ 38.25
Power[2]	18.13	15.34	18.11	17.54
Equipment[3]	21.60	36.48	29.57	22.28
Vehicles[4]	9.55	31.38	28.45	24.43
Material:				
Seed[5]	48.36	48.36	48.36	48.36
Water[6]	5.25	5.25	5.25	5.25
Fertilizer[7]	9.27	9.27	9.27	9.27
Manure	6.40	6.40	6.40	6.40
Spray Chem.[8]	1.00	1.00	1.00	1.00
Contract Harvesting[9]	60.00	-----	-----	-----
Taxes	6.00	6.00	6.00	6.00
Interest[10]	13.00	12.85	12.85	12.85
Storage[11]	10.00	10.00	10.00	10.00
Insurance	.50	.50	.50	.50
Total	$239.51	$232.63	$213.56	$202.13
Cost per Hundredweight (Based on a yield of 200 sacks per acre)	$ 1.20	$ 1.16	$ 1.07	$ 1.01

Source: Jones, Elwood C. unpublished master's thesis, Agricultural Economics Department, University of Idaho, 1958. Figures adjusted to 1962 prices.

1 Labor appears low because no harvest labor is included here. On the 20-acre enterprise the harvesting was assumed to be contracted for $60.00 per acre. This is also true for vehicles and equipment expense.

Labor—This figure is the hours of labor spent multiplied by $1.50.

2 **Power**—This is the calculated amount of tractor cost including fuel, oil, grease and repairs in addition to depreciation. Because prices increased between 1957 and 1962 when the two studies were made, an adjustment had to be made in order to compare the two areas. Since tractor prices increased about 9 percent over this period and there was relatively little change in fuel prices the 1957 power costs were increased by 5 percent.

3 Equipment costs were taken as given and increased by 16 percent to account for price increases between 1957 and 1962.

4 Vehicle costs were taken as given and increased by 10 percent to cover price increases.

5 According to Jones's study, farmers used an average of $13.25 hundredweight of seed per acre. He estimated the price at $4.25 for seed which had been cut and treated. Moller's study used $2.96 as the price for seed. (Seed prices apparently vary widely between years and even between areas.) Thus the difference was divided and a seed price of $3.65 was used to compare the studies. It was estimated that 14.1 hundredweight of seed was used in southcentral Idaho.

6 Price was taken as given. This was primarily Snake River water taken by gravity flow and was somewhat less expensive than well water pumped onto the land.

7 Fertilizer prices had not changed much between 1957 and 1962 so prices were taken as given. However, upper Snake River Valley farms used a considerable amount of barnyard manure and smaller quantities of commercial fertilizer. It was estimated that an average of about four tons of manure were applied per acre and that the value after deducting $1.00 application, cost was $1.60 per ton.
Ref. U.S.D.A. unpublished data.

8 Spray material was valued at $1.00 per acre for the upper Snake River Valley study. The southcentral Idaho study used the commercial rate for the material applied or $2.75 per acre.

9 On the 80-acre farm in the upper Snake area harvesting was assumed to be contracted at $.30 per hundredweight or $60 per acre producing 200 hundredweight. All other farms were assumed to do the harvesting themselves.

10 Interest on land was figured at 4 percent of an estimated value of $250 per acre. Interest on working capital was figured as 6 percent of working capital used, for a six-month period.

11 Storage was figured at the commercial rate of $.05 per hundredweight.

Again with the assumption of a constant 211 hundredweight per acre yield total cost per hundredweight ranged from $.99 on the 140-acre enterprise to $.90 on the 300-acre enterprise.

The upper curve in Figure 2 was derived from estimated costs on potato enterprises ranging from 20 to 100 acres. A further breakdown of costs is given in Table 4. Because this part of the study was analyzed and presented on a different basis than that for the larger acreages, figures are not given in the same form except those for cost per hundredweight. Total costs for various items rather than fixed and variable are given in Table 4. It should also be noted that harvesting was figured on a contract basis for the 20-acre enterprise. On all others it was assumed that harvesting was done by the farm operator.

The estimated cost of producing potatoes ranged from $1.20 on the 20-acre enterprise to $1.01 per hundredweight for the 100-acre enterprises. This was on the basis of a constant yield of 200 hundredweight of potatoes per acre regardless of acreage. Costs may be reduced somewhat for farmers who are able to increase yields without increasing costs proportionately, or those who have lower production costs because of outstanding efficiency.

COST ITEMS IN DETAIL

Production factors have traditionally been broken down into 4 areas—land, labor, capital and management. These will be discussed somewhat in that order.

Land

Although potatoes are produced on some of the best irrigated land there is great variation in soil and land characteristics. There is a correspondingly wide variation in the value or price attached to the land. Figures used in this study were based on a value of $250 per acre for land. With a conservative interest rate of 4 percent, the annual charge for an acre of land was figured to be $10.

It was customary for farmers to rotate crops in order to control diseases and pests more effectively. Potatoes were usually not grown on more than about one-third of a farm's cropland in any one year except perhaps on newly developed land. Alfalfa hay and grain were most often rotated with potatoes, and sugar beets were sometimes grown.

Water

Water is another essential item in the production of potatoes. Between 6 and 10 irrigations were applied to the potato crop. Cost of irrigation water varied considerably depending upon the source and the difficulty involved in getting it to the land. The type of water right was also a factor.

Water costs in the upper Snake River Valley area were esti-

mated to be about $5.25 per acre in 1957. The Snake River was the principal source. All of the farms studied in southcentral Idaho pumped water from wells on or near the farm. These pumps were driven by electric motors varying in size up to 250 horsepower. The average cost of power per acre was $9.52 per year. In addition there was a small cost for maintenance and depreciation on the pump and motor. These costs were based on gravity flow rather than sprinkler irrigations.

Taxes

Another cost attached to the land was the property tax. This varied depending upon assessed value and the mill levy rate for the area. The average property tax per acre for the upper Snake River Valley study was $6.00 while the estimated property tax for the pump irrigated farms in southcentral Idaho was $4.06 per acre. The difference was probably due to the fact that a newly developed area with few buildings was being compared with an older, established area. Land values would also be lower in the newly developed regions.

Labor

Sources of labor for the potato enterprise are the operator and his family plus hired labor which may be full time, seasonal or some combination. All labor applied to the crop was charged a rate of $1.50 per hour. The estimated labor requirement per acre of potatoes for the southcentral Idaho study was 21.7 hours or $32.55 per acre. The labor requirement for small enterprises (less than 100 acres) was somewhat higher on a per acre basis because more efficient equipment was used on the larger acreages. Also, fields tended to be larger for the high acreages which added something to efficiency.

Housing was provided for hired labor on some farms. This expense was figured as a part of the wage of $1.50 per hour. Wages were somewhat reduced for those who lived in the operator's housing.

Materials Used

Seed. Seed was the most expensive single item used on the potato enterprise. In the analysis presented, a price of $3.65 per hundredweight was charged for cut and treated seed. Seed was used at a rate of 13.25 hundredweight per acre in the upper Snake River Valley and 14.1 hundredweight per acre in southcentral Idaho. Prices for potato seed have varied greatly from one year to another and to some extent even during one season. Thus it was difficult to settle on one price for the study. There is some indication that seed price follows the price for U.S. No. 1 potatoes.

Certified seed was used by most growers in the southcentral Idaho study. Use of certified seed was thought to be good insurance against disease and related problems in potatoes.

Fertilizer. Some kind of livestock was kept on most of the farms studied in the upper Snake River Valley. Therefore, manure

was used on much of the potato land. The manure used was supplemented with about 20 pounds of nitrogen and 65 pounds of phosphorus per acre. Very little manure was used on the potato acreages studied in southcentral Idaho. The most common fertilizer used was 16-20-0 in dry form. This was applied at a rate of about 595 pounds per acre or 95 pounds of nitrogen and 119 pounds of phosphoric oxide per acre. The fertilizer and application cost $28.28 per acre. Custom application was figured at $1.50 per acre.

Insect and disease control. Various types of insecticides and sprays are sometimes used on potatoes depending upon conditions which exist. Spraying for potato beetles was the only application considered in the southcentral Idaho study. This was usually done on a custom basis for $2.75 per acre. Farmers in the upper Snake River Valley usually applied their own spray which cost about $1.00 per acre plus application. Where additional materials are applied such as for wire worm or early blight, costs would increase correspondingly.

Other materials. Other materials include fuel, oil, grease and repair items. Assuming direct harvesting the typical use of these items per acre was 10.7 gallons of diesel fuel, 6.8 gallons of gasoline, 1.3 quarts of oil, .3 pounds of grease and $7.39 for repairs for a total cost per acre of $11.08. Prices used for these items are given in the appendix Table 7. Materials required on a per acre basis are given on Table 7 of the appendix.

Machinery and Equipment

Many changes have occurred in the amount of machinery and equipment used for potato production in recent years. The general trend of the change is to more mechanization which has resulted in larger and larger machinery investments for farmers. In addition, the new machines usually have greater capacity than older ones so that farmers have needed to expand the potato enterprise in order to more fully utilize their equipment. When they do not expand as more equipment is purchased costs increase with no corresponding increase in production and debts become more difficult to pay.

Because of the large investment required for modern potato equipment farmers with small potato acreages cannot afford to own a full set of potato equipment. It has been estimated that in 1962 the average value of the minimum amount of equipment necessary to maintain a reasonable potato enterprise was about $38,700. The depreciation alone on such an investment would be approximately $5,000 per year. Thus, many acres of potatoes would need to be produced and sold just to pay depreciation which is only one of many costs. Of course, it is not always necessary for each farmer to own a complete set of equipment in order to produce potatoes. It is often possible to trade work with neighbors or to hire part of the work done on a custom basis. Others have even rented out potato land to another farmer to avoid the necessity of owning so much equipment.

Table 5—Initial Cost, Expected Life, Salvage Value, and Annual Depreciation for Potato Equipment, Southcentral Idaho, 1962

Equipment	Initial Cost	Salvage Value	Expected Life (yrs)	Depreciation[1] (Annual)
Tractor (50-60 hp diesel)	$ 5,695	$ 854.25	7	$ 691.54
Tractor (40-50 hp diesel)	4,116	617.40	8	437.32
2-way, 3-bottom plow	1,016	101.60	9	101.60
Tandem disk	962	96.20	9	96.20
Spike harrow (4 sections)	168	16.80	12	12.60
Tool bar, shanks & shovels	350	35.00	10	31.50
Ditcher	380	38.00	10	34.20
New 2-ton truck	3,781	567.15	8	40.17
Used 2-ton truck	1,149	114.90	8	129.26
Bulk potato bed	600	60.00	9	60.00
Stub piler	348	34.80	9	34.80
Seed cutting equipment	1,067	106.70	9	106.70
2-row planter	1,104	110.40	6	165.60
2-row cultivator	419	41.90	10	37.71
Potato roller	325	32.50	10	29.25
Potato piler	1,378	137.80	9	137.80
Electric motor	199	19.90	12	14.92
Scraper	400	40.00	10	36.00
Irrigation equipment[2]	1,970	197.00	10	177.30
Well[3]	4,500	.....	20	225.00
Pump & 250 hp motor	12,000	1,200.00	20	540.00
Equipment repair shop	3,637	.....	20	181.85
Shop tools	1,750	175.00	10	157.50
New pickup	2,400	360.00	5	408.00
Used pickup	484	46.40	5	87.52
Labor housing	4,500	.....	20	225.00
Vine eliminator	836	83.60	7	107.49
2-row potato digger	1,059	105.90	7	136.18
2-row indirect harvester[4]	4,305	430.50	7	553.50
2-row direct harvester[4]	5,750	575.00	7	739.29
2-row independent harvester[4]	12,350	1,235.00	7	1,587.86

[1] Annual depreciation was found as follows: $\frac{\text{Initial Cost—Salvage Value}}{\text{Expected Life}} = \text{Annual depreciation}$

[2] Irrigation equipment assumes flood irrigation, thus would be considerably higher for sprinkler irrigation.

[3] No information was found as to the actual life of a well. Some will probably last indefinitely. Twenty years was an arbitrary figure used in the analysis.

[4] One of 3 types of harvester was used. The indirect harvester was a loader type used with a digger and vine eliminator. The direct harvester dug and loaded simultaneously. The independent harvester eliminated vines, dug and loaded all in one operation.

According to Moller's study it was possible to handle up to 300 acres of potatoes with one set of equipment. This set of equipment would include the following items:

2 or 3 tractors—40-60 hp.	Pilers and motors
Tillage equipment	Scraper
Ditcher	Irrigation equipment
3 trucks with potato beds	Repair shop and tools
Seed cutting equipment	2 pickups
2-row planter	Vine eliminator*
Cultivator	2-row loader harvester*
Potato roller	Labor housing

* Vine eliminators and diggers may or may not be necessary.

Annual depreciation on such equipment is very expensive. Thus, it should be used as efficiently as possible, meaning that if a farmer is to own a set of potato equipment he should operate a large enough potato enterprise to attain some degree of efficiency.

Table 5 lists estimated annual depreciation for machinery and equipment used in potato production. These figures were based upon the straight line method of depreciation. Salvage value was subtracted from the initial cost and this figure was divided by expected years of use to get annual depreciation. Other methods of depreciation which may have been used are the sum-of-the-years-digits and the declining-balance.

Total annual depreciation for each item is given in Table 5. Some of this equipment, such as tractors and tillage equipment, was used on enterprises in addition to potatoes. Where this occurred, depreciation was charged to potatoes in proportion to the amount of the total use which went to that enterprise. Thus, cost figures derived in this study include only that amount of depreciation which could rightfully be charged to potatoes.

Operating Capital

Operating capital was needed to pay for such items as fuel, seed, fertilizer and labor from planting until the crop was sold. Operating capital can come from personal savings or it can be borrowed from one of several lending agencies. The usual situation is for the farmer to go as far as he can with his own money and borrow as much additional cash as is needed to get the crop harvested. Interest should be charged to the crop for the full amount of capital used because it could be used elsewhere if not invested in potatoes. In this presentation, 6 percent was charged on the operating capital for a 6-month period. On a per acre basis this amounted to 4 or 5 dollars.

Insurance

The usual types of insurance were charged to machines and vehicles used on the farm, as well as liability for machines and farm property.

Storage

Since nearly all fall potatoes are harvested within a few weeks, most of the crop must be stored until put on the market as fresh or potatoes for processing. Therefore, most potatoes are stored for a time either in farm storage cellars or in commercial storage owned by processors and packers. In figuring costs, the commercial storage rate of $.05 per hundredweight was used to alleviate the necessity of figuring depreciation and charges on a great variety of storage facilities. Another consideration related to storage is the amount of shrinkage involved. This varies widely depending upon the condition of potatoes going into storage and also the type of storage facility. In storage periods of 8 months under ideal conditions, moisture loss may be as low as 4 percent. Serious bruises, however, may cause storage losses as high as 50 percent during a storage period of 8 months.[1]

Management

The management function is all important to the success of the enterprise. It is also difficult to measure satisfactorily. No cost was figured for management in this study since the management usually gets the residual or net profit if any. What was left after all other costs, including interest, was thought of as a profit or return to management for planning and risk bearing. All manual labor performed by the manager was charged against the potato enterprise in the same manner as was hired labor.

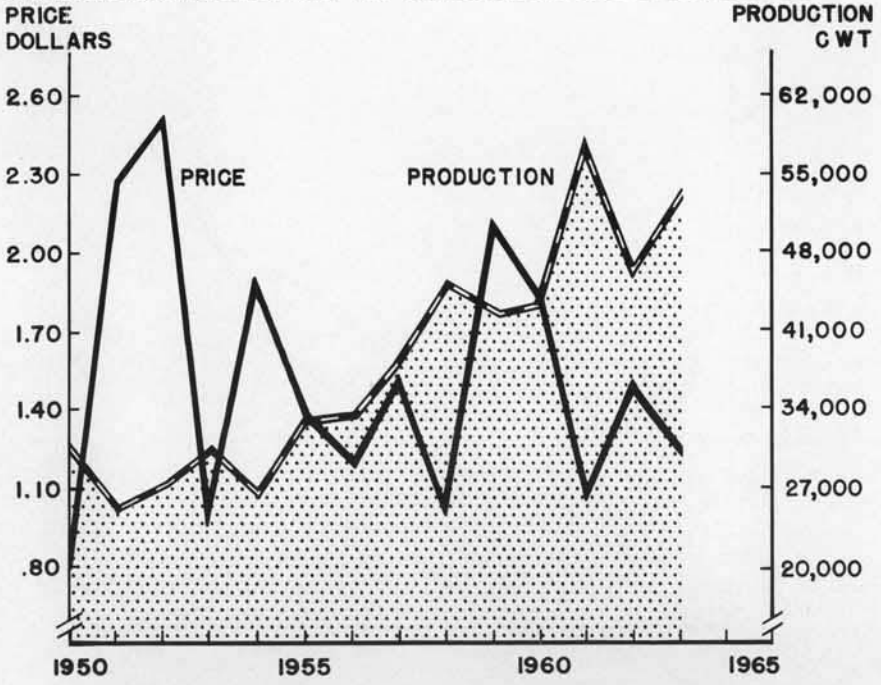
A question which is important in the management function but which is not answered here is, at what point would more equipment be justified to offset the possibility of a loss. For example, if unfavorable weather prevailed during the first half of the harvest period when would the purchase of additional equipment be justified to save part of the crop? The answer to this would relate to the cost of the machinery involved and the value of the crop. In many cases it may be justified even though the farm appeared to be over mechanized.

POTATO PRODUCTION — HIGH RISK ENTERPRISE

Even though potato production has been expanding and is one of Idaho's most important crops, much risk is involved in this enterprise. Cold or unpleasant weather is often associated with potato planting and sometimes with harvesting. Potatoes are sometimes retarded by frost in the early summer. On occasions they are frozen in the ground before they can be harvested. They can also deteriorate in storage due to rough handling or inadequate storage facilities. Insects and disease are also hazards to potato production but new sprays and techniques have somewhat reduced these. Also, use of certified seed has helped to reduce disease problems.

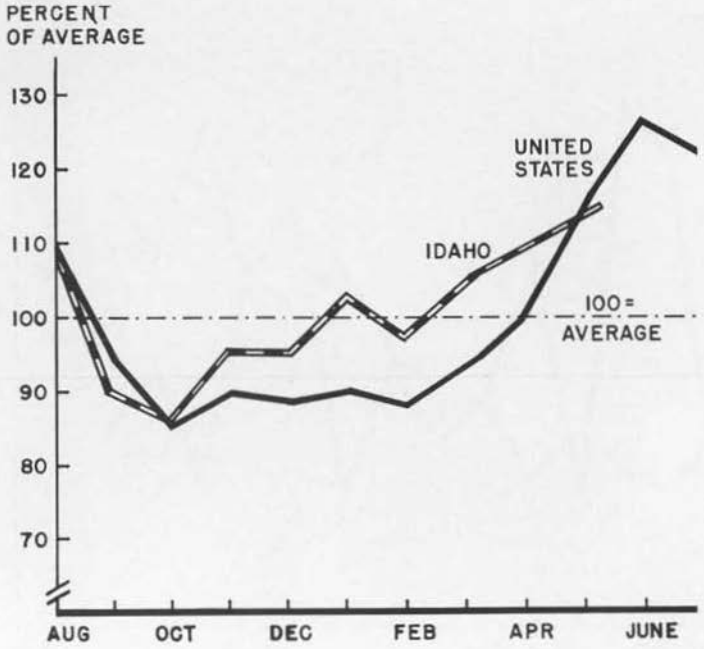
1 Sparks, W. C. et. al. **Idaho Potato Storages,** Idaho Agricultural Exp. Sta. Bul. 410, Moscow, Idaho, September, 1963.

Figure 3. Average production and price for potatoes in Idaho, 1950-63.



Probably the greatest risk of all, however, is that of changing price. Potato prices are noted for their wide fluctuations during the storage season and between seasons. Historically potatoes have had a rather inelastic demand, meaning that people tend to buy rather fixed quantity of potatoes whether the price is high or low. When the supply has been small, prices have tended to be high. On the other hand, a large supply is associated with low prices. Figure 3 illustrates price and production relationships for Idaho. Note the inverse relationship between production and price. To get the full picture, however, one would need to also look at production in the entire United States since potato production in other areas can also influence the price of Idaho potatoes.

Figure 4. Average seasonal price variation for Idaho and the United States, 1959-63.



SEASONAL PRICE FLUCTUATIONS

Prices also fluctuate within the storage season as well as between seasons. Figure 4 illustrates average seasonal variation for Idaho and the United States, 1959-1963. As would be expected, the highest price occurs at the end of the storage season in April and May and the lowest price at, and soon after, harvest. One should be cautious using the average variation as a guide, however, since any one particular year may vary considerably from the average sitution. Prices vary not only because of conditions occurring in the state but also those in other potato producing areas.

APPENDIX

Table 6—Hours of Equipment Use, Repairs, Labor and Material Required Per Acre for Potato Production, Southcentral Idaho, 1962

Operation	Hours of Equipment Operation	Equipment Repairs	Tractor Repairs	Labor		Materials				Other Material
				Equipment Operator	Other	Diesel Fuel	Gasoline	Grease	Oil	
	Hours	Dollars	Dollars	Hours	Hours	Gals.	Gals.	Lb.	Qts.	
Pre-irrigation corrugation	.28	.025	.079	.293	.....	.487	.....	*	.034	
Fertilizing[1]	(Custom application)									595 lb. 16-20-0
Plowing	.63	.400	.177	.670	.....	1.890	.....	.019	.076	
Disking and harrowing	.26	.070	.073	.277	.....	.694	.....	.008	.031	
Cutting potato seed[2]	(Custom rate included in seed price)									14.1 cwt of seed
Trucking seed to planter	10.	.186	.....			.....	.423	.017	.190	
Planting seed	.69	.420	.195	.745	.690					
Harrowing for weed control	.19	.005	.039			1.640	.....	.048	.083	
Three cultivations	1.29	.245	.364	.199	.....	.350	.....	.....	.023	
Ten irrigations[3]	.44	.250	.....	1.360	.....	2.245	.....	.013	.159	
Ditching	.03	.005	.008	.....	3.800	.....	.800	*	.009	
Burning and spraying ditches	---	.....	.....	.031	.....	.039	.....	*	.004	
Spraying for beetles[4]	(Custom application)			.....	.190	.....	.....	.....	.....	Fuel for burner Spray Mat.
Rolling potato field	.22	.013	.045	.230	.....	.220	.....	*	.027	
Vine elimination	.47	.760	.133	.499	.....	.799	.....	.014	.057	
Harvesting potatoes	1.40	1.900	.395	1.528	4.200	1.820	3.640	.140	.338	
Hauling potatoes to cellar	1.43	1.149	.....	4.200	.....	.....	1.794	*	.194	
Putting potatoes in storage	11[5]	.217	.022	1.400	1.400	.487	.....	.040	.034	
Farm operator transportation	.67	.218	.....	.....	.....	.....	1.330	*	.015	
Total	8.21 hr	$5.863	$1.530	11.432 hr	10.280 hr	10.671 gal.	7.987 gal.	.299 lb.	1.274 qt.	

1 Fertilizer application $1.50 per acre.
2 Cutting and treating $.31 per hundredweight
3 One pre-plowing irrigation and 9 during growing season
4 Custom spraying $2.75 for material and application
5 This was the time spent by a tractor and scraper removing dirt from cellar. Potato piler operation was not included.
* Too small to measure or not available

Table 7—Prices of Potato Production Resources Used in Calculations of this Bulletin, Idaho, 1962

Item	Unit	Price Per Unit
Equipment Needs:		
Diesel fuel	gallon	$ .168
Gasoline	gallon	.203[1]
Grease	pound	.240
Oil	quart	.350
Equipment Repairs[2]		
Tractor (50-60hp)	hour	.282
Tractor (40-50 hp)	hour	.204
Two-way 3 bottom plow	hour	.582
Tandem disk	hour	.260
4 sections of harrow	hour	.007
Tool bar, shanks & shovels	hour	.090
Ditcher	hour	.170
2-ton truck	load	.750
Bulk potato bed	load	.383
Stub piler	cwt	.006
2-row planter	hour	.610
2-row cultivator	hour	.190
Potato roller	hour	.060
Potato piler	cwt	.001
Scraper	hour	.060
Pickup	mile	.015
Vine eliminator	hour	1.620
2-row digger	hour	.450
2-row indirect harvester	hour	1.200
2-row direct harvester	hour	1.360
2-row independent harvester	hour	2.520
Labor	hour	1.50
Materials:		
Fertilizer (16-20-0)	lb. available	.125
Potato seed	cwt	3.650
Services:		
Custom fertilizer application	acre	1.500
Custom spraying	acre	2.750
Irrigation electricity	acre	9.520
Custom potato hauling	cwt	.092
Storage	cwt	.050

[1] Price after Federal and State Highway taxes are deducted.

[2] Repairs are for fixed resources on a 220 acre potato enterprise.

Source: Moller, Kurt L. **Cost Economics Associated with an Increase in Size of Potato Enterprise on Pump Irrigated Farms in south-central Idaho.** Unpublished master's thesis in Agricultural Economics, University of Idaho, Moscow, 1963.

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