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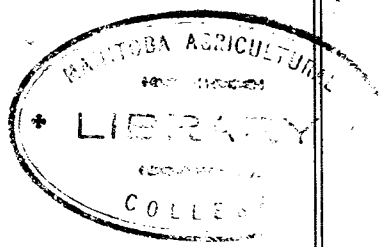
COST OF PRODUCING CROPS ON IRRIGATED FARMS

BY R. T. BURDICK AND H. B. PINGREY



In Cooperation with Division of Farm Management and Costs, Bureau of Agricultural Economics, U. S. D. A.

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COST OF PRODUCING CROPS ON IRRIGATED FARMS

By R. T. Burdick and H. B. Pingrey

In the spring of 1922 the Colorado Agricultural Experiment Station in cooperation with the United States Department of Agriculture, began a detailed study of irrigation farming in Northern Colorado. Weld County was chosen because of the wide selection of enterprises possible in the area. The results of the first 4 years' work were published as Colorado Station Bulletin 318. The cost of producing crops, the reasons for variation in costs and the use of costs as a guide to future farming plans are discussed in this bulletin.

Precipitation.—The rainfall each month and yearly totals are shown in Tables 1 and 2. The Greeley and Windsor records are not available prior to 1924.

It is customary to rely upon rainfall during the spring months to give sufficient moisture to start crops. Consequently, when the spring rainfall is abnormal many seedings fail to germinate. The rainfall in April, 1925, was 0.1 inch in Fort Collins, .06 in Greeley and .05 at Windsor. Following that about 1 inch fell in May. The normal for these 2 months is 4.95 inches, while about 1 inch actually fell. By the time the farmers realized the situation it was so late that sugar beets would make a poor yield if they were irrigated up, so many acres were abandoned and put into other crops.

The rainfall by months is an example of the factors which farmers cannot control. In 1923 there was so much rain and snow in February, March and early April that all spring work was delayed. The other years were about normal for spring work.

Hail.—This section of Colorado suffers frequently from severe hail storms. These are usually local in nature, damaging only a few square miles at any one time. In 1922 one or two farms just starting in to keep records on this project were so severely hailed out that they withdrew. Other farms were hurt to a less extent.

Note: The authors wish to express their appreciation for painstaking work performed in computing these records by the following members of the research staff of the Department of Economics and Sociology: Edna Bigelow, Ethel M. Barnhart and Nan Paterson; also to two field men who assisted part of the time, George Knutson and Chas. H. Russell. The farmers who gave so freely of their time and patience in getting the field records deserve special mention. Without their aid this work could not have been done. The following had records one or more years: E. R. Bliss, R. Bliss, R. Clark, B. A. Colwell, O. Erickson, J. Flint, W. B. Gress, W. J. Harding, A. S. Harris, J. Haythorn, O. Hurick, T. Ireland, G. Johnson, J. Kaufman, E. J. Kellogg, A. D. King, A. Lair, R. E. Larkin, A. A. Leafgren, S. A. Lindblad, C. Magnuson, H. Magnuson, C. Meyer, J. Mills, W. H. Monfort, G. E. Nelson, J. McCullough, T. J. Nix, M. N. Robinson, C. H. Russell, J. Rutz, J. Thompson, J. Tinsman, G. P. Watson, R. Wilson, E. L. Wrighton.

A 16-ton beet crop secured by irrigating early in May, 1925.

In 1927 a very severe hail cut a swath from one end of the area to the other, damaging more crops than almost any hail storm on record. The men in this study were not in the direct path of this particular storm, but several of them suffered considerable damage.

Individual farms suffered damage from hail in other years—1923, 1924, 1925 and 1928.

Some farmers can count on being hailed out every year. Several men in this study were hailed out three different years so that crop yields were noticeably reduced. Few total crop failures resulted from hail except in the case of potatoes and grain.

Table 1.—Ten Years' Rainfall, Fort Collins, 1919 to 1928, Inclusive[1]

	PRECIPITATION										
Month	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	Normal
Jan. ...	T	0.54	0.96	0.35	0.19	0.51	0.27	0.25	0.04	0.26	.43
Feb. ...	0.30	0.64	0.19	0.53	1.39	0.54	0.09	0.28	0.40	0.52	.62
Mar. ...	1.65	0.14	0.13	0.36	2.74	1.83	0.58	1.54	1.87	1.38	1.01
Apr. ...	0.93	3.60	1.71	2.80	2.18	0.93	0.10	2.99	2.69	0.98	2.12
May ...	0.45	1.95	1.97	0.87	4.46	3.90	1.18	1.76	0.91	3.55	2.83
June ...	0.19	0.60	3.66	1.03	6.23	0.22	1.50	1.58	2.17	2.73	1.60
July ...	0.64	0.58	1.40	0.80	4.50	0.21	1.85	0.93	2.19	0.83	1.83
Aug. ...	0.61	1.72	2.55	0.73	0.62	0.05	1.32	0.86	2.10	0.69	1.19
Sept. ..	2.61	0.60	0.68	0.02	1.36	0.84	1.96	1.03	1.10	0.09	1.28
Oct.	1.93	0.50	0.37	0.74	3.55	0.78	3.26	1.15	1.05	1.50	1.16
Nov. ...	1.22	0.24	0.32	1.44	0.10	0.09	0.89	0.36	1.00	1.15	0.47
Dec. ...	0.39	0.54	0.89	0.31	0.25	0.74	1.50	0.83	0.25	0.06	0.49
Yearly	10.92	11.65	14.83	9.98	27.57	10.64	14.50	13.56	15.77	13.54	15.03
Percentage of precipitation of total Mar. to Sept. incl.)	64.8	78.8	81.7	66.2	80.1	75.1	58.5	78.8	82.7	74.2	78.9

[1]Robert E. Trimble, The Climate of Colorado, Colo. Bul. 340.

Table 2.—Five Years' Rainfall, Greeley and Windsor[1]

Month	GREELEY					WINDSOR				
	1924	1925	1926	1927	1928	1924	1925	1926	1927	1928
Jan.	....	.21	.27	T	.08	....	.15	.22	T	.15
Feb.	.49	.05	.25	.63	.15	.46	.01	.20	.47	.03
Mar.	1.45	.26	.35	1.75	.54	.88	.30	1.33	1.34	.65
Apr.	.84	.06	1.03	2.34	.87	.66	.05	1.67	1.32	.75
May	2.59	1.01	.97	.88	2.87	3.38	.98	1.88	.69	3.68
June	.38	3.09	1.44	2.78	6.04	.14	1.89	1.70	1.38	1.73
July	.05	1.76	1.82	2.29	2.78	.50	2.17	2.69	2.86	.78
Aug.	T	4.25	.59	1.32	1.39	.01	2.36	1.14	1.16	.38
Sept.	1.88	.22	.94	.46	T	1.76	2.12	.94	1.25	T
Oct.	1.04	3.05	1.71	.23	.51	1.00	2.01	1.02	.58	2.06
Nov.	....	.66	.55	1.50	1.05	.04	.43	.17	.79	.35
Dec.	.80	1.27	1.10	.05	.01	.37	.33	.84	.11	.05
Yearly	9.52	15.89	11.02	14.23	16.29	9.20	12.80	13.80	11.95	10.61

[1]Courtesy Great Western Sugar Company.

Irrigation

In general, water is supplied by irrigation companies to their share holders about May 1. No exact date can be secured since the moisture conditions in the valley and storage conditions in the mountains affect the initial delivery of water any particular year. Furthermore, there are some ditch companies that have direct appropriations from the main river during the entire season and make delivery of water a few days to a week previous to May 1.

The large ditch companies have, in addition to some direct appropriation from the river, storage facilities for late irrigation. Late irrigation, principally of row crops, begins about July 15. From this date on the main irrigation water supply is furnished by storage lakes and reservoirs which have been filled during the flood stage of the river. The discharge from the river varies from year to year and depends upon the amount of snow on the upper slopes of the drainage basin and upon the rapidity with which this snow melts.

History of Ditches[2].—The Larimer and Weld ditch was incorporated in 1879. Water rights call for a continuous flow of 144 second feet thruout the season when water is available in rivers. Considerable land under this system is susceptible to irrigation and as the supply tends to be limited, the value of irrigation stock has therefore increased considerably.

The carrying capacity of this ditch is 750 second feet. The main canal is 40 miles long. The canal is divided in to 3 sections. The company controls only the main ditch and delivers water to the laterals owned and controlled by separate companies. No records are kept of water delivered from direct appropriations.

[2]U. S. D. A. Bul. 1126, Irrigation in Northern Colorado, p. 30.

Storage or reservoir water may be drawn when 250 rights are called for and delivery stops when demand drops to 200 rights.

The Larimer County or Water Supply and Storage ditch was organized in 1880. The water supply direct from the river was not sufficient and steps were taken early in its history to construct storage facilities. In 1892 it was reorganized as the Water Supply and Storage Company with 600 shares. Assessments have been approximately $150 per share for the last 20 years. Recently this was increased slightly to complete another storage reservoir. The system includes 11 reservoirs with 4 canals tapping watersheds which are directed into the Poudre Valley shed. These waters are diverted into Chambers Lake, the present large storage reservoir. Water in this ditch runs continuously so long as there is water in the ditch for direct irrigation, that is, the flow of water is not intermittent after it is once determined when the water is to be turned out. The policy of the company has been to so gauge the flow of water during seasons by reducing the number of inches per share as to prolong the irrigation as climatic and seasonal conditions demand.

Pump Irrigation.—Irrigation by pumping is relatively unimportant in the Eaton and Greeley area. A few farms located west of Eaton and Greeley have installed wells from which irrigation water is pumped. The main reason why such wells are so few in number is the extremely high cost of digging and operating such wells and the risk that they may later cave with a complete loss of capital invested. A few wells for irrigation are found east of Eaton and near Galeton. In this section the water-table rises close to the surface and the cost of installation and operation is considerably less than that territory west of Eaton.

Pump irrigation has various economic aspects which should be given careful consideration. Water at any time may be had for irrigation and several hundred dollars may be made in a given year by being able to irrigate at the proper time. Especially is this true during dry seasons or a droughty spring. Furthermore, the water may be applied or withheld from any crop at the convenience of the producer. It often happens that some farmer may be decidedly busy with important farm operations which must be dropped for the time being in order to use ditch water for irrigation regardless of the actual need of his crops for moisture; otherwise the water is a total loss. He may not be able to secure water for a week or 10 days later and during a portion of this time the crops may have suffered considerably.

Irrigation Practice.—The effective use of irrigation water is one of the most important problems which confronts the farmers. As

the irrigated area tends to increase, the amount of available water per acre of irrigated land tends to decrease. It is therefore important that the farmer should have a knowledge of soil types, the water requirements of different crops, and finally, the proper time to apply water to each crop in order that the greatest yield be secured with the minimum amount of water.

The time of irrigation is largely influenced by the amount of natural precipitation which falls and its general distribution. Well-distributed showers during March and April are generally sufficient to germinate the seed and supply soil moisture until the early part of May. Careful preparation of the seedbed aids in preserving the soil moisture and making it available for plant growth. A definite plan of the farm operations aids the farmer in timely cultural practices which serve to conserve moisture for plant nourishment.

The application of water to crops is therefore in a sense within the control of the individual farmer. In another sense it is without his control in that the water is not available to the grower at such times and in such quantities as he may desire.

The practice of the irrigation companies is to turn water thru their ditches only after a certain number of shares have been ordered. This practice has been made necessary in order to escape as large a loss of water as possible by evaporation and seepage from the carrying canal or ditch. Therefore the availability of irrigation water is governed not by individual needs of any particular grower but by a group of growers. Local showers extending over a relatively small area of a few miles may supply sufficient moisture for a week in that area and yet crops may suffer for water in the surrounding area, in so far as the same ditch serves the two areas, because sufficient shares of water are not ordered in the company's office.

Influence of Soil on Irrigation Practice.—Soil type is also of importance. Some soils retain but a small portion of the water supplied to them. Sandy and gravelly soils are of this type. Crops on these soils may suffer severely unless lying under ditches that have early priority rights in the river. A knowledge of the distribution of natural precipitation in the early growing season and planting in accordance with the distribution and the general time of delivery of irrigation water will aid in eliminating any great and unnecessary risks.

The silt and clay soils being more retentive of the water applied need not have as frequent irrigations as the sandy soils. It is the need for more frequent irrigations upon sandy soils that has been of prime importance in the development of pumping plants. Practically all irrigation pumping has been developed on the lighter

soils. However, timeliness of plowing and other seedbed operations are highly important to successful farming and the distribution of the available supply of irrigation water thruout the season.

Time of Irrigating Crops.—Farmers have learned by experience when to apply water to crops to secure the greatest efficiency. This does not necessarily mean that all crops are irrigated at the proper time or at the critical period in the growth of the plant. What is meant is that farmers tend to irrigate those crops which make the best use of the water at the time it is available and at the same time allow for an even distribution of labor.

As a result alfalfa is the first crop to be irrigated. The earliness of the plant, the relatively large total leaf surface and rapid growth of the plant necessitate early application of irrigation water. Following the irrigation of the alfalfa crop small grains are irrigated for the first time at the jointing stage to secure the highest yield. Sometimes two irrigations are necessary, depending on climatic conditions. The second irrigation is generally at the filling stage. This irrigation may not be necessary some years for the crop itself but is made necessary if a succeeding stand of alfalfa is to be secured, the alfalfa being planted with the grain crop in the early spring. Too early irrigations at the germination or the filling stage produce a poor quality of grain.[1]

The irrigation of row crops, potatoes, beets and corn, as a general rule, begins in July and continues thruout the season at intervals of a week to 10 days apart until September. Corn is irrigated twice to three times, depending on climatic conditions. Beet and potato irrigation occurs at frequent intervals, depending on climatic conditions, type of soil and practice of irrigating, whether alternate rows or every row is irrigated. The common belief among farmers is that by withholding water from the beets, forcing the root to penetrate deeper, larger beets and increased tonnage is secured. This practice is questionable as it may result in a severe setback to the plant. It can be generally said that in so far as yield of beets depends upon irrigation practice and an optimum moisture content of the soil, the situation is largely within the control of the grower.

The first irrigation of potatoes after planting is generally at the time the tubers begin to set. This is largely dependent on climatic conditions affecting growth and date of planting. Infrequent rains after the tubers have set is desired by most potato growers inasmuch as they can control irrigations and thereby increase the quality of the tubers. A relatively dry period during the ripening stage

[1]Critical period of applying irrigation water to wheat. Kezer and Robertson. Journal of American Society of Agronomy, Vol. 19, No. 2, Feb. 1927.

is desirable since too great an amount of moisture results in a second growth which is detrimental to a high quality of potatoes.

Size of Farm

Table 3 shows the average areas of each farm for the period studied, with the area in each important crop. Corn, cabbage and peas were included in the column of miscellaneous crops. In most cases the size of farm was constant for the period. But in several cases the farm area was increased. The average shown for such farms is somewhere between the small and the large acreages that existed for individual years. Farms 11 and 17 increased their acreage, farm 13 both increased and decreased the acreage.

Five farms grew no potatoes during the period of this study. Three of these were on heavy soil, the other two had records for only 1 year.

Six men grew no sugar beets, largely for personal reasons.

The area of pasture is comparatively small. Many farmers have given permanent pastures serious consideration within the past few years since the alfalfa crop has tended toward lower yields. Some saving may be secured by planting 5 or 10 acres of permanent pasture inasmuch as the labor necessary to cut, rake, stack and haul alfalfa to stock kept in a dry corral is eliminated during the summer season. Furthermore, stock run on green pasture will not require the same amount of concentrates that is required on dry feed. Stock is also less subject to disease.

Little information of value concerning pastures was secured by the end of the year 1927. The general tendency seemed to be to pasture too soon and too heavy. On one farm the pasture was ruined by overgrazing. As experience is gained, undoubtedly permanent pastures will occupy a larger place in the plans of farmers in this area.

Table 3.—Average Area Each Crop Per Farm for Years 1922 to 1927 Inclusive

Farm No.	Number years	Total farm area	Crop area	Alfalfa	Barley	Oats	Wheat	Beans	Beets	Potatoes	Misc.	Pasture	Waste
1	5	79.4	75.72	27.46	3.90	7.20	3.31	.....	3.40	17.39	13.06	.74	2.94
2	4	81.1	72.27	23.46	.....	7.59	12.41	22.15	3.72	2.67	.26	1.93	3.15
5	6	159.07	150.75	44.87	13.77	.....	17.79	9.61	17.31	32.53	14.75	.....	8.32
6	4	121.57	97.94	30.69	.....	16.61	.....	15.84	.....	18.16	16.65	17.46	6.17
7	2	62.66	59.38	19.54	.....	.....	10.74	.....	5.61	9.16	14.31	.....	3.28
8	2	181.02	166.74	63.85	2.83	6.21	26.40	4.74	10.30	13.41	39.00	.....	14.55
11	6	139.63	135.60	42.30	.....	8.75	18.50	12.68	26.65	26.61	.08	.....	4.03
12	5	330.37	313.74	89.69	43.47	23.02	10.85	1.76	55.45	80.34	8.56	3.04	19.59
13	6	317.73	242.11	83.68	54.51	.41	.....	7.28	36.20	60.04	.....	.....	75.62[1]
14	3	229.93	219.13	77.35	22.69	4.28	20.42	7.61	34.77	29.18	22.87	.....	10.80
15	2	157.23	142.38	47.80	27.60	3.25	.....	.....	21.69	42.04	.....	.....	14.85
16	2	137.63	132.99	27.45	42.74	.....	.....	.....	22.02	40.78	.....	.....	4.64
17	6	208.31	193.21	73.58	50.48	11.36	1.35	8.64	42.04	4.91	.84	.53	14.74
18	2	92.99	88.45	32.77	22.76	.....	.....	.54	9.70	19.13	3.55	.....	4.54
20	3	184.95	165.00	52.27	17.78	1.33	22.58	2.00	48.63	14.64	5.74	.....	19.95
21	2	153.42	130.04	40.29	17.12	8.99	16.72	.....	.....	33.92	12.99	16.34	6.84
24	2	154.06	144.55	53.72	.....	.....	40.97	.....	.....	27.54	44.62	4.19	5.32
25	6	117.61	112.56	35.82	6.03	5.96	9.92	15.63	17.32	20.07	1.81	.....	5.05
26	6	153.59	138.58	37.93	18.39	14.60	6.86	4.82	29.56	23.94	2.67	8.46	6.55
27	6	112.43	74.44	18.33	13.41	.....	4.03	6.65	16.86	4.34	10.82	30.12	7.87
28	6	111.13	91.14	39.79	1.87	.....	16.16	.....	2.19	21.71	9.44	3.42	16.56
29	6	146.52	123.57	54.75	10.10	10.23	12.78	2.59	.....	26.58	6.56	11.75	11.20
31	4	204.24	192.47	66.58	7.99	8.51	10.62	9.87	52.97	30.84	5.08	3.87	7.90
32	1	158.57	152.24	30.69	33.12	27.55	.....	6.31	27.91	22.10	4.56	.....	6.33
33	4	160.75	151.17	66.00	19.50	2.16	.....	8.63	39.39	7.49	7.98	.45	9.13
34	4	160.14	143.27	36.41	36.54	.....	.....	.....	51.68	.....	13.64	11.57	5.30
35	2	180.00	144.49	71.09	12.36	.....	39.93	.....	16.06	.....	5.03	9.71	25.80
36	1	127.00	103.50	76.00	10.00	9.50	8.00	.....	.....	.....	.....	15.00	9.00
38	3	220.00	209.12	59.97	10.82	10.96	19.75	19.29	29.81	39.05	9.47	.....	10.88
39	3	80.00	78.15	6.40	9.75	7.83	2.23	2.67	24.62	14.41	10.25	.....	1.85
40	3	170.00	152.18	36.79	9.48	19.39	.....	.....	37.94	33.85	14.73	.....	17.82
42	2	80.00	78.56	38.20	13.05	1.86	6.01	.....	17.03	2.40	.....	.....	1.44
43	1	150.00	140.00	25.00	20.00	.....	24.00	.....	71.00	.....	.....	.....	10.00
45	1	115.76	111.87	.....	.....	40.02	.....	25.58	46.27	.....	.....	.....	3.89
	Percent		100.00	32.73	12.07	5.03	6.85	4.61	16.56	16.44	5.68		

[1]Includes land rented out.

Methods of Handling Factors of Cost

Man Labor.—The costs shown represent in each case the actual costs of man labor on the farms growing each crop. This method was followed because there was no basis upon which uniform rates could be developed at the start of the project.

The results on 123 total records for the period studied show that man labor cost 32.8 cents per hour. There was some variation from year to year. The highest yearly rate was in 1924 with 34.0 cents, the lowest was in 1927 with 29.92 cents. The variation between individual farms was widest in 1922 when one farm had a labor cost of 24.8 cents per hour while another farm showed a cost of 48.25 cents per hour. This was the highest rate on any farm any year.

These variations in the cost per hour of labor are due to many causes. Some farmers were able to hire help at lower rates per month; some paid high wages; some farmers worked long hours; some failed to report all their time on miscellaneous jobs around the farm; some hired almost all their labor; some did most of the work themselves. All these things affect the labor cost per hour. By using a uniform rate of 32.8 cents per hour for man labor in all the tables shown in this study, one can quickly note the effect upon total cost per acre or per unit of crop.

For the individual farmer there is a value in comparing his actual labor costs with the 7-year average. He can see whether his labor is costing more or less than is typical for the region. For example farm 5 had a labor cost per hour below the average each year for 6 years out of 7. The saving which he made amounted to $300 per year compared to labor at the average rate per hour or 11.16 percent less than the average cost on all farms. Farm 26 secured labor for $360 per year less than the average or 11.9 percent saving per year for the 7 years.

Contrasted with these two farms, farm 13 had a labor cost of $432 per year higher than the average of all farms, due to the fact that his cost per hour of man labor was 12.46 percent higher than the 32.8 cents average for all farms. Farm 28 had $190 more labor each year than the average or 15.46 percent increased labor cost per hour.

Farm 13 gets greater efficiency from labor because more time is spent in supervision of that labor. This becomes increasingly necessary as the size of plant or organization becomes greater or larger. Tools and machinery are kept in repair by the operator so that when hired men enter the field more ground is actually covered in a given time.

The actual cost per hour of man labor for each year is shown in Table 4. By comparing this rate with the 7-year average of 32.8

cents, one can find the saving or loss on each farm. Where labor rates are higher than the average they should be compared with the cost per hour of horse labor and then the total cost of man and horse labor per acre should be studied. A farmer with high costs per hour of man labor but with a low cost per acre is apparently using his labor more effectively.

In the case of farm 5, man labor cost 11.16 percent less per hour than the average on all farms. On the three crops—potatoes, sugar beets and alfalfa—the operator of this farm spent 7.3 percent more hours per acre than the average, making his actual labor cost in dollars just a little below average. Farm 13 had 12.46 percent more cost per hour of man labor than the average, but spent 19.8 percent less hours per acre on potatoes, sugar beets and alfalfa. The actual cost of labor per acre on these crops was less than the average. Apparently this operator used high-priced labor, but used it more effectively than the average.

Farm 26 had labor costs per hour 11.9 percent below the average. The hours per acre on potatoes, sugar beets and alfalfa were 16.8 percent above the average. Here was a case of low-cost labor, but to offset that more hours were required.

Table 4.—Cost per Hour of Man Labor for Each Farm Each Year Studied

Farm No.	1922	1923	1924	1925	1926	1927	1928
1	$.3213	$.3080	$.3846	$.5055	$	$	$ ....
2	.3963	.4613	.4340	.4265	....	....	....
5	.2655	.2426	.3080	.3116	.3061	.3085	.3108
6	.3177	.3441	.3490	.3500	....	....	....
7	.4065	.3867	....	....	....	....	....
8	....	.4100	....	.2810	....	....	....
9	.2480	....	....	....	....	....	....
11	.3581	.3056	.3074	.3682	.3361	....	....
12	.3303	.3204	.3520	.3809	.3360	....	....
13	.4825	.4015	.3618	.3591	.3785	.2982	.3423
14	.2934	.3513	.4260	....	....	....	....
15	.3673	.3129	.3300	....	....	....	....
16	.3515	.2726	....	....	....	....	....
17	.3153	.2963	.3054	.3540	.4155	....	....
18	.2892	.2882	....	....	....	....	....
20	.3461	.3446	.3240	....	....	....	....
21	.2495	.2429	....	....	....	....	....
24	.4392	.3076	....	....	....	....	....
25	.3193	.3455	.3056	.3537	.3811	....	....
26	.2930	.3164	.2611	.3165	.3227	.2358	.2729
27	.2549	.2466	.2831	.2739	.2764	.2404	....
28	.3809	.4104	.3906	.3699	.3660	.3711	.3563
29	.3810	.3747	.3687	.3846	.4470	....	....
31	....	....	.3179	.2563	.3110	....	....
32	....	....	.3996	....	....	....	....
33	....	....	.3621	.2491	.2987	.2964	....
34	....	....	.3936	.2552	.2810	.2868	....
35	....	....	....	.3587	.3820	....	....
36	....	....	....	.3442	....	....	....
38	....	....	....	.3878	.3450	.3578	.3271
39	....	....	....	.2765	.3220	....	....
40	....	....	....	.3146	.2150	.3177	.3092
42	....	....	....	....	.3350	.2333	.2295
43	....	....	....	....	.3580	....	....
45	....	....	....	....	....	.3106	....
Yearly Average	.3251	.3240	.3406	.3317	.3377	.2992	.3113

The farmers worked about 3,000 hours per man per year as shown by Table 5. A few men who did not feed livestock in the winter months worked less hours each. Practically all the men who made good profits worked long hours. Three thousand hours is equivalent to 25 days per month at 10 hours per day, or 300 days in a year. Few industries can show as high or uniform a labor record for their working force. This is one of the items that causes farmers to compare their business with industry, and ask why industry should pay better wages.

Table 5.—Hours Worked Per Man Per Year

Farm No.	1922	1923	1924	1925	1926
1	3516	3929	3528	2504	....
2	2436	2383	2387	2160	....
5	3153	3095	3556	3326	3355
6	2234	2456	2521	....	....
7	2208	....	....	....	....
11	3034	3407	3115	3110	3794
12	3343	3268	3322	3214	3143
13	2536	3021	2977	2893	3160
14	3463	....	2732	....	....
15	3159	3333	....	....	....
16	2434	....	....	....	....
17	3092	3277	3388	3286	2985
18	3755	....	....	....	....
20	3019	3075	3282	....	....
21	3622	....	....	....	....
24	2696	....	....	....	....
25	3305	3074	3130	2959	2886
26	3227	3382	3632	3309	3126
27	3931	3498	3678	3643	4097
28	2482	2413	2426	1521	2489
29	2468	2620	2200	2538	2765
31	....	....	3393	2760	3190
32	....	....	2641	....	....
33	....	....	3575	3743	3396
34	....	....	3227	3080	3263
35	....	....	....	3057	3190
36	....	....	....	2174	....
38	....	....	....	3647	3128
39	....	....	....	2874	4661
40	....	....	....	3137	3445
42	....	....	....	....	3407
43	....	....	....	....	3252
Average per farm	3005	3082	3090	2947	3302

Horse Labor.—The method of handling the cost of horse labor was the same as for man labor. The 7-year average on 123 records shows that an hour of horse labor cost 14.05 cents. The year 1925 had the highest rate of 15.36 cents and 1927 had the lowest of 11.99 cents. In 1922 the range in cost on individual farms was from 7.63 cents to 29.46 cents.

To a considerable extent this variation is due to the number of hours worked per horse. For the same four farms discussed under man labor, a 7-year average shows the following results:

Table 6.—Relation of Hours Worked Per Horse on 4 Farms to Cost Per Hour

Farm No.	Hours worked per horse	Cost per hour	Percent saving in horse labor compared to average	Percent extra cost of horse labor compared to average
13	1231	$.1143	18.84	....
5	982	.1279	9.19	....
26	735	.1869	....	32.75
28	493	.2130	....	51.30

Farm 13 saved $363 per year on horse labor when compared to average costs. Farm 5 saved $116 per year. Farm 26 had $357 greater cost of horse labor per year compared to the average while farm 28 had $203 extra horse cost. Table 7 shows the cost per hour of horse labor on each farm each year.

Table 7.—Cost Per Hour for Horse Labor for Each Farm Each Year Studied

Farm No.	1922	1923	1924	1925	1926	1927	1928
1	$.1492	$.2378	$.2408	$.2414	$	$	$ ....
2	.2503	.1996	.2523	.2451	....	....	....
5	.1348	.1434	.1259	.1177	.1143	.1182	.1475
6	.2172	.1747	.1690	.1455	....	....	....
7	.2946	.1835	....	....	....	....	....
8	....	.2041	....	.0902	....	....	....
9	.1743	....	....	....	....	....	....
11	.1224	.1155	.1223	.2234	.1140	....	....
12	.0996	.1126	.096	.1234	.1249	....	....
13	.1922	.0965	.1454	.1160	.1029	.1050	.0837
14	.0763	.1064	.0976	....	....	....	....
15	.1208	.1292	.1187	....	....	....	....
16	.1211	.1397	....	....	....	....	....
17	.1090	.1013	.1330	.1405	.1091	....	....
18	.1466	.1578	....	....	....	....	....
20	.1452	.1007	.1280	....	....	....	....
21	.1286	.1424	....	....	....	....	....
24	.2422	.1356	....	....	....	....	....
25	.1389	.1396	.1398	.1581	.1433	....	....
26	.1562	.1681	.1711	.1807	.2060	.1971	.2703
27	.2265	.1716	.2075	.2145	.1471	.0920	....
28	.1789	.2254	.2446	.2631	.1917	.1990	.2100
29	.1820	.2119	.2282	.2104	.1775	....	....
31	....	....	.1512	.1540	.1380	....	....
32	....	....	.1400	....	....	....	....
33	....	....	.2260	.1531	.1316	.1432	....
34	....	....	.1249	.1778	.1352	.1733	....
35	....	....	....	.1940	.1574	....	....
36	....	....	....	.2350	....	....	....
38	....	....	....	.1210	.1610	.1036	.0990
39	....	....	....	.1997	.2267	....	....
40	....	....	....	.1240	.1162	.0934	.1291
42	....	....	....	....	.1765	.1123	.1720
43	....	....	....	....	.1500	....	....
45	....	....	....	....	....	.0942	....

One of the things that seems to affect the cost of horse labor is the use of a tractor. Several men included in this study purchased a tractor during the years 1924 to 1927.

In 1923 farm 17 secured 1406 hours work from each horse at a cost of 10.13 cents per hour. In 1924 the operator of this farm had a tractor. His horses in 1924 worked 1371 hours each at a cost of 13.3 cents per hour. In 1925 the horses worked 1335 hours each at a cost of 14.05 per hour. This farmer had a high standard of use of horses. The average on all farms showed 874 hours worked per horse in 1923. Farm 17 had 1406. In 1924 the average was 962.

Farm 17 had 1371. In this case the hours per horse were slightly reduced and the cost per hour slightly increased after the tractor was purchased.

Compare this with farm 26. In 1926 and 1927 farm 26 secured about 650 hours of work per horse at a cost of about 20 cents per hour. In the year 1928 the operator of this farm had a tractor. He worked his horses only 588 hours each and it cost him 27 cents per horse hour. Here was a case where the horses had not been used as much as normal. Then a tractor was purchased and the horses remained idle, running up a big feed bill while the tractor was doing the work. Any saving that this farmer might have made by using the tractor was more than lost by the heavy cost of keeping idle horses.

Farm 17 operates approximately 223 acres of land with 5 horses and a tractor. The operator of this farm plants about as many row crops proportionately as the operator of farm 26 who has 10 horses and a tractor. Farm 17 follows a cropping program that necessitates more plowing than farm 26. The operator of farm 26 has potatoes in his rotation and need not plow for beets. Therefore farm 26 does not need a tractor. In addition, this farm is overstocked with horses. The cost of horse labor each year was as follows:

Table 8.—Cost of Horse Labor by Years

Year	Number farms	Horses per farm	Hours worked per horse	Cost per hour	Cost per horse
1922	22	8.2	807	$.1438	$116.20
1923	23	8.2	874	.1338	117.02
1924	20	8.8	962	.1465	140.90
1925	22	8.4	912	.1535	140.07
1926	19	8.8	1077	.1377	148.31
1927	11	8.7	935	.1199	112.13
1928	7	9.0	857	.1355	114.92
Weighted average	123	8.7	921	$.1405	$129.39

The most important method of reducing the cost per hour of horse labor seems to be that of keeping the horses at work. Idle horses cost money. The feed that they consume can be used to a better purpose for cattle or sheep. If there is not enough work to keep them busy it is possible by a little planning to do the work with one or two less horses. The relation between hours worked per horse and costs is shown by the following comparison made for the first 6 years of the study.

Table 9.—Relation of Hours Per Horse to Horse Costs

Hours worked per horse from	to	Av. hours worked per horse	Number farms	Cost per hour	Cost per horse
0	500	446	16	$.1835	$ 81.78
501	700	612	19	.1675	102.61
701	900	795	23	.1364	108.44
901	1100	1010	23	.1228	124.04
1101 and over		1298	35	.1073	139.16

The cost of keeping a horse a year increased as he was worked harder, but not as fast in proportion. Horses in the last group worked 1298 hours each or nearly three times as much as those in the first group. The cost per horse increased about $58 or 70 percent, but the cost per hour was nearly 8 cents less or a decrease of over 41 percent.

Equipment Costs.—The equipment costs in this study have been prorated to each crop on the basis of the number of hours of horse labor spent on that crop. The average cost of equipment per hour for the period studied figured in this way was 6.22 cents. Comparing this with the cost of horse labor per hour (14.05 cents) it shows that equipment costs were about 44 percent as much as horse-labor costs.

For the year 1926 some of the most common machines were studied separately to find the costs for each machine. The averages for all farms for 1926 are shown in the following table. The outstanding thing about this is the small number of hours that any one machine was actually used. Wagons were used 342 hours each per year; beet pullers, 171 hours; plows, 155; while grain binders were used only 44 hours. Many farms had more than one machine. From 30 to 40 acres seemed to be about the limit of area for one machine. Potato diggers cost nearly $1 per acre. Harrows cost only 6 cents. Grain binders cost the most per hour used, 37.95 cents. Wagons cost the least, 6.14 cents.

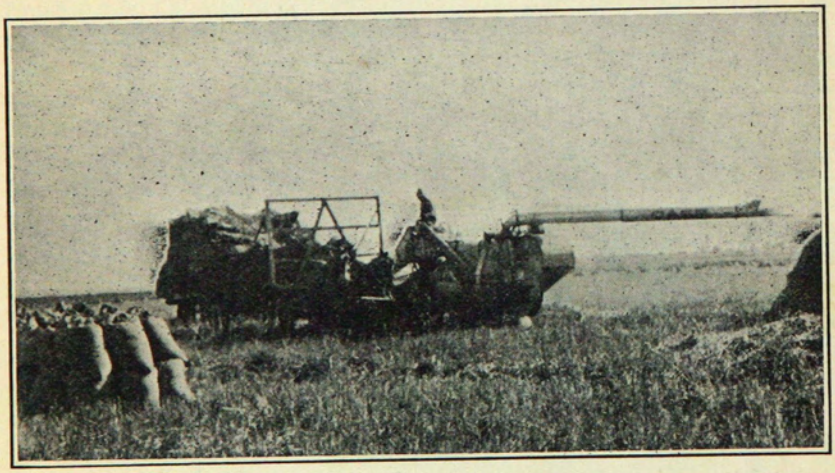
These costs per hour might be used as a guide to the rental value of machinery. On the basis of a 10-hour day grain drills cost $2.80; grain binders, $3.80; and wagons, 61 cents.

The investment in machinery on these farms was between $1200 and $1400. The total annual cost of operating machinery was $431 per year per farm or over one-third as much as the value of machinery.

Table 10.—The Cost and Use of Farm Machinery in 1926 on Weld County Irrigated Farms

Machine	Hours used per mach.	Acres per machine	Cost	
			Per hour cents	Per acre once over cents
Plow	155	38.8	11.38	45.52
Harrows	56	40.7	10.72	6.00
Grain drill	53	52.3	28.04	28.60
Potato planter	58	31.4	25.60	47.10
Sugar-beet planter	48	49.5	33.16	32.50
Sugar-beet cultivator	143	36.6	16.20	13.77
Potato cultivator	118	26.7	7.61	11.49
Mower	74	25.8	20.60	19.98
Rake	25	14.6	34.69	20.12
Binder	44	43.4	37.95	58.06
Potato digger	91	31.5	33.87	98.22
Sugar-beet puller	171	40.5	11.02	46.61
Wagons { 167 on crop / 175 on stock }	342 total		6.14	

Threshing Costs.—Custom rates for threshing varied in the area according to the amount of help furnished with the threshing crew. Where the farmer did his own hauling of grain to the thresher the most common charge was 6 cents per bushel on barley and oats, and 8 cents on wheat. Where the hauling was done by the threshing crew the customary rate was 10 cents per bushel on barley and oats, and 12 cents on wheat.



A small cooperative threshing machine.

A 5-year average on two farms that were part owners of a neighborhood thresher showed that it cost them 10 cents per 100 pounds to thresh all grain. This includes interest and depreciation

on the investment in the threshing rig. With usual weights per bushel that are common for machine measure, namely, 40 pounds for oats, 50 for barley, and 60 for wheat, this gives a cost of 4 cents per bushel of oats, 5 cents per bushel of barley and 6 cents per bushel of wheat. These costs are somewhat less than custom rates where farmers do their own hauling. However, no charge for the men operating the rig is included in this charge. The wages of two men per day for tending the machine would raise these rates, so that there would be very little real saving other than the convenience of threshing when ready.

Tractor Costs.—Tractor operation and charges were kept separate from farm machinery. Twenty-two records scattered thru the years showed that each tractor was used an average of 267 hours per year at a cost of practically $1 per hour. This includes cash costs, depreciation and interest. In 1924 three men used their tractors 353 hours each at a cost of 69 cents per hour. In 1927 two men used their tractors 181 hours each at a cost of $2.50 per hour. Depreciation and interest count up fast on an idle tractor, just as the feed bill counts up on an idle horse.

Irrigation or Water Tax.—The charge for the use of irrigation water was distributed on the basis of the area irrigated once. If potatoes or beets were irrigated five times, they received five times as large a charge per acre as did barley that was irrigated once. Early and late water were not separated in making this charge, as it was practically impossible to keep reservoir and river water charges separate, often with both kinds of water coming thru the ditch at the same time. Consequently the water charges shown on these farms are somewhat less for late crops such as potatoes and beets, than would be the case if they stood the entire cost of reservoir water. The total cost of water per farm was highest in 1925, amounting to $339, and lowest in 1923, being only $187. This coincides with the weather records which show 1923 to be the wettest and 1925 the driest year included in the study. In 1926, which was considered by many to be about ideal for crop growth, the irrigation cost per farm was $311, or 57 cents per acre for one irrigation.

Building Charge.—The use of buildings was distributed on the basis of the value of buildings used by each class of livestock or crop. The residence furnished to beet workers was charged to sugar beets; potato cellars to potatoes, etc. The total annual cost of buildings per farm was usually between $300 and $500. Individual farms varied from this figure due to size of farm or amount of buildings. On the whole these farms were well equipped with buildings.

Overhead Costs.—In checking over the records on these farms

every effort was made to charge labor and expenses directly to the part of the farm business that used them. But there were some items that could not be disposed of that way, or if they were, they resulted in a charge to an unproductive part of the farm business. Labor was used repairing fences, making roadways, or cleaning along ditches and fences; cash was spent for telephone and electric light charges, association dues and items for general farm repair; the auto or truck was used for general farm work. These and similar items represent what is called overhead.

These overhead charges have been distributed to the crops and livestock on the basis of the hours of man labor used by the different enterprises. This method was used because of the ease of checking, because man labor was involved to a large extent in the charges themselves, and because it is one of the methods used for distributing such charges in industry. Any method of distributing overhead is arbitrary and open to some criticism; consequently the effort was made to select a base that could be used by any farmer wishing to compare his own farm with the average shown in this study.

The average overhead per farm and per hour spent on productive enterprises is shown in the following table:

Table 11.—Overhead Charge Per Farm and Per Man Hour

Year	Total overhead charged	Overhead charged per man hour
1922	$386.67	$.0820
1923	434.12	.0822
1924	500.40	.0842
1925	541.75	.0955
1926	718.36	.1074
1927	632.42	.1209
1928	732.28	.1364

At the outset it was thought that the amount of overhead would decrease as the study progressed. Actually it increased. The reason apparently was that more and more detail was secured as the men became familiar with the work, consequently the items of general farm expense were more accurately reported the last years than at first. Also more trucks and autos were used for general use as the years went past. The significant thing is that these overhead items amounted to about one-third as much as the regular labor cost on these farms.

Manure Charge.—The charge for the use of manure was distributed to each crop on the basis of the amount of fertility removed. The value of man and horse labor spreading manure, the use of the manure spreader, and the value of the manure, usually estimated

as $1 per ton, all were added to find the total manure charge for each farm.

The yield of each crop was reduced to tons. For each crop a figure was used[1] that reflected the relative amount of fertility required in its production. This was based on a table prepared by the United States Department of Agriculture showing the relative use of fertility per ton by the important crops. By this method the entire manure charge was distributed each year, and none of it was held over as a deferred charge for the following crops.

The effect of farm manure is seen in crop yields over a period of years. A farm using farm manure consistently shows an increase in crop yields over a period of years. Practically all farmers in this section rotate their crops, if not by a definite area each year, at least according to a general plan of following alfalfa by potatoes, then by sugar beets, then by grain seeded back into alfalfa. Manure is quite generally applied to the sugar beets direct or to the potatoes. Other crops coming after these crops benefit from the residue left in the soil. All the hours of labor and other costs of applying manure are distributed as stated above. This reduced the hours that farmers might show for crops where they have made direct application to some one crop. The actual time spent per acre manuring each crop is shown in Table 38 in connection with the discussion of labor by operations.

Cash Costs.—All the items of cost as used in this study were based on cash out-of-pocket cost plus calculated items. The labor of the operator and his family was charged at current rates for labor. Horse costs include home-grown feeds at their farm value, also interest on investment and a credit for manure. Depreciation and interest were figured on buildings, machinery, etc. Interest on land was shown separately in each case, but interest on horses, equipment, tractor or truck was included in the charge for these items.

A study of the results will show many cases where crops were produced at a loss, yet farmers continued to grow the crop. There are several reasons why they do not abandon crops under such circumstances. They may hope for better yields or prices next year. They may know the reason for loss and plan to avoid it next year. It may be due to weather conditions that are abnormal. But in addition to these there is the point which some believe is most important of all, namely, that farmers consider cash out-of-pocket costs when they decide whether to keep producing or to quit. Cash costs are not the total. Depreciation must be met if the farmer is

[1]For potatoes, sugar beets and root crops this figure was 1; for alfalfa hay, peas and beans it was 2; and for field corn and small grains it was 6.

to remain in business. He must get paid for his own time if he plans to meet his grocery bills. He should allow for interest on his investment before he decides that a crop is profitable.

Just what is the relationship between total costs and actual cash out-of-pocket expenses? In an endeavor to answer this question the records for the year 1926 were analyzed in detail. This year was selected as coming nearest to a normal year. Results based on this year might be used as a guide in noting the relationship that should exist. Abnormal conditions largely speak for themselves.

For the year 1926 the percentage of each item of cost that was cash out-of-pocket expense is shown in the following table as an average for all farms that year. Taxes and irrigation water are all cash.

Table 12.—Relation of Cash to All Expenses for 1926

Item	Cash as a percentage of total cost pct.
Taxes	100.0
Irrigation water	100.0
Overhead	51.4
Truck	44.9
Equipment	43.4
Tractor	43.2
Man labor	42.3
Horse labor	19.8
Building charge	19.3
Manure	12.2

Overhead is the only other item for which cash is over 50 percent of the total expense. With man labor cash was 42.3 percent of the total expense. With horse labor it was only 19.8 percent.

By applying these detailed percentages to each item of expense, the cash cost of producing each crop in 1926 in relation to total costs was as follows:

Table 13.—Proportion of Crop Costs That Were Cash in 1926

Crop	Cash costs as a percentage of—	
	Operating cost pct.	Total cost pct.
Alfalfa	50.4	31.9
Barley	54.6	37.1
Wheat	55.8	37.3
Oats	56.2	37.3
Sugar beets	63.4	53.5
Potatoes	42.7	36.7
Beans	56.9	41.6
Corn for grain	43.6	33.6

Sixty-three and four-tenths percent of the operating costs on sugar beets was cash. Only 42.7 percent of the operating costs on

potatoes was cash. The lower percentage shown for total costs is on the assumption that interest on the investment in land shown as a cost is all computed. As a matter of fact most farmers pay interest on mortgages. A correction for this should be made in the case of a farmer in debt. The actual cash and non-cash items of cost for each crop for the year 1926 were as follows:

Table 14.—Cash and Non-cash Costs Per Acre 1926

Crop	Operating costs		Non-cash interest on land	Value of crops per acre
	Cash	Non-cash		
Alfalfa	$10.64	$10.44	$12.23	$20.53
Barley	14.12	11.70	12.20	25.45
Wheat	17.39	13.70	15.45	48.35
Oats	14.11	10.95	12.76	33.36
Sugar beets	51.36	31.22	13.42	148.08
Potatoes	36.88	49.46	14.11	136.78
Beans	21.99	16.66	14.26	46.90
Corn grain	16.13	20.88	10.75	39.60

When one considers the first column of cash operating costs it is apparent that a farmer must have secured rather poor yields or low prices before his income per acre fell below the cash cost per acre. The value per acre of each crop for 1926 is shown in the last column. Not a crop in the list but shows a good balance above actual cash expenses. This was a year of good yields and fair prices.

Instead of laying too much emphasis upon these cash items, farmers would do well to consider the total of cash and non-cash before deciding as to the profitableness of any one crop.

Cost of Producing Crops

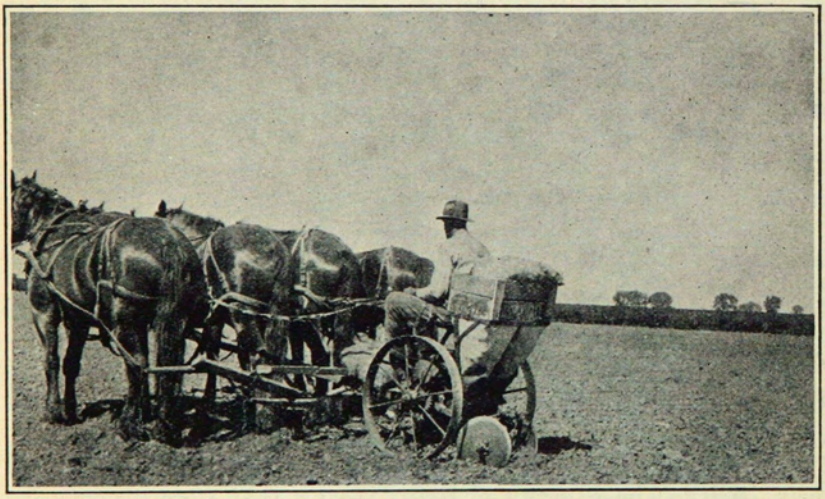
Costs were worked out on all crops grown on these farms. Some crops were grown on all farms, some on a majority of the farms, while scattered crops were grown on only one or two farms. The important crops for this region were alfalfa, potatoes, sugar beets, barley, wheat, oats and beans. Crops that were grown to a much less extent were corn for grain, silage corn, pastured corn, cabbage, peas, sudan and cane, onions and popcorn. The results on these minor crops are far from conclusive. Especially is this true for grain corn. In practically no instance was grain corn grown as a major important crop on these farms. It was usually planted as a filler and given scant consideration.

At the other extreme, sugar beets on these farms received first place in attention and care. The soil was adapted to methods which reduced the time required per acre for handling sugar beets, and the general care given the crop resulted in average yields considerably in excess of the averages for Northern Colorado.

In the case of the important crops, the number of farms reporting the crop varied so from year to year that it seemed best to show the average of all years as an average of each yearly figure. In all cases the acre costs are based upon the harvested acreage. Some years a large acreage of failure causes the cost per acre that year to be excessive, yet it represents the risks for that particular crop.

The total cost of labor is shown in the tables for each crop. For the time spent on each operation see Table 38.

Potatoes.—Table 15 gives the area, production, hours of labor and costs per acre for potatoes on farms where records are available for 4 or more years. Farms 12 and 13 had the lowest costs per acre for the period studied. Farms 25 and 11 had the highest yields. Both these farms are favored with level, productive land, kept in high fertility by frequent applications of manure.



Planting potatoes on well-prepared alfalfa ground.

The higher yields of potatoes secured on farms 11 and 25 were mainly due to more care in seed selection, adherence to a more strict rotation, and character of soil. The soil on these two farms was of a more sandy nature than that on many of the other farms. Disease was not so prevalent on these two farms, mainly due to the fact that potatoes very seldom were planted after potatoes, but followed alfalfa or a cultivated crop such as beans; the ground planted to beans having been out of potatoes at least 3 years.

Farm 12 secured a relatively cheap cost as a result of the use of labor on the crop. All necessary work was performed at the

proper time, climatic conditions permitting. All unnecessary work was eliminated. Crop rotation was adhered to as a general policy, modified according to the farmer's judgment. Potatoes might follow potatoes 2 years in succession if the price outlook was favorable.

Table 15.—Summary of Potato Production on Farms with 4 or More Years Record

Farm No.	Number years	Area harvested	Yield per acre	Yield accounted for	Hours per acre		Per acre costs	
					Man	Horse	Operating	Total
			Lbs.	Lbs.				
5	6	32.53	11,959	10,469	58.55	85.06	$75.42	$92.57
11	5	26.40	12,888	9,889	58.01	75.32	73.85	94.24
12	5	80.34	12,091	9,933	45.25	83.56	67.05	78.86
13	6	58.53	9,049	6,860	36.10	66.05[1]	67.85	82.31
25	5	20.27	15,622	13,000	65.20	98.07	83.41	97.12
26	6	23.94	11,136	8,463	72.50	88.40	81.68	98.72
28	6	20.12	9,927	7,828	63.00	67.70	77.30	94.34
29	5	24.79	11,165	9,542	61.00	66.50	90.87	107.95

[1]This farm also had an average of 2.67 hours tractor labor per acre.

Farm 13 reduced the labor requirements on potatoes by the purchase of a power sorter. In addition, a tractor was used for plowing and a truck for marketing the potatoes, which aided in reducing the hours per acre required for the crop. Farm 13 showed the lowest average yield per acre of all farms. The yields on this farm

Harvesting potatoes in Greeley area.

varied from 12,000 pounds to 4,875 pounds per acre, the latter occurring in 1926 when germination was poor and growth stunted even tho the soil preparation had been excellent. The fear of a repetition of another dry year such as 1925 resulted in irrigating potatoes before planting, and this apparently caused the seed to rot and resulted in a poor yield.

The average results each year in producing potatoes are shown in Table 16. The number of farms growing potatoes varied from 21 in 1922 to 8 in 1927. For the year 1928 the final sales in the spring of 1929 were not completed in time to include the results in this study. In all 89 records are available. The average for the 6 years shows what could be expected on a farm that grew potatoes each year under the conditions that were found in this study.

Table 16.—Average Yearly Cost Per Acre of Producing Potatoes, 1922 to 1927

	1922	1923	1924	1925	1926	1927	Yearly average
Number of farms	21	20	14	13	13	8	....
Acres in crop harvested	31.09	26.61	26.66	31.37	31.43	26.27	28.91
Yield per acre, lbs.	10,311	11,774	13,071	11,619	9,868	12,120	11,461
Accounted for per acre	7,826	9,235	11,445	9,528	8,443	9,370	9,308
Waste per acre, lbs.	2,485	2,539	1,626	2,091	1,425	2,750	2,153
Seed per acre, lbs.	788	842	816	830	864	894	839
Man hours per acre	50.79	53.21	49.31	57.20	53.20	56.95	53.44
Horse hours per acre	82.16	81.44	82.09	79.40	76.95	84.57	81.10
Tractor hours per acre	.50	.50	.62	.43	.52	.22	.46
Costs per acre:							
Man labor	$17.14	$17.42	$16.69	$20.11	$18.15	$17.87	$17.89
Horse labor	12.00	11.24	12.20	11.70	10.78	9.94	11.31
Hand contract	5.02	7.20	8.38	9.00	7.21	8.00	7.47
Haul contract	.36	.58	.56	1.39	.48	.12	.58
Seed	8.17	6.27	8.83	7.16	22.64	16.28	11.56
Manure	2.62	2.02	3.42	5.05	3.07	2.92	3.18
Twine	.11	.20	.20	.25	.17	.29	.20
Sacks	3.33	5.16	6.47	7.05	5.62	5.70	5.56
Water tax	3.18	2.11	2.71	5.87	3.28	2.20	3.22
Real estate tax	3.27	3.07	2.80	2.73	2.74	3.07	2.95
Buildings	1.21	1.66	1.55	1.32	1.16	1.21	1.35
Equipment	4.05	3.39	3.79	3.66	3.79	5.96	4.11
Tractor	.90	.44	.35	.31	.38	.40	.46
Miscellaneous	.05	.48	.12	.25	.38	1.95	.54
Overhead	3.41	4.33	4.15	5.05	6.49	6.80	5.04
Total operating cost	$64.82	$65.57	$72.22	$80.90	$86.34	$82.71	$75.42
Interest on land	16.66	15.23	14.49	15.16	14.11	13.35	14.84
Total all costs	81.48	80.80	86.71	96.06	100.45	96.06	90.26
Value per cwt.	.389	.795	.75	2.29	1.62	.84	1.114
Value per acre	30.44	73.42	85.84	218.19	136.78	78.71	103.89
Returns per acre:							
Without interest	—34.38	7.85	13.62	137.29	50.44	—4.00	28.47
With interest	—51.04	—7.38	—.87	122.13	36.33	—17.35	13.63
Cost per cwt. used:							
Without interest	.84	.71	.63	.85	1.02	.88	.81
With interest	1.04	.88	.76	1.01	1.19	1.02	.97

Such a farm would have 28.91 acres of potatoes yielding 11,461 pounds or about 100 sacks at harvest time. Of this production 9,308 pounds were accounted for during the year either by sales, home use, seed or feed. The balance of 2,153 pounds or 18.8 percent of the total harvested was lost by shrinkage or thrown out at sorting time. This item of waste was heavy on some farms, amounting to

as high as 4,000 to 8,000 pounds in several instances, due to freezing, rot or other disease. In 1926 the least shrinkage occurred, and in 1927 the largest shrinkage. The years 1922 and 1923 were also years of heavy shrinkage. In the fall of 1925 a heavy freeze caused severe losses on some farms.

Table 17.—Cost Per Acre of Producing Potatoes, 1922 to 1927. Farms With Low Costs Per 100 Pounds Each Year

	1922	1923	1924	1925	1926	1927	Yearly average
Farm No.	24	25	6	25	25	38	....
Acres in crop harvested	44.49	19.34	15.53	17.39	20.45	43.20	26.73
Yield per acre, lbs.	13,756	15,512	19,349	17,369	17,070	16,667	16,620
Used per acre, lbs.	10,790	15,032	18,403	15,012	14,636	14,533	14,734
Waste per acre, lbs.	2,966	480	946	2,357	2,434	2,134	1,886
Man hours per acre	42.50	64.94	66.06	78.75	65.28	62.99	63.42
Horse hours per acre	63.25	105.33	89.25	90.10	108.00	70.83	87.79
Tractor hours per acre	1.10	....	....	....	....	....	.18
Cost per acre:							
Man labor	$18.68	$22.47	$23.07	$27.87	$24.87	$22.55	$23.25
Horse labor	15.30	14.73	15.08	14.23	15.45	7.36	13.69
Hand contract	6.68	8.73	12.31	10.66	9.05	10.25	9.61
Haul contract	.45	....	1.25	....	....	....	.29
Seed	6.50	4.39	6.40	7.18	28.20	16.22	11.48
Manure	....	3.87	....	9.16	4.08	6.12	3.87
Twine	.20	.83	.45	.29	.38	.14	.38
Sacks	3.12	4.52	14.65	4.48	8.98	8.02	7.29
Water tax	3.07	1.23	1.65	6.27	1.47	.63	2.39
Real estate tax	2.22	3.47	2.34	3.21	3.58	3.31	3.02
Buildings	.21	.80	....	.17	.32	.53	.34
Equipment	4.53	4.24	3.01	3.80	3.77	5.74	4.18
Tractor	2.84	....	....	....	....	....	.48
Miscellaneous	.22	....	....	.07	....	3.97	.71
Overhead	1.84	6.54	6.06	9.41	9.67	9.48	7.17
Total operating cost	65.86	75.82	86.27	96.80	109.82	94.32	88.15
Interest on land	18.37	14.13	16.23	13.50	12.58	11.28	14.35
Total all costs	84.23	89.95	102.50	110.30	122.40	105.60	102.50
Value per cwt.	.525	.764	.75	2.48	1.55	.84	1.17
Value per acre	56.65	114.84	138.02	372.30	226.86	122.08	171.79
Returns per acre:							
Without interest	—9.21	39.02	51.75	275.50	117.04	27.76	83.64
With interest	—27.58	24.89	35.52	262.00	104.46	16.48	69.29
Cost per cwt. used:							
Without interest	.61	.504	.47	.64	.75	.65	.60
With interest	.78	.598	.56	.73	.84	.73	.70

Table 18.—Cost Per Acre of Producing Potatoes, 1922 to 1927. Farms with High Costs Per 100 Pounds Each Year

	1922	1923	1924	1925	1926	1927	Yearly average
Farm No.	18	14	26	26	26	28	....
Acres in crop harvested	22.21	29.00	22.48	24.54	56.77	20.37	29.23
Yield per acre, lbs.	7,866	4,966	9,175	11,808	4,822	2,946	6,930
Used per acre, lbs.	2,199	4,547	6,289	7,591	3,415	1,267	4,218
Waste per acre, lbs.	5,667	419	2,886	4,217	1,407	1,679	2,712
Man hours per acre	32.92	61.52	56.90	89.17	36.48	34.81	51.97
Horse hours per acre	69.52	104.28	69.48	107.38	65.02	56.04	78.62
Cost per acre:							
Man labor	$ 9.52	$21.59	$14.85	$28.18	$13.79	$12.91	$16.81
Horse labor	10.22	11.05	11.88	19.43	6.70	11.15	11.74
Hand contract	4.18	....	....	11.62	4.25	6.13	4.36
Haul contract	....	....	....	.13	.83	....	.16
Seed	7.87	7.92	11.37	7.21	25.03	12.75	12.02
Manure	1.94	.66	5.57	6.94	.94	....	2.68
Twine	....	.21	....	.30	.10	.15	.13
Sacks	....	3.20	8.34	6.78	3.33	1.32	3.83
Water tax	3.03	.69	1.13	4.94	2.79	.39	2.16
Real estate tax	4.29	3.06	3.02	2.67	2.67	2.55	3.04
Buildings	....	5.45	.35	.18	2.65	1.20	1.64
Equipment	3.38	5.56	2.63	4.92	2.54	3.21	3.71
Miscellaneous	....	.17	.01	....	2.48	1.19	.64
Overhead	4.75	8.11	4.33	6.63	4.21	4.68	5.45
Total operating cost	49.18	67.67	63.48	99.93	72.31	57.63	68.37
Interest on land	20.94	18.06	17.35	17.34	12.94	13.60	16.70
Total all costs	70.12	85.73	80.83	117.27	85.25	71.23	85.07
Value per cwt.	.188	.687	.70	2.10	1.62	.73	1.20
Value per acre	4.13	31.24	44.02	159.41	55.32	9.25	50.56
Returns per acre:							
Without interest	—45.05	—36.43	—19.46	59.48	—16.99	—48.38	—17.81
With interest	—65.99	—54.49	—36.81	42.14	—29.93	—61.98	—34.51
Cost per cwt. used:							
Without interest	2.24	1.49	1.01	1.32	2.11	4.55	1.62
With interest	3.19	1.89	1.28	1.55	2.50	5.62	2.02

It took 43.44 man hours, 81.1 horse hours and 0.46 tractor hours per acre to produce, harvest, sort and sell an acre of potatoes. This does not include contract picking of the potatoes.

Seed cost an average of $11.56 per acre for 839 pounds. Sacks cost $5.56; water, $3.22; equipment, $4.74; overhead, $5.04; operating costs were $76.05 per acre; total costs, $90.26. The value of the crop was $103.89 per acre, giving a profit for the 6 years above all costs of $13.63.

The cost of producing 100 pounds of potatoes accounted for was 81 cents without interest, and 97 cents with interest. The average sale price was $1.11 per 100 pounds.

There were many variations from farm to farm and from year to year. Yields per acre varied from as low as 2,946 pounds to 19,804 pounds per acre. Farmers showed ability in some cases to cut their costs and in other cases they had high costs. For each year the

farm was selected which had the lowest total cost per 100 pounds accounted for, and the farm with the highest cost. Tables 17 and 18 show these farms and the 6-year average in each case.

The six low-cost farms showed an average yield per acre of 16,620 pounds, of which 14,734 were accounted for, while the six high-cost farms, had yields of only 6,930 pounds per acre, of which only 4,218 pounds were accounted for. Obviously yield per acre was the big factor that caused these men to have low or high costs per hundredweight produced. It cost the first group $20 per acre more to produce potatoes, but they made a profit of $69.29 per acre where the second group lost $34.51 per acre.

The price at which farmers sold their potatoes showed more variation than might be expected. In 1922 six men got over 50 cents per 100 and four men got less than 25 cents per 100 pounds.

In 1923 four men got over 90 cents per 100 pounds and three got less than 65 cents. In 1924 two men got over 85 cents per 100 pounds and three got less than 65 cents. In 1925 two men got more than $2.90 and four got less than $2.15 per 100 pounds.

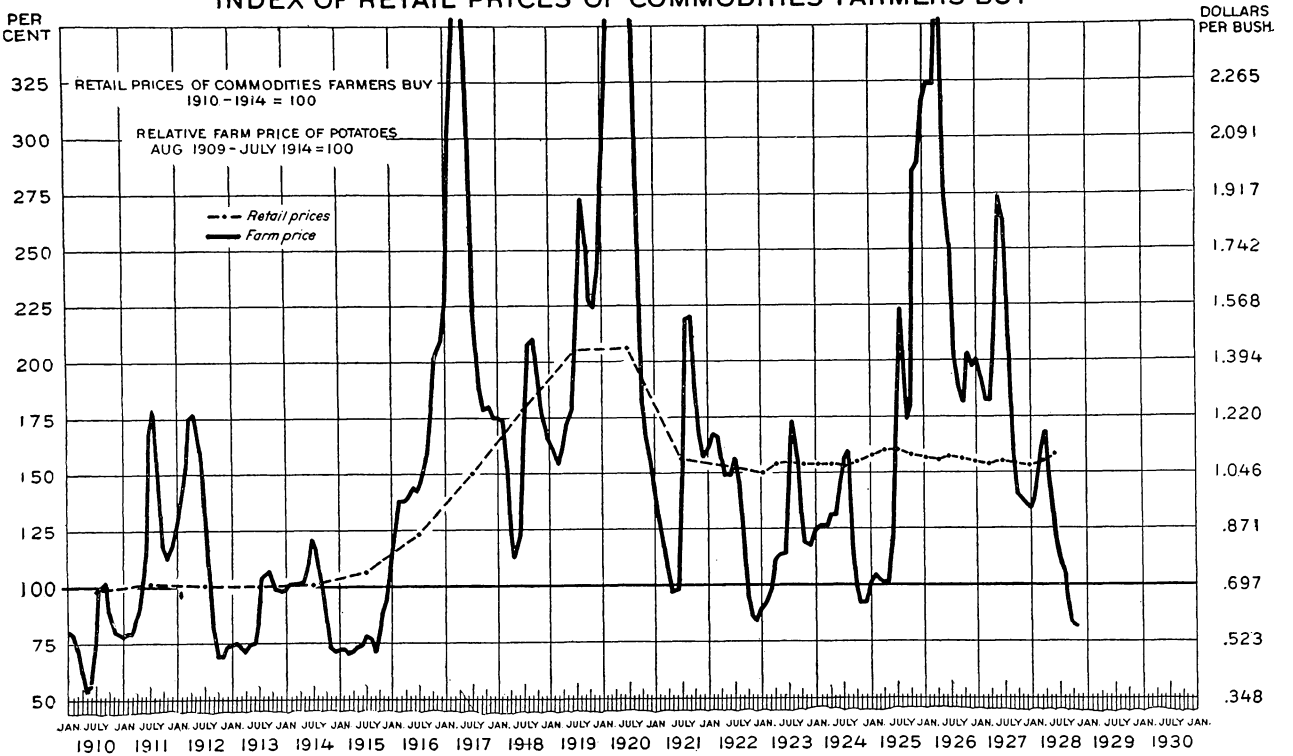
Obviously with a crop like potatoes where there are wide fluctuations in market price, the final results of the year's work depend nearly as much upon the ability to make a good sale as they do upon the ability to grow a large crop at a low cost. Yet in the long run the farmer who can produce a high yield at a low cost will win because the wide fluctuations in potato prices are between years. The accompanying chart shows how the price paid to farmers in the United States has varied from year to year.

The most consistent farms in producing potatoes for a low cost were farms 12 and 25. Records are available for each of these farms for the 5 years, 1922 to 1926 inclusive. They show as follows:

Table 19.—Five-year Average Potato Record on Two Farms

Item	Farm 25	Farm 12	Av. of 93 records
Average potato area	20.27	80.34	28.89
Yield per acre, lbs.	15,622	12,091	11,363
Pounds accounted for	13,000	9,933	8,744
Waste, lbs.	2,622	2,158	2,017
Man hours per acre	65.2	45.25	53.07
Horse hours per acre	98.07	83.56	80.98
Operating cost per acre	$83.41	$67.05	$73.53
Total cost per acre	91.12	78.86	88.88
Operating cost per cwt. accounted for	.641	.675	.841
Total cost per cwt.	.747	.794	1.016

FARM PRICES OF POTATOES
AND
INDEX OF RETAIL PRICES OF COMMODITIES FARMERS BUY



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The significant thing is that these two farms required sale prices of at least 75 cents per 100 pounds to pay all costs, while for all records all years a price of $1 per 100 pounds was necessary. Analysis of 81 records for 5 years showed the following:

Table 20.—Effect of Net Yield and Price Upon Profit from Potatoes

Pounds per acre accounted for from	to	Number farms	Number making a profit	Number having cost over $1 per cwt.
0	8,000	27	3	27
8,001	10,000	26	8	13
10,001	12,000	16	7	1
12,000	plus	12	10	0

Price received for potato sales per cwt. from	to	Number farms	Number making a profit
0	75c	42	0
76c	$1.00	13	7
$1.00	and above	26	22

Ten farms out of the 12 with yields over 12,000 pounds per acre made money and none of them produced potatoes at a cost as high as $1 per 100 pounds.

Twenty-two farms out of 26 that sold potatoes for $1 per 100 pounds or above made money.

Look at it either way and one comes to the same conclusion, that yields of 12,000 pounds or better, or prices of $1 per 100 pounds or better, are needed in order to make money with potatoes.

Sugar Beets.—The average cost per acre of producing sugar beets is shown for each year in Table 21. Average yields each year varied from 11.25 tons in 1922 to 18.51 in 1926. The year 1925 was a hard year for sugar beets to get started. The area that grew and was harvested that year made fairly good yields.

The yearly average for 6 years shows 14.92 tons per acre. This is somewhat less than an average based on total area harvested in the 6 years. This shows 15.77 tons per acre, due to the fact that more records were secured in years with high yields.

The contract labor shown is based on actual payments divided by measured area harvested. This does not agree exactly with the standard payments per acre which are based on areas computed by field men of the sugar company.

The section of Weld County in which these farms are located has certain advantages for sugar-beet production which result in higher yields than can be secured elsewhere for the same cost.

The chief advantage possessed by the area in Northern Colorado in the raising of sugar beets is that of climate. The monthly

mean temperature at Fort Collins over a period of 40 years is 46.5 degrees, while that of Rocky Ford is 52 degrees. Yields of sugar beets in these respective sections were 15.57 tons and 12.99 tons.[1]

Table 21.—Average Yearly Cost Per Acre of Producing Sugar Beets, 1922 to 1927, Inclusive

	1922	1923	1924	1925	1926	1927	Yearly average
Number of farms	12	13	17	10	17	10	....
Acres in crop harvested	23.31	26.63	37.17	20.19	43.87	43.97	36.08
Yield per acre, tons	11.25	15.38	16.02	13.68	18.51	14.68	14.92
Seed per acre	16.5	16.2	16.8	43.	18.	22.6	22.2
Man hours per acre	35.35	36.20	37.88	59.20	40.22	35.30	40.69
Horse hours per acre	72.00	81.82	77.76	113.56	81.30	77.50	83.99
Tractor hours per acre	....	.38	.50	2.35	.56	.47	.71
Costs per acre:							
Man labor	$11.60	$11.58	$12.97	$18.42	$13.22	$10.30	$13.01
Horse labor	9.51	9.93	11.20	16.35	11.02	9.21	11.20
Hand contract	17.15	21.17	23.72	19.37	26.33	24.66	22.07
Haul contract	....	.82	.05	.41	1.46	.38	.52
Seed	3.12	2.43	2.52	6.50	2.75	3.37	3.45
Manure	5.48	5.04	7.48	13.41	9.59	6.62	7.94
Water tax	2.20	1.43	2.18	4.62	2.77	2.32	2.59
Real estate tax	3.41	3.20	3.02	2.62	2.94	3.20	3.06
Buildings	.43	.60	.57	1.75	.49	.40	.71
Equipment	3.09	3.44	3.85	6.32	4.71	5.31	4.45
Tractor	....	.28	.37	1.74	.57	1.28	.71
Truck	....	.20	.13	.22	1.83	1.71	.68
Miscellaneous	.18	.07	1.15	.31	.75	.31	.46
Overhead	2.46	2.96	3.15	4.28	4.15	4.37	3.56
Total operating cost	58.63	63.15	72.36	96.32	82.58	73.44	74.41
Interest on land	14.78	14.71	14.04	13.05	13.42	12.90	13.82
Total all costs	73.41	77.86	86.40	109.37	96.00	86.34	88.23
Value per ton	7.88	8.19	7.50	6.00	8.00	8.00	7.62
Value per acre	88.65	125.96	120.15	82.08	148.08	117.44	113.73
Returns per acre:							
Without interest	30.02	62.81	47.79	—14.24	65.50	44.00	39.32
With interest	15.24	48.10	33.75	—27.29	52.08	31.10	25.50
Costs per ton:							
Without interest	5.21	4.10	4.52	7.04	4.46	5.00	4.99
With interest	6.52	5.06	5.39	7.99	5.18	5.88	5.91

Sugar beets are a relatively cool-climate crop. The temperature during the months of June, July and August is very important. A comparison of temperatures during these months at Rocky Ford and Fort Collins is given below:

	June	July	August
Fort Collins	63.4	68.3	67.3
Rocky Ford	70.5	74.8	73.4

Not only is the temperature during these months important, but the temperature between night and day just preceding beet harvest is also an important factor in the development and the storage of sugar. The maximum activity of sugar storage is during

[1]U. S. D. A. Bul. 917, Farm practice in growing sugar beets in three districts of Colorado.

Using furrow openers on a beet drill permits early cultivation or irrigation.

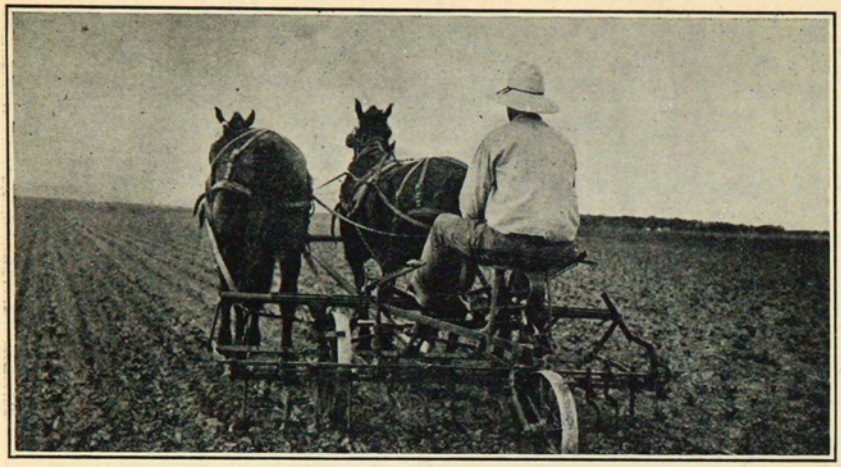
the last month of the growing season. Northern Colorado has cooler nights than the Arkansas Valley, and fairly warm days.

The soil in this area is medium to light. Potatoes are widely grown. Many farmers follow potatoes by sugar beets. This tends to cheapen the cost of production inasmuch as plowing is eliminated. It secures an early preparation of seedbed and allows for early planting. These are important factors in raising beets, as labor performed and yields are two important factors in cheapening costs and thereby raising the profit from sugar beets.

Many farmers feed either sheep or cattle and have sufficient manure to maintain their soil in high fertility. There is normally sufficient irrigation water to keep crops growing thru the year. These and other items have combined to make the Windsor-Eaton-Greeley area highly productive. In 1926 the farms included in this study averaged 18.51 tons of beets per acre. Northern Colorado made an average of 14.40 tons the same year. The lowest yield on any of these farms that year was 14.99 tons.

For the above reasons the average cost per acre or per ton shown for this study is less, proportionately, than what might be considered normal under Northern Colorado irrigated conditions.

Not all these farms made money on beets. Tables 22 and 23 show for each year the farms that produced beets at the lowest cost per ton and at the highest. The average for the six farms with lowest costs per ton shows a yield of 18.39 tons. The lowest yield any year was 14.02 tons in 1922. The average cost per acre, including interest, was $81.21, the cost per ton, $4.42. These men made $58.97 profit per acre.



Early cultivation of beets reduces weed growth and increases yield.

The six men with highest costs per ton had yields of 10.31 tons per acre, the highest attained by these farms was 14.99 tons in 1926. Their costs per acre were $121, and $11.74 per ton. They lost $43.31 per acre. The bad year of 1925 hit this group and partly accounted for the extremely bad showing.

In 1925 the harvested area bore the expenses of the entire sugar-beet crop. Time and money spent on abandoned beet land helped to swell the total cost. For the 6-year average this is spread over the years and represents the cost of risk of loss from the crop.

Ditching beets with a beet cultivator.

Table 22.—Cost Per Acre of Producing Sugar Beets, 1922 to 1927, Inclusive. Farms with Low Costs Per Ton

	1922	1923	1924	1925	1926	1927	Yearly average
Farm No.	17	12	25	17	38	5	....
Acres in crop harvested	16.46	49.81	20.31	51.99	36.08	35.84	35.08
Yield per acre, tons	14.02	16.23	22.15	16.18	22.28	19.52	18.39
Man hours per acre	38.70	23.33	37.86	50.38	45.87	32.17	38.05
Horse hours per acre	78.68	59.28	110.34	62.34	63.33	62.72	72.78
Tractor hours per acre	....	....	....	4.08	....	....	.68
Cost per acre:							
Man labor	$12.18	$ 7.47	$11.58	$17.83	$15.82	$ 9.91	$12.46
Horse labor	8.58	6.75	15.46	8.76	10.20	7.40	9.52
Hand contract	18.01	20.60	26.83	23.95	29.54	27.23	24.36
Haul contract	....	1.49	....	....	....	....	.25
Seed	4.45	2.04	2.99	2.62	2.61	2.61	2.89
Manure	....	3.55	9.42	8.75	3.58	5.12	5.07
Water tax	4.40	1.33	2.07	4.51	1.09	3.52	2.82
Real estate tax	2.91	2.20	3.22	2.10	2.78	3.41	2.77
Buildings	.21	.34	.69	.06	2.83	.67	.80
Equipment	3.37	1.28	4.22	4.02	3.45	4.34	3.45
Tractor	....	....	....	2.75	.03	....	.46
Truck	....	....	....	.59	5.08	3.94	1.60
Miscellaneous	.06	.10	1.51	.41	.44	....	.42
Overhead	3.16	1.35	5.01	2.81	3.94	1.85	3.02
Total operating cost	57.33	48.50	83.00	79.16	81.39	70.00	69.89
Interest on land	7.29	11.70	13.93	6.62	11.43	16.95	11.32
Total all costs	64.62	60.20	96.93	85.78	92.82	86.95	81.21
Value per ton	7.88	8.19	7.50	6.00	8.00	8.00	7.62
Value per acre	110.48	132.92	166.20	97.08	178.24	156.16	140.18
Returns per acre:							
Without interest	53.15	84.42	83.20	17.92	96.85	86.16	70.29
With interest	45.86	72.72	69.27	11.30	85.42	69.21	58.97
Costs per ton:							
Without interest	4.09	2.99	3.75	4.89	3.65	3.59	3.80
With interest	4.61	3.71	4.37	5.30	4.16	4.45	4.42

An interesting fact in connection with the cost of beets on the low-cost farms during the period of 1922 to 1927 is how the costs per ton (without interest) have varied. Inputs of materials and labor are responsible for this variation.

Farm 12 in 1923 used very few man and horse hours per acre. The general practice on this farm has been to follow some cultivated crop such as beans or potatoes with beets. Spring-toothing, harrowing and leveling are the only operations before planting beets. Timeliness of operations during the cultivating seasons reduces the number of cultivations by at least one. The distance to the beet dump does not exceed 1¼ miles from any part of the farm. Generally four-horse teams are used in hauling beets after the season is well started. This utilizes man labor to a greater degree than two-horse teams.

Table 23.—Cost Per Acre of Producing Sugar Beets, 1922 to 1927, Inclusive. Farms with High Costs Per Ton

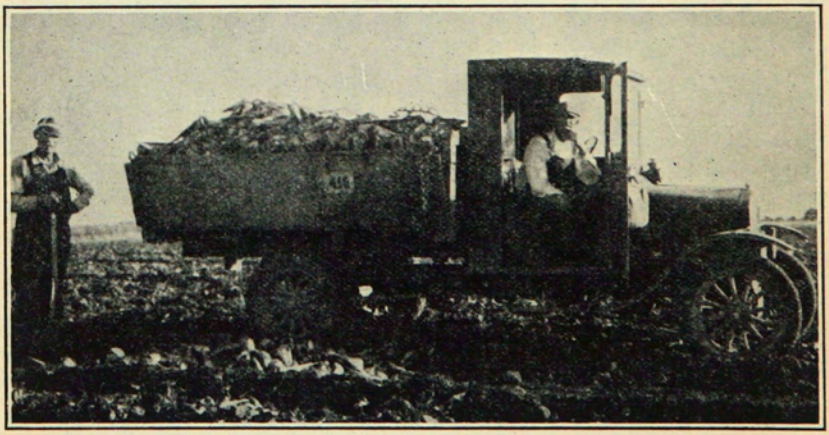
	1922	1923	1924	1925	1926	1927	Yearly average
Farm No.	16	27	26	38	39	42	....
Acres in crop harvested	20.42	7.13	34.30	3.00	38.68	16.52	20.01
Yield per acre, tons	5.6	6.81	11.77	11.72	14.99	10.96	10.31
Man hours per acre	32.62	60.17	36.41	202.67	36.34	37.65	67.64
Horse hours per acre	84.72	75.74	78.69	360.67	63.88	91.77	125.91
Cost per acre:							
Man labor	$11.48	$14.85	$ 9.50	$78.39	$11.70	$ 8.77	$22.45
Horse labor	10.25	13.05	13.46	43.64	14.48	10.28	17.53
Hand contract	18.54	17.18	22.81	15.34	27.44	29.54	21.81
Haul contract	....	....	....	....	.55	....	.09
Seed	3.88	3.04	2.81	29.95	2.57	2.25	7.42
Manure	5.72	2.02	14.31	10.06	5.42	2.13	6.61
Water tax	3.13	.68	1.12	2.23	3.76	2.33	2.21
Real estate tax	3.42	2.66	3.02	8.49	2.22	3.40	3.87
Buildings	.44	.86	.75	34.57	.25	1.10	6.33
Equipment	3.39	3.54	2.98	18.03	5.84	5.81	6.59
Truck	....	....	....	3.99	6.68	....	1.77
Miscellaneous	....	....	.30	....	....	....	.05
Overhead	1.00	4.99	2.77	15.54	4.59	6.87	5.96
Total operating cost	61.25	62.87	73.83	260.23	85.50	72.48	102.69
Interest on land	18.85	8.43	17.51	41.57	12.07	11.43	18.31
Total all costs	80.10	71.30	91.34	301.80	97.57	83.91	121.00
Value per ton	7.88	8.19	7.50	6.00	8.00	8.00	7.54
Value per acre	44.13	55.77	88.35	70.32	119.92	87.68	77.69
Returns per acre:							
Without interest	—17.12	—7.10	14.52	—189.91	34.42	15.20	—25.00
With interest	—35.97	—15.53	—2.99	—231.48	22.35	3.77	—43.31
Costs per ton:							
Without interest	10.94	9.23	6.27	22.20	5.70	6.61	9.96
With interest	14.30	10.47	7.76	25.75	6.51	7.66	11.74

Hauling beets with four horses.

Farm 25 in 1924 planted beets in potato and bean ground. The land of this farm is fairly heavy which necessitated plowing. A good seedbed was prepared by frequent harrowing. Beets were irrigated six times this particular year due to the fact that the season was fairly dry. Good yields were secured due to rotation methods and frequent applications of manure. Plowing on this farm increases the labor input over that of farm 12.

Farm 17 plowed the land for beets. The practice was to manure grain stubble during August. The land would be disced thoroly, incorporating the manure into the soil. Later when moisture conditions were right the land was fall plowed. Seedbed preparation in the spring consisted of harrowing and leveling. A good firm seedbed was thereby secured. Irrigation water was applied from three to five times per season, depending on type of soil and the particular season. A tractor has been added to the farm equipment in order that the ground may be prepared at the right time. Deeper plowing has also been the practice since the purchase of the tractor. A truck has also been purchased which in the opinion of the operator has aided in reducing the cost of producing beets.

The practice in growing sugar beets on farm 5 was to follow potatoes by beets. Some years it was necessary to follow beets by beets. In this event the land was spring plowed and manured. All work was done by horses, no tractor being owned. Due to distance from the beet dump (3½ miles), a truck has been purchased which facilitates beet harvest. In the years 1924 and 1925 the cost to farm 5 was 78 cents per ton to haul beets to the beet dump. In the 3 years, 1926 to 1928 inclusive, when a truck was used, this cost



Hauling beets by truck may aid in lowering the cost of marketing.

was reduced to 65 cents per ton or a saving of $2.57 per acre for a 19.77 ton yield.

Table 24, which gives the results on all farms where records were available for over 4 years, shows that farm 12 used less hours of man labor per acre on beets for a period of 5 years than any other farm. The use of horse hours was relatively efficient also. Farm 11 also used a low number of man hours and less horse hours than farm 12. Rotation methods are responsible for these low labor requirements since these two farms rather consistently follow the practice of planting beets after some other cultivated crop without plowing.

Table 24.—Average for Farms Growing Sugar Beets 5 Years or More

Farm No.	No. of years	Acres planted	Acres harvested	Production per acre tons	Hours per acre			Operating costs	Total costs
					Man	Horse	Tractor		
5	5	22.17	20.77	19.77	43.73	96.97	....	$78.23	$96.03
11	5	28.98	24.95	17.14	30.69	62.81	....	68.20	88.66
12	5	55.45	55.01	15.94	27.89	71.54	....	64.35	76.23
13	5	50.58	39.53	17.48	37.76	96.24	.49	77.72	91.96
17	5	41.40	39.01	16.56	40.12	78.34	3.12	74.80	81.92
25	5	18.98	15.25	19.25	36.27	98.00	....	78.89	93.04
26	6	32.36	29.56	13.91	38.84	65.90	....	71.47	88.19
27	6	19.66	16.42	12.62	45.64	90.36	....	77.54	84.06

Normal Sugar-beet Costs.—In order to show what would be the result under conditions that exist over a wide area of Northern Colorado, a few changes were made in the 1926 year's costs to make them conform as far as possible to normal practice.

Out of 746.83 acres in sugar beets in 1926 only 329 acres were plowed. Taking the actual time for plowing 329 acres as a basis and using the average rates for man, horse, equipment, tractor and overhead costs, it was found that the cost per acre in 1926 would have been increased $4.39 if all the land had been plowed.

If the yield had been 14.4 tons per acre[1] instead of 18.51 tons there would have been certain savings. The extra bonus for topping beets would have been saved on 4.11 tons. This amounts to $2.06. These 4.11 tons would not have been hauled to the beet dump, a further saving of $2.71, as it cost 65 cents per ton to haul beets to the dump based on all records.

Hence a normal beet crop of 14.4 tons per acre based on the 1926 practice would cost $82.20 per acre without interest, or $95.72 including interest. This amounts to $5.71 operating cost per ton and $6.65 total cost.

A similar comparison based on all the records for the 6 years

[1]This was the average yield in Northern Colorado in 1926.

shows that a 13-ton yield would show $73.91 operating cost per acre and $87.68 total costs, or $5.68 operating costs per ton and $6.74 total costs per ton. These two figures are interesting as showing what might be expected with average yields and normal practice.

Twenty farm records out of 75 actually showed costs per ton greater than these computed averages so that they appear reasonable.

The difficulty of using these or any other costs as normal lies in the fact that no one farm any year is normal. Something is out of line. Extra work on this or that operation, higher water costs, changes in method, all tend to upset any normal. Take the one item of changes in method. Tractors are coming into the region. What effect will they have on costs per acre? Trucks are being used to haul to the beet dump. How are their costs compared to the use of teams? Pumping plants are coming to supplement reservoir water. What is the cost of pumped water?

Hence with these costs, they should be used as a starting point and each farmer can then make such changes as make them conform more closely to his conditions. In that way he will come nearer the truth than if he relies blindly on an "average."

Profit or loss per acre is not necessarily a reliable guide as to whether, if the particular crop were increased in acreage, say doubled, the total net profit from the doubled acreage would be two-fold. It might be greater or less than this. However, in determining how far one should increase or decrease his production he should take into consideration not only the one particular crop but the entire combination of crops raised on his farm. Labor distribution, extra machinery, rotation practices all need to be considered.

If the individual farmer can, by varying his inputs of labor, material, etc., secure greater proportionate yields with less proportionate expense of production, his profits per acre may be greater proportionately than his increase in expenses. If this be the case then he has not reached the point of diminishing returns for that particular crop. In seeking greater profit he should be careful his costs do not exceed his returns.

Barley.—Table 25 gives the average yearly results from raising barley. The year 1927 was the best year for all farms so far as yield was concerned. A crop over 400 pounds larger than any other year was produced at no greater cost per 100 pounds. The years 1924 and 1927 were the only years that barley paid all the costs of production, including interest on investment. In 1922, 1925 and 1926 the value of the crop barely equalled the operating costs, leaving nothing for interest.

Here is a crop that seldom is produced at a profit, yet persistently grown. Why? Farmers will tell you that they grow barley for feed. Agronomists will tell you that it is needed as a nurse crop for alfalfa. The facts are, if one refers back to the table showing cash costs, that barley produces more than enough to pay cash costs. It is a good feed and nurse crop. A farmer can grow it in addition to the area of potatoes, beets and alfalfa that he can handle, and practically with the same horses and equipment. It can be planted and harvested when other crops do not need attention. Consequently it remains in the rotation because there is nothing better to take its place.

Table 25.—Cost Per Acre of Producing Barley, 1922 to 1927

	1922	1923	1924	1925	1926	1927	Yearly average
Number of farms	13	15	14	15	16	8	....
Acres in crop harvested	20.62	25.24	27.54	24.50	29.58	17.01	24.08
Yield per acre, lbs.	2,187	2,402	2,427	1,822	2,314	2,869	2,337
Seed per acre	95	90	79	87	66	86	84
Man hours per acre	14.72	13.37	13.58	13.05	17.00	12.90	14.10
Horse hours per acre	24.69	20.94	19.52	22.26	22.43	16.48	21.05
Tractor hours per acre	.09	.69	.47	.41	.80	.34	....
Cost per acre:							
Man labor	$ 4.83	$ 4.26	$ 4.67	$ 4.43	$ 5.94	$ 3.67	$ 4.63
Horse labor	3.40	2.58	2.75	3.34	3.02	2.25	2.89
Seed	1.11	1.15	.99	1.64	1.02	.99	1.15
Manure	2.68	2.50	3.56	4.84	3.59	3.09	3.38
Twine	.42	.49	.44	.48	.56	.44	.47
Sacks	....	....	.10	.07	.07	.10	.06
Coal	.11	.11	.20	.12	.07	.06	.11
Threshing	4.04	4.34	4.13	2.02	3.01	3.89	3.57
Water tax	1.45	.49	.56	1.11	1.16	1.03	.97
Real estate tax	3.68	3.13	2.77	2.68	2.73	3.45	3.07
Buildings	.30	.26	.69	.60	.44	.97	.55
Equipment	1.11	.94	.94	1.15	1.18	1.26	1.10
Tractor	.07	.54	.33	.29	.67	1.04	.49
Miscellaneous	.01	.11	.07	.14	.50	.27	.18
Overhead	1.34	1.03	1.09	1.52	1.86	1.51	1.39
Total operating cost	24.55	21.93	23.29	24.43	25.82	24.02	24.01
Interest on land	16.05	13.28	12.23	13.25	12.20	13.96	13.49
Total all costs	40.60	35.21	35.52	37.68	38.02	37.98	37.50
Value per cwt.	1.13	1.11	1.56	1.36	1.10	1.36	1.27
Value per acre	24.71	26.66	37.86	24.78	25.45	39.02	29.75
Returns per acre:							
Without interest	.16	4.73	14.57	.35	—.37	15.00	5.74
With interest	—15.89	—8.55	2.34	—12.90	—12.57	1.04	—7.75
Costs per cwt.:							
Without interest	1.12	.91	.96	1.34	1.12	.84	1.03
With interest	1.86	1.47	1.47	2.07	1.64	1.32	1.60

Thirty records out of the total for the 6 years showed operating costs less than $1.00 per 100 pounds. The price of barley seldom falls below $1.00. In fact, with corn above $1.50 per 100,

farmers can afford to raise barley because barley has a feeding value about the same as corn.[1] The saving in the feed bill will balance the apparent loss on the barley. The farm as a whole will be ahead.

This emphasizes another phase of the use of crop costs. It is of doubtful value to consider the farm as made up of separate crops. It should be viewed as a whole. One crop may be necessary in the rotation in producing another crop.

Beets require exceptional care. Grain and hay in the rotation may be continued at a loss because they are necessary to complete the rotation.

Table 26 shows the results on farms where barley records were obtained 4 or more years. Farm 29 had the best yield, farm 17 the lowest cost per acre, and the least time per acre, due to the efficient use of both horses and tractor.

Table 26.—Farms Growing Barley 4 or More Years

Farm No.	No. years	Acres harvested	Yield per acre lbs.	Hours for acre			Costs per acre	
				Man	Horse	Tractor	Operating	Total
5	6	13.61	2892	16.7	27.8	....	$28.52	$45.89
12	5	43.47	2168	15.3	21.6	....	21.49	32.93
13	5	69.41	1999	16.2	27.3	.48	24.28	37.90
17	5	52.97	2558	12.0	11.5	2.17	20.90	27.27
26	6	18.39	1993	12.4	20.0	....	23.74	39.91
27	6	13.41	2008	14.7	23.5	....	24.25	31.15
29	4	7.97	3086	18.3	30.0	....	35.10	56.97
33	4	19.50	2654	17.7	23.4	.22	31.96	39.84
34	4	36.54	3028	12.4	14.6	.60	26.87	42.27

Alfalfa.—This is the only crop that every farmer grew every year, yet only 1 year out of 6 did it pay all expenses. In 1924 alfalfa was worth practically $15 per ton and showed a small profit as a consequence. See Table 27.

The yields for three cuttings were close to 2½ tons per acre. These yields were based on measured stacks, not on actual weights. Some farmers used one formula for measuring hay, some used another, but in most cases one-fourth of the over times the width times the length; this result divided by 512 was used for finding the tonnage. Experiments by J. W. Sjogren of the Colorado Agricultural College, and work in other states suggests that for all except the low, squatty stacks this rule underestimates the tons in a stack. If this is true the actual yields in this area as found by scale weights would have run higher than shown.

Most of the hay produced in this area is fed on the farms. In

[1]E. J. Maynard, Colorado Experiment Station.

this case the question of measuring stacks is of minor importance. On farms where hay is sold, it becomes of major importance. The whole purpose of a rule for measuring stacks is to find some easy method to determine the cubic contents of the stack, then to determine the number of cubic feet per ton. When one considers the number of things which cause variations in results, it is apparent that any rule is a makeshift. The best method is to weigh the hay when it is sold. This eliminates the chance of either party getting an advantage.

Table 27.—Average Yearly Cost Per Acre of Producing Alfalfa, 1922 to 1927

	1922	1923	1924	1925	1926	1927	Yearly average
Number of farms	22	22	20	22	19	9	....
Acres in crop	43.37	48.52	53.47	48.09	49.25	49.20	48.65
Yield per acre, tons	2.62	2.64	2.41	2.37	2.68	2.09	2.47
Man hours per acre	14.32	16.50	16.03	16.94	18.79	14.43	16.17
Horse hours per acre	20.02	19.11	18.61	23.02	23.10	18.87	20.46
Cost per acre:							
Man labor	$ 4.67	$ 5.34	$ 5.63	$ 5.55	$ 6.50	$ 4.44	$ 5.35
Horse labor	2.93	2.67	2.86	3.50	3.16	2.39	2.92
Seed	.70	1.22	.98	1.48	1.11	.76	1.04
Manure	2.19	3.57	2.17	3.87	2.72	2.29	2.80
Water tax	1.27	1.38	1.21	1.44	1.28	1.17	1.30
Real estate tax	3.41	2.97	2.90	2.56	2.87	2.98	2.95
Equipment	.95	.93	.95	1.33	1.31	1.43	1.15
Miscellaneous	.02	.02	.09	.16	.05	.06	....
Overhead	1.17	1.41	1.45	1.60	2.08	1.74	1.57
Total operating cost	17.31	19.51	18.24	21.49	21.08	17.20	19.14
Interest on land	15.12	14.10	13.68	14.14	12.23	11.78	13.51
Total all costs	32.43	33.61	31.92	35.63	33.31	28.98	32.65
Value per ton	11.91	10.65	14.87	13.83	7.66	10.45	11.51
Value per acre	31.20	28.12	36.13	32.78	20.53	21.84	28.43
Returns per acre:							
Without interest	13.89	8.61	17.89	11.29	—0.55	4.64	9.29
With interest	—1.23	—5.49	4.21	—2.85	—12.78	—7.14	—4.22
Costs per ton:							
Without interest	6.61	7.39	7.57	9.07	7.86	8.23	7.75
With interest	12.38	12.73	13.25	15.05	—12.44	13.87	13.22

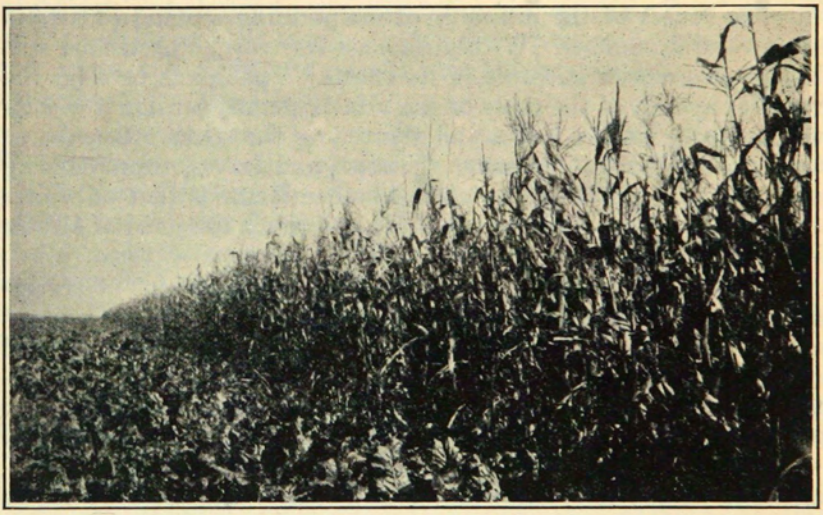
Table 28 gives the area, yield and costs per acre for growing alfalfa on all farms with records over four years. Farm 25 had the highest average yield. Farm 12 had the lowest hours per acre, and the lowest operating costs.

Alfalfa is recognized as an essential part of any crop rotation. Yet as the years pass it seems to become increasingly difficult to secure a stand. The years 1924 and 1925 were the worst in the history of the valley. Since then better stands have been secured.

The general opinion based upon the 1924 experience seemed to be that there were two outstanding reasons for the increased difficulty in securing a stand of alfalfa: First, the fact that long use

of manure and better rotations had increased the richness of the soil so that more leaf and stem growth on barley and other grain tended to smother the alfalfa seedlings; second, the nurse-crop grains have always been planted from the point of view of getting a good yield of grain, and not from the point of view of securing a good stand of alfalfa.

In 1924 many fields showed alfalfa plants that came up, then smothered, or other fields where the plants were so weak that they died soon after grain harvest. However, these do not explain the difficulties with the alfalfa crop as a whole.



Corn or sorghum provide excellent roughage when alfalfa fails.

Table 28.—Average for Farms Growing Alfalfa Four or More Years

Farm No.	No. Years	Acres in alfalfa	Tons per acre	Hours per acre			Cost per acre	
				Man	Horse	Tractor	Operating	Total
1	4	28.89	2.61	14.50	16.40	....	$18.19	$30.71
2	4	23.46	2.79	21.00	23.20	....	24.47	36.42
5	6	44.87	2.28	16.30	20.60	....	19.37	36.78
6	4	30.69	1.98	20.10	18.60	....	19.18	34.86
11	5	41.49	2.70	17.10	20.95	....	22.46	42.03
12	5	89.69	2.15	10.58	16.27	....	14.18	25.82
13	6	83.68	2.60	14.73	21.31	....	19.18	32.37
17	5	74.79	2.06	16.40	20.33	.68	17.25	23.65
25	5	36.68	3.41	18.74	25.51	....	23.78	36.93
26	6	37.93	2.87	17.58	25.07	....	23.14	39.51
27	6	18.33	2.55	14.49	19.84	....	17.62	24.08
28	6	39.76	3.04	17.88	17.70	....	20.67	34.55
29	5	56.51	2.24	13.60	14.33	....	20.07	36.68
33	4	66.00	2.25	15.02	17.62	....	18.95	26.76

Probably the most important difficulty is that of securing a stand of alfalfa for a period longer than 3 years. Experience during the past few years indicates that the rotation may have to be shortened. This may eventually be beneficial inasmuch as all the farm will be rotated whereas previously there has been a tendency to plant particular fields better adapted to certain crops several years in succession. As a result the nematode disease of beets and various potato diseases have tended to increase somewhat rapidly. Yields have become less while the quality of product has decreased. Therefore rotating the entire farm may in the years to come actually increase the normal production.

The causes of the difficulty of maintaining a stand of alfalfa are several in number. Within the past few years a bacterium wilt has become more noticeable in its effects. This muds or clogs the vascular system of the roots of the alfalfa plants, causing a continual dropping of the leaves and shortening the stems. Because of this, plant food fails to enter the stem and leaves, thus reducing plant growth and thereby yield. Another factor is that of winter killing. It is impossible to determine how much the yield of alfalfa is reduced by these two causes.

It is also possible that with continued applications of irrigation waters the amount of salts in the soil may have become increased, which also may aid in the so-called clogging of the vascular system of the alfalfa roots. It has not as yet been definitely determined whether the clogging is wholly that of the bacterium, or partly that of the collection of salts, or both. Evidence is at hand which tends to show that the disease may be somewhat more prevalent where heavy applications of irrigation water are supplied to the alfalfa.[1]

Another cause is that of planting poor seed. When alfalfa was first planted in Northern Colorado the seed mostly came from Hamburg, Germany. This was exceptionally good seed. Of late years seed has been used from other foreign countries such as Argentine, Turkestan and from various locations within the United States, and has not been adapted to climatic and soil conditions of Northern Colorado.

Failure to plant the better grades and varieties of alfalfa may be somewhat responsible for increased winter killing or bacterium wilt. Some farmers who have shown care in the selection of alfalfa seed, and in their methods of seeding, have had no trouble with alfalfa stands during the period of this study.

In the last few years some farmers have used Grimm alfalfa seed in order to secure a better stand of hay.

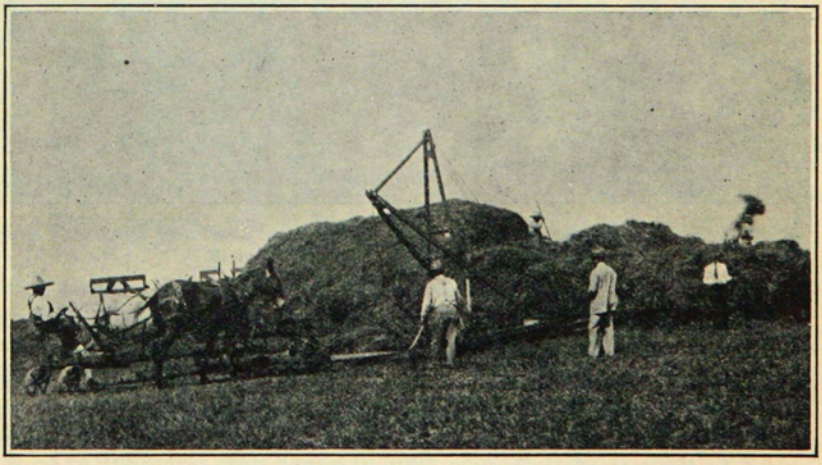
[1]L. W. Durrell, Colorado Experiment Station.

The cost of producing alfalfa is influenced by the methods of handling the crop. One of these methods is that of irrigation practice and the corresponding labor involved. Some farmers practice more or less consistently the irrigation of alfalfa at night. Nearly all farmers practice this method to some extent, some more than others. This practice depends largely on the amount of water to be had, the proportion of grain and row crops to alfalfa, and the lay of the land.

A large supply of water will be allowed to run on alfalfa longer than a more limited supply. Therefore the labor requirements are reduced in making sets. Especially is this the case in night sets. A larger proportion of grain or row crops relative to the alfalfa acreage results in day sets of water on the grain or row crops and night sets on the alfalfa, thus reducing the labor requirements on the alfalfa.

Another variation in practice is in the method of stacking. Two methods of stacking alfalfa are followed in the Eaton-Greeley area. Near Greeley the crane stackers and sleds are used. This method necessitates the use of three sleds pulled by two horses per sled, in order to keep the stacker occupied. Three teamsters and at least one field pitcher are necessary in addition to the men at the stack. Ten to 15 acres will normally be stacked in a day's time with such a crew

In the Eaton-Severance area the overshot stacker is the more common practice. Three sweeps and a stacker team driven by a boy, with two men on the stack, will normally stack 14 to 20 acres



Buck rakes and an overshot stacker save labor in stacking alfalfa according to data secured in this study.

per day. The latter method is less expensive while the former method results in better quality of hay and less wastage about the stacks. Especially is this true if the season is at all wet.

For the year 1926 four men were selected who used one method, and four who used the other. Farms 11, 25, 31 and 38 used the sled and crane stacker. Farms 5, 13, 26 and 28 used the buck rake and overshot stacker. The results on the two groups of farms were as follows:

Table 29.—Hours Labor Stacking Hay by Different Methods, 1926

Item	Sled stacking		Buck rake stacking	
Number of farms.....	4		4	
Area alfalfa	176.5		216.9	
Yield per acre, tons.....	3.6		2.2	
Hours per acre	Man	Horse	Man	Horse
For three cuttings.....	14.51	17.46	6.05	8.23
For one cutting.....	4.84	5.82	2.02	2.74
Hours per ton.....	4.04	4.86	2.75	3.74

Getting a load of hay with sleds and slings. This takes more time than with rakes.

The time per acre for the group using sleds should be more than for the others, as the yield per acre was 1.4 tons greater. Even when put on a ton basis, however, the buck rake method shows a saving of 1.29 man and 1.12 horse hours per ton. At average rates for man, horse, equipment and overhead, this means a saving in labor per ton of about 75 cents for the buck rake method as compared to the use of sleds.

Variation in the cost of producing a ton of alfalfa is there-

fore partly due to failure in securing a stand, and partly to different ways of irrigating and stacking.

Beans.—The bean crop is normally a crop which is planted in lieu of some other cultivated crop, which may, because of climatic conditions, be unprofitable to cultivate that particular year. The land can be worked at small cost and planted to beans later in the season. This crop therefore serves the purpose of being a catch crop which brings in some ready money during the season. Many farmers planting beans under these conditions consider that any return over and above actual prime costs is that much gained, as the land might be otherwise idle or planted to some feed crop which may not be needed the year in question.

Beans may also be planted on land not suited for potatoes or beets or may replace a portion of these crops any given year, should the cultivated acreage of these crops be exceptionally large in proportion to the total cultivated area. In the case of land not suited for potatoes or beets, beans, being a cash crop, will supply a portion of the operating expenses and yield a financial return comparable with a poor beet or potato crop. In the case of beans replacing a portion of the beet or potato acreage, the question of supply of irrigation water becomes a factor inasmuch as beans require less water than potatoes or beets. Beets the year following beans receive but little soil preparation as it is seldom necessary to plow. Bean growers who consistently plant a small portion of their farm to beans therefore find serious competition some years from those who continually change their policy as to growing beans.

Two types of beans were grown in this area. Pinto or Mexican beans, and seed beans, so-called, which include all varieties of beans grown under contract for seed houses. Table 30 shows the average results for 4 years on pinto beans. Table 31 shows the result with seed beans for 3 years. In the years 1922 and 1923 no separation was made between the two kinds of beans. There were 12 records these years. The average for the 12 showed a loss of 57 cents per acre without any interest, and a loss of $14.30 per acre when interest was included. Neither of these years offers any suggestion or hope of profit, altho farm 14 did make a profit each year.

In 1925 and 1926 pinto beans made more money than seed beans. In 1924 seed beans did the better. In 1924 and 1927 pinto beans were very poor. Blight and rust nearly ruined the crop.

Considering all records and years, the bean crop at yields and prices existing during this study was not a profitable crop. Pinto beans in 1926 and seed beans in 1924 were the only instances where they paid interest on the investment in land.

Because beans are grown to fill a gap, so to speak, in the cropping program, the supply fluctuates considerably, with the result that wide variations in price occur. Especially is this true of pinto beans which are grown extensively in the more arid sections of Colorado as well as on irrigated farms. Cost records kept by 17 farmers during 1926 and 1928 on dry land[3] show that $4.53 per 100 pounds is necessary to meet all expenses of production, including interest on investment. A comparison of this figure with that in Table 30 shows that only 1 year out of the 4 were farmers on irrigated farms able to meet this comparative price.

Table 30.—Average Yearly Cost Per Acre of Producing Pinto Beans, 1924 to 1927

	1924	1925	1926	1927	Yearly average
Number of farms	2	6	3	4	....
Acres in crop	5.34	14.74	9.73	11.03	10.21
Yield per acre, lbs.	251	1,156	1,085	154	662
Seed per acre	17	24	41	55[1]	34.2[2]
Man hours per acre	24.18	32.63	45.52	51.79	38.53
Horse hours per acre	36.18	30.41	48.41	75.29	47.57
Tractor hours per acre	....	.11	....	1.09	.30
Cost per acre:					
Man labor	$ 8.85	$10.56	$14.40	$15.78	$12.40
Horse labor	5.96	5.00	6.56	7.51	6.26
Seed	.85	1.59	1.64	4.24	2.08
Manure	.14	.78	.98	.65	.64
Coal	....	.10	.17	....	.07
Threshing	.95	3.83	3.02	1.63	2.36
Water tax	....	1.55	1.79	5.23	2.14
Real estate tax	3.26	2.25	3.14	5.52	3.54
Equipment	2.29	1.51	2.64	4.14	2.65
Tractor	....	.12	....	1.85	.50
Miscellaneous	.05	.55	.14	.15	.21
Overhead	2.66	3.08	3.61	6.47	3.95
Total operating cost	25.01	30.92	38.09	53.17	36.80
Interest on land	12.88	11.24	13.57	24.23	15.48
Total all costs	37.89	42.16	51.66	77.40	52.28
Value per cwt.	4.61	3.58	5.00	4.94	4.34
Value per acre	11.59	41.38	54.25	7.59	28.70
Returns per acre:					
Without interest	—13.42	10.46	16.16	—45.58	—8.10
With interest	—26.30	—.78	2.59	—69.81	—23.58
Cost per cwt.:					
Without interest	9.95	2.67	3.51	34.52	5.56
With interest	15.07	3.65	4.76	50.26	7.91

[1]28 lbs. per acre planted; 87.80 acres planted; 44.11 acres harvested.
[2]28 lbs. per acre based on area planted.

[3]T. H. Summers, Colorado Extension Service.

In the absence of disease, pinto beans are a profitable crop.

Table 31.—Yearly Average Cost Per Acre of Producing Seed Beans, 1924 to 1926

	1924	1925	1926	Yearly average
Number of farms	5	9	4	....
Acres in crop	15.26	20.23	14.12	16.54
Yield per acre, lbs.	1,427	919	905	1,084
Seed per acre	60	52	71	61
Man hours per acre	34.9	36.89	40.25	37.35
Horse hours per acre	50.0	35.22	43.90	43.04
Cost per acre:				
Man labor	$12.59	$12.13	$13.18	$12.63
Horse labor	8.91	6.11	5.84	6.95
Seed	2.88	2.57	3.48	2.98
Manure	.60	.88	.33	.60
Coal	.21	.04	.04	.10
Threshing	5.00	3.35	3.13	3.83
Water tax	1.93	3.36	2.99	2.76
Real estate tax	2.87	2.96	3.19	3.01
Equipment	3.10	2.00	2.49	2.53
Miscellaneous	.17	.17	.22	.19
Overhead	3.15	3.03	4.07	3.41
Total operating cost	41.41	36.60	38.96	38.99
Interest on land	15.41	15.28	14.64	15.08
Total all costs	56.82	51.80	53.60	54.07
Value per cwt.	4.56	4.88	4.89	4.74
Value per acre	65.10	44.84	44.25	51.40
Returns per acre:				
Without interest	23.69	8.24	5.29	12.41
With interest	8.28	—6.96	—9.35	—2.67
Costs per cwt.:				
Without interest	2.90	3.98	4.30	3.40
With interest	4.56	5.64	5.92	4.99

Oats.—Fifty-five records were secured on oats during the 6 years. The average results each year are shown in Table 32. Each

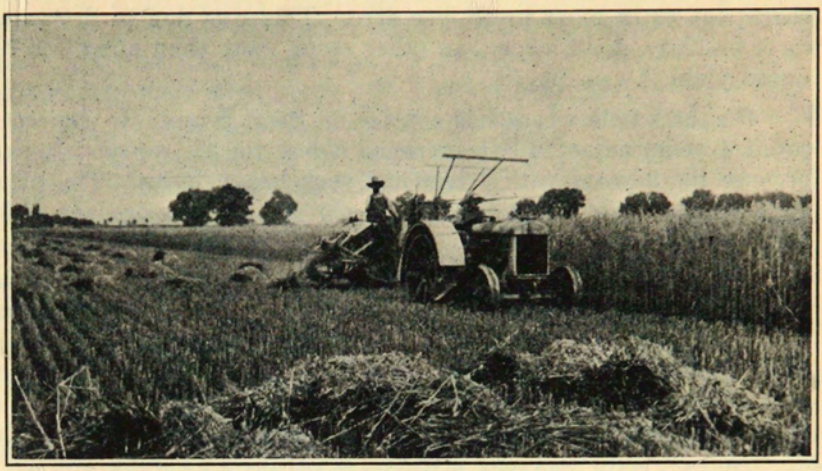
year they failed to earn interest on the average investment in land. A few farms were able to grow oats at a profit, notably 12, 25 and 38. These results were secured by men who had shown the ability to produce other crops at a profit when some of their neighbors were scarcely breaking even. But their profits were small. Oats have little to recommend them for wide use under conditions that obtain in this region. They do not yield as heavily as barley; are not as good a nurse crop for alfalfa; and apparently do not offer as much chance for profit.

They do supply a certain need in furnishing feed for horses. Probably in this respect they are superior to barley, which is the more general horse feed, mainly because farmers do not like to bother with a few acres of oats just for the work stock.

Table 32.—Average Yearly Cost Per Acre of Producing Oats, 1922 to 1927

	1922	1923	1924	1925	1926	1927	Yearly average
Number of farms	9	12	11	11	8	4	....
Acres in crop harvested	9.57	11.21	14.67	17.26	16.55	10.97	13.37
Yield per acre, lbs.	1,892	1,906	1,798	1,887	2,527	1,802	1,968.6
Seed per acre	81	100	68	104	69	93	85.8
Man hours per acre	17.20	13.26	13.31	12.47	13.53	12.03	13.6
Horse hours per acre	26.59	17.42	16.95	21.45	18.61	16.59	19.6
Tractor	....	.16	....	.20	....	....	.06
Cost per acre:							
Man labor	$ 5.32	$ 4.45	$ 4.75	$ 4.44	$ 4.74	$ 3.42	$ 4.52
Horse labor	4.67	2.63	2.56	3.54	2.80	2.14	3.06
Seed	1.14	1.09	1.20	2.02	1.15	1.24	1.31
Manure	1.92	1.94	2.48	4.50	3.54	2.79	2.86
Twine	.47	.45	.53	.49	.60	.40	.49
Coal	.39	.15	.20	.10	.08	....	.15
Threshing	3.94	4.28	3.25	4.08	4.57	3.73	3.97
Water tax	1.40	.95	.79	1.33	1.18	1.16	1.13
Real estate tax	3.78	2.77	2.62	3.21	2.75	3.33	3.08
Buildings	.34	.20	.56	.53	.40	.24	.38
Equipment	1.28	.69	.85	1.12	.94	1.18	1.01
Tractor	....	.19	....	....	.07	....	.04
Miscellaneous	.11	.08	.11	.23	.41	.36	.22
Overhead	1.13	1.06	1.04	1.19	1.83	1.60	1.31
Total operating cost	25.89	20.93	20.94	26.78	25.06	21.59	23.53
Interest on land	17.14	14.16	13.80	17.96	12.76	14.14	14.99
Total all costs	43.03	35.09	34.74	44.74	37.82	35.73	38.52
Value per cwt.	1.43	1.42	1.66	1.53	1.32	1.60	1.48
Value per acre	27.06	27.06	29.85	28.87	33.36	28.83	29.17
Returns per acre:							
Without interest	1.17	6.13	8.91	2.09	8.30	7.24	5.64
With interest	—15.97	—8.03	—4.89	—15.87	—4.46	—6.90	—9.35
Cost per cwt.:							
Without interest	1.37	1.10	1.16	1.42	.99	1.20	1.20
With interest	2.27	1.84	1.93	2.37	1.50	1.98	1.96

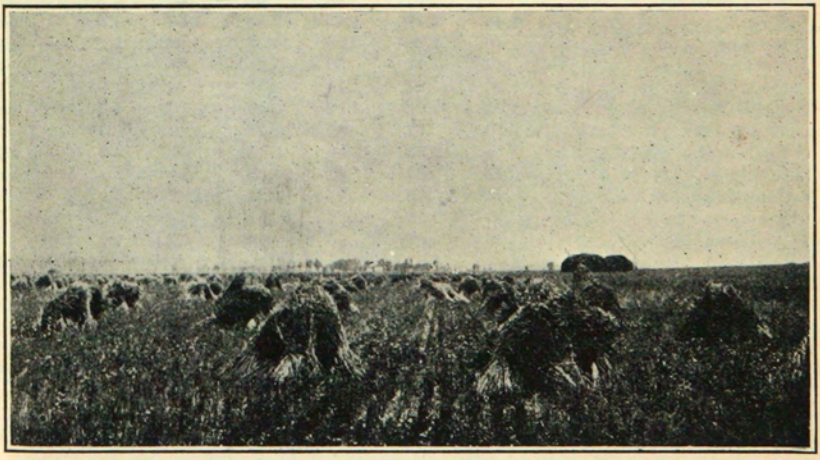
Wheat.—There was much variation in the importance of wheat in this area from year to year. Wheat is a cash crop that can be



Harvesting an excellent crop of oats.

grown in place of other cash crops. When prices of wheat looked attractive, or prices of other crops did not look attractive, then more wheat was grown. In 1922 15 farms grew wheat. In 1924 only 2 farms grew wheat. And, as such things have a habit of doing, the results in 1922 were the poorest and those in 1924 were the best. In 1922 nobody made money on wheat.

In 1927, with yields 470 pounds per acre less than in 1926,



Wheat serves as one of the minor cash crops in the Greeley area.

there was $3.12 more profit per acre. This was due to decreased costs in 1927. Less labor, less other costs, more than offset the reduced yield.

On the whole wheat has a place on these farms. It showed a profit 4 years out of 6 but averaged a loss for all records studied because the 2 years with a loss had such heavy losses. The price apparently should be at least $1.75 per 100 pounds or over $1.00 per bushel before it offers much chance of profit.

At the price of $1.75 per cwt. one must secure 37 bushels of marketable wheat in order to secure wages for himself and return for use of land. Wheat must be produced in competition with other sections of the United States which have comparative advantages in labor requirements, large scale machinery, less overhead, and a lower necessary return for use of land to keep the supply forth-

Table 33.—Average Yearly Cost Per Acre of Producing Wheat, 1922 to 1927

	1922	1923	1924	1925	1926	1927	Yearly average
Number of farms	15	12	2	9	9	4	....
Acres in crop harvested	27.44	23.77	12.50	13.77	20.14	17.65	19.21
Yield per acre, lbs.	1,552	1,718	2,348	1,687	2,686	2,218	2,034.8
Seed per acre	76	84	86	94	75	82	82.8
Man hours per acre	13.32	11.22	16.99	12.14	17.24	11.82	13.79
Horse hours per acre	18.57	15.12	17.28	18.18	28.96	14.74	18.81
Tractor hours per acre	.08	.11	....	.19	.20	....	.10
Costs per acre:							
Man labor	$ 4.50	$ 3.82	$ 6.40	$ 4.15	$ 6.31	$ 3.85	$ 4.84
Horse labor	2.92	2.15	2.94	3.05	4.28	2.05	2.90
Haul contract	....	....	.65	.06	.07	.30	.18
Seed	1.48	1.40	1.45	2.88	1.97	1.69	1.81
Manure	2.40	1.66	3.29	4.23	3.94	2.12	8.61
Twine	.46	.51	.52	.40	.98	.56	.57
Coal	.23	.21	.13	.23	.14	.08	.17
Threshing	2.72	3.20	4.92	3.21	5.05	4.16	3.88
Water tax	1.50	.77	.67	.78	1.01	.75	.91
Real estate tax	3.14	2.96	2.88	3.08	3.30	3.05	3.07
Buildings	.27	.23	.11	.06	.10	....	.13
Equipment	.94	.73	.96	1.22	1.62	.97	1.07
Tractor	.20	.14	....	.11	.15	....	.10
Miscellaneous	.25	.06	.13	.04	.32	.55	.23
Overhead	1.01	1.01	1.41	1.12	1.90	1.51	1.33
Total operating cost	22.02	18.85	26.46	24.62	31.14	21.64	24.12
Interest on land	14.86	14.44	10.45	17.12	15.45	13.40	14.29
Total all costs	36.88	33.29	36.91	41.74	46.59	35.04	38.41
Value per cwt.	1.45	1.38	1.91	2.48	1.80	1.80	1.81
Value per acre	22.50	23.71	44.85	41.84	48.35	39.92	36.86
Returns per acre:							
Without interest	.48	4.86	18.38	17.12	17.21	18.28	12.74
With interest	—14.38	—9.58	7.94	.10	1.76	4.88	—1.55
Cost per cwt.:							
Without interest	1.42	1.10	1.13	1.46	1.16	.97	1.18
With interest	2.38	1.94	1.57	2.47	1.73	1.57	1.89

coming. Wheat has a limited place on the irrigated farms of Colorado, after sufficient feed crops are grown and where the soil is not adapted to some other crops and where a cash crop is desirable.

The average yield has been, for the six years studied, about 33 bushels, or 4 bushels less than necessary to pay all expenses of production. Yields on the heavier soils of Northern Colorado irrigated farms are reported well above this necessary profit yield of 37 bushels.

As a cash crop, wheat in this area is superior to barley. The demand for barley as a sheep and cattle feed, however, results in a larger acreage being grown.

Corn.—Corn was not grown extensively any year, yet it was handled in many ways. One man grew silage corn every year. Some grew grain corn; some fed off the standing corn. In 1925 five men cut corn for fodder for sheep or cattle, two men grew popcorn. Because of the small number of records in each case, the only figures shown are the average results for each method of handling. Even these are of doubtful value because of the small number of records. In the case of silage corn, the result comes nearer to what might be called normal, as a definite place in the rotation was assigned to corn, and it had an equal chance with other crops. But even here the averages are low on yield. Fodder corn or fed-off corn was more of a fill-in crop to take the place of some crop that had been originally planned for.

The yield of silage corn shows as 8.09 tons per acre. This average is somewhat below normal, due to a low yield in 1925. The

Inspecting a field of corn on a farm-management tour.

farm where corn silage was grown every year is in a state of high fertility. The cornfields were the equal of any in the neighborhood, yet the measured yield as shown by weight tables for settled silage never went above 9 tons except 1 year, when the average was 10.16 tons. The value per ton for silage was $5.64. Compared to average alfalfa values this appears reasonable. Costs may appear high yet this same farm made a very good comparative showing in producing other crops. The conclusion is that silage does not pay in this region. Empty silos on some farms testify to the accuracy of this conclusion.

Table 34.—Average Cost of Producing Corn—All Records

Method of handling	Grain	Silage	Fodder	Fed-off	Popcorn
Number of records	13	8	5	7	2
Acres in crop harvested	7.67	12.98	17.63	16.29	21.19
Yield per acre	2,251 lbs.	8.09 T[1]	3.66 T	[2]	2,614 lbs.
Seed per acre, lbs.	12.4	11.2	17.0	10.7	contract
Man hours per acre	35.2	43.9	25.78	17.6	30.2
Horse hours per acre	58.8	66.6	36.21	29.4	49.6
Tractor hours per acre	....	....	1.06	.6	....
Costs per acre:					
Man labor	10.71	12.30	6.98	5.93	11.36
Horse labor	10.15	9.23	5.63	4.95	9.75
Hand contract	....	....	....	....	7.94
Seed	.67	.33	.82	.51	contract
Manure	2.51	6.15	6.41	1.46	4.45
Twine	....	.63	.14	....	....
Sacks	....	....	....	....	.71
Threshing	.93	....	....	....	....
Water tax	1.33	1.63	2.30	1.28	1.82
Real estate tax	3.68	3.41	2.97	2.39	2.18
Buildings	.62	4.53	....	....	.85
Equipment	2.49	3.67	2.82	1.91	2.15
Tractor	....	....	.58	.67	....
Miscellaneous	.26	2.80	.03	.09	....
Overhead	2.99	3.56	2.26	1.52	4.22
Total operating cost	36.34	48.24	30.94	20.71	45.43
Interest on land	17.13	15.99	13.08	15.25	9.44
Total all costs	53.47	64.23	44.02	35.96	54.87
Value per cwt. or ton	1.30	5.64	8.48	....	2.82
Value per acre	29.26	47.76[1]	31.02	24.12[2]	73.74
Returns per acre:					
Without interest	—7.08	—.48	.08	3.41	28.31
With interest	—24.21	—16.47	—13.00	—11.84	18.87
Cost per cwt. or ton:					
Without interest	1.61	6.77[3]	8.46	....	1.74
With interest	2.37	9.12[3]	12.02	....	2.10

[1]134 lbs. grain per acre picked before silo filled. Included in value per acre. Silage only $45.62 per acre.

[2]103 lbs. grain per acre picked before fed-off included in value per acre.

[3]Net after value of grain deducted.

Corn for grain averaged 2,251 pounds per acre or about 40 bushels. Good irrigated land is capable of yields much above this figure. Conservative opinion in the region claims that the yields shown here are about the same as yields of 10 tons of beets. If that is the case, 60 to 75 bushels of corn would be entirely within the possibilities where the same care is given that results in 15 to 20 tons of beets.

The question might arise as to whether barley or corn is the more profitable to grow. It is not so much a question of profitableness as it is a question of labor distribution. Corn cultivating interferes with beet and potato labor. Corn planting and harvesting tends to increase the peak load of labor in May and September. Furthermore, corn land requires additional labor over what barley land would for succeeding crops such as beets in that discing the corn row is necessary before plowing.

The cost of growing corn for pasture was $20.71 per acre without any charge for interest. It was valued at about $24 per acre, leaving only $3.41 return for the use of land.

Popcorn proved profitable on the two records shown. This is a poor guide to the future, as the market is easily flooded with popcorn. However, at prices of 2 cents per pound or better popcorn will give a fair return if these yields are normal.

Miscellaneous Crops.—Fourteen records on cabbage showed this crop to be profitable over a period of years. In 1922, 1923 and 1926 the cabbage crop resulted in a loss. These were all years of low prices. Whenever prices were 50 cents per 100 pounds or better

When cabbage is transplanted, immediate irrigation is necessary.

the crop returned a profit. The average yield on these records was nearly 12 tons per acre and the price a little over $10.00 per ton.

The high charge for hand contract labor is due to the method of handling the crop. In many instances the cabbage crop was rented out to someone who would do all the hand work and receive a share of the crop. For all records this share amounted to $47.75 per acre listed as contract labor. If this is deducted from $93.84, it gives $46.09 per acre as the operating cost to the owner and similarly $60.84 as the total cost.

Six records on canning factory peas gave a net profit per acre of $1.66. Four of the records failed to pay expenses, the other two made enough to offset the four and show an average profit for all records. The yield per acre on these two records was 2,370 pounds shelled peas per acre compared to 1,604 pounds for all records. The price was $3.64 per cwt., compared to a price of about $2.50 per 100 pounds other years.

The average cost per acre on all records was $47.61 or approximately $3.00 per hundred for a 1,604-pound yield.

Table 35.—Average Cost Per Acre of Producing Cabbage and Peas—All Records

Crop	Cabbage	Peas
Number of records	14	6
Acres in crop	9.16	16.26
Yield per acre, lbs.	23,471[1]	1,604
Seed per acre	....	90
Man hours per acre	43.77	17.6
Horse hours per acre	67.50	33.2
Tractor hours per acre	.55	....
Costs per acre:		
Man labor	$15.07	$ 6.08
Horse labor	7.72	5.62
Hand contract	47.75	6.07
Haul contract	.06	....
Seed	3.12	5.52
Manure	5.32	.32
Water tax	1.81	1.26
Real estate tax	2.87	2.87
Equipment	3.10	1.46
Tractor	.52	....
Truck	1.24	....
Miscellaneous	.57	.34
Overhead	4.69	2.08
Total operating cost	93.84	31.62
Interest on land	14.75	15.98
Total all costs	108.59	47.61
Value per cwt.	.534	3.07
Value per acre	116.65	49.27
Returns per acre:		
Without interest	22.81	17.65
With interest	8.06	1.66
Cost per cwt.:		
Without interest	.430	1.97
With interest	.497	2.97

[1]Based on 13 farms. On one farm no yield was reported.

Using a pea divider previous to harvest.

It would appear from these few records that yields of over 2,000 pounds per acre or prices of 3 cents per pound or better, were necessary in order to insure a profit on peas. Both of these are within the range of possibility. Hence the crop is worthy of more attention than it has had in previous years.

One decided advantage of the crop is the time of harvest. It

Trucks may enlarge the area over which peas may be grown.

brings in a cash income early in the summer when there is very little money coming in on the average farm.

Peas must be grown in relatively close proximity to the canning factory and therefore cannot be grown over a very large area.

The culture of peas, due to early harvest, allows the land to be double cropped, providing a feed crop cut for hay is grown. Cane or sudan grass or millet is an excellent combination with the pea crop.

Harvesting of peas is generally done by the canning factory except the cutting or pulling. Harvesting does, however, come at the same time as first cutting of alfalfa. Late peas do not interfere except with cultivation and irrigation of other crops.

1928 Crops.—The costs for 1928 for the important crops are shown in Table 36. The largest number of farms with complete costs for any one crop was six, hence the results for 1928 were not given equal weight in the averages previously discussed. The records are included here for comparison only. On the whole these results for 1928 agree closely with the records previously discussed.

Table 36.—Cost Per Acre of Producing Crops in 1928

Crop	Alfalfa	Barley	Oats	Wheat	Pinto beans	Sugar beets	Potatoes	Silage corn	Grain corn	Cabbage
Number of farms	6	6	5	2	2	2	6	1	1	1
Acres in crop	36.54	26.15	17.76	22.94	22.58	24.35	45.34	17.99	15.00	13.72
Yield per acre	2.09 T	2443 lbs.	2031 lbs.	1928 lbs.	796 lbs.	17.90 T	13,930 lbs.	4.21 T	45 bu.	27,248 lbs.
Man hours per acre	15.40	13.49	11.91	13.56	22.70	30.68	44.43	19.84	45.07	16.69
Horse hours per acre	18.74	20.21	21.52	6.89	32.40	57.85	65.37	28.52	32.67	39.87
Tractor hours per acre	.06	.31	.34	2.28	....	....	1.30	....	3.0	....
Costs per acre:										
Man labor	$ 4.78	$ 4.19	$ 3.48	$ 5.00	$ 7.28	$ 8.66	$14.06	$ 6.17	$12.30	$ 5.16
Horse labor	3.03	2.55	3.00	1.22	4.07	9.22	9.05	4.22	8.82	5.14
Hand contract	....	....	....	....	....	23.97	9.03	....	....	79.62
Haul contract	....	....	....	....	....	7.82	.55	....	....	7.69
Seed	2.05	1.31	1.67	1.45	2.85	3.00	9.33	.62	.58	.11
Manure	3.21	6.97	5.42	1.30	1.00	8.72	6.10	7.34	11.69	6.56
Twine	....	.47	.57	.42	....	....	.29	.39	....	....
Coal	....	.12	....	....	.17	....	....	....	....	....
Threshing	....	3.56	4.73	3.77	2.82	....	6.48[3]	4.20[2]	....	....
Water tax	1.25	.89	.66	.93	.31	3.07	2.55	2.58	.99	.36
Real estate tax	3.16	3.16	3.24	2.48	3.51	3.32	3.15	3.08	3.75	2.98
Buildings	....	.22	.33	....	....	.83	.68	3.65	....	....
Equipment	1.53	1.49	1.38	.50	3.05	4.29	5.28	2.14	3.44	2.14
Tractor	.10	.44	.33	.33[1]	....	....	.94	....	4.65	....
Truck	....	....	....	....	....	....	2.13	....	....	2.89
Miscellaneous	....	.20	.48	.43	.83	4.02	.28	2.50	....	....
Overhead	2.08	1.91	1.79	1.49	4.88	4.62	6.14	1.62	3.20	2.14
Total operating cost	21.19	27.48	27.08	19.32	30.77	81.54	76.04	38.51	49.42	114.79
Interest on land	14.97	15.23	13.77	13.05	11.58	15.03	14.45	16.82	15.74	14.01
Total all costs	36.16	42.71	40.85	32.37	42.35	96.57	90.49	55.33	65.16	128.80
Value per unit	16.05	1.15	1.43	1.385	5.42	7.00	.454	7.00	.82	.6075
Value per acre	33.54	28.19	29.04	26.70	43.14	125.30	52.30[4]	29.47	36.90	165.53
Returns per acre:										
Without interest	12.35	.71	1.96	7.38	12.37	43.76	—23.64	—9.04	—12.52	50.74
With interest	—2.62	—14.52	—11.81	—5.67	.79	28.73	—38.19	—25.86	—28.26	36.73
Cost per unit:										
Without interest	10.12	1.12	1.33	1.00	3.87	4.55	.66[4]	9.15	1.10 bu.	.421
With interest	17.26	1.75	2.01	1.68	5.32	5.39	.79[4]	13.15	1.45	.472

[1]This abnormally low cost for 2.28 tractor hours represents fuel and oil only. Farm 28 secured the use of a tractor free of charge.
[2]Filling silo.
[3]Sacks.
[4]Based on 11,519 lbs. accounted for.

Returns Per Hour of Man Labor.—In all the previous discussions the returns from each crop have been shown on an acre basis. To a farmer seeking the most profitable use of his time it is equally important to know which crop gives the best pay per hour for the time spent upon it.

Table 37 shows the average returns per man hour for the important crops based on the average for 6 years, 1922 to 1927. Sugar beets paid $.9464 per hour; potatoes, $.5898; and cabbage, $.5284.

The significant thing about this table is the fact that, with the exception of barley, oats and pinto beans, every crop in this list gave some return per hour for the time spent on it. Where these crops can be grown without adding directly to the demand for more labor expenses, they offer some return for time that might otherwise be unused. Hence the total farm income will be increased altho it will be done at a low rate per hour for these particular crops such as alfalfa, seed beans and wheat.

For comparative purposes the net profit above all costs is shown for each crop in the last column. There were only four crops that paid all costs including interest and left a profit.

Table 37.—Average Returns Per Hour Man Labor for Important Crops

Crop	Return per acre for use labor	Hours per acre man labor	Return per hour man labor	Net profit per acre
Potatoes	$31.52	53.44	$.5898	$13.63
Sugar beets	38.51	40.69	.9464	25.50
Barley	—3.12	14.10	—.2212	—7.75
Alfalfa	1.13	16.17	.0698	—4.22
Beans, seed	9.96	37.35	.2666	—2.67
Beans, pinto	—11.18	38.53	—.2901	—23.58
Oats	—4.83	13.60	—.3551	—9.35
Wheat	3.29	13.79	.2385	—1.55
Cabbage	23.13	43.77	.5284	8.06
Peas	7.74	17.60	.4397	1.66

Influence of Livestock on Crop Returns.—In the discussion of each crop in the preceding pages, no mention was made of any possible revenue from the straw, stubble or other waste products. As a matter of fact these crop residues are pastured by livestock in many instances. The value of sugar-beet tops was estimated to be from $1.25 per acre up to $7.00 per acre in different years. The average on 85 percent of the beet crop was $4.19 per acre. For the 6 years, 1922 to 1927, the value of beet tops per acre in beets harvested was $3.55. Hence $3.55 should be added to the returns per acre shown.

Similarly the men estimated that alfalfa and grain-stubble

pasture was worth $.95 per acre for all farms. And the value of straw used for feeders amounted to $.30 per acre in grain. These pasture and feed values should be added to the return per acre of grain, and the pasture value of $.95 should be added to the return per acre of alfalfa if one desires the total income from all sources from crops.

In the case of alfalfa and barley, livestock are largely responsible for the values placed on these crops. In years when few feeder sheep or cattle are fed in the area alfalfa drops to less than $7.00 per ton. When feeding is normal, the price goes above $15.00 per ton. Sale prices each year were used in showing the returns from crops.

Hours of Labor Used on Important Crops by Operations.— In the previous discussion of each crop the time required per acre has been shown as an average for each year and then a yearly average. In the following table the records for 6 years have been totalled and the labor on each crop for the period shown by operations. It will be noted that the total hours of labor per acre differ slightly in this table from that shown in the previous tables. Each acre is counted as one in getting these totals. Each year is counted as one in the other tables. To aid in comparison the time is shown as a sub-total up to harvest, then harvesting and marketing are shown separately.

The time actually spent manuring each crop is shown at the bottom and a new total given which includes manure. As previously noted, the cost of manuring crops on these farms was charged to each crop in proportion to the fertility removed, rather than in proportion to the time and manure directly used on each crop. Potatoes, sugar beets, corn and beans in the order named had the most time spent on them in applying manure. The number of records on cabbage was too small to separate them into two groups according to the method of handling the crop. An average composed of records where the farmer did all the work on cabbage along with records where the crop was rented out, would give a result with little meaning, consequently no labor figures are shown on cabbage. Actually more time was spent per acre applying manure to cabbage than to any other crop.

Some variation occurs between different crops for the same operation. This is due partly to the fact that the figures shown are based upon the entire acreage, while for some crops only part of the acreage was covered. In other cases there was a variation in the number of times the task was performed.

For example, plowing was a universal practice for potatoes. The average showed 4.7 man and 18.2 horse hours together with

0.5 tractor hours. Only a few men had tractors, and the time on their farms was not kept separate from the other farms. The time per acre plowing for beets was about one-half as much as for potatoes, because not over one-half of the land was plowed. More time was spent cultivating potatoes than beets. The time shown irrigating also includes the time cleaning and opening ditches, which explains the horse hours under this heading. Alfalfa and grain crops show about one-half as much time irrigating as was the case with beets and potatoes.

Table 38.—Hours Per Acre Producing Crops

Crop Acres in crop	Sugar Beets 2,638			Potatoes 2,739			Beans 666			Corn 460			Alfalfa 5,601			Barley 2,051			Oats 717			Wheat 1,109		
Average hours per acre	Man	Horse	Tractor	Man	Horse	Tractor	Man	Horse	Tractor	Man	Horse	Tractor	Man	Horse	Tractor	Man	Horse	Tractor	Man	Horse	Tractor	Man	Horse	Tractor
Operations:																								
Plowing	2.9	9.1	.5	4.7	18.2	.5	3.3	11.8	.1	3.8	12.5	.4	..	..	..	.7	1.8	.1	.5	1.7	.1	.6	2.2	..
Seedbed preparation	4.1	13.8	.1	2.6	8.5	..	3.0	9.9	..	3.2	9.3	.1	.2	.6	..	2.5	8.5	.2	2.2	7.6	..	2.4	8.0	.1
Planting	1.1	2.2	..	6.2	6.8	..	1.4	2.7	..	1.4	3.0	..	.3	.8	..	1.2	3.6	..	1.3	3.9	..	1.1	3.0	..
Cultivating	4.5	8.6	..	6.5	16.7	..	9.0	6.1	..	6.6	9.5	..	..	..	..	..	..	..	..	..	..	..	..	..
Irrigating	8.5	2.9	..	8.3	4.9	..	6.4	3.3	..	3.3	.9	..	3.7	.2	..	3.8	.7	..	4.0	.7	..	4.2	.7	..
Miscellaneous	.7	.4	..	.2	.1	..	.2	..	..	..	.1	..	..	..	..	..	..	..	.1	..	..	.1	.1	..
Sub-total till harvest	21.8	37.0	.6	28.5	55.2	.5	23.3	33.8	.1	18.3	35.3	.5	4.2	1.6	..	8.2	14.6	.3	8.1	13.9	.1	8.4	14.0	.1
Harvesting	5.8	14.9	..	5.2	14.1	..	12.1	7.6	..	..	..	..	12.1	19.0	..	6.0	6.6	.2	6.1	6.8	..	4.8	5.0	..
Marketing	12.0	30.0	..	18.9	11.3	..	.4	.6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total per acre	39.6	81.9	.6	52.6	80.6	.5	35.8	42.0	.1	..	..	..	16.3	20.6	..	14.2	21.2	.5	14.2	20.7	.1	13.2	19.0	.1
Manuring	3.2	7.1	..	5.0	11.6	..	1.9	4.7	..	..	..	..	.1	.1	..	.1	.3	..	.2	.3	..	.1	.2	..
Total including manure	42.8	89.0	.6	57.6	92.2	.5	37.7	46.7	.1	..	..	..	16.4	20.7	..	14.3	21.5	.5	14.4	21.0	.1	13.3	19.2	.1

Variations in Method of Handling Corn.—In the case of corn, the record given is up to harvest. All methods of handling corn are included, as there was little change in practice up to harvest regardless of how the crop was harvested. If corn was fed off, the extra labor would be charged to the livestock. On 86 acres of grain corn and 104 acres of silage corn the time spent in harvest was as follows:

Table 39.—Comparison of Hours Per Acre on Grain and Silage Corn

	Hours per acre	
	Man	Horse
Harvesting		
Grain corn	12.36	13.41
Silage corn	18.76	19.76
Total except manure[1]		
Grain corn	30.71	48.69
Silage corn	37.11	55.04
Total including manure[2]		
Grain corn	33.63	35.30
Silage corn	40.13	61.85

Rotations

The area of crops grown on all the farms included in this study indicates that about one-third of the crop area was in alfalfa, one-third equally divided between potatoes and beets, and one-third in grain and miscellaneous crops. This means a 6-year rotation Actually many farmers leave their alfalfa in one field as long as it yields anything at all and alternate their other crops in the balance of the fields until a new seeding of alfalfa is necessary.

It would be a wiser policy to keep alfalfa only 3 years and change the other crops more frequently. The failures of alfalfa seeding during the past few years have raised a question in the minds of farmers and students of farming as to how we can assure better success in the future. Better alfalfa seed; thinner seeding of nurse crop; irrigating so that seedling alfalfa plants are not left in soil too dry for their continued growth after the grain is harvested; keeping livestock off newly seeded alfalfa until the plants are firmly rooted; all these are necessary to secure good stands of alfalfa.

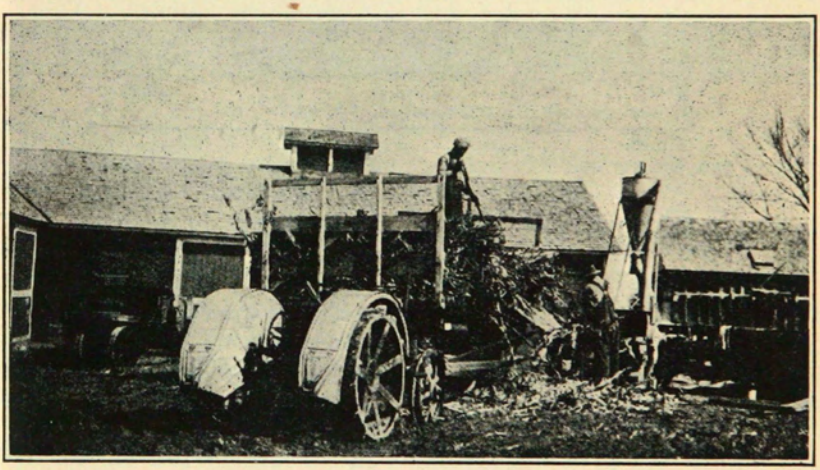
With these things in mind, experience in the region strongly recommends the following rotation: Alfalfa 3 years followed by potatoes, then by beets, then by grain reseeded to alfalfa. This gives one-half of the land in alfalfa. Where feeding is not favored

[1]Harvesting time plus hours up to harvest for all corn of 18.35 man hours and 35.26 horse hours.

[2]Includes 2.92 man hours and 6.81 horse hours per acre manuring all corn.

and more reliance must be placed upon cash crops, it seems that this rotation might be lengthened to alfalfa, 3 years; potatoes, 1 year; beets, 1 year; grain or beans, 1 year; beets, 1 year; and grain, 1 year, reseeded to alfalfa. This gives an 8-year rotation. When this rotation is followed it will be well to include a seeding of sweet clover in the grain crop between the two beet crops to furnish green manure for the second beet crop.

Where the new seeding of alfalfa fails and thus reduces the area of hay planned on for the next year, farmers are finding that cane, sudan or corn give a large amount of roughage. Men who shred corn fodder claim that it is an excellent feed when combined with alfalfa and concentrates.



Shredding corn fodder for cattle feed.

If the conditions at planting time are not favorable for sugar beets, cabbage or beans may be substituted for part of this acreage.

Potatoes are especially suited to the crop rotation systems in the area of Northern Colorado included in this study. Alfalfa is the principal hay crop. About every 3 years alfalfa must be plowed. The land has rested, so to speak, and is reasonably free from disease. The lateness with which potatoes may be planted allows for considerable green manure to be plowed under. This is ideal for potatoes, which respond to disease-free soil and green manures. The value of potatoes in rotation is still further realized the following year where beets may be planted on potato land without the necessity of plowing. Early seeding of beets can be accomplished, which increases the beet yield.

To find the effect of different rotations on returns, the per-

centage of cash and non-cash items of cost as previously discussed for the year 1926 were used as a basis and applied to the 5-year period, 1922 to 1926, inclusive. All costs except the farmer's own time were considered, and the return from the entire rotation was expressed as pay per hour for the farmer's time. The use of alfalfa, barley and other feed crops for feeding sheep or cattle and the possibility of extra profit from this source was not included. The figures were confined to the crop returns at 5-year average crop values. The results for different rotations are as follows:

Table 40.—Effect of Rotation upon Pay for Farmer's Time, Estimated from 5-Year Average Yields and Prices

Crop	No. years in rotation	Pay per hour for farmer's own time
Alfalfa	3	
Potatoes	1	
Beets	2	$.891
Wheat	1	
Alfalfa	3	
Wheat	1	
Beets	2	$.807
Barley	1	
Alfalfa	3	
Potatoes	1	
Beets	1	
Beans	1	$.752[1]
Beets	1	
Barley	1	

[1]By putting in wheat for beans this becomes $.781.

Controllable vs. Uncontrollable Factors

In all the previous discussion, comment has been made frequently showing the reasons why the growing of some crop resulted in a profit or a loss. These reasons might be summarized into two groups: First, those which the farmer can control, and second, those that are outside his immediate control. Some of the more important factors which are largely under the farmer's control are seed, cultural practices, timeliness of operations, use of irrigation water and productive capacity of the farm.

A factor that is important in affecting yield is that of pure seed. The effect of pure seed free from disease was clearly shown on farm 13 in 1928. One field of potatoes of home-grown stock yielded 6,500 pounds per acre, while certified seed free from disease yielded 10,500 pounds per acre.

It is within the power of every farmer to secure pure, clean seed, free from disease, for planting. The difference between profit and loss per acre may be due entirely to seed used. Inasmuch as seed is one of the important factors affecting yield, serious attention

The harrow aids in making a fine seedbed.

should be given in selecting the proper varieties which are true to type and free from disease.

Cultural Practice and Timeliness of Operations

Some farmers have their machinery ready for the field with all repairs and adjustments made so there will be no delay with the farm work. Some watch every crop and do their work when the most can be accomplished with the least effort. One case not included in these records, but on a neighboring farm, shows the difference between men.

In the fall of 1925 when potato prices were high and going higher, this farmer neglected potato digging for a week while he went on a hunting and fishing expedition. Then the heavy freeze came and he lost much of his crop. Other men were using two potato diggers to harvest their crop at a price seldom secured.

Other examples of doing work when it counts are: Planting beets early; cultivating when weeds are small; irrigating to keep crops growing at their maximum.

Productive Capacity of the Soil

Farmers who use manure, rotate their crops and make every effort to improve their land, such as leveling for better use of water, draining low spots or filling them in, find that their crop yields tend to improve.

With few exceptions the soil in this region is fertile and adapted to producing good crops. Yet the yields secured today are to a large degree due to the methods of handling the soil to build up

its content of organic matter and to make it more responsive to irrigation.

Of the uncontrollable factors little need be said. The weather comes and goes. Hail hits or misses the individual farm; frost kills the crops; rain delays spring work; prices rise and fall. Yet even here there is a chance for reducing the severity of these adverse conditions. Crops can be selected that are resistant to hail, or that mature early and avoid frost. Tractors can be used day and night to offset a late wet spring.

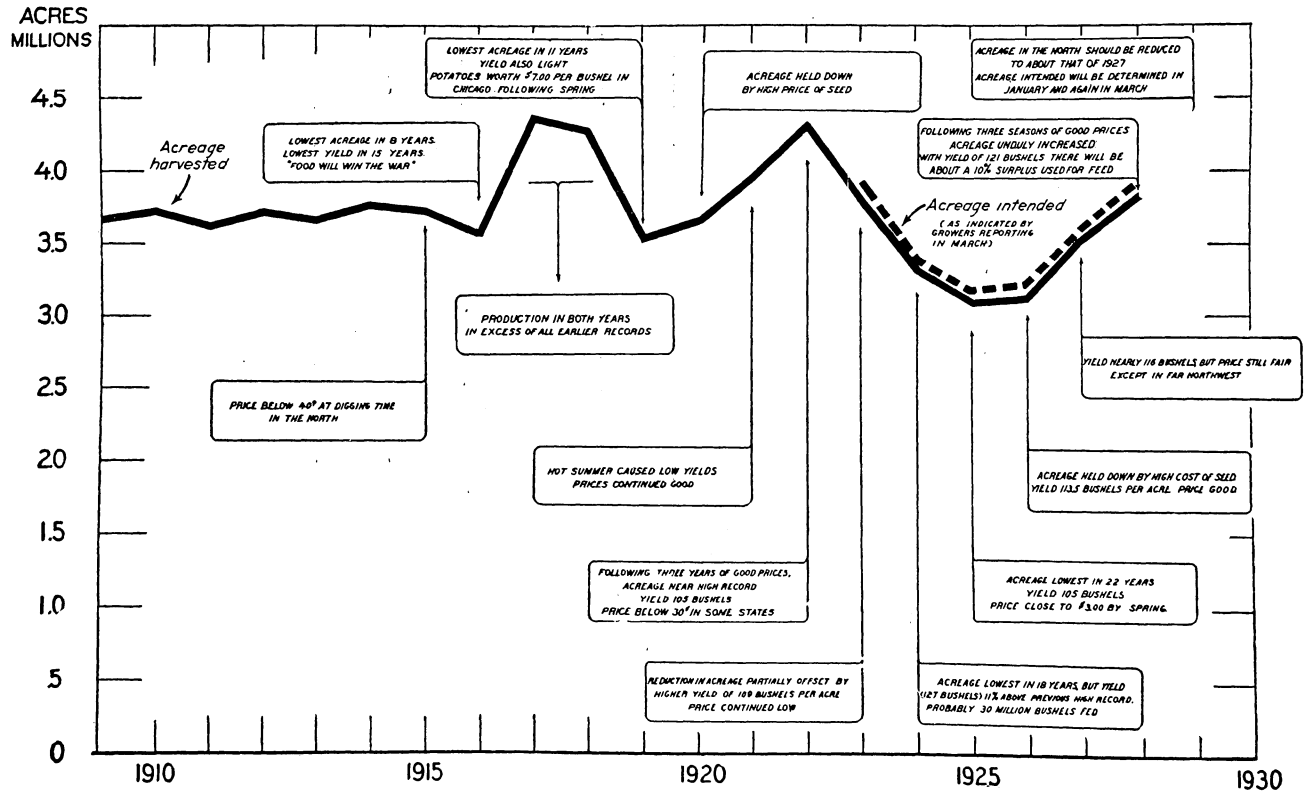
Prices are a problem and a study in themselves. Space does not permit a thoro analysis of this factor, yet it outweighs all others in its direct bearing on profit or loss. Several things should be studied closely by the individual farmer. First, what is the trend of prices. The chart of potato prices shows how they have fluctuated during the period of this study. First low, then high, it may be taken for granted that prices seldom remain the same. They are either getting better or worse. Hence the need for study to see what way they are headed and to find if there is anything that will change their direction. Government reports are the best guide for such a study.

Next is the question of foreign competition. Here the individual farmer is largely helpless unless he has political power sufficient to cause a change in the tariff to protect him, as is necessary with sugar beets. Failing in this move, the only recourse to meet foreign competition is to adapt and change the crops and methods of farming.

But above all other things in its importance in connection with price is the problem of when to sell. **Farmers should learn to sell on a rising market.** What do they actually do? Try to hold for the top price so they will make every possible profit! How does it usually work out? They never know when the top is reached. The price begins to fall. Then panic comes and they dump their crops, thus forcing prices farther down and resulting in more panic. Many instances of this could be cited from these records, especially with potatoes.

To sum up the problems of price: It would appear the part of wisdom to decide upon the rotation and crops that are adapted to one's location and soil, then keep to this plan over a period of years. If some great change in prices seems unavoidable, it might be advisable to make some modifications in acreage to result in an increased acreage when prices are high or a reduced acreage when prices are low. That is a hard thing to do. Few men can do it. Most are better off to ignore cycles of prices and grow the crop every year, or not at all.

FACTORS AFFECTING POTATO ACREAGE IN THE UNITED STATES



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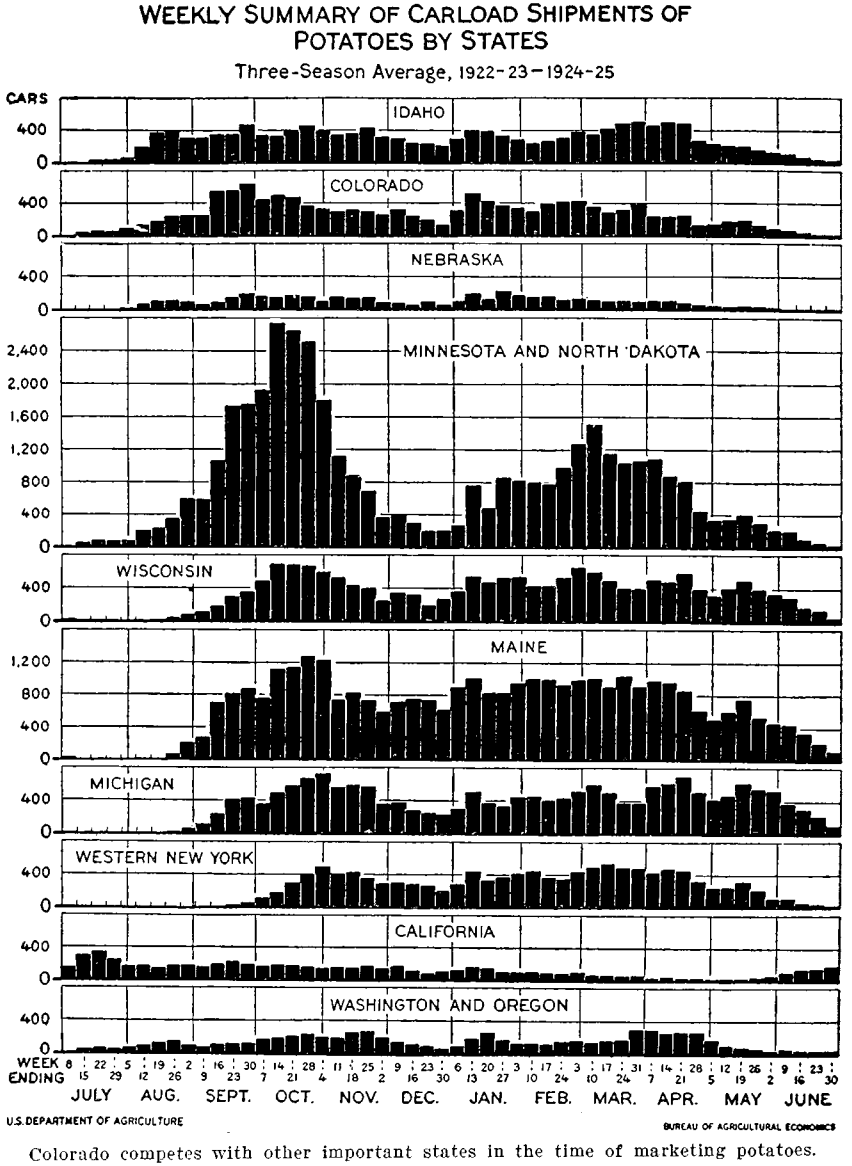
Bureau of Agricultural Economics.



Colorado competes with other important states in the time of marketing potatoes.

Conclusion

The value of such data as are found in this bulletin is in aiding an individual farm operator in attempting to become more familiar with his own business enterprise.

The hours of man and horse labor can be used in planning the farm program. It has been pointed out that labor requirements vary between farms and between years. Reasons have been given for such variation, as to methods employed. Low labor requirements are generally associated with managerial ability of the farmer, able and skillful employees, large-sized units both in machinery and power units, and a tentative but carefully laid out farm program.

Any individual farmer applying these results should make allowance for conditions which exist under his particular environment different from those included in this study. He should also make allowance for his inability to use any of the methods of labor economy employed by others. After having made due allowance for non-similar conditions, the farmer may use these facts presented in this bulletin in determining his labor program and his cropping system. His object should be to so combine the crop and livestock enterprises as to make full utilization of his own labor and a reasonable amount of hired labor. The planning of a labor program will help to distribute the labor evenly thruout the year, avoiding peak loads and thereby high-priced labor. Doing those operations on crops and livestock which are pertinent to increased yields or economy of production should be the guide in choosing what to do and when to do it.

In other words, a seasonal distribution of labor should be the aim of all producers. How to secure a well-distributed labor program is partly determined by the crops that are included in the rotation and the sequence in which they follow each other. In choosing crops to be included one must determine what proportion of the farm should be included in row crops, in non-cultivated crops and in feed crops and cash crops.

This problem becomes interrelated then with what livestock program to follow consistently. How much livestock to keep and what kinds must be determined. A proper balance of crops will reduce the work stock to a minimum and at the same time result in a maximum net income.

Day to day planning of labor becomes necessary after laying out the whole labor and enterprise schemes. Some tasks must be performed every day, others may be shifted to periods when the work is not so pressing. Here again a knowledge of sequence of crops work is pertinent to economical planning. Weather may

interfere and then it becomes necessary to choose the crops which will return the greatest income for any given operation.

Relative labor requirements and relative expenses of production are invaluable to an enterprising farmer who desires to secure a comparative advantage over other producers.

The time is here when each and every producer must realize that those who are dominated by economic motives are those who will attempt to seek the largest net return from their business. Every man has under his control such things as the securing of the best seed, proper rotation of crops, use of farm manure, proper irrigation, work done at the right time. The old adage, "the eye of the master fattens the cattle," is equally true in the case of crops. The eye of the master does raise better crops at lower costs.

What hope do these records offer to the man who has been unsuccessful in past years? Can these records help him? Yes and no. No, if he cares not how things are done. Yes, if he is seeking for ways to increase his income. Why were his yields low? Why were his costs high? Why did he waste so large a percentage of his crop? Why did his alfalfa seeding fail? Are there things which he has left undone? If so, the fact that others in the same region have found a way to do better than he means that, within reason, possibly he, too, can change for the better.

What farming in the future needs more than all else is an alert, keen, businesslike supervision by the men on the job. A willingness to learn by experience! A willingness to exchange views, to seek ever for better methods!

Is it true that we irrigate our potatoes too late in the fall, thus injuring their quality? Then there is something to think about. Is it true that we have assumed that alfalfa seed from anywhere will grow under any kind of care? Then here is a chance to improve our stand and our yields. Is it true that we have overlooked the possibilities of permanent pastures? Then here is a way to get returns from our land with less expense.

The value of these cost figures is not so much a matter of their accuracy or their permanency as it is a matter of challenge to our ways of farming. If they do no more than cause us to search our own methods and seek for better ways, they have done their part toward improving the farming situation.

At all events they represent a starting point. One thing is sure, they are based on detailed records, kept as carefully as possible by men in sympathy with the study of farming, checked and calculated by men seeking knowledge of better practices and lower costs. They should stimulate further study by each individual farmer. They should be used as a guide and a starting point by one studying his own business.