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AGRICULTURAL EXPERIMENT STATION

WASHINGTON
AGRICULTURAL EXPERIMENT STATION
and
BUREAU OF AGRICULTURAL ECONOMICS
UNITED STATES DEPARTMENT
OF AGRICULTURE
in cooperation

Farming Systems for Eastern Washington and Northern Idaho

By
GEORGE SEVERANCE, BYRON HUNTER, AND PAUL EKE

BULLETIN No. 173* JULY 1930

Published by the University of Idaho, Moscow, Idaho

* Also published by the Washington Experiment Station as Bulletin No. 244

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* On leave of absence.
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SUMMARY

This publication applies to those portions of the wheat region of eastern Washington and northern Idaho where the average annual precipitation exceeds 18 inches.

Practically all of the crop land of this area has been devoted exclusively to small grain farming for 35 to 50 years. Under this treatment the soils have lost at least 35 per cent of their organic matter, 25 per cent of their nitrogen and much of their capactiy for absorbing moisture. Furthermore, soil erosion has increased during this period until it has now become a serious menace.

Using sweet clover, peas and alfalfa as soil improving crops, this bulletin presents five practical cropping systems which provide for maintaining or increasing the organic matter of the soil and checking erosion while at the same time continuing wheat production as the major farm enterprise.

The estimated net return from each of these five cropping systems and that of the fairly standard two-year system of wheat alternating with summer fallow when applied to 300 acres and 600 acres of crop land, respectively, are compared in Tables 5 and 14.

Of the six cropping systems compared in Table 5, the two-year wheat and pea system ranks highest with a labor income of $1422, while the two-year wheat and summer fallow system is lowest with a labor income of $91. This difference is chiefly due to the production of salable crops on all of the crop land in the one case, whereas, in the other, half of the crop land is idle as summer fallow.

Although the two-year system of wheat and peas ranks highest in labor income as calculated in Tables 5 and 14, pea production in this area should be increased with caution because of the limited market demand for this crop.

Cropping Systems "C" and "D" (Table 5), in which sweet clover is used for improving the soil, may be applied very generally over the entire area since they introduce no marketing problem and sweet clover thrives everywhere.

The substitution of the combined-harvester (Table 10) for the stationary thresher used in Table 5 effects a saving ranging from $481 to $835, under the different cropping systems.

The labor incomes from the respective cropping systems on 600 acres of crop land, Table 14, where the work is done by one man with a tractor, is considerably more than twice as large as it is from 300 acres of crop land, Table 5, where the work is done by one man with horses.

The six cropping systems vary considerably in their requirements for labor during peak load periods. The estimated full acreage for each system that can be handled in good workmanlike manner prior to harvest, without hiring extra labor or using the tractor overtime during peak periods of work, is shown in Table 12 for the 9-horse equipment and in Table 20 for the 25 drawbar horse-power tractor.

Sheep and dairy cattle may prove profitable on a long time basis on farms where sweet clover is given a prominent place in the cropping system provided (1) that the loss from bloat is not excessive, (2) that a fairly good quality of hay can be made from second year sweet clover, and (3) that the yield of wheat following sweet clover is about as high when the clover is used for pasture from May 1 to late in September as it is when the clover is plowed under as a green manure late in May or early in June.

Hog production in this area must compete with the growing of wheat and in order to be highly profitable the price of pork must be relatively high as compared with that of wheat.

Poultry seems to offer a much better means of using skim milk in this area than do hogs.

FARMING SYSTEMS FOR EASTERN WASHINGTON AND NORTHERN IDAHO[1]

By

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INTRODUCTION

In the summer of 1929 the Bureau of Agricultural Economics of the United States Department of Agriculture, the State College of Washington, and the University of Idaho, cooperated in making a study of those portions of the wheat region of eastern Washington and northen Idaho where the average annual precipitation exceeds 18 inches per annum, to work out profitable cropping systems and plans of farm organization that will build up the soil and check erosion by suitable crop rotations and make it possible and profitable to reduce the amount of fallow. This bulletin reports the results of that study.

DESCRIPTION OF THE AREA

The area covered in the study is shown by the shaded area on the accompanying map, Figure 1. The outlines of the area cannot be too sharply defined because there are favored tracts below the 18 inch precipitation line where crop rotation is feasible because of exceptionally favorable conditions of soil or topography, while there are many tracts above the 18 inch precipitation line where a crop rotation including legumes is not practical because of unfavorable conditions of soil and topography.

[1] The authors wish to express their hearty appreciation of the cooperation of the many farmers, seed companies, and grain and implement dealers, who contributed much valuable data, and to the staffs of the Dairy, the Animal Husbandry, the Poultry, the Agricultural Engineering, and the Agronomy departments of the University of Idaho and the State College of Washington for much data and many useful suggestions regarding the preparation of the bulletin.

Fig. 1. Map Showing Location of Area Studied and Average Annual Precipitation and Altitudes at Observation Points.

The soil of this entire area is a deep, rich, silt loam resulting from the decomposition of basalt which has drifted into its present rolling topography by wind action. It is very retentive of moisture.

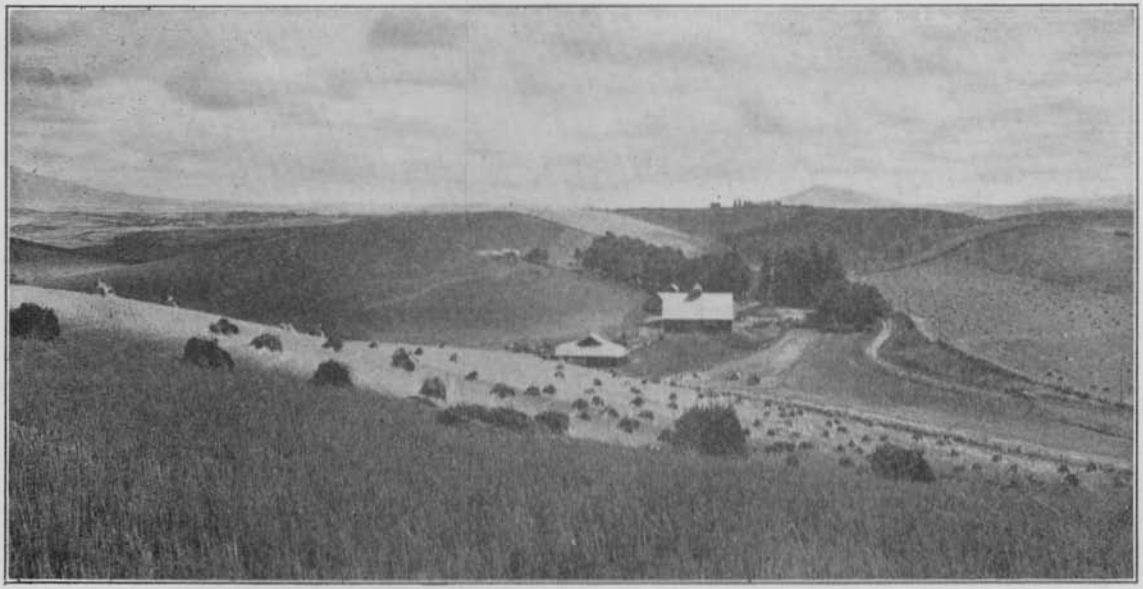

Fig. 2. Average topography of the area.

It is free from rock and well supplied with the essential mineral elements, comparing favorably with the rich silt loams of the Mississippi and the Red River valleys.

The topography of the area is rolling. Figure 2 is very typical of a large portion of the district. The elevation of most of the area varies from 1,500 to 3,000 feet.

The district is well supplied with good water for domestic purposes. Many farms have springs that furnish an abundance of water throughout the entire season. An adequate supply of water can be secured from wells in any part of the area.

The average annual precipitation at all observation points within the area, as well as a few points outside the margin of the area, is shown on the map, Figure 1. The precipitation recorded at each observation station is the average for all the years that the record has been kept. The precipitation for individual years varies quite widely from the average.

The distribution of precipitation by months is shown graphically for Rosalia, Pullman, Dayton and Nez Perce in Figure 3. The chart shows also the great variation in amount and distribution of precipitation in different seasons. It shows that the summers are very dry, giving almost ideal conditions for harvesting grain, but making it difficult to grow crops that make the greater part of their growth in the summer months like corn or potatoes. This particular distribution of precpitation is doubtless largely responsible for the predominance of grain, particularly fall wheat, in this area.

Figure 4 shows the length of frost-free period for the years 1918 to 1927, inclusive, for four representative points in the area. The warmer districts are usually two weeks or more earlier than the cooler districts and the growing season is longer, as indicated in this chart, which increases the range of crop possibilities somewhat.

AGRICULTURAL HISTORY OF THE AREA

Before settlement by the whites this area was a treeless prairie covered with a heavy growth of bunch grass. It was devoted largely to stock raising in the early days of its settlement, but was broken up rapidly for grain raising as soon as the railroads began construction

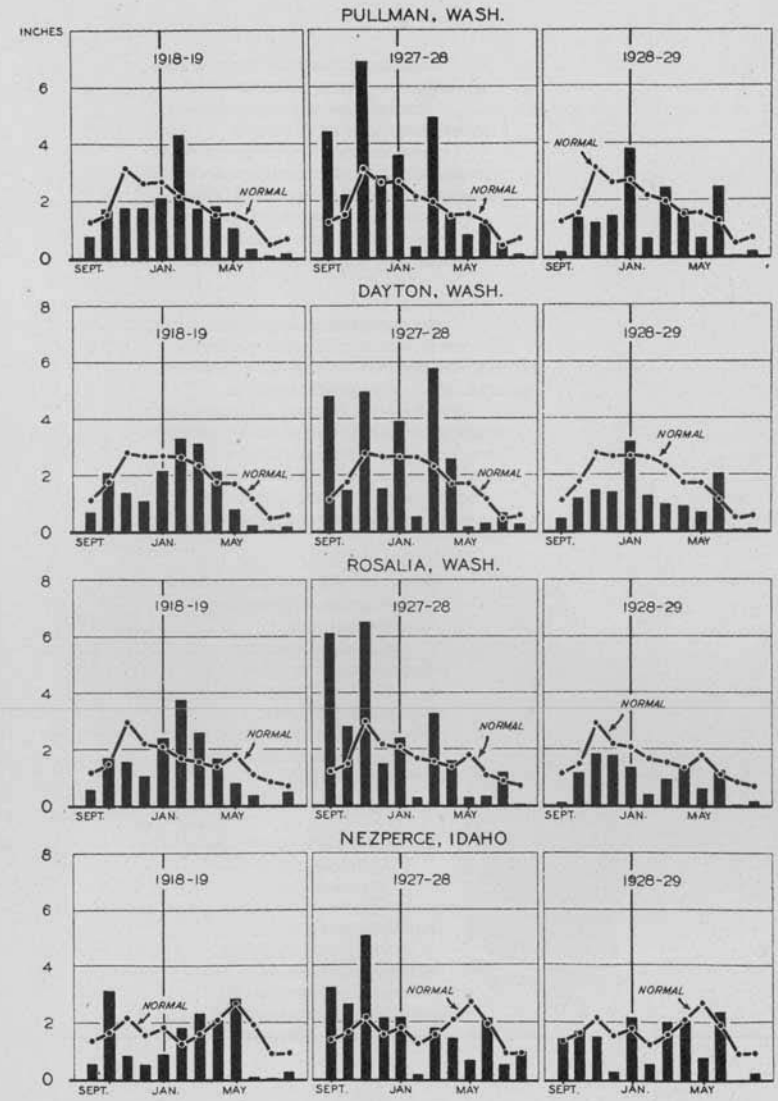

Fig. 3. Distribution of precipitation by months at four representative points in the area.

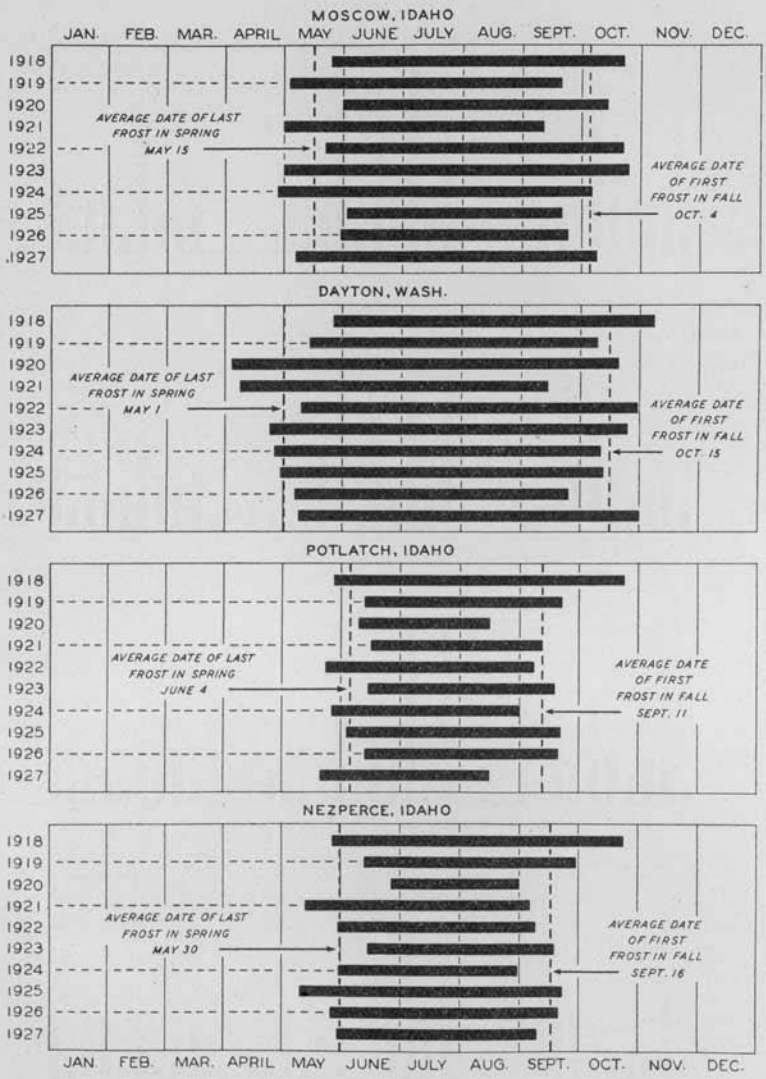

Fig. 4. Frost-free period for ten consecutive years at four representative points.

within the area in the early eighties. Practically the whole area has now been farmed from thirty-five to fifty years and the greater portion has been devoted almost exclusively to grain growing. In the

beginning much of the land was cropped each year, but in a few years the summer fallow practice was introduced. At first, land was summer fallowed only once in three or four years, but there has been a marked trend in recent years toward summer fallowing in alternate years.

As a result of continuous grain farming the soil over most of the area is becoming quite seriously depleted of organic matter and nitrogen. The soil absorbs and retains moisture less readily than in the early years of cultivation and erosion is becoming a serious menace. Figure 5 shows a fairly common example of erosion. Grain growth is much less vigorous than formerly and former yields are now secured only by much more thorough tillage methods. Farmers now very generally concede that some shifts must soon be made to farming systems that will build up the organic matter and nitrogen supply of the soil and help control erosion.

I. CROP FARMING

Basis for Setting Up Farm Plans

These conditions have already lead to many attempts by individual farmers as well as by the State Experiment Stations of Washington and Idaho to devise workable plans to place grain growing on a more permanent basis. As a basis for determining what crops might be profitably introduced into the rotations, what influence such crops would have on the soil and the yield of succeeding crops, and what methods of culture are most successful, data were secured by interviewing farmers scattered quite generally over the area who had taken one or more steps toward improving their soil and increasing their income by crop rotation and the elimination of the summer fallow. A few farmers have made so complete an adjustment as to entirely eliminate the summer fallow, but the majority of farmers visited were in the transitional stage.

The data secured from farmers were supplemented by results of experimental work at Pullman and Moscow. Farmers' experiences and Experiment Station results both indicate that alfalfa, biennial sweet clover, and peas are the three crops most widely applicable for crop rotation and soil improvement to the area under study.

Fig. 5. A fairly common example of soil erosion.

Beans and potatoes have been grown for sale to a limited extent in this area and corn and sunflowers have been grown by a few individuals for silage, but owing to their limited adaptability they have not been used in any of the cropping systems in this bulletin.

The records obtained show the materials used, the tillage operations performed, and the hours of man labor and horse and tractor work required to produce an acre of each crop. The records also show the cost of operating tractors and combines.

The information assembled in the 1929 study was further supplemented by the results of a former economic study of the agriculture of eastern Whitman County, Washington and Latah County, Idaho. Records were obtained covering the year's business of 229 farms for 1919, 241 farms for 1920 and 250 farms for 1921. These records furnished the information necessary for computing the cost of producing all of the crops grown at that time. This survey was used to check such items as crop yields, the operations performed and the materials used in crop production, the acres covered per day with teams and implements of given size, machinery charge, and upkeep of buildings, fences, and work animals.

Schedule of Farm Operations. In computing the acreage that can be handled in good workmanlike manner under the respective cropping

systems with either the 9-horse or the 25 drawbar H. P. tractor equipment, it was estimated that there would be available for field work under average weather conditions 18 days in April, 21 in May, 22 in June, 24 in July, 24 in August, 23 in September, 20 in October and 15 in November. A uniform set of field operations was adopted also for producing each crop. These operations and the usual time for their performance are shown in Figure 6. Table 1 shows the acres covered per day and the hours required per acre for each operation when horses are used to draw different sized implements and Table 2 shows similar data for tractor drawn implements. In these farm plans the peas, sweet clover, and alfalfa are planted before May 6. The plowing and first harrowing of the land to be summer fallowed are finished prior to June 11 and the winter wheat is planted between September 15 and November 1.

Table 1. Acres Normally Covered per 10-hour Day with Horse-drawn Implements of Specified Size, Crew Used and Hours of Man and Horse Work Required per Acre.

Operation	Size of implement	Crew		Acres per day	Hours per acre	
		Man	Horse		Man	Horse
Plowing	42 inches	1	8	7.50	1.33	10.67
Plowing sweet clover	42 inches	1	9	7.50	1.33	12.00
Plowing alfalfa	28 inches	1	12	4.00	2.50	30.00
Double disking	8 feet	1	8	15.00	.67	5.33
Harrowing	30 feet	1	8	50.00	.20	1.60
Rod weeding	12 feet	1	6	24.00	.42	2.50
Packing	15 feet	1	4	30.00	.33	1.33
Applying land plaster	10 feet	1	4	20.00	.50	2.00
Drilling	10 feet	1	4	20.00	.50	2.00
Mowing hay	5 feet	1	2	9.00	1.11	2.22
Mowing peas	5 feet	1	2	6.00	1.67	3.33
Raking hay	10 feet	1	2	20.00	.50	1.00
Raking peas	10 feet	1	2	12.00	.83	1.67
Binding grain	8 feet	1	4	14.00	.71	2.86
Combining grain	16 feet	5	16	25.00	(a)2.10	(a)6.72
Combining peas	12 feet	4	12	18.00	(a)2.33	(a)7.00
Shocking hay	.....	1	....	7.00	1.43	.....
Shocking grain	.....	1	....	8.00	1.25	.....
	Acre yld.					
Stacking wheat hay	2.5 tons	2	4	2.40	(b)8.33	b)16.67
Stacking wheat hay	2.2 tons	2	4	2.73	(b)7.33	b)14.67
Stacking alfalfa hay	1.5 tons	4	8	8.00	(c)5.00	c)10.00

(a) Hours per acre computed on the basis of a 10.5 hour day during harvest.
(b) Stacking done at the rate of 6 tons per day.
(c) Stacking done at the rate of 12 tons per day.

Table 2. Acres Normally Covered per 10-hour Day with Implements of Specified Size When Drawn by a 25 Drawbar H. P. Tractor and Man and Tractor Hours Required per Acre

Operation	Size of implement	Crew used		Acres per day	Hours per acre	
		Men	Tractor		Man	Tractor
Plowing	56"	1	1	15	.667	.667
Disking	16'	1	1	40	.250	.250
Harrowing	40'	1	1	100	.100	.100
Rod weeding	20'	1	1	70	.143	.143
Packing	22'	1	1	75	.133	.133
Drilling	20'	1	1	60	.167	.167
Combining wheat	12'	5	1	25	(a)2.100	(a) .420
Combining peas	12'	4	1	18	(a)2.333	(a) .583

(a) Computed on the basis of a 10.5 hour day during harvest.

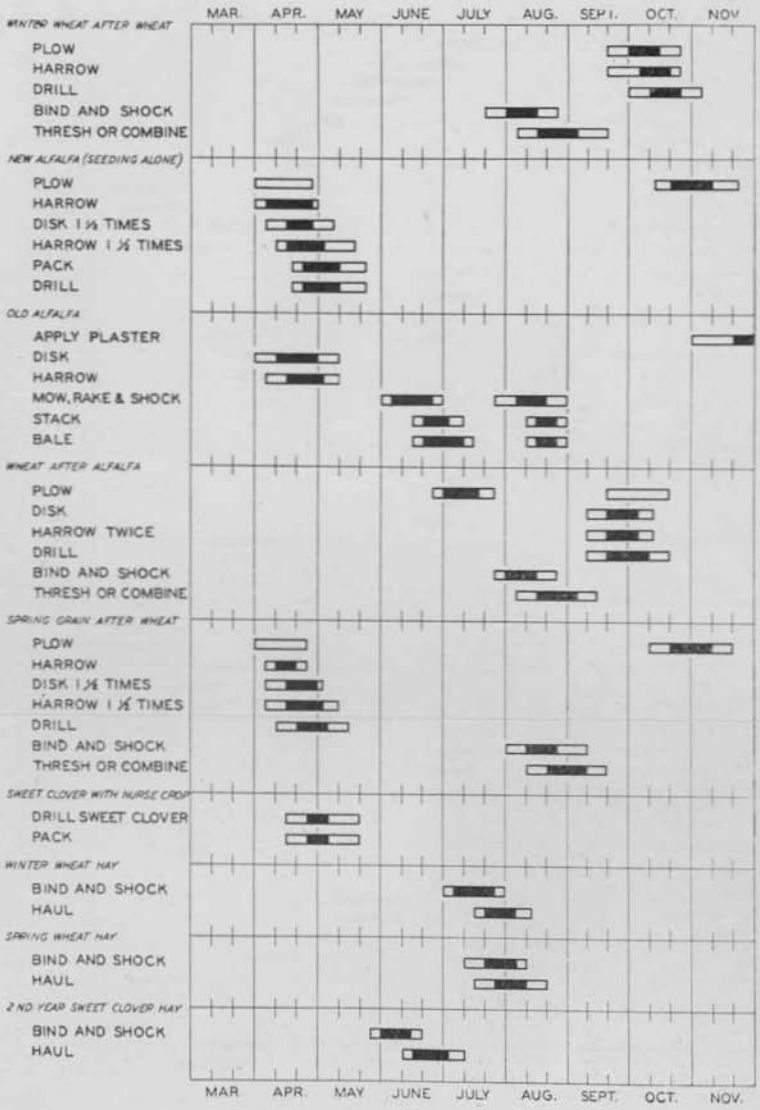

Fig. 6. Schedule of field operations—Black indicates normal periods for performing operation; white indicates range in period due to variations in seasonal conditions or cultural practices.

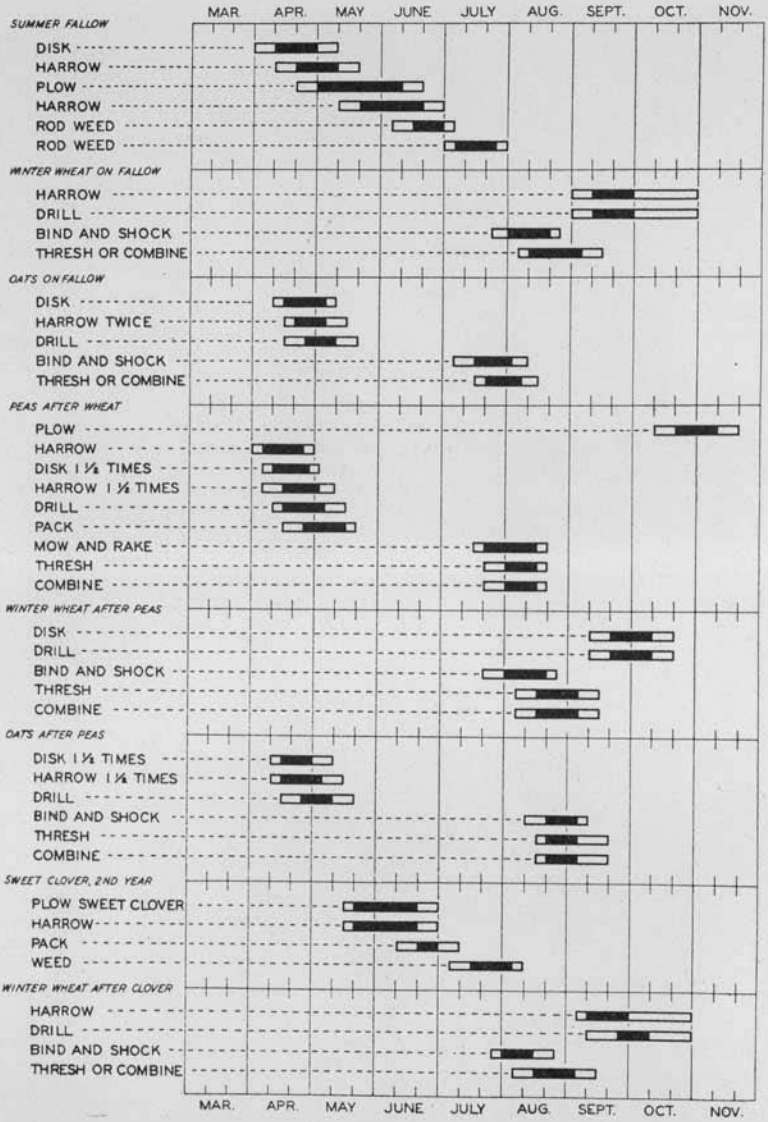

Fig. 7. Schedule of field operations (continued)—Black indicates normal periods for performing operation; white indicates range in period due to variations in seasonal conditions or cultural practices.

It must be emphasized that this schedule of operations represents a certain standard or degree of thoroughness. It represents reasonably thorough soil preparation for an average tract when the soil is in normal tilth. The amount of work may be reduced some seasons when the soil is more friable than usual or on mellow tracts in an average season, but this saving is likely to be balanced by putting on a little extra work in seasons when the soil is not normally friable or on tracts that are considerably below average in tilth. The aim is to develop a good seed bed and not necessarily to perform an unvarying set of operations. The amount of tillage outlined is somewhat above the average and amply justifies the scale of yields adopted.

It is assumed that the operations will be effective. One disking applied at the right time followed closely by a harrow is often more effective than two diskings and harrowings performed too late or when the soil is not in proper condition to work. There are probably few places where timeliness of operation is more important than in this area, and there are few places where a proper preparation of the soil more nearly guarantees at least a fair crop than in this area of rich, deep soil.

Figure 6 also shows the range of dates within which the operations should ordinarily be done. The solid portion of the bar represents a desirable range in a normal season, and the lighter portions of the bar represent the variation in date that may occur due to variations in season. The purpose of the chart is not to recommend dates for performing various operations, but primarily to show the demand for, and the distribution of labor. The dates used are arranged on the basis of conditions around Pullman and Moscow in the heart of the entire area and would not be correct for the earlier or the later parts of the area under study. No allowance was made for late spots on individual farms which often cannot be seeded for two or three weeks after the balance of the farm has been seeded.

Labor Requirements. The man and the horse labor required on a horse operated farm for the production of an acre of each crop are shown in Table 3. The labor requirements are segregated into labor required before harvest and labor required during harvest. The table also shows the amount that is hired. Table 4 shows corresponding data for the tractor operated farm.

Table 3. Crop Yields, Man Labor and Horse Work Required per Acre for Specified Crops, the Grain Crops Being Threshed from the Shock and the Peas from the windrow or Shock at Custom Rates

Crop	Yield per acre	Man labor required						Horse work required		
		Before harvest		For harvest		Total				
		Operator	Hired	Operator	Hired	Operator	Hired	Before harvest	Harvest	Total
	Bu.	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours
Winter Wheat:										
After summer fallow	35	3.94	....	.71	1.25	4.65	1.25	27.80	2.86	30.66
After peas	30	1.17	.....	.71	1.25	1.88	1.25	7.33	2.86	10.19
After sweet clover, plowed May-June	37	2.98	.....	.71	1.25	3.69	1.25	19.43	2.86	22.29
After sweet clover, plowed Sept.-Oct.	37	2.03	.....	.71	1.25	2.74	1.25	14.27	2.86	17.13
2nd or 3d crop after sweet clover	30	2.03	.....	.71	1.25	2.74	1.25	14.27	2.86	17.13
After alfalfa, plowed July	28	4.07	.....	.71	1.25	4.78	1.25	40.53	2.86	43.39
After alfalfa, plowed Sept.-Oct.	28	3.40	.....	.71	1.25	4.11	1.25	35.20	2.86	38.06
2nd, 3d or 4th crop after alfalfa	31	2.03	.....	.71	1.25	2.74	1.25	14.27	2.86	17.13
Spring wheat:										
2nd, 3d or 4th crop after alfalfa	28	3.08	.25	.71	1.25	3.79	1.50	24.67	2.86	27.53
2nd or 3d crop after sweet clover	27	3.08	.25	.71	1.25	3.79	1.50	24.67	2.86	27.53
Peas:	Pounds									
After wheat, oats or barley	900	3.25	.41	.83	1.67	4.08	2.08	26.00	5.00	31.00
After wheat, oats or barley (a)	900	3.50	.67	.83	1.67	4.33	2.34	28.00	5.00	33.00

(a) Sweet clover is seeded with this crop.

(Continued on next page)

Table 3 (Continued)

Crop	Yield per acre	Man labor required						Horse work required		
		Before harvest		for harvest		Total				
		Operator	Hired	Operator	Hired	Operator	Hired	Before harvest	Harvest	Total
	Bu.	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours
Oats:										
After summer fallow	2000	4.81	.....	.71	1.25	5.52	1.25	34.75	2.86	37.61
After peas	1860	1.55	.25	.71	1.25	2.26	1.50	12.40	2.86	15.26
2nd, 3d or 4th crop after sweet clover or alfalfa	1860	3.08	.25	.71	1.25	3.79	1.50	24.67	2.86	27.53
2nd or 3d crop after s. clover(a)	1860	3.50	.67	.71	1.25	4.21	1.92	28.00	2.86	30.86
Hay, winter wheat:	Tons									
After summer fallow	2.5	3.94	.....	4.86	5.41	8.80	5.41	27.80	19.53	47.33
After peas	2.2	1.17	.....	4.38	4.92	5.55	4.92	7.33	17.53	24.86
2nd, 3d or 4th crop after clover or alfalfa	2.2	2.03	.....	4.38	4.92	6.41	4.92	14.27	17.53	31.80
Hay, Spring wheat:										
After wheat (a)	2.2	3.50	.67	4.38	4.92	7.88	5.59	28.00	17.53	45.53
Hay, alfalfa:										
Cut 1½ times and put into cock	1.5	.79	.....	(b).83	3.40	1.62	3.40	5.73	4.83	10.56
Cut 1½ times and put into stack	1.5	.79	.....	(c)2.08	7.15	2.87	7.15	5.73	14.83	20.56
Alfalfa, new seeding alone	....	3.24	.42	.....	.....	3.24	.42	26.00	.....	26.00

(a) Sweet clover is seeded with this crop.
(b) The crew used for mowing and raking includes 3 men and 6 horses.
(c) The crew used for stacking includes 4 men and 8 horses. Twelve tons are stacked per day.

Table 4. Estimated Machinery Expense per Acre and Hours of Man Labor and Tractor Work Required to Produce an Acre of Wheat or Peas under Designated Sequence of Crops

Crop and crop sequence	Machinery charge per acre (a)	Hours of man labor per acre (b)			Hours of tractor work per acre (c)		
		Before harvest	Harvest	Total	Before harvest	Harvest	Total
	Dollars	Hours	Hours	Hours	Hours	Hours	Hours
Winter wheat after summer fallow	1.39	1.67	2.10	3.77	1.67	.420	2.090
Winter wheat after peas	.37	.42	2.10	2.52	.42	.420	.840
Winter wheat, 1st crop after sweet clover (s. clover plowed in June)	.97	1.31	2.10	3.41	1.31	.420	1.730
Winter wheat, 1st crop after sweet clover (s. clover plowed in Oct.)	.71	.93	2.10	3.03	.93	.420	1.350
Winter wheat after wheat	.71	.93	2.10	3.03	.93	.420	1.350
Spring wheat after wheat (land fall plowed, s. clover seeded)	1.40	1.76	2.10	3.86	1.76	.420	2.180
Peas after wheat	1.30	1.60	2.33	3.93	1.60	.583	2.183
Peas after wheat (s. clover seeded)	1.40	1.77	2.33	4.10	1.77	.583	2.353

(a) The tractor and combined harvester-thresher expense not included.
(b) The farm operator does all of the work before harvest. When combining wheat a crew of 5 men are required; a tractor driver and 4 men on the combine (a separator tender, header tender, sack sewer and sack jigger). The crew required for combining peas is 4 men, since one man jigs and sews the sacks.
(c) All farm power is supplied by the tractor.

In the main the field work prior to harvest is done by one man (the farm operator), using either the 8-horse team or the tractor equipment. When seeding peas two four-horse teams are used to harrow, seed and pack, which necessitates the hiring of an additional man for a short period. Wages for the services of the operator are not charged in the expense since pay for his services is represented in these calculations by "Labor income." In estimating labor it is assumed that the operator works full time whenever the farm requires the full time of one or more men.

Yields. Especial attention was given to securing information regarding crop yields. Based on these investigations, the scale of yields shown in Table 3 was adopted for use in developing the various farm budgets of receipts and expenses. The yields adopted for most of the crops are based on averages of the yield data secured from farmers by visitation. Records of wheat yields after alfalfa were secured from 38 farmers for the first crop, 37 for the second, 30 for the third, and 17 for the fourth crop; yields after sweet clover from 36 farmers for the first crop and 31 for the second and third crops; yields of wheat after peas from 142 farmers; and wheat after fallow from 74 farmers. The yields of peas were secured from the Associated Seed Pea Companies operating in the Fairfield area, and the Washburn-Wilson Seed Company of Moscow, Idaho. The Associated Seed Pea Companies furnished the records of weighed production of their contract peas for the years 1919 to 1928, inclusive, including 316 individual farm records, thus providing an unusually reliable average. The Washburn-Wilson Seed Company furnished the weighed production of its contract peas for the years 1926, 1927, and 1928.

Figure 8 displays all the individual records of wheat yields that were used in calculating averages.

It must be borne in mind that the scale of yields that was adopted represents averages that may be realized from good average farming over a period of years. These particular yields would probably not be secured in any given year. Better yields may usually be expected in the more humid portions than in the drier portions of the area. Furthermore, the more efficient farmers may expect to average better than this scale while the less efficient will fall below, but the farmer who follows the production methods outlined in the schedule of farm operations (Figures 6 and 7) and the discussion of alfalfa, page 43, sweet colver, page 39, and peas, page 33, on a good average farm within the area may safely expect to secure these average yields over a period of years.

Budgeting the Selected Cropping Systems for a 320 Acre Farm with 300 Crop Acres Operated with a 9-Horse Outfit, Grain Cut with a Binder, Peas with a Mower, and Threshing Done with a Stationary Outfit.

Using the three legumes that have been found to be adapted to this area, alfalfa, sweet clover and peas as a basis for rotation with grain crops, a series of cropping systems were selected that are already being used in at least a limited way in this area. All are designed to maintain soil productivity so that grain may continue to be the major crop indefinitely. Each system was budgeted to compare the net returns from each with the net return from the fairly standard system of wheat alternating with summer fallow as shown in Table 5. The gross receipts in these budgets are derived entirely from the sale of marketable crops. Complete farm budgets with both crops and livestock are presented in the latter part of this bulletin. Each budget represents one complete year's business taken after the cropping system has been fully established on the entire farm.

Calculating the season's business as outlined in this bulletin enables one to prepare in advance for needed labor and supplies, makes possible the securing of better terms and frequently insures more timely completion of operations.

The Cropping Systems and Size of Farms. The rotations are shown in the top horizontal column in Table 5 and are designated by letters "A" to "F", inclusive. Budgets were first worked out for each cropping system for a 320 acre farm containing 300 acres net available for crops. This would fairly represent a half section farm ordinarily spoken of as "all tillable." According to the 1925 census this size would seem to represent the situation of a larger number of farmers in this area than a larger or a smaller unit. Although all items do not vary in proportion to the relative sizes of farms, it is believed that these budgets may be quite readily adjusted to other sizes of farms.

Capital Investment. In determining the capital investment, farm land was valued at $100. This valuation is based on the judgment of several men who handle loans and real estate in different parts of this area and represents a general average for the area as a whole

Table 5. Estimated Annual Returns from Following Different Cropping Systems on a 320 Acre Farm having 300 Acres of Crop Land, the Field Work being Done with a 9-horse Equipment, the Wheat Cut with a Binder, the Peas and Alfalfa with a Mower, and the Threshing Done from the Field with a Stationary Machine at Custom Rates

Cropping system	A S. fallow, 1 yr. wheat, 1 yr.	B Peas, 1 yr. wheat, 1 yr.	C S. clover, 1 yr. wheat, 2 yrs. (s. clo. seeded)	D S. clover, 1 yr. wheat, 3 yrs. (s. clo. seeded)	E S. clover,1 yr. wheat, 2 yrs. peas, 1 yr. (s. clo. seeded)	F Alfalfa, 3 yrs. wheat, 4 yrs. n. alfalfa, 1 yr. (seeded alone)
Length of rotation	2 years	2 years	3 years	4 years	4 years	8 years
Capital:						
Real estate	$32000	$32000	$32000	$32000	$32000	$32000
Equipment	1560	1810	1560	1560	1810	1810
Receipts:						
Wheat	4658	3910	5920	6532	4422	4221
Peas	.....	2925	.....	.....	1463	.....
Alfalfa hay	.....	.....	.....	.....	.....	1480
Total	4658	6835	5920	6532	5885	5701
Expenses:						
Hired labor	101	300(a)	151	159	174	452 (b)
Machinery	241	301	273	271	284	353
Threshing	646	1228	808	889	955	592
Hauling	119	158	152	167	143	108
Materials	369	309	605	618	459	483
Insurance	22	33	27	30	28	20
Constant Costs(c)	1055	1055	1055	1055	1055	1055
Total	2553	3384	3071	3189	3098	3063
Farm income	2105	3451	2849	3343	2787	2638
Interest on capital 6%	2014	2029	2014	2014	2029	2029
Labor income	91	1422	835	1329	758	609
Family living from farm (d)	554	554	554	554	554	554
Total operator's earnings	645	1976	1389	1883	1312	1163

(a) Includes disking hired done in April (66 acres @ $1.00).
(b) Includes $37 for the hire of four horses while plowing alfalfa in July.
(c) Includes the upkeep expense of buildings ($196), fences ($51), ton truck ($275), and 9 work animals ($108), the telephone ($9), and taxes ($416).
(d) Includes the use of the farm dwelling and the fruits, vegetables, meats, milk, butter and eggs produced on the farm and used by the farm family.

when applied to a farm that is generally spoken of as "all tillable." The equipment used in calculating the budget in Table 5 is a practically uniform 9-horse equipment as listed in Table 6 for all cropping systems. The investment in equipment in the going concern is taken at half the cost since the average investment in any tool for its entire period of service is one-half its first cost. The cost of equipping new would therefore be approximately double the investment listed under "Capital" in Table 5.

Table 6. Equipment for 320 Acre Farm Operated with Horses.

Number	Kind
9	Work animals
4	Sets harness
1	Gang plow, 3 bottoms 14 inch
1	Double disk harrow, 8 foot
2	Drills, 10 foot
1	Harrow, 30 foot
2	Cultipackers, 15 foot
1	Wagon, 1-¾ inch.
1	Grain cleaner and treater
1	Revolving rod weeder, 12 foot
	Shop and miscellaneous
	To the above list the following have been added under the conditions specified:
	1. Where the wheat is threshed with a stationary machine
	1—8 ft. binder
	2. Where both peas and wheat are grown and threshed with a stationary machine
	1—8 ft. binder
	2—5 ft. mowers
	1—10 ft. rake
	3. When alfalfa is grown and wheat is threshed with a stationary machine
	1—8 ft. binder
	2—5 ft. mowers
	1—10 ft. rake
	1—1 ¾ in. wagon
	4. Where all threshing is done with a combine
	Omit the binder
	Add an interest in a combine as outlined in Table 23
	Add one mower in System "A" to cut hay for horses
	Drop one mower from System "B"

Uniform acreage and practically uniform equipment were used throughout Table 5 so that the net returns would more accurately show the relative profitableness of the different cropping systems.

Receipts. Table 7 shows the number of acres in each crop, the total production based on the scale of yields given in Table 3, the amount held for feed and seed, and the amount left for sale.

In estimating receipts, all wheat was computed at $1.04 per bushel net to the grower at the warehouse. To derive the price of $1.04 per bushel the prices quoted in the Spokesman Review on the first and fifteenth of each month at Pullman for No. 1 White and No. 1 Red wheat for the years 1922 to 1927 were weighted according to the percentage of wheat sold each month, given an average dockage of two cents per bushel, a differential of two cents between No. 1 and No. 2 and further weighted on the basis of 40 per cent of the entire crop white, 60 per cent red, and 20 per cent of both white and red grading No. 1. The Department of Farm Crops, Washington State College, furnished the estimate of the relative percentage of white and red and the Kelley-Hughes Warehouse Co., Pullman, furnished the estimate of the percentage grading No. 1.

In preparing the budgets, wheat was used wherever grain occurs in the rotation except for a small acreage of oats grown for feed. In actual operations deviations from these cropping systems would be justified on portions of many farms where experience has demonstrated that oats or barley usually do better than wheat.

Peas were estimated at $2.50 per 100 pounds which is the contract price that has been more commonly paid by the seed companies for the past ten years. There is no regular market for alfalfa, but it was estimated at $10 per ton in the stack which represents approximately the average price paid by the University of Idaho for baled hay in June, July, and August for the years 1922 to 1929, less $5 per ton for baling and delivery. This price also represents the experience and judgment of a few farmers in the area who have sold some alfalfa. The prices used in computing livestock receipts are given in that section of the bulletin.

Table 7. Estimated Production and Disposal of Crops from Following Different Cropping Systems on a 320 Acre Farm Having 300 Acres of Crop Land, the Field Work Being Done with a 9-horse Equipment.

Cropping systems	Acres	Produced	Feed and seed	For sale
SYSTEM A, 2-YEAR ROATION (Summer fallow-winter wheat):				
Summer fallow	150	.....	.....	.....
Winter wheat after fallow	132	4620 bu.	141 bu.	4479 bu.
Winter wheat hay after fallow	9	22 T.	22 T.	.....
Oats after fallow	9	186 cwt.	186 cwt.	.....
SYSTEM B, 2-YEAR ROATION (Peas-wheat):				
Peas	150	1350 cwt.	180 cwt.	1170 cwt.
Winter wheat after peas	130	3900 bu.	140 bu.	3760 bu.
Winter wheat hay after peas	10	22 T.	22 T.	.....
Oats after peas	10	186 cwt.	186 cwt.	.....
SYSTEM C, 3-YEAR ROATION (Sweet clover-wheat 2 years):				
Sweet clover plowed June	100	.....	.....	.....
Winter wheat after s. clover	100	3700 bu.	100 bu.	3600 bu.
Spring wheat (s. clover seeded)	80	2160 bu.	68 bu.	2092 bu.
Spring wheat hay (s. clo. seeded)	10	22 T.	22 T.	.....
Oats (s. clover seeded)	10	186 cwt.	186 cwt.	.....
SYSTEM D, 4-YEAR ROTATION (Sweet clover-wheat 3 years):				
Sweet clover	75	.....	.....	.....
Winter wheat	75	2775 bu.	75 bu.	2700 bu.
Winter wheat	65	1950 bu.	75 bu.	1875 bu.
Winter wheat hay	10	22 T.	22 T.	.....
Spring wheat (s. clover seeded)	65	1755 bu.	49 bu.	1706 bu.
Oats (sweet clover seeded)	10	186 cwt.	186 cwt.	.....
SYSTEM E, 4-YEAR ROATION (S. clover-wheat 2 years-peas):				
Sweet clover plowed June	75	.....	.....	.....
Winter wheat after clover	66	2442 bu.	75 bu.	2367 bu.
Winter wheat hay after clover	9	22.5 T.	22.5 T.	.....
Winter wheat after wheat	65	1950 bu.	65 bu.	1885 bu.
Oats after wheat	10	186 cwt.	186 cwt.	.....
Peas (sweet clover seeded)	75	675 cwt.	90 cwt.	585 cwt.
SYSTEM F, 8-YEAR ROATION (Alf. 3 yrs.-wheat 4 yrs.-alf. seeded):				
Alfalfa	113	170 T.	22 T.	148 T.
Winter wheat after alfalfa	37	1036 bu.	28 bu.	1008 bu.
Winter wheat after wheat	90	2790 bu.	90 bu.	2700 bu.
Spring wheat after wheat	13	364 bu.	13 bu.	351 bu.
Oats after wheat	10	186 cwt.	186 cwt.	.....
New alfalfa	37	.....	.....	.....

Expenses. Expenses include all labor except that of the operator, any seed that is purchased, copper carbonate for treating seed wheat, pea inoculation, binding and sack twine, sacks, land plaster for alfalfa, crop and building insurance, threshing, hauling crops to the warehouse, upkeep of machinery, telephone, taxes, upkeep of buildings and fences, operation and upkeep of light truck, and upkeep and maintenance of horses and harness. Rates used in computing all these cost items are shown in Table 8.

Table 8. Prices of Cost Items Used in Computing Returns

Item	Unit	Price per unit	Remarks
Labor (a)		Dollars	
Before and after harvest	Day	3.50	For ten hour day
Haying	Day	4.00	For ten hour day
Harvesting	Day	4.50	Grain cut with binder, peas with mower
Combine crew:			
Driver	Day	5.00	For 10.5 hour day
Separator tender	Day	8.00	For 10.5 hour day
Header tender	Day	5.00	For 10.5 hour day
Sack sewer	Day	7.00	For 10.5 hour day
Sack jigger	Day	5.00	For 10.5 hour day
Tractor driver:			
Before and after harvest	Day	5.00	For ten hour day
Harvest	Day	6.00	For 10.5 hour day
Threshing			
Wheat	Bu.	.13	Threshing from shock
Oats	Cwt.	.25	Threshing from shock
Barley	Cwt.	.22	Threshing from shock
Peas	Cwt.	.50	Threshing from shock or windrow
Hauling			
Wheat	Bu.	.0266	From thresher, 6c sack
Wheat	Bu.	.0355	From combine, 8c sack
Peas	Cwt.	.0428	From thresher, 6c sack
Peas	Cwt.	.0571	From combine, 8c sack
Sacks			
Wheat	Sack	.135	135 lbs. wheat per sack
Barley	Sack	.135	110 lbs. barley per sack
Oats	Sack	.13	100 lbs. oats per sack
Peas	Sack	.135	140 lbs. peas per sack (company furnishes sack when peas are grown on contract)

(a) The wages for all labor includes board at $1.00 per day per man.

(Continued on next page)

Table 8 (Continued)

Item	Unit	Price per unit	Remarks
Twine			
Binding	Lb.	.15	This amounts to about .5c
Sack	Lb.	.90	per sack
Seed			
Wheat	Bu.		Seed reserved from crop
Oats	Cwt.		Seed reserved from crop
Barley	Cwt.		Seed reserved from crop
Sweet clover	Lb.	.14	
Alfalfa	Lb.	.25	
Peas	Cwt.		When grown on contract pea seed is advanced by company and taken out of crop
Inoculation material	Acre	.25	Used only when legume first planted
Copper carbonate	Oz.	.02	Two oz. per acre for small grain
Land plaster	Ton	15.00	Applied only to 1 yr. old alfalfa at rate of 200 lbs. per acre
Crop insurance	$100	.45	Computed on full value of crop
Taxes	Acre	1.30	On real estate and personal property
Buildings upkeep	Farm	196.	
Fence upkeep	Acre	.16	
Telephone	Farm	9.00	
Work animals			
Depreciation	Head	7.50	
Medicine, harness, etc.	Head	4.50	

Farm Income. Total receipts minus total expenses leaves "Farm Income" which is the amount left for the operator's services and interest earned by the capital.

Labor Income. Subtracting six per cent interest on the capital investment from the "Farm Income" leaves a sum termed "Labor Income," which represents what is left to pay the operator for his services. In case a farmer operates his own farm this interest item would represent what should be credited to capital investment though the actual cash paid out for the use of capital would be only the annual interest on whatever is still owed on the farm and equipment. In case of a farm operated by a renter this item of "Interest on Capital" would represent what the renter pays in cash or share for the use of the farm plus interest on his own investment in equipment.

The cost to the renter may be greater or less than the six per cent on total investment as calculated in the budgets, depending upon the terms of rental.

In actual operation it is not expected that any given farmer would secure the exact labor income shown in the budgets in Table 5, but they do represent the relative profitableness of the several cropping systems when applied to a given size of farm. On every farm there will be minor items of expense not included in these budgets, but it is believed their omission will not affect the relative position of the several cropping systems when they are compared for net profits.

Family Living from Farm. "Family Living from Farm," which is estimated at $554, includes a moderate rent value placed on the house and a farm value on all food items secured from the farm. This estimate is derived from cooperative studies made in 1919, 1920, and 1921. It is assumed that the production of this food would be provided for in the one-sixteenth of the total farm area allowed for farmstead, garden, orchard and cow pasture, but for simplicity it is left out of detailed calculations. Handled in this way this portion of the income is not dependent upon the particular cropping system or farm organization adopted. The "Family Living from Farm" may be more or less than this average according to the efforts of the family.

Operator's Earnings. "Operator's Earnings" is the sum of the "Labor Income" plus the "Family Living from Farm."

Adaptability of the Cropping Systems

System "A," the common two-year system of alternating winter wheat with summer fallow, is a favorite system for various reasons. It is very simple, gives a fairly good distribution of labor throughout the season, and is easily administered between the landlord and tenant on rented farms. Crops are quite certain if summer fallowing is well done and it affords opportunity for good control of weeds.

On the other hand, this system continually depletes the soil of humus and nitrogen which causes a serious increase in erosion and a gradual decline in yielding power. One of the most serious difficulties from the standpoint of the individual is the inadequate income. Table 5 shows $91 left for labor income after deducting six per cent

interest on capital invested. The operator who must pay interest on the capital investment or pay its equivalent in rent for the use of the farm would have practically nothing for family expenses other than the portion of living secured from the farm. On the other hand, the man who owns his farm free from indebtedness, hence having no interest to pay, would have the total estimated "Farm Income," $2,105, to use in addition to shelter and food secured from the farm, which would enable him to live quite comfortably.

Those who own farms free from indebtedness, or nearly so, and renters whose landlords are willing to permit the summer fallow system, may continue to follow this system and live, but those who must make their farms pay for themselves under present valuations, and who wish to secure the largest possible net profit, will be forced to make adjustments.

System "B," wheat and peas alternating, produces slightly the largest labor income, $1,422, in addition to $554 of "Family Living from the Farm." One of the principal reasons for the greater net return from this system is that the entire 300 acres produces a salable crop each year.

This system has been practiced quite extensively in the Fairfield district for over fifteen years. In certain neighborhoods this system has been adopted so generally that the summer fallow has been practically eliminated. In 1929 it is estimated that over 60,000 acres of peas were grown in eastern Washington and northern Idaho on what would otherwise have been summer fallow. Farmers who have given the system a thorough trial have usually found it more profitable than the common two-year system of wheat and summer fallow.

It would doubtless be much more extensively adopted over the entire area except for market limitations. The seed pea industry has been established in eastern Washington and northern Idaho for a quarter of a century. Several seed companies have main branch houses in Spokane, Fairfield, Garfield, and Palouse, Washington, and Moscow, Idaho. Some of these companies limit their operations to the growing of peas on contract to fill orders for seed from eastern canning companies, while others buy *commercial* peas on the open market as well. Representatives of the seed companies state that the needs of the market in the present stages of its development are practically supplied with the acreage now grown.

Pea splitting factories have been established at Palouse, Washington, and Moscow, Idaho, and the split pea industry seems to be increasing considerably, but there is no way of predicting what the future trend of human consumption of peas may be. It does not seem at all likely that, at best, it will increase enough to take care of any large portion of the peas that could be grown on the unused summer fallow in this area.

Peas make good stock feed, particularly for hogs, being worth, if fed in proper combinations, about the same as barley or wheat by weight, which is usually considerably less than the contract price paid for peas by the seed companies. In recent years these companies have paid from fifty to sixty dollars per ton on a clean basis, whereas peas would ordinarily be worth around thirty dollars per ton for feed. When peas can be produced cheaply enough so that they may show profit when fed or sold for feed the acreage may be extended to the point of supplying the demand for feed.

The limited market seems to offer the most serious check to any large expansion of pea growing. Although pea growing on a commercial scale has been confined to rather limited distances from the branch houses, it is believed that it is physically possible to grow a good crop of peas almost anywhere in this area except on clay points and white soil in poorly drained bottoms. However, peas do not seem as drought resistant as alfalfa or sweet clover and probably cannot be grown profitably quite as close to the dry margin of this area as those crops.

Although farmers who have given this system a thorough trial have usually found it more profitable than the two-year system of wheat and summer fallow, it cannot be recommended to others except where a market for the crop is assured.

Since peas have not been grown commercially by the great majority of farmers in this area, and many have given peas limited trial and failed, the following suggestions are offered: Peas that are seeded on any piece of land for the first time in this area must be inoculated. It is quite common experience in the pea districts that the first crop of peas on any piece of land is considerably lighter than later crops, even when inoculation is successful, and is often almost a failure if inoculation has not succeeded. It is only necessary to inoculate when peas are seeded the first time on a given piece of land.

Wherever peas are used in these systems it is planned to plow in the fall, harrow in the spring as soon as the soil is fit to work in order to conserve moisture and prevent crusting, disk deep once over, harrow, redisk the poorer half of the tract, harrow it, seed deep two bushels per acre and pack. This detail is designed to be representative of good practice and to represent the amount of preparation that should give excellent results on an average piece of land in an average season. On poor tracts or on an average tract in a season when all soil works particularly hard or cloddy more tillage might be necessary. On choice tracts or on average tracts in a season when all soil works up mellower than common this amount of work may be reduced. The packing may often be omitted. Its chief purposes are to make a smooth surface for harvest and in some cases to pack the soil about the seed to insure germination. The most vital points in insuring a crop are securing as complete absorption and retention of precipitation as possible, preparation of a deep mellow seed bed in early spring, and reasonably early deep seeding.

An important period in pea production is the harvest. The most common system of harvesting peas up to the present time has been to mow the peas, either shock them by hand or rake them into windrows with a horse rake and thresh later with a stationary outfit, hauling the peas from the shock or windrow to the thresher. If they get a little over ripe before they are cut, or if allowed to stand too long after cutting before shocking, peas shell very badly. Frequently heavy winds scatter the shocks or windrows after they have become thoroughly dry, resulting in very heavy losses. Some pea growers have estimated their loss in unusually bad cases as high as 75 per cent of the crop. Figure 9 illustrates a very severe case in 1929. Much of this field was swept almost bare and fully 75 per cent of the crop was lost except what might have been recovered through livestock.

If peas are to be mowed, they should be cut before they are dead ripe and shocked immediately after the mower. They then handle with a minimum of shelling and have enough weight and pliability to settle into a relatively compact shock. Some use a horse rake instead of shocking by hand. A 10-foot rake drawn with one horse following behind two 5-foot mowers reduces both man labor and the loss by shattering that frequently attends handshocking where the

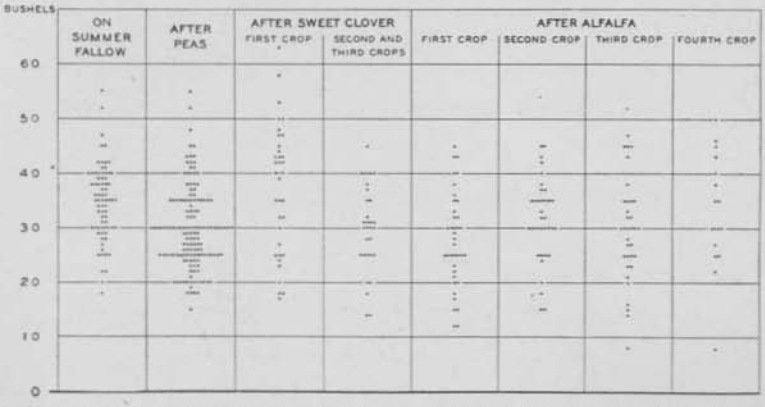

Fig. 8. Yields of wheat per acre following summer fallow, peas, sweet clover and alfalfa. Each dot represents an average farm yield.

Note: The number of records of yields and the standard deviation of the yield frequencies are as follows: (1) Wheat following summer fallow, 74 records and 6.8 bushels; (2) wheat following peas, 142 records and 7.4 bushels; (3) first crop of wheat following sweet clover, 36 records and 11.5 bushels; (4) second crop after sweet clover, 31 records and 7.9 bushels; (5) first, second, third, and fourth crops of wheat, respectively following alfalfa, 38 records and 8.5 bushels, 37 records and 8.2 bushels, 35 records and 9.8 bushels, and 17 records and 10.1 bushels.

shockers get a little behind the mowers. Furthermore, when the ordinary rake is used the vines tend to interlock and seem to require a much harder wind to roll and scatter the windrows than when made by hand.

Recent developments in the use of the combined harvester for peas indicate a possibility of reducing the cost of harvest very materially. An adjusted combined harvester owned and operated by Mr. Hays, Worley, Idaho, was found doing a very clean job of cutting peas with three men operating the outfit. By the commonly used method of mowing and shocking by hand, later threshing with a stationary machine, there would have been at least four or five times as much man labor involved in putting these peas into sacks. Furthermore, in this particular case a cleaner was installed on top of the combine so that the peas were recleaned for the market as they ran into the sack. This saved the screenings for the farmer, whereas the seed companies commonly retain the screenings to pay for cleaning the peas. Figure 10 shows an adjusted combined harvester owned and operated by Ward Gano, Moscow, Idaho, in which the adjustment is somewhat

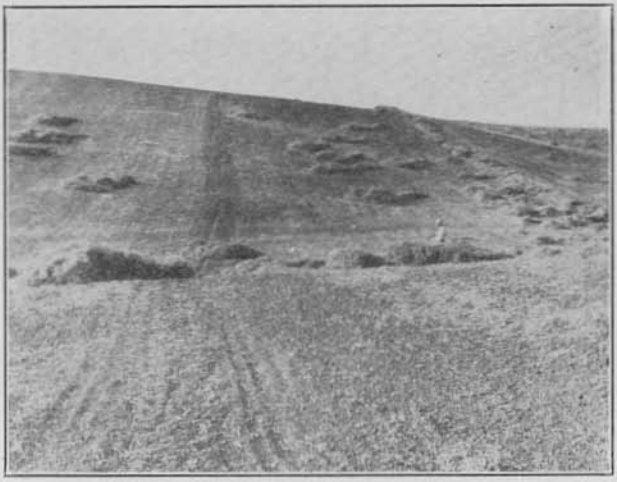

Fig. 9. Severe case of wind damage.

different from that made by Mr. Hays of Worley. Both machines were working successfully which indicates that there may be various ways of accomplishing the same result. Several unsuccessful attempts have been made which emphasizes the importance of correct detail.

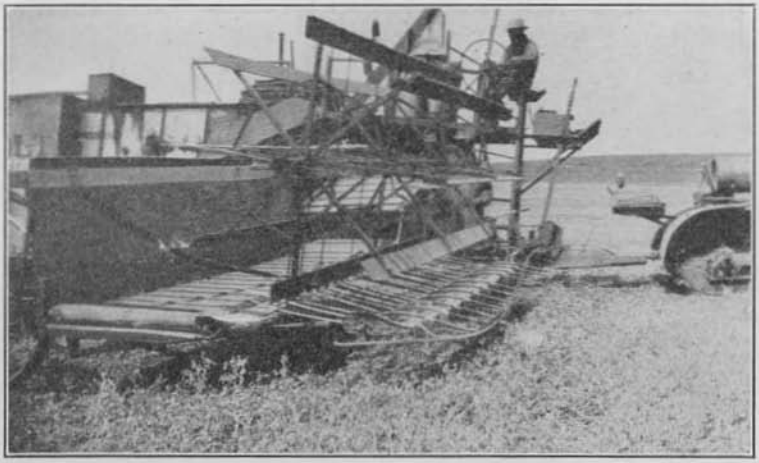

Fig. 10. A combined harvester adjusted for harvesting peas, operating near Moscow, Idaho.

Details of the successful adjustments may be secured by writing to or visiting the Department of Agricultural Engineering at the University of Idaho at Moscow, or at the State College of Washington at Pullman. The purpose of this bulletin is to discuss farm systems rather than mechanical details.

Contrary to the belief that has prevailed in the past, there is less loss of peas when harvested with a combine than when mowed, shocked by hand, and threshed with a stationary machine. The University of Idaho made a study of the comparative losses and found the loss when handled by the old method varied from 2 to 7.5 bushels per acre and when harvested with the combine was 2.5 bushels or less per acre in the fields studied. A loss of 7.5 bushels per acre is illustrated in Figure 11. A very small percentage of peas shell out in an ordinary season while peas are standing until they are ripe enough to be cut with a combined harvester. Furthermore, the heavy losses that are experienced occasionally from winds are practically eliminated when the peas are cut with the combined harvester. In order to use the combine method economically, a fairly large acreage of peas is required to reduce the overhead. The desired acreage is secured in some cases by partnership ownership, and in others by taking on contract cutting. As yet the rather limited experience in cutting the standing peas with the combine has been confined to the smoother Palouse areas. Since peas quite commonly go down unusually flat to the ground on the steep slopes and often in the wrong direction to be picked up readily, it remains to be determined how rough a tract may be harvested satisfactorily by this method.

An intermediate system of harvesting is being practiced by some growers around Fairfield, Washington, in which the peas are mowed and raked with a side delivery rake into broad windrows running with the contours and later picked up with a combine fitted with a pickup attachment. This method is not quite as economical of labor as cutting with a combine, but it posseses the advantage of permitting the mowing of the peas before wild oats and other weeds have dropped all their seed. It is considered by those who have adopted the method to offer considerable advantage over the older method of shocking by hand and hauling to a stationary thresher.

The labor distribution in System "B" is not as satisfactory as with System "A," the straight summer fallow system. It is necessary to hire extra help and operate two four-horse teams to get the peas seeded in proper season, after which there is practically no team work until haying and harvest. However, one advantage of this system is the small amount of labor required to produce a crop of winter wheat after peas. Table 3 shows 7.33 hours of horse labor required per acre before harvest for winter wheat after peas as compared to 27.8 hours of horse labor before harvest for summer fallow wheat. Furthermore, the use of an acre for two years must be charged against the 35 bushels of wheat produced on summer fallow and only one year against the 30 bushels produced on pea stubble. This system seems to just about keep up the nitrogen supply without increasing it. Unless care is exercised, weeds tend to increase. This system reduces erosion very materially as compared to the summer fallow system if carried out as outlined in the "Schedule of Operations," Figure 6. When the pea stubble is disked and seeded without further tillage the pea residue that is mixed up with the surface soil praccally eliminates all erosion except on the steepest areas. When wheat stubble is plowed deep (7 in.) in late fall for the pea crop and left rough over winter, the open furrows are able to absorb quickly the majority of heavy rains, after which the water gradually works into the subsoil.

Where there is a market and other conditions are suitable for peas and the prices of wheat and peas are maintained in the ratio approximately like that used in Table 5, System "B" is the most profitable system. Table 9 shows the influence of changes in the price of wheat on the relative profitableness of the different cropping systems.

System "C," a three-year rotation of sweet clover one year, followed by wheat two years, shows a labor income of $835 besides the $554 for family living as compared to $91 from the summer fallow system. This increased income compared to the straight summer fallow System "A," is due to a fuller use of the land, two-thirds of the farm being in grain, and to increased fertility, due to the effect of sweet clover. In this system the sweet clover is seeded with the second crop of wheat and plowed under the following spring, and the land treated as summer fallow.

Of the adjusted crop systems "B" to "G," inclusive, "C" and "D" are doubtless of widest application in this area because they involve the introduction of nothing but sweet clover, which experience has shown can be plowed under with successful results, and they introduce no marketing problem because no salable crop is grown except wheat.

Since the sweet clover has been grown in this area only to a very limited extent, the following suggestions are made:

At the present time biennial sweet clover seems to possess the widest adaptation to the particular needs of the area studied of all the soil improving crops that have been tried either by the farmers, or by the experiment stations. It grows well on any kind of soil and produces a heavy mass of vegetation. Apparently it can be used in a rotation satisfactorily a little farther into the dry belt than alfalfa or peas.

A good stand is secured quite economically by seeding with a crop of spring grain or peas by the following method: The land should be packed after seeding spring grain or peas, after which the sweet clover is seeded with a grain drill with a grass seeder attachment conducting the seed into the disks of the drill and with the pressure removed from the disks. The packing tends to draw the moisture near the surface and running the seed down into the disks of the drill more nearly gets all the seed down into the moisture than where seed is broadcast and harrowed in. Early seeding is important when a nurse crop is used.

Good stands have been secured sometimes with less effort, but the method outlined reduces the risk of failure to a minimum. The vital point is to provide a soil condition that will maintain a supply of moisture around the seed until the plants become well rooted. With a loose, deep seedbed it is almost impossible to seed down into moist soil without seeding too deep for the seedlings to come up. Proper preparation and early seeding become increasingly important as the drier margin of the area is approached.

By using the second year growth for spring and summer pasture and new seeding for fall pasture, biennial sweet clover furnishes more abundant and continuous pasture throughout the entire growing season than any other plant that has been tried. Managed in that

way it has a carrying capacity of about one and one-half dairy cows or their equivalent per acre from May 1 to October 1. For example, 10 acres of second year sweet clover supplemented with 10 acres of new seeding should ordinarily carry 15 cows from about May 1 to October 1. Pasture methods have not been satisfactorily worked out as yet. Experience to date indicates that it must be kept pastured down fairly close or be clipped back frequently in order that stock may eat it readily.

Some farmers have pastured sheep and cattle on sweet clover without trouble while others have suffered losses from bloat. Some have pastured one season with no trouble, and then had apparently unexplainable trouble another season. The concensus of opinion, however, is that when everything is considered it is the best pasture plant now available for the area under study.

If livestock is kept and the operator prefers not to grow any alfalfa for hay, sweet clover may be used since it is found to make a hay quite comparable to alfalfa if cut early and handled without losing the leaves.

Fig. 11. View showing loss of peas by shattering in a field mowed and shocked by hand calculated at 7.5 bushel per acre by the University of Idaho.

If used for pasture, the sweet clover stubble would be plowed in the fall of the second year and seeded to wheat preferably the same fall if moisture conditions permit.

Sweet clover decays in the soil readily and is therefore adapted to use strictly for soil improvement in a short rotation over this entire area thus eliminating any necessity for livestock and introducing no marketing problems. When the sweet clover is seeded with spring grain the farmer does not lose his income from the land for the first year of the biennial crop and ordinarily some time in June the following year the clover will have made about as much growth as can be plowed under. Farmers have secured excellent results from plowing under sweet clover from late May until early July, then treating the land as summer fallow. Figure 12 shows a farmer near Pullman plowing under sweet clover in July, 1929. Some results indicate that three grain crops may be grown in succession before reseeding to sweet clover while other results seem to indicate that the influence of sweet clover in producing an increased yield ends with the second grain crop. In either case it appears to the writers that the growing of sweet clover in a short rotation is the most feasible system for the maintenance of an adequate supply of organic matter in the soil and for checking soil erosion over the entire area under consideration involving a minimum of adjustment of the present farming system. With the general use of the combined harvester and the burning of a large per cent of the grain stubble, it becomes doubly important that an adjustment be made at an early date over a large percentage, if not all of this area, to keep up the supply of organic matter and check erosion. Figure 5 gives some idea of how serious the erosion problem has become. Where alfalfa or sweet clover are broken up the vegetation plowed into the furrow makes the soil more spongy and absorptive while the long decaying tap roots open channels to permit the moisture to work quickly into the subsoil. This condition reduces the run-off very materially.

System "D," produces a labor income of $1,329 in addition to $554 of "family living." This increased income over System "C" is due to still more complete use of land, three-fourths of the farm being in wheat. This system produces nearly as large a labor income as System "B," the two-year system of wheat and peas, and possesses

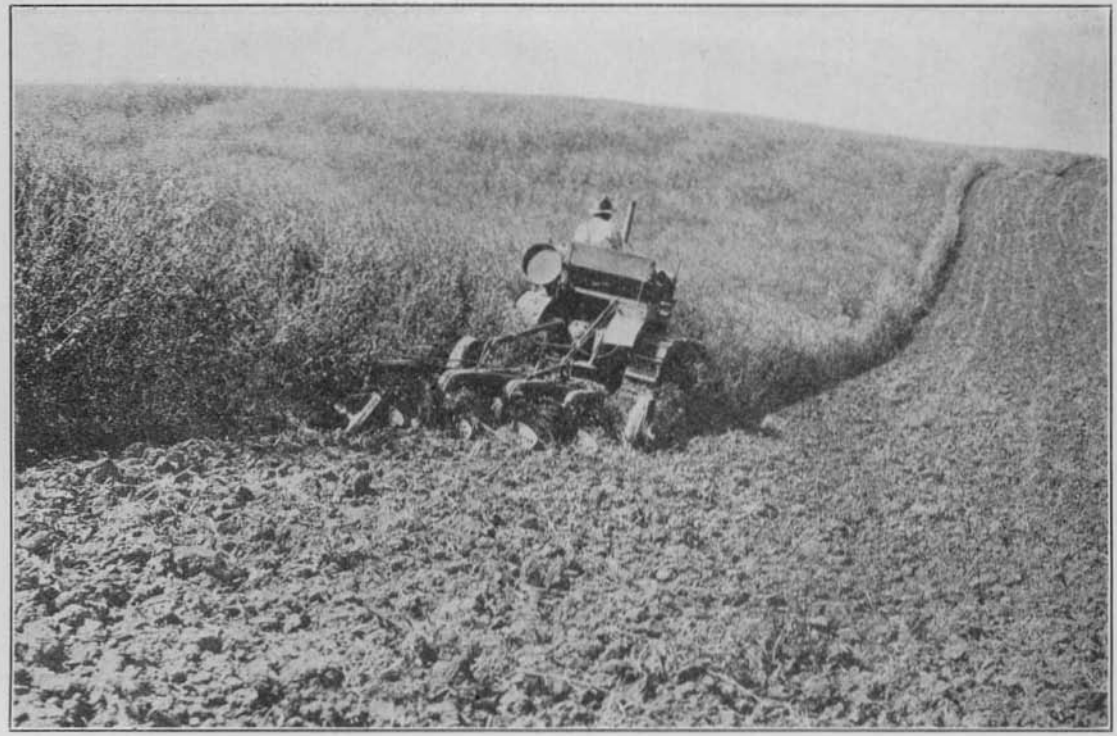

Fig. 12. Plowing under sweet clover near Pullman in early July, 1929.

the advantage of introducing no marketing problem and of being more beneficial to the soil. Where the soil condition justifies the third crop of wheat before seeding to sweet clover again this seems to be a particularly desirable system. Limited evidence seems to indicate that tracts may vary in this particular, it being desirable in some cases to reseed to sweet clover after two crops of wheat. The operator must decide this point for the individual farm. It would appear that either System "C" or "D" would be applicable to any farm in the entire area.

System "E" is like "D" except that peas are substituted for the third crop of wheat as a nurse crop for sweet clover. It produces $77 less labor income than System "C," with wheat two years after sweet clover, and possesses the disadvantage of requiring equipment for handling the peas and a market for them.

System "F" is an eight-year rotation, alfalfa four years, followed by wheat four years, the alfalfa being seeded alone the first year. It is adapted to situations where alfalfa can be disposed of to advantage either by direct sale or through livestock. This system gives a labor income of $609 as calculated in Table 5. In this budget the alfalfa sold at $10 per ton in the stack.

Common alfalfa usually produces one good cutting each season almost anywhere in the area studied, with a small second cutting on from one-third to two-thirds of the area in alfalfa. The upper portions of the hills seldom produce enough second crop to justify cutting it. The estimate of 1.5 tons per acre per year is considered conservative for the average farm where a good stand is secured and cared for as outlined in the "Schedule of Operations," Figure 6. The smoother farms with practically no clay points would produce more while the roughest farms with a relatively large percentage of high hills and clay points might average less.

Alafalfa possesses certain advantages and certain disadvantages when compared with sweet clover for use in diversified farm systems in this area.

1. Alfalfa makes a marketable hay, whereas sweet clover hay as yet has no recognized place on the market. Feeding tests indicate that sweet clover hay is practically equal in feeding value to alfalfa

provided it is cut before the stems become woody, but it remains to be seen whether it will earn a place on the market. However, it would not seem feasible to add any large acreage of alfalfa in this area for the general market because the irrigated areas of Idaho, Oregon, and Washington already produce about all that can be marketed profitably. In many localities the production of alfalfa is profitable to the extent of supplying the local demands. If alfalfa were to become a more prominent crop in this area, it would apparently be necessary to consume the greater part of it within the area with some form of livestock.

2. Alfalfa is a perennial, hence is preferable where for any reason it is desirable to leave the crop longer than two years.

3. The beneficial influence of alfalfa on succeeding crops continues longer than sweet clover.

4. It is more difficult to secure a stand of alfalfa with a nurse crop than it is to secure a stand of sweet clover. The Washington Experiment Station has secured good results from seeding alfalfa with peas, but finds it unsafe to seed with grain, whereas a good stand of sweet clover can be secured with spring grains if handled properly.

5. It causes bloat of sheep and cattle more readily than sweet clover when pastured. In some cases the difficulty has been largely overcome by seeding orchard grass with the alfalfa.

6. It is not as well adapted to a short rotation as sweet clover.

7. It quite commonly causes burning of the first grain crop after breaking up the alfalfa and in dry seasons the second crop also.

8. It is more difficult to break up than sweet clover. The experience of farmers indicates that sweet clover can be plowed up about as readily as wheat stubble, whereas alfalfa requires fifty to one hundred per cent more power.

In **System "F"** alfalfa is seeded alone. It may be seeded with peas except in the drier parts of this area, but to insure a stand one should follow the method outlined for seeding sweet clover with spring grain or peas, page 39.

Where the moisture will permit the seeding of alfalfa with peas, and there is a suitable market for peas, the addition of this crop should increase the labor income from this system nearly $500. Since

the tillage necessary to prepare a proper seed bed for alfalfa seeded alone is practically equal to the tillage necessary to prepare a seed bed for peas, the additional expense of growing the peas would be reduced practically to the cost of seed and of drilling and harvesting the pea crop.

Budgets for the six cropping systems are made on the basis of dividing the farm into equal fields for the respective crop rotations. This was necessary in order that the returns from the several cropping systems might be comparable. In actual practice, however, the rough topography of the area makes it impractical to divide but few farms into fields of equal size for the rotation of crops. In these systems wheat is used exclusively for the grain crop except for oats grown in sufficient acreage to feed the horses. In many cases there is considerable acreage of low land where oats might be a more profitable market crop than wheat. In the systems providing for some spring grain, barley might be more profitable than wheat in many cases. Certain farmers following System "B," wheat and peas, might find it advantageous to grow an acreage of potatoes if they have suitable land and a market outlet. The potato crop would provide labor to partly fill in the gap between pea seeding and harvest. When they succeed well a few acres will increase the gross receipts from the farm very materially. These are merely illustrative of the variations that the individual operator may and often should make from the simplified systems in the table. Furthermore, there are probably very few individual cases where it would be wise to apply any one of these cropping systems to the entire farm at once. The adjustment should be made gradually.

We would emphasize the fact that the increase in net returns from the adjusted cropping systems over the summer fallow system is due to a considerable extent to the greater percentage of the land in crop.

Farm operators are cautioned against interpreting these figures too literally. All crops do not react the same to seasonal variations. The systems are not equally well adapted to all farms. Prices of various crops bear different relations in different seasons. These are a few of the numerous reasons why one should not expect exactly these relationships in any one year or on any one farm. Over a period of years, however, it is reasonable to look forward to results in yields similar to those used in

the budgets. If price relationships between wheat and peas changed radically, the budgets would show some marked differences in relative farm income from the different cropping systems. The choice of the most profitable rotation plan, therefore, cannot be made once for all, but according to the price outlook for a few years in advance.

Influence of Variations in Price of Wheat on Labor Incomes

The labor incomes that have been computed in Table 5 with wheat at $1.04 have been recomputed in Table 9 to show the effect of variations in wheat price from $.75 to $1.25 per bushel. This table emphasizes the marked influence of price on net returns. All systems show a negative labor income when wheat sells at 75 cents per bushel, except System "B," peas and wheat, which is also the only system showing a positive labor income with wheat at 80 cents; all systems show some labor income when wheat sells at 90 cents, except the straight summer fallow System "A" which first shows a positive labor income in this

Table 9. Estimated Labor Income from Farming 300 Acres of Crop Land by Different Cropping Systems with a 9-horse Equipment, the Wheat Being Cut with a Binder, the Peas with a Mower, the Threshing Done from the Field with a Stationary Machine at Custom Rates, the Price of Peas held Constant at 2.5 Cents per Pound and the Price of Wheat Ranging from 75 Cents to $1.25 per Bushel

Price of wheat per bushel	System A Summer fallow wheat	System B Peas wheat	System C S. clover wheat wheat (a)	System D S. clover wheat wheat wheat (a)	System E S. clover wheat wheat Peas (a)	System F Alfalfa 3yr. wheat 4 yr. alf. (seeded alone)
Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
.75	-1,208	332	-816	-492	-475	-568
.80	-984	520	-531	-178	-262	-365
.85	-760	708	-246	136	-50	-162
.90	-536	896	38	450	163	41
.95	-312	1,084	323	764	375	244
1.00	-88	1,272	607	1,078	588	447
1.05	136	1,460	892	1,392	801	650
1.10	360	1,648	1,177	1,706	1,013	853
1.15	584	1,836	1,461	2,020	1,226	1,055
1.20	808	2,024	1,746	2,334	1,438	1,258
1.25	1,032	2,212	2,030	2,648	1,651	1,461

(a) Sweet clover is sown with this crop in the spring.

scale when wheat reaches $1.05 per bushel. Attention is called to the fact that while the systems that include peas, "B" and "E," show an advantage when wheat is low, the advantage gradually shifts to the systems with wheat as the principal or only market crop as the price of wheat increases. For example, System "D" with three-fourths of the farm in wheat shows $160 less labor income than System "B" with half peas and half wheat with wheat at 75 cents per bushel, but "D" gradually gains on "B" with the increase in price of wheat until at $1.10 per bushel "D" shows $58 more labor income than "B." With wheat at $1.25 per bushel "D" shows $436 more labor income than "B." This principle is further emphasized in Tables 13, 19, and 21.

Savings Made by Harvesting the Wheat and Peas of Table 5 with a Combined Harvester-Thresher

On account of the rapid increase in use of the combined harvester it is substituted for the binder and stationary thresher used in calculating the budget in Table 5 and the savings effected by the combine are shown in Table 10. The methods of arriving at the combine

Table 10. Estimated Savings Made by Harvesting the Wheat and Peas of Table 5 with a Combined Harvester-thresher Instead of Cutting the Wheat with a Binder and the Peas with a Mower and Threshing with a Stationary Machine, All Other Expenses and Receipts Remaining the Same

Cropping system	System A Summer fallow wheat	System B Peas wheat	System C S. clover wheat(a) wheat(a)	System D S. clover wheat wheat wheat	System E S. clover wheat wheat peas(a)	System F Alfalfa 3 yrs. wheat 4 yrs. alfalfa (seeded alone)
Expenses when harvesting is done with:	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
1. Binder-mower-thresher	2,553	3,384	3,071	3,189	3,098	3,063
2. Combined harvester	1,982	2,549	2,421	2,486	2,389	2,572
Difference (b)	571	835	650	702	709	491

(a) Sweet clover is seeded with this crop.
(b) Estimated savings made by doing the harvesting with a combine.

Table 11. Estimated Expense of Harvesting Wheat and Peas with a 12-foot Combined Harvester-thresher Where the First Cost of the Machine is $2,000 and Where the Expense of Drawing the Machine, the Interest on the Value of the Machine and the Tax on the Machine Are Not Included in the Estimates

Machine expense:		Annual
1. Fixed charges per machine where		Charge
a. The machine cuts about 600 acres annually and its life is 7 years		
(1) Depreciation ($2,000 ÷ 7)	$286	
(2) Insurance	30	$316.00
b. The machine cuts about 400 acres annually and its life is 10 years		
(1) Depreciation ($2,000 ÷ 10)	200.	
(2) Insurance	30	230.00
2. Repairs and materials per 10.5 hour day and per acre		Per day
a. Repairs including labor hired for repairs	6.51	
b. Gasoline, 17.5 gal. at 18 cents	3.15	
c. Oil, 1.3 gal. at 80 cents	1.04	
d. Grease, 2 lbs. at 11 cents	.22	10.92
		Per acre
e. Harvesting wheat at the rate of 25 acres per day		$0.436
f. Harvesting peas at the rate of 18 acres per day		0.607
		Per acre
Wages and board of hired crew:		
1. Harvesting wheat, oats or barley where		
a. One man owns the combine and hires 4 members of the crew		$1.00
b. Two men own the combine and hire 3 members of the crew		.68
c. Three men own the combine and hire 2 members of the crew		.48
d. Four men own the combine and hire 1 member		.20
2. Harvesting peas where		Per acre
a. One man owns the combine and hires 3 members of the crew		1.11
b. Two members own the combine and hire 2 members of the crew		.67
c. Three men own the combine and hire 1 member of the crew		.39
d. Four men own the combine and do the work themselvs		.00

Note: These estimates are based on the assumption that where two or more men own the combine they exchange work in harvesting their crops, each man taking his place in the harvesting crew and furnishing his proportional part of the power required to draw the combine.

In harvesting wheat the crew consists of four men: Separator tender, $8 per day; header tender, $5; sack sewer, $7; and sack jigger, $5. These figures include the cost of board and wage. In harvesting peas the sack sewer also jigs the sacks.

The combine may be drawn by either horses or tractor and in either case a driver is required in addition to the crew listed above. In all cases it is assumed that the farm operator acts as driver. Thus, if one man owns and operates the combine, 4 men must be hired to operate the machine when harvesting wheat; if the combine is owned by two men, 3 members of the combine crew must be hired, and so on.

expenses are shown in Table 11. All other expenses and all receipts are assumed to remain the same as in Table 5. These calculations show important savings in every system by the use of the combine, varying from $491 in System "F" to $835 in System "B." Rather limited experience indicates that the combine effects a greater saving in expense in harvesting peas than in harvesting grain. Hence, the savings in the several systems increase in proportion to the increase in percentage of crop acres in peas.

Acreages That May Be Farmed by a Uniform 9-Horse Outfit Under the Different Cropping Systems Without Additional Hiring

Since the selected crop systems do not make equally full use of a 9-horse outfit, Table 12 was calculated to show what acreage could be handled by a 9-horse outfit under each of the cropping systems without hiring additional help during the peak period. The method of computing the acreage for System "A" will illustrate the method used in all cases. The peak load in this system occurs in the spring in getting the fallow disked, harrowed, plowed and harrowed once before June 11. The average time available for field work prior to June 11 is estimated to be 463 hours. Nine acres held out of the preceding fallow to seed to oats for horse feed require 14 hours for preparation and seeding during this period. Deducting this 14 hours from 463 hours available leaves 449 hours available for summer fallowing. Using the schedule of a normal day's work adopted in Table 1. it is calcultated that 2.4 hours of man labor will be required per acre for the work done on the fallow before June 11. The available hours, 449, divided by 2.4, gives 187 as the acres of summer fallow that will give full employment to the outfit during the peak period in seasons when the number of days are available as outlined. With the 187 acres in fallow there would be 187 acres in grain, making a total of 374 crop acres. Allowing one-sixteenth for roads, farmstead, etc., as with the farms of 300 crop acres, we obtain a farm of 398 acres total.

A study of Table 12 shows a variation in size of farm that could be handled with the 9-horse outfit from 244 crop acres in System "B," wheat and peas, to 400 crop acres for System "F." These variations are due in part to variations in distribution of labor as shown in Table 14 and partly to variations in labor requirements of different

Table 12. Estimated Acreage of Crop Land That Can Be Handled Efficiently Under the Different Systems Under Average Weather Conditions with a 9-horse Equipment Where the Harvesting of the Wheat and Peas is Done with a "Combine"

Cropping system	A S. fallow, 1 yr. wheat, 1 yr.	B Peas, 1 yr. wheat, 1 yr.	C S. clover, 1 yr. wheat, 2 yrs. (s. clo. seeded)	D S. clover, 1 yr. wheat, 3 yrs. (s. clo. seeded)	E S. clover, 1 yr. wheat, 2 yrs. peas, 1 yr. (s. clo. seeded)	F Alfalfa, 3 yrs. wheat, 4 yrs. n. alf., 1 yr. (seeded alone)
Length of rotation	2 years	2 years	3 years	4 years	4 years	8 years
Crop land, acres	374	244	294	392	392	400
Size of farm, acres	398	260	314	418	418	427
Investment	$41553	$27753	$33153	$43720	$43720	$44620
Receipts	5966	5445	5791	8715	7887	7814
Expenses	2353	1948	2347	3056	2877	3218
Farm income	3613	3497	3444	5659	5010	4596
Interest on capital, 6%	2493	1665	1989	2623	2623	2677
Labor income	1120	1832	1455	3036	2387	1919

crops as shown in Table 3. System "F," which includes 3 years of alfalfa, has a good labor distribution because haying fills a labor gap that occurs in most other systems. In addition to this advantage, alfalfa after it is established has a low horse labor requirement. Table 3 shows 20.56 hours of horse labor per acre for alfalfa as compared to 31 hours for peas after wheat.

The wheat and pea combination has about the poorest labor distribution of the entire group, because half the farm must be fitted and seeded in early spring. The balance of the year the outfiit would carry a light load. In practice it would be logical to handle a larger acreage and hire the additional labor needed to get the work done on time or to own a larger outfit and take on outside work if available in slack periods.

The sweet clover systems have a good labor distribution where the clover is plowed under in June.

The variation in "Labor Income" must not be interpreted as showing the relative producing capacity of the different cropping systems. The land investment varies from $26,000 to $41,800. The variations in both "Farm Income" and "Labor Income" in Table 12 are due as much or more to variations in size of business as to variations in cropping system. System "D" in this table shows the largest labor income, but the increase over "B" is just about in proportion to the greater size of farm operated.

This table is of interest to the renter whose limiting factor is the amount of equipment that he possesses or has the means to acquire and wishes to know what type of farming will enable him to make the most profitable use of his outfit and who is able to secure the size of farm that fits his equipment. For the majority of operators, however, it is more important to know what system of cropping will produce the largest income from the particular acreage that they may secure possession of and then equip to operate the acreage efficiently. On the other hand, even though it is hard at present to secure additional acreage, the desire for profits would, of course, point to the advisability of each operator obtaining the use of as much land as the equipment he is able to manage will handle in a workmanlike manner.

Table 13. Distribution of Man and Horse Labor by Months on a 320 Acre Farm for the Different Crop Systems

Cropping systems from Table 5	Systems	A		B		C		D		E		F	
		M	H	M	H	M	H	M	H	M	H	M	H
	March	....	....	....	....	....	....	....	....	....	....	15	60
	April	144	1136	181	1487	200	1400	213	1300	212	1300	160	1154
	May	200	1600	143	624	83	333	50	450	20	252	46	322
	June	93	615	.....	.....	186	1493	90	670	140	1120	664	1004
	July	80	401	207	402	42	250	125	364	237	582	508	1780
	August	351	554	534	922	468	722	496	761	354	557	390	621
	September	99	508	94	746	70	360	.....	.....	38	150	59	389
	October	.....	.....	170	1080	133	1067	191	1220	145	1051	183	1284
	November	.....	.....	100	800	.....	.....	100	800	100	800	80	640
	Total	967	4814	1429	6061	1182	5625	1265	5565	1246	5812	2105	7254

Distribution of Man and Tractor Labor by Months on a 640 Acre Farm for the Different Crop Systems

Cropping systems from Table 15	Systems	A		B		C		D		E		F	
		M	T	M	T	M	T	M	T	M	T	M	T
	April	98	98	196	196	133	133	.....	.....	96	96	.....	.....
	May	97	97	29	29	103	103	.....	.....	74	74	.....	.....
	June	48	48	.....	.....	128	128	.....	.....	97	97	.....	.....
	July	42	42	132	33	28	28	.....	.....	85	37	.....	.....
	August	475	95	995	225	513	125	.....	.....	772	180	.....	.....
	September	222	96	223	95	397	109	.....	.....	187	59	.....	.....
	October	86	86	163	163	84	84	.....	.....	203	203	.....	.....
	November	65	65	100	100	67	67	.....	.....	50	50	.....	.....
	Total	1133	627	1838	841	1453	777	.....	.....	1564	796	.....	.....

Table 14 shows the influence of varying prices of wheat on the labor income computed in Table 12.

Table 14. Influence of Varying Prices of Wheat from $.75 to $1.25 per Bushel on Labor Incomes from Cropping Systems Budgeted in Table 12. All Other Items Remain Constant

System	A	B	C	D	E	F
Acres in farm	398	260	314	418	418	427
Price, bu.	L. I.(a)	L. I.	L. I.	L. I.	L. I.	L. I.
$ .75	-$ 543	$ 977	-$ 159	$ 606	$ 720	$ 306
.80	- 256	1124	119	1025	1008	584
.85	30	1272	397	1444	1295	862
.90	317	1419	676	1863	1582	1140
.95	604	1567	954	2282	1870	1418
1.00	891	1714	1232	2701	2157	1697
1.05	1178	1861	1511	3120	2444	1975
1.10	1465	2009	1789	3539	2732	2253
1.15	1752	2156	2067	3958	3019	2531
1.20	2038	2304	2346	4377	3307	2809
1.25	2325	2451	2624	4796	3594	3087

(a) L. I. = Labor income.

Comparative Returns from Different Cropping Systems on a 640 Acre Farm Operated by a Tractor

Since tractors are rapidly replacing horses even in the rolling Palouse country, Table 15 was calculated to show the comparative results from the several cropping systems under tractor farming from a one section farm with 600 crop acres. System "F" was omitted because of the large proportion of the farm in alfalfa which probably can be harvested to better advantage with horses. The acres in each crop, total production, reservations for seed, and amount left for sale from each system, are shown in Table 16. The popular size track-layer tractor, 25 drawbar horse power, was selected with suitable equipment as listed in Table 17. A standard day's work for different operations is scheduled in Table 2, and the cost of maintaining and operating the tractor in Table 18.

The cost and the performance standards for tractors were compiled from research data secured from the departments of Agricultural Engineering in the University of Idaho, the State College of Washington, and the University of California, and records gathered from farmers in this study.

Table 15. Comparison of Estimated Average Returns Which May be Expected from Following Different Systems of Farming on a 640 Acre Farm with 600 Acres of Crop Land with a 25 Drawbar H. P. Tractor Where the Harvesting is Done with a Combined Harvester-thresher

Cropping system	A S. fallow, 1 yr. wheat, 1 yr.	B Peas, 1 yr. wheat, 1 yr.	C S. clover, 1 yr. wheat, 2 yrs. (s. clo. seeded)	D S. clover, 1 yr. wheat, 3 years (s. clo. seeded)	E S. clover, 1 yr. wheat, 2 years peas, 1 year (s. clo. seeded)
Length of rotation	2 years	2 years	3 years	4 years	4 years
Capital:					
Real estate	$64000	$64000	$64000	$64000	$64000
Equipment (a)	3525	4150	4150	4150	4150
Receipts:	10608	14898	12948	14236	13065
Expenses	4088	5384	5246	5470	5120
Farm income	6520	9514	7702	8766	7945
Interest on capital, 6%	4052	4089	4089	4089	4089
Labor income	2468	5425	3613	4677	3856

(a) In System "A" the combine was owned by two farmers, while in Systems "B" to "E," inclusive, the combine was owned by one man. For this reason the investment in equipment in System "A" is $625 less than for the other systems.

Table 16. Estimated Production and Disposal of Crops from Following Different Cropping Systems on a 640 Acre Farm Having 600 Acres of Crop Land, the Field Work Being Done with a 25 Drawbar H. P. Tractor.

Item	Acres	Produced	Seed	For sale
SYSTEM "A", 2-year rotation (Summer fallow - wheat)				
Summer fallow	300	.....	....	.....
Winter wheat	300	10,500 bu.	300 bu.	10,200 bu.
SYSTEM "B", 2-year rotation (Peas-winter wheat)				
Peas after wheat	300	2,700 cwt.	360 cwt.	2,340 cwt.
Winter wheat after peas	300	9,000 bu.	300 bu.	8,700 bu.
SYSTEM "C", 3-year rotation (Sweet clover-wheat 2 years)				
Sweet clover plowed June	200	.....	....	.....
Winter wheat after s. clover	200	7,400 bu.	200 bu.	7,200 bu.
Spring wheat (s. clover seeded)	200	5,400 bu.	150 bu.	5,250 bu.
SYSTEM "D", 4-year rotation (Sweet clover-wheat 3 years)				
Winter wheat after s. clover	150	5,550 bu.	150 bu.	5,400 bu.
Winter wheat after wheat	150	4,500 bu.	150 bu.	4,350 bu.
Spring wheat (s. clover seeded)	150	4,050 bu.	112 bu.	3,938 bu.
SYSTEM "E", 4-year rotation (S. clover-wheat 2 yrs.-peas)				
Sweet clover plowed June	150	.....	....	.....
Winter wheat after clover	150	5,550 bu.	150 bu.	5,400 bu.
Winter wheat after wheat	150	4,500 bu.	150 bu.	4,350 bu.
Peas (s. clover seeded)	150	1,350 cwt.	180 cwt.	1,170 cwt.

Table 17. Equipment for Tractor Power Farming

No.	Kind	No.	Kind
1	Tractor, 25 drawbar H. P.	1	Truck, 1 ton
1	Combine, 12 foot	2	Double disk, 8 foot
1	Gang plow, 4 bottom 14 inch	2	Drills, 10 foot
2	Revolving rod weeders, 10 foot	1	Harrow, 40 foot
1	Grain cleaner and treater	2	Packers, 11 foot
	Hitches and shop equipment		

One *drawback* to tractor farming is the heavy investment involved as shown under "Capital" in Table 15. The investment in equipment, as shown in Table 15 is placed at approximately half the cost of the list of equipment purchased new. This represents the average investment over the life of the outfit.

Table 18. Estimated Expense of Operating a 25 Drawbar H. P. Track-laying Type of Tractor Where the First Cost is $2800 and Where the Wage of the Driver, Interest on the Value of the Tractor and Taxes Are Not Included in the Estimates

		Annual Charge
1. Fixed charge per tractor where		
a. The life of the tractor is 7 years and it is used approxiamtely 850 hours annually:		
Depreciation ($2800 ÷ 7)	$400	
Insurance	30	$430
b. The life of the tractor is 6 years and it is used approximately 1,000 hours annually:		
Depreciation ($2800 ÷ 6)	467	
Insurance	30	497
c. The life of the tractor is 5.5 years and it is used approximately 1,100 hours annually:		
Depreciation ($3000 ÷ 5.5)	509	
Insurance	30	539
2. Repairs and materials:		Per Hour
a. Repairs including hired labor for repairs	$0.21	
b. Gasoline, 3.5 gal. at 18 cents	0.63	
c. Oil, 0.1 gal. at 80 cents	0.08	$0.92

On the other hand, when an operator can finance a business of the size necessary for efficient use of a tractor, it offers some outstanding advantages. A tractor can be worked double shift and hurry the work when it will be most effective. It is much more nearly possible to perform every operation at the optimum time than with an outfit of horses that will provide equal power. In this area it frequently means the difference between success and flat failure on part of the crop. The tractor consumes nothing when idle and reduces the total amount of man labor required.

As should be expected, the "Labor Income" from the cropping systems "A" to "F" bear practically the same relation to each other as where horses furnished the power for the 320 acre farm in Table 5. The "Labor Income" from each system for the one section tractor farm shown in Table 15, however, is much more than double the "Labor Income" from the half section horse farm shown in Table 5. This may be partly due to the influence of greater economy of tractor power and partly due to the advantage of larger size of business. The reduction in man labor requirements by the use of a tractor may

be noted by comparing the "Before harvest" man labor requirements per acre for various crops shown in Table 3 for horse farming and Table 4 for tractor farming.

Table 15 must not be interpreted as a recommendation for a specific size and type of tractor or for a specific acreage for tractor farming, but it is believed that this size of farm and size of tractor will apply to a greater number of situations in this area than either a materially larger or a materially smaller farm and tractor. It would not seem as feasible for two small scale farmers to own a tractor in partnership, as it would a combined harvester, because timeliness is much more important in tillage and seeding than in harvest operations in this climate. While one partner's crop was being put in, the other partner's soil might be getting into bad condition.

Table 19 shows the influence of varying prices of wheat on the labor incomes computed in Table 15.

Table 19. Influence of Varying Prices of Wheat from $.75 to $1.25 per Bushel on Labor Incomes from the Cropping Systems Budgeted in Table 15. All Other Items Remain Constant

System	A	B	C	D	E
Acres in farm	640	640	640	640	640
Price per bu.	L. I. (a)	L. I.	L. I.	L. I.	L. I.
$ .75	—$ 490	$2902	$ 3	$ 707	$1029
.80	20	3337	625	1392	1516
.85	530	3772	1248	2076	2004
.90	1040	4207	1870	2761	2491
.95	1550	4642	2493	3445	2979
1.00	2060	5077	3115	4129	3466
1.05	2570	5512	3738	4814	3954
1.10	3080	5947	4360	5498	4441
1.15	3590	6382	4983	6183	4929
1.20	4100	6817	5605	6867	5416
1.25	4610	7252	6228	7551	5904

(a) L. I. = Labor income.

Acreages That Can Be Handled Under the Selected Cropping Systems With A 25 Drawbar Horse-Power Tractor Without Working Double Shift in an Average Season During the Peak Load.

In Table 20 is computed the acreage that can be handled efficiently by the tractor outfit calculated in the same way that the acreage

Table 20. Estimated Acreage of Crop Land for Different Systems of Farming That Can Be Handled Efficiently Under Average Weather Conditions with a 25 Drawbar H. P. Tractor Equipment. Also Comparison of Estimated Average Returns Which May Be Expected from the Respective Systems of Farming

Cropping system	A S. fallow, 1 year wheat, 1 year	B Peas, 1 year wheat, 1 yr.	C S. clover, 1 yr. wheat, 2 years (s. clo. seeded)	D S. clover, 1 yr. wheat, 3 years (s. clo. seeded)	E S. clover, 1 yr. wheat, 2 years peas, 1 year (s. clo. seeded)
Length of rotation	2 years	2 years	3 years	4 years	4 years
Crop land, acres	830	538	585	780	780
Size of farm, acres	885	574	625	832	832
Capital	$92324	$61224	$66324	$87024	$87024
Receipts	14674	13359	12625	18506	16984
Expenses	5728	4993	5203	6890	6605
Farm income	8946	8366	7422	11616	10379
Interest on capital, 6%	5539	3673	3979	5221	5221
Labor income	3407	4693	3443	6395	5158

for the horse outfit was calculated as described on page 49. The acreages show what the tractor could handle in the period allotted for field work as outlined under "Schedule of Operations" on papge 14, working 10.5 hours per day in harvest and 10 hours at other times. On this basis the table shows that the tractor cannot handle quite one section under Systems "B" and "C." In most cases it would be advisable, however, to work the tractor double shift during peak periods rather than operate the reduced acreage. In fact it would be necessary to work double shift during peak periods to handle the acreages indicated in any season when there happened to be fewer days available for field work than have been used in these calculations.

The "Labor Incomes" do not represent the relative producing capacity of the different cropping systems when applied to a uniform acreage. The land investment in this table varies from $57,400 to $88,500, or a variation of $31,100. Table 20 is of interest primarily to the renter whose investment is in equipment only, but it may be of interest also to a land owner who can rent or buy additional acreage to give him the size of farm which most nearly fits his equipment. In Table 20, System "D" is the most profitable rotation and size of

Table 21. Influence of Varying Prices of Wheat from $.75 to $1.25 per Bushel on Labor Incomes from the Different Sizes of Farms and Cropping Systems Budgeted in Table 20. All Other Items Remain Constant

System	A	B	C	D	E
Acres in farm	885	574	625	832	832
Price per bu.	L. I. (a)	L. I.	L. I.	L. I.	L. I.
$ .75	—$ 685	$2431	—$ 77	$1235	$1482
.80	21	2821	530	2124	2116
.85	726	3211	1137	3014	2750
.90	1432	3601	1744	3904	3384
.95	2137	3991	2350	4794	4017
1.00	2843	4381	2957	5683	4651
1.05	3548	4771	3564	6573	5285
1.10	4254	5161	4171	7463	5919
1.15	4959	5551	4778	8352	6552
1.20	5665	5941	5385	9242	7186
1.25	6370	6331	5992	10132	7820

(a) L. I. = Labor income.

farm business for a 25 drawbar H. P. tractor equipment if prices of wheat and peas remain in about the same ratio as during the past seven years and the farmer does not wish to work double shift during peak periods.

Table 21 shows the influence of varying prices of wheat on the labor income calculated in Table 20.

II CROP AND LIVESTOCK FARMING

The estimated returns from following six different systems of crop farming on 300 acres of tillable land where the work is done with horses, the small grains cut with a binder, the peas with a mower, and the threshing done at custom rates with a stationary machine, are compared in Table 5 with no livestock in the organization except the work animals. In the budgets which follow, livestock production is combined with crop farming on this same unit of land, 300 acres, with all conditions remaining the same except that the cropping system is modified sufficiently to provide the required feed for the livestock that is added. Each of the livestock enterprises is incorporated into the organization of Farming System "E," Table 5 which has a four-year crop rotation consisting of peas (sweet clover seeded with the peas)—second year sweet clover—wheat—wheat.

The chief purpose of these budgets is to provide a means of judging under what price relationships the addition of either sheep, hogs, dairy cattle and hogs, or dairy cattle and poultry to Farming System "E," Table 5 will give a net return to the labor used in caring for the livestock. No attempt is made to show the amount of each kind of livestock that should be added to this unit of land in order to give the greatest net return. The return to labor for caring for larger units of livestock should be in approximately the same proportion as the figures given in these budgets.

The final figure in the summary of each livestock budget is NET RETURN TO LABOR USED ON LIVESTOCK. This figure is computed as follows: (1) The capital in the livestock enterprise is added to the total capital of Farming System "E," Table 5. (2) All items of receipts and expenses are computed in the usual way except that no charge is made for labor used in looking after the livestock.

(3) The expenses are subtracted from receipts, the remainder being Farm Income. (4) The sum of interest on the total capital at six per cent and the labor income of System "E," Table 5, which is $758, is subtracted from farm income. The remainder is return to labor used on the livestock.

If the farmer with the assistance of members of his family is able to look after the livestock in addition to doing the regular farm work as is required in System "E," Table 5, the amount returned to the labor used on livestock is an increase in his net income. If, on the other hand, the labor used on the livestock must be hired, the difference between the amount returned to the labor used on livestock and the cost of the labor so used shows whether the livestock enterprise has returned a net profit.

The production of livestock in this area is a much greater problem on some farms than it is on others. In some cases there is an abundance of water, while in other cases the supply must be developed. All kinds of livestock require shelter in this area. On many farms there are now buildings which can be made to serve the purpose at a small cost for alterations. The addition of livestock on other farms will require the construction of new buildings.

The budgets are based on production requirement standards for the different livestock enterprises after they have been carried on long enough to have reached the full swing of a going concern. Hence, a beginner in livestock production may require some time to work up to these standards. For example, it may require several years for a wheat farmer who is not experienced in dairying to assemble or build up a dairy herd of 10 cows having an average production of 300 pounds of butterfat per cow.

Information on the feeding and management of livestock can be obtained from the State College of Washington or the University of Idaho.

Crop and Sheep Farming

On some farms where sweet clover has been given a prominent place in the cropping system, the clover has been used for hay and pasture for sheep. In most cases the sheep have given a good return for the extra labor which they require. All farmers, however, have

not been successful with the sheep venture. The most serious cause of failure is the bloating of the sheep on the sweet clover pasture. In the majority of cases the loss has not been serious, but in a few instances it has been disastrous.

In the following budget a flock of 100 ewes, 20 yearling ewes, and 2 rams is added to Farming System "E," Table 5. The lamb crop in these estimates is figured at 120 per cent. That is, the 100 ewes raise 120 lambs. After being used for five years the ewes are sold. A death loss of five per cent among the ewes is allowed, which leaves 15 ewes for sale each year. Twenty of the best ewe lambs are retained each year to maintain the breeding flock at 100 head. The remaining 100 lambs are sold during July at an average weight of 80 pounds. Each year a yearling ram is bought at $40 and a ram which has been used for two years is sold at $20.

The pasture season, as here planned, extends from May 1 to October 31. The 100 ewes and their lambs and the 20 yearling ewes are pastured on 75 acres of second year sweet clover from about May 1 to late in September or early October. About August 15, 75 acres of pea stubble are ready for gleaning, and early in September, 150 acres of wheat stubble are also available. Since the 75 acres of sweet clover will carry fully twice the number of sheep during the first half of the pasture season, enough hay is cut from the field to winter the sheep. The 75 acres of first year sweet clover will furnish considerable pasturage after the peas are harvested when the autumn rainfall is normal or above normal.

From November 1 to April 30, the 100 ewes and the 20 ewe lambs are fed an average of five pounds of sweet clover hay per head per day, about one fifth of the hay being waste. This calls for about 54 tons of hay. The 20 ewe lambs are fed one-half pound of oats per head per day from November 1 to April 30, and the 100 ewes each receive one and one-half pounds of oats per day from March 1 to April 30. The amount of oats required is five and one-half tons. The decrease in the amount of feed required due to the death loss of five ewes is considered sufficient to take care of the rams.

The addition of sheep to this farm organization necessitates the following changes in cropping System "E," Table 5:

Table 22. Production and Disposal of Crops from System "E," Table 5, Adjusted for Sheep.

Crops	Acres	Production	Disposal		
			Seed	Feed	Sales
Sweet clover pasture	39	.....	.....	.....	.....
S. clover, 2nd. yr. (a)	36	54 T.	.....	54 T.	.....
Winter wheat after sweet clover	66	2,442 bu.	75 bu.	.....	2,267 bu.
Winter wheat hay after sweet clover	9	22½ T.	.....	22½ T.	.....
Winter wheat after wheat	59	1,770 bu.	59 bu.	.....	1,711 bu.
Oats after wheat	16	29,760 lbs.	960 lbs.	288 cwt.	.....
Peas, with sweet clover seeded.	75	675 cwt.	90 cwt.	.....	585 cwt.

(a) Also used for pasture after removing the hay.

1. Instead of plowing under the 75 acres of second year sweet clover during June, 39 acres are used as pasture from May 1 to late in September, and hay is cut from 36 acres. After the hay is stacked in June, the 36 acres are also used for pasture.

2. The oat acreage is increased from 10 to 16 acres to provide grain for the sheep. This in turn decreases the wheat six acres.

The increase in the farm capital due to the addition of the sheep is shown in Table 23. The value of the material for one mile of new woven wire, sheep-tight fence, rebuilding three and one-half miles of old fence, and making the required lambing panels is estimated at $800, while $200 is allowed for providing a sheep shed and sheep equipment.

The year's business is summarized in Table 23. The farm income, $3,440, is the difference between receipts and expenses. Subtracting from farm income the sum of interest on the total capital at 6 per cent and labor income for Farming System "E," Table 5, gives $517, the amount left as a return to the labor used in caring for the sheep. If the farmer does his regular farm work and also looks after the sheep, the $517 is a net profit. If, on the other hand, he pays out $517 to hired labor for caring for the sheep, then the sheep enterprise just breaks even. In making these computations wheat was figured at $1.04 per bushel, lambs at 9.6 cents per pound and wool at 30 cents.

These prices are based on market quotations for the years 1922 to 1929 less the cost of marketing. Peas are figured at the usual contract price of 2.5 cents per pound for hand picked peas.

Table 23. Estimated Capital, Receipts, Expenses, and Return to Labor Used on Sheep

CAPITAL		
Farm, 320 acres equipped for grain farming, System "E," Table 5		$33810
Sheep enterprise:		
100 ewes and 20 yearling ewes @ $10	$1200	
2 rams, 1 @ $40, and 1 @ $30	70	
Sheep shed and sheep equipment	200	
Material for 1 mile new sheep-tight fence and rebuilding 3½ miles of old fence	800	2270
Total capital		$36080

EXPENSES		RECEIPTS	
General farm:		Crops:	
Hired labor	$276	Wheat, 4078 bu. @ $1.04	$4241
Seed bought	105	Peas, 585 cwt. @ $2.50	1463
Sacks and twine	302		
Hauling peas and wheat	137	Sheep enterprise:	
Threshing	960	100 lambs, 80 lbs. each @ 9.6¢	768
Farm truck	275	15 aged ewes	75
Machinery	283	1 used ram	20
Buildings,upkeep	216	1000 lbs. of wool @ 30¢	300
Taxes	442		
Other (a)	315	Total receipts	$6867
Sheep enterprise:			
Dip, 10 gallons	15		
Salt (500 lbs.)	6		
Wool sacks	2		
Medicine	10		
Shearing 120 sheep	18		
Replacing equipment	25		
Ram bought	40		
Total expense			3427
FARM INCOME			$3440
Deduct:			
Interest on capital, $36080 @ 6%	$2165		
Labor income, Farming System "E," Table 5	758		2923
RETURN TO LABOR USED ON SHEEP			$ 517

(a) Binding twine $83, copper carbonate $6, fences $80, insurance $29, work animals $108, telephone $9.

Table 24 is presented to show how much the 100-ewe sheep enterprise, when added to Farming System "E," Table 5, will return to the labor used in caring for the sheep with wheat prices ranging from 70 cents to $1.20 per bushel, wool prices from 15 cents to 40 cents and lamb prices from 8 cents to 12 cents per pound. For comparison the labor income of farming System "E," Table 9, with wheat at different prices is presented in the second column of the table.

Table 24. Amount Returned to the Labor Used in Caring for a 100-ewe Flock of Sheep Added to Farming System "E," Table 5, with Wheat Prices Ranging from 70 cents to $1.20 per Bushel, Wool Prices from 15 cents to 40 cents per Pound, Lamb Prices from 8 cents to 12 cents per pound, and with Crop Yields, Price of Peas, Other Minor Items of Receipts, and Rates Used in Computing Expenses Held Constant.

Wheat price per bu.	Labor income System "E" Table 9 without sheep	Wool prices: Cents per pound to the producer						Lamb price per pound
		15	20	25	30	35	40	
		Return to the labor used on sheep enterprise						
$	$	$	$	$	$	$	$	$
.70	-688	298	348	398	448	498	548	
.80	-262	280	330	380	430	480	530	
.90	163	263	313	363	413	463	513	
1.00	588	246	296	346	396	446	496	.08
1.10	1,013	229	279	329	379	429	479	
1.20	1,438	211	261	311	361	411	461	
.70	-688	378	428	478	528	578	628	
.80	-262	360	410	460	510	560	610	
.90	163	343	393	443	493	543	593	.09
1.00	588	326	376	426	476	526	576	
1.10	1,013	309	359	409	459	509	559	
1.20	1,438	291	341	391	441	491	541	
.70	-688	458	508	558	608	658	708	
.80	-262	440	490	540	590	640	690	
.90	163	423	473	523	573	623	673	.10
1.00	588	406	456	506	556	606	656	
1.10	1,013	389	439	489	539	589	639	
1.20	1,438	371	421	471	521	571	621	
.70	-688	538	588	638	688	738	788	
.80	-262	520	570	620	670	720	770	
.90	163	503	553	603	653	703	753	
1.00	588	486	536	586	636	686	736	.11
1.10	1,013	469	519	569	619	669	719	
1.20	1,438	451	501	551	601	651	701	
70	-688	618	668	718	768	818	868	
.80	-262	600	650	700	750	800	850	
.90	163	583	633	683	733	783	833	.12
1.00	588	566	616	666	716	766	816	
1.10	1,013	549	599	649	699	749	799	
1.20	1,438	531	581	631	681	731	781	

With wheat selling at 70 cents per bushel, the labor income of this farm without the sheep is —$688. That is, the interest on the farm capital at six per cent exceeds the farm income by $688. But with wheat selling at $1.20 per bushel labor income is $1,431. Sheep interfere very little with the production of crops for sale when added to this farming system and even with lambs at 8 cents per pound, with wool at 15 cents, and wheat at $1.20, the 100-ewe flock returns $211 to the labor used in caring for the sheep. With each five cent increase in the price of wool, the prices of wheat and lambs remaining the same, the return to the labor used in caring for the sheep increases $50. Likewise with each increase of one cent in the price of lambs, the prices of wheat and wool remaining unchanged, the return to the labor used in caring for the sheep increases $80.

In considering the profits to be derived from sheep, it must be remembered that these figures are based on the assumption that the yield of winter wheat following sweet clover will be the same whether the clover is plowed under during June or whether it is used for pasture and the land plowed late in September or early October and then seeded to winter wheat. The limited information available indicates the June plowing of the sweet clover gives the better yields on the average.

The budget is also based on gleaning the stubble fields with sheep where the grain is cut with a binder and the peas with a mower. Where the harvesting is done with the combine, sheep will probably require some additional feed during the late autumn.

Severe losses are sometimes caused in this area by coyotes, dogs and the bloating of the sheep when grazing on the sweet clover. Such losses are irregular and are not covered by the death loss of five per cent allowed among the ewes.

Plowing the clover under during June gives a much better chance to keep wild oats and other weeds under control, and a better distribution of the farm work than does the pasture method.

Crop and Hog Farming

The state of Washington is a deficit swine producing area which makes it necessary to import a considerable volume of hogs each year from other states. Since many of these hogs are shipped from

east of the Rocky Mountains, the Pacific Coast prices are usually considerably higher than Chicago prices. It would seem, therefore, that the production of hogs might be increased with profit in the area covered by this study. This area, however, is especially well adapted to small grain farming and either wheat, barley, or oats must furnish the bulk of the feed used in growing hogs. Since wheat is the leading cash grain crop, swine production in this area must compete with the growing of wheat. The question naturally follows: With wheat at different prices what prices must a farmer obtain for hogs in order to make a profit on the enterprise? This budget is offered as at least a partial answer to this question.

The hog enterprise provided in this budget consists of four purebred or high grade sows, four gilts, and a purebred boar. The four sows and four gilts are bred to farrow early in March, and the eight sows raise to maturity an average of 48 pigs. The four young sows are bred to farrow again about September 1. Of the fall pigs farrowed, 24 are raised to maturity. The four older sows, after weaning their March pigs, are fattened and sold during July. To replace the sows sold each July, four of the best gilts in the March litter are retained for brood sows. Together with four sows which farrowed September 1, the four gilts are bred to farrow early in March. It will thus be seen that each sow raises three litters of pigs before she is sold in July. A young purebred boar weighing 200 pounds is bought in September each year. He is used during the fall and spring breeding seasons and sold as a stag with the sows in July.

The spring litter of 48 pigs are given a limited grain ration while on alfalfa pasture from about May 1 to August 15 when they are given the run of 65 acres of pea stubble. Early in September they also have access to 150 acres of wheat, barley, and oat stubble. During the six weeks they are in the stubble fields they receive no feed except what they pick up. They are fattened during October and November, and marketed at an average weight of 200 pounds about December 1.

The fall litter of 24 pigs runs in the stubble field with the sows from early September until about the middle of October, when it is necessary to begin feeding because so much of the land must be plowed for fall and spring seeding. They are sold in May at an average weight of 200 pounds.

Table 25. Estimated Feed Required for an 8-brood Sow Hog Enterprise with Limited Grain Ration for Spring Pigs on Alfalfa Pasture. (48 Mar. 1 Pigs Raised from 8 Sows and 24 Sept. 1 Pigs from 4 Sows; 4 Sows and a Stag Sold Each July; 4 Gilts Saved from the Spring Litter for Brood Sows and a Boar Bought Every Year in the Fall)

Item	Days	Number and kind of hogs and Rate of feeding (a)	Estimated feed required-lbs.			
			Barley	Oats	Tankage	Hay
Sows: Mar. 1 - April 30	61	8 sows and 48 pigs 15 lbs. mixed feed (ration No. 2) and 1 lb. alfalfa hay per sow per day	5124	1684	512	488
May 1 - June 30	61	8 dry sows on alfalfa pasture 2½ lbs. mixed feed (ration No. 1) and alf. pasture	976	183	61	.....
July 1 - 16	16	4 dry sows sold July 16 15 lbs. mixed feed (ration No. 1) per head daily	768	144	48	.....
July 1 - Aug. 31	62	4 dry sows on alfalfa pasture 2 lbs. mixed feed (ration No. 1) per head daily and pasture	397	74	25	.....
Sept. 1 - 15	15	4 sows farrowed Sept. 1 15 lbs. mixed feed (ration No. 2) per head daily	630	207	63	.....
Sept. 16 - Oct. 15	30	4 sows and 24 Sept. 1 pigs Stubble fields—no other feed	.....	.....	.....	.....
Oct. 16 - 31	16	4 sows and 24 pigs 15 lbs mixed feed (ration No. 2.) per sow daily	672	221	67	.....
Nov. 1 - Feb. 28	120	8 sows (4 old sows and 4 gilts) 4 lbs. mixed feed (ration No. 1) and 1½ lbs. hay per head daily	3072	576	192	1440
Spring pigs May 1 - Aug. 15	107	48 spring pigs (gain from 30 lbs. to 100 lbs.) 2 lbs. mixed feed (ration No. 1) per head and pasture	8217	1541	514	.....
Aug. 16 - Sept. 30	46	48 pigs (gain from 100 lbs. to 140 lbs. each) In stubble—no other feed	.....	.....	.....	.....

(a) The grain is fed in two mixtures:
No. 1. Barley 80 lbs., Oats 15 lbs., Tankage 5 lbs.
No. 2. Barley 70 lbs., Oats 23 lbs., Tankage 7 lbs.

(Continued on next page)

Table 25 (Continued)

Item	Days	Rate of feeding (a) Numbe and kind of hogs and	Estimated feed required-lbs. Barley	Oats	Tank-age	Hay
Oct. 1 - Nov. 30	61	44 spring pigs (gain from 140 lbs. to 200 lbs. 4.5 lbs. mixed grain (ration No. 1) to 1 lb. gain	9504	1782	594	.....
Oct. 1 - Oct. 15	15	4 gilts retained for sows In stubble field	.....	.....	.....	.....
Oct. 16 - Oct. 31	16	4 gilts retained for sows 4 lbs. mixed feed (ration No. 1) each daily	205	38	13	.....
Fall pigs Nov. 1 - May 15	196	24 fall pigs (gain from 30 lbs. to 200 lbs.) 4.5 lbs. mixed grain (ration No. 1) to 1 lb. gain and ½ lb. hay per head daily	14688	2754	918	2352
Boar: Sept. 1 - June 30	303	1 boar 4 lbs. mixed feed (ration No. 1) and 1½ lbs. hay per day	970	182	60	450
July 1 - 16	16	1 boar on full feed 10 lbs. mixed feed (ration No. 1) daily	128	24	8	.....
TOTAL			45351	9410	3075	4730

(a) The grain is fed in two mixtures:
No. 1. Barley 80 lbs., Oats 15 lbs., Tankage 5 lbs.
No. 2. Barley 70 lbs., Oats 23 lbs., Tankage 7 lbs.

Table 25 shows in considerable detail how the sows and pigs are managed and fed during the year and the quantity of the different feeds required.

In this budget the 300 acres of crop land are divided into two crop rotations: (1) An 8-year alfalfa-barley rotation occupying 40 acres, and (2) a 4-year pea (sweet clover seeded with the peas)—sweet clover—wheat—wheat rotation which occupies 260 acres. The former rotation is to provide alfalfa pasture, hay, and barley for the hogs. Half of the 40 acres is in barley each year and half in alfalfa. To be certain of getting a stand, the alfalfa is seeded alone, five acres being seeded each year. The alfalfa is used for hay the second and third years and for hog pasture the fourth year. It is then plowed up and used for producing barley for four years. In actual practice it may be advisable to seed 20 acres to alfalfa at one time, leave it down four years, then plow it up and seed another 20 acres. The hogs are changed on to fresh pasture each year in order to control worms.

In the 4-year rotation, one-fourth of the land is in peas, one-fourth in second year sweet clover, and one-half in wheat, oats, and barley. The acreage devoted to each crop, the yields per acre and the disposal of each crop are shown in Table 26.

Table 26. Production and Disposal of Crops on 320 acre farm from System "E," Table 5, Adjusted for 38 sow enterprise

Crop	Acres	Yield	Production	Disposal		
				Seed	Feed	For sale
Alfalfa rotation:						
Alfalfa new seeding	5	....	....	....	....	....
Alfalfa hay	10	1.5 T.	15 T.	....	15 T.	....
Alfalfa hog pasture	5	....	....	....	....	....
Barley	20	2,300 lbs.	46,000 lbs.	1,200 lbs.	44,800 lbs.	....
S. clover rotation:						
Peas (s. clo. seeded)	65	900 lbs.	58,500 lbs.	7,800 lbs.	....	50,700 lbs.
S. clover. 2nd. yr.	65	....	....	....	....	....
W. wheat after sweet clover	65	37 bu.	2,405 bu.	65 bu.	....	2,340 bu.
W. wheat after wheat	46	30 bu.	1,380 bu.	51 bu.	....	1,329 bu.
W. wheat hay	4.5	2.2 T.	9.9 T.	....	9.9 T.	....
Oats	14.5	1,860 lbs.	26,970 lbs.	870 lbs.	26,100 lbs.	....

Table 27 presents the financial summary of this budget. The addition of the 8-sow hog unit increases the capital $1,665. Of this increase, $1465 is to provide a feeding shed, cots, a water system, a feed mill and gas engine, and 4 and one-half miles of hog-tight fence.

The 44 spring pigs, after gleaning the stubble fields, are fattened

Table 27. Estimate Capital, Receipts, Expenses, and Return to Labor Used on the Hog Enterprise

CAPITAL		
Farming System "E," Table 5, equipped for grain farming		$33810
Hog enterprise:		
4 sows and 4 gilts @ $20	$160	
1 boar	40	
8 cots, 8′ x 8′, @ $25	200	
Material for feed shed, feed troughs, etc.	100	
Water system and gas engine, pump, pump jack, tank, pipe, etc.	165	
Feed mill and gas engine	200	
Material for rebuilding 3½ miles of old fence and building one mile of new hog-tight fence making movable panels	800	1665
Total capital		$35475

EXPENSES		RECEIPTS	
General farm:		Crops:	
Hired labor	$187	3669 bu. wheat @ $1.04	$3816
Seed bought	103	507 cwt. peas @ $2.50	1268
Sacks and twine	259		
Hauling peas and wheat	122	Hogs:	
Threshing	953	44 sp. pigs 8800lbs. @ 8.75¢	770
Farm truck	275	24 fall pigs, 4800lbs. @ 9.55¢	458
Machinery (gas engines inc.)	335	4 sows, 1600lb @ 6.85¢	110
Building upkeep	226	1 stag, 370lbs. (docked 70lbs.) @ 6.85¢	21
Taxes	441		
Other(a)	298	Total	$6443
Hog enterprise:			
Boar bought in September	40		
3075lbs. tankage @ 4.5¢	138		
300lbs. bone meal	6		
300lbs. gr. limestone	6		
400lbs. salt	5		
Dip, medicine, etc.	20		
Total expense			$3414

FARM INCOME		$3029
Deduct:		
Interest on capital ($35,475) at 6 per cent	$2128	
Labor income for System "E," Table 5	758	2886
RETURN TO LABOR USED ON HOG ENTERPRISE		$ 143

(a) Includes binding twine $68, copper carbonate $6, fence upkeep $80, insurance $27, telephone $9, and upkeep of 9 work animals $108.

and sold about December 1 at an average weight of 200 pounds for 8.75 cents per pound. The 24 fall pigs are sold about May 15, weighing 200 pounds each, at 9.55 cents. After being docked 4 cents per pound the 4 sows and stag bring 6.85 cents per pound in July. The stag is also docked 70 pounds in weight. These prices are based on market quotations for the respective months in which the sales occur for the period 1921 to 1929 less shipping expenses to market. In other words, the November farm price for this period averaged 8.75 cents per pound, the May price 9.55 cents and the July price 10.85 cents.

The gross receipts from this organization is $6,443 and the expenses $2,414, which leaves a farm income of $3,029. After subtracting from farm income the sum of interest on the total farm capital at six per cent ($2,128) and the labor income of System "E," Table 5 ($758), there remains $143 as the return to the labor used in caring for the hogs for the year. If the labor used in caring for the hogs is hired, the $143 must pay the labor bill or the hog enterprise is a losing concern. This should explain why but few farmers in this area have been enthusiastic about hog raising during the past eight or nine years.

For the nine year period, 1921 to 1929, the average September 1 price of hogs is about two cents per pound higher than the average December 1 price. This differential can be taken advantage of by feeding the spring litter of 48 pigs a full grain ration while on alfalfa pasture and marketing them September 1 at an average weight of 180 pounds each. This would require about 6,700 pounds more grain, and would produce about 880 pounds less pork for sale. With the higher price of two cents per pound for the hogs sold, the full feeding method gives a net return of $16 less than does gleaning the stubble fields with these pigs and marketing about December 1 at a weight of 200 pounds each. Where the combine is used and there is but little waste in the stubble to be picked up, this method may prove more satisfactory than gleaning the stubble fields and selling in November or December.

The purpose of Table 28 is to show approximately what the 8-sow hog unit, when added to System "E," Table 5, would return to the labor used in caring for the hogs with wheat prices varying from 70 cents to $1.20 per bushel and hog prices from 6 cents to 13 cents per

pound. It is seen from the table that the return to the labor used in caring for the hogs is $67 with wheat selling at 70 cents per bushel and hogs at 7 cents per pound; $73 with wheat at 9.5 cents and hogs at 8 cents; and $79 with wheat at $1.20 and hogs at 9 cents. These amounts, it would seem, are not sufficient to justify the farmer to assume the additional risk even though he can take care of the hogs without having to hire additional help. In order for hog production to be attractive in this area, it would appear from the table that the farm price of hogs should be about 8 cents per pound when wheat is selling for 70 cents per bushel; about 9 cents when wheat is 95 cents; and about 10 cents when wheat is $1.20.

Table 28. Return to the Labor Used on the 8-sow Hog Enterprise, Added to Farming System "E," Table 5, with Wheat Prices Ranging from 70 Cents to $1.20 per Bushel, and with Hog Prices from 6 Cents to 13 Cents per Pound,and with Crop Yields, the Price of Peas, and other items of Receipts and the Rates Used in Estimating Expenses Held Constant

Wheat price per bu.	Labor income without hogs System "E" Table 9	Hog prices: Cents per pound to the producer							
		6	7	8	9	10	11	12	16
		Return to the labor used on an 8-sow hog enterprise							
$	$	$	$	$	$	$	$	$	$
.70	-688	- 85	67	219	371	523	675	827	979
.75	-475	-115	37	189	341	493	645	797	949
.80	-262	-144	8	160	312	464	616	768	920
.85	- 50	-173	- 21	131	283	435	587	739	891
.90	163	-202	- 50	102	254	406	558	710	862
.95	275	-231	- 79	73	225	377	529	681	833
1.00	588	-260	-108	44	196	348	500	652	804
1.05	801	-290	-138	14	166	318	470	622	774
1.10	1,013	-319	-167	-15	137	289	441	593	745
1.15	1,226	-348	-196	-44	108	260	412	564	716
1.20	1,438	-377	-225	-73	79	231	383	535	687

Crop, Dairy, and Hog Farming

A dairy herd of ten cows, three heifers, three calves, and a bull is added in this budget to the 320-acre grain farm, System "E," Table 5. Since any material expansion of dairying in this area will probably be on a cream basis for some time, the 8-sow hog unit of the previous budget is also incorporated in this one to provide a means of utilizing the available skim milk. The hog unit in all detail remains

the same as in the previous budget except for the replacement of 13000 pounds of grain and 3075 pounds of tankage by 57840 pounds of skim milk. The replacement is done on the basis of the total digestible nutrients in the feeds concerned.

The cows added in this budget produce an average of 7,500 pounds of four per cent milk. They are bred to freshen around September 15. A death loss of one cow per year is allowed and two low producing cows or barren cows or heifers are sold. This makes it necessary to raise three of the best heifer calves each year. The other calves are given a birth value of $2.00 each. Since the herd is maintained by raising heifer calves, it is necessary to keep a fairly good bull. His value is placed at $250 and he is given an annual depreciation of $50.

Table 29. Livestock: Feed Requirements

Kind	Number	Hay	Barley	Oats	Bran	Skim milk	Whole milk
		T.	lbs.	lbs.	lbs.	lbs.	lbs.
Work horses	9	22.5	.....	16,200	.....	....	....
Cows	10	37.8	7,200	2,400	2,400	....	....
Heifers	3	5.4	1,260	420	420	....	....
Calves	3	.9	720	240	240	7,500	750
Bull	1	2.7	1,095	365	365	....	....
Hogs (whole herd)	....	2.3	42,087	8,734	....	57,840	....
Total	....	71.6	52,362	28,359	3,425	65,340	750

The feed required for the livestock is shown in Table 29. The cows are provided alfalfa hay and second year sweet clover pasture but no silage. The feed allowed per cow during the different periods of the year is as follows: From September 16 (the assumed date of freshening) to September 30, 20 pounds of hay, 7 pounds of grain and some pasture; October 1 to April 30, 30 pounds of hay and 5 pounds of grain; May 1 to July 15, 5 pounds of hay and pasture; July 16 to July 25, only pasture while being turned dry; July 26 to September 15, 10 pounds of hay 2 pounds of grain and pasture.

The crops are grown in two rotations as shown in Table 30: First, an 8-year alfalfa rotation which occupies 100 acres of land and which is used to furnish hay for the dairy cattle and hogs, and pasture for

Table 30. Production and Disposal of Crops on 320 Acre Farm from System "E," Table 5, Adjusted for Dairy and Hog Enterprises.

Crop	Acres	Yield	Production	Disposal		
				Seed	Feed	Sales
Alfalfa rotation:						
Hog pasture	5	....	....	....	....	....
Hay	33	1.5 T	49.5 T	....	49.5 T	....
Alf. new seeding	12	....	....	....	....	....
Wheat after alfalfa	12	28 bu.	336 bu.	....	....	....
Wheat after wheat	23	31 bu.	713 bu.	32 bu.	....	1,017 bu.
Oats	15	1860 lbs.	27,900 lbs.	900 lbs.	27,000 lbs.	....
Sweet clover rotation:						
Peas (s. c. seeded)	50	900 lbs.	45,000 lbs.	6,000 lbs.	....	390 cwt.
2nd. yr. s. clover	50	....	....	....	....	....
W. wheat	50	37 bu.	1,850 bu.	50 bu.	....	1,800 bu.
Barley	24	2300 lbs.	55,200 lbs.	1,440 lbs.	53,760 lbs.	....
Wheat	16	30 bu.	480 bu.	26 bu.	....	454 bu.
Wheat hay	10	2.2 T	22 T	....	22 T	....

the hogs; and, second, the 4-year clover rotation used in Farming System "E," Table 5.

The year's business is summarized in Table 32. The total capital of the 320 acre farm equipped for producing wheat, System "E," Table 5, is $33,810. To this the 10-cow dairy unit adds $2450 and the 8-sow hog unit $1,665, making a total capital for the grain, dairy and hog farm of $37,925. The capital of the hog unit has already been discussed in the previous chapter. Of the items in the dairy capital only the $600 allowed to provide shelter needs comment. It may be

Table 31. Livestock: Numbers, Production, and Sales

Kind	Number	Production	Sales
Cows	10	75000 lbs. 4% milk	2970 lbs. butterfat; 2 cull cows
Heifers	3	.....	.....
Calves	3	3	.....
Bull	1	.....	.....
Brood sows	4	.....	4 Sows, 1600 lbs.
Gilts	4	.....	.....
Boar	1	.....	1 Stag, 300 lbs.
Spring pigs	48	48	44 Pigs, 8800 lbs.
Fall pigs	24	24	24 Pigs, 4800 lbs.

Table 32. Estimated Capital, Receipts, Expenses and Return to the Labor Used on the Hog and Dairy Enterprise

CAPITAL				
Farm, 320 acres equipped for grain farming, System "E," Table 5				$33,810
Hog enterprise:		Dairy enterprise:		
4 sows	$ 80	10 cows	$1100	
4 gilts	80	3 heifers	150	
Boar	40	3 calves	75	
Material for cots, shed, troughs	300	1 bull	250	
Water system: Gas engine, pump, pump jack, piping, etc.	165	Shelter	600	
Feed mill, and gas engine	200	Milk house	150	
Material for 4½ mi. hog-tight fence and panel fencing	800	Dairy equipment	125	
		Total		2450
Total				1665
Total Capital				$37925

EXPENSES		RECEIPTS		
Hired labor	$ 250	Crops:		
Seed bought	100	Wheat, 3271 bu. @ $1.04		$3402
Sacks and twine	236	Peas, 390 cwt. @ $2.50		970
Threshing	855			
Hauling	106	Hog enterprise:		
Farm truck	275	4 sows, 1600 lbs. @ 6.85¢		110
Machinery and gas engine	344	1 stag, 370 lbs. (dock 70 lbs.) @ 6.85¢		21
Buildings	250	44 sp. pigs 8800 lbs. @ 8.75¢		770
Taxes	477	24 fall pigs 4800 lbs. @ 9.55¢		458
Other (a)	297			
Special dairy and hog:		Dairy enterprise:		
300 lbs. bone meal	6	Butterfat, 2970 lbs. @ 43¢		1265
300 lbs. ground limestone	6	2 cull cows @ $50		100
1100 lbs. salt	11	4 calves @ $2 birth value		8
Medicine, veterinary, dip, etc.	60	Total receipts		$7104
Dairy equipment	35			
3425 lbs. bran	51			
Bull depreciation	50			
Boar bought	40			
Total expense				3449
FARM INCOME				$3655
Deduct:				
Interest on capital @ 6%			$2,276	
Labor income, Farming System "E," Table 5			758	3034
RETURN TO LABOR USED ON HOG AND DAIRY ENTERPRISE				$ 621

(a) Binding twine $68, copper carbonate $6, fences $80, insurance $26, telephone $9, workstock $108.

said that on farms where new buildings are required this may be meager, but in most cases the $600 will be ample to remodel buildings already on the farm.

The total receipts amount to $7,104. Of this amount $4,372 comes from the sale of crops, $1,373 from the dairy cattle and $1,359 from the hog enterprise. The price at which the butterfat is sold is based on monthly market quotations from May 1924 to March 1929 less marketing expenses. The total expenses, $3449, subtracted from the total receipts give a farm income of $3,655.

Deducting the sum of labor income, System "E," Table 5 ($758), and interest on the total capital at 6 per cent ($2276), from farm income leaves $621, the return to the labor used on the hog and dairy enterprises. This amount, $621, must satisfy the labor spent on the two livestock enterprises. If the farmer and the members of his family do the livestock work, is $621 sufficient inducement to cause them to put forth the extra effort? If the livestock labor is hired, will $621 pay for the labor?

Of the crops grown in the alfalfa rotation, as shown in Table 30, 12 acres of alfalfa are seeded alone each year. Where it is possible to get a satisfactory stand of alfalfa by seeding it with peas, which yield 900 pounds of hand picked peas per acre and sell for 2.5 cents per pound, this would increase the net income of this farm approximately $160.

The returns to the labor used in operating the 8-sow hog and 10-cow dairy units when added to System "E," Table 5, are given in Table 33 with wheat varying from 70 cents to $1.20 per bushel, hog prices from 6 cents to 12 cents per pound, and butterfat from 30 cents to 50 cents per pound.

The addition of either or both of these enterprises to farming System "E," Table 5, materially reduces the amount of wheat for sale and it naturally follows that with the prices of hogs and butterfat held constant, the return to the labor used in operating the hog and dairy enterprises decreases as the price of wheat increases.

With wheat at $1.00 per bushel, hogs at 7 cents, and butterfat at 30 cents, nothing is returned to the labor used in operating the hog and dairy enterprises. But with wheat at 80 cents, hogs at 8 cents, and butterfat at 35 cents, the return to labor is $497. If no additional labor is hired because of the addition of the dairy and hogs, the farm income is increased $497. If, however, help must be hired to care for the livestock, little or nothing is gained, for this would require about one-half of a man's time.

Table 33. Return to the Labor Used in Operating the 8-sow Hog and 10-cow Dairy Enterprises Added to System "E," Table 5, with Wheat Prices Ranging from 70 Cents to $1.20 per Bushel, Hog Prices from 6 cents to 12 Cents per Pound, Butterfat Prices from 30 Cents to 50 Cents per Pound, and with Crop Yields, Price of Peas, and Other Minor Items of Receipts and Rates Used in Estimating Expenses Held Constant.

Wheat price bu.	Labor Income "E" Table 9	Hog prices: Cents per pound to the producer 6	7	8	9	10	11	12	Butter fat per lb.
		Return to the labor used on hog and dairy enterprise							
$	$	$	$	$	$	$	$	$	$
.70	-688	143	295	447	599	751	903	1055	
.80	-262	45	197	349	501	653	805	957	
.90	163	-53	99	251	403	555	707	859	
1.00	588	-125	00	125	304	465	608	790	.30
1.10	1,013	-250	-98	54	206	358	510	662	
1.20	1,438	-348	-196	-44	108	260	412	564	
.70	-688	291	443	595	747	899	1051	1203	
.80	-262	193	345	497	649	801	953	1105	
.90	163	95	247	299	551	703	855	1007	.35
1.00	588	-3	149	301	453	605	757	909	
1.10	1,013	-101	51	203	355	507	659	811	
1.20	1,438	-199	-47	105	257	409	561	713	
.70	-688	440	592	744	896	1048	1200	1352	
.80	-262	342	494	646	798	950	1102	1254	
.90	163	244	396	548	700	852	1004	1156	
1.00	588	145	297	449	601	753	905	1057	.40
1.10	1,013	47	199	351	503	655	807	959	
1.20	1,438	-51	101	253	405	557	709	861	
.70	-688	588	740	892	1044	1196	1348	1500	
.80	-262	490	642	794	946	1098	1250	1402	
.90	163	392	544	696	848	1000	1152	1304	
1.00	588	294	446	598	750	902	1054	1206	.45
1.10	1,013	196	348	500	652	804	956	1108	
1.20	1,438	98	250	402	554	706	858	1010	
.70	-688	737	889	1041	1193	1345	1497	1649	
.80	-262	639	791	943	1095	1247	1399	1551	
.90	163	541	693	845	997	1149	1301	1453	
1.00	588	442	594	746	898	1050	1202	1354	.50
1.10	1,013	344	496	648	800	952	1104	1256	
1.20	1,438	246	398	550	702	854	1006	1158	

Crop, Dairy and Poultry Farming

The 10-cow dairy herd of this budget is identical in every detail with that of the previous budget, "Crop, Dairy, and Hog Farming," and for that reason it is not discussed again. The poultry unit consists of a flock of 200 hens and 300 pullets. The flock is maintained

at 500 birds by buying 800 day-old chicks each year from which 300 pullets are raised to maturity. A mortality rate of twelve and one-half per cent is allowed for baby chicks up to 10 weeks of age, and ten per cent for young pullets and laying hens. This makes it possible to cull out 250 birds each year and with this culling and reasonably good care, the production is figured at 165 eggs per bird. The cockerels are disposed of when nine to ten weeks of age at an average weight of one and one-fourth pounds.

Table 34. Feed Required for Livestock: Nine Work Animals, a Ten-Cow Dairy Herd, and a Flock of 500 Hens

Kind	Hay	Wheat	Oats	Barley	Bran	Mash & scratch	Meat scrp.	Whole milk	Skim milk
	Tons	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Horses	22.5		16,200						
Dairy cattle	46.8		3,425	10,275	3,425			750	7,500
Poultry	1.5	20,420	10,210	10,210		2,800	672		57,840
Total	70.8	20,420	29,835	20,485	3,425	2,800	672	750	65,340

The feed required for the livestock is given in Table 34. The wheat, oats, barley, hay and milk are all home produced, and these items do not appear in the list of expenses. For the poultry, the wheat is ground coarse and the oats and barley fine.

Table 35. Production and Disposal of Crops

Crop	Acres	Acre yield	Product'n	Disposal			
				Seed	Feed	For	Sale
Alfalfa rotation:							
Alfalfa, new	11	.....	.....	.....	.....	.....	
Alfalfa hay	33	1.5 T.	50 T.	.....	50 T.	.....	
Wheat, 1st after alfalfa	11	28 bu.	308 bu.	8 bu.	.....	300 bu.	
Wheat after wheat	23	31 bu.	713 bu.	33 bu.	240 bu.	440 bu.	
Wheat hay	10	2.2 T.	22 T.	.....	22 T.	.....	
Sweet clover rotation:							
Peas (s. clover seeded)	53	900 lbs.	47700 lbs.	6360 lbs.	.....	41340 lbs	
Sweet clover, 2nd. year	53	.....	.....	.....	.....	.....	
W. wheat after s. clover	53	37 bu.	1961 bu.	53 bu.	.....	1908 bu.	
Wheat after wheat	27	30 bu.	810 bu.	27 bu.	.....	783 bu.	
Barley after wheat	9	2300 lbs.	20700 lbs.	540 lbs.	20160 lbs.	.....	
Oats after wheat	17	1860 lbs.	31620 lbs.	1020 lbs.	30600 lbs.	.....	

As in the previous budget the crops are grown in two rotations (Table 35). The eight-year alfalfa rotation occupies 88 acres, half of which is in alfalfa and half in small grain. As figured here, eleven acres of alfalfa are seeded alone each year and eleven acres are plowed up. Four grain crops follow the alfalfa. The sweet clover rotation is the same as that used in System "E," Table 5, except some of the wheat is replaced by barley and oats to give the required feed of these grains.

Table 36. Livestock: Number, Production, and Sales

Kind	Number	Production	Sales
Cows	10	7500 lbs. 4% milk	2,970 lbs. butterfat 2 cows
Heifers	3	.....	.....
Calves	3	7	4 sold at birth
Bull	1	.....	.....
Hens	500	6875 doz. eggs 800 baby chicks	6875 doz. eggs 260 hens 350 broilers

The livestock and livestock products for sale are listed in Table 36. Since no deductions have been made for home used products, these figures represent the full amounts to be credited to the dairy and poultry enterprises.

Table 37. Estimated Capital, Receipts, Expense and Return to the Labor Used on the Dairy and the Poultry Enterprises

CAPITAL				
Farm, 320 acres equipped for grain farming, System "E," Table 5				$33810
Poultry enterprise:		Dairy enterprise:		
500 hens	$ 750	10 cows	$1100	
Laying house (500 hens)	1000	3 heifers	150	
Brooder house (800 chicks)	150	3 calves	75	
Brooders	50	1 bull	250	
Fencing	45	Feed mill & gas engine	200	
Miscellaneous	30	Shelter	150	
		Milk house	150	
		Dairy equipment	125	2650
Total	2025	Carried forward		2025
TOTAL CAPITAL				$38485

EXPENSES		RECEIPTS	
General farm:		Crops:	
Hired labor	$249	Wheat, 3431 bu. @ $1.04	$3568
Seed bought	102	Peas, 41340 lbs. @ 2.5¢	1034
Sacks and twine	253		
Threshing	857	Dairy enterprise:	
Hauling	111	Butterfat, 2970 lbs. @ 43¢	1265
Farm truck	275	2 cull cows	100
Machinery and gas engine	400	4 calves @ $2 birth value	8
Buildings	278		
Taxes	482	Poultry enterprise:	
Other(a)	276	6875 doz. eggs @ 25¢	1719
Special dairy:		260 hens and pullets @ 50¢	130
3425 lbs. bran	51	350 broilers @ 25¢	88
600 lbs. salt	6		
Medicine, veterinary, etc.	40	Total	7912
Dairy equipment	35		
Bull depreciation	50		
Special poultry:			
800 baby chicks	128		
2800 lbs. mash and scratch	98		
672 lbs. meat scraps	34		
2000 lbs. oyster shell	30		
Equipment upkeep	12		
Miscellaneous	20		
Total			3787
FARM INCOME			4125
Deduct:			
Interest on capital ($38,485 @ 6%)		$2309	
Labor income, System "E," Table 5		758	3067
RETURN TO LABOR USED ON DAIRY AND POULTRY			$1058

(a) Includes binding twine $66, copper carbonate $6, fence upkeep $60, insurance $27, upkeep of 9 work animals $108, and telephone $9.

Table 37 summarizes the year's business. The addition of the ten-cow dairy and 500-hen poultry units increases the farm capital $2,650 and $2,025 respectively. The dairy capital is $200 greater in this budget than in the previous one because of adding the feed grinding equipment to the dairy capital.

In the poultry capital $1,150 are allowed for material and labor for building a 24′ x 60′ laying house and two 10′ x 12′ portable brooder houses. The labor is estimated at $6.00 per day.

The receipts from this budget are estimated at $7,912. Of this amount 58 per cent came from the sale of crops, 17 per cent from the dairy herd, and 25 per cent from the poultry. The eggs are sold at an average yearly price of 25 cents. This price was adopted by weighting the average monthly market quotations for "Extras" f. o. b. Spokane by the percentage of eggs going to market by months for the period 1925 to 1929 and then deducting the marketing expenses.

The return to the labor used during the year on the dairy and poultry enterprises is $1,058. The poultry unit should require about 1,100 hours (three hours per day) and the ten-cow dairy unit approximately 1500 hours or a total for the year of 2,600 hours. This is a trifle over forty cents per hour. There is sufficient available family labor on some farms to take care of these two units of livestock. On other farms additional help would have to be hired.

The return to the labor used in operating the 500-hen poultry and 10-cow dairy units added in this budget to System "E," Table 5 are given in Table 38 with wheat prices varying from 70 cents to $1.20 per bushel, egg prices from 22 cents to 28 cents per dozen, and butterfat prices from 30 cents to 50 cents per pound.

Within the range of these prices there is no combination of prices for the three commodities (wheat, eggs, and butterfat) where the addition of the hen and dairy units fail to give a return to the labor required for their operation. The lowest return to labor is $334 with wheat at $1.20 per bushel, eggs at 22 cents per dozen, and butterfat at 30 cents per pound. The highest is $1751 with wheat at 70 cents, eggs at 28 cents, and butterfat at 50 cents. If we assume 2,600 hours as the amount of labor required for these two livestock enterprises,

Table 38. Return to the Labor Used in Operating the 10-cow Dairy and 500-hen Poultry Enterprises Added to System "E," Table 5, with Wheat Prices Ranging from 70 Cents to $1.20 per Busel, Eggs form 22 Cents to 28 Cents per Dozen, Butterfat from 30 Cents to 50 Cents per Pound, and with Crop Yields, Prices of Peas, and other Minor Items of Receipts and all Rates Used in Estimating Receipts and Expenses Held Constant.

Wheat price per bu.	Labor income System "E" Table 9	Egg prices: Cents per dozen to producers 22	23	24	25	26	27	28	Butter fat price per lb.
		Return to the labor used on dairy and poultry							
$	$	$	$	$	$	$	$	$	$
.70	-688	745	813	882	951	1020	1088	1157	
.80	-262	663	731	800	869	938	1006	1075	
.90	163	581	649	718	787	856	924	993	.30
1.00	588	498	567	636	705	775	842	911	
1.10	1,013	416	485	554	623	691	760	829	
1.20	1,438	334	403	472	540	609	678	747	
.70	-688	893	962	1031	1099	1168	1237	1306	
.80	-262	811	880	949	1017	1086	1155	1224	
.90	163	729	798	867	935	1004	1073	1142	.35
1.00	588	647	716	784	853	922	991	1059	
1.10	1,013	565	634	702	771	840	909	977	
1.20	1,438	483	551	620	689	758	826	895	
.70	-688	1042	1110	1179	1248	1317	1385	1454	
.80	-262	960	1028	1097	1166	1235	1303	1372	
.90	163	878	946	1015	1084	1153	1221	1390	.40
1.00	588	795	864	933	1002	1070	1139	1208	
1.10	1,013	713	782	851	920	988	1057	1126	
1.20	1,438	631	700	769	837	906	975	1044	
.70	-688	1190	1259	1328	1396	1465	1534	1603	
.80	-262	1108	1177	1246	1314	1383	1452	1521	
.90	163	1026	1095	1164	1232	1301	1370	1439	.45
1.00	588	944	1013	1081	1150	1219	1288	1356	
1.10	1,013	862	931	999	1068	1137	1206	1274	
1.20	1,438	780	848	917	986	1055	1123	1192	
.70	-688	1339	1407	1476	1545	1614	1682	1751	
.80	-262	1257	1325	1394	1463	1532	1600	1669	
.90	163	1175	1243	1312	1381	1450	1518	1587	.50
1.00	588	1092	1161	1230	1299	1367	1436	1505	
1.10	1,013	1010	1079	1148	1217	1285	1354	1423	
1.20	1,438	928	997	1066	1134	1203	1272	1341	

and that the labor including board will cost 30 cents per hour, eggs would have to sell at about 24 cents per dozen and butterfat at 30 cents per pound when wheat is selling at 80 cents, to prevent these two livestock enterprises from being operated at a loss. These illustrations should be sufficient to make the use of this table clear.