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FOREWORD

Soil conservation is of vital importance to the wheat producing areas of the Pacific Northwest. Trashy fallow, or "stubble mulch" is extensively followed by wheat farmers as a means of preventing soil losses by wind and water erosion.

This publication presents the results of a study in Sherman and Gilliam Counties, dealing with one very important phase of the trashy fallow problem; that is, the effect of trashy fallow upon the costs of farm operations. The data presented not only indicate the effect of trashy fallow upon costs of farm operations for the particular year and farms studied, but they show in detail the effect upon each operation so that other farmers should be able to estimate costs under their own individual conditions.

This is the fourth in a series of publications dealing with the economic aspects of the soil conservation program in the dry-land wheat region of Eastern Oregon. Publications now available include:

(1) Crested Wheat Grass Practices on Wheat Farms in Four Eastern Oregon Counties. (Station Circular of Information No. 203) 1939.

(2) Some Economic Aspects of the Soil Conservation Program in the Dry-Land Wheat Region, Oregon. (mimeograph report) 1941.

(3) Culling Wheat Land in Eastern Oregon. (Station Circular of Information No. 247) 1941.

—Wm. A. Schoenfeld
Director

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SUMMARY

Location of Area Studied

This publication is based on cost data secured from 50 Columbia Basin wheat farmers in Sherman and Gilliam Counties, during the month of March 1941. Farmers and farming areas were selected for study which would reflect differences in physical farming conditions as well as cultural practices, especially as related to methods of fallow.

Number of Records Taken and Size of Farms

Schedules or questionnaires were completed on 26 farms in Sherman County and 24 farms in Gilliam County. Approximately one-half of the total wheat land is fallow and one-half is in wheat each year. Of the 16,151 acres of fallow studied in Sherman County, 9,743 acres were black fallow, made with the moldboard plow, and 6,408 acres were trashy fallow, made with the one-way disc. Of the 23,586 acres of fallow in Gilliam County, 6,150 acres were black fallow and 17,436 acres were trashy fallow.

The average acreage in wheat on Sherman County farms was 642 as compared with 1,113 acres for Gilliam County farms. The average yield of wheat in 1940 on the farms studied was 20.1 bushels per acre in Sherman County, and 12.2 in Gilliam County. Thus, the total bushels of wheat produced per farm was approximately the same for both counties. The average value of machinery per farm in Sherman County was $4,321 as compared with $5,303 for Gilliam County. (See Appendix Table 8 for average investment in farm machinery.)

Cost of Field Operations in Sherman and Gilliam Counties

The working width of farm machinery and acres per day is higher for Gilliam County than for Sherman County. This may reflect differences in soil, topographic conditions, the size of farms, the yield of wheat, and the weight of the stubble.

The cost of performing field operations is from five to thirty-five per cent higher on Sherman County farms than on Gilliam County farms. This difference in cost is probably due to differences in soil, topography, size of farms, size of power machinery, and the yield of wheat. In addition, Sherman County farmers apparently disc and harrow more than Gilliam County farmers. The total cost for all operations in Sherman County is more than $1.00 per acre higher than for Gilliam County.

Except for plowing, the working width of farm machinery and acres per day was higher for black fallow than trashy fallow in both counties. This may reflect the interference of the straw which increases the draft and reduced the speed of harrowing and weeding operations in the trashy fallow system.

Sequences of Tillage Operations for Black and Trashy Fallow

The typical sequence of tillage operations in Sherman County was as follows:

Black Fallow: moldboard plow, spring and spike-tooth harrow, and one rod weeding.

Trashy Fallow: plowing with the one-way disc, spring-tooth harrowing, and two rod weedings.

The typical sequence of tillage operations in Gilliam County was as follows:

Black Fallow: moldboard plow, spring-tooth harrow, and one rod weeding.

Trashy Fallow: plowing with the one-way disc, and two rod weedings.

Cost of Trashy Fallow vs. Black Fallow

The cost of trashy fallow as compared with black fallow, is reduced by the use of the one-way disc which, due to a greater working width, covers more acres per day and costs less per acre to operate than the moldboard plow. The cost of fallow is lowered further, in the case of trashy fallow, from less harrowing. The saving from these two operations more than compensates for an increase in cost due to an additional rod weeding which seems necessary for trashy fallow.

The cost of trashy fallow in Sherman County is 41 cents per acre higher than black fallow if double discing, prior to plowing, is included as one of the operations for trashy fallow and not for black fallow. But the results of this study indicate that double discing may be a desirable method of handling heavy stubble regardless of which method of fallow is used. A comparison of the cost per acre for black and trashy fallow on heavy stubble, disced before plowing, and trashy fallow on light stubble, not disced before plowing, indicates a slightly lower cost for trashy fallow.

The cost of trashy fallow in Gilliam County is lower than black fallow, due to the lower cost of plowing with the one-way disc, and less harrowing, even though there is an increase in the cost of rod weeding.

The Effect of Topography and Size of Tractor on Cost

The results of this study show the difference in efficiency and operating cost between hilly and comparatively level land. The average cost of operating on "combination" hilly and level farms was 12 per cent higher, and on hilly and steep farms was 36 per cent higher, than the average cost on level and gently sloping farms.

The cost of performing individual field operations is materially affected by the size of the tractor. This is largely due to the difference in the acres covered per day as between large and small power units. Variations in cost may also be due partly to the high operating efficiency of Diesel tractors in the case of the large power group.

The total cost of all field operations, for a group of farms using medium size tractors (40-50 H.P.), was seven per cent lower, and the total cost for farms using large tractors (50 H.P. and over) was 23 per cent lower than for farms using small tractors (less than 40 H.P.)

Conclusion

From the results of this study, it seems safe to conclude that trashy fallow or "stubble mulch" can be prepared without additional cost to the farm operator. For the areas under consideration, the cost of trashy fallow is as low as, and for certain soil conditions may be actually lower than, black fallow.

AGRICULTURAL EXPERIMENT STATION
Oregon State College, Corvallis
Wm. A. Schoenfeld, Director
and
The Soil Conservation Service
United States Department of Agriculture
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SOME ELEMENTS OF COST IN WHEAT FARMING
With Special Consideration of the COST OF BLACK AND TRASHY FALLOW Made with the One-Way Disc

by

H. L. Thomas, Virgil D. Kennedy
and
D. Curtis Mumford/1

INTRODUCTION

Studies of the effects of soil conservation practices on farm income have developed the need for more precise information on certain elements of the cost of farming. This is especially true with reference to the cost of trashy fallow (stubble mulch). Wheat farmers generally have been skeptical of the cost of trashy fallow. Many still adhere to the standard black fallow because they fear a sudden rise in the cost of wheat farming from adopting trashy fallow. This fear has undoubtedly retarded the rate of getting this soil conservation practice on wheat land.

Another suggested adjustment in the interest of soil conservation is the retirement of certain steep and erosive wheat land to grass. Cost information relative to this shift in land use is necessary to determine its effect on farm income. The costs in question are those which vary with the acres of wheat produced, such as labor, fuel, and machinery repairs.

Objectives. The objectives of this study are: (1) To determine the relative cost of two methods of fallow; namely, black and trashy fallow. (2) To determine the cost of operating with different kinds and sizes of tractors and power equipment. (3) To determine the variation in operating

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cost on hilly as compared with gently sloping wheat land, and (4) To assemble certain cost information that can be used in budgeting expenses for wheat farms when retiring a portion of the wheat land to grass.

No attempt has been made to gather complete information on all elements of cost in wheat farming. The reader is referred to Oregon Agricultural Experiment Station Bulletin No. 373 for additional information on the cost of wheat production. /2

Source of data. The data upon which this study is based were secured through personal interviews with Sherman and Gilliam County wheat farmers during the month of March 1941. /3 In this manner, 50 records were completed which contained detailed information on such factors as the sequence of field operations, size of tractor, working width of farm machinery, acres covered per day, and the quantities of labor and fuel used. Additional information was secured on the capital investment in wheat, machinery, annual machinery repairs, and the working life of different kinds of machines.

Method of analysis and presentation. In this study considerable emphasis is placed upon the individual field operation, the acres covered per day, and the requirements for labor and fuel with different sizes of tractors. The per-acre cost of labor and fuel is computed by dividing the cost of these items for a 10-hour day by the acres covered per day. This procedure facilitates an expression of cost for individual field operations on a basis of performance for different makes and sizes of tractors, operating under different topographic conditions. This procedure, also, makes possible a compilation of costs for several sequences of operations used in different methods of fallow.

The per-acre cost of repairs, interest, and depreciation on farm machinery is computed by dividing the annual cost or charge by the acres of land in wheat. These costs for the tractor are prorated to the several field operations on the basis of days used for each operation. For example, if the tractor was used 100 days per year, and 20 days were used in plowing, then 20 per cent of the tractor repairs and overhead is allocated to plowing.

The results are expressed as averages in dollars and cents by county and by method of fallow. The value of labor is computed at the rate actually paid by the farmers. Interest on machinery is calculated at the rate of five per cent of the average investment, /4 and depreciation at the rate of seven per cent of the original investment. /5

/2 Oregon Agricultural Experiment Station Bulletin No. 373. "Land Use and Production Costs on Dry Land Wheat Farms, Columbia Basin, Oregon" by A.S. Burrier and W. W. Gorton, 1940.

/3 The data as gathered are for the fallow year 1940.

/4 The original machine cost divided by two.

/5 This is based on an average life of 14 years for all machinery.

THE SIZE OF FARMS AND SAMPLE

Of the 50 farm-survey records completed, 26 were taken on Sherman County farms, and 24 on Gilliam County farms. These farms embrace 32,302 acres of wheat land (average 1,284 acres per farm) in Sherman County, and 47,172 acres (average 2,226 acres per farm) in Gilliam County. Under the wheat fallow system of farming, approximately one-half of the wheat land is in wheat and one-half is in fallow each year. Of the 16,151 acres of fallow studied in Sherman County, 6,408 acres were trashy fallow made with the one-way disc, and 9,743 acres were black fallow made with the moldboard plow. Of the 23,586 acres of fallow in Gilliam County, 17,436 acres were trashy fallow, and 6,150 acres were black fallow. Table 1 presents a comparison of farms included in this study by size groups with those for the county as a whole for 1930.

The results show that the farms included in this study are generally larger than those for the county as a whole. A noticeable increase is apparent in the size of farms in these counties since 1930. The 1940 census shows an increase of 169 acres in Sherman County, and 818 acres in Gilliam County in the average size of farms. This means that the sample is perhaps more representative as to size than the data in Table 1 indicate.

Table 1. A Comparison of the Size of Farms Included in This Study with Wheat Farms for the County*

Total farm acres	Sherman County				Gilliam County			
	1930 Census		1941 Study		1930 Census		1941 Study	
Interval	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
0- 499	34	11	1	4	14	6	-	-
500- 999	126	40	8	31	63	28	2	8
1,000-4,999	152	48	17	65	135	60	18	75
5,000-9,999	3	1	-	-	12	6	3	12
10,000 & over	-	-	-	-	-	-	1	5
Total	315	100	26	100	224	100	24	100

* Corresponding data for 1940 included many small hay farms which could not be used for comparison with the farm sampled.

THE COST PER ACRE OF INDIVIDUAL FIELD OPERATIONS

Table 2 shows the average cost per acre of individual field operations for 50 wheat farms in Sherman and Gilliam Counties. These results are for all sizes of farms, operating under different soil and topographic conditions, and using different sizes of power machinery units.

The results contain worthwhile information with reference to the cost of performing individual field operations. For example, the data show that moldboard plowing costs 15 cents more per acre than plowing with the one-way disc, and that it costs nine cents more per acre to harrow with a spring-tooth

than with a spike-tooth harrow. Such data indicate that, from the standpoint of operating costs, it would seem advisable to use the one-way disc and the spike-tooth harrow where soil and erosion conditions permit. In considering substitutions, the farm operator should be cautioned against the use of implements and methods which aggravate rather than correct the problem of soil erosion.

VARIATIONS IN COST BETWEEN SHERMAN AND GILLIAM COUNTIES

The results contained in Table 2 are based upon information from many farms representing a considerable range in farming conditions. There is both strength and weakness in an average figure based on results from many farms. The weakness results from the fact that the data are too inclusive and do not apply to any particular situation. To partly overcome this difficulty, the data have been broken down to show the results for different methods of plowing, for different sizes of tractors, and for different topographic conditions by counties.

Table 2. The Average Cost Per Acre of Performing Individual Field Operations for 50 Wheat Farms in Sherman and Gilliam Counties, Oregon (1940)

Field operations	No. reporting	Cost per acre: Labor	Fuel	Machine repairs*	Total operating cost	Interest and depreciation*	Total cost
Double disc.....	9	$.06	$.06	$.08	$ .20	$.17	$ .37
One-way disc.....	25	.10	.10	.11	.31	.26	.57
Moldboard plow.....	28	.13	.17	.13	.43	.29	.72
Modified moldboard plow**.....	5	.11	.20	.12	.43	.26	.69
Spring-tooth harrow..	33	.04	.05	.04	.13	.13	.26
Spike-tooth harrow...	15	.03	.03	.03	.09	.08	.17
Rod weeder.....	54	.03	.04	.05	.12	.16	.28
Drill.....	54	.05	.05	.06	.16	.18	.34
Combine.....	51	.60	.20	.35	1.15	.59	1.74

* Includes tractor cost allocated to each operation on the basis of number of days used. (See Appendix Table 1, for breakdown of tractor and overhead costs.)

** Moldboards removed.

The data in Table 3 are designed to show the variation in cost per acre of performing individual field operations in Sherman and Gilliam Counties. With the exception of spike-tooth harrowing, the results show that the unit cost of performing individual field operations is consistently higher in Sherman than in Gilliam County.

Table 3. The Cost Per Acre of Performing Individual Field Operations in Sherman and Gilliam Counties

Field operations	No. reporting	Cost per acre: Labor	Fuel	Machine repairs	Total operating cost	Interest and depreciation	Total cost
		Sherman County					
Double disc	8	$.06	$.06	$.08	$ .20	$.17	$ .37
One-way disc	11	.10	.12	.11	.33	.28	.61
Moldboard plow	16	.14	.17	.13	.44	.32	.76
Spring-tooth harrow (1.3)*	25	.06	.07	.05	.18	.14	.32
Spike-tooth harrow	10	.03	.03	.03	.09	.07	.16
Rod weeder (1.6)*	27	.07	.07	.07	.21	.17	.38
Drill	27	.07	.06	.05	.18	.21	.39
Combine	27	.66	.23	.40	1.29	.72	2.01
		Gilliam County					
One-way disc	14	$.09	$.08	$.11	$ .28	$.25	$ .53
Moldboard plow	12	.12	.17	.13	.42	.25	.67
Modified moldboard plow	5	.11	.20	.12	.43	.26	.69
Spring-tooth harrow	8	.05	.04	.05	.14	.11	.25
Spike-tooth harrow	5	.02	.03	.03	.08	.10	.18
Rod weeder (1.8)*	27	.06	.07	.07	.20	.16	.36
Drill	27	.04	.04	.05	.13	.16	.29
Combine	26	.50	.18	.31	.99	.50	1.49

* Average times over.

A partial explanation for this difference in operating cost can be found by an examination of the data in Table 4, where it is shown that the average working width of farm machinery, and the acres covered per day is greater for Gilliam than for Sherman County.

It has been pointed out that the size of farms, as measured in terms of acres, is almost twice as large in Gilliam County (2,226 acres) as in Sherman County (1,284 acres). Some of the Sherman County farms, especially those in the northern part of the county, are located on steep, hilly land. This condition would necessitate the use of smaller machinery, operating at a reduced speed, both of which would reduce operating efficiency and increase the cost per unit of farming. In addition, the average yield of wheat is about eight bushels per acre higher on the farms studied in Sherman County than the farms studied in Gilliam County. The speed at which field operations are performed, especially combining, is reduced by heavy stubble and high wheat yields. /6

/6 The farms in Sherman and Gilliam Counties, as measured by the total bushels of wheat produced, are not greatly different in size. That is, the difference in yield between the two counties makes up for the difference in acres in wheat so that total production of wheat per farm is essentially the same.

Thus, smaller farms, employing slightly smaller machinery, operating at a reduced speed are factors which account for the lower acres per day and the higher cost per acre in Sherman County. The lower operating cost in Gilliam County is partly the result of internal economies resulting from the use of large machinery units on relatively large, gently sloping fields.

The overhead cost per acre in Sherman County is higher than in Gilliam County because of fewer acres of wheat on which to charge interest and depreciation on farm machinery. Actually, the average value of farm machinery per farm is higher in Gilliam County ($5,303) than in Sherman County ($4,321)./7 This is further evidence of the larger size of farm machinery in Gilliam County, but the overhead cost per acre is less than in Sherman County because of larger farming units and the larger wheat acreage over which to prorate the overhead cost.

Table 4. The Average Working Width of Farm Machinery and the Acres Covered Per Day for Sherman and Gilliam Counties

Field operations	Sherman County			Gilliam County			Increase in acres per day in Gilliam County
	No. reporting	Average working width (Feet)	Acres per day	No. reporting	Average working width (Feet)	Acres per day	
Double disc.....	8	25	71	1	30	100	+29
One-way disc.....	11	11	33	14	12	40	+ 7
Moldboard plow.....	16	8	23	12	10	30	+ 7
Spring-tooth harrow..	25	30	71	8	26	79	+ 8
Spike-tooth harrow...	12	50	146	5	45	146	0
Rod weeder.....	27	30	83	27	35	110	+27
Drill.....	27	28	76	27	32	99	+23
Combine.....	25	15	37	26	18	45	+ 8

THE COST OF TRASHY FALLOW

Trashy fallow is practiced extensively in the Columbia Basin Wheat Region to control erosion. It represents a method of farming which is designed to leave all or a portion of the wheat stubble on or near the soil surface. The amount of stubble, and the methods and implements used in making trashy fallow vary with soil and erosion conditions. Plowing implements used in making trashy fallow include: the one-way disc, the modified moldboard plow, the

/7 See Appendix Table 8 for itemized average value of farm machinery in Sherman and Gilliam Counties.

lister bottom plow, the rod tiller, and the sub-surface blade./8 Each of these implements have advantages and disadvantages in making trashy fallow under different soil conditions. Wheat farmers should choose the appropriate implement after taking into account their individual conditions and needs. They should make such adjustments in all their tillage operations as will leave sufficient stubble on the soil surface to insure against the possibility of erosion during the following winter.

One of the main objectives of this study is to determine the probable changes in the cost of wheat farming which would result from the adoption of trashy fallow. This method of fallow may cause an increase or decrease in the cost of farming through: (1) a change in the method of plowing, (2) a change in the kind or number of tillage operations, such as, harrowing and weeding, (3) a change in the rate or speed with which individual operations are performed.

Table 5 shows the change in the sequence of field operations for Sherman and Gilliam Counties. It will be noticed, first of all, that the usual sequence of operations for moldboard plowing is rather well standardized in both counties. Plowing with the moldboard plow, spring-tooth harrowing, and one or two rod weedings is the usual sequence for black fallow in both counties. The only significant exception is an additional spike-tooth harrowing on most of the Sherman County farms. A few farmers rod-weeded twice in both counties, but none weeded three times for black fallow.

Eighty-five per cent of the trashy fallow covered by this cost study was made with the one-way disc. The other 15 per cent was made with the modified moldboard plow. Throughout the balance of this report, the term

/8 The estimated percentage of trashy fallow made with different plowing implements in three Oregon wheat counties in 1941 is as follows:

Implement used	Sherman County	Gilliam County	Morrow County
One-way disc	98%	70%	87%
Modified moldboard plow	-	15%	4%
Lister bottom	-	5%	1%
Rod tiller	-	10%	7%
Sub-surface blade	2%	-	-
Soilivator	-	-	1%

"trashy fallow" is used to designate fallow made by these methods./9

It is not presumed that all fallow made with the one-way disc can be classed as good trashy fallow. In areas of light stubble, or where the one-way disc is operated at high speeds the resulting fallow may result in black rather than trashy fallow. Under these conditions other plowing implements should be considered. The one-way disc can be adapted to various soil and stubble conditions if operated at a moderate rate of speed.

Table 5. The Sequence of Operations by County and by Kind of Fallow

Field operations	Sherman County Number cases		Gilliam County Number cases	
	Black	Trashy	Black	Trashy
Number reporting*.....	16	11	7	20
Double disc.....	-	8	-	1
One-way disc.....	-	11	-	14
Moldboard plow.....	16	-	7	-
Modified moldboard plow.....	-	-	-	5
Spring-tooth harrow.....	15	10	5	3
Spike-tooth harrow.....	12	5	2	3
Rod weeder—one time over...	9	3	5	3
2 times over...	7	6	2	10
3 times over...	-	2	-	7
Average times over all farms.....	1.4	1.9	1.3	2.2
Drill.....	16	11	7	20
Combining.....	16	11	7	20

* A few farms used both methods of fallow. This accounts for a slight discrepancy between the number of farms reporting black and trashy fallow and the total number of farms included in the study.

/9 The data gathered for this study cover the fallow year 1940. At that time other methods of making trashy fallow were not in general use. It should be explained that all the farmers included in this study qualified for a trashy fallow soil conservation payment under the A.A.A. program. Some of them have adopted a complete soil conservation program in accordance with Soil Conservation Service recommendations. A study of trashy fallow in 1937 and 1938 showed the following with reference to the effectiveness of different methods of making trashy fallow in Eastern Oregon wheat land.*

Implement	Ave. pounds of straw on surface Before plowing	After plowing	Per cent of straw on surface after plowing
One-way disc.....	1,768	844	48
Duck-foot cultivator...	1,100	740	67
Lister bottom plow.....	1,513	1,196	79

* Data secured from unpublished report on trashy fallow by Lawrence Jenkins, May, 1938.

Trashy fallow has given rise to some significant changes in the number and kind of field operations in both counties. The main change, in case of plowing, is from the moldboard plow to the one-way disc. Five out of 20 Gilliam County farms used the modified moldboard plow (moldboards removed) instead of the one-way disc to make trashy fallow.

In Sherman County the plowing operation is preceded by fall discing on heavy stubble land. The plowing operation is followed with one spring-tooth harrowing. Spike-tooth harrowing is less common with trashy fallow. This apparent reduction in harrowing is compensated for by an increase in rod weeding. The average number of rod weedings for black fallow is 1.4 as compared with 1.9 for trashy fallow.

In Gilliam County only one farmer out of 16 who practiced trashy fallow preceded the plowing operation with fall discing. There is an apparent decrease in harrowing with trashy fallow in this county. Only six out of 20 farmers using this method reported harrowing after plowing, whereas all the farmers performed this operation for black fallow. The number of rod weedings, however, increased from an average of 1.3 for black fallow to 2.2 for trashy fallow. Only 3 farmers out of 20 who practiced trashy fallow reported one rod weeding, 10 reported two, and seven reported three rod weedings.

Any tillage implement or field operation which pulverizes or otherwise produces a dust mulch on the surface soil increases the hazard of erosion. It is a known fact that harrow implements, especially the spike-tooth harrow, produce an undesirable soil condition from the standpoint of erosion. For this reason the trend as noted in Table 5 is one to be commended.

During the field survey farmers were asked whether or not trashy fallow aggravated the problem of weed control. Of 37 farmers who answered this question, 23 answered in the affirmative, stating that weed control had become more difficult. Twenty-two farmers stated that one additional rod weeding is necessary with trashy fallow. Of the 23 farmers who answered "yes" to the weed question, 17 were located in Gilliam County.

One other question needs to be considered here. Does the trashy fallow method slow down or otherwise decrease the rate at which field operations are performed? In partial answer to this question, the data have been summarized to show the working width of farm machinery and acres per day for different methods of fallow.

The results in Table 6 show that the one-way disc covers about 10 acres more per day than the moldboard plow. This is largely due to the greater working width of the one-way disc. The working width and acres per day for the spike-tooth harrow in both counties, and the working width and acres per day for the spring-tooth harrow in Gilliam County are lower for trashy fallow than for black fallow. The working width and acres per day for rod weeding in Gilliam County are higher for trashy fallow than for black fallow. Very little difference exists between methods of fallow in the performance of other field operations.

The question immediately arises as to whether or not the reduction in working width and acres per day of harrows and rod weeders, as noted for trashy fallow in Table 6, is caused by the interference of straw.

Table 6. Acres Covered Per Day for Trashy and Black Fallow in Sherman and Gilliam Counties

Field operations	Black fallow			Trashy fallow			Increase or decrease in acres per day
	No. reporting	Average working width	Acres per day	No. reporting	Average working width	Acres per day	
		Feet			Feet		
Sherman County							
Double disc	-	-	-	8	24.9	71	-
One-way disc	-	-	-	11	11	33	+10*
Moldboard plow	16	8.2	23	-	-	-	-
Spring-tooth harrow	15	29.2	71	10	31.6	72	+ 1
Spike-tooth harrow	10	52.0	146	2	42.0	105	-41
Rod weeder	16	30.5	84	11	31.6	82	- 2
Drill	16	28.6	74	11	27.5	74	0
Combine	14	15.8	37	11	15.2	36	- 1
Gilliam County							
Double disc	-	-	-	1	30.0	100	-
One-way disc	-	-	-	14	12.7	40	+ 9*
Moldboard plow	7	10.2	31	5	10.3	29	- 2
Spring-tooth harrow	5	28.4	78	3	24.0	55	-23
Spike-tooth harrow	2	53.0	175	3	36.0	127	-48
Rod weeder	7	34.4	103	20	36.2	113	+10
Drill	7	33.9	106	20	31.7	95	-11
Combine	7	18.3	47	19	17.2	44	- 3

* Compared with moldboard plowing.

In answer to this question 10 out of 30 farmers interviewed mentioned specifically the interference of straw as requiring more power or slowing down the speed of field operations. These farmers may have reduced the working width of their implements to overcome this handicap and, thereby, increased the cost of performing these operations. As pointed out above, however, the saving of time and cost for plowing with the one-way disc compensates, in a large measure, for an increase in the cost of harrowing and weeding.

THE COST OF TRASHY FALLOW IN SHERMAN COUNTY

In accordance with the previous breakdown of physical performance data by counties, the cost of trashy fallow is considered first in Sherman County and second in Gilliam County.

The following table presents a comparison of the cost of black and trashy fallow in Sherman County. Note that the spring-tooth harrow and rod weeder operations are performed more than once by most farmers, and that the cost per acre is for the average number of times these operations were actually performed. The results are expressed as operating and total cost for each operation. Separate cost items, including labor, fuel, and repairs, are computed for all operations.

Table 7. The Per Acre Cost of Black and Trashy Fallow in Sherman County, 1940

Field operations	Average times over	No. reporting	Cost per acre: Labor	Fuel	Machine repairs*	Total operating cost	Interest and depreciation*	Total cost
BLACK FALLOW								
Moldboard plow.....	1	16	$.14	$.17	$.13	$ .44	$.32	$ .76
Spring-tooth harrow	1.3	15	.06	.07	.05	.18	.13	.31
Spike-tooth harrow.	0.9	12	.02	.02	.03	.07	.07	.14
Rod weeder.....	1.4	16	.06	.07	.07	.20	.16	.36
Drill.....	1	16	.07	.06	.05	.18	.20	.38
TOTAL	-	-	$.35	$.39	$.33	$1.07	$.88	$1.95
TRASHY FALLOW								
Double disc.....	1	8	$.06	$.06	$.08	$ .20	$ .17	$ .37
One-way disc.....	1	11	.10	.11	.11	.32	.28	.60
Spring-tooth harrow	1.4	10	.07	.08	.06	.21	.13	.34
Spike-tooth harrow.	0.36	5	.08	.04	.03	.15	.07	.22
Rod weeder.....	1.9	11	.08	.08	.08	.24	.20	.44
Drill.....	1	11	.06	.05	.07	.18	.21	.39
TOTAL	-	-	$.45	$.42	$.43	$1.30	$1.06	$2.36**

* See Appendix Table 4 for a breakdown of tractor and overhead costs.

** Subsequent to the actual field enumeration, considerable evidence has been procured pointing to the fact that double discing is not an additional operation peculiar to the preparation of trashy fallow. If the cost of double discing were eliminated from this table, the cost of the two methods of fallow would be essentially the same.

The results for each operation show that the cost of plowing is less for trashy fallow than for black fallow. The cost of harrowing and rod weeding is higher for trashy fallow than for black fallow. The operating cost of spike-tooth harrowing on trashy fallow is double that of black fallow. This increase, however, is based upon only five cases. The cost of drilling is essentially the same for both methods.

The total cost for each item is consistently higher for trashy fallow than for black fallow. The total cost for black fallow is $1.95 per acre as compared with $2.36 per acre for trashy fallow.

A part of this increase in cost for trashy fallow is due to an increase in the cost of harrowing and weeding. This increase, to a large extent, compensates for the lower cost of plowing. The main reason for the increase in the cost of trashy fallow in Sherman County is an extra double discing operation. The costs of the two methods of fallow are essentially the same if the discing operation is omitted.

This brings up the question of whether or not discing stubble prior to plowing is an operation peculiar to trashy fallow or whether it is necessary, under certain conditions, for other methods. Additional information gained through correspondence with the County Agricultural Agent and the farmers involved has disclosed that fall discing is a necessary operation on heavy stubble, regardless of which method of fallow is used, to put the stubble in contact with the soil where it will decompose during the winter months. On a percentage basis, between 10 and 15 per cent of the farmers in Sherman County follow this practice. The percentage is not high but it represents practically all the farms included in the study with heavy stubble.

Five of the eight farmers who performed a double disc operation in the fall answered a follow-up questionnaire to discover whether or not this operation is necessarily a part of their trashy fallow program. Four of the five who responded stated that this operation was performed for black fallow prior to adopting trashy fallow. One farmer indicated that discing has become a part of his tillage practices since initiating trashy fallow on his farm.

This suggests that a more valid comparison between the cost of black and trashy fallow in Sherman County is possible by comparing the cost of the two methods on heavy stubble land, with fall discing, and the cost of the two methods on light stubble land, without fall discing. Such a comparison is made in Table 8. These data show the operating cost for some typical cultural sequences for black and trashy fallow in Sherman County.

The results, as compiled in this table, make a distinction between the cost of fallow on light and heavy stubble land. They also segregate and show the cost for one or two harrowings and rod weedings rather than the fractional number shown in Table 7. The cost of the spike-tooth harrow operation is not included in the sequence for trashy fallow, but the cost of an additional rod weeding is included.

Table 8. The Average Operating Cost of Some Typical Sequences for Black and Trashy Fallow in Sherman County

Field operations	Cost per acre			
	Heavy stubble		Light stubble	
	Black fallow	Trashy fallow	Black fallow	Trashy Fallow
Double disc	$ .20	$ .20	$ -	$ -
Moldboard plow	.44	-	.44	-
One-way disc	-	.32	-	.32
Spring-tooth harrow	.15	.15	.15	.15*
Spike-tooth harrow	.07	-	.07	-
Rod weeder	.14*	.26**	.28**	.26**
Drill	.18	.19	.18	.19
TOTAL	$1.18	$1.12	$1.12	$ .92

* Cost of operation, once over. (See footnote, Table 4, Appendix.)
** Cost of rod weeding, twice over. (See footnote, Table 4, Appendix.)

These results show that trashy fallow costs six cents per acre less than black fallow on heavy stubble land. It costs 20 cents per acre less than black fallow on light stubble if the same number of rod weedings are used for both methods. If one additional weeding is necessary for trashy fallow, the difference in cost between the two methods on light stubble is seven cents, or essentially the same difference as between black and trashy fallow on heavy stubble. /11

The adoption of trashy fallow on wheat farms may create a need for making some adjustments in farm machinery. For example, a substitution of the one-way disc for the moldboard plow, disc drills for hoe drills, and the elimination of harrows. These changes are not expected to cause a material change in the total investment in farm machinery or a change in the overhead cost of this item.

The estimated average value of the one-way disc in Sherman County was $264 as compared with $228 for the moldboard plow. In Gilliam County the investment was $292 for the one-way disc as compared with $279 for the moldboard plow. The average value of the spike-tooth harrow was about $60. If this implement is omitted from the inventory of farm machinery for trashy fallow, the total machinery investment for this method is less than for black fallow. (See Appendix Table 8 for an itemized valuation of farm machinery.)

/11 Using the cost data presented in this report, farmers and farm planners may determine the cost of other cultural sequences which would seem more appropriate for an individual farm or area.

THE COST OF TRASHY FALLOW IN GILLIAM COUNTY

Table 9 shows the cost of black and trashy fallow in Gilliam County. As with Sherman County, the main difference in cost is between plowing with the moldboard plow and the one-way disc. This shift results in a saving of six cents per acre in the cost of plowing. The most important change in the sequence of operations is the elimination of the harrow operation and the addition of one rod weeding. This results in a saving of 13 cents per acre from less harrowing, and an increase of nine cents for the additional weeding, or a net saving of four cents per acre.

The compensating effect of these several shifts in the method saves eight cents per acre in operating cost, and three cents in total cost from adopting trashy fallow. Such a saving, however slight, would tend to dispel the somewhat common belief that trashy fallow costs more than black fallow.

Table 9. The Per Acre Cost of Black and Trashy Fallow in Gilliam County, 1940

Field operations	No. reporting	Cost per acre: Labor	Fuel	Machine repairs	Total operating costs	Interest and depreciation*	Total cost
		BLACK FALLOW					
Moldboard plow.....	7	$.10	$.12	$.13	$.35	$.23	$ .58
Spring-tooth harrow..	5	.04	.04	.05	.13	.10	.23
Rod weeder (1.3)**...	7	.04	.04	.06	.14	.10	.24
Drill.....	7	.04	.03	.05	.12	.12	.24
TOTAL.....	-	$.22	$.23	$.29	$.74	$.55	$1.29
		TRASHY FALLOW					
One-way disc.....	14	$.09	$.09	$.11	$.29	$.25	$ .54
Rod weeder (2.2)**...	27	.07	.08	.08	.23	.17	.40
Drill.....	27	.04	.04	.06	.14	.18	.32
TOTAL.....	-	$.20	$.21	$.25	$.66	$.60	$1.26

* See Appendix Table 5 for distribution of tractor and overhead costs.
** Times over.

The data in Table 10 shows the operating costs for some typical cultural sequences for black and trashy fallow in Gilliam County. The comparison is between the standard sequence of operations for black fallow with one rod weeding, the one-way disc with two and three weedings, and the modified moldboard plow with two weedings.

Table 10. The Operating Cost of Some Typical Sequences for Black and Trashy Fallow in Gilliam County

	Cost per acre			
	Black fallow	Trashy fallow		
Field operations	Moldboard plow	One-way disc		Modified moldboard plow
Moldboard plow.....	$.35	-	-	-
One-way disc.....	-	$.29	$.29	-
Modified moldboard plow.	-	-	-	$.43
Spring-tooth harrow.....	.13	-	-	-
Rod weeder**.....	.11(1)*	.21(2)*	.32(3)*	.24(2)*
Drill.....	.12	.14	.14	.22
TOTAL	$.71	$.64	$.75	$.89**

* Times over.

** This cultural sequence and its cost are based upon the results for only five farms.

As between these several cultural sequences, the one-way disc with two weedings represents the lowest cost combination. This cost (64 cents per acre) reflects the lower cost of plowing with this implement and the exclusion of the cost of harrowing. Three rod weedings with the one-way disc result in a four cent increase (75 cents as compared with 71 cents) over the black fallow sequence. This may indicate that farmers can afford to rod weed three times for trashy fallow without experiencing a significant change in their operating costs.

The cost of the modified moldboard method of plowing is considerably higher than either of the other two methods. These results, however, are based on only five operators, which may be too small a sample to permit reaching a definite conclusion on the cost of this method of fallow. Farmers need not be too much impressed with the preliminary results for this method, and should not abandon a method of plowing which, for other reasons than cost, is best suited to their respective needs.

FARMERS' OPINIONS ON THE COST OF TRASHY FALLOW

Farmers were asked their opinion regarding the cost of black and trashy fallow. Of the 43 farmers who answered this question, 14 expressed an opinion that trashy fallow caused an increase in cost, either because of an increase in the amount of weeding or because the job was made more difficult from the interference of stubble. /12 Twenty-nine farmers stated that the cost of trashy fallow was about the same or less because of the lower cost of plowing.

/12 Includes both Gilliam and Sherman County farmers.

The question might be raised as to whether or not the quality of trashy fallow is as good as black fallow from the standpoint of seedbed, stand, and yield of wheat. Of the 43 farmers who answered the question as to the effect of trashy fallow on the yield of wheat, 10 reported as having experienced a reduction, 20 reported no change, and 13 reported an increase in yield from trashy fallow. /13 Those who reported a lower yield attributed the decrease to the interference of weeds.

THE COST OF OPERATING WITH DIFFERENT SIZE TRACTORS

As indicated by the foregoing tables, operating costs vary with the method of fallow. These variations are due essentially to different sequences of field operations used in making summer fallow in Sherman and Gilliam Counties. The cost of field operations varies also with the size and kind of farm machinery.

The farms covered by this study have been sorted, according to the size of tractor used, into three groups, and the data summarized to show the difference in operating costs as between those using small tractors (less than 40 H.P. tractors), medium size tractors (40 to 50 H.P. tractors), and large tractors (50 H.P. and over). The results of this analysis are shown in Table 11.

The results show that acres-per-day increases and the operating-cost-per-acre decreases with the size of tractor and machines operated. This would be expected since the speed and working width of machines is largely determined by the power. The overhead cost per acre is higher for medium size tractors and lower for large tractors. This may indicate that maximum economy of operation and use of farm machinery on wheat farms in the Columbia Basin is achieved with large tractor outfits on large acreages of land.

/13 Only 31 of the 43 farmers who answered this question were practicing trashy fallow in 1940.

Table 11. Acres Per Day and Cost Per Acre by Operations and by Size of Tractor*

Field operations	Acres per day			Per acre					
				Operating cost**			Total cost		
	Under 40 HP	40 to 50 HP	50 HP over	Under 40 HP	40 to 50 HP	50 HP over	Under 40 HP	40 to 50 HP	50 HP over
Double disc.....	60	79	87	$ .21	$ .19	$ .17	$ .34	$ .39	$ .33
One-way disc.....	29	40	48	.33	.28	.27	.58	.59	.47
Moldboard plow.....	21	30	33	.50	.36	.38	.81	.65	.61
Spring-tooth harrow***	57	82	88	.24	.13	.14	.37	.26	.23
Spike-tooth harrow....	122	165	177	.10	.07	.08	.18	.15	.15
Rod weeder***.....	72	114	121	.23	.20	.22	.39	.40	.36
Drill.....	68	92	117	.20	.14	.13	.39	.34	.26
Combine.....	34	47	48	1.22	1.12	.95	1.88	1.81	1.37
TOTAL.....				$3.03	$2.49	$2.34	$4.94	$4.59	$3.78

* See Appendix Tables 6a, b, and c for more detailed information.

** Operating cost includes labor, fuel, and repairs or those costs which tend to increase or decrease with the acreage operated.

*** The cost for these operations is for the average times over.

THE COST OF OPERATING ON DIFFERENT LAND SLOPES

In accordance with the soil conservation program, most of the land recommended for retirement to grass is steep land or land which costs more to operate than the general run of wheat land. In taking into account the probable saving of cash expenses from not growing wheat on this land, it is necessary to have at hand information which shows the variation in operating costs for different kinds of land.

An attempt was made during the field survey to select farms from different locations within the county. Some of these were located in hilly or strongly rolling land areas. These farms have been sorted according to topographic characteristics into three groups; namely, level, combination level and hilly, and hilly farms. This general classification is based on the judgment of the field men.

The data in Table 12 show the acres per day and the cost per acre for different size tractors operating on different kinds of land. The results show a consistent decline in the acres covered per day and an increase in the cost per acre as between level and hilly land. The only important exception is in the case of combining for the small tractor group. The information, based upon six level farms and six hilly farms, shows that the acres per day are highest and the cost per acre is lowest for this operation on hilly land as compared with level land. In almost every other instance, as expected, the cost increases with the slope or topographic irregularity of the land.

Table 12. Acres Per Day and Operating Cost by Size of Tractor and by Topographic Groups
(See Appendix Table 7 for detailed information)

Field operations	Acres per day			Operating cost per acre		
	Level	Comb.*	Hilly	Level	Comb.*	Hilly
		UNDER 40 H.P.				
Spring-tooth harrow.....	69	58	48	$ .18	$ .18	$ .40
Spike-tooth harrow.....	133	90	83	.07	.08	.13
Rod weeder.....	73	74	72	.20	.18	.29
Drill.....	69	78	62	.20	.18	.22
Combine.....	29	33	42	1.29	1.21	1.19
		40 to 50 H.P.				
One-way disc.....	45	40	37	.23	.32	.33
Rod weeder.....	183	101	96	.15	.20	.22
Drill.....	103	88	92	.11	.14	.16
Combine.....	50	46	36	.88	1.08	1.31
		50 H.P. & OVER				
One-way disc.....	70	45	35	.22	.32	.32
Moldboard plow.....	28	32	32	.43	.36	.39
Spring-tooth harrow.....	90	83	93	.14	.14	.14
Rod weeder.....	162	118	90	.18	.20	.27
Drill.....	138	120	91	.13	.11	.18
Combine.....	53	51	38	.93	.90	1.15

* Combination hilly and level or gently sloping land.

SUMMARY OF RESULTS AND CONCLUSIONS

The results of this study show the cost per acre of performing individual field operations on wheat farms in Sherman and Gilliam Counties. The cost per acre varies from farm to farm, and from county to county with changes in soil, topography, the size of farms and power machinery, and specific cultural practices. The topography is more rolling and steep in Sherman County, the farm and power machinery units are smaller in size, the land is more productive, and, under these corditions, there appears to be a tendency to disc and harrow more than in Gilliam County. For these reasons the per acre cost of field operations is considerably higher in Sherman than in Gilliam County. According to Tables 2 and 3 in the Appendix, the difference is about $1.25 per acre, or 33 per cent more, for a complete sequence of cultural operations.

In Sherman County trashy fallow costs 41 cents more per acre than black fallow if double discing prior to plowing is necessary only for trashy fallow. If fall discing on heavy stubble is necessary to condition the land

for plowing, regardless of the method of fallow, the cost of trashy and black fallow is essentially the same. In fact, the results for typical cultural sequences on heavy and light stubble land indicate that trashy fallow costs a few cents less per acre than black fallow.

The lower cost of trashy fallow is largely the result of using the one-way disc which has a greater working width than the moldboard plow and costs about 15 cents less per acre to operate. The cost of farming is further reduced in the case of trashy fallow from less harrowing. The saving from these two operations more than compensates for the increased cost of additional rod weedings which seem necessary for trashy fallow.

In Gilliam County, the cost of trashy fallow is at least as low as, if not lower than, black fallow. For the average sequence of cultural operations in 1940, the operating cost of trashy fallow was $0.66 per acre as compared with $0.74 for black fallow. The operating cost for selected cultural sequences was $0.64 for trashy fallow with two rod weedings and $0.71 for black fallow with one rod weeding. The cost of preparing trashy fallow with the modified moldboard plow (moldboards removed) was significantly higher than with the regular moldboard plow or one-way disc. These results were based on data from only five farms which does not permit drawing final conclusions on the cost of this method.

From the results of this study, it would seem safe to conclude that trashy fallow can be prepared without additional cost to the farm operator. For the areas under consideration, the cost of trashy fallow is at least as low as, and for certain soil conditions may be actually lower than, black fallow. It has been demonstrated that trashy fallow is a very effective means of retarding erosion on wheat land. If it can be accomplished without additional cost, as this study would seem to indicate, or without causing a decrease in wheat yields, as seems probable in low rainfall areas, farmers should not hesitate to make trashy fallow a more common practice in the dry-land wheat region of Eastern Oregon.

APPENDIX

Further Explanation of the Use of Cost Data

This appendix contains a detailed breakdown of cost information which has been compiled in this study. (See Tables 1 to 8.) This information is included primarily for the benefit of farm and land planners who wish to estimate returns from two land uses; namely, wheat and grass.

To avoid misuse of cost information, the data should not be used in gross or blanket fashion. It may be necessary to make certain adjustments in cost rates to conform with individual farm conditions. The kind and size of tractor or the soil and topography will have a bearing on the appropriate cost rate to use in a specific case analysis.

It should be explained further that only certain cash costs in wheat production can be saved by retiring wheat land to grass. Fuel and oil are the only items of cost which vary proportionately with the acreage of land in wheat. The expenses of hired labor can be saved only when labor is hired for a specific job, such as, plowing, weeding or combining. The expense of labor, hired on a seasonal or annual basis, would not be affected by retiring a portion of the land to grass.

In a similar manner, the expense of annual or periodic overhauling of farm machinery would not be materially affected unless a significantly high proportion of the wheat land is retired. On the other hand, all or a relatively large proportion of the current breakage bills may be saved by retiring steep, rough or stony land to grass. Overhead costs such as interest and taxes on land, interest and general depreciation on machinery, and the cost of management remain relatively constant in spite of the retirement of land to grass and, therefore, do not enter into the calculation.

In this study all labor used directly in connection with tillage operations is assumed to be hired labor and paid for at the rate being paid by farmers in 1940. The cost of machinery repairs includes both current and annual repairs, such as, the periodic overhauling of tractors and combines. The results of this study are regarded as reasonably reliable and, with minor adjustments, can be used to estimate net returns for other wheat farms in Oregon, operating under low rainfall conditions (less than 12 inches per year).

Other cash costs not included in this study are as follows:

(1) Seed: At 70 cents per bushel and 1 1/4 bushels per acre, this expense would amount to about 87 cents per acre.

(2) Sacks: The number required varies with the yield and the price varies from year to year. At 10 cents each, and from six to ten per acre, this cost would range from 60 cents to $1.00 per acre.

(3) Delivery and Warehouse Costs: This item of expense will vary with the yield and distance from point of delivery. It will also depend upon whether the farmer hauls his own wheat or hires it hauled at going rates. A reasonable allowance here is three cents per sack for hauling and six cents for warehouse charges, making a total of nine cents per sack. With normal yields ranging from six to ten sacks per acre, this cost would range from 54 cents to 90 cents per acre.

Table 1. Acres Covered Per Day and Cost Per Acre by Operations for 50 Wheat Farms in Sherman and Gilliam Counties, Columbia Basin, Oregon

Field operations	No. cases	Acres per day	Operating cost					Overhead cost					
			Labor	Fuel	Mach. repair	Trac. Repair	Total operating cost	Machine Depr.	Machine Int.	Tractor Depr.	Tractor Int.	Total overhead	Grand total
Double disc.....	9	74	$.06	$.06	$.05	$.03	$ .20	$.06	$.02	$.07	$.02	$.17	$ .37
One-way disc.....	25	37	.10	.10	.05	.06	.31	.06	.02	.14	.04	.26	.57
Moldboard plow.....	28	28	.13	.17	.05	.08	.43	.05	.02	.17	.05	.29	.72
Spring-tooth harrow	33	71	.06	.07	.01	.03	.17	.02	.01	.08	.02	.13	.30
Spike-tooth harrow.	15	146	.03	.03	.01	.02	.09	.02	.01	.04	.01	.08	.17
Rod weeder.....	54	97	.06	.07	.03	.04	.20	.03	.02	.08	.03	.16	.36
Drill.....	54	86	.05	.05	.03	.03	.16	.08	.03	.05	.02	.18	.34
Combine.....	51	41	.60	.20	.30	.05	1.15	.33	.12	.11	.03	.59	1.74

Table 2. The Per Acre Cost of Performing Field Operations in Sherman County, Columbia Basin

Field operations	No. cases	Acres per day	Operating cost					Overhead cost					
			Labor	Fuel	Mach. repair	Trac. repair	Total operating cost	Machine Depr.	Machine Int.	Tractor Depr.	Tractor Int.	Total overhead	Grand total
Double disc.....	8	71	$.06	$.06	$.05	$.03	$ .20	$.06	$.02	$.07	$.02	$.17	$ .37
One-way disc.....	11	33	.10	.12	.06	.05	.33	.07	.03	.14	.04	.28	.61
Moldboard plow.....	16	23	.14	.17	.05	.08	.44	.04	.02	.20	.06	.32	.76
Spring-tooth harrow.	25	71	.06	.07	.02	.03	.18	.03	.01	.08	.02	.14	.32
Spike-tooth harrow..	10	146	.03	.03	.01	.02	.09	.01	.01	.04	.01	.07	.16
Rod weeder.....	27	83	.07	.07	.04	.03	.21	.04	.02	.09	.02	.17	.38
Drill.....	27	76	.07	.06	.03	.02	.18	.09	.04	.06	.02	.21	.39
Combine.....	27	37	.66	.23	.35	.05	1.29	.41	.15	.12	.04	.72	2.01

Table 3. The Per Acre Cost of Performing Field Operations in Gilliam County, Columbia Basin

Field operations	No. cases	Acres per day	Operating cost					Overhead cost					
			Labor	Fuel	Mach. repair	Trac. repair	Total operating cost	Machine Depr.	Machine Int.	Tractor Depr.	Tractor Int.	Total overhead	Grand total
One-way disc.....	14	40	$.09	$.08	$.04	$.07	$.28	$.05	$.02	$.14	$.04	$.25	$ .53
Moldboard plow.....	12	30	.12	.17	.05	.08	.42	.04	.02	.14	.05	.25	.67
Spring-tooth harrow	8	79	.05	.04	.01	.04	.14	.02	.01	.06	.02	.11	.25
Spike-tooth harrow.	5	146	.02	.03	.01	.02	.08	.02	.02	.04	.02	.10	.18
Rod weeder.....	27	110	.06	.07	.03	.04	.20	.03	.01	.09	.03	.16	.36
Drill.....	27	99	.04	.04	.02	.03	.13	.07	.02	.05	.02	.16	.29
Combine.....	26	45	.50	.18	.25	.06	.99	.26	.09	.11	.04	.50	1.49

Table 4. Costs Per Acre for Average Sequences for Black and Trashy Fallow in Sherman County

Field operations	No. cases	No. times over	Operating cost: Labor	Fuel	Mach. repair	Trac. repair	Total operating cost	Overhead cost: Machine Depr.	Machine Int.	Tractor Depr.	Tractor Int.	Total overhead	Grand total
BLACK FALLOW													
Moldboard plow.....	16	1	$.14	$.17	$.05	$.08	$ .44	$.04	$.02	$.20	$.06	$.32	$ .76
Spring-tooth harrow	15	1.2	.06	.07	.02	.03	.18*	.02	.01	.08	.02	.13	.31
Spike-tooth harrow.	12	1	.02	.02	.01	.02	.07	.01	.01	.04	.01	.07	.14
Rod weeder.....	16	1.4	.06	.07	.04	.03	.20*	.04	.02	.08	.02	.16	.36
Drill.....	16	1	.07	.06	.03	.02	.18	.09	.03	.06	.02	.20	.38
TOTAL.....	-	-	$.35	$.39	$.15	$.18	$1.07	$.20	$.09	$.46	$.13	$.88	$1.95
TRASHY FALLOW													
Double disc.....	8	1	$.06	$.06	$.05	$.03	$ .20	$.06	$.02	$.07	$.02	$ .17	$ .37
One-way disc.....	11	1	.10	.11	.06	.05	.32	.07	.03	.14	.04	.28	.60
Spring-tooth harrow	10	1.5	.07	.08	.02	.04	.21*	.02	.01	.08	.02	.13	.34
Spike-tooth harrow.	5	1	.08	.04	.01	.02	.15	.01	.01	.04	.01	.07	.22
Rod weeder.....	11	1.9	.08	.08	.04	.04	.24**	.05	.02	.10	.03	.20	.44
Drill.....	11	1	.06	.05	.05	.02	.18	.10	.04	.06	.01	.21	.39
TOTAL.....	-	-	$.45	$.42	$.23	$.20	$1.30	$.31	$.13	$.49	$.13	$1.06	$2.36

* One spring-tooth harrowing cost $.15 per acre; one rod weeding for black fallow cost $.14 per acre.
** One rod weeding for trashy fallow cost $.13 per acre.

Table 5. Costs Per Acre for Average Sequences for Black and Trashy Fallow in Gilliam County

Field operations	No. cases	No. times over	Operating cost: Labor	Fuel	Mach. repair	Trac. repair	Total operating cost	Overhead cost: Machine Depr.	Machine Int.	Tractor Depr.	Tractor Int.	Total overhead	Grand total
BLACK FALLOW													
Plow	7	1	$.10	$.12	$.04	$.09	$.35	$.03	$.02	$.14	$.04	$.23	$ .58
Spring-tooth harrow	5	1	.04	.04	.02	.03	.13	.02	.01	.05	.02	.10	.23
Rod weeder	7	1.3	.04	.04	.03	.03	.14*	.02	.01	.05	.02	.10	.24
Drill	7	1	.04	.03	.02	.03	.12	.05	.02	.04	.01	.12	.24
TOTAL	-	-	$.22	$.23	$.11	$.18	$.74	$.12	$.06	$.28	$.09	$.55	$1.29
TRASHY FALLOW													
One-way disc	14	1	$.09	$.09	$.04	$.07	$.29	$.05	$.02	$.14	$.04	$.25	$ .54
Rod weeder	20	2.2	.07	.08	.03	.05	.23*	.03	.01	.10	.03	.17	.40
Drill	20	1	.04	.04	.03	.03	.14	.07	.03	.06	.02	.18	.32
TOTAL	-	-	$.20	$.21	$.10	$.15	$.66	$.15	$.06	$.30	$.09	$.60	$1.26

* One rod weeding cost $.105 per acre.

Table 6a. Acres Per Day and Cost Per Acre in Relation to Size of Tractor, Sherman and Gilliam Counties, 1940

Under 40 H.P.

Field operations	No. cases	Acres per day	Operating cost					Overhead cost					
			Labor	Fuel	Mach. repair	Trac. repair	Total operating cost	Machine Depr.	Machine Int.	Tractor Depr.	Tractor Int.	Total overhead	Grand total
Double disc.....	3	60	$.06	$.08	$.05	$.02	$ .21	$.05	$.02	$.05	$.01	$.13	$ .34
One-way disc.....	11	29	.11	.10	.05	.07	.33	.05	.02	.14	.04	.25	.58
Moldboard plow.....	13	21	.16	.21	.05	.08	.50	.05	.02	.19	.05	.31	.81
Spring-tooth harrow	16	57	.08	.09	.02	.05	.24	.02	.01	.08	.02	.13	.37
Spike-tooth harrow.	8	122	.04	.03	.01	.02	.10	.01	.01	.05	.01	.08	.18
Rod weeder.....	24	72	.08	.08	.03	.04	.23	.04	.02	.08	.02	.16	.39
Drill.....	24	68	.07	.06	.04	.03	.20	.08	.03	.06	.02	.19	.39
Combine.....	21	34	.61	.23	.33	.05	1.22	.38	.14	.11	.03	.66	1.88

Table 6b. Acres Per Day and Cost Per Acre in Relation to Size of Tractor, Sherman and Gilliam Counties, 1940

40 to 50 H.P.

Field operations	No. cases	Acres per day	Operating cost					Overhead cost					
			Labor	Fuel	Mach. repair	Trac. repair	Total operating cost	Machine Depr.	Machine Int.	Tractor Depr.	Tractor Int.	Total overhead	Grand total
Double disc.....	4	79	$.05	$.05	$.05	$.04	$ .19	$.07	$.02	$.08	$.03	$.20	$ .39
One-way disc.....	8	40	.09	.09	.05	.05	.28	.07	.03	.16	.05	.31	.59
Moldboard plow.....	9	30	.11	.11	.06	.08	.36	.04	.02	.17	.06	.29	.65
Spring-tooth harrow.	11	82	.04	.04	.02	.03	.13	.02	.01	.08	.02	.13	.26
Spike-tooth harrow..	6	165	.02	.02	.01	.02	.07	.02	.01	.04	.01	.08	.15
Rod weeder.....	17	114	.06	.06	.04	.04	.20	.05	.02	.10	.03	.20	.40
Drill.....	17	92	.05	.04	.03	.02	.14	.09	.03	.06	.02	.20	.34
Combine.....	17	47	.55	.19	.33	.05	1.12	.38	.14	.13	.04	.69	1.81

Table 6c. Acres Per Day and Cost Per Acre in Relation to Size of Tractor, Sherman and Gilliam Counties, 1940

50 H.P. & Over

Field operations	No. cases	Acres per day	Operating cost					Overhead cost					
			Labor	Fuel	Mach. repair	Trac. repair	Total operating cost	Machine Depr.	Machine Int.	Tractor Depr.	Tractor Int.	Total overhead	Grand total
Double disc.....	2	87	$.04	$.05	$.04	$.04	$.17	$.04	$.02	$.08	$.02	$.16	$ .33
One-way disc.....	5	48	.07	.12	.05	.03	.27	.04	.02	.11	.03	.20	.47
Moldboard plow.....	7	33	.10	.14	.05	.09	.38	.03	.01	.15	.04	.23	.61
Spring-tooth harrow.	6	88	.04	.06	.01	.03	.14	.02	.01	.05	.01	.09	.23
Spike-tooth harrow..	3	177	.02	.03	.01	.02	.08	.02	.02	.02	.01	.07	.15
Rod weeder.....	13	121	.06	.08	.03	.05	.22	.03	.01	.07	.03	.14	.36
Drill.....	13	117	.04	.04	.02	.03	.13	.06	.02	.04	.01	.13	.26
Combine.....	13	48	.49	.19	.21	.06	.95	.22	.07	.10	.03	.42	1.37

Table 7. Acres Per Day and Operating Cost Per Acre by Size of Tractor and Topographical Groups

	50 H.P. & over			40 to 50 H.P.			Under 40 H.P.		
	Level	Comb.*	Hilly	Level	Comb.*	Hilly	Level	Comb.*	Hilly
Double disc.....No. cases	1	-	1	-	1	3	-	2	1
Acres per day.....	100	-	75	-	60	85	-	75	30
Total operating cost.....	.17	-	.17	-	.18	.19	-	.18	.28
One-way disc.....No. cases	1	3	1	3	3	3	-	6	5
Acres per day.....	70	45	35	45	40	37	-	28	31
Total operating cost.....	.22	.32	.32	.23	.32	.33	-	.32	.34
Moldboard plow.....No. cases	1	4	2	-	4	3	4	-	1
Acres per day.....	28	32	32	-	33	25	20	-	28
Total operating cost.....	.43	.36	.39	-	.31	.40	.49	-	.43
Spring-tooth harrow.....No. cases	1	3	3	-	6	5	5	6	4
Acres per day.....	90	83	93	-	86	78	69	58	48
Total operating cost.....	.14	.14	.14	-	.12	.13	.18	.18	.40
Spike-tooth harrow.....No. cases	2	1	-	-	2	4	3	2	3
Acres per day.....	165	200	-	-	200	148	133	90	83
Total operating cost.....	.08	.05	-	-	.06	.08	.07	.08	.13
Rod weeder.....No. cases	3	7	3	3	8	6	6	10	8
Acres per day.....	162	118	90	183	101	96	73	74	72
Total operating cost.....	.18	.20	.27	.15	.20	.22	.20	.18	.29
Drill.....No. cases	3	7	3	3	8	6	6	10	8
Acres per day.....	138	120	91	103	88	92	69	78	62
Total operating cost.....	.13	.11	.18	.11	.14	.16	.20	.18	.22
Combine.....No. cases	3	7	3	3	8	6	6	10	6
Acres per day.....	53	51	38	50	46	36	29	33	42
Total operating cost.....	.93	.90	1.15	.87	1.08	1.31	1.29	1.21	1.19

* Combination--hilly and level land.

Table 8. The Average Value of Farm Machinery Included in this Study

Machine	Average value per machine			
	Sherman County		Gilliam County	
	Number	Value	Number	Value
Double disc	8	$ 234	1	$ 632
One-way disc	11	264	14	292
Moldboard plow	16	228	12	279
Spring-tooth harrow	25	90	8	108
Spike-tooth harrow	17	60	4	65
Rod weeder	27	175	27	186
Drill	27	353	27	375
Combine	25	1,566	26	1,567
Tractor	27	1,750	27	2,303
Total value of all machinery	-	$112,350	-	$127,262
Average value of machinery per farm	-	$ 4,321	-	$ 5,303