

DEPRECIATION ON DIFFERENT CLASSES OF FARM
MACHINERY ON DIFFERENT TYPES OF
FARMS IN OREGON

by

ARTHUR MASON GOFF

A THESIS

submitted to the

OREGON STATE AGRICULTURAL COLLEGE

in partial fulfillment of
the requirements for the
degree of

MASTER OF SCIENCE

June 1936

APPROVED:

Redacted for privacy

Professor of Farm Management

In Charge of Major

Redacted for privacy

Head of Department of Farm Management

Redacted for privacy

Chairman of School Graduate Committee

Redacted for privacy

Chairman of College Graduate Council.

482 Bdy.

Oct. 5, 50

g. Author

23 Oct 36

ACKNOWLEDGMENTS

The writer wishes to express his sincere appreciation to Professor H. D. Scudder whose suggestion, interest, and cooperation have made this study possible. To Robert Wilcox, senior in Agricultural Economics, the writer is indebted for many hours of painstaking assistance in machine calculation work.

TABLE OF CONTENTS

	Page
I. Introduction	1
A. Importance of depreciation as an item of farm operation cost	1
B. The extent to which depreciation is a non-cash or a cash expense	1
C. Methods of reducing depreciation and the extent to which they are used	1
D. No previous research published on the depreciation of farm machinery in Oregon	2
E. Limited published research in other states	3
F. Nothing published in any state on variations in depreciation of farm machinery on different types of farms	3
II. Objectives of this study	4
III. Sources of Oregon data	4
IV. Methods of study	6
A. Transcription of data	6
B. Computation work required	6
V. Analysis of findings	6
A. Depreciation on individual machines--average on all farms in Oregon	7
B. Depreciation by kinds of machines--all farms in Oregon	12
C. Depreciation by classes of machines--all farms in Oregon	14
D. Depreciation on individual machines by types of farms in Oregon	16
E. Depreciation by classes of machines by types of farms in Oregon	24
VI. Conclusions	27

- VII. Review of published research in other states
- VIII. Bibliography
- IX. Appendix

LIST OF TABLES

I.	Extent of cost and efficiency studies of Oregon farms	Page 5
II.	Depreciation on individual machines--average on all farms in Oregon	8
III.	Depreciation by kinds of machines---all farms in Oregon	13
IV.	Depreciation by classes of machines---all farms in Oregon	15
V.	Depreciation on individual machines by types of farms in Oregon	17
VI.	Depreciation by classes of machines by types of farms in Oregon	25
VII.	Data from other research	
A.	Summary showing cost new and average life of 18 kinds of farm implements in western New York	31
B.	Life of farm machines, as determined by Hardy and Wallace surveys at Iowa State College	33
C.	Annual depreciation in value of farm machinery expressed in percentages as determined by a Minnesota survey	35
D.	Estimated depreciation of farm machines in per cent of first cost according to a Missouri survey	37
E.	Percentage distribution of total annual expense of farm implements based on original cost as determined by a Kentucky survey.	39

DEPRECIATION ON DIFFERENT CLASSES OF FARM
MACHINERY ON DIFFERENT TYPES OF
FARMS IN OREGON

I. INTRODUCTION

A. IMPORTANCE OF DEPRECIATION AS AN ITEM OF FARM OPERATION COST

Depreciation is the most important item of expense in farm machinery with which the farmer has to contend. Research studies in farm equipment costs have shown that depreciation makes up from 45% to 47% of the total cost for farm machinery (17) (4).

B. THE EXTENT TO WHICH DEPRECIATION IS A NON-CASH OR A CASH EXPENSE

Depreciation representing the annual allowance for normal wear and tear on farm machinery is usually considered as a non-cash cost, although eventually the machinery must be replaced through more or less cash expenditure. A good way to provide necessary funds to replace farm machinery is to set aside an annual depreciation charge which if allowed to accumulate will be sufficient to replace the machinery at the end of its life.

C. METHODS OF REDUCING DEPRECIATION AND THE EXTENT TO WHICH THEY ARE USED

Very few farm machines actually wear out. Most of them are discarded because of lack of care and repair and from obsolescence. Depreciation of agricultural machines can be effectively reduced by protecting from the weather by housing; protecting of parts subject to

decay or corrosion by paint or a protecting coating of oil or grease; by repairing promptly; by keeping in adjustment; sharpening and replacement of parts; by proper lubrication; and by frequent tightening of bolts.

Systematic repairing has perhaps more influence on the life of farm machinery than housing. A well-equipped farm shop is an especially important aid to the systematic repairing of farm machines. Mowry (17) recommends that the cost of housing should not exceed 15% of the total cost of machinery. A shelter for agricultural machinery should be a simple inexpensive building that will protect the machines from moisture, sun, and dust. Its chief requirement is a good foundation. A good machine shed plan may be secured from the Department of Farm Management, Oregon State College.

Obsolescence cannot be controlled by the individual farmer because in the progress and development of agricultural machinery the development of a new machine may make it quite unprofitable to continue to use an old machine, although the older machine may be in good condition. The economy of labor and power, better quality of work, or improvement in rate of work, may easily justify replacement.

D. NO PREVIOUS RESEARCH PUBLISHED ON THE DEPRECIATION OF FARM MACHINERY IN OREGON

There has been nothing published on the depreciation of farm machinery in Oregon except that in the cost and efficiency studies

of the different farm enterprises in Oregon published by the Oregon Agricultural Experiment Station as station bulletins in which depreciation has been taken into account as an item in cost of production per acre, per animal unit, or per crop unit.

Professor H. D. Scudder (21) in his notes on "Farm Machinery Equipment" in his course in "Principles of Farm Management" at Oregon State College and also E. M. D. Bracker (2) in Oregon Station Bulletin 133 "Points on the Selection, Adjustment, and Care of Farm Machines" use depreciation percentages on farm machinery reported in Minnesota Bulletin 117 on studies in Minnesota from 1902 to 1907.

E. LIMITED PUBLISHED RESEARCH IN OTHER STATES

A very limited number of investigations have been made in other states to determine the life and depreciation on farm machinery. These investigations are reviewed herein under "Review of Published Research in Other States" as much of the literature on this subject is not readily available.

F. NOTHING PUBLISHED IN ANY STATE ON VARIATIONS IN DEPRECIATION OF FARM MACHINERY ON DIFFERENT TYPES OF FARMS

The writer has not found anything published in any state on variations in depreciation of farm machinery on different types of farms except that the Minnesota Agricultural Experiment Station cooperating with the Bureau of Statistics, U. S. Department of Agriculture conducted a very thorough survey of a limited number of farms in three typical agricultural regions in Minnesota from 1902

to 1907. Parker and Cooper (19) in their bulletin telling of this survey do give the variations in depreciation of farm machinery in the three different regions but they do not give them on different types of farms except for two larger farms in one of the regions.

II. OBJECTIVES OF THIS STUDY

The objectives of this study are to determine by the straight line method the average rates of depreciation:

1. On individual machines, on all farms in Oregon
2. On different kinds of machines, on all farms in Oregon
3. On different classes of machines, on all farms in Oregon
4. On individual machines by types of farms in Oregon
5. On different classes of machines by types of farms in Oregon.

III. SOURCES OF OREGON DATA

The sources of the data used in this study are the original records from the cost and efficiency studies of Oregon farms conducted by the Department of Farm Management, Oregon Agricultural Experiment Station, at Corvallis.

These studies were made by the field survey method. A large number of representative farms were selected with the assistance of the county agents and others familiar with local conditions. The cost data were obtained from these farmers in personal visits to the farms by representatives of the Oregon Agricultural Experiment Station.

The figures obtained were based largely on careful, detailed estimates made by the farmers, but books and records were used whenever available.

The following table indicates the extent of these surveys:

TABLE I

EXTENT OF COST AND EFFICIENCY STUDIES OF OREGON FARMS

Type of Farm	Number of Records	Number of Farms	Years Conducted	Numbers of Oregon Experiment Station bulletins published, based on these surveys
General (Forage)	1505	549	1925-1926 1927	241-248-250-251
Dairy	1733	574	1930-1931 1932-1933	312-318-324
Poultry	441	229	1926-1927 1928	237
Prunes	375	155	1923-1924 1925	292
Pears	162	58	1924-1925 1927	267
All Farms	4216	1565		

IV. METHODS OF STUDY

A. TRANSCRIPTION OF DATA

The data were transcribed directly from the original field records of the Oregon Agricultural Experiment Station cost and efficiency surveys of Oregon farms to classified computation sheets like the sample in the Appendix. About 560 sheets or some 13,440 seven figure lines of original data were transcribed by the writer in this way.

B. COMPUTATION WORK REQUIRED

A large amount of computation work was required to obtain the average rate of depreciation and other data on each individual machine, kind of machine, and class of machine on all farms and on different types of farms in Oregon.

V. ANALYSIS OF FINDINGS

The following five tables give the results obtained. They give the kinds and classes of farm machines, number of machines, original cost, estimated life, annual depreciation rate in per cent of original cost, amount of yearly depreciation in dollars, age in years at the time of the survey, and the value of the machine in dollars at the age given.

A. DEPRECIATION ON INDIVIDUAL MACHINES--AVERAGE ON ALL FARMS
IN OREGON

Table II covers 82 individual machines and pieces of equipment used on Oregon farms. It is made up of the totals from the 560 sheets of data taken from the original records.

The table gives the total number of each individual machine covered by this study. The number varies from just a few as in the case of orchard plows and hay tedders to several hundreds of the more common machines like mowers, dump rakes, walking plows, and wagons.

It shows that the average depreciation rate on farm machinery in Oregon on all farms varies from 4.6% for fanning mills to 21.3% for hay racks.

Average depreciation rates on some of the more important machines are: walking plows, 8.1%; spike tooth harrows, 7.8%; grain drills, 7.9%; wagons, 7.3%; mowers, 9.6%; dump rakes, 7.8%; hay stackers, 8.6% and cream separators, 9.8%.

TABLE II.

FARM MACHINERY DEPRECIATION STUDY

8

DEPRECIATION OF INDIVIDUAL MACHINES--AVERAGE ON ALL FARMS IN OREGON

Kind or Class of Machine	No. of machines	Type of Farm	Orig. Cost \$	Est. Life Yrs.	Depr. Rate %	R a n k	Yrly. Depr. \$	Age Yrs.	Val. at Age \$
TILLAGE MACHINERY									
Walking plows	393	All	10.51	12.3	8.1		1.24	4.4	9.38
Two way plows	27		112.32	14.7	6.8		7.22	5.4	63.66
Sulky plows	65		72.45	13.5	7.4		4.57	7.4	30.36
Orchard plows	5		65.20	15.0	6.7		5.24	5.6	37.08
Gang plows	102		131.70	11.7	8.5		12.91	4.5	80.30
Tractor plows	128		156.46	12.0	8.3		13.64	4.2	91.38
Miscellaneous plows	79		42.67	10.6	9.43		1.61	3.7	15.24
Spike tooth harrows	327		22.58	12.8	7.8		2.56	7.6	12.09
Spring tooth harrows	325		33.80	11.5	8.7		3.34	4.7	20.55
Drag harrows	48		18.36	12.8	7.8		1.66	5.6	9.42
"A" harrows	14		21.28	5.8	17.2		4.32	1.6	14.66
Miscellaneous harrows	105		21.57	9.1	11.0		1.48	2.9	12.45
Tandem disks	5		132.75	15.4	6.5		8.51	4.0	94.36
Double disks	66		116.12	10.0	10.0		12.92	3.7	72.88
Miscellaneous disks	288		68.09	10.6	9.4		4.60	4.8	37.24
Go-devil cultivators	15		15.20	9.0	11.1		1.47	4.4	7.82
Spring tooth cultivators	34		29.22	9.7	10.3		3.37	3.0	20.68
Single row cultivators	19		8.53	16.4	6.1		0.67	8.4	3.75
Orchard cultivators	10		105.50	8.2	12.2		12.86	1.6	87.82
Weeders	67		21.86	9.2	10.9		2.70	5.1	10.37
Miscellaneous cultivators	164		34.66	10.8	9.3		1.83	6.2	16.97
Rollers	196		63.45	15.1	6.6		3.79	5.7	36.19
Corrugators	45		40.89	12.2	8.2		2.49	4.7	22.44

TABLE II. (cont.) FARM MACHINERY DEPRECIATION STUDY

9

DEPRECIATION OF INDIVIDUAL MACHINES--AVERAGE ON ALL FARMS IN OREGON

Kind or Class of Machine	No. of machines	Type of Farm	Orig. Cost \$	Est. Life Yrs.	Depr. Rate %	R a n k	Yrly. Depr. \$	Age Yrs.	Val. at Age \$
TILLAGE MACHINERY (cont.)									
Floats	42		16.06	6.0	16.7		2.08	3.4	8.06
SEEDING MACHINERY									
Grain drills	247		89.40	12.6	7.9		6.81	5.5	51.80
Corn planters	54		62.08	14.0	7.1		3.08	3.0	35.50
Potato planters	10		41.25	9.9	10.1		4.22	3.5	32.65
Seeders	7		16.86	19.3	5.2		1.13	12.7	6.83
HARVESTING MACHINERY									
Wagons & racks	519		73.69	12.1	8.3		4.96	8.6	46.23
Wagons	462		66.57	13.7	7.3		4.67	5.4	31.06
Wagon trucks	17		48.94	21.6	4.6		2.37	9.7	25.23
Hay racks	42		18.12	4.7	21.3		2.45	--	10.95
Mowers	767		56.50	10.4	9.6		5.70	6.0	31.82
Dump rakes	591		32.46	12.8	7.8		3.08	6.6	20.67
Buck rakes	84		85.08	8.1	12.3		7.93	3.4	47.88
Side delivery rakes	14		84.14	8.4	11.9		7.07	5.4	45.86
Tedders	8		65.00	12.1	8.3		4.43	3.1	48.12
Slings	110		9.19	7.8	12.8		1.32	1.7	7.93
Hay stackers	209		61.40	11.6	8.6		7.14	3.0	69.32
Grain binders	123		160.10	9.8	10.2		13.35	6.3	72.38
Corn binders	24		96.18	10.2	9.8		8.68	4.8	52.70
Potato diggers	14		87.25	10.2	9.8		7.82	3.6	60.29
Slips	123		12.40	5.2	19.2		3.20	3.0	11.51

TABLE II. (cont.) FARM MACHINERY DEPRECIATION STUDY

11

DEPRECIATION OF INDIVIDUAL MACHINES--AVERAGE ON ALL FARMS IN OREGON

Kind or Class of Machine	No. of machines	Type of Farm	Orig. Cost \$	Est. Life Yrs.	Depr. Rate %	R a n k	Yrly. Depr. \$	Age Yrs.	Val. at Age \$
DAIRY & ORCHARD & POULTRY SPECIAL EQUIPMENT									
Cream separators	359		82.72	10.2	9.8		7.82	4.5	51.88
Cream separators (electric power)	62		147.73	12.7	7.9		10.61	4.6	100.96
Cream separators (gas engine power)	22		161.17	12.5	8.0		13.02	3.6	113.54
Milking machines	183		414.30	13.6	7.4		31.83	3.0	314.47
Sterilizers	21		45.88	10.5	9.5		4.77	0.6	50.61
Milk coolers	30		37.47	12.3	8.1		3.28	2.8	34.53
Sprayers	24		400.37	11.4	8.8		13.82	6.0	112.58
Oil tanks	16		93.75	9.0	11.1		11.09	2.4	70.68
Tank wagons	14		68.00	11.0	9.1		6.72	2.7	54.29
Brush burners	12		28.08	7.8	12.8		4.30	1.2	22.73
Orchard boxes	12,425		0.18	6.1	16.3		0.03	2.1	0.118
Ladders	160		6.13	4.1	24.1		1.81	1.3	3.64
Smudge pots	58,725		0.16	7.4	13.4		10.03	3.3	0.09
Orchard heaters	775		1.23	10.0	10.0		0.12	1.5	1.01
Lug boxes	47,624		0.22	8.5	11.8		0.03	4.7	0.09
Brooders	401		28.50	10.9	9.2		2.23	2.3	22.59
Incubators	239		94.29	11.5	8.7		4.78	3.1	45.02
MISCELLANEOUS EQUIPMENT									
Harness sets	697		37.62	8.6	11.6		4.14	5.6	19.28
Ditchers	25		51.54	14.9	6.7		3.26	4.3	35.82
Fresnos	14		40.00	14.6	6.8		1.95	10.0	24.93

B. DEPRECIATION BY KINDS OF MACHINES---ALL FARMS IN OREGON

In Table III the data are given by kinds of machines. For example all the different types of plows are grouped as "plows" with an annual depreciation rate of 7.8%. Power operated machines have the longest life, 14.3 years, and the lowest depreciation rate, 7%. Orchard equipment has the shortest life, 9.8 years, and the highest depreciation rate, 10.2%. It is somewhat interesting to note that 640 pieces of poultry equipment and 283 clod mashers have exactly the same 9% rate of depreciation and that 677 pieces of dairy equipment and 192 fertilizing machines have likewise exactly the same 8.3% depreciation rate.

The records of 8423 individual machines are given in condensed form in this table.

TABLE III. FARM MACHINERY DEPRECIATION STUDY

13

DEPRECIATION BY KINDS OF MACHINES--ALL FARMS IN OREGON

[illegible]

C. DEPRECIATION BY CLASSES OF MACHINES---ALL FARMERS IN OREGON

Table IV gives in very condensed form the data by classes of machines on all farms in Oregon. Power operated machinery has the lowest depreciation rate, 7%; next comes seeding machinery, 7.3%; then certain miscellaneous equipment, 7.9%; fertilizing machinery, 8.3%; tillage machinery, 8.7%; harvesting machinery, 9.3%; and finally special dairy, orchard, and poultry equipment, 10%, the highest depreciation rate.

The attention is called especially to the tillage and harvesting machinery records in this table. The tillage machinery records are derived from the records of 2569 machines and the harvesting machinery records are derived from the records of 2788 machines.

This table shows that the average annual rate of depreciation of all farm machines and equipment on all different types of farms in Oregon included in this study is 8.26% and the average life of all farm machines on all farms in Oregon included in this study is 12.1 years.

D. DEPRECIATION ON INDIVIDUAL MACHINES BY TYPES OF FARMS IN OREGON

Table V gives a list of individual farm machines segregated as to the type of farm on which they are used. It gives at a glance a comparison of the depreciation rates on the different individual machines as affected by use on different types of farms.

Machinery on prune farms has by far the lowest depreciation rate, next comes general type farms, then poultry farms, and then pear farms with the highest depreciation rate.

This table shows that on prune farms 22 of the machines had the lowest depreciation rate in comparison with machines on the other types of farms. On general type farms only 5 machines had the lowest depreciation rate but 14 machines had the second lowest depreciation rate. On poultry type farms 4 machines had the lowest depreciation rate and 11 machines had the second highest depreciation rate. On pear farms only one machine had the lowest depreciation rate, only 3 had the second lowest, and 13 the fourth lowest.

TABLE V.

FARM MACHINERY DEPRECIATION STUDY

17

DEPRECIATION OF INDIVIDUAL MACHINES BY TYPES OF FARMS IN OREGON

Kind or Class of Machine	No. of machines	Type of Farm	Orig. Cost \$	Est. Life Yrs.	Depr. Rate %	R a n k	Yrly. Depr. \$	Age Yrs.	Val. at Age \$
TILLAGE MACHINERY									
Walking plows	165	Prune	13.75	15.1	6.6	1	1.27	8.8	6.69
	17	Poult.	-----	13.7	7.4	2	0.88	-----	11.53
	129	Gen.	19.40	13.1	7.6	3	1.31	7.1	12.30
	82	Pear	8.90	7.2	13.9	4	1.51	1.7	7.01
Two way plows	2	Prune	109.50	17.5	5.7	1	6.68	8.0	59.02
	25	Gen.	115.13	11.9	8.4	2	7.75	2.9	68.30
Sulky plows	10	Poult.	76.50	15.0	6.7	1	2.09	10.0	23.87
	5	Prune	84.00	13.4	7.5	2	7.26	8.4	29.83
	50	Gen.	56.85	12.2	8.2	3	4.36	3.9	37.38
Orchard plows	5	Prune	65.20	15.0	6.7	1	5.24	5.6	37.08
Gang plows	14	Prune	137.50	13.4	7.5	1	12.28	4.9	87.07
	76	Gen.	129.69	13.2	7.6	2	9.11	5.2	78.61
	12	Pear	127.92	8.5	11.8	3	17.35	3.4	75.22
Tractor plows	44	Pear	146.18	9.0	11.1	1	15.54	2.3	94.40
	5	Gen.	188.75	10.0	10.0	2	18.92	5.2	86.80
	56	Prune	166.82	12.9	7.8	3	13.80	4.4	104.92
	23	Poult.	124.07	16.3	6.1	4	6.30	4.8	79.38
Miscellaneous plows	79	Poult.	42.67	10.6	9.43	1	1.61	3.7	15.24
Spike tooth harrows	51	Prune	20.26	21.0	4.8	1	1.53	8.7	9.08
	223	Gen.	27.69	12.9	7.6	2	1.98	9.1	15.43
	33	Poult.	25.25	10.6	9.4	3	1.45	10.8	13.19
	20	Pear	17.10	6.5	15.4	4	5.27	2.0	10.67

TABLE V. (cont.) FARM MACHINERY DEPRECIATION STUDY

18

DEPRECIATION OF INDIVIDUAL MACHINES BY TYPES OF FARMS IN OREGON

Kind or Class of Machine	No. of machines	Type of Farm	Orig. Cost \$	Est. Life Yrs.	Depr. Rate %	Rank	Yrly. Depr. \$	Age Yrs.	Val. at Age \$
Spring tooth harrows	67	Prune	31.25	16.0	6.3	1	2.37	7.5	16.18
	218	Gen.	43.25	11.6	8.6	2	3.41	5.8	24.59
	20	Poult.	24.00	10.45	9.6	3	2.11	2.3	19.56
	20	Pear	36.70	8.1	12.3	4	5.49	3.2	21.88
Drag harrows	44	Prune	21.72	13.1	7.6	1	2.10	7.3	10.33
	4	Poult.	15.00	12.5	8.0	2	1.21	4.0	8.50
"A" harrows	14	Pear	21.28	5.8	17.2	1	4.38	1.6	14.66
Miscellaneous harrows	105	Poult.	21.57	9.1	11.0	1	1.48	2.9	12.45
Tandem disks	5	Poult.	132.75	15.4	6.5	1	8.51	4.0	94.36
Double disks	12	Prune	121.67	12.7	7.9	1	9.99	5.9	63.22
	7	Pear	113.00	7.3	13.7	2	16.35	2.1	72.62
Tractor disks	12	Poult.	102.83	14.1	7.1	1	7.02	4.8	69.49
	38	Prune	142.87	10.4	9.6	2	15.53	4.3	78.95
	16	Pear	102.67	6.9	14.5	3	16.21	1.9	70.21
Miscellaneous disks	167	Gen.	82.99	11.8	8.5	1	6.14	5.3	48.39
	121	Poult.	53.18	9.4	10.6	2	3.05	4.3	26.10
Go-devil cultivators	5	Prune	14.00	9.2	10.9	1	1.62	5.0	7.55
	10	Gen.	16.40	8.7	11.4	2	1.32	3.8	8.10
Spring tooth cultivators	22	Poult.	26.60	11.7	8.5	1	2.00	3.2	20.53
	12	Pear	31.85	7.7	13.0	2	4.74	2.8	20.84
Single row cultivators	19	Prune	8.53	16.4	6.1	1	0.67	8.4	3.75
Orchard cultivators	10	Pear	105.50	8.2	12.2	1	12.86	1.6	87.82
Miscellaneous cultivators	155	Gen.	41.10	11.9	8.4	1	2.67	5.6	23.45
	173	Poult.	24.22	9.7	10.3	2	0.99	6.9	10.49

TABLE V. (cont.) FARM MACHINERY DEPRECIATION STUDY

19

DEPRECIATION OF INDIVIDUAL MACHINES BY TYPES OF FARMS IN OREGON

Kind or Class of Machine	No. of machines	Type of Farm	Orig. Cost \$	Est. Life Yrs.	Depr. Rate %	Rank	Yrly. Depr. \$	Age Yrs.	Val. at Age \$
Rollers	39	Poult.	72.50	17.6	5.7	1	2.47	5.4	40.17
	66	Prune	68.96	16.4	6.1	2	4.95	6.6	37.60
	71	Gen.	76.22	15.6	6.4	3	4.04	8.3	41.73
	20	Pear	35.60	10.8	9.2	4	3.69	2.5	25.26
Corrugators	45	Gen.	40.89	12.2	8.2	1	2.49	4.7	22.44
Floats	18	Prune	8.36	8.8	11.4	1	1.39	5.4	3.58
	10	Gen.	-----	6.5	15.3	2	1.90	-----	10.50
	4	Pear	23.75	4.5	22.2	3	5.58	1.5	13.17
	10	Poult.	-----	4.2	23.8	4	1.26	-----	5.00
Weeders	46	Prune	19.86	12.7	7.9	1	2.01	7.4	7.81
	10	Poult.	27.00	9.3	10.8	2	1.67	5.0	14.20
	11	Pear	18.73	5.5	18.5	3	4.41	3.0	9.09
SEEDING MACHINERY									
Grain drills	42	Prune	76.49	16.1	6.2	1	5.79	9.2	32.71
	142	Gen.	107.97	11.8	8.5	2	6.59	3.4	55.52
	51	Poult.	72.54	11.0	9.1	3	4.63	6.4	42.03
	12	Pear	100.58	11.5	8.7	4	10.24	2.9	76.93
Corn planters	4	Poult.	67.50	14.8	6.8	1	2.19	1.0	36.81
	50	Gen.	56.65	13.1	7.6	2	3.97	4.9	34.18
Potato planters	10	Gen.	41.25	9.9	10.1	1	4.22	3.5	32.65
Seeders	7	Prune	16.86	19.3	5.2	1	1.13	12.7	6.83
HARVESTING MACHINERY									
Wagons & racks	519	Gen.	73.69	12.1	8.3	1	4.96	8.6	46.23

TABLE V. (cont.) FARM MACHINERY DEPRECIATION STUDY

20

DEPRECIATION OF INDIVIDUAL MACHINES BY TYPES OF FARMS IN OREGON

Kind or Class of Machine	No. of machines	Type of Farm	Orig. Cost \$	Est. Life Yrs.	Depr. Rate %	R a n k	Yrly. Depr. \$	Age Yrs.	Val. at Age \$
Wagons	201	Prune	68.45	19.7	5.1	1	3.93	10.4	22.33
	156	Poult.	78.10	12.8	7.8	2	3.10	3.9	34.69
	105	Pear	45.99	8.6	11.6	3	6.98	1.8	36.15
Wagon trucks	17	Prune	48.94	21.6	4.6	1	2.37	9.7	25.23
Hay racks	42	Gen.	18.12	4.7	21.3	1	2.45	----	10.95
Mowers	90	Prune	55.24	15.7	6.4	1	4.32	9.7	22.59
	535	Gen.	80.32	10.2	9.8	2	7.27	7.1	44.21
	98	Poult.	48.80	8.7	11.5	3	4.19	4.8	30.28
	44	Pear	41.66	6.8	14.7	4	7.00	2.3	30.21
Dump rakes	77	Prune	30.92	19.7	5.1	1	1.87	10.5	14.44
	395	Gen.	43.25	13.0	7.7	2	3.41	8.1	25.20
	86	Poult.	26.10	11.2	8.9	3	2.36	5.8	20.65
	33	Pear	29.58	7.5	13.3	4	4.67	1.8	22.42
Side delivery rakes	14	Gen.	84.14	8.4	11.9	1	7.07	5.4	45.86
Buck rakes	84	Gen.	85.08	8.1	12.3	1	7.93	3.4	47.88
Tedders	8	Gen.	65.00	12.1	8.3	1	4.43	3.1	48.12
Slips	123	Gen.	12.40	5.2	19.2	1	3.20	3.0	11.51
Slings	110	Gen.	9.19	7.8	12.8	1	1.32	1.7	7.95
Hay stackers	197	Gen.	123.29	12.0	8.3	1	9.08	5.9	80.30
	12	Poult.	----	11.2	8.9	2	5.21	----	58.35
Grain binders	37	Prune	150.64	15.2	6.6	1	12.38	10.5	54.51
	44	Poult.	123.23	9.7	10.3	2	8.51	5.2	69.28
	39	Gen.	137.55	7.4	13.5	3	11.92	6.7	65.53
	3	Pear	229.00	6.7	14.9	4	20.60	2.7	100.20

TABLE V. (cont.) FARM MACHINERY DEPRECIATION STUDY

21

DEPRECIATION OF INDIVIDUAL MACHINES BY TYPES OF FARMS IN OREGON

Kind or Class of Machine	No. of machines	Type of Farm	Orig. Cost \$	Est. Life Yrs.	Depr. Rate %	Rank	Yrly. Depr. \$	Age Yrs.	Val. at Age \$
Corn binders	24	Gen.	96.18	10.2	9.8	1	8.68	4.8	52.70
Potato diggers	14	Gen.	87.25	10.2	9.8	1	7.82	3.6	60.29
POWER OPERATED MACHINERY									
Gas engines	74	Prune	70.50	12.7	7.9	1	5.98	6.4	34.54
	29	Gen.	136.79	9.3	10.8	2	10.03	5.5	66.67
	43	Poult.	78.00	8.9	11.2	3	6.03	3.3	45.57
	20	Pear	42.75	7.0	14.2	4	7.29	1.0	35.46
Pumping plants	14	Gen.	718.00	16.4	6.1	1	42.05	6.75	17.70
	10	Prune	221.00	15.7	6.4	2	14.12	5.8	30.91
Hay balers	3	Prune	308.33	14.0	7.1	1	25.00	3.0	49.17
	6	Gen.	548.25	9.5	10.5	2	54.04	2.2	364.50
Ensilage cutters	36	Gen.	163.36	11.4	8.8	1	12.63	4.7	99.07
	3	Prune	291.66	11.3	8.8	1	29.26	6.7	22.59
	6	Poult.	-----	10.8	9.3	3	6.50	-----	76.67
Feed grinders	12	Prune	90.33	20.0	5.0	1	5.35	9.6	56.22
	32	Poult.	59.75	13.6	7.4	2	2.11	6.0	25.86
	13	Gen.	60.00	12.1	8.3	3	3.88	2.5	29.31
	2	Pear	22.50	5.0	20.0	4	4.50	1.0	18.00
Kale & feed cutters	30	Poult.	27.80	12.4	8.1	1	2.13	3.2	22.87
Straw cutters	14	Poult.	187.00	12.9	7.8	1	1.91	5.0	26.76
Feed choppers	7	Prune	39.71	18.1	5.5	1	1.89	11.4	16.16
Fanning mills	12	Prune	31.41	21.7	4.6	1	1.89	15.2	9.21
Cleaners	17	Poult.	40.25	14.4	6.9	1	1.90	7.0	22.07

TABLE V. (cont.) FARM MACHINERY DEPRECIATION STUDY

22

DEPRECIATION OF INDIVIDUAL MACHINES BY TYPES OF FARMS IN OREGON

Kind or Class of Machine	No. of machines	Type of Farm	Orig. Cost \$	Est. Life Yrs.	Depr. Rate %	R a n k	Yrly. Depr. \$	Age Yrs.	Val. at Age \$
Drag saws	10	Prune	124.70	11.8	8.5	1	12.69	5.1	69.94
	3	Pear	58.33	11.7	8.5	1	4.56	1.7	48.63
	11	Poult.	97.33	10.7	9.7	3	6.35	4.7	54.41
Wood saws	14	Prune	154.93	16.1	6.2	1	11.99	6.7	84.55
	8	Poult.	46.00	12.0	8.3	2	3.74	----	34.85
	4	Pear	40.00	7.1	14.1	3	6.38	1.1	32.88
Electric motors	3	Prune	43.33	19.3	5.2	1	2.33	6.7	29.69
Lighting systems	23	Prune	573.17	17.1	5.8	1	50.15	5.5	293.93
FERTILIZING MACHINERY									
Manure spreaders	13	Prune	128.85	14.5	6.9	1	10.25	7.8	47.89
	5	Pear	145.00	12.0	8.3	2	12.50	5.6	84.50
	87	Gen.	162.14	12.0	8.3	2	10.08	5.3	94.00
	31	Poult.	143.33	9.5	10.5	4	7.63	4.8	62.18
Fertilizer spreaders	43	Gen.	34.38	14.7	6.8	1	2.08	6.5	22.07
Fertilizer drills	10	Gen.	52.00	8.8	11.4	1	3.20	2.5	22.84
Landplaster spreaders	3	Poult.	10.00	12.7	8.0	1	0.67	10.0	6.00
SPECIAL EQUIPMENT									
Cream separators	14	Prune	83.85	13.0	7.7	1	7.28	5.2	50.51
	256	Dairy	99.75	12.0	8.3	2	7.40	4.7	61.92
	77	Gen.	93.55	9.6	10.4	3	7.84	4.3	56.69
	12	Pear	53.75	6.3	15.7	4	8.79	2.0	38.60
Cream separators (electric power)	62	Dairy	147.73	12.7	7.9	1	10.61	4.6	100.96
Cream separators (gas engine power)	22	Dairy	161.17	12.5	8.0	1	13.02	3.6	113.54
Milking machines	183	Dairy	414.30	13.6	7.4	1	31.83	3.0	314.47

TABLE V. (cont.) FARM MACHINERY DEPRECIATION STUDY

23

DEPRECIATION OF INDIVIDUAL MACHINES BY TYPES OF FARMS IN OREGON

[illegible]

E. DEPRECIATION BY CLASSES OF MACHINES BY TYPES OF FARMS IN OREGON

Table VI shows the depreciation by classes of machinery by types of farms.

Prune farms have the lowest rate of depreciation on tillage, seeding, and harvesting machinery.

Pear farms have the lowest depreciation rate on power operated machinery, special equipment, and miscellaneous equipment.

Poultry farms have the lowest depreciation rate on fertilizing machinery and next to the lowest rate on tillage, seeding, harvesting machinery, and miscellaneous equipment.

General farms do not have the lowest depreciation rate on any class of machinery but they have the next to lowest on tillage, power operated, and fertilizing machinery, and on special equipment.

VI. CONCLUSIONS

1. Depreciation is the most important item of expense in the cost of use of farm machinery, amounting to about 45% of the total cost of use of the machine. Cost of use of the machine includes depreciation, interest, taxes, repairs, and housing but does not include labor cost of operation.

2. Depreciation, generally called a non-cash item of expense, becomes eventually a cash item when the worn out machine must be replaced.

3. Lack of care such as in housing, prompt repairs, painting or greasing against weathering and rust, proper lubrication, proper adjustment, sharpening, tightening of bolts, etc., and obsolescence--are the major causes of depreciation of farm machinery.

4. Depreciation can be materially reduced at a considerable saving of farm operation costs in this respect by proper attention to these features of farm machinery care.

5. No previous research has been done on farm machinery depreciation in Oregon and no extensive published research has appeared in other states.

6. No research on variations in depreciation of farm machinery on different types of farms has been published.

7. The average annual depreciation on 82 individual farm implements and machines as used on all types of farms in all regions of Oregon is shown in detail in Table II.

8. The average annual depreciation rate varies from 4.6% on

fanning mills to 21.3% on hay racks. On some of the more important implements and machines the annual depreciation rate was found to be as follows: walking plows 8.1%, spike tooth harrows 7.8%, grain drills 7.9%, wagons 7.3%, mowers 9.6%, dump rakes 7.8%, hay stackers 8.6%, and cream separators 9.8%.

9. Average annual rate of depreciation on all farm machines and equipment on all different types of farms in all regions in Oregon included in this study was 8.26% and the average life was 12.1 years.

10. Depreciation covering 8423 individual implements and machines by kinds of machines is set forth in detail in Table III. Plows for example were found to have a depreciation rate of 7.8%, power operated machinery 7%, orchard equipment 10.2%, dairy equipment 8.3% and poultry equipment 9%.

11. Depreciation by classes of machines is shown in Table IV. Records of 2569 tillage implements and 2788 harvesting machines are covered. Power operated machinery has the lowest depreciation rate of any class of machinery on Oregon farms; next comes seeding machinery; then certain miscellaneous equipment; fertilizing machinery; tillage machinery; harvesting machinery; and finally special dairy, orchard, and poultry equipment which has the highest depreciation rate.

12. Depreciation on individual implements and machines as it varies on different types of farms is given in detail in Table V. Machinery on prune farms was found to have the lowest rate of depreciation; general farms next lowest; then poultry farms; and

then pear farms last and highest.

13. Depreciation by classes of machinery on different types of farms is shown in Table VI.

Prune farms were found to have the lowest depreciation rate on tillage, seeding, and harvesting machinery.

Pear farms have the lowest rate on power operated machinery and certain special equipment as listed.

Poultry farms have the lowest depreciation rate on fertilizing machinery and next to lowest on tillage, seeding, and harvesting machinery.

General farms have the next to lowest depreciation rate on tillage, power operated, and fertilizing machinery.

VII. REVIEW OF PUBLISHED RESEARCH IN OTHER STATES

- A. Mowry, H. H., Machinery Costs of Farm Operations in Western New York, U. S. Department of Agriculture, Washington, D. C., Bulletin 338, 1916 (17)

This investigation is based on an inquiry addressed to several thousand farmers in western New York. The inquiry secured data concerning a fairly large number of agricultural machines varying in number from 97 two-row cultivators to 232 mowers. This analysis of costs of farm machinery revealed that depreciation made up a little more than 45% of the total cost.

TABLE A

SUMMARY SHOWING COST NEW AND AVERAGE LIFE OF 18 KINDS OF FARM IMPLEMENTS IN WESTERN NEW YORK (1916) WITH DEPRECIATION RATE AND AMOUNT OF YEARLY DEPRECIATION CALCULATED ON BASIS OF DATA GIVEN

Implement	Cost New	Life in Years	*Depreciation	
			Rate	Amount
Walking plow	\$10.00	11.7	8.5%	\$.85
Sulky plow	42.50	8.1	12.3	5.23
Spring-tooth harrow	17.50	11.0	9.1	1.59
Spike-tooth harrow	10.50	14.0	7.1	.75
Disk harrow	27.00	13.0	7.7	2.08
Land roller	24.00	16.0	6.2	1.50
Grain drill	72.00	16.4	6.1	4.39
Corn Planter, 1-row	12.00	11.7	8.5	1.02
Corn Planter, 2-row	40.00	11.0	9.1	3.64
Cultivator, 1-row	6.50	14.0	7.1	.46
Cultivator, 2-row	32.00	12.5	8.0	2.56
Cabbage transplanter	45.00	12.8	7.8	3.51
Mower	41.00	14.8	6.8	2.79
Hay rake	24.00	14.5	6.9	1.66
Hay tedder	34.00	14.0	7.1	2.41
Bean harvester	25.00	12.9	7.8	1.95
Grain binder	125.00	15.4	6.5	8.12
Corn binder	125.00	10.8	9.3	11.62
*Average		13.03	7.6%	\$3.12

*Calculated on basis of data given

B. Davidson, J. B., Life, Service, and Cost of Service of Farm Machinery, Agri. Exp. Sta. Iowa, Bul 260, 1929 (5)

The table quoted from this bulletin tabulates the results of two surveys made at Iowa State College. The first was made by Evan A. Hardy in 1921 and 1922. The second study was made later by H. Lew Wallace on a complete life history of a limited number of farm machines rather than on general and incomplete information concerning a large number.

Davidson in his summary says: "1. The average life of farm machines on Iowa farms varies from 8 years for a spring tooth harrow to 24 years for the farm wagon. The average life of all machines is 15.2 years. 2. The life of individual machines varies much from the average. The average life of grain binders, for illustration, was found to be 16 years, but machines were found which lasted only 5 years; while others had a life of 33 years."

TABLE B

LIFE OF FARM MACHINES, AS DETERMINED BY SURVEYS

		Hardy survey		Wallace survey				
		No. machines in use	Estimated life, years	No. machines worn out	Actual life, years	No. machines in use	Estimated life, years	Estimated normal life years
1	Automobile	132	8.9					
2	Buggy	81	15.0					
3	Corn binder	71	16.7	5	8.6	19	14.8	14
4	Corn Planter	144	16.1	38	12.36	53	18.6	15
5	Corn Sheller	57	21.7					18
6	Cultivator 1-row Walk	102	16.5	15	11.53			15
7	Cultivator 1-row Ride	156	17.0	35	14.31	101	16.6	15
8	Cultivator 2-row					13	16.0	15
9	Engine-Gasoline Stationary	82	13.3			15	16.2	15
10	Ensilage Cutter	35	12.8					10
11	Feed Grinder	68	16.3			6	17.6	15
12	Grain Binder	129	18.1	31	15.00	50	19.5	16
13	Grain Drill	45	20.9					18
14	Harrow, Disk	143	17.1	38	12.60	70	17.5	15
15	Harrow, Smoothing	146	23.0	9	18.11	34	21.5	20
16	Harrow, Spring Tooth	12	8.8					8
17	Hay Loader	91	18.8	15	11.3	47	27.9	20
18	Hay Rake, Dump	113	23.3	6	19.0	17	22.2	20
19	Hay Rake, Side Delivery	36	22.7			24	18.9	16
20	Manure Spreader	136	18.1	33	10.8	54	14.3	14
21	Mower	141	18.1	40	12.9	59	16.9	15
22	Plow, Walking	116	27.6	Combined next two columns		9	14.4	14
23	Plow, Sulky	90	17.9	19	15.26	28	19.6	16
24	Plow, Gang	104	17.9	5	12.20	29	19.1	15
25	Plow, Tractor	48	9.3					9
26	Roller	15	18					16
27	Seeder, End Gate			11	12.63	21	20.6	16
28	Seeder, Broadcast	102	28.8					16
29	Threshing Machine	28	16.1	Combined with mach.		8	14.4	15
30	Tractor	57	8.0	in use		14	10.1	8
31	Wagon	183	24.6	12	21.91	63	26.2	24

C. Parker, Edw. C. and Cooper, Thos. P., The Cost of Producing Minnesota Farm Products, 1902-1907, Minnesota Exp. Sta. Bul 117, 1910 (19)

This bulletin states that the annual farm machinery depreciation rate is commonly estimated at 10 per cent but statistics collected in this investigation show the average annual depreciation rate of all classes of farm machinery to be approximately 7.3 per cent.

TABLE C

ANNUAL DEPRECIATION IN VALUE OF FARM MACHINERY EXPRESSED IN PERCENTAGES
MINNESOTA 1902-1907

Machine	North- field (Rice County)	Marshall (Lyon County)	Halstad (Norman County)	1,820 acre farm (Norman County)	640 acre farm (Norman County)	Average all Machines
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Grain binders	8.33	9.44	7.47	6.53	10.57	7.91
Grain drills and seeders	7.27	8.07	6.53	4.36	6.47	6.75
Thrashing outfit				12.00		12.00
Corn binders	11.46	10.16	11.40		9.00	10.03
Corn planters	6.74	8.54				7.15
Corn cultivators	6.67	9.04	6.97	4.66	5.00	7.25
Mowers	7.25	10.01	6.97	7.28	8.93	7.80
Hay tedders	4.84					4.84
Hay loaders	11.78					11.78
Hay rakes	7.68	7.51	8.46	5.81	5.00	7.80
Gang plows	10.51	7.16	6.69	8.46	6.71	7.40
Sulky plows	10.27	11.93	5.77		3.70	8.42
Walking plows	4.77	7.29	7.64		8.82	6.09
Wagons	6.66	4.86	5.44	2.47	5.90	4.89
Harrows	11.01	8.20	7.93	8.89	6.78	8.72
Disks	5.41	7.46		3.35	7.50	5.19
Manure spreaders	10.50	12.59			10.00	11.67
Hay racks	14.57	14.89	10.30	5.12		7.76
Reapers				8.13		8.13
Grain tanks				3.47		3.47
Sleds	5.66	4.50	6.82	8.20		5.81
Fanning mills	5.00	4.97		3.66	3.33	4.58
Horse weeders					5.71	5.71
Harness (heavy)	5.97	6.63	7.21		4.44	6.17
Gasoline engines	3.92				10.00	7.35

D. Smith, Dwight and Jones, Mack M., Power, Labor, and Machine Costs in Crop Production, Linn County, Missouri, 1930. Missouri Exp. Sta. Research Bul. 197, 1933 (22)

In the summary of the results of a survey on 66 Linn County, Missouri farms in 1931 (covering the 1930 farm business) it was found that: 1. The average depreciation rate on farm machines was 4.8% but at the time of this survey farm machinery was not being replaced as fast as would ordinarily have been customary. 2. The depreciation rates on machines, which were used a very limited amount per year, which had few moving parts, and which were constructed mainly of iron and steel, did not vary significantly with the amount of use per year.

TABLE D

ESTIMATED DEPRECIATION OF FARM MACHINES IN PER CENT OF FIRST COST (1930)

Machine	Depreciation Per Cent
Mower	3.6 (plus .22 times days used per year)*
Sulky rake	2.9 (plus .30 times days used per year)
Sweep rake	5.4 (plus .17 times days used per year)
Corn planter	4.8 (plus .26 times days used per year)
Corn cultivator, 1-row	3.9 (plus .11 times days used per year)
Corn binder	5.0 (plus .45 times days used per year)
Ensilage cutter	4.9 (plus .21 times days used per year)
Grain binder	6.3 (plus .18 times days used per year)
Walking plow	3.7
Sulky plows	4.2
Gang plows	4.2
Tractor plows	7.0
Single disk harrow	4.8
Tandem disk harrow	5.6
Spike tooth harrow	5.0
Rotary hoes	7.0
Hay stackers	4.1
Seeders	5.1
Buhr mills	5.4
Gas engines	5.9
Wagons	3.5
Manure spreader	4.7
Lime spreader	6.0

*The variation in the number of days a wheeled machine, (chiefly of the harvester class) was used each year, materially affected the depreciation.

E. Byers, Geo. B. and Inman, B. T., The Use and Expense of Farm Implements, Kentucky Agri. Exp. Sta. Bul. 345, 1933 (4)

This bulletin presents a description of the use and an analysis of the expense of farm implements on 101 farms in representative Kentucky counties for the farm year 1930.

The largest factor of implement expense was depreciation, which is largely dependent upon years of life. Depreciation ranged from 3.2 per cent of the original cost for the steam tractor to 20.8 per cent for the electric motor. For the implements studied depreciation was 47.7 per cent of the total annual expense; repairs, 22.4 per cent; interest, 17.8 per cent; housing, 4.6 per cent; oil and grease, 4.6 per cent; insurance, 2 per cent; and taxes, .9 per cent. Original cost, years of service, and days of annual use are the most important factors affecting the annual expense. Minor factors are size of farm, type of operating labor, use of repair shop, and housing, purchasing, and discarding practices.

TABLE E
PERCENTAGE DISTRIBUTION OF TOTAL ANNUAL EXPENSE OF IMPLEMENTS,
BASED ON ORIGINAL COST (1930) (Abridged)

Kind of implement	Number of implements	Original cost for implement	Percent of original cost			
			Total annual expense	Annual depreciation	Annual repair expense	Other annual expense
Wagon	220.	\$85.35	13.9	5.6	3.3	5.0
Gasoline engine	20	125.25	16.7	5.7	3.5	7.5
Steam tractor	6	2566.67	7.0	3.2	.7	3.1
Tractor	44.5	830.56	17.8	10.4	1.9	5.5
Tractor implements:						
Plow	27.5	128.55	11.6	6.1	1.9	3.6
Disk	40.5	122.28	12.0	6.6	1.7	3.7
Cultivator	8.5	141.94	12.6	7.6	1.0	4.0
Mower	7.5	103.93	23.1	10.4	8.8	3.9
Breaking plows:						
2-Horse	178	16.03	18.0	4.7	9.5	3.8
3-Horse	151	19.74	21.6	4.8	13.0	3.8
1-Horse	189	7.04	11.8	4.4	3.4	4.0
Sulky	33	52.64	14.3	5.1	5.5	3.7
Disk harrow	132	47.69	13.0	5.3	3.6	4.1
Spike harrow	150	17.70	15.2	6.4	5.0	3.8
Smoothing drag	61	4.56	17.2	13.4	.4	3.4
Roller	28.2	35.00	8.7	4.1	.8	3.8
Cultipacker	30	62.27	8.9	4.3	.8	3.8
Rotary hoe	12.5	76.32	14.8	8.8	1.9	4.1
Cultivators:						
Two-horse riding	176	56.45	19.0	6.4	2.9	9.7
Double shovel	225	5.26	15.2	5.5	5.9	3.8
1-horse harrow	310	5.38	14.9	5.8	5.2	3.9
Single shovel	21	3.77	9.8	5.3	.8	3.7
2-horse corn planter	95.5	61.09	11.1	5.6	1.5	4.0
Grain drill	82.5	77.78	10.3	4.9	1.9	3.5
Hand grass seeder	251	1.16	23.3	17.2	2.6	3.5
Mower	130	66.93	19.3	6.7	8.7	3.9
Sulky rake	93.5	29.07	10.3	4.6	1.8	3.9
Hay tedder	14	54.82	9.8	4.9	1.4	3.5
Grain binder	56	159.68	12.0	5.1	3.3	3.6
Ensilage cutter	8.7	287.93	11.7	5.2	3.0	3.5
Wagon harness	237	36.29	13.0	5.4	3.9	3.7
Cream separator	36	87.03	14.3	7.9	1.8	4.6
Incubator	12	26.83	10.0	5.9	.7	3.4
Brooder	10	17.70	19.0	8.0	7.5	3.5
Manure spreader	38.2	126.74	11.1	6.3	1.0	3.8
Lime spreader	18	59.73	11.5	6.3	1.5	3.7
Feed grinder	12.5	87.84	11.4	6.6	1.0	3.8
Fanning mill	11.5	33.30	8.3	4.5		3.8

BIBLIOGRAPHY

1. Bainer, H. M. and Bonebright, H. B., Life and Care of Farm Machinery in Colorado, Colorado Agri. Exp. Sta. Bul. 167, 1910.
2. Bracker, E. M. D., Points on the Selection, Adjustment, and Care of Farm Machinery, Oregon Agri. Exp. Sta. Bul. 133, 1915.
3. Burger, A. A., Bill for Rust and Decay, *Successful Farming*, 25:13, Oct. 1927.
4. Byers, Geo. B. and Inman, B. T., The Use and Expense of Farm Implements, Kentucky Agri. Exp. Sta. Bul. 345, 1933.
5. Davidson, J. B., Life, Service, and Cost of Service of Farm Machinery, Iowa Agri. Exp. Sta. Bul. 260, 1929.
6. Davidson, J. B., To Cut Machinery Costs, *Successful Farming*, 29:7, Jan. 1931.
7. Davidson, J. Brownlee, *Agricultural Machinery*, John Wiley & Sons, Inc., New York, 1931.
8. Davidson, J. B. and McCuen, G. W. and Blasingame, R. U., Report of an Inquiry into Changes in Quality Values of Farm Machines between 1910-14 and 1932, *Amer. Soc. Agr. Engin.*, 1933.
9. Deere, John, *The Operation, Care, and Repair of Farm Machinery*, John Deere, Moline, Illinois, Ninth Edition.
10. Ellis, L. W., A Study of Farm Equipment in Ohio, U. S. Department of Agriculture, Bur. Plant Industries, Bul. 212, 1911.
11. Fox, Kirk, Our Annual Bill for Rust is too Large, *Successful Farming*, 23:13, Oct. 1925.
12. Harriot, J. F., Depreciation, Cost, and Use of Farm Machinery, *Ag. Engin.*, 11:397-400, Dec. 1930.
13. Heckbert, S. C., Care and Treatment of Farm Implements, *Farmers Advocate*, 62:713, May 5, 1927.
14. Kranich, Frank N. G., *Farm Equipment for Mechanical Power*, The MacMillan Company, New York, 1923.

15. Minor Jr., W. A., Research in Farm Equipment Costs, Jour. Farm Econ., 14:341-344, Apr. 1932.
16. Morrison, F. L., Life of Farm Machinery, Ohio Agri. Exp. Sta. Bimonthly Bul., Sept.-Oct. 1931.
17. Mowry, H. H., Machinery Cost of Farm Operations in Western New York, U. S. Department of Agriculture, Bul. 338, 1916.
18. Ocock, C. A., Farm Implement Investigation, Wisconsin Agri. Exp. Sta. Report 1906, pp 285-287.
19. Parker, Edw. C. and Cooper, Thos. P., Cost of Producing Minnesota Farm Products, 1902-1907, Minnesota Agri. Exp. Sta. Bul. 117, 1910.
20. Sauve, E. C., Method of Computing Machinery Costs, Michigan Agri. Exp. Sta. Quar. Bul. V 13:187-190, May 1931.
21. Scudder, H. D., Farm Machinery Equipment, Unpublished.
22. Smith, Dwight D. and Jones, Mack M., Power, Labor, and Machine Costs in Crop Production, Linn County, Missouri, 1930, Missouri Agri. Exp. Sta. Research Bul. 197, 1933.
23. Spillman, W. J., Formulas for Calculating Interest on Farm Equipment, U. S. Department of Agriculture, Office Sec., Circ. 53, 1915.
24. Stone, Archie A., Farm Machinery, John Wiley & Sons, Inc. New York, 1928.
25. Trullinger, R. W., Problem of Research in Farm Equipment, Ag. Eng. 6:214-215, 15 Sept. 1925.
26. Walker, H. B., Research in Farm Equipment, Bur. Farmer, 3:13-14, Sept. 1927.
27. Wallace, Lew, Depreciation of Farm Machinery, Agr. Engin., 7:49,50,56, 1926.
28. Warren, G. F., An Erroneous Method of Calculating Depreciation, Jour. Farm Econ. 4:154-155, 1922.
29. Zimmerman, O. B., When Does Farm Equipment Become Junk? Bur. Farmer, 2:8, Aug. 1927.

APPENDIX

FARM MACHINERY DEPRECIATION STUDY

[illegible]