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APRIL, 1910.

THE COST OF PRODUCING MINNESOTA FARM PRODUCTS.

1902-1907.

UNIVERSITY FARM, ST. PAUL, MINNESOTA.

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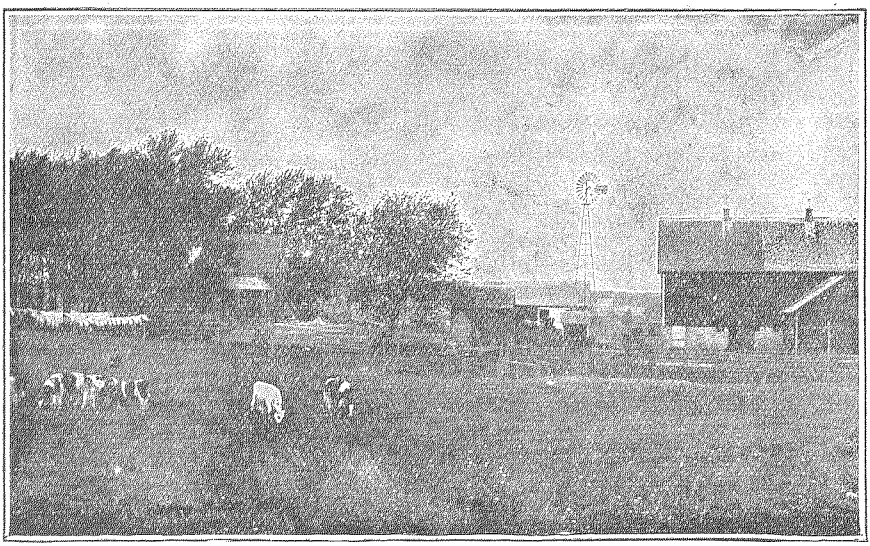

Fig. 1.—Farmstead at Northfield.

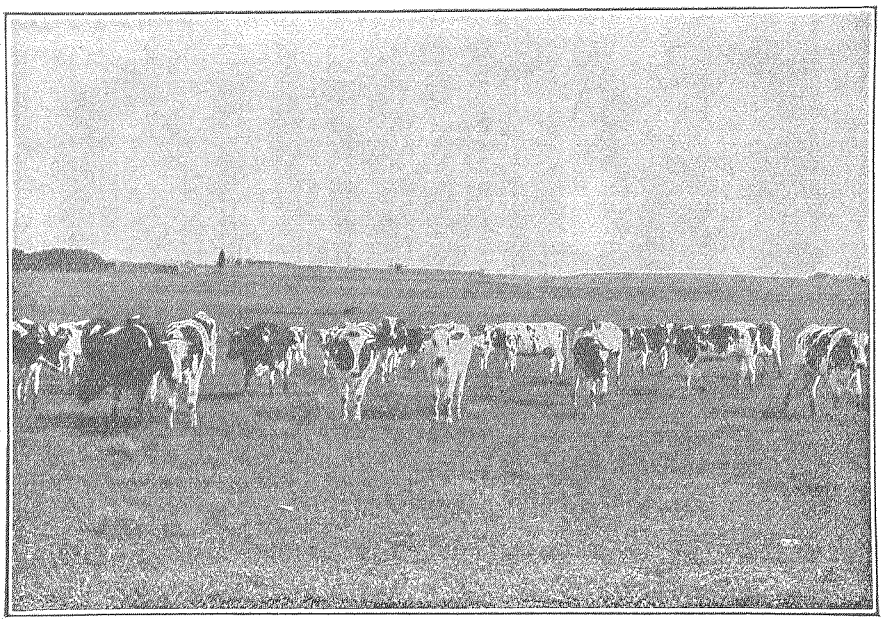

Fig. 2.—A Farmer's Herd of Pure-Bred Holsteins that has Proved Exceedingly Productive.

MINNESOTA EXPERIMENT STATION,
St. Anthony Park, Minn., Feb. 12, 1910.

SIR: I have the honor to transmit, herewith, and to recommend for publication as Bulletin 117 of the Minnesota Experiment Station, a report relating to the cost of producing the various farm products in Minnesota during the years 1902 to 1907 inclusive. It is based on investigations of the Division of Agriculture of the Minnesota Experiment Station, in cooperation with the Bureau of Statistics, Department of Agriculture.

This work is a continuation of the work originated and organized with the object of investigating (1) the cost to the farmer of producing agricultural products on private farms under normal conditions; (2) the cost of different systems of farm management; and (3) the cost of experimental crop rotations and with the object also of devising methods for the statistical study of the farming business and farm life. The statistics obtained and the conclusions reached for the years 1902, 1903 and 1904 together with a careful explanation of the methods of procedure were published in Bulletin 97 of the Minnesota Experiment Station. The statistics for 1905, 1906 and 1907 have now been combined with those for the earlier years, and the present bulletin is therefore a cumulative report upon the entire period rather than a supplement to the earlier bulletin.

It is intended that following this bulletin supplementary reports will be issued treating of particular phases of the investigation fully.

Respectfully,
ANDREW BOSS,
Agriculturist.

A. F. WOODS, Director,
Minnesota Experiment Station,
St. Anthony Park, Minnesota.

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PREFACE.

During the years 1902–1907 the following-named gentlemen have served as special agents of the Minnesota Agricultural Experiment Station and the Bureau of Statistics, U. S. Department of Agriculture, for collecting the statistics on agricultural production embodied in this bulletin: Messrs. E. C. Parker, H. H. Mowry, H. G. Krum, F. B. Headley, W. A. Peck, J. W. Schneider, Thomas Cooper, H. R. Danielson, Earl Hacking, William Mackenzie, John Gregor, Harvey M. Bush, Geo. McClelland, Edwin Mayland, W. I. Peterson, and Harold Greaves.

The authors acknowledge the expert assistance rendered by Mr. Harvey M. Bush and Miss Hattie M. Wilson in compiling the statistics presented.

Assistance given by Profs. Andrew Boss, C. P. Bull, and A. D. Wilson in reviewing and editing this work is acknowledged. Superintendent L. B. Bassett has also given valuable aid in furnishing accurately kept cost statistics of mangel and ensilage crops grown on the university farm.

The thanks of the authors and of the Department are due the following farmers, who have cooperated with the route statisticians during the years 1902–1907:

Northfield (*Rice County*).—W. H. Holden, Nicholas Lamberty, John Melvin, John Linster, John and James Bruce, W. E. Chester, John Miller, John Morrison, Patrick Heffernan, Will Heffernan, Edward Heffernan, Samuel Kennedy, Charles O. Nichols, John Clifford, Charles E. Taylor, George Taylor, Fred Hibbard, George Lyman, Simon LaPoint, James Sheridan, Hyland Taylor, Robert A. Whitson, Charles Drentlaw, George Miller.

Marshall (*Lyon County*).—B. Snyder and Henry Snyder, Henry E. Meehl, J. W. Pike, W. E. Heagle, Henry Preston, Vernon Tubbs, C. J. Spong, John Fligge and F. Fligge, Rasmus Nelson, C. C. Rock, Charles Middleton, Fred Marks, John Spong, John Myhrvold, Herman Marks, H. J. Newhouse, D. M. Moore, Homer N. Robinson.

Halstad (*Norman County*).—Henry Henderson, I. L. Houske, J. K. Hage, Martin Rasmusson, Matt Rasmusson, Oscar Olson, Halvor Helgeson, Knute Olson, B. O. Hellerud, Joseph Henderson, Sivert Viig, Anthony Sheie, Nels Enger, L. J. Enger, John Gunderson, Knute Haugen, Edw. Salverson, A. Stennes, J. Hellerud, A. Aarrestad, Hans P. Olson, Oscar Carlson, Nels H. Nelson, R. I. Steen, A. O. Sandvold, Simeon Rasmusson, Sven Carlson, C. L. Sulerud, John Sulerud, L. W. Pederson, Martin Arneson, Edward T. Stennes, Henry Holte, Aslak Hanson, L. H. Houske.

Sabin (*Clay County*).—Henry Schroeder, Edward C. Schroeder.

Morris (*Stevens County*).—Beyer Aune.

THE AUTHORS.

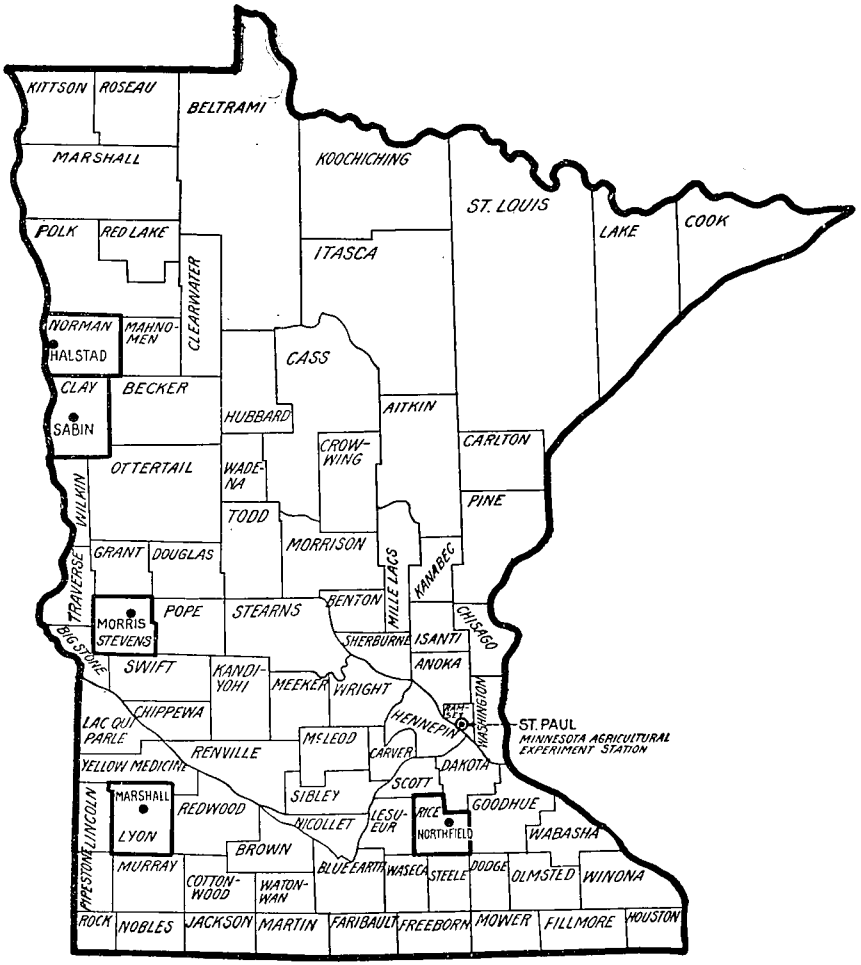

FIG. 1.—Localities in which statistics were obtained.

At each of the stations, Halstad, Marshall, and Northfield, is located a joint agent of the U. S. Department of Agriculture and of the Minnesota Agricultural Experiment Station, who visits eight farms each day and secures reports of labor, sales, purchases, and other data necessary to keep a double-entry set of books concerning the business and concerning all costs of production. Each of these agents lives for three days a month on each of the eight farms on his route, and weighs the feed given to all classes of live stock, as well as the milk of dairy cows. He also samples the milk for testing. At Sabin, Clay County, statistics of commercial potato production were collected in 1907 through weekly correspondence and numerous visits by a crop statistician. A complete set of accounts has been kept with a large farm at Morris, Stevens County, during the years 1906 and 1907, the manager keeping a daily journal of the farm business and forwarding data to the Minnesota Agricultural Experiment Station for posting. The location of each place in which statistics have been gathered is shown on the State map above.

THE COST OF PRODUCING MINNESOTA FARM PRODUCTS, 1902-1907.

EDW. C. PARKER. THOS. P. COOPER.

AGRICULTURE AND THE SCIENCE OF BUSINESS.

At no other period in the history of the United States has so much attention been given to the development of the "science of business" as at the present time. Colleges and universities are adding to their curriculums courses which treat of accounting, statistics, insurance, and commerce, and the popularity of these courses indicates a growing demand among Americans for knowledge of the most approved business methods. Not only is this tendency apparent in the colleges, but also among men of practical affairs. The owners and managers of large factories and business establishments find it essential to maintain accounting departments, not only to keep profit and loss accounts, but also to tabulate cost data of every department and of every kind of merchandise.

Quite often the manager of a large business, at a loss to understand reasons for an unprofitable department, calls to his assistance men capable of analyzing his methods and aiding in successful reorganization. So, too, in the railroad world the "division's operating expense" is a statistical table much perused by officials for the purpose of correcting leakage and reducing expense to the minimum. In every art or business the need for scientific or exact methods of management becomes more imperative as civilization advances, as raw materials approach exhaustion, and skilled labor becomes high priced. Thus there is arising a new science popularly called the "science of business," which involves principles of management that reduce expense and waste to a minimum; cost statistics exemplify the theory and practice of this new science.

In the history of American agriculture little attention has been paid to the "science of business." American agriculture a little over a generation ago had not been commercialized. The farmer produced food only for himself, family, and live stock; the women made the clothes; very little farm produce was bought or sold. In the present decade new problems confront him. Many farm laborers and farm-bred youths have gone into the manufacturing industry or migrated west to aid in developing the new country; land values have increased; soil fertility shows signs of depletion; weeds, fungus diseases, and insect pests unknown a generation ago are to be combated, and conditions demand more attention to marketing

than ever before. For many years men have been studying physics, chemistry, botany, and zoology for principles which could be applied profitably to the practice of agriculture, and much success has crowned their efforts. The application of these sciences has done much to increase productiveness and to benefit not only farmers, but all classes of people. The agricultural colleges and experiment stations have been more than justified as institutions for investigating the scientific principles applicable to agriculture and teaching them to farmers. Making the facts concerning soil, crop, and live stock management common knowledge is to-day an important feature of government aid to agriculture. In the science of business as applied to agriculture, there is, however, a dearth of knowledge. It is almost impossible for the college instructor in "farm management," or the agricultural press to secure authentic and exhaustive material on this science. Occasionally a farm manager has recorded facts concerning "costs" on his farm which have placed him in the front rank as a successful manager, but these cases are rare.

In the past two or three years there is much evidence that farmers are awakening to the need of more knowledge concerning the science of business, and that they recognize it as a necessity if farming is to be profitable. Editors of agricultural papers are often asked: "What is the cost of producing an acre of corn? Or of keeping a milch cow? Or the comparative cost of dairy farming and beef or hog farming?" These and similar questions indicate a growing desire and need for cost data which may find as profitable application in agriculture as "cost data" tables have in civil engineering or as the railroad "operating expense" table has in the economical management of a railroad.

This bulletin is presented to the agricultural public with the hope that it will be useful to farm managers, editors of agricultural papers, and college instructors in furnishing new and authentic data concerning the science of business as applied to certain lines of agriculture. The statistics, although incomplete in many phases of farm management, are unusually valuable for "cost data," having been collected throughout six years, 1902–1907, in the same localities. The authors hope that other experiment stations will enter this field of research, and aid in collecting agricultural "cost data" concerning every phase of agriculture.

METHODS OF COLLECTING AND COMPILING AGRICULTURAL COST DATA.

In a report of this work for the years 1902, 1903, and 1904, by Hays and Parker, published in 1906,[a] a full and detailed account was given

[a] The Cost of Producing Farm Products. Bulletin 48, Bureau of Statistics, U. S. Department of Agriculture, and Bulletin 97, Minnesota Agricultural Experiment Station.

of the methods employed in collecting statistics of cost. Therefore, the following discussion of methods is given only in a condensed form. The work was started in 1902 in cooperation with three communities of farmers in typical agricultural regions of Minnesota, namely, Northfield (Rice County) in southeastern Minnesota, Marshall (Lyon County) in southwestern Minnesota, and Halstad (Norman County) in northwestern Minnesota. A "route man" employed as a special agent was located in each community who daily visited each of as many farms as he could handle and received reports from the farmers concerning the number of hours of work performed by men and teams in the various farm operations, together with reports of sales, expenditures, and all items relative to crop production. Machinery, harness, live stock, feed, etc., were inventoried at the beginning and close of each year so that all cost and depreciation could be accurately determined. The cost of boarding farm help was determined, including all farm produce consumed and labor used in the household. It was thus possible by adding board to actual wages paid and dividing this sum by the total hours worked to ascertain the actual "cost per hour" of farm labor. By multiplying this hour cost by the total hours of labor performed on each operation and each crop, the total labor cost of the respective crops and operations was ascertained. A similar process was employed in obtaining the cost of horse labor. The cost of man and horse labor on farms is shown in Tables IV, V, VI, VII, VIII, and IX. Each year the crop areas have been accurately surveyed so that all cost of crop production could be reduced to the acreage basis.

In 1904 the number of farms reporting in each community was reduced from 15 to 8, and statistics of live-stock production were recorded in detail as well as those of crop production. The route man, after this date, spent three days in the month on each farm, during which the grain and roughage fed to each class of live stock were weighed and the milk of dairy cows was weighed and tested. Daily labor reports from each farm were taken as in previous years. By this method every detail of expense and receipt was recorded, and this, combined with more thorough inventories, made it possible to carry a double-entry set of accounts for each farm and to render financial statements to the farmers annually. Beginning with 1905 all original data collected on the farms—labor reports, cash accounts, amounts of feed to the various classes of live stock, dairy records, wages of regular help and day help, farm produce consumed in the household, and local prices on all agricultural products—have been mailed to the Experiment Station monthly and there posted. In 1906 a farm of 640 acres at Morris, Stevens County, was added to the list of farms reporting. The manager of this farm keeps a daily journal of the farm business and mails his records to the experiment

station for posting. In 1907 two large potato and grain farms at Sabin, Clay County, cooperated in the collection of statistics concerning commercial potato production. In securing statistics on these farms, methods were employed similar to those used on the statistical farms.

In compiling statistics in this bulletin the object has been to present in as simple and concise a form as possible the summary of six years' work relative to the cost of producing field crops, and four years' work concerning a few phases of the cost of live-stock production.

CLIMATIC CONDITIONS AND AVERAGE FARM PRICES, 1902–1907.

General information concerning the climatic conditions, crop prices and yields, and the average wages of farm labor on the statistical routes during the years 1902–1907 is given in succeeding tables. Cost of production varies according to weather conditions, size of crop, and wages. This information is essential to illustrate the conditions under which the "cost data" of this bulletin were prepared.

TABLE I.—*Climatic conditions at specified points in Minnesota, 1902–1907.*

Weather station.	Annual precipitation.				Mean temperature of growing season, April 1 to September 30.			
	Years of weather reports prior to 1902.	Average annual precipitation prior to 1902.	Average annual precipitation, 1902–1907.	Departure in the period 1902–1907 from the annual average prior to 1902.	Years of weather reports prior to 1902.	Average mean temperature prior to 1902.	Average mean temperature, 1902–1907.	Departure in the period 1902–1907 from the average prior to 1902.
Southeastern Minnesota, Farmington, Dakota County	*Number.* 15	*Inches.* 28.71	*Inches.* 33.71	*Inches.* +5.00	*Number.* 14	*Degrees.* 66.67	*Degrees.* 59.79	*Degrees.* —6.88
Southwestern Minnesota Lynd, Lyon County	11	24.12	26.39	+2.27	10	61.88	58.85	—3.03
Northwestern Minnesota, Moorhead, Clay County.	22	23.77	27.38	+3.61	21	60.43	57.43	—3.09

The climatic conditions, 1902–1907, at weather stations of Minnesota near the statistical routes are shown in the above table. Comparisons are made with the average rainfall and mean temperature during the growing seasons prior to 1902. The weather-record stations, Farmington, Lynd, and Moorhead, are fairly representative of the regions in which the cost statistics were collected, Farmington, in southeastern Minnesota, being located about 15 miles from Northfield; Lynd, in southwestern Minnesota, about 8 miles from Marshall; and Moorhead, in northwestern Minnesota, about 30 miles from Hal-

stad. An analysis of these records shows that the average annual precipitation was greater in each region during the six years, 1902–1907, than the average of all preceding years of which there is record. At Farmington the departure from the average precipitation prior to 1902 amounted to an average annual increase of 5 inches; Lynd and Moorhead also show an increase. The mean temperature during the growing season, April 1 to September 30, 1902–1907, averaged considerably lower than the mean temperature for preceding years. At Lynd and Moorhead this lowering of mean temperature amounted to an average of approximately 3 degrees, while at Farmington the difference was still more noticeable—a departure of 6.88 degrees from the average of preceding years.

The effect of this period of excessive rainfall and low temperature was undoubtedly to lower the yield and quality of small grain and corn and to increase the yield of hay and pastures; the effect upon the cost of labor was slightly to increase it above normal. This statement holds true particularly in the case of the cost of labor at Marshall and Halstad. Much waste land and loss of labor in producing crops was caused at Marshall, because the rolling land is characterized by numerous low swales in which the surface water was collected and retained throughout the crop season. With few exceptions the crops at Northfield were sown and harvested in a husbandmanlike manner. The diversified character of agriculture and the larger proportion of grass land at Northfield prevented such losses as occurred at Marshall and Halstad in the large areas devoted exclusively to grain.

A detailed analysis, by years, of the weather records at Farmington, Lynd, and Moorhead follows, with comments upon crop conditions by the authors:

1902: Mean temperature slightly below average at each station. Excess precipitation at Farmington above normal 8.51 inches, and at Moorhead 5.35 inches; normal at Lynd.

1903: Mean temperature slightly below average at each station. Excess precipitation at Farmington 6.83 inches, Lynd 8.84 inches, and Moorhead 4.52 inches.

1904: Mean temperature slightly below average at each station. Normal conditions of precipitation at Farmington and Moorhead. Precipitation at Lynd 2.03 inches below normal. The spring was very backward at Halstad and a heavy snow in April made the soil cold and difficult to till. Extensive damage this season from black rust, the damage being greatest at Halstad.

1905: Mean temperature slightly below average at each station. Excess precipitation at Farmington 2.95 inches and at Moorhead 7.71 inches. The excess rainfall at Moorhead, northwestern Minnesota, was during the summer and harvest months. In many fields at Hal-

stad the water table rose so close to the surface as to prevent harvesting, and excellent crops crinkled down in the mud. Some cutting was done by driving the binder gear with gasoline engines or by putting a roller under the binder to prevent the bull wheel from cutting into the soil. Many fields were left unplowed in the fall.

1906: The mean temperature at each station was normal and close to the average. The excess precipitation at Farmington amounted to 9.55 inches, at Lynd 5.6 inches, and at Moorhead 2.23 inches. Heavy snows in the spring at Halstad made the land wet and cold, and this condition, together with the heavy fall rains of 1905, prevented farmers from plowing and sowing large areas. Practically no feed grain was grown at Halstad and feed was shipped in throughout the year. The land was weedy and out of condition all the year, but mostly plowed again by the fall of 1906.

1907: The precipitation at each station was practically normal, but very heavy in the early spring at Marshall, flooding much of the low-lying land and either preventing tillage or making it very difficult. Mean temperatures for the crop season were extremely low. The mean temperature from April 1 to September 30 at Farmington was 9.52 degrees below the average for fourteen years prior to 1902, at Lynd 6.1 degrees below the normal for ten years, and at Moorhead 6.06 degrees below the normal for twenty-one years. The mean temperatures were lowest during April and May, retarding corn planting until June 1 and causing slow, weak growth in the grain. The corn crop was hardly worth harvesting at Marshall. Oats were low in yield and in natural weight at all stations. Wheat yielded well at Halstad.

TABLE II.—*Average farm prices of agricultural products in Minnesota December 1, 1902–1907.*

[As reported annually by the Bureau of Statistics, U. S. Department of Agriculture.] [a]

Year.	Corn.	Wheat.	Flaxseed.	Oats.	Barley.	Rye.	Potatoes.	Hay.
	Per bu.	*Per bu.*	*Per bu.*	*Per bu.*	*Per bu.*	*Per bu.*	*Per bu.*	*Per ton.*
1902	$0.40	$0.61	$1.07	$0.27	$0.37	$0.43	$0.31	$5.36
1903	.38	.69	.83	.30	.37	.45	.61	6.61
1904	.36	.87	1.01	.26	.32	.64	.29	5.51
1905	.33	.71	.86	.24	.32	.53	.50	5.80
1906	.34	.65	1.03	.27	.35	.50	.37	5.50
1907	.50	.92	.98	.41	.67	.66	.41	7.50
Average, six years.	.385	.742	.965	.292	.40	.535	.415	6.047

[a] Yearbooks U. S. Department of Agriculture.

CROP YIELDS ON THE STATISTICAL ROUTES.

All yields are presented in the following table, by weight, for the agricultural communities at Northfield, Marshall, and Halstad. The yields are based on the crop acreage harvested. The yield of wheat, oats, and barley at Marshall and Halstad is much below the normal

yield on these farms, owing to the unfavorable crop seasons in 1905 and 1906, in which years the crops were nearly a total failure. The yield of corn at Marshall and Halstad is also below normal, owing, undoubtedly, to the unfavorable corn year of 1907.

The average yield per acre on the statistical farms is not determined by averaging the yields at Northfield, Marshall, Halstad, and the large farm in northwestern Minnesota, but by dividing the total acreage of all farms into the total yield. Comparing the average yield on these farms with the State average, it may be seen that these communities secured a higher yield per acre of oats, corn, and hay, but other crops ran lower than the State average.

TABLE III.—*Crop yields, 1905–1907, at Northfield, Marshall, and Halstad, compared with State average for the same period.*

Crop.	Northfield (Rice County).			Marshall (Lyon County).		
	Total acreage.	Total yield.	Yield per acre.	Total acreage.	Total yield.	Yield per acre.
	Acres.	*Bushels.*	*Bushels.*	*Acres.*	*Bushels.*	*Bushels.*
Wheat	[a] 41.697	625.50	15.00	1,352.460	17,032.22	12.59
Durum wheat	[b] 9.770	221.00	22.62	12.491	124.26	9.71
Oats	1,863.633	76,994.50	41.31	847.287	34,775.89	41.04
Barley	203.407	6,846.00	33.66	429.785	12,922.92	30.07
Flaxseed	81.662	986.00	12.07	168.176	1,475.50	8.77
Corn—grain	353.374	13,391.63	37.90	510.645	23,613.00	46.24
		Tons.	*Tons.*		*Tons.*	*Tons.*
Corn—fodder	258.893	622.24	2.40	242.721	462.63	1.91
Hay—wild and tame	561.101	1,281.66	2.28	343.456	607.89	1.77
					Bushels.	*Bushels.*
Timothy seed				9.720	46.50	4.78
		Tons.	*Tons.*			
Hemp	[c] 18.300	54.58	2.98			

Crop.	Halstad (Norman County).			Large farm in northwestern Minnesota.			All statistical farms: Average yield per acre.	Entire State: Average yield per acre.[d]
	Total acreage.	Total yield.	Yield per acre.	Total acreage.	Total yield.	Yield per acre.		
	Acres.	*Bushels.*	*Bushels.*	*Acres.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Wheat	1,496.698	18,497.24	12.36	1,972.855	22,921.00	11.62	12.15	12.4
Durum wheat	[a] 131.491	2,169.72	16.50				16.34	
Oats	467.295	13,540.12	28.98	[a] 352.707	6,496.00	18.42	37.33	31.5
Barley	425.189	8,685.22	20.43	[a] 147.432	2,169.00	14.71	25.40	25.8
Flaxseed	463.194	4,258.48	9.19	[a] 422.039	2,665.00	6.31	8.27	10.9
Corn—grain	[e] 14.86	541.00	36.40				42.72	31.0
		Tons.	*Tons.*		*Tons.*	*Tons.*	*Tons.*	*Tons.*
Corn—fodder	143.325	446.668	3.12				2.37	
Hay—wild and tame	[a] 553.994	960.964	1.73	227.187	269.00	1.18	1.85	1.72
		Bushels.	*Bushels.*		*Bushels.*	*Bushels.*	*Bushels.*	
Timothy seed	17.213	104.00	6.04	[f] 34.393	103.00	2.99	4.13	
							Tons.	
Hemp							2.98	

[a] Two years, 1906 and 1907.
[b] One year, 1905.
[c] Two years, 1905 and 1906.
[d] Compiled from Yearbook of the Department of Agriculture.
[e] One year, 1907.
[f] One year 1906.

NOTE. The weight per bushel of the grain as used in determining yield on the statistical farms is as follows: Wheat, 60 pounds; oats, 32 pounds; barley, 48 pounds; flaxseed, 56 pounds; corn, 56 pounds; timothy seed, 45 pounds. The State average is in Winchester bushels.

FACTORS OF COST.

The various factors which enter into the cost of producing field crops may be enumerated as follows: Man labor; horse labor; values consumed in farm machinery, seed, twine, etc.; and the rental value of land. In Tables IV, V, VI, and VII the cost of farm board and the cash value per hour of month labor and day labor are shown. Having obtained the actual cost per hour of man labor in any month the cost of any operation is easily computed by multiplying the number of hours of labor by the rate.

WAGES OF FARM LABOR AND COST.

AVERAGE MONTHLY CASH WAGES FOR FARM LABOR.

As man labor constitutes a large proportion of the cost of farm production, the average monthly wages paid to farm laborers indicates in a general way the comparative cost of production. It should be noted that laborers receive board in addition to the cash wages shown in the table following.

Labor receiving this scale of wages is usually hired by the season or by the year. In Minnesota, the wages of month labor are scaled to meet the demands of two seasons: The crop season from April 1 to November 30, when most of the work is done, and the winter season from December 1 to March 31, when there is little labor beside chores and the care of stock.

TABLE IV.—*Average monthly cash wages paid to farm laborers, 1904–1907.*

Month.	Northfield (Rice County).[a]			Marshall (Lyon County).				Halstad (Norman County).			
	1905.	1906	1907.	1904.	1905.	1906.	1907.	1904.	1905.	1906.	1907.
January	$14.29	$13.67	$18.75	$12.50	$10.50	$13.42	$13.57	$12.00	$10.00	$14.00	$12.00
February	13.33	13.67	17.75	12.50	11.00	12.12	11.58	12.00	10.00	14.00	10.66
March	16.43	13.67	18.75	14.00	17.86	13.33	16.28	12.00	10.00	14.00	13.00
April	25.33	24.33	28.00	26.66	21.29	23.13	28.98	25.00	25.00	23.70	26.50
May	25.14	24.33	28.00	24.80	23.71	28.08	28.88	24.40	25.00	24.33	27.50
June	25.14	24.33	28.33	26.40	23.71	27.08	27.35	24.40	25.00	25.00	27.50
July	25.14	25.17	29.17	29.00	24.86	27.76	27.35	25.40	25.00	25.00	27.50
August	25.14	25.37	29.17	30.00	27.33	27.76	27.35	22.60	25.00	25.00	30.50
September	25.14	25.50	28.33	29.00	29.86	29.23	27.05	24.80	25.00	25.00	28.00
October	25.29	25.50	28.33	28.00	26.43	26.71	26.18	25.25	25.00	25.00	28.00
November	24.86	24.33	28.37	22.20	25.00	26.29	25.00	25.00	25.00	25.00	27.50
December	13.14	18.75	17.37	13.00	17.14	16.47	22.00	11.66	11.66	12.00	8.00

LARGE FARM IN NORTHWESTERN MINNESOTA.

Month.	1904.	1905.	1906.	1907.	Month.	1904.	1905.	1906.	1907.
January	$12.00	$15.00	$16.12	$15.00	July	$25.00	$20.33	$28.00	$30.00
February	12.00	15.00	16.12	15.00	August	25.00	25.00	28.00	30.00
March	12.00	15.00	15.00	12.00	September	25.00	25.00	28.00	30.00
April	25.00	25.00	28.00	30.00	October	25.00	27.50	28.00	30.00
May	25.00	25.00	28.00	30.00	November	22.00	27.50	28.00	30.00
June	25.00	20.33	28.00	30.00	December	15.00	16.50	15.00	13.00

[a] No data for 1904.

RATE OF FARM BOARD.

The cost per month of board for a farm laborer is obtained by determining the total cost of board for the farm family and dividing this sum by the number of mature men boarded. This is arrived at in an arbitrary manner by considering the adult man as the unit. A boarder, be he hired or a part of the family, is considered as a unit or fraction of a unit according to size, weight, and labor performed. The average 16-year-old farm boy would be considered an equivalent of a man, while younger children are considered as fractions of the unit. The cost of board includes groceries, meats, farm produce of all kinds consumed in the household, fuel, depreciation of household goods, and current wages—usually $3 to $5 per week—for woman labor. All labor performed about the house by the men is also charged up at regular rates.

The "average cost, all farms," is obtained by adding the costs of all regions and dividing this sum by the total years of record.

The cost of board on these Minnesota farms makes up about one-third the total real wage received by the farm laborer, which is made up of cash wages and board.

TABLE V.—*Cost of farm board per month and per day per man, 1905–1907.*

Rate.	Northfield (Rice County).				Marshall (Lyon County).			
	1905.	1906.	1907.	Average.	1905.	1906.	1907.	Average.
Month	$11.18	$15.56	$16.35	$14.36	$11.89	$11.92	$14.39	$12.73
Day	.3726	.5186	.5450	.4786	.3963	.3973	.4796	.4243

Rate.	Halstad (Norman County).				1,820-acre farm (Norman County).			
	1905.	1906.	1907.	Average.	1905.	1906.	1907.	Average.
Month	$11.13	$12.01	$11.60	$11.58	$11.13	$10.46	$8.48	$10.02
Day	.3710	.4003	.3866	.3860	.3710	.3486	.2826	.3340

Rate.	640-acre farm (Stevens County).				Average, all farms.
	1905.	1906.	1907.	Average.	
Month	(a)	$16.00	$15.00	$15.50	$12.65
Day	(a)	.5333	.5000	.5166	.4216

[a] No data.

WAGES PER HOUR FOR MONTH LABOR, INCLUDING COST OF BOARD.

The wage rates shown in the table following are based upon cash wages and board cost as shown in Tables IV and V. In each region the total number of hours worked each month by the hired men

(monthly wage) is recorded, together with cash wages and cost of board. Dividing the sum of wages and board by the total hours of work gives the average rate per hour for the month. The labor of proprietors and other labor not paid for in cash is converted into a cash value at these rates, so that it may be included in the actual cost of production. Boy labor on farms is converted into the equivalent of man labor and reduced to a cash value at these same rates.

In the conversion of boy labor to man labor the labor performed is used as a criterion. A boy employed in plowing who covers the same extent of ground per day as a man would be considered as performing the labor of a man. A boy incapable of performing the work of a man, when engaged in heavy work, would be scaled according to the judgment of the route man, and be reported as a five-tenths or six-tenths man, etc.

The average, all farms, is determined by adding the rates, each month separately, for all years and all regions and dividing the result by the total number of rates given for each month.

TABLE VI.—*Rate of wages per hour (including cost of board) for man labor hired by the month, 1905–1907.*

Month.	Northfield (Rice County).				Marshall (Lyon County).				Halstad (Norman County).			
	1905.	1906.	1907.	Average.	1905.	1906.	1907.	Average.	1905.	1906.	1907.	Average.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	10.97	11.07	10.18	10.74	9.50	10.34	9.91	9.92	10.52	11.58	10.42	10.84
February	12.18	12.37	10.73	11.76	8.40	11.19	10.37	9.99	10.80	12.82	10.79	11.47
March	9.78	9.62	10.88	10.09	10.90	9.45	10.11	10.15	8.75	11.69	13.86	11.43
April	11.02	11.97	14.06	12.35	11.20	11.27	14.43	12.30	13.07	12.80	8.73	11.53
May	12.18	12.48	14.70	13.12	11.00	12.50	13.47	12.32	12.22	12.12	11.14	11.83
June	11.95	12.39	15.67	13.34	12.20	11.69	13.90	12.60	12.80	11.83	13.23	12.62
July	12.00	12.41	14.91	13.11	13.00	13.15	13.11	13.08	13.39	11.27	11.22	11.96
August	11.47	11.66	13.60	12.24	13.50	10.65	12.84	12.33	13.02	10.96	12.01	12.00
September	11.39	11.48	15.67	12.85	16.20	13.80	12.78	14.26	12.50	10.78	12.01	11.76
October	11.44	11.77	14.07	12.43	15.50	12.64	13.93	14.02	10.95	10.79	10.88	10.87
November	11.80	12.68	12.95	12.48	13.50	12.93	15.02	13.82	14.13	11.22	14.18	13.18
December	9.47	10.92	12.88	11.09	11.90	10.51	14.53	12.31	10.54	9.60	11.65	10.40

Month.	1820-acre farm (Norman County).				640-acre farm (Stevens County).				Average, all farms.
	1905.	1906.	1907.	Average.	1905.	1906.	1907.	Average.	
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	10.52	10.68	8.08	9.76	(a)	13.99	14.50	14.25	10.87
February	10.80	11.33	8.19	10.11	(a)	14.65	14.05	14.35	11.33
March	8.75	8.27	8.14	8.39	(a)	13.71	14.10	13.90	10.57
April	11.98	11.75	12.25	11.99	(a)	10.27	13.30	11.78	12.01
May	12.11	12.90	11.45	12.15	(a)	10.17	12.76	11.46	12.23
June	11.20	12.93	12.85	12.33	(a)	11.71	13.04	12.38	12.67
July	12.10	12.12	12.46	12.23	(a)	12.36	13.20	12.78	12.62
August	13.51	11.09	12.66	12.42	(a)	11.47	12.26	11.86	12.19
September	12.59	11.85	12.80	12.41	(a)	12.30	16.46	14.38	13.04
October	11.11	11.99	12.40	11.83	(a)	12.24	14.17	13.20	12.42
November	11.89	16.25	14.58	14.24	(a)	13.84	14.03	13.94	13.50
December	8.55	8.98	7.73	8.42	(a)	13.58	13.30	13.44	10.97

[a] No data.

WAGES PER HOUR FOR DAY LABOR, INCLUDING COST OF BOARD.

The rates per hour for this class of labor are based on the daily cash wage and the daily cost of farm board, this sum being divided by the number of hours' work performed. During July, August, September, October, and November these rates apply almost entirely to extra help hired for haying, harvest, and thrashing. At other seasons day help is employed on the small farms mainly in hauling manure and building, and in plowing and general farm work on the large farm in northwestern Minnesota.

In preparing the "cost tables" in this bulletin all day labor was kept separate from labor hired by the month and converted into a cash equivalent at its own rate.

TABLE VII.—*Rate of wages per hour (including cost of board) for man labor hired by the day, 1905–1907.*

Month.	Northfield (Rice County).				Marshall (Lyon County).				Halstad (Norman County).			
	1905.	1906.	1907.	Average.	1905.	1906.	1907.	Average.	1905.	1906.	1907.	Average.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	(a)	(a)	(a)	(a)	(a)	(a)	20.00	20.00	(a)	13.50	13.69	13.59
February	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	13.55	11.57	12.56
March	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	12.35	11.85	12.10
April	(a)	(a)	(a)	(a)	12.50	16.50	22.01	17.00	(a)	11.94	15.41	13.68
May	(a)	(a)	27.34	27.34	13.40	10.00	12.29	11.89	11.54	(a)	14.14	12.84
June	(a)	(a)	25.35	25.35	25.00	19.74	14.50	19.75	13.69	20.42	16.60	16.90
July	(a)	23.50	20.70	22.10	14.00	17.59	16.49	16.03	18.60	13.31	13.93	15.28
August	(a)	24.33	27.04	25.68	19.39	24.43	19.22	21.01	20.04	19.78	26.32	22.05
September	(a)	(a)	24.48	24.48	24.05	25.71	(a)	24.88	22.15	26.73	22.42	23.76
October	(a)	(a)	21.47	21.47	21.03	41.80	29.12	30.65	22.56	22.50	29.21	24.76
November	(a)	(a)	22.28	22.28	(a)	31.00	43.25	37.12	(a)	18.23	13.38	15.89
December	(a)	(a)	17.80	17.80	(a)	.....	20.55	20.55	(a)	19.75	19.73	19.74

Month.	1,820-acre farm (Norman County).				640-acre farm (Stevens County).				Average, all farms.
	1905.	1906.	1907.	Average.	1905.	1906.	1907.	Average.	
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	(a)	17.40	(a)	17.40	(a)	(a)	16.20	16.20	16.16
February	(a)	17.40	(a)	17.40	(a)	(a)	14.60	14.60	14.28
March	12.54	(a)	(a)	12.54	(a)	(a)	13.40	13.40	12.74
April	(a)	(a)	(a)	(a)	(a)	12.61	(a)	12.61	15.16
May	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	14.78
June	16.08	(a)	14.10	15.09	(a)	(a)	(a)	(a)	18.39
July	16.41	(a)	(a)	16.41	(a)	16.45	17.67	17.06	17.15
August	17.93	(a)	(a)	17.93	(a)	23.42	21.04	22.23	22.09
September	21.74	29.40	49.75	33.63	(a)	22.58	24.37	23.48	26.67
October	14.43	16.00	49.75	26.73	(a)	(a)	(a)	(a)	26.79
November	18.61	16.00	17.28	17.29	(a)	17.30	13.05	15.18	21.04
December	(a)	(a)	(a)	(a)	(a)	15.24	12.47	13.86	17.59

(a) No data.

MAINTAINING THE FARM HORSE AND COST OF HORSE LABOR.

The labor of horses, practically the entire motive power in farm operations, constitutes one of the heavy costs of farming. In order to have motive power available at seed time and harvest, the farmer is obliged to feed and house horses through seasons of practical idle-

ness. The average annual cost of maintaining a farm work horse is approximately $80, and for this cost of maintenance the animal gives a return in work of about three hours per day throughout the year (see Tables VIII and XLII). Managing horse labor so as to keep this cost at a minimum is one of the difficult problems in farm management. At the Minnesota Experiment Station, where the teams are kept busy approximately eight hours per day, the cost per hour of horse labor is about 3 cents, while on the average Minnesota farm it is about 8 cents. Any system of farming which provides regular summer and winter work for the horses will prevent the waste caused by their "eating their heads off" half the year so that they may be available for work at other seasons. In Table IX it may be seen that the cost per hour of horse labor at Northfield is 2 cents higher than at Halstad, showing contradictory evidence, therefore, to the general contention that diversified farming decreases the cost of horse labor. The main cause for this difference lies in the higher feed cost at Northfield (see Table VIII). Dividing the average annual cost ($90.40) by the average cost per hour ($0.0925) gives 977 as the total number of hours worked in a year by the average horse at Northfield. At Halstad by the same process $75.07 divided by $0.0732 gives 1,025 hours for the average horse in the grain-growing country. This is a good example of waste caused by unnecessarily heavy feeding and lack of good care.

The explanation for fewer hours of work annually in the region of diversified farming (Northfield) lies undoubtedly in the large area of grass land per farm, which reduces the amount of work for the horses below any amount which is substituted in the horse labor necessary to the care of stock, marketing produce, etc. While the area of grass land is greater, thus affording less field work per farm, the trouble would seem to be in the fact that the system of management is wrong that reduces the amount of work to be performed and does not reduce the number of work horses on the farm to a corresponding extent. On many farms from one to three unnecessary horses are kept, mainly that they may be available during a few days when the crops are being harvested. The cost of keeping a horse for a year ($80) is sufficient to hire a team for a number of days. Any farmer who studies his cost of production can soon tell whether a horse can well be dispensed with, and thus reduce his cost of horse labor by the cost of keeping one horse.

The cost of horse labor per hour is determined by dividing the average annual cost of maintenance by the average number of hours each horse works during the year. This cost per hour is then charged against each project according to the number of hours' horse labor it receives.

ANNUAL COST OF MAINTENANCE.

The cost of depreciation and interest on investment have been computed in the table below from actual inventories of work horses taken during these years. The annual depreciation of $5 or $6 per horse is probably not high enough to represent an average through a long term of years. The depreciation has been affected by the abnormal conditions prevailing in the Minnesota horse markets during the past few years. The value of a horse has increased almost rapidly enough to offset the depreciation, while in young horses the increase in values has been so great that no depreciation is shown. This was particularly the case on the large farm in Norman County, where very little depreciation is shown.

The average life of a farm horse does not exceed ten to fifteen years, so that the annual depreciation is between $6 and $10. The annual cost per horse is higher in 1907 than in preceding years, owing principally to the large increase in cost of feed in 1907.

TABLE VIII.—*Average annual cost of maintaining a farm work horse.*

Item.	Northfield (Rice County).					Marshall (Lyon County).				
	1904.	1905.	1906.	1907.	Average.	1904.	1905.	1906.	1907.	Average.
Interest on investment	$3.24	$5.76	$6.43	$6.74	$5.54	$3.79	$4.96	$5.16	$4.83	$4.68
Depreciation	15.48	.98	1.45	4.35	5.56	9.86	4.20	6.71	6.97	6.94
Harness depreciation	1.47	1.89	3.64	1.39	2.10	1.47	2.18	2.35	.57	1.64
Shoeing	1.11	1.55	1.54	1.46	1.42	.53	.41	.45	.57	.49
Feed	63.49	51.91	63.54	75.03	63.49	68.96	51.91	50.05	63.90	58.70
Labor	11.77	9.65	11.11	15.01	11.88	13.14	13.92	13.35	15.81	14.06
Miscellaneous expenses	.55	.44	.34	.29	.40	.62	.55	.23	.57	.49
Total	97.11	72.18	88.05	104.27	90.40	98.37	78.13	78.30	93.22	87.00

Item.	Halstad (Norman County).					1,820-acre farm (Norman County).				
	1904.	1905.	1906.	1907.	Average.	1904.	1905.	1906.	1907.	Average.
Interest on investment	$5.14	$5.55	$5.63	$4.32	$5.16	$4.47	$4.56	$4.29	$3.64	$4.24
Depreciation	7.37	6.20	7.12	2.60	5.82	.....	1.77	.....	2.38	1.04
Harness depreciation	1.95	1.27	1.85	.32	1.35	1.56	1.45	1.33	.05	1.10
Shoeing	.14	.11	.10	.12	.12	.....	.....	.....	.....	.....
Feed	42.28	37.69	42.23	47.15	42.34	40.18	37.29	36.54	46.82	40.21
Labor	20.09	16.86	19.03	22.73	19.68	14.24	18.06	20.54	21.64	18.62
Miscellaneous expenses	.33	1.64	.28	.18	.61	.....	.12	.....	.....	.03
Total	77.30	69.32	76.24	77.42	75.07	60.45	63.25	62.70	74.53	65.23

The annual cost of horse labor must be reduced to "cost per hour" in order accurately to distribute it to the various farm enterprises. The cost of horse labor is sometimes computed on the daily basis—in this table the average cost per day is about 25 cents—and the various farm enterprises charged with so many days' horse labor. This method is incorrect. Ten hours of horse labor on the corn crop cost

80 cents, not 25 cents, for the farm horse constitutes an item of expense for many days when he is idle, and the annual cost of maintenance should be distributed pro rata by hours to the various enterprises.

The cost per hour of horse labor on the 1,820-acre grain farm in Norman County is approximately the same as on the small farms in the same region, and yet, as shown in Table VIII, the average annual cost of keep on the large farm is $65.23 and $75.07 on the small farms. The similar rates per hour on the true costs in production are caused, therefore, by a greater number of hours' work annually by the horses on the small farms (1,025 hours per horse on the small farms and 877 hours per horse on the large farm). It is undoubtedly true on the large grain farms that in order to seed and harvest "in season" a larger proportionate number of idle horses must be maintained throughout the idle seasons than on the small farms.

TABLE IX.—*Cost of horse labor per hour.*

Station.	1904.	1905.	1906.	1907.	Average.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Northfield (Rice County)	8.33	8.52	9.13	11.02	9.25
Marshall (Lyon County)	8.95	7.16	8.31	9.62	8.36
Halstad (Norman County)	7.27	6.72	7.62	7.67	7.32
1,820-acre farm (Norman County)	6.66	7.68	6.79	8.77	7.46

DEPRECIATION OF FARM MACHINERY PER ACRE.

The annual farm-machinery depreciation is commonly estimated at 10 per cent. Statistics collected show the average annual depreciation of all classes of farm machinery to be approximately 7.3 per cent (see Table X). Total depreciation of all classes of farm machinery constitutes a single item of expense in ordinary accounting, but in determining the cost of producing field crops per acre machine depreciation must be reduced to the acre cost and then distributed to the various crops. The values consumed per acre in farm machinery are shown in Tables XI and XII. These are necessary in computing the cost of production per acre, while Table X shows the relative average life of machinery and the rapidity of its depreciation.

The annual rates of depreciation for all classes of farm machinery are expressed in Table X in percentage terms. One hundred per cent representing the original value of the machine and 10 per cent the annual depreciation, the life of the machine would then be ten years. The average annual depreciation of grain binders is shown to be 7.91 per cent, indicating an average life on these farms of 12.6 years. The annual depreciation—expressed in percentages—has been computed from inventories of each class of machinery showing the original price, years in use, and present value. The annual depreciation in

dollars thus obtained divided by the average original investment gives the annual percentage rate of depreciation.

The average depreciation of all machinery was obtained by adding the statistics for all machines inventoried and making computations as previously described—not by averaging the rates of depreciation in each region of Minnesota.

TABLE X.—*Annual depreciation in value of farm machinery expressed in percentages.*

Machine.	Northfield (Rice County).	Marshall (Lyon County).	Halstad (Norman County).	1,820-acre farm (Norman County).	640-acre farm (Stevens 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	7.89
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	7.20	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

The values consumed in farm machinery comprise depreciation, cash and labor repairs, and interest on the average annual investment. Dividing the sum of these items for each kind of machine by the average annual acreage upon which the machine is used gives the values consumed per acre per year. All of the above costs, except "interest on the average investment," were computed from inventories and repair charges recorded during the years 1902–1907. From the inventories of these machines and the "years-in-use" records it was possible to compute the average original investment and total life of each class of machinery. The average investment in a machine is the sum of all inventory values during the life of the machine divided by the number of years in the life period. The average investment in any machine is easily computed by adding the original investment, closing invoice and annual depreciation and dividing the sum by 2. Interest on this sum at 6 per cent constitutes the average annual "carrying charge" on machinery.

The values consumed in wagons, sleds, and racks are distributed to the various crops in proportion to the number of hours these im-

plements were used in producing the corn, small grain, and hay crops, respectively.

The average of all machine cost per acre is determined by totaling the costs for all machines in all regions and dividing this sum by the total average annual number of acres gone over with the machines.

The present value or the inventory value is based upon the relative value of the machine as nearly as it can be ascertained, taking into consideration the life of the implement, its use, the condition it is now in, and its future usefulness. Due consideration is given to the exchange value of the machine if sold or traded for new machines, or its auction value.

TABLE XI.—*Values in farm machinery consumed per acre annually, 1902–1907.*

Machinery.	Northfield (Rice County).	Marshall (Lyon County).	Halstad (Norman County).	1,820-acre farm (Norman County).	640-acre farm (Stevens County).	Average, all farms.
Grain machinery:						
Binders	$0.240	$0.247	$0.160	$0.135	$0.175	$0.181
Reapers	.....	.....	.....	.171	.....	.171
Drills, seeders	.104	.101	.077	.036	.075	.075
Fanning mills	.019	.016	.....	.004	.016	.010
Grain tanks	.....	.....	.....	.012	.....	.011
Wagons, sleds, and racks	.041	.041	.036	.023	.....	.034
Corn machinery:						
Binders	1.199	.911	.653	.....	.251	.826
Planters	.094	.080	.....	.....	.....	.087
Cultivators	.171	.145	.218	.....	.086	.155
Wagons, sleds, and racks	.171	.159	.100	.....	.....	.158
Hay machinery:						
Mowers	.332	.310	.150	.146	.166	.206
Rakes	.152	.106	.081	.018	.026	.085
Tedders	.113	.....	.....	.....	.....	.113
Loaders	.300	.....	.100	.....	.....	.151
Ropes, forks, etc	.078	.200	.....	.....	.....	.120
Wagons, sleds, and racks	.064	.061	.059	.036	.....	.059
All crop machinery:						
Plows	.086	.132	.078	.061	.119	.087
Harrows	.027	.021	.017	.006	.024	.017
Disks	.185	.097	.....	.....	.632	.089
Thrashing outfit	.....	.....	.....	.335	.....	.335

The acre cost of all machines commonly used in the production of corn, small grain, and hay is assembled to show the total values consumed per acre on each route. The wide difference between the same classes of machinery on different routes is principally due to the smaller acreage upon which the machines were used, thus increasing the cost per acre, since a large part of the values consumed per acre is the interest and the depreciation charge. The charge is practically the same on each route. The prolongation of the life of the machine, which may be accomplished on a smaller acreage for a year or two, does not materially affect the acre cost. When corn is husked in the field, no binder being used, the values in farm machinery consumed per acre on the corn crop decrease by the value consumed in corn binders; thus the cost per acre for machinery values on the corn crop at Northfield becomes 54.9 cents, at Marshall 53.7 cents, and 49 cents at Halstad.

The higher cost of grain machinery on the 1,820-acre farm, 61.2 cents per acre against 37.2 cents at Halstad, is due partly to the fact that a thrashing outfit is maintained on the large farm. This is a machine not commonly owned by the small farmer, so that the value consumed per acre does not appear in the values of grain machinery on the other routes.

TABLE XII.—*Values in farm machinery consumed per acre annually for the corn, small grain, and hay crops.*

Machine.	Corn.			Small grain.				Hay.			
	Northfield (Rice County).	Marshall (Lyon County).	Halstad (Norman County).	Northfield (Rice County).	Marshall (Lyon County).	Halstad (Norman County).	1,820-acre farm.	Northfield (Rice County).	Marshall (Lyon County).	Halstad (Norman County).	1,820-acre farm.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Grain binders				24.0	24.7	16.0	13.5				
Grain drills			7.7	10.4	10.1	7.7	3.6				
Fanning mills				1.9	1.6	.4	.4				
Grain tanks							1.2				
Thrashing outfit							33.5				
Corn binders	119.9	91.1	65.3								
Corn planters	9.4	8.0									
Corn cultivators	17.1	14.5	21.8								
Mowers								33.2	31.0	15.0	14.6
Rakes								15.2	10.6	8.1	1.8
Plows	8.6	13.2	7.8	8.6	13.2	7.8	6.1				
Harrows	2.7	2.1	1.7	2.7	2.1	1.7	.6				
Disks											
Wagons, sleds, and racks	17.1	15.9	10.0	4.1	4.1	3.6	2.3	6.4	6.1	5.9	3.6
Total	174.8	144.8	114.3	51.7	55.8	37.2	61.2	54.8	47.7	29.0	20.0
Disks used instead of plows (corn land)				18.5	9.7						
Total (disks instead of plows)				61.6	52.3						

LAND RENTAL.

The rental value of land is not usually considered by farmers as an item of expense in the production of crops when they own the land. It is a legitimate item of expense, however, and must be included in those costs which when substracted from the gross receipts will give net receipts. Land rental, as the term is popularly used, refers to interest on the investment, and, as used in this bulletin, includes interest on investment, taxes, and insurance. The average selling value of the land at Northfield is $70; Marshall, $60; Halstad, $35, and the 1,820-acre farm, $30. With an interest rate of 5 per cent at Northfield and Marshall, and 6 per cent at Halstad and the large farm, land rental amounts to $3.50 at Northfield, $3 at Marshall, $2.10 at Halstad, and $1.80 on the large farm.

These land rentals have been used throughout the bulletin in the tables on cost of producing field crops. Many farms in Minnesota do not return 5 or 6 per cent upon the investment, nor could they be rented for a cash rent of $1.80 to $3.50 per acre. Yet the farmer should not, as a business man, be satisfied with a return on his investment of less than the current interest rates, for his capital withdrawn from agriculture might be reinvested in other industries or loaned, thus obtaining the "going rate" upon his money. The assertion is often made that the farmer can well be satisfied with a low return upon his investment, since his money is invested in the safest of all securities—land—and that a satisfactory return would be the equivalent of that obtained from our highest class bonds. This may be true to a limited extent, but the farmer's investment in his farm differs from a mere investment in a gilt-edge security. It is an investment in his business from which he must obtain his livelihood, and, furthermore, a business that has its vicissitudes, that is subject to great risks and to competition. Hence it is just to include land rent, determined by current interest rates on land value, as an item of expense in the production of crops.

It is held by some writers on agricultural "cost data" that the loss of soil fertility should also be included as an item of expense in the production of crops. This claim is not tenable. The soil, as a form of capital, can not be compared with machinery or buildings which undergo depreciation. These forms of capital depreciate in spite of the best management, and all costs must, therefore, include a reasonable charge for depreciation of this kind. The loss of soil fertility, on the other hand, depends upon the system of farming practiced, the number of live stock kept on the land, and the methods of tillage. Good farm management continually maintains the productivity of the soil, while poor farm management gradually decreases it. If loss of soil fertility were charged as an expense in the cost of producing wheat, it would also be fair to decrease the cost of producing clover by the estimated value of nitrogen returned to the soil.

THE ACRE AS A BASIS.

Cost per acre, rather than the cost per bushel or per ton, has been made the basis for computing the cost of producing field crops. Cost per bushel or per ton varies so greatly with yield that neither can be used as a basis, unless statistics of yield are collected for many years in order to secure a representative average. Moreover, cost per acre does not vary in direct proportion to the yield. The cost of producing a 3-ton crop of hay is not one-half greater than that of producing a 2-ton crop. Items of cost such as mowing, raking, machinery depreciation, and land rental are approximately the same for each crop,

and the cost of cocking and loading will not increase greatly for the heavier crop, because both man labor and horse labor are employed more efficiently and with less waste. The same statement is true of wheat and other small grain. Items of cost such as seed, plowing, harrowing, seeding, cutting, machinery values consumed, and land rental are fixed charges comprising about 76 per cent of the total cost of wheat production, and are the same for a 10 as for a 20-bushel crop. The cost of twine, shocking, stacking, and thrashing varies somewhat with the crop yield, but the variation is so small that the acre cost is applicable to the great majority of crops. Yields can undoubtedly be made to vary according to the cost of preparation of soil, and an extra dollar per acre spent in tillage is likely to be returned with a profit. With similar cost of soil preparation and varying yields due to climatic influences, the acre cost of production varies but little from year to year because of differences in yield.

In the accompanying tables the individuality of a large grain farm in Norman County has been preserved, and the statistics secured from it have not been included in the averages for Norman County. The size of the fields, the character of the machinery, and the management of the labor are so widely different from the conditions on the 160-acre farms of the same region as to make the costs more comparable with the general average.

The cost per acre of potato production (Tables XXXV and XXXVI) was computed from two large potato and grain farms in Clay County, northwestern Minnesota, where the annual area of potatoes is about 500 to 600 acres. This cost is, therefore, truly representative of commercial potato production.

The cost of production per acre is uniformly higher at Northfield than at either Marshall or Halstad. This is mainly due to the higher land rental, but, exclusive of this item, the cost of labor and machinery is also higher. This higher labor cost at Northfield is undoubtedly due to smaller and more irregular fields and to the use of many walking plows, sulky plows, two-horse and three-horse drills and harrows, instead of the gang plows and other four-horse outfits used at Halstad. The difference in the capacity of thrashing outfit should also be considered, the efficiency being less for a given amount of labor at Northfield than at Marshall or Halstad.

The cost per acre of marketing farm products has not been included in the statistics of cost of production. The cost per acre of marketing varies so greatly with the distance hauled, size of load, condition of roads, and yield per acre that it was omitted from the tables. It is an expense that must not be ignored, however, and will fall heaviest on those crops which are marketed directly, as wheat and flaxseed, and least on those which are condensed by feeding to live stock. By using the rates of wages for man and horse labor

given in Tables VI and IX, the cost of marketing a given unit of product may easily be determined.

The cost of marketing grain was found to average about 17 cents per ton per mile under the conditions of these farms, which were 2 to 10 miles from town. The roads in these counties are mostly earth roads, comparatively level, and, when in good condition, permit large loads.

GENERAL EXPENSE.

Upon all farms certain expenditures of cash and labor are made which constitute a charge against the farming operations as a whole rather than against any one enterprise. Such charges are therefore grouped under the head, "General expense."

Thus far no entirely satisfactory method has been determined whereby this expense may be properly and justly distributed to the various enterprises of the farm. No attempt has therefore been made in this bulletin to include any portion of the general expense account as an item of expense against each crop.

General expense on each farm has averaged between 80 cents and $1 per acre. Thus the acre cost of production would be increased by this amount. It is probable that in a future study of farm profits this account will be apportioned among the productive enterprises in proportion to the other expenses incurred by them.

COST OF PRODUCTION PER ACRE.

The cost exhibits, Table XIII, include seed, labor of men and horses, machinery values consumed, and land rental.

In making comparisons between the cost of production of various crops, the statistics should be used from one county if exactness of conditions influencing cost is desired. Land rental, size of farms, and the character of labor differ quite materially in the different sections of the State in which these statistics were gathered.

In column 1, Table XLI, the average cost of production for the important crops is shown, exclusive of land rental, the average being based on total acreage of crop.

The other statistics of cost of production in Table XLI include land rental and are weighted averages—that is, the sum of the total cost of production of each crop on its total acreage in each region is divided by the total acreage of that crop in all regions.

The detailed tables which follow on the cost of producing the grains include stack thrashing, rather than shock thrashing, on account of the fact that there was a larger acreage thrashed from the stack than from the shock; hence stacking and stack thrashing are considered typical operations in obtaining the cost of production. A discussion

of the relative cost of stack and shock thrashing may be found in Bulletin No. 48, Bureau of Statistics, and in Bulletin No. 97, Minnesota Experiment Station.

TABLE XIII.—*Average annual cost per acre of producing field crops, 1902–1907.*

[Including rental of land.]

Crop.	Number of table which shows detailed cost.	Northfield (Rice County).	Marshall (Lyon County).	Halstad (Norman County).	Minnesota Agricultural Experiment Station.	Large farm, northwestern Minnesota.	Average, all farms.
Barley—fall plowed	XIV	$9.647	$8.880	$7.003	.....	$6.179	$8.211
Clover—cut for seed	XV	6.500	.....	.....	.....	.....	6.500
Corn—ears husked from standing stalks	XVI	11.658	9.662	.....	.....	.....	10.438
Corn—cut, shocked, and shredded	XVII	15.297	.....	.....	.....	.....	15.297
Corn—cut, shocked, and hauled in from the field	XVIII	.....	10.265	.....	.....	.....	10.265
Corn—grown thickly and siloed	XIX, XX	20.627	.....	.....	$19.187	.....	19.892
Flaxseed—thrashed from windrow	XXII	10.072	.....	7.272	.....	6.283	7.496
Flaxseed—stacked from windrow	XXIII	.....	8.861	7.028	.....	.....	7.851
Flaxseed—bound, shocked, stacked, and thrashed	XXIV	.....	8.400	6.895	.....	.....	7.278
Fodder corn—cut and shocked in field	XXV	10.733	.....	8.912	.....	7.896	9.650
Fodder corn—cut, shocked, and stacked	XXVI	12.362	.....	.....	.....	.....	12.362
Hay—timothy and clover (first crop)	XXVII	6.185	5.553	4.567	.....	.....	5.591
Hay—timothy and clover (two cuttings)	XXVII	7.178	.....	.....	.....	.....	7.178
Hay—millet	XXVIII	9.317	7.971	6.349	.....	.....	7.105
Hay—wild grasses	XXIX	6.036	5.478	2.970	.....	2.584	4.042
Hay—timothy	XXX	.....	.....	.....	.....	3.394	3.394
Hemp	XXXI	6.741	.....	.....	.....	.....	6.741
Mangels	XXXII	.....	.....	.....	32.682	.....	32.682
Oats—fall plowed	XXXIII	9.854	9.039	7.110	.....	6.073	8.863
Oats—on disked corn stubble	XXXIV	9.158	8.092	.....	.....	.....	8.884
Potatoes—machine production	XXXV	.....	.....	.....	.....	[a]26.366	26.366
Potatoes—machine production (use of fertilizer)	XXXVI	.....	.....	.....	.....	[a]37.721	37.721
Timothy—cut for seed	XXXVII	5.985	5.512	4.310	.....	3.432	4.332
Wheat—fall plowed	XXXVIII	9.861	8.389	6.977	.....	6.056	7.249

[a] Figures of Clay County large farm.

BARLEY.

Barley is grown mostly on late spring plowing at Halstad, fall plowing at Marshall, and part spring and part fall plowing at Northfield. In order to eliminate differences in cost due to season of plowing, the cost of plowing has been entered in all tables as fall plowing.

The average number of harrowings the land received at Northfield was two and one-third; Marshall, one and two-thirds; Halstad, two and one-half; and the large farm in northwestern Minnesota, two.

TABLE XIV.—*Cost of producing barley—fall plowed.*

Item.	Northfield (Rice County).			Marshall (Lyon County).			Halstad (Norman County).		
	Total acreage, five years.[a]	Total cost.	Cost per acre.	Total acreage, five years.[a]	Total cost.	Cost per acre.	Total acreage, five years.[a]	Total cost.	Cost per acre.
Seed	360.552	$364.430	$1.011	1,067.562	$1,047.480	$0.981	722.544	$495.180	$0.685
Cleaning seed	202.815	8.465	.042	848.978	31.335	.037	500.631	24.702	.049
Plowing	4,773.396	5,996.560	1.256	5,973.625	6,814.320	1.141	7,186.027	8,120.460	1.130
Dragging	397.488	133.614	.336	953.082	150.187	.158	841.282	262.330	.312
Seeding	403.608	110.186	.273	1,048.472	278.606	.266	807.988	236.463	.293
Cutting	411.248	185.717	.452	1,088.764	373.225	.343	782.452	284.702	.364
Twine	300.408	87.900	.293	997.124	301.930	.303	513.652	119.260	.232
Shocking	411.248	69.344	.169	1,074.244	144.202	.134	772.232	120.331	.156
Stacking	224.359	153.298	.683	1,056.835	631.436	.597	490.313	250.700	.511
Stack thrashing (labor)	199.582	98.969	.496	804.405	239.725	.298	374.293	119.960	.320
Thrashing, cash cost	86.162	53.340	.619	804.405	855.660	1.064	374.293	179.790	.480
Machinery cost			.517			.558			.371
Land rental			3.500			3.000			2.100
Total			9.647			8.880			7.003

LARGE FARM IN NORTHWESTERN MINNESOTA.

Item.	Total acreage, five years.[a]	Total cost.	Cost per acre.	Item.	Total acreage, five years.[a]	Total cost.	Cost per acre.
Seed	358.742	$253.340	$0.706	Shocking	358.742	$57.945	$0.162
Cleaning seed	306.590	20.540	.067	Shock thrashing (labor)	240.192	199.570	.831
Plowing	5,363.458	4,958.430	.924	Values consumed in thrashing outfit			.335
Dragging	358.742	95.118	.265	Machinery cost			.276
Seeding	358.742	80.464	.224	Land rental			1.800
Weeding	117.040	1.400	.012				
Cutting	358.742	124.028	.346				
Twine	358.742	82.770	.231	Total			6.179

[a] "Total acreage," in these tables, does not mean the number of acres devoted to the crop in question; it means the number of acres on which the computation is based, the number for which statistics were collected.

The acreage shown is not the same for all operations, for several reasons. Climatic conditions during the summer season may decrease the harvested as compared with the sown area; or to illustrate more fully, the farmers may sow 3,400 acres to wheat in the spring; the seed sown on 25 acres may not be properly reported; for only 2,400 acres may seed have been cleaned, the remainder being sown with uncleaned seed; because of tracts being drowned out or, on account of weediness, cut for hay, only 3,300 acres may have been harvested, of which perhaps 3,200 acres only may have been shocked; of this 2,000 acres may have been stacked and thrashed from the stack. The table of acreage would be as follows:

	Acres.		Acres.
Seed	3,375	Shocking	3,200
Cleaning seed	2,400	Stacking	2,000
Seeding	3,400	Stack thrashing	2,000
Cutting	3,300		

The cost of plowing is based on the total acreage plowed on each route in the fall or spring; this acreage and this cost are applied to the various crops according to the season in which plowing was done in preparing for them (see Table XXXIX).

CLOVER.

The net profit in saving the second crop of red clover for seed is equal to that of any other field crop adapted to Minnesota conditions when yields of two or more bushels per acre are obtained. In northern Minnesota the crop of seed is reliable and always of high quality, offering great possibilities to the farmer as a money crop.

There is no expense for soil preparation, seeding, or cultivation involved in growing the clover crop, as the seed is generally sown at the same time and with a grain crop.

TABLE XV.—*Cost of producing clover—cut for seed.*

Item.	Northfield (Rice County).			Item.	Northfield (Rice County).		
	Total acreage, two years.	Total cost.	Cost per acre.		Total acreage, two years.	Total cost.	Cost per acre.
Mowing	79.06	$29.084	$0.368	Cleaning seed	22.00	$0.838	$0.038
Raking	79.06	9.780	.124	Machinery cost			.484
Cocking	42.322	3.408	.081	Land rental			3.500
Hulling (labor)	22.00	6.905	.314				
Hulling (cash cost)	22.00	35.000	1.591	Total			6.500

CORN.

HILL CORN.—The seed bed at Northfield received an average of five harrowings and the crop was cultivated an average of four and one-half times. At Marshall the average number of harrowings was three and one-third, and number of times cultivated three and one-half.

In previously published tables of cost of corn production (Bulletin No. 48, Bureau of Statistics), 40 per cent of the cost of distributing manure on corn land was charged to the corn crop, the assumption being that the corn crop utilized this proportion of the manure value, the remainder being retained in the soil for succeeding crops. The effects of barnyard manure can be traced in the soil for many years, and since preparing Bulletin 48 the authors have decided that the distribution of manure is a "general expense" of the farm; hence no arbitrary division of the cost thereof among crops has been made in this bulletin.

On 235 acres of land at Morris, Stevens County, the cost of hauling and distributing 8 loads of manure to the acre with a 3-horse spreader was found to be $2.20 per acre. The cost per acre at Marshall, computed from 235.79 acres on four farms, was $2.86; on these farms the manure was all hauled with 3-horse spreaders an average distance of 67 rods; the average number of loads per acre was 8.2.

In computing the cost per acre of husking ears from standing stalks, all labor of men and horses was charged at the rates per hour for October and November shown in Tables VI and IX. Practically all husking in these sections of Minnesota is done by regular month laborers and by proprietors; labor is therefore charged at rates per month instead of per day or per bushel, as is the custom in some localities. Horse labor is charged at regular rates in husking corn,

in order to make the expense of this operation comparable with the cost of cutting and shredding corn. There is no justification, it may be noted, for omitting the charge for horse labor from the cost of husking corn. It is true that the work is easy for a team and that horses may increase rather than decrease in value while performing it; yet, although horses may be easily maintained while at this work, it is done at the expense of the corn crop. To do this work satisfactorily, moreover, requires a reliable team, and if used in husking instead of plowing, there is no good reason why horse labor should not be charged to the former the same as to the latter.

Husking ears from the standing stalks is undoubtedly done somewhat cheaper in the corn belt farther south than in Minnesota, owing to the greater proficiency of labor in this particular operation and to the larger sized ears.

No accurate data are available concerning the value for pasture of an acre of standing stalks. Stockmen estimate it at $1 to $1.50 per acre.

TABLE XVI.—*Cost of producing corn—ears husked from standing stalks.*

Item.	Northfield (Rice County).			Marshall (Lyon County).		
	Total acreage, five years.	Total cost.	Cost per acre.	Total acreage, five years.	Total cost.	Cost per acre.
Seed	694.725	$157.290	$0.226	1,293.749	$246.140	$0.190
Shelling seed	559.545	14.400	.026	584.896	14.898	.025
Plowing	803.331	1,053.520	1.311	1,413.235	1,655.342	1.171
Dragging	990.448	538.977	.544	1,224.083	536.826	.439
Planting (horse planter)	834.228	200.602	.240	1,255.053	320.350	.255
Cultivating	960.388	1,734.079	1.806	1,251.318	1,818.042	1.453
Weeding				192.455	22.940	.119
Husking	446.430	1,542.824	3.456	338.414	836.732	2.473
Machinery cost			.549			.537
Land rental			3.500			3.000
Total			11.658			9.662

SHREDDED CORN.—The cost of shredding is made up of several items: Cash paid per acre or per hour for the use of the shredder, the motive power, and the labor of machinists; the labor of the proprietor, hired men, and horses; board for that portion of the crew whose wages do not cover the cost of board.

Shredding the corn stover is often advocated as good farm economy because it saves a by-product otherwise wasted, and because cutting the corn cleans the stalks off the land and the shredded stover waste makes better manure than that containing coarse stalks. The cost of production, $15.297 per acre at Northfield, as compared with $11.658 for husked corn and $12.362 for thickly grown fodder corn, indicates, however, that the crop is expensive to handle. The yield of shredded stover in Minnesota will rarely exceed one and one-fourth tons per acre, and Prof. T. L. Haecker, of the Minnesota Ex-

periment Station, estimates the feeding value of a ton of shredded stover at $2.84 as compared with that of timothy at $6 and fodder corn at $4.90.

These statistics serve to show that the cost of shredding is not recovered in the value of product, and, if a minimum of $1 per acre be allowed for the pasture value of the cornstalks, the shredded stover is still more costly.

Fodder corn and clover hay are much cheaper forage crops than shredded stover, and the latter should be utilized only in case of losses to the hay or fodder-corn crops or the unforeseen need for additional forage. In localities where a high price can be obtained for hay in city markets and hay is, therefore, a valuable money crop, shredded stover is the relatively cheaper feed; where cost of production represents the value of the crops, a given acreage devoted partly to hill corn to be husked from the standing stalks and partly to thickly sown fodder corn will yield greater net values in grain, winter forage, and stalk pasture than the same acreage devoted entirely to hill corn. with the winter forage provided by shredding the stover.

For a complete discussion of this problem in farm management see Bulletin 48, Bureau of Statistics, Department of Agriculture.

TABLE XVII.—*Cost of producing corn—cut, shocked, and shredded.*

Item.	Northfield (Rice County).			Item.	Northfield (Rice County).		
	Total acreage, five years.	Total cost.	Cost per acre.		Total acreage, five years.	Total cost.	Cost per acre.
Seed	694.725	$157.290	$0.226	Shocking and tying	343.579	$175.050	$0.509
Shelling seed	559.545	14.400	.026	Twine	321.499	143.710	.447
Plowing	803.331	1,053.520	1.311	Picking up ears	139.230	34.600	.249
Dragging	990.448	538.977	.544	Shredding	181.164	717.929	3.963
Planting (horse planter)	834.228	200.602	.240	Machinery cost			1.748
Cultivating	960.388	1,734.079	1.806	Land rental			3.500
Cutting (corn binder)	367.399	267.547	.728	Total			15.297

SHOCK CORN.—For yard feeding to fat cattle and hogs in the late fall a portion of the crop can be handled economically by shocking, and, if cut when the ears are matured but prior to frosts and full maturity of stalk and leaf, the fodder will be more valuable than shredded stover from fully matured cornstalks.

This method of handling corn is, because of economy of labor, especially valuable to the cattle or hog feeder, as the stock readily do the husking and with a minimum of waste.

TABLE XVIII.—*Cost of producing corn—cut, shocked, and hauled in from field.*

Item.	Marshall (Lyon County).			Item.	Marshall (Lyon County).		
	Total acreage, five years.	Total cost.	Cost per acre.		Total acreage, five years.	Total cost.	Cost per acre.
Seed	1,293.749	$246.140	$0.190	Shocking and tying	386.777	$113.130	$0.292
Shelling seed	584.896	14.898	.025	Twine	422.387	127.470	.302
Plowing	1,413.235	1,655.342	1.171	Hauling	205.987	206.512	1.003
Dragging	1,224.083	536.826	.439	Machinery cost	.....	.....	1.448
Planting (horse planter)	1,255.053	320.350	.255	Land rental	.....	.....	3.000
Cultivating	1,251,318	1,818.042	1.453	Total	.....	.....	10.265
Cutting (corn binder)	420,577	288.924	.687				

ENSILAGE.—The cost of seed, plowing, dragging, planting, cultivating, farm-machinery cost, and land rental has been calculated from statistics on the cost of producing fodder corn at Northfield, and all other costs, as expense for silo, from statistics secured at the Minnesota Agricultural Experiment Station during the years 1905, 1906, and 1907. Amounts of labor have been reduced to a cash equivalent at Northfield rates of wages for month labor, so that the entire cost of producing this crop is representative of actual farm conditions.

The average yield per acre of green corn during these years was 10.84 tons. In 1906 a 2-acre crop of silage corn, grown on alfalfa sod at the Experiment Station, yielded 15 tons to the acre.

The cost of power machinery used in cutting ensilage is estimated on the basis of a cost of $8 a day. Of this $3 covers engineer's wages and $5 the rental of an engine with a capacity of at least 50 tons per day. Coal has been considered as a separate item. In some instances an engine and engineer can not be hired for this sum, and, especially if engines are in demand for thrashing, the cost of power and machinery will amount to $10 or $15 per day. Eight dollars per day is thought to be an average charge for power machinery, for a majority of farmers prefer to rent power for this work, unless the farm is large enough to make a large engine a useful machine for other work.

The annual depreciation, repairs, and interest on investment on a $175 ensilage cutter in use at the Minnesota Agricultural Experiment Station is about $30. Forty-five acres of fodder corn are raised annually, making the cost per acre $0.666.

In the absence of exact statistics on silos, the depreciation charges and interest on the silo investment have been estimated as follows: A good wood silo, capacity 150 tons, costing $300, will last about fifteen years. This makes an average annual depreciation charge of $20. While repairs might prolong the life of the silo beyond fifteen years, it is not probable that repair and depreciation charges could be

reduced below $20 per year. The average investment in the silo per year is $160. At 5 per cent this makes an annual expense of $8 for interest on investment. A 150-ton silo will require about 15 acres of fodder corn each year to fill it. Therefore, total annual charges for depreciation and interest on investment are divided by 15 to reduce to cost per acre.

It is impracticable to make exact charges for interest on investment and depreciation in buildings in the case of such crops as hay, fodder corn, and shredded stover, which are either shocked or stacked in the field or stored in the mows of barns built primarily for the shelter of live stock. Special hay sheds are, of course, an exception. When corn is siloed, however, a special and expensive building must be erected for storing the crop, and therefore the entire charges for interest on investment and depreciation must be debited against the ensilage.

TABLE XIX.—*Cost of producing ensilage—Minnesota Agricultural Experiment Station, 1905–1907.*

Item.	Total acreage, three years.	Total cost.	Cost per acre.[a]	Item.	Total acreage, three years.	Total cost.	Cost per acre.
Seed	371.194	$161.960	$0.436	Values consumed in ensilage cutter	45	$30.000	$0.666
Plowing	803.331	1,053.520	1.311	Interest on silo investment	15	8.000	.533
Dragging	372.844	198.071	.531	Silo depreciation (150-ton)	15	20.000	1.333
Planting	344.005	101.367	.295	Farm machinery cost			1.748
Cultivating	353.904	431.009	1.218	Land rental			3.500
Cutting (corn binder)	115.500	76.405	.662				
Twine (714 pounds)	115.500	68.030	.589				
Hauling from field	115.500	300.988	2.606				
Loading, feeding, packing	115.500	188.462	1.632	Total			19.187
Coal (19,888 pounds)	115.500	57.690	.499				
Rental, power machinery, 23½ days	115.500	188.000	1.628				

[a] See Table XXV for items, seed, plowing, harrowing, planting, and cultivating.

The cost of seed, plowing, harrowing, planting, cultivating, farm machinery cost, and land rental in the following table are taken from data on the cost of producing fodder corn at Northfield. The labor of harvesting the crop and storing in the silo is figured from four farms in southeastern Minnesota for the years 1906 and 1907, the labor being partly day help and partly regular monthly labor. When labor in harvesting and storing is exchanged among farmers, so that no high-priced day labor need be included, the total cost of producing an acre of silage as determined from above amounts of labor and converted into cash values at month wages is reduced from $20.627, as indicated in Table XX, to $19.187.

TABLE XX.—*Cost of producing corn—thickly planted and siloed: Average of four farms in southeastern Minnesota, 1906–1907.*

Item.	Total acreage.	Total cost.	Cost per acre.[a]	Item.	Total acreage.	Total cost.	Cost per acre.[a]
Seed	371.194	$161.960	$0.436	Engine rent and engineer	70.89	$96.340	$1.359
Plowing	803.331	1,053.520	1.311	Values consumed in ensilage cutter	15.00	12.830	.855
Harrowing	372.344	198.071	.531	Interest on silo investment	82.50	60.120	.729
Planting	344.005	101.367	.295	Silo depreciation	82.50	117.99	1.430
Cultivating	353.904	431.009	1.218	Farm machinery cost			1.748
Cutting (oinder)	82.89	62.520	.754	Land rental			3.500
Twine (432½ pounds)	82.89	44.120	.532	Total			20.627
Loading and hauling, feeding and packing	82.89	447.100	5.394				
Fuel (coal, 13,730 pounds)	70.89	37.940	.535				

[a] See Table XXV for items, seed, plowing, harrowing, planting, and cultivating.

The average yield per acre of green corn on these farms, as determined from the silage mass, was 9.59 tons.

The use of a gasoline engine in place of renting a steam engine will usually cheapen the cost of production. Three farmers owning a gasoline engine in partnership report the power cost per acre at 82 cents, this amount including depreciation, interest on investment, repairs, and gasoline.

Statistics on the values consumed in ensilage cutters, interest on silo investment, and silo depreciation have been computed from inventories on farms, also the annual cost of the crop.

ENSILAGE IN MINNESOTA.

A few statistics are presented herewith to illustrate the comparative cost and feeding value per ton of ensilage, clover hay, fodder corn, and mangels. The comparative feeding values of these forage crops are taken, by the author's courtesy, from an unpublished work of Prof. T. L. Haecker of the Minnesota Agricultural Experiment Station.

TABLE XXI.—*Cost of production and feeding value of forage crops.*

Crop.	Yield per acre.	Cost of production.	Feeding value.	
	Tons.	*Per acre.*	*Per ton.*	*Per acre.*
Clover and timothy	2½	$7.178	$6.35	$15.873
Fodder corn	3½	12.362	4.90	17.150
Ensilage	10	19.187	1.88	18.800
Mangels	20	32.682	1.30	26.000

It may be seen from this table that mangels and ensilage at average yields return larger values in nutrients per acre than either hay or fodder corn, but that these nutrients are secured at much greater cost. In other words, the net value of the nutrients is not so great

for ensilage and mangels as for hay and fodder corn, and seems to be produced at a loss. To express these values in another way, $1 expended in capital and labor on the hay crop will give a return of $2.21; fodder corn, $1.38; ensilage, $0.98; and mangels, $0.79.

Neither ensilage nor mangels can be considered a cheap forage crop. Ensilage is a crop that belongs only with intensive farming, where the greatest profit results from keeping as large a number of live stock as possible on a given acreage. Clover benefits the land more in diversified systems of farming and reduces the operating expense of the farm. On all farms, however, where much live stock is kept, succulent feed is necessary for the best results from feeding. Where the number of stock is not sufficient to warrant the storing of from 100 to 150 tons of succulent feed, the erection of the silo is anything but economical, for the cost of storing and housing a small amount of ensilage is relatively greater than for a large tonnage, and the percentage of waste would also be much higher. Under such conditions a very small acreage of mangels will provide sufficient succulent feed for the live stock at less cost than ensilage. One acre of mangels yielding 20 tons will furnish 10 pounds of succulent feed per day to each of a herd of twenty cows through the winter feeding period of two hundred days, and a yield of 30 tons per acre will supply succulent food for thirty cows. Mangels fed in small amounts in conjunction with clover hay and fodder corn make a palatable and much cheaper ration than if ensilage be used as a large part of the roughage. Roots can be stored in a cellar dug under the barn alley, and thus the cost of a special building for storing the crop is avoided.

Two rations for a cow yielding 25 pounds of 4 per cent milk daily are appended hereto to illustrate the fact that mangels and mixed hay furnish a well-balanced ration with a reasonable amount of succulence, and considerably cheaper than a ration the roughage of which is composed largely of ensilage.

The special or good dairyman with twelve to twenty highly productive cows, well cared for, can feed ensilage with profit. The average farmer with six to twelve common cows which receive ordinary or indifferent care will find it more profitable to feed Ration II (roots and mixed hay) than to feed the more expensive ration containing ensilage. The question is not one to be decided offhand for every dairyman, but depends upon the conditions under which he is following the industry, the relative cost of feeds, and the productivity of the animals. The more expensive feeds can not be so profitably fed to animals of low productivity as to those of high productivity.

RATION I.—*Ensilage and clover.*

Feed.	Ration.	Protein.	Carbohydrates.	Fat.	Cost of producing forage crop in ration.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Cents.*
Bran	5	0.645	2.00	0.170	.....
Corn	3	.237	2.00	.129	.....
Clover	10	.680	3.58	.170	1.45
Ensilage	40	.360	4.52	.280	3.80
Total	.....	1.922	12.10	.749	5.25

RATION II.—*Mangels and mixed hay.*

Feed.	Ration.	Protein.	Carbohydrates.	Fat.	Cost of producing forage crop in ration.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Cents.*
Bran	4	0.516	1.604	0.136	.....
Corn	4	.316	2.668	.172	.....
Clover	13	.884	4.654	.221	1.88
Timothy	6	.168	2.694	.084	.87
Roots	20	.020	1.080	.020	1.60
Total	.....	1.904	12.610	.633	4.35

NOTE.—A more detailed discussion of Minnesota forage crops is given in Bulletin 18 of the Bureau of Statistics, and in Bulletin No. 97 of the Minnesota Agricultural Experiment Station.

FLAXSEED.

Flax is often grown on sod land, in which case the cost of production is higher than indicated in the following tables. The breaking of the sod and greater labor in the preparation of the seedbed increase the cost from 50 cents to $1 per acre. The average number of times the seedbed was harrowed at Northfield was two and four-fifths; Marshall, two and one-sixth, and Halstad, twice.

TABLE XXII.—*Cost of producing flaxseed—threshed from windrow.*

Item.	Northfield (Rice County).			Halstad (Norman County).		
	Total acreage, five years.	Total cost.	Cost per acre.	Total acreage, five years.	Total cost.	Cost per acre.
Seed	160.154	$171.900	$1.073	783.929	$571.170	$0.729
Cleaning seed	148.552	4.802	.032	483.968	32.733	.068
Plowing	4,773.396	5,996.560	1.256	7,186.027	8,120.469	1.130
Dragging	147.324	78.014	.530	466.207	166.547	.357
Seeding	190.794	50.375	.264	783.929	214.134	.273
Weeding	.....	.....	.....	142.330	33.590	.235
Cutting (binder)	173.022	70.217	.406	470.873	141.890	.301
Turning	25.420	2.610	.103	.....	.....	.....
Thrashing (labor)	183.362	268.343	1.463	278.914	249.879	.896
Thrashing, cash cost	183.362	170.210	.928	278.914	226.440	.812
Machinery cost	.....	.....	.517	.....	.....	.371
Land rental	.....	.....	3.500	.....	.....	2.100
Total	.....	.....	10.072	.....	.....	7.272

TABLE XXII.—*Cost of producing flaxseed—thrashed from windrow*—Cont'd.

LARGE FARM IN NORTHWESTERN MINNESOTA.

Item.	Total acreage, five years.	Total cost.	Cost per acre.	Item.	Total acreage, five years.	Total cost.	Cost per acre.
Seed	648.159	$480.250	$0.741	Thrashing (labor)	618.969	$857.338	$1.385
Cleaning seed	253.589	4.172	.016	Values consumed in thrashing outfit			.335
Plowing	5,363.458	4,958.430	.924	Machinery cost			.276
Dragging	648.159	186.175	.287	Land rental			1.800
Seeding	497.999	98.236	.197				
Cutting (reaper)	497.379	159.915	.322	Total			6.283

The flaxseed crop is generally thrashed directly from the windrow. This, the cheaper method of production, is advisable in those regions where there is little autumn rainfall, or where thrashing machines are readily obtainable.

TABLE XXIII.—*Cost of producing flaxseed—stacked from windrow.*

Item.	Marshall (Lyon County).			Halstad (Norman County).		
	Total acreage, three years.	Total cost.	Cost per acre.	Total acreage, three years.	Total cost.	Cost per acre.
Seed	204.72	$163.78	$0.800	467.57	$368.35	$0.788
Cleaning seed	24.90	2.00	.080	231.00	14.33	.062
Plowing	376.59	407.16	1.081	472.49	483.04	1.022
Dragging	117.61	33.60	.286	151.63	52.11	.344
Seeding	234.27	73.09	.312	467.57	122.47	.262
Weeding				142.39	33.50	.235
Cutting (binder)	186.06	75.20	.404	343.77	108.76	.316
Turning	84.29	9.02	.107			
Stacking	119.94	96.28	.803	35.72	18.51	.518
Thrashing (labor)	123.58	50.69	.410	35.72	11.30	.316
Thrashing, cash cost	128.24	156.70	1.222	35.72	25.74	.721
Machinery cost			.356			.344
Land rental			3.000			2.100
Total			8.861			7.028

Flax, unlike the grain crops, is seldom bound, for the reason that this is an expensive method of handling and often causes delay in thrashing on account of the slow drying of the bundles.

In the following table the seedbed was harrowed on an average three times at Marshall and two and one-sixth times at Halstad.

TABLE XXIV.—*Cost of producing flaxseed—bound, shocked, and stacked.*

Item.	Marshall (Lyon County).			Halstad (Norman County).		
	Total acreage, five years.	Total cost.	Cost per acre.	Total acreage, five years.	Total cost	Cost per acre.
Seed	257.666	$203.640	$0.790	783.929	$571.170	$0.729
Cleaning seed	24.900	2.000	.080	483.908	32.733	.068
Plowing	5,973.625	6,814.320	1.141	7,186.027	8,120.460	1.130
Dragging	170.556	49.495	.299	466.207	166.547	.357
Cutting (binder)	59.885	23.387	.391	197.096	68.611	.348
Twine	59.885	10.800	.180	139.032	14.030	.101
Shocking	59.885	5.913	.099	172.373	22.500	.131
Stacking	59.885	38.486	.643	124.342	58.319	.469
Thrashing (labor)	56.205	8.295	.148	111.282	47.237	.424
Thrashing, cash cost	56.205	60.710	1.080	111.282	74.200	.667
Machinery cost			.558			.371
Land rental			3.000			2.100
Total			8.400			6.895

FODDER CORN.

The fodder-corn crop is unique in Minnesota's agriculture. The corn is sown thickly, either with grain drill or corn planter, at the rate of one-half to 1 bushel per acre. It is cultivated one way, cut with the corn binder, shocked in the field, and either allowed to stand until fed or hauled to the barn and stacked.

The seedbed at Northfield was harrowed an average of four times and at Halstad three and one-half, and the number of cultivations at Northfield was three and one-third.

The machinery cost for a fodder-corn crop on the large farm in northwestern Minnesota has not been accurately determined, as only one crop has been cut since statistics have been kept on that farm. Machinery cost has, therefore, been substituted from the Halstad route.

Fodder corn cut and shocked in the field has no market value until hauled to the barn or feed lot. The cost of hauling fodder from the field is between $1.50 and $2 per acre, varying with distance from barn, ease of loading, etc.

The feeding value of a ton of field and fodder corn is estimated by Prof. T. L. Haecker at $4.90, as compared with that of timothy hay at $6 a ton.

TABLE XXV.—*Cost of producing fodder corn planted thick for forage—cut and shocked in the field.*

Item.	Northfield (Rice County).			Halstad (Norman County).		
	Total acreage, five years.	Total cost.	Cost per acre.	Total acreage, five years.	Total cost.	Cost per acre.
Seed	371.194	$161.960	$0.436	311.179	$224.240	$0.721
Plowing	803.331	1,053.520	1.311	925.882	1,097.690	1.186
Dragging	372.844	198.071	.531	414.385	212.227	.512
Planting (horse planter)	344.005	101.367	.295			
Planting (grain drill)				327.438	90.132	.275
Cultivating	353.904	431.009	1.218	392.852	536.859	1.367
Cutting (binder)	334.128	232.697	.696	224.418	134.196	.598
Shocking and tying	334.128	169.984	.509	169.828	103.119	.607
Twine	298.632	145.970	.489	117.256	47.230	.403
Machinery cost			1.748			1.143
Land rental			3.500			2.100
Total			10.733			8.912

LARGE FARM IN NORTHWESTERN MINNESOTA.

Item.	Total acreage, three years.	Total cost.	Cost per acre.	Item.	Total acreage, three years.	Total cost.	Cost per acre.
Seed	118.86	$42.50	$0.358	Shocking and tying	118.86	$34.87	$0.293
Plowing	118.86	99.51	.837	Twine	118.86	26.64	.224
Dragging	118.86	37.82	.318	Machinery cost			1.143
Planting (grain drill)	118.86	33.27	.280	Land rental			1.800
Cultivating	118.86	257.12	2.163				
Cutting (binder)	118.86	57.00	.480	Total			7.896

When fodder corn is hauled and stacked in the farmstead the cost is increased. The following table represents the cost of this method as determined on the Northfield route.

TABLE XXVI.—*Cost of producing fodder corn planted thick for forage—cut, shocked, and stacked in the farmstead.*

Item.	Northfield (Rice County).			Item.	Northfield (Rice County).		
	Total acreage, five years.	Total cost.	Cost per acre.		Total acreage, five years.	Total cost.	Cost per acre.
Seed	371.194	$161.960	$0.436	Shocking and tying	334.128	$169.984	$0.509
Plowing	803.331	1,053.520	1.311	Twine	298.632	145.970	.489
Dragging	372.844	198.071	.531	Hauling and stacking	246.225	401.217	1.629
Planting (horse planter)	344.005	101.367	.295	Machinery cost			1.748
Cultivating	353.904	431.009	1.218	Land rental			3.500
Cutting (corn binder)	334.128	232.697	.696	Total			12.362

HAY.

TIMOTHY AND CLOVER.—The hay crop, one of the most important farm crops, is the cheapest to produce on account of being sown with a grain crop; there is consequently no charge against the crop for

preparation of the seedbed. When the second crop of clover is utilized for hay an additional cost of about $1 per acre is incurred.

The value of the seed was determined as follows: Amount sown, timothy, 8 pounds, clover, 4 pounds, at 3 cents and 16 cents, respectively, making the total cost per acre $0.880. Dividing this sum by three for three years of grass gives the annual cost per acre $0.293.

The feeding value of timothy and clover hay (two-thirds clover and one-third timothy) is estimated by Prof. T. L. Haecker at $6.35, as compared with timothy at $6 a ton.

TABLE XXVII.—*Cost of producing hay—timothy and clover.*

IRST CROP.

Item.	Northfield (Rice County).			Marshall (Lyon County).			Halstad (Norman County).		
	Total acreage, five years.	Total cost.	Cost per acre.	Total acreage, five years.	Total cost.	Cost per acre.	Total acreage, five years.	Total cost.	Cost per acre.
Seed			$0.293			$0.293			$0.293
Mowing	793.706	$291.705	.368	260.204	$85.352	.328	417.647	$151.637	.363
Raking	618.474	109.977	.178	260.204	55.407	.213	287.250	71.169	.248
Cocking and spreading	624.645	124.500	.199						
Hauling in	591.514	650.056	1.099						
Hauling in and stacking				260.204	323.135	1.242	369.202	470.047	1.273
Machinery cost			.548			.477			.290
Land rental			3.500			3.000			2.100
Total first crop			6.185			5.553			4.567

SECOND CROP.

Item.	Northfield (Rice County).		
	Total acreage, five years.	Total cost.	Cost per acre.
Mowing	245.090	$64.734	$0.264
Raking	231.090	26.580	.115
Cocking and spreading	89.502	13.448	.150
Hauling in	128.230	59.506	.464
Total second crop			.993
Total cost of two cuttings at Northfield			7.178

MILLET.—The millet crop as regards cost of production and effect on land is more like the small grain crops than common grass crops. The feeding value of millet hay, when it can be properly cured, is about the same as that of timothy. The yield of hay is lighter than that of mixed timothy and clover and the cost of production much higher, making the crop unprofitable in Minnesota except as a catch crop; then fodder corn is usually superior to it.

TABLE XXVIII.—*Cost of producing hay—millet.*

Item.	Northfield (Rice County).			Marshall (Lyon County).			Halstad (Norman County).		
	Total acreage, five years.	Total cost.	Cost per acre.	Total acreage, five years.	Total cost.	Cost per acre.	Total acreage, five years.	Total cost.	Cost per acre.
Seed	13.640	$6.470	$0.474	64.560	$22.460	$0.348	222.360	$165.300	$0.743
Plowing	803.331	1,053.520	1.311	1,413.235	1,655.342	1.171	925.882	1,097.690	1.186
Dragging	20.532	7.270	.354	90.323	43.817	.485	217.653	82.309	.378
Seeding	16.562	5.901	.356	83.343	28.838	.346	222.990	58.925	.264
Mowing	13.640	6.270	.460	73.913	28.980	.392	117.303	46.340	.395
Raking	12.070	1.810	.150	34.533	8.788	.254	101.698	18.815	.185
Hauling in	18.132	35.307	1.947						
Stacking and hauling in				72.893	90.583	1.244	125.653	79.920	.636
Machinery cost			.765			.731			.462
Land rental			3.500			3.000			2.100
Total			9.317			7.971			6.349

WILD HAY.—The wild hay crop at Halstad and on the large farm in northwestern Minnesota is cut from low-lying undrained lands, unfit for cultivation. These wild lands can be rented for meadows for 75 cents to $1.25 per acre. The wild hay crops at Northfield and Marshall are cut from small fields of unbroken prairie sod and small pockets and undrained sloughs on improved farms. Whenever such meadows exist on improved farms they are included in the valuation per acre of the farm, and must be debited with the same rental value as improved land. Growing wild hay on improved farms is bad farm management, and causes an appreciable loss in the profits of the farm. Wherever wild hay is grown it prevents systematic crop rotation, because if hay is grown continuously on the lowlands grain would be grown continuously on the uplands. Tame grasses not only yield a much larger product of forage per acre than do the wild grasses, but they improve the productivity of the soil, when properly rotated with grain and cultivated crops.

The feeding value of wild hay is estimated, in an unpublished work by Prof. T. L. Haecker, at $5.78 per ton, as compared with that of timothy at $6.

TABLE XXIX.—*Cost of producing hay—wild.*

Item.	Northfield (Rice County).			Marshall (Lyon County)			Halstad (Norman County).		
	Total acreage, five years.	Total cost.	Cost per acre.	Total acreage, five years.	Total cost.	Cost per acre.	Total acreage, five years.	Total cost.	Cost per acre.
Mowing	70.39	$27.87	$0.396	511.08	$205.76	$0.403	586.10	$155.732	$0.266
Raking	60.29	11.50	.191	511.08	132.63	.260	586.10	96.409	.165
Cocking and spreading	53.83	8.04	.149	315.49	22.90	.073			
Hauling in	46.88	55.06	1.174						
Stacking and hauling in				478.36	509.53	1.065	586.10	732.637	1.250
Machinery cost			.626			.677			.290
Land rental			3.500			3.000			1.000
Total			6.036			5.478			2.970

TABLE XXIX.—*Cost of producing hay—wild*—Continued.

LARGE FARM IN NORTHWESTERN MINNESOTA.

Item.	Total acreage, five years.	Total cost.	Cost per acre.
Mowing	141.25	$43.725	$0.309
Raking	141.25	17.950	.127
Stacking and hauling in	101.25	95.874	.947
Machinery cost			.200
Land rental			1.000
Total			2.584

TIMOTHY.—The value of the seed for the following table was determined as follows: Twelve pounds of seed per acre at 3 cents equals 36 cents. Dividing this sum by 4 for four years of grass gives 9 cents per acre per crop.

Yields of timothy hay on the large farm in northwestern Minnesota rarely exceed 1 ton per acre, owing to the aged and sod-bound condition of the meadows. Timothy gives better yields when sown with clover, one or two crops cut for hay and then either broken up or pastured.

Timothy hay at $6 per ton has been made the basis for computing the cash feeding value of all kinds of roughage published in this bulletin.

TABLE XXX.—*Cost of producing hay—timothy.*

Item.	Large farm in northwestern Minnesota.		
	Total acreage, five years.	Total cost.	Cost per acre.
Seed			$0.090
Mowing	304.453	$107.955	.355
Raking	304.453	29.337	.096
Cocking and spreading	304.453	54.418	.179
Hauling and stacking at barn	304.453	205.326	.674
Machinery cost			.200
Land rental			1.800
Total			3.394

HEMP.

The cost per acre of producing hemp, as shown in this table, does not include the cost of seed, twine, and depreciation of hemp binders, items which were paid for by the company contracting with the farmers for the crop. Where good markets for fiber exist hemp makes a very profitable money crop.

Hemp is superior to buckwheat, barley, or millet as a quick-growing, leafy crop that will completely shade the ground and weaken, though not destroy, the growth of such weeds as quack grass and Canada thistle.

TABLE XXXI.—*Cost of producing hemp.*

Item.	Northfield (Rice County).		
	Total acreage, one year.	Total cost.	Cost per acre.
Plowing	[a]4,773.396	$5,996.560	$1.256
Harrowing	146.470	44.562	.304
Seeding	146.470	38.291	.261
Cutting	146.470	146.302	.999
Shocking	146.470	29.810	.204
Machinery cost			.217
Land rental			3.500
Total			6.741

[a] See Table XXXIX.

MANGELS.

The root crop is not a popular one in the Northwestern States, principally because of the great amount of hand labor required. It is considered less troublesome to grow crops that require a greater proportion of horse labor than of hand labor.

The labor records in the production of this crop were secured from the Minnesota Agricultural Experiment Station, and the labor was converted into terms of money at the prevailing rate of wages at Northfield.

The average yield per acre during the four years was 22.9 tons, the maximum yield 32½ tons, and the minimum yield 16.2 tons.

The land was plowed both fall and spring for each crop and thoroughly harrowed before planting. Manure was distributed on the land prior to spring plowing, but the cost has not been included in this table (see page 25).

The feeding value of a ton of mangels is estimated, in an unpublished work by Prof. T. L. Haecker, at $1.30, as compared with that of timothy at $6.

TABLE XXXII.—*Cost of producing mangels.*

Item.	Minnesota Agricultural Experiment Station.			Item.	Minnesota Agricultural Experiment Station.		
	Total acreage, four years.	Total cost.	Cost per acre.		Total acreage, four years.	Total cost.	Cost per acre.
Plowing (twice)	10.25	$25.268	$2.465	Cultivating (horse)	10.25	$12.748	$1.244
Harrowing and planking	10.25	10.957	1.069	Harvesting and storing	10.07	130.960	13.005
Cost of seed (99½ bushels)	10.25	16.385	1.599	Machinery cost			.325
Planting	10.25	5.173	.505	Land rental			3.500
Hand cultivation and hoeing	10.25	91.929	8.969	Total			32.682

OATS.

The seedbed was harrowed, on an average, two and one-fourth times at Northfield, twice at Marshall, two and one-half times at Halstad, and twice on the large farm in northwestern Minnesota.

TABLE XXXIII.—*Cost of producing oats—fall plowed.*

Item.	Northfield (Rice County).			Marshall (Lyon County).			Halstad (Norman County).		
	Total acreage, five years.	Total cost.	Cost per acre.	Total acreage, five years.	Total cost.	Cost per acre.	Total acreage, five years.	Total cost.	Cost per acre.
Seed	3,321.512	$3,313.180	$0.997	1,651.541	$1,447.940	$0.877	1,205.252	$735.860	$0.610
Cleaning seed	2,438.632	55.157	.023	1,059.412	34.631	.033	638.767	35.551	.056
Plowing	4,773.396	5,996.560	1.256	5,973.625	6,814.320	1.141	7,186.027	8,120.460	1.130
Dragging	3,057.393	870.218	.285	1,602.168	282.731	.176	1,168.062	326.630	.279
Seeding	3,498.768	911.749	.261	1,711.897	463.082	.271	1,205.252	328.873	.273
Weeding							168.550	4.530	.027
Cutting	3,478.167	1,395.977	.401	1,551.803	584.241	.376	1,188.617	419.514	.353
Twine	2,497.940	835.660	.335	1,505.013	458.240	.304	843.907	193.670	.229
Shocking	3,399.237	562.536	.165	1,450.833	217.982	.150	1,140.047	171.857	.151
Stacking	1,460.070	1,126.749	.772	1,339.017	935.748	.699	652.736	326.603	.500
Stack thrashing (labor)	1,460.070	829.602	.568	976.119	285.832	.293	394.556	158.848	.403
Thrashing, cash cost	1,460.070	1,130.050	.774	976.119	1,134.740	1.161	394.556	247.620	.628
Machinery cost			.517			.558			.371
Land rental			3.500			3.000			2.100
Total			9.854			9.009			7.110

LARGE FARM IN NORTHWESTERN MINNESOTA.

Item.	Total acreage, five years.	Total cost.	Cost per acre.	Item.	Total acreage, five years.	Total cost.	Cost per acre.
Seed	638.867	$453.690	$0.710	Shock thrashing (labor)	369.647	$334.624	$0.905
Cleaning seed	638.867	24.337	.038	Value consumed in thrashing			.335
Plowing	5,363.458	4,958.430	.924	Machinery cost			.276
Dragging	638.867	134.257	.210	Land rental			1.800
Seeding	638.867	141.967	.222				
Cutting (binder)	578.367	198.380	.343	Total			6.073
Twine	578.367	109.410	.189				
Shocking	578.367	70.156	.121				

The cost of disking shown in the table below is for the work of going over the land but once. When cross disking or lapping the disk is practiced the acre cost will range from 50 to 75 cents. On all soils in Minnesota, except a few of the heaviest clays, wheat and oats thrive better on disked corn land than on plowed land. Weeds having been cleaned off the upper side of the furrow slice by the cultivation of the corn, the land remains clean of weeds until the furrow slice is again inverted. If grass seed is to be sown, the disking of corn land provides better conditions for germination and early growth than would plowing the corn land. Leaving the lower half of the furrow slice compact enables the roots of the small seedling clover or grass plant to quickly secure a foothold in moist earth below the loose dust blanket made by stirring the soil.

TABLE XXXIV.—*Cost of producing oats on disked corn stubble.*

Item.	Northfield (Rice County).			Marshall (Lyon County).		
	Total acreage, five years.	Total cost.	Cost per acre.	Total acreage, five years.	Total cost.	Cost per acre.
Seed	3,321.512	$3,313.180	$0.997	1,651.541	$1,447.940	$0.877
Cleaning seed	2,438.632	55.157	.023	1,059.412	34.631	.033
Breaking and burning stalks	209.560	42.200	.201			
Disking	545.840	141.690	.260	109.227	25.876	.237
Dragging	3,057.393	870.218	.285	1,602.168	282.731	.176
Seeding	3,498.768	911.749	.261	1,711.897	463.082	.271
Cutting (binder)	3,478.167	1,395.977	.401	1,551.803	584.241	.376
Twine	2,497.940	835.660	.335	1,550.013	458.240	.295
Shocking	3,399.237	562.536	.165	1,450.823	217.082	.150
Stacking	1,460.070	1,126.749	.772	1,339.017	935.748	.698
Stack thrashing (labor)	1,460.070	829.602	.568	976.119	285.832	.293
Thrashing, cash cost	1,460.070	1,130.050	.774	976.119	1,134.740	1.163
Machinery cost			.616			.523
Land rental			3.500			3.000
Total			9.158			8.092

POTATOES ON UNFERTILIZED LAND.

The statistics of potato production given in the table were collected from a large potato and grain farm in Clay County, northwestern Minnesota, where 300 to 400 acres of potatoes are grown annually.

The average yield of all fields in 1907 was 127 bushels per acre. Machinery cost of 59.6 cents per acre is based upon the annual values consumed in plows, harrows, wagons, sorters, diggers, weeders, cultivators, sprayers, and planters.

The cost per acre of manuring is shown on page 42. The potato crop is well adapted as a money crop to many large areas of land in Minnesota, and in the northern latitudes where it is difficult to mature corn the potato crop may take its place as a cleaning crop in the rotation. The production of seed potatoes in several Minnesota counties is a well-established industry, and many more communities could profitably take up the work. In the growing of no other field crop in Minnesota is a community of interests so desirable as in that of potatoes. A large area in one community devoted to the same variety of potatoes will bring better prices than small areas devoted to a number of varieties.

TABLE XXXV.—*Cost of producing potatoes on unfertilized land.*

Item.	Clay County, Minn., 1907.			Item.	Clay County, Minn., 1907.		
	Total acreage, one year.	Total cost.	Cost per acre.		Total acreage, one year.	Total cost.	Cost per acre.
Seed (3,984 bushels)	331.642	$1,925.00	$5.804	Digging	331.642	$443.88	$1.338
Plowing	2,790.984	3,322.25	1.190	Picking up 42,000 bushels, at 3½ cents per bushel and board	331.642	1,594.00	4.806
Harrowing	331.642	60.96	.184	Hauling and storing	331.642	863.24	2.603
Cutting seed	331.642	265.68	.801	Machinery cost			.596
Planting	331.642	205.68	.620	Land rental			3.000
Weeding (horse weeder)	331.642	180.41	.544				
Cultivating (three times)	331.642	920.54	2.776				
Spraying (three times)	331.642	97.55	.294				
Paris green	331.642	425.00	1.282	Total			26.366
Bluestone	331.642	175.00	.528				

POTATOES ON FERTILIZED LAND

Table XXXVI is presented to show the cost of production under more intensive methods of culture. A three-year rotation is practiced—one year of grain, one of grass, generally clover, and one year of potatoes. The land is either heavily manured at the rate of 10 to 12 loads per acre, or commercial fertilizers are used. In this instance commercial fertilizers were used at the rate of 500 pounds to the acre. The seed potatoes were cut by means of power-driven machinery, and treated with corrosive sublimate for scab.

The yield on 237 acres was, on an average, 162 bushels per acre.

The large potato producer must generally meet charges other than those which appear in the cost of production. These are the cost of handling after the crop has been stored or placed in the warehouse. The cost includes labor, sacking and loading, cost of sacks, and shrinkage, and varies from 8 to 10 cents per bushel.

The farmer raising 10 to 20 acres of potatoes annually can not hope to produce as cheaply as can the producer on large areas, where the latest and most efficient machinery is used.

TABLE XXXVI.—*Cost of producing potatoes on fertilized land.*

Item.	Clay County, Minn., 1907.			Item.	Clay County, Minn., 1907.		
	Total acreage, one year.	Total cost.	Cost per acre.		Total acreage, one year.	Total cost.	Cost per acre.
Spring plowing	237.962	$241.90	$1.017	Paris green	237.962	$234.00	
Harrowing (four times)	237.962	182.07	.765	Lime	237.962	42.00	$1.833
Cost of seed (3,360 bushels)	237.962	2,016.00	8.472	Bluestone	237.962	160.00	
Cutting seed	237.962	89.55	.376	Digging	237.962	430.82	1.810
Treating seed	180.250	21.60	.120	Picking up 38,300 bu., 3½c. bu. and board	237.962	1,513.80	6.362
Corrosive sublimate	180.250	50.00	.277	Hauling, storing, and sorting	237.962	789.40	3.317
Planting	237.962	163.97	.689	Machinery cost			.596
Fertilizers (25 tons)	100.000	650.00	6.500	Land rental			3.000
Weeding (twice)	237.962	77.70	.327				
Cultivating (three times)	237.962	431.73	1.814				
Spraying (four times)	237.962	106.10	.446	Total			37.721

TIMOTHY SEED.

It is becoming common in southeastern Minnesota to devote a portion of the farm to growing timothy for seed. This is true especially in localities where farms are large and the labor force employed limited. The cost of producing timothy for seed is low, and but a small percentage of the cost is made up of labor. The yield of seed per acre runs from 5 to 10 bushels; with fair prices the returns are highly satisfactory. However, the effect on the soil of raising a crop of timothy seed is similar to that of a grain crop.

The value of the seed for this crop was determined as follows: 12 pounds of seed per acre at 3 cents equals 36 cents. Dividing this sum by 4, for four years of grass, gives 9 cents per acre per crop.

Digging Potatoes on the Farm of E. C. Schroeder, Glyndon, Clay County, Minn.

TABLE XXXVII.—*Cost of producing timothy—cut for seed.*

Item.	Northfield (Rice County).			Marshall (Lyon County).			Halstad (Norman County).		
	Total acreage, five years.	Total cost.	Cost per acre.	Total acreage, five years.	Total cost.	Cost per acre.	Total acreage, five years.	Total cost.	Cost per acre.
Seed			$0.090			$0.090			$0.090
Cutting (binder)	5.99	$3.25	.543	11.266	$6.195	.550	22.417	$6.649	.297
Twine	5.99	1.09	.182	6.000	.440	.073	22.417	3.020	.135
Shocking	4.14	.69	.167	11.266	1.670	.148	22.417	2.552	.114
Stacking	3.58	1.60	.447	11.266	7.479	.664	17.739	8.206	.463
Stack thrashing	5.99	4.64	.775	11.266	2.604	.231	17.739	7.339	.414
Thrashing, cash cost				7.440	3.480	.468	17.739	8.880	.501
Machinery cost			.281			.288			.196
Land rental			3.500			3.000			2.100
Total			5.985			5.512			4.310

LARGE FARM IN NORTHWESTERN MINNESOTA.

Item.	Total acreage, five years.	Total cost.	Cost per acre.	Item.	Total acreage, five years.	Total cost.	Cost per acre.
Seed			$0.090	Machinery cost			$0.158
Cutting (binder)	112.093	$40.800	.364	Land rental			1.800
Twine	112.093	16.700	.149				
Shocking	112.093	11.010	.098	Total			3.432
Shock thrashing (labor)	34.393	15.048	.438				
Value consumed in thrashing outfit			.335				

SPRING WHEAT.

The seedbed at Northfield received an average of two harrowings; Marshall, one and three-fourths; Halstad, two and three-fourths; and the large farm in northwestern Minnesota, two.

The average annual yield of wheat on the farms at Northfield during the years 1906–1907 was 15 bushels per acre, with an average farm value per acre (December 1) of $11.77. The average yield at Marshall for the years 1905–1907 was 12.59 bushels—farm value per acre (December 1) $9.56—and at Halstad the average yield for the years 1905–1907 was 12.36 bushels—farm value per acre $9.38 (see Tables II and III).

The average yield of wheat in Minnesota for the years 1897–1906, according to the Bureau of Statistics, United States Department of Agriculture, was 12.96 bushels, having an average farm value per acre (December 1) of $8.55. (See Yearbook of the Department of Agriculture.)

These statistics of yield and farm value of wheat illustrate the fact that Minnesota has many wheat growers who receive wages for their labor and sufficient income from the crop to pay the cost of horse labor, machinery depreciation, etc., but no net profit for "managing ability." The Northwest will probably always grow spring

wheat as a money crop, just as cotton, tobacco, and corn are now the staple money crops of the South, but the crop of wheat is not profitable when yields of less than 12 bushels are obtained. High yields of spring wheat can be maintained in the Northwest if the crop is grown in rotation with corn, potatoes, and clover. In a three-year rotation of corn, wheat, and clover (no manure) at the Minnesota Agricultural Experiment Station wheat has yielded an average of 21.8 bushels for the past ten years, and in a five-year rotation of corn, wheat, meadow, pasture, oats (manured once in five years), wheat has yielded an average of 26.3 bushels for the past ten years.

TABLE XXXVIII.—*Cost of producing spring wheat—fall plowed.*

Item.	Northfield (Rice County).			Marshall (Lyon County).			Halstad (Norman County).		
	Total acreage, five years.	Total cost.	Cost per acre.	Total acreage, five years.	Total cost.	Cost per acre.	Total acreage, five years.	Total cost.	Cost per acre.
Seed	41.697	$56.280	$1.350	3,891.984	$3,909.910	$1.005	5,196.833	$4,300.810	$0.828
Cleaning seed				455.586	15.890	.035	4,965.968	147.571	.030
Plowing	4,773.396	5,996.560	1.256	5,973.625	6,814.320	1.141	7,186.027	8,120.460	1.130
Dragging	41.697	9.984	.239	4,204.806	722.712	.172	5,184.833	1,456.853	.281
Seeding	41.697	15.485	.371	4,311.334	1,016.375	.236	5,196.833	1,415.490	.272
Weeding							3,501.440	278.270	.079
Cutting (binder)	41.697	19.182	.460	4,227.757	1,407.239	.333	5,124.194	1,706.019	.333
Twine	41.697	11.950	.287	3,744.207	1,082.380	.289	3,041.414	593.200	.195
Shocking	41.697	9.100	.218	3,901.137	428.305	.110	5,124.194	690.165	.135
Stacking	11.430	9.021	.789	2,814.768	1,516.979	.539	2,448.241	1,177.160	.481
Stack thrashing (labor)	11.430	6.037	.528	1,621.959	416.240	.257	1,297.101	404.508	.312
Thrashing, cash cost	11.430	3.960	.346	1,621.959	1,158.110	.714	1,297.101	557.310	.430
Machinery cost			.517			.558			.371
Land rental			3.500			3.000			2.100
Total			9.861			8.389			6.977

LARGE FARM IN NORTHWESTERN MINNESOTA.

Item.	Total acreage, five years.	Total cost.	Cost per acre.	Item.	Total acreage, five years.	Total cost.	Cost per acre.
Seed	4,851.276	$4,501.205	$0.928	Shock thrashing (labor)	3,187.216	$2,089.767	$0.656
Cleaning seed	4,705.576	62.211	.013	Value consumed in thrashing outfit			.335
Plowing	5,363.458	4,958.430	.924	Machinery cost			.276
Dragging	4,851.276	1,175.517	.242	Land rental			1.800
Seeding	4,851.276	1,101.490	.227				
Weeding	4,707.576	149.299	.032				
Cutting (binder)	4,851.276	1,483.647	.306				
Twine	4,851.276	919.530	.190	Total			6.056
Shocking	4,851.276	614.420	.127				

COST OF PLOWING.

The total acreage plowed—horses the motive power—and the cost thereof are shown in this table for the years 1902–1907. The cost of breaking 72.53 acres at Halstad was $106.60, or $1.468 per acre.

No plowing has been done on these routes by steam or gasoline power. It is commonly asserted that plowing may be done more

cheaply by steam or gasoline than by horse power, but no accurate figures, which include interest, depreciation, repairs on engines, and all charges for man and horse labor, fuel, oil, etc., are available to prove the assertion.

TABLE XXXIX.—*Cost of plowing, 1902–1907.*

Route.	Fall plowing.			Spring plowing.		
	Total acreage, five years.	Total cost.	Cost per acre.	Total acreage, five years.	Total cost.	Cost per acre.
Northfield (Rice County)	4,773.396	$5,996.56	$1.256	803.331	$1,053.520	$1.311
Marshall (Lyon County)	5,973.625	6,814.32	1.141	1,413.235	1,655.342	1.171
Halstad (Norman County)	7,186.027	8,120.46	1.130	925.882	1,097.690	1.186
Large farm in northwestern Minnesota	5,363.458	4,958.43	.924	526.000	512.000	.973

COST OF PRODUCTION IN KIND.

This table illustrates the amount of crop products necessary to equal the cost of production at the prices indicated. The average cost of production per acre is based on the total of all acreages and costs for each crop grown at Northfield, Marshall, Halstad, and the large farm in northwestern Minnesota, 1902–1907. These figures should be considered only as averages. The cost of production is a nearly constant factor, varying somewhat with wages and cost of feed for the horses, but price is extremely variable. A low price would require larger amounts of product than are here indicated to cover the cost of production and a high price smaller amounts.

TABLE XL.—*Amount of product necessary to cover cost per acre of producing field crops, 1902–1907.*

Crop.	Average cost of production per acre.	Average farm price December 1, 1902–1907.[a]	Product necessary to pay cost of production.[b]
Barley—spring plowed	$8.211	$0.400	20.53
Corn—ears husked from the stalks	10.438	.385	27.11
Flax—thrashed from windrow	7.496	.963	7.78
Hay—timothy and clover (first crop)	5.591	6.047	.92
Oats—fall plowed	8.863	.292	30.46
Potatoes	26.366	.415	63.51
Wheat—fall plowed	7.249	.742	9.78

[a] Price per ton for hay, per bushel for other crops.
[b] Quantities expressed in tons for hay, in bushels for other crops.

VALUE OF LAND A FACTOR IN DETERMINING THE MOST PROFITABLE SYSTEM OF FARMING.

Profits constitute one of the factors which operate to fix the market value of land. A clear illustration of the manner in which profits affect the market value of agricultural land is seen in the effect which the location of a beet-sugar factory has upon land values in its imme-

diate vicinity. A demonstration that greater net profits can be made from sugar-beet culture than from grain growing or corn and hog farming will tend to appreciate the value of all land within the territory of the factory. Landowners will quote their land higher than prior to the establishment of the new industry, whether they are producing beets or not.

Location is undoubtedly an important factor in determining profits and, therefore, in determining the market value of land; fertility or productivity of the soil is relatively a less important factor as compared with location. Poor land near good markets and with good transportation facilities may yield greater profits per acre from crops adapted to such locations than will the most fertile soils remote from good markets. Thus good roads, the increase of city industries, the use of refrigerator cars, and many other factors of a similar nature all tend to make land more accessible, to better its location, to increase the opportunities for profit making, and to cause an increase in the market values of the land.

A number of special causes which have influenced profits in American agriculture and caused appreciation in land values are worthy of mention. The coming of the settler into the grazing lands west of the Missouri River increased the value of Dakota farm lands, because the profits per acre in wheat culture, even with poor tillage, were greater than those in grazing cattle, and as wheat supplanted grazing the price of wild land was quoted on the basis of profits in wheat, not cattle. Again, the introduction of new crops and machinery has had much to do with increasing land values. Durum wheat has made profitable much semiarid land that was capitalized very low prior to the introduction of that crop, and many a new farm machine, the creation of American genius, has increased the profits from the soil. The partial passing of the widespread cotton-crop "lien system" in the South has greatly influenced the profits from southern soil and caused a noticeable increase in farm-land values.

Farm-land values in the United States, as a whole, have increased enormously, as shown by figures quoted herewith from Bulletin 43, Bureau of Statistics, United States Department of Agriculture. From 1890 to 1900 the average increase in the value of all farm lands was 25 per cent, or an average annual increase of 2.5 per cent. From 1900 to 1905 the average increase in the value of all farm lands was 33.5 per cent, or an average annual increase of 6.7 per cent. The increase was remarkable in some of the newer States, Oklahoma values increasing 76.7 per cent, or an average annual increase of 15.3 per cent. North Dakota's total increase was 70.6 per cent, annual increase, 14.1; Texas, total increase, 70.6 per cent, annual increase, 8 per cent; and many other States in the south central, south Atlantic, and western divisions show rapid advance in the value of land.

It is not uncommon in modern American agriculture to find communities in which land values have doubled or trebled since the days of settlement, and yet there has been little or no change therein in the system of farming. New and improved machinery has taken the place of old and relatively inefficient machinery, and buildings have usually increased in number, size, and usefulness. The crops, the methods of cropping and of marketing have nevertheless remained unchanged in many instances, although the land has appreciated in value 100 per cent or more. In such communities the market value of the land has been influenced, not by profits on land within the territory, but by those on other land equally well located, under similar climatic conditions, that has yielded profits proportionate to the higher capitalization.

One reason why profits from farm lands are not always in proportion to the market value of the land is that men who secured homesteads or cheap land soon became independent, debts were wiped out, a living was assured, and the habit of cropping the land with the methods of early times persisted even though other men on similar land might be reaping greater profits. Such men or such communities not having interest accounts to pay on the new valuations may not have been forced into more profitable systems of farming. Many such communities could be cited in the old wheat-growing regions of Minnesota and the corn-growing sections of Illinois. Such land may yield a fair profit on the original capitalization and enable the owner to create a surplus, but how different the situation becomes to the man who buys a piece of high-priced land, places a mortgage on it at current interest rates, and starts out to make a living, to pay interest charges on the high valuation, and, in addition, to pay off the mortgage.

Land rental, or interest on the investment in land, is not usually considered an item of expense in the production of farm products, but such a charge is fully justified. If capital can be withdrawn from agriculture and yield 6 per cent in other industries, then the business of farming must be debited with interest on the investment, as well as the wages paid to labor, in the determination of net profit. On high-priced land interest becomes an important item of expense as compared with conditions of relatively low land values. It is not beyond the range of possibility in new wheat regions for two good wheat crops to pay costs of production and pay for the land, but, even with equal fertility, on relatively high-priced land the situation is materially changed because the costs of production are much higher. Table XXXVIII shows the cost of producing wheat at Northfield to be $9.861 per acre, at Marshall $8.389, and at Halstad, $6.977, the chief difference in cost being accounted for by differences in land rental or in the interest on the investment. Reference should be

made to Table XLI, in which it may be seen that the cost of producing wheat is 66.9 per cent higher on land valued at $100 than on land valued at $20. Increases in the cost of producing field crops, due to changes in land value, fall heaviest on those crops that require only a relatively small application of capital and labor in their production. The increase of cost is greater for crops like wheat and clover that require but a small amount of capital and labor in their production than for crops like potatoes, mangels, or ensilage which require a relatively large amount. For example, it may be seen in Table XLI that the cost of producing wheat on $20 land is $7.18 and on $100 land $11.98, an increase of $4.80, or 66.9 per cent. The cost of producing potatoes on $20 land is $24.566 and on $100 land $29.366, an increase of $4.80, or 19.5 per cent. The cost of producing corn ensilage on $20 land is $17.592 and on $100 land $22.392, an increase of $4.80, or 27.3 per cent.

TABLE XLI.—*Relation of cost of producing field crops to land values.*

Crop.	Average cost of production per acre, exclusive of land rental.	Cost of production, including land rental, on land having a value per acre of—								
		$20.	$30.	$40.	$50.	$60.	$70.	$80.	$90.	$100.
Barley—fall plowed	$5.563	$6.763	$7.363	$7.963	$8.563	$9.163	$9.763	$10.363	$10.963	$11.563
Corn—ears husked from standing stalks	7.238	8.438	9.038	9.638	10.238	10.838	11.438	12.038	12.638	13.238
Corn—grown thickly and siloed	16.392	17.592	18.192	18.792	19.392	19.992	20.592	21.192	21.792	22.392
Flaxseed—thrashed from windrow	5.314	6.514	7.114	7.714	8.314	8.914	9.514	10.114	10.714	11.314
Fodder corn—cut and shocked in field	6.912	8.112	8.712	9.312	9.912	10.512	11.112	11.712	12.312	12.912
Hay—timothy and clover (one cutting)	2.577	3.777	4.377	4.977	5.577	6.177	6.777	7.377	7.977	8.577
Mangels	29.182	30.382	30.982	31.582	32.182	32.782	33.382	33.882	34.582	35.182
Oats—fall plowed	5.869	7.069	7.669	8.269	8.869	9.469	10.069	10.669	11.269	11.869
Potatoes	23.366	24.566	25.566	25.766	26.366	26.966	27.566	28.166	28.766	29.366
Wheat—fall plowed	5.980	7.180	7.780	8.380	8.980	9.580	10.180	10.780	11.380	11.980

NOTE.—The average cost of production exclusive of land rental which forms the basis of this table has been computed from the total cost (exclusive of land rental) for each crop in all regions of Minnesota where statistics have been collected during the years 1902–1907. This sum of all costs divided by the total acreage in crop gives the average. The cost of production in the other columns of this table varies according to the amount of land rental or interest on investment in land—a factor of cost which varies with the value of the land. Land rental as an item of cost amounts to $1.20 (6 per cent on $20) on the $20 land and $6 (6 per cent on $100) on the land valued at $100 per acre.

These premises concerning the causes of increase in land value and the effect of "interest on investment" in the cost of production have a practical application in the study of farm management. Systems of crop rotation and farm organization must be chosen and efficiently followed which will yield an income larger than the cost. When land rental or interest on investment is considered as an item of expense, other items of cost remaining the same, the net product per acre must

also increase, to yield equal rates of profit. That many localities exist in which "net proceeds" and land values are not proportionate must be conceded by all students of agriculture. The chief reason for this situation, wheresoever found, is that the system of farming and the crops grown by that system are not adapted to the economic environment of the farm. Such conditions are nearly impossible in industries other than agriculture, but the independent farmer has his living and his home whether he manages his land to secure the highest possible profits or not, and so systems of farming which, because of changed economic conditions, are antiquated persist for many years in spite of the progress which appreciates the value of land.

To illustrate the fact that certain crops and systems of farming are adapted to profitable management only under certain economic conditions, some conclusions may be drawn from Table XLI relative to the cost of producing wheat, corn, and potatoes. Fifteen bushels of wheat per acre on $20 land at an average farm price of 66 cents per bushel will return a net profit of 13.6 per cent on the investment (i. e., on the value of the land), "net profit" being over and above the "land rental," which is counted as an item in the cost. The same crop on $50 land gives a net profit of 1.84 per cent, and on $100 land a net loss of 2 per cent. In order to secure equal rates of profit from the $50 land and the $100 land with this crop, price being the same, a yield of 23.9 bushels is necessary on the $50 land and 38.8 bushels on the $100 land. It may thus be seen that wheat is not adapted to profitable culture on high-priced land—in fact, it is absolutely impossible to grow it and secure the same rate of profit as can be secured on the cheaper lands, less favorably located, but equal to or excelling the high-priced land in productiveness for wheat. Average spring wheat yields of 24 or 39 bushels can not be secured, and wheat grown on $50 to $100 land can not compete with wheat on $20 land.

Corn responds better to costly tillage, thrives better on old soils, and in regions favorable to its growth has greater possibilities for returning a fair profit on high-priced land than wheat. Fifty bushels of corn per acre on $50 land at an average farm price of 32 cents per bushel will give a net profit of 11.52 per cent. The same crop on $100 land gives a net profit of 2.76 per cent, and on $150 land a net loss of 0.15 per cent. In order to secure equal rates of profit from the $100 land and the $150 land with the corn crop (price being the same) a yield of 77.47 bushels is necessary on the $100 land and 104.7 bushels on the $150 land. These figures indicate that the corn crop has greater possibilities for profit making on land valued above $50 per acre than wheat. Yields of 75 to 100 bushels of corn per acre are not impossible in southern Minnesota, with good management; this will pay cost of production and give a reasonable profit on the high-priced land. The value of the corn crop can also be enhanced by

feeding to cattle and hogs, and profits thus increased; and as the manure produced will tend to maintain the yields of corn at a high level this increased profit will also thus again be enhanced. Wheat can not be fed profitably under ordinary conditions except at prices below 50 cents per bushel. One hundred bushels of corn per acre is a very high yield for our average farm lands, even in Iowa and Illinois. Thus at present prices this crop under the system of farming associated with it ceases to be profitable when land values approximate $150 per acre.

Potatoes illustrate a third type of staple crop that has greater possibilities through intensive culture on high-priced land than corn or wheat. One hundred bushels of potatoes per acre at 39 cents on the farm will give a net profit of 25.3 per cent on $50 land. The same crop on $100 land gives a net profit of 9.6 per cent, on $150 land a net profit of 4.4 per cent, and on $200 land a net profit of 1.8 per cent. To secure the same rate of profit as was obtained on the $100 land with a 100 bushel crop (9.6 per cent) the yield per acre must be 119.9 bushels on land valued at $150 and 139.9 bushels on the $200 land. Such yields are possible with fair cultivation. The potato crop, then, is adapted to intensive culture on high-priced land, and large applications of capital and labor are justified by the additional returns—a condition that is not true with the wheat and small grain crops.

As land values increase beyond $200 to $300 per acre the potato crop becomes relatively unprofitable as compared with the onion crop and other garden crops requiring large amounts of labor per acre in their production. Onions, for example, under good cultivation, will yield 600 to 1,000 bushels per acre, giving a gross income ranging from $200 to $400 per acre. Strawberries, small fruits, and orchard crops are also illustrative of crops adapted to soils so located as to have a value of $400 per acre or higher. The value of land is thus seen to be a most important factor which governs the determination of the most profitable system of agriculture. The crops and the systems of farming must be in accord with land values, or financial loss is the result. Wheat, because of its low acre cost of production and its ease of storage and transportation, is adapted to culture only on relatively low-priced lands. The cost of producing this crop mounts up so rapidly on high-priced land as to make profits impossible; for the crop does not lend itself to intensive culture, and a high application of labor and capital in production can not be recovered in increased yields. When wheat is grown on land valued at $100 per acre the net product must be approximately five times as great as on land valued at $20 per acre in order to yield the same rate of profit, and it is impossible to raise the yield to that point. Waste and loss are, therefore, the results of growing wheat on high-priced land, for 5 acres of $20 land will produce a much greater net

product of wheat than 1 acre of $100 land. Similar illustrations might be given with other crops, such as corn, potatoes, and onions, but enough has been given to show that the most successful farm management demands that a system of cropping and field management be followed which is in accord with the land values. When land values are relatively low a system of farming which raises crops capable of extensive cultivation at low cost of production per acre is usually more profitable than one producing crops of a high cost of production, and when land values are high the intensively cultivated crops are the most profitable.

Wheat farming must, of course, give some consideration to problems of soil fertility, so that the production of clovers and the raising of live stock are advisable. Where grain is to be the chief crop of the farm, a large area of grass pastured and fed to those classes of live stock demanding a low cost for labor in their keep is the solution of the fertility problem, and the markets and economic environment of such a farm rarely justify dairying and intensely cultivated crops, such as ensilage. Likewise, in corn and potato farming on high-priced land, live stock is essential to good farm management and to the maintenance of profitable yields. Cattle and hog feeding are well adapted for combination with the corn crop, and dairying with conditions which make potatoes profitable.

Good farm management demands the application of the principles outlined in this discussion—principles which, if ignored, result in "no-profit" farming. Those conditions and factors which determine the value of land give a different environment to all grades of land, and the system of cropping and farm management, to be profitable, must recognize the environment.

THE LABOR DAY FOR MEN AND HORSES.

These figures are obtained by dividing the total man labor on all farms on each route for each month of the years 1902–1907, inclusive, by the number of adult males on the farms, and by dividing the total hours of horse labor each month by the number of farm work horses kept. The hours of labor per day is then the average for hired and resident laborers and represents the average number of hours of employment per day for the average farm dweller. The hours of employment for hired labor exceed the figures here given, as the hired hand is only employed when he may be steadily employed for a full day. Contrary to popular opinion, the modern farmer does not work an excessive number of hours daily. In fact, the time spent in actual labor is probably no greater than that so spent by the city worker.

The figures in the daily column are averaged for three hundred and thirteen days in the year, no account being taken of holidays. The number of hours worked by the horses may seem exceedingly small, but it should be remembered that under ordinary methods of farm management the farm horses are idle for the greater part of the year and that the farmer, in order to have the use of a sufficient number of good teams at the time of year when work is pressing, is obliged to maintain them throughout the entire year. The question of sufficient and steady employment for the farm horse each month in the year is a fundamental one in farm management.

TABLE XLII.—*Average number of hours worked per day by men and horses on the statistical routes at Northfield, Marshall, and Halstad, Minn.*

[Average for six years, 1902–1907.]

Month.	Northfield (Rice County).			Marshall (Lyon County).			Halstad (Norman County).		
	Week days.		Sunday.	Week days.		Sunday.	Week days.		Sunday.
	Man.	Horse.	Man.	Man.	Horse.	Man.	Man.	Horse.	Man.
	Hours.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	*Hours.*	*Hours.*	*Hours.*	*Hours.*
January	6.80	1.16	4.85	6.06	0.81	3.79	5.40	0.71	3.46
February	6.62	1.14	4.80	6.24	.96	3.66	5.94	.80	3.57
March	7.57	1.34	4.63	7.42	1.72	3.44	6.26	.86	3.42
April	9.88	4.54	4.02	9.05	4.46	3.15	7.65	2.48	2.82
May	9.03	4.00	3.46	9.46	4.66	2.84	9.08	5.06	2.80
June	9.64	3.11	3.11	9.65	3.55	2.63	8.60	3.14	2.35
July	9.32	3.44	2.82	9.52	3.68	2.38	9.49	3.24	2.41
August	10.25	4.78	2.66	10.28	5.07	2.74	9.83	5.21	2.29
September	11.03	4.07	2.93	9.80	5.08	2.57	9.48	6.07	2.24
October	9.56	3.86	2.84	9.66	4.61	2.67	9.59	6.56	2.42
November	9.08	3.05	3.55	9.14	3.57	3.27	8.10	2.77	2.92
December	7.29	1.55	4.57	7.00	1.37	3.54	5.61	.71	3.33
Average	8.94	3.03	3.64	8.66	3.29	3.05	8.10	3.14	2.76

STATISTICS OF COST RELATING TO LIVE STOCK.

Many of the statistics concerning the feeding of live stock, gains in weight, and net gain from various methods of feeding can be collected only by experiment stations and individual feeders who carefully tabulate daily statistics. The cost statistics of live stock presented herewith in Tables XLII to LI are averaged from all live-stock records in each region where statistics were gathered, and are capable of wide use as average costs. The statistics on the cost of maintaining milch cows and on the average product from Minnesota cows form an accurate basis for the discussion of dairy conditions within the State. The statistics gathered at Northfield are representative of an excellent dairy community where dairy products are the chief products of the farms.

MILCH COWS.

CARE.—The labor cost of caring for milch cows shown in the following table includes feeding, bedding, and cleaning stalls, marketing products, and all other labor connected with the care of a herd of milch cows. The product was generally marketed in the form of cream or of whole milk. The total cost is based on the total cost of labor for all cows on the three statistical routes. The cost per head, $17.038, is the total cost of caring for one cow one year, and represents the average cost on the three routes. The total number of cows cared for, for the years 1905–1907, was 787, or an annual average of 262.

TABLE XLIII.—*Yearly labor cost of caring for milch cows, 1905–1907.*

Period.	Northfield (Rice County).			Marshall (Lyon County).			Halstad (Norman County).		
	Total number of cows.	Total labor cost.	Cost per head.	Total number of cows.	Total labor cost.	Cost per head.	Total number of cows.	Total labor cost.	Cost per head.
Winter months—January, February, March, April, November, December[a]	394	$3,814.74	$9.682	153	$1,102.31	$7.205	240	$2,340.68	$9.753
Summer months—May, June, July, August, September, October[a]	396	3,081.40	7.781	165	1,183.11	7.170	240	1,996.43	8.318
Total cost per head per year			17.463			14.375			18.071

TOTAL FOR THE THREE STATIONS.

Period.	Total number of cows.	Total labor cost.	Cost per head.
Winter months—January, February, March, April, November, December[a]	787	$7,257.73	$9.222
Summer months—May, June, July, August, September, October[a]	801	6,260.94	7.816
Total cost per head per year			17.038

[a] For the purposes of this bulletin January, February, March, April, November, and December are arbitrarily classed as winter and others as summer months.

FOOD.—The quantity and cost of grain and roughage have been distributed among all cows in the herds classed as milch cows; this number includes all dry cows and cows not fed grain at all seasons. Of the 260 cows at Northfield during the winter months, 192, or 73.8 per cent, were actually fed grain; little summer feeding of grain was done, 216 cows being fed grain for fifteen days in May, and 18 cows for seven days in October. At Marshall, 28 cows out of 143, or 19.5 per cent, received grain during the summer months, and 74 cows out of 115, or 64.3 per cent, during the winter months. At Halstad,

59 cows out of a total of 288, or 20.4 per cent, were fed grain during the summer months, and 190 out of 294, or 64.6 per cent, during the winter months.

Of the concentrates fed, the per cent of mill feed was small on all routes, averaging 40.3 per cent of the total grain at Northfield, 4.7 per cent at Marshall, and 11.7 per cent at Halstad.

The pasture charge per cow per month at Northfield was $1, and at Marshall and Halstad, 75 cents.

The average number of cows kept per farm per year at Northfield was 16.4, at Marshall 8.6, and at Halstad 9. The number of young stock per farm per year averaged 9.5 at Northfield, 15 at Marshall, and 11 at Halstad.

TABLE XLIV.—*Yearly cost of feeding milch cows.*

Item.	Northfield (Rice County) 1906–7.			Marshall (Lyon County) 1906–7.			Halstad (Norman County) 1904 to 1907.		
	Six summer months.	Six winter months.	Total for year.	Six summer months.	Six winter months.	Total for year.	Six summer months.	Six winter months.	Total for year.
Number of cows	264	260	.....	143	115	.....	288	294	.....
Grain fed, pounds	22,698	209,556	232,254	39,181	114,804	153,985	40,837	157,711	198,548
Roughage fed, pounds	107,347	1,211,414	1,307,761	88,358	400,411	488,769	289,334	1,344,362	1,633,696
Grain value	$202.590	$1,567.960	$1,770.55	$286.520	$800.840	$1,087.36	$322.630	$1,227.950	$1,550.58
Roughage value	$309.620	$2,860.040	$3,169.66	$199.180	$798.800	$967.98	$404.260	$2,119.510	$2,523.77
Grain, pounds per cow	86	806	892	274	998	1,272	142	536	678
Roughage, pounds per cow	407	4,621	5,028	618	3,482	4,100	1,005	4,569	5,574
Grain, value per cow	$0.767	$6.030	$6.797	$2.000	$6.960	$8.96	$1.120	$4.18	$5.30
Roughage, value per cow	$1.172	$11.000	$12.172	$1.180	$6.950	$8.13	$1.400	$7.21	$8.61
Pasture, charge per cow	$6.000	.....	$6.000	$4.120	.....	$4.12	$3.750	.....	$3.75
Total cost of feed per cow	$7.939	$17.020	$24.970	$7.300	$13.910	$21.21	$6.270	$11.39	$17.66

AVERAGE, ALL COWS—THREE STATIONS—1906–7.

Item.	Six summer months.	Six winter months.	Total for year.	Item.	Six summer months.	Six winter months.	Total for year.
Number of cows	551	522	.....	Grain, value per cow	$1.18	$5.71	$6.89
Grain fed, pounds	82,297	403,215	485,512	Roughage, value per cow	$1.24	$9.04	$10.28
Roughage fed, pounds	340,372	2,273,506	2,613,878	Pasture, charge per cow	$4.92	.....	$4.92
Grain value	$650.42	$2,982.77	$3,633.19	Total cost of feed per cow	$7.34	$14.75	$22.09
Roughage value	$680.93	$4,718.60	$5,399.53				
Grain, pounds per cow	149	772	921				
Roughage, pounds per cow	618	4,355	4,973				

MAINTENANCE.—The cost of labor and feed per cow shown in detail in Tables XLIII and XLIV are summarized in the table below, together with the cost item, interest on investment. The average value per head of the dairy cows at Northfield was $37.24, at Marshall $25.84, and at Halstad $24.66. The average value per head of all cows in these districts is $30.76. The interest rate used in computing interest on investment is 6 per cent.

The cost of sheltering the milch cow should be included if the total of all costs is desired. It has been omitted because of the difficulty in making this cost representative and accurate. Since many farm barns shelter cows, young stock, horses, hay, fodder corn, grain, sheep, and poultry, the cost of sheltering the milch cow can not be accurately computed. This cost will usually approximate $4 to $8 per year. For example, a barn costing $2,500, sheltering 30 head, and having an estimated life of fifty years, will have an annual depreciation charge of $50, and an annual interest or investment charge of $76.50, insurance $10, and painting and repairs about $25. This makes a total annual cost of $161.50, or an annual cost of shelter per head of $5.38. In many dairy barns, where economy in the cost of construction has not been thoughtfully considered, the cost of sheltering a cow will run as high as $7 to $10.

TABLE XLV.—*Average annual cost of maintaining a milch cow.*

Item.	Northfield (Rice County).	Marshall (Lyon County).	Halstad (Norman County).	Average all cows—three stations.
Grain	$6.797	$8.960	$5.300	$6.890
Roughage	12.172	8.130	8.610	10.280
Pasture	6.000	4.120	3.750	4.920
Labor	17.463	14.374	18.071	17.038
Interest on investment	2.234	1.550	1.480	1.846
Total	44.666	37.134	37.211	40.974

PRODUCTION.—The average annual yield (1905–1907) of butter fat per cow from 550 cows in Minnesota was 186.49 pounds, and the average annual yield of milk 4,950 pounds. The average price of butter fat at Northfield was 25.92 cents per pound: Marshall, 23.28 cents, and Halstad, 20.71 cents, and the average price, 23.94 cents.

The value of the product as shown in this table is computed from the pounds of butter fat at prices given above with an additional credit of 15 cents per hundredweight for the skim milk.

In Table XLV the average cost of maintaining a milch cow at Marshall is shown to be $37.134, and $44.666 at Northfield, while in Table XLVI the average value of the product per cow at Marshall is $43.02, and at Northfield, $60.05. Expressing these comparisons in percentages, the cost of maintaining the average cow at Marshall is 83 per cent of the cost per cow at Northfield, while the value of the product of the average cow at Marshall is only 71 per cent of that at Northfield.

These percentages serve to illustrate the fact that the cost of maintenance for dairy cows of poor type and productiveness is higher in proportion to product than for those of good type. Maintenance, cost of feed, labor, and interest on investment can not be reduced much lower for the cow of poor type than for the one of good type

(17 per cent less in those averages), and for this 17 per cent reduction in expense the product returned was 29 per cent less—a loss of 12 per cent. In other words, a dollar expenditure for food, labor, and interest with good types gave a return of $1.34 and with the poor types $1.15.

TABLE XLVI.—*Total and average yield of milk and butter fat per cow at Northfield, Marshall, and Halstad, 1905–1907.*

Station.	Total.				Average.		
	Number of cows.	Milk.	Butter fat.	Value of product.	Milk per cow per year.	Butter fat per cow per year.	Value of product per year.
		Pounds.	*Pounds.*		*Pounds.*	*Pounds.*	
Northfield (Rice County)...	261	1,458,149	53,260.93	$15,673.34	5,587	204.06	$60.05
Marshall (Lyon County).....	128	536,591	20,732.99	5,507.18	4,192	161.98	43.02
Halstad (Norman County).	161	727,788	28,574.22	6,839.25	4,520	177.48	42.48
Three stations.....	550	2,722,528	102,568.14	28,019.77	4,950	186.49	50.95

TOTAL AND NET VALUE OF PRODUCT.—No better picture can be drawn of agricultural conditions in Minnesota than is here drawn with statistics of cost and value of product from a large number of Minnesota's dairy cows. The statistics of average cost and product for Northfield, Marshall, and Halstad, and all cows at three stations have been taken from Tables XLV and XLVI, and similar statistics for a typical herd of productive dairy cattle and a typical herd of unprofitable cattle are shown in comparison. In comparing the two herds, one of which is above the average and the other below the average, it may be said that in the one case $1 expended in costs of maintenance gave a return of $1.41 and in the other case a return of 99 cents. Keeping dairy cows for the manure they produce is a poor business. Feeder cattle and sheep will produce manure with a smaller investment of capital and labor than dairy cows. Profitable dairying demands good markets, good cows, good feeding, and business management.

TABLE XLVII.—*Cost of maintenance, total and net value of product per cow.*

COST OF MAINTENANCE.

Item.	Northfield (Rice County).	Marshall (Lyon County).	Halstad (Norman County).	All three stations.	Average.	
					A good dairy herd.	A poor dairy herd.
Grain.....	$6.797	$8.960	$5.300	$6.890	$6.565	$4.371
Roughage.....	12.172	8.130	8.610	10.280	14.302	7.598
Pasture.....	6.000	4.120	3.750	4.920	6.000	4.120
Labor.....	17.463	14.374	18.071	17.038	18.932	11.623
Interest on investment.....	2.234	1.550	1.446	1.846	3.878	1.297
Total cost.....	44.666	37.134	37.211	40.974	49 677	29.009

TABLE XLVIII.—*Cost of maintenance, etc., per cow*—Continued.

VALUE OF PRODUCT.

Item.	Northfield (Rice County).	Marshall (Lyon County).	Halstad (Norman County).	All three stations.	Average.	
					A good dairy herd.	A poor dairy herd.
Total value of product	$60.050	$43.020	$42.480	$50.950	$69.970	$28.860
Net value of product	15.384	5.886	5.269	9.976	20.293	—.149

SWINE.

CARE.—The average annual labor cost of caring for swine can not be satisfactorily based upon the cost per head, hence the average size herd per farm is considered as the unit. The size of the herd is determined from the number of swine kept on the farm for the entire year and the number of pigs sold. Thus the average herd of swine on the farm at three stations consisted of three sows and nineteen pigs, cared for at an average cost of $30.37.

TABLE XLVIII.—*Average annual labor cost per farm of caring for swine, 1905–1907.*

Item.	Northfield (Rice County).	Marshall (Lyon County).	Halstad (Norman County).	Three stations.
Average annual number of sows per farm	3	5	2	3
Average annual number of pigs sold per farm	18	30	9	19
Number of farms	24	20	18	62
Total labor cost	$580.15	$763.31	$539.62	$1,883.08
Annual labor cost per farm	$24.17	$38.17	$29.98	$30.77

SHEEP.

CARE.—The annual cost of caring for sheep is based upon the average flock per farm rather than upon the cost per head. The cost of care does not increase proportionately with each additional head, as the large flock is frequently cared for as cheaply as the smaller one. The average labor cost of feeding and managing a small flock of native sheep is shown in the table under the heading "Native flocks, Northfield and Marshall." The annual labor cost per farm at two stations has been affected by including in the statistics a large flock of western sheep that were brought in and pastured for a few months. This cost is therefore not representative of average farm conditions as in the case of the two native flocks.

TABLE XLIX.—*Average annual labor cost per farm of caring for sheep, 1905–1907.*

Item.	Northfield (Rice County).	Marshall (Lyon County).	Two stations.	Native flocks, Northfield and Marshall.
Average annual number of flock	56	311	275	48
Number of farms	1	6	7	4
Total labor cost	$32.54	$169.54	$202.08	$81.37
Annual labor cost per farm	$32.54	$28.26	$28.87	$20.34

PASTURING CATTLE.

The gains of cattle on pasture are based on returns for the year 1907 from eight farms at Marshall and Northfield. The pastures were of tame grass, mostly timothy, and furnished an abundance of food throughout the season. The gains may be considered as representative of average conditions with average cattle rather thin in flesh. The greatest gains are made on grass when cattle originally carry but little fat.

The use of tame-grass pasture in the farm rotation is growing in favor, and, as indicated by the gains made, is a profitable farm practice.

The cost of pasture is made up of cost of seed and of sowing, interest, depreciation and repairs of fences, and land rental. The ordinary 3-wire fence with posts 1½ rods apart costs annually about 2.7 cents per rod. On rectangular fields 40 by 160 rods the annual charge for fencing per acre would be 27 cents, since 10 rods of fence are required for each acre inclosed. The seed cost, obtained from Table XXVII, is 29.3 cents. Thus the annual cost of pasture on $70 land would be 27 cents plus 29.3 cents plus $3.50, or $4.063 per acre.

Reports thus far received show that on tame-grass pasture 1¼ acres are required per 1,000-pound animal.

The gains made indicate that a method of farm management in which pasture is largely used can be made very profitable.

TABLE L.—*Gains of cattle on pasture in 1907.*

YEARLINGS AND TWO-YEAR-OLDS.

Station.	Number of cattle.	Total weight in spring.	Total weight in fall.	Total gain.	Average time pastured.		Gain per head.	Gain per head per month.
		Pounds.	*Pounds.*	*Pounds.*	*Months.*	*Days.*	*Pounds.*	*Pounds.*
Northfield (Rice County)	34	17,261	26,346	9,085	5	26	267.2	45.6
Marshall (Lyon County)	41	25,565	36,849	11,284	5	16	275.2	49.8
Average					5	20	271.6	47.9

CALVES.

Northfield (Rice County)	26	7,767	13,210	5,443	6	3	209.3	34.3
Marshall (Lyon County)	16	5,214	7,445	2,231	5	13	139.4	25.8
Average					5	25	182.7	31.5

FOOD OF THE FARM HORSE.

The term "work horse" here, as in Table VIII, signifies those horses used primarily for farm work, and excludes all colts, young horses, and stock kept only for driving. The total cost of feed shown is for the concentrates, and for roughage only in form of hay. Pasturage and straw fed do not appear in this table. Straw is

charged against the horses at the cost of hauling, but no record has been kept of the pounds fed, as straw in Minnesota is generally a by-product of no market value. Straw is largely fed during the winter months at Marshall, Halstad, and on the 1,820-acre farm.

Practically all grains fed were farm-grown, being principally oats, barley, and corn.

All feeds used were charged at the local market prices, less cost of hauling from farm to market.

The average number of horses per farm at Northfield was 5.4, at Marshall 6.8, at Halstad 7, and on the 1,820-acre farm 39.66.

TABLE LI.—*Cost of food of farm work horses, 1905–1907.*[a]

Item.	Northfield (Rice County).			Marshall (Lyon County).			Small farms, Halstad (Norman County).		
	Inactive season.	Active season.	Total yearly.	Inactive season.	Active season.	Total yearly.	Inactive season.	Active season.	Total yearly.
Horses.....number..	147	134	.....	158	157	.....	136	135	.....
Grain.....pounds..	217,017	502,453	719,470	254,577	676,755	931,332	100,149	386,700	486,849
Roughage.....do....	282,602	692,493	975,095	284,290	745,025	1,029,315	106,808	767,234	874,042
Grain.....value..	$1,525.37	$4,444.80	$5,970.17	$1,576.05	$5,149.44	$6,725.49	$818.02	$3,315.52	$4,133.54
Roughage.....do....	$784.62	$2,179.87	$2,964.49	$563.79	$1,451.61	$2,015.40	$166.06	$1,494.44	$1,660.50
Grain per horse, pounds.....	1,477	3,736	5,213	1,610	4,299	5,909	735	2,856	3,591
Roughage per horse, pounds.....	1,924	5,149	7,073	1,798	4,733	6,531	784	5,666	6,450
Grain per horse, value.....	$10.38	$33.05	$43.43	$9.96	$32.71	$42.67	$6.00	$24.49	$30.49
Roughage per horse, value.....	$5.34	$16.21	$21.55	$3.56	$9.22	$12.78	$1.22	$11.04	$12.26
Total cost of feed per horse	.....	.....	$64.98	.....	.....	$55.45	.....	.....	$42.75

Item.	1,820-acre farm, Halstad (Norman County).			Average, all farms.		
	Inactive season.	Active season.	Total yearly.	Inactive season.	Active season.	Total yearly.
Horses.....number..	119	119	.....	560	545	.....
Grain.....pounds..	86,228	347,436	433,664	657,971	1,913,344	2,571,315
Roughage.....do....	106,847	494,061	600,908	780,541	2,698,813	3,479,360
Grain.....value..	$704.53	$2,891.87	$3,596.40	$4,623.97	$15,801.63	$20,425.60
Roughage.....do....	$213.70	$897.08	$1,110.78	$1,728.17	$6,023.00	$7,751.17
Grain per horse.....pounds..	726	2,917	3,643	1,175	3,511	4,686
Roughage per horse.....do....	899	4,148	5,047	1,394	4,952	6,346
Grain per horse.....value..	$5.93	$24.25	$30.21	$8.26	$28.99	$37.25
Roughage per horse.....do....	$1.80	$7.53	$9.33	$3.09	$11.05	$14.14
Total cost of feed per horse	.....	.....	$39.54	.....	.....	$51.39

[a] Inactive season: December, January, February, March; active, all other months.

SUMMARY OF RESULTS OBTAINED IN COLLECTING AGRICULTURAL COST STATISTICS, 1902–1907.

For the years 1904–1907, the average monthly wages paid farm laborers during the eight "crop-season" months, April 1 to November 30, were approximately as follows: Northfield (1905–1907), $26.16; Marshall, $26.64; Halstad, $25.56; and the large farm in

northwestern Minnesota, $26.77. During the months of December, January, February, and March the average monthly wage at Northfield was $15.80; Marshall, $14.20; Halstad, $11.69; and the large farm in northwestern Minnesota, $14.36. (See Table IV, p. 10.)

The cost of farm board per month for one laborer, averaged for the three years 1905–1907, amounted to $14.36 at Northfield, $12.73 at Marshall, $11.58 at Halstad, and $10.02 on the large grain farm in northwestern Minnesota. The average cost per day was 47.9 cents at Northfield, 42.4 cents at Marshall, 38.6 cents at Halstad, and 33.4 cents for the large farm in northwestern Minnesota; the average cost of board per month on all farms was $12.65 and per day 42 cents. (See Table V, p. 11.)

The average cash value per hour of farm labor on all farms, for the three years 1905–1907, is 11.2 cents for December, January, February, and March, and 12.7 cents for the "crop-season" months, April to November, inclusive. While wages are lower in the winter months, the number of hours worked by the laborers is much less than in the summer—thus there is little difference between summer and winter in the cost per hour for farm labor. This cost is based upon the wages paid to men plus the cost for board. (See Table VI, p. 12.)

The average annual cost of maintaining a farm work horse during the years 1904–1907 amounted to $90.40 at Northfield, $87 at Marshall, $75.07 at Halstad, and $65.23 for the large farm in northwestern Minnesota. This cost is based on the following items of expense: Interest on investment, depreciation, harness depreciation, shoeing, feed, labor, and miscellaneous expense. (See Table VIII, p. 15.)

The labor of the farm horse comprises a large proportion of the cost of crop production. The average cost per hour of horse labor, 1904–1907, was 9.25 cents at Northfield, 8.36 cents at Marshall, 7.32 cents at Halstad, and 7.46 cents on the large farm in northwestern Minnesota. The annual cost of maintaining the farm horse has been divided by the total number of hours of work in a year to obtain the cost per hour. (See Table IX, p. 16.)

The depreciation in value of all classes of farm machinery is approximately 7.3 per cent annually. The annual depreciation of the most universally used farm machinery is as follows: Grain binders, 7.91 per cent; grain drills, 6.75 per cent; corn binders, 10.03 per cent; corn cultivators, 7.25 per cent; mowers, 7.8 per cent; hayrakes, 7.8 per cent; sulky plows, 8.4 per cent; wagons, 4.89 per cent; harrows, 8.72 per cent, and harness, 6.17 per cent. A complete list of machinery is shown in Table X, page 17.

The annual values consumed per acre in a number of the most universally used farm machines are as follows: Grain binders, 18.1 cents; grain drills, 7.5 cents; corn binders, 82.6 cents; corn cultivators, 15.5

cents; mowers, 20.6 cents; hayrakes, 8.5 cents; plows, 8.7 cents, and harrows, 1.7 cents. The term "values consumed" includes the machinery cost items of depreciation, interest on investment, and repairs. The average annual acreage covered by each class of machinery is divided into the total cost to obtain the cost consumed per acre. (See Table XI, p. 18.)

The value in farm machinery consumed per acre for the corn, grain, and hay crops is as follows: Northfield, corn, $1.748; grain, 51.7 cents; hay, 54.8 cents; Marshall, corn, $1.448; grain, 55.8 cents; hay, 47.7 cents; Halstad, corn, $1.143; grain, 37.2 cents; hay, 29 cents; large farm in northwestern Minnesota, grain, 27.7 cents; thrashing outfit, 33.5 cents; hay, 20 cents. (See Table XII, p. 19.)

The total cost per acre of producing a number of the staple field crops of Minnesota is as follows, including seed, labor of men and horses, twine, machinery depreciation, and land rental: Corn husked from the standing stalks, Northfield, $11.658; Marshall, $9.662; corn cut, shocked, and shredded, Northfield, $15.297; corn grown thickly and siloed, Northfield, $20.627; Minnesota Agricultural Experiment Station, $19.187; flaxseed, thrashed from the windrow, Northfield, $10.072; Halstad, $7.272; large farm in northwestern Minnesota, $6.283; fodder corn, cut and shocked in the field, Northfield, $10.733; Halstad, $8.912; hay, timothy, and clover, one cutting, Northfield, $6.185; Marshall, $5.553; Halstad, $4.567; mangels, Minnesota Agricultural Experiment Station, $32.682; oats, fall plowed, Northfield, $9.854; Marshall, $9.039; Halstad, $7.110; large farm in northwestern Minnesota, $6.073; potatoes, machine production, large farm in northwestern Minnesota, $26.366; intensive culture, $37.721; wheat, fall plowing, Northfield, $9.861; Marshall, $8.389; Halstad, $6.977; large farm in northwestern Minnesota, $6.056. (See Table XIII, p. 23.)

The net feeding value of forage crops per acre (Table XXI, p. 30), as determined from statistical and feeding investigations, is $8.69 per acre for a two-and-one-half-ton yield of timothy and clover, $4.79 per acre for a three-and-one-half-ton yield of cured fodder corn; while the net loss on 10 tons to the acre of ensilage is $0.39, and for a 20-ton yield of mangels, $6.68. One dollar expended in capital and labor in hay production gives a return of $2.21; fodder corn, $1.38; ensilage, 98 cents; and mangels, 79 cents. Under conditions of higher land values, and relatively higher prices for feeds than are assumed in Table XXI, these relative net values or net losses would not apply. (See Table XXI and p. 31.)

Potato production by machine methods has greater possibilities in Minnesota for large profits per acre than grain crops. The cost per acre of producing potatoes, as determined from a large potato farm in Clay County, Minn., is $26.37, this cost including seed, labor, ma-

chinery cost, land rental, and the cost of labor and materials to spray the crop three times for blight and the potato beetle.

The average yield per acre was 127 bushels, which, at 40 cents per bushel, gives a gross income per acre of $50.80, or a net profit of $24.43. The rate of profit on land valued at $50 per acre is 48.9 per cent. (See Table XXXV, p. 41.) Where fertilizers and more intensive methods are used the cost is increased to $37.72, with an increase in yield to 162 bushels per acre, and at 40 cents per bushel gives a net profit of 54.2 per cent on $50 land.

The cost per acre of fall plowing, as averaged from 4,773 acres at Northfield (Rice County), is $1.256; from 5,974 acres at Marshall (Lyon County), $1.141; from 7,186 acres at Halstad (Norman County), $1.13; and from 5,363 acres on the large farm in northwestern Minnesota, 92.4 cents. (See Table XXXIX, p. 46.)

The average farm price December 1, 1902–1907, in Minnesota for barley is 40 cents per bushel, corn 38.5, flax 96.3 cents, hay $6.05 per ton, oats 29.2 cents per bushel, potatoes 41.5 cents, and wheat 74.2 cents.

At these prices the amount of product per acre necessary to cover the cost of producing field crops is as follows: Barley, 20.53 bushels; corn, 27.11 bushels; flaxseed, 7.78 bushels; hay, 0.92 ton; oats, 30.46 bushels; potatoes, 63.51 bushels; wheat, 9.78 bushels. (See Table XL, p. 46.)

When interest on the investment in land is considered as an item of expense, the cost of producing wheat on $20 land is $7.18, and on land valued at $100 the cost increased to $11.98, an increase of 66.9 per cent in cost. Potatoes can be produced on $50 land for $26.366, on $100 land for $29.366, an increase of 9.7 per cent in cost. Fifteen bushels of wheat, at the average farm price of 66 cents, when grown on the $20 land will return a net profit of 13.6 per cent, and on $100 land will give a net loss of 2 per cent. A yield of 38.8 bushels must be obtained on the $100 land to yield the same rate of profit as could be secured on the cheap land with 15 bushels. Potatoes yielding 100 bushels to the acre, and valued at 39 cents per bushel on the farm, when grown on $50 land will return a net profit of 24.5 per cent, and a net profit of 9.6 per cent on $100 land.

Wheat and other grain crops grown on high-priced land can not compete with grain grown on cheap land, for such crops are not adapted to intensive culture, as are the corn, potato, and onion crops, or as are forage crops fed to productive milch cows near good markets. (See Table XLI, p. 49.)

The average length of the working day for men on the farms at Northfield, southeastern Minnesota, is 8.94 hours, with 3.64 hours for Sunday work. At Marshall, in southwestern Minnesota, 8.66 hours for the week days and 3.05 hours for Sundays; and at Halstad, in

northwestern Minnesota, 8.10 hours for the week days and 2.76 hours for Sundays. The average length of the working day for horses at Northfield, southeastern Minnesota, is 3.03 hours; at Marshall, southwestern Minnesota, 3.29 hours; and at Halstad, northwestern Minnesota, 3.14 hours. (See Table XLII.)

Milch cows in Minnesota were maintained at an average annual cost per head of $40.97, exclusive of the cost of shelter, which will range from $4 to $8. The total cost was made up of the following items: Grain, $6.89; roughage, $10.28; pasture, $4.92; labor, $17.038; interest on investment, $1.846. The average annual value of the product from milch cows (550 in number) was $50.95, leaving a net value of product of $9.98. (See Tables XLV and XLVI, pp. 56, 57.)

The amount of grain fed annually to the average cow concerning which statistics were collected was 921 pounds; roughage, 4,973 pounds. The average cow receiving these amounts of feed gave an annual milk yield of 4,950 pounds, containing 186.49 pounds of butter fat. (See Tables XLIV and XLVI, pp. 55, 56.)

One dollar expended in cost of maintenance of milch cows at Northfield gave a return of $1.34; at Marshall, $1.15; and at Halstad, $1.14.

Individual herds show a much wider difference between cost and value of product. One of the best dairy herds at Northfield gave a return of $1.41 for every dollar expended, and one of the poorest herds at Marshall gave a return of 99 cents to the dollar. While a better market at Northfield than on the other routes has some influence in determining the greater profit in dairying in that region, more productive types of cows and better management are the chief factors. (See Tables XLVI, XLVII, p. 56.)

The average labor cost of feeding and managing 3 sows and 19 pigs amounted to $30.37 per year.

The average annual labor cost of feeding and managing a flock of 48 native sheep amounted to $20.34.

Yearlings and 2-year-old cattle on pasture made an annual gain of 271.6 pounds, and calves averaged 182.7 pounds. The cost of production of pasture per acre on $70 land is about $4.07. (See Table L, p. 59.)

The average cost of feeding a farm work horse a year was $51.39. The average quantity of grain fed per horse was 4,686 pounds, and the average amount of roughage, 6,346 pounds. (See Table LI.)

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