5-1934

Estimated Returns from Farms of Large, Medium and Small Size of Business in the Spring Wheat Areas of South Dakota

C. M. Hampson
South Dakota State University

P. Christophersen
South Dakota State University

Circular 20 May ,1934

Estimated Returns From Farms of Large, Medium, and Small Size of Business in the Spring Wheat Area of South Dakota

C. M. Hampson, Poul Christophersen

Agricultural Economics Department
Agricultural Experiment Station
South Dakota State College of
Agriculture and Mechanic Arts
Brookings
Cooperating with the
Bureau of Agricultural Economics
United States Department of Agriculture

Foreword and Acknowledgments

This is one of a series of three circulars which is being published on the economics of agriculture in the Spring Wheat Area of South Dakota. The three publications are:

Experiment Station Circular 19, An economic study of farming in the Spring Wheat Area.

Experiment Station Circular 20, Estimated returns from farms of large, medium and small size of business in the Spring Wheat Area.

Experiment Station Circular 21, Estimated returns from operating 800 acres in the Spring Wheat Area under four different plans.

Circular 19 is of historic nature, in that it gives results that have been attained. It presents a summary of four years of study of farms, and attempts to explain why some farms are more profitable than others.

Circular 20 discusses the comparative returns that may be expected from farms of large, medium and small size of business, under different situations of prices, production and land valuations.

Circular 21 discusses the comparative returns that may be expected from diversified farms of a given area, operated under four different plans of organization and under different price and production situations.

Acknowledgments are due to the Division of Farm Management and Costs of the Bureau of Agricultural Economics, United States Department of Agriculture for aid in collecting and tabulating data on which the publications are based. Credit is also due to the farmers who, by faithful cooperation in keeping records and supplying information, have made the study possible. The authors also appreciate the assistance given by members of the Department of Agricultural Economics of South Dakota State College.

Estimated Returns from Farms of Large, Medium and Small Size of Business in the Spring Wheat Area of S. D.

By

C. M. Hampson, Poul Christophersen

Size of farm business is recognized by all farm management investigators and by many farmers as one of the most important factors making for success or failure in farming. A moderately large size of business, doubtless is more profitable in so-called normal times than is a small sized business.

Size of business in this circular is not measured in acres only, as is common in certain sections where most of the land is fertile and tillable, and most of the farms are of the same type. Size of business cannot be measured accurately, nor by a single descriptive term such as acres. It includes the area farmed, the area in crop land, the amount of productive labor employed, the amount of capital used, the rate of turnover of capital, the total production and the quality of production. Size of business may be increased by employing a laborer for productive work, by increasing the numbers of livestock, by increasing yields per acre, by doing work for hire outside the farm, etc.

The purpose of this circular is to discuss the relative profitableness of a selected type of farm when operated as a business of different sizes. In the discussion six hypothetical farms are used for illustration. In the first group of three, a diversified farm, which is farmed rather intensively, is shown as a business of large size, of medium size, and of small size. The same plan is used for presenting the second group, a diversified farm which is farmed rather extensively.

Some crops, such as corn and alfalfa, require more labor than some other crops, such as wheat and native hay. Likewise, some livestock, such as dairy cattle, require more labor than some other livestock, such as beef cattle. Farms with enterprises which require considerable labor are said to be intensive, in contrast to farms with enterprises which require less labor. The latter are said to be extensive.

Each of the hypothetical systems is very similar to some one actual farm common to the Spring Wheat Area and from which records have been obtained. The similarities include acres of crops, numbers of livestock, amounts of labor, power and equipment used, amount of land rented, receipts and expenses, and income.

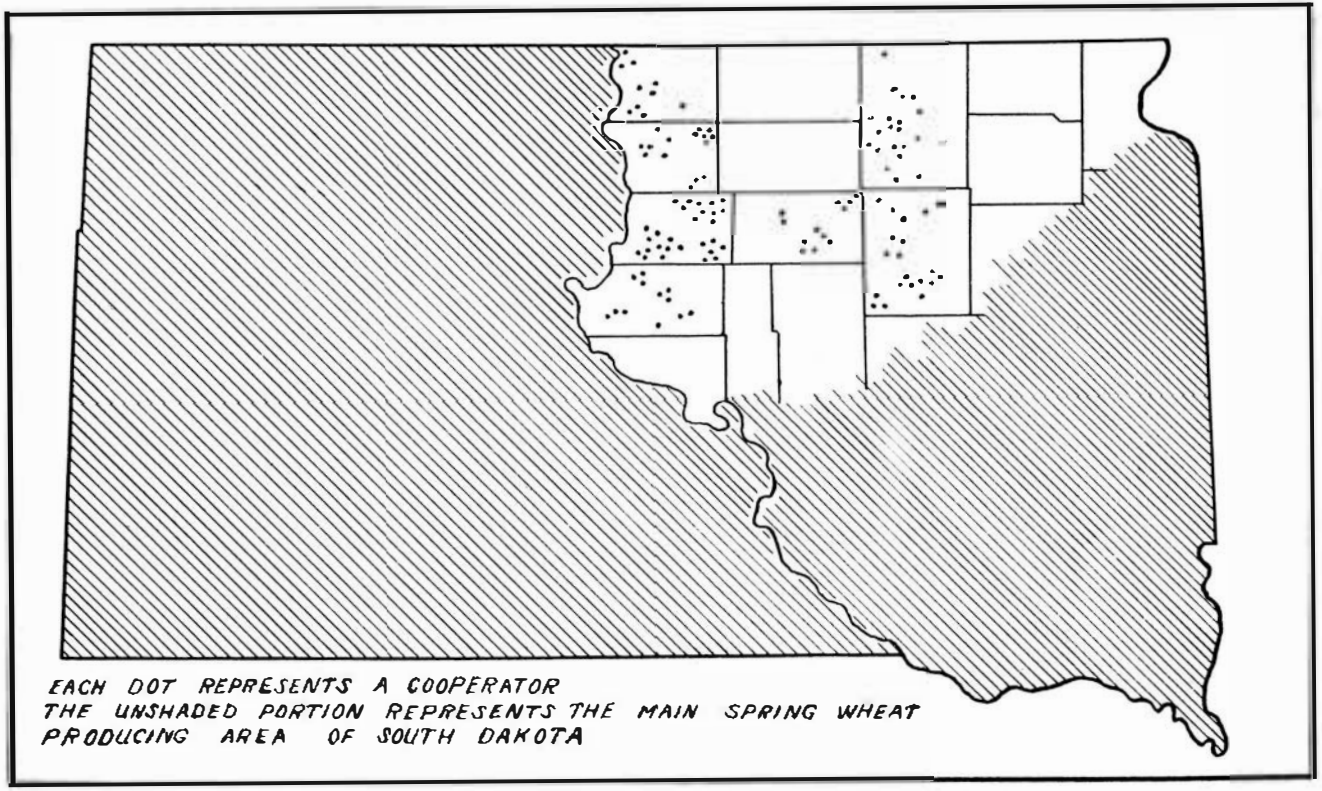

Fig. 1.—Location of farms studied. Each dot represents a cooperator. The unshaded portion represents the main spring wheat producing area of South Dakota.

The standards of production used in budgeting the farms are based upon unpublished data secured from the study on which this circular is based, and from records obtained from the United States Division of Crops and Livestock Estimates. The standards of labor required and the use of tractor and horses in producing crops were taken from South Dakota Circular 6, "Tractor and Horse Power in the Wheat Area of South Dakota." The prices used are based on those of 1932, but were adjusted for a normal ratio of prices between farm products and for compensation received from AAA contracts.

The information presented is based on farm business records which were kept by farmer cooperators, and through several visits made each year to the cooperators. The records were secured from seven counties of the spring wheat producing area of the state. Fig. 1. During 1930, 44 complete records were secured; during 1931, 29 records; during 1932, 112 records; and during 1933, 98 records. Eighty per cent of all the farms studied were diversified farms.

The crop yields when compared with the ten-year average of the area and expressed as a percentage were 83, 40, 108, and 15 for the years 1930 to 1933, respectively. The extremely low yields of 1933 were caused by a widespread drouth which covered almost the entire state. The yields of 1931, 1932, and 1933 were all reduced somewhat because of grasshopper infestations. The total production of pork in 1933 was greatly reduced by shortage of feed that year, but the income was supplemented considerably by the purchase of piggy-sows and small pigs by the United States Government.

The records of 1932 were selected as a base for calculations because of their being more representative of a long-time period than any other of the four years.

The average annual precipitation of the region varies from 16 to 25 inches, being somewhat heavier in the eastern part of the area. The average growing season varies from 120 to 140 days. The soil of Brown and Spink counties is mostly lacustrine, while the remainder of the soil is glacial. The topography of the area is generally level; however, there are a few ranges of low hills extending across the western counties, and many of the farms have one or more quarters which are rough or stony, or sometimes too low and wet for cultivation. Only 87 per cent of the area is in farms, leaving a large amount of land belonging to various divisions of the Government which may be secured at nominal rental rates for pasture and for making of native hay.

The information given in this circular should be applicable to general farms throughout the northeast quarter of the state, especially since the systems used for illustration are very much like actual farms of the area as they were operated during the last four years.

Analysis

The plan of discussion, as previously stated, is to show the estimated net returns from two given types of farms, each of which is operated as a business unit of different sizes. The organizations of diversified farms with dairying, hogs and wheat as major enterprises, are shown as of large, medium and small sizes in Table 1 and are labeled as Systems 1, 2, and 3 respectively. System 1 in this circular is the same as System 2 discussed in Circular 21. This type of organization was chosen because it is one of the most common to the area.

Some items common to the area, but relatively unimportant so far as the discussion is concerned, have been omitted from the farm organizations to make comparisons more simple and easy. These items include sheep, colts, poultry other than chickens, spelt, rye, flax, sorghums, sweet clover, and potatoes. Wheat is the only crop sold from the hypothetical farms, although in practice, feed crops are also sometimes sold. Practically all factors vary in each of the three systems in accordance with the size of business, and so as to conform with the practices commonly found on similar farms in the area.

Farm Organization of Intensive Diversified Farms

A study of Table 1 shows the area of the three farms to be 800 acres, 480 acres, and 240 acres. The number of acres of each kind of crop and the numbers of each kind of livestock are in approximate ratio to the respective total areas. The areas assigned to pasture and feed crops provide feed in sufficient amounts and desirable proportions for the livestock. Alfalfa occupies approximately 7 per cent of the acreage of each farm and wheat is grown as a cash crop on the remainder of the tilled area. No provision was made in the organization for AAA contracts. The plan does not provide a perfect rotation but it is typical of the region.

The number of horses varies in accord with the amount of work to be done and the numbers usually found on similar farms. There are not enough cattle and hogs on the smaller farms to justify owning sires for these herds. All the cattle are Holsteins.

Capital Investment.—It was assumed that the owned acreage of Systems 1, 2, and 3 was 320, 240 and 160 respectively. The rented acreage was 480, 240, and 80 respectively. The total value of land owned by the operator was calculated by valuing the crop land at $30 per acre, and the native grass land at $10 per acre. These values are somewhat less than those estimated by the farmers, but are greater than those given in the United States Census of 1930. The total valuations of all buildings, and other improvements on the farms varied in accord with the needs, excepting the dwelling. A stave silo was included in System 1 and trench silos were included in systems 2 and 3. The dwellings varied in value according to the average value of dwellings found on farms similar in size to those discussed. The total values of all capital investments are given in Table 1.

The implements and machinery on the farms varied with custom and minimum requirements of each farm. A two-unit milking machine was provided for System 1. A tractor and an auto were assumed to be owned on each farm; an auto truck on System 1, and an auto trailer on System 2. Neither a combine nor a thresher was included in the equipment. Livestock values per animal were held uniform, but of course the total varied due to the number of livestock on the farms. The same statement may be made for the feeds and supplies on hand at the time of taking inventory. No cash was allowed for operating the farms or for family living, because it was assumed the regular income from the dairy and poultry, and income from the sale of hogs and wheat carried in the inventories would be sufficient for these expenses.

TABLE 1.--Organization plans for operating a diversified farm in the South Dakota Spring Wheat Area as a business of three different sizes

Item	Unit	System 1 Large size	System 2 Medium size	System 3 Small size
Land Use:				
Wheat	acre	240	140	60
Feed grains	acre	160	80	50
Corn	acre	160	100	50
Alfalfa	acre	60	40	20
Total tilled land	acre	680	360	180
Hay and pasture	acre	140	80	40
Farmstead, waste, etc.	acre	40	40	20
Total farm	acre	800	480	240
Livestock:				
Milk cows	number	20	14	7
Young cattle	number	14	8	5
Calves saved	number	18	12	7
Brood sows	number	16	10	5
Hens	number	125	80	80
Work horses	number	7	5	2
Total animal units*		51	33	18
Capital Investment:				
Land owned		$ 8,400	$ 6,400	$ 4,000
Improvements		7,500	5,525	4,375
Equipment		2,855	2,180	2,035
Livestock		2,235	1,225	610
Crops		1,660	955	765
Total investment		$22,650	$16,285	$11,785
Man Labor:				
Required	month	30	20	13
Productive work units†		835	535	285
Tractor Power:				
Approximate requirements	hour	800	480	300

* An animal unit is the approximate equivalent from the standpoint of feed required, of a mature cow or horse. A unit may be one mature cow or horse, two young cattle or horses, five sows, ten pigs, seven sheep, 14 lambs, 100 hens, or 25 turkeys.

† A productive work unit is the accomplishment expected of an average man in a 10-hour day when performing work directly connected with securing farm income. Such work as building or repairing buildings and fences, overhauling machinery, clearing land of stones, etc. is not considered productive except when done for hire.

Labor.—The operator of each farm was credited with 12 months of labor. All other labor was assumed to be hired since that is the only fair way of comparing the farms. The wheat was harvested with a hired combine and crew on Systems 1 and 2 and the remainder of the small grain was cut and threshed. On System 3 all of the grain was cut with a binder and later was threshed. On Systems 1 and 2 part of the corn was husked with hired labor not regularly employed; on all of the farms, much corn was hogged down to save labor. The total hours of labor required for all operations, excepting custom work, are shown in Table 1. The hours of work performed by men, horses and tractor, and the mileage of trucks was computed from South Dakota Circular 6 and unpublished data. Ample allowance was made for all operations under average conditions common to the region.

Table 2.—Estimated production and disposal of crops on diversified farms of three different sizes in the South Dakota Spring Wheat Area

Item	Unit	System 1	System 2	System 3
Wheat:				
Used for seed	bu.	240	140	60
Landlord's share	bu.	440	220	110
Sold	bu.	1,900	1,100	450
Used for feed	bu.	60	80	40
Total production	bu.	2,640	1,540	660
Harvested for grain	acre	240	140	60
Oats:				
Used for seed	bu.	160	80	60
Landlord's share	bu.	450	150	--
Used for feed	bu.	1,190	370	540
Total production	bu.	1,800	600	600
Harvested for grain	acre	60	20	20
Harvested for hay	acre	20	20	10
Barley:				
Used for seed	bu.	120	60	30
Landlord's share	bu.	360	180	90
Used for feed	bu.	960	480	240
Total production	bu.	1,440	720	360
Harvested for grain	acre	80	40	20
Corn:				
Used for seed	bu.	20	15	10
Landlord's share	bu.	360	180	90
Used for feed	bu.	2,050	1,335	620
Total production	bu.	2,430	1,530	720
Harvested for grain	acre	135	85	45
Harvested for silage	acre	25	15	10
Alfalfa:				
Harvested for hay	acre	50	30	15
Pastured	acre	10	10	5
Native:				
Pastured	acre	120	80	40
Total Feed Available:				
Concentrates	ton	101	57	33
Dry roughage	ton	85	60	30
Silage	ton	100	60	40
Pasture	day	5,700	3,900	1,950

Crop and Livestock Production.—The field operations assumed to be performed in operating the farms are quite common to the region and represent reasonably thorough soil preparation and cultivation, such as should result in crop yields equal to those shown in Table 13. The yields are based on a 15-year average of the region given by the United States Division of Crops and Livestock Estimates.

Alfalfa in each system remains on the land five years. All manure from the stables and feed lots is applied to land which is put into corn.

No commercial fertilizer is used on farms in the area. The production and disposal of each crop for each farm is shown in Table 2.

The methods assumed to be used in producing the livestock and livestock products of each of the farms are also quite common to the area and represent practices followed by the better livestock men. The gains in weight of animals, the production of butterfat and eggs, the production of offspring, the death losses and the use of farm products in the home are all based on averages of the farms studied. The standards used for both crops and livestock are slightly above the average production of the cooperators, but are considerably below those of the best farms on record.

TABLE 3.—Estimated production and disposal of livestock and livestock products on diversified farms of three different sizes in the South Dakota Spring Wheat Area

Item	Unit	System 1	System 2	System 3
Cattle enterprise:				
Calves saved	number	18	12	7
Calves sold for veal	number	12	8	4
Yearlings used in home	number	1	1	1
Yearlings for replacement	number	5	3	2
Heifers for replacement	number	4	2	1
Cows sold	number	3	2	1
Cows bred	number	20	14	7
Meat sold	pound	5,100	3,400	1,700
Meat used in home	pound	500	500	500
Net meat production	pound	5,600	3,900	2,200
Death losses after weaning	number	2	2	1
Butterfat sold	pound	4,640	3,140	1,390
Butterfat used in home	pound	360	360	360
Net butterfat production	pound	5,000	3,500	1,750
Hog Enterprise:				
Pigs saved	number	96	60	30
Hogs sold	number	73	44	22
Hogs used in home	number	4	4	4
Sows sold	number	14	9	4
Sows bred	number	16	10	5
Meat sold	pound	22,450	11,490	6,700
Meat used in home	pound	1,100	1,100	1,100
Net meat production	pound	23,550	12,590	7,800
Death losses after weaning	number	5	3	1
Poultry Enterprise:				
Hens, average	number	125	80	80
Meat sold	pound	800	500	500
Meat used in home	pound	200	200	200
Eggs sold	dozen	720	360	360
Eggs used in home	dozen	280	280	280

The feed requirements used are likewise slightly above the average, thus justifying higher production and at the same time avoiding the risk of shortage of feed in years of moderate drouth. Stubble and straw are not included in the budget of feeds. This provides considerable additional feeds for years of extreme drouth, also a better fertility program for the land. Total production and disposal of livestock and livestock products are shown in Table 3. Feed requirements and production per animal are given in Table 13.

On each of the three farms all livestock, except sires of hogs and cattle, were produced on the farm. All of the calves, except the most promising heifers, were sold for veal. Skimmilk was omitted from all computations. All dairy products were considered at butterfat prices because of the scarcity of markets for whole milk and sweet cream. All pigs were produced from spring litters farrowed by gilts and sold at an average weight of 225 pounds. The weights varied slightly between the systems because of the amount of feed available.

Prices.—Prices used in computing both receipts and expenses for the three farm systems were based on those received and paid in 1932, but adjusted for a long time normal ratio of prices between farm products, and for compensation received because of AAA contracts with wheat and hog producers. Prices per unit of products sold are shown in Table 13.

Receipts and Expenses.—Totals for the various items of receipts and expenses are shown in Table 4. The amounts received per unit of product sold and the rates of charging expenses are given in Table 13. The charges made for sires, seed, feed, veterinary services, repairs, taxes, and insurance on buildings and crops, are based on the four-year average of all of the farms on record. Because of the depression, the four-year average may be lower than a long-time average. Charges for each item of expense vary in accord with the size of each enterprise as it is found in each system. No charge was made for the labor of the farm operator, but all other labor was charged at an average rate of $25 per month for the actual work needed for production. The depreciation charge allows an amount sufficient to make major repairs and to replace improvements and equipment over a period of years so as to keep them in good condition. Gross income tax was not an expense of 1932 but was added to conform to current tax laws.

Miscellaneous receipts represent largely the average income to the farms on record for services rendered in public work. Many farmers living in the wheat area secure additional income from combining, threshing, silo filling, etc. Such income was excluded from the calculations. Likewise, the cost of such work was not included as an expense.

Income

Farm Income and Labor Income of each of the three systems is given at the botton of Table 4. Farm Income is the difference between the sum of the receipts and the sum of the expenses, not including interest. It represents returns for the use of the operator's capital invested in the farm business and for his services, both as a laborer and a manager. Since all labor except that of the operator was charged as an expense, differences between farms due to unpaid family labor were eliminated.

Labor Income is calculated by deducting a uniform interest charge from Farm Income. It represents net returns to the operator for his own labor and management after paying all expenses, including a charge for family labor and a charge for the use of his capital. Labor Income is a fair measure for comparing returns to all farmers, since even those operators who have no indebtedness are charged with interest on the capital used, and those who have workers within the family are charged with labor performed. In addition to Labor Income the farmer and his family have the use of the house, and food and fuels furnished by the farm.

TABLE 4.—Estimated receipts, expenses, and income from diversified farms of three different sizes in the South Dakota Spring Wheat Area

Item	System 1 Large size	System 2 Medium size	System 3 Small size
Farm Receipts:			
Wheat	$1,425	$ 825	$ 338
Cattle	207	138	69
Cream	1,253	848	375
Hogs	1,193	609	357
Poultry and eggs	166	93	93
Miscellaneous	45	45	45
Total farm receipts	$4,289	$2,558	$1,277
Farm Expenses:			
Breeding livestock	18	15	18
Seeds	45	30	15
Commercial feed	40	29	18
Veterinary and medicines	23	14	10
Twine	33	15	22
Labor (exclusive operator)	450	200	20
Threshing	194	79	110
Combining wheat	300	175	--
Corn husking	54	22	--
Silo filling	30	18	12
Tractor, gas and oil	288	173	108
Tractor repairs	44	26	16
Auto truck (100%)	60	--	--
Auto (50%)	60	90	60
Repairs and upkeep	118	72	40
Miscellaneous	25	15	10
Insurance, property	53	36	25
Insurance, hail	84	48	24
Taxes, real estate and personal	240	173	122
Taxes, gross income	35	21	10
Cash rent for pasture	20	10	--
Total cash expenses	$2,214	$1,261	$ 640
Depreciation	830	606	439
Total farm expenses	$3,044	$1,867	$1,079
Farm Income: (Receipts minus expenses)	$1,245	$ 691	$ 198
(Interest on investment @ 5%)	$1,182	$ 814	$ 589
Labor Income: (Farm income minus interest on investment)	$ 113	$-123	$-391

Comparing Returns

The relative merits of the three sizes of business as measured by labor income are given in Table 4. This measure indicates that among diversified farms with hogs, dairying, and wheat as major enterprises, those with a comparatively large business are likely to be the most profitable and those with the smallest size of business are likely to be the least profitable.

Such comparisons have their limitations because they are based on definite prices of each receipt and expense item, definite production of both livestock and crops, and a limited area of land. The returns from any system would vary somewhat with any change in any price, any quantity of labor or materials used in production, or any rate of production. However, the comparisons made seem valid under the conditions and standards used, and the conditions and standards are very similar to those found on actual typical farms in 1932. For these reasons the computations and discussions found in this circular should have considerable practical use in the spring wheat area of the state when determining what size of business one should try to acquire.

No claim is made that any one of the systems represents the best plan that might be devised for operating any one of the three farms, because other combinations of crops and livestock enterprises could probably be set up which would have some advantage over the systems offered. For example, sweet clover might have been sowed with a nurse crop, thus increasing the total pasture carrying capacity of the farms and providing a better program for the maintenance of fertility. Or the addition of a few cows, a few sheep, or a flock of turkeys might have added to the profit. The labor incomes for the three systems should be compared as relative and not as absolute figures.

With these reservations in mind a summary of the reasons for the differences in estimated returns for the three farms may now be given:

> The better net returns of System 1 as compared with that of Systems 2 and 3, were due primarily to its larger size. Larger size provides larger gross income and lends to efficiency in the use of capital, labor and land.

Gross Income.—The larger total receipts of the large farm ($4,289) provided for fairly large farm expenses and left a small positive labor income. The smaller total receipts of the two smaller farms ($2,558 and $1,277) were not sufficient to meet the business charges, therefore minus labor income figures resulted.

Efficiency of Capital.—The investment in buildings, fences, water system, and machinery and equipment, is higher per acre and per animal unit[1] on farms with a smaller size of business than on farms with a large size of business. The total investment in implements, machinery and equipment per acre was $12.95, $16.05 and $26.70, respectively for the large, medium and small farms. The investment in those items per animal unit was $203, $233, and $356 respectively. The higher investment per

1. An animal unit is the approximate equivalent from the standpoint of feed required, of a mature cow or horse. A unit may be one mature cow or horse, two young cattle or horses, five sows, ten pigs, seven sheep, 14 lambs, 100 hens, or 25 turkeys.

acre and per animal unit means higher cost of production per bushel, per pound, per ton, etc., because the charges for depreciation, repairs, interest, taxes, and insurance were based principally upon the total investment. Adjustments were made in depreciation and repairs for the less use of machinery and equipment on the small farms. The higher cost of production means less profit per unit of product sold from the farm. Efficiency in use of capital is, on the average, greater on moderately large farms.

Efficiency of Labor.—Efficiency of labor on diversified farms may be compared by calculating crop acres per man employed, animal units per man and productive work units per man. The crop acres per man on Systems 1, 2, and 3 were 248, 211 and 164, respectively. The animal units per man were 20, 18 and 16, respectively, and the productive work units per man were 333, 313, and 259, respectively. These comparisons indicate that greater efficiency of laborers may be expected on farms with a moderately large business.

A rough comparison of the efficiency of horses and tractor may be made in an similar way if a tractor is assumed to equal six horses for field work. By using this method of calculation, the acreage of crops per horse unit was found to be 48, 33, and 22 for the large, medium and small farms, respectively. The hours of tractor work to be done with the tractor, were calculated to be 800 on System 1, 480 on System 2, and 300 on System 3. These figures all point to the greater efficiency of larger farms.

Efficiency of Land.—The average farm of approximately 800 acres had 5 per cent of its measured area in farmstead, roads, headlands and waste. The farms of approximately 480 acres and 240 acres, had approximately 8 per cent and 12 per cent, respectively, in such use. This gives the larger farms the advantage of having a greater proportion of the total area for pasture and for crop production.

Productivity.—The idea that larger farms have a lower production per acre, per cow, etc., than do small farms, prevails in some communities The results of the study do not support such an idea. The production of crops, livestock, and livestock products all averaged as good for the larger farms as for the smaller farms of the same type.

The most important measure of productivity is that of productivity per laborer. The larger farms excel in that respect. The earnings per man per month averaged $18.76, $3.85, and -$2.85 on the large, medium, and small sized farms, respectively.

Effect of Changes in Prices

The incomes from the different systems, as previously stated, would be changed if any change were made in computing the receipts and expenses. Table 5 gives the estimated labor income for each system due to varying price conditions, assuming there would be no other change which would affect receipts or expenses.

If the price of butterfat were 3 cents above the basic price of 27 cents, the resulting labor income would be $252, –$29, and –$349, respectively for Systems 1, 2, and 3. At this price, System 1 would have a greater advantage over the other two systems, than when the basic price is used.

Likewise, if the prices of pork and wheat were raised, System 1 would have relatively the greater advantage. If the prices were lower than the basic price, the labor income of System 1 would be lowered at a greater rate than either of the other two systems, but it would continue to have the best income until the combined effect of lower prices reduced the gross income by approximately $760.

TABLE 5.—Estimated labor income resulting from differences in prices of products sold from diversified farms of three different sizes in the South Dakota Spring Wheat Area

Item	System 1	System 2	System 3
Labor income with prices unchanged (Table 4)	$ 113	$ −123	$ −391
Labor income with prices higher for:			
Butterfat @ $ .30, others unchanged	252	− 29	−349
Pork @ 7.00, others unchanged	450	49	−291
Wheat @ .90, others unchanged	398	42	−324
Combination of three prices	874	208	−182
Labor income with prices lower for:			
Butterfat @ $ .22, others unchanged	−119	−280	−460
Pork @ 4.00, others unchanged	−224	−295	−491
Wheat @ .55, others unchanged	−267	−342	−481
Combination of three prices	−836	−672	−650

Effect of Changes in Production

Table 6 gives the estimated labor income for each of the three systems due to the varying rates of production, assuming the changes in rates to be due to differences in breeding, culling, feeding home grown feeds, sanitation, care, and other factors of efficiency which would not increase total costs. A study of the table indicates that any such increase in production would profit the large business most. If the production were decreased, the labor income of System 1 would be decreased at a greater rate than that of either of the other two systems. However, it would continue to have the best income until the production of all of the commodities were lowered about 20 per cent from the standards used.

TABLE 6.—Estimated labor income resulting from changes in rates of production due to efficiency on diversified farms of three different sizes in the South Dakota Spring Wheat Area

Item	System 1	System 2	System 3
Labor income, production unchanged (Table 4)	$113	$ −123	$ −391
Labor income, with production increased:			
Butterfat, 10%, others unchanged	238	− 38	−353
Hogs, 10%, others unchanged	236	− 60	−354
Total of two commodities	361	− 25	−816
Labor income, with production decreased:			
Butterfat, 25%, others unchanged	−200	−335	−485
Hogs, 25%, others unchanged	−196	−281	−483
Total of two commodities	−509	−493	−577

Analysis of Extensive Diversified Farms

The organization of diversified farms with grazing beef cattle as the major enterprise, is shown as of large, medium, and small sizes in Table 7, and are labeled as Systems 4, 5, and 6, respectively. System 5 in this circular is the same as System 4 in Circular 21. This type of organization was chosen for discussion because it is one of the most common in the Spring Wheat Area of the State.

TABLE 7.—Organization plans for operating a diversified farm in the South Dakota Spring Wheat Area as a business of three different sizes

Item	Unit	System 4 Large size	System 5 Medium size	System 6 Small size
Land use:				
Wheat	acre	80	120	40
Feed grains	acre	160	120	120
Corn	acre	160	160	100
Alfalfa	acre	80	40	40
Total tilled land	acre	480	440	300
Hay and pasture	acre	1400	320	310
Farmstead, waste, etc.	acre	40	40	30
Total farm		1920	800	640
Livestock:				
Beef cows	number	95	37	24
Milk cows	number	5	3	4
Young cattle	number	99	42	24
Calves saved	number	90	36	25
Brood sows	number	16	16	10
Hens	number	125	125	80
Work horses	number	7	7	5
Total animal units		211	99	67
Capital investment:				
Land owned		$16,800	$ 7,600	$ 6,400
Improvements		8,100	6,330	6,900
Equipment		2,880	2,780	2,120
Livestock		7,143	3,675	2,485
Crops		2,850	1,600	1,185
Total investment		$37,773	$21,985	$18,090
Man labor:				
Required	month	28	19	13
Productive work units		740	600	370
Tractor power:				
Approximate requirements	hour	600	600	420

The conclusions of Circular 21 indicate that a farm of this type, if only 800 acres in area, is less profitable than an equal area used for more intensive farming, such as the production of hogs and dairy products. The discussion in this publication is intended to indicate the probable returns to this type of organization when operated with more than 800 acres and with less than 800 acres, and with livestock to correspond to the amount of feed produced and the acres of pasture available on the given areas.

It should be noted that System 4 with 1920 acres operated extensively is not to be considered a larger business than System 1 with 800 acres operated somewhat intensively. An absolute comparison cannot be made but the following indicates the size of the two systems to be relatively about the same. System 1 has 30 months of productive labor, 800 hours of tractor work, 680 acres of tilled crop land, an investment of $23,000, receipts of $4300, expenses of $3,000, a $1,250 farm income, and a labor income of $113. System 4 has 28 months of productive labor, 600 hours of tractor work, 480 acres of tilled crop land, an investment of $38,000, receipts of $4,700, expenses of $3,100, a $1,600 farm income, and a labor income of -$277.

TABLE 8.—Estimated production and disposal of crops on diversified farms of three different sizes in the South Dakota Spring Wheat Area

Item	Unit	System 4	System 5	System 6
Wheat:				
Used for seed	bu.	80	120	40
Landlord's share	bu.	—	220	210
Sold	bu.	800	900	250
Used for feed	bu.	—	80	40
Total production	bu.	880	1,320	440
Harvested for grain	acre	80	120	40
Oats:				
Used for seed	bu.	160	120	120
Landlord's share	bu.	—	150	300
Used for feed	bu.	1,040	330	780
Total production	bu.	1,200	600	1,200
Harvested for grain	acre	40	20	40
Harvested for hay	acre	40	40	20
Barley:				
Used for seed	bu.	120	90	90
Landlord's share	bu.	—	270	180
Used for feed	bu.	1,320	720	810
Total production	bu.	1,440	1,080	1,080
Harvested for grain	acre	80	60	60
Corn:				
Used for seed	bu.	20	20	15
Landlord's share	bu.	—	360	180
Used for feed	bu.	1,780	1,789	885
Total production	bu.	1,800	2,160	1,080
Harvested for grain	acre	100	120	60
Harvested for fodder	acre	60	40	40
Alfalfa:				
Harvested for hay	acre	60	30	35
Pastured	acre	20	10	5
Native:				
Harvested for hay	acre	480	80	—
Pastured	acre	920	240	310
Total feed available:				
Concentrates	ton	93	75	58
Dry roughage	ton	450	180	130
Silage	ton	—	—	—
Pasture	day	30,600	8,700	10,050
Cattle on rented pasture	day	—	6,300	—

The plans followed in making the budget for the two groups of systems are alike in the following respects:

1. Various items common to the organization of actual farms were omitted so as to better retain simplicity and easy comparison.
2. The methods of operation are common in the region and represent practices followed by the better farmers.
3. The operator was credited with 12 months of labor. All other labor was hired.
4. The prices, rates of production and standards of performance of labor, tractor and horses, are those listed in Table 13.

The organization of the less intensive farms of the area is usually based largely on physical factors which cannot be changed. Most such farms have comparatively large portions of their area in land which is unsuitable for cultivation. Under such conditions the alternative is to fit the livestock of the farm to the pasture and to the amount of crops that can be grown. That means either grazing sheep or cattle as the major enterprise. The farms with a larger area of crop land may fatten the

TABLE 9.—Estimated production and disposal of livestock and livestock products on diversified farms of three different sizes in the South Dakota Spring Wheat Area

Item	Unit	System 4	System 5	System 6
Cattle Enterprise:				
Calves saved	number	90	36	25
Yearlings sold	number	77	25	19
Yearlings used in home	number	1	1	1
Yearlings for replacement	number	12	10	5
Heifers for replacement	number	10	8	5
Cows sold	number	8	7	4
Cows bred	number	100	40	28
Meat sold	pound	62,700	25,200	17,700
Meat used in home	pound	500	500	500
Net meat production	pound	63,200	25,700	18,200
Death losses after weaning	number	4	3	1
Butterfat sold	pound	640	–	440
Butterfat used in home	pound	360	360	360
Net butterfat production	pound	1,000	360	800
Hog Enterprise:				
Pigs saved	number	96	96	60
Hogs sold	number	73	73	47
Hogs used in home	number	4	4	4
Sows sold	number	14	14	9
Sows bred	number	16	16	10
Meat sold	pound	19,925	18,830	12,120
Meat used in home	pound	1,100	1,100	1,100
Net meat production	pound	21,025	19,930	13,320
Death losses after weaning	number	4	5	3
Poultry Enterprise:				
Hens, average	number	125	125	80
Meat sold	pound	800	800	500
Meat used in home	pound	200	200	200
Eggs sold	dozen	720	720	360
Eggs used in home	dozen	280	280	280

market class of livestock in years when the weather is favorable to grain production, and there is a favorable price relation between feed and livestock. Within the region where most of the land is not suitable for cultivation, large areas are available for rent. Much livestock is commonly pastured during the summer and fall at a stated rate per head. Much other native grass land is rented by the acre for both hay and pasture. The organizations of Systems 4, 5, and 6 are based on the above conditions.

Tables 8 and 9 show the production and disposal of crops, livestock and livestock products for each of the systems.

Receipts and Expenses

The receipts and expenses of Systems 4, 5, and 6 are shown in Table 10. In general, the charges made for each item of expense are in accord with the size of each enterprise as it is found in each system and are based on averages of all the farms studied. The cost of harvesting grain varies because of following the practices prevailing when the acres of wheat harvested are either high or low. In System 5 there were 120 acres of wheat cut with a combine-thresher. In the other two systems there were only 80 and 40 acres of wheat, respectively. In such cases, wheat is usually cut with a binder and threshed with a grain separator. The total pasture costs correspond to the amount of pasture rented. The methods of renting are in accord with common practices.

Comparing Returns

The relative merits of the three sizes of business as measured by labor income, are given in Table 10. This measure indicates that among diversified farms with grazing beef cattle as the major enterprise, those with a comparatively large business are likely to have better incomes than those with a comparatively small business. It should be remembered that the smaller minus labor income figures indicate better incomes than the larger minus income figures.

Such comparisons have their limitations as has been previously stated, because they are based on definite standards of prices and production and on narrow limits of organization. The returns from any system would vary somewhat with any change in the factors which enter into production. However, the comparisons made seem valid under the conditions and standards used, and the conditions and standards are very similar to those found on actual, typical farms in 1932. For these reasons, the computations and discussions found in this circular should have considerable practical use in the Spring Wheat Area of South Dakota when determining what size of business one should try to acquire.

The better net returns of System 4 as compared with the returns of Systems 5 and 6, were due primarily to its larger size. Principles of the advantage of large size of business are discussed on page 12 of this circular.

TABLE 10.—Estimated receipts, expenses and income from diversified farms of three different sizes in the South Dakota Spring Wheat Area

Item	System 4 Large size	System 5 Medium size	System 6 Small size
Farm Receipts:			
Wheat	$ 600	$ 675	$ 188
Cattle	2,690	1,018	731
Cream	178	---	119
Hogs	1,061	1,001	644
Poultry and eggs	146	166	93
Miscellaneous	45	45	45
Total farm receipts	$4,735	$2,906	$1,820
Farm Expenses:			
Breeding livestock	40	18	18
Seeds	45	40	35
Commercial feed	60	40	29
Veterinary and medicines	46	36	26
Twine	52	28	36
Labor (exclusive operator)	400	175	20
Threshing	229	101	172
Combining wheat	---	150	---
Corn husking	22	54	11
Tractor, gas and oil	216	216	151
Tractor repairs	33	33	24
Auto truck (100%)	40	40	---
Auto (50%)	80	60	60
Repairs and upkeep	97	79	65
Miscellaneous	50	25	15
Insurance, property	82	43	45
Insurance, hail	60	60	39
Taxes, real estate and personal	378	220	180
Taxes, gross income	28	19	11
Cash rent for pasture	320	55	40
Livestock on pasture	---	105	---
Total cash expenses	$2,278	$1,602	$ 977
Depreciation	845	737	543
Total farm expenses	$3,123	$2,339	$1,520
Farm Income: (Receipts minus expenses)	$1,612	$ 567	$ 300
(Interest on investment @ 6%)	$1,889	$1,099	$ 905
Labor Income: (Farm income minus interest on investment)	$ -277	$ -532	$ -605

If the foregoing reasons for the larger net returns of System 4 are valid, then many farmers in the Spring Wheat Area of South Dakota could increase their profits by increasing their size of business. The questions then arise, would the larger size of business be more profitable under different price conditions, and with different land values? Also, would a business larger than that of System 4 have a plus farm income? An attempt to answer these questions is made in the following pages.

Effect of Changes in Prices

The incomes from the different systems, as previously stated, would be changed if any change were made in computing the receipts and expenses. Table 11 gives the estimated labor income for each system due to varying price conditions, assuming there would be no other change which would affect receipts or expenses.

TABLE 11.—Estimated labor income resulting from differences in prices of products sold from diversified farms of three different sizes in the South Dakota Spring Wheat Area

Item	System 4	System 5	System 6
Labor income with prices unchanged (Table 10)	$-277	$-532	$-605
Labor income with prices higher for:			
Beef @ $6.00, others unchanged	664	-151	-340
Pork @ 7.00, others unchanged	22	-250	-423
Combination of two prices	963	128	-158
Labor income with prices lower for:			
Beef @ $3.50, others unchanged	-904	-784	-782
Pork @ 4.00, others unchanged	-576	-814	-787
Combination of two prices	-1,203	-1,066	-964

If the prices of beef cattle or of pork were raised above the basic price used in calculating Table 10, System 4 would have a relatively greater advantage than Systems 5 and 6 because it has more farm products for sale. For the same reason, if the prices were reduced below the basic price, the labor income of System 4 would be lowered at a greater rate than either of the other two systems. However, until the lowered prices reduced the gross income by approximately $685, System 4 would continue to have an advantage over Systems 5 and 6.

Effect of Changes in Land Value

System 4, although larger and with better income than that of Systems 5 and 6, was an unprofitable business under low price conditions. Perhaps low priced beef cannot be grazed with profit where the tilled land is valued at $30 per acre and the native grass land is valued at $10 per acre, as is given in Table 13. If the land values had been placed at $15 and $5, respectively, for the tilled and for the native grass land, and the rentals had been correspondingly low, the labor income of System 4, as shown in Table 12 would have been plus $271. Under the same conditions, the net

TABLE 12.—Estimated labor income resulting from changes in valuation of land on diversified farms of three different sizes in the South Dakota Spring Wheat Area

Item	System 4	System 5	System 6
Labor income with land valuations unchanged (Table 10)	$-277	$-532	$-605
Labor income with land values and rentals lower:			
Crop land @ $15.00 per acre, hay and pasture land @ $5.00 per acre, others unchanged	143	-342	-445
Rental for hay and pasture land, $.15 per acre, others unchanged	-149	-510	-589
Total of two costs lowered	271	-320	-429

returns to Systems 5 and 6 would have remained minus figures, indicating that few, if any, small diversified farms with grazing beef cattle as the major enterprise, can hope to be profitable in the Spring Wheat Area of South Dakota under conditions outlined in this publication.

Effect of Increasing the Size of Business

If System 4 were increased in size of business approximately 50 per cent by adding 50 cows to the beef herd, the gross income would be increased about $1380. The increase would require additional expenses, particularly pasture and concentrate feeds, the total amounting to approximately $685, using the standards of Table 13. The labor income resulting would be $420, indicating that four or five sections of land operated on a plan similar to that of System 4, should be more profitable than three sections or less of land.

Cash for Family Living

Labor income does not indicate in any way the amount of money a family may have in any one year for its own spending. When computing labor income, charges are made for the non-cash items of depreciation, interest on capital used, unpaid family labor, and for the items designated as cash expenses. The difference between the total charges made in a financial statement and the actual cash expenditures should be added to the labor income to determine the total amount a family has for its personal use. Thus in System 1, if the family performed all of the work on the farm and no labor were hired, the cash saved for family living would be $450. Since depreciation was not a cash expense of the current year, $830 more would be available for family use; and if no interest payments were made, $1,132 more would be available. These amounts added to the labor income of $113 would make a total of $2,525 for the family to use. Calculating in the same manner, the total amounts available for family living in Systems 2 and 3 are found to be $1,497 and $657 respectively; the amounts available in Systems 4, 5 and 6 would be $2,857, $1,479 and $863 respectively.

Many farm families have appeared to do well during the depression because one or more of the above items were not a cash cost and such amounts were used to maintain standard of living rather than for the farm business. Some have added to their purchasing power for personal living by borrowing money outright and by making purchases on credit.

Capacity for Carrying Indebtedness

When computing farm income no charges are made for interest due on indebtedness and none for family living. If we assume $600 to be the cash cost for the family living and deduct that amount from the farm income of Systems 1, 2, and 3, we have remaining $645, $91, and -$402, respectively, which might be used for interest payments. If each of these amounts is capitalized at six per cent, we find System 1 could, under the conditions imposed in this circular, pay six per cent annually on $10,750. Systems 2 and 4 could likewise pay interest on $1,515, and $16,865, respectively, and Systems 3, 5, and 6 could pay no interest at all. These figures indicate the probable maximum debt which each system could well carry and have sufficient funds for a comfortable family living in years of average crop and livestock production.

Conclusions

Physical limitations, particularly untillable land and lack of rainfall, determine the type of many farms in the Spring Wheat Area of South Dakota. Lack of capital determines both the type and size of many farms, and the mere existence of many small farms makes it difficult to expand the acreage of many farms. With these facts in mind, the following conclusions may be drawn for diversified farms in the Spring Wheat Area of South Dakota:

1. Better net returns may be expected from a moderately large farm business of a given type than from smaller farms of the same type.
2. A moderately large farm business should be a better risk to creditors than smaller farms of the same type, because of the better net returns to the larger business.
3. Farms with a small size of business and operated under plans and conditions similar to those outlined in this publication, are not likely to be profitable.
4. Greater efficiency in the use of capital, land, labor, machinery and horses may be obtained on large farms of a given type than on small farms of the same type.
5. Average production per acre and per animal is not lower on large farms of a given type than on small farms of the same type.
6. Higher total production per man may be secured on large farms of a given type than on small farms of the same type.
7. An area of 2000 acres seems insufficient for the profitable operation of a diversified farm with grazing beef cattle as the major enterprise, and when operated under conditions outlined in this publication, using prices shown in Table 13.

Methods of Increasing Size of Business

Farmers living within the area have increased the size of their business in one or more of the following ways: added to the farm acreage by renting and by purchase; increased the number of livestock; improved the quality of livestock through culling and breeding; improved livestock production through better care, feeding, and sanitation; produced breeding stock for sale; changed to higher producing varieties of crops; increased crop production by seed selection, seed testing and treatment, and better tillage practices; produced high grade seed for sale; replaced some beef cows with dairy cows; fattened market beef cattle when there was a good supply of home grown feeds; did work off the farm for hire; retailed certain farm products; and increased the production of farm products for home use.

Other methods of increasing the size of business and the gross income are: grade market products to secure higher prices for the best quality; bargain shrewdly; produce vegetables for sale; keep informed on the market prices and market prospects.

TABLE 13.—Standards used for calculating the budgets of farms of three different sizes in the Spring Wheat Area of South Dakota

Item		
1. Rates for custom work hired:		
Combining wheat per acre		$1.25
Threshing wheat per bu.		.08
Threshing oats and barley per bu.		.06
Husking corn per bu.		.06
Filling silo per ton		.30
2. Tractor cost per hour:		
Cost of fuel and oil		.36
Cost of repairs		.065

3. Prices of products sold:					
Wheat*	per bu.	$ .75	Culled beef cows	per cwt.	$3.50
Eggs	per doz.	.12	Culled dairy cows	per cwt.	3.00
Poultry	per lb.	.10	Yearlings off grass	per cwt.	4.50
Sows*	per cwt.	4.50	Veals	per cwt.	6.00
Fat hogs*	per cwt.	5.50	Butterfat	per lb.	.27

* Price includes anticipated compensation from AAA contracts.

4. Crop yields per acre:	
Wheat	11 bus.
Oats	30 bus.
Barley	18 bus.
Corn	18 bus.
Alfalfa	1.3 tons
Native hay	.5 tons
Silage	4 tons

Carrying capacity of native pasture 5 acres for one animal unit.

5. Livestock production:	
Cattle:	
Calf crop	90%
Death loss after weaning	4%
Replacements of cows	20%
Average weight of long yearlings sold off grass	700 lbs.
Butterfat production:	
Systems 4, 5, 6	120 lbs. per cow
Systems 1, 2, 3	250 lbs. per cow
Hogs:	
Pig crop, per litter	6 pigs
Death loss after weaning	5%
March farrowed pigs, average weight when sold	250 lbs.
May farrowed pigs, average weight when sold	210 lbs.
Poultry:	
Eggs per hen	8 doz.
Chicks saved per hen kept	2 head

6. Feed requirements per head:		**Grain lbs.**	**Dry roughage tons**	**Pasture days**
Milk cows:				
250 lbs. butterfat production		2,400*	2.5	100
120 lbs. butterfat production		1,000	2.	150
Stock cows		200	2.	180
Heifers, 2 and 3 years		200	2.	150
Yearlings		200	1.5	120
Calves		40	.5	60
Hogs, per 100 lbs. produced:				
Market weight	250 lbs.	500		
Market weight	210 lbs.	475		
Sows, per head			.25	40
Poultry, 100 head		5,000		
Horses, per head		2,000	2.5	120

* If silage is fed, the grain requirement is 2,000 lbs. and dry roughage, 2 tons.