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DEPARTMENT OF AGRICULTURAL ECONOMICS

THE EFFECT OF THE COMBINED HARVESTER-THRESHER ON FARM ORGANIZATION IN SOUTHWESTERN KANSAS AND NORTHWESTERN OKLAHOMA[1]

W. E. GRIMES, R. S. KIFER,[2] and J. A. HODGES

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INTRODUCTION

Farming in the southern great plains region has undergone rapid changes in recent years. Further changes are to be expected. The introduction of improved power machinery and of better adapted varieties of crops has resulted in rapid expansion of the acreage of crops, particularly of wheat. New land has been broken and seeded to wheat. The acreage that can be farmed profitably by one man has been increased through the use of improved machines and methods. More farms and larger farms have resulted and the agriculture of the entire region is undergoing transition.

The farmers of the region face distinct and vital problems of size of farms, acreages of various crops, methods of handling these crops, and kinds and numbers of live stock to be produced. It is decidedly

1. Contribution No. 45 from the Department of Agricultural Economics, Kansas Agricultural Experiment Station. In coöperation with the Division of Farm Management, Bureau of Agricultural Economics, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

2. Assistant agricultural economist, Bureau of Agricultural Economics, United States Department of Agriculture.

important to these farmers that those changes be made that past experience, present conditions, and prospects for the future indicate will prove most profitable. It is the purpose of this circular to bring together information concerning past experience, present conditions, and probable future trends that will be most helpful in adjusting to the changed and changing conditions.

CONDITIONS WITHIN THE AREA

Location.—The area to which this discussion applies is in southwestern Kansas and northwestern Oklahoma. It includes part or all of 20 Kansas counties and of 7 counties in Oklahoma. The conditions described and the discussion apply, in part at least, to adjoin-

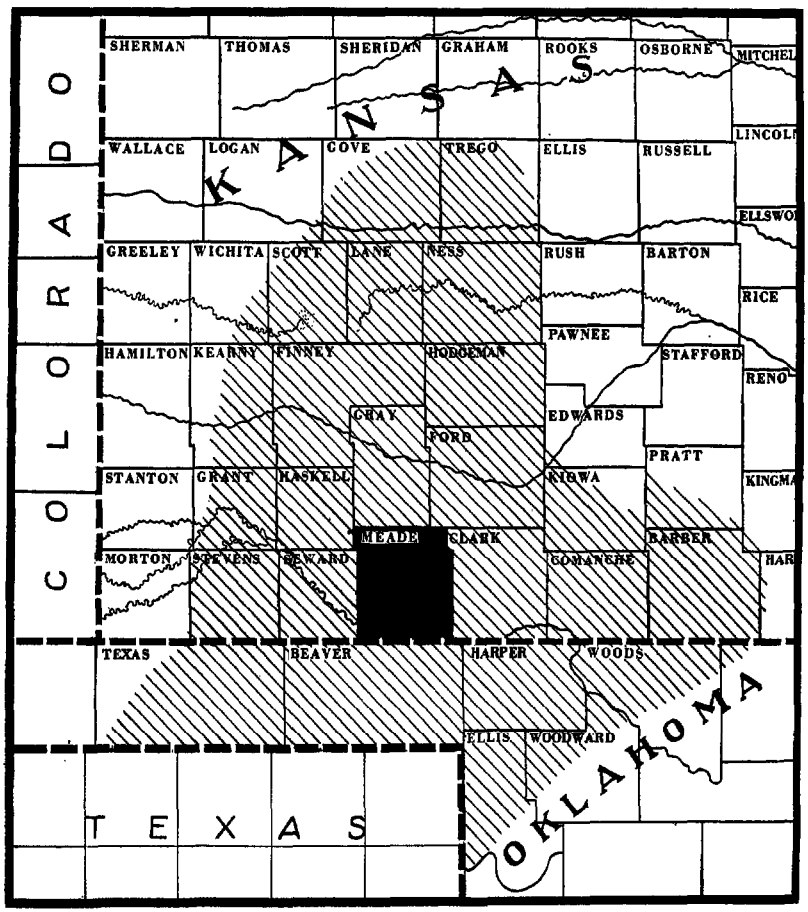

FIG. 1.—The shaded portion of southwestern Kansas and northwestern Oklahoma indicates the area to which the discussion in this circular applies.

ing counties where conditions are similar. The counties directly concerned are shaded in figure 1.

Soil Types and Topography.—The soil types of the area vary from a heavy clay loam to light sand. Soil blowing occurs on all types unless preventative measures are taken. Wheat is most commonly grown on the heavier soils while the sandier land is usually used for the production of grain sorghums or for pasture.

The topography is level to gently rolling. Large units of heavy machinery can be used on practically all of the land excepting where the soil is too sandy to give proper traction.

Rainfall.—Moisture is the limiting factor in crop production. The average annual rainfall at most of the stations within the area is 18 to 20 inches.[3] This rainfall usually comes during the spring and summer months when it is most needed for crop production. Plains, in Meade county, Kansas, is near the center of the area. At Plains, approximately two-thirds of the annual rainfall in the average of the years for which rainfall data are available has come during the 5-month period from April to August. (Fig. 2.) The variation in annual rainfall from year to year is large, having been as little as 14 inches and as much as 26 inches. (Fig. 3.) Crops frequently fail in the drier seasons.

Type of Farming.—Wheat is the chief crop grown in the region. Corn and grain sorghums are important, but occupy much smaller

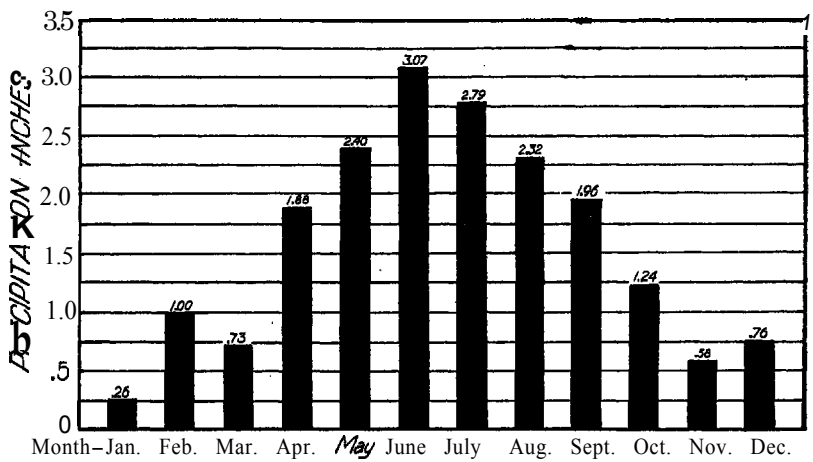

FIG. 2.—Normal monthly precipitation at Plains, Meade county, Kansas

Source: Climatology Data—Kansas section Annual Report, 1927. United States Department of Agriculture, Weather Bureau. p. 103.

3. Climatology Data for Kansas. Reports of the United States Weather Bureau.

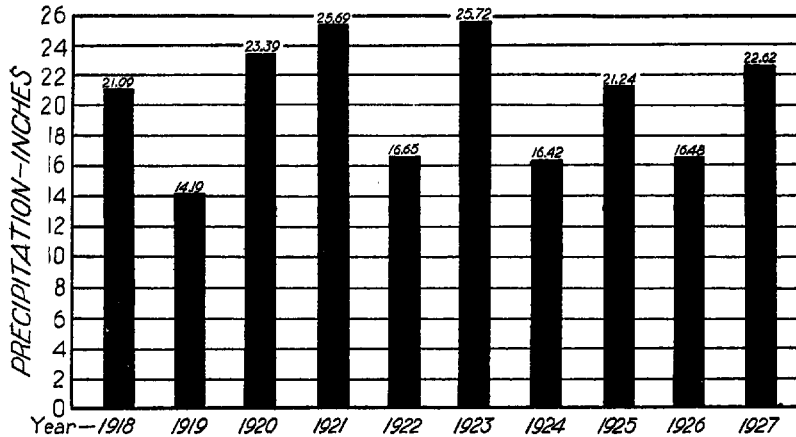

FIG. 3.—Annual precipitation at Plains, Meade county, Kansas, 1918 to 1927.

Source: Climatology Data—Kansas section, Annual Reports, 1918 to 1927. United States Department of Agriculture, Weather Bureau.

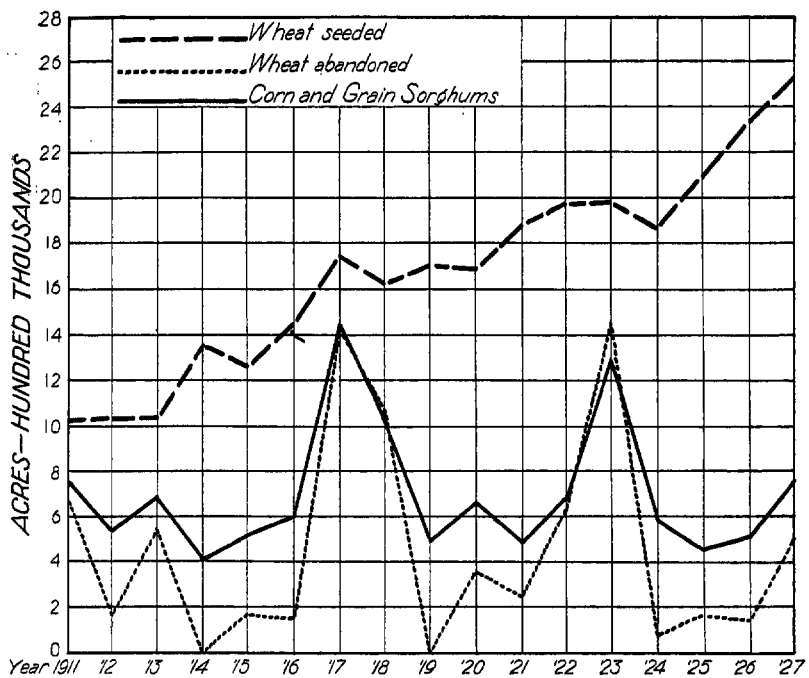

FIG. 4.—Acreages of wheat seeded, wheat abandoned, and corn and grain sorghums grown in a portion of southwestern Kansas, 1911 to 1927.

Source: Reports of Kansas State Board of Agriculture.

acreages than wheat. In 1925 wheat occupied more than one-half of the cultivated area. The acreage seeded to wheat has been steadily increasing, while the acreage in corn and the sorghums has declined. Large areas of corn and the sorghums are grown only in those years when there is large abandonment of wheat. Oats and barley are also used as catch crops where wheat has failed. The acreage of grain sorghums has been expanded at the expense of the corn acreage in recent years.

Figure 4 shows the acreages of wheat, corn, and grain sorghums grown from 1911 to 1927 in that portion of the region which is within Kansas.

Beef cattle have been the principal live stock of the area. The expanding wheat acreage has reduced their numbers since 1919. Milk cows have been fairly constant in number in recent years. Hogs have never been an important part of the agriculture of the region. The numbers of the various kinds of live stock on the farms of the portion of the area that is within Kansas, in the years 1911 to 1926, are shown in figure 5.

FIG. 5.—Numbers of beef cattle, dairy cows, and hogs in a portion of southwestern Kansas, 1911 to 1927.

Source: Reports of Kansas State Board of Agriculture.

Meade County, Kansas, a Typical County.—Meade county, Kan., is near the center of the area and is fairly typical of the entire area. A more detailed study of the agriculture of this county should give a better understanding of the agriculture of the area and its problems.

The average farm in Meade county contained 616 acres in 1925, according to the United States census. The average farm had 262 acres of crops, 9 acres in fallow, and 328 acres in pasture. Of the pasture, 123 acres were plowable and could be used for crops if this were desirable.

In 1926, on the farms reported by assessors, there was an average of 251 acres seeded to wheat, 54 acres in sorghums for grain and forage, and the remainder in other crops. The average farm in 1926 had 10 horses and mules, 34 cattle, 4 hogs, and 90 poultry. These data are given in Table I.

TABLE I.—FARM ORGANIZATIONS, MEADE COUNTY, KANSAS, 1926.

	All farms.	Farms with 200 to 360 acres in wheat.	Farms with 380 to 600 acres in wheat.
Number of farms	748	210	127
Number of combines	132	41	47
Number of tractors	363	92	87
Average per farm:			
Wheat, acres seeded	251	254.6	472.3
Corn	6	4.2	3.5
Oats	1	2.3	1.3
Barley	5	5.5	7.9
Cane	13	10.8	11.3
Grain sorghums	39	31.8	29.2
Sudan grass	2	1.8	2.1
Alfalfa	2	1.5	1.0
Prairie hay	12	4.5	.....
Pasture	328	207.9	221.0
Horses and mules	10	9.1	10.9
Milk cows and other cattle	34	17	25
Sows	} 4	1	2
Other hogs		3.6	3.0
Hens	90	90	84

Source: Biennial Report of Kansas State Board of Agriculture and Assessors' Rolls 1926.

Those farms growing 200 to 360 acres of wheat in 1926 were grouped and the averages are given in Table I. Those growing 380 to 600 acres of wheat were similarly grouped, and Table I also shows the averages for this group. Of the 748 farms reported by the assessors for Meade county in 1926, 210 had between 200 and 360 acres of wheat with an average of 255 acres. Forty-one, or 20 per cent, had combined harvester-threshers, or "combines," and 92, or 39 per cent, had tractors. One hundred twenty-seven farms had between 380

and 600 acres of wheat with an average of 472 acres. Of these, 47 farms, or 37 per cent, had combines and 87 farms, or 68 per cent, had tractors. The average acreage of the other crops grown and the average numbers of the various classes of live stock were approximately the same for these two groups of farms excepting for beef cattle, which averaged higher on the larger farms due to one farm in this group that had a large herd of cattle.

CHANGING CONDITIONS AND PROBLEMS PRODUCED BY THEM

The Combined Harvester-Thresher. — The combined harvester-thresher was first used in this area about 1917. Since then its use has rapidly increased. The size of the machines used has also been increased so that the usual machine now used is capable of harvesting a larger area than could be harvested with the machines first used. In the earlier years of the use of the combine, most of the machines were 9 to 12 feet in width. The usual combine used at present is 15 or 16 feet in width, with many machines still wider, Meade county, Kansas, reported 68 combines in 1923, 105 in 1925, and 132 in 1926.[4] This is typical of the rapid introduction of these machines in this area in recent years. Combines are now harvesting practically all of the wheat of the region.

The combine cuts the grain and threshes it at one operation. This lowers harvesting costs, shortens the harvest season, and increases the acreage of wheat that one farmer can grow. As a consequence of these changes, land that formerly was used for grazing has been broken and seeded to wheat and, as shown in figure 4, the area in cultivation has been materially increased. In many cases wheat has replaced other crops and, if the farm area has not been increased, wheat tends tobecome the sole source of income from the farm.

Tractors and Other Improved Machinery. — The tractor preceded the combine in this area. In 1915 Meade county had 42 tractors, in 1920, 84, and in 1926, 363.[5] Trucks used in transporting farm products, automobiles for business uses as well as for pleasure purposes, and improved farm machinery all have joined with the combine and the tractor to speed up farm operations and to increase the area one farmer can farm. Production costs have been lowered wherever these modern machines have been effectively used.

Changes in Crop Production. — New and better adapted crops such as Kanred wheat and the grain sorghums have contributed their share to the changing conditions. The introduction and wide

4. Biennial Reports of Kansas State Board of Agriculture.
5. Biennial Reports, Kansas State Board of Agriculture.

adoption of these crops and of improved production methods has aided in the tendency to lower production costs and to make a larger acreage of wheat and larger total farm acreage desirable.

Simultaneously with these changes affecting conditions of production on the farms of the area has come increased market demand for high-protein wheat of good milling quality. The wheat grown in this area is usually well suited to this demand and premiums of 5 to 25 cents a bushel over hard winter wheat of average protein content are frequently paid for this type of wheat. Lowered production costs and a relatively more favorable market for wheat have contributed to the tendency toward single-crop farming and an expanding wheat acreage.

Problems.—A combine of the usual size—15 to 16 feet in width—can harvest 500 or more acres of wheat in a season. Few farmers in this area were growing so large an acreage of wheat prior to the introduction of the combine. In attempting to use combines on a sufficient acreage to permit of their most efficient use, many farmers have been forced to devote more of their land to wheat or to secure a larger area in one farm. Both of these things have been occurring. Farms are becoming larger and greater dependence has been placed upon wheat. Experience has effectively demonstrated that the larger farm area is desirable, but single-crop farming is open to serious objection. It is too hazardous and furnishes too little employment for labor and other farm resources.

The farmers of the area face two distinct problems in the organization of their farms. First, to expand the area per farm, either by renting or buying more land, so that they may utilize equipment most efficiently. This may be accomplished by bringing in new land to the extent that such land is available and by combining farms now in existence so that the average area is increased and the number of farms decreased.

The second of the farm organization problems of the area is to determine the acreages of crops other than wheat and the numbers of the differemt kinds of live stock that can be combined most profitably with the acreage of wheat that one farmer can handle.

These two problems can be expressed in one question which is—Under existing conditions how large should a farm be to give the most desirable acreage of each crop and the most desirable number of each kind of live stock, and how can this size of farm be secured? It is not to be assumed that the answer will be the same under all conditions. The size will vary with the farmer's ability and desire,

the soil and topography and many other factors. Each farmer's problem is different from the others, but it is hoped that the discussion and the illustrations which follow may be helpful in suggesting ways in which each problem may be solved.

These problems in farm organization are not the only problems growing out of the changing conditions. The wheat is threshed as it is cut with the combine and consequently much of it goes directly to market. This produces problems in local storage, transportation, and terminal storage that are beyond the limits of the present discussion. This tendency to market wheat early is accentuated by the high moisture content of some of the combined wheat. This occurred more frequently in the earlier years of the use of the combine. Experience was not available as a guide to indicate when wheat was sufficiently ripe to combine. Consequently, experimentation was necessary and some wheat was combined with too high a moisture content. This wheat went out of condition in transit or in storage. In more recent years, with more experience with combines, less trouble has been experienced from this cause. However, the problem remains, particularly in years of wet harvests. The use of the combine in such seasons reduces the time when wheat is in proper condition to harvest and increases the probability of getting wheat into storage with too high moisture content. The organization of farms using combines should provide for farm storage space to aid in handling this problem.

Other problems resulting from the changing conditions within the area include increased needs for funds to invest in farm equipment, decreased funds required for harvest, a lessened demand for harvest labor, and a number of social problems growing out of the probable reduction in the farm population. With reduced farm population, fewer children of school age are in the community and fewer schools may be needed. This may make necessary consolidation of districts or some other provision. Other social institutions such as churches are also affected. Good roads are needed to transport farm products to market and to permit easy access to community facilities which may be farther away from the usual farmer due to the decreased farm population.

This latter group of problems is mentioned to indicate the far-reaching effects of the changing conditions. In working out the problems in farm organization these other problems must not be ignored. However, the present discussion is confined primarily to the two farm organization problems of the size of farms and the

combination of crops and live stock most desirable for farms of various sizes. In the following pages are to be found data from the experiences of the farmers in the region and illustrations of how these data may be used in solving these problems.

EXPERIENCE WITH MODERN FARM MACHINES AND METHODS IN THIS REGION[6]

The following are experiences of farmers within this region, and in other regions where conditions are similar, with modern farm machines and also a statement of cropping systems that have been recommended for the region.

What a Combine Can Do.—A 15- or 16-foot combine is capable of cutting 35 to 40 acres of grain a day. Machines of this size are commonly used in this region. However, both smaller and larger machines are used effectively on a number of farms. The rate of cutting compared with the 15- or 16-foot combine is approximately proportional to the length of the cutter bar.

Harvest begins in Oklahoma about June 15 and 10 days to two weeks later in the Kansas portion of the area. The varieties of wheat usually grown in the region will stand two to three weeks with little damage unless unusual weather conditions prevail. A season of 20 or more days for combining grain is not unusual. In a study made in 1926, few farmers reported serious losses of grain due to waiting to combine it.

A combine cutting 35 acres a day can harvest 500 acres in 15 days. Many combines of 15- or 16-foot cut have been harvesting 500 to 700 acres of grain in favorable seasons. In wet seasons the capacity of the machine is reduced. The harvest season with the combine is rarely prolonged beyond 15 to 20 days unless oats or barley are included. However, these crops are not important in the agriculture of the region and even if they become more important would probably not materially prolong the harvest season. Those farms growing considerable acreages of the grain sorghums sometimes use the combine for harvesting these crops.

Items of Cost in Harvesting with *a* Combine.—A 15-foot combine pulled by a tractor can be operated by two men. Frequently three men are used to prevent loss of time as a result of stops in the field. On a number of farms studied in 1926, the average man labor

6. Many of the data given in this section are taken from a coöperative study of the combine in the Great Plains published in United States Department of Agriculture Technical Bulletin 70, and from "Harvesting Wheat with a Combined Harvester-Thresher in the Great Plains Region, 1926," a preliminary report issued by the United States Department of Agriculture, April, 1927.

required to combine wheat with a machine of this size was 0.65 hour per acre. The labor needed to haul the grain from the field depends upon the facilities for hauling and the distance hauled. With wheat yielding 15 bushels, approximately 60 bushels of wheat an hour would have to be taken away from a 15-foot combine cutting at an average rate.

Tractors of varying sizes are used to pull combines. Tractors having a rating of 15 drawbar horsepower are most frequently used to pull 15- or 16-foot combines. Larger tractors are sometimes used where the soil is loose or the surface uneven. In a study of combine operation in 1926 it was found that an average of 1.4 gallons of fuel and 0.05 of a gallon of oil per acre were used by both the tractor and auxiliary engine used in operating 15- and 16-foot combines. Repairs on machines operated for five years cost approximately 10 cents an acre.

The high first cost of combines offsets, in part, the savings in labor and other operating costs. The cost of a 15- or 16-foot combine varies from $2,000 to $2,500. The length of life of combines varies. The average has been estimated at eight years. Using this estimated life of eight years and the lowest cost of $2,000, the annual replacement charge would be $250. Interest actually paid would depend upon the terms of purchase. A charge of 6 per cent has been used in estimating costs in this discussion. Fire and tornado insurance is carried on some machines.

The acreage cut in a year would have little effect on the total annual charges for interest, insurance, and depreciation. The working parts that wear out with usage can be replaced so that greater usage would not materially affect the life of the machine. With fairly constant total charges for these three items, costs per acre will decline as the acreage cut with the combine in one season is increased. The most economical harvesting with a combine is secured with utilization of the machine on a maximum acreage.

Comparative Costs of Harvesting with Binders, Headers, and Combines.—The lower harvesting cost has been one of the most important advantages of the combine over binders and headers. Comparison of the costs with the three types of harvesting machinery and with varying acreages are shown in Table II.

Table II shows the power used, the size of crew required under usual conditions, the usual number of working days, and the cost per acre of cutting and threshing the wheat on varying acreages by each of the three methods. The larger the acreage cut the greater

TABLE II.—COMPARATIVE COSTS OF HARVESTING ON DIFFERENT ACREAGES WITH BINDERS, COMBINES, AND HEADERS.

Acreage.	Machine.	Power.	Crew (a)	Cutting. days.	Cost per acre (b).
50	Binder 7 ft.	4 horses	2 men	3.3	$5.03
	Header 12 ft.	10 horses	6 men	2.0	3.78
	Combine 15-16 ft. (c)	15 h. p. tractor	2 men	1.4	8.30
100	Binder 7 ft.	4 horses	2 men	6.7	4.53
	Header 12 ft.	10 horses	6 men	4.0	3.57
	Combine 15-16 ft.	Tractor	2 men	2.9	4.91
200	1 binder	4 horses	2 men	13.4	4.37
	2 binders	8 horses	4 men	6.7	4.53
	Header	10 horses	6 men	8.0	3.47
	Combine	Tractor	2 men	5.7	3.20
300	2 binders	8 horses	4 men	10.0	4.43
	3 binders	12 horses	6 men	6.7	4.53
	1 header	10 horses	6 men	12.0	3.43
	2 headers	20 horses	12 men	6.0	3.50
	Combine	Tractor	2 men	8.5	2.64
400	2 binders	8 horses	4 men	13.4	4.37
	3 binders	12 horses	6 men	8.9	4.45
	1 header	10 horses	6 men	16.0	3.41
	2 headers	20 horses	12 men	8.0	3.47
	Combine	Tractor	2 men	11.4	2.35
500	3 binders	12 horses	6 men	11.1	4.41
	2 headers	20 horses	12 men	10.0	3.44
	1 combine	Tractor	2 men	14.3	2.18

(a) The crew of binder and header does not include threshing crew. Hauling grain is not included.

(b) Cost per acre is taken from table 12, page 17, preliminary report on harvesting wheat with a combined harvester-thresher, April, 1927.

(c) The rate of cutting is somewhat faster with a 16-foot than with a 15-foot cut, but the per acre cost is practically the same.

the economy in using a combine. With 200 or more acres of wheat the combine has distinctly lower costs an acre than either of the other machines. The costs of harvesting are based on yields of 15 bushels per acre and, for binding and heading, a threshing charge of 10 cents a bushel has been included. Higher yields would not materially increase costs with the combine but would increase them with binders and headers since the threshing charge would increase directly with the yield. Consequently, the combine would leave a still greater advantage in heavier wheat.

Recommended Cropping Systems for the Region.—With modern machines a farmer can harvest as large an acreage of wheat as he can prepare the seedbed for and properly seed in this region. Where the land is prepared soon after harvest and a part of the land is summer followed, as much as 500 acres may be prepared and seeded to wheat by one man.

Dependence upon a single crop such as wheat is hazardous and inadvisable in this region. A permanent system of farming should include enterprises other than wheat. Sorghums for grain and forage are grown in the region, particularly on the lighter soils that

are not well adapted to wheat growing, and on other land when wheat fails.

Some live stock and sufficient feed crops for them are advisable in this region. They prevent complete loss of income in years when wheat fails. Milo and kafir for grain, sweet sorghum or Sudan grass for roughage and, where possible, a small acreage of hay are valuable supplements to the wheat crop. Where pasture is available, beef cattle make a desirable addition to the farm business. Milk cows, hogs, and poultry are profitable enterprises on many farms and every farm offers at least some opportunity for the keeping of these kinds of live stock.

The most common practice in growing wheat in this section is to reseed a field to wheat with no fallow or intervening crop. Yields with this practice are uncertain. Experiments at Garden City and Hays indicate that some degree of the risk is removed and average yields increased through summer fallowing at least a portion of the land.[7] A good method of summer fallowing is to list the ground in early fall, work the ridges down in the spring, and cultivate during the summer to keep down weeds. Good yields were obtained by this method, and over much of the area the soil would be in good condition for seeding a second crop without further plowing or listing. Listing for each crop but with no summer fallow gave somewhat smaller yields.

The grain sorghums are the most reliable crops grown in this section and should be included in the cropping system. Cultivated crops help to keep the land free from weeds and to maintain a balance of plant food in the soil. In addition they provide feed for live stock. The sorghums grow late in the season and deplete soil moisture so that wheat following sorghum is seldom profitable. For this reason, when sorghums are included in the rotation it is best to summer fallow the land the year following the sorghum crop. Some farmers plant cultivated crops in alternate rows and so dispense with fallow. In years when the ground has a good supply of moisture in early spring, barley and oats have a good chance to produce profitable crops. Barley is probably a better crop for this section than is oats.

A rotation recommended for this section by the Kansas Agricultural Experiment Station[7] consists of fallow, 1 year; wheat, 3 years; sorghum for grain or forage or spring grain, 1 year; followed again

7. Coles, E. H., and Wagner, F. A. Crop Production in Southwestern Kansas. Kan. Agr Expt. Sta. Bul. 289:1-30. 1927.

by summer fallow. Under this system the crop land is divided into five fields. Each year three fields are seeded to wheat, one to sorghum or feed crops, and one field is fallow. The sequence of crops in each field would be as follows: First year fallow, prepared by listing in early fall, working down the ridges in the spring, and cultivating during the summer to keep the land free of weeds; second year, wheat; third year, wheat, which could in most cases be seeded with no preparation other than disking; fourth year, Wheat, on ground listed immediately after harvest unless the soil was in good condition and could be seeded after disking; the fifth year the field would be in sorghum or small grain crops for feed. The field would be fallowed again the sixth year. The use of the one-way disk plow will reduce the amount of labor required to prepare the land for seeding.

The cropping system outlined might be used as a basis and could be followed in many years with little variation. The system must be flexible enough, however, to meet the emergencies arising from crop failures. Failure of wheat to germinate, winter killing, or loss through soil blowing may leave some land that could be seeded to oats or barley in the spring or later to grain sorghums. A larger acreage might be summer fallowed. Where wheat is to follow grain sorghum on the land, the sorghum should be planted in alternate rows to leave the land in condition for the following crop.

SUGGESTED ORGANIZATIONS FOR WHEAT FARMS IN THE REGION

One of the purposes of a farm business is to give the largest net income from the available resources. The following suggested organizations of farms have been worked out with the data available to indicate the probable returns to be expected and to suggest ways of solving the problems immediately confronting the farmers of this region.

Probable Yields.—The average yields that can be reasonably expected in this region are given in Table III. These yields correspond to average yields obtained at Garden City under similar methods. In many sections of the area higher yields could be expected where crops are seeded with the best seedbed preparation.

In this section crop production is hazardous and some provision should be made to carry a part of the surplus feed from exceptionally good years over as an insurance against probable failures.

Live Stock Production.—Before the range was broken up into farms this region was devoted to beef-cattle production. With the

TABLE III.—PROBABLE CROP YIELDS IN SOUTHWESTERN KANSAS.

CROP.	Yield per acre (a).	CROP.	Yield per acre (a).
Wheat:		Kafir:	
Summer fallow	11 bushels.	Grain	14 bushels.
Disked after summer fallow	10 bushels.	Fodder	1.25 tons.
Early fall listed	8 bushels.	Feterita:	
		Grain	15 bushels.
Oats	15 bushels.	Fodder	1 ton.
Barley	15 bushels.	Corn	10 bushels.
Milo:		Sudan grass	1.5 tons.
Grain	16 bushels.		
Fodder	1 ton.		

(a) These yields are approximately the same as those reported for counties by the Kansas State Board of Agriculture. The average for each county is based, however, on the acres harvested and does not take the abandoned acreage into account. The cropping system suggested should give somewhat higher yields than the practices generally followed. In many years the crop yields will be much larger than the yields given here, but in unfavorable years low yields must be expected and the yields given should represent the average over a long period.

first attempts at crop farming the number of cattle decreased, but with further development of farms cattle production increased until even with large acreages of wheat the number of cattle is almost equal to the number previously kept. Live stock to utilize the feed produced and to provide an income in case of wheat failure are essential to a safe system of farming in this section.

Much of the land unsuited to cultivation can be used for cattle pastures, and roughage is available for wintering stock. Pastures should carry the equivalent of one animal unit for each 10 acres. Normal feed requirements for producing live stock are given in Table IV.

The number of cattle kept usually depends on the pasture available. In sections where the land is better adapted to pasture and feed crops than to wheat, cattle may be the most important single farm enterprise.

TABLE IV.—FEED NEEDED PER UNIT OF LIVE STOCK.

Data from United States Department of Agriculture (a).

LIVE STOCK.	Unit.	Pounds of feed.		
		Grain.	Protein. concentrates.	Roughage.
Horses	One horse	2,000		4,200
Cattle	One animal unit (b)	600	100	3,100
Pork	100 pounds	400	40	
Poultry	100 hens	6,000	500	

(a) A Study of Farm Organization in Central Kansas. United States Department of Agriculture Department Bulletin No. 1296. 1925. Pp. 1-75, illus.
(b) The equivalent of one mature animal.

Pork production is limited by the quantity of grain and suitable hog pastures, but the production of some pork should have a place on most farms. With a wide range available, turkeys may prove a profitable enterprise.

Prices Used in Estimating Farm Returns.—Farm returns, and the most desirable combination of enterprises, depend on the prices received for products and the cost of elements used in production. Table V shows the prices of the principal products and the cost of the important items of expense which are used in estimating returns from the suggested farming systems. Prices are subject to seasonal and yearly fluctuation and the relation between prices of different

TABLE V.—PRICES ASSUMED IN COMPUTING RETURNS ON SUGGESTED FARMS.

PRODUCT.	Price.	ITEM OF EXPENSE.	Price.
Wheat	$1.15 bu.	Cottonseed meal	$50.00 ton
Sorghum	.70 bu.	Tankage	80.00 ton
Cows	.05 lb.	Bran	30.00 ton
Young cattle	.09 lb.	Gasoline	.22 gal.
Hogs	.085 lb.	Distillate	.10 gal.
Poultry	.22 lb.	Oil	.65 gal,
Eggs	.23 doz.		

Sources: These data are taken from prices paid to farmers as reported by the Bureau of Crop and Live Stock Estimates, the value of farm products reported by the Kansas State Board of Agriculture, and statements regarding price trends from the Agricultural Outlook, 1928.

products may vary widely from year to year. The prices given are based on farm prices in this section for the past 10 years or on the apparent trend of prices and should represent the relation normally existing among the prices of the different products.

Equipment Used on Farms.—The cost of equipment and its replacement and repair constitutes one of the chief items of expense on grain farms in this region. Economical use of machinery is an important factor determining farm profits. The amount and kind of machinery used depend somewhat on the size of the farm. The life of machines and the cost of repairs depend as much on the way they are handled as on the work done. In general large units of machinery use less man labor for the work accomplished than do smaller machines. Since the necessary equipment differs on farms of different size the items and estimated cost of operating will be taken up under each size of farm.

The Size of the Farm.—The western edge of the wheat belt is not a region for small farms. Crop yields are low and a large acre-

age is necessary to give adequate returns for the support of a farm family. Crop production, at best, carries with it a large element of risk. The return in good years must be sufficient to carry the operator through the years of poor yields. Sufficient acreage to maintain more than one enterprise and so distribute the risk of total failure is essential.

Farms have been tending to increase in size and with the introduction of larger units of farming machinery should continue to do so. The use of tractors and combines in the area calls for a larger unit. than the average size at present. The following suggested systems of farming show the acreages of crops needed to fully utilize machinery of different-size units.

A PLAN FOR A FARM USING A 15- OR 16-FOOT COMBINE

A farm using the cropping system previously described, growing the acreage of wheat that can be harvested with a 15- or 16-foot combine, and allowing pasture for live stock to utilize feed crops would contain approximately 1,000 to 1,200 acres. Three-fifths of the crop land would be in wheat each year. The utilization of farm land is shown in figure 6.

With the necessary pasture to carry live stock the farm outlined occupies two sections. Under actual conditions it is probable that the pasture and crop land would be separated since the land adapted to wheat might not join that used for pasture. Furthermore the sorghums might be grown on land better adapted to row crops than to wheat and a longer wheat rotation used on the wheat land.

With the pasture available a herd of approximately 40 cows or the equivalent in young stock could be kept.

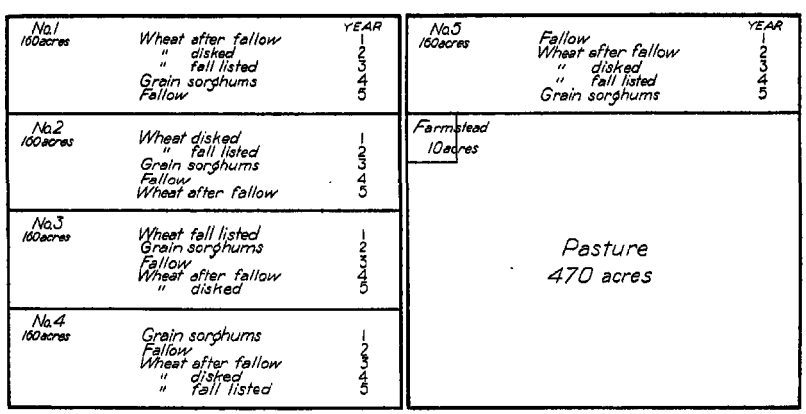

FIG. 6.—Suggested cropping system for farm using a 15- or 16-foot combine.

The crop acres and normal production is given in Table VI. The 480 acres of wheat would produce 4,640 bushels of grain with yields as given in Table III. In considering this yield, however, it should be recalled that the variation in yearly production is quite wide. In favorable years the production may be much greater while in other years the yield may be practically nothing.

TABLE VI.—ESTIMATED CROP PRODUCTION AND USE OF CROPS ON FARM WITH 480 ACRES OF WHEAT.

Crop.	Acres.	Production.	Use of crop.			
			Feed.	Seed.	Sales.	
					Quantity.	Values.
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	
Wheat	480	4,640	.....	360	4,280	$4,922
Barley	40	600	560	40	.....	.....
Grain sorghums:						
Grain	100	1,500	588	10	902	631
		Tons.	*Tons.*			
Stover	100	100	50	.....	.....	.....
Sudan grass	20	30	30	.....	.....	.....

Table VI also gives the feed used by live stock and the quantity of the crops to be sold. The beef cattle for sale each year should be approximately four mature cows at 1,100 pounds each and 14 head of young stock at approximately 650 pounds each. Dairy products, pork, and poultry products for home use would also be available. Some surplus of pork and poultry products could be sold.

Estimates of the probable receipts and the more important expenses on the farm are listed in Table VII. This estimate of returns does not include returns from outside work with tractor or combine, although on many farms this item is important. The prices on which this estimate is based are derived from available data on prices in this section. Approximately two-thirds of the gross farm income is from the sale of wheat.

The most important cash expenses are for purchased feed, hired labor for harvest and for preparation of the seedbed, fuel, oil, and repairs for machinery. Replacement of machines is an important item of expense on farms of this type.

A farm of this size operated as outlined would not give the full use of a number of machines required on the farm. The combine in this section could harvest more than 500 acres. The tractor and horsepower available could, with some sacrifice in care and time-

TABLE VII.—ESTIMATED RECEIPTS, EXPENSES, AND FINANCIAL STATEMENT FOR FARM WITH 480 ACRES OF WHEAT.

Receipts:		
Crops	$5,553	
Live stock	1,468	
Total receipts		$7,021
Expenses:		
Purchased feed	$125	
Hired labor	400	
Fuel and oil	392	
Repairs and replacement of machinery	961	
Live stock expense	25	
Farm upkeep and miscellaneous	275	
Taxes	450	
Total expenses		2,628
Return to farm and operator		$4,393
Land and capital charge at 5 per cent		1,900
Return to operator		$2,493

TABLE VIII.—MACHINERY USED AND ANNUAL REPLACEMENT COST ON FARM WITH 480 ACRES OF WHEAT.

MACHINE.	Cost.	Estimated life.	Annual replacement charge.
		Years.	
Tractor, 15-27	$1,200	6	$200
Tractor plow, 2-bottom	105	12	9
Tractor lister, 2-row (*a*)	135	12	11
Tractor disk	125	10	12
One plow, 2-bottom	120	12	10
One lister, 2-bottom	135	12	11
One disk	75	10	8
Two drills, 20x8	500	10	50
One smoothing harrow	50	12	4
Two 2-row cultivators	85 115	12	17
One 1-row cultivator	55	12	5
One mower	85	8	10
One rake	45	15	3
One corn binder	210	8	26
One truck, 1-ton	800	6	133
Two wagons	350	15	23
One combine	2,250	8	281
Manure spreader	160	8	20
	$6,600		$833

(*a*) The one-way disk is being used extensively in place of the lister in soil preparation.

liness of seeding, handle a larger acreage. A list of the machinery used and the replacement charge of each is given in Table VIII.

A farm of this size, or approximately two sections, would have a total investment of nearly $40,000 and would return the operator an annual income of $2,500 to $3,000, on the basis of the estimates that have been made.

A PLAN FOR A FARM UNIT USING A LARGE COMBINE

The level land of this region encourages the use of large units of machinery. On many farms it is probable that a 20-foot combine would be preferable to the smaller sizes. The first cost of large machines is somewhat higher than for smaller machines, but they are more economical in their use of fuel and labor.

A 20-foot combine should harvest 45 acres of grain a day, and in many seasons could cut 800 to 1,000 acres of grain in this region. This combine would probably use a three-man crew with grain haulers in addition. The cost of harvesting an acre is practically the same as for a 16-foot machine. The advantage of the large machine lies in the greater rapidity of cutting and the capacity to handle a larger acreage.

A farm with a balanced organization, growing approximately 1,000 acres of wheat, with some cultivated crops and pasture for live stock to utilize the feed crops grown, would require approximately 2,560 acres, or four sections of land. Production and returns from a farm of this size with 960 acres of wheat, 320 acres of fallow, 320 acres of spring crop, and carrying a herd of cattle equivalent to 90 mature animals is shown in Tables IX and X.

TABLE IX.—ESTIMATED CROP PRODUCTION AND USE OF CROPS ON FARM WITH 960 ACRES OF WHEAT.

Crop.	Acres.	Production.	Use of crop.			
			Feed.	Seed.	Sales.	
					Quantity.	Value.
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	
Wheat	960	9,280	.....	720	8,560	$9,844
Barley	80	1,200	1,120	80	.....	.....
Grain sorghums:						
Grain	200	3,000	620	20	2,360	1,652
		Tons.	*Tons.*			
Stover	200	200	100	.....	.....	.....
Sudan grass	40	60	60	.....	.....	.....

TABLE X.—ESTIMATED RECEIPTS, EXPENSES, AND FINANCIAL STATEMENT FOR FARM WITH 960 ACRES OF WHEAT.

Receipts:		
Crops	$11,496	
Live stock	2,592	
Total receipts		$14,088
Expenses:		
Purchased feed and seed	$340	
Fuel and oil	649	
Repairs on machinery	300	
Replacement on machines	1,055	
Hired labor	1,500	
Live stock expense	35	
Farm upkeep and miscellaneous	525	
Taxes	875	
Total expenses		5,279
Return to farm and operator		$8,809
Land and capital charge at 5 per cent		3,750
Return to operator		$5,059

To care for the live stock and crops would demand the time of two men for practically the entire year and some extra labor during harvest and seeding. The production and use of crops are given in Table IX. The cropping system is the same as was used in the previous illustration.

There would be 1,040 acres of small grain to harvest each year. A 20)-foot combine cutting at the rate of 45 acres a day could harvest this acreage in 23 cutting days. Unless the weather was abnormally unfavorable the harvest could be completed in about a month.

The live-stock production and feed requirements are estimated for a herd of 50 stock cows with the young stock sold as yearlings and 20 per cent of the breeding herd replaced each year. Eight mature animals and 32 head of young stock should be available for sale each year. Feed allowance was made for 7 hogs and a flock of 100 chickens. Feed to care for 10 head of horses is also included in the quantity of crops fed.

The equipment required to operate the farm is practically the same as that given in Table VIII, except that larger machinery would be used. To insure sufficient power for the combine a large tractor is necessary. The large tractor will also pull larger plow or lister units than will a small tractor. Much of the work, such as harrowing, disking, working down lister ridges, and seeding, can be done as well with a light tractor. Two tractors are in use on some farms of this size. Horse work could be substituted for the work of the light tractor, where horse power is available.

Where more pasture is available the size of the cattle enterprise could be larger than that given in the outline. The acreage of feed

crops will produce more feed than is necessary for the live stock except in unfavorable years.

With the equipment suggested, the farm would use the labor of two men for the greater part of the year, and during harvest would require two or more additional helpers.

The use made of the crops and the value of sales are also shown in Table IX. With the assumed normal yields and prices, approximately 70 per cent of the gross income is from the sale of wheat. The income from other crops and from live stock helps to stabilize the income.

Estimated expenses and the net return to the operator are given in Table X. The heaviest expenses on a farm of this type are taxes, labor, and replacement of machinery. These expenses are estimated for years of average yields when all the operations for harvesting and preparation for reseeding would be performed. In years of low yields and an abandonment of acreage some operations could be dispensed with and expenses would be reduced. In years of higher than average yields expenses would not be materially increased.

A farm of four sections at an average value of $26 per acre and with the machinery and live stock to equip it would represent an investment of about $75,000. After deducting a 5 per cent charge for land and capital investment, the farm, at average yields and normal prices, should return approximately $5,000 a year to the operator.

SUGGESTED SYSTEM FOR A SMALLER FARM

Many farmers in this area will be unable to obtain enough land to handle a farm as outlined. Others with a farm containing considerable rough land may find so large a wheat acreage impractical. A farmer with 300 or 400 acres in wheat might prefer a smaller combine and smaller units of tillage machinery.

The following outline is suggested for a farm having the wheat acreage which could be handled by a 10- or 12-foot combine. However, some farmers may consider the greater cost of a larger machine justified by the shorter harvesting period.

Following the cropping system already described, a farm with 360 acres of wheat would also have 120 acres of spring crops and 120 acres in summer fallow. If beef cattle are included in the farm business, the number of head kept will depend on the pasture available. The equivalent of approximately 40 mature animals and about 320 acres of pasture is used in the illustration. Other live stock which could be included consist of horses for farm work, a few hogs, and a flock of chickens.

Table XI shows the crop organization on such a farm and the estimated production. In normal years, 3,210 bushels of wheat and 387 bushels of sorghum would be produced for sale. Other crops would be used by farm live stock. A wide variation in crop yields

TABLE XI.—ESTIMATED CROP PRODUCTION AND USE OF CROPS ON FARM WITH 360 ACRES OF WHEAT.

Crop.	Acres.	Production.	Use of crop.			
			Feed.	Seed.	Sales.	
					Quantity.	Value.
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	
Wheat	360	3,480	.....	270	3,210	$3,691
Barley	20	300	280	20	.....	.....
Grain sorghums:						
Grain	70	1,050	581	7	387	323
		Tons.	*Tons.*			
Stover	70	70	35	.....	.....	.....
Sudan grass	30	45	45	.....	.....	.....

must be expected and crop production would be much higher than this some years and much lower in others. More roughage than that produced on 30 acres of Sudan grass may be required for the given herd of stock cattle and horses. Some kafir or milo would necessarily be used for feed.

The feed used by live stock as estimated in Table XI would, with the 360 acres of pasture, care for 6 horses, the equivalent of 40 mature cattle, 5 hogs, and 100 chickens. Some roughage in addition to

TABLE XII.—ESTIMATED RECEIPTS, EXPENSES, AND FINANCIAL STATEMENT FOR FARM WITH 360 ACRES OF WHEAT.

Receipts:		
Crops	$4,014	
Live stock	1,043	
Total receipts		$5,057
Expenses:		
Purchased feed	$113	
Hired labor	200	
Fuel and oil	208	
Repairs and replacement of machinery	688	
Live stock expense	20	
Farm upkeep and miscellaneous	225	
Taxes	350	
Total expenses		1,804
Return to farm and operator		$3,253
Land and capital charge at 5 per cent		1,700
Return to operator		$1,553

the Sudan grass produced might be required, but the deficiency could be made up from the sorghums.

Estimated receipts, expenses, and net returns are given in Table XII. With expenses and income estimated on the same basis as for farms with 480 and 960 acres of wheat, the net annual return to the operator for his services is $1,553.

An investment of approximately $34,000 would be necessary to purchase the land, equipment, and live stock as outlined for this size of farm.

MODIFICATIONS OF THE ILLUSTRATIONS

Systems for different sizes of farms have been presented in a general way. It is not to be expected that the outlined plans can be applied to many farms without modification. The system, when put into practice, would necessarily be modified to fit the peculiarities of the individual farm and the changes made necessary by weather and crops.

The balance between crop acreages and machinery used is being attained on most farms. In many cases where the owner does not have sufficient land, additional land is rented for wheat. It may be impossible to include row crops or summer fallow in the cropping system on rented land because of limitations contained in the lease.

The systems outlined are applicable to farms having some land suited to wheat and other land suited only to pasture. However, it would not be necessary for the crop and pasture land to be adjoining. The extent of the live-stock enterprises would be affected by the pasture available. Beef cattle make good use of native pasture and require less labor during the busy season than do dairy cattle.

Where no pasture is available, a small herd of dairy cows, pastured on Sudan grass or sweet clover, may give good returns. Although the illustrations assumed beef cattle to be kept, hogs offer an alternative live-stock enterprise on farms where grain sorghum is available and pasture is limited. A poultry enterprise larger than that suggested may also be profitable on some farms.

The risk involved in crop production makes a certain degree of flexibility necessary in the production program. The acreage of row crops or the amount of summer fallow may often be increased in years when wheat winter kills. Where wheat is to follow corn or sorghum, it may be advisable to plant the cultivated crop in alternate rows.

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