SOME CONCEPTS OF THE IMPACT OF ACREAGE ALLOTMENTS AND MARKETING QUOTAS ON CENTRAL AND WESTERN KANSAS FARMS

by

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INTRODUCTION

The use of acreage allotments and marketing quotas in an effort to bring about a balance between production and consumption is not a new idea in American agriculture. Acreage allotments first appeared on the American farm scene in the early 1600's when an effort was made to control production of tobacco with acreage allotments.[1] That early trial was the result of sagging tobacco prices. An attempt at privately imposed acreage controls was made in the 1930's by cotton growers in the South. Menchen's sarcasm about their joint agreement to cut cotton acreage voluntarily was well founded. The group decision to reduce acreage followed by private decisions to take advantage of the expected higher price is a familiar characterization of privately administered production controls.[2]

Production adjustment programs in agriculture have generally been designed for three purposes: (1) to reduce the depletion of the soil associated with certain crops, (2) to support farm incomes with government payments to farmers, (3) to curtail production and thus raise farm prices and income on the assumption of an inelastic demand.[3]

Elasticity of demand is the responsiveness of a quantity demanded or consumed to a change in price, within a given demand schedule. An inelastic demand is one in which a change in price is accompanied by a less than proportional change in quantity demanded. An elastic demand is characterized by greater than proportional quantity changes for a given percentage change in price.

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[1] Gove Hambidge, editor, Farmers in a Changing World, p. 184.
[2] H. L. Menchen, Prejudices, Fourth Series, p. 46.
[3] Harold G. Halcrow, Agricultural Policy of the United States, p. 293.

Research indicates that agricultural commodities in general have inelastic demand schedules.[1] Certain products have a more inelastic demand than others, but the past production adjustment programs have been based on the assumption of an inelastic demand for certain products. Wheat, cotton, tobacco, milk, sugar, and potatoes were those products considered to have a highly inelastic demand. The typical values fell between -.25 and -.50.[2]

Figures 1 and 2 show elastic and inelastic demand curves respectively. It can be seen that a decrease in the quantity produced will result in a greater increase in price in the case of an inelastic demand. A change in the quantity produced from OQ' to OQ results in a change in price from OP' to OP in the case of an inelastic demand curve in Fig. 2. This increase in price is greater than in the case of the elastic demand curve in Fig. 1. When demand is inelastic, total revenue from quantity OQ is greater than total revenue from quantity OQ', a larger quantity. Production restriction, with resulting increased total revenue has been an aim of recent government production control programs. The means by which production has been reduced are discussed in a later section.

Production adjustment may be viewed quite differently by the producer than by the consumer. The producer desires to receive a high price for his products as a means of earning a suitable income. Price is thus a means toward a given level of living for the farmer. But a given price can be obtained only for a unique quantity of a commodity. Demand, by definition, is a schedule of the quantities of a product which will be taken at all possible prices. If the quantity of a product supplied cannot be sold at a price producers consider adequate, they may look for means of securing

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[1] Theodore W. Schultz, Agriculture in an Unstable Economy, p. 150.
[2] Ibid.

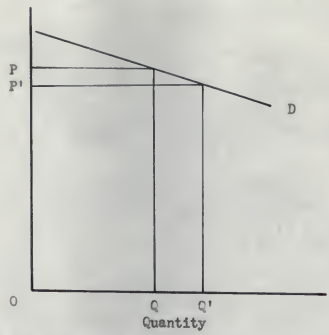

Fig. 1. The effect of a change in the quantity produced on the price and gross income from the product under conditions of an elastic demand curve.

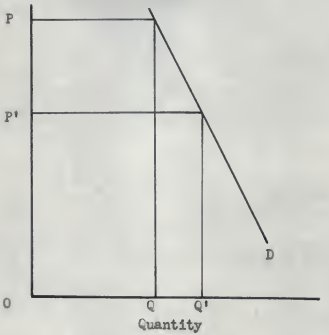

Fig. 2. The effect of a change in the quantity produced on the price and gross income from the product under conditions of an inelastic demand curve.

such a price. In recent years, farmers have indicated their dissatisfaction with prices and incomes, resulting in pressure for and adoption of programs to alter the situation. Farmers have chosen to restrict acreage, and implicitly to restrict production, in order to reduce the supply of certain crops to that quantity which can be sold at or near a selected price.

The consumer on the other hand desires to purchase agricultural products at a relatively low price. He may oppose production restrictions because they tend to raise the prices of the goods he buys. Also, price programs applied differently to different crops may alter relative prices and lead to unwanted changes in consumption patterns.

Government production programs have not always been intended to limit the supply of agricultural products. During World War II devices such as patriotic appeals, incentive payments, farm production goals, price supports, and subsidies were used in an effort to expand supply. This method of influencing supply was quite successful as shown by increases in agricultural production during the war years and early postwar years.

After the war ended in 1945, production continued to be encouraged to supply the needs of the war-damaged areas. This encouragement consisted chiefly of relatively high wheat prices, both in the market, and in terms of the rate of support. Acreage restrictions with accompanying marketing quotas were not used until 1953-54, although they were established and then abandoned in 1950.

This study was initiated to discover some of the impacts of acreage allotments on western Kansas farmers, compared to the effects on central and eastern Kansas farmers. The major hypothesis guiding the study was that both alternative crops, and input substitutes for land resources excluded from wheat production, were less desirable from an income standpoint in western

Kansas than in more humid areas. If this were found to be true, wheat farmers in fallow areas would have their production and thus their income reduced more severely by the acreage allotment program than farmers in non-fallow areas. It is doubtful if the intent of the allotment program is to affect wheat farmers' incomes differently in different regions. However, conditions may exist which rationalize such a situation. It is intended that data studied here will suggest whether or not such a condition exists, and may indicate means of more adequately meeting the goals of the wheat program.

The acreage allotment program was based on average wheat acreage during a historical base period. This points up a second hypothesis, that farmers who were not following recommended fallow practices during the certain base years received proportionally higher allotments than did those farmers who had followed fallow practices during the base period.[1] If a farmer was planting continuous wheat during the base period his average wheat acreage would be higher than the farmer who fallowed one-half of his land unless statutory adjustments were made in the alloted acreages. These adjustments are discussed later.

If the second hypothesis is substantiated, a third hypothesis is suggested: that farmers may have fallowed less than the long-run optimum acreage in anticipation of subsequent historically based acreage allotments. Implicit also is the study of reasons other than anticipation of acreage controls, for planting continuous wheat, thus increasing the base acreage.

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[1] In general agronomists recommend that one-half to one-fourth of the land in the western four tiers of counties should be in fallow each year, with successive decreases in fallowed acreage farther east. Continuous wheat is recommended in all the eastern half of Kansas (Throckmorton and Myers, Summer Fallow in Kansas, p. 23).

This study is limited by the fact that only two recent allotment years are available for study. These are wheat crop years 1954 and 1955.[1] Allotments were placed on wheat in the 1930's and 1940's as discussed later, but were administered under different conditions and regulations so they were not directly useful in this study.

BRIEF BACKGROUND OF WHEAT ALLOTMENT PROGRAMS

The Pre-War Period

The renewal of acreage allotments and marketing quotas for the 1954 crop represented a return to programs similar to those established by the Agricultural Adjustment Act of 1933. This Act gave the Secretary of Agriculture the power to enforce acreage allotments on products declared in surplus. Previous to the Agricultural Adjustment Act of 1933 there was no means of enforcing acreage allotments. However, the 1933 law was not a complete break with the past, since positive action on farm prices had been advocated for several years.

From 1920 to 1930 foreign trade was curtailed due to the tightening of foreign lending policy and the industrial depression in Europe. Farm products could be exported only at low prices. Surpluses of agricultural products began to pile up. The demands of the farmers for relief measures were felt in Congress, resulting in the enactment of the Capper-Volstead Act in 1921 and higher tariffs in 1922.[2] The Capper-Volstead Act provided aid for cooperative organizations through which farmers could sell their

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[1] A wheat crop year refers to the year of harvest. Thus, wheat crop year 1955 refers to wheat seeded in 1954.

[2] Edwin G. Nourse, Joseph S. Davis, John D. Black, Three Years of Agricultural Adjustment Administration, p. 5.

products jointly with the expectation of higher prices. Also in this period, several farm organizations were formed and old organizations became more active.

Among the specific proposals for securing equality of agricultural prices with prices paid by farmers was the idea introduced by George N. Peek and Hugh S. Johnson. Their ideas were first presented to Congress as the McNary-Haugen Bill in 1924. Revisions were introduced in Congress from 1924 to 1928 but either failed to pass or were vetoed by President Coolidge.

The McNary-Haugen bill advocated a minimum of interference with the existing marketing agencies. It is of interest here because its proponents opposed any action to limit production, while production limitations are basic to current programs.

When all McNary-Haugen proposals had failed, the Federal Farm Board was established in 1929. This Board tried to control and reduce farm surpluses by orderly production and distribution of farm products. The problem confronting the Farm Board was the marketing of agricultural produce coupled with the control of agricultural production. The recommendations of the Farm Board were completely advisory. Chairman Legge tried vigorously to reduce surplus crop acreages by admonitions to the farmers to cut acreage.[1] This, however, had little effect on crop acreages. It became evident to Congress and farm leaders that stronger measures had to be implemented to aid farmers and raise sagging prices. The Board also acquired some wheat stocks but was ineffective in the wheat market.

The proposals, trials, and failures from 1924-1933 set the stage for positive action in 1933. The Agricultural Adjustment Act of 1933 gave the

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[1]Edwin G. Nourse, Joseph S. Davis, John D. Black, Three Years of Agricultural Adjustment Administration, p. 9.

Secretary of Agriculture the power to enforce acreage allotments, production reductions, or a combination of both on those agricultural commodities which were considered to be in surplus.[1] The Act also provided for benefit payments to farmers, financed by a tax upon processors, as an incentive to reduce crop acreages. The main provisions of the 1933 Act were to establish and maintain a level of production equal to what the market would absorb at reasonable prices. Reasonable prices were defined in terms of parity.[2] Parity was the ratio of present prices to the prices received during a base period, 1910-1914.

The Agriculture Adjustment Act of 1933 was declared unconstitutional by the Supreme Court in the Hoosac Mills case in January of 1936.[3] The decision was based on the opinion of the Supreme Court of the United States that the Act was a program for regulating and controlling production, a power not granted to the Federal government.

Soil Conservation and Domestic Allotment Act. In order to replace the invalidated Agricultural Adjustment Act of 1936 Congress immediately began work on new legislation. On February 29, 1936, Sections 7 to 17 of the Soil Conservation and Domestic Allotment Act were enacted. These sections replaced the invalidated parts of the 1933 Agricultural Adjustment Act.[4] The new Act provided for the replacement of the former processing tax by Federal appropriations and direct payments to farmers for certain soil conservation practices.

Agricultural Adjustment Act of 1938. Provisions of both the Agricultural Adjustment Act of 1933 and the Soil Conservation and Domestic Adjustment Act

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[1] Agricultural Adjustment, 1937-38, United States Department of Agriculture, p. 11.

[2] Harold G. Halcrow, Agricultural Policy of the United States, p. 290.

[3] Ibid., p. 291.

[4] Agricultural Adjustment, 1937-38, United States Department of Agriculture, p. 15.

were incorporated in the Agricultural Act of 1938. This Act contained the features which have since been associated with production adjustment. These features include:[1]

1. The re-establishment of acreage allotments.
2. The use of marketing quotas if they were approved by producers in a special referendum.
3. Provisions for marketing agreements which were to be exempt from anti-trust laws.

While the Agricultural Adjustment Act of 1938 reflected provisions of past farm legislation, it was enacted as a result of three main factors.[2] First was the drought of 1934 and 1936 which pointed to the need for some type of storage plan to take up the deficiencies of low production years. As a result of these two drought years an "Ever-Normal Granary" plan was written into the law. The second factor was the record crop produced in 1937 and the prospects of another record breaking crop in 1938. This again called for some sort of storage plan. The third factor was the invalidation of the Agricultural Adjustment Act of 1933 which was replaced by the emergency enactment of the Soil Conservation and Domestic Allotment Act.

The Agricultural Adjustment Act of 1938 with minor amendments established farm programs in effect until the enactment of the Agricultural Act of 1954.

The Hope Amendment. One of the major amendments to the Act of 1938 was Public Law 272, commonly known as the Hope Amendment. This amendment was an effort by Congress to adjust inequalities between wheat farmers in non-fallow areas as compared to wheat farmers in fallow areas. It is discussed in a later section, with specific emphasis upon current revisions and their effects.

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[1]Malorow, op. cit., p. 292.

[2]Agricultural Adjustment, 1937-38, United States Department of Agriculture, p. 18.

The World War II Period

During the 1930's the farm situation was serious. Prices of farm products were low and continued at low levels during this period. The beginning of the Second World War in Europe had little effect on the prices of agricultural products.

With the entrance of the United States into the war in the fall of 1941, conditions began to improve. War increased the demand for food products. Prices rose and production incentives replaced production restrictions. Acreage allotments and marketing quotas for agricultural products were removed and bonuses and subsidies were paid to increase production. The surpluses which had accumulated under legislation during the 1930's were not used.[1] Instead these surpluses acted as a buffer against possible crop failures during the war years. No crop failures, however, were forthcoming. During the war and post war effort, the seeded wheat acreage increased from 63 million acres in 1939 to 84 million acres in 1949, and wheat production from 741 million bushels in 1939 to 1,359 million bushels in 1949.[2]

The Agricultural Adjustment Act of 1949. With the tremendous increase in production and a drop in demand for wheat, farmers found themselves in need of some form of government support by 1949. Support prices which had been in effect but not actually effective, were continued in the Agricultural Adjustment Act of 1949. Acreage allotments were again made operative in 1950 and 1951 in an effort to reduce the large supply of agricultural commodities and support falling prices. However, the Korean War, beginning in June, 1950 resulted in the elimination of acreage restrictions. Prices of agriculture products again rose and remained at a high level through out the conflict.

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[1]Murray R. Benedict, Farm Policies of the United States 1790-1950, p. 410.

[2]Ibid., p. 496.

Acreage allotments and marketing quotas for wheat were imposed in 1954 and remained in effect through 1956. Acreage allotments have been in effect for the years 1938-1943 inclusive and during 1950, 1951, 1954, 1955 and 1956.[1] Marketing quotas have been in effect for the years 1941, 1942, 1943 and from 1954 to 1956 inclusive.[2]

Agricultural Adjustment Act of 1954. The Agricultural Adjustment Act of 1954 provided for flexible price supports for agricultural commodities. It did not change any of the essential features of acreage allotments and marketing quotas. The 1938 Agricultural Adjustment Act was the law spelling out the provisions for acreage allotments and marketing quotas in 1956. Public Law 690, known as the Agricultural Adjustment Act of 1954 is discussed in a later section.

PRESENT ADMINISTRATIVE PROCEDURES

Since one of the hypotheses of this study is concerned with a specific phase of allocating wheat allotments, a brief description of the more general regulations follows, so that the specific case of allotments in fallow areas may be more adequately understood.

The National Wheat Acreage Allotment

Under the Agricultural Adjustment Act of 1938 as amended by the Agricultural Adjustment Act of 1954, the Secretary of Agriculture must proclaim the national acreage allotment for the next succeeding calendar year not later than May 15 of each calendar year.[3] This allows an interval of

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[1] Murray R. Benedict, Oscar C. Stine. The Agricultural Commodity Programs, p. 113, 115 and 117.

[2] Ibid., p. 113, 117.

[3] Agricultural Adjustment Act of 1938, as amended. Title III, Subtitle B, Part III, Section, 332.

approximately four months between the date on which the national acreage allotment is declared and the date the farmer sows his wheat. During this four month interval the national allotment must be divided into state allotments. These in turn are broken down by the state ASC Committee into county allotments. The County ASC Committee must have the farm allotment determined and the producer informed of his wheat acreage allotment before the wheat is sown. In practice, farmers may compute their allotments roughly from previous allotments and knowledge of the general increase or decrease in the national allotment.

The national acreage allotment for any crop of wheat is that acreage which the Secretary determines will make available a supply for the marketing year equal to a normal year's domestic consumption plus 30 percent.[1] In order to arrive at the national acreage allotment for wheat the Secretary must consider the estimated carry-over from previous years, normal domestic imports, and the national average yield of wheat.[2] The law further states that the national acreage allotment for wheat for any year shall not be less than 55 million acres.

Table 1 shows the formula followed by the Secretary in determining the national acreage allotment for the 1957-58 marketing year.

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[1] Agricultural Adjustment Act of 1938, as amended. Title III, Subtitle B, Part III, Section, 333.

[2] Loc. Cit.

Table 1. National wheat acreage allotment determinations for 1957.[a]

	Millions of bushels
Beginning stocks--July 1, 1956	960
Imports	3
Available without 1957 crop production	963
Normal year's domestic consumption	675
Normal year's exports	280
Total	955
Plus 30 percent	286
Total	1,241
Normal year's domestic consumption and exports plus 30 percent	1,241
Available stocks--July 1956	-963
Needed from 1957 crop	278

278 million bushels - 15.5 (National Average Yield) = 17,935,000 acres needed.

[a]Manhattan ASC office, Wheat Handbook, 1957.

It is shown in Table 1 that 17,935,000 acres of wheat were needed in order to produce an adequate supply for the marketing year. Since the present law requires a minimum national wheat acreage allotment of 55 million acres, the 1957 national allotment was set at the legal minimum, rather than at the computed acreage.[1]

[1]"Agriculture", Federal Register, May 14, 1956, 21:3216.

The State Wheat Acreage Allotment

The national wheat acreage allotment less a reserve not to exceed one percent is apportioned among the states.[1] This one percent reserve is to be used to make allotments to counties because of reclamation projects and new areas coming into production during the preceding ten calendar years. It may be apportioned to counties with the reserve held out of each state allotment. The state wheat allotment acreage is based on the acreage seeded to wheat during the ten years immediately preceding the year in which the national acreage allotment is determined.[2] The national acreage allotment is determined the year preceding the year in which the allotment is in effect. For example, the ten year period considered in determining the 1957 acreage allotment was 1946 to 1955 inclusive. An upward adjustment in wheat seeded acreage is made for acreage diverted under previous agricultural adjustment and conservation programs. If the Secretary determines that the seeded wheat acreage was abnormally low in a particular year due to weather conditions, adjustments are made in the seeded acreage figures for the year for the state.[3]

An adjustment in trend of seeded wheat acreage is made by taking, in addition to a ten year average, an average over the last five years in the series, an average of the last two years of the series, and an average of the five year average and the two year average. The ten year average seeded wheat acreage would equal the established base acreage except that (a) if the ten year average exceeds 102 percent of the average of the five year and two year

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[1] Agricultural Adjustment Act of 1938, as amended, op. cit., Section 334.
[2] Agricultural Adjustment Act of 1938, as amended, op. cit., Section 334 (b).
[3] 1956 State and County Wheat Acreage Allotments and National Reserve Allocations, United States Department of Agriculture, Commodity Stabilization Service, p. 2.

averages, or (b) if the ten year average is less than 98 percent of the average of the two year and five year averages, the base acreage will be 98 percent of the average of the two year and five year average and (c) under no circumstances can the base acreage exceed 125 percent of the two year average.[1]

In order to obtain the states' acreage allotment the national base acreage is divided into the national allotment. This factor is multiplied times the state's base acreage in order to obtain the states acreage allotment.[2]

The County Wheat Acreage Allotment

The state acreage allotment when received by the state ASC Committee is in turn apportioned among the counties within the state. All of the state allotment is apportioned to the counties except a reserve not to exceed three percent. Not more than 3 percent of the state allotment could be apportioned to farms on which wheat was not planted during any of the three marketing years immediately preceding the marketing year in which the allotment was made.[3] The state allotment is apportioned in a manner essentially the same as that used in apportioning the national acreage allotment. Adjustments are made for abnormal weather, war crop credit, diversion under previous allotment programs, and trends in production. The base acreage is determined on the basis of the wheat acreage for the preceding ten year period. The state allotment is then divided by the state base acreage and this factor multiplied by the county base acreage in order to obtain the county allotment.

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[1] Sheet 56 W-2, 1956 Wheat Allotment Program: Worksheet for Establishing State Base and Allotment Acreages, Manhattan ASC office.

[2] National Allotment
National base acreage x state base acreage = state acreage allotment.

[3] Agricultural Adjustment Act of 1938, as amended, op. cit., Section 334 (c).

The Farm Acreage Allotment

The procedure followed for determining the farm acreage allotment is somewhat different than that used for establishing the state and county allotments. The law provides that the county acreage allotments be apportioned to farms on the basis of past acreage of wheat, tillable acres, crop rotation practices, type of soil, and topography.[1]

Once base acreage allotments were determined for acreage allotments in 1954, these base acreages were continued if the county committee decided that they reflect the five factors used in apportioning acreage allotments.[2]

If the county committee decided that these five factors were not reflected, a new base acreage was established for the farm by upward or downward adjustments in the base acreage.

The alloted acreage for the individual farm was obtained by multiplying a county scaling factor times the farms base acreage.[3]

SUBSTITUTION ALTERNATIVES IN CENTRAL AND WESTERN KANSAS

The Theory of Substitution

Acreage allotments enforced by marketing quotas require farmers to reduce their wheat acreage as a condition for price supports. In order to utilize both land and other resources removed from wheat production, farmers may try to substitute other crops or farming practices in place of wheat.

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[1] Agricultural Adjustment Act of 1938, as amended, op. cit., Section 334 (f).

[2] County Office Procedure for Determination of 1956 Farm Wheat Acreage Allotments, U. S. Department of Agriculture, Commodity Stabilization Service, p. 11.

[3] The scaling factor equals the total acreage alloted minus reserve acreage divided by the total county base acreage.

Substitution as used in production economics involves the choice between alternatives in production.[1] This choice may concern either the combination of factors to use in producing a product or the combinations of products to produce from given resources. Both are discussed below in theoretical and practical situations.

Product Substitution

Here the choice in general concerns what product to produce from given resources. Specifically, this study is concerned with the existence of products which may replace wheat in western Kansas. Product substitution may be discussed from the standpoint of joint products, competing products or complementary products. While all these cases are of importance to the agriculture industry, the case of competing products is more relevant to this study.

A constant rate of substitution between products is shown in Figure 3, by the line $Y_3 Y_4$. In this case, each additional unit of one product requires a fixed decrease in the amount of the other product. Conversed, each unit reduction in production of one, presents the possibility of a given increase in the other product. This is a substitution situation taken as existing between wheat and sorghum.

Substitution of Productive Factors

Agricultural production possibilities may be represented by a production function of the type $Y = f(X_1 X_2 X_3 \ldots X_n)$. In this production function Y

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[1] For a more complete discussion of substitution refer to Earl O. Heady, Economics of Agricultural Production and Resource Use. Chapters 5 and 6.

the product produced, is a function of the factors $X_1, X_2 X_3 \ldots X_n$. Those factors to the left of the bar are known variable factors while those to the right of the bar are unspecified fixed factors. While there are cases in which the variable factors must be combined in a definite ratio, this is not usually the case in agriculture. Instead variable combinations of productive factors may usually be used to produce a given amount of product. Alternative substitution possibilities are shown below.

Constant Rates of Substitution. Constant rates of substitution exist when an amount of one factor replaces a given quantity of another factor for all combinations of the two which will produce a given output. In Fig. 4 X_1 and X_2 represent substitutable factors, while the lines marked 100, 200, and 300 indicate combinations of X_1 and X_2 which will produce the quantity represented by the various iso-product curves. For example if 100 units of product are desired they may be obtained by use of only the X_1 factor, only the X_2 factor, or any combination of the two shown on the line marked 100.

Varying Rates of Substitution. Varying rates of factor substitution are found in agricultural production more often than the above types. Varying rates of substitution are represented by the curvilinear iso-product curve in Fig. 5. There it is seen that two units of X_2 are needed to replace two units of X_1 at a, but when more X_1 was in use at b, only one unit of X_2 is required to replace two units of X_1.

Factor substitution theory applied to western Kansas and to the wheat acreage allotment program involves the problem of inputs which may substitute for land. Specifically, these may be improved cultivation, fertilizer, or new varieties. The intent of the substitution process would be to maintain bushel output despite reduction in land inputs. Whether or not this can be done depends on the existence of substitute inputs, and the rates at which they substitute for land.

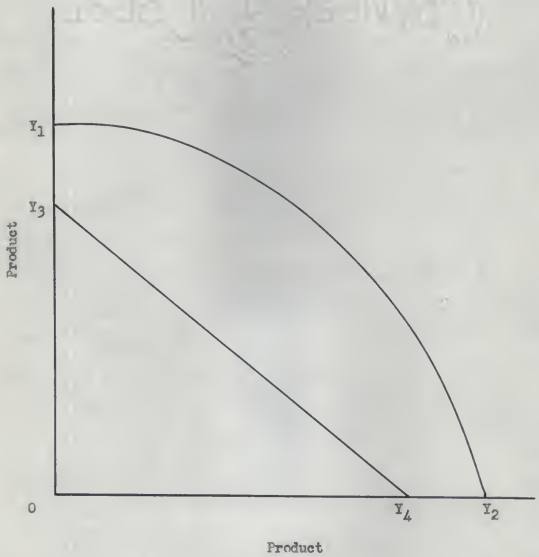

Fig. 3. Increasing and constant rates of product substitution.

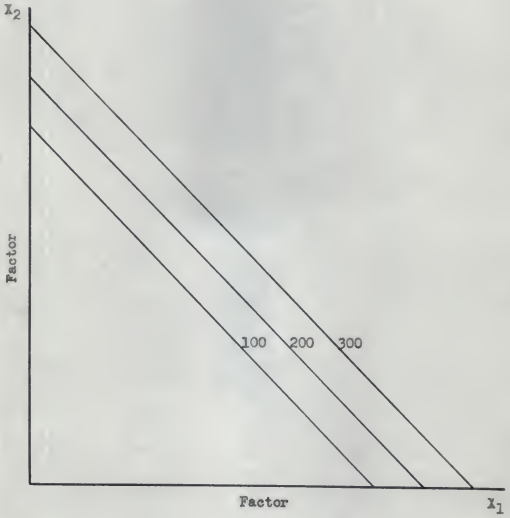

Fig. 4. Iso-product lines showing constant rates of factor substitution.

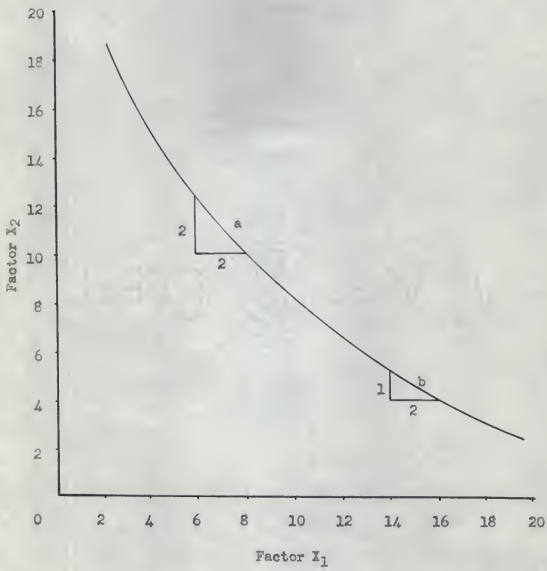

Fig. 5. Iso-product lines showing varying rates of factor substitution.

In Fig. 6 X_1 is land, X_2 represents prospective substitute inputs, and Y_1 is bushels of wheat. Before the acreage allotment program, a farmer was using Oa land and Ob other inputs. The acreage restriction limits land use to Oa'. So maintenance of Y_1 production requires use of Ob' other inputs with the reduced land input. If these added inputs are available and the substitution situation above prevails, output may be maintained.

However, if additional other inputs are not available, or if the substitution rates are such that additional inputs are of no use in maintaining production, the producer may simply have to drop back to Y_2 output in Fig. 6.

Figure 7 shows the factor substitution relationship suggested for western Kansas. Output Y_1 may be produced either with a very narrow range of inputs X_1 and X_2 as shown in Figure 7 or, perhaps, only at point c. Output maintenance under such conditions is difficult and of negligible importance.

Competing Products. Competing products are those which cannot be produced at the same time with the same resources. As more of one competing product is produced less of its competitor can be produced because each product needs the same resources for its production.[1]

Curve Y_1 Y_2 in Fig. 5 represents combinations of products Y_1 and Y_2 which may be produced from given resources. It is seen that as greater amounts of product Y_1 are produced, less of Y_2 can be produced since the two compete for the same resources. The reverse is also true. The shape of the line representing competition between two crops is determined by effects the crops have on each other.

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[1] An assumption of the theoretical model is that the same resources may be used to produce either product. This assumption appears realistic, especially for wheat and grain sorghum in western Kansas.

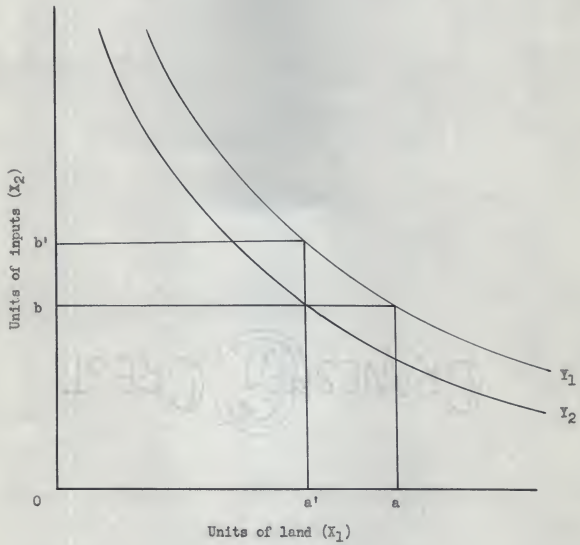

Fig. 6. The possible effects of acreage allotments on wheat production.

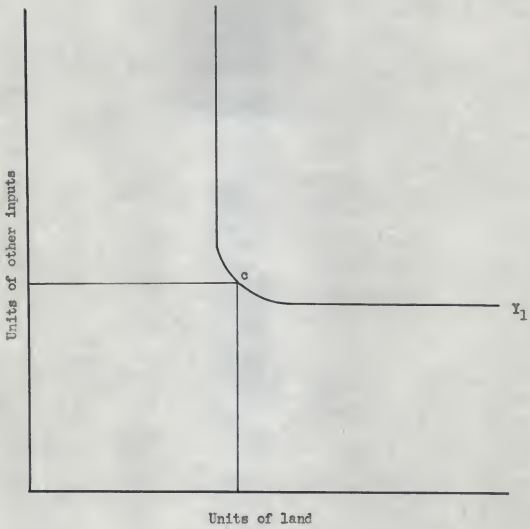

Fig. 7. Possible factor substitution relationships in Western Kansas.

Practical Substitution Alternatives in Western Kansas

Substitute Products. Wheat farmers throughout the state were faced with the decision of what to plant on the land acres taken out of wheat production in compliance with acreage allotments. If farmers have acted rationally in pursuit of the goal of profit maximization, they will have planted the excess acres to the crops which would give them the greatest return in some chosen time period. What crops farmers actually chose is of interest, since it indicates the most profitable alternative use of wheat land not planted to wheat, if the assumption with respect to profit maximization is well founded.

It was found in all six crop reporting districts studied (see Fig. 8 for districts 1, 2, 4, 5, 7, and 8) that the percentage of the crop land used for wheat decreased in 1954 as compared to the percentage of crop land in wheat from 1947-1953. The percentage of land in fallow was less in 1954 than during the previous seven year period in the northwest and west central districts. In all other districts the percentage of crop land in fallow increased in 1954 over previous years. As can be seen from Tables 1a and 2 the percentage of land planted to grain sorghum, forage sorghum, and alfalfa hay increased in all six of the crop reporting districts studied in 1954.

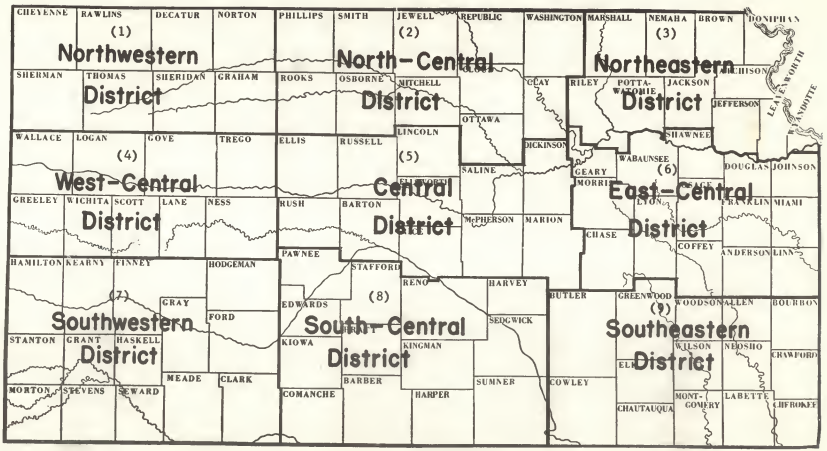

Fig. 8. Kansas Crop Reporting Districts

Table 1a. Percentage of total crop land placed in various crops for the years 1947-1953 and 1954 in the western crop reporting districts.[a]

Crop	Crop reporting district					
	Northwest		West Central		Southwest	
	'47-'53	1954	'47-'53	1954	'47-'53	1954
Wheat	45.4	36.1	47.4	34.9	52.8	32.3
Summer Fallow	37.9	37.3	36.0	33.9	28.5	31.2
Grain Sorghum	3.9	11.7	8.2	21.5	11.8	25.8
Forage Sorghum	5.2	5.9	5.6	6.0	4.8	7.8
Corn	4.0	4.7	.4	.5	.1	.1
Alfalfa Hay	1.2	1.8	.5	.8	.7	1.2

[a]Computed from data compiled by the Kansas Crop and Livestock Reporting Service, Topeka, Kansas.

Table 2. Percentage of total crop land placed in various crops for the years 1947-1953 and 1954 in the central crop reporting districts.[a]

Crop	Crop reporting district					
	North Central		Central		South Central	
	'47-'53	1954	'47-'53	1954	'47-'53	1954
Wheat	54.6	43.5	69.8	56.5	69.2	60.3
Summer Fallow	7.3	9.0	6.9	9.1	6.6	7.4
Grain Sorghum	4.1	11.2	4.5	8.5	7.1	8.2
Forage Sorghum	4.7	5.9	5.5	9.2	5.9	9.2
Corn	17.5	14.7	4.1	3.4	2.4	1.1
Alfalfa Hay	6.8	10.5	3.8	5.6	3.8	5.5

[a]Computed from data compiled by the Kansas Crop and Livestock Reporting Service, Topeka, Kansas.

Table 3. Percentage of the total crop land in fallow and wheat in 1947-1953 and 1954 by crop reporting districts.[a]

Crop reporting district	Percentage of land in wheat and fallow	
	1947-1953	1954
Northwest (1)	83.3	73.4
West Central (4)	83.4	68.8
Southwest (7)	81.3	63.5
North Central (2)	61.9	52.5
Central (5)	76.7	65.6
South Central (8)	75.8	67.7

[a]Percentage figures calculated from crop acreage data supplied by the Kansas Crop and Livestock Reporting Service, Topeka, Kansas.

The percentage of total crop land planted to corn in 1954 increased in the northwest and west central crop reporting districts but decreased in the north central, central and south central crop reporting districts over the percentage of total crop land in corn during 1947 to 1953.

It was observed that in all six crop reporting districts studied wheat was planted on 32.3 to 60.3 percent of the crop land in 1954. From 1947 to 1953, however, wheat was planted on from 45.4 to 69.8 percent of the crop land. The percentage decrease in wheat acreage under allotments was about 10 percent. The percentage planted to wheat was actually higher in the north central, central and south central crop reporting districts than in the other three crop reporting districts. Table 3 shows the percentage of the total crop acreage in summer fallow and wheat. The percentage figures were higher in the western crop reporting districts than in the central crop reporting districts. A comparison of Tables 1 and 2 with Table 3 shows that although the percentage of the land planted to wheat was higher in the central crop

reporting districts the percentage planted to wheat plus fallow land was higher in the western crop reporting districts. If farmers had been following recommended fallow practices as defined earlier, about 42 percent of the crop land would have been in fallow in the western crop reporting districts while approximately ten percent of the crop land would have been in fallow in the central crop reporting districts. The percentage of land in fallow did not reach the recommended percentage in fallow in any district in either of the periods studied.

When acreage allotments became effective in 1954 farmers increased their acreage of grain sorghum as much as 14 percent in the southwest district and as little as one and one tenth percent in the south central district. As can be seen from Table 4 there was a greater increase in the percentage of land planted to sorghum than any other crop when wheat acreage was diverted to other crops because of allotments. More grain sorghum than any other crop studied was placed on land diverted from wheat. From Table 4 it was observed that the greatest increase in sorghum occurred in the southwest district. The least increase occurred in the south central district.

The central crop reporting districts also show an increase in the percentage of land planted to sorghum. However this increase in percentage of total crop land planted to sorghum was greater in the western crop reporting districts. While the data of Tables 1 and 2 represent what the farmers of Kansas actually did in 1954 as compared to the previous seven year period it cannot be assumed that the only factor causing this change was acreage allotments. Weather conditions, especially rainfall, probably were important factors as discussed in a later section.

Table 4. Changes in the percentage of total crop land placed in various crops.[a]

Crop	Change in percentage of total land in crops 1954 relative to 1947-53, by crop reporting districts					
	NW	WC	SW	NC	C	SC
Wheat	-9.3	-12.5	-20.5	-11.1	-13.3	-8.9
Summer Fallow	- .6	- 2.1	2.7	1.7	2.2	.8
Grain Sorghum	7.8	13.3	14.0	7.1	4.0	1.1
Forage Sorghum	.7	.4	3.0	1.2	3.7	3.3
Corn	.7	.1	0.0	-2.8	- .7	-1.7
Alfalfa Hay	.6	.3	.5	3.7	1.8	1.7

[a]Figures calculated from average prices and yield data in the Biennial Report of the Kansas State Board of Agriculture 1945-1952, No. 35-38, and Farm Facts, Kansas State Board of Agriculture 1953-1955.

Table 5. Changes in percentage of total crop land in grain and forage sorghum in allotment and pre-allotment years.[a]

Crop reporting district	% of total crop land in sorghum		
	1947-1953	1954	Change
Northwest	9.1	17.6	8.5
West Central	13.8	27.5	13.7
Southwest	16.6	33.6	17.0
North Central	8.8	17.1	8.3
Central	10.0	17.7	7.7
South Central	13.0	17.4	4.4

[a]Figures calculated from average prices and yield data in the Biennial Report of the Kansas State Board of Agriculture 1945-1952, No. 35-38, and Farm Facts, Kansas State Board of Agriculture 1953-1955.

In order to estimate the prospects for western Kansas farmers to maintain their incomes despite wheat acreage reductions, comparisons were made of average yields of wheat, sorghum, and corn in all counties of the six crop reporting districts studied. These data appear in Table 6 and represent a ten-year average. Since yield variability in all crops in western and central Kansas is high, any year taken at random may be considerably different from the ten year average.

Substitution rates were computed for counties, and crop reporting districts, indicating the number of acres which would produce as many bushels of wheat as one acre in sorghum or corn would produce. Application of ratios of wheat and sorghum, and wheat and corn prices permits specification, for each county, of the income effect of substituting sorghum or corn for wheat, production costs assumed to be the same for wheat or sorghum.

If income were to be constant, despite use of substitute crops, the yield substitution rate would have to just equal the price ratio. That is:

$$Pw/Po = Yo/Yw$$

where Pw and Po are per bushel prices of wheat and the other crop being considered Yw and Yo are the bushel yields per acre of wheat and the other crop.

If income were to be increased following substitution of another crop for wheat, the condition:

$$Pw/Po \quad Yo/Yw$$

must prevail. If income falls following crop substitution the situation:

$$Pw/Po \quad Yo/Yw$$

must prevail.

Interpretation of the income implications of data in Tables 6 and 7 is limited by the fact that the 10 year average may be unlike any given year, by

the assumption of equal variable costs of production, and the assumption that the yields given for each crop were made on soils of given quality.

County price ratios are not shown in Table 6, since they are quite constant in each crop reporting district. Price ratios for crop reporting districts are shown in Table 7.

It is seen in Table 6 that for sorghum, the major alternative to wheat, no county in any of the six crop reporting districts had sorghum/wheat yield ratios high enough to equate income from an average sorghum yield with income from an average wheat yield. In district 1, for example, county yield ratios ranged from .76 to 1.15. In the same counties, the wheat price (Table 7) was 1.58 times the sorghum price (per bushel). Thus in the two extremes, gross income from an acre of wheat in the northwest district would have been 1.4 to 2.1 times the gross income from an acre of sorghum. Other areas present similar but less extreme differences.

By districts, the ten year average yield of grain sorghum and corn was greater than the ten year average yield of wheat in all except the northwest district. There the average sorghum yield exceeded the average wheat yield only in Thomas, Sheridan, and Graham Counties. In the northwest district average corn yields exceeded average wheat yields in Decatur, Norton, and Graham Counties. Wallace County and Stanton County were the only other counties in which average corn and sorghum yields did not exceed average wheat yields for the ten year period from 1945 to 1954. If the prices of corn, grain sorghum, and wheat had been the same then these figures would indicate that more income could be received by increasing the acreage of corn or grain sorghum.

Table 6. Average yields per acre of wheat, grain sorghum and corn (1945-1954).

County	Yield in bushels per harvested acre			Substitution rate	
	Wheat	Grain Sorghum	Corn	Sorghum / Wheat	Corn / Wheat
Crop Reporting District #1					
Cheyenne	19.8	16.6	17.8	.84	.90
Rawlins	20.6	16.8	19.7	.82	.96
Decatur	19.9	18.0	20.8	.90	1.05
Norton	17.6	16.0	18.2	.91	1.03
Sherman	18.2	13.9	16.6	.76	.91
Thomas	18.1	18.3	17.7	1.01	.98
Sheridan	16.8	17.0	16.2	1.01	.96
Graham	13.7	15.7	16.1	1.15	1.17
Average	18.1	16.5	17.9	.91	.99
Crop Reporting District #4					
Wallace	15.9	13.1	15.0	.82	.94
Logan	14.6	15.6	16.0	1.07	1.10
Gove	15.7	18.5	17.0	1.17	1.08
Trego	13.2	16.8	15.8	1.27	1.20
Greeley	14.7	15.2	16.1	1.03	1.10
Wichita	15.6	15.9	19.4	1.02	1.24
Scott	16.8	21.7	25.0	1.29	1.49
Lane	15.6	18.9	16.6	1.21	1.06
Ness	13.1	17.4	17.5	1.31	1.34
Average	15.0	17.0	17.6	1.13	1.17

Table 6 (con't)

County	Yield in bushels per harvested acre			Substitution rate	
	Wheat	Grain Sorghum	Corn	Sorghum / Wheat	Corn / Wheat
Crop Reporting District #7					
Hamilton	15.3	16.5	16.2	1.08	1.06
Kearny	16.1	18.3	17.6	1.14	1.09
Finney	15.1	20.8	18.4	1.38	1.22
Hodgeman	11.9	18.1	15.5	1.52	1.30
Ford	13.0	17.0	15.7	1.31	1.21
Gray	12.2	15.8	15.0	1.30	1.23
Haskell	12.3	15.9	15.4	1.29	1.25
Grant	14.9	17.4	15.1	1.17	1.01
Stanton	17.4	15.4	14.1	.89	.81
Morton	12.7	14.7	14.2	1.16	1.12
Stevens	13.3	16.3	13.5	1.23	1.02
Steward	11.3	14.9	12.8	1.32	1.13
Meade	13.2	14.2	14.2	1.07	1.08
Clark	13.5	14.5	14.4	1.07	1.07
Average	13.7	16.4	15.2	1.20	1.10
Crop Reporting District #2					
Phillips	13.3	17.0	16.4	1.27	1.23
Smith	13.9	16.3	18.1	1.17	1.30
Jewell	14.8	17.4	19.6	1.18	1.32
Republic	17.1	19.4	21.0	1.13	1.23
Rooks	12.7	15.4	17.0	1.21	1.34

Table 6 (con't)

County	Yield in bushels per harvested acre			Substitution rate	
	Wheat	Grain Sorghum	Corn	Sorghum : Wheat	Corn : Wheat
Osborne	13.1	17.4	19.5	1.33	1.49
Washington	16.8	21.9	26.5	1.30	1.58
Mitchell	14.4	18.8	22.4	1.31	1.56
Cloud	15.4	19.6	25.2	1.27	1.64
Clay	16.8	21.4	25.4	1.27	1.51
Ottawa	15.5	17.8	24.3	1.14	1.57
Average	14.9	18.4	21.4	1.24	1.44
Crop Reporting District #5					
Ellis	12.5	17.5	17.5	1.40	1.40
Russell	12.6	16.6	19.2	1.32	1.52
Lincoln	14.5	18.6	20.1	1.28	1.39
Saline	16.9	20.5	24.1	1.21	1.43
Dickinson	16.8	18.4	21.6	1.09	1.28
Marian	16.2	19.1	20.2	1.17	1.25
McPherson	17.6	21.2	22.8	1.20	1.30
Rice	15.9	19.7	19.1	1.24	1.20
Ellsworth	15.3	19.8	21.1	1.29	1.38
Barton	14.3	19.5	18.2	1.36	1.27
Rush	13.2	18.7	17.3	1.42	1.27
Average	15.1	19.1	20.1	1.26	1.33

Table 6 (concl.)

County	Yield in bushels per harvested acre			Substitution rate	
	Wheat	Grain Sorghum	Corn	Sorghum / Wheat	Corn / Wheat
Crop Reporting District #8					
Pawnee	13.7	19.8	16.7	1.45	1.22
Stafford	13.7	17.8	16.0	1.26	1.17
Reno	16.6	19.8	20.3	1.19	1.22
Harvey	17.6	19.3	20.7	1.10	1.18
Sedgwick	17.0	17.7	20.0	1.04	1.18
Kingman	14.2	15.2	16.6	1.07	1.17
Sumner	16.8	16.9	21.2	1.01	1.26
Harper	15.8	16.2	18.0	1.03	1.14
Pratt	14.7	17.0	15.4	1.16	1.05
Barber	15.0	15.8	18.5	1.05	1.23
Kiowa	13.9	17.1	15.2	1.23	1.09
Commanche	13.3	14.2	15.2	1.07	1.14
Edwards	12.9	17.0	15.5	1.32	1.20
Average	15.0	17.2	15.3	1.14	1.17

Substitution rates in Table 7 show that, with the average prices and yields of corn, sorghum, and wheat for the ten year period given, the total income could have been increased by increasing the acreage of corn in the north central and central crop reporting districts, production costs not considered. This is indicated when the ratio, Pw/Pc, is less than the yield substitution rate of wheat for corn. Thus, in Table 7, it appears that an

acre in corn would have yielded an income of 1.1 times the income from an acre in wheat in district 2, and 1.04 times the income from an acre of wheat in district 5.

Table 7. Substitution rates and price ratios based on average prices and yields in Kansas from 1945-1954.[a]

Crop Reporting District	Substitution Rate			
	Price ratio Wheat/Sorghum	Yield ratio Sorghum/Wheat	Price ratio Wheat/Corn	Yield ratio Corn/Wheat
Northwest (1)	1.58	.91	1.29	.99
West Central (4)	1.61	1.13	1.23	1.17
Southwest (7)	1.60	1.20	1.22	1.10
North Central (2)	1.57	1.24	1.33	1.44
Central (5)	1.56	1.26	1.28	1.33
South Central (8)	1.53	1.14	1.24	1.02

[a]Computed from acreage price data in Biennial Report of the Kansas State Board of Agriculture 1945-1952, No. 35-38 and Farm Facts, Kansas State Board of Agriculture, 1953-1955.

Table 8 shows those counties in which corn could profitably be substituted for wheat based upon the 10-year average yields and assumptions noted above concerning soils producing each crop, and costs of production.

However, equipment used for wheat production is not adapted to corn production. The change over from producing all wheat to producing some wheat and some corn may involve additional cost which would affect apparent additional income.

Table 8. Counties in which corn acreage could be profitably increased.[a]

County	Price ratio Wheat/Corn	Yield ratio Corn/Wheat
Rooks	1.33	1.34
Osborne	1.33	1.49
Washington	1.33	1.58
Mitchell	1.33	1.56
Cloud	1.33	1.64
Clay	1.33	1.51
Ottawa	1.33	1.57
Scott	1.23	1.49
Ness	1.23	1.34
Ellis	1.28	1.40
Russell	1.28	1.52
Lincoln	1.28	1.39
Saline	1.28	1.43
McPherson	1.28	1.30
Ellsworth	1.28	1.38
Finney	1.21	1.22
Hodgeman	1.20	1.30
Gray	1.21	1.23
Haskell	1.19	1.25

[a]Computed from average crop yield and value figures computed by the statistical laboratory, Department of Economics and Sociology, Kansas State College, Manhattan, Kansas. Data was contained in the Biennial Report of the Kansas State Board of Agriculture, Topeka, Kansas, dated 1945 to 1954.

Cost studies indicate that per acre variable costs for producting corn is greater than those for producting wheat.[1] Based on 1953 prices, variable cost of producing one acre of corn in eastern Kansas was $18.15. The cost of producing an acre of wheat in the same area was $16.07. The figures used indicate an increased cost of $2.08 per acre on corn.

The data above on comparative yields and prices substantiate, for a wide area, the widely held contention that sorghum is an inferior substitute for wheat from an income standpoint.

Data of Table 7 also are useful in testing the hypothesis that crop substitutes are "poorer", income-wise, in western compared with central or eastern Kansas.

In the West income from average yields of wheat are estimated as 1.7, 1.4, and 1.3, the income from average sorghum yields for districts 1, 4, and 7 respectively. In central Kansas, income from wheat is estimated as 1.3, 1.2, and 1.3, income from sorghum for districts 2, 5, and 8 respectively. Conversely sorghum income would have been .57, .70, and .75 wheat income for western counties, while sorghum income in central counties would have been .79, .81, and .75 wheat income in central counties. The northwest, where the short growing season makes sorghum less attractive, stands out in the above comparison, while differences between other areas do not appear to be extreme. Differences which appear, however, tend to substantiate the hypothesis of greater income sacrifice when substitute crops replace wheat in allotment years. No comparisons were made with eastern Kansas.

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[1]James O. Bray, John A. Schnittker, Legumes or Commercial Fertilizers? Kansas State Agricultural Experiment Station Bulletin 384, p. 11.

Factor Substitution. If farmers could not place other crops on the land taken out of wheat by acreage allotment or had relatively poor crop substitutes, they may turn to another method of income maintenance. This choice involves factor substitution. While allotments limit acreage in wheat, there are no regulations controlling use of other factors of production. In some areas, farmers may be able by the application of fertilizer, or by other cultural practices, to produce as much wheat as they had before acreage allotments.

A situation of this type developed in the potato industry when acreages were limited. Potato yields had risen less than 40 percent in the 35 years prior to acreage allotments in 1944. After 1944, the yield rose more than 70 percent in seven years.[1]

Western Kansas farmers could maintain their preallotment income if fertilizer could be applied to wheat so that enough increase in yield was obtained to compensate for reduced acreage. The main alternative crop, sorghum, also could aid in maintaining income if its yield could be increased so that an acre of sorghum produced a value of product to an acre of wheat.

There are two main factors which determine the crop response to fertilizer. These are the availability and level of nutrients in the soil and the moisture available. The most important factor as applied to western Kansas appeared to be soil moisture. Progressing from eastern Kansas to western Kansas the yearly precipitation varies from a high of 40 inches in the south-eastern counties to a low of 16 inches in the west central crop reporting district.

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[1] Roger W. Gray, Vernon L. Sorenson, and Willard W. Cochrane, The Impact of Government Programs on the Potato Industry, North Central Regional Publication No. 42, p. 57.

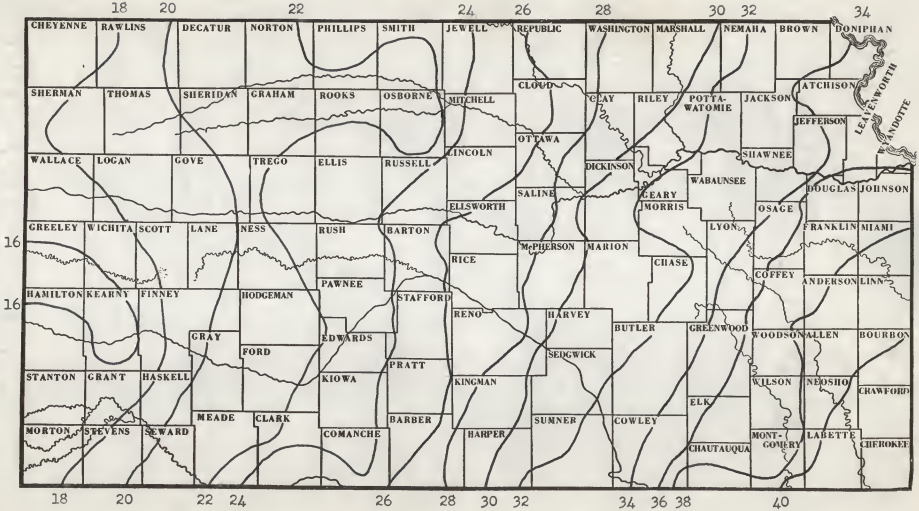

Fig. 9. Kansas average annual rainfall

Wheat has responded to fertilizer application under Kansas conditions more consistantly and more profitably than any other crop.[1]

Table 9. Effect of fertilizer upon wheat yield in Kansas 1948-1954.[a]

Rate of fertilizer application	Average yield of wheat bu./acre
No fertilizer	23.2
25 lb/A N P and K where needed	32.7
50 lb/A N P and K where needed	36.7
100 lb/A N P and K where needed	37.5

[a]Floyd W. Smith, Fertilizers for Wheat and Grain Sorghum, A talk presented at the Great Plains Agricultural Ammonia Conference, Lincoln, Nebraska, August 29, 1956, p. 4.

Table 9 shows that the application of 100 pounds of fertilizer increased wheat yields as much as 14.3 bushels per acre as an average for Kansas. The application of only 25 pounds of fertilizer increased the yield by 10.3 bushels per acre under the same conditions. However, rainfall variation is extreme, data are the average over the state of Kansas and so cannot be applied to the extreme western sections of the state. Instead the effects of fertilizer applied to the western wheat growing area are considered to the limited extent of their availability. Research indicated that the application of fertilizers resulted in significant and consistent increases in the yield of Pawnee wheat at Belleville, Goddard, and Hutchinson, all in Central Kansas.[2]

[1]Floyd W. Smith, Fertilizers for Wheat and Grain Sorghum, a talk presented at the Great Plains Agricultural Ammonia Conference, Lincoln, Nebraska, August 29, 1956, p. 4.

[2]Charles A. Simkins, The Effects of Various Rates, Times of Application and Combination of Fertilizer on the Yield Quality and Plant Characteristics of Pawnee Wheat at Various Locations in Kansas, 1947-1948, p. 59. Unpublished Masters thesis, Kansas State College, 1950.

Table 10 shows that the average yield per acre was increased as much as 10.4 bushels per acre with the application of nitrogen and phosphate in the Belleville area. The same fertilizer applied at either Goddard or Hutchinson showed an increase of 8.7 bushels per acre over that receiving no treatment for a seven year period.

The application of phosphate fertilizer to wheat on the Dodge Experiment Field resulted in a yield increase of only 1.7 bushels per acre over the yield under no treatment.[1] These were seven year averages for years between 1939 and 1952. This was not as great an increase as that realized on fields further east.

Experiments on western Kansas sandylands also showed a wheat yield response to fertilizer application.[2] This area, however, involved a relatively small part of the crop reporting districts studied. In general, the sandyland area lies south of the Cimarron River and include parts of Morton, Stevens, and Seward Counties. The very absence of fertilizer data in the three western crop reporting districts indicated the support of the hypothesis that western Kansas farmers had no alternatives in the form of factor inputs to increase wheat yields.

Since grain sorghum would involve less adjustment than corn when used in a wheat farming system it may have been possible to make sorghum a good substitute for wheat by increasing sorghum yields. In the previous section it was shown that at the yields and prices of wheat and sorghum for a ten year period, sorghum was not a good income substitute for wheat. However, if

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[1] Southwest Kansas Experiment Field Annual Report, M. C. Axelton, Superintendent, p. 70.

[2] Floyd W. Smith, Fertilizers for Wheat and Grain Sorghum. A talk presented at the Great Plains Agricultural Ammonia Conference, Lincoln, Nebraska, August 29, 1956, p. 2.

Table 10. Average wheat yields in bushels per acre at Belleville, Kansas, 1948-1955.

Treatment	1948	1949	1950	1951	1952	1953	1954	1955	Average
0 - 0 - 0	31.3	16.8	28.2	20.2	17.5	17.9	25.2	8.8	20.7
100 - 0 - 0	44.1	19.7	33.6	35.8	29.6	19.3	44.3	9.7	29.5
100 - 50 - 0	45.5	20.7	37.6	37.5	31.2	24.2	42.8	9.3	31.1
100 - 50 - 25	43.0	16.3	40.3	35.1	32.0	22.4	46.3	7.0	30.4

Source: Fertilizer Conference Handbooks (1948-1955) prepared by the Staff of the Department of Agronomy, Kansas State College, Manhattan, Kansas.

Table 11. Average wheat yields in bushels per acre at Goddard and Hutchinson, Kansas, 1948-1954.

Treatment	1948[a]	1949[a]	1950[a]	1951	1952	1953	1954	Average
0 - 0 - 0	13.8	9.2	23.5	27.1	41.3	10.4	30.1	22.2
100 - 0 - 0	19.1	12.1	22.4	35.7	39.9	10.0	29.9	24.2
100 - 50 - 0	26.1	27.3	24.5	49.7	47.9	12.5	28.6	30.9
100 - 50 - 25	23.3	23.8	28.6	45.2	49.3	10.9	30.8	30.2

[a]Yields at the Goddard field.
Source: Fertilizer Conference Handbooks (1948-1955) prepared by the Staff of the Department of Agronomy, Kansas State College, Manhattan, Kansas.

sorghum yields could be increased by fertilizer application, the increased yield might make sorghum a suitable substitute for wheat.

The application of fertilizer to grain sorghum showed an increase in all cases at Great Bend, Kansas. From Table 12 it is seen that the greatest average yield increase for a three year period was obtained by the application of a fertilizer mixture of 80-40-40. This increase averaged 12.1 bushels per acre. When nitrogen was applied, grain sorghum yield was increased an average of nine bushels per acre.

The application of 80-40-40 to grain sorghum at Belleville resulted in a maximum increase of 12.9 bushel per acre over a three year period. The application of 40-40-0 resulted in a three year average yield increase of 9.5 bushels per acre.

If sorghum yield could be increased in the central crop reporting districts as these experiments indicate, then sorghum may be substituted for wheat in certain districts.

By increasing the yield a total of six bushels, it can be seen from the following Table 14 that sorghum became a substitute for wheat in the north central and south central crop reporting districts.

As long as the yield of sorghum over the yield of wheat is greater than the price of wheat over the price of sorghum then sorghum became a suitable substitute for wheat land. This is true in the north central, central, south central, and southwest crop reporting districts.

The yield of sorghum would have to be increased to eight bushels per acre in order for sorghum to be substituted for wheat in the west central district at the 10 year average of wheat and sorghum used. This indicates the lack of substitutes for wheat as a means of maintaining farmers incomes in the western crop reporting districts, excepting the southwest district.

Data indicated that farmers in the central crop reporting districts did have opportunities to raise the wheat yield by the use of fertilizer. A questionnaire study, however, showed that only one percent of the 200 farmers interviewed in five Kansas counties credited fertilization practices with increased wheat yields.[1] Instead they indicated that weather was the dominant factor influencing wheat yields.

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[1]John A. Schnittker, James O. Bray and Bernard J. Bowlen, Kansas Farmers' Views on the Wheat Price Support and Control Program. Kansas Agricultural Experiment Station, Agricultural Economics Report No. 77, p. i.

Table 12. The response of grain sorghum to fertilizer on the Edward Voight farm, Great Bend, Kansas.[a]

Treatment N - P_2O_5 - K_2O	Yield of grain sorghum in bushels per acre			
	1952	1953	1954	Average
0 - 0 - 0	42.9	48.5	30.3	40.6
40 - 0 - 0	49.5	55.2	29.4	44.7
80 - 0 - 0	47.5	59.6	28.6	45.2
0 - 40 - 0	48.3	45.4	31.0	41.6
40 - 40 - 0	56.4	65.7	26.7	49.6
80 - 40 - 0	50.8	67.8	25.9	48.2
0 - 40 - 40	52.5	49.3	23.2	41.7
40 - 40 - 40	57.7	65.8	24.2	49.2
80 - 40 - 40	60.0	69.3	28.7	52.7

[a]Floyd W. Smith, Fertilizers for Wheat and Grain Sorghum, a talk presented at the Great Plains Agricultural Ammonia Conference, Lincoln, Nebraska, August 29, 1956, p. 6.

Ohio farmers also failed to credit fertilizer practices with any increase in wheat yields.[1] However some changes were made. About 35 percent of the farmers in Ohio increased the amount of fertilizer being used on wheat, seven percent reduced their application of fertilizer and 58 percent did not change their fertilizing program.

If farmers did not apply fertilizer to wheat, the main crop of the state, it does not seem likely that they have used fertilizer to increase yields of

[1]Mervin G. Smith, Francis B. McCormick, and Donald D. Steward, An Analysis of Ohio Farmers Views and Responses to Wheat Price Support and Control Programs, p. 7.

Table 13. Response of grain sorghum to fertilizer at Belleville 1952-1954.[a]

Treatment N - P_2O_5 - K_2O	Yield of grain sorghum (bu/A) Three year average yield
0 - 0 - 0	40.4
40 - 0 - 0	45.5
80 - 0 - 0	50.5
0 - 40 - 0	40.2
40 - 40 - 0	49.7
80 - 40 - 0	52.7
0 - 40 - 40	40.2
40 - 40 - 40	47.2
80 - 40 - 40	55.2

[a]Floyd W. Smith, Fertilizers for Wheat and Grain Sorghum, a talk presented at the Great Plains Agricultural Ammonia Conference, Lincoln, Nebraska, August 29, 1956, p. 6.

Table 14. The comparison of price and hypothetical yield substitution for wheat and sorghum by crop reporting districts.[a]

Crop reporting district	Price substitution Wheat/Sorghum	Yield substitution Sorghum/Wheat
Northwest (1)	1.58	1.25
West Central (4)	1.61	1.53
Southwest (7)	1.60	1.63
North Central (2)	1.57	1.64
Central (5)	1.56	1.66
South Central (8)	1.63	1.54

[a]Average yield of sorghum increased by six bushels.

sorghum or corn. Lack of capital, the uncertainty of yield response, or other factors may have discouraged attempts to substitute fertilizer for land, even though it offered some prospect of being profitable. If these factors prevent or minimize this type of substitution in humid areas, it is reasonable to expect they would assert the same influence in other areas, even if fertilizers were found to provide yield increases. Thus, it may be tentatively concluded that the lack of the technical substitution opportunity in the west is not a particular disadvantage, since other conditions appear to discourage use of such opportunity where it exists.

THE EFFECT OF FALLOW PROVISIONS OF CURRENT FARM LAWS

Kansas divides roughly into four summer fallow areas, as shown in Figure 10.

The following recommendations are made for these summer fallow areas:[1]

Area 1 - Alternate crop and fallow.

Area 2 - Fallow followed by two years of cropping.

Area 3 - Fallow followed by three years of cropping.

Area 4 - Fallow not generally recommended.

Acreage allotments were based on historical annual wheat acreage not including fallow. However, in areas where summer fallow is practiced, farmers generally consider an acre of wheat plus an acre of fallow as an income stabilizing, erosion minimizing substitute for two acres of wheat on land cropped year after year. Congress recognized this special situation with the passage of Public Law 272, commonly known as the Hope Amendment, in 1949.

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[1] R. I. Throckmorton and H. E. Myers. Summer Fallow in Kansas, p. 23.

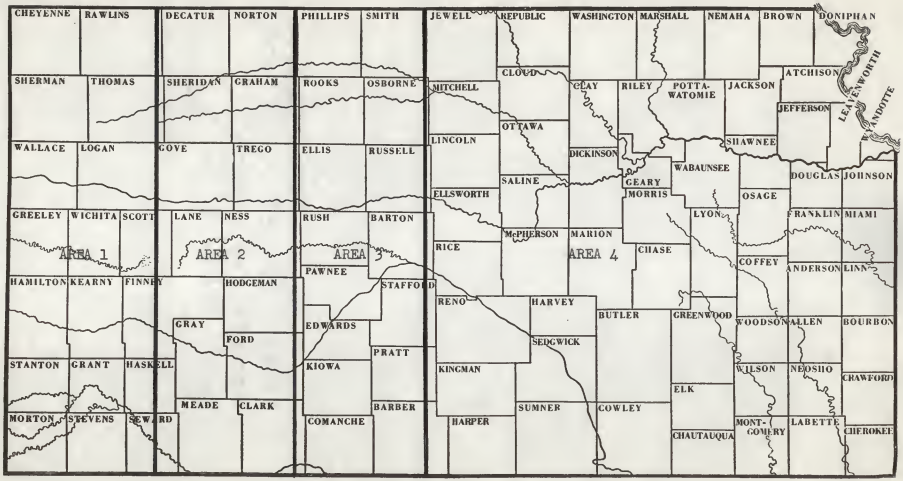

Fig. 10. Fallow areas of Kansas.[a]

[a]R. I. Throckmorton and H. E. Myers, Summer Fallow in Kansas, p. 23.

The Hope Amendment provided that "- - - - - -the farm acreage allotment of wheat for the 1950 crop for any farm shall not be less than the larger of:

(A) 50 per centum of

(1) the acreage on the farm seeded for the production of wheat in 1949 and

(2) any other acreage seeded for production of wheat in 1948 which was fallowed and from which no crop was harvested in the calendar year 1949 or

(B) 50 per centum of

(1) the acreage on the farms seeded for the production of wheat in 1948 and

(2) any other acreage seeded for the production of wheat in 1947 which was fallowed and from which no crop was harvested in the calendar year 1948 - - - - - -"[1]

These adjustments were to be made in the alloted acreages in addition to any and all adjustments provided for by the Agricultural Adjustment Act of 1938 or any amendments there to.

The method of calculation of wheat and the effects of the Hope Amendment are shown in Table 15.

The larger of either (c) or (f) in Table 15 was used in determining the acreage allotment for the farm. The Hope Amendment raised the base acreage for those farms having fallow land. The base acreage was multiplied by the normal scaling factor for the county in order to determine the final acreage allotment.

The Hope Amendment resulted in an additional 4.5 million acres being distributed to farmers in 1950. The previously declared national acreage allotment was 68.9 million acres.[2] Under this amendment which was to aid the

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[1] United States Statutes at Large. 81 Congress, 1st Session (1949), p. 677.
[2] Wheat Program Hearings. 81 Congress, 2nd Session (1950), p. 17.

farmer in summer fallow areas, wheat acreages were actually increased in several eastern states, where fallowing is not a common practice, as shown in Table 16.[1]

Table 15. The application of the hope amendment formula to a hypothetical farm.

Year	No. of acres
1949 Wheat acreage for the farm	300 (a)
*1949 Summer fallow acreage	200 (b)
Total base acreage	500 (c)
1948 Wheat acreage for the farm	250 (d)
*1948 Summer fallow acreage	175 (e)
Total base acreage	425 (f)

*Was wheat acreage the previous year.

Table 16. Percent of farms in selected states receiving increased acreage due to the hope amendment.[a]

State	Percent receiving increase
Indiana	31.5
Missouri	32.8
Alabama	32.4
Utah	36.3
Oregon	32.4
California	34.2

[a] Wheat Program Hearings, 81st Congress, 2nd Session, (1950), p. 17.

[1] Wheat Program Hearings, 81st Congress, 2nd Session, (1950), p. 121.

Under Public Law 272, Kansas received about 13 additional acres per farm on 30,000 farms, or 15 percent of all farms.[1] Since it was felt that the Hope Amendment did not do what it was intended to do it was not renewed in 1951.

The passage of Public Law 690 by the 83rd Congress was another attempt to make allowances for farmers in fallow areas. The law provided that in summer fallow areas

> - - - - - - the 1955 wheat acreage allotment for any farm on which such rotation was practiced with respect to the 1952 and 1953 crops for wheat shall not be less than 50 per centum of (1) the average acreage planted for the production of wheat for the calendar years 1952 and 1953 plus (2) the average of the acreage summer fallowed during the calendar year 1951 for the seeding of wheat for 1952 and the acreage summer fallowed during the calendar year 1952 for the seeding of wheat for 1953 - - - - - -.[2]

This law was applicable only on farms on which at least 90 percent of the acreage seeded for production of wheat was fallowed the previous year. The base acreage figure obtained was adjusted in the same ratio as the national average seedings for the production of wheat during the calendar years 1952 and 1953 are to the national acreage allotment for wheat for the 1955 crop.

Public Law 690 could be applied only on farms on which a definite rotation of wheat and fallow had been in operation in previous years, thus, eliminating the use of its provisions as with Public Law 272.

The application of Public Law 690 to a hypothetical farm is shown in Table 17. On this farm it is assumed that an average of 275 acres of fallow land was planted to wheat in the years 1952 and 1953. It was also assumed that the 1951 and 1952 summer fallow acreage averaged 263 acres. This summer

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[1] Wheat Program Hearings. Op. Cit., p. 496.
[2] Agriculture Handbook No. 79, U. S. Government Printing Office, p. 42.

fallow acreage was planted to wheat the following year. According to law the acreage allotment could not be less than 50 percent of 538 acres or 269 acres.

A national adjustment figure of .615 applied to 538 acres resulted in an acreage allotment of 330 acres.

The second hypothesis was that farmers who were fallowing during preallotment years received smaller allotments than those who were not fallowing. It seemed that larger allotments would have been given to non-fallowing farmers because of their larger historical acreage. Historical acreage was one of the basis for determining base acreage. The effects of Public Law 690 in this case are shown in Table 18. Two farms with the same crop acreage were considered. It was assumed that farm "A" followed a strict fallow, wheat rotation. Farm "B" did not follow such a rotation. If the historical wheat acreage were considered to be the base acreage for each farm without recourse to a special fallow provision, farm "B" would receive 104 more acres of wheat allotment than farm "A". Under Public Law 690, farm "B" would still receive 310 acres of wheat since 90 percent of the wheat acreage was not seeded on fallow land. Farm "A", however, would receive an allotment of 476 acres under Public Law 690.

Under Public Law 690 the acreage would have been increased appreciably on farms where a definite rotation of wheat and fallow had been followed. However, it was determined that many of the adjustments provided for by the law had already been provided by the county committee. Acreage allotments were actually increased very little in Kansas by Public Law 690.[1] For

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[1]Conversation held with Mr. Carl Williams, State Agriculture Stabilization and Conservation Service, Manhattan, Kansas, March 29, 1957.

Table 17. The application of public law 690 to a hypothetical farm.

	Acres	
1952 Wheat acreage[a]	300	
1953 Wheat acreage	250	
Total wheat acreage		550
Average		
1951 Acres in summer fallow	300	
1952 Acres in summer fallow	225	
Total fallow acreage		525
Total wheat plus fallow		1,075
Average wheat plus fallow		538

Acreage allotment = .615 (ratio) times 538 acres = 330

[a]Without the fallow provision, the farm allotment would have been based on the average acreage actually planted to wheat, but over a larger base period.

Table 18. Effects of acreage allotments under varying degrees of fallowing.

Farm	Crop acreage	Historical wheat acreage	Historical fallow acreage	Acreage allotment[a]	Allotment under P. L. 690[b]
A	800	400	400	(206)	476
B	800	600	200	310	(310)

[a]County scaling factor equals .517.
[b]National scaling factor equals .615.
[c]Scaling factors are assumed to be the above values. Thus, figures will vary in each state and within each county in each state.

example, only four farmers in Ohio Community in Ness County received allotment increases of one, four and six acres.[1] However, as seen in Table 18, if county committees had not made such adjustments in other counties, Public Law 690 contained provisions to equate differences, and apparently, to establish differences in the opposite direction.

The enforcement of acreage allotments in 1954 and 1955 was concurrent with a greater percentage of wheat in western Kansas being planted on summer fallow land. In Table 19 the percentage of wheat seeded on fallow land in allotment and pre-allotment years is compared. The percentage of wheat seeded on fallow land increased in all crop reporting districts in allotment years. It was observed that this increase was greater in the western crop reporting districts than in central districts. There was an average of 17.6 percent increase in wheat seeded on fallow in the western districts as compared with 4.6 percent increase in the central districts.

As shown in Figure 10 the crop reporting districts are divided into fallow areas. Different fallow recommendations are made for each of these areas.[2] From Table 20 it was observed that the difference in percentage of wheat seeded on fallow land was greatest in area 1 and 2. These areas corresponded to crop reporting districts 1, 4, and 7. Figures in Tables 19 and 20 indicated that farm programs coincided with an increase in the acres of wheat seeded on fallow land. Thus, the farm program may have been responsible for the adoption of "recommended" farming practices in western Kansas.

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[1] 1955 Summer Fallow and Wheat Listing Sheet, Ness County, Kansas State ASC Office, Manhattan, Kansas.

[2] Fallow recommendations for the fallow areas are found on page 48 of this paper.

While the acreage allotment program is a logical and obvious explanation for the increasing percentage of wheat on fallow, other factors may have been partly responsible. One such factor is weather conditions in the affected areas. Specifically, lack of summer rainfall concurrent with enforcement of acreage allotments and marketing quotas may have discouraged continuous cropping or conversely, increased the proportion of wheat on fallow. The sum of June, July and August rainfall in inches, averaged over crop reporting districts was taken as a potential auxiliary explanation of the percentage of wheat planted on fallow acreage.

The calculation of the slope of the regression line of the percentage of wheat seeded on fallow land as a fraction of inches of rainfall in June, July and August resulted in a negative slope in all crop reporting districts. From Table 21, it is seen that the slope of the regression line was greater in the western crop reporting districts. This indicated that precipitation in the period considered had a greater influence on the percentage of wheat seeded in the western crop reporting districts than in the central districts.

Another influencing factor may have been the change in technology during these years. Correlation coefficients in Table 22 indicate rejection of the hypothesis that there was no correlation between the percentage of wheat seeded on fallow and the years 1947-1955. Since rainfall was low in the late years of the period considered, it is seen that the effects of time are fused here with moisture effects shown previously. Definite changes in technology (knowledge of fallow techniques) may be suggested but have not been isolated.

Table 19. A comparison of wheat acreage planted on fallow land before and after acreage allotments.[a]

Crop reporting district	Percent seeded on fallow land 1947-1953	Percent seeded on fallow land 1954-1955	Difference
Northwest	65.8	84.0	18.2
West Central	54.5	69.9	15.4
Southwest	40.0	59.4	19.4
North Central	11.2	17.3	6.1
Central	8.2	12.2	4.0
South Central	7.5	11.7	4.2

[a]Figures calculated from wheat acreage data compiled by the Division of Statistics, Office of the Agricultural Statistician, Kansas State Board of Agriculture, Topeka, Kansas, 1947-1955.

Table 20. Percentage of wheat seed on summer fallow land.[a]

Fallow area	Percent seeded on fallow land 1947-1953	Percent seeded on fallow land 1954-1955	Difference
Area 1	61.6	79.9	18.3
Area 2	40.7	47.9	17.2
Area 3	16.0	24.7	8.7
Area 4	4.1	5.9	1.8

[a]Figures calculated from wheat acreage data compiled by the Division of Statistics, Office of the Agricultural Statistician, Kansas State Board of Agriculture, Topeka, Kansas, 1947-1955.

Table 21. Regression of percentage of wheat seeded on fallow land and precipitation during june, july, and august by crop reporting district, 1947-1955.

Crop reporting district	Slope of regression line	Standard error	Correlation	T. value	T. 20[a]
Northwest (1)	-1.17	1.02	-.41	1.149	1.415
West Central (4)	- .82	.56	-.49	1.470	1.415
Southwest (7)	-1.69	.94	-.56	1.807	1.415
North Central (2)	- .04	.22	-.07	.189	1.415
Central (5)	- .02	.19	-.04	.114	1.415
South Central (8)	- .09	.16	-.20	.541	1.415

[a]Only two regression coefficients are acceptable at the stated probability level, and none of the coefficients are acceptable at usual (.05) probability levels.

Table 22. Trends and correlation of percentage of wheat seeded on summer fallow land over time (1947-1954).

Crop reporting district	y Intercept	Slope of regression line	Correlation (r)	r .05
Northwest (1)	52.52	3.49	.9088	.666
West Central (4)	43.03	2.78	.9538	.666
Southwest (7)	25.66	3.77	.9148	.666
North Central (2)	9.44	.62	.5254	.666
Central (5)	6.34	.55	.5359	.666
South Central (8)	5.62	.58	.6521	.666

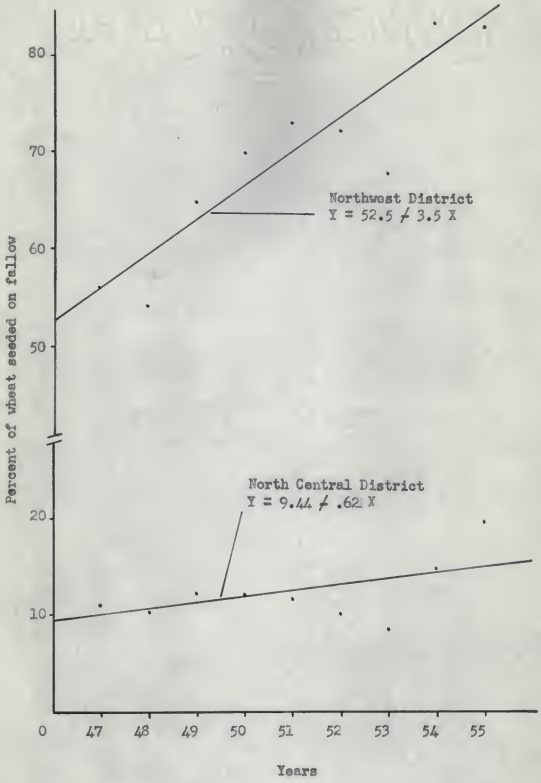

Fig. 11. Trends in the percentage of wheat seeded on fallow land in the northern districts.

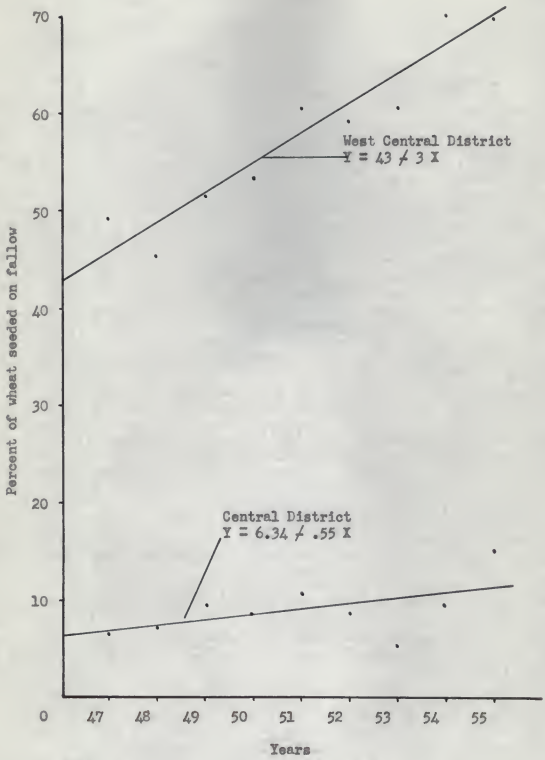

Fig. 12. Trends in the percentage of wheat seeded on fallow land in the central districts.

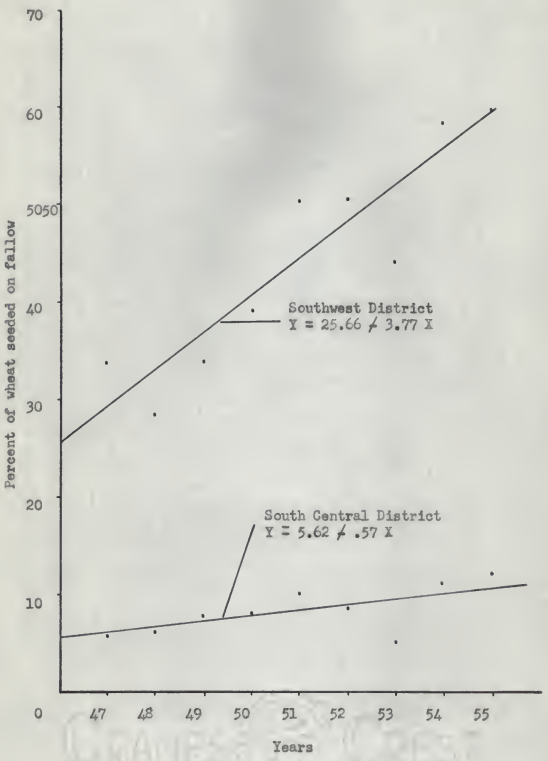

Fig. 13. Trends in the percentage of wheat seeded on fallow land in the southern districts.

SUMMARY AND CONCLUSIONS

Farmers in western and central Kansas have a limited number of substitute crops which may be produced on excess wheat land. They increased the percentage of crop land seeded to grain sorghum, forage sorghum, and alfalfa hay in wheat acreage allotment years 1954 and 1955. More excess wheat acreage was diverted to grain sorghum than any other crop.

Consideration of average yields of alternative crops failed to discover any crops in western and central crop reporting districts which matched or exceeded wheat from a gross returns standpoint. Both county and crop reporting district data were examined for possible superiority of grain sorghum gross revenue relative to wheat gross revenue. Results were negative, but differences were small in some cases.

It was estimated that raising the ten year average yield of sorghum six bushels per acre would make gross income from sorghum about equal to that of wheat. Experimental data on fertilizer application indicated that this was a possible solution in the central crop reporting districts. The lack of data on fertilizer application implies that fertilizer can not be profitably applied to land in the western districts except in the sandyland area.

While data indicated a lack of substitution alternatives in western Kansas which would allow farmers to maintain their incomes on a level with farmers incomes in more humid areas, central Kansas farmers had better technical opportunities to maintain their incomes by fertilizer application. However, studies in Kansas and Ohio indicated that farmers have not adopted fertilizer use rapidly under acreage allotments and do not credit fertilizer with increasing wheat yields.

The percentage of wheat seeded on summer fallow land during allotment years was greater than during any year of the previous seven year period. Decreased total acres seeded, an upward time trend of fallow on wheat and drouth in allotment years contributed to this situation. The increase in the percentage of wheat seeded on fallow land was greatest in the western districts, a pattern consistent with fallow recommendations, and with the severity of rainfall shortage.

Another factor which may have influenced the acreage or wheat seeded on fallow was precipitation. Regression of percentage of wheat seeded on fallow on precipitation during June, July, and August indicated relationship of the two variables in the west central and southwest districts.

An upward trend in the percentage of wheat seeded on fallow over time was evident in all crop reporting districts, despite the opposite rainfall trend. Correlation was significant at the five percent level in the western districts.

The effect of acreage allotments, marketing quotas, precipitation, and trend of the percentage of total wheat seeded on fallow was not determined individually in this study. Indications were that acreage allotments affect the adoption of fallow especially in the western districts.

Public Law 690 had little effect on acreage allotments in Kansas since adjustments for fallow practices had already been made by county committees.

Evidence is inconclusive to support hypothesis that farmers planted less wheat on fallow preceding allotments in order to establish an acreage base. Other factors noted above influenced the amount of wheat seeded on fallow land.

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SOME CONCEPTS OF THE IMPACT OF ACREAGE ALLOTMENTS AND MARKETING QUOTAS ON CENTRAL AND WESTERN KANSAS FARMS

by

CARROL DAVONNE SPENCER

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AN ABSTRACT OF A THESIS

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Forms of production adjustment to obtain higher prices and thus higher incomes have been an important part of American farm history. This study was initiated to discover some of the influences and results of acreage allotments and marketing quotas.

Acreage allotments have been based on the principle of an inelastic demand for farm products. By reducing the quantity produced the price of the product is raised. The resulting industry gross income at the new, lower quantity is greater than the gross income at the old, greater quantity.

While farmers in humid areas had many alternative crops suitable for acreage which could not be planted to wheat because of acreage allotments, farmers in western Kansas had very few such crops.

A comparison was made of alternative crops available and the income from these crops in central and western Kansas. The influence of acreage allotments on farm practices was also considered.

As a result of acreage allotments farmers increased the percentage of crop land seeded to grain sorghum, forage sorghum and alfalfa hay. More of the land not seeded to wheat was seeded to grain sorghum than any other crop.

Consideration of average yields of alternative crops failed to discover any crops in western and central crop reporting districts which matched or exceeded wheat from a gross returns standpoint. Both county and crop reporting district data were examined for possible superiority of grain sorghum gross revenue relative to wheat gross revenue. Results were negative, but differences were small in some cases.

Using gross income as a criteria for substitution of corn for wheat indicated that corn could be substituted for wheat in some central crop reporting district counties if production costs were considered as equal for the two crops. Previous research data, however, indicated that the cost of producing corn is greater than the cost of producing wheat.

The lack of experimental data on fertilizer application in the western districts indicated that fertilizer application for raising crop yields was of little value. While data indicated a lack of substitution alternatives in western Kansas which would allow farmers to maintain their incomes on a level with farmer's incomes in more humid areas, central Kansas farmers had better technical opportunities to maintain their incomes by fertilizer application. These opportunities apparently are not widely used.

The percentage of wheat seeded on summer fallow in allotment years versus pre-allotment years was much greater in the western districts. Allotments also resulted in more wheat being seeded on fallow in the central districts. Precipitation received during June, July, and August influenced the percentage of wheat seeded on fallow land, chiefly in the west central and southwest districts.

Trends of percentage of wheat seeded on summer fallow land have been upward in all crop reporting districts despite high rainfall and low fallow in the same years. The upward trend has been greater in the western districts than in the central districts.

The practice of seeding wheat on summer fallow was found to be influenced by acreage allotments, marketing quotas, precipitation and trend. The influence of these factors independent of other factors was not determined.

Public Law 690, enacted to aid farmers in fallow areas, did not increase acreage allotments appreciatable in western Kansas. Adjustments had already been made by county committees.