VARIABILITY IN BROOMCORN PRICES AND LAND USE ADJUSTMENTS IN SOUTHCENTRAL OKLAHOMA

By

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CHAPTER I

INTRODUCTION

Early History and Importance of Crop

Broomcorn, a member of the group of plants called sorghums, appears first to have been grown in the United States by Benjamin Franklin.[1] The growing of the crop on a commercial scale began in the Connecticut Valley near Hadley, Massachusetts in 1797. Since that time broomcorn production gradually shifted westward until it became concentrated in the Southwest. Two primary reasons for this shift were: (1) the availability of cheaper land in the West, and (2) the drought-resistant characteristics of the plant making it particularly adaptable to semi-arid conditions in the Plains States.[2]

Census data indicated broomcorn production for Oklahoma in 1889 to be only eight tons. Production increased tremendously, and, by 1909, Oklahoma, with a production of 21,371 tons, had become the number one producing state in the nation.[3] Yearly production in Oklahoma exceeded any other state from 1915 to 1940 with the exception of 1936, when Illinois led. Average annual production for Oklahoma was 11,630 tons from 1945 to

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[1] R. S. Washburn and J. H. Martin, Broomcorn Growing and Handling, Farmer's Bulletin No. 1631, United States Department of Agriculture (Washington, D. C., September 1930), p. 1.

[2] R. S. Washburn and J. H. Martin, An Economic Study of Broomcorn Production, Technical Bulletin No. 347, United States Department of Agriculture (Washington, D. C., February, 1933), p. 40.

[3] Ibid. p. 4.

1954, an average of 2,620 tons per year above second-ranked Colorado. Oklahoma was the leading grower in 1955 and 1956, producing 17,100 tons and 7,200 tons respectively in these years.

Previous Research

No major economic research on broomcorn has been performed since 1933. A bulletin by Martin and Washburn[4] published in 1933 contained estimates of production costs and expected net returns from broomcorn and competing cash crops. No previous analysis has been made of broomcorn prices.

Background of General Area

This study is confined mainly to the principal broomcorn producing area of Oklahoma located in the southcentral section of the state in Garvin, Grady and McClain counties. Lindsay, centrally located in the area, is the leading broomcorn market in Oklahoma.

Broomcorn is grown on rich bottomland soils such as are found along the Washita River, Finn Creek and Rush Creek. The most prominent soil series found in these bottomlands are the McLain, Reinach and Yahola.[5] The soils are of alluvial origin, and they are highly fertile. High crop yields can be sustained on these soils over a period of years. Occasionally, some areas are inundated to a shallow depth during high floods. The

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[4] Ibid.

[5] Harvey M. Galloway, ed., Description of Soil Series, compiled from reports of the Division of Soil Survey, Bureau of Plant Industry, United States Department of Agriculture (Washington, D. C.), p. (not given).

soils are well suited to the growing of alfalfa, corn, cotton, broomcorn, sorghums and small grains.[6]

Average annual rainfall for the Lindsay weather station was 35.4 inches from 1939 to 1952.[7] Precipitation during the period ranged from a high of 51.43 inches in 1945 to a low of 22.03 inches in 1939.[8]

Problems of the Broomcorn Producer

The broomcorn industry is characterized by unusually high price variability among years, within years and among individuals. The past three-year average prices received by Oklahoma farmers per ton of broomcorn are examples of the unusually high among-year (annual) fluctuations. Average price per ton dropped from $415 in 1954 to $288 in 1955, then rose to $480 in 1956. The annual price variation is illustrated graphically in Figure 1. The coefficient of variation of adjusted[9] annual prices received by Oklahoma farmers from 1929 to 1955 for broomcorn was .38. During this period, the coefficients of price variability for other major crops of the state were as follows: corn, .30; grain sorghum, .30; cotton, .28; oats, .27; wheat, .24; and alfalfa, .22.

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[6] W. H. Buckhannan, Soil Survey of Cleveland County, Oklahoma, United States Department of Agriculture, Soil Conservation Service in cooperation with Oklahoma Agricultural Experiment Station (Stillwater, Oklahoma, October, 1954), pp. 30, 37 and 46.

[7] Because of incomplete data, the years 1947 and 1948 were omitted from the average.

[8] R. J. Martin, ed., Climatic Summary of the United States, No. 30, U. S. Department of Commerce, Weather Bureau (Washington, D. C.), p. 24.

[9] Adjusted by the index of prices paid by U. S. farmers, including interest, taxes and wage rates.

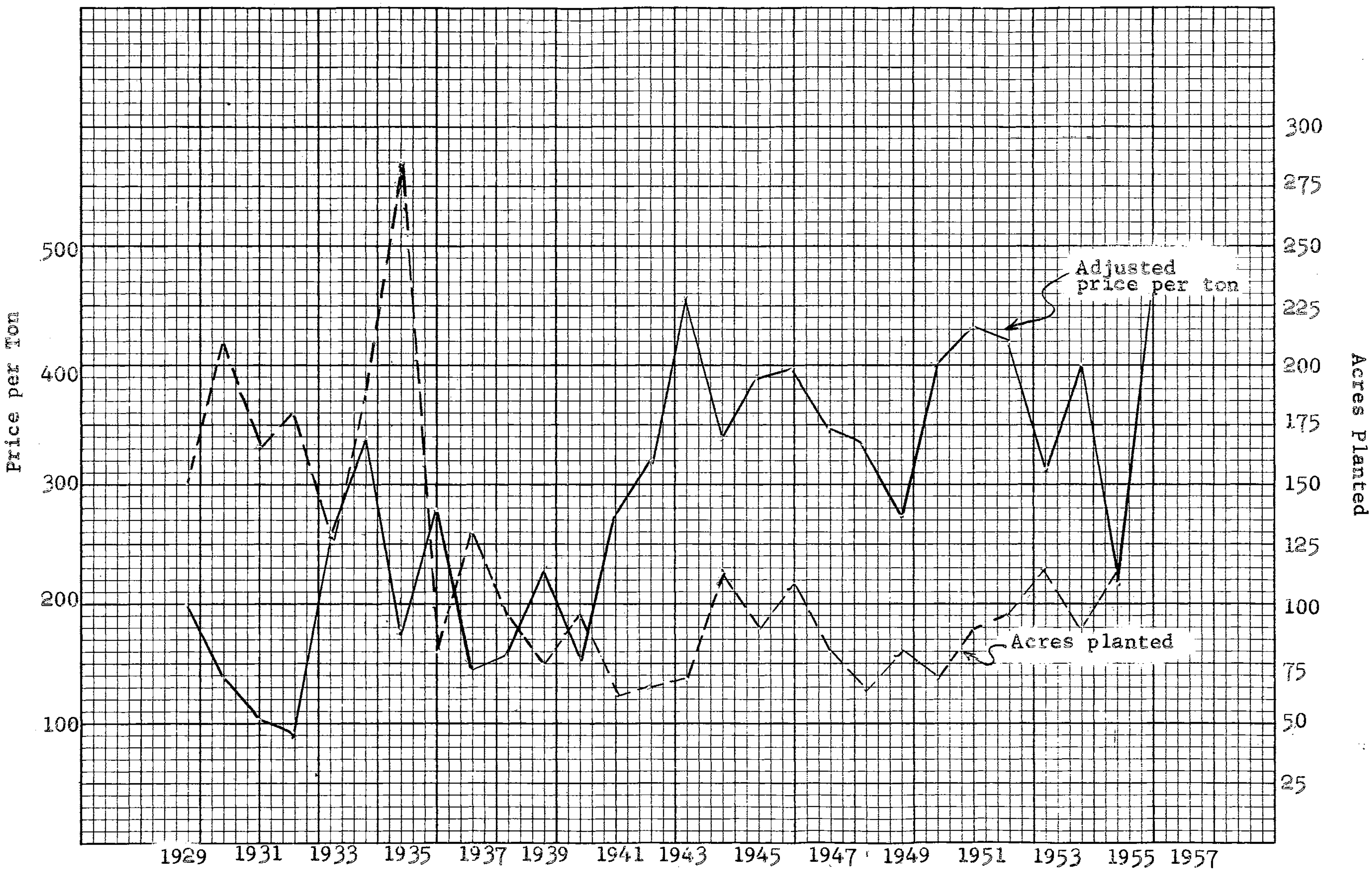

Figure 1. Adjusted Price per Ton and Acres Planted of Broomcorn in Oklahoma (1929-1956)
(Prices adjusted by index of prices paid by U. S. farmers, including interest, taxes and wage rates.)

The within-year price variation for broomcorn does not follow a regular cyclical pattern. Thus, it cannot be classed into seasonal price variation patterns as can be done for many other agricultural products. The within-year coefficient of variation of .22 was computed from prices received for broomcorn in 1955 by 38 farmers surveyed in southcentral Oklahoma. Variation in prices resulting from grade differences among individual farmers could not be removed from this estimate.

A major concern of broomcorn producers is how to maintain efficiency of production under unpredictable prices. Economic inefficiency results from inability of individual producers to equate marginal costs with marginal returns. Equilibrium conditions are difficult to approach and impossible to maintain in the face of fluctuating product prices. Technical inefficiency arises from farmers' unwillingness to adopt improved production techniques due to uncertainty of returns. The impact of unfavorable prices is increased by the high cash cost of approximately $150 per ton required to harvest the crop. Broomcorn brush is used only in the making of brooms. Since the harvested brush cannot be utilized on the farm, it must eventually be placed on the market.

A second major concern of producers is the long-run decline in consumption of broomcorn brush. Despite the increase in national population the quantity of broomcorn produced and consumed has steadily decreased. In 1930, Martin and Washburn[10] stated that for many years the average annual disappearance of brush in this country for domestic manufacture and for export was about 50,000 tons[11]. The average annual disappearance

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[10] Martin and Washburn, Broomcorn Growing and Handling, p. 1.

[11] Imports of this period were relatively insignificant as shown by Appendix Table XXVIII.

(production plus imports minus exports) of brush from 1950 to 1955 was approximately 35,000 tons (Appendix Table XXVIII). The decline in Oklahoma production is shown graphically in Figure 1.

The decline in consumption of broomcorn may have resulted from (1) a decreasing supply of brush placed on the market by farmers over time, (2) a decreasing demand for broomcorn, or (3) a combination of (1) and (2).

Thus, producers are confronted with two principal adjustments. The first is an adjustment to preserve efficiency of resource use in the face of unusually high price variability. The second is a long-run adjustment to the declining demand for broomcorn.

Objectives of the Thesis

The principal objectives of the study are:

(1) To determine the reasons for the unusually high variability in annual prices paid Oklahoma producers for broomcorn;

(2) To gain some insight into producer resource situations, knowledge of markets, and response to within-year and among-year variation in broomcorn prices; and,

(3) To evaluate alternative opportunities of producers in adjusting to variable broomcorn prices and to long-run decline in demand for broomcorn.

The analysis of Chapters II, III, and IV will be concerned with objectives (1), (2) and (3), respectively. In Chapter II, two relevant hypotheses regarding the source of the unusually high price variability will be tested. The first hypothesis states that excessive price variability arises from a relatively inelastic demand for the crop. The second states that excessive price variability results from cyclical price and quantity changes as explained by the cobweb theorem. To gain information as an aid in accepting or rejecting the hypotheses, secondary data will be used in an analysis of demand and supply in the farm market.

Chapter III will contain an evaluation of producer resource situations. The chapter will embody a discussion of how management decisions by farmers have contributed to the variable rate of production and the consequent price variability. Also, the hypothesis that farmers lack knowledge of the market and of factors underlying price variability will be evaluated. Secondary data obtained from farmers will be used throughout the analyses in the chapter.

Chapter IV will contain an evaluation of alternative adjustments which producers can make to maintain efficiency in the face of declining production and unusually high variation in prices. Through a partial budget analysis, returns from various alternatives to broomcorn will be computed for use as a guide in future enterprise adjustments. Primary and secondary data will be used in the analyses.

CHAPTER II

ANALYSIS OF BROOMCORN PRICES IN THE FARM MARKET

The analyses of this chapter begin with the presentation of the two hypotheses concerning the source of the unusually high variability in price, followed by a statistical analysis of broomcorn supply and demand in the farmer-dealer market.[1] The parameter estimates obtained will aid in evaluating the hypotheses and will also give some insight into factors responsible for the decline of the broomcorn industry.

Inelastic Demand

The first hypothesis states that the relatively high variability of prices originates from an inelastic demand for broomcorn. An inelastic demand exists when the percentage change in quantity taken is less than the percentage change in price; therefore, $E_p < 1$ in absolute value.[2] (Figure 2, A). Unitary elasticity is characterized by an equal percentage

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[1]The analysis was restricted to evaluation of what were considered to be the two most relevant hypotheses. Other hypotheses ($H_3 \ldots H_n$) were examined in another phase of the study, and they were found to be irrelevant and/or of minor importance in explaining price variability. These hypotheses pertained to (1) instability in operations of dealers and manufacturers which were unrelated to instability in production, (2) instability in demand, and (3) instability in yields.

[2]Price elasticity of demand (E_p) for any product is defined as

$$\frac{\text{Percentage change in quantity taken}}{\text{Percentage change in price}}, \text{ or } \frac{dQ}{dP} \cdot \frac{P}{Q} .$$

change in quantity taken and price, or $E_p = 1$. Unitary elasticity on arithmetic scales is illustrated graphically by a rectangular hyperbola. (Figure 2, B).

When the percentage change in quantity taken exceeds the percentage change in price, demand is elastic, or $E_p > 1$ (Figure 2, C). It is evident that for a given change in quantity supplied, price changes are greater with a relatively inelastic demand than with unitary or relatively elastic demand. Conversely, a given percentage change in price will result in a smaller percentage change in quantity taken off the market when demand is relatively inelastic.

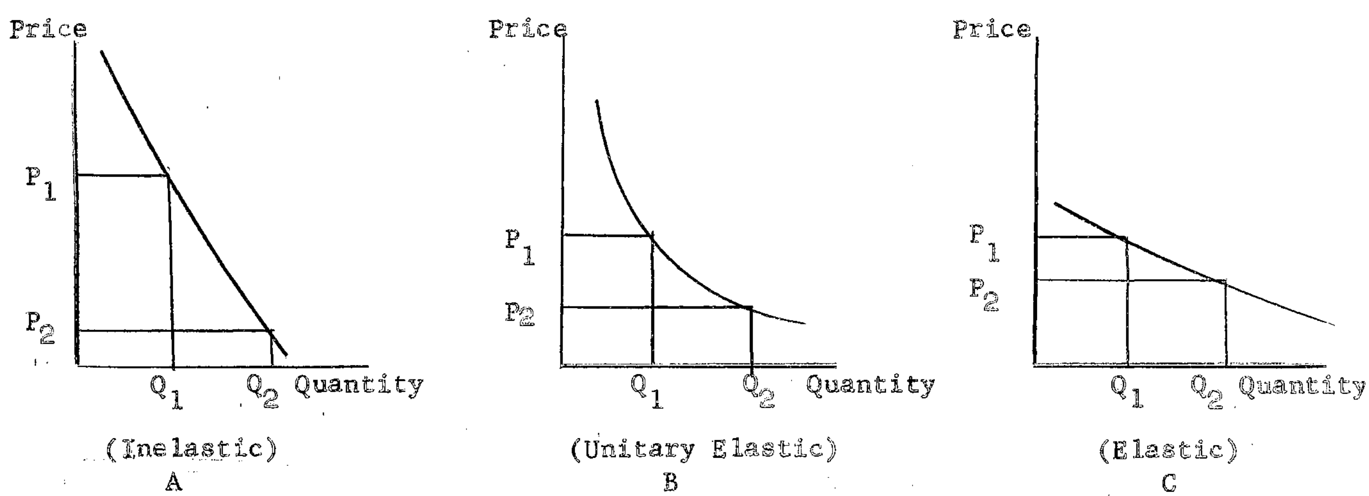

Figure 2. Hypothetical Illustration of Relatively Inelastic, Elastic, and Unitary Elastic Demand Curves

Cobweb Theorem

The second hypothesis states that unusually high price variability originates from cyclical fluctuations in price and quantity as explained by the cobweb theorem. Ezekiel[3] demonstrates three basic types of cyclical patterns: continuous, convergent and divergent. (Figure 3). The demand curve DD applies to the current period. The supply curve ss, however, represents the quantity produced in the current period in response to price of the previous period. In addition, ss includes carry-over of stored supply to the succeeding period in response to price of the current period.

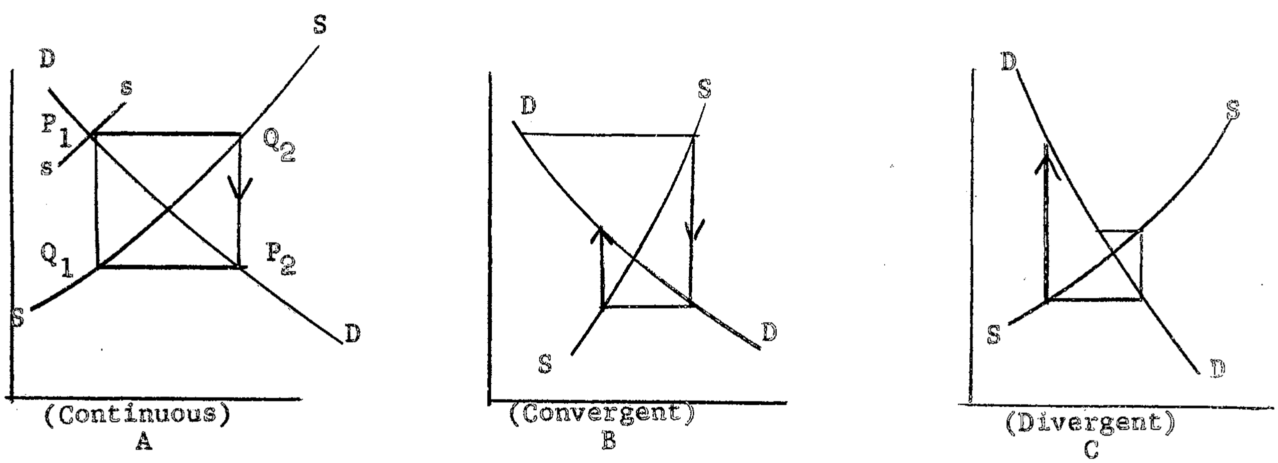

Figure 3. Hypothetical Illustration of Cobweb Patterns

[3]Mordecai Ezekiel, "The Cobweb Theorem", Quarterly Journal of Economics, LII (February, 1938), pp. 263-266.

The original disturbance giving rise to the oscillation can be generated by a shift in the demand or in the supply curve. In the case of continuous oscillation, the original supply curve is ss, with price and quantity in equilibrium at P_1 and Q_1 respectively (Figure 3). Assuming a shift in the supply curve to a new position SS, sellers are willing to place Q_2 on the market at price P_1. In response to this price, quantity Q_2 is produced, resulting in price P_2. Price P_2, however, calls forth a production Q_1 the following period, causing price to rise to P_1. If producers expect price P_1 to prevail in the ensuing period, quantity Q_2 is produced, resulting in price P_2. Thus, the cyclical pattern is repeated with no equilibrium being reached.

The type of fluctuation taking place (continuous, convergent or divergent) depends upon the slopes of the demand and supply curves in the relevant range. Buchanan[4] and Ackerman[5] demonstrate that the possibility is very unlikely of any commodity giving rise to a continuous or divergent pattern.

Ezekiel[6] states that the theorem can apply exactly to only those commodities fulfilling three conditions: (1) production is completely determined by the response of producers to price, under conditions of pure

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[4]Norman S. Buchanan, "A Reconsideration of the Cobweb Theorem," Journal of Political Economy, IIIL (1939) pp. 70-81.

[5]Gustav Ackerman, "The Cobweb Theorem: A Reconsideration," Quarterly Journal of Economics, LXXI (February, 1957), pp. 155-159.

[6]Ezekiel, p. 272.

competition and producer anticipation of present prices continuing; (2) time needed for adjustments in production is one full period, once the plans are made; and (3) price is determined by the available supply.

Two additional assumptions stated by Buchanan are: (1) the response of producers to current prices, or prices in the last production period, does not alter the supply function (supply is completely reversible throughout the entire range in output)[7], and (2) farmers never learn from past experience, no matter how protracted.[8]

Models of Supply and Demand

Estimates of the supply and demand functions are necessary to evaluate the stated hypotheses. The actual method used to estimate these functions must conform with research objectives and various economic assumptions. Economic theory postulates that economic variables are generated by a number of interrelated factors. Thus, the simultaneous equation method of estimating parameters embodies certain advantages - namely, the recognition of the joint or mutual determination of variables.

Problems of identification characteristic of the least squares method can be reduced by use of lagged endogenous[9] variables. These variables are classified with exogenous[10] variables and are called

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[7]Buchanan, p. 68.

[8]Ibid., p. 81.

[9]Endogenous variables are considered to be determined by interaction within the model.

[10]Exogenous variables are considered to be determined outside the operation of the model.

predetermined variables. Because of the limited data available, the least squares method was used in estimating parameters despite certain advantages of other methods. Supply was estimated by the use of Oklahoma variables. Due to data limitations, demand for Oklahoma's broomcorn was estimated from a derived national demand function.

Specification of the Economic Model of Demand

The model specifying the demand relationship is of the form:

$$(1) \quad Y = f(x_1, x_2, x_3, \ldots x_n)$$

where the dependent variable Y, specified as the price received by farmers for broomcorn, is a function of production, population, income, tastes and preferences, price and number of substitutes and other relevant variables. A change in the combination and levels of the independent variables $(x_1, x_2, x_3 \ldots x_n)$ will result in a change in price (Y). A demand function expressing a relation between Y (price) and x_1 (quantity), with $x_2 \ldots x_n$ (all other independent variables) fixed, is of the form:

$$(2) \quad Y = f(x_1 \mid x_2 x_3 \ldots x_n \mid)$$

A change in the level of the fixed variables will result in a shift in the level of the price-quantity function. The final economic specification is that demand applies to a specific commodity in a well-defined market area at a particular period in time.

Specification of the Statistical Model

The statistical model used to express the demand and supply relationship is of the form:

$$(3) \quad Y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + z$$

Assumptions of the model are as follows:

(1) The relevant mathematical form of the equation is known;

(2) Variance of the dependent variable is homogeneous for each value of a given independent variable;

(3) The independent variables are measured without error; and,

(4) The error term z is independent of specified independent variables and is normally distributed with variance σ^2 and mean 0.

The α and β_i's are parameters expressing the relationship between variables. Time series data will be used, posing problems of analysis such as multicolinearity and interdependence of successive observations.[11] Due to data limitations, temporal, geographical and commodity aggregation is unavoidable, violating assumptions of the economic model. Other complications imposed by time series data are limited sample size and error introduced through correcting data for trends through use of indices. Parameter estimates are averages for the total period covered by the data. However, parameters such as price elasticity of demand may have been at different values during various parts of the total period.

Variables in the equation were selected on the basis of three criteria: (1) availability of data, (2) consistency of variables with the economic model, and (3) statistical significance of variables at a given probability level. The only exceptions to the third criterion are the quantity and price variables. Because estimates of price elasticity of supply and demand are necessary for evaluation of the stated hypotheses,

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[11] E. L. Baum, "Critical Review of Demand Studies - Discussion", Journal of Farm Economics, XXXV (1953), p. 896.

these variables are essential elements of the model, even though they fail to add to the explanation of price or quantity variability.

The algebraic form of the statistical model was selected on the basis of conformity to the economic model and size of the R^2. The fraction of the sum of squares removed by regression, or R^2, is a measure of how well the equation fits the data. Logarithm and square root forms of equations were fitted to the data. Both equations conformed to the economic model. The logarithm equation was selected to represent both supply and demand due to higher R^2 values and due to the added convenience of working with estimated parameters in the form of elasticities.

The Estimated Demand Equation

The demand equation was fitted to annual data for the period from 1929 to 1955. The data were converted to logarithms, resulting in a fitted equation of the form:

$$(4) \quad \hat{P} = -9.95\, Q^{-.91} D^{1.96} V_{-1}^{-.69}$$

where P was price, Q was quantity, D was income, and V was vacuum cleaner production. (Table I).

The dependent variable P was the adjusted annual seasonal-average price received by farmers per ton of broomcorn in the United States. The prices were adjusted by the index of prices paid by U. S. farmers, including interest, taxes, and wage rates.

The Q variable was annual national production per 100,000 population. A one percent increase in production (Q) results in a .91 percent decrease in the price of broomcorn. Thus, $E_p = \frac{1}{-.91} = -1.10$. The 95 percent confidence interval for price elasticity of demand was $-2.04 < E_p < -.76$, indicating that E_p in the farm market was not significantly different from unity.

TABLE I

ESTIMATED DEMAND AND SUPPLY EQUATIONS

Equation[a]	Variables	b_i[b]	Confidence Interval	s_{b_i}	R^2 and a value
Demand					
$\hat{P} = aQ^{b_1} D^{b_2} V_{-1}^{b_3}$	P Price				
	Q Production[c]	b_1 - .9051**	$-1.32 < \beta_1 < -.49$	s_{b_1} .20	R^2 .7409
	D Income[c]	b_2 1.9590**	$1.21 < \beta_2 < 2.71$	s_{b_2} .36	a - 9.9459
	V Vacuum cleaner production[c]	b_3 .6942**	$-.83 < \beta_3 < -.55$	s_{b_3} .07	
$\hat{P} = a + b_1\sqrt{Q} + b_2\sqrt{D} + b_3\sqrt{V_{-1}}$		b_1 -72.9507**	$-109.95 < \beta_1 < -35.95$	s_{b_1} 17.88	R^2 .7004
		b_2 22.6671**	$12.89 < \beta_2 < 32.44$	s_{b_2} 4.72	a 122.4022
		b_3 - 6.6362*	$-12.20 < \beta_3 < -1.07$	s_{b_3} 2.69	
Supply					
$\hat{A} = aP_{-1}^{b_1} O_{-1}^{b_2} Y_{-1}^{b_3} T^{b_4}$	A Acres planted				
	P Price	b_1 .9700**	$.59 < \beta_1 < 1.35$	s_{b_1} .18	R^2 .8403
	O Opportunity cost	b_2 - 1.0315**	$-1.60 < \beta_2 < -.47$	s_{b_2} .27	a 4.2101
	Y Yield	b_3 - .8501**	$-1.21 < \beta_3 < -.49$	s_{b_3} .17	
	T Time	b_4 - .4184**	$-.55 < \beta_4 < -.29$	s_{b_4} .06	
$\hat{A} = a + b_1\sqrt{P_{-1}} + b_2\sqrt{O_{-1}} + b_3\sqrt{Y_{-1}} + b_4\sqrt{T}$		b_1 -16.4464**	$9.09 < \beta_1 < 23.81$	s_{b_1} 3.54	R^2 .8031
		b_2 -21.4426**	$-38.53 < \beta_2 < -4.35$	s_{b_2} 8.22	a 416.3907
		b_3 -12.4567*	$-19.99 < \beta_3 < -5.71$	s_{b_3} 3.24	
		b_4 -45.3549**	$-60.70 < \beta_4 < -30.01$	s_{b_4} 7.38	

a/ Minus one (-1) subscripts denote lagged variables.

b/ *Significant at .95 level **Significant at .99 level.

c/ Variables on a per capita basis.

The D variable was the disposable income per 100,000 population in the United States. Income was adjusted, using the consumer price index. The V variable was the number of vacuum cleaners produced in the United States per 100,000 population. The variable was lagged one year to conform with an assumed delay between the time of vacuum cleaner production and its effect on the broomcorn market. Vacuum cleaners are perhaps the most important of several substitutes for brooms. Data on other substitutes for brooms were not available. Because data on vacuum cleaner production were not available for the war years (1941-1945) and for alternate pre-war years, it was necessary to interpolate between existing estimates.

The effects of the D and V variables upon shifts in the price-quantity relation are illustrated in Figure 4. Through time, the effect of the vacuum cleaner variable has been to move the demand curve to the left. However, increase in the income variable has more than offset the population effect, causing absolute demand to shift to the right. Despite the increase in absolute demand, relative demand may have decreased; that is, the demand for other products may have increased more than the demand for broomcorn.

Several variables in addition to those included in the equation affect demand. Adding a time variable to the estimated demand equation changed slightly the values of other estimated parameters.[12] Perhaps the

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[12] $\log \hat{Y} = -12.48 - 1.06 \log Q + 2.29 \log D - .63 \log V_{-1} - .01\, T$ where the Y, Q, D, and V variables were unchanged from equation (4). The T (time) variable is a linear variable measuring the effects of gradually changing factors. All independent variables were highly significant except T, which was not significant at the .95 level. The R^2 was .75.

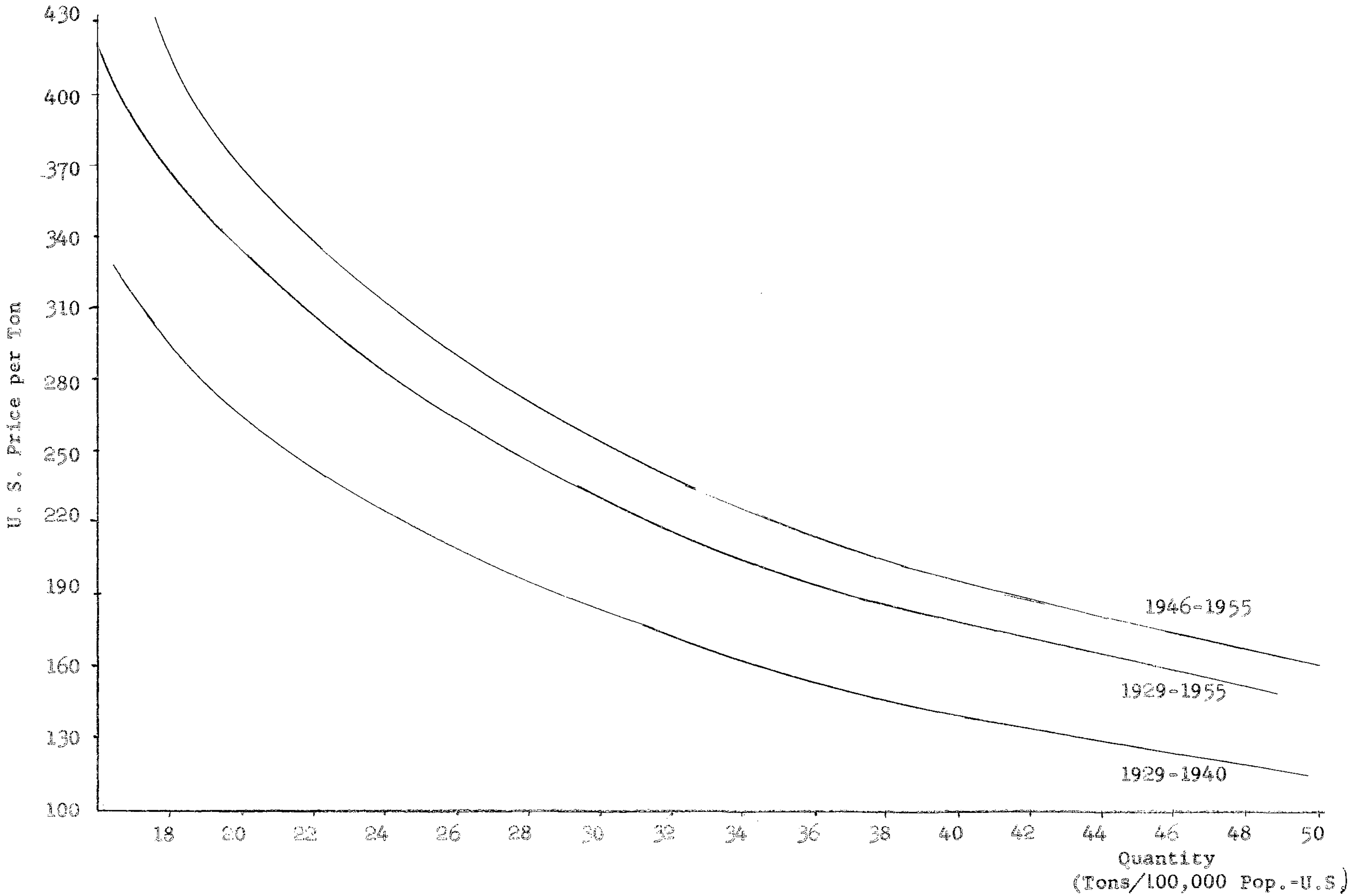

Figure 4. Estimated Demand for Broomcorn in the Farm Market

most obvious omission is a carry-over variable including net imports. Due to lack of data on carry-over, several attempts were made to construct a dummy variable. However, each attempt resulted in failure to construct a variable statistically significant at the 95 percent probability level. The constructed variables also added little to the percent of variability explained (R^2).

Specification of the Economic Model of Supply

The crop supply function also applies to the farm market level, but differs from demand in that it was estimated, not for the nation, but for Oklahoma. Supply was defined as the number of acres of broomcorn which producers will plant in response to various possible prices of the previous year and to other variables. The model specifying the relationship is of the form:

$$(5) \quad Y = f(x_1, x_2, x_3, \ldots x_n)$$

where the independent variable Y, specified as acres planted, is a function of price, opportunity costs, yield, weather conditions, labor costs and other relevant variables through x_n. Variables such as price and opportunity cost, which apply to the previous year, are lagged endogenous (predetermined) variables.

A supply function expressing a relation between Y (acres planted) and x_1 (price), with $x_2 \ldots x_n$ (all other independent variables) fixed, is of the form:

$$(6) \quad Y = f(x_1 | x_2, x_3 \ldots x_n |)$$

A change in the fixed level of the $x_2 \ldots x_n$ variables results in a shift in the relation, $Y = f(x_1)$.

The Estimated Supply Equation

The supply equation was fitted to annual data for a period from 1930 to 1955. The logarithmic equation was:

$$(7) \quad \hat{A} = 4.21\ P_{-1}^{.97}\ O_{-1}^{-1.03}\ Y_{-1}^{-.85}\ T^{-.42}$$

where A was acres planted, P was price, O was opportunity cost, Y was yield, and T was time (Table 1). The minus one (-1) subscripts denoted variables lagged one year.

The price variable P was the seasonal average price per ton paid to Oklahoma farmers for broomcorn. The variable was adjusted for long-term price trends by the index of prices paid by U. S. farmers, including interest, taxes and wage rates. The equation indicated a price elasticity of supply (acres planted) of .97. Thus, a one percent increase in previous year prices resulted in a .97 percent increase in acres planted. The 95 percent confidence interval ranged from .59 to 1.35, indicating an elasticity insignificantly different from unity.

The opportunity cost variable (O) was an index of the relative profitability of producing alternative crops. Hence, it gave an estimate of the cost of the lost opportunity of producing other crops. The index for any one crop in a given year was found by the formula:

$$\frac{\text{Adjusted price of the crop for a given year} \times 100}{\text{Average adjusted price of the crop during 1948-54 base period}}$$

The observations in the variable were simple averages of annual indices of price received by Oklahoma farmers for corn, wheat, grain sorghum, oats and alfalfa, the principal competing crops with broomcorn in southcentral Oklahoma.

The yield variable (Y) was the yield of broomcorn per harvested acre in Oklahoma, lagged one year. The time variable (T) measured the effects upon acres planted of factors changing gradually through time. The following factors were possible components of this variable:

(1) Increased mechanization and decreased cost of harvesting competing crops. Methods of harvesting broomcorn have remained almost unchanged since the 1930's.

(2) Improved varieties of competing crops. Broomcorn producers of the area have been using the same variety, Black Spanish, for many years.

(3) Decreased availability and quality of labor for harvesting broomcorn. Harvest labor requirements have remained almost unchanged while real wages have increased.

The effect of the time, opportunity cost, and yield variables is illustrated in Figure 5. Through time, these variables have shifted the supply curve to the left. Results suggest that the above components of the time variable have played a major role in the decline of the broomcorn industry. Projection of past trends to 1965 results in a forecast of an output of 9,166 tons for Oklahoma. This figure is approximately 25 percent below the past five-year average production of about 12,000 tons per year.

The R^2 was reduced to approximately .50 when the time variable was eliminated from the equation. Thus, approximately 50 percent of the variability in acres planted is accounted for by price, opportunity cost and yield variables one year previous to the date of planting.

Supply and Demand Relationship

The changes taking place in the broomcorn producing industry from 1930 to 1955 are illustrated by Figure 6. The percentage decrease in supply exceeded the percentage increase in demand. Shift in supply from

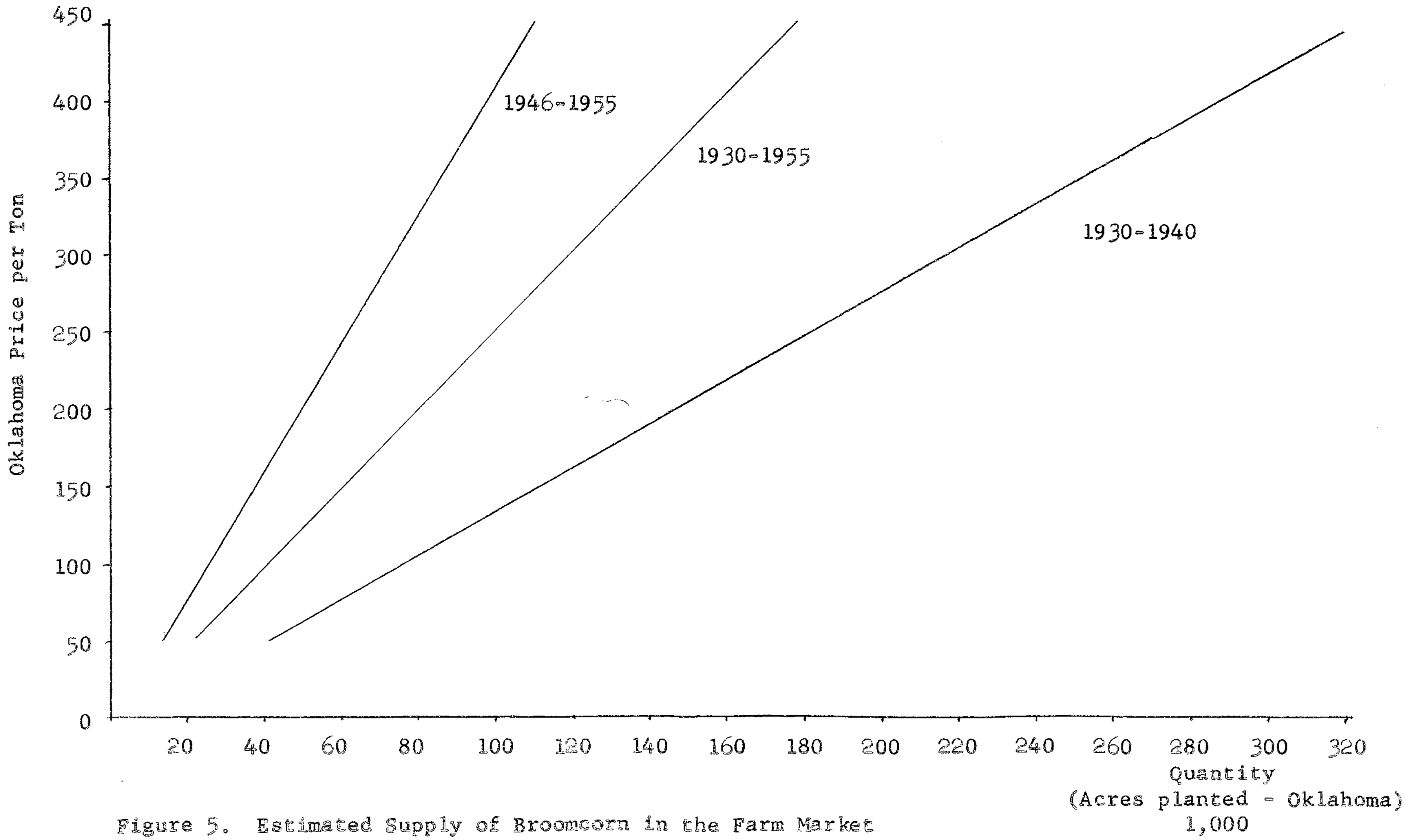

Figure 5. Estimated Supply of Broomcorn in the Farm Market

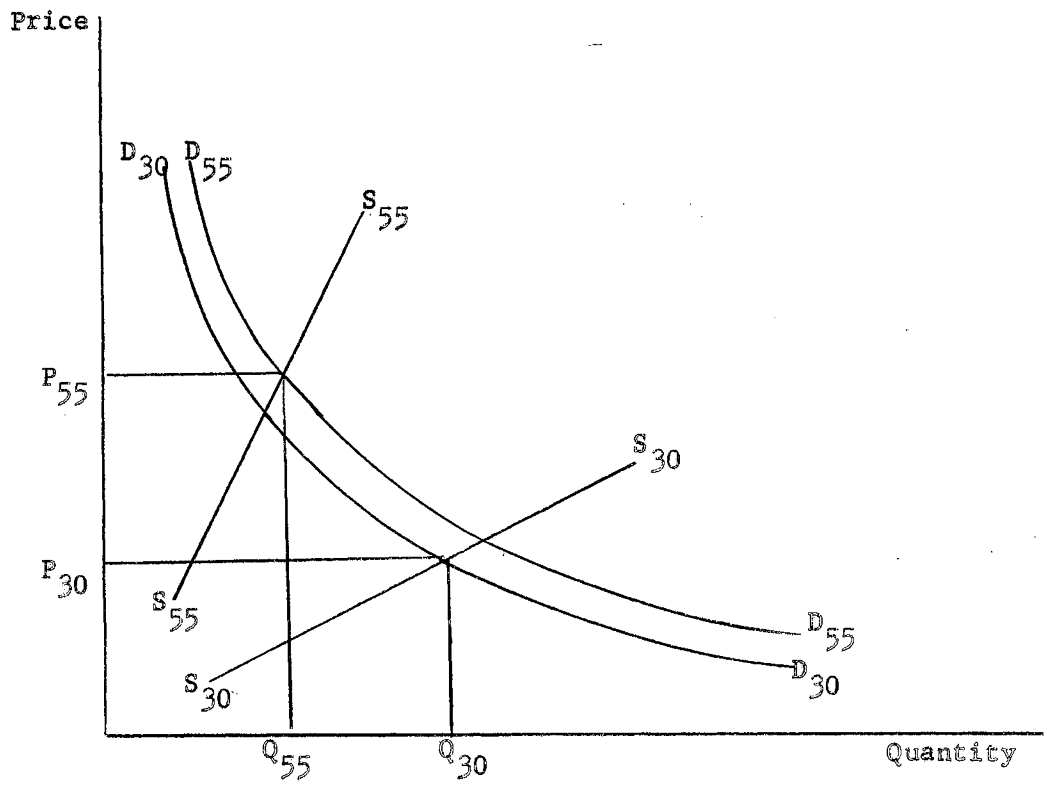

Figure 6. Relative Shifts in the Broomcorn Demand and Supply Curves Through Time

$S_{30}S_{30}$ to $S_{55}S_{55}$ and in demand from $D_{30}D_{30}$ to $D_{55}D_{55}$ caused a reduction in quantity from Q_{30} to Q_{55} and an increase in real price per ton from P_{30} to P_{55}. The increase in purchasing power of broomcorn per ton is illustrated graphically in Figure 1.

Evaluation of the Hypotheses

It is recognized that the two hypotheses are not mutually exclusive; both may have been sources of price variability. Also, both are related in two respects. First, cobweb fluctuations in quantity supplied will cause greater price fluctuations if demand is relatively inelastic than if highly elastic. Second, fluctuations in quantity supplied are necessary for a gradually shifting, relatively inelastic demand to be a source of unusually high price variability.

To test the first hypothesis, therefore, it is assumed that changes in quantity supplied are not excessive but are characteristic of other farm crops. From the demand analysis, E_p of broomcorn was estimated to be -1.10, or approximately unity. Because a demand function of unitary elasticity is not a source of extreme price variability as found in the broomcorn producing industry, the first hypothesis is rejected.

The demand for brooms may be inelastic at the retail level. The quantity of brooms sold remains relatively constant from year to year (except for secular trends) despite price fluctuations. To what can the change in elasticity be attributed as broomcorn moves from the farm to the consumer? The effect of storage on the change in elasticity is illustrated by Figure 7.

Assume a large broomcorn production Q_4 in a given year. If the broomcorn were sold on a relatively inelastic (D_1D_1) retail demand market, farmers would receive price P_1. However, if the quantity Q_3Q_4 is placed in storage,[13] farmers will receive a higher price P_2 for quantity Q_4.[14]

On the other hand, if production were low, such as Q_1, farmers would receive a price P_4 by selling on the retail demand market. However, the quantity Q_1Q_2 is placed on the market from storage, causing farmers to

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[13]Storage is defined as the summation of storage in all market levels, including dealer, manufacturer, wholesaler, etc.

[14]Marketing costs such as transportation, broker margins, etc. are not included.

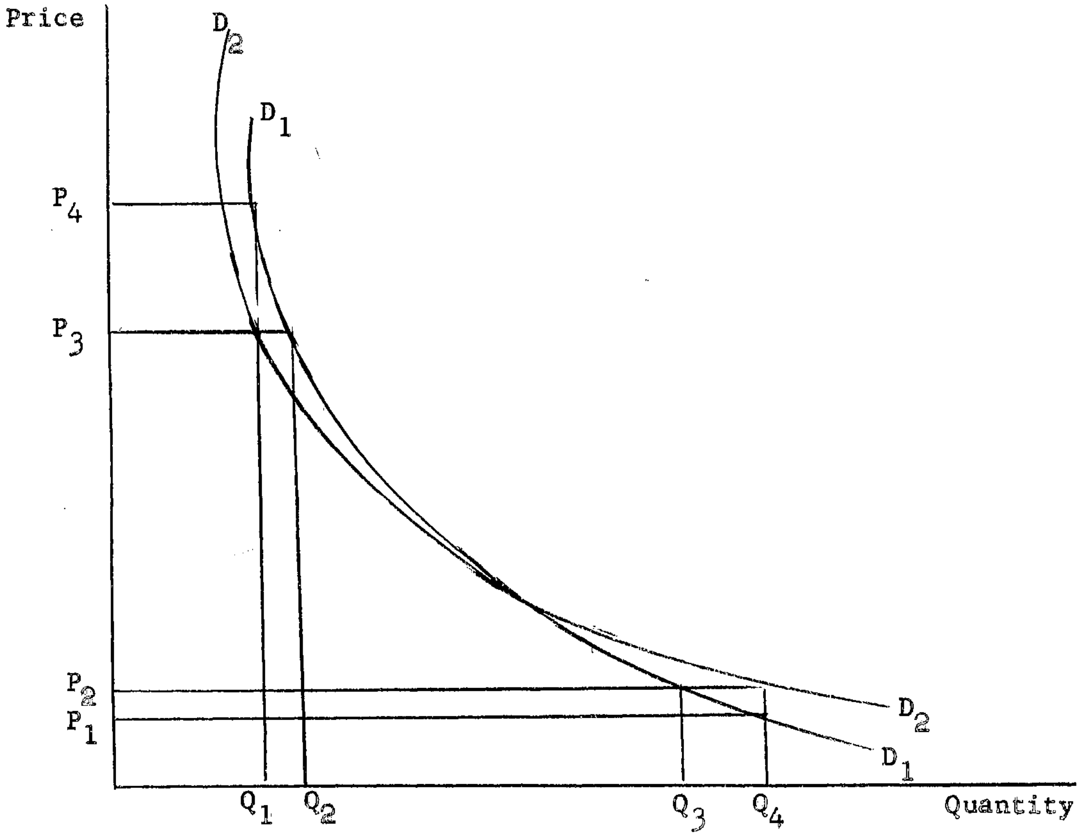

Figure 7. Hypothetical Effects of Storage on Elasticity of Demand

receive a lower price P_3 for quantity Q_1. Thus, demand curve D_2D_2 in the farm market may be more elastic than demand curve D_1D_1 at the retail level.

To evaluate the second hypothesis, we must examine how closely the assumptions for the cobweb theorem are met by the broomcorn industry. Ezekiel's first assumption states that production must be determined by producers' response to price. Price and yield variables in the preceeding crop year did account for about 50 percent of the variation in acres planted. Due to the large number of producers, no one farmer can believe his production will influence price. In conformity with Ezekiel's third assumption, broomcorn prices and production are not determined by administrative decisions but are determined by supply and demand conditions.

Buchanan states that the supply curve must be reversible throughout its entire length. Reversibility of the supply curve is dependent upon the ease of entry or withdrawal of new firms and upon the ease of expansion or contraction of existing firm output. Such adjustment must be made in an interval no longer than between production periods, or approximately one year for broomcorn. A low ratio of fixed to variable costs is characteristic of broomcorn production. The major fixed investment, the broomcorn drying shed, averages approximately $1200 per farm, but more than one half of the sheds are rented. Preharvest machinery may be used to produce several alternative crops. The major portion of the labor and machinery required for harvest is hired. Thus, adequate flexibility exists to approach Buchanan's assumption of a reversible supply curve.

Two factors contribute to the inability of farmers to learn from past experience. First, cyclical fluctuations are obscured by unforeseen weather phenomena; and second, psychological pressure of group behavior may influence farmers to act against their "better" judgment.

Certain aspects of broomcorn production fail to satisfy several assumptions of the cobweb theorem. It is evident that factors in addition to producers' response to price determine production. Weather is a major factor causing variation in yield and in acres planted. For Oklahoma from 1929 to 1955, the coefficient of variation in acres planted was .46; yield per planted acre, .25; and production, .31.[15] Producers may alter final output once plans have been made. Although it may be impossible to increase production after planting, it is not difficult to abandon planted acreages.

Despite the minor inconsistencies encountered in fitting the cobweb model to the broomcorn producing industry, it appears that the necessary

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[15]Corrected for long-term trends, the coefficient of variation for acres planted was .38; yield per acre, .19; and production, .30.

assumptions are sufficiently fulfilled to warrant acceptance of the hypothesis stating that cobweb oscillations have been a major source of unusually high variability of annual prices. If fluctuations were of the assumed convergent pattern, theoretically, equilibrium would be restored in time. However, changing weather conditions cause changes in production, reactivating the cyclical pattern.

CHAPTER III

PRODUCERS' RESOURCE SITUATIONS, RESPONSE TO PRICE VARIABILITY AND KNOWLEDGE OF MARKETS

All analyses of this chapter will be based upon information obtained from 38 broomcorn producers selected at random and interviewed in south-central Oklahoma in July, 1956 (Appendix A). Farms surveyed were divided into four groups. One objective of the chapter will be to describe the criteria for grouping, then to evaluate the resource situation of an average farm representing each of the groups.

The level and combination of resources on a farm have a definite impact upon management decisions concerning adjustments to preserve efficiency in the face of price variability and declining demand. Thus, Chapter III establishes a framework for the subsequent analysis of alternative adjustments in Chapter IV.

The remaining sections of the chapter will include a discussion of how farmers' management decisions have affected price variability, followed by an evaluation of the hypothesis that farmers lack knowledge of markets and of factors causing excessive price fluctuations.

Criteria for Grouping Farms

The 38 farms surveyed were first grouped into two geographical areas reflecting differences in soil type, livestock organization and land use. Farms of the Garvin county area were further subdivided on the basis of crop acres per animal unit (AU). A low ratio implies greater pressure on cropland acres to provide feed for livestock.

Farms of the Grady-McClain county area were further subdivided, using the criterion of regularity of broomcorn production. Farmers who were consistent growers, i.e., who have grown broomcorn each of the past five years (1952-1956), were placed in Group II (Table II). Two growers of small acreages plus five farmers who raised the crop from one to four years out of the past five years were placed in Group I.

Resource Situation

Several differences between the Garvin county area and the Grady-McClain area are notable. The Garvin area is the more intensive broomcorn producing section, lying in rich bottomlands such as along the Washita River and Rush Creek. Farms of the area are larger in acreage and in machinery inventories. Beef cattle are the predominant livestock.

The Grady-McClain area is a less intensive producing section, lying principally along smaller river and creek bottoms, but extending into upland areas. Smaller farm size, less fertile land and a lower percentage of cropland acres characterize the area. Perhaps these characteristics have contributed to the smaller percentage of acres in cash crops and to the relatively greater livestock numbers in the area. Dairy cattle are the predominant livestock.

Garvin Area

Considering only the Garvin area, the farms in Group I average 40 AU per farm, contrasting with only 10 AU per farm in Group II (Table II). The ratio of crop acres to AU ranges from 4.9:1 in Group I to 35.1:1 in Group II. Differences in livestock organization are reflected by differences in cropland use (Table III). The crop farmers (Group II) plant

TABLE II

LIVESTOCK AND LAND ORGANIZATION OF FARMS SURVEYED IN SOUTHCENTRAL OKLAHOMA (1956)

Classification	Garvin Area				Grady-McClain Area			
	I		II		I		II	
Number of farms in group	11		10		9		8	
Animal Units per farm[a]	40		10		40		19	
Crop acres per animal unit	4.9		35.1		4.1		7.1	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Land organization:[b]								
Total farm land	478	100	487	100	401	100	236	100
Acres owned	184	39	274	56	238	59	32	14
Acres rented	294	61	213	44	163	41	204	86
Cropland	199	42	350	72	162	40	136	57
Non-cropland	279	58	137	28	239	60	100	43

a/ Cows, bulls and sows equal one animal unit (AU) per head; other cattle equal one half AU per head. One hundred chickens equal one AU.

b/ Acreages are the average per farm.

TABLE III

CROPLAND ORGANIZATION OF FARMS SURVEYED
IN SOUTHCENTRAL OKLAHOMA (1956)

Classification	Garvin Area				Grady-McClain Area			
	I		II		I		II	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Total Cropland[a/]	199	100	350	100	162	100	136	100
Cash crops	83	42	250	71	75	46	64	47
Broomcorn	20	10	108	31	10	6	30	22
Cotton, peanuts, wheat	30	15	28	8	22	14	24	18
Alfalfa	33	17	114	32	43	26	10	7
Feed grain crops	61	30	63	18	58	36	46	34
Corn	36	18	48	14	17	11	12	9
Oats and barley	11	5	8	2	15	9	8	6
Sorghums	14	7	7	2	26	16	26	19
Other cropland	55	38	37	11	29	18	26	19
Improved pasture	7	4	3	1	19	12	19	14
Acres left idle, Johnson grass, etc.	48	24	34	10	10	6	7	5

a/ Acreages are the average per farm.

a high percentage of cropland acres to cash crops.

The higher percentage of acres planted to broomcorn by crop farmers over the percentage planted by livestock-crop (Group I) farmers is indicative of the place of cash crops in the organization.

Differences in the percentage of acres planted to feed grains are also characteristic of the type of farming organization. The livestock-crop farmers planted 30 percent of available cropland to feed-grain crops; the crop farmers planted only 18 percent. The greater livestock requirement of the former group undoubtedly was responsible for the difference.

Differences also appear in the acres of the other cropland, including rotation pasture, acres left idle, etc. Much of this land is marginal cropland. The amount of marginal land was perhaps higher than normal in 1956 due to severe drought conditions in the area. Livestock-crop farmers can better utilize such acreage than can crop farmers because livestock can pasture volunteer stands of Johnson grass and other forages.

Grady-McClain Area

Considering only the Grady-McClain area, the livestock crop farms (Group I) average 40 AU per farm, and the crop farms (Group II) average 19 AU per farm (Table III). The ratio of crop acres to AU is higher among crop farms (7.1:1) than among livestock-crop farms (4.1:1), although the farms were grouped on the basis of in-and-out characteristics in broomcorn production.

Table III indicates an approximately equal percentage of cash crops in the two groups. However, information from competent sources suggests that alfalfa is grown primarily for use as livestock feed in the Grady-McClain area and is not generally used as a cash crop. If alfalfa acreage is subtracted from the cash crop total, the remaining percentage of cash crops on the crop farms is 40 compared with 20 percent on the livestock-crop farms.

Another obvious characteristic of the livestock-crop farms is the high percentage of owners. Thus, the main characteristics of Group I or livestock farms of the Grady-McClain area compared with Group II crop farms are (1) larger total farm acreages, (2) greater livestock inventories, (3) a higher percentage of feed crops and a lower percentage of cash crops, (4) larger machinery investments, and (5) a higher percentage of owned land.

One may well question why these farmers are in-and-out in the production of broomcorn. One reason may be that resources on these farms are sufficiently diversified to preclude dependence upon income from cash crops each year. Judging from the high percentage of owned land, capital limitations are not as severe as is the case on crop farms. Also, large machinery inventories facilitate flexibility in land use.

Farmer Evaluation of Alternatives

As a basis for subsequent analysis of alternative adjustments in Chapter IV, farmers were asked to rank alternative crops in order of preference to broomcorn on land upon which broomcorn usually is grown. The results are summarized in Table IV.

Relationship of Farmer Decisions to Price Variability

The year 1955 was characterized by high production (17,100 tons) and below-average price ($228 per ton) for broomcorn in Oklahoma. The estimate of crop elasticity of supply (.97) of the previous chapter indicates that

TABLE IV

RANKING BY FARMERS OF ALTERNATIVE CROPS TO BROOMCORN ON FARMS SURVEYED IN SOUTHCENTRAL OKLAHOMA

Crop	Garvin Area	Grady-McClain Area
Alfalfa	1	1
Corn	2	3
Wheat	3	4
Grain sorghum	5	2
Oats and barley	4	5

a one percent decrease in price the previous year results in approximately a one percent decrease in acres planted. Therefore, if the estimate is correct, farmers would have reduced acreage in 1956 in response to the below average price of 1955.

Tabulation of total acres planted to broomcorn on farms surveyed reveals a decrease from 2230 acres in 1955 to 1640 acres in 1956. A question was included in the schedule to determine the reason for changes in broomcorn acreage. Of the 38 farmers interviewed, six increased acreage, five planted the same acreage, and 27 reduced acreage in 1956 (Table V). Of the 27 who reduced acreage, 12 gave "low price in 1955" as a reason. This tends to add support to the hypothesis on operation of the cobweb theorem.

Farmer Knowledge of the Market

To evaluate the hypothesis that farmers lack knowledge of the market and of factors underlying price variation, farmers were asked to state the broomcorn marketing problems of the area. The results are included in Table VI.

TABLE V

FACTORS DETERMINING BROOMCORN ACRES PLANTED ON FARMS SURVEYED IN SOUTHCENTRAL OKLAHOMA (1956)

Classification	Garvin Area I	Garvin Area II	Grady-McClain Area I	Grady-McClain Area II	Total
	No. of Farms	No. of Farms	No. of Farms	No. of Farms	No. of Farms
Number of farms	11	10	9	8	38
In 1956, the number of farmers who:					
Increased acreage	1	4	1	0	6
Reasons for increasing acreage[a]					
More land available	1	2	1	0	4
Failure of other crops	0	1	0	0	1
Planted same acreage	1	1	0	3	5
Reduced acreage	9	5	8	5	27
Reasons for reducing acreage					
Low price in 1955	4	3	2	3	12
Increase planting of competing crops	2	1	1	2	6
Labor problems	0	0	4	0	4
Unfavorable moisture conditions	1	0	1	0	2
Less land	0	0	1	1	2
Other	2	1	0	0	3

a/ Individual respondents were allowed to give more than one reason for acreage changes.

TABLE VI

BROOMCORN MARKETING PROBLEMS OF FARMERS SURVEYED IN SOUTHCENTRAL OKLAHOMA

Classification	Garvin Area I	Garvin Area II	Grady-McClain Area I	Grady-McClain Area II	Total
	No. of Farmers	No. of Farmers	No. of Farmers	No. of Farmers	No. of Farmers
Total no. of farmers in group	11	10	9	8	38
Farmers reporting problems	10	9	9	7	35
Types of problems:a/					
Buyer problem	9	5	3	5	22
Overproduction and low price	1	4	4	2	11
Labor problem	0	4	1	0	5
Poor quality broomcorn	0	0	2	0	2
Price uncertainty	0	0	0	1	1

a/ Individual respondents were allowed to state more than one problem.

"Buyer problem" was the most frequent response. It is a general classification for a broad range of answers. Growers accused buyers of organizing against producers, setting price, forcing farmers to sell, dishonest grading, and other practices. Although buyers may have been guilty of some of these practices, many farmers apparently have made the buyers the "scapegoat" for market phenomena they do not understand. An example of such phenomena is within-year price variability. Farmers who are unfamiliar with the grading system and with supply and demand conditions do not understand why their individual prices received within a season differ or why the annual prices differ.

Farmers were also asked to state why broomcorn prices fluctuate more than prices of other crops. Of the 38 farmers interviewed, 32 stated, "supply and/or demand conditions"; seven, "buyer influence"; three, "quality changes"; and two, "localized production". Supply and/or demand conditions" seemed to be a stock answer, and respondents who gave it appeared to possess little real knowledge of underlying factors.

In general, the results were consistent with the hypothesis that farmers lack knowledge about the market and problems underlying price variability.

CHAPTER IV

ADJUSTMENTS OF PRODUCERS

The chapter begins with a discussion of expected future trends in broomcorn price variability and in other aspects of the industry. The primary objective of the chapter will be an analysis of adjustments of producers. Various theoretical concepts of adjustments will be discussed, followed by an analysis of alternatives to broomcorn based on budget estimates. The final section of the chapter will contain recommendations of adjustments for specific resource situations.

Future Prospects

Factors causing variability in production and the consequent price variability are expected to remain almost unchanged in the foreseeable future. These variables were discussed in detail in Chapter II. Natural phenomena, such as rainfall, will continue to cause variation in production. Cyclical fluctuations in production, growing out of imperfect price expectations as characterized in the cobweb theorem, are expected to continue as in the past. Thus, there is little prospect for an appreciable decline in price variability for several years.

Oklahoma production is expected to decline to approximately 9,000 tons per year by 1965, which is about 25 per cent below the past five-year average. Farm size in the area is expected to increase approximately 50 per cent over 1957 levels by 1965. Therefore, despite the decline in production, broomcorn acreage per farm will probably remain about constant or increase slightly. The actual number of farms in the area and also the number of farmers producing broomcorn will decline, however.

Theoretical Concepts of Adjustments

Theoretical considerations of adjustments to price variability falls logically into a framework of risk and uncertainty. Uncertainty, in the economic sense, refers to an inability to predict future events. Uncertainty is a phenomenon of dynamic conditions.

The role of management under conditions of uncertainty is to (1) formulate expectations, (2) determine a plan of action, reformulating it, if necessary, as the time of action nears, (3) take action, and (4) accept responsibility for the action. To perform the first role, formulating expectations, the entrepreneur may use one or more naive models to estimate future prices or yields. One example of such a model is the use of price last year as a predictor of future prices.

Assume that the entrepreneur is subjectively certain of an outcome, has formulated plans, and has put the plans into operation. Although the entrepreneur is completely rational and logical in his ex ante decision, the outcome, when viewed ex post, is likely to involve inefficiency in resource use. In the ex ante sense, the entrepreneur can only equate expected marginal costs with expected marginal returns. The difficulty is further complicated when motives such as stability and survival alter the significance of the motive for monetary profits. Thus, the result of uncertainty is economic and technical inefficiency in resource use.

Response by entrepreneurs to risk and uncertainty may take one or more of three forms. First, he may avoid the risk or uncertainty by eliminating the enterprise from the firm. Second, he may transfer some or all of the risk through purchase of insurance. Third, he can accept the risk, but reduce the impact of an unfavorable outcome. The latter can be accomplished through adjustments in (1) scale, (2) resource selection and combination, and (3) enterprise selection and combination.[1]

Through adjustments in scale, the size of the "uncertain" enterprise can be reduced relative to the total operation of the firm, and unfavorable outcomes from this enterprise thereby have a smaller effect on total farm income.

Through enterprise selection and combination, flexibility can be introduced, allowing adjustments to changing expectations with a minimum cost as the date for putting the plan into effect approaches. Figure 8 illustrates the average-cost curves of a flexible firm A and of an inflexible firm B. It is apparent that firm B is more efficient for output from X_1 to X_2. For outputs below X_1 or above X_2, however, firm A is more efficient. Firm A illustrates cost flexibility. By selecting enterprises requiring short planning and production periods, time flexibility is introduced.

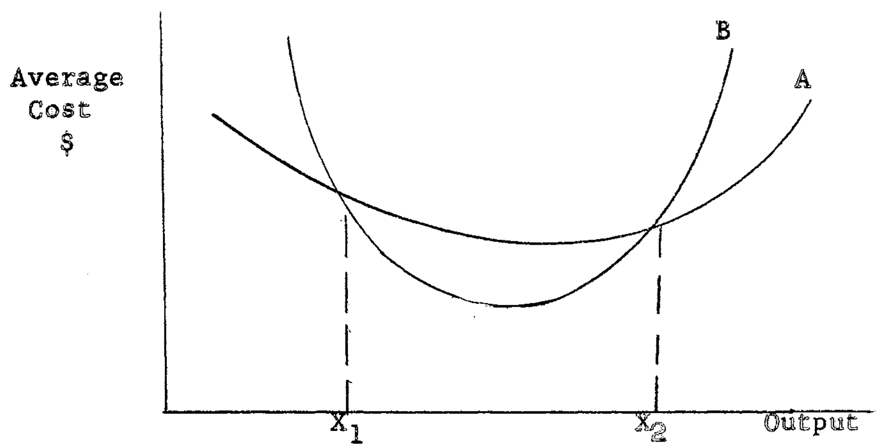

Figure 8. Hypothetical Average Cost Curve of a Flexible Firm A and an Inflexible Firm B.

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[1] C. B. Baker, "Specialization and Diversification, Diversification as a Response to Uncertainty", Proceedings of Research Conference on Risk and Uncertainty, Agricultural Experiment Station Bulletin 400 (Fargo, North Dakota, August, 1955), p. 57.

Diversification is a second means of reducing the impact of uncertainty through resource selection and combination. The total variance in price or in yield resulting from a combination of two enterprises is known to be:[2] $s_t^2 = s_1^2 + s_2^2 + 2s_1s_2r_{12}$. Therefore, to reduce variance, enterprises with prices or yields negatively correlated should be selected. Since prices and also yields are generally positively correlated between enterprises, combinations to reduce variance are difficult to obtain. Another method of reducing variance is to select "certain" enterprises with low variance in yield and price.

Selecting and combining enterprises to obtain flexibility and diversification may result in inefficiency. Enterprises possessing greater uncertainty may actually give greater income over time. However, diversification toward complementary or supplementary enterprises may actually increase resource efficiency.

Elements of uncertainty also exist for the entrepreneur who faces a supply curve shifting to the left in the long-run. If the shift is at a constant rate, expectations can be formed with a small margin of error. However, if the shift is not gradual, but at a variable rate, expectations may be inaccurate.

Nature of Adjustments

The goal of adjustment is to increase efficiency and income to the farmer without subjecting him to undue instability or income variability. Adjustments to meet price variability in general involve resource and enterprise selection to obtain flexibility, diversification and proper scale.

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[2] cf. Earl O. Heady, Economics of Agricultural Production and Resource Use, (New York, 1952), pp. 510-522.

One element of flexibility in broomcorn production - the low ratio of fixed cost to variable cost - was discussed in Chapter II. Another important element of flexibility is time. Time flexibility relating to the broomcorn enterprise is dependent upon (1) the period within which broomcorn acreages can be adjusted to changing expectation and (2) the flexibility of competing enterprises. This latter point is illustrated by a farmer who is unwilling to plow down a stand of alfalfa to increase his broomcorn acreage.

Alternative enterprises may be classified in relation to the flexibility allowed in broomcorn acreage. In order to make such a classification, it is necessary to know when broomcorn producers determine the number of acres they will plant.

The survey data indicate that 12 of 17 respondents determined acreage size in December or later. The remaining five made the decision before December.

Acreages of annual spring-seeded crops such as corn, spring oats and sorghums are not planted when the majority of land use decisions are made. Because these acreages can be readily adjusted, they are classified as short-run enterprises. Other crops such as winter oats and wheat, seeded in the fall before broomcorn acreage plans are made, are classified as intermediate adjustment enterprises. Crops such as alfalfa, seeded for a period of years, are classified as long-run enterprises. Flexibility of livestock depends upon the type of organization; however, in general, the livestock enterprise is less flexible than individual crop enterprises and, therefore, will be classified as a long-run adjustment. It is apparent that to maintain flexibility in broomcorn acreage, short-run enterprises should be selected.

Through diversification, the broomcorn enterprise can be combined with other enterprises to reduce the impact of unfavorable broomcorn prices. Criteria such as "certainty" and high net returns per acre should be considered in selecting other enterprises.

Scale adjustments are related to diversification. The impact of unfavorable prices is reduced by decreasing the proportion of income derived from broomcorn. The proportion can be decreased by increasing the size of other enterprises while holding broomcorn acreage constant or by decreasing the size of the broomcorn enterprise while holding other enterprises at the same size.

Adjustments to the declining demand for broomcorn involve long-run decisions. Farmers must choose alternatives which promise high returns over time. Such factors as soil, capital, uncertainty of the enterprise, and preferences of the farmer influence the selection. It is obvious that adjustments toward short-run enterprises to preserve flexibility may run counter to long-run adjustments to declining demand. Therefore, it may be well to discuss the various adjustments in terms of past adjustments and present resource situations.

The analysis of Chapter II indicates that farmers have contributed to price variability by changing acreage in response to imperfect price expectations. Thus, the flexibility which farmers have maintained in the past has contributed to price variability. Had farmers not possessed this flexibility and had they maintained nearly constant acreage from year to year, price variability would have been reduced. Unless farmer expectations are improved, they would do well to sacrifice flexibility, and, in general, hold broomcorn acreage somewhat constant from year to year.

Future changes in scale will be sufficient to reduce the impact of price fluctuations. If farmers do not increase broomcorn acreage per farm and if farm size increases by approximately 50 percent by 1965, farmers will be much less dependent upon income from the broomcorn enterprise. However, since broomcorn will be grown on a decreasing proportion of total cropland, farmers must be concerned about which crops to plant on the larger acreage of cropland per farm. As a guide for farmers in enterprise expansion, returns from broomcorn and alternative crops have been estimated under normal moisture and yield conditions.

Budget Analysis

The procedure used in the budget analysis is explained in Appendix B. Table VII contains a summary of returns from the various crops under assumed yield and price relationships.

When variable costs are subtracted from gross sales, the remainder is an estimate of returns to land, family labor, capital and management. These resources are considered fixed, i.e., they cannot be varied in the short-run. The cost of fixed resources represents farming expenses of an "overhead nature", i.e., such expenses do not change with output. Variable costs refer to farming expenses which do change with output. Only variable costs are subtracted from gross returns due to the assumption that substitution of one alternative for another in the short-run will affect only variable costs. Hence, knowledge of gross returns and variable costs will give sufficient data to serve as a guide in determining which enterprises to expand.

Returns per acre from alfalfa are considerably higher than from alternative crops (Table VII). One may well question why farmers are

TABLE VII[a]

SUMMARY OF ESTIMATED RETURNS TO LAND, LABOR, CAPITAL AND MANAGEMENT FROM AN ACRE OF BROOMCORN AND ALTERNATIVE CROPS GROWN ON McLAIN, REINACH AND YAHOLA SOILS IN SOUTHCENTRAL OKLAHOMA

Crop	Yield Estimate[b] A (Customary Management)		Yield Estimate B (Good Management)		Yield Estimate C (Farmer Estimate)	
	Garvin Area	Grady-McClain Area	Garvin Area	Grady-McClain Area	Garvin Area	Grady-McClain Area
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Alfalfa	50.55	39.80	61.51	47.41	68.68	52.55
Corn	31.13	22.67	60.32	44.81	58.91	43.40
Wheat	22.45	16.42	28.06	20.02	44.14	32.08
Grain sorghum	24.76	18.91	29.68	21.49	28.51	20.32
Oats	18.59	13.41	21.55	14.89	20.07	13.41
Barley					23.48	16.41
Broomcorn					59.58[c]	37.28[c]
					73.59[d]	47.82[d]
					38.13[e]	22.17[e]

a/ Summary of Appendix Tables XII to XXV.
b/ See Appendix Table X for sources of yield estimates.
c/ Returns using average price 1953-1956.
d/ Returns using average price of upper two quartiles (1947 to 1956).
e/ Returns using average price of lower two quartiles (1947 to 1956).

not producing more alfalfa in the area. Perhaps land on which high yields (such as assumed in the budgets) can be obtained is limited. Also, the alfalfa aphid has been a major problem in recent years. The budget is computed for "normal" conditions. Since the aphid is considered an "abnormal" situation, spraying costs were not included.

Returns from an acre of corn are approximately equal to broomcorn under normal moisture and price conditions (Table VII). Data indicate corn acreage has been reduced in the area in recent years. Two primary reasons for this are (1) drought conditions and (2) European and Southwestern corn-borer infestation. The area has not been designated as a commercial corn-growing area; and, therefore, the farmers of this area are not eligible for government price supports.

Wheat returns are generally high, but acreage is limited due to government restrictions. A considerable acreage of grain sorghum is grown in the Grady-McClain area (Table III). Although returns from corn are higher under normal moisture conditions, data indicate grain sorghum will outyield corn on certain soils under low moisture conditions. Because grain sorghum is rated nearly as high as corn in feeding value, farmers may prefer the stability of grain sorghum yields in preference to the higher, but more variable, yields of corn.

Considering the problems of price uncertainty and high cash cost inherent in broomcorn production, why do farmers continue to plant large acreages when normal returns per acre are no greater than $59.58 and $37.28 in the Garvin and Grady-McClain areas, respectively? Disadvantages of producing alternative crops have already been discussed. Another factor may be the nature of price expectations. The returns of $73.59 and $47.82 in the Garvin and Grady-McClain areas, respectively, are examples of returns if the high price corresponding to P_1 in the cobweb illustration is received (Figure 3). If the expectation were realized, returns would be approximately equal to returns from alfalfa and would be considerably higher than returns to other crops budgeted.

Another factor influencing farmers to plant broomcorn is the high level of knowledge they possess of broomcorn production. Thus, farmers who use customary management for other crops may be using a good level of management for broomcorn. Where this condition exists, the Garvin return of $59.58 for broomcorn compares very favorably with Garvin yield estimate A (customary management) returns of $50.55 for alfalfa, $31.13 for corn, etc.

Yet another factor may be the low yield variability of broomcorn relative to other crops. Controlled yield experiments from 1927 to 1955 at the Southern Great Plains Field Station resulted in a coefficient of variation of .43 in yield of good brush of Black Spanish broomcorn, .48 for dwarf yellow milo, and .49 for Sharon kafir.[3]

The average farm in each group as defined in the preceeding chapter appears to possess sufficient flexibility and diversification to meet unfavorable broomcorn prices. Farmers of all groups should attempt to reduce broomcorn acreage variation from year to year. However, this is particularly true of Grady-McClain Group I where in-and-out characteristics are most evident. These farmers especially can increase income over time by improving broomcorn price expectations or holding acreage constant.

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[3]John B. Seiglinger and Robert A. Hunter, Forty-Second Annual Report of Sorghum and Broomcorn Investigations, Southern Great Plains Field Station, (Woodward, Oklahoma, 1955), pp. 68, 72 and 81.

As farm size increases, managers are concerned with which enterprises to expand. In general, high return crops such as alfalfa and corn should be expanded if soil conditions and other factors permit. Farmers of the Grady-McClain area may find grain sorghum higher and more stable in yield than corn, particularly on sandy soils.

Crop farmers of Group II in the Garvin and Grady-McClain areas may adjust by increasing livestock numbers to (1) reduce dependence on cash crops, (2) better utilize small grain and non-cropland pastures, and (3) make fuller use of available labor.

The foregoing statements have not supplied sufficient information for the individual farmer to make necessary adjustments on any given farm. Farmers need to appraise alternatives on a continuing basis through budgeting analysis to determine proper adjustments. Such analysis can be of an informal type. If possible, however, the farmer should make a complete budget analysis of his farm.

CHAPTER V

SUMMARY AND CONCLUSIONS

Two hypotheses were evaluated as sources of the high degree of annual price variation for broomcorn. The first hypothesis stated that unusually high fluctuations have resulted from an inelastic demand for broomcorn in the farmer-dealer market. The second hypothesis stated that the variability arises from cyclical fluctuations in quantity supplied as explained by the cobweb theorem.

To evaluate the two hypotheses, demand and supply were analyzed. Demand was estimated, using price as a function of production, income and vacuum cleaner production. In estimating supply, acres planted was considered a function of prices received by farmers for broomcorn last year, opportunity cost of producing other crops last year, yield of broomcorn last year, and time.

The estimated price elasticity of demand (-1.10) indicated demand is not highly inelastic at the farm level. Therefore, the first hypothesis was rejected, and the second hypothesis was examined as a source of the variation. About half of the annual variation in acres of broomcorn planted in Oklahoma was explained by price, opportunity cost, and yield variables in the preceeding year. Also, the survey data indicated the majority of the farmers who decreased acreage of broomcorn in 1956 did so because of price and yield conditions in 1955. This behavior of farmers gives rise to cyclical fluctuations in production. Thus, the second hypothesis was accepted as a major source of the unusually high price variation.

The broomcorn industry has also been characterized by a long-run decline in consumption and production of brush. Analysis of supply and demand revealed that supply has decreased, although the demand schedule has shifted to the right through time. Factors such as the reduced cost of harvesting competing crops to broomcorn and increased costs of producing broomcorn (increase in real wages with no reduction in labor requirements) have contributed to the reduction in supply.

Future adjustments by farmers to price variability and to the decline in consumption and production of broomcorn may take several forms. Farmers as a group could reduce annual price variation by holding acreage more nearly constant from year to year. They could reduce the impact of a given amount of broomcorn price variability upon their total farm incomes by: (1) reduction in the proportion of cropland per farm in broomcorn through expansion in farm size without a corresponding expansion in the broomcorn enterprise or (2) reduction in broomcorn acreage per farm through diversion of some land now used for broomcorn production to more stable enterprises.

Farmers might well sacrifice some flexibility and adjust toward long-term, high-return enterprises such as livestock and alfalfa. On the basis of budget estimates for the broomcorn producing areas in southcentral Oklahoma, expansion of the corn and alfalfa acreage appears promising.

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A P P E N D I C E S

APPENDIX A

SURVEY OF BROOMCORN PRODUCTION AND MARKETING

Area No.____________ Farm No.____________ Enumerator________________

Name of Farmer________________________ Address____________________

How many crops of broomcorn have you grown in the past 5 years?________
(If none, don't take the schedule from the farmer)

1. When did you make up your mind to plant (not plant) this year's crop of broomcorn? Month__________

2. What were the main reasons for your deciding to plant (not plant) broomcorn this year?________________________

   Is this more or less broomcorn than you planted last year? More______ Less____________ Same____________ Why did you plant this acreage?

   ____

3. If you couldn't grow broomcorn what would you consider growing on the land?

	Broomcorn alternative rank	Expected normal yield per acre	Fertilizer practices Kind	lbs./acre
Grain sorghum				
Corn				
Small grain				
Alfalfa				

4. In your opinion, what are the broomcorn marketing problems in this area?

   ____

5. Do you think the grading system used by the buyer is satisfactory to growers? Yes__________ No__________ Don't know________. If no, what improvement do you think should be made in the grading system?

   ____

Appendix A (Continued)

6. Why do you think broomcorn prices go up and down more than the price of other crops?____________________________________

7. Have you ever stored broomcorn? Yes_______ No_______. If no, what are the reasons you didn't store broomcorn?____________________

   If yes, what was the period of time that you stored? From______ To____

   How did storing affect: Weight__________ Quality_______ Price________

   How much money did you gain or lose per ton by storing?________________

8. At the present operating cost, what price of broomcorn do you feel you need to continue growing broomcorn? $ per ton______________

   What price of broomcorn do you need to break even on costs?___________

Land Operated, 1956

	Acres owned	Acres rented in	Acres rented out	Total acres
Cropland				
Open pasture				
Other land				
Total				

Use of Cropland, 1956

Crop	Acres owned	Acres rented in	Acres rented out	Total acres

Appendix A (Continued)

Operators Livestock, 1956

Kind	Number Jan. 1, 1956	Now	Kind	Number Jan. 1, 1956	Now
Workstock			Ewes		
Milk cows			Other sheep		
Other dairy			Goats		
Beef cows			Laying hens		
Other beef			Other chickens		
Sows			Other		
Other hogs					

Item	Machinery owned No.	Model or kind	Size	Year
Tractor				
Plows				
Etc.				

Building Facilities

	Size (Tons)	Age	Approximate replacement cost
Shed (broomcorn)	____________	________	______________

Number of Slats ________________.

If rented, explain agreement (who bought and keeps up slats, terms on lease of buildings, etc.).____

Appendix A (Continued)

	Growing	Harvesting	Marketing
Production Practices Crop Year:	________	________	________

Operation	Date	Crew men: Total	Crew men: No. of men over 16 yrs.	Acres per 10 hr. day	Times over	Labor per acre, man hrs.	Materials and supplies: Kind	Materials and supplies: Quantity	Wages or custom rate
Plow									
Seedbed preparation									
Other practices									

1. Cost per ton to put on the slats? (Harvesting Cost) $________

2. How many members of the family help with the harvest? ________

Crop Rotation

Planting	1956	1955	1954	1953	1952	1951
1.						
2.						

Expected Yield

Normal year	Moisture Level: Low	Moisture Level: Average	Moisture Level: High
	________	________	________

Record of Production and Marketing Practices and Prices

Year	Acres	Variety	Row spacing	Fertilizer practices: Kind	Fertilizer practices: Amt. per acre	Yield per acre	Date harvested	Date sold	Buyer	Place sold	Grade	Price per ton
1956												
Etc.												

1. Were you a member of the broomcorn association which was formed some years ago? Yes___ No___ Why do you think it failed?________

2. Do you think a broomcorn growers' association would be helpful in the marketing problem? Yes____ No____ Don't know____. If yes, what are the main things it could do in helping market broomcorn?________

APPENDIX B

BUDGET PROCEDURE

In the survey of 38 broomcorn producers taken in July 1956, farmers were asked to rank various alternative crops, in order of preference, to be grown on land on which broomcorn is normally grown. The response obtained served as the basis for selecting the crops to be singled out for a partial budget analysis.

Data needed to complete the budget analysis were obtained from several sources including college specialists, technical publications, county agents, and farmer surveys.

Input Data

Because preharvest operations did not differ markedly between the Garvin and Grady-McClain areas, a single, typical set of operations was compiled for each crop (Appendix Tables IV to IX). By using the "typical", some operations not performed by a majority of the farmers were omitted. Using broomcorn as an example, operations involving the disk plow, one-way, hoeme and knifer (go-devil) were omitted. However, because many of these minor operations are substitutes for major operations, total time requirements and costs are not changed by an appreciable amount.

Only a small percentage of the farmers surveyed possessed major harvesting machinery (Appendix Table I). Therefore, all major harvesting operations were computed as being custom hired.

Few farmers used fertilizer in 1956. Crops in the area do not respond well to fertilizer in years of low moisture, and after a series of drought years such as preceded 1956, most farmers had discontinued using fertilizer. To sustain high yields over a period of years, however, fertilizer is essential. One of the costs of producing a high soil nutrient-consuming crop such as alfalfa is the cost of replacing nutrients removed from the soil. A level of fertilizer application sufficient to maintain yield levels indicated in Appendix Table X is included in the budgets. Fertilizer is not included in the customary level of management, however.

Output Data

The Cleveland County Soil Survey[1] report on McLain, Reinach and Yahola soils was used to obtain the A and B yield estimates. The modal yield estimate of the three soils was used. Where a mode did not exist, a simple average was used. The C yield levels are based on estimates made by farmers during the survey. The figure is based upon normal moisture conditions on soil where broomcorn is generally grown. Because the relationship between yields is as important as yield levels, adjustments of farmer estimates were made to obtain the proper relationship. To accomplish this, yield data from secondary sources were secured for the three counties for the period from 1946 to 1951. The average yields of the three counties were divided into the average of farmer estimates for Garvin County. Garvin estimates were used because of the larger number of responses. After dividing, the median quotient was selected and was multiplied by the county averages from secondary sources to obtain the C-yield estimates for the Garvin area. The actual farmer estimates were used for corn, wheat and broomcorn.

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[1]W. H. Buckhannan, pp. 60-61.

A comparison between Garvin and Grady-McClain farmer yield estimates revealed the latter estimates to be approximately 80 per cent of the former. Thus, to compute the yield estimates for the Grady-McClain area, .80 was multiplied by the Garvin estimates.

All prices, with the exception of alfalfa and broomcorn, are the simple past four-year (1953-1956) average prices received by Oklahoma farmers for the various crops. An even number was used because of the two-year production cycle of broomcorn.

Alfalfa prices appeared to be abnormally high. Due to high transportation costs, alfalfa prices are raised more than grain prices during periods of drought and consequent short supply, such as occurred during several of the past years. To compute a normal price, simple averages were obtained of prices paid by farmers in the nation for alfalfa for the period from 1946 to 1950 and from 1953 to 1956.[2] Also, the average price received by Oklahoma farmers for baled alfalfa from 1946 to 1950 was computed. Since it was desired to determine an Oklahoma price for the 1953 to 1956 period which bore the same relationship to the United States price as existed during the normal period from 1946 to 1950, the following formula was used:

$$\frac{\text{Oklahoma price (1946-50)}}{\text{U. S. price (1946-50)}} = \frac{\text{Estimated normal Oklahoma price (1953-56)}}{\text{U. S. price (1953-56)}} =$$

$$\frac{\$24.61}{\$32.75} = \frac{\text{Estimated Oklahoma price}}{\$33.43}$$

Estimated normal Oklahoma price (1953-56) = $25.12 per ton.

Prices received for broomcorn by farmers in the Lindsay area average higher than state prices due to quality differences. A survey conducted

[2] Prices received by farmers for alfalfa were not available.

of buyers in the spring of 1957 revealed buyers estimated Lindsay broomcorn to be worth $82 more per ton than brush produced in Colorado, Kansas, Texas and New Mexico. Therefore, to determine the Garvin area price, $82 was added to the 1953 to 1956 average price received for broomcorn by farmers in the above-mentioned states. The Grady-McClain area produces broomcorn of lower quality. The Grady-McClain price was set below the Garvin price by the same proportion as existed in 1955, a year for which actual prices received by surveyed farmers was computed.

The above method was modified to compute two additional broomcorn price estimates. The cobweb theorem indicates farmers form price expectations of a bimodal nature over time. Thus, instead of an average price, they expect a high and low price alternate years, depending upon last year's price. The higher price (Garvin, $457) estimate conforming to price P_1 of Figure 3 was found by computing the mean of the upper two quartiles of prices received for the period from 1947 to 1956. The lower price (Garvin, $333) was found by computing the mean of the lower two quartiles.

Prices and yields are for normal conditions. Farmers may substitute their own prices and yields for individual conditions.

APPENDIX TABLE I

NUMBER OF FARMERS OWNING HARVESTING MACHINES ON FARMS SURVEYED IN SOUTHCENTRAL OKLAHOMA

Machine	Garvin area	Grady-McClain area
Total number of farmers	21	17
No. of farmers surveyed who own:[a/]		
Combine	7	5
Cornpicker	5	4
Baler, pickup	10	5
Broomcorn thresher (seeder)	9	1
Broomcorn baler	1	2

a/ Farmers who owned one-half interest were computed as full owners.

APPENDIX TABLE II

VARIABLE COST PER HOUR TO OPERATE FARM MACHINES

Machine (Typical)	Size	New price[a/]	Repairs percent of new price[b/]	Repair cost per year	No. days operated per year[b/]	Repair in cost per hour	Cost of lubrication per hour	Total variable cost per hour	Total variable cost per hour with tractor
		Dollars	Percent	Dollars		Dollars	Dollars	Dollars	Dollars
Tractor, row crop	2 plow	2350	3.5	82.25	86	.10	.02	.12	.55[c/]
Plow, mold board	2-14 inch	300	7	21.00	20	.11	.02	.13	.68
Harrow, disk, tandem	7 foot	235	3	7.05	14	.05	.03	.08	.63
Harrow, spiketooth	3 section	95	1	.95	11	.01	.01	.02	.57
Harrow, springtooth	2 section	90	1	.90	11	.01	.01	.02	.57
Lister, with planter	2 row	330	5	16.50	13	.13	.02	.15	.70
Drill	10 foot	500	1.5	7.50	10	.08	.03	.11	.66
Cultivator	2 row	285	3.5	9.98	14	.07	.02	.09	.64
Rake	10 foot	400	2	8.00	10	.08	.02	.10	.60[d/]
Mower	7 foot	300	3.5	10.50	10	.11	.02	.13	.63[d/]

a/ Source: Carol Rickstrew, (farm equipment company, 500 East 12th, Stillwater, Oklahoma), and "Agricultural Prices", United States Department of Agriculture, Agricultural Marketing Service, Crop Reporting Board, (Washington 25, D.C., October 15, 1956), p. 30.

b/ Source: F. C. Fenton and G. E. Fairbanks, The Cost of Using Farm Machinery, Engineering Experiment Station Bulletin 74 (Kansas State College, September 1, 1954), pp. 13 and 24.

c/ See Appendix Table III.

d/ Tractor cost $.50/hour due to reduced fuel consumption.

APPENDIX TABLE III

VARIABLE COST PER HOUR TO OPERATE TRACTOR[a/]

Item		Cost per hour[b/]
		Dollars
Gasoline	1.70 gal./hr. at $.225/gal.	.38
Oil	52 gal./yr. at $.80/gal. = $41.60	
	$\frac{41.60}{860 \text{ hrs./yr.}}$	.05
Lubrication		.02
Repair		.10
Total variable cost per hour		.55

a/ Source of oil, lubrication and repair estimates: F. C. Fenton and G. E. Fairbanks, The Cost of Using Farm Machinery, Engineering Experiment Station Bulletin 74, Kansas State College (Manhattan, Kansas, September 1, 1954), p. 24 and 25.

b/ Source of gasoline, oil and grease prices: Farmers Co-op Incorporated, (723 North Main Street, Stillwater, Oklahoma).

APPENDIX TABLE IV

TYPICAL PREHARVEST OPERATIONS, TIME REQUIREMENTS AND COSTS OF PRODUCING AN ACRE OF ALFALFA IN SOUTHCENTRAL OKLAHOMA

Operation[a]	Size of equipment	Times over[b]	Acres per 10-hour day	Time per acre[c]	Total time per acre	Cost of operation per hour[d]	Cost of operation per acre
				Hours	Hours	Dollars	Dollars
Plow, moldboard	2-14 inch	1	8.5	1.18	1.18	.68	.80
Harrow, disk, tandem	7 foot	3	20	.50	1.50	.63	.95
Harrow, springtooth	2 section	3	30	.33	1.00	.57	.57
Harrow, spiketooth	3 section	2	45	.22	.44	.57	.25
Drill	10 foot	1	25	.40	.40	.66	.26
Total					4.52		2.83

a/ Source of typical operations and times over data: Wesley Chaffin, Agronomist, United States Department of Agriculture, Agricultural Extension Service, (Stillwater, Oklahoma).

b/ The preharvest operations listed above are performed only when alfalfa is seeded, i.e., approximately once per five years.

c/ Does not include time for servicing.

d/ See Appendix Table II.

APPENDIX TABLE V

TYPICAL PREHARVEST OPERATIONS, TIME REQUIREMENTS AND COSTS OF PRODUCING AN ACRE OF BROOMCORN IN SOUTHCENTRAL OKLAHOMA[a/]

Operation	Size of equipment[b/]	Times over	Acres per 10-hour day	Time per acre[c/]	Total time per acre	Cost of operation per hour[d/]	Cost of operation per acre
				Hours	Hours	Dollars	Dollars
Stalk cutter	2 row	1	40	.25	.25	.55	.14
Plow, moldboard	2-14 inch	1	8.5	1.18	1.18	.68	.80
Lister	2 row	1.4	18	.56	.78	.70	.55
Harrow, disk, tandem	7 foot	1.2	20	.50	.60	.63	.38
Harrow, spiketooth	3 section	1.3	45	.22	.29	.57	.17
Planter, lister	2 row	1.3	15	.67	.87	.70	.61
Cultivator	2 row	3.4	20	.50	1.70	.64	1.09
Total					5.67		3.74

a/ Source of data: Survey of 38 Garvin, Grady and McClain county broomcorn producers in August, 1956.

b/ Typical set of equipment.

c/ Does not include time for servicing.

d/ See Appendix Table II.

APPENDIX TABLE VI

TYPICAL PREHARVEST OPERATIONS, TIME REQUIREMENTS
AND COSTS OF PRODUCING AN ACRE OF CORN
IN SOUTHCENTRAL OKLAHOMA

Operation[a/]	Size of equipment[b/]	Times over	Acres per 10-hour day	Time per acre[c/]	Total time per acre	Cost of operation per hour[d/]	Cost of operation per acre
				Hours	Hours	Dollars	Dollars
Plow, mold board	2-14 inch	1	8.5	1.18	1.18	.68	.80
Harrow, disk, tandem	7 foot	1.4	20	.50	.70	.63	.44
Harrow, spiketooth	3 section	1.3	45	.22	.29	.57	.17
Plant, lister	2 row	1.0	15	.67	.67	.70	.47
Cultivate	2 row	3.0	20	.50	1.50	.64	.96
Total					4.34		2.84

a/ Source of operation and times over data: Crop Production Practices, F.M. 92, U. S. Department of Agriculture, Bureau of Agricultural Economics (Washington 25, D. C., January 1953), pp. 54 and 55.

b/ Typical set of equipment.

c/ Does not include time for servicing.

d/ See Appendix Table II.

APPENDIX TABLE VII

TYPICAL PREHARVEST OPERATIONS, TIME REQUIREMENTS AND COSTS OF PRODUCING AN ACRE OF WHEAT IN SOUTHCENTRAL OKLAHOMA

Operation a/	Size of equipment b/	Times over	Acres per 10-hour day	Time per acre c/	Total time per acre	Cost of operation per hour d/	Cost of operation per acre
				Hours	Hours	Dollars	Dollars
Plow, moldboard	2-14 inch	1.0	8.5	1.18	1.18	.68	.80
Harrow, disk, tandem	7 foot	1.3	20	.50	.65	.63	.41
Harrow, spiketooth	3 section	1.4	45	.22	.31	.57	.18
Seed, drill	10 foot	1.0	25	.40	.40	.66	.26
Total					2.54		1.65

a/ Source of operations and times over data: Crop Production Practices, F. M. 92, United States Department of Agriculture, Bureau of Agricultural Economics (Washington 25, D. C., January 1953), pp. 204 and 205.

b/ Typical set of equipment.

c/ Does not include time for servicing.

d/ See Appendix Table II.

APPENDIX TABLE VIII

TYPICAL PREHARVEST OPERATIONS, TIME REQUIREMENTS AND COSTS OF PRODUCING AN ACRE OF GRAIN SORGHUM IN SOUTHCENTRAL OKLAHOMA

Operation[a]	Size of equipment[b]	Times over	Acre per 10-hour day	Time per acre[c]	Total time per acre	Cost of operation per hour[d]	Cost of operation per acre
				Hours	Hours	Dollars	Dollars
Plow, moldboard	2-14 inch	1	8.5	1.18	1.18	.68	.80
Harrow, disk, tandem	7 foot	1.5	20	.50	.75	.63	.47
Harrow, spiketooth	3 section	1.5	45	.22	.33	.57	.19
Plant, lister	2 row	1	15	.67	.67	.70	.47
Cultivator	2 row	2.5	20	.50	1.25	.64	.80
Total					4.18		2.73

a/ Source of operation and times over data: Survey of 22 Caddo County grain sorghum producers in August, 1956.

b/ Typical set of equipment.

c/ Does not include time for servicing.

d/ See Appendix Table II.

APPENDIX TABLE IX

TYPICAL PREHARVEST OPERATIONS, TIME REQUIREMENTS AND COSTS OF PRODUCING AN ACRE OF OATS AND BARLEY IN SOUTHCENTRAL OKLAHOMA

Operation[a/]	Size of equipment[b/]	Times over	Acres per 10-hour day	Time per acre[c/]	Total time per acre	Cost of operation per hour[d/]	Cost of operation per acre
				Hours	Hours	Dollars	Dollars
Plow, moldboard	2-14 inch	1.0	8.5	1.18	1.18	.68	.80
Harrow, disk, tandem	7 foot	1.1	20	.50	.55	.63	.35
Harrow, spiketooth	3 section	1.4	45	.22	.31	.57	.18
Seed, drill	10 foot	1.0	25	.40	.40	.66	.26
Total					2.44		1.59

a/ Source of operations and times over data: Crop Production Practices, F. M. 92, United States Department of Agriculture, Bureau of Agricultural Economics (Washington 25, D. C., January 1953), pp. 130 and 131.

b/ Typical set of equipment.

c/ Does not include time for servicing.

d/ See Appendix Table II.

APPENDIX TABLE X

ESTIMATED YIELD PER ACRE OF BROOMCORN AND ALTERNATIVE CROPS ON McLAIN, REINACH AND YAHOLA SOILS IN SOUTHCENTRAL OKLAHOMA

		Soil Survey Yield Estimates a/				Farmer Yield Estimates b/ (adjusted)	
		A c/		B d/		C	
		Garvin area	Grady-McClain area	Garvin area	Grady-McClain area	Garvin area	Grady-McClain area
Alfalfa	(tons)	3.0	2.4	4.0	3.2	4.4	3.5
Corn	(bushel)	28	22	55	44	54	43
Wheat	(bushel)	15	12	20	16	28	22
Grain sorghum	(bushel)	27	22	35	28	34	27
Oats	(bushel)	35	28	45	36	43	34
Barley	(bushel)					35	28
Broomcorn	(tons)					.286	.229

a/ Source: W. H. Buckhannan, Soil Survey, Cleveland County, Oklahoma, United States Department of Agriculture, Oklahoma Agricultural Experiment Station, (October 1954), pp. 60 and 61.

b/ Source: Survey of 38 farmers conducted in southcentral Oklahoma during July 1956.

c/ A estimate for customary management

d/ B estimate for good management.

APPENDIX TABLE XI

FERTILIZER REQUIREMENTS TO MAINTAIN HIGH YIELDS ON McLAIN, REINACH AND YAHOLA SOILS IN SOUTHCENTRAL OKLAHOMA

	Fertilizer Application[a/]			
Crop	Frequency of Application	Kind	Amount	Cost per cwt.[b/]
			Lbs.	Dollars
Alfalfa	Annual	0-45-0	150	3.75
	Once per three yrs.	0-0-60	100	2.50
Corn	Annual	16-20-0[c/]	200	4.44
Broomcorn	Annual	16-20-0	100	4.44
Wheat	Annual	16-20-0	100	4.44
Grain sorghum	Annual	16-20-0	100	4.44
Barley	Annual	16-20-0	100	4.44
Oats	Annual	16-20-0	100	4.44

a/ Source: Soil and Crop Factors for Fertilizer Recommendations 1957 Mimeographed Circular M-282, Department of Agronomy, Oklahoma State University, (Stillwater, Oklahoma, November, 1956).

b/ Source: Ahrberg Milling Company, (512 E. 12th Street, Stillwater Oklahoma).

c/ 10-20-10 may be substituted for 16-20-0 under certain conditions. The cost of 10-20-10 is $4.18 per cwt. This substitution may be made whenever 16-20-0 appears in the table.

APPENDIX TABLE XII

ESTIMATED VARIABLE PRODUCTION COSTS AND RETURNS FROM AN ACRE OF ALFALFA GROWN ON McLAIN, REINACH AND YAHOLA SOILS IN SOUTHCENTRAL OKLAHOMA (Garvin Area)

Item		Cost per acre		
		Dollars		
Preharvest Cost		A		B and C
Seed and treatment 18 lbs. at $.23/lb./5 yrs.		.83		.83
Machinery repair, gas, oil, lubrication $2.83/5 yrs.[a/]		.57		.57
Fertilizer[b/] 150 lbs. 0-45-0 at $3.75/cwt.				5.63
100 lbs. 0-0-60 at $2.50/cwt./3 yrs.				.83
Cost of application (with grain drill fertilizer attachment)				.26
TOTAL PREHARVEST COST		1.40		8.12
Harvest Cost		A	B	C
Mow (4 cuttings)	.29 hrs./acre at $.63/hr.	.73	.73	.73
Rake	.25 hrs./acre at $.60/hr.	.60	.60	.60
Baling	$.16 bale (custom)[c/]	14.72	19.68	21.60
Hauling	$.08/bale (custom)	7.36	9.84	10.80
TOTAL HARVEST COST		23.41	30.85	33.73
Total Variable Cost		24.81	38.97	41.85

Yield estimate[d/]	Yield per acre	Unit	Price per unit	Gross returns per acre	Less variable costs	Returns to land, labor, capital and management
			Dollars	Dollars	Dollars	Dollars
A	3	ton	25.12	75.36	24.81	50.55
B	4	ton	25.12	100.48	38.97	61.51
C	4.4	ton	25.12	110.53	41.85	68.68

a/ See Appendix Table IV.

b/ ASC payments may reduce fertilizer costs. See Appendix Table XI for fertilizer application.

c/ Source of all baling, combining and cornpicking rates: E. A. Tucker, Odell L. Walker and D. B. Jeffrey, Custom Rates for Farm Operations in Oklahoma, Experiment Station Bulletin No. B-473, Oklahoma State University (Stillwater, Oklahoma, July, 1956).

d/ A, customary management; B, good management; and C, farmer estimate.

APPENDIX TABLE XIII

ESTIMATED VARIABLE PRODUCTION COSTS AND RETURNS FROM AN ACRE OF BROOMCORN GROWN ON McLAIN, REINACH AND YAHOLA SOILS IN SOUTHCENTRAL OKLAHOMA
(Garvin Area)

Item	Cost per acre
Preharvest Cost	Dollars
Seed and treatment 2.5 lbs. at $.25/lb.	$ .63
Machinery repair, gas, oil, lubrication[a/]	3.74
Fertilizer 100 lbs. 16-20-0 at $4.44/cwt.	4.44
TOTAL PREHARVEST COST	$ 8.81
Harvest Cost[b/]	
Cutting .286 tons at 93.91 hrs./ton ($1.00/hr.)	26.86
Hauling in .286 tons at 13.50 hrs./ton	3.86
Threshing	
Labor .286 tons at 26.69 hrs./ton	7.63
Machine (seeder) .286 tons at $10.00/ton	2.86
Baling	
Labor and machine[c/] .286 tons at $16.25/ton	4.65
Wire[d/] .286 ton at $1.50/ton	.43
Hauling to market .286 ton at $3.75/ton	1.07
Machinery repairs, gas, oil, lubrication 2 hrs./acre at $.47/hr.	.94
TOTAL HARVEST COST	$48.30
Total Variable Cost	57.11

Yield estimate[e/]	Yield per acre	Unit	Price per unit	Gross returns per acre	Less variable costs	Returns to land, labor, capital and management
			Dollars	Dollars	Dollars	Dollars
C	.286 (ton/3.5 acres)	ton	408	116.69	57.11	59.58
	.286	ton	457[f/]	130.70	57.11	73.59
	.286	ton	333[f/]	95.24	57.11	38.13

a/ See Appendix Table V.

b/ Harvest cost per ton may deviate considerably from this estimate, depending on yield, stand, etc.

c/ Usual custom rate $3.25 per bale for machine and labor. Assume 400 lbs./ bale.

d/ Wire cost $.30 per bale.

e/ C, farmer estimate.

f/ Average price of upper two quartiles ($457) and of lower two quartiles ($333), 1947 to 1956.

APPENDIX TABLE XIV

ESTIMATED VARIABLE PRODUCTION COSTS AND RETURNS FROM AN ACRE OF CORN GROWN ON McLAIN, REINACH AND YAHOLA SOILS IN SOUTHCENTRAL OKLAHOMA (Garvin Area)

Item		Cost per acre	
		Dollars	
Preharvest Cost	A		B and C
Seed and treatment 7 lbs. at $.18/lb.	1.26		1.26
Machinery repair, gas, oil and lubrication a/	2.84		2.84
Fertilizer 200 lb. 16-20-0 at $4.44/cwt.			8.88
TOTAL PREHARVEST COST	4.10		12.98
Harvest Cost	A	B	C
Picking (custom)	4.25	4.25	4.25
Hauling (custom) $.05/bu.	1.40	2.75	2.70
TOTAL HARVEST COST	5.65	7.00	6.95
Total Variable Cost	9.75	19.98	19.93

Yield estimate b/	Yield per acre	Unit	Price per unit	Gross returns per acre	Less variable costs	Returns to land, labor, capital and management
			Dollars	Dollars	Dollars	Dollars
A	28	bu.	1.46	40.88	9.75	31.13
B	55	bu.	1.46	80.30	19.98	60.32
C	54	bu.	1.46	78.84	19.93	58.91

a/ See Appendix Table VI.

b/ A, customary management; B, good management; C, farmer estimate.

APPENDIX TABLE XV

ESTIMATED VARIABLE PRODUCTION COSTS AND RETURNS FROM AN ACRE OF WHEAT GROWN ON McLAIN, REINACH AND YAHOLA SOILS IN SOUTHCENTRAL OKLAHOMA (Garvin Area)

Item	Cost per acre		
	Dollars		
Preharvest Cost	A		B and C
Seed and treatment 1 bu. at $2.05/bu.	2.05		2.05
Machinery repair, gas, oil, lubrication a/	1.65		1.65
Fertilizer 100 lbs. 16-20-0 at $4.44/cwt.			4.44
TOTAL PREHARVEST COST	3.70		8.14
Harvest Cost	A	B	C
Combining (custom)	4.00	4.00	4.00
Hauling (custom) $.05/bu.	.75	1.00	1.40
TOTAL HARVEST COST	4.75	5.00	5.40
Total Variable Cost	8.45	13.14	13.54

Yield estimate b/	Yield per acre	Unit	Price per unit	Gross returns per acre	Less variable costs	Returns to land, labor, capital and management
			Dollars	Dollars	Dollars	Dollars
A	15	bu.	2.06	30.90	8.45	22.45
B	20	bu.	2.06	41.20	13.14	28.06
C	28	bu.	2.06	57.68	13.54	44.14

a/ See Appendix Table VII.

b/ A, customary management; B, good management; C, farmer estimate.

APPENDIX TABLE XVI

ESTIMATED VARIABLE PRODUCTION COSTS AND RETURNS FROM AN ACRE OF GRAIN SORGHUM GROWN ON McLAIN, REINACH AND YAHOLA SOILS IN SOUTHCENTRAL OKLAHOMA (Garvin Area)

Item	Cost per acre		
	Dollars		
Preharvest Cost	A		B and C
Seed and treatment 4.5 lbs. at $.023/lb	.10		.10
Machinery repair, gas, oil, lubrication[a]	2.73		2.73
Fertilizer 100 lbs. 16-20-0 at $4.44/cwt.			4.44
TOTAL PREHARVEST COST	2.83		7.27
Harvest Cost	A	B	C
Combining (custom)	4.00	4.00	4.00
Hauling (custom) $.05/bu.	1.35	1.75	1.70
TOTAL HARVEST COST	5.35	5.75	5.70
Total Variable Cost	8.18	13.02	12.97

Yield estimate[b]	Yield per acre	Unit	Price per unit	Gross returns per acre	Less variable costs	Returns to land, labor, capital and management
			Dollars	Dollars	Dollars	Dollars
A	27	bu.	1.22	32.94	8.18	24.76
B	35	bu.	1.22	42.70	13.02	29.68
C	34	bu.	1.22	41.48	12.97	28.51

a/ See Appendix Table VIII.

b/ A, customary; B, good management; C, farmer estimate.

APPENDIX TABLE XVII

ESTIMATED VARIABLE PRODUCTION COSTS AND RETURNS FROM AN ACRE OF BARLEY GROWN ON McLAIN, REINACH AND YAHOLA SOILS IN SOUTHCENTRAL OKLAHOMA (Garvin Area)

Item	Cost per acre
	Dollars
Preharvest Cost	C
Seed and treatment 2 bu. at $.92/bu.	1.84
Machinery repair, gas, oil and lubrication a/	1.59
Fertilizer 100 lbs. 16-20-0 at $4.44/cwt.	4.44
TOTAL PREHARVEST COST	7.87
Harvest Cost	B
Combining (custom)	4.00
Hauling (custom) $.05/bu.	1.75
TOTAL HARVEST COST	5.75
Total Variable Cost	13.62

Yield estimate b/	Yield per acre	Unit	Price per unit	Gross returns per acre	Less variable costs	Returns to land, labor, capital and management
			Dollars	Dollars	Dollars	Dollars
C	35	bu.	1.06	37.10	13.62	23.48

a/ See Appendix Table IX.

b/ C, farmer estimate.

APPENDIX TABLE XVIII

ESTIMATED VARIABLE PRODUCTION COSTS AND RETURNS FROM AN ACRE OF OATS GROWN ON McLAIN, REINACH AND YAHOLA SOILS IN SOUTHCENTRAL OKLAHOMA (Garvin Area)

Item	Cost per acre		
	Dollars		
Preharvest Cost	A		B and C
Seed and treatment 2 bu. at $.86/bu.	1.72		1.72
Machinery repair, gas, oil, lubrication[a/]	1.59		1.59
Fertilizer 100 lbs. 16-20-0 at $4.44/cwt.			4.44
TOTAL PREHARVEST COST	3.31		7.75
Harvest Cost	A	B	C
Combining (custom)	4.00	4.00	4.00
Hauling (custom) $.05/bu.	1.75	2.25	2.15
TOTAL HARVEST COST	5.75	6.25	6.15
Total Variable Cost	9.06	14.00	13.90

Yield estimate[b/]	Yield per acre	Unit	Price per unit	Gross returns per acre	Less variable costs	Returns to land, labor, capital and management
			Dollars	Dollars	Dollars	Dollars
A	35	bu.	.79	27.65	9.06	18.59
B	45	bu.	.79	35.55	14.00	21.55
C	43	bu.	.79	33.97	13.90	20.07

a/ See Appendix Table IX.

b/ A, customary management; B, good management; C, farmer estimate.

APPENDIX TABLE XIX

ESTIMATED VARIABLE PRODUCTION COSTS AND RETURNS FROM AN ACRE OF ALFALFA GROWN ON McLAIN, REINACH AND YAHOLA SOILS IN SOUTHCENTRAL OKLAHOMA (Grady-McClain Area)

Item		Cost per acre		
		Dollars		
		A	B	C
	TOTAL PREHARVEST COST[a/]	1.40	8.12	8.12
Harvest cost				
Mow (4 cuttings)	.29 hrs./acre at $.63/hr.	.73	.73	.73
Rake	.25 hrs./acre at $.63/hr.	.60	.60	.60
Baling	$.16/bale (custom)	11.84	15.68	17.28
Hauling	$.08/bale (custom)	5.92	7.84	8.64
	TOTAL HARVEST COST	19.09	24.85	27.25
	Total Variable Cost	20.49	32.97	35.37

Yield estimate[b/]	Yield per acre	Unit	Price per unit	Gross returns per acre	Less variable costs	Returns to land, labor, capital, and management
			Dollars	Dollars	Dollars	Dollars
A	2.4	ton	25.12	60.29	20.49	39.80
B	3.2	ton	25.12	80.38	32.97	47.41
C	3.5	ton	25.12	87.92	35.37	52.55

a/ See Appendix Table XII.

b/ A, customary management; B, good management; C, farmer estimate.

APPENDIX TABLE XX

ESTIMATED VARIABLE PRODUCTION COSTS AND RETURNS FROM AN ACRE OF BROOMCORN GROWN ON McLAIN, REINACH AND YAHOLA SOILS IN SOUTHCENTRAL OKLAHOMA
(Grady-McClain Area)

Item		Cost per acre
		Dollars
		C
	TOTAL PREHARVEST COST[a/]	$ 8.81
Harvest Cost[b/]		
Cutting	.229 ton at 92.60 hrs./ton ($1.00/hr.)	21.21
Hauling in	.229 ton at 13.76 hrs./ton	3.15
Threshing		
Labor	.229 ton at 19.68 hrs./ton	4.51
Machine (seeder)	.229 ton at $10.00/ton (custom)	2.29
Baling		
Labor	.229 ton at 13 man hrs./ton	2.98
Machine(custom)[c/]	.229 ton at $5.00/ton	1.15
Wire[d/]	.229 ton at $1.50/ton	.34
Hauling to mkt.	.229 ton at $5.00/ton	1.15
Machinery repair, gas, oil, lubrication	2 hrs./acre at $.47/hr.	.94
	TOTAL HARVEST COST	$37.72
	Total Variable Cost	46.53

Yield estimate[e/]	Yield per acre	Unit	Price per unit	Gross returns per acre	Less variable costs	Returns to land, labor, capital and management
			Dollars	Dollars	Dollars	Dollars
C	.229 (4.4 acres/ton)	ton	366	83.81	46.53	37.28
	.229	ton	412[f/]	94.35	46.53	47.82
	.229	ton	300[f/]	68.70	46.53	22.17

a/ See Appendix Table XIII.

b/ Harvest cost per ton may deviate considerably from this estimate, depending upon yield, stand, etc.

c/ Usual custom rate $1.00 per bale for machine. Assume 400 lbs. per bale.

d/ Wire cost $.30 per bale.

e/ C, farmer estimate.

f/ Average price of upper two quartiles ($412) and of lower two quartiles ($300), 1947 to 1956.

APPENDIX TABLE XXI

ESTIMATED VARIABLE PRODUCTION COSTS AND RETURNS FROM AN ACRE OF CORN GROWN ON McLAIN, REINACH AND YAHOLA SOILS IN SOUTHCENTRAL OKLAHOMA (Grady-McClain Area)

Item	Cost per acre		
	Dollars		
	A	B	C
TOTAL PREHARVEST COST[a/]	4.10	12.98	12.98
Harvest Cost			
Picking (custom)	4.25	4.25	4.25
Hauling (custom) $.05/bu.	1.10	2.20	2.15
TOTAL HARVEST COST	5.35	6.45	6.40
Total Variable Cost	9.45	19.43	19.38

Yield estimate[b/]	Yield per acre	Unit	Price per unit	Gross returns per acre	Less variable costs	Returns to land, labor, capital and management
			Dollars	Dollars	Dollars	Dollars
A	22	bu.	1.46	32.12	9.45	22.67
B	44	bu.	1.46	64.24	19.43	44.81
C	43	bu.	1.46	62.78	19.38	43.40

a/ See Appendix Table XIV.

b/ A, customary management; B, good management; C, farmer estimate.

APPENDIX TABLE XXII

ESTIMATED VARIABLE PRODUCTION COSTS AND RETURNS FROM AN ACRE OF WHEAT GROWN ON McLAIN, REINACH AND YAHOLA SOILS IN SOUTHCENTRAL OKLAHOMA (Grady-McClain Area)

Item		Cost per acre	
		Dollars	
	A	B	C
TOTAL PREHARVEST COST[a/]	3.70	8.14	8.14
Harvest Cost			
Combining (custom)	4.00	4.00	4.00
Hauling (custom) $.05/bu.	.60	.80	1.10
TOTAL HARVEST COST	4.60	4.80	5.10
Total Variable Cost	8.30	12.94	13.24

Yield estimate[b/]	Yield per acre	Unit	Price per unit	Gross returns per acre	Less variable costs	Returns to land, labor, capital and management
			Dollars	Dollars	Dollars	Dollars
A	12	bu.	2.06	24.72	8.30	16.42
B	16	bu.	2.06	32.96	12.94	20.02
C	22	bu.	2.06	45.32	13.24	32.08

a/ See Appendix Table XV.

b/ A, customary management; B, good management; C, farmer estimate.

APPENDIX TABLE XXIII

ESTIMATED VARIABLE PRODUCTION COSTS AND RETURNS FROM AN ACRE OF GRAIN SORGHUM GROWN ON McLAIN, REINACH AND YAHOLA SOILS IN SOUTH-CENTRAL OKLAHOMA
(Grady-McClain Area)

Item	Cost per acre		
	Dollars		
	A	B	C
TOTAL PREHARVEST COST[a/]	2.83	7.27	7.27
Harvest Cost			
Combining (custom)	4.00	4.00	4.00
Hauling (custom) $.05/bu.	1.10	1.40	1.35
TOTAL HARVEST COST	5.10	5.40	5.35
Total Variable Cost	7.93	12.67	12.62

Yield estimate[b/]	Yield per acre	Unit	Price per unit	Gross returns per acre	Less variable costs	Returns to land, labor, capital and management
			Dollars	Dollars	Dollars	Dollars
A	22	bu.	1.22	26.84	7.93	18.91
B	28	bu.	1.22	34.16	12.67	21.49
C	27	bu.	1.22	32.94	12.62	20.32

a/ See Appendix Table XVI.

b/ A, customary management; B, good management; C, farmer estimate.

APPENDIX TABLE XXIV

ESTIMATED VARIABLE PRODUCTION COSTS AND RETURNS FROM AN ACRE OF BARLEY GROWN ON McLAIN, REINACH AND YAHOLA SOILS IN SOUTHCENTRAL OKLAHOMA (Grady-McClain Area)

Item		Cost per acre
		Dollars
		C
	TOTAL PREHARVEST COST[a/]	7.87
Harvest Cost		
Combining (custom)		4.00
Hauling (custom) $.05/bu.		1.40
	TOTAL HARVEST COST	5.40
	Total Variable Cost	13.27

Yield estimate[b/]	Yield per acre	Unit	Price per unit	Gross returns per acre	Less variable costs	Returns to land, labor, capital and management
			Dollars	Dollars	Dollars	Dollars
C	28	bu.	1.06	29.68	13.27	16.41

a/ See Appendix Table XVII.

b/ C, farmer estimate.

APPENDIX TABLE XXV

ESTIMATED VARIABLE PRODUCTION COSTS AND RETURNS FROM AN ACRE OF OATS GROWN ON McLAIN, REINACH AND YAHOLA SOILS IN SOUTHCENTRAL OKLAHOMA (Grady-McClain Area)

Item	Costs per acre		
	Dollars		
	A	B	C
TOTAL PREHARVEST COST[a/]	3.31	7.75	7.75
Harvest Cost			
Combining (custom)	4.00	4.00	4.00
Hauling (custom) $.05/bu.	1.40	1.80	1.70
TOTAL HARVEST COST	5.40	5.80	5.70
Total Variable Cost	8.71	13.55	13.45

Yield estimate[b/]	Yield per acre	Unit	Price per unit	Gross returns per acre	Less variable costs	Returns to land, labor, capital and management
			Dollars	Dollars	Dollars	Dollars
A	28	bu.	.79	22.12	8.71	13.41
B	36	bu.	.79	28.44	13.55	14.89
C	34	bu.	.79	26.86	13.45	13.41

a/ See Appendix Table XVIII.

b/ A, customary management; B, good management; C, farmer estimate.

APPENDIX TABLE XXVI

BROOMCORN ACREAGE, YIELD, PRODUCTION, PRICE AND VALUE FOR OKLAHOMA (1919-1956)[a/]

Year	Acreage Planted (1,000 acres)	Acreage Harvested (1,000 acres)	Yield per harvested acre (Pounds)	Production (Tons)	Season's average price per ton	Farm value ($1,000)
1919		233	307	35,800	145	5,191
1920		178	250	22,200	114	2,531
1921		146	330	24,100	67	1,615
1922		195	210	20,500	214	4,387
1923		273	240	32,800	153	5,018
1924		246	369	45,400	84	3,814
1925		120	210	12,600	132	1,663
1926		169	350	29,600	71	2,102
1927		106	370	19,600	98	1,921
1928		128	360	23,000	109	2,507
1929	152	125	287	17,900	119	2,130
1930	208	164	220	18,000	80	1,440
1931	167	144	290	20,900	51	1,066
1932	180	150	250	18,800	39	733
1933	127	103	225	11,600	106	1,230
1934	188	135	140	9,400	153	1,438
1935	284	210	210	22,000	83	1,826
1936	80	100	170	8,500	131	1,114
1937	132	100	300	15,000	70	1,050
1938	95	76	310	11,800	71	838
1939	75	61	268	8,200	105	861
1940	95	84	310	13,000	71	923
1941	63	60	340	10,200	135	1,377
1942	65	62	385	11,900	180	2,142
1943	67	58	325	9,400	291	2,735
1944	115	109	375	20,400	230	4,692
1945	91	80	290	11,600	275	3,190
1946	110	102	295	15,000	305	4,575
1947	82	75	320	12,000	310	3,720
1948	65	59	300	8,800	325	2,860
1949	80	72	295	10,600	255	2,703
1950	67	59	320	9,400	380	3,572
1951	91	83	315	13,100	450	5,895
1952	96	87	295	12,800	450	5,760
1953	115	97	300	14,600	325	4,745
1954	92	78	215	8,400	415	3,486
1955	116	105	325	17,100	228	3,899
1956[b/]		65	220	7,200	480	

a/ Source: United States Department of Agriculture, Agricultural Statistician (Oklahoma City, Oklahoma). "Broomcorn," Statistical Bulletin No. 155, USDA, Agricultural Marketing Service (Washington, D. C. February, 1955).

b/ Preliminary.

APPENDIX TABLE XXVII

BROOMCORN ACREAGE, YIELD, PRODUCTION, FARM PRICE AND VALUE FOR THE UNITED STATES (1929-1956)a/

Year	Acreage harvested	Yield per acre	Production	Season's average price per short ton	Farm value
	(1,000 acres)	(Pounds)	(Short Tons)	Dollars	(1,000)
1929	310	304.5	47,300	114.52	5,417
1930	392	260.8	51,100	66.26	3,386
1931	314	313.7	49,300	44.81	2,209
1932	313	261.8	40,900	37.04	1,515
1933	277	216.5	30,000	102.00	3,060
1934	305	188.9	28,700	164.43	4,719
1935	501	247.1	61,800	73.75	4,558
1936	309	231.4	35,800	116.03	4,154
1937	282	298.2	42,100	70.14	2,953
1938	267	280.3	37,500	62.13	2,330
1939	228	263	30,000	107.00	3,204
1940	298	295	43,900	66.00	2,897
1941	250	370	46,300	119.00	5,498
1942	230	339	39,000	174.00	6,776
1943	244	298	36,200	267.00	9,663
1944	382	362	69,200	215.00	14,862
1945	286	281	40,300	259.00	10,420
1946	300	291	43,500	292.00	12,686
1947	235	292	34,400	300.00	10,323
1948	207	291	30,000	308.00	9,233
1949	291	314	45,700	214.00	9,771
1950	216	257	27,700	367.00	10,156
1951	267.5	258	34,500	436.00	15,033
1952	263	242	31,800	401.00	12,751
1953	268	239	32,000	335.00	10,719
1954	260	220	28,600	364.00	10,401
1955	316.9	278	44,000	223.00	9,795
1956	203.4	200	20,300	445.00	9,038

a/ Source: United States Department of Agriculture, Agricultural Estimates Division, Agricultural Marketing Service (Washington, D. C., December, 1956).

APPENDIX TABLE XXVIII

BROOMCORN EXPORTS, IMPORTS AND SUPPLIES FOR THE UNITED STATES (1929-1955)[a/]

Year	Imports	Exports (Short tons)	Imports Minus Exports (Short tons)	Supplies (Production plus Imports minus Exports) (Short Tons
1929	0	4,896	- 4,896	42,404
1930	0	4,931	- 4,931	46,169
1931	11	4,517	- 4,506	44,794
1932	0	3,758	- 3,758	37,142
1933	0	3,791	- 3,791	26,209
1934	3,398	2,651	747	29,447
1935	2,646	2,243	403	62,303
1936	969	2,890	- 1,921	33,879
1937	363	1,950	- 1,587	40,513
1938	96	1,903	- 1,807	35,693
1939	104	2,186	- 2,082	27,918
1940	23	2,685	- 2,662	41,238
1941	360	3,127	- 2,767	43,533
1942	432	4,303	- 3,871	35,129
1943	796	2,969	- 2,173	34,027
1944	4,770	1,878	2,892	72,092
1945	1,104	3,799	- 2,695	37,605
1946	5,224	2,342	2,882	46,382
1947	2,951	1,282	1,669	36,069
1948	4,660	1,533	3,127	33,127
1949	1,168	2,197	- 1,029	44,671
1950	2,997	3,162	- 165	27,535
1951	5,131	1,795	3,336	37,836
1952	5,943	1,519	4,424	36,224
1953	3,618	1,015	2,603	34,603
1954	5,251	1,307	3,944	32,544
1955	973	1,998	- 1,025	42,975

a/ Source: United States Department of Agriculture, Agricultural Estimates Division, Agricultural Marketing Service (December, 1956).

VITA

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Candidate for the Degree of

Master of Science

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THESIS TITLE: VARIABILITY IN BROOMCORN PRICES AND LAND USE ADJUSTMENTS IN SOUTHCENTRAL OKLAHOMA

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