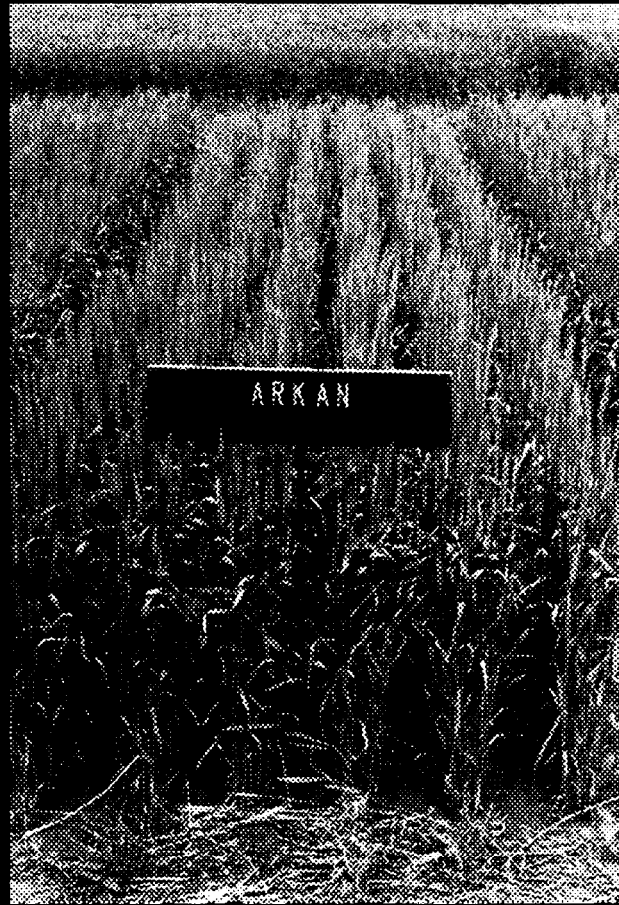


SELECTION OF WHEAT  
VARIETIES IN KANSAS:



# DOES QUALITY MATTER?



**REPORT OF PROGRESS 730**  
**AGRICULTURAL EXPERIMENT STATION**  
**KANSAS STATE UNIVERSITY, MANHATTAN**  
**MARC A. JOHNSON, DIRECTOR**

# **SELECTION OF WHEAT VARIETIES IN KANSAS: DOES QUALITY MATTER?<sup>1</sup>**

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## **ABSTRACT**

Over the past several decades, wheat breeders have developed varieties characterized by high milling and bread-baking qualities. However, wheat producers have not planted these varieties widely. This apparent neglect of end-use quality information in wheat variety selection by Kansas producers, together with industry concern over wheat quality, provided the motivation to investigate the determinants and implications of wheat variety selection in Kansas. This research identified the relationship between planted wheat varieties and wheat characteristics relating to production and end-use qualities. The results indicated that Kansas wheat producers consider end-use qualities, production characteristics, yields, and previous varietal decisions when selecting wheat varieties. The adjustment to a newly introduced, high-quality wheat variety is likely to occur if financial incentives for quality are strengthened, but the process probably would require several years.

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## INTRODUCTION

Over the past several decades, wheat breeders have developed varieties characterized by high milling and bread-baking qualities. However, wheat producers have not planted these varieties widely, often claiming that no financial incentive exists to produce high-quality wheat. In 1993, 36 percent of the planted wheat acres in Kansas were seeded to varieties that were ranked as having “less desirable” quality by grain scientists at the Kansas Agricultural Experiment Station (1). Many wheat varieties planted extensively in Kansas have at least one serious defect in milling or baking quality, intensifying concern about wheat quality within the milling and baking industries.

Figure 1 illustrates the percentage of total wheat acres in Kansas planted to six leading varieties over the 1974 to 1993 period. Of these varieties, only Karl and Eagle have milling and baking qualities ranked “exceptional” (1). The variety, TAM 107, introduced in 1986 by Texas A&M University, has “less desirable” milling and baking qualities, yet has been seeded increasingly and reached 19.8 percent of all planted wheat acreage in Kansas in 1993. The varieties Newton, Larned, and Scout all have “acceptable” end-use qualities and continue to be planted extensively by Kansas farmers. Eagle was planted widely in the 1970s, but dropped off to represent only 1 percent of all acres planted in 1993, in spite of its “exceptional” ranking for milling and baking qualities. This apparent neglect of information on end-use quality in wheat variety selection by Kansas producers, together with industry concern over wheat quality, provided the motivation to investigate the determinants and implications of wheat quality selection in Kansas.

## WHEAT PRICE ADJUSTMENTS

Wheat usually is marketed by producers at a local grain elevator or local terminal based on physical characteristics established by the Federal Grain Inspection Service (FGIS). The price received by farmers typically is adjusted on the basis of test weight, moisture level, damaged kernels, and foreign matter. Premiums have been awarded for high test weight (often associated with higher flour yields), exceptional protein content, and low moisture content. In some cases, premiums have been awarded for specific varieties of wheat and pesticide-free wheat. Discounts have been applied to wheat prices for high moisture content, low test weight, and excessive foreign material.

Data on price premiums and discounts are available in the publication *Kansas Grain Marketing and Transportation*, distributed by Kansas Agricultural Statistics, a branch of the Kansas State Board of Agriculture. The data are collected from surveys of grain producers and elevators throughout the state. The surveys ask whether producers received discounts or premiums for the previous year’s crop. Producers also are asked to designate the specific reason for the price adjustment.

Table 1 shows the percentage and type of price adjustments that were reported in 1992 (2). The percentages do not always sum to 100 percent, because some producers received both discounts and premiums. Data are reported for the entire state and the nine crop reporting districts. In seven of the nine crop reporting districts, 80 percent or more of the price adjustments were discounts, whereas between 6 and 25 percent of the adjustments were premiums. In the Southwest and South Central crop reporting districts, roughly two-thirds of the adjustments were discounts and one-third were premiums. These data demonstrate that a lion’s share of price adjustments for Kansas wheat are discounts, giving some credence to the claim that wheat prices typically do not reflect high-quality wheat characteristics.

Table 2 presents the reported causes of the price adjustments (2). Low test weight, high moisture content, and excessive foreign material were the major causes of discounts. High test weights and exceptional protein content were the major determinants of upward price adjustments. Specific levels of protein and high test weights often are desired by wheat millers, and higher prices sometimes are received for these qualities, particularly in the Southwest and South Central crop reporting districts.

However, the relationship between the physical characteristics that affect prices and the end-use value of wheat is not robust. This gives rise to the contention that wheat producers may not be rewarded for end-use characteristics, such as milling and baking quality. Given the claim of a lack of financial incentive to select and produce wheat varieties characterized by high milling and baking quality, farmers are thought to select wheat varieties based on production characteristics alone, such as yield per acre and resistance to disease, insects, and adverse weather conditions. Wheat millers and bakers often claim that the wheat delivered to them is of poor quality. Thus, it is of interest to find *the* determinants of wheat variety choices made by Kansas producers in order to understand how quality characteristics affect their decisions.

## PROCEDURES

This study sought to formalize the extent to which production characteristics and end-use qualities of wheat varieties are related to selection of wheat varieties in Kansas. Specifically, the objective was to identify and quantify the determinants of the percentages of Kansas wheat acres planted to a given variety over the period 1974 to 1993.

Data on percentages of wheat acres planted to a given variety, together with production characteristics and end-use quality rankings, are available in the publication, *Performance Tests with Winter Wheat Varieties* (1). A statistical model was developed to analyze how the production and end-use characteristics reported for the preceding year's wheat crop affected varietal choice in the current year. Many wheat producers typically use the KAES report in choosing varieties, so the published varietal characteristics were expected to influence their decisions. One aspect of wheat production was incorporated into the study, i.e., the ability of producers to retain grain harvested in one year for seed to be planted in the following year. The percentage of acres seeded to each variety in each crop reporting district in the preceding year was included as a determinant of the percentage of acres seeded to the same variety in the current year in a multiple regression analysis. This feature of wheat production results in a long adjustment period, or time lag, before a new variety is adopted fully by wheat producers; complete adoption of a new variety was found to take over 10 years.

## RESULTS

Table 3 reports the results of the study. For each determinant of wheat variety choice included in the multiple regression model, the direction of impact, significance of impact, and relative size of impact are reported. The direction and significance of impact results summarize the estimated coefficients of each variable in the regression model, as explained in further detail in Porter (3). The relative size of impact can be interpreted as the response by wheat producers in the percentage of district acres planted to a given variety to a 1 percent increase in each of the determinants reported in the table. Past production decisions, as measured by the percentage of a given variety planted in the previous year, and relative yield, as measured by the ratio of a given variety's yield to the district average yield for all varieties, were the most significant and important determinants of wheat variety choice in Kansas over the 1974 to 1993 period. Percentage of acres planted was responsive to the previous year's percentage of acres planted and yield. Publicly distributed varieties were found to be planted more widely than privately distributed varieties, when all other characteristics were taken into account.

Production characteristics such as resistance to diseases (leaf rust, stem rust, wheat streak mosaic virus, and soil borne mosaic virus) also were found to affect producers' variety choice. Agronomic characteristics, including maturity and straw strength, were statistically significant determinants of wheat varietal choice. Winter hardiness did not affect wheat variety choice, and the impact of resistance to the Hessian fly was of the opposite direction than anticipated. Of the two end-use qualities, test weight was not found to affect wheat variety choices, but the measure of milling and baking quality had a high impact on varietal choice.

## IMPLICATIONS AND CONCLUSIONS

During the 1974 to 1993 period, variety decisions by Kansas wheat producers, as measured by percentage of wheat acres planted to each variety, were associated statistically with production characteristics and end-use qualities of the over 40 varieties available for planting. Varietal decisions also were found to be strongly responsive to past production decisions and relative yields. To the extent that new varieties such as Karl are characterized by higher yield potential and higher milling and baking quality, the overall quality of wheat produced in Kansas is expected to increase over time.

The results provide evidence that wheat producers in Kansas take into account end-use quality in varietal selection decisions, but economic considerations lead many farmers to plant higher-yielding varieties, some of which are characterized by low milling and baking qualities. The milling and baking industries currently do not receive the highest quality wheat that could be produced, if varietal decisions were weighted more heavily towards quality considerations. However, given the negative correlation between protein levels and yield faced by wheat breeders, an increase in the financial rewards for higher end-use qualities would be likely to decrease the quantity of wheat produced over time, placing upward pressure on overall wheat prices.

The major implication to be drawn from this study is that higher quality wheat likely would be forthcoming from Kansas producers over time, if stronger economic incentives in the form of higher price premiums were provided for growing wheat with high end-use qualities. Given the long production period associated with winter wheat and the ability of farmers to retain wheat for seed, this adjustment to high-quality varieties likely would require several years. However, the length of adjustment would be expected to vary with the type and magnitude of the price incentives. A related implication is that, if wheat breeders release new varieties that are characterized by higher end-use qualities and similar yield potentials relative to previous releases, the production of higher quality wheat is likely to result. Wheat producers do include milling and baking qualities in their production decisions, together with published yield histories, past production decisions, and production characteristics.

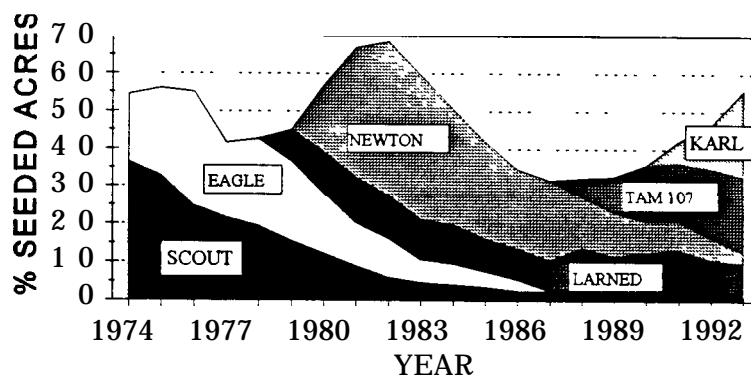
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1. Kansas Agricultural Experiment Station. 1974- 1993. *Kansas Performance Tests with Winter Wheat Varieties*. Kansas State University, Manhattan, KS.
2. Kansas State Board of Agriculture. 1993. *Kansas Grain Marketing and Transportation*. Kansas Agricultural Statistics, Topeka, KS.
3. Porter, Lori L. 1994. *An Economic Analysis of Kansas Wheat Producers' Variety Decisions*. M .S. Thesis. Department of Agricultural Economics, Kansas State University, Manhattan, KS.

**Table 1. Percent of Kansas Wheat Producers Receiving Price Adjustments and Type of Adjustment, 1992.**

Crop Reporting District	% Receiving Price Adjustment	Type of Adjustment (%)	
		Discount	Premium
Northwest	32	94	6
West Central	28	80	25
Southwest	15	68	37
North Central	29	94	10
Central	42	92	11
South Central	44	64	44
Northeast	29	90	10
East Central	42	94	6
Southeast	34	89	14
Kansas State	35	81	24

Source: 2.



**Figure 1. Kansas Wheat Acres Seeded to Leading Varieties**

**Table 2, Percent of Kansas Wheat Producers Receiving Price Adjustments by Reported Cause, 1992.**

Crop Reporting District	Discounts				Premiums			
	Moisture Content	Test Weight	Foreign Material	Other	Test Weight	Protein Content	Moisture Content	Other
Northwest	8	28	6	2	-	2	-	-
West Central	6	19	1	4	3	5	1	-
Southwest	1	10	2	-	3	2	2	2
North Central	3	23	4	1	1	2	-	-
Central	9	36	4	2	1	1	1	3
South Central	6	18	12	1	7	5	-	10
Northeast	12	27	-	9	3	-	-	-
East Central	27	29	10	5	2	-	2	-
Southeast	15	21	10	2	3	-	-	2
Kansas State	8	23	6	2	3	3	1	4

Source: 2.

**Table 3. Determinants of Wheat Variety Decisions in Kansas, 1974 - 1993.**<sup>a</sup>

Variable from Previous Year	Direction of Impact <sup>b</sup>	Significance of Impact <sup>b</sup>	Relative Size of Impact <sup>c</sup>
Percentage acres seeded to variety i	+	high	0.78
Relative yield of variety i <sup>d</sup>	+	high	0.71
Publicly distributed variety	+	high	0.14
<u>Production Characteristics</u>			
Maturity	+	low	0.08
Straw strength	+	high	0.19
Winter hardiness	0	insignificant	0.00
Resistance to leaf rust	+	high	0.13
Resistance to stem rust	+	high	0.08
Resistance to Hessian fly		high	0.09
Resistance to wheat streak mosaic	+	moderate	0.13
Resistance to soil borne mosaic	+	low	0.04
<u>End-Use Qualities</u>			
Test weight	0	insignificant	0.00
Milling and baking quality	+	high	0.22

Source: 3.

<sup>a</sup>Variable to be explained: Percent Kansas wheat acres planted to a given variety.

<sup>b</sup>The direction and significance of impact results summarize the estimated coefficients of each variable in the regression model.

<sup>c</sup>The relative size of impact can be interpreted as the change in percentage acres planted to a given variety in a crop reporting district given a 1 percent increase in the determinant in a single year. Larger numbers indicate a greater degree of producer responsiveness to the listed variable.

<sup>d</sup>Relative yield is the ratio of a given variety's yield to the district average yield of all varieties in the district.



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