AGRICULTURAL EXPERIMENT STATION
KANSAS STATE COLLEGE OF AGRICULTURE
AND APPLIED SCIENCE
MANHATTAN, KANSAS

COMANCHE AND PAWNEE: NEW VARIETIES OF HARD RED WINTER WHEAT FOR KANSAS

PRINTED BY KANSAS STATE PRINTING PLANT
W. C. AUSTIN, STATE PRINTER
TOPEKA, 1943
20-229

TABLE OF CONTENTS

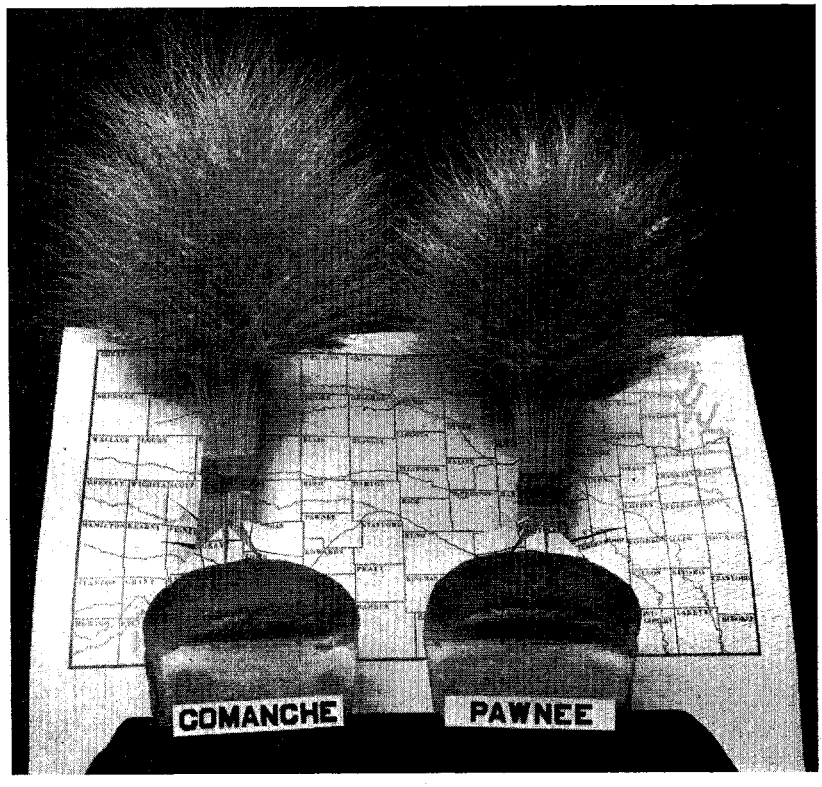
PAGE

INTRODUCTION 5

COMANCHE 5
- Yield of grain 6
- Test weight per bushel 6
- Other agronomic data 7
- Disease resistance 7
- Insect resistance 8
- Milling and baking characteristics 8

PAWNEE 8
- Yield of grain 9
- Test weight per bushel 9
- Other agronomic data 10
- Disease resistance 10
- Insect resistance 11
- Milling and baking characteristics 11

APPENDIX 13
- Table 1: Results of Experiment Station yield tests 13
- Table 2: Results of coöperative tests with farmers 14
- Table 3: Average test weight per bushel 15
- Table 4: Disease reaction of different varieties 15
- Table 5: Milling and baking tests 16



TWO NEW VARIETIES OF HARD WINTER WHEAT FOR KANSAS—THE RESULT OF 14 YEARS OF BREEDING AND TESTING.

COMANCHE AND PAWNEE: NEW VARIETIES OF HARD RED WINTER WHEAT FOR KANSAS [1]

By L. P. Reitz and H. H. Laude [2]

INTRODUCTION

Comanche and Pawnee are new varieties of hard red winter wheat for Kansas. Comanche is recommended for the southcentral, central, and southwestern parts of the state, and Pawnee for the hard wheat portion of the eastern one-half of the state. The origin and characteristics of these varieties, their performance under various conditions, milling and baking results are presented in this bulletin.

COMANCHE

(KANSAS No. 2729, C. I. No. 11673)[3]

Comanche is a bearded hard red winter wheat. Its superior characteristics are high yield, good test weight, earliness, stiff straw, milling and baking quality equal to Tenmarq, high resistance to many important races of stinking smut, and considerable resistance to leaf rust. Comanche is susceptible to loose smut and Hessian fly, and while not highly resistant to stem rust it shows more tolerance to this disease than commercial hard wheat varieties now common in Kansas and in other portions of the southern Great Plains. It possesses only moderate winter hardiness, and, therefore, cannot be expected to be a satisfactory variety north of the area to which Blackhull and Tenmarq are adapted. It appears best adapted to central, southcentral, and southwest Kansas.

This variety was bred by the Kansas Agricultural Experiment Station in cooperation with the Division of Cereal Crops and Diseases, United States Department of Agriculture. Several state experiment stations cooperating in the regional hard red winter wheat improvement program assisted by testing Comanche in plantings with other varieties.

1. Contribution No. 354 from Department of Agronomy. Results reported herein were obtained in coöperation with the Departments of Botany, Entomology and Milling Industry, Kansas Agricultural Experiment Station; and the Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture.

2. Associate Agronomist and Agronomist, Kansas Agricultural Experiment Station. Acknowledgment: Work has been in progress for 14 years in the development, testing and increase of these varieties, and numerous workers have been involved one or more years. The authors desire especially to acknowledge the contributions of J. H. Parker, C. O. Johnston, C. A. Wismer and C. A. Suneson in the development and early testing of these varieties; A. L. Clapp, A. F. Swanson, E. H. Coles, T. B. Stinson, A. E. Lowe, A. B. Erhart, C. R. Porter, F. E. Davidson, Erwin Abmeyer, C. L. Lefebvre, D. B. Creager, E. D. Hansing, R. H. Painter, E. T. Jones, K. S. Quisenberry, E. G. Heyne, M. A. Barmore, K. F. Finney, and the Agricultural Experiment Stations in Nebraska, Oklahoma, Texas, and Colorado for extensive testing work.

3. Accession numbers assigned by the Kansas Agricultural Experiment Station and the Division of Cereal Crops and Diseases, respectively.

Comanche is a selection in the fifth generation following the cross Oro (C. I. 8220) X Tenmarq Sel. (Ks. No. 2637) made at Manhattan, Kansas, in 1928. Pedigree cultures of the first, second, and third generations were grown in the Agronomy Department plant breeding greenhouse and nursery. Final selections and special bunt resistance studies were made in the Botany Department bunt nursery in the fourth and fifth generations. The first yield tests were made on Comanche in the Agronomy Department nursery in 1934. This hybrid selection was advanced to rod rows in 1935, and to farm plots at Manhattan in 1936. In 1937 Comanche was included in the uniform yield nursery grown at nine stations located in five central and southern Great Plains states, and the following year was included in uniform plot tests at 13 stations in this area. Tests on disease resistance, winter hardiness, quality, etc., have been made.

Yield of grain

The comparative average yields of Comanche and several other varieties at several locations in Kansas are given in Table 1.

Comanche yielded higher than other varieties at the Garden City station during the years tested while at the Kingman, Wichita, Hutchinson and Manhattan stations it averaged second, being exceeded by Pawnee. At the Meade field, Comanche was about equal to Pawnee and Chiefkan, and about equal to these varieties and Tenmarq at Tribune. At the Hays, Colby and Dodge City stations it ranked third, being exceeded by Pawnee and Chiefkan. Tests in eastern Kansas are limited to one year each on the Thayer and McLouth fields. At Thayer, Comanche was exceeded by Pawnee, Tenmarq, Kawvale and Clarkan, while at McLouth it was exceeded by Pawnee, Kawvale and Clarkan. Considering all stations in Kansas where comparable yields are available, Comanche gave an average yield in 42 tests of 26.2 bushels, Pawnee 28.4, Chiefkan 25.2, Tenmarq 24.2, Early Blackhull 22.4, Blackhull 21.2 and Turkey 20.0 bushels per acre, respectively, ranking second to Pawnee in these extensive trials. Examination of yields by individual years shows the relative rank of the varieties has changed somewhat from year to year. However, for the most part, Comanche has yielded well except in eastern Kansas.

In cooperative experiments with farmers, Comanche was tested on 86 farms during 1941 and 1942. The average yields are shown in Table 2. In general, Comanche equaled or exceeded in yield all other varieties with which it was compared except Pawnee.

Test weight per bushel

Comanche has produced grain having higher test weight per bushel than Tenmarq or Turkey in most of the tests on experiment stations as shown by the data in Table 3. It has not produced a test weight equal to Chiefkan at any of the stations, but appears to fall mid-way between Tenmarq and Blackhull in this respect. The average of 37 comparable tests is for Comanche 57.2 pounds, Chief-

kan 59.8, Early Blackhull 58.2, Pawnee 57.8, Blackhull 57.7, Tenmarq 56.5, and Turkey 56.4 pounds per bushel. In northeast Kansas at McLouth in 1942 Comanche tested 58.2 compared with Tenmarq 58.3, Pawnee 60.1, Kawvale 57.9, Turkey 58.3, and Clarkan 60.5. In cooperative experiments in central and western Kansas on 70 farms in 1941 and 1942 Comanche gave lower test weights than Turkey, Pawnee and Chiefkan, but was equal to Tenmarq.

Other agronomic data

Many other agronomic characteristics of Comanche have been observed, including date of maturity, height, lodging, tillering, shattering and winter hardiness. Tests conducted thus far show that Comanche heads and matures one or two days earlier than Tenmarq, Blackhull or Chiefkan, about five days earlier than Turkey, but about five days later than Early Blackhull. Its straw is slightly shorter, on the average, than most other varieties with which it was compared. The straw of Comanche is strong like Tenmarq, and lodged less than Tenmarq in nearly all tests. Comanche has produced more heads per acre than Early Blackhull, about the same number as Tenmarq and Chiefkan, and fewer than Turkey, Blackhull and Pawnee. The heads of Comanche resemble Tenmarq in shape and length of beaks or short awns on the outer chaff, but the heads have averaged considerably larger than those of Turkey and Blackhull, and slightly larger than Tenmarq, Pawnee, Chiefkan and Early Blackhull. The large size of head is due both to more and larger kernels. The kernels of Comanche have been slightly smaller than Chiefkan, and larger than the other hard wheat varieties. Only a few records are available on the shattering tendency of Comanche, but the data indicate that this variety shatters less than Tenmarq, but is easily threshed out by harvesting machinery. Tests on the winter hardiness of Comanche indicate that it is fully as hardy as Tenmarq and Blackhull.

Disease resistance

The disease reaction of Comanche and several other varieties has been tested by artificial inoculation under conditions favorable for the various diseases. Results obtained in the Botany Department disease nurseries at Manhattan are shown in Table 4. Comanche is resistant to many races of leaf rust, making it less likely to be damaged by this disease than other varieties now grown extensively. It has shown marked resistance to stinking smut or bunt, averaging 2 percent infection; in contrast, Chiefkan has averaged 64 percent infection in these tests. Most of this resistance was derived from Oro, a selection from Turkey, chosen as one parent partly because of its resistance to bunt. Comanche is the first bunt resistant variety to be released in Kansas.

Comanche appears to have resistance to certain races of stem rust, but is susceptible to others. This resistance combined with slightly earlier maturity, however, has given Comanche some ad-

vantage over susceptible and later maturing varieties in years when stem rust has been a limiting factor.

Insect resistance

So far as is known, Comanche resembles Tenmarq and Turkey in reaction to common insectsin Kansas. It is susceptible to Hessian fly and, like Tenmarq, it is damaged by that insect especially in the eastern third of Kansas where outbreaks occur frequently. Partly for this reason, it is not recommended for eastern Kansas.

Milling and baking characteristics

Comanche has been tested for milling and baking characteristics by workers in the Department of Milling Industry and the Federal Hard Winter Wheat Quality Laboratory at Manhattan and a few commercial laboratories. It has given satisfactory results in milling and baking tests conducted on several crops. In general terms it appears to be equal to Tenmarq. Results on flour yield and loaf volume are presented in Table 5. It is obvious that Comanche has produced high yields of flour and large loaves of bread. The flour milled from Comanche has been similar to that from Tenmarq, being about the same in ash content and of a creamy white color. Dough made from Comanche flour requires a longer mixing time than that from Turkey or Tenmarq for full development. The gluten appears to be strong, capable of making loaves of large volume, and requires rather long mixing for full development, which indicate that Comanche may enter the trade channels where Tenmarq, Turkey and other strong wheats are required.

PAWNEE

(KANSAS No. 2723, C. I. No. 11669)

Pawnee is a bearded, hard red winter wheat variety that appears to be well adapted to Kansas, especially to the hard wheat producing areas in central and eastern Kansas. Its superior characteristics are high yield and test weight, short stiff straw, high resistance to loose smut, and moderate resistance to leaf rust, stem rust, bunt, and Hessian fly. Pawnee has good milling qualities, and has proved satisfactory in bread-baking trials. The variety is moderately winterhardy, somewhat more hardy than Tenmarq or Blackhull. It is susceptible to speckled leaf blotch *(Septoria)*, and may shatter slightly more than Tenmarq.

Pawnee was bred by the Kansas and Nebraska agricultural experiment stations in cooperation with the Division of Cereal Crops and Diseases, United States Department of Agriculture. It was selected from a hybrid poulation arising from the cross Kawvale X Tenmarq. The first, second and third generations were grown at Manhattan. In the fall of 1931 seed from 138 individual plant selections was sent to the Nebraska Agricultural Experiment Station at Lincoln where the fourth generation was grown and the final selection was made and increased. This strain has been tested continu-

ously in Nebraska since 1932, and was named Pawnee in the fall of 1941. It has been in nursery tests in Kansas since 1935, in plot tests at one or more stations in Kansas since 1936, and has been tested widely in the central and southern Great Plains in the uniform yield nursery since 1935 and in the uniform-plot variety test since 1938.

Yield of grain

Grain yields of Pawnee compared with several other varieties are shown by individual years and stations for Kansas in Table 1. From the averages shown for each station, Pawnee has exceeded the yield of the other varieties at the Manhattan, Hays, Colby, Dodge, Kingman, Hutchinson and Wichita stations. It was about equal to Chiefkan at Tribune, nearly equal to Comanche at Garden City, and exceeded the other varieties at these stations. Only Chiefkan exceeded Pawnee at Meade. The average yields from 42 comparable tests were as follows: Pawnee 28.4 bushels, Comanche 26.2, Chiefkan 25.2, Tenmarq 24.2, Early Blackhull 22.4, Blackhull 21.2 and Turkey 20.0 bushels per acre. Two tests were conducted in southeast Kansas. At Columbus in 1938 Pawnee exceeded other varieties, and at Thayer in 1942 it ranked below Tenmarq, but exceeded Kawvale, Clarkan and several other varieties. In northeast Kansas it has been tested on the McLouth field five years where it exceeded Tenmarq, Turkey, Kawvale and Clarkan. Pawnee and Comanche have exceeded Tenmarq 16 and 7 percent respectively, on the average, in the plant-breeding nursery at Manhattan during the last 8 years. Pawnee has been remarkably consistent in producing high grain yields year after year at most of the stations.

Pawnee was in cooperative tests on 114 farms during 1941 and 1942. The average of these tests by districts is shown in Table 2. In northeast Kansas Pawnee exceeded the other hard wheats, but yielded slightly less than Kawvale. In southeast Kansas, Pawnee yielded more than Turkey, but less than Tenmarq and Kawvale. Pawnee yielded more grain per acre than the other varieties tested in the other districts including central and western Kansas. Thus it appears that Pawnee possesses capacity for producing high yields over a large area.

Test weight per bushel

Pawnee has given an average test weight per bushel equal to Blackhull. In general it has exceeded Tenmarq, Comanche and Turkey in this respect. Records at experiment stations in 37 tests show that Pawnee was 1.3 pounds heavier than Tenmarq, 1.4 pounds heavier than Turkey, 0.1 pounds heavier than Blackhull, 0.4 pounds lighter than Early Blackhull and 2.0 pounds lighter than Chiefkan. Data for the stations are shown in Table 3.

In cooperative experiments on farms scattered over Kansas, Pawnee has tested heavier than Tenmarq, Comanche and Turkey in all districts except in southwest Kansas where Turkey was heavier than Pawnee. It has been about two pounds per bushel lighter than Chiefkan in these tests.

Other agronomic data

Pawnee has been observed for a number of characteristics other than yield and test weight. It has been found to be about two days earlier in maturity than Tenmarq, Blackhull or Chiefkan, five days earlier than Turkey, equal to Comanche and five or six days later than Early Blackhull. It is not as tall as other varieties tested. For example, at Manhattan it has averaged 36 inches tall over a 6-year period compared with 39 inches for Tenmarq, 40 inches for Turkey and Kawvale, 41 for Blackhull, and 42 inches for Chiefkan. Similar differences have been noted at other stations although not so marked in western Kansas. Pawnee has lodged less than other varieties in most of the tests. Its strong short straw is a prominent feature in its appearance.

Pawnee has produced more heads per acre than Tenmarq, Comanche, Chiefkan and Early Blackhull, and about the same number as Turkey and Blackhull. The heads have been about the same size, both with respect to number of kernels and weight of grain, as those of Tenmarq, and considerably larger than Turkey and Blackhull. The beaks vary from short to mid-long in contrast to the longer beaks on Comanche and Tenmarq. The kernels of Pawnee have been slightly smaller than Comanche and Chiefkan, about the same size as Tenmarq and Early Blackhull and larger than Turkey and Blackhull. The leaves grow more upright than Turkey, and partly as a consequence, Pawnee may yield more pasturage than Turkey and other common varieties. In winter hardiness, Pawnee probably is superior to Tenmarq and Blackhull, but it is somewhat less hardy than Turkey or Kanred.

Only a few observations are available on the tendency of Pawnee to shatter. In most of the tests with Pawnee, shattering has not occurred. At the Wichita field in 1939 Pawnee shattered from 3 to 4 percent, contrasted with 2 to 3 percent for Turkey, and 1 to 2 percent for Tenmarq. Kawvale shattered 25 to 50 percent in the same test. At the Meade field in 1941, Pawnee shattered 15 percent, Tenmarq 30 percent, Comanche 5 percent and Turkey 6 percent. In the plant-breeding nursery at Manhattan certain plots are allowed to stand for two weeks after reaching full maturity. Shattering at the end of this period in 1940 and 1941 showed an average of 2 percent for Pawnee and 40 percent for Kawvale, while Tenmarq and Turkey showed none. Pawnee does not shatter as much as Kawvale, but may shatter slightly more in occasional years than the common hard wheat varieties now grown in Kansas.

Disease resistance

As shown in Table 4, Pawnee has been free from loose smut in tests when the plants have been subjected to artificial inoculation. Observations in the field under natural conditions substantiate the belief that Pawnee, like one of its parents, Kawvale, is highly resistant to loose smut. Under conditions of extremely heavy inoculation in the Botany Department disease nurseries, Pawnee has been

moderately resistant to bunt or stinking smut and leaf rust. Its resistance to leaf rust is of value both in the fall and spring; in the fall, more pasturage may be produced than on more badly rusted varieties, and in the spring, this resistance will aid it to make a normal grain crop in years when susceptible varieties are severely damaged by leaf rust. It is resistant to several races of stem rust, hence in some years it may be free while other varieties will be badly rusted. Pawnee, like Kawvale, is more susceptible to speckled leaf blotch *(Septoria)* than most other common varieties. This disease has been less important in Kansas than the rusts and smuts.

Insect resistance

The cross from which Pawnee was selected was made in part to combine the good characteristics of Tenmarq with the Hessian fly resistance of Kawvale. Tests in the presence of this insect show that much of the Kawvale type of resistance has been transferred to Pawnee. West of a line from Brown to Cowley county Kansas, Pawnee and Kawvale have so far been moderately resistant to the fly as measured by the percentage of plants and culms infested or number of flaxseed present. East of this area these varieties have frequently, though not always, shown infestations comparable to other common varieties. Pawnee, like Kawvale, possesses tolerance to the Hessian fly, enabling it to produce a crop in spite of light infestation. This tolerance to fly is evident to a lesser degree in Blackhull, Early Blackhull and Chiefkan, but is not present in Tenmarq or Turkey. In 21 tests conducted in central Kansas from 1933 to 1942 in areas where fly has been abundant, Pawnee has averaged 39 percent infested plants compared to 68 percent infested plants in Tenmarq. Such resistance and tolerance are of value as an aid to other Hessian fly control measures, but cannot be expected to replace other means of control.

Milling and baking characteristics

Pawnee has been tested for wheat and flour quality by the Department of Milling Industry and the Federal Hard Winter Wheat Quality Laboratory at Manhattan and in a few commercial laboratories. It has produced good yields of low ash flour of creamy white color, superior to Turkey and Kharkof in appearance. Data on the flour yields are shown in Table 5. No objectionable features have appeared in the milling tests conducted on Pawnee; in general it appears equal to Turkey or Kharkof and superior to Blackhull.

Loaf volume is the most widely used single measure of gluten strength in bread wheats. In general, flours capable of producing large loaves with good texture and color of crumb are readily accepted in the trade for bread-making purposes. Loaf volumes produced under similar conditions from the same amount of flour are shown in Table 5 for a number of varieties. In each case Pawnee exceeded Early Blackhull and Chiefkan, and seemed to vary around the volumes produced by Comanche, Tenmarq, Blackhull and Khar-

kof or Turkey. Good texture and color of crumb have been produced by Pawnee in these tests.

The dough characteristics of Pawnee are different from Tenmarq and Comanche; Pawnee dough develops more rapidly upon mixing and is more pliable. Its dough-mixing time approximates that of Blackhull, but is shorter than Tenmarq and Comanche. Dough from Pawnee flour can be classified with that from Blackhull as *pliable* in contrast to the dough from Tenmarq, which sometimes tends to be *bucky,* and to the soft or less elastic type of dough from Chiefkan. The baking strength of the gluten of Pawnee is equal to or greater than Blackhull and appears suitable for general market use.

APPENDIX

TABLE 1. *Annual and average grain yields in bushels per acre of Comanche, Pawnee and other varieties of winter wheat at experiment stations and fields in Kansas, 1937 to 1942, inclusive.*

YEARS.	Comanche.	Pawnee.	Tenmarq.	Blackhull.	Early Blackhull.	Chiefkan.	Turkey.
Agronomy Farm, Manhattan							
1937	48.2	52.1	42.4	45.6	42.2	45.4	41.5
1938	22.4	27.2	19.0	11.9	10.4	19.5	12.3
1939	17.3	18.2	17.3	17.1	17.8	16.3	16.8
1940	28.6	32.3	29.8	28.5	26.2	29.9	25.2
1941	29.6	31.4	23.9	23.3	23.8	26.3	19.6
1942	30.9	34.4	27.6	19.3	21.9	23.4	18.8
6-year av.*	29.5	32.6	26.7	24.3	23.7	26.8	22.4
Fort Hays Branch Agricultural Experiment Station							
1937	26.5	.....	29.6	28.3	27.0	29.4	24.2
1938	29.9	42.0	28.6	23.6	21.9	31.1	21.5
1939	19.4	19.4	20.5	16.2	18.8	20.6	16.5
1940	17.8	16.3	15.1	14.5	17.3	17.4	12.4
1941	40.6	42.8	35.0	23.6	33.8	35.0	21.8
1942	22.8	25.1	23.8	24.0	27.3	27.8	21.8
6-year av.	26.2	.....	25.4	21.7	24.4	26.9	19.7
5-year av.*	26.1	29.1	24.6	20.4	23.8	26.4	18.8
Colby Branch Agricultural Experiment Station							
1941	37.5	41.0	38.6	32.5	29.2	36.7	33.2
1942	49.4	58.3	47.1	44.3	40.3	52.7	39.2
2-year av.*	43.5	49.7	42.9	38.4	34.8	44.7	36.2
Tribune Branch Agricultural Experiment Station							
1939	9.2	8.5	9.4	10.3	11.7	9.9	5.0
1940	6.5	6.4	5.8	6.3	7.6	6.9	5.1
1941	34.0	35.1	33.9	24.9	22.9	32.6	26.7
1942	23.1	25.9	23.8	.....	22.5	27.0	13.6
4-year av.	18.2	19.0	18.2	.....	16.2	19.1	12.6
3-year av.*	16.6	16.7	16.4	13.8	14.1	16.5	12.3
Garden City Branch Agricultural Experiment Station							
1939	10.8	9.0	9.2	9.6	9.7	8.3	7.0
1940	10.6	8.2	9.9	10.6	14.1	9.9	8.7
1941	32.6	35.0	29.0	22.0	20.1	24.6	19.8
1942	14.3	15.7	12.9	11.9	14.6	14.7	7.6
4-year av.*	17.1	17.0	15.3	13.5	14.6	14.4	10.8
Southwest Kansas Experiment Fields, Meade							
1939	6.7	9.6	6.4	11.4	5.8	9.3	4.6
1940	18.4	15.4	15.4	17.4	26.2	19.8	14.4
1941	26.8	26.2	21.1	6.9	9.5	25.3	11.2
1942	20.5	21.4	22.0	19.7	19.8	20.5	16.7
4-year av.*	18.1	18.2	16.2	13.9	15.3	18.7	11.7
Dodge City							
1939	25.4	22.4	21.3	22.3	19.9	21.2	20.1
1940	27.2	31.6	25.0	28.1	27.2	29.2	23.5
1941	41.1	48.6	36.9	22.6	25.9	41.2	25.4
1942	27.7	31.6	28.6	30.0	24.7	34.0	29.3
4-year av.*	30.4	33.6	28.0	25.8	24.4	31.4	24.6
Southcentral Kansas Experiment Fields, Kingman							
1937	.....	27.5	23.3	21.1	21.0	22.7	21.7
1938	22.2	30.5	25.8	18.5	15.9	21.2	20.2
1939	25.9	20.5	20.8	25.2	24.9	24.1	23.8
1940	21.8	22.0	20.6	19.6	19.9	20.7	16.8
1941	32.2	31.4	27.3	17.1	21.9	27.2	20.5
1942	9.9	13.1	12.1	10.8	10.5	12.5	13.1
6-year av.	.....	24.2	21.7	18.7	19.0	21.4	19.4
5-year av.*	22.4	23.5	21.3	18.2	18.6	21.1	18.9

TABLE 1. *Concluded*

YEARS.	Comanche.	Pawnee.	Tenmarq.	Blackhull.	Early Blackhull.	Chiefkan.	Turkey.
Hutchinson							
1939	25.8	26.0	20.0	26.9	31.4	26.2	25.8
1940	27.7	41.5	27.0	23.6	33.2	30.8	17.6
1941	28.5	27.7	26.0	18.5	18.8	25.5	18.7
1942	25.4	32.7	25.7	22.2	23.5	25.3	25.5
4-year av.*	26.9	32.0	24.7	22.8	26.7	27.0	21.9
Wichita							
1937	.....	43.6	38.4	38.2	38.3	42.0	38.0
1938	26.2	29.8	21.4	10.9	14.7	19.4	15.3
1939	41.0	38.2	34.7	38.6	37.3	40.4	36.9
1940	43.7	48.7	43.9	41.5	46.7	42.8	35.0
1941	32.8	34.0	30.4	20.9	27.9	26.7	22.5
1942	29.6	29.1	23.4	16.7	22.2	24.7	21.4
6-year av.	.....	37.2	32.0	27.8	31.2	32.7	28.2
5-year av.*	34.7	36.0	30.7	25.7	29.8	30.8	26.2
Southeast Kansas Experiment Fields, Columbus							
1938	.....	48.2	41.2	31.7	.....	.....	32.6
Thayer							
1942	25.4	28.1	29.9	18.4	.....	.....	22.3
Northeast Kansas Experiment Field, McLouth							
1937	.....	37.5	32.8	28.6	31.0	.....	31.0
1938	.....	40.4	34.1	25.8	25.3	.....	33.2
1939	.....	29.4	27.2	30.4	28.1	.....	27.8
1940	.....	42.4	34.9	36.8	.....	.....	33.5
1942	18.4	19.7	16.6	.....	.....	.....	13.1
5-year av.	.....	33.9	29.1	.....	.....	.....	27.7
Weighted av. 42 tests*	26.2	28.4	24.2	21.2	22.4	25.2	20.0

* Averages included in weighted average are starred.

TABLE 2. *Grain yields in bushels per acre of Comanche, Pawnee and other varieties of winter wheat grown in coöperative experiments on farms in Kansas, 1941 and 1942.*

SECTION.	No. of tests.	Comanche.	Pawnee.	Tenmarq.	Chiefkan.	Turkey.	Early Blackhull.	Kawvale.
Northeast	13	.....	32.7	26.0	.....	24.6	.....	34.2
Eastcentral	5	.....	28.6	22.4	.....	19.0	.....	25.4
Southeast	10	.....	20.4	21.9	.....	17.8	.....	21.3
Northcentral	21	31.4	33.5	31.8	30.2	26.8	.....	.....
Southcentral	33	31.0	31.1	29.0	26.8	24.7	25.0	.....
Southwest	24	31.1	33.5	30.5	27.4	24.1	25.8	.....
Northwest	8	42.4	43.7	42.8	39.2	33.9	.....	.....

TABLE 3. *Average test weight in pounds per bushel for Comanche, Pawnee and other varieties of winter wheat grown at experiment stations and fields in Kansas, 1937 to 1942.*

STATION.	No. of years.	Comanche.	Pawnee.	Tenmarq.	Blackhull.	Early Blackhull.	Chiefkan.	Turkey.
Manhattan	6	57.1	58.3	56.4	57.9	58.8	59.6	56.2
Hays	5	59.6	59.8	59.1	60.4	61.0	62.6	59.2
Colby	2	58.5	60.0	56.5	58.5	59.3	61.3	57.5
Tribune	1	58.0	58.5	57.5	56.0	55.5	60.5	56.5
Garden City	4	56.9	55.7	56.3	58.2	56.5	59.1	57.5
Meade	2	52.5	50.5	52.0	55.0	53.0	55.5	52.5
Dodge City	4	55.8	57.0	55.5	56.8	56.5	58.8	56.0
Kingman	5	56.8	57.6	56.5	56.9	58.3	59.5	55.8
Hutchinson	3	57.2	59.5	56.6	57.7	59.7	60.3	54.8
Wichita	5	57.9	58.9	56.3	57.1	58.9	59.6	55.7
McLouth*	5	.....	60.8	58.5	.....	.....	.....	59.0
Weighted average 37 tests	.....	57.2	57.8	56.5	57.7	58.2	59.8	56.4

* Not included in weighted average.

TABLE 4. *Disease reaction of Comanche, Pawnee and other varieties of winter wheat in the disease nurseries of the Department of Botany at Manhattan, Kansas, 1938 to 1942.* (Figures show percentage infection.)

DISEASE.	Years tested.	Comanche.	Pawnee.	Tenmarq.	Blackhull.	Early Blackhull.	Chiefkan.	Turkey.
Leaf rust	5	25	24	59	82	84	49	81
Stem rust	5	56	55	64	55	19[1]	49	73
Bunt (Stinking smut)	5	2	17	34	31[2]	74[3]	64	24[2]
Loose smut	2	33[4]	0	35	69	64	79	48

1. May escape infection owing to early maturity. 2. Tested only 3 years. 3. Tested only 2 years. 4. Tested only 1 year.

TABLE 5. *Flour yields and loaf volumes for Comanche, Pawnee and other varieties of winter wheat grown in the central and southern Great Plains, 1938 to 1942.*

SOURCE OF GRAIN AND YEARS.	Comanche.	Pawnee.	Tenmarq.	Blackhull.	Early Blackhull.	Chiefkan.	Kharkof.
Average yield of flour in percent							
Central District composites, 1938 to 1941	71.9	71.8	71.7	70.2	.....	71.4	70.8
Southern District composites, 1938 to 1941	71.7	72.2	71.7	69.7	69.2	72.2	70.8
Uniform Nursery composites, 1938 to 1942	71.8	72.7	.....	70.8	70.6	.....	72.6
Individual samples, 1939 to 1941	73.2	73.1	72.8	71.0	.....	73.5	71.5
Average loaf volume in cubic centimeters							
Central District composites, 1938 to 1941[1]	950	960	960	949	.....	788	985
Southern District composites, 1938 to 1941[1]	933	923	957	906	878	781	944
Uniform Nursery composites, 1938, 1940 to 1942[1]	960	900	.....	903	887	.....	945
Individual samples, 1939 to 1941[1]	926	935	899	932	.....	766	940
Ten Kansas stations, 1942[2]	1,010	1,020	1,004	899	.....	818	932

1. Volumes adjusted to a uniform protein level of 13.5 percent. Baking procedure for the varieties was varied within practical limits to give the best loaves from each. Data from reports of the Federal Hard Winter Wheat Quality Laboratory.

2. The percentages of protein in the flour were: Comanche 15.2, Pawnee 14.7, Tenmarq 14.2, Blackhull 14.4, Chiefkan 14.4, and Turkey, reported in the column for Kharkof, 14.0. Data from the Department of Milling Industry.

□