

WINTER WHEAT VARIETIES FOR OKLAHOMA

OKLAHOMA AGRICULTURAL EXPERIMENT STATION
IN COOPERATION WITH
UNITED STATES DEPARTMENT OF AGRICULTURE

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VARIETAL RECOMMENDATIONS

Wheat varietal recommendations in Oklahoma are based primarily on the yields and other results obtained at the experiment stations and on the milling and baking analyses conducted by various commercial millers and bakers of the State and the Federal laboratories. The varieties which have proved superior are recommended. They are:

Hard red winter wheat: Cheyenne, Comanche, Pawnee, Tenmarq, and Turkey.

Soft red winter wheat: Clarkan and Fulcaster.

OKLAHOMA AGRICULTURAL EXPERIMENT STATION

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in cooperation with

Bureau of Plant Industry, Soils, and Agricultural Engineering

Agricultural Research Administration

United States Department of Agriculture

Winter Wheat Varieties for Oklahoma*

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This bulletin summarizes the wheat varietal testing work conducted at Stillwater, Lawton, and Woodward, during the period, 1931-1945. It also presents average yields from the Oklahoma Farm Wheat Improvement Program in counties and for varieties where three or more years of data are available. In addition, general statements regarding milling and baking tests along with information on quality of specific varieties are included, as well as data pertaining to the value of winter wheat as a fall, winter, and spring pasture.

Winter wheat is the most important crop in Oklahoma. During the 10-year period, 1936-1945, there was an annual production of about 57,000,000 bushels grown on approximately 4,356,000 acres, at an annual cash value of about \$58,000,000.

The distribution of the harvested acreage of winter wheat in Oklahoma is shown in Figure 1. Hard red winter wheat occupies approximately 95 percent of the total wheat acreage of the State, which in turn finds its heaviest concentration of acreage in the north-central portion of the State.

Estimates of the acreage and of the percentage of the total wheat occupied by each of the important wheat varieties grown in Oklahoma by five-year periods from 1919 to 1944 are given in Table 1. In 1944 Tenmarq occupied about 40 percent of the total wheat acreage of the State. Turkey has shown a rather rapid decline, decreasing from 68.6 percent of the total wheat acreage in 1919 to only 15 percent in 1944.

* Cooperative investigations of the Oklahoma Agricultural Experiment Station and the Division of Cereal Crops and Diseases and the Division of Soils, Fertilizers, and Irrigation, Bureau of Plant Industry, Soils, Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture. These results were obtained as a part of the Coordinated Hard Red Winter Wheat Improvement Program.

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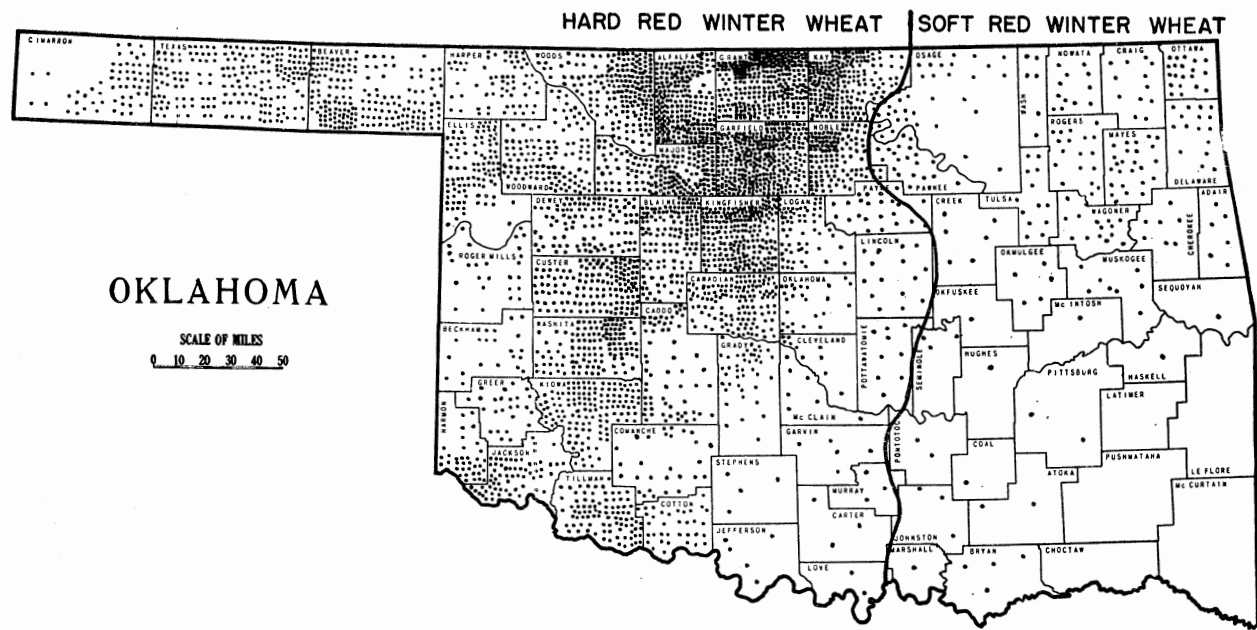


Fig. 1.—Harvested Acreage of Winter Wheat in Oklahoma.
 Each dot represents 1,000 acres. Dots are placed approximately in townships where production occurred, as reported by the 1940 census.

Table 1.—Estimated acreage and percentage of the total acreage occupied by each of the important wheat varieties grown in Oklahoma.¹

Variety	Acreage			Percentage					
	1934	1939	1944	1919	1924	1929	1934	1939	1944
Hard Red Winter:									
Tenmarq	1,505	484,321	2,096,400	---	---	---	(2)	10.0	40.3
Blackhull	1,107,049	1,749,910	881,037	---	12.2	33.9	31.3	36.6	16.9
Turkey	1,589,960	1,420,815	781,346	68.6	52.3	47.4	44.9	29.3	15.0
Early Blackhull	---	92,729	363,437	---	---	---	---	1.9	7.0
Chiefkan	---	75,383	308,906	---	---	---	---	1.5	5.9
Cheyenne	600	32,996	210,603	---	---	---	(2)	0.7	4.0
Red Chief	---	---	182,155	---	---	---	---	---	3.5
Triumph	---	---	65,878	---	---	---	---	---	1.3
Kanred	177,199	119,927	39,018	0.2	19.5	7.5	5.0	2.5	0.7
Soft Red Winter:									
Fulcaster	103,338	123,532	59,832	6.8	5.3	2.1	2.9	2.5	1.2
Currell	159,353	144,934	52,699	1.5	1.9	1.6	4.5	3.0	1.0
Clarkan	---	6,541	39,119	---	---	---	---	0.1	0.8
Red May	---	---	25,455	---	---	---	---	---	0.5
Kawvale	---	19,308	14,415	---	---	---	---	0.4	0.3
Mediterranean	73,992	40,076	14,175	4.6	1.4	1.0	2.1	0.8	0.3
Others and not reported	196,229	235,133	71,525	9.6	3.1	4.6	5.6	4.4	1.4
Total	3,540,833	4,851,000	5,206,000	99.2	99.5	99.5	100.0	100.0	100.0

¹ The authors express appreciation to J. Allen Clark and K. S. Quisenberry, Senior Agronomists, Wheat Investigation, Division of Cereal Crops and Diseases, for making available the unpublished data for 1944.

² Less than 0.1 percent of the total acreage.

RESULTS OF VARIETAL TESTS

Stillwater

The annual and average grain yields per acre of hard and soft red winter wheat varieties and selections grown in plot tests near Stillwater during all or a part of the period 1931-1945 are presented in Table 2. Only four varieties—Cheyenne, Kharkof, Tenmarq, and Early Blackhull—were grown during the entire 15-year period. Grain yields of Kharkof and Tenmarq were practically identical, being 26.1 and 26.0 bushels per acre, respectively. The yield of Cheyenne (27.4 bu.) exceeded Kharkof by five percent. In this same comparison, Early Blackhull yielded 24.6 bushels per acre, fully six percent less than either Kharkof or Tenmarq.

Although the yields for varieties tested three years or less, are shown in Table 2, it is entirely unsafe to evaluate varieties on the basis of such short-term testing. Of the varieties tested for more than three years, only two (Comanche and Pawnee) show a decided advantage in yield over the standard varieties, Turkey, Tenmarq, or Cheyenne. For the 7-year period, 1939-45, the yields of Comanche and Pawnee were nearly identical, being 28.8 and 28.7 bushels per acre, respectively; but the yearly fluctuation was less for Comanche than for Pawnee. The yield of Kharkof during this same period was only 23.6 bushels per acre, which is 22 percent less than for Comanche or Pawnee.

None of the soft red winter wheats tested had any material advantage in yield over Kharkof and all were decidedly inferior to Comanche and Pawnee.

The test weight per bushel, date of ripening, and height of eight hard red winter wheat varieties are given in Table 3. The highest test weights were recorded for the three varieties Early Blackhull, Blackhull, and Chiefkan. Early Blackhull and Chiefkan are inferior in milling and baking characteristics. Of the varieties with acceptable baking characteristics, Cheyenne, Comanche, and Pawnee had similar test weights—57.7, 57.6, and 57.5, respectively. Tenmarq, however, was two pounds lighter, weighing only 55.7 pounds per bushel.

Pawnee and Comanche ripened, on the average, one day earlier than Tenmarq and two days earlier than Cheyenne. In height of straw, Pawnee averaged one inch less than Cheyenne and Comanche but five inches shorter than Chiefkan.

Table 2.—Annual and average grain yields in bushels per acre of winter wheat varieties and selections grown in plot tests at the Oklahoma Agricultural Experiment Station, Stillwater, during all or a part of the period, 1931-1945.

Variety or Selection	C. I. No.*	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Hard Red winter wheat											
Cheyenne	8885	39.9	21.8	29.7	32.9	25.6	25.3	26.8	23.4	39.4	29.3
Kharkof	1442	41.0	21.4	26.6	29.2	29.2	26.1	28.0	24.3	32.8	36.0
Tenmarq	6936	32.9	23.1	28.6	40.1	29.5	18.9	29.2	24.9	33.8	33.5
Early Blackhull	8856	25.0	23.0	32.9	37.3	21.2	15.4	29.6	13.0	33.5	25.2
Blackhull	6251	37.8	21.5	31.9	37.0		22.2	26.4	13.3	38.7	39.0
Turkey	1558	39.5	29.4	27.4	30.5	23.3	23.4	28.3	14.4	32.4	32.2
Sibley 81	10084	37.4	20.8	30.6	30.3	30.1	24.0	26.4	32.3	33.2	32.7
Eagle Chief	8868	37.0	25.8	27.2	34.0	29.1	21.7	29.5	23.7	33.1	35.3
Kanred	5146	27.8	24.9	26.3	34.3	30.1	24.9	27.3	25.6	31.4	29.1
Sibley 62	11523	39.1	28.0	24.2	32.8	29.2	25.9	25.5	25.6	36.7	24.8
Quivira	8886	31.3	17.5	27.4	38.6	26.6	18.0	30.1	32.1	41.8	25.1
Redhull	11534	37.7	24.2	26.9	33.6						
Nebraska 60	6250	40.5	19.4	22.9	35.9	24.5	28.1	23.9			
Ioturk	11388	38.6	21.9	23.0	33.3						
Purkof	8381	36.3	21.9	23.5	33.9						
Turkey Sel.	10083		26.2	24.2	33.7	27.0	29.1	28.9			
Turkey Nebr. Sel.	10016				34.0			26.3	23.5		
Turkey Sel. 1-27-84						25.5	21.2	28.6	22.2	34.9	26.1
Kanred x Hard Fed. III-30-38											
Menno						26.3	16.4	29.1	30.8	44.4	
Ukrainka	8859					35.9	19.2	30.2			
Chiefkan	11754					27.9	25.3	21.2			
Kanhull	11877							29.4	21.4	39.8	33.5
Turkey Sel. 1-27-85									22.6	33.8	31.0
Turkey Sel. 1-27-87									22.8	32.8	25.6
Turkey Sel. 1-27-94									19.7	32.0	26.2
									22.7	33.2	

Winter Wheat Varieties

Table 2.—(Continued).

Variety or Selection	1941	1942	1943	1944	1945	No. Yrs. Grown	Average Yield	Percent of Kharkof Same Yrs.
Hard Red winter wheat								
Cheyenne	27.2	23.0	12.8	29.4	24.8	15	27.4	105
Kharkof	17.0	20.9	8.1	30.4	20.2	15	26.1	100
Tenmarq	17.4	18.8	9.9	28.6	20.7	15	26.0	100
Early Blackhull	19.3	21.0	13.6	31.1	28.2	15	24.6	94
Blackhull	21.5	24.2	10.8	28.2	23.8	14	26.9	104
Turkey	19.2	*	9.4	25.3	17.9	14	25.2	95
Sibley 81				31.2	22.6	12	29.3	102
Eagle Chief	20.4	*	10.6			12	27.3	102
Kanred	16.6	*				11	27.1	96
Sibley 62						10	29.2	99
Quivira						10	28.9	98
Redhull	20.0	*	9.8			6	25.4	106
Nebraska 60						7	27.9	97
Ioturk						4	29.2	99
Purkof						4	28.9	98
Turkey Sel.						6	28.2	105
Turkey Nebr. Sel.						3	27.9	103
Turkey Sel. 1-27-84	17.0	23.8				8	24.9	93
Kanred x Hard Fed. III-30-38						5	29.4	105
Menno						3	28.4	102
Ukrainka						3	24.8	89
Chiefkan	15.8	18.2	5.0	29.3	22.7	9	23.9	99
Kanhull	18.2					4	26.4	96
Turkey Sel. 1-27-85	17.8	*				4	24.8	90
Turkey Sel. 1-27-87	17.8	*				4	23.9	87
Turkey Sel. 1-27-94	19.1	*				3	25.0	101

Table 2.—(Continued).

Variety or Selection	C. I. No.*	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Hard Red winter wheat											
Pawnee	11669									44.2	35.0
Comanche	11673									42.8	34.4
Red Chief	12109										
Reliant	12144										
Triumph	12132										
Cheyenne x Tenmarq	11972										
Wichita	11952										
Westar	12110										
Soft Red winter wheat											
Denton	8265	34.5	23.0	26.5	37.3	33.6	23.2	29.0	27.2	36.3	24.4
Kawvale	8180	29.2	17.9	26.4	38.6	34.0	19.1	28.9	32.0	35.6	25.4
Harvest Queen	6199	32.2	20.2	21.8	28.9	26.8	22.2	25.8	18.7	34.9	24.8
Fulcaster	6471	34.1	20.5		34.0	27.3	23.6	21.9	21.8	35.4	28.0
Penquite†	5948	39.2	25.2	30.1	36.4	27.1	25.3	31.4	20.9	36.3	33.0
Nebraska 28	5147	18.8	11.1	25.3							
Nittany	6962		22.1	23.3	33.1	20.0	26.8	25.4			
Clarkan	8858					31.2	25.3	32.0	27.4	35.9	28.2

Table 2.—(Continued).

Variety or Selection	1941	1942	1943	1944	1945	No. Yrs. Grown*	Av. Yield	Percent of Kharkof same Yrs.
Hard Red winter wheat								
Pawnee	25.9	24.5	9.5	32.3	30.1	7	28.8	122
Comanche	25.8	25.5	10.9	31.9	29.8	7	28.7	122
Red Chief		20.9	13.2	28.5	22.9	4	21.4	107
Reliant			12.8	31.6	25.9	3	23.4	120
Triumph			10.6	32.2	26.4	3	23.1	118
Cheyenne x Tenmarq			9.9	29.1	25.6	3	21.5	110
Wichita		*	16.5		18.5	2	17.5	124
Westar					23.4	1	23.4	116
Soft Red winter wheat								
Denton	14.3	16.1	12.1	30.6	25.1	15	26.2	101
Kawvale	26.4	12.7	7.7	30.7	22.9	15	25.8	99
Harvest Queen	8.6	15.5	5.7			13	22.0	84
Fulcaster	10.3	15.1				11	24.7	89
Penquite†						10	30.5	103
Nebraska 28						3	18.4	62
Nittany						6	25.1	94
Clarkan	20.2	15.0	10.0	33.4	19.8	11	25.3	102

* C. I. refers to the accession number of the Division of Cereal Crops and Diseases.

**Omitted because of late planting.

† Penquite (C. I. 5948) was grown from 1931-34, and Penquite selection (C. I. 11745) from 1935-40.

Table 3.—Agronomic data for winter wheat varieties grown at Stillwater during the period 1939-45.

Variety	C. I. No.	Test Weight	Date Ripe	Height
		1939-45	Av. for 1942 and 1945	Av. for 1940 and 1945
		Lbs.	June	In.
Blackhull	6251	58.7	10	37
Kharkof	1442	56.7	12	36
Early Blackhull	8856	59.8	3	34
Cheyenne	8885	57.7	12	36
Tenmarq	6936	55.7	11	37
Chiefkan	11754	58.6*	12	40
Comanche	11673	57.6	10	36
Pawnee	11669	57.5	10	35

* Average of six years, 1942 omitted.

Lawton

Extended periods of drought in the early spring and hot, dry weather during the ripening period are the major factors limiting wheat production in southwestern Oklahoma. Winterkilling is not important, but late spring freezes sometimes damage very early maturing varieties such as Early Blackhull.

Winter wheat varieties have been tested at the Lawton station for 22 years. Since 1930 the varietal testing work has been in cooperation with the Division of Cereal Crops and Diseases, U. S. Department of Agriculture. The primary effort in the varietal testing has been to compare yields of standard and widely grown varieties with promising new varieties for the southwestern Oklahoma wheat-growing region.

The annual and average grain yields of 22 varieties of hard red winter wheat and 5 varieties of soft red winter wheat grown during all or a part of the period 1931-45 at Lawton are presented in Table 4. Only two varieties, Tenmarq and Kanred, were grown the same 13 years. In this comparison, Tenmarq outyielded Kanred by 0.5 bushel per acre. During a 10-year period the average yield of Turkey was 89 percent of Tenmarq. Kawvale yielded the same as Tenmarq during this period. Although Kawvale proved to be productive its susceptibility to shattering makes it entirely unsuitable for combine harvesting. Furthermore, it is classed as a semihard wheat. Currell, Clarkan, Penquite, and Denton—varieties of soft red winter wheat—produced from 80 to 91 percent as much grain as Tenmarq in the same years.

Newer hard wheat varieties commanding wide interest among southwestern Oklahoma wheat growers are Chiefkan,

Table 4.—Annual and average grain yields in bushels per acre of winter wheat varieties and selections grown in field plot tests at the Lawton, Oklahoma, Field Station, during all or a part of of the period, 1931-1945.

Variety or Selection	C. I. No.	1931	1932	1933	1934	1936	1937	1939	1940
Hard Red winter wheat									
Tenmarq	6936	28.7	32.8	23.6	21.8	16.2	33.5	12.9	22.2
Kanred	5146	28.7	33.7	23.0	19.8	17.0	32.4	13.7	22.0
Cheyenne	8885	27.5	31.6	23.8	17.7	17.6	32.8	**	21.7
Early Blackhull	8856	21.2	30.5	19.8	22.0	14.3	34.6	14.0	16.9
Blackhull	6251	25.9	31.9	23.5	19.1	17.6	33.2	**	21.5
Kharkof	1442	30.7	31.9	22.7	17.0	16.9	32.0	**	20.1
Turkey	1558	29.3	29.9	22.7	17.9	17.6	29.9	12.4	19.6
Ioturk	11388	27.4	25.3	25.4	16.2	15.8	31.2		
Nebraska 60	6250	25.1	29.0	22.6	15.8	17.9	30.2	**	
Eagle Chief	8868	28.3	33.0	23.2	18.7	16.1			
Kanred x Hard Federation	11373		33.0	19.6	28.7	13.6	34.0	**	
Kanred x Marquis	10589				23.2	15.6	36.6	**	19.1
P-1066-1 x Prelude	11590				25.4	15.2	34.0	**	17.7
Chiefkan	11754						34.2	14.1	22.3
Turkey x Kawvale, 35-96 La.							34.1	11.9	18.7
Comanche	11673							12.9	21.7
Pawnee	11669							13.6	22.4
Wichita	11952								
Red Chief	12109								
Cheyenne x Tenmarq	11972								
Westar	12110								
Cheyenne x Early Blackhull	12122								
Soft Red winter wheat									
Kawvale	8180	32.5	32.6	22.9	25.5	16.3	32.1	**	18.1
Denton	8265	23.7	32.1	21.2	22.6	15.7	31.9	**	15.4
Currell	3326	19.0	30.2	16.9	15.7	16.1			
Clarkan	8858					17.9	32.8	11.6	18.5
Penquite Sel.	11745						33.4	13.3	19.1

Table 4.—(Continued)

Variety or Selection	1941	1942	1943	1944	1945	No. Yrs. Grown*	Average Yield	Pct. of Tenmarq Same Years
Hard Red winter wheat								
Tenmarq	26.7	16.9	34.6	36.4	17.8	13	24.9	100
Kanred	21.9	19.5	31.1	32.6	21.4	13	24.4	98
Cheyenne	25.0	14.9	32.1	31.6	23.5	12	25.0	96
Early Blackhull	24.2	24.2	27.6	37.9	**	12	23.9	94
Blackhull	15.1	18.0	28.1	31.9	21.9	12	24.0	92
Kharkof	19.9	12.9	25.4	31.1	21.7	12	23.5	91
Turkey	19.6	10.9				10	21.0	89
Ioturk						6	23.6	90
Nebraska 60						6	23.4	90
Eagle Chief						5	23.9	97
Kanred x Hard Federation						5	25.8	101
Kanred x Marquis						4	23.6	101
P-1066-1 x Prelude						4	23.1	99
Chiefkan	20.4	11.7	27.7	32.4	18.6	8	22.7	90
Turkey x Kawvale, 35-96 La.	27.0	12.2				5	20.8	93
Comanche	31.6	20.8	29.3	38.7	28.9	7	26.3	110
Pawnee	26.2	15.4	29.5	39.2	29.3	7	25.1	105
Wichita	24.9	27.5	32.1	40.2	21.0	5	29.1	110
Red Chief		13.4	26.7	30.6	18.9	4	22.4	85
Cheyenne x Tenmarq			33.7	38.5	26.5	3	32.9	111
Westar				36.0	28.7	2	32.4	119
Cheyenne x Early Blackhull					33.1	1	33.1	186
Soft Red winter wheat								
Kawvale	28.7	20.6	26.6			10	25.6	100
Denton						7	23.2	91
Currell						5	19.6	80
Clarkan	17.6	15.1	27.4	32.9	17.1	9	21.2	88
Penquite Sel.	13.8					4	19.9	84

* 1935 and 1938 yield data not included because of hail damage.

** No emergence.

Comanche, Pawnee, Red Chief, Westar, and Wichita. Chiefkan, a beardless Blackhull type of wheat with a high test weight, has been grown for eight years and yielded only 90 percent as much as Tenmarq. Comparing Chiefkan and Comanche for seven comparable years, the yields were 21.0 and 26.3 bushels per acre, respectively. Red Chief, another beardless hard wheat similar to Chiefkan, produced only 85 percent as much grain as Tenmarq over a 4-year period. Comanche and Pawnee have been tested seven years, 1939-45. The 7-year average yield of Comanche was 1.2 bushels per acre higher than Pawnee and 2.4 bushels more than Tenmarq. Comanche also outyielded Early Blackhull by 1.7 bushels per acre over a 6-year period. Wichita, in the variety test for five years, 1941-45, outyielded one of its parents, Tenmarq, by 2.6 bushels per acre for the 5-year period and the other parent, Early Blackhull, by 2.7 bushels per acre for the 4-year period 1941-44.

Agronomic data other than yield on 13 varieties of hard red winter wheat grown at Lawton are shown in Table 5. Of the five recommended varieties—Cheyenne, Comanche, Pawnee, Tenmarq, and Turkey (Kharkof)—Cheyenne has the highest average test weight with 60.0 pounds per bushel, followed by Comanche with 59.6. While the test weight of Red Chief is high (62.4), the yields presented in Table 4 show it to be 15 percent less productive than Tenmarq and 24 percent less than Comanche.

Table 5.—Agronomic data on winter wheat varieties grown at the Lawton, Oklahoma Field Station during the the period 1941-45.

Variety	C. I. No.	Test Weight	Date Ripe	Height	Lodging	Leaf Rust
		Lbs.	June	In.	Pct.	Pct.
Tenmarq	6936	57.8	6	37	14	51
Kanred	5146	58.0	6	36	17	58
Early Blackhull*	8856	61.5	5/31	36	36	58
Blackhull	6251	60.1	6	39	15	66
Kharkof	1442	57.8	8	35	16	82
Cheyenne	8885	60.0	7	35	1	84
Chiefkan	11754	60.2	7	37	18	63
Pawnee	11669	59.1	4	34	5	32
Comanche	11673	59.6	3	39	18	24
Wichita	11952	61.4	5/31	38	28	69
Red Chief**	12109	62.4	7	37	3	59
Westar†	12110	59.0	3	42	0	35

* Four-year average, 1941-1944.

** Four-year average, 1942-1945.

† Two-year average, 1944-1945.

The earliest maturing varieties at Lawton are Wichita and Early Blackhull, followed by Pawnee and Comanche. Both Early Blackhull and Wichita are susceptible to lodging; Cheyenne and Pawnee, both rather short-strawed varieties, showed very little lodging in these tests. Comanche with 24 percent and Pawnee with 32 percent showed the lowest leaf rust infections.

Woodward

The extremes of temperature, wind, and precipitation in northwest Oklahoma have a definite and sometimes very detrimental effect on the time of emergence, survival, rate and amount of growth, shattering, protein content, of the wheat. These conditions also affect the abundance of wire worms, joint worms, army worms, stem maggots, grubs, and bacterial growths; the prevalence of leaf and stem rusts, covered and loose smuts; the time of heading and the date of maturity. Any one or all of these factors may have a definite bearing on grain yields, causing them to fluctuate considerably from year to year. Table 6, giving the annual and average yields of winter wheat varieties grown at Woodward from 1931 to 1945, shows a 49.2-bushel variation in the yield of Kharkof and nearly as great a variation for a dozen other varieties. Kharkof yielded only 4.0 bushels per acre in the adverse year of 1937—compared with 53.2 bushels in 1944. For various reasons, no one variety is best in yield every year, although the average yields of some are definitely higher than those of others. For example, Cheyenne outyielded Pawnee in 1939 and in 1944, yet on the average Pawnee has nearly a 5-bushel advantage as may be seen in Tables 6 and 8. Further, the yearly fluctuation of Pawnee was considerably less than for Cheyenne.

Climatic conditions also cause varieties to vary in relative weight of grain per bushel, in time of maturity, height, and lodging, from year to year although on the average some varieties are definitely earlier, others shorter-strawed, and still others more resistant to lodging and disease and test more per bushel than others.

Average agronomic data on winter wheat varieties grown at Woodward (Table 7) show Early Blackhull and Wichita to be the earliest maturing with Turkey and Kharkof the latest of the varieties grown. Pawnee, Wichita, and Blackhull normally will produce heavier grain than other varieties commonly grown on farms and will average 3 to 4 pounds per bushel heavier than Turkey or Kharkof. Some new, unnamed, hy-

Table 6.—Annual and average yields in bushels per acre of winter wheat varieties and selections grown in field plot tests at the Southern Great Plains Field Station Woodward, Oklahoma, during all or a part of the period, 1931-1945.

Variety or Selection	C. I. No.	1931	1932	1933	1934	1936	1937	1938	1939	1940
Hard Red winter wheat										
Tenmarq	6936	48.8	39.3	16.8	15.2	20.0	9.5	41.3	36.4	16.0
Cheyenne	8885	47.0	39.6	21.7	13.8	18.3	5.3	35.6	42.9	17.9
Kharkof	1442	45.4	42.8	18.5	16.0	22.5	4.0	36.2	39.5	17.7
Blackhull	6251	46.9	36.1	18.0	13.8	18.0	10.9	28.5	38.4	20.3
Early Blackhull	8856	36.0	30.0	22.1	20.7	12.0	14.4	27.2	38.2	18.3
Turkey	1558	44.7	42.0	18.3	14.5	20.2	4.9	34.1	38.6	18.2
Quivira	8886	46.6	35.5	16.2	19.0	16.2	10.6	44.2	38.7	20.4
Kanred	5146	44.8	38.2	16.6	12.1	19.9	7.2	36.4	39.8	17.3
Oro	8220	40.2	39.1	19.2	12.2	18.2	4.2	35.5	40.4	17.4
Nebraska 60	6250	42.2	39.6	18.1	16.1	21.4	4.3			
Sibley 81	10084	43.3	36.9	15.6	12.3	17.6	5.6			
Chiefkan	11754						10.0	43.2	41.4	22.9
Sibley 62	11523				11.9	20.1	8.1	35.1	38.6	18.5
Pawnee	11669							56.2	42.1	23.2
Comanche	11673							43.9	37.5	21.7
Wichita	11952									
Red Chief	12109									
Blackhull x Hd. Federation	12120									
Westar	12110									
Triumph	12132									
Soft Red winter wheat										
Kawvale	8180	46.4	34.0	16.7	16.1	13.6	8.6	45.3	34.1	16.4
Denton	8265	33.3	34.1	15.4	14.3	15.3	6.7	33.1	35.6	17.2
Fulcaster	6471	41.5	35.8	17.0	14.9	15.7	9.5	31.4		

Table 6.—(Continued)

Variety or Selection	1941	1942	1943	1944	1945	No. Yrs. Grown*	Average Yield	Percent of Kharkof same years
Hard Red winter wheat								
Tenmarq	38.8	36.6	31.2	49.4	28.5	14	30.6	108
Cheyenne	30.4	34.5	28.4	58.9	30.6	14	30.3	107
Kharkof	24.1	27.7	21.6	53.2	29.1	14	28.4	100
Blackhull	29.0	28.6	31.5	46.4	28.7	14	28.2	99
Early Blackhull	29.4	35.0	29.1	42.6	24.1	14	27.1	95
Turkey	28.4	25.3	25.5			12	26.2	100
Quivira	38.4	37.6				11	29.4	110
Kanred	24.9	29.8				11	26.1	97
Oro						9	25.2	93
Nebraska 60						6	23.6	95
Sibley 81						6	21.9	88
Chiefkan	30.2	27.1	26.8	47.7	28.1	9	31.8	113
Sibley 62						6	22.1	97
Pawnee	42.7	38.6	33.3	47.9	34.2	8	39.8	128
Comanche	38.8	43.6	33.5	46.8	32.1	8	37.2	120
Wichita		43.2	32.2	47.0	33.2	4	38.9	118
Red Chief		30.3	31.5	56.2	31.3	4	37.3	113
Blackhull x Hd. Federation			26.1	49.8	36.2	3	37.4	108
Westar				52.3	31.9	2	42.1	102
Triumph					31.1	1	31.1	107
Soft Red winter wheat								
Kawvale	38.8	33.3				11	27.6	103
Denton						9	22.8	84
Fulcaster						7	23.7	89

* Grain yields were not taken in 1935.

Table 7.—Agronomic data on winter wheat varieties grown at the Southern Great Plains Field Station, Woodward, Oklahoma during the period 1941-45.

Variety	C. I. No.	Test Weight	Date Ripe	Height	Lodging	Leaf Rust*
		Lbs.	June	In.	Pct	Pct.
Blackhull x Hard						
Federation	12120	63	13	36	0	29
Pawnee	11669	62	11	38	7	28
Wichita	11952	62	9	39	8	64
Blackhull	6251	62	14	40	10	67
Comanche	11673	61	12	39	8	32
Cheyenne	8885	61	14	38	6	78
Red Chief	12109	61**	13**	40**	Trace**	68†
Early						
Blackhull	8856	61	9	39	7	45
Tenmarq	6936	60	13	41	7	63
Chiefkan	11754	60	15	41	9	56
Westar	12110	60**	12**	36**	Trace**	Trace**
Turkey	1558	59	16	38	7	52
Kharkof	1442	58	16	38	9	63

* Three-year average, 1941, 1943 and 1945.

** Four-year average, 1942-1945.

† Two-year average, 1943 and 1945.

brids have the ability to produce grain of even higher test weight per bushel than Pawnee or Blackhull. For example, the average test weight of Blackhull × Hard Federation (C. I. 12120) was 63 pounds per bushel compared with 62 pounds for Pawnee and Blackhull (Table 7).

Comparative Grain Yields at the Three Stations

A comparison of average grain yields of eight varieties grown for different periods of years at each of the three Oklahoma stations, Stillwater, Lawton, and Woodward, is made in Table 8. A weighted average of 20 station years, five at Lawton, seven at Stillwater, and eight at Woodward, is also given in order to show the over-all performance of these varieties. The varieties are listed in the table in order of the weighted average yields. Pawnee ranks first and was highest in average yield at Stillwater and Woodward and third at Lawton. Comanche yielded 0.6 bushel per acre less than Pawnee for all stations but ranked first at Lawton. Cheyenne ranked third for all three stations but averaged 3.1 bushels per acre less than Pawnee and 2.5 less than Comanche. Tenmarq ranked fourth for all three stations but was second at Lawton. The average yield of Chiefkan was 5.3 bushels per acre less than that of Pawnee and 4.7 less than that of Comanche.

Table 8.—Average grain yields in bushels per acre of eight hard red winter wheat varieties grown uniformly at three Oklahoma stations during all or a part of the period 1938-1945.

Variety	C. I. No.	Lawton 1940-44	Stillwater 1939-45	Woodward 1938-45	Weighted Average (20 station- years)
Pawnee	11669	26.5	28.8	39.8	32.6
Comanche	11673	28.4	28.7	37.2	32.0
Cheyenne	8885	25.1	26.6	34.9	29.5
Tenmarq	6936	27.4	23.2	34.8	28.9
Blackhull	6251	22.9	26.6	31.4	27.6
Early Blackhull	8856	26.2	24.6	30.5	27.4
Chiefkan	11754	22.9	23.5	33.4	27.3
Kharkof	1442	21.9	23.6	31.1	26.2

Comparative Grain Yields in Oklahoma Farm Wheat Improvement Tests

The average grain yields in bushels per acre of 11 varieties of hard red winter wheat tested in the Oklahoma Farm Wheat Improvement Program are presented in Table 9. In addition, this table shows the relative yields, expressed in percentage of Tenmarq grown for the same years and locations. As expected, there is a larger variation in yield within varieties grown at different localities than there is between varieties grown at the same localities. For instance, the yield of Tenmarq ranged from 28.9 bushels per acre in Ellis County to 13.0 in Dewey County, whereas the range of the 10 varieties grown in Ellis County was from 31.5 bushels per acre for Pawnee to 25.8 for Red Chief.

The yield data in Table 9 not only give the relative performances of these 11 varieties for Oklahoma in general but also serve to stress the local varietal adaptation of varieties tested for 4 years or more. As an average of all tests, Comanche and Pawnee rank first and second with 112 and 111 percent of Tenmarq, respectively. Next in relative yield are Reliant with 109 percent, and Triumph with 108 percent, of the yield of Tenmarq. Both Reliant and Triumph, however, need more adequate testing for yield, milling and baking characteristics, disease resistance, and other characters before they can be satisfactorily evaluated for those characters.

Table 9.—Average and relative grain yields of hard red winter wheat varieties tested in the Oklahoma Farm Wheat Improvement Program during all or a part of the period, 1939-45.

Variety County	Tenmarq		Turkey			Cheyenne		
	No. Yrs. Grown	Av. Yield Bu.	No. Yrs. Grown	Av. Yield Bu.	Pct. Tq.*	No. Yrs. Grown	Av. Yield Bu.	Pct. Tq.*
Alfalfa	3	25.3	3	22.5	89	3	25.5	101
Beaver	4	21.7	4	18.5	85	4	21.2	98
Blaine	4	18.9	4	15.0	79	4	17.6	93
Caddo (Anadarko area)	3	18.6	3	15.8	85	3	12.9	70
Caddo (Hinton area)	4	16.9	4	15.5	92	4	18.4	109
Canadian	3	22.6	3	16.0	71	3	17.6	78
Carter	3	13.7	3	17.8	94	3	11.3	83
Comanche	3	15.6	3	14.7	94	3	19.8	128
Dewey	3	13.0	3	7.4	57	3	12.0	92
Ellis	3	28.9	3	26.3	91			
Grady	3	16.3	3	17.0	104	3	17.5	107
Garfield (Enid area)	3	28.3	3	23.7	84	3	25.6	90
Garfield (Covington area)	5	17.0	5	15.3	90	5	19.0	112
Grant (Medford area)	5	24.2	5	19.7	81	5	23.3	96
Grant (Nash area)	5	19.3	5	16.1	83	5	18.5	96
Kay (Blackwell area)	3	17.3	3	14.6	85	3	18.2	103
Kay (Newkirk area)	3	18.4	3	17.9	98	3	20.1	109
Kiowa	7	20.2	7	13.9	69	7	18.1	90
Logan	4	16.2	4	19.0	118	4	15.5	96
Noble	5	15.5	5	16.1	103	5	16.1	104
Pottawatomie	3	16.6	3	15.5	91	3	15.9	93
Tillman (Frederick area)	7	15.7	7	12.1	77	7	17.9	114
Tillman (Grandfield area)	6	15.7	6	13.8	88	6	15.1	96
Woods	5	27.2	5	22.2	82	5	24.4	90
Total No. Tests	97		97			94		
Weighted Av.		19.2		15.6			18.4	
Percent of Tenmarq same years					81			98

* Percentage of Tenmarq grown for the same years.

Table 9.—(Continued).

Variety	Chiefkan			Blackhull			Early Blackhull			Comanche			
	County	No. Yrs. Grown	Av. Yield Bu.	Pct. Tq.*	No. Yrs. Grown	Av. Yield Bu.	Pct. Tq.*	No. Yrs. Grown	Av. Yield Bu.	Pct. Tq.*	No. Yrs. Grown	Av. Yield Bu.	Pct. Tq.*
Alfalfa		3	26.9	106	3	20.7	82	3	23.1	91			
Beaver		3	22.5	99	3	19.2	84	3	21.9	97	3	24.6	109
Blaine		4	18.0	95	3	17.3	92	4	19.8	105	3	17.9	95
Caddo (Anadarko area)		3	21.4	115	3	15.9	86	3	18.9	102	3	21.1	114
Caddo (Hinton area)		4	16.9	100	4	16.3	96	4	18.4	109	4	18.9	112
Canadian		3	19.3	84	3	17.9	80	3	19.0	84	3	21.8	96
Carter		3	9.8	72	3	12.1	88	3	14.0	102	3	18.4	136
Comanche		3	17.8	114	3	14.3	91	3	20.5	132	3	24.8	159
Dewey		3	12.1	92	3	9.8	75	3	13.9	107			
Ellis		3	31.1	108	3	26.1	90	3	28.2	98	3	29.5	102
Grady		3	15.6	96	3	15.8	97	3	15.0	92			
Garfield (Enid area)		3	28.1	98	3	27.1	95	3	27.5	97			
Garfield (Covington area)		5	15.9	94	5	15.1	89	5	16.4	96	5	18.9	111
Grant (Medford area)		5	23.1	95	5	20.5	84	5	20.8	86	4	24.7	131
Grant (Nash area)		5	17.6	91	5	16.2	84	5	21.2	110	5	20.2	105
Kay (Blackwell area)		3	22.9	133	3	20.1	116	3	20.9	121			
Kay (Newkirk area)		3	21.4	116							3	23.7	129
Kiowa		7	17.2	86	7	15.7	78	7	18.9	94	5	20.8	107
Logan		4	13.9	85	4	14.8	91	4	15.4	96	3	18.8	117
Noble		5	16.0	103	5	14.7	94	5	17.3	112	4	16.1	126
Pottawatomie					3	16.9	101						
Tillman (Frederick area)		7	15.2	97	7	14.1	89	7	18.2	116	6	16.6	108
Tillman (Grandfield area)		5	14.7	96	6	12.1	77	6	17.9	113	6	17.7	113
Woods		5	23.9	88	5	22.2	82	5	24.9	92	5	28.0	103
Total No. Tests		92			92			90			74		
Weighted Av.			18.9			16.4			19.7			21.0	
Percent of Tenmarq same years				97			85			101			112

* Percentage of Tenmarq grown for the same years.

Table 9.—(Continued).

Variety	Pawnee			Red Chief			Reliant			Triumph		
	No. Yrs. Grown	Av. Yield Fu.	Pct. Tq.*	No. Yrs. Grown	Av. Yield Bu.	Pct. Tq.*	No. Yrs. Grown	Av. Yield Bu	Pct. Tq.*	No. Yrs. Grown	Av. Yield Bu.	Pct. Tq.*
Alfalfa												
Beaver	3	26.2	116	3	22.5	99	3	21.6	111			
Blaine	3	20.4	109	3	19.0	101				3	19.4	104
Caddo (Anadarko area)												
Caddo (Hinton area)	4	19.0	112	4	18.7	111	3	17.5	107	3	19.0	117
Canadian												
Carter												
Comanche												
Dewey												
Ellis	3	31.5	109	3	25.8	89	3	30.6	106	3	30.1	104
Grady												
Garfield (Enid area)												
Garfield (Covington area)	4	19.6	122	4	18.1	112	4	18.6	115	4	19.9	117
Grant (Medford area)	3	26.8	133	3	21.7	108	3	25.8	128	3	21.9	109
Grant (Nash area)	4	23.7	116	4	22.8	111	4	22.9	112	4	24.0	117
Kay (Blackwell area)												
Kay (Newkirk area)												
Kiowa	4	20.1	93	3	22.3	86	3	17.9	97	3	21.5	116
Logan												
Noble												
Pottawatomie												
Tillman (Frederick area)	4	14.1	111	3	14.8	106	3	14.9	119	3	18.9	151
Tillman (Grandfield area)	4	20.1	117	3	21.7	120	3	17.2	101	3	19.6	113
Woods	4	27.3	101	4	23.9	89	3	24.2	105	3	20.9	91
Total No. Tests	40			37			32			32		
Weighted Av.		22.3			21.0			21.1			21.4	
Percent of Tenmarq same years			111			109			109			108

* Percentage of Tenmarq grown for the same years.

Milling and Baking Characteristics

Millers who buy hard red winter wheat want strong gluten and a relatively high percentage of protein. Gluten strength and protein percentage usually depend more on soil and climate than on varietal differences. For instance, of four varieties in 23 comparable tests in 1941 (Table 10), the difference in percentage protein between the variety with the highest average (Tenmarq, 15.52) and the variety with the lowest average (Turkey, 14.47) was only 1.05; whereas in Tenmarq there was a difference of 10.35 percent between the highest protein (22.12% in Alfalfa County) and the lowest protein (11.77% in Logan County) in the same season. Similar differences occur in the quality of the protein, or gluten. The type of gluten is important to a baker because it determines to a large extent the length or severity of mixing. Some doughs will not tolerate long mixing times, while others must be mixed for a longer period to produce a loaf of bread that is considered satisfactory by the baker.

The wheat breeder must consider the needs and demands of the grower, the miller, the baker, and of the consuming public. The grower demands a variety with high yield, and such other factors as high test weight, resistance to shattering, freedom from lodging, and resistance to diseases; in other words, a combination of all the factors that, in the final analysis, will "spell out" *dollars* and *cents* per acre. However, it is equally important that the milling and baking characteristics of all otherwise desirable important strains be carefully determined and studied before any variety is released. Such studies, in cooperation with various commercial millers and bakers of Oklahoma and the Federal Laboratories located at Beltsville, Md., and Manhattan, Kans., are included in the testing program by the Oklahoma Agricultural Experiment Station. No variety of wheat, however desirable it may be agronomically, will be released by the Oklahoma Agricultural Experiment Station unless it has satisfactory milling and baking characteristics. A statement of these qualities is included in the varietal descriptions.

Grain and Forage Yields as Determined by Clipping Experiments

The value of winter wheat as a fall, winter, and spring pasture crop for livestock is commonly recognized in Oklahoma. Advantage is taken of wheat pasturage more often than it is neglected, so that ordinarily the problem is not one

Table 10.—Data on protein percentages of Hard Red winter wheat varieties grown in Farm Wheat Improvement Program tests, 1941-1945.

Year	Number of Varieties Compared	Number of Comparable Tests	Variety and protein percent with			County and protein percent in Tenmarq with		
			Highest Average	Lowest Average	Difference	Highest Pct.	Lowest Pct.	Difference
1941	4	23	Tenmarq, 15.52	Turkey, 14.47	1.05	Alfalfa, 22.12	Logan, 11.77	10.35
1943	3	10	Tenmarq, 15.93	Turkey, 15.39	0.54	Grant, 18.04	Tillman, 13.65	4.39
1944	10	19	Blackhull, 14.21	Turkey, 13.46	0.75	Beaver, 16.20	Grant, 9.80	6.40
1945	7	7	Comanche, 15.28	Wichita, 13.24	2.04	Woods, 18.15	Kingfisher, 11.94 (Hard land)	6.21

of full utilization but one of avoiding overgrazing or other abuse. Through clipping experiments, an attempt has been made to answer some of the questions about the relative merits of different varieties of winter wheat for pasture, and how late these varieties can be pastured and yet yield a good crop of grain at harvest.

WOODWARD RESULTS

Clipping and grain yield studies conducted on five hard red winter wheat varieties (Cheyenne, Turkey, Blackhull, Early Blackhull, and Tenmarq) at Woodward during the 6-year period, 1938-43, show that wheat varieties clipped severely (all leaves taken from the plant) after April 1 will suffer 50 to 80 percent reduction in grain yield whereas moderate clipping (upright growth removed with a lawn mower and prostrate leaves left on the plant) to March 15, or about jointing time, does not decrease grain yields and in some seasons will increase them. Moderate clipping to April 1 decreased average grain yields only slightly, though later clipping caused progressively lower grain yields. The relative grain yields for varieties clipped to given periods in the spring did not differ enough to indicate any distinct varietal superiority except that the grain yields of early-maturing varieties were damaged more by delayed clipping than were later varieties. The 5-year average grain yield in bushels per acre of all five varieties was as follows:

Not clipped -----	26.8
Moderately clipped	
To March 1 -----	26.6
To March 15 -----	27.9
To April 1 -----	25.4
To April 15 -----	16.8
To May 1 -----	5.2

Winter wheat varieties will generally produce about the same amount of green forage as Ward winter barley and more green forage than oats in northwestern Oklahoma. Wheat is generally less injured by late clipping than are oats or barley.

The average pounds per acre of green forage of all five varieties when clipped to different dates in the spring were as follows:

March 1 -----	1,427
March 15 -----	1,719

April 1	3,022
April 15	3,705
May 1	4,960

The variation in forage production of the different varieties tested was very similar.

In general, the early-maturing varieties are more erect in growth habit than are the later varieties which gives a false appearance of producing more forage. However, the early varieties do produce slightly more forage in the fall and early spring forage but not during the entire grazing period.

STILLWATER RESULTS¹

The clipping experiments at Stillwater were started in September, 1942. The results for the first three years are summarized below.

A total of 21 different crop plant varieties including five of hard red winter wheat (Turkey, Cheyenne, Blackhull, Tenmarq, and Chiefkan), and four of soft red winter wheat (Clarkan, Currell, Fulcaster, and Kawvale), were included in this test. Four clipping treatments were employed throughout the three years: (1) clip to March 25, or about jointing time; (2) clip to April 15, or after jointing time; (3) clip all season; and (4) no clipping. The clipping dates were not fixed. The plant development was given consideration each year and the above dates are approximate. Clipping to a height of about one inch was done with a lawn mower and the prostrate leaves were left on the plants.

Clipping to March 25 reduced the grain yields 2.8 bushels per acre as an average of the four varieties of soft red winter wheat and 3.2 bushels in the hard red winter wheats. Clipping to April 15 at Stillwater corresponded very closely to the May 1 clipping at Woodward, reducing the grain yields to approximately five bushels per acre.

In contrast to the results at Woodward, barley and oats were superior to wheat in the production of pounds of green forage per acre. The soft red winter wheats, as a class, were slightly superior to the hard red winter wheats. The average pounds per acre of green forage were as follows:

¹ The authors express appreciation to H. W. Staten, In Charge, Grass and Pasture Crops Research, Oklahoma Agricultural Experiment Station, for making available these data, part of which have been published in Oklahoma Agricultural Experiment Station Mimeographed Circular M-161, May, 1946.

Soft red winter wheats	
Clipped to March 25	3,397
Clipped to April 15	6,481
Clipped all Season	7,967
Hard red winter wheats	
Clipped to March 25	2,969
Clipped to April 15	5,700
Clipped all Season	7,257

In total forage production (clipped all season), the five varieties of hard red winter wheat ranked as follows: Turkey, Cheyenne, Blackhull, Tenmarq, and Chiefkan; the rank of the four varieties of soft red winter wheat was Kawvale, Currell, Fulcaster, and Clarkan. However, it is felt that these tests have not been conducted long enough to properly evaluate the relative forage-producing capacities of these varieties.

DESCRIPTION OF WHEAT VARIETIES²

The following descriptions of the varieties are given with the idea of increasing the acquaintance with them. All varieties described are either important commercially or are otherwise of special interest in Oklahoma. The listing of varieties is alphabetical.

Blackhull (C. I. 6251) was selected, increased, and distributed by E. G. Clark, a farmer of Sedgwick, Kansas. In most seasons the glumes or chaff develops black stripes, serving as an easy means of identification. The heads are bearded and the red kernels are mid-long and semihard to hard. It is earlier than Turkey, less winter-hardy, and has high test weight. Lodging, particularly in wet seasons, is often of a serious nature. It is susceptible to leaf and stem rust and to stinking smut (bunt). In spite of its high test weight, it usually produces a lower percentage of straight flour than other varieties. There has been much discussion of its milling and baking characteristics, and in some areas millers and bakers object to this variety. Blackhull is not recommended for Oklahoma.

Cheyenne (C. I. 8885) is the result of a plant selection made from Crimean (C. I. 1435) in 1922 at the Nebraska Agricultural Experiment Station. It has bearded, short erect heads; kernels red, midlong, hard. It is susceptible to stem and leaf rusts and to bunt but is tolerant to hessian fly and does not shatter easily. The dough of Cheyenne requires a longer mix-

² For more detailed descriptions see U. S. D. A. Bul. 1074, revised 1923; U. S. D. A. Tech. Bul. 459, 1935; and U. S. D. A. Tech. Bul. 795, 1939.

ing period than that of Turkey, but if mixed and fermented properly it can be made into a good bread. Cheyenne is one of the varieties recommended for the entire hard red winter wheat area of Oklahoma.

Chiefkan (C. I. 11754) is a beardless, black-glumed, hard red winter wheat developed by E. G. Clark of Sedgwick, Kans. It is probably the result of a natural cross between some Blackhull strain and Harvest Queen. When released in 1936 it was advertised as a "beardless superhard Blackhull wheat." It is very susceptible to bunt and loose smut, is susceptible to stem rust, but has some resistance to leaf rust. The grain is dark red in color and has a high test weight. While it seems to mill in a satisfactory manner, the dough will not stand long or severe mixing, and is generally not liked by the trade. In loaf volume and general characteristics of the baked bread, it is generally considered inferior to Blackhull. Because of its questionable baking characteristics, its general susceptibility to diseases, and inferior yielding ability compared to such new promising varieties as Comanche and Pawnee, Chiefkan is not recommended for Oklahoma.

Comanche (C. I. 11673) was developed from an Oro x Tenmarq cross in experiments cooperative between the Kansas Agricultural Experiment Station, other State experiment stations in the hard red winter wheat region, and the U. S. Department of Agriculture. It was released by the Kansas Station in 1942. It is a bearded, fairly early, moderately winter hardy, hard red winter wheat possessing fairly good straw and good test weight. It has high resistance to many important races of bunt, has some resistance to leaf rust, and is not seriously injured by stem rust. It is susceptible to loose smut and hessian fly. The milling and baking characteristics of Comanche are similar to those of Tenmarq. Comanche is recommended for the entire hard red winter wheat area of Oklahoma.

Clarkan (C. I. 8858), a soft red winter wheat, was developed by E. G. Clark, of Sedgwick, Kans., from a natural hybrid found in a field of Blackhull. It probably was a Blackhull x Harvest Queen cross. It is beardless and has white glumes that sometimes develop faint black stripes. It is very susceptible to loose smut and bunt, susceptible to stem and leaf rust, and has only a fair amount of winter hardiness. It is one of the higher-yielding soft red winter wheats and is recommended for the soft red winter wheat area of Oklahoma.

Currell (C. I. 3326), a soft red winter wheat variety, according to Carleton³ "was selected by Mr. W. E. Currell of Virginia, from a field of Fultz in 1881. The original seed was made from three spikes. It was first sold for seed in 1884." The glumes are brown, stems usually purple, beardless heads, and kernels dull red. It reached its peak production in Oklahoma in 1934 when 159,353 acres were harvested. In 1934, it occupied 4.5 percent of the total wheat acreage of the State but in 1944 only 1 percent. *Currell* is not recommended for Oklahoma.

Early Blackhull (C. I. 8856) was selected from a field of Blackhull in 1921 by A. P. Haeberle of Clearwater, Kans. It differs from Blackhull principally in being about a week earlier, having a somewhat shorter straw, and in producing flour of poorer baking quality. It is not disease resistant, but sometimes ripens early enough to escape severe rust infection. The flour of *Early Blackhull* is not liked by the trade. *Early Blackhull* is not recommended for Oklahoma.

Fulcaster (C. I. 6471), a variety of soft red winter wheat, has a rather uncertain origin. It is bearded, has purple stems and prominent orange-colored stripes on the glumes. It has long been one of the popular and widely grown varieties of soft red winter wheat in the United States, and in 1944 it was the leading soft red winter wheat grown in Oklahoma. In grain yield, *Fulcaster* is not outstanding; however, with the possible exception of Clarkan which increased in acreage from 6,541 acres in 1939 to 39,119 in 1944 in Oklahoma, no variety of soft red winter wheat has been tested that can take the place of this variety. *Fulcaster* is recommended for the soft red winter wheat area of Oklahoma.

Harvest Queen (C. I. 6199) is another variety of soft red winter wheat whose history and origin are not definitely known. E. S. Marshall of DeSoto, Kans., claims to have applied the name "Harvest Queen" to this variety. He selected a tall, promising stool of the wheat from some other variety in 1895, increased it in 1896, and named it in 1897. It is a beardless variety with dull red kernels and is distinct in having tall, bright strong straw and a thick oblong spike. This variety, like *Fulcaster*, is not outstanding in grain yield.

Kanred (C. I. 5146) was selected from Crimean (C. I. 1435) at the Kansas Agricultural Experiment Station. It is similar to Turkey but it can be distinguished from that variety by

³ Carleton, M. A., *The Small Grains*. 699 pp., Illus. New York 1916.

its longer beaks on the outer glumes. Kanred is slightly earlier than Turkey, has resistance to some races of both leaf and stem rust, and in milling and baking characteristics it is equal to Turkey. Its principal faults are weak straw and low test weight. Kanred is not recommended for Oklahoma.

Kawvale (C. I. 8180) is a semihard variety developed by the Kansas Station and distributed in the eastern part of that State. It is bearded and has a purple stem. It has considerable resistance to leaf rust and is a so-called "late ruster" with regard to stem rust. It also carries resistance to loose smut and hessian fly. The variety is very susceptible to shattering. Some difficulty has been caused in the grading because it is neither a typical hard nor a typical soft wheat. In milling and baking characteristics the variety resembles hard more than it does soft wheat. *Kawvale* is not recommended for Oklahoma.

Kharkof (C. I. 1442) was introduced into the United States by M. A. Carleton in 1900. It is very similar in appearance and performance to Turkey but is somewhat more uniform. Because of this uniformity, it is a more useful "measure" than Turkey in the yield evaluation of new varieties. *Kharkof* is considered a synonym of Turkey and its acreage is included with that variety.

Pawnee (C. I. 11669) is the result of a *Kawvale* x *Tenmarq* cross. It was developed in experiments cooperative between the Nebraska Agricultural Experiment Station, other State experiment stations in the hard red winter wheat region, and the U. S. Department of Agriculture. It was released by the Nebraska and Kansas Agricultural Experiment Stations. It is a bearded hard red winter wheat with smooth, white glumes. Its superior characteristics include a short stiff straw, resistance to loose smut, and moderate resistance to leaf rust, bunt, and hessian fly. It either has some resistance to or is able to escape severe stem rust damage because of earliness. *Pawnee* has a slight tendency to shatter when ripe, but it is not so bad as *Kawvale* in this respect. Growers of *Pawnee* in this state have registered no complaints concerning the snattering of this variety. Flour from *Pawnee* is of a creamy white color. Protein characteristics and the mixing time are similar to those of *Blackhull*. The dough handling properties are satisfactory; the loaf volume is about the same as for Turkey and *Blackhull*. Bread from *Pawnee* has good color and texture of crumb. While *Pawnee* is not outstanding in quality,

it is superior to Blackhull and nearly equal to Turkey. Pawnee is recommended for the entire hard red winter wheat section of Oklahoma.

Red Chief (C. I. 12109) was released to Kansas farmers by E. G. Clark of Sedgwick, Kans., in 1940. The exact origin of the variety is not known, but it may be a selection from a natural Redhull x Chiefkan hybrid. It is beardless, has red chaff, dark red grain color, and is high in test weight. Red Chief has little or no disease resistance and is more susceptible to bunt than is Chiefkan. In loaf volume and general characteristics of the baked bread, Red Chief, like Chiefkan, is generally considered inferior to Blackhull. Because of its questionable baking characteristics, its general susceptibility to disease, and inferior yielding ability compared to such new promising varieties as Comanche and Pawnee, Red Chief is not recommended for Oklahoma.

Reliant (C. I. 12144) is the result of a cross made in 1924 by Mr. Joseph Danne, a farmer residing near El Reno, Okla., who distributed it to farmers in 1940. It is a bearded, white-glumed hard red winter wheat with rather tall straw, a growth habit similar to Turkey, and matures along with Cheyenne or Tenmarq. The variety is very susceptible to bunt, loose smut, and stem rust, but shows moderate resistance to leaf rust. Preliminary data indicate it has acceptable milling and baking characteristics. The first appreciable acreage of it in Oklahoma was in 1944 with 6,022 acres, comprising approximately 0.1 percent of the total wheat acreage. The experimental testing period of this variety has been of too short a duration for satisfactory evaluation.

Sibley 81 (C. I. 10084) was selected from a field of Sibley at the Oklahoma Agricultural Experiment Station in 1921. One of these selections, Number 81, was included in a wheat test on the farm of Mr. Earl Estil at Carrier, Okla., in 1927. This selection showed up well and was distributed in 1930 as Sibley 81. It is bearded, has purple straw, is resistant to bunt, and is susceptible to lodging and shattering. It is classed as a semi-hard to hard wheat. In grain yield it is not outstanding and is not recommended for Oklahoma.

Tenmarq (C. I. 6936) was selected from a Marquis (spring) x Crimean selection (winter) cross at the Kansas Agricultural Experiment Station. It was distributed in Kansas in 1932 and the acreage increased rapidly in that state as well as in Oklahoma and Texas. It is bearded, early, has a fair straw,

and short plump kernels. The variety has some resistance to leaf rust and because of its earliness it may escape serious damage from stem rust. Tenmarq is very susceptible toessian fly. Two of the chief objections to the variety are its tendency to "yellow berry" and low test weight; however, the milling and baking characteristics are well liked by most of the trade. Tenmarq flour produces a good loaf of bread but the dough requires a relatively long mixing time. The acreage in Oklahoma increased from 484,321 in 1939 to 2,096,400 in 1944. It occupied 40.3 percent of the total wheat area in the state in 1944. Tenmarq is recommended for the entire hard red winter wheat area of Oklahoma.

Triumph (C I. 12132), or Early Triumph as it is frequently called, was developed and distributed about 1940 by Joseph Danne of El Reno, Okla. It is an early, bearded, white-glumed, short, stiff-strawed hard red winter wheat. The variety is extremely susceptible to leaf rust and susceptible to bunt and stem rust, but appears to have some resistance to loose smut. Because of its earliness, it frequently escapes heavy rust infections. Preliminary data indicate it has acceptable milling and baking characteristics.

Turkey was introduced into the United States in 1873 from Russia by the Mennonite immigrants. It was then and is now composed of many hard red winter types and so is not a pure variety. Turkey is bearded, has a white chaff, and produces a hard red grain. It is susceptible to the same diseases as Cheyenne and Tenmarq. In milling and baking characteristics Turkey is an acceptable variety, frequently being used as a standard of comparison. It is a good average variety and in 1944 it occupied 15 percent of the total wheat acreage in Oklahoma. Turkey is recommended for the entire hard red winter wheat area of Oklahoma.

Westar (C. I. 12110) was selected from a Kanred-Hard Federation x Tenmarq cross, in experiments cooperative between the Texas Agricultural Experiment Station and the U. S. Department of Agriculture. The early breeding work was done at the Denton (Texas) Substation and it was distributed from the Soil Conservation Experiment Station at Amarillo. The variety was developed for the Panhandle Plains region of Texas. In general appearance, it is similar to Tenmarq and Comanche and is reported to have good milling and baking characteristics. It is highly resistant to leaf rust, but susceptible to stem rust. Under Oklahoma conditions, the

testing period has been of too short a duration to satisfactorily evaluate the variety.

Wichita (C. I. 11952) was developed from an Early Blackhull x Tenmarq cross in experiments cooperative with the Kansas Agricultural Experiment Station and the U. S. Department of Agriculture. In most plant characteristics it is similar to Early Blackhull. It is approximately one to two days later in maturity, has a slightly better straw, higher yield, and has better milling and baking characteristics than Early Blackhull.

SUMMARY

Winter wheat is the most important crop in Oklahoma, an average of approximately 57,000,000 bushels being produced annually over the last 10-year period.

Hard red winter wheat occupies approximately 95 percent of the total wheat acreage of the state. In 1944, Tenmarq was the leading variety occupying 40 percent of the total wheat acreage. Turkey decreased from 68.6 to 15.0 percent of the total wheat acreage between 1919 and 1944.

Milling and baking characteristics are determined during the process of improving and testing of wheat varieties. Only those varieties with acceptable milling and baking characteristics will be released by the Oklahoma Agricultural Experiment Station.

Yield and agronomic data are reported from wheat varietal trials conducted on the Experiment Stations at Stillwater, Lawton, and Woodward for the period 1931-1945. In addition, yields are presented from county nursery trials conducted by the Oklahoma Farm Wheat Improvement Program for counties and for varieties with three or more years' data.

In grain yield of the varieties with known acceptable milling and baking characteristics, the leading varieties are Pawnee, Comanche, and Cheyenne at Stillwater and Woodward; and Comanche, Tenmarq, and Pawnee at Lawton (Tables 2, 4, 6, and 8). In the county nursery tests the rank is Comanche, Pawnee, Tenmarq. In test weight, these varieties ranked as follows: Cheyenne, Comanche, Pawnee, Tenmarq at Stillwater and Lawton; Pawnee, Comanche and Cheyenne (tied), Tenmarq at Woodward. In maturity, the varietal rank is similar at all three stations, being either Pawnee or Comanche, Tenmarq, Cheyenne; however, at Lawton these

varieties mature on the average from five to nine days earlier than at Stillwater or Woodward. In resistance to lodging, Cheyenne was definitely superior to the other three varieties, but in leaf rust, it showed more than twice as much infection as Pawnee or Comanche.

Clipping experiments to determine the value of winter wheat for pasture conducted at Stillwater and Woodward are reported. At Stillwater, clipping to March 25 produced approximately 3,000 pounds of green forage per acre, and reduced the grain yield about 3.0 bushels per acre. Clipping to April 1 doubled the production of green forage but reduced the grain yield to only about 5.0 bushels per acre. At Woodward there was no reduction in grain yield when clipped to March 25, and only slight reduction when clipped to April 1. Clipping later than April 1, however, produced substantial decreases in grain yield. Approximately 1,700 pounds per acre of green forage was produced when clipped to March 15 and about 3,000 pounds when clipped to April 1. There were no marked varietal differences either at Stillwater or Woodward, either in grain reduction following clipping or in the production of green forage.

A varietal description of wheats of interest in Oklahoma is given.

APPENDIX

EXPERIMENTAL METHODS

Stillwater, Lawton, and Woodward

The soil on which the wheat varieties were planted at Stillwater has been classified as Kirkland very fine sandy loam. This soil has a dense clay pan at a depth of 9 to 12 inches and the crops grown on it frequently are subjected to drought injury. At Lawton, the soil is a heavy clay loam designated as Foard clay or as Comanche clay loam that has developed under grass, mainly from granitic materials. The soil at Woodward is a very fine sandy loam with a red sub-soil phase, typical of much of the better wheat land in north-western Oklahoma.

The wheat varieties in these tests were grown in systematically arranged field plots at all three stations. The number of replications of each variety was as follows: Stillwater—4 every year with the exception of 7 in 1931 and 5 in 1935; Lawton—3; Woodward—4. Size of the plot: Stillwater—varied from 1/138 to 1/89 of an acre depending on availability of land, and type of planting and harvesting machinery; Lawton—1/75 acre; Woodward—1/47 acre from 1931 to 1942, and 1/51 acre from 1943 to 1945.

At Stillwater and Lawton the wheat plots were located on summer-fallowed land; at Woodward, two replications were on fallow and two on land cropped to spring oats.

All seedings were made with a regular 7-inch disk grain drill at the rate of 60 pounds per acre at Stillwater and Lawton, and three pecks at Woodward every year with the exception of 1943 when a two-peck rate was used.

Seeding dates were sometime within the first two weeks in October at Stillwater, about October 5 at Lawton, and about October 1 at Woodward.

Throughout the growing period such data as percent stand, dates of heading and ripening, winterkilling, diseases and insect damage, height of straw, amount of lodging, and shattering were recorded. When mature, the plots were harvested individually with an ordinary grain binder at Stillwater and Lawton and with a binder at Woodward in 1931 and 1932, and with a combine thereafter. After threshing, the grain from each plot was sacked for subsequent data such as yield, test weight, milling and baking determination.

In the analysis of the yield data, the performance of each variety was compared with Kharkof (C. I. 1442)⁴ at Stillwater and Woodward and with Tenmarq (C. I. 6936) at Lawton.

Oklahoma Farm Wheat Improvement Program

Tests conducted by the Oklahoma Farm Wheat Improvement Program are located in important wheat-producing counties of the state in cooperation with county agricultural agents, vocational agricultural instructors, elevator operators, millers and farmers. The farmer on whose land the tests were conducted prepared the seedbed, usually at the time his own seedbed was prepared. Each variety was seeded at the rate of 35 to 40 pounds per acre in three-row plots 18 feet long with three to five systematically arranged replications, depending on the availability of land. Sixteen feet of the center row of each replication were harvested and taken to Stillwater for threshing. Grain yields and test weights were taken on individual plots while the protein determinations and milling and baking tests were made on composites of the variety from all replications.

The grain yield of all varieties was compared with Tenmarq.

⁴ Turkey type