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Ponca Winter Wheat



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ON THE COVER—Sample heads and grain of Ponca winter wheat. Photography by Floyd Hanna.

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PONCA WINTER WHEAT

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Ponca wheat, a variety released by the Kansas and Oklahoma agricultural experiment stations in 1951, is highly resistant to hessian fly and to leaf rust. In eastern Oklahoma where Ponca probably has its best adaptation, it has produced higher yields of grain than has Pawnee. In eastern Kansas where Ponca has been nearly equal to that of Pawnee. When leaf rust and hessian fly are present in damaging amounts, Ponca can be expected to outyield Pawnee in eastern Kansas. Ponca is equal to Pawnee in test weight, time of maturity, straw strength, height, milling characteristics, resistance to loose smut, and susceptibility to stem rust. Ponca is superior to Pawnee in that the grain does not bleach

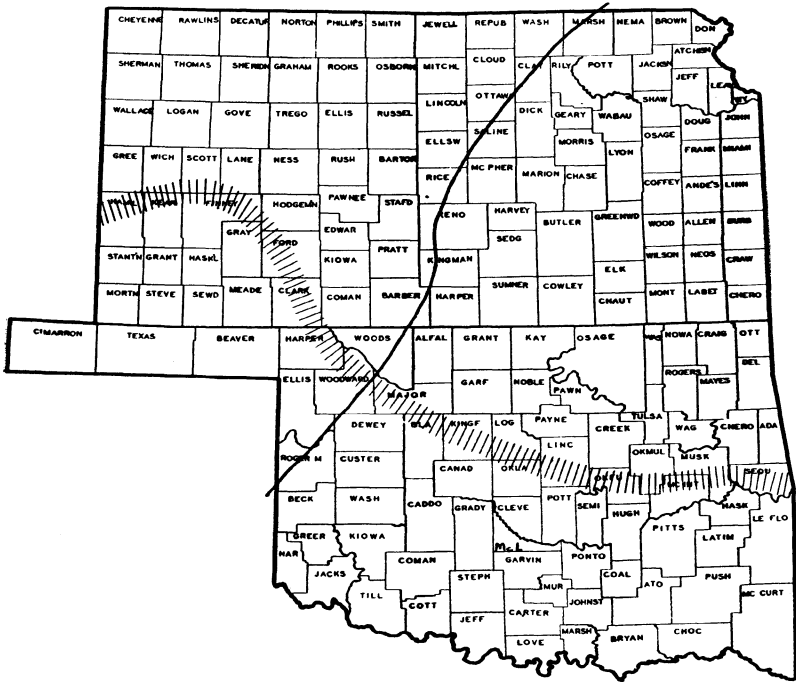


Fig. 1.—Ponca is adapted southeast of the line from Beckham (Beck) county, Oklahoma, to Marshall (Marsh) county, Kansas. The approximate southern limit of the occurrence of hessian fly in Kansas and Oklahoma is indicated by the band from Hamilton (Hamil) county, Kansas, to Sequoyah (Sequ) county, Oklahoma.

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as readily, sprout in the head, nor shatter as much if left standing in the field. The bread baking quality of Ponca is equal to or superior to that of Pawnee. Ponca is susceptible to bunt whereas Pawnee is resistant under ordinary field conditions. It should be noted, however, that this disease is

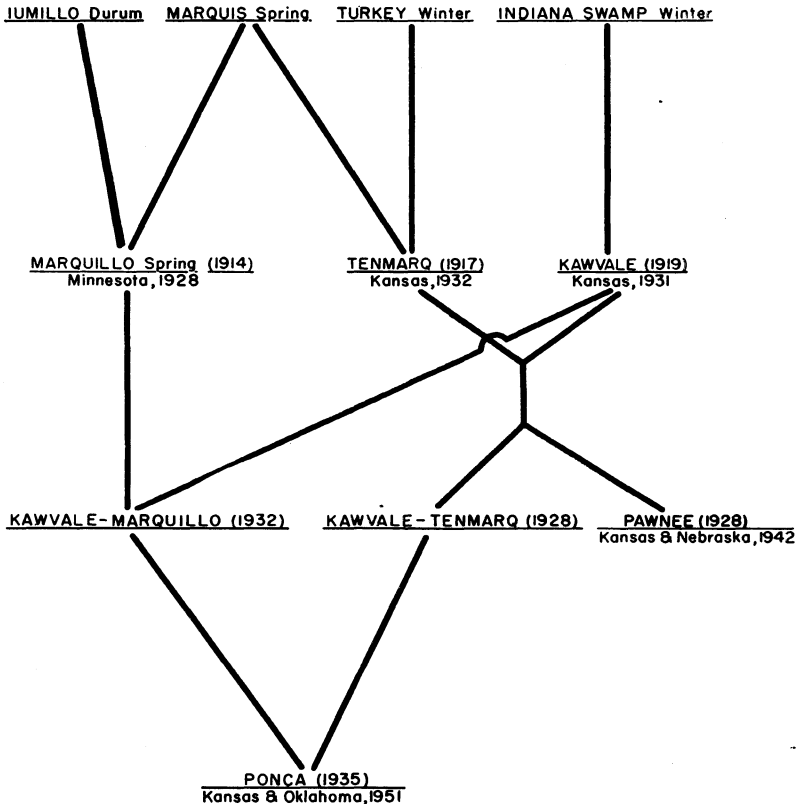


Fig. 2.—PEDIGREE OF PONCA WHEAT—The figure in the parentheses indicates the year the cross (or selection, in the case of Kawvale) was made. The state name and the other figure, if given, indicate the place and time the variety was released to growers.

readily controlled by seed treatment. Ponca is somewhat less winter hardy than Pawnee.

Ponca is recommended for growing in Oklahoma southeast of a line drawn through the northwest corners of Alfalfa and Beckham counties (see map, Figure 1). It is not recommended for the extreme northwestern part of the state nor

the Panhandle since it is somewhat less winter hardy than Pawnee. In Kansas, the value of Ponca will be greatest in the eastern part of the state (see Figure 1) where winter damage is less common and where the variety will afford the greatest protection against leaf rust and hessian fly.

ORIGIN AND HISTORY OF PONCA

Ponca wheat is the result of many crosses that were made in order to develop a hessian fly-resistant variety adapted to eastern Kansas and Oklahoma. This represents the work of wheat breeders from several different states. The great grandparents of this variety include Turkey winter wheat, Marquis spring wheat, a variety of durum, and a soft wheat. All of these made a contribution in the development of Ponca. Turkey wheat provided the winter characteristics and adaptation to the plains region; Marquis and Turkey contributed quality to the flour milled from the grain; Iumillo durum was the source of resistance to hessian fly and of some leaf rust resistance; loose smut resistance and additional leaf rust and hessian fly resistance came from Kawvale. A pedigree of Ponca wheat is illustrated in Figure 2. The particular cross that resulted in Ponca was made in 1935 between a selection from the cross of Kawvale x Marquillo and Kawvale x Tenmarq. The first generation of the cross was grown at Manhattan, Kansas, in 1936, and the selection that became Ponca was finally made in 1941, and assigned the number of CI 12128. From 1942 to 1944 Ponca was tested in several locations in Kansas. Ponca was tested throughout the southern Great Plains region in 1945. Since that time it has been tested extensively in this area, particularly in Kansas and Oklahoma. During the summer of 1951 the Kansas and Oklahoma experiment stations approved Ponca for distribution to farmers in the eastern portions of those two states. Approximately 3,000 bushels of seed were available for distribution in the fall of 1951.

YIELD OF GRAIN

Ponca has been tested continuously in Oklahoma since 1945. Average yields of Ponca and seven other varieties of hard red winter wheat recommended in Oklahoma and tested in that state during all or a part of the period 1945 to 1951 are shown in Table 1. Considering all of the tests, Ponca ranked first in yield, averaging .6 bushel more than Comanche, 1.1 bushels more than Triumph, and 1.6 bushels more than Pawnee.

Yield data from eastern Oklahoma indicate Ponca probably has its best adaptation in that area. The average yield of Ponca in 19 tests in that section was 4.6 bushels higher than Pawnee. The greater resistance to hessian fly and to leaf

Table 1.—Comparative Acre Yields in Bushels of Ponca and Seven Other Wheat Varieties in Oklahoma. 1945-1951

Variety	Nursery tests ¹ 10 station years		Variety tests ² 16 station years		Experiment station tests ³ 26 station years		Western Oklahoma ⁴ 38 station years		Eastern Oklahoma ⁵ 19 station years		Average of all tests 83 station years	
	av. rank	av. rank	av. rank	av. rank	av. rank	av. rank	av. rank	av. rank	av. rank	av. rank	av. rank	av. rank
Ponca	31.4	1	21.8	6	25.5	1	21.3	5	26.8	1	23.9	1
Pawnee	28.2	4	22.0	5	24.4	4	21.0	6	22.2	6	22.3	4
Comanche	26.8	5	22.6	4	24.2	5	21.4	3	25.8	2	23.3	2
Triumph	30.1	2	21.0	8	24.5	3	21.4	3	23.4	4	22.8	3
Westar	28.3	3	23.5	1	25.4	2	23.3	1	.....	..	.....	..
Wichita	.....	..	23.2	2	.....	..	22.1	2	24.2	3	.....	..
Cheyenne	.....	..	22.8	3	.....	..	19.6	7	22.4	5	.....	..
Tenmarq	.....	..	21.5	7	.....	..	19.6	7	22.2	6	.....	..

¹ Uniform Yield Nurseries: at Stillwater, Woodward, and Cherokee, 1945-48.

² Variety Tests: at Stillwater, Woodward, Cherokee, Lawton, and Goodwell, 1948-51.

³ Weighted Average of Variety Tests and Uniform Yield Nurseries.

⁴ State-wide Nurseries: total of 16 locations, 1948-51.

⁵ State-wide Nurseries: total of 9 locations, 1948-51.

rust of Ponca in comparison with Pawnee and other varieties accounts at least in part for this superiority.

In western Oklahoma as an average of 38 tests during the period 1948 to 1951 at 16 locations, the yields of Ponca, Pawnee, and Comanche were nearly equal and about 2 bushels lower than Westar.

Yields of Ponca compared with other varieties were obtained in experimental tests in Kansas from 1943 to 1951, mostly in the absence of hessian fly. These tests were made

Table 2.—Comparative Acre Yields in Bushels of Ponca, Pawnee, and Comanche in Kansas. 1943-1951

Kind of test	No. of tests	Eastern Kansas		No. of tests	Western Kansas		
		Ponca	Pawnee		Pawnee	Ponca	Comanche
Nursery	22	30.1	29.7	12	26.5	27.2	-
Field plots	33	31.6	32.1	34	27.9	27.9	28.8
Co-operative farm tests	145	28.4	28.9	92	26.1	27.0	28.6
Average	200	29.1	29.5	138	26.6	27.2	

in nurseries, in field plots, and in co-operative tests on farms as shown in Table 2, where the data are presented for Ponca, Pawnee, and Comanche both in eastern and western Kansas.

Experiments in eastern Kansas show Ponca and Pawnee yielding nearly the same. The average difference of 200 tests

is .4 bushel less for Ponca than for Pawnee, which is the highest-yielding variety now grown extensively in eastern and central Kansas.

In western Kansas Comanche was the highest-yielding variety, and Pawnee averaged a little higher in yield than Ponca.

RESISTANCE TO HESSIAN FLY

Ponca wheat possesses the highest level of hessian fly resistance now available in a commercial variety of hard red winter wheat.

Hessian fly infestation has caused heavy losses to farmers for many years in areas inhabited by this insect (see Figure 1). Since the distribution of Pawnee in 1943, there has been a conspicuous decrease in the population of fly in central Kansas and corresponding reduction in the losses caused by this insect in that area. The much greater resistance of Ponca wheat should reduce hessian fly further as a factor in wheat production where this variety is grown extensively.

The time in the fall at which wheat should be seeded has been determined in part by the danger of hessian fly infestation. If wheat is desired for fall pasture, Ponca may be sown somewhat earlier than other wheat varieties, without entailing much risk of hessian fly injury. Wheat sown too early, however, may risk damage by armyworms, greenbugs, fall infection of rust, winter injury, and depletion of moisture and soil nutrients, especially nitrogen.

The incorporation of hessian fly resistance into commer-

Table 3.—Average Percentage of Wheat Plants Infested by Hessian Fly, 1942-1945

Variety	In area where Pawnee carries considerable resistance: 27 tests ¹	In area where Pawnee is less resistant: 25 tests ²
Ponca	2	6
Pawnee	48	79
Tenmarq (a susceptible variety)	75	85

¹ Manhattan and Bennington, Kansas.

² Springfield, Missouri.

cial wheat was the most important objective in making some of the crosses which eventually gave rise to Ponca wheat. This fly resistance is derived from the spring wheat Marquillo and from the winter wheat Kawvle. Pawnee, which carries the Kawvle fly resistance, and Kawvle, have a low fly infestation only in central and western Kansas, but Ponca has been resistant wherever grown. The relative infestations of Pawnee and Ponca, compared with a completely

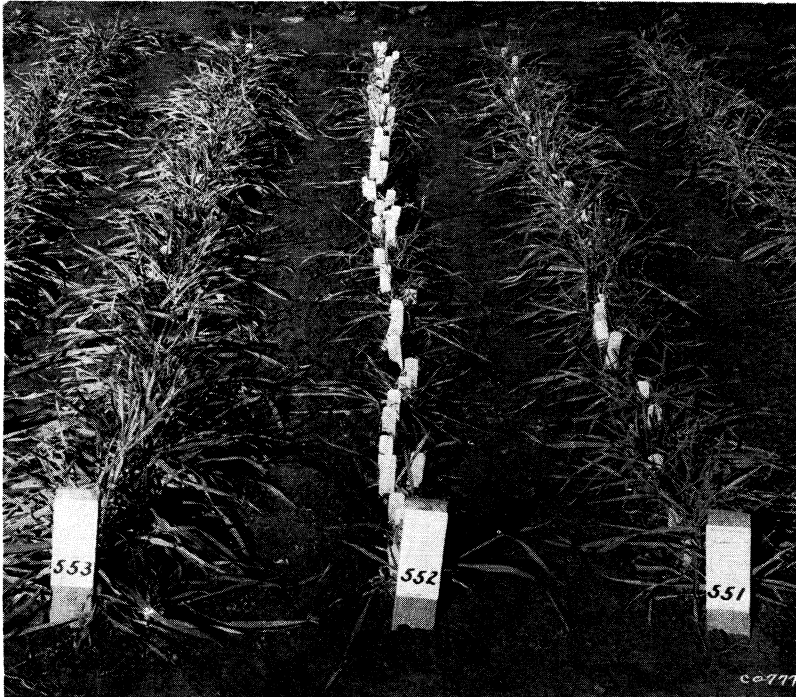


Fig. 3.—Comparison of infestation and injury to wheat varieties by hessian fly, Manhattan, Kansas, November 1946. Each small stake is by an infested plant. Row 551 (Pawnee), 65 percent of the plants infested; Row 552 (Tenmarq) 95 percent of the plants infested; Row 553 (Kawvale-Marquillo x Kawvale-Tenmarq C. I. 12128) 11 percent of the plants infested.

susceptible variety grown under the same conditions, are shown in Table 3. Hessian fly eggs are laid on the leaves of Ponca, and the larvae reach the normal feeding position, but most of them do not grow.

LEAF RUST RESISTANCE

One of the outstanding desirable characteristics of Ponca is its high resistance to leaf rust (see Table 4). All available information indicates that it has, at present, the highest resistance to that disease of any variety ever approved for distribution in the central plains area. During the 5-year period 1947-51, Ponca had only traces of leaf rust each year in the field plot tests at Manhattan under conditions of natural infection, while Pawnee and other standard varieties were heavily infected. In the rust nursery at Manhattan,

Table 4.—Reaction of Ponca and Several Other Varieties to Four Major Diseases in Kansas and Oklahoma.

Variety	Leaf rust	Stem rust	Bunt	Loose smut
Ponca	HR*	S	S	R
Pawnee	MS	S	MR	HR
Comanche	MS	S	HR	MS
Wichita	VS	S	S	S
Triumph	VS	S	S	R
Westar	R	VS	S	S
Red Chief	S	S	VS	VS

*HR = highly resistant, R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible, VS = very susceptible.

where heavy infections were produced artificially each year using eight of the most common physiologic races found in the central plains area, Ponca had low infections annually while Pawnee and other commercial hard red winter varieties had very heavy infections during the same period.

An average of eight tests with leaf rust infection in Oklahoma revealed that Ponca had very light infections, compared with susceptible Triumph which had nearly four times as much. Westar was about as resistant as Ponca early in the spring, but infection developed on it later in the season while Ponca remained almost free of rust. For example, at Lawton, Oklahoma, in 1949, leaf rust readings were made on three different dates, as shown in Table 5. On all three dates Ponca showed only a trace of rust, whereas Westar had only a trace on the first two dates but had 25 percent infection on the last date. All of the other varieties tested had 90 percent infection on the last date.

The resistance to leaf rust shown by Ponca in widespread tests apparently is due to its resistance to many physiologic races. Tests with young plants made in the greenhouse have

Table 5.—Field Reactions of Ponca and Five Other Wheat Varieties to Natural Infection of Leaf Rust on Different Dates at Lawton, Oklahoma, in 1949.

Variety	Percent Severity		
	May 2	May 8	May 12
Ponca	T*	T	T
Pawnee	25	65	90
Comanche	25	65	90
Triumph	25	65	90
Westar	T	T	25
Wichita	25	65	90

*T = trace.

shown that it is highly resistant to 9 of 12 important races. There is evidence that it possesses adult plant resistance to some other races, since it has shown resistance in the field

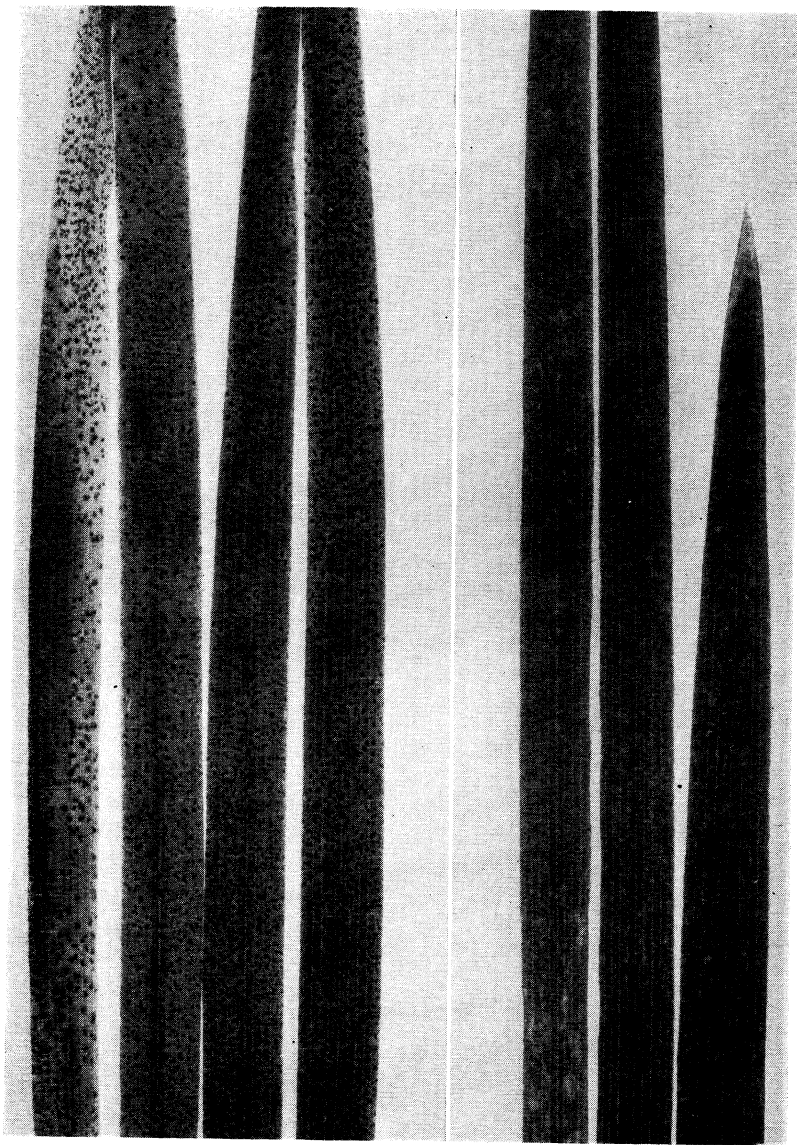


Fig. 4.—Leaves of wheat showing reaction to leaf rust. **Left**, complete susceptibility, such as shown by Comanche, Pawnee, and Wichita. **Right**, high resistance, as shown by Ponca.

in localities where one or more of those races were known to be present. The resistance of young plants of Ponca to leaf rust is clearly demonstrated by its freedom from rust in the fall. This is of great value to farmers who depend on winter wheat for fall pasture. As has been pointed out, Ponca is susceptible to a few races of leaf rust which may increase after distribution and impair the resistance of the variety. This change, if it should come about, will require several years to reach its maximum. In the meantime growers will have had the advantage of the resistance of Ponca.

REACTION TO OTHER DISEASES

Ponca has very little resistance to stem rust although it frequently escapes heavy infection through early maturity. In the rust nursery at Manhattan where heavy infections are produced, Ponca has been infected slightly less than other hard red winter varieties. The data indicate that Ponca is equal to Pawnee, and possibly a little better, in reaction to stem rust. Like the other varieties grown commercially in the central plains area, it is susceptible to the new race of stem rust, race 15B.

Ponca has been nearly as resistant to loose smut as Pawnee, both when subjected to artificial inoculation and under natural conditions in the experimental nursery where abundant inoculum was present. Pawnee is highly resistant to loose smut and has maintained its resistance when grown in farm fields. No loose smut has been observed in foundation fields of Ponca. Comanche, Wichita, and Red Chief are all susceptible to loose smut, and Triumph is similar to Ponca.

Ponca, like Wichita, is susceptible to bunt or stinking smut. In this characteristic it is not as good as Pawnee or Comanche but is better than Red Chief. Bunt may be controlled easily by seed treatment with Panogen, Ceresan M, or New Improved Ceresan.

Ponca is similar to Comanche, Wichita, and Triumph in susceptibility to *Septoria* leaf blotch, but it is less susceptible than Pawnee. An undesirable characteristic of Ponca from the pathological viewpoint is its high susceptibility to a bacterial head blight. This disease was especially prevalent and severe in Kansas during June and July of 1950 and 1951 following abundant precipitation. Triumph is also highly susceptible to this disease.

WINTER HARDINESS

Ponca is moderately winter hardy. In most of the trials in Kansas and Oklahoma it has survived the winter with little or no damage. In some cases, however, Ponca has suffered serious winter injury resulting in considerable loss of stand, especially in tests outside the area of recommendation.

In the same experiments Pawnee and Comanche survived with less injury. In controlled freezing experiments, Ponca has been less cold hardy than Pawnee. There is somewhat more danger of winter damage in Ponca than in Pawnee or Comanche, especially in northwestern Oklahoma and western and northern Kansas.

MILLING AND BAKING PROPERTIES

Ponca has all the milling and baking properties of a good quality wheat. It has a high water absorption requirement equal to that of Comanche and greater than that of Wichita, Pawnee, and Triumph. Ponca has a medium-long mixing time and stable dough properties during fermentation, being similar to Comanche in these respects. It requires more mixing than Wichita, Pawnee, and Triumph. The oxidation requirement of Ponca is somewhat less than that of Comanche and about one-half that of Wichita, Pawnee, and Triumph. The loaf volume potentialities of Ponca are adequate, but somewhat less than those of Wichita, Comanche, and Pawnee. Ponca should satisfy the demands of the milling and baking industries for a strong type wheat variety.

OTHER CHARACTERISTICS

Test Weight—Ponca has produced grain of high test weight under most conditions. In experiments in Kansas, the weight per bushel of Ponca has averaged slightly higher than that of Pawnee. In Oklahoma it has averaged about one pound heavier than Pawnee and a little lower than Wichita.

Lodging—In strength of straw and extent of lodging, Ponca has been about equal to Pawnee and somewhat superior to Comanche and Wichita. When lodging occurs, the plants usually lean over rather than bend sharply or break.

Bleaching and Shattering—Ponca has been superior to Pawnee in that the grain does not bleach as readily, sprout in the head, nor shatter as much as Pawnee does if left standing in the field.

Maturity—Ponca is classed as a medium early wheat. It usually has ripened at about the same time or a day later than Pawnee, several days later than Wichita and Triumph, and three to five days earlier than Turkey.

Height—Plants of Ponca usually are slightly taller than Pawnee and somewhat shorter than Comanche.