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Late Emergence Effects on Agronomic Characteristics of Wheat

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Conclusions

- Spring-emerged wheat reduced grain yield by 47%.
- Test weight of spring-emerged wheat was reduced by 2.5 lbs/bu.
- Thousand kernel weight of spring-emerged wheat was 3.1 grams lower than fall-emerged wheat because it was filling grain during hotter conditions.
- Kernel diameter of spring-emerged wheat was smaller than fall-emerged wheat.
- Kernel hardness of spring-emerged wheat was slightly lower than fall-emerged wheat, but kernel hardness for both spring-emerged and fall-emerged wheat were considered acceptable for hard red winter wheat.
- Spring-emerged wheat had a higher protein concentration than fall-emerged wheat (14.5% versus 13%).
- Farmers need to determine the yield potential of each late-emerged field, realizing its potential will be dramatically reduced and considering its variable costs and the variable costs associated with replanting another crop before they decide to destroy the wheat.

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Keeping Up With Research 131

LATE EMERGENCE EFFECTS ON AGRONOMIC CHARACTERISTICS OF WHEAT

by

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Wheat stand establishment is the foundation for realizing maximum yield potential. Dry conditions during autumn can slow wheat seed germination and emergence, and consequently limit yield. Fall 1999 was very dry in north central Kansas. It was not uncommon to see, within the same field, some wheat plants that emerged in the fall and some that did not emerge until rains occurred in spring 2000. This resulted in erratic stands with plants of different maturities and reduced yield potential. In the late spring, many farmers wanted to know the yield potential of these fields so they could decide whether or not to destroy them. However, no field studies had compared fall-emerged wheat with spring-emerged wheat from a single fall planting date. The objective of this study was to compare yields and other agronomic characteristics of fall-emerged and spring-emerged wheat in farmers' fields.

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Procedures

County agricultural extension agents identified cooperators' fields that had erratic plant stands, laid out plots within the fields, and harvested heads from the plots. Sixteen sites were identified in eight counties. Plots were two drill rows wide and five feet long. Plots with fall-emerged plants were located as near to plots with spring-emerged plants as possible. There were four replications. Head samples were dried at 120 °F for 48 hours and threshed. The grain was cleaned and weighed. Yield per acre and test weights were calculated. Grain samples were analyzed using the single-kernel characterization system to determine thousand kernel weight, kernel diameter, and kernel hardness.

Results

Fall-emerged wheat headed 7 to 14 days earlier than spring-emerged wheat, which allowed the grain to begin filling earlier in milder conditions. The spring-emerged wheat experienced greater environmental stresses during grain-filling. Thus, grain yields of fall-emerged plants ranged from 36 to about 71 bu/a, while yields of spring-emerged plants ranged from 15 to nearly 45 bu/a (Table 1). The smallest yield difference between fall- and spring-emerged plants was 9 bu/a in Riley County and the greatest yield difference was 46 bu/a in Phillips County. The average grain yield was 53 bu/a for fall-emerged wheat and 28 bu/a for spring-emerged wheat.

Fall-emerged wheat had higher test weights than spring-emerged wheat. The average test weight for fall-emerged wheat was 59.8 lbs/bu, while the test weight for spring-emerged wheat was 57.3 lbs/bu. Test weights for fall-emerged wheat ranged from 53.4 lbs/bu in Norton County to 62.1 lbs/bu in Saline County. Test weights for spring-emerged wheat ranged from 52.7 lbs/bu in Norton County to 59.7 lbs/bu in Riley County. The smallest differences between fall and spring emergence was 0.2 lbs/bu in Republic County and 0.7 lbs/bu in Norton County, while the greatest difference was 4.9 lbs/bu in Osborne County (Table 1).

Thousand kernel weight (TKW) was affected differently by time of emergence within counties. Thousand kernel weight for fall-emerged wheat ranged from 25.1 g in Norton County to 33.0 g in Riley County and for spring-emerged wheat TKW ranged from 23.5 g in Osborne County to 28.1 g in Riley County (Table 1). Norton and Republic counties, which had the smallest differences in

test weights between fall and spring-emerged wheat, also had the smallest differences in TKW. Osborne County, which had the greatest difference in test weight, had the greatest difference in TKW between fall and spring-emerged wheat. Overall, thousand kernel weight for spring-emerged wheat was 3.1 g lower than for fall-emerged (29.0 g versus 25.9 g).

The protein concentration differed by county and by time of emergence within counties. Protein concentration for fall-emerged wheat ranged from 10.9% in Riley County to 15.2% in Norton County. Protein concentration for spring-emerged wheat ranged from 12.2% in Riley County to 17.3% in Norton County. Overall, protein concentration was greater for spring-emerged wheat (14.5%) than for fall-emerged wheat (13%) (Table 1).

Kernel diameter was smaller for spring-emerged wheat than for fall-emerged wheat. Kernel hardness was statistically greater for fall-emerged wheat than for spring-emerged wheat, but, in practical terms, the difference was not important and kernel hardness was within acceptable limits for hard red winter wheat for both spring- and fall-emerged wheat (data not shown).

Discussion

These data indicate that spring-emerged wheat experienced greater environmental stresses during grain-filling than fall-emerged wheat due to its delayed heading dates. This resulted in lower grain yield, test weight, and thousand kernel weight, but higher grain protein concentration. Although tiller and head numbers were not determined in this study, it is generally accepted that late-emerged wheat plants, caused by late planting dates or delayed germination and emergence, develop fewer tillers and productive heads than wheat planted at optimal dates. This results in lower yields. Thus, it can be expected that yield losses will occur when wheat emerges late, especially after December. Based on wheat date of planting research in southwest Kansas (See Keeping Up With Research # 107, Merle Witt) yield losses of 40 to 60% were observed when planting occurred in January and February. Overall, yield, test weight, and TKW were respectable for fall-emerged wheat; however the 13% protein, which was slightly higher than recently experienced protein levels, indicates that fall-emerged wheat did not completely avoid the hot, windy conditions.

Table 1. Yield, test weight, protein, and thousand kernel weight of fall-emerged wheat and spring-emerged wheat.

County	Time	Yield bu/a	Test Weight lbs/bu	Protein %	Thousand kernel weight g
Clay	Fall	55.4a*	60.6a	13.0a	28.8a
Clay	Spring	37.4b	58.5b	13.7a	27.1a
Norton	Fall	36.1a	53.4a	15.2a	25.1a
Norton	Spring	14.7b	52.7a	17.3b	24.2a
Osborne	Fall	39.9a	60.9a	14.1a	27.8a
Osborne	Spring	16.3b	56.0b	16.1b	23.5b
Ottawa	Fall	60.0a	60.8a	12.4a	29.6a
Ottawa	Spring	33.9b	57.5b	13.9b	25.8b
Phillips	Fall	70.6a	59.6a	11.3a	30.9a
Phillips	Spring	25.0b	56.7b	13.4b	26.9b
Republic	Fall	40.8a	59.6a	15.1a	26.9a
Republic	Spring	22.2b	59.4a	16.5b	25.9a
Riley	Fall	54.4a	60.9a	10.9a	33.0a
Riley	Spring	44.8b	59.7a	12.2b	28.1b
Saline	Fall	66.8a	62.1a	11.4a	29.7a
Saline	Spring	32.0b	57.9b	12.7a	25.3b

*Values within counties followed by different letters differ significantly at P = 0.05.