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Recommended Citation
Shroyer, James P.; Wood, Denise; McClure, Gregory W.; and Creager, Brian (1988) "Late Emergence Effects on Agronomic Characteristics of Wheat (1988)," Kansas Agricultural Experiment Station Research Reports: Vol. 0: Iss. 12. https://doi.org/10.4148/2378-5977.7314

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Keywords
Keeping up with research; 95 (Feb. 1988); Kansas Agricultural Experiment Station contribution; no. 88-273-S; Agronomic characteristics; Wheat; Late emergence

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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.

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.

Acknowledgments

The authors wish to thank the Kansas Wheat Commission and the Finnup Foundation for providing financial support for this research.

Keeping Up With Research

This publication from the Kansas State University Agricultural Experiment Station and Cooperative Extension Service has been archived. Current information is available from http://www.ksre.ksu.edu.
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).

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

| County     | Time | Yield | Test Weight | Protein | Thousand kernel weight |
|------------|------|-------|-------------|---------|------------------------|
|            |      | bu/a  | lbs/bu      | %       | 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.