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Seeding Rate for Dryland Wheat

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Seeding Rate for Dryland Wheat

Abstract

Four winter wheat varieties (PlainsGold Byrd, Limagrain T158, Syngenta TAM 111, and WestBred Winterhawk) were planted at five seeding rates (30, 45, 60, 75, and 90 lb/a) in the fall of 2014 and 2015 at Colby, Garden City, and Tribune, KS. The objective of the study was to identify appropriate seeding rates for dryland winter wheat in western Kansas. Averaged across varieties, a seeding rate of 60 lb/a seemed to be adequate at all locations in 2015. However, with higher yields in 2016, a higher seeding rate (75 lb/a) was beneficial. The wheat variety T158 was the highest yielding (or in the highest group) at all locations in 2015. Other varieties may have been affected by differential response to stripe rust and winter injury resulting in lower yields. In 2016, the highest yielding variety varied by location. Variety selection appears to have more effect on wheat yields than seeding rate.

Keywords

wheat, seeding rate, wheat varieties

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Seeding Rate for Dryland Wheat

A. Schlegel, J. Holman, and L. Haag

Summary

Four winter wheat varieties (PlainsGold Byrd, Limagrain T158, Syngenta TAM 111, and WestBred Winterhawk) were planted at five seeding rates (30, 45, 60, 75, and 90 lb/a) in the fall of 2014 and 2015 at Colby, Garden City, and Tribune, KS. The objective of the study was to identify appropriate seeding rates for dryland winter wheat in western Kansas. Averaged across varieties, a seeding rate of 60 lb/a seemed to be adequate at all locations in 2015. However, with higher yields in 2016, a higher seeding rate (75 lb/a) was beneficial. The wheat variety T158 was the highest yielding (or in the highest group) at all locations in 2015. Other varieties may have been affected by differential response to stripe rust and winter injury resulting in lower yields. In 2016, the highest yielding variety varied by location. Variety selection appears to have more effect on wheat yields than seeding rate.

Introduction

The purpose of this project is to determine appropriate seeding rates for dryland winter wheat in western Kansas. In recent years, there appears to be an increase in seeding rate without corresponding increase in grain yields. A preliminary study conducted in 2014 found no yield benefit from increasing seeding rates from 30 to 75 lb seed/a for 4 wheat varieties at Tribune while a similar study at Garden City suffered severe hail damage, causing yields to be less than 10 bu/a. The objective is to evaluate seeding rates on grain yield of several popular wheat varieties under dryland conditions at three sites in western Kansas.

Experimental Procedures

Four winter wheat varieties (Byrd, T158, TAM 111, and Winterhawk) were planted at five seeding rates (30, 45, 60, 75, and 90 lb/a) in the fall of 2014 and 2015 at Colby, Garden City, and Tribune, KS. The date of seeding was October 20, 2014, and October 14, 2015, at Colby; October 9, 2014, and October 9, 2015, at Garden City; and September 26, 2014, and October 13, 2015, at Tribune. Seed size in 2015 was 15,839, 15,479, 17,627, and 12,921 seed/lb for Byrd, T158, TAM 111, and Winterhawk, respectively. All plots were planted on no-tillage fallow land. Harvest was done on July 4, 2015, and July 10, 2016, at Colby; June 29, 2015, and June 22, 2016, at Garden City; and June 30, 2015, and July 4, 2016, at Tribune. Growing season precipitation (October through June) for 2015 wheat was 14.03 in. at Colby, 12.18 in. at Garden City, and 12.83 in. at Tribune. For 2016, growing season precipitation was 12.36 in. at Colby, 11.31 in. at Garden City, and 14.32 in. at Tribune. Starter fertilizer was applied (5.5-26-0 (nitrogen, N; phosphorus, P; and potassium, K)) at Garden City and (6-20-0) at

Tribune in 2015 and 2016. The wheat was topdressed with 90 lb N/a at Colby, 30 lb N/a at Garden City, and 60 lb N/a at Tribune in 2015. In 2016, wheat was fertilized pre-plant with 90 lb N/a at Colby, and topdressed with 100 lb N/a at Garden City and 80 lb N/a at Tribune. Herbicides were applied in the spring for weed control: Ally Extra (0.5 oz/a) at Colby in 2015, and Huskie (15 oz/a) + Dicamba (2 oz/a) + Zidua (2 oz/a) in 2016; Starane Ultra (0.4 pt/a) + MCPA (0.75 pt/a) + Ally (0.1 oz/a) at Garden City in 2015 and 2016; and dicamba (4 oz/a) + Ally (0.1 oz/a) at Tribune in 2015 and 2016. Plot size was 7.5- by 30-ft at Garden City, and 5- by 40-ft at Colby and Tribune. Fungicide was applied for control of stripe rust at flag leaf emergence at Colby and Tribune in 2016. All treatments were replicated four times. Grain yields were determined by harvesting with a plot combine with moisture corrected to 13%.

Results and Discussion

Growing season precipitation was near normal for Garden City and Tribune and above normal for Colby in 2015. However, this was created by a wet May (6.38 in. in Garden City, 6.16 in. at Tribune, and 6.42 in. at Colby), making up for a dry winter and early spring. For 2016, rainfall was above normal for Tribune, slightly below normal for Garden City, and below normal at Colby. April was wet, with 5.16 in. at Tribune, 4.59 in. at Garden City, and 5.64 in. at Colby.

In 2015, averaged across seeding rates at Tribune, T158 and Winterhawk produced the greatest yields, with TAM 111 producing the lowest yields (Table 1). At both Colby and Garden City in 2015, T158 produced significantly higher yields than all other varieties. Stripe rust was prevalent in the 2015 growing season. Resistance ratings from the Kansas State University Department of Plant Pathology (publication MF991, Wheat Variety Disease and Insect Ratings 2016), with a scale of 1 being resistant to 10 being susceptible, were 8, 2, 8, and 6 for Byrd, T158, TAM111, and Winterhawk, respectively. Stripe rust infestation and associated yield reductions at Colby (and other locations) were consistent with these ratings.

At all sites averaged across varieties in 2015, there was a positive yield response to increased seeding rates, with greatest response when increasing from 30 up to 60 lb/a and minimal response above 60 lb/a.

Wheat yields were very good at all locations in 2016 (Table 2). The response to variety and seeding rate varied greatly across locations. Averaged across seeding rates, Byrd produced the greatest yields at Tribune, while it produced the lowest yields at Garden City. Winterhawk and T158 were the lowest yielding at Tribune, while they were the highest yielding at Garden City and Colby. There was a significant positive yield response to increased seeding rate at Tribune and Colby but no significant response to seeding rate at Garden City.

Based on 2015 results, it appears that a seeding rate of 60 lb/a was adequate for all locations. However, based on 2016 results and higher wheat yields (>70 bu/a), it appears that a seeding rate of 75 lb/a produced near maximum yields with little benefit from a 90 lb/a seeding rate. Variety selection had a significant effect on yield but was inconsistent across locations and years. There was no variety by seeding rate interaction at any location in 2016, showing that the seeding rate decision could be made independently of variety selection.

Table 1. Dryland wheat response to variety and seeding rate at three locations in 2015

| Variety | Seeding rate | Grain yield | | | |
|------------|-----------------|-------------|----------------|-------|---------|
| | | Tribune | Garden City | Colby | Average |
| | lb/a | bu/a | | | |
| Byrd | 30 | 47 | 38 | 23 | 36 |
| | 45 | 53 | 42 | 25 | 40 |
| | 60 | 60 | 50 | 27 | 46 |
| | 75 | 54 | 51 | 29 | 45 |
| | 90 | 59 | 53 | 28 | 46 |
| T158 | 30 | 59 | 72 | 45 | 59 |
| | 45 | 60 | 71 | 53 | 61 |
| | 60 | 64 | 79 | 56 | 67 |
| | 75 | 70 | 71 | 53 | 65 |
| | 90 | 71 | 65 | 55 | 64 |
| TAM 111 | 30 | 39 | 34 | 20 | 31 |
| | 45 | 41 | 40 | 25 | 35 |
| | 60 | 43 | 44 | 28 | 39 |
| | 75 | 46 | 50 | 32 | 43 |
| | 90 | 45 | 52 | 34 | 43 |
| Winterhawk | 30 | 60 | 31 | 21 | 37 |
| | 45 | 67 | 41 | 25 | 44 |
| | 60 | 68 | 42 | 29 | 47 |
| | 75 | 64 | 51 | 34 | 50 |
| | 90 | 68 | 50 | 35 | 51 |

continued

Table 1. Dryland wheat response to variety and seeding rate at three locations in 2015

| Variety | Seeding rate lb/a | Grain yield | | | |
|-----------------------------------|----------------------|------------------|----------------|-------|---------|
| | | Tribune | Garden City | Colby | Average |
| | | ----- bu/a ----- | | | |
| ANOVA (P>F) | | | | | |
| Variety | | 0.001 | 0.001 | 0.001 | 0.001 |
| Seeding rate | | 0.001 | 0.001 | 0.001 | 0.001 |
| Variety × seeding rate | | 0.046 | 0.001 | 0.731 | 0.124 |
| Location | | --- | --- | --- | 0.001 |
| Location × variety | | --- | --- | --- | 0.001 |
| Location × seeding rate | | --- | --- | --- | 0.743 |
| Location × variety × seeding rate | | --- | --- | --- | 0.001 |
| MEANS¹ | | | | | |
| Variety | | | | | |
| Byrd | | 55b | 47b | 26b | 43c |
| T158 | | 65a | 72a | 53a | 63a |
| TAM 111 | | 43c | 44bc | 28b | 38d |
| Winterhawk | | 65a | 43c | 29b | 46b |
| LSD _{0.05} | | 2 | 3 | 3 | 2 |
| Seeding rate (lb/a) | | | | | |
| 30 | | 51c | 44c | 27c | 41c |
| 45 | | 55b | 49b | 32b | 45b |
| 60 | | 59a | 54a | 35ab | 49a |
| 75 | | 59a | 56a | 37a | 50a |
| 90 | | 61a | 55a | 38a | 51a |
| LSD _{0.05} | | 3 | 4 | 4 | 2 |

¹ Means within a column with the same letter are not statistically different at $P = 0.05$.

ANOVA = analysis of variance.

LSD = least significant difference.

Table 2. Dryland wheat response to variety and seeding rate at three locations in 2016

| Variety | Seeding rate lb/a | Grain yield | | | |
|------------|-------------------------|------------------|----------------|-------|---------|
| | | Tribune | Garden City | Colby | Average |
| | | ----- bu/a ----- | | | |
| Byrd | 30 | 70 | 78 | 89 | 79 |
| | 45 | 76 | 79 | 100 | 85 |
| | 60 | 81 | 76 | 103 | 87 |
| | 75 | 86 | 79 | 116 | 94 |
| | 90 | 90 | 78 | 103 | 90 |
| T158 | 30 | 60 | 107 | 102 | 90 |
| | 45 | 67 | 109 | 115 | 97 |
| | 60 | 69 | 110 | 107 | 95 |
| | 75 | 74 | 114 | 111 | 99 |
| | 90 | 73 | 115 | 115 | 101 |
| TAM 111 | 30 | 63 | 89 | 95 | 82 |
| | 45 | 65 | 91 | 91 | 82 |
| | 60 | 72 | 90 | 106 | 89 |
| | 75 | 75 | 95 | 108 | 93 |
| | 90 | 77 | 96 | 110 | 94 |
| Winterhawk | 30 | 61 | 95 | 94 | 83 |
| | 45 | 65 | 99 | 100 | 88 |
| | 60 | 67 | 101 | 112 | 94 |
| | 75 | 70 | 105 | 111 | 95 |
| | 90 | 74 | 103 | 114 | 97 |

continued

Table 2. Dryland wheat response to variety and seeding rate at three locations in 2016

| Variety | Seeding rate lb/a | Grain yield | | | |
|-----------------------------------|----------------------|------------------|-------------|-------|---------|
| | | Tribune | Garden City | Colby | Average |
| | | ----- bu/a ----- | | | |
| ANOVA (P>F) | | | | | |
| Variety | | 0.001 | 0.001 | 0.029 | 0.001 |
| Seeding rate | | 0.001 | 0.205 | 0.001 | 0.001 |
| Variety × seeding rate | | 0.361 | 0.999 | 0.190 | 0.584 |
| Location | | --- | --- | --- | 0.015 |
| Location × variety | | --- | --- | --- | 0.001 |
| Location × seeding rate | | --- | --- | --- | 0.058 |
| Location × variety × seeding rate | | --- | --- | --- | 0.594 |
| MEANS¹ | | | | | |
| Variety | | | | | |
| Byrd | | 81a | 78d | 102b | 90c |
| T158 | | 68bc | 111a | 110a | 96a |
| TAM 111 | | 71b | 92c | 102b | 88c |
| Winterhawk | | 68c | 101b | 106ab | 91b |
| LSD _{0.05} | | 2 | 5 | 6 | 3 |
| Seeding rate (lb/a) | | | | | |
| 30 | | 63d | 92 | 95c | 84d |
| 45 | | 68c | 95 | 102b | 88c |
| 60 | | 72b | 94 | 107ab | 91b |
| 75 | | 76a | 98 | 112a | 95a |
| 90 | | 78a | 98 | 111a | 96a |
| LSD _{0.05} | | 2 | 6 | 6 | 3 |

¹ Means within a column with the same letter are not statistically different at $P = 0.05$.

ANOVA = analysis of variance.

LSD = least significant difference.