

Effect of Variety and Wheat Management Strategy on Wheat Yield Components

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Objective:

- To quantify the affect of wheat variety and management strategy on soft red winter wheat yield.

Materials and Methods:

Field studies were conducted in the 2003-2004 winter wheat growing season at Columbia, Lamar, and Portageville, MO. The experimental design was a randomized complete block factorial design with four replications. The main plot factors were wheat variety (Ernie, P25R37, and Truman) and wheat management strategy (Please see Table 1. below for specific treatment details). Wheat varieties were drilled on 7" centers at a seeding rate of 1,500,000 seeds acre⁻¹ on October 7th, 22nd, and 23rd, at Columbia, Lamar, and Portageville, respectfully. The seeding rate in pounds acre⁻¹ for Ernie, P25R37 and Truman were 120, 153, and 117, respectfully. These differences were due to variations in seed size.

Wheat followed soybean at Portageville and Columbia and corn at Lamar. A fall pre-plant application of 40-40-60 followed by a spring application of 80 pounds N acre⁻¹ was applied at each location. At each location weed density and aphid population were collected prior to pesticide application. Following fungicide application percent disease infection and severity were documented. Wheat head number (3 ft.⁻¹ row) and crop height (inches) was taken just prior to wheat harvest. Wheat grain yield, test weight, thousand kernel weight, and kernel number head⁻¹ were taken at crop physiological maturity and adjusted to 13% moisture.

Results and Discussion:

There was a significant location by treatment interaction ($P \leq 0.001$) therefore data was separated by location. Within each location there was not a variety by treatment interaction ($P \geq 0.05$); indicating that Ernie, P25R37, and Truman responded similarly to each management strategy.

At Columbia and Lamar wheat yield was greatest when a spring insecticide application was applied just prior to jointing (4/12/04 and 4/08/04 respectfully) (Table 1-2). The mean aphid population was ~5 oat bird cherry aphid's (OBCA) ft.⁻¹ row at the time of application. At Lamar, the application of Gaucho 480 also significantly increased grain yield over the no fall insecticide treatments (Table 2). Fall aphid numbers were not collected. At Portageville the application of a spring insecticide did not increase wheat yield, though at the time of application (3/11/04) the mean aphid population was 11 OBCA and 0.5 greenbug ft.⁻¹ row (Table 3). The presence of barley yellow dwarf virus (BYDV) was verified at each location using ELISA. At Columbia, the BYDV strains PAV and RPV were detected; whereas at Lamar and Portageville RPV was detected. These BYDV strains are vectored by the OBCA.

The application of a spring herbicide to control winter annual weeds did not increase wheat yield at any location. This however may be misleading in that weed populations were relatively low and did not emerge until wheat jointing or later. At Columbia, common chickweed and henbit were the predominant weed species present at 1.5 and 5.0 plants ft.⁻². At Lamar, common speedwell was the predominant weed species present at 14.0 plants ft.⁻². At Portageville, common chickweed, henbit, and annual bluegrass were the predominant weed species present at 6.0, 19.0, and 10.0 plants ft.⁻².

The application of a foliar fungicide decreased percent disease infection at Columbia and Lamar and decreased disease severity at all locations (Tables 1-3). However, Portageville was the only location where a significant yield response due to a fungicide application was detected. Though *Septoria tritici* was evident at all locations in 2004 the disease did not significantly infect the flag leaf (> 30%) except at Portageville.

Our results indicate that proper management of the entire pest complex that affects winter wheat in Missouri will prove beneficial. Scouting and timely management of insects, diseases, and weeds will increase the economic profitability and sustainability of current winter wheat production systems.

Table 1. Effect of Wheat Management Strategy on Ernie, P25R37, and Truman Wheat Yield Components at Columbia, MO in the 2003-2004 growing season.

| Treatment | Percent infection† | Severity‡ | Head number (yard ⁻¹ row) | Crop height (inches) | Grain yield (bu a ⁻¹) | Test weight | Thousand kernel weight (g 1000 ⁻¹ kernels) | Kernels head ⁻¹ |
|-----------------------|--------------------|-----------|--------------------------------------|----------------------|-----------------------------------|-------------|---|----------------------------|
| Variety | | | | | | | | |
| Ernie | 92.3 a§ | 24.0 a | 119.3 a | 31.7 c | 60.5 c | 58.5 ab | 37.4 a | 20.3 c |
| P25R37 | 68.5 b | 6.7 b | 117.1 a | 34.7 b | 72.8 a | 58.0 b | 36.6 b | 25.1 b |
| Truman | 53.3 c | 1.8 b | 92.7 b | 36.5 a | 66.5 b | 58.6 a | 30.4 c | 35.9 a |
| LSD: 0.05 | 13.8 | 7.2 | 11.6 | 0.9 | 4.7 | 0.5 | 0.7 | 1.6 |
| Management Strategy | | | | | | | | |
| Untreated | 86.7 a | 12.0 ab | 99.6 b | 33.9 a | 58.3 c | 58.6 ab | 35.4 a | 27.3 a |
| Herb | 96.3 a | 19.4 a | 119.3 a | 33.9 a | 59.6 c | 58.0 b | 33.8 b | 27.5 a |
| FG fb Herb | 94.6 a | 14.7 a | 110.4 ab | 34.8 a | 66.1 b | 58.4 ab | 34.0 b | 27.4 a |
| FG fb Herb fb FF | 42.9 b | 3.3 b | 110.5 ab | 34.0 a | 69.7 b | 58.3 ab | 35.2 a | 26.2 a |
| FG fb Herb + SI fb FF | 36.3 b | 4.7 b | 108.5 ab | 34.9 a | 79.4 a | 58.7 a | 35.5 a | 26.7 a |
| LSD:0.05 | 17.8 | 9.2 | 15.0 | 1.1 | 6.1 | 0.7 | 1.0 | 2.1 |

†Percent infection: Percentage of total plants per plot affected by disease (*Septoria tritici*).

‡Severity: Percent flag leaf area affected by disease (*Septoria tritici*).

§Treatment means within the same column and treatment followed by the same letter were not considered different at $P \geq 0.05$.

Abbreviations:

fb: followed by

Herb: Spring application of Harmony Extra herbicide at 0.5 oz. acre⁻¹ + 1 qt. NIS. (Application timing: Feekes 3-5 or Zadoks 26-30)

FG: Fall application of Gaucho 480 insecticide at 1.5 oz 100⁻¹ pound seed

FF: Foliar fungicide application of Quadris at 8 oz. acre⁻¹ (Application timing: Feekes 10.1-10.5 or Zadoks 50-59)

SI: Spring application of Warrior insecticide at 3.84 oz. acre⁻¹. (Application timing: Feekes 3-5 or Zadoks 26-30)

Table 2. Effect of Wheat Management Strategy on Ernie, P25R37, and Truman Wheat Yield Components at Lamar, MO in the 2003-2004 growing season.

| Treatment | Percent infection† | Severity‡ | Head number (yard ⁻¹ row) | Crop height (inches) | Grain yield (bu a ⁻¹) | Test weight | Thousand kernel weight (g 1000 ⁻¹ kernels) | Kernels head ⁻¹ |
|-----------------------|--------------------|-----------|--------------------------------------|----------------------|-----------------------------------|-------------|---|----------------------------|
| Variety | | | | | | | | |
| Ernie | 68.8a§ | 3.5 a | 116.1 a | 30.8 c | 74.7 a | 56.6 b | 36.6 a | 21.6 c |
| P25R37 | 56.5 ab | 3.7 a | 105.1 b | 32.8 b | 78.9 a | 57.5 a | 35.5 b | 29.2 b |
| Truman | 51.8 b | 1.9 b | 84.8 c | 35.9 a | 76.3 a | 56.9 b | 28.2 c | 41.2 a |
| LSD: 0.05 | 15.5 | 1.0 | 9.9 | 1.2 | 7.7 | 0.4 | 0.7 | 1.9 |
| Management Strategy | | | | | | | | |
| Untreated | 90.0 a | 4.2 a | 95.4 b | 33.7 a | 75.1 b | 56.6 b | 32.5 c | 30.8 a |
| Herb | 90.0 a | 4.3 a | 99.6 ab | 32.1 b | 67.9 b | 56.7 b | 33.0 c | 31.0 a |
| FG fb Herb | 75.8 a | 3.7 a | 102.4 ab | 32.6 ab | 73.4 b | 57.0 b | 32.5 c | 31.3 a |
| FG fb Herb fb FF | 26.7 b | 1.3 b | 110.2 a | 33.3 ab | 77.3 b | 57.0 b | 33.9 b | 30.1 a |
| FG fb Herb + SI fb FF | 12.5 b | 1.7 b | 102.5 ab | 34.0 a | 89.3 a | 57.7 a | 35.2 a | 30.3 a |
| LSD:0.05 | 20.0 | 1.3 | 12.7 | 1.5 | 10.0 | 0.5 | 0.8 | 2.5 |

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SI: Spring application of Warrior insecticide at 3.84 oz. acre⁻¹. (Application timing: Feekes 3-5 or Zadoks 26-30)

Table 3. Effect of Wheat Management Strategy on Ernie, P25R37, and Truman Wheat Yield Components at Portageville, MO in the 2003-2004 growing season.

| Treatment | Percent infection† | Severity‡ | Head number (yard ⁻¹ row) | Crop height (inches) | Grain yield (bu a ⁻¹) | Test weight | Thousand kernel weight (g 1000 ⁻¹ kernels) | Kernels head ⁻¹ |
|-----------------------|--------------------|-----------|--------------------------------------|----------------------|-----------------------------------|-------------|---|----------------------------|
| Variety | | | | | | | | |
| Ernie | 95.6 a§ | 30.3 b | 101.8 a | 31.0 c | 70.6 a | 59.1 a | 35.8 a | 24.3 c |
| P25R37 | 95.5 a | 34.5 a | 82.8 b | 33.7 b | 73.4 b | 56.4 b | 33.7 b | 38.6 b |
| Truman | 95.5 a | 31.5 ab | 82.5 b | 36.2 a | 71.4 a | 56.4 b | 27.6 c | 43.8 a |
| LSD: 0.05 | 0.7 | 2.6 | 15.0 | 1.5 | 9.9 | 0.8 | 1.3 | 4.6 |
| Management Strategy | | | | | | | | |
| Untreated | 95.8 ab | 34.2 a | 85.9 a | 34.0 abc | 66.0 b | 57.2 ab | 32.0 b | 36.6 a |
| Herb | 95.0 b | 33.8 a | 84.1 a | 32.8 bc | 66.0 b | 56.3 b | 31.4 b | 34.5 a |
| FG fb Herb | 96.0 a | 35.0 a | 87.3 a | 32.2 c | 69.6 b | 57.2 ab | 32.5 ab | 33.9 a |
| FG fb Herb fb FF | 95.5 ab | 29.6 b | 96.0 a | 35.1 a | 84.0 a | 57.9 a | 32.2 ab | 38.1 a |
| FG fb Herb + SI fb FF | 95.3 ab | 29.6 b | 92.0 a | 34.1 ab | 73.3 ab | 57.9 a | 33.9 a | 34.6 a |
| LSD:0.05 | 0.9 | 3.4 | 19.4 | 1.9 | 12.9 | 1.0 | 1.7 | 5.9 |

†Percent infection: Percentage of total plants per plot affected by disease (*Septoria tritici*).

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