Fungicide + Insecticide Applications for Increasing Winter Wheat Grain Yield in Oklahoma

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Introduction:

- Winter wheat (*Triticum aestivum L.*) is the largest production crop in Oklahoma with 5-6 million acres planted annually.
- Fungal diseases and insects are significant yield-limiting factors to its production.
- Some producers have begun tank-mixing an insecticide with a foliar fungicide applied at Feekes 9 (ligule of flag leaf visible), but little is known about this practice in the state.

Objective:

- Determine whether a fungicide + insecticide application at Feekes 9 results in increased wheat grain yield compared to each pesticide applied alone

Material and methods:

- Trials were established at Chickasha, OK and Lahoma, Ok in 2016 as the first year of a two-year project.
- Trials was both established using conventional tillage following winter wheat.
- Experimental design was a randomized complete block in a split-plot arrangement with 4 reps.
- Main plot factor was two winter wheat varieties.
  - At Chickasha: Ruby Lee and Gallagher were used
  - At Lahoma: Ruby Lee and Doublestop CL Plus were used.
    - Chosen on susceptibility to leaf and strip rust. Gallagher and Doublestop CL Plus = resistant & Ruby Lee = susceptible
- Subplot factor was four pesticide treatments applied at Feekes 9:
  1. Control (no fungicide or insecticide)
  2. Fungicide-only
     - 292 mL ha^{-1} of Tebucure (tebuconazole)
  3. Insecticide-only
     - 280 mL ha^{-1} of Silencer ® (lambda-cyhalothrin)
  4. Fungicide + insecticide
- Disease and insect ratings were collected prior to the pesticide treatment application and two weeks after the application. Area under the disease progress curve (AUDPC) was calculated with the disease ratings.
- Plots were 1.52 m wide and 7.62 m long and were later shortened to 6.09 m for harvest.
- Grain weight, test weight, and moisture were collected from each plot, and yield was adjusted to 13% moisture content.
- Yield and test weight data were subjected to analysis of variance (ANOVA) using PROC GLIMMIX within SAS v. 9.4. Analyses were performed for each location separately.
- Means were separated using Fisher's Protected LSD at 5% significance level. The SLICE option was used to compare means of significant interactions.

Results:

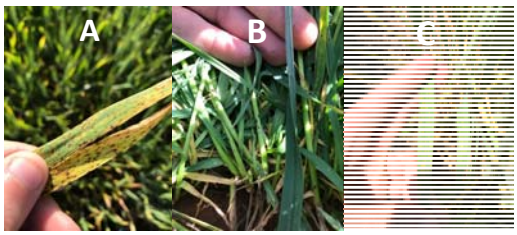


Figure 1. *Bipolaris sorokinianas* (spot blotch) was present at Chickasha but at low levels overall (A). *Rhopalosiphum padi* (bird-cherry oat aphid) was also present at Chickasha with below threshold numbers at the Feekes 6 (jointing) growth stage, but it was not was not found before or after the pesticide treatments were applied (B). Spot blotch and bird-cherry oat aphid were not found at Lahoma. *Puccinia triticina* (leaf rust) was the most prevalent disease at both locations, and the results for its ratings are presented below (C).

Table 1. Analysis of variance (ANOVA) results for yield and test weight for Chickasha and Lahoma in 2016-2017.

	Chickasha		Lahoma	
Effect	Yield	Test weight	Yield	Test weight
Variety (V)	0.0391	0.0786	0.0122	0.2697
Pesticide treatment (P)	0.8648	0.0381	0.0973	0.2960
V × P	0.0061	0.0050	0.6597	0.7802

- Yield for the variety Ruby Lee (5390 kg ha^{-1}) was significantly greater than the yield of Doublestop CL Plus (4320 kg ha^{-1}) at the Lahoma location.

Figure 2. Yield and test weight results for the variety × pesticide treatment at Chickasha, OK.

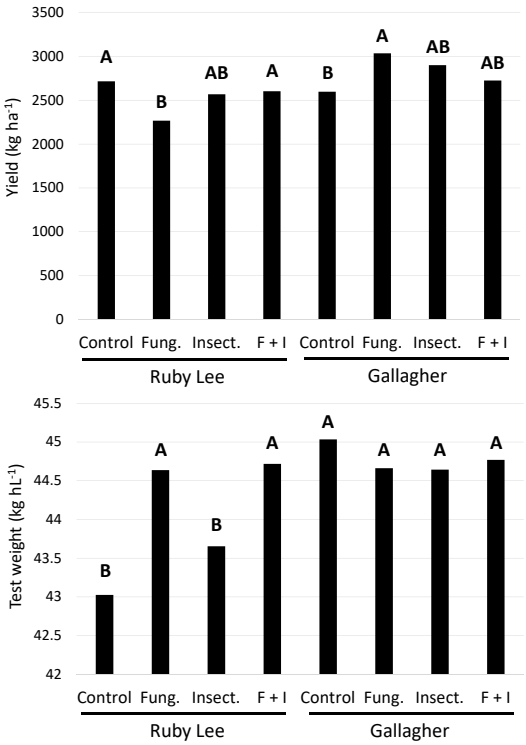
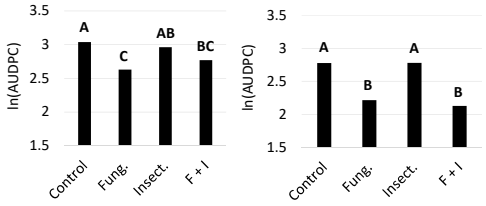


Table 2. Analysis of variance (ANOVA) results for leaf rust area under the disease progress curve (AUDPC) ratings collected at Chickasha and Lahoma in 2016-2017. The natural logarithm transformation was used to meet model assumptions.

	Chickasha	Lahoma
Effect	AUDPC	AUDPC
Variety (V)	0.0983	0.0456
Pesticide treatment (P)	0.0053	<0.0001
V × P	0.5090	0.5651

- ln(AUDPC) for the variety Ruby Lee (2.53) was significantly greater than Doublestop CL Plus at Lahoma (2.41).

Figure 3. AUDPC leaf rust results for the pesticide treatment main effect at Chickasha (left) and Lahoma (right).



Discussion:

- Due to the early onset of disease at Chickasha we did not see a yield increase from Ruby Lee as we did in Gallagher, due to resistance against leaf rust in Gallagher.
- Ruby Lee yielded significantly greater in the fungicide treatment at Lahoma because disease pressure was later allowing the fungicide to protect against the leaf rust that was present.
- Results of the first years study indicated there was no consistent yield response with the fungicide + insecticide tank mix.

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