

EVALUATION OF INSTINCT II AND RADIATE ON SOFT RED WINTER WHEAT IN NORTHWEST OHIO

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ABSTRACT

Producers in Northwest Ohio are encouraged to purchase various additives for urea-ammonium nitrate (UAN) with the expectation to increase grain yields; however, they have limited information on the benefits of these products except what was provided by the selling company. Two products that were commonly promoted were Instinct II, a nitrification inhibitor, and Radiate, a growth regulator. A three-year study was completed at the OARDC Northwest Agricultural Research Station near Custar, Ohio to see the benefits of using these products in soft red winter wheat in northwestern Ohio. AGI 217B, a medium-maturity variety, was established in the fall of 2018, 2019, and 2020 in late September or early October. There were three treatments in the study: 90 lb A⁻¹ of UAN-N, 90 lb A⁻¹ of UAN-N plus 37 oz Instinct II, and 90 lb A⁻¹ of UAN-N plus 4 oz Radiate. Treatments were applied at greenup (Feekes 3.0). Experimental design was randomized block replicated four times. Measurements included grain yield, harvest test weight, flag leaf N concentration, and spikes per foot-row. There was no difference among treatments in 2019 for yield, but the Instinct II and Radiate had significantly lower yields than the UAN alone in 2020 and 2021 ($p < 0.10$). There were no differences among the treatments for the other measurements in any year. This study found no benefit adding Instinct II or Radiate to UAN in wheat. These two additives did not increase yields compared to UAN alone, and in some years, yields were reduced.

INTRODUCTION

Most of Ohio's wheat production occurs in the northwestern part of the state. Agricultural fields are relatively flat with poor internal drainage. As a result, most of the land is systematically tilled. Because of the poor drainage, nitrogen loss is a concern. Companies promote various products to limit N loss or to enhance plant growth. Producers are encouraged to purchase these additives to mix in UAN solution with the expectation to increase grain yields, but they have limited information on the benefits of these products except what was provided by the selling company. Two commonly promoted products in the region are Instinct II, a nitrification inhibitor (Corteva), and Radiate, a growth regulator containing IBA and kinetin (Loveland). The objective of this study was to evaluate Instinct II and Radiate for yield and other agronomic traits in soft red winter wheat under Northwest Ohio field conditions.

MATERIALS AND METHODS

To investigate the potential benefits of additives to UAN (28-0-0) in wheat, a three-year field experiment was completed at the Ohio Agricultural and Research Development Center's Northwest Agriculture Research Station near Custar, OH. Soft red winter wheat variety AGI 217B was established in the fall of 2018, 2019, and 2020 in late September or early October. Tillage was conventional and 300 lb A⁻¹ of 10-26-26 was added prior to planting. Previous crop was soybean. Seeding rate was 1.4 to 1.8 million seeds A⁻¹ drilled in 7.5-inch row spacing. Soil type was a Hoytville silty clay. Experimental design was a randomized complete block with three treatments replicated four times. Treatments consisted of 90 lb UAN-N A⁻¹, 90 lb UAN-N A⁻¹ plus 37 oz of Instinct II, and 90 lb UAN-N A⁻¹ plus 4 oz of Radiate applied at Greenup (Feekes 3.0). Nitrogen was applied as a broadcast. Seven ounces of Prosaro fungicide was applied at Feekes 10 in 2020 and 2021; no fungicide was applied in 2019. Forty to fifty flag leaves were collected at flowering (Feekes 10) for N analysis. Spikes were counted from a one-foot section of a row from two areas in each plot during early grain fill. Grain harvest occurred in early July. Plots were 10 feet wide and 60 - 80 feet long. The center 11 rows were measured for grain yield. A combine scale estimated grain weight and a sensor estimated grain moisture and test weight. Yields were adjusted to 13.5% moisture. Statistical analysis was ANOVA.

RESULTS AND DISCUSSION

Results are given for each year rather than a three-year summary since weather for a given year has a large impact on N utilization. Table 1 shows that 2019 was an abnormally wet year and 2020 and 2021 were slightly drier than normal.

Table 1. Total rainfall averages (inches) from April 10 to June 10 for years 2019-2021, historical average rainfall for April 10 to June 10, and the difference for rainfall between a given time compared to the historical average.

Year	2019	2020	2021
Recorded rainfall	11.9	6.0	6.7
Historical rainfall average	6.9	6.9	6.9
Difference	+5	-0.9	-0.2

Results for grain yields and agronomic traits for Instinct II and Radiate are given in Table 2. Year 2019 would be characterized as an abnormally low yielding year, year 2020 as an average yielding year, and year 2021 as an abnormally high yielding year. Disease was not factor for any of the years. To limit the potential for head scab disease a fungicide was sprayed at flowering in 2020 and 2021. Rainfall at flowering in 2019 prevented the timely application of fungicide; however, disease was not a problem that year (Table 2).

In 2019, there was no benefit adding Instinct II or Radiate to UAN for grain yield, test weight, and spike count. The overall mean for yield was 48.9 bu A⁻¹ and the range was 37.8 to 65.9. Test weight overall mean was 50.8 lb bu⁻¹ and the range 47.7 to 55.5. test weight. With the excessive rainfall, test weights would be expected to be low. However, Variety AGI 217B is known for large yields but not large test weights. The overall mean for spike counts (spike ft-row⁻¹) was 44.5 and the range 35.5 to 56.5. Leaf N analysis was not completed.

There were significant differences for yield among treatments in 2020. Yields were 10.6% and 10.9% lower for Instinct II and Radiate, respectively, compared to UAN alone. Differences were not significant among treatments for test weight, leaf N content, and spikes. The overall mean for test weight was 56.9 with a range of 52.6 to 58.9. Leaf N levels were in the nutrient sufficiency range for all three treatments (2.59 - 4.00). The overall mean was 3.45 with a range of 2.84 to 4.18. The overall mean for spikes was 44.0 with a range of 35.0 to 56.0.

Table 2. Grain yields, harvest test weights, blade leaf N, and spike number means for soft red winter wheat with and without Instinct II and Radiate.

Year	Treatment	Yield bu A ⁻¹	Test Weight lb bu ⁻¹	Leaf N %	Spikes ft-row ⁻¹
2019	None	47.7	49.3	---	43.8
	Instinct II	51.8	52.0	---	44.1
	Radiate	47.5	51.1	---	45.6
	lsd _{0.10}	ns	ns	---	ns
2020	None	84.3 ^a	57.5	3.57	45.1
	Instinct II	75.4 ^b	55.5	3.38	41.5
	Radiate	75.1 ^b	57.6	3.39	45.4
	lsd _{0.10}	3.3	ns	ns	ns
2021	None	121.8 ^a	57.3	3.71	49.5
	Instinct II	117.6 ^b	57.1	3.79	45.9
	Radiate	116.4 ^b	57.0	3.55	42.0
	lsd _{0.10}	1.2	ns	ns	ns

means with different letters are significant; ns = no significance (p < 0.10)

For 2021, there were significant differences for yield among treatments. Yields were 3.4% and 4.4% lower for Instinct II and Radiate, respectively, compared to UAN alone. Differences were not significant among treatments for test weight, leaf N content, and spikes. The overall mean for test weight was 57.1 with a range of 56.3 to 57.9. Leaf N levels were in the nutrient sufficiency range. The overall mean for leaf N was 3.68 with a range of 3.33 to 3.91. The overall mean for spikes was 45.8 with a range of 30.5 to 60.5.

The potential for N loss was the largest in 2019 where rainfall was five inches over the long-term average. Excessive rainfall during the 2019 spring growing season

resulted in below average yields compared to other years (Table 1). Nitrogen loss may have been the main factor for lower yields, though other factors may have contributed to the low yields. However, diseases were not an observed problem. Instinct II would only be effective on $\text{NH}_4\text{-N}$ portion of UAN, and not the $\text{NO}_3\text{-N}$ portion. The $\text{NO}_3\text{-N}$ portion is about 25% of UAN. The loss of 25% of the N from excessive rainfall may have attributed to the lower yields across the treatments. Still, the Instinct II treatment, a nitrification inhibitor only had similar yields to UAN alone in 2019. Nitrogen loss was not an issue in 2020 and 2021 as evident by the leaf N content. Thus, a benefit would not be expected from a nitrification inhibitor for those years. However, yields were significantly lower for Instinct II compared to UAN alone. These yield differences could not be explained by test weight, leaf N content, or spike number.

Growth regulators are often utilized by producers with the expectation that additional plant hormones will increase yields. However, the increase was not observed in this study. Yields and other agronomic traits were similar between Radiate and urea alone in 2019. However, yields were significantly lower for Radiate compared to urea alone in 2020 and 2021 (4.4 – 10.9%). The yield reduction could not be explained by test weight, leaf N content, or spike number.

SUMMARY AND CONCLUSION

In summary, Instinct II and Radiate were evaluated during three distinctly different growing seasons: abnormal wet with low yields, slightly dry with average yields, and slightly dry with high yields (Table 1). Instinct II did not increase yields in the three years of this study (Table 2). In two of the three years, observed yields were statistical lower than urea alone. Agronomic characteristics were similar between Instinct II and urea alone for test weight, leaf N content, and spike number for each year. Similar results were observed for Radiate (Table 2). Yields were similar to urea alone in 2019, but significant yield decreases were observed in the other two years. Agronomic measurements were similar between Radiate and urea alone for test weight, leaf N content, and spike number. The results of this study would suggest little benefit from the addition of Instinct II and Radiate to UAN in wheat on northwestern Ohio soils.