



Introduction

Determining nitrogen (N) rates is difficult because the “right” N rate varies by crop, yield, soil, climate, and farmer practices. Additionally, there is no soil test for N in North Carolina (NC) that has been shown efficacy. Recommended N rates have been established for each soil and crop combination based on the realistic yield expectation (RYE). However, often these rates are disregarded in actual nutrient application. Using the least amount of N for crop production, while optimizing yield increases economic well-being for farmers and environmental benefits for society at large. Through previous research, we know that farmers learn best through self-experimentation or farmer-to-farmer programs. To address this, our current adaptive N management project works directly with farmers, in the Coastal Plain of NC, on N application to corn, sorghum, and wheat.

OBJECTIVE:

Help farmers optimize commercial N inputs through multiple rate strip trials.

Methods and Materials

TRIAL SUMMARY:

20 growers in 5 counties participated in the project.

- In 2013 there were 54 trials.
 - Total trial area = 108 ac.
- In 2014 there were 38 trials.
 - Total trial area = 76 ac.

EXPERIMENTAL DESIGN:

Randomized complete block design (3 treatments with 4 replications).

- Treatment 1: 25% less nitrogen than the grower applied during season.
- Treatment 2: The grower’s typical nitrogen application rate.
- Treatment 3: 25% more nitrogen than the grower applied during season.
- Nitrogen rates for the treatments ranged from: 99 to 188 lb ac⁻¹ for corn, 76 to 132 lb ac⁻¹ for sorghum, and 70 to 145 lb ac⁻¹ for wheat.

NITROGEN APPLICATION:

Commercial nitrogen was applied in parallel with each growers last N application for each crop (corn at V6, sorghum at GSII, and wheat at GS30) with a 35 ft Reddick ground-driven boom sprayer and variable rate flat fan nozzles (auto-steer used for wheat application). The sprayer was calibrated before each trial was applied to using the 1/128th of an acre method.

HARVEST DATA:

Yield data was collected using calibrated yield mapping equipment. Farmers either used existing yield monitors on their combines or newly purchased yield monitors that were retrofitted to combines without the necessary equipment. Combines were calibrated using a weigh wagon before each trial was harvested.

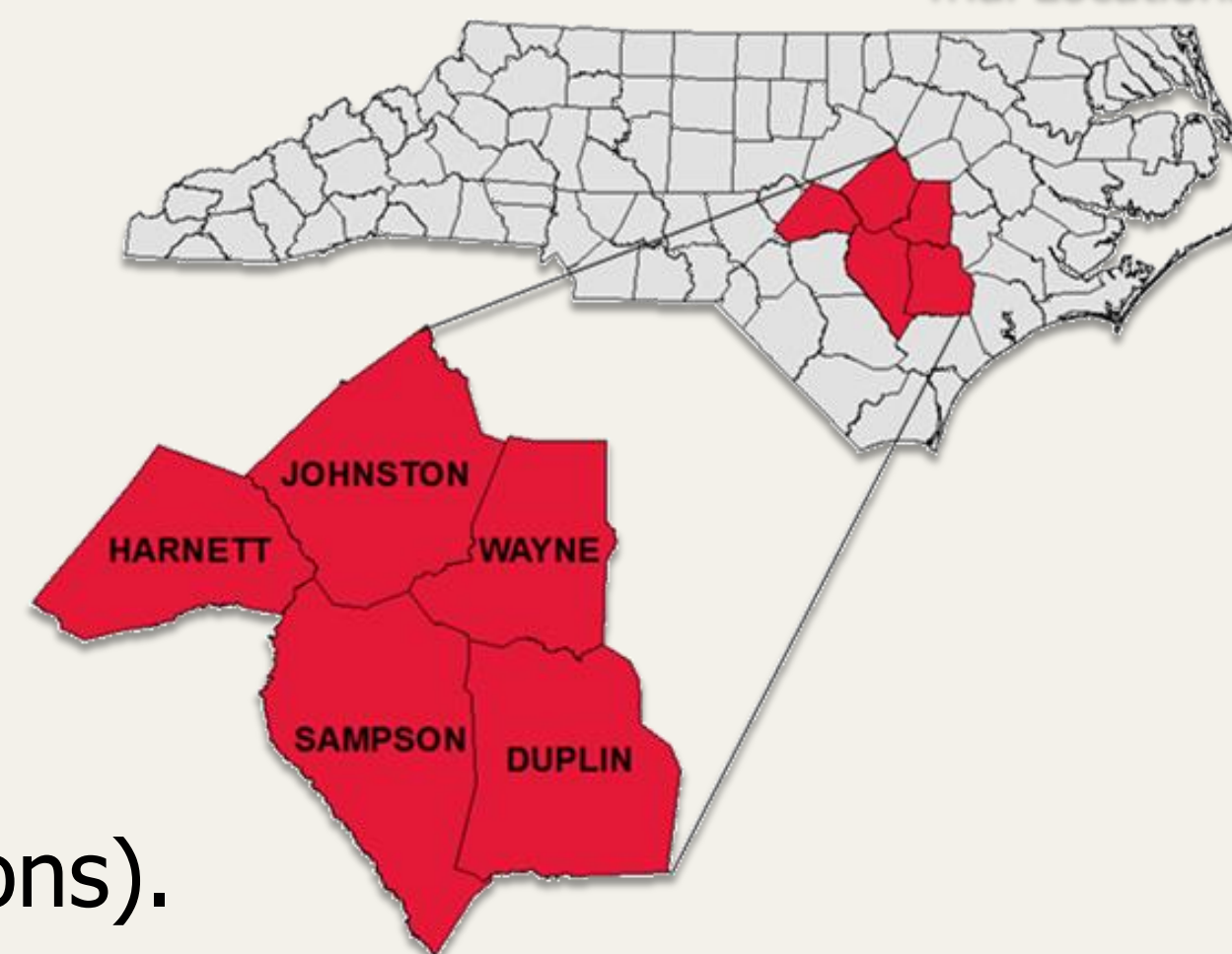
Nitrogen Treatments on Wheat



Combine Calibration



Trial Locations

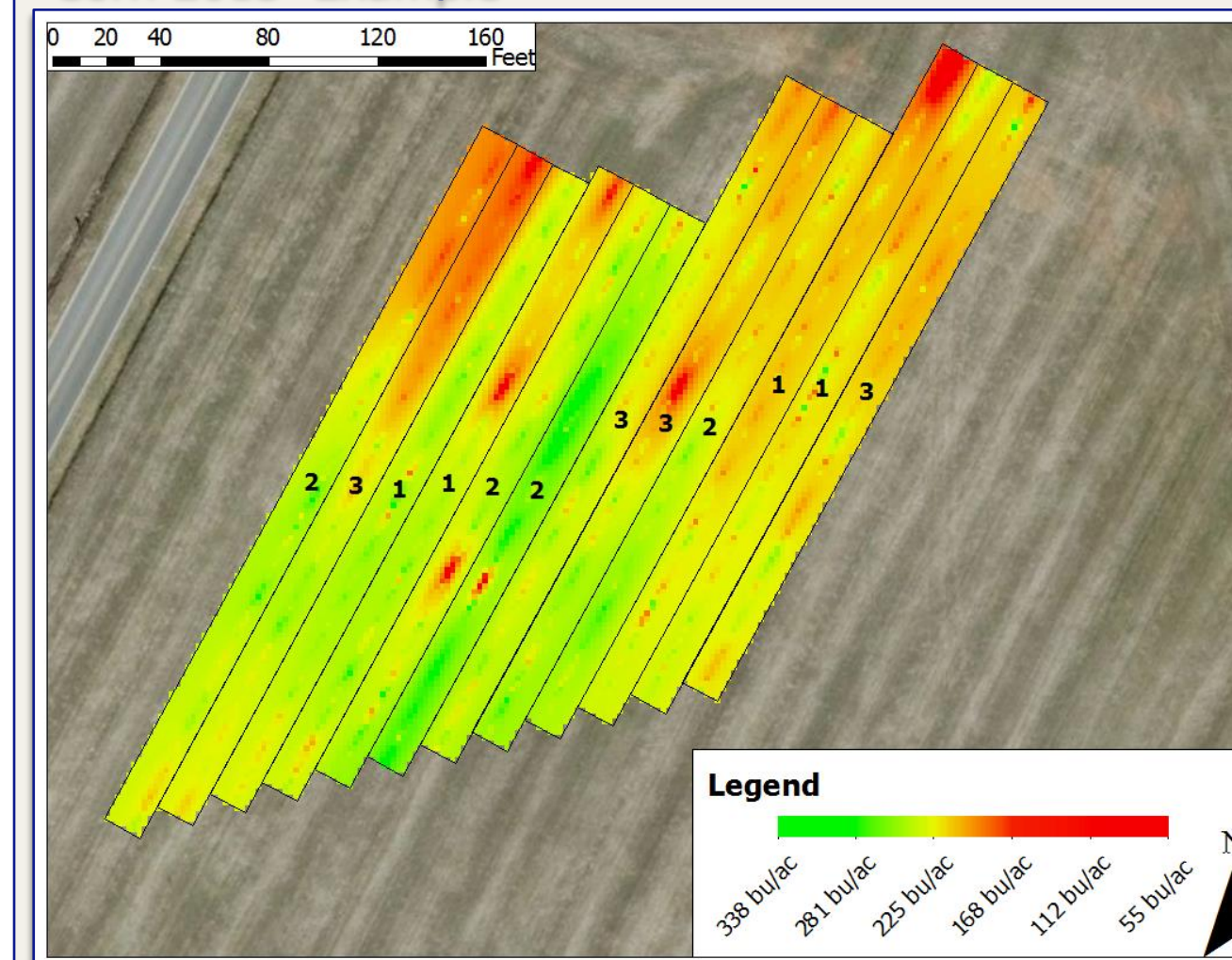


Results and Discussion

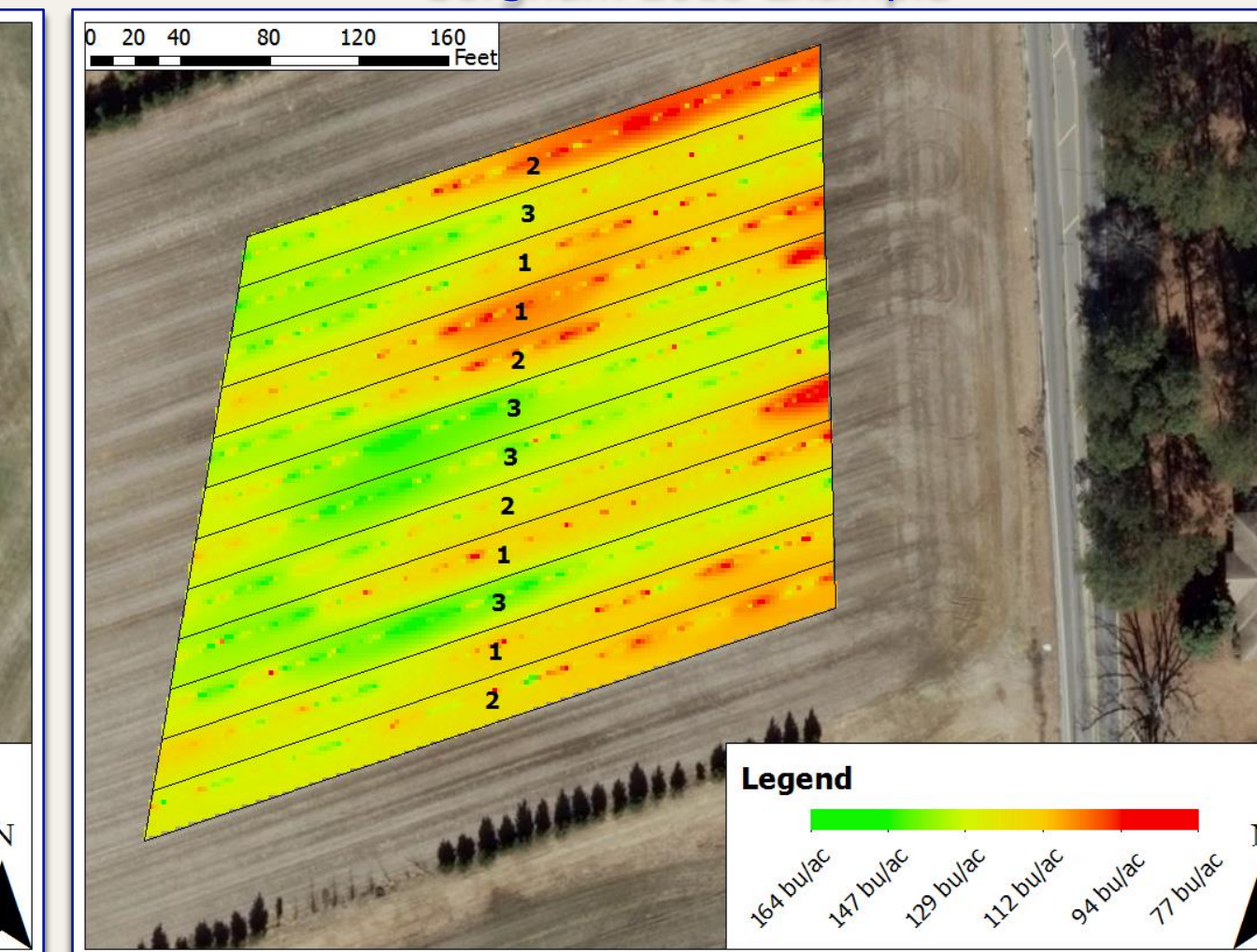
RESULTS SUMMARY:

Data was captured from May 2013 through October 2014. Spatial analysis was completed in ArcGIS and statistical analysis was conducted using an ANOVA mixed model.

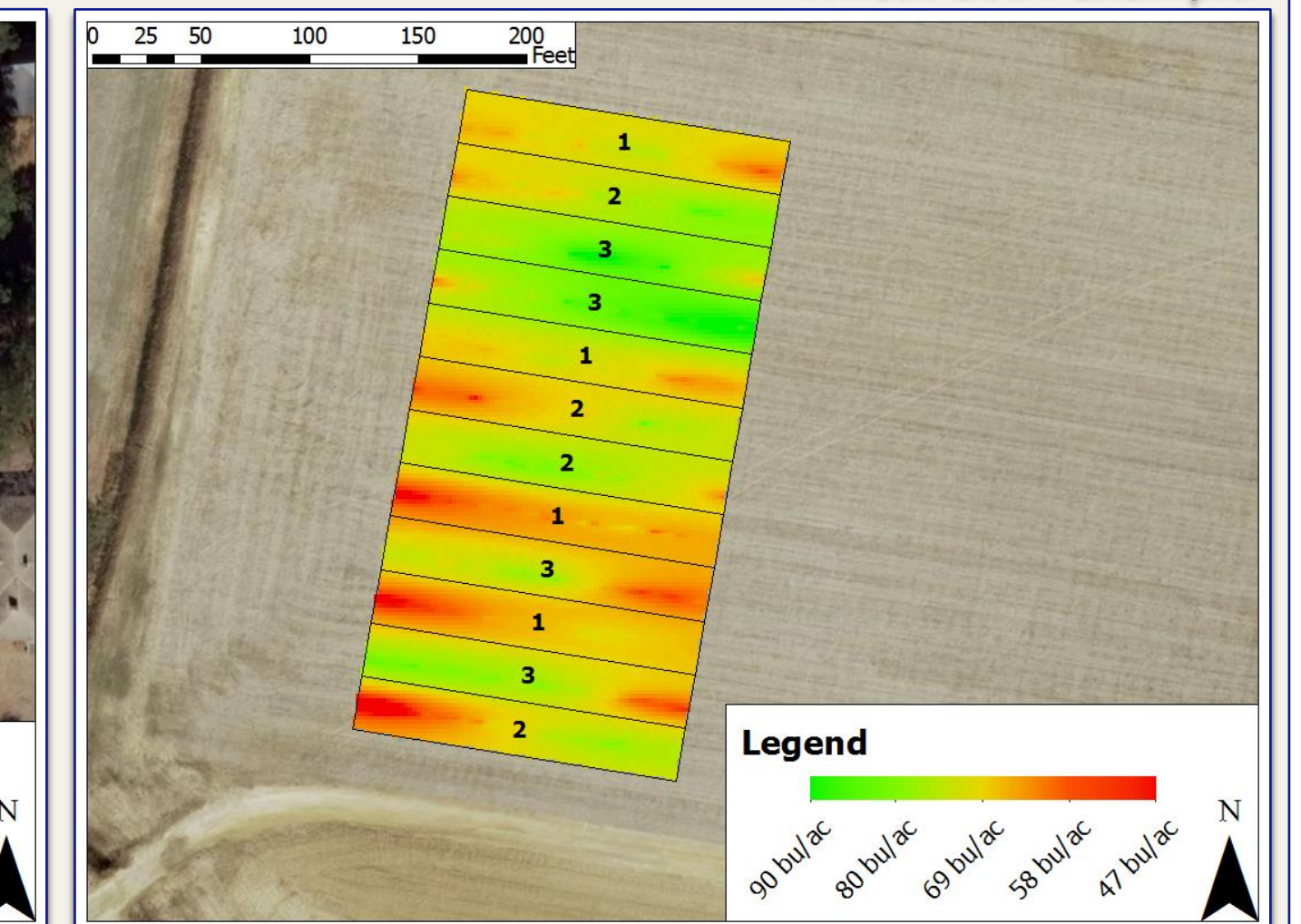
Corn 2013 Example



Sorghum 2013 Example



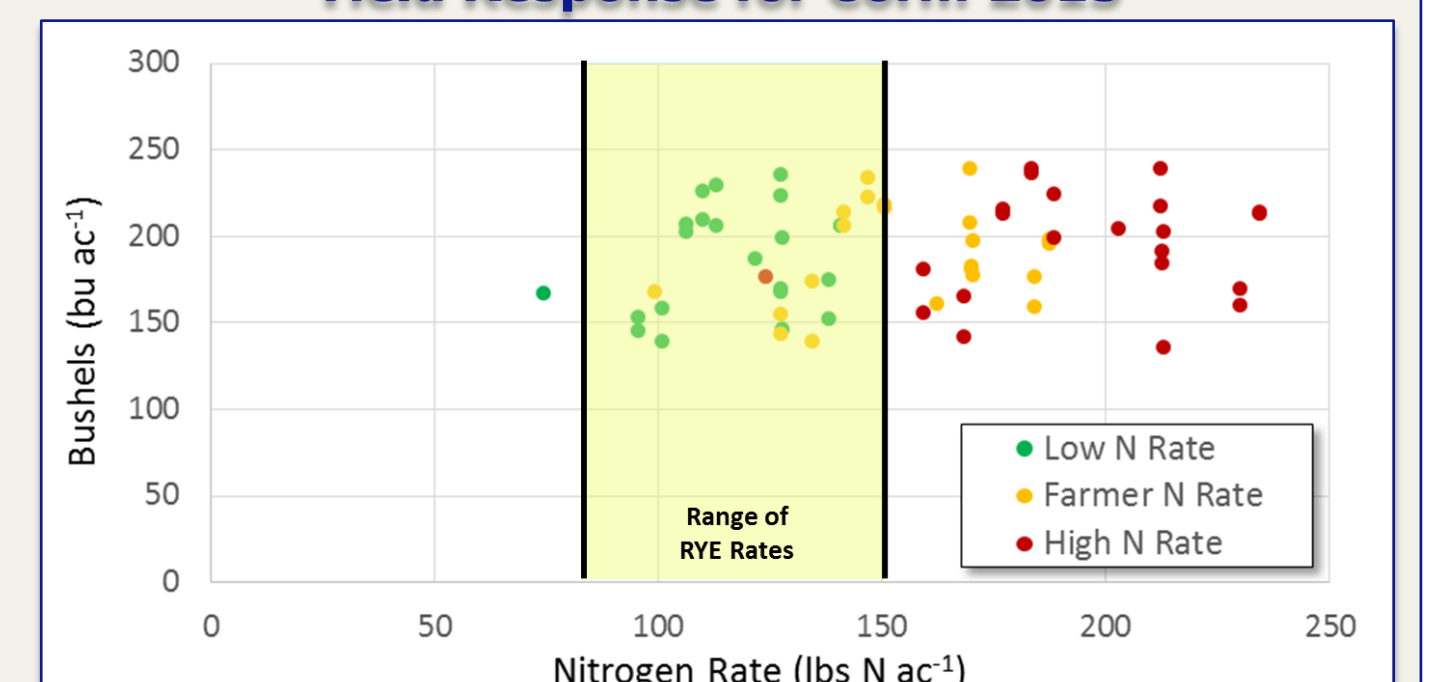
Wheat 2014 Example



CORN SUMMARY:

- There were a total of 22 trials performed in 2013.
 - Total precipitation for the season ranked 39th highest over a 40 year period (36 in, average = 20 in).
 - Average yield for trials = 190 bu/ac.
 - The nitrogen treatments had no effect on yield for any of the 20 harvested trials.
 - Grower rates were within 26% of recommended RYE rates.
- There were a total of 18 trials performed in 2014.
 - Data analysis has not been completed for this year.

Yield Response for Corn: 2013

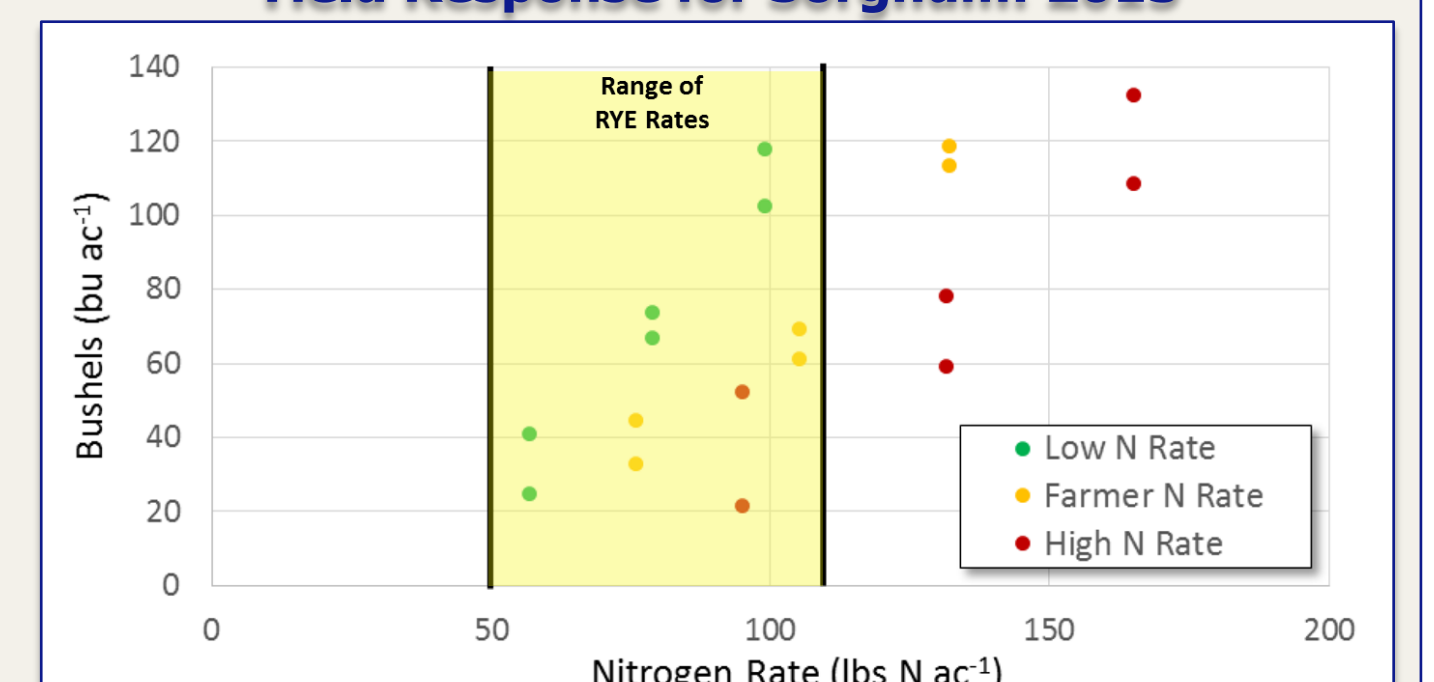


Yield response from 2013 corn trials indicate 50% of harvested grower rates fall within the recommended RYE range.

SORGHUM SUMMARY:

- There were a total of 14 trials performed in 2013.
 - 8 trials not harvested due to very low yields, 2 of which were used for silage.
 - Average yield for trials = 74 bu/ac.
 - The nitrogen treatments had an effect on 3 of the 6 harvested trials; farmer rate was “right” in 1/2 the fields.
 - Grower rates were within 9% of recommended RYE rates.
- There were a total of 2 trials performed in 2014.
 - Data analysis has not been completed for this year.
 - Number of acres planted dropped in 2014 compared to the previous year because of low sorghum prices.

Yield Response for Sorghum: 2013

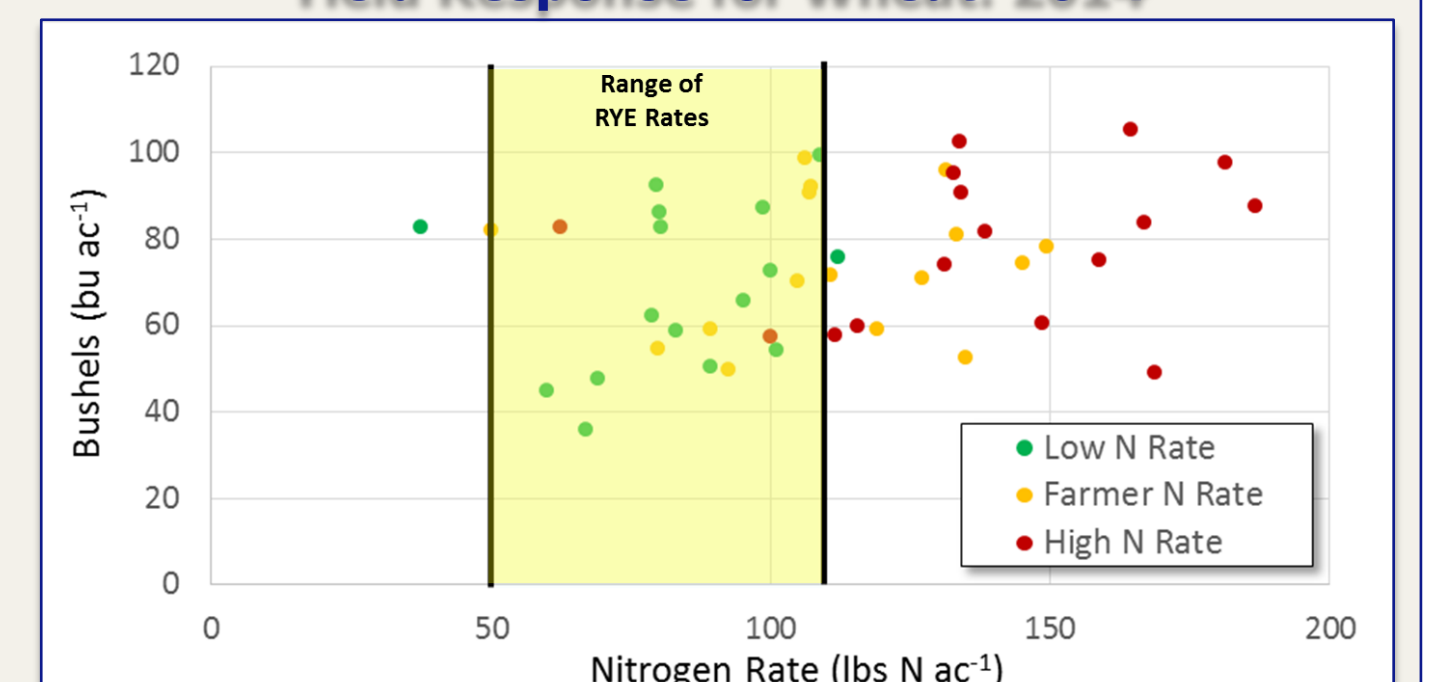


Yield response from 2013 sorghum trials indicate 67% of harvested grower rates fall within the recommended RYE range.

WHEAT SUMMARY:

- There were a total of 18 trials performed in 2013.
 - Total precipitation for the season ranked 30th highest over a 40 year period (35 in, average = 28 in).
 - Wet conditions resulted in late harvest and wheat sprouting in heads for 3 trials.
 - Average yield for trials = 73 bu/ac.
 - Overlapping into adjacent strips and sprouting wheat kernels confounded data.
- There were a total of 18 trials performed in 2014.
 - Average yield for trials = 73 bu/ac.
 - The nitrogen treatments had an effect on 8 of the 16 harvested trials; farmer rate was “right” in 1/2 the fields.
 - Grower rates were within 6% of recommended RYE rates.

Yield Response for Wheat: 2014



Yield response from 2014 wheat trials indicate 50% of harvested grower rates fall within the recommended RYE range.

Conclusion

Preliminary conclusions are:

- When determining the “right” N rate for growers:
 - 2013 corn trials = 100% of the time the low rate treatment was the “right” rate.
 - 2013 sorghum trials = 50% of the time grower rate treatment was the “right” rate.
 - 2014 wheat trials = 50% of the time grower rate treatment was the “right” rate.
 - There was a significant variability within and between fields.

- When conducting on-farm research:
 - Research with 20 growers across 5 counties proved to be logistically challenging.
 - The precision agriculture equipment and software used had little to no product support.
 - Growers did not have time to fully engage in training of yield monitoring technology.
 - Weather provided obstacles with N application timing and harvest windows.

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