PROGRESS REPORT
TO
NORTH CAROLINA SMALL GRAIN GROWERS ASSOCIATION, INC.

TITLE: **Large-scale Examination of Variety-specific Responses to multiple Nitrogen Treatment Levels**

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DEPARTMENT(S): **Crop and Soil Sciences**

REPORT:

Objectives were to:

1. **Identify variety-specific responses of high performing wheat lines in the North Carolina OVT to different Nitrogen treatment levels.**
2. **Compare variety responses to blanket applications of Nitrogen versus the N-rich strip decision-making tool.**

Fifteen varieties were included in replicated trials at three locations in NC for 2017-18: Lenoir, Rowan and Union Counties. Of the Fifteen varieties used in 2017-18, only thirteen were available for use in 2018-19. AgriMAXX 474 and Harvey's AP 1882 were replaced with SY Viper and Dyna-Gro 9811. These fifteen varieties were included in replicated trials at three locations in North Carolina for 2018-19: Chowan, Moore (Sandhills) and Union Counties. The Sandhills location replaced Lenoir from 2017-18 to provide a location where nitrogen would be limiting across all treatments. Nitrogen rates across all varieties included 90, 120, and 150 units applied as 30 units at planting and the remainder prior to jointing in one spring application. The Nitrogen rates were planned to remain the same over both years except for the addition of a zero nitrogen rate but due to application error the chosen nitrogen rates in 2019 increased by 30 lb/ac overall. A zero nitrogen rate was added to the nitrogen treatment list to provide a baseline yield response for each variety. The final nitrogen treatment for each variety was a sensor-based rate utilizing the GreenSeeker crop sensor used in conjunction with the Nitrogen-rich strip at each location. The N-rich strips were initiated at planting with a single application of 120 units of N followed by an additional 120 units in the spring if needed.

Normalized Difference Vegetative Index (NDVI) was measured just prior to topdressing for all plots and was used to determine the sensor-based nitrogen rate treatment for individual varieties. Tissue samples were taken at Union and Moore county sites prior to topdress to determine N concentrations in the wheat tissue. Plots were tissue sampled and NDVI was measured a second time after topdress at the Moore county site to determine the change in tissue concentration of nitrogen across all varieties. The Chowan site was abandoned soon after topdress due to severe *Fusarium* root and crown rot at that location confirmed by samples submitted to the NC State University Plant Disease and Insect Clinic.

RESULTS

Variety yield response to nitrogen application is significant and positive across Union County for both growing seasons. The level of this response varies by variety, with some varieties having a stronger correlation of yield response to increasing nitrogen rate. For example, two varieties yielded highest at the sensor-based N rate: Gerard 557 and Southern Harvest 7200 in 2018 and Southern Harvest 4300 and 7200 in 2019. The 150 lb N/A rate resulted in the highest yield in ten varieties in 2018 and six in 2019. In 2018, three of 15 varieties yielded highest at a nitrogen rate of 120 lbs N/A. In 2019, 180 lb N/A resulted in a higher yield in seven varieties.

Nitrogen Use Efficiency (NUE) was examined in 2019 with the addition of a zero N rate. The NUE by nitrogen rate interaction was significant at Union County in 2019 but not in Moore County. In Union County, ten of the sensor-based N rates resulted in the highest NUE, five at the 120 lbs. N, three at the 150 lbs. N, and one at the 180 lbs. N. Dyna-Gro 9701 resulted in the same NUE at 120 lbs. N and the sensor based rate, Pioneer 26R59 resulted in the same NUE at 120 lbs. N, 150 lbs. N, and the sensor based rate, and Hilliard resulted in the same NUE at 120 lbs. N and the sensor based rate. In Moore County, the sensor-based N rate resulted in the highest NUE in seven of the variety and N rate combinations, 120 lbs. N resulted in four, and 150 lbs. N resulted in six. Featherstone VA had the same NUE at 120 lbs. and150 lbs. N while Southern Harvest 7200 had the same NUE at 120 lbs. N and the sensor-based N rate.

Evaluating the Nitrogen Use Efficiency by the Delta Yield from the plots that received N to the check, the varieties separate out into categories. These categories are; low yield and low NUE, low yield and high NUE, high yield and low NUE, high yield and high NUE (Figure 1). Varieties Gerard 557 and Southern Harvest 4300 both perform similarly in that they all perform at a similar yield regardless of the N rate (Table 1). Varieties such as these would be result in a lower yield and low NUE. Dyna-Gro 9811, Pioneer 26R59 and 26R41, AgriMAXX 473, VA Tech Hilliard, AG South Genetics 2024, and Syngenta Viper all continue to increase in yield as more N is applied. Growers in higher yielding environments where the more N that is applied the more the yield potential increases would prefer varieties such as these where a high yield and high NUE are achieved. The high response to N category is for growers in those regions who have management practices that support supplying the wheat with additional N to increase yield. Dyna-Gro 9701, CROPLAN 8550, and Southern Harvest 7200 all perform moderately well but not as well as the varieties in the high nitrogen response category. Varieties in the moderate category are for growers who may not have the management practices to support supplying a higher than normal rate of N but still wish to achieve a higher yield. Uni-South Genetics 3536 and 3895 and Featherstone VA 258 are varieties that do not have similar characteristics at all nitrogen rates or locations and are considered varieties that can be chosen based on location and management practices. As an example, Featherstone VA 258 performs similarly at three locations where yield increases as additional N is applied and at two other locations, the amount of N applied does not drastically change the yield.

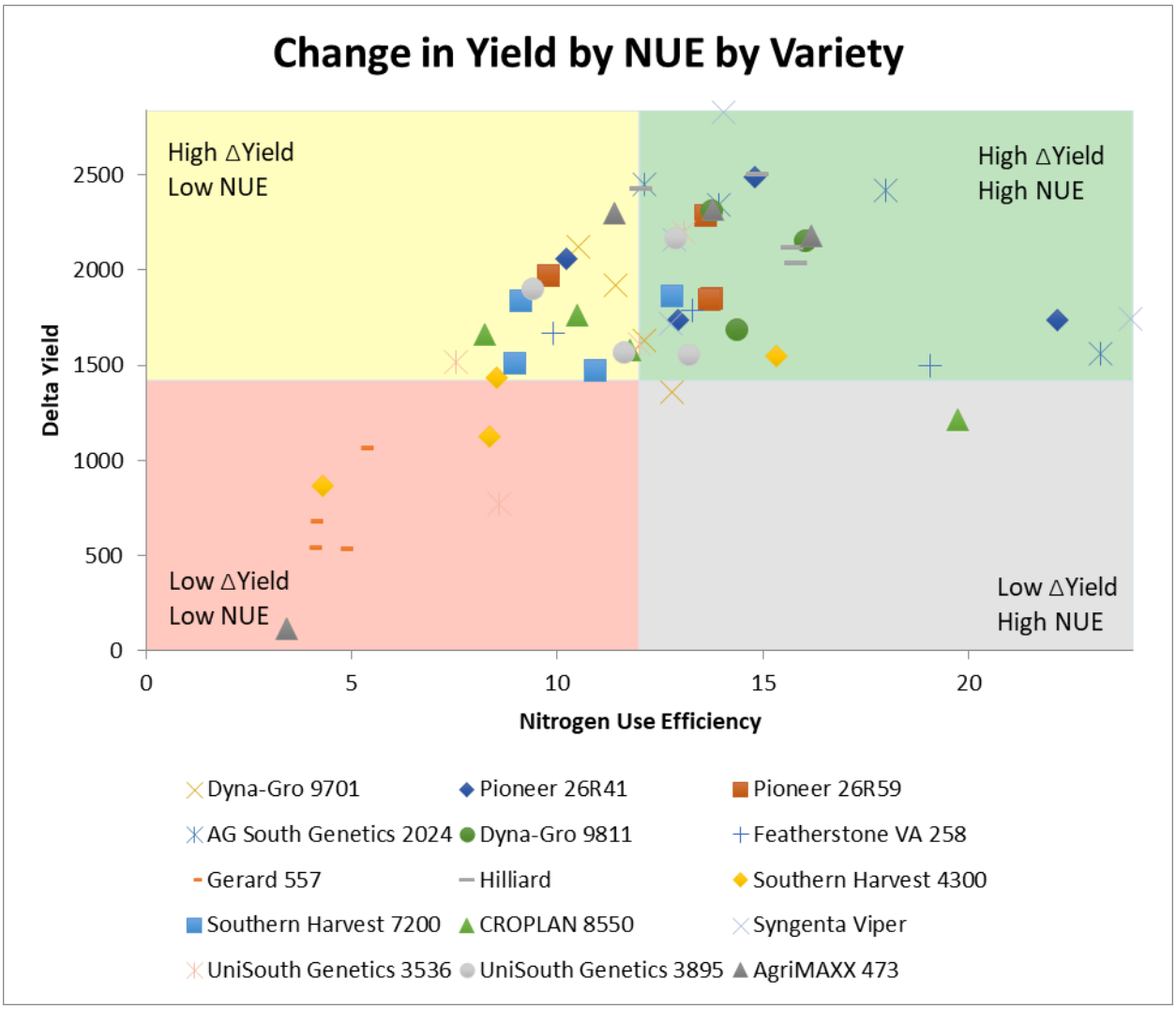

Figure 1. Change in yield by nitrogen use efficiency by variety in Union County in 2019.

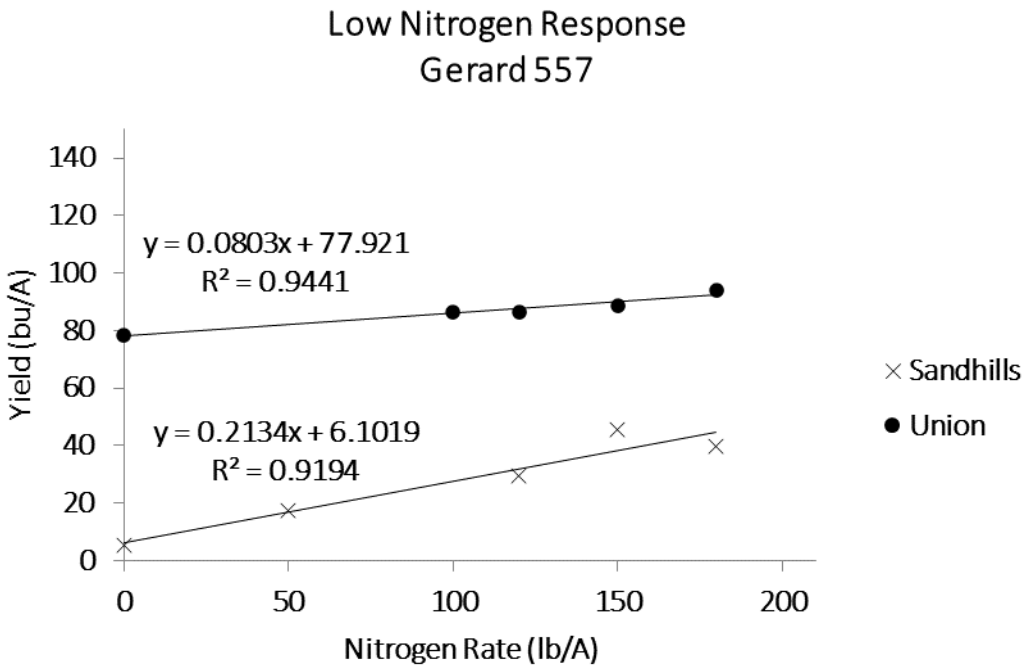

Figure 2. Yield response to nitrogen for low nitrogen response

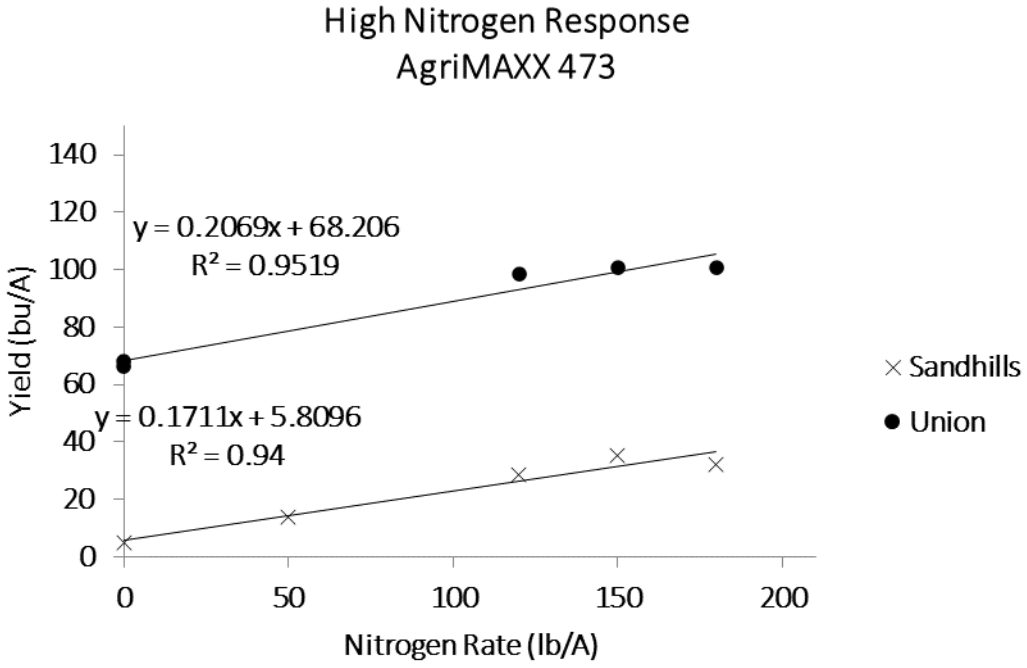

Figure 3. Yield response to nitrogen for high nitrogen response

Table 1. Varieties separated into categories high, moderate, low, and nitrogen rate dependent in response to additional nitrogen from Union County in 2019.

Variety	High Response	Moderate Response	Low Response	Rate/Environment Dependent
USG 3536				✓
DG 9701		✓		
AGS 2024	✓			
AgriMAXX 473	✓			
FSVA258				✓
CROPLAN 8550		✓		
VA Tech Hilliard	✓			
Pioneer 26R41	✓			
Pioneer 26R59	✓			
SH 7200		✓		
USG 3895				✓
SH 4300			✓	
Gerard 557			✓	
Syngenta Viper	✓			
DG 9811	✓			

BUDGET / EXPENDITURE UPDATE:

Of $5,000 awarded in support of this project for 2019-20, all funds have been expended.

IMPACT STATEMENT:

This project was a part of the Master's thesis work of Kaitlyn Moody in combination with the demonstration nitrogen-rich strip work we have been conducting. Each of these locations were demonstrated to farmers and agents at the small grain field days and whistle stop tours in 2019. Preliminary results were communicated to growers during grain production meetings in 2018 and 2019. Growers showed a lot of interest in the potential of this project to identify best management practices of nitrogen applications based on variety and environment. Formal nitrogen recommendations by variety for the 15 varieties tested were made available to growers in time for topdress applications for the 2019-20 growing season, specifically presented at the NE Ag EXPO in 2020.

Research continued for this project in the 2019-20 growing season, where we examined 6 additional varieties at three locations. We will continue to add new varieties to this testing protocol as new varieties rise to the top of the official variety trials each year so that growers remain informed about the nitrogen use efficiency for newly released varieties.