

Due to the timing of the received award, we were able to initiate the proposed three-year study in 2018 growing season. At this point we do not have any results to present, however, this section clearly defines the methods followed this year. A 'control' plot which did not receive any additional N was added in the experimental block at all sites. At SDSU NE and SE Research Farms, each nitrogen treatment was split for additional treatment with plant growth regulator (PGR) and the effects of PGR were evaluated under different nitrogen regimes. Fields at all locations were planted with variety 'Hayden' except Brookings which was planted with variety 'Goliath'. (Note: Variety decision was made by the producer). Before applying N treatments, a composite soil sample from 0-6" and 6-24" were collected to test for pre-trial N level. The N treatments were arranged in Randomized Complete Block (RCB) design with three replicates at all sites. The plot size was 15' x 30'. The PGR Palisade EC (Syngenta) was applied at Feekes growth stage 5-6 (leaf sheath strongly erected-first node visible).

NE Farm by South Shore and SE Farm by Beresford

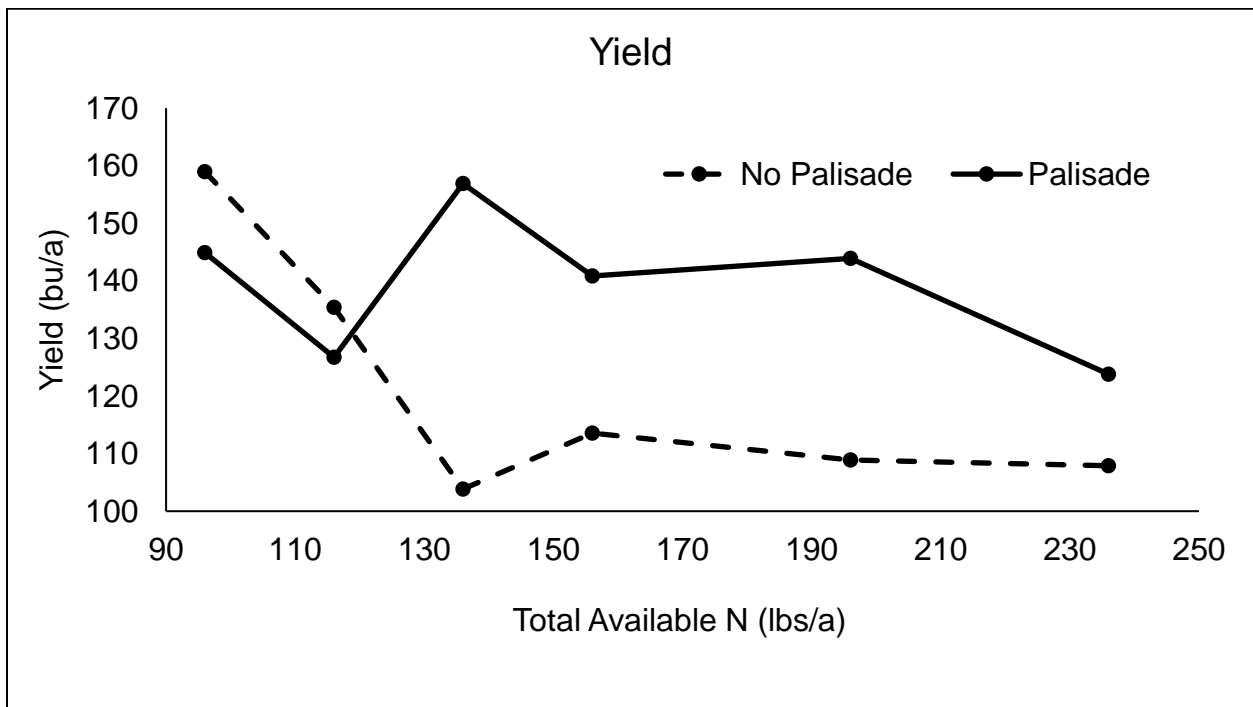


Fig 1. Average Oat Yields under Various Nitrogen levels and Plant Growth Regulator 'Palisade' at NE Research Farm.

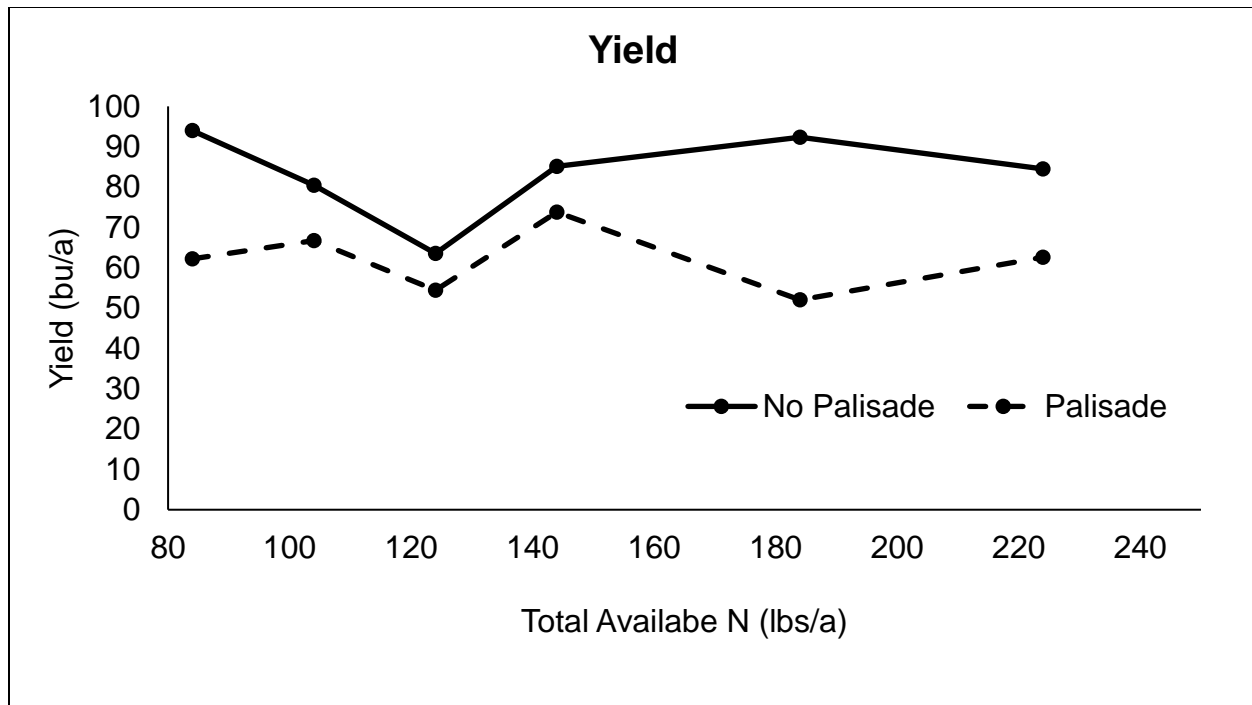


Fig 2. Average Oat Yields under Various Nitrogen levels and Plant Growth Regulator 'Palisade' at SE Research Farm.

The PGR used in this study was able to significantly reduce height and lodging on oats. At NE farm, the highest yield of 159 bu/a was achieved without applying any extra N which suggest that, the total available N in the soil (96 lbs/a) was enough to produce optimal yield under 2018 growing conditions. At NE farm, the highest yield to applied N ratio for non-PGR plots was 0.6. On the other hand, highest yield to N ratio for PGR applied plots was 0.85 (Fig 1.)

Similar to NE farm, the pre-trial N of 84 lbs/a at SE farm was enough for achieving the highest grain yield in this trial. The trend of grain yield response for applied N treatments and PGR were almost identical except for 180 lbs/a N plots (Fig 2.). The yields were significantly lower than NE farm which could be due to elevated stress in early growth stage caused by delayed planting and extremely high temperatures in May. The highest yield of 94 bu/a was achieved for 'control' (no additional N) treatment, which shows that even under low production weather conditions, 0.9 lbs N was able to produce a bushel of oat grain.

Aurora Research Station, Salem, and Bruce

At these three locations, PGR was not used, therefore, height notes were not obtained as there were no visible differences in height. Plots at Aurora were 100% for all applied treatments due to two due extremely strong storm in quick succession in late July. The highest yield of 93 bu/a was obtained for control plots which had 88 lbs/a of pre-trial N.

At Bruce, the yields were comparatively higher than other locations which ranged from 155 bu for 100 lbs/a N treatment to 161 bu/a for control. The pre-trial N in Bruce was 92 lbs/a. The lodging score ranged from 30% (control) to 47% (100 lbs N/a).

At Salem, the yields ranged from 112 bu/a (control) to 143 bu/a (60 lbs N/a). The pre-trial N at this location was 76 lbs/a. The lodging score ranged from 7% (control) to 60% (140 lbs N/a).

Conclusion

From first year study, we can safely conclude that a bushel of oat grain was achieved by much less available N than our current recommendation of 1.3 lbs. Applying PGR consistently reduced height and lodging at both locations which could be used as a tool along with variety selection for better plant standability.

Project Budget

In the first year, we expended about \$20,000 to complete the above tasks.

Calibration of Nitrogen Requirement of Oats Grown for Grain in South Dakota

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Background

The fertilizer recommendations guide for South Dakota (SD) crops was last updated in 2005 (EC750, 2005), and the nitrogen (N) recommendations for the oat grain crop are higher than guidelines recommended by other public institutions. The SD guideline uses expected yield goal to be multiplied by 1.3 (minus soil test N and legume credit) to estimate total N requirement by the oat crop. Perhaps, due to improved genetics and other management tools, producers in productive environments have consistently grown oat crop with yield of more than 100 bu/a with significantly lower levels of nitrogen than recommended in the EC750 guide. The proposed study aims at developing an up-to-date nitrogen fertilizer recommendation for oats grown for grain production in SD. This will help narrow the knowledge gap among oat growers in terms of applying the correct amount of nitrogen fertilizer on oat crops to maximize production and profitability, and avoid lodging. Sharing results from each growing season in the form of web articles (igrow.org), fact sheets/publications, summer field days, winter crop meetings, and events organized by other education groups such as USDA-NRCS will effectively impact the decision making for oats producers in SD and surrounding regions. Application of fertilizer N as required by the crops will benefit growers to obtain highest yield potential without negative impact on environment.

Goal and Objectives:

The goal of the proposed study is to develop a revised nitrogen fertilizer recommendation for oat grown for grain production in SD environments. The objective of this study is to determine oat yield response to varying levels of applied nitrogen fertilizer. Some SD growers have shown interest in using plant growth regulators (PGR) to shorten plant height as a mean to prevent lodging. In one or more location, we used both growth regulator and nitrogen levels as treatments. This will allow us to see if there is any financial benefit of using growth regulator to increase grain yield by applying higher N rates without potential crop lodging.

2019 Growing Season

Performance of Oats under different Nitrogen Regimes when grown with and without Plant Growth Regulator (PGR)

In 2019, the trials that consisted PGR (Palisade by Syngenta) as an added variable were conducted at the SDSU Southeast and Northeast Research Farms near Beresford and South Shore, SD. However, due to excess moisture it was not feasible to apply Palisade at SE farm. Therefore, we considered SE to be an additional site for testing nitrogen rates. A total of five N rates (20, 40, 60, 100 and 140 lbs/a) were used in the study with additional 'control' treatment which did not receive any nitrogen. At planting

NE farm had about 80 lbs/a available N (40 lbs in soil and 40 lbs soybean legume credit) and SE farm had 88 lbs/a available N at planting. A split plot design was used with N treatment as the main factor and growth regulator the split factor. All treatments were arranged in Randomized Complete Block (RCB) design with three replicates. The plot size was 15' x 30'. Both sites were planted to variety 'Saddle' in 2019. At NE farm due to standing water immediately after planting, one range (about 9 plots) had poor emergence.

Two other locations- Aurora Research Farm (variety Saddle) and farmer cooperator's field in Garretson (variety Hayden) were used to test nitrogen rates without the application of PGR. At the beginning of the season we had planned to add two more locations- Salem and Miller, however due consistent precipitation in the spring we could not continue beyond soil sampling at these sites.

Results:

Effects of N Rates on Oat Performance in 2018 Growing Season

The average grain yields were inferior to previous test years. At SE farm, the yield ranged from 30 bu/a (60 lbs N) to 55 bu/a (100 lbs N) whereas, at Aurora and Garretson the yields ranged from 87 bu/a (control) to 113 bu/a (20 lbs N) and 67 bu/a (control) to 94 bu/a (60 lbs N) respectively. The rates did not show significant effects on lodging and plant height.

Effects of N Rates and Plant Growth Regulator on Oat Performance in 2018 Growing Season

In 2019 the Palisade treatment was only tested at NE farm. It was applied at 14 oz/a with at least 15 gallon of water at Feekes 6 growth stage (1st node visible). The label states for 10.5 to 14.4 oz per acre from Feekes 4 (leaf sheath strengthening) to Feekes 7 (2nd node visible) growth stages. The total available N (legume credit + soil test N) prior to the application was 80 lbs/a.

The average yields ranged from 75 bu/a (control plot with Palisade) to 113 bu/a (140 lbs N with no Palisade). Due to weather factors and comparatively lower yields than in usual year, we did not notice much lodging at the site, however, the PGR showed significant effects on plant height.

Grain Quality Parameters

Sub-samples taken from each plot from all test sites were run for several grain quality parameter at the General Mills laboratory. Among the sites tested for nitrogen rates (i.e. Aurora, SE Farm, and Garretson), only grain protein content from Garretson samples showed significant response to applied nitrogen. All other quality measures such as plump grain, thin grain, percent groat, beta glucan, and fatty acid content did not show significant response to applied nitrogen at these sites.

At NE farm, we added plant growth regulator a variable in addition to nitrogen rates. Plant growth regulator (PGR) showed significant response to following grain quality parameters- protein content and grain plumpness. However, nitrogen rates showed significant effects on protein content and percent goat.

Conclusion

The PGR used in this study was able to significantly reduce height and in rare cases lodging (on plot wise basis) on oat crop. Generally, the 'control' plots yielded lower than the nitrogen treated plots. In most cases lower range of nitrogen rates were able to produce the optimum yields which suggests that our current recommendation of 1.3 lbs N/bu oats is higher than possibly required by the crop. After completion of proposed three years study, all obtained yield data will be pooled to accurately estimate the recommended N rate for oats in SD environments.

Acknowledgment

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