# Sustainable Fungicide and Nitrogen Management to Malting Barley

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## INTRODUCTION

Demand is increasing for more sustainable crop production practices and locally grown brewing ingredients, including malting barley for a nationally expanding microbrewing industry. Sustainable malting barley management added to an existing cropping system rotation such as corn, soybean, and alfalfa can provide an alternative crop in many of the cooler growing areas of the nation.

## OBJECTIVE

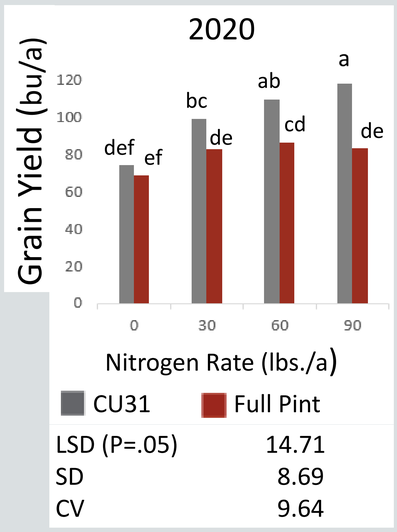
Determine sustainable economic application rates of nitrogen and fungicides.

## MATERIALS AND METHODS

- The studies established at two locations in Wisconsin in Buffalo County (2018, 2020) and Chippewa County 2018, 2019, and 2020. Weather conditions prohibited data collection from Buffalo County in 2019.
- Soil types were Seaton Silt Loam in Buffalo County and Scott Lake Sandy Loam in Chippewa County.
- Malting barley was planted into soybean residue at both locations during each year of the study using a Hegge four-foot grain drill.
- Fungicide and nitrogen rate studies used a randomized complete block design. Individual plots were 4 feet by 10 feet and replicated four times.
- The nitrogen rate applications consisted of 0 (check), 30, 60, and 90 pounds per acre nitrogen equivalent of urea (46-0-0).
- The fungicide study included foliar and heading applications and an untreated check.
- Harvest was conducted at each location using a Hegge four-foot combine with a Draper head.
- Grain was tested for moisture and yields adjusted to 10% moisture standard.

## RESULTS

Figure 1: Interaction of Nitrogen Rate and Variety 2018, 2020 at Buffalo County



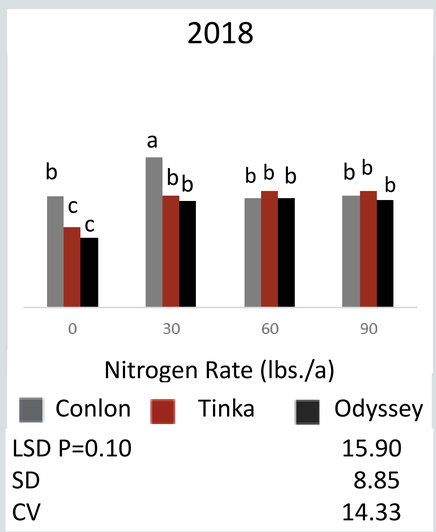
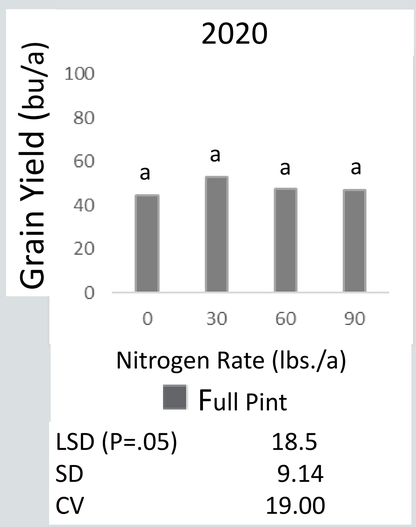
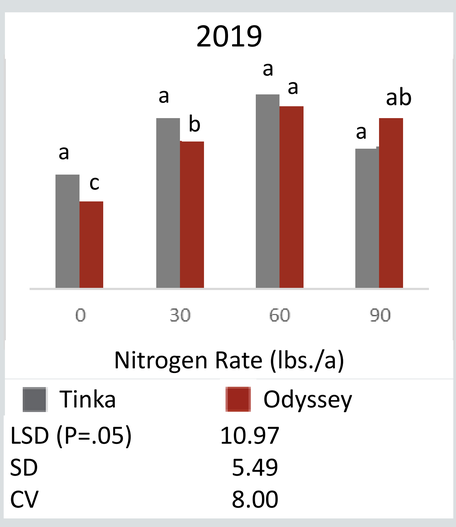




Figure 1 and 2 indicate statistical differences in grain yield in response to urea nitrogen equivalent applications of 0, 30, 60, and 90 pounds/acre

Figure 2: Interaction of Nitrogen Rate and Variety across all years at Chippewa County



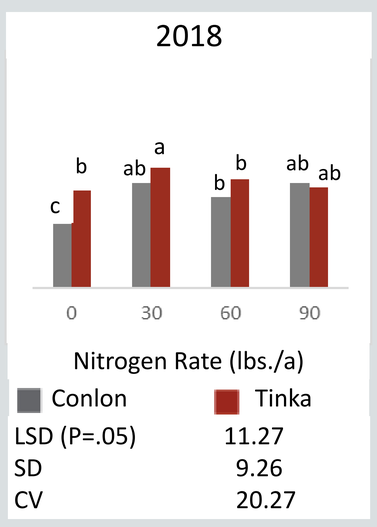




Table 1: Yield and DON levels of malting barley varieties with fungicide application timing at two western Wisconsin locations

| | | Buffalo | | Chippewa | |
|---|---|---|---|---|---|
| **Variety** | Treatment | **Yield Bushels/Acre** | **DON** | **Yield Bushels/Acre** | **DON** |
| 1 Robust | NT | 49.28d | 4.533d | 40.503e | 0.613d |
| 2 Robust | LD | 57.700cd | 3.45b | 48.477cd | 0.578d |
| 3 Robust | LD+PR (HE) | 51.968e | 3.225b | 51.82c | 0.498c |
| 4 Robust | LD+MIR (HE) | 53.006de | 2.450a | 52.188c | 0.48c |
| 5 Robust | LD+PR (AHE) | 57.494c | 3.067a | 44.961 | 0.565d |
| 6 Robust | LD+MIR (AHE) | 58.236c | 2.550a | 50.461c | 0.558d |
| 7 Pinnacle | NT | 74.651b | 3.75b | 23.552f | 0.055a |
| 8 Pinnacle | LD | 81.908a | 4.2c | 37.356e | 0.090a |
| 9 Pinnacle | LD+PR (HE) | 84.908a | 4.25c | 67.228ab | 0.218a |
| 10 Pinnacle | LD+MIR (HE) | 85.056a | 2.800a | 83.260a | 0.068a |
| 11 Pinnacle | LD+PR (AHE) | 81.304a | 2.667a | 57.956b | 0.078a |
| 12 Pinnacle | LD+MIR (AHE) | 75.235ab | 1.660a | 83.027a | 0.100a |
| 13 Odyssey | NT | 39.721e | 3.9bc | 37.894e | 0.565 |
| 14 Odyssey | LD | 53.984e | 7.433e | 51.93c | 0.425c |
| 15 Odyssey | LD+PR (HE) | 56.77d | 5.8d | 79.292a | 0.31b |
| 16 Odyssey | LD+MIR (HE) | 49.651d | 4.975d | 62.58b | 0.240a |
| 17 Odyssey | LD+PR (AHE) | 62.259c | 3.167b | 73.217a | 0.423c |
| 18 Odyssey | LD+MIR (AHE) | 61.857c | 4.167d | 81.349a | 0.245a |
| *LSD (P=.05)* | | 10.250 | 1.80 | 15.21 | 0.5 |
| *Standard Deviation* | | 7.420 | 1.20 | 8.78 | 0.1 |
| *CV* | | 8.480 | 1 | 9.28 | 1 |
| Means followed by same letter do not significantly differ (P=.05, Duncan's New MRT) | | | | | |
| NT= No Treatment; LD=Approach @ 12.0 oz./acre; PR=Prosaro @ 8.0 oz./acre | | | | | |
| MIR=Miravis Ace @ 13.7 oz./acre; HE=Heading; AHE=After Heading | | | | | |

Yield and quality testing for the mycotoxin deoxynivalenol (DON) was conducted on the fungicide trial represented in Table 1. A significant yield difference was observed between varieties and treatments at both locations. Non treated areas yielded significantly lower with all varieties at both locations. The malting industry standard for DON is <1 ppm for large scale brewers and <0.5 ppm for craft brewers.

## Conclusions

The results of the nitrogen application study indicate a minimum of 30 pounds per acre of nitrogen is needed to statistically increase yield. The response to nitrogen is dependent on location, variety, and soil type. The results also indicate an application of 30 pounds of nitrogen resulted in yields statistically comparable to higher rates. The results of the fungicide application study indicate an application of fungicide at Feekes 10.0 (boot stage) and/or 10.5 (flowering) statistically increased yield compared to the non-treated check.

## Acknowledgements

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