PERFORMANCE OF WINTER BARLEY (*Hordeum vulgare* ssp. *vulgare*) AND SPRING WAXY BARLEY VARIETIES PLANTED IN THE FALL

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Introduction

Treasure Valley Renewable Resources is in the process of putting a grain fractionation plant in Ontario, Oregon and one of their primary interests includes contracting barley that has fully waxy starch, and is high in beta-glucan fiber and protein. Very little research has been done on growing barley for high protein and response of barley varieties to nitrogen application. Previous work by Brad Brown, Cereal Specialist for University of Idaho at Parma, has shown that 'Merlin' and 'Salute', spring genotypes that were developed by WestBred (Bozeman, MT), are among the best waxy cultivars available. A fall barley genotype would work best in our rotational system due to higher yields obtained. Unfortunately, right now there are no fall waxy barley cultivars available. Pat Hayes, barley breeder at Oregon State University (OSU), has started a winter waxy breeding project. Waxy barley would fit into the Treasure Valley cropping system as a rotational crop where traditionally wheat and corn were grown. Pat Hayes indicated the current fall non-waxy genotypes that are either standards in the industry or are very high yielding for the Treasure Valley include 'Strider' released by OSU, 'Maja' (Stab 113) released by Agrisource, 'Eight-Twelve' released by the University of Idaho, and 'Sunstar Pride' released by Sunderman Breeding. Brad Brown has planted spring barley genotypes in the fall with a fair degree of success, including Merlin and Salute. The purpose of this trial was to determine winter survival of two fall-planted spring waxy barley varieties to compare yield and quality to the four barley industry standard varieties when heading nitrogen was foliarly applied.

Methods

The experiment was planted on Owyhee silt loam at the Malheur Experiment Station on a field that grew field corn the previous year. Seedbed preparation included disking, cultivating, and furrowing. Soil samples were collected prior to fall tillage and showed 31 lb/acre nitrogen (N) in the top 2 ft of soil, in the top foot of soil 25 ppm phosphorus (P) (Olson method), 313 ppm potassium (K), 16 ppm sulfate (SO_4), 2,442 ppm calcium (Ca), 501 ppm magnesium (Mg), 1.75 ppm zinc (Zn), 5.25 ppm iron (Fe), 5 ppm magnesium (Mn), 0.6 ppm copper (Cu), 0.4 ppm boron (B) and 1.0 percent organic matter. Fall fertilizer rates applied per acre were 50 lb/N, 50 lb/P, 50 lb/SO_4, 50

lb/elemental S, 1 lb/Cu, and 1 lb/B on August 8, 2005. The field was planted on October 24, 2005 with a plot drill on 30-inch beds with 3 drill rows per bed. The experimental design was a randomized complete block design with four replications. Spring fertilizer was 100 lb/acre N as urea applied by aerial application on March 31, 2006. Visual plant stand estimations were taken on April 12. Eight flag leaves were taken from all plots and combined into one sample for each variety on May 25 and sent to Brookside Laboratory, New Knoxville, Ohio, for analysis. A heading N application of 74 lb N/acre of fluid urea was made on May 26, 2006, when most varieties had reached 50 percent heading. The field was sprayed for weeds with Bronate® herbicide at 1 qt/acre applied May 11, 2006. The trial was furrow irrigated for 24 hours on May 2, May 19, June 1, and June 14. Plant height was measured on June 23, 2006. Plots were cut to size and harvested with a Hege combine on July 21 and 24.

Response variables were compared using ANOVA and least significant differences at the 10 percent probability, LSD (0.10). Differences between response variables should be equal to or greater than the corresponding LSD (0.10) value before any variety is considered different from another in this trial.

Results

Plant stands of Salute (74 percent) and Merlin (61 percent) were significantly less than the winter varieties planted, which ranged from 89 to 90 percent (Table 1.). Flag leaf samples taken on May 25 revealed lower N levels (2.5 percent N) than the no-N plots (3.0 percent N) in another study this year that was looking at the response of Salute and Merlin to N. Considering 180 lb/acre of N applied prior to heading, it is interesting that N levels in the plant were so low. Flag leaf concentrations ranged from 2.5 to 3.0 percent depending on cultivar (Table 2). A heading N rate of 74 lb/acre foliar N was applied on May 26. Once heading occurred it was obvious that birds preferred eating the two-row barley varieties, Salute and Merlin, compared to the six-row cultivars. Bird netting was placed over all the plots to decrease damage.

Sunstar Pride had a later heading date than the other varieties (Table 1). This later heading date coupled with the heading N application done to all treatments on one date may have had a strong impact on seed yield and seed number. Sunstar Pride had significantly higher yield than Strider and all other varieties in the test (Table 2). Variety research conducted by the University of Idaho at Parma has shown that Strider generally yields as well as Sunstar Pride. Sunstar Pride, with significantly lower grain protein levels (Table 2) than all other cultivars, suggest that most of the heading N went toward yield. Strider significantly outyielded all other varieties in the trial except Sunstar Pride. Salute had the third highest yield and its mean was higher than Eight-Twelve and Maja, although not significantly different. Salute also significantly outyielded Merlin in this low N environment. Merlin, the only hulless variety in the trial, had significantly higher test weight and seed moisture as well as fewer seeds per pound (higher seed weight). Merlin was also significantly shorter than any other variety in the trial and had the lowest yield of the trial.

Conclusion

When applying N at heading in a variety trial, careful attention to growth stage is important to reduce the likelihood of giving a yield advantage to late maturing cultivars such as Sunstar Pride. Literature recommends applying N after 50 percent heading in wheat. Sunstar Pride put its N into increasing seed number and consequently yield. Even though Merlin was the lowest yielder it had significantly higher grain protein content than any other cultivar in the test. Strider outyielded Salute and Merlin by 15.6 percent and 32 percent, respectively. Further research needs to be conducted to see how different barley varieties respond to heading N applications.

Acknowledgement

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Table 1. Barley stand on April 12, maturity, heading date, and plant height on July 23 at the Malheur Experiment Station, Oregon State University, Ontario, OR, 2006.

Variety	Plant maturity	Date of 50% heading	Plant height	Plant stand
	date	date	inch	%
Sunstar Pride	Aug. 5	May 28	28	89
Strider	July 27	May 18	31	89
Salute	July 27	May 21	30	74
Eight-Twelve	July 24	May 18	29	89
Maja (Stab 113)	July 25	May 16	33	90
Merlin	July 25	May 21	20	61
LSD (0.10)	2 days	N/A[a]	3	5

[a]N/A = Not available since not replicated.

Table 2. Barley yield and quality results. Malheur Experiment Station, Oregon State University, Ontario, OR, 2006.

Variety	Yield[a]	Seed # per area	Seed weight	Crude protein	Flag leaf N	Harvest moisture	Test weight
	bu/acre	Seed # per ft^2	seed # per lb	%	%	%	lb/bu
Sunstar Pride	135.3	2,102	11,270	8.3	2.5	7.7	52.2
Strider	99.5	1,677	12,270	11.1	2.6	7.0	49.4
Salute	83.9	1,308	11,290	11.1	2.5	7.6	53.6
Eight-Twelve	75.9	1,189	11,400	10.3	2.7	7.6	51.0
Maja (Stab113)	73.1	1,194	11,870	10.9	3	7.3	50.6
Merlin	67.5	866	9,330	12.1	2.5	9.5	61.6
LSD (0.10)	14.4	260	770	0.9	N/A[b]	0.5	0.7

[a]Yield is corrected to a 12 percent moisture basis, bu = 48 lb.
[b]N/A = Not available since not replicated.