Barley Cultivar Performance Following Corn in Clean-, Reduced-, and No-Till Systems

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SUMMARY

Previous research indicated a consistent advantage in spring wheat grain yield when tillage was eliminated across contrasting cropping systems in southwestern North Dakota. Our objective is to determine if barley is responsive to changes in tillage, and if cultivar selection affects barley performance. Six barley cultivars were compared for grain yield and quality across clean- and no-till management at Dickinson during 2009, and across clean-, reduced-, and no-till systems in 2010. Cultivar rank did not change across tillage systems. Similarly, reductions in tillage did not affect grain yield in either year, averaging 103 bu/acre in 2009 and 63 bu/acre in 2010. Grain test weight was affected by tillage system in 2010 ($P < 0.05$), but not in 2009. Grain yield differed by 35 bu/acre across the six barley cultivars in 2009, and by 9 bu/acre in 2010. The two-rowed cultivar Pinnacle produced equal or greater amounts of grain compared with the other five cultivars in both years, while grain test weight of 'Conlon' was equal or heavier than that of other cultivars. These results indicate that tillage may not affect barley grain yield and quality consistently, if at all, under the environmental conditions similar to those encountered during the first two years of this 4-yr study.

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INTRODUCTION

Tillage has declined in western North Dakota (Carr et al., 2003a). Previous research at the NDSU Dickinson Research Extension Center indicated that reductions in tillage failed to affect grain yield and quality in a wheat-fallow system (Carr et al., 2003a, 2003b), but wheat grain yield and quality were enhanced by eliminating tillage in more intensive cropping systems (Carr et al., 2006). The objective of this research is to determine if barley performance and cultivar rank change across contrasting tillage systems in a barley-corn rotation.

MATERIALS AND METHODS

Three 2-rowed (Conlon, Conrad, and Pinnacle) and three 6-rowed (Lacey, Stellar-ND, and Tradition) barley cultivars were established in clean-, reduced- and no-till plots in a field where corn previously was grown. The tillage systems were established in 1993. A tandem disk is used in both the fall and the spring so that less than 15% of the soil surface is covered with crop residue at seeding in clean-till plots. A single disking occurs in the spring so that between 30 and 50% of the soil surface is covered with crop residue in reduced-till plots. Sixty percent or more of the soil surface is covered with crop residue at seeding in no-till plots, where soil is not disturbed except by a low-disturbance, no-till planting unit. Plots were arranged in a randomized complete block in a split plot arrangement. Tillage system comprised whole plots and barley cultivar comprised subplots. Tillage by barley cultivar combinations were replicated three times. Data were analyzed using PROC GLM from SAS for balanced data.

RESULTS AND DISCUSSION

Close to 70% of the soil surface was covered by previous crop residue at seeding in no-till plots in 2009 and 2010, compared with less than 15% in clean-till plots (Table 1). However, differences in soil surface residue cover failed to impact barley plant stand establishment (data not presented). Average heading date was two days later under no-till than clean-till in 2010, whereas differences in heading date were not detected in 2009. Plant height was unaffected by tillage system in either year. Similarly, spike density and grain yield were unaffected by tillage system. Grain yield averaged 103 bu/acre in 2009 and 63 bu/acre in 2010. Grain with a heavier test weight was produced under no-till than under clean- and reduced till systems in 2010, but there was no difference in grain test weight across clean- and no-till systems in 2009.

Barley cultivar rank was unaffected by reductions in tillage for any parameter considered, except grain test weight in 2010 (data not presented). However, Conlon produced grain with equal or heavier test weight than that produced by other cultivars in all three tillage systems in 2010. Conlon also headed 3 to 6 days earlier than other cultivars included in the study in 2009, and 3 to 15 days earlier in 2010 (Table 1). Plant height was similar among all cultivars except Conrad, which was 4 to 5 inches shorter in 2009 and 2 to 3 inches shorter in 2010. The number of reproductive spikes/ft^2 was consistently greater among two- than six-rowed cultivars in both 2009 and 2010, and this translated into greater yields for the two-rowed cultivars Conrad and Pinnacle compared with all three, six-rowed cultivars in 2009. This was not the case in 2010, when differences in grain yield were not detected between two- and six-rowed cultivars, with one exception. Grain yield for Conlon was 58 bu/acre and

lower than the grain yield of both Lacey (65 bu/acre) and Pinnacle (67 bu/acre).

Heavier kernel weight was produced by Conlon than any other barley cultivar in 2010 (Table 1). Differences in grain test weight were not detected between Conlon, Conrad, Lacey, and Tradition in 2009. Test weight was relatively light for grain produced by Stellar-ND in both years. This ongoing study will be continued through 2012.

REFERENCES

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Table 1. Tillage Systems by Barley Variety Trial, NDSU Dickinson Research Extension Center 2009-2010

	Surface residue			Days to heading			Plant height		
	2009	2010	Average	2009	2010	Average	2009	2010	Average
Tillage system	-%-			-d-			-in-		
Clean-till	8	14	11	55	57	56	30	29	30
Reduced-till	-	39	-	-	58	-	-	29	-
No-till	73	67	70	56	59	58	29	29	29
LSD 0.05	57	13	-	NS	1	-	NS	NS	-
Barley varieties									
Conlon	41	51	46	52	53	53	30	30	30
Conrad	45	50	48	58	68	63	26	27	27
Lacey	-	29	-	55	57	56	30	29	30
Pinnacle	-	-	-	56	56	56	31	29	30
Stellar-ND	-	29	-	56	57	57	30	29	30
Tradition	-	-	-	55	56	56	30	30	30
LSD 0.05	NS			1	1	-	2	1	-

	Spike density			Grain yield			Grain test weight		
	2009	2010	Average	2009	2010	Average	2009	2010	Average
Tillage system	-Spikes/ft^2-			-bu/acre-			-lb/bu-		
Clean-till	42	33	38	107	58	83	49	44	46
Reduced-till	-	32	-	-	67	-	-	45	-
No-till	40	31	36	99	63	81	48	47	47
LSD 0.05	NS	NS	-	NS	NS	-	NS	1	-
Barley varieties									
Conlon	51	40	46	105	58	81	50	48	49
Conrad	56	40	48	121	62	91	50	45	48
Lacey	24	24	24	87	65	76	49	45	47
Pinnacle	51	35	43	121	67	94	48	45	46
Stellar-ND	30	23	27	86	60	73	46	44	45
Tradition	32	29	31	97	63	80	49	46	48
LSD 0.05	11	4	-	12	5	-	1	1	-