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

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SUMMARY

Tillage is being reduced in dryland cropping regions. Our objective is to determine if tillage systems impacts barley cultivar ranking for yield and grain quality traits. Six barley cultivars were compared for grain yield, test weight, and kernel plumpness under clean- and no-till management in southwestern North Dakota during 2009. Grain yield ranged from 86 bu/acre for the 6-rowed cultivar Stellar-ND to 121 bu/acre for the 2-rowed cultivars Conrad and Pinnacle ($P < 0.05$). Grain test weight ranged from 46 lb/bu for Stellar-ND to 50 lb/bu for Conrad and another 2-rowed cultivar, Conlon. Fewer plump kernels were produced by Conlon than all other cultivars. Tillage had no or minimal effect on grain yield and quality. Similarly, tillage did not affect barley cultivar rank for any grain trait. These results suggest that barley cultivar rank is unchanged as tillage is reduced, but additional data are needed to verify this preliminary observation.

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INTRODUCTION

Tillage is declining in western North Dakota and other dryland cropping regions (Carr et al., 2003a). Previous research at the NDSU Dickinson Research Extension Center indicated that cultivar rank was unchanged for grain yield and quality when tillage was reduced in a wheat-fallow system (Carr et al., 2003a, 2003b). Grain yield also was unaffected by tillage in that study (Carr et al., 2003a). Grain yield and quality were enhanced under no-till compared with clean-till when cropping intensity was increased from crop-fallow to crop-crop in a subsequent study (Carr et al., 2006). This suggests that cultivar rank may be affected by tillage system when crops are grown annually. The objective of this research is to determine if barley cultivar rank changes 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 no-till and clean-till plots in a field where corn previously was grown. A barley-corn rotation was selected because of interest in determining if fusarium head blight would become a problem when these two crops are grown in a 'tight' 2-yr rotation in western North Dakota. Tillage plots were maintained as described previously (Carr et al., 2006). Soil surface coverage by previous crop cover and barley stand counts were determined as described elsewhere (Carr et al, 2006). Days to heading were recorded for plants in each plot, as was plant height at physiological maturity. Grain yield was determined by harvesting each plot. A subsample was used for determination of grain test weight, kernel weight.

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

Over 70% of the soil surface was covered by previous crop residue in no-till plots, compared with less than 10% in clean-till plots (Table 1). However, no impact was detected on barley stand establishment by surface residue coverage. Barley heading date, plant height, and spike density were unaffected by tillage system. Grain yield averaged over 100 bu/acre and test weight over 48 lb/bu, regardless of tillage system. There was a statistically significant advantage in kernel weight when barley was grown in clean-till plots (9726 kernels/lb) compared with no-till plots (9999 kernels/lb), as well as in kernel plumpness (clean-till = 98.5% and no-till = 97.9%), although the practical impacts of these small differences are limited.

Barley cultivar selection did not affect plant stand (Table 1). In contrast, Conlon headed 3 to 6 days earlier than other cultivars included in the study. Plant height was similar among all cultivars except for Conrad, which was 4 to 5 inches shorter. Over 50 reproductive spikes/ft^2 were counted in plots of each 2-rowed cultivar included in the study, compared with fewer than 35 for the three 6-rowed cultivar. This may explain why 2-rowed cultivars generally produced more grain than 6-rowed cultivars in this study. Average grain yield of Conlon, Conrad, and Pinnacle were 105, 121, and 121 bu/acre, respectively, compared with an average grain yield of 87, 86, and 97 bu/acre, respectively, for the 6-rowed cultivars Lacey, Stellar-ND, and Tradition (LSD = 12). With the exception of Tradition, 2-rowed cultivars also produced grain with a heavier test weight than 6-rowed cultivars. Heavier kernel weight was produced by Conlon and Pinnacle than any 6-rowed cultivar, but no advantage in kernel weight occurred between Conrad and 6-rowed cultivars. Conrad also produced a relatively low number of plump kernels (96%) compared with other cultivars (98-99%).

Cultivar ranking was unaffected by tillage system for any trait considered in this field experiment (data not presented). Cultivar selection may not be impacted by the tillage reductions that are occurring across cropping systems in western North Dakota. However, additional research is needed to validate the preliminary results generated from this study in 2009.

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Table 1. 2009 Tillage System and Barley Tillage Study, NDSU Dickinson Research Extension Center[1]

	Surface	Plant	Days to	Plant	Spike	Grain			
	Cover	count	heading	height	density	Yield	TW	Kernels	
Tillage system	-%-	-no./ft^2-	-d-	-in-	-no./ft^2-	-bu/ac-	- lb/bu-	- no./lb-	-% plump-
Conventional	8	19	55	30	42	107	48.7	9726	98.5
No-till	73	16	56	29	40	99	48.4	9999	97.9
LSD 0.05	57	NS	NS	NS	NS	NS	NS	84	0.1
Barley cultivars									
Conlon	41	17	52	30	51	105	50	8841	99
Conrad	45	18	58	26	56	121	50	10,297	96
Lacey	-	19	55	30	24	87	49	10,621	98
Pinnacle	-	17	56	31	51	121	48	8439	98
Stellar-ND	-	18	56	30	30	86	46	10,272	99
Tradition	-	19	55	30	32	97	49	10,702	99
LSD 0.05	NS	NS	1	2	11	12	1	360	0.9