Wheat Head Type and Varietal Differences in Deer Browsing Damage

William P. Bruening*

ABSTRACT

Deer browsing on wheat heads has been shown to reduce grain yield, and deer prefer to browse on awnless varieties rather than bearded (awned) varieties. However, this observation has only been reported in a few published articles. In this study, deer damage was recorded at the 2019 University of Kentucky, Ohio Valley Region Wheat Variety Trial. This large scale trial evaluated 84 soft red winter wheat entries in a randomized complete block design with 4 replications and provided an opportunity to further evaluate wheat varietal differences in deer browsing damage. The results supported previously reported findings on varietal differences in deer damage between head types. All 23 awnless varieties sustained deer damage ranging from 5 – 88% and bearded varieties showed miniscule (1%) or in nearly all cases, no damage. The results indicate that wheat producers in areas prone to deer damage should plant bearded varieties and landowners interested in growing wheat food plots to enhance deer habitat should plant awnless varieties. Furthermore, the broad range of damage among awnless varieties indicate that deer may prefer certain awnless varieties over others. This finding merits further investigation to identify more specific genotypic characteristics that affect browsing preference aside from head type.

INTRODUCTION

In many regions of the United States, crop damage from deer (*Odocoileus* spp.) browsing is a perennial problem. Deer are primarily associated with damage to soybean (*Glycine max*) and corn (*Zea mays*), but are also known to damage wheat (*Triticum aestivum*). According to the National Agricultural Statistics Service (USDA-NASS, 2002), deer accounted for 58% of U.S. wildlife damage to field crops in 2001, resulting in $359 million in losses. A survey of farmers also found that 80% experienced wildlife damage in the previous year and that deer accounted for the majority of damage (Conover 1998). Most deer browsing damage on grain crops occur near woodlot/field edges (DeCalesta and Schwendeman, 1978; Barnes 1993).

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Winter wheat foliage provide deer a source of high protein forage throughout winter and spring. Deer have been shown to graze more on wheat than oat, cereal rye, ryegrass and fescue (Springer et al., 2016). The effect of wheat foliage grazing on grain yield has shown mixed results (Vecellio et al. 1994; Austin and Urness, 1995).

Wheat seed heads are also eaten by deer from the milk stage to maturity (Harper and Blair, 2015), which has been shown to reduce grain yield (Vecellio et al. 1994). Removal of wheat heads at heading resulted in proportional reductions in grain yield (Brown, 1944).

Selective head browsing on awnless wheat varieties was reported in a University of Tennessee wheat variety strip trial and the yield of awnless varieties was 80% lower than the bearded (awned) varieties (Harper and Blair, 2015). Consumption of mature awns has been shown to be detrimental to deer health (Winter and Honess, 1952). Springer et al. (2013) showed evidence of deer avoiding bearded wheat, but browsing pressure was not great enough to show grain yield differences between bearded and awnless varieties. When selecting wheat varieties to enhance habitat for hunting, awnless varieties are recommended for deer plots (Harper and Blair, 2015).

Managing deer population numbers by state wildlife agencies (hunting) is the primary way to limit deer damage to wheat crops. Use of chemical retardants, taste retardants, fencing, and frightening devices may also discourage browsing (Barnes 1993), but wheat variety selection may be the simplest, most cost effective way to minimize potential crop loss by planting unpalatable bearded varieties.

There is little data in the literature on wheat varietal differences with respect to deer damage, particularly replicated studies with a high number of varieties. The objective of this study was to evaluate varietal differences in deer damage observed at the 2019 University of Kentucky, Ohio Valley Region Wheat Variety Trial.

METHODS

Deer damage was recorded at the 2019 University of Kentucky, Ohio Valley Region Wheat Variety Trial in Crittenden County, Kentucky. The trial was located approximately 50 meters from a forest edge and was surrounded by bearded wheat planted by the cooperating grower. There were 84 soft red winter wheat entries (59 bearded, 23 awnless and 2 awnletted [Tip-Awned]) in the trial. The trial was set up in a randomized complete block design with four replications per entry. Plots were 4’ wide and 15’ in length and planted under conventional tillage on October 24, 2018. The trial (and surrounding

wheat field) was managed using intensive wheat management practices.

Deer were observed in the variety trial near maturity and footprints indicated heavy deer traffic throughout the field. At harvest maturity, deer damage was estimated for each plot as the percentage of heads removed. Data was analyzed using Analysis of Variance in AGROBASE software (Version 38.32.1, Agronomix Inc.). Mean, range and median deer damage values were presented for varieties that showed damage. Plant height and heading date were recorded, but grain yield was not measured due to the extensive deer damage. Since damage occurred late in the growing season (no deer damage was observed while taking heading notes), it was assumed that the de-heading damage percentage would be comparable to grain yield reductions, as previously documented (Brown 1944).

RESULTS AND DISCUSSION

Deer caused substantial damage to awnless varieties, but minimal to no damage to bearded varieties (Table 1). Fifty-seven of the fifty-nine bearded variety entries had no deer damage. Damage was minimal (1%) for the two bearded varieties that showed damage. The average level of de-heading damage for all bearded varieties was 0.04%. All awnless varieties showed deer damage ranging from 5 to 88% and averaged 54.4% (Image 1). The two awnletted varieties had 0 and 21% damage indicating some level of non-palatability protection. These results indicate that deer avoided browsing on bearded heads and caused considerable browsing damage to the awnless varieties.

Image 1. The bearded variety on the right had 0% deer damage and the awnless variety on the left had 95% of seedheads selectively eaten.

The University of Tennessee wheat variety strip trial (Harper and Blair, 2015) documented varietal head type differences in deer damage using a non-replicated trial with 24 entries, five of which were awnless. The results presented here support their findings using a larger scale study with replicated plot data and a substantially higher number (84) of wheat entries.

The damage notes were taken just as the trial reached harvest maturity and there was no de-heading damage observed when heading notes were taken, so the damage occurred between heading and harvest maturity onset.

There was no relationship between deer damage and plant height (data not shown). There was a weak positive correlation (0.33) between heading date and the mean damage values for varieties that had some level of damage. Using median damage values to potentially eliminate outlying data points, slightly increased the correlation (0.37).

It is not clear why the range in damage among awnless entries was so wide (5 – 88%). Spatial variability in browsing location could have contributed to the wide range in damage among awnless varieties. Spatial variability in browsing has been associated with forest line proximity (DeCalesta and Schwendeman, 1978; Barnes 1993). Figure 1 shows the distribution and degree of plot damage across the trial. White boxes indicate plots with no deer damage. Colored boxes with values indicate damaged plots (darker red colors correspond with higher levels of damage). The left side of the trial faced the forest line and the right side bordered a road. With the exception of 2 plots marked with a star, all other bearded plots had no damage. All but 4 individual awnless plots had damage. There were a greater number of awnless plots with lower damage ratings near the "right" road side, which is expected given deer tendency to browse near forest edges and avoid roadways. These awnless plots with lower levels of damage along the road (right side) of the trial may have reduced average damage values, and may have contributed to the large range in damage among awnless entries. Range and median values were presented (Table 1) for each variety that showed some level of damage. The range values indicate the level of variability between reps for each variety. Median values may provide a better estimate a damage by potentially removing outlier plots. The median damage levels (5 – 92%) were similar to that of the mean values. The median values tended to increase the level of damage for varieties with higher levels of damage and reduce the level of damage for varieties with lower levels of damage when compared with the mean values. Factors other than spatial variability are likely the cause of damage differences among awnless varieties.

Table 1. 2019 Deer Damage - Kentucky Wheat Variety Trial - Ohio Valley Region.

VARIETY	Deer Damage (%)*	Head Type		VARIETY	Deer Damage (%)	Head Type
Dyna-Gro 9862	88 (80-95; 88)	Awnless		CROPLAN CP8800	0	Bearded
AgriMAXX 485	86 (60-99; 92)	Awnless		CROPLAN CP9415	0	Bearded
Pioneer variety 26R45	83 (50-95; 92)	Awnless		CROPLAN CP9606	0	Bearded
LOCAL LW 2867	78 (40-90; 90)	Awnless		Liberty 5658	0	Bearded
Truman	76 (40-95; 85)	Awnless		Dyna-Gro 9701	0	Bearded
Bess	75 (20-95; 92)	Awnless		Dyna-Gro 9932	0	Bearded
Go Wheat 4059S	71 (50-95; 70)	Awnless		Dyna-Gro 9941	0	Bearded
SYNGENTA SX 8186	71 (50-95; 70)	Awnless		Dyna-Gro 9980	0	Bearded
PROGENY #WARRIOR	70 (40-90; 75)	Awnless		Dyna-Gro 9002	0	Bearded
AgriMAXX 463	69 (50-85; 70)	Awnless		Dyna-Gro WX19711	0	Bearded
KAS Lincoln	64 (20-95; 70)	Awnless		Dyna-Gro WX19713	0	Bearded
SYNGENTA SY 100	63 (5-95; 75)	Awnless		Dyna-Gro WX19714	0	Bearded
Go Wheat 2059	58 (40-70; 60)	Awnless		Go Wheat 4010	0	Bearded
KY09C-1245-99-12-3	58 (40-80; 55)	Awnless		Go Wheat 2058	0	Bearded
SYNGENTA SY VIPER	51 (0-80; 62)	Awnless		KAS 19X9EX	0	Bearded
KY07C-1145-94-12-5	38 (5-60; 42)	Awnless		KAS Roosevelt	0	Bearded
Pioneer variety 26R59	38 (30-50; 35)	Awnless		KAS Truman 18X6	0	Bearded
KY09C-0128-72-2-1	33 (5-70; 28)	Awnless		KWS 19X09	0	Bearded
SYNGENTA SY 547	26 (5-70; 15)	Awnless		KY06C-1178-16-10-3-34	0	Bearded
DH12SRW057-006	23 (0-50; 20)	Awnless		LCS L11713	0	Bearded
KY10-0178-1-2-5	21 (5-40; 20)	Tip-Awned		LCS L11719	0	Bearded
KWS 19X03	16 (5-30; 15)	Awnless		LOCAL LW 2848	0	Bearded
KY09C-1245-99-1-5	11 (5-20; 10)	Awnless		LOCAL LW 2937	0	Bearded
X10-0594-7-1-3	5 (0-10; 5)	Awnless		LOCAL LW 2958	0	Bearded
PROGENY #BLAZE	1 (0-5; 0)	Bearded		LOCAL LW Ex19D	0	Bearded
PROGENY PGX 18-2	1 (0-5; 0)	Bearded		PEMBROKE 2008	0	Bearded
AgriMAXX 454	0	Bearded		PEMBROKE 2014	0	Bearded
AgriMAXX 473	0	Bearded		PEMBROKE 2016	0	Bearded
AgriMAXX 486	0	Bearded		Pioneer variety 26R10	0	Bearded
AgriMAXX 495	0	Bearded		Pioneer variety 26R36	0	Bearded
AgriMAXX 496	0	Bearded		Pioneer variety 26R41	0	Bearded
AgriMAXX EXP 1906	0	Bearded		PROGENY #BULLET	0	Bearded
AgriMAXX 492	0	Bearded		PROGENY PGX 17-16	0	Bearded
ARMOR ARW1766	0	Bearded		PROGENY PGX 18-8	0	Bearded
ARMOR ARW1815	0	Bearded		SYNGENTA SX 8146	0	Bearded
ARMOR ARW1816	0	Bearded		USG 3316	0	Bearded
CROPLAN CP8550	0	Bearded		USG 3329	0	Bearded
ARMOR ARW1819	0	Bearded		USG 3404	0	Bearded
ARMOR MAYHEM	0	Bearded		X11-0420-120-13-3	0	Bearded
ARMOR/KAS RAGE	0	Bearded		X12-3010-3-5-3	0	Tip-Awned
ARMOR SPIRIT	0	Bearded		X12-619-205-14-1	0	Bearded
ARMOR VELOCITY	0	Bearded		**Average**	**15**	**LSD**(0.10)**=20.3**

Deer Damage = percent of seedheads removed by deer browsing. Location: Crittenden Co., KY.
*** Mean Value, (Range of values; Median Value)**

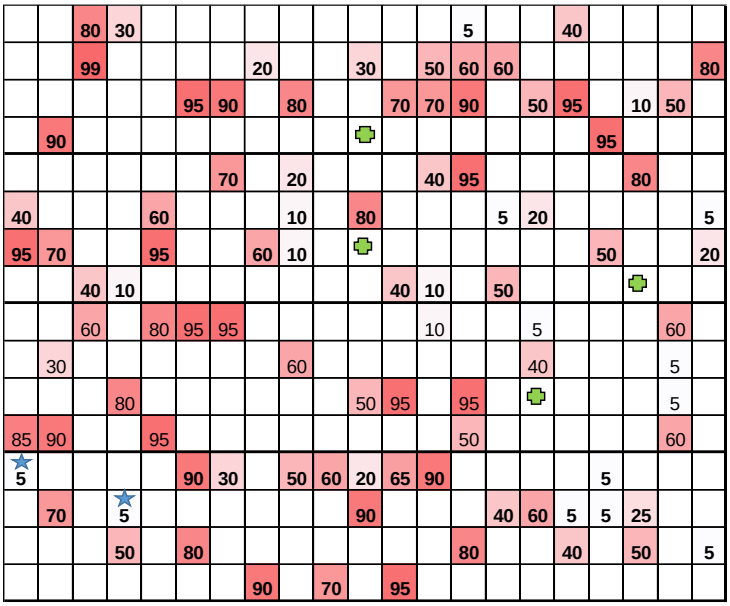

Figure 1. Distribution and degree of deer browsing damage to plots within variety trial.

★ Indicate the 2 awned plots that showed damage.

Indicate 4 awnless plots that did not have damage.

It is possible that there may be a genetic flavor/aroma component involved with the wide range in browsing differences among awnless varieties. Challacombe, et al. (2011) reported differences in sensory properties (flavor and aroma) between red and white wheat types. Morris, et al. (2014) reported that mice exerted strong differential grain consumption preferences among wheat varieties. The varieties Truman and Bess were bred from the same genetic cross and had the 5th and 6th highest level of damage. Likewise, 5 of the top 11 damaged varieties shared similar physiological characteristics and may be the same genetics under different brand names. These groupings indicate the theoretical possibility of a genetic flavor/aroma component affecting browsing preferences among awnless varieties.

In conclusion, this study supported the findings reported by (Harper and Blair, 2015) that when given the option of both head types, deer prefer to browse on awnless wheat varieties and avoid bearded lines. This study, being a large replicated field trial will bolster the previously reported findings. The high levels of late season de-heading among awnless varieties demonstrate potential grain yield loss associated with deer browsing. This study showed on average a 54% reduction in heads of awnless varieties, thus the potential to cut grain yield in half compared with using bearded varieties. In areas with high deer population, growers should select bearded wheat varieties. This study also showed a wide range in damage among awnless varieties. Additional research is needed to investigate differences in browsing damage among awnless varieties.

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