Preliminary Results from a Study of the Effect of Deer Browsing on Bearded and Unbearded Wheat Yield

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ABSTRACT Wheat is an important agronomic crop that is a common winter food source for white-tailed deer (*Odocoileus virginianus*) in agricultural landscapes. In 2007 and 2008, I investigated spatial and temporal browsing on 2 types of wheat (bearded and unbearded) in fields bordered on one side by a forest. I placed 960 4.6 m^2 plots in the middle of 10 m distance classes (5m, 15m, 25m, 35m, 45m, 55m). In 2007, I systematically assigned 1 of 2 treatments (no protection, protected at planting), and in 2008, I added a third treatment, protected prior to heading. After head emergence, I conducted weekly browse surveys and collected biomass samples. I harvested a 1 m^2 area in the middle of each plot to determine yield. We used a two-way ANOVA with the main effects of wheat type and protection to determine the impact on yield. The main effects did not interact to affect yield either year ($P>0.05$). In 2007, bearded wheat yielded 523.7 kg/ha greater than unbearded wheat ($P<0.001$), whereas the opposite was true in 2008 with unbearded yielding 155.3 kg/ha greater ($P<0.001$). In 2007, deer browsing increased yield by 284.8 kg/ha ($P<0.015$), conversely in 2008, fully protected wheat yielded 226.3 kg/ha greater than all other treatments ($P<0.008$). Browsing increased in intensity as head development progressed with most browsing occurring on the unbearded wheat. Our results varied annually, which suggests that factors other than deer browsing may be more important to determining wheat yield. More research is needed to better elucidate the effect of deer browse on wheat yield.

KEY WORDS browse, deer, *Odocoileus virginianus*, wheat, wildlife damage management

White-tailed deer (*Odocoileus virginianus*) cause more than $100 million in crop damage per year (Conover 1997). The effect of deer browsing on corn and soybean yields have been documented (DeCalesta and Schwendeman 1978, Garrison and Lewis 1987, Rogerson 2005, Colligan 2007, and Tzilkowski et al. 2002) but little is known about the effect of deer browsing on wheat yield. Vecellio et al. (1994) observed that wheat yield decreased by 30% because of deer browse, whereas pronghorn antelope did not impact wheat yield in a winter grazing study (Torbit et al. 1993).

Recently, some producers have suggested that different types of wheat may affect deer browsing and the subsequent yield. Two types of wheat heads exist: bearded, which has bristle-like features located on the head of the plant called awns, and unbearded, lacking awns. Nothing is known about the impact awns have on deer browse. Our objectives were to determine if deer browsing affects wheat yield and if awns on wheat heads affect deer browsing.

STUDY AREA

The research farm is located in Kent County, Delaware, 10 km south of Little Creek on the Delmarva Peninsula (Rogerson 2005). The farm is 261 ha in size and approximately 80% crop fields (i.e., corn, wheat, and soybean) and 20% forested. Forested portions are primarily sweetgum (*Liquidambar styraciflua*), white oak (*Quercus alba*), red maple (*Acer rubrum*), and American holly (*Ilex opaca*). The fields used for agriculture range in size from 8–20 ha. The crop rotation for a field is corn in year 1, soybeans in year 2, and wheat followed by soybeans in year 3. Wheat is planted in mid- to late-October after the full season soybeans are harvested. The average temperatures for October to July range from

26.4 °C to 6.1 °C and the average precipitation is 123.0 cm (National Climatic Data Center 2004).

METHODS

We selected fields with one wooded edge. We divided each field into 6 distance intervals: 0–10 m, 10–20 m, 20–30 m, 30–40 m, 40–50 m, and 50–60 m from the field edge. Within each distance interval, we established 4.6 m^2 circular plots in the middle of the distance interval. In 2007, we established 2 fields, 1 bearded and 1 unbearded, with a total of 240 plots. We systematically assigned one of 2 treatments, protection from planting and no protection, to the plots. In 2008, we added a third treatment, protection prior to heading to better understand the effect of the awns. We used 4 fields, 2 for each wheat type, and increased our sample size to 720 plots, 180 plots per field. For protection treatments, we placed a 1.22 m welded-wire fence around plots to keep deer from browsing the wheat.

After the wheat came to a head, we estimated browse weekly in the center 1 m^2 area of the unprotected plots. We estimated browse in two ways. First, we counted the total number of heads present and the number of heads browsed upon. We obtained the number of browsed heads specific to the week by subtracting the number of wheat heads browsed at the plot for the previous week from the total for the current week. Second, we randomly collected 30 plants at each distance class outside of the plots. We placed these plants in a paper bag and dried them for 7 days at 43.3 °C in a plant drier. We multiplied the average weight for a head for each distance interval by the number of heads browsed in each plot within the respective distance interval. By doing this, we were able to estimate the biomass removed in each plot during a week.

We harvested the plots when the wheat had reached maturity in late June through early July. We harvested each plot by hand by cutting the wheat plant at the base. We obtained the wheat grains by running the plants through a thresher. We dried the grain for 7 days in paper bags at 43.3 °C in a plant drier and then weighed the grain in each bag. We estimated crop yield for the 3 treatments and assumed the differences between protected and unprotected plots were caused by deer browsing. We used a two-way ANOVA with the main effects of wheat type and protection to determine the impact on yield with alpha = 0.05.

RESULTS

The main effects did not interact to affect yield either year ($P>0.05$). In 2007, bearded wheat (4187.2 ± 91.4) yielded 522.5 more kg/ha than unbearded wheat (3664.7 ± 113.2; $P<0.001$), whereas the opposite was true in 2008 with unbearded (4890.1 ± 95.9) yielding 155.4 more kg/ha than unbearded (4734.7 ± 68.8; $P<0.001$). In 2007, unprotected plots (4068.3 ± 105.0) yielded 284.8 more kg/ha than protected plots (3783.5 ± 104.7; $P=0.015$), whereas in 2008, fully protected wheat (4962.7 ± 105.7) yielded 226.4 more kg/ha than all other treatments (4736.3 ±93.9 and unprotected 4715.0 ± 98.3; $P=0.008$).

DISCUSSION

We documented increased browsing intensity as head development progressed with less browsing occurring on bearded wheat. Our results show that even with the increased browsing on unbearded wheat, the effect on yield was not significant. Our data demonstrates that browsing prior to heading is more influential on yield than browsing occurring after heading, making wheat type inconsequential for deterring browsing.

MANAGEMENT IMPLICATIONS

We recommend that selection of wheat type should be based on factors other than deterring deer browse. The effect of deer browse on wheat yield varied annually with positive and negative implications. Deer may not be removing enough vegetation to cause extensive damage to crop yield. Another year of data is in the process of being collected and will help elucidate the relationship between deer browsing and wheat yield.

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