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Demonstration of deer repellent applications for season-long control in soybean

Abstract

White-tailed deer (*Odocoileus virginianus*) damage to soybeans continues to be a significant problem for South Carolina soybean growers. Growers in SC have several options for managing deer damage including lethal removal, exclusion fencing, harassment, and repellents. Repellents, if effective, could be widely accepted by growers and citizens. Growers frequently report that single applications of deer repellents have been ineffective at protecting yields. In this demonstration, a multiple application approach of using a deer repellent to provide season-long management of deer browsing injury. Xfence® deer repellent was applied 4 times throughout the growing season. Applications were made upon observation of new feeding injury. Yield estimates indicate saving approximately 94.8% of the field's yield potential with 4 applications of Xfence® throughout the growing season. Application effective longevity ranged from one week to two months. This demonstration was conducted in a single field, over a single growing season. Observations from this demonstration justify a need to scientifically study repellent applications for season-long reduction of deer browsing injury.

Abbreviations: Sandhill Research and Education Center (SREC)

Keywords: White-tailed deer, soybeans, repellent

Introduction

White-tailed deer (*Odocoileus virginianus*) feeding injury in soybeans has become a financial issue for producers in South Carolina and other states. Research indicates that white-tailed deer are responsible for most of the wildlife-induced crop damage in North America (Begley-Miller et al. 2015, NJAES 1998, Yue et al. 2018). Agriculture producers need methods to reduce damage that fit into their normal production operations. Over the past ten years, researchers with Clemson Extension Service have extensively studied the effectiveness of deer repellents through replicated small plot trials. Trials indicate that nearly all repellents tested provided some level of protection from deer feeding injury. This has also been documented by researchers in Connecticut (Ward and Williams, 2010). Unfortunately, none of the products tested seem to provide season-long control from a single application. As a result, many growers feel like repellents are an ineffective method of reducing deer damage. Ward and Williams (2010) reported that repellents applied more frequently provided better protection.

During the 2024 growing season, field experiments with Xfence® deer repellent were conducted. Xfence® contains a proprietary mixture of plant-based oils including but not limited to garlic oil and peppermint oil.One of the projects conducted with the product was a demonstration of season-long protection using repellent applications. The primary goal of this demonstration was to identify how many applications of Xfence® were needed to provide season-long control of deer feeding injury to soybeans. A main component of the primary goal was to expand our understanding of the product so that applied/technical advice could be shared with soybean growers.

Study Site

This demonstration was conducted at Clemson University's Sandhill Research and Education Center (SREC). SREC is in the northeast corner of Richland County, South Carolina. The area is highly urbanized with no row crop agriculture in the immediate area. SREC is a 570-acre property consisting of planted longleaf pine, natural regeneration longleaf pine and turkey oak forests, bottomland hardwoods, ponds, and agricultural fields. The site is aptly named due to the Lakeland sands that dominate the

location. Wildlife and natural resource management are major focuses of the property. SREC supports a diversity of wildlife species including white-tailed deer. Annual spotlight surveys are conducted on the property to estimate deer density. Deer density on the property ranges from 58-65 deer per square mile over the past 5 years. Density estimates for 2024 were 65 deer per square mile. Deer feeding injury is substantial on agronomic crops grown at SREC. This demonstration was planted in a portion of a field that suffers from severe deer feeding injury. The severity of deer feeding injury in the study site has proven to be catastrophic, consistently producing complete crop failure.

Methods

The demonstration site was planted with a cover crop mix consisting of cereal rye, crimson clover, rape, and Austrian winter pea in November of 2023. The cover crop was crimped on April 30, 2024. A pre-plant herbicide application consisting of Dual Magnum (S-metolachlor, 1pt/ac), Pursuit (imazethapyr, 4oz/ac), and Prowl H2O (pendimethalin, 1pt/ac) was applied on May 6, 2024. Dynagro S72XT80 soybeans were planted immediately following the pre-plant herbicide application. Beans were no-till planted on 36-inch rows with 6 seed/row ft, for an estimated plant population of 87,100 plants/acre. Beans emerged uniformly on May 13, 2024, 7 days after planting. A post-emergent herbicide application of Round-Up (glyphosate, 1qt/ac) and Reflex (fomsafen, 1pt/ac) was made on June 3, 2024.

Exclusion cages (n=2) were installed at emergence. Cages were constructed using 49-inch high-tensile fixed-knot woven cattle fence. Cages were 72-inch x 72-inch, allowing 2 rows inside. Cages prevented deer feeding and allowed us to see what yields would be in the absence of deer feeding injury. Beans inside cages were susceptible to all other factors as beans outside of the cage (insect, disease, weeds, moisture, etc.). Checks were established 100’ from the cages on the same two rows. Checks had no cage and were fully available to deer browsing. In cages we harvested the center 60 inches of each row, and 60 inches of each row were harvested in the check plots. Xfence® applications were made at the rate of 1 qt/ac plus 4 oz/acre of 80-20 non-ionic surfactant. Initial application of Xfence® was made at emergence on May 13, 2024. The crop was monitored daily. When deer feeding injury was observed, additional

applications of Xfence® were made. This process continued throughout the growing season. A total of 4 applications were made throughout the growing season. Xfence® application dates were as follows:

1) May 13, 2024
2) May 20, 2024
3) June 24, 2024
4) August 21, 2024

Soybeans were harvested from cages and check plots on December 12, 2024.

Results

Yields observed inside deer exclusion cages were 22.4 bu/ac and 25.11 bu/ac. Yields observed in the checks (no-cage) were 20.87 bu/ac and 24.2 bu/ac. This represents a difference of 1.53 bu/ac and 0.91 bu/ac in yield. As a percentage, 6.8% yield loss and a 3.6% yield loss were observed. Averaging these losses indicates approximately 1.22 bu/ac (5.2%) yield loss from deer feeding injury.

Table 1: Soybean yield data from the demonstration

Plot	Yield (bu/ac)	Yield Difference (bu/ac)	% Difference
Cage 1	22.4		
Check 1	20.87	1.53	- 6.8
Cage 2	25.11		
Check 2	24.2	0.91	-3.6

Discussion

The goal of this demonstration was to develop a better understanding of using Xfence® to manage deer feeding injury in soybeans. The intent was to determine if the product could reduce or eliminate deer feeding injury, and if so, how many applications would be necessary to maintain effectiveness throughout the season. The project answered those questions. Deer feeding injury stopped or drastically declined following each application. Each application seemed to have different lengths of effectiveness. Reapplications were

needed at approximately 1 week, 1 month, and 2 months. By doing so, approximately 93 – 96% of the crop's potential yield was saved with 4 applications of Xfence®.

Discussions with SC soybean growers indicated mixed opinions of the effectiveness of deer repellents in soybeans. Growers who felt repellents were ineffective typically applied the products a single time during the growing season. In this project, 32 oz/ac of Xfence® was applied as soon as deer browsing became noticeable. The crop was monitored daily, and applications were made timely. Making a single bushel of beans would be an improvement over recent years in this location. By staying diligent and applying as needed the product was able to allow the crop to produce nearly the same yield as if all deer had been removed from the field. Knowledge gained from this demonstration will help to better serve soybean growers with deer repellent use questions. The results of this project were informative but lacked the scientific vigor to draw conclusions. This work provides an excellent base for additional research that can be conducted to increase the data set. Conducting this work in multiple locations with multiple check points and multiple years would likely strengthen findings of this project and allow extension agents to make sound repellent application recommendations. Until then, this demonstration provides a clear example of how deer depredation was successfully mitigated in soybeans using a multi-application approach with a deer repellent.

Literature Cited

Begley-Miller, D.R. and Cady, A.B. 2015. White-tailed deer browsing of soybeans significantly changes plant morphology and reduces yield, contributing to large financial losses. Ohio Journal of Science, 115, 56-61.

NJAES. 1998. How are white-tailed deer affecting agriculture in New Jersey. Center for Wildlife Damage Control. Rutgers Cooperative Extension Service.

Ward, J.S. and Williams, S.C. 2010. Effectiveness of deer repellents in Connecticut. Human-Wildlife Interactions, 4(1), 56-66.

Yue, Z., Tseng, T.M., and Lashley, M. 2018. Characterization and deer-repellent property of chrysophanol and emodin from sicklepod weed. American Journal of Plant Sciences, 9, 266-280.