EFFECTIVENESS OF HUMAN HAIR, BGR, AND A MIXTURE OF BLOOD MEAL AND PEPPERCORNS IN REDUCING DEER DAMAGE TO YOUNG APPLE TREES

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ABSTRACT

We evaluated the ability of three repellents [human hair, Big Game Repellent (BGR), and a mixture of blood meal and peppercorns] to reduce deer damage on young apple trees in two Connecticut orchards. Most of the deer damage consisted of winter browsing on dormant apple buds. Little browsing occurred on leaves or buds during the growing season and only a few cases of pre-rut rubbing of trees were observed. In one orchard, buds were browsed during the winter on 52% of the untreated control trees, 45% of the trees sprayed with BGR, and 40% of the trees containing a hair ball. By winter's end, the severity of deer browsing (number of buds browsed per tree) was significantly less on trees with hair balls (0.5) than on control trees (1.1), but there was no significant difference between control trees and BGR-treated trees (0.8). In two fields at another apple orchard, deer browsed 83% and 89% of the control trees, 61% of the trees containing a hair ball and 55% of the trees with a bag of blood meal and peppercorns. The differences between the control and the treated trees were statistically significant. The number of browsed buds per tree was also significantly higher on control trees (2.9) than on trees with hair balls (1.1) or trees with bags containing a mixture of blood meal and peppercorns (1.2).

INTRODUCTION

Deer damage to apple trees can be a major problem for growers (Harder 1970, Scott and Townsend 1985a). Deer browsing on young trees is particularly grievous because any injury to the leader branches may cause these trees to become misshapen or stunted which lowers their future fruit production (Harder 1970).

Numerous odor and taste repellents have been developed to reduce deer browsing on ornamental plants and fruit trees. The effectiveness of these repellents has been tested by sending questionnaires to growers (Scott and Townsend (1985) and by using controlled experiments involving penned deer (Harris et al. 1983, Palmer et al. 1983) and free-ranging deer (Conover 1984, 1987). Of the repellents tested, Big Game Repellent (BGR) was consistently one of the most effective. For instance, browsing by free-ranging deer on Japanese yews (Taxus spp.) was 50% less on plants sprayed with BGR than on untreated control plants (Conover 1984, 1987). However, many of the nurserymen involved in these studies still considered browsing on the BGR-treated yews to be unacceptably high (Conover 1987).

Our previous field studies have been limited to Japanese yews. Whether these results can be generalized to other plant species is unclear. Yews are such a highly-preferred winter food of the white-tailed deer (Odocoileus virginianus), that perhaps no repellent can lower its palatability to a level at which deer will stop browsing it. Repellents may be more effective on less-palatable species, such as apple (Conover 1987). Although human hair was ineffective in reducing deer damage to yews (Conover 1984), some apple growers in Connecticut reported that hanging balls of human hair on their apple trees was an effective deer deterrent. Other growers reported success by placing on each tree a bag containing blood meal and peppercorns. Consequently, we initiated two experiments to examine the effectiveness of human hair, BGR, and a mixture of blood meal and peppercorns to reduce deer damage to young apple trees when the terminal buds of major branches are within the reach of deer.

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STUDY AREA AND METHODS

Experiment 1 -- Blue Jay Orchard

This study was conducted between May 1983 and July 1986 at Blue Jay Orchard in Bethel, CT. This 27 ha orchard contained both standard and semi-dwarf apple trees of various varieties. In May 1983, 16 plots were established within blocks of both young and mature trees where winter deer browsing had previously occurred. Each plot consisted of three experimental apple trees which were interplanted within an established row of trees. Adjacent experimental trees within a plot were 4-5 m apart and separated by an established tree. Plots were separated from each other by at least 40 m. Experimental trees were either Red Delicious (Idaho Spur) or Mutsu variety apple trees grafted on a ELMA 106 semi-dwarf rootstock.

Within each plot, one tree was treated by tying a hair ball to it, another was sprayed with BGR, and the third was left untreated as a control. BGR and hair balls were reapplied three times a year: in the spring after the leaves emerged, in the fall, and in mid-winter. Assignments of treatments to the trees in each plot were conducted randomly each spring and fall.

BGR is made from putrescent whole egg solids by McLaughlin, Gormely, King Co. (Minneapolis, MN). BGR was applied to apple trees in accordance with label directions using a Solo backpack sprayer. Trees were sprayed until dripping wet. Hair balls were made by placing a handful of human hair obtained from local barber shops in nylon mesh bags (0.3 cm mesh). Each bag was 10 to 15 cm in diameter. One hair ball was hung on each tree approximately 0.7 to 0.9 m above ground level.

Deer damage was monitored by recording all browsed buds and leaves on each tree. Any browsing by rabbits was excluded. Damage was surveyed thrice annually; at the end of summer, during mid-winter, and at winter's end. Data were statistically analyzed using a balanced design, 1-way analysis of variance (ANOVA). A plot was excluded from the analysis if any tree in a plot had died.

Experiment 2 -- Blue Hills Farm

This experiment was conducted at the 96 ha Blue Hills Farm in Wallingford, CT. All of the apple trees at this farm were grafted onto dwarf and semi-dwarf rootstocks. In an effort to protect young apple trees from deer browsing, the owner had suspended a human hair ball from each tree in one of his fields in the fall of 1982. These hair balls were constructed by placing a handful of human hair collected at local barber shops into a plastic bag. Numerous holes (approximately 1 mm) were punched into each bag to allow air to circulate. Although the owner attempted to suspend a hair ball from each tree, several trees were missed. This provided an opportunity to evaluate the effectiveness of hair to alleviate deer damage to young apple trees. In May 1983, we located trees lacking a hair ball and counted the number of deer-browsed buds on each. We also recorded similar data on the nearest apple tree which had a hair bag. Data were collected on 38 pairs of trees in this field. A contingency table corrected for continuity was conducted to determine if the percentage of trees that were browsed by deer differed between treated and control trees. An F-test also was conducted to assess whether the number of buds browsed per tree differed between treated and control trees.

In an adjacent field, the owner hung bags of blood meal and peppercorns from his trees as a deer deterrent. Approximately 100 ml of blood meal and 5 ml of peppercorns were poured into a plastic bag. The peppercorns were added prim-

arily to discourage dogs from destroying the bags. These bags were then closed and small holes were punched in them, much like the hair balls used in the other field. The bags were then suspended from most, but not all, of the trees in the field. Data were collected on 72 pairs of untreated control trees and adjacent trees containing a blood meal--pepper bag. The data were analyzed in the same manner as for the field with hair balls. Since hair balls and blood meal--pepper bags were not used in the same field, we did not make a direct comparison between these two treatments. Instead both were compared only to their paired control trees.

RESULTS

Experiment 1 -- Blue Jay Orchard

During the growing season, deer browsed leaves on 20% of the untreated control trees and the buds on 7% of these trees (Table 1). The incidence of deer browsing during the summer on trees protected with BGR and hair balls was similar to those on control trees. Also, the mean number of leaves or buds per tree browsed by deer during the summer was low (less than 2 leaves and 0.2 buds per tree) and did not significantly vary among untreated and treated trees (Table 2).

By mid-winter, deer had browsed buds on 45% of the control trees but on only 25% of the trees treated with BGR or hair balls (Table 1). Deer browsed an average of 1.0 bud per tree from untreated trees and 0.4 buds from trees treated with BGR or hair balls (Table 2). All of these differences between treated and untreated trees were statistically significant.

By winter's end, deer had browsed 52% of the control trees, 45% of the trees sprayed with BGR and 40% of the trees with hair balls. These differences were not significant (Table 1). The number of buds browsed per tree, however, was significantly less on trees with hair balls than on control trees (Table 2). There was no significant difference between trees sprayed with BGR and control trees.

Experiment 2 -- Blue Hills Farm

In the field where a blood meal-pepper mixture was suspended in bags from most of the trees, deer browsed 83% of the control trees and 55% of the treated trees. This difference was statistically significant ($X^2 = 14.64$, $P<0.01$). The intensity of deer browsing on control trees (2.8 buds/tree) was also significantly higher ($F = 29.21$, $P<0.01$) than on treated trees (1.2 buds/tree).

In the field where hair balls were suspended from most of the trees, more

Table 1. Incidence of deer damage to apple trees at Blue Jay Orchard.

	No. Plots	% of trees damaged			X^2
		Control	BGR	Hair	
Bud damage					
Fall count	41	7.3	7.3	9.8	0.21
Mid-winter count	44	45.4	25.0	25.0	5.66*
Spring count	40	52.5	45.0	40.0	1.19
Leaf damage					
Fall count	41	19.5	21.9	19.5	0.10

* $P<0.05$

Table 2. Severity of deer damage to apple trees at Blue Jay Orchard (numbers within a single row that share the same letter are not significantly different based on the Duncan's new multiple range test, $P<0.05$).

	Mean number of buds or leaves browsed per tree				
	Control	BGR	Hair	d.f.	F
Bud damage					
Fall count	0.2^a	0.1^a	0.1^a	2,80	0.27
Mid-winter count	1.0^a	0.4^b	0.4^b	2,86	3.75*
Spring count	1.1^a	0.7^{ab}	0.5^b	2,78	0.86
Leaf damage					
Fall count	2.0^a	1.6^a	0.7^a	2,80	1.14

* $P<0.05$

control trees (89%) than trees with hair balls (61%) were browsed by deer ($X^2 = 4.67$, $P<0.01$). The intensity of browsing per tree also differed significantly ($F = 14.35$, $P<0.01$) between control trees (2.9 buds browsed per tree) and trees with hair balls (1.1).

DISCUSSION

During the 3-year study at Blue Jay Orchard, we evaluated the effectiveness of BGR and hair to reduce deer browsing during the growing season. We found that deer browsing during the summer was slight and that neither BGR nor hair significantly reduced browsing below levels found on untreated control trees.

In some states, pre-rut rubbing by deer can be substantial in some nurseries and orchards (Nielsen et al. 1982). During the three years of this study, only three of our 48 trees at Blue Jay Orchards showed signs of such rubbing (two control and one BGR-treated tree). Three of the 220 trees we examined at Blue Hills Farm were rubbed (two control trees and one with a bag containing blood meal and peppercorns). Hence this type of deer damage was too infrequent to evaluate the repellents' effectiveness in reducing it.

Deer browsing on dormant buds during the winter was the most serious type of damage we found; at Blue Jay Orchard, over half of the untreated apple trees experienced this type of damage as did over 80% of the untreated trees at Blue Hills Farm. At the latter site, both hair and a mixture of blood meal and peppercorns significantly reduced both the incidence and severity of deer browsing on dormant buds. At Blue Jay Orchard, both BGR and hair reduced the percentage of trees damaged by deer and the number of browsed buds per tree during the first part of winter. By the end of winter, there still were fewer browsed buds on trees with hair balls than on control trees, but the number of browsed buds on BGR-treated trees was now similar to the number on control trees despite a mid-winter reapplication of BGR.

Conover (1987) also noted that BGR was much more effective in reducing deer browsing to Japanese yews during the first half of the winter than the second. In that experiment, BGR was applied only once at the beginning of the winter, and Conover (1987) suggested a mid-winter reapplication of BGR may be necessary for winter-long protection on yews (Taxus spp.). In our study, we found a similar trend despite a mid-winter reapplication of BGR. This suggests that a reapplication of BGR may not be sufficient to halt its decreasing effectiveness during the latter part of winter. Rather this decline may stem from the deer habituating to BGR or to decreasing food sources as the winter progresses. In contrast, hair balls remained effective throughout the entire winter at Blue Jay Orchard.

Conover (1984, 1987) found that non-

of the repellents tested reduced deer browsing of yews by more than 50%. He cautioned that all of his data came from yews and that the repellents might be more effective on other plant species, especially those which deer do not find as palatable as yews. In the present study on apple trees, the repellents still reduced deer damage during the winter by about 50%. The one difference between our findings and those of Conover (1984, 1987) was that for apple trees, hair appeared to be slightly more effective than BGR while the opposite was true for yews. This suggests that interaction effects may exist between plant species and repellents.

Our results indicate that while these repellents reduced deer browsing on apple trees by about 50%, they were ineffective in completely preventing it. Hence before an apple grower decides to use one of these repellents, he should determine if a 50% decrease in deer damage is satisfactory. If not, the grower should consider some other method for reducing deer damage, such as erecting a deer-proof fence (Caslick and Decker 1979, Ellingwood et al. 1985, Palmer et al. 1985). Another consideration in selecting a repellent is cost. Conover (1987) reported that a liter of spray material of BGR (after dilution) costs $3.96; thus, the chemical cost to spray a hectare of yews at a rate of 140 liters/ha was $554.40. In contrast, the materials to make hair balls or bags of blood meal and pepper are inexpensive, but labor requirements are considerable.

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