AN EVALUATION OF THE COST AND EFFECTIVENESS OF REPELLENT APPLICATIONS IN PROTECTING FRUIT ORCHARDS

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A summer repellent spray program was devised and implemented on a total of 110 acres (9 orchard blocks) of 1- to 3-year-old semi-dwarf apple trees. Cooperating growers were supplied with repellent (Hinder or Clearepel) as required, to allow them to adhere to a flexible 3- to 6-application schedule from May through August. Spraying costs, including labor, equipment, and spray materials, were estimated based on data provided by each cooperating grower for each application completed.

Damage assessments of sprayed blocks were initiated in October. Blocks were sampled to determine the frequency of deer damage. Based upon the distribution of damage throughout each block, a stratified sample of damaged and undamaged trees was selected. For each tree in the stratified sample, the following data were collected: age, variety, rootstock, basal diameter, stem diameter and past season's growth increment for the main leader and 3 systematically selected limbs, twig availability, and number of browsed twigs.

Of the 9168 trees used in these tests, 4691 (51%) were evaluated for deer damage. The percentage of damaged trees per block ranged from 6.6% to 86.5%. The mean incidence of browsing per damaged tree for each block, a reflection of damage severity, ranged from 1.6 to 8.9.

During the course of this study 17 spray applications were completed: 14 with Hinder and 3 with Clearepel. The mean cost per Hinder application for 4 growers was $21.05 per acre ($11.06 to $31.83), with Hinder comprising 53.7% ($11.30) of the cost. Labor, equipment cost, and additional spray materials made up 16.2%, 18.3%, and 11.8% of the application costs, respectively.

Three Clearepel applications resulted in a mean per acre application cost of $43.60. Clearepel (including Clearspray sticker) comprised 74% ($32.21) of the application cost, a reflection of Clearepel's higher cost relative to Hinder.

Analysis of variance contrasting the cost of Hinder applications between cooperating growers indicated no significant differences ($p > 0.1$) existed. Despite this result, there was considerable variability in cost between growers. This variability resulted from differing equipment, number and speed of the workers, the presence of non-repellent spray materials in the repellent solution, and the quality of repellent solution applied (a function of application methodology, tree age, and size). Additional variability resulted from growers spraying areas adjacent to the actual test acreage.

Because orchard cover spray applications are scheduled throughout the growing season, repellent application costs were minimized by mixing compatible repellents with the cover spray solution. This resulted in reduced net cost of summer repellent programs. Adding an inexpensive repellent (20 to 50 cents per gallon of solution) to a young orchard cover spray solution nearly doubled the cost of the application process. On a per acre basis, the 6 cover-spray schedule resulted in repellent costs of approximately $70 per year, or $350 over the first 5 years of growth. Considering the potential profit of an acre of fruit trees over a 20-year period (roughly $20,000, Gerling 1981), a 5-year investment in early growth protection can be offset by a 2% increase in yield per acre.

A contrast of damaged and undamaged tree growth parameters was made to quantify the impact of deer damage on young fruit trees. Preliminary analysis indicated no significant difference ($p > 0.2$) in basal diameter and limb growth of undamaged and moderately damaged Empires and Red Delicious trees. Under severe damage, no difference ($p > 0.2$) was observed in Tydemans, while in Romes a notable difference ($p < 0.1$) in basal diameter and to a lesser extent ($p < 0.2$) limb growth was detected. Basal diameter was greatest on undamaged Romes while stem growth was greater on the damaged trees.

The impact of deer damage on tree vigor was difficult to assess due to the wide array of variables that influenced growth. In addition, deer damage also impacted tree structure which in turn may only be detected through future yields. Regardless, the assessment and quantification of deer damage impacts would be of long-term benefit. Differences in growth between damaged and undamaged trees over a multiple-year period will continue to be used as an index of deer damage severity. Ultimately, certain of the quantified parameters will allow for meaningful contrasts of deer damage control strategies.