EVALUATION OF INSECTICIDES FOR MANAGEMENT OF CLOVER CROWN BORER IN RED CLOVER SEED PRODUCTION IN THE WILLAMETTE VALLEY

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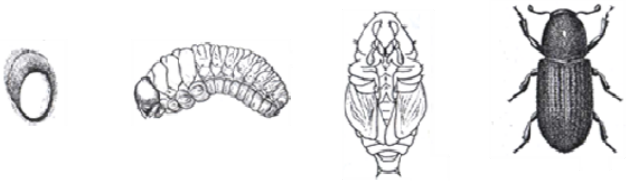
Red clover is raised for seed in the Willamette valley on over 15,000 acres. Due to its nitrogen fixing abilities it is an important rotation crop for grass seed and wheat. The Willamette Valley not only produces very high red clover seed yields, but is also ranked first for total production in the United States (NASS, 2009).

Red clover is a perennial but in the Willamette Valley, by the end of the second year, the crop stand is very poor due to infestation by the clover crown borer. This insect pest, also known as the clover root borer, is a minute bark beetle, native to Europe. It has infested red clover fields in the Willamette Valley for over 100 years. It is one of the principal factors limiting the longevity of red clover stands after the second year crop, and frequently causes substantial yield losses due to severe infestation, even in first year crops.

The clover crown borer has been observed to attack a range of leguminous crops including peas, vetch, alfalfa, alsike, mammoth and red clover. However, it appears to prefer red clover and mammoth clover (Rockwood, 1926).

All life stages of the clover crown borer pest (Figure 1) develop underground. Due to its minute size and subterranean life cycle, the pest is difficult to detect in the field. Adult beetles, 0.1 inch long and dark brown, are present briefly above ground in the spring when they emerge, mate and then migrate from old clover fields to young clover fields. The remainder of the life cycle occurs below ground where they feed on red clover roots. Beginning in late April and May, females lay eggs in niches in the walls of burrows made in clover roots. Each female lays approximately 20 eggs over her life span. Eggs hatch in 17-30 days. Larvae are creamy white and burrow within the roots of red clover. The larvae develop slowly over the summer, and pupate in pupal chambers at the end of the larval mines inside the clover root. The pupal period lasts 8-13 days. Adults are fully formed by late summer but remain below ground.



Egg Larva Pupa Adult

Figure 1. Life stages of clover crown borer.

The pest overwinters primarily in the adult stage, although a few larvae are also present in the soil in winter and transform to adults the following spring. The total development period from egg to adult is 90 days or more while the total life span of an individual may last a year or longer. As the egg laying period extends over a considerable length of time, there is great diversity in stages of development of the pest within a clover root at any given time from late spring to fall. The pest undergoes one generation a year (Rockwood, 1926).

The earliest injury to new clover (first crop, seeded the previous fall), is observed in the spring, one to two weeks after the first adult migratory flight (Rockwood, 1926). Both males and females feed on the roots and crowns of the red clover plant. Simultaneous attacks by 5-6 root borers on one small root often causes the root to girdle which results in wilting and early death of the plant. This occurs in April and May. However, greater damage occurs in the summer and fall due to feeding by larvae and young adults. As many as 45 larvae have been observed in a single root, at varying stages of development. Feeding by larvae and adults hinders nutrient and moisture transport inside of the plant. As a result, infested plants turn brown, wilt, and die (Rockwood, 1926). Thus, damage by CCB results in a decrease in both forage yield and seed production in the subsequent year. Mining caused by the pest often becomes a site for infection by root rot fungus and other pathogens that also contribute to a decline of clover stands (Rockwood, 1926). A third year of seed production is generally not economical.

Since the clover crown borer undergoes most of its life cycle below ground, confined to the interior of host roots, control with insecticides is a challenge. Nonetheless, organochlorine pesticides similar to DDT proved to be effective in the past (Gyrisco and Marshall, 1950; Gyrisco et al., 1954). However, organochlorine insecticides are no longer available due to their persistence and toxic impacts on the environment. Currently, no labeled insecticides exist for controlling this pest. With the current economic

downturn, there is renewed interest in clover crown borer management as red clover producers are seeking to reduce costs associated with reseeding or with crop removal and field preparation for a different crop. Hence, the objective of this study was to determine whether currently registered insecticides labeled for use in red clover seed production are effective in controlling the pest.

Material and Methods

The experiment was conducted in a red clover seed production field in Albany, Oregon, in 2011. The experiment was set up in a randomized block design with four replications. The following insecticides were applied in July using labeled rates: 1) Brigade® 2EC; 2) Carbaryl® 4L; 3) Lorsban ® Advanced; 4) Seduce® Spinosyn A and D; and 5) Control (no insecticide). In November, after the rains commenced and it was possible to dig plants, 10 plants were removed from each plot and placed in Berlese funnels at OSU to estimate the numbers of adult crown borers per plot.

Results

The results indicated that there were no statistical differences in the numbers of adults across the various treatments (P=0.29). However, the plots sprayed with Brigade and Lorsban had fewer adults compared to the other treatments and the control (Figure 2). Hence, further studies are warranted for a closer look at the impacts of these insecticides on clover crown borer adults.

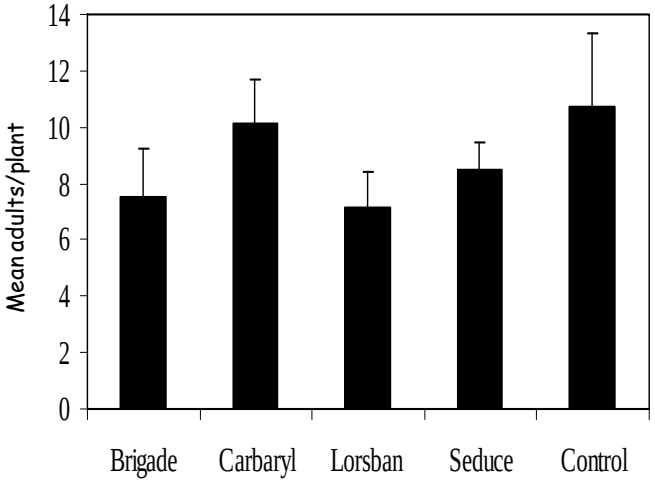


Figure 2. Comparison of the average number of clover crown borer adults in plots treated with insecticides in a red clover seed production field in 2011.

Discussion

The clover crown borer is a challenge to manage with insecticides currently labeled for use in red clover seed production. These are safer to the environment but less persistent as compared to the organochlorines which were effective in the past. However, it is possible that precise timing of the application of insecticides such as Lorsban and Brigade to coincide with the brief period when the adults emerge and disperse to infest new plants may provide an effective management tactic. Further research to determine if this is indeed possible, is planned at OSU.

References Cited

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