Evaluation of Slug and Snail Control Measures

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Nature Of Work: Slugs and snails are common in almost any ecosystem and particularly in nurseries where ideal habitats exist. As a general rule, slugs and snails are almost always considered as pests. Most slugs and snail pests in horticultural crops are invasive species. For example, the three-banded gardenslug (*Lehmannia valentiana* (Ferussac)) is a terrestrial slug native to Europe's Iberian Peninsula that has spread throughout the world. The three-banded slug is generally considered a greenhouse slug throughout most of its range, probably because of its intolerance to cold but has been found established in natural areas of the southern United States such as California and Alabama. *L. valentiana* is considered a generalist feeder and feeds on decayed wood and green plants.

The objective of our project was to evaluate a number of control measures for slugs and snails. There are few educational resources available describing the great diversity of snails, many of which are beneficial snails which suffer unnecessary controls. Beneficial slugs and snails contribute to the organic fraction of the soil cycle, and in addition, some species serve strictly as predators of other slugs and snails. Slugs and snails do most of their damage to leaves. In the spring and summer, plant damage normally occurs after dark when moisture levels are higher and temperatures are lower. Many of the products currently used for slug and snail control kill non-target arthropods and lead to an increase in mite populations and therefore increased pesticide usage. Traditionally, slug and snail control has relied mainly upon chemicals such as metaldehyde and carbamates (e.g. Mesurol). Metaldehyde has been the leader in slug and snail control since its introduction as a molluscicide to the market in the 1930's. Metaldehyde is marketed mainly as a molluscicidal bait and its proper use should be timed with slug and snail activity as well as weather conditions. Metaldehyde has a reputation for affecting non-target organisms. Mesurol is probably second in popularity as a molluscicide although it is a broad-spectrum pesticide and its number of yearly applications is severely restricted.

Other methods of slug and snail control are recent introductions to the market (e.g. iron phosphate). There has been little research into the use of iron phosphate as a molluscicide but what work has been done suggests that it is more environmentally safe than other molluscicides. However, studies have also shown that iron phosphate is less effective than metaldehyde and requires higher rates making it more expensive to use. Nevertheless, these studies suggest that in certain niche markets (e.g. organic farming) and homeowner markets where the price of pest control is less of an issue, iron phosphate could be a commercially successful molluscicide. Additionally, there is ongoing research into the use of naturally occurring chemicals (e.g. caffeine) and botanicals as molluscicides and repellents. The goal of these botanicals seems to be the development of more environmentally safe pesticides.

Even though there are slug and snail controls on the market, their mode of action is non-selective, killing whatever comes in contact with them and thus reducing the populations of slugs

and snails that do damage. The underlying goal of a slug and snail control is to reduce damage to a plant. A more effective method would be to prevent as much damage as possible by deterring the slug or snail from wanting to eat a plant. It is known that slugs and snails have an aversion to copper barriers. Nurseries use copper barriers around their property as deterrents to any slugs or snails moving into their facilities. The USDA also requires the use of copper barriers in the containment of snails in heliciculture (the raising of snails). Copper sulfate is used in the chemical control of aquatic snails. With all of the uses of copper and copper materials in some aspect of the control of slugs and snails, it makes sense to look for alternative copper materials/chemicals for molluscicides or repellents. Kocide (copper hydroxide) is a common fungicide used in agriculture to control a wide variety of plant diseases.

We placed slugs (*L. valentiana*) individually in petri dishes containing lettuce leaf tissue plugs treated with Kocide and untreated plugs. Our treatments included 1x, 2x, 3x, and 4x the minimum recommended rate of 1.5 tablespoons per gallon of powder Kocide. At this time, our data shows that Kocide has a strong repellent effect on the feeding preferences of slugs when used on lettuce leaf plugs. When given a choice between treated and untreated leaf plugs, slugs consistently prefer the untreated plugs, which are normally completely consumed. In some cases slugs did feed on the treated plugs, but the plugs were usually not completely consumed. Usually, the slugs appear to cease feeding after a short exposure to the treated leaf plugs.

Additionally, we placed *L. valentiana* individually in petri dishes containing only one leaf plug. The same rates of Kocide were used as in the choice studies. Preliminary results show that slugs consistently choose the untreated leaf plugs, which are normally completely consumed. As with the choice tests, treated plugs sometime show damage although it is minimal.

Results and Significance to the Industry: All rates appear to have the same effect of repelling slugs from the leaf plugs. Additionally, we believe that a much lower rate of Kocide will have the same effect as the rates used in our studies because of the apparently similar effect of all rates. Recent discoveries of the slug *Limax maximus* (leopard slug, giant garden slug) in a localized area of Auburn, Ala. have given us the opportunity to begin colonies for use in experiments. The leopard slug is a much larger slug (4-8 inches) than the three-banded slug (2-3 inches). We believe that the leopard slug will demonstrate feeding preferences to a broader range of plant material.