THE WASHINGTON STATE WARNING SYSTEM FOR THE GREEN PEACH APHID ON POTATOES IN THE COLUMBIA BASIN

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The green peach aphid, Myzus persicae (Sulzer), is, without a doubt, the most destructive insect that feeds on potatoes in eastern Washington. Some economic loss, as you very well know, may result from direct feeding of the aphids (sucking the plant sap), but a more important loss may follow the transmission of leaf-roll virus which causes net necrosis in potato tubers. Strictly speaking, leaf roll and net necrosis cannot be controlled since there is no cure once the plants and tubers are infected.

The distribution of the green peach aphid is outstanding; it occurs almost world-wide, and its host range includes plants in more than 30 families and nearly 200 species. Also, this aphid is able to transmit over 100 plant diseases that attack many major crops, potatoes, beans, sugarbeets, brassicas, sugar cane, tobacco, and citrus (van Emden et. al. 1969). Because leaf-roll infection should be avoided if possible, a method of predicting the time of appearance and the size of the population of aphids that may develop in and near potato fields is essential in making plans to ward off leaf-roll infection. A warning system was therefore developed to alert growers to the need to control aphids as a means of reducing the possibility that net necrosis will develop in their potatoes.

The flight habits of the green peach aphid: The green peach aphid normally flies low to the ground and for short distances, and the arrival of winged aphids in an area is undirected (van Emden et al. 1969). Kennedy (1959) and Landis (1966) reported that some aphids may be carried for some distance in the air current; however, Kennedy reported that these aphids come to the end of their flying life in a few hours and are probably dead in a few more hours. Therefore, though such long-distance fliers cannot be ignored, they may be relatively unimportant in the mass spread of leaf roll if we control the local population.

The low flight of aphids was one of the major factors that enable Moericke (1951) to observe the attraction of this aphid to yellow and its revulsion to white. Also, Kennedy (1959) mentioned that the green peach aphid was forever resisting the upward air currents (turning away from the blue-green color of the sky) toward the yellow-green plants, which contributes to making the aphid into a short-distance flier. This turning away from the color of the sky was also demonstrated when aluminum foil, which reflects the blue of the sky, was found to repel aphids (van Emden et al. 1969). In addition, Macias and Mink (1969) found that more winged green peach aphids alighted on yellow (infected) sugarbeet plants than on healthy sugarbeet plants and that they avoided plants infected with curlytop virus.

Clear evidence exists that winged green peach aphids alight on host and nonhost plants with equal frequency (van Emden et al. 1969). He found that the aphids frequently alighted and took off again for further aerial dispersal at low levels. This type of distributuion occured with greater frequency where the plants were not dense (Kennedy 1959), with the result that the aphids concentrated along the edge of the field. We also have observed (unpublished data) that aphids are first found on nightshade along the borders of potato fields.

Probing habits of the green peach aphid: The green peach aphid is an effective vector of virus because it makes numerous probes of the leaf surface by short (1- to 5-minute) and repeated insertions of its stylet at different sites. However, the number of probes an aphid attempts is greater and the probes are deeper and more prolonged on host plants than on nonhost plants (van Emden et al. 1969). It may take as much as 15 minutes for the aphid to pierce the epidermis of the leaf and for the stylet to reach the phloem.

The situation: The use of chemicals to prevent the spread of viruses by controlling the aphid vectors has been only partially successful (van Emden et al. 1969). However, Powell (1966) showed that the proper timing of applications of an aphicide for the control of the green peach aphid to prevent rapid multiplication of the aphid significantly reduced the spread of leaf-roll virus in potatoes. Such timing requires constant information about the aphid population in the potato field, information about the aphid population moving into the field, and information about where they are coming from.

Plainly we need to use an integrated approach in which we put together all the information at hand about the green peach aphid and its relationship to leaf roll on potatoes. Thus, we must: (1) do the best job we can in controlling the overwintering population on peach trees, (2) use the most effective methods of detecting spring migrant populations before they become infected with the leaf-roll virus and enter the potato field, (3) use the most effective chemical and timing of applications to control the aphids in the potato field before they cause mass spread of the leaf-roll virus, and (4) do all we can to protect the natural enemies of the aphids.

The aphid warning system and how it works: The aphid warning system is simply a system begun by the cooperative efforts of the Agricultural Research Service, the Washington State Potato Commission, and the Washington State University Agricultural Extension Service by which the aphid situation is reported to potato growers once a week. Yellow-pan aphid traps filled with water are placed at key locations in the Columbia Basin and checked twice weekly. The aphids are collected, the green peach aphids are separated from other aphids, and the information obtained is sent to the Potato Commission. The Commission publishes this data in Spud Topics for weekly distribution to potato growers.

The aphid warning system is based on what we know about the green peach aphid. Nearly all the aphids in the Columbia Basin overwinter in the egg stage on peach trees, but the overwintering population can be greatly reduced by spraying the peach trees after the eggs hatch and before the aphids begin to migrate from the peach trees. The 1st winged aphids are found on peach trees about April 20, and winged aphids begin to leave trees in increasing numbers about May 1. A peak of flight is reached about June 1-10, and the aphid migration from peach stops about June 20. The aphids settle on many wild and cultivated host plants and multiplication increases rapidly, especially on weeds. Since weeds on unirrigated lands begin to dry up about June 1-20, large numbers of aphids begin to make short flights from plant to plant, including volunteer potatoes, some of which are infected with the leaf-roll virus. The probing habit of the aphid affords great opportunity for the aphids to acquire the leaf-roll virus.

Landis and Powell (1969) suggested that the collection of 0 to 10 aphids/trap in 3 to 4 days was a light infestation. However, this judgment needs to be qualified in the light of the percentage of winged aphids carrying the leaf-roll virus. A higher percentage of aphids will have acquired the virus in June than in July because the aphids will have had a better chance to feed on volunteer diseased potato plants in June. By July, many of these plants have been destroyed or camouflaged by other crop plants--sometimes by potato plants; but we hope not.

The trap-pan data must also be supplemented by counts of aphids in potato fields. More winged aphids alight on the yellow-green diseased plants and on their favorite host, the nightshade, than on dark green healthy potato plants. Therefore, frequent observation for aphids on nightshade plants on head ditches and drain ditches surrounding potato fields is important.

We can normally say that when aphids are found on potato leaves 100 feet into the field, they have been on nightshade along the borders of the field for at least 10 days. Bishop (1968) showed that the spread of leaf-roll from infected potato plants to adjacent potato plants is usually done by wingless aphids. This spread can and should be eliminated by the proper use of insecticides.

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