THE 1965 COLUMBIA BASIN POTATO GROWERS APHID CONTROL PROGRAM IN RELATION TO LEAF-ROLL SPREAD AND DEVELOPMENT OF NET NECROSIS

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The history of the leaf-roll problem in eastern Washington and several practices designed to help prevent spread of the disease were reported by Landis, Powell and Hagel in 1965. A review of certain physiological characteristics of the potato plant in relation to periods of high and low susceptibility to infection with leaf-roll and the ability of the green peach aphid to transmit the virus to potatoes is helpful in better understanding this problem.

Many researchers including Davidson and Sanford (1954), and Knutson and Bishop (1964) have clearly shown that young potato plants are more susceptible than older plants to leaf-roll infection. Potato plants and tubers are less susceptible to leaf-roll infection during bud formation and flowering than either before or after (Knutson and Bishop 1964). Also during the period of bud and flower production, they found that the number of partially infected hills containing one or more infected tubers increased.

Figures 1 and 2 reproduced from publication by Knutson and Bishop (1964) show that the percent of infected plants and the percent of infected tubers produced by these plants decreased as the age of the plants increased. This emphasizes the importance of protecting potato plants from aphid attack during the early part of their growth as a means of preventing as much leaf-roll infection in the tubers as possible.

Klostermeyer (1953) found that the green peach aphid was able to obtain the leaf-roll virus from diseased plants in a 10-minute feeding period and was also able to transmit the virus to healthy Physalis indicator plants in a 10-minute feeding period immediately after feeding on the diseased plant. Smith (1931), however, found that after aphids had fed on a diseased plant, a 2-hour feeding period was required to transmit the virus to potato plants. MacCarthy (1954) reported that 83% of the aphids that had acquired the leaf-roll virus were capable of transmitting it to healthy plants. Most aphids retain the virus in their bodies as long as they live.

The number of tubers that contain net necrosis, and the extent of the discoloration in tubers produced from leaf-roll plants depends to a great extent on the time during the growth of the potato plant that infection takes place and on the developmental stage of the tubers at the time of infection. Soliman (1953) found that 20% of the tubers from leaf-roll infected plants produced net necrosis. The maximum number of net-necrotic tubers is more likely to be produced when infection

takes place when the tubers are setting. Knutson and Bishop (1964) showed the highest percent of infective tubers when infection occurred early in the season. In this case an infective tuber does not mean a net-necrotic tuber.

The green peach aphid overwinters in the egg stage on peach twigs and also in the summer reproductive stage on winter hardy weeds in protected places. The small number of peach trees located in towns and near farm houses can be an important reservoir for the overwintering aphid eggs. A possible 3,000 to 30,000 green peach aphid eggs may overwinter on a single peach tree depending on the fall aphid population and the size of the peach tree. As the number of peach trees increases and the number of weeds in drain ditches and canals increases in the Columbia Basin the aphid and leaf-roll problem will probably also increase.

The green peach aphid has increased in the Othello area in recent years. Volunteer potato plants, an abundant and convenient source of the leaf-roll virus, are present every spring throughout the Columbia Basin.

Thirty-four potato fields were surveyed during the fall of 1965 for current season leaf-roll symptoms and potato tubers were collected from each field and examined for net necrosis.

Because the plants were large with vines 6 to 7 feet long, it was difficult to make accurate disease reading. However, the number of potato stems that appeared to be healthy and those with leaf-roll symptoms in 400 feet of row (100 feet of row in each of 4 locations) were counted in each field. Later, 100 tubers were collected from each field, or 25 from each of the 4 rows of plants that had been examined for leaf-roll symptoms. During October and November 1965 the stem end of each tuber was cut and examined for net necrosis and other internal discolorations. A record was made of planting date, seed source, disulfoton (Di-Syston) soil treatments, the number of endosulfan foliage applications and location of volunteer potato plants near each field. All of these fields were in the Othello area. Unfortunately, aphid population counts were not made in all of the fields during the growing season. However, in 1 field planted April 16, aphids were present on 33% of the plants on June 3 and on more than 50% of the plants by June 24.

Because both aphids and diseased volunteer plants were present in the spring some leaf-roll infection must have taken place early in the season. If there was a small amount of spread of leaf-roll before the volunteers were destroyed this provided a readily available source of the virus in the presence of an increasing aphid population in all potato fields. Very little spread of leaf-roll may have occurred in fields where aphids were present but few sources of leaf-roll were nearby. On the other hand, extensive spread of leaf-roll occurred

where relatively few aphids were present near an abundant source of leaf-roll.

Of the 34 fields surveyed current season leaf-roll spread in the plants ranged from 1.1 to 33.8% and the tubers showing net necrosis ranged from 1 to 32%. No direct correlation between the abundance of plants with foliage symptoms of leaf-roll and net necrosis could be shown, or between the number of insecticide applications and the number of plants obviously infected with leaf-roll. The chronic leaf-roll symptoms produced after replanting the tubers in 1966 should reveal the total leaf-roll spread and make the 1965 survey more meaningful.

Results of the 1965 survey were less conclusive than those obtained in the 1964 study. Although several investigations have shown that leaf-roll spread can be reduced by the proper timing of effective aphicides the best insecticide program is likely to fail unless a conscientious effort is also made to reduce the overwintering sources of leaf-roll.

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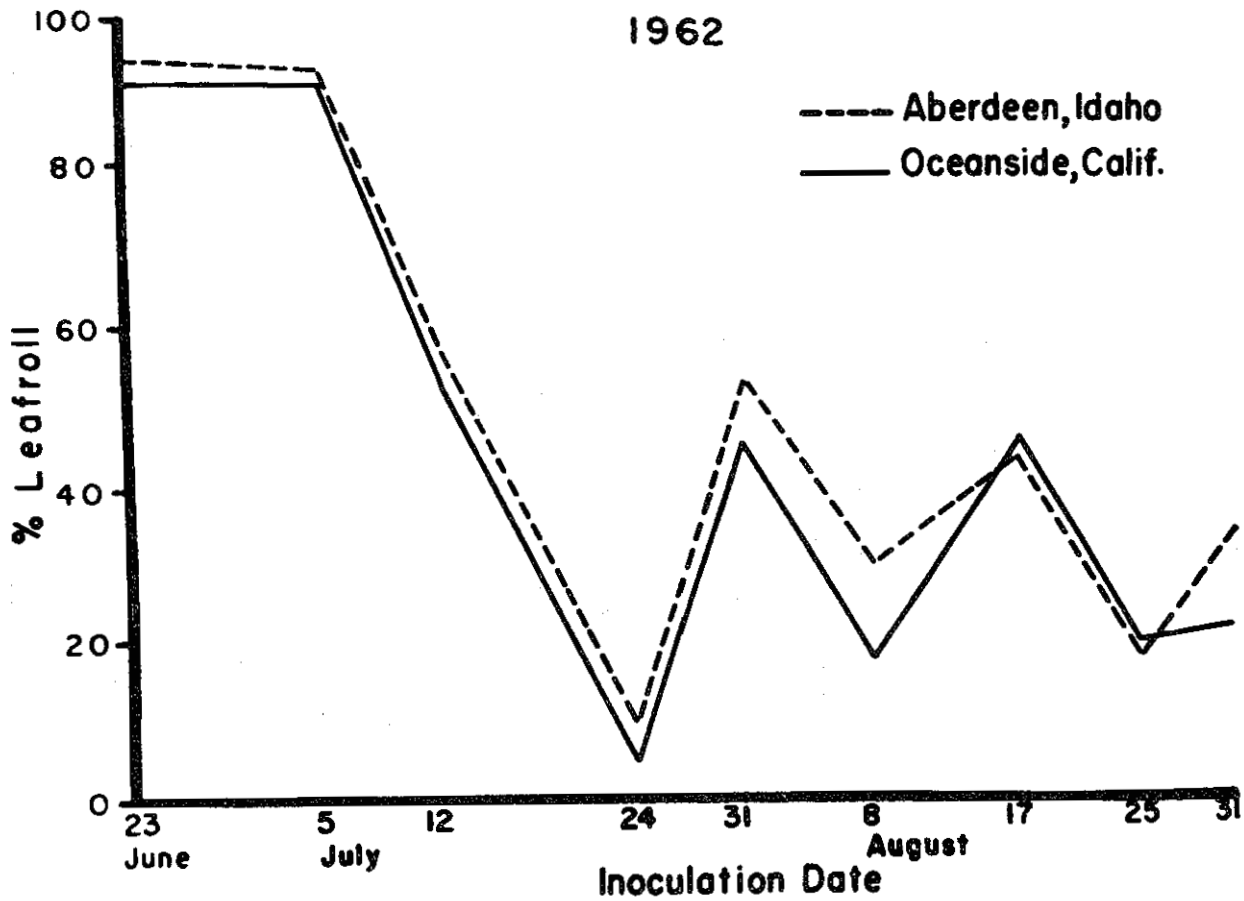

Figure 1. Effect of date of inoculation and location of growing tuber progeny on percent of leaf roll infection and expression of symptoms. Duplicate seed pieces from a single tuber planted at each respective location. Knutson and Bishop (1964)

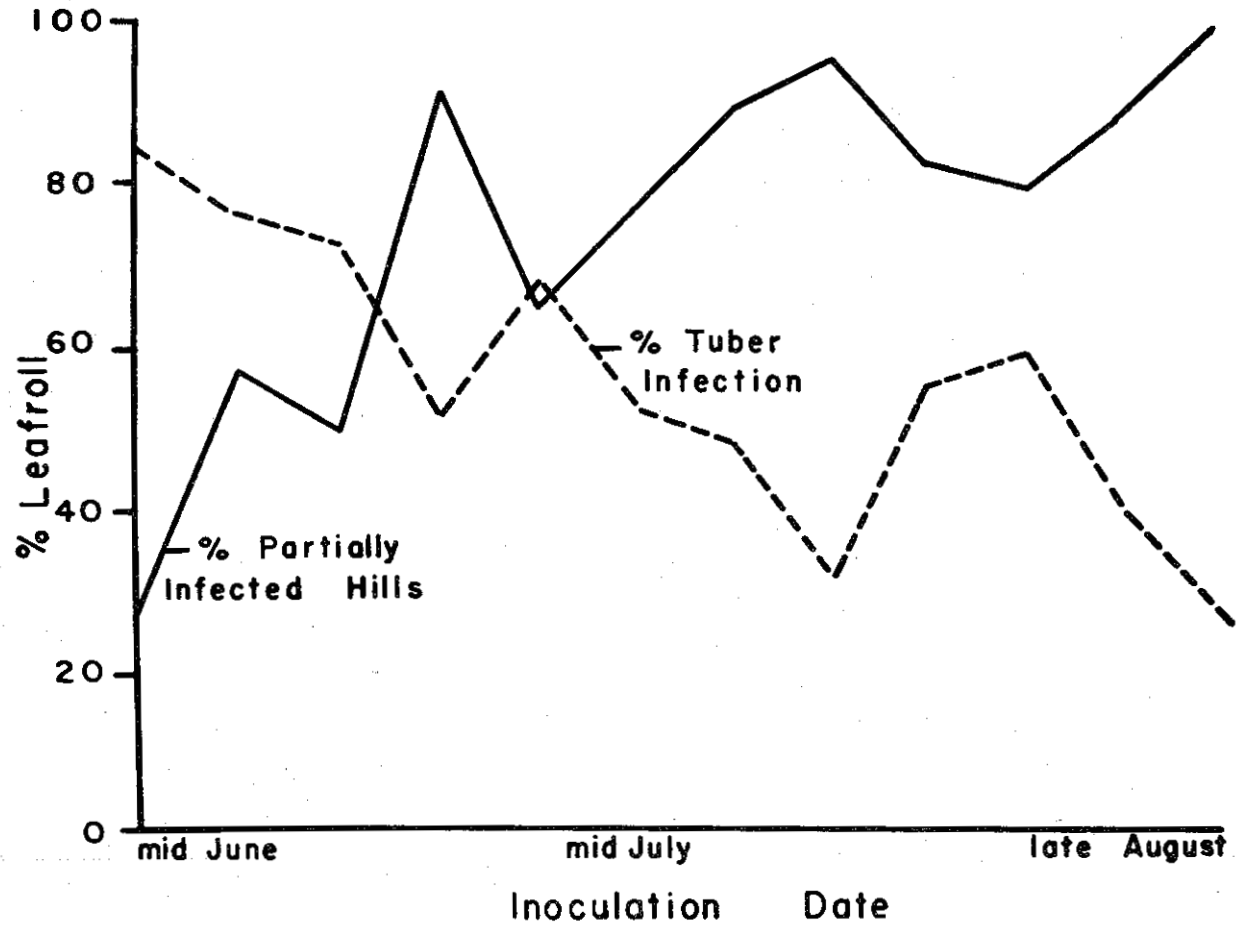

Figure 2. Effect of date of inoculation on percent tuber infection and partially infected hills --- average of three experiments. (Tubers from noninfected hills were excluded). Knutson and Bishop (1964).