Papaya Ringspot Virus Cross Protection – An Update

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Background

Papaya ringspot virus (PRSV) is about the most serious disease problem growers must manage to successfully grow papayas in Hawaii. Growers on Oahu have long experienced the effects of this virus disease, the result of which has seen the decline of papaya production on Oahu to about 40 harvested acres in 1991 (Statistics of Hawaiian Agriculture, 1991). With the discovery of PRSV in the commercial growing areas in May 1992, growers face the serious possibility of losing their industry.

One of the few options available to growers is the use of cross protection. Cross protection is the "deliberate use of a mild or attenuated virus strain to protect against economic loss by the severe strain of the same virus." Cross protection is not a perfect or ideal disease management tool. We can expect reduced plant growth and yield as demonstrated and reported to you previously. For this reason, we think of cross protection as a last resort approach to PRSV management. However, the grower can expect certain benefits to using cross protection. By using cross protection, the grower obtains a lower, but more consistent and predictable yield for a known period of time. Thus, he avoids the wild swings in production often associated with crop failures due to high virus levels. Only by using the last-resort approach of cross protection is it at all possible to produce a crop economically.

In spite of its limitations, we believe that the use of cross protection affords growers a viable option for managing the virus disease. This is based on our previous studies which can be summarized as follows:

The mild protecting strain does not reduce fruit quality as measured by brix or sugar content for the important cultivars grown in Hawaii ('Line 8', 'X-77', 'Kamiya', and 'Sunrise'). Information on the variety 'Kapoho' is not available at this time since trials could not be conducted on the island of Hawaii.

Ringspots occur on fruit of all varieties. Ringspot occurrence varied by season, and tended to be most intense during the late spring and early summer, with fruit set in the cooler winter months prone to expression of the virus.

Some cultivars should not be cross protected because they are too sensitive to the mild strain. In terms of the occurrence of ringspots on fruit, 'Line 8' was most resistant followed equally by 'X-77' and 'Kamiya', with 'Sunrise' the most sensitive. With 'Sunrise', fruit was also severely distorted for part of the year. This observation suggested that cultivars such as 'Sunrise' were too susceptible to be cross protected.

Growers produced acceptable yields of grade A quality.

Infection by the severe strain of PRSV (breakdown or superinfection) was substantially reduced by the use of cross protection. Rates of infection were reduced by over 90% even for the more susceptible cultivar, 'Sunrise'.

Cross protection technology is available now. Effective September 13, 1993, the governor approved the commercial use this technology on the island of Oahu. After testing on the island of Hawaii, similar approvals ought to be forthcoming.

Commercialization of Cross Protection on Oahu

At the completion of our large-scale field trials/demonstrations of cross protection, a field day was held on Oahu in March, 1993, for growers to observe one of our trials. Results of the trials were presented, and discussion was initiated on how to commercialize or make cross protection available to growers. Over 50 growers attended the field day. Most growers seemed impressed with the consistency of production possible with this technology, and much discussion took place on how to proceed with commercialization of cross protection.

Growers decided that seedlings would be distributed equally to all interested growers who attended the field day. Mr. Ken Kamiya, an original cooperating grower for evaluating cross protection, was chosen to produce cross-protected seedlings for distribution at cost. The first two production runs of cross-protected seedlings would

be used to teach Mr. Kamiya how to produce cross-protected seedlings.

In mid-May 1993 about 37,000 seedlings were distributed to 16 growers from all of Oahu. Subsequently, additional growers who had not attended the field day expressed an interest in cross-protected seedlings. To accommodate these growers, additional cross-protected seedlings were produced and distributed. At this time, because we expected to experience a problem with producing cross-protected seedlings because of the warmer summer temperatures, only 21,000 seedlings were produced and only 15,000 seedlings were distributed to 11 growers.

In all, the number of seedlings distributed was adequate for planting 45–55 acres, or more than the 40 acres of papaya harvested for all of Oahu in 1991. Many growers expressed a desire for more seedlings, but initial distribution had to be limited to provide an opportunity for as many growers as possible to obtain experience with using cross protection. Growers receiving protected seedlings varied in previous experience with growing papayas from highly experienced to no previous experience. Their reactions and experiences with these seedlings will be monitored to determine the level of acceptance of cross protection by Oahu growers.

Cross Protection on the Island of Hawaii.

The cross protection program at the University of Hawaii was initiated about 10 years ago, anticipating a need for its deployment on the island of Hawaii whenever PRSV would become established in the commercial papaya-producing areas. Work proceeded only on Oahu because this was where PRSV was a problem. Since the cultivar 'Kapoho' is not grown commercially on Oahu, our experience with it is limited to greenhouse and small plots. In these tests, 'Kapoho' reacted intermediately compared to 'Line 8' and 'X-77'. Reactions must be confirmed in field-scale trials in soil and environmental conditions similar to the Puna area. We have received permission from the Hawaii Department of Agriculture to install the trial in Hilo.

In a few weeks, we shall install the experiment to evaluate cross protection on 'Kapoho' at Mr. Pang Van Lo's farm (located 0.3 miles west of the intersection of Kahaopea Rd. and Auwae Rd., on the right side of Auwae Rd.) in Hilo. We will assess the effect of the mild strain on fruit quality, the occurrence of ringspots on harvested fruit, visual plant reactions, yield, and superinfection, or "breakdown," by the severe strains of PRSV. Results will be shared with the industry as they become available.