RESEARCH SUMMARY FOR 1986

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I. Leafroll Project - Studies dealing with the potential resistance to leafroll infection in Centennial Russet and Sangre as compared with Russet Burbank, aphid vector identification and their relative numbers on each cultivar and the timing of leafroll spread in the San Luis Valley.

Plots were designed and planted in 1984, 1985 and 1986 to examine the factors listed above dealing with leafroll in the San Luis Valley. Three main factors were studied:

a) How do Russet Burbank, Centennial Russet and Sangre compare in their leafroll infection rates during the growing season?
b) Which of the aphid vectors (green peach aphid (GPA) or potato aphid (POA)) is most instrumental in the leafroll spread in the San Luis Valley and what is their colonization level on each of the three cultivars? And,
c) When does most of the actual leafroll spread take place during the growing season, especially in relation to the aphid vectors present?

There is strong evidence over the past three seasons that Russet Burbank shows a significant increase in leafroll spread over Centennial Russet or Sangre. The data shows that Russet Burbank has an average of 3 to 4 times more leafroll spread than either Centennial Russet or Sangre. While this may not seem like a very high level, it should be considered that there was essentially no leafroll spread to either Centennial Russet or Sangre in 2 out of 3 seasons and less than a one-fold increase in the third season when the aphid populations were abnormally high early in the season. There is resistance to leafroll spread evident in both Centennial Russet and Sangre.

A second piece of evidence that may become very important in leafroll control strategies in the San Luis Valley is that the majority of leafroll spread took place intra-field versus inter-field. This means that in those plots where a leafroll source plant was located, classic plant to plant spread from the source plant to surrounding plants was taking place (intra-field). While some leafroll spread was evident in the surrounding plots without a source plant present (inter-field), it appeared to take place later in the season and was not the primary source of high leafroll levels in the plots. This late inter-field type of spread may be a critical factor in the recontamination of clean stocks, but it is apparent that controlling early season aphid levels may be of as much or more benefit in reducing leafroll spread if leafroll source plants are present.

The primary aphid vectors in the spread of leafroll in the San Luis Valley appear to be the green peach aphid and the potato aphid. Both vectors can spread the virus, but it appears that the POA is implicated in the intra-field type of spread more than the inter-field type of spread which has been the trademark of the GPA. In 1984, POA were approximately 98% of the total vector population in the plots and there was a high rate of intra-field spread early in the season. In 1985 and 1986, there was a more even split in the vector populations with POA/GPA percentage being about 50/50 in 1985 and 75/25 in 1986. However, in 1986, there was a higher percentage of early season POA than GPA and indeed, there was a relatively high level of intra-field spread as compared with levels in 1985. It should also be noted that there was a significant difference in the colonizing rates of aphids with Russet Burbank

showing higher numbers of aphids per plant in all three years than either Centennial Russet or Sangre. This may reflect an aphid preference for Russet Burbank over the other two cultivars or that Russet Burbank acts as a better host for aphid population increase. This may in part explain why Centennial Russet and Sangre show resistance to leafroll spread, but does not explain the entire story as aphid populations were more than adequate in all years for leafroll transmission.

The timing of leafroll spread in each year varied slightly, but was in all cases taking place earlier than was previously thought. In general, the evidence suggests that leafroll spread takes place by the first or second week in July in most years. This can be moved later in the season depending upon the actual early season aphid numbers. Another factor suggested by the data is that the later the peak aphid populations occur, the less likely that high levels of leafroll spread will occur even if leafroll source plants are present. This may be a demonstration of a mature plant leafroll resistance.

Finally and probably the most important in relation to timing of spread was the numbers of aphids present per plant. In two out of three years, numbers lower than 4 aphids/plant showed that leafroll transmission to plants surrounding the leafroll source plant was possible. These kind of numbers may play an important role in the timing of insecticide applications for maximum benefit. In conjunction with this, it is important to keep cultivar variations to leafroll spread in mind.

II. Clonal evaluation for the timing of leafroll spread and the intensity of the leafroll symptoms observed.

In each of the last four years, a program of evaluating clones from the breeding program for leafroll symptom development and intensity has taken place. This program has been very beneficial in establishing the appearance of leafroll symptoms in a given clone, when these symptoms develop in the field and how susceptible a given clone might be to leafroll spread. In 1986, ten clones with three controls (Russet Burbank, Centennial Russet and Sangre) were evaluated. The results obtained from the winter test plots in Oceanside, California, follow. These infected clones will also be planted in the San Luis Valley in 1987 for comparison. These results will be reported during the evaluation for clone release into the Colorado Certified Seed Potato program. Two items of interest should be noted: 1) The WNC230-14 and the AC77652-1 did not show any leafroll symptoms even after early season inoculation with viruliferous aphids. This could have implications relating to leafroll resistance or leafroll expression when the plant is infected; and 2) all other clones showed very adequate leafroll symptoms with some being extremely intense reactions. There is some evidence that those clones showing intense reactions may be more susceptible to leafroll spread. This still needs to be confirmed.

III. Bacterial ring rot stress studies.

In 1986, tests were conducted on bacterial ring rot infected tubers to determine if early season frost damage to the plants might promote more intense ring rot symptoms at an earlier stage of plant growth in the field. The plants were frozen in the upper whorl of leaves during the last week of June. Readings for bacterial ring rot symptoms were made at weekly intervals starting at June 30th and continuing through mid-August. The results indicated that there was no major time difference in symptom development in the Russet Burbank cultivar, but there was an increase in intensity of the symptoms in the treated plots. In Centennial Russet, there was no difference in the timing of symptom development either, but there were more plants expressing symptoms in the treated replications

than the untreated and the symptom intensity again appeared to be stronger in the frozen plants. In the Sangre replications, there were plants showing ring rot symptoms in the treated portion one to two weeks earlier than in the untreated portion. In the Ute Russet plots, there was no difference expressed either in the timing of symptoms or in their intensity. In fact, it was difficult to detect any ring rot symptoms in any of the Ute Russet plots. It would seem that early season stress may play a role in both symptom expression intensity and the timing of these symptoms. This is similar to what has been observed in certified seed fields, but further work needs to be accomplished before any definitive conclusions can be drawn.

1986 Clonal Evaluation for PLRV Symptom Development

Clone #	Height	Intensity, etc.
AC77652-1	6"	0
AC79128-1	6"	3+ LL, CC (3+)
BR7093-24	6"	3+ LL, CC (3+)
CO7916-3	6"	3+ LL, CC (1+)
CO7922-1	6"	1+ LL (light), CC (1+)
TXA17-1	6"	3+ LL, CC (3+)
WNC230-14	6"	0
Sangre 10	6"	3+ OL, CC (2+) purpling evident
Sangre 11	6"	3+ OL, CC (2+) purpling evident
Sangre 14	6"	3+ OL, CC (2+) purpling evident
Russet Burbank	6"	3+ OL, CC (3+)
Centennial	6"	3+ LL, CC (2+)
Sangre	6"	3+ OL, CC (2+) purpling evident

Symptom expression range includes a 0 to 3+ rating for intensity, CC for good, typical color change, LL for good, typical lower leaf roll, and OL for good, typical overall rolling of the leaves such as on a Sangre or the later stages of Russet Burbank leafroll infection. These results were recorded from growth in the winter test plots in Oceanside, California.