Effect of Virus Yellows on the Yield and Sucrose Percentage of the Sugar Beet at Salinas, California, in 1952

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A problem of severe yellowing of sugar beets during the late spring and summer months has been under study in the Salinas Valley of California for several years. In September, 1951, Dr. Raymond Hull, a specialist on virus yellows from the Rothamsted Experiment Station in England inspected beet fields around Salinas and stated that the symptoms of many of the yellowed plants were comparable to those of European plants known to be affected with virus yellows. Coons (l)[2] reported the results of transmission and serological tests which definitely established that the yellows virus was one cause of yellowing of sugar beets in the Salinas Valley. This paper reports the results of two experiments conducted at Salinas in 1952 to measure the damage to sugar beets from virus yellows resulting from natural infection.

Experiment 1

One-half acre of the U. S. 56/2 variety was planted February 26, 1952. adjacent to an overwintered planting of miscellaneous sugar beet varieties. The beets were planted on beds 28 inches apart and were thinned to nine inches in the row. The planting was divided into six replications and each replication into two plots. Strips of barley approximately five feet in width were planted along the sides of the planting, between the replications and between the plots in such a manner that each of the plots was surrounded bv a barley barrier. The purpose of the barrier was to reduce the migration of the aphid vector from one plot to another.

One plot in each replication was sprayed with demeton (systox) to control aphids, and the second plot was left unspraved. The first application was made April 5 at the rate of 140 cc. demeton (32 percent) per acre. Four applications were made at the 140-cc. rate. Beginning June 13, the rate was increased to 168 cc. of demeton per acre in order to compensate for the larger size of the plants. Four applications were made at the 168-cc. rate, the last application being made July 28. The first application was made with a power sprayer and the remainder with a knapsack sprayer.

Counts of plants showing virus yellows svmptoms were made July 8, 1952. and the results are shown in Table 1. The percentage of plants with vellows svmptoms varied greatly among replications and also among plots. In replications 1, 3, and 5, the unsprayed plots were separated from the overwintered beet planting by only the five-foot barley barrier whereas in replications 2, 4, and 6, the reverse situation existed and the sprayed plots were closest to the overwintered planting. These results show that infective aphids moved into the plots from the overwintered beets and that the in-

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[2] Numbers in parentheses refer to literature cited.

fcction was greatest in those beets closest to the source of infection. Infection was about three times greater in the unsprayed plots than in the sprayed plots when they occurred adjacent to the source of infection. When the sprayed plots occurred closest to the source of infection, there was slightly more infection in the sprayed than in the unsprayed plots.

Table 1.—A Comparison of the Percentage of Plants with Virus Yellows in Deineton-Sprayed vs. Unsprayed Plots of Sugar Beets Planted February 26 and Counted July 8, 1952.

Replication No.	Percent of Yellowed Plants	
	Sprayed	Unsprayed
1	5	24
2	12	10
3	7	16
4	16	14
5	13	33
6	15	11
Average	11	18

Variability in the amount of yellows infection and in the degree of control made it inadvisable to harvest the experiment on a complete plot basis. July 8, 100 beets in each replication with typical virus yellows symptoms were staked and on August 6, 100 healthy beets were staked in each replication. No healthy plants were staked which occurred next to diseased plants. The staked beets were harvested October 7 and the results are shown in Table 2. No difference was found in the yield of healthy as compared with yellowed beets but the sucrose percentage was one percent lower for the yellowed beets.

Table 2.—A Comparison of the Yield, Sucrose Percentage, and Other Qualities of Healthy vs. Virus Yellows-Infected Sugar Beets Planted at Salinas, California, February 26 and Harvested October 7, 1952.

Treatment	Wt. of 100 Beets	Sucrose	Purity	Na	Amino N
	Lbs.	%	%	PPM	%
Healthy	208	17.64	92.0	242	.25
Yellows-Infected	204	16.57	91.5	324	.27
	NS	HS	NS	S	NS

NS—Not significant
S—Significant (odds 19:1)
HS—Highly significant (odds 99:1)

Experiment 2

A four-acre block within a commercial field of sugar beets near Salinas, California, was selected for experimentation with virus yellows control. The field was planted with the U. S. 15 variety April 4, following standard cultural practices for the area. The four-acre block was divided into five replications measuring 130 feet by 270 feet. Each replication was divided into two plots, one of which was dusted with five percent malathion dust at the rate of approximately 45 pounds per acre, and the second left undusted. A total of six applications was made with a tractor-mounted duster beginning April 17 and ending July 1.

Four hundred plants in each plot were counted and observed for virus yellows symptoms August 7. The results of these counts are shown in Table 3. The percentage of plants showing virus yellows symptoms averaged about 3 percent in the dusted plots as compared with about 20 percent in the non-dusted plots. These results show that naturally occurring virus yellows infection can be significantly reduced by controlling the aphid vector with frequent applications of malathion dust.

Table 3.—A Comparison of the Percentage of Plants Showing Virus Yellows Symptoms in Malathion-Dusted vs. Non-Dusted Plots of Sugar Beets Planted April 4 and Counted August 7, 1952.

Replication No.	Percent of Yellowed Plants	
	Dusted	Non-Dusted
1	6.0	29.0
2	2.5	17.8
3	2.0	14.3
4	4.3	22.5
5	2.3	14.0
Average	3.4	19.5

The relatively low percentage of infection in the experimental area and lack of complete control in the dusted plots made it inadvisable to harvest the experiment as complete plots. One hundred yellowed plants and 100 healthy plants were staked in each of the five non-dusted plots August 7. In order to reduce bias, healthy plants were staked by selecting every third, fourth, fifth, or sixth healthy plant in any particular row. No healthy plants adjacent to diseased plants were staked. In cases where the count fell on a mildewed or yellows plant, the next competitive plant in the row, not adjacent to a diseased plant, was staked.

The staked plants were harvested October 10 and the results are shown in Table 4. Both the yield and sucrose percentages of the yellowed beets were lower than those of the healthy bets. The yield was reduced by one-third and the sucrose percentage was a full percent lower.

Table 4.—A Comparison of the Yield, Sucrose Percentage, and Other Qualities of Healthy vs. Virus Yellows-Infected Sugar Beets Planted at Salinas, California, April 4 and Harvested October 10, 1952.

Treatment	Wt. of 100 Beets	Sucrose	Purity	Na	Amino N
	Lbs.	%	%	PPM	%
Healthy	255	16.44	83.3	584	.47
Yellows-infected	165	15.33	87.7	748	.43
	HS	HS	NS	NS	NS

NS—Not significant
HS—Highly significant (odds 99:1)

Conclusions and Summary

These two experiments demonstrated that the yellows virus is an important cause of yellowing of sugar beets in the Salinas Valley of California.

Through the use of demeton spray and malathion dust the aphid vector of the virus was partially controlled and the amount of infection was reduced but not prevented.

In both experiments the sucrose percentage of virus-yellows-infected beets was one percent lower than that of healthy beets, but the results with yields were inconsistent. In experiment *2*, the yield of the yellowed beets was one-third less than that of the healthy beets whereas in experiment 1, there was no significant difference in the yield of yellowed and healthy beets.

These results indicate that a reduction in the yield of gross sugar occurs in the Salinas Valley from virus yellows infection but additional tests are required before accurate estimates of the loss can be made.

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Literature Cited

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