Mosaic Viruses Not Sole Cause of Crown Blight

M. R. Nelson

Are the mosaic virus diseases responsible for crown blight of cantaloups? Unfortunately, this question has not yet been fully answered. Controlled greenhouse and field screen cage studies, however, have shown that mosaics, as separate diseases or in combination, can have devastating effects on cantaloup production.

The disease known as crown blight has been considered the most serious threat to cantaloup production in the southwest. It is not only serious in Arizona cantaloup districts, but has also caused severe losses in the Imperial and Palo Verde Valleys of California and in the Rio Grande Valley of Texas.

A large number of symptoms have been ascribed to this disease, but the main one is an early and general decline of the crown leaves of the cantaloup plant which exposes the crown set of fruit. These fruit, which are the first to ripen and hence the ones that usually bring the best price, are severely sunburned and rendered unmarketable.

Severe In 1950's

Attention was first called to crown blight in the southwest during the middle 1940's and it was routinely observed each year up into the early 1950's. By 1953 the disease was well established and since that time it has been considered of major importance in influencing yields.

Mosaic virus diseases have been present in these cantaloup production districts for 20 years or more. During the past decade they have frequently been suggested as possible causes of crown blight.

Many other possible causes of crown blight have been suggested through the years, but because the distribution of mosaic viruses is independent of soil types, crop rotational practices, cultural practices and nutrition, and since the reported distribution of crown blight indicates that it is also largely independent of these factors, the study of the effects of mosaic viruses on cantaloups was undertaken.

Watermelon Mosaic Most Common

The most common mosaic virus present in the Yuma cantaloup district is watermelon mosaic virus (WMV). Isolations from several hundred cantaloup plants showing mosaic symptoms over the past two years have yielded WMV in approximately 95 percent of the cases. Cucumber mosaic virus (CMV) was recovered in 10 percent of the isolations.

The effects of these two mosaics were studied in two separate ways, first in the field, using 5x5x2 foot 32x32 mesh saran screen cages to exclude virus transmitting insects, secondly in nutrient culture in the greenhouse. Field screen cages were placed over a standard cantaloup bed and the single plant in each cage was subjected to normal cultural practices. The cage provided a favorable environment for growth, since the plants inside grew better than those outside.

Plants in the greenhouse were grown in nutrient culture. In this case eight inch earthenware crocks were used with perlite as the solid inert aggregate. Plants grew well in this type of culture. Effects of pot binding, encountered when soil or soil mixes were used, was avoided. Fruit was set in both cases by bees introduced into the appropriate environment. Data include fruit weight and size, total soluble solids in the fruit, total fresh plant weight after harvest, length of the main runner, total number of leaves on the main runner, number of leaves on the main runner one half or more dead, and disease index based on the over-all condition of the plant.

Plants were inoculated when the main runners were between two and four feet long by rubbing the leaves with juice extracted from greenhouse grown plants known to contain specific viruses. Data, except for disease index, were taken at the completion of fruit harvest.

Plant Size Reduced

Data accumulated thus far have shown that a primary effect of mosaic infection is on plant size. Both WMV and CMV reduce fresh plant weight, with CMV being the most severe. Fruit size is also reduced. An important secondary effect in relation to fruit damage is related to plant size. Reduction of overall plant size means sparser foliage and consequently a reduction in the amount of fruit protection from the sun and hence more sunburned, unmarketable fruit. In cases of severe infections, marketable fruit may be difficult to find.

Time of mosaic infection is very definitely related to the amount of damage inflicted on the cantaloup plant. Very early infections during runner formation result in a runty, stunted plant that is unlikely to produce any marketable fruit.

Plants infected at a later stage, when runners are several feet long, are not so drastically affected, but yield of marketable melons may still be reduced 25 to 75 percent, depending on the virus involved and the time of infection. Very late infections, those that occur after fruit are well along to maturity, seem to cause virtually no damage although plants may show severe mosaic symptoms.

Control Difficult

Virus diseases are at best difficult to control. The most effective and easiest way is to use resistant or tolerant varieties. There are no available commercial cantaloup varieties, however, that are resistant or tolerant to mosaic infection. There are two other possible approaches to the problem. One is to control the aphids that are responsible for spreading the disease; another is to find and eliminate the most important source or sources of primary infection.

During the past several years attempts to control the aphids with insecticidal sprays, or influence their flight habits, have resulted in complete failure in affecting the thoroughness or rapidity of spread of mosaic infection.

The search for the primary mosaic virus sources is continuing. If, when found, the source can easily be eliminated, damage by mosaic viruses will be

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Dr. W. D. Pew, University of Arizona horticulturist and superintendent of the Branch Agricultural Experiment Station at Mesa, has achieved international note with publication of an article he had written in "Tierra", Mexico's national farm journal, published at Mexico City. The article, reporting on timing and quantity of irrigation of cantaloup, appeared under the title, "Cuando tan Importante como Cuanto en el Riego del Melon Cantalupo." The article first appeared in "Progressive Agriculture in Arizona."

UNTREATED potato plant, left, shows effects of psyllid yellows on top growth, also has poor tuber set. Contrast it with treated plant at right, with its healthy foliage and good tuber set.

Potato Research Is Spurred by Growing Acreage

W. D. Pew and Paul D. Gerhardt

Sharp increases in potato acreage in recent years indicate the immediate trends and importance of this crop in Arizona's vegetable industry.

In 1959-60 the state's total area devoted to potatoes was 9,713 acres. To illustrate the trends in production, in relation to the ultimate use of the potatoes, this acreage is divided as follows: red varieties for fresh market, 6,321 acres; white varieties for fresh market, 826 acres; varieties for processing—chiefly chipping—2,566 acres. It is estimated there will be a 15 to 20 percent increase in 1961 over last year's acreage, and almost all of this will be production for processing.

Effects of Certain Chemically and Mechanically Mixed Fertilizers on Yield and Tuber Size in Red Pontiac Potatoes

Treatment		Commercial Sizes or Grades			
		US No. 1A	US No. 1B	US Jumbo	
No.	Material	Number of 100 lb. Bags Per Acre			Total Marketable
1	No Fertilizer	129	20	1	150
2	Ammonium Nitrate÷ N. P. K.	201	9	4	214
3	20-10-0	207	14	3	224
4	10-10-0*	231	14	9	254
5	10-10-10*	213	11	10	234
6	16-20-0	230	16	22	268
7	16-48-0	252	17	6	275
8	11-48-0	259	18	18	295

*Mechanically mixed fertilizers.
÷Equivalent to 33-0-0

Although considerable research has been done with fresh market potatoes, chiefly in the phases of nutrition (fertilization), insect control, irrigation and quality control, little has been done in the production and handling of processing varieties.

Nitrogen, Phosphorus Value Proven

An appropriate review of the most recent work would require a comment on all the phases of production just mentioned. In the past, in trials with fresh market potato varieties, fertilization research has received the greatest effort. Findings from these tests point up the vital role of nitrogen and phosphorus in a fertilizer program. The importance of potash is not so clearly developed. At this point its use in fertilizers for this crop is questionable. In fact, the need for continued caution and a thorough understanding of potash is evident from these data.

In recent studies, nitrogen and phosphorus have each been applied at rates of 60, 120 and 240 pounds per acre. There were definite yield increases, with increases in phosphorus rates up to 240 pounds per acre. At low levels of phosphorus (up to 60 pounds per acre) no increase in production was noted even with high levels of nitrogen. Yet, at the high levels of phosphorus, a yield response to additional nitrogen was obtained. Highest production was recorded from the treatment receiving 120 pounds of nitrogen and 240 pounds of phosphorus.

Potash was also applied to certain of the high phosphorus-nitrogen treatments. The 200 pound rate of potash, even when applied in the presence of relatively high levels of nitrogen and phosphorus, seriously reduced the yields and cut the specific gravity to a level usually considered unacceptable. In the table you can see, in treatments 4 and 5, how potash resulted in a decrease in yield. From these data it appears that potash should be used only after considerable study.

The data in the table not only illustrate the need for adequate levels of nitrogen and phosphorus, but also an appropriate ratio. Note the progressive increase in yield as the ratio of phosphorus to nitrogen widens. Although the maximum increase is obtained from the 1 to 4 ratio, the most efficient level appears to be somewhere between the 1 to 2 and 1 to 3.

Place at Seed Level

Placement of fertilizer is an important consideration. It has been found that fertilizers for potatoes should be placed approximately at seed level and 3 to 4 inches to each side. Placing the fertilizer 3 to 4 inches to the sides and either above or more than 2 to 3 inches below the seed piece rendered it relatively ineffective. Fertilizers banded at deeper positions were almost totally ineffective.

Tests involving soil moisture levels show that, for the most part, irrigations in commercial fields are applied too frequently for best results. Maintaining the soil moisture at approximately field-holding capacity, the common commercial practice, not only cuts yield, but also reduces specific gravity and dry matter, causes large unsightly lenticels, and adversely affects shipping quality. Doubling the usual time between irrigations would do much to improve potato production and quality.

It has recently been found that the two major potato insect pests can be effectively controlled by a single application of phorate (commercially marketed as Thimet) applied in either of the fertilizer bands at planting time. This material not only controls potato psyllids and green peach aphids, but also thrips and leafhoppers.

Phorate, a systemic insecticide is relatively ineffective on potatoes until activated by the first post-planting irrigation and absorbed by the plants.

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greatly reduced. If the source cannot be eliminated, then still other means of control must be investigated.

Mosaic Not Sole Cause

These investigations indicate that the two mosaic viruses, alone or in combination, are not wholly responsible for crown blight. It is apparent that these diseases can reduce yields, but careful comparisons of healthy and diseased (mosaic) cantaloup plants, both in greenhouse experiments and field cage experiments, have failed to show any correlation between mosaic diseases and any of the many symptoms described for crown blight.