New Variety of Canning Tomato

recommended for trial where Verticillium wilt is serious

J. W. Lesley and John T. Middleton

TOMATOES GROWN IN CALIFORNIA are likely to become affected with either Fusarium wilt, caused by the fungus *Fusarium oxysporum* f. *lycopersici*, or Verticillium wilt, caused by *Verticillium albo-atrum*.

Fusarium wilt has long been known to be an important disease of tomatoes.

The importance of Verticillium wilt was not recognized until 1931 when it was determined that tomatoes grown in the Santa Clara Valley were infected with the fungus responsible for Verticillium wilt. Since then Verticillium wilt has been found in the Great Central Valley, the south coastal plain, and in some intermediate inland areas, notably the Simi and Santa Rosa valleys of Ventura County.

The leaves of tomato plants affected with either Fusarium or Verticillium wilt turn yellow, wilt, become brown, and then may fall off. A brown discoloration develops in the woody tissue of the root and stem. Wilting may not occur in plants infected with Verticillium under moderate climatic conditions, but other symptoms of infection may be noted, namely premature browning of the leaves, loss of most of the crown foliage, and subsequent reduction in fruit yield due to the production of small-sized fruits and loss from sunburn damage.

Definite identification of the disease should be based upon the isolation of the causal fungus from infected tissue, as positive diagnosis of either disease is not possible solely from symptoms.

Some varieties of the common tomato *Lycopersicon esculentum* are moderately resistant to Verticillium. Pearson, which originated at the University of California and is very extensively grown in the state, is less susceptible than Norton or Marglobe. Santa Clara is also somewhat resistant, as is Essar, a variety of a similar type selected especially for quality and resistance to this disease. The Riverside variety — which originated from crossing Cal. 2, a selected line from San Jose Canner, with large regular fruit, and Marvana—is somewhat resistant both to Verticillium and Fusarium wilt. None of these varieties has sufficient resistance to produce a heavy crop of large-sized fruits under field conditions favorable for the development of Verticillium wilt.

In 1939 a cross was made between Riverside and N.D. 216–2–3, a very fruitful early ripening variety with uniform green immature fruit and determinate growth, from North Dakota. An F_3 plant was crossed with a plant which originated from an F_2 plant backcrossed with Riverside. It was hoped from this cross to select a variety somewhat more resistant to Verticillium wilt than Riverside, with large fleshy fruit, less white core tissue than Pearson, and highly productive. After selection for these qualities in families consisting of from 16 to 176 plants obtained by selfing for seven generations, has come a new variety named Simi.

Two generations of plants grown at Riverside were artificially infested with Verticillium and Fusarium before planting but the last four generations were planted in a field at Simi known to be naturally infested with Verticillium.

Planting in this infested soil at Simi generally caused severe disease in susceptible varieties, although the severity varied from year to year, and was more effective than field tests in artificially inoculated soil at Riverside.

The Simi Variety

At Simi, in infected soil in 1944 and 1945 the Simi tomato gave a better yield and had larger fruit than Pearson.

In a canning test the Simi variety was good in color and wholeness; opinions as to flavor, however, ranged according to personal preference.

The Simi variety may briefly be characterized as having a fruit similar in appearance and time of maturity to Santa Clara but a "semideterminate" vine and greater resistance to Verticillium wilt.

Simi and Pearson are probably similar in tolerance to Fusarium wilt. It is promising as a canning tomato for the Simi Valley and other places adjacent to the coast and perhaps for the Sacramento Valley where Verticillium is a serious disease. At Riverside, where Verticillium is not abundant in the soil, Simi is probably less productive than Pearson.

The vine of Pearson is determinate so that terminal growth ceases beyond about the 12th–16th node and only one or two nodes occur between adjacent inflorescences. The semideterminate character of the Simi is due presumably to the shortness of the internodes, the slowing down of the terminal growth as soon as fruit sets on the lower inflorescences, and the determinate character of some branches. As a rule three nodes occur between inflorescences. The shape index of the fruit, mean diameter ÷ length from attachment scar to stylar end, is about 1.23. The immature fruit is uniformly green as in the parent variety N.D. 216–2–3. The number of loculi is from seven to 12 and the seeds relatively few.

The amount of white vascular tissue or core in the fruit is considerable but is much less in fully ripe fruit and not as much as in Pearson. The keeping quality of the fruit grown at Simi was very good. From small plantings it appears that the fruit was more irregular in shape especially from the first picking on the coastal plain than in the Simi Valley. This new variety is recommended for trial as a canning tomato especially if Verticillium wilt is a serious disease.

The genus *Lycopersicon*, to which the common tomato belongs, contains five other species. In two of these species, which grow wild in South America and can be crossed with the common tomato, a greater degree of resistance has been found to Verticillium wilt than in the common tomato.

Three races of *L. hirsutum* were tested and two had mild symptoms and the third none. F_1 hybrids of the common tomato and a subspecies of *L. peruvianum* showed darkening of the vascular tissue but no other wilt symptoms. Hybrids between the common tomato and these wild species were backcrossed to the common tomato for four generations followed by selfing.

Several determinate and indeterminate plants with fruit similar in appearance to cultivation varieties produced good crops in soil heavily infested with Verticillium wilt. Their progeny will be tested in the future.

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The canning test mentioned in the foregoing article was made by G. C. Hanna, Associate Olericulturist in the Experiment Station, Davis.

Small samples of the Simi tomato seed may be obtained without charge from the Division of Plant Breeding, Citrus Experiment Station, University of California, Riverside.

The biochemical aspects of research in tracer studies, artificial radioactive elements and stable isotopes are under active study by the Division of Plant Nutrition.

IRRIGATION

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a depth of about six feet, the trees and vines probably will come through the season without serious damage, but the current season crop may be reduced.

We suggest that the first irrigation be applied now if the rainfall has not been enough to wet the soil to a depth of about six feet.

If water for only one additional irrigation is available, a second watering, for fruit trees, should be given about the latter part of June.

Our experiments show that it is best to keep the trees and vines supplied with water early in the season. Lack of water is more injurious in early season than in the fall, although a continuous supply of readily available water at all times is most desirable.

Economizing

Economy in the use of water by annual crops may also be obtained by applying the principle that satisfactory returns can be obtained by delaying irrigation until the soil moisture is reduced close to the permanent wilting percentage.

For example, in the Sacramento Valley it is possible to raise as large a crop of sugar beets with three irrigations of eight acre-inches each as with more frequent applications, provided the soil is wet to a depth of about six feet by rains.

Cotton usually is irrigated very frequently, but good crops may be obtained with one or two irrigations in addition to the preplanting irrigation.

Watermelons on deep loam or clay soils may not need irrigation if the soil is wet deeply before planting, but cantaloupes which are not so deep rooted as watermelons, probably will need irrigation during the growing season.

Tomatoes, a deep rooted crop, likewise may be raised with one or two irrigations on deep fine textured soil.

Suggested Practices

The suggestions made may be summarized briefly as follows:

Do not plant annual crops unless an assured supply of water is available.

Remove all weeds, but do not waste time and effort cultivating in their absence.

Put water on in one application to wet to the full depth of rooting rather than giving frequent applications with shallower wetting, thus reducing waste.

Delay irrigation until the soil moisture is reduced to about the permanent wilting percentage, taking into consideration the size of the stream available and the acreage to be irrigated.

With a limited supply of water, irrigate in the first part of the season to keep the crops supplied with readily available moisture, because lack of water is more injurious in early summer than late in the fall.

Find out how much water in depth of application is required and how frequently it should be applied for each crop. Material savings may be made by reducing the frequency of irrigations.

Farm advisers have bulletins and detailed information concerning the depth of rooting and irrigation of various crops.

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QUICK DECLINE

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all probability, be found to be carriers of the quick decline virus.

Progress has been slow because symptoms do not appear on one- to two-year-old trees until 15 months or longer after inoculation. Smaller trees are now being used in certain experiments. A sweet orange top is grafted onto sour orange seedlings having trunk diameters of from one-eighth to one-quarter inch.

Such trees can be prepared in a relatively short time and it is hoped that after being inoculated they will show symptoms quicker than the larger trees.

Seek Virus Carriers

In the late summer of 1946, graft-transmission experiments, started in June of 1945, showed conclusively that quick decline is a virus disease.

A study, commenced two years before it was known that quick decline was a virus disease, discovered that more than 225 different species of sucking insects were present in affected areas. Perhaps not more than one species will be found to be capable of transmitting the virus. Extensive experimental studies are thus necessary to determine the role of insects in the spread of quick decline.

In order to establish ideal conditions for experiments involving insect carriers of virus, the Riverside Experiment Station erected a "screen house" at one of the experimental plots within the quick decline area. The screen is small enough to filter out practically all insects that could cause infection. Controlled inoculation tests are now being conducted by entomologists of the Citrus Experiment Station.

Similar Disease in South America

Experiments in Brazil have indicated an aphid to be the virus carrier of the disease, Tristeza, which is similar to the California orange tree quick decline.

An aphid closely related to the Brazilian carrier is present in California and efforts are being made to determine if this insect may be causing spread of the quick decline virus.

Other insects, particularly several other aphids and leaf-hopper species, are also being tested as carriers.

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PUNJAB FLAX

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Harvesting

To windrow the flax and later thresh with combine equipped with pick-up attachment, or to combine the standing grain direct, is a question on which there is divided opinion among growers and threshermen alike. Naturally, there are both advantages and disadvantages to each method. Both methods are extensively used. In many cases, circumstances force the decision, for if the flax contains any appreciable amount of green weeds it cannot be threshed standing.

Only clean fields of mature dry flax, or ones in which the weeds and flax are both dry, can be direct combined. If conditions are favorable to direct combining, the cost of windrowing is avoided. On the other hand, dry standing flax is susceptible to loss by wind damage which in many cases more than offsets the cost of windrowing.

If windrowed, the flax should be cut as soon as the seeds are botanically ripe. This occurs several weeks before the plants are dry enough to permit direct combining. At this stage, no loss of seed from shattered bolls will have occurred. Windrowing also permits harvesting early enough to destroy most summer-growing weeds before they mature their seeds to infest the soil. Other advantages of windrowing are the more favorable weather conditions—less humidity—for threshing early in the season, and earlier use of the land for the summer rotation crop.

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Improvement in the technology of preservation of fruit juices by freezing, particularly control of the enzymes responsible for the curdling of frozen juice, is under study by the Division of Food Technology.