Citrus Replant Seedling Tests

trifoliate orange rootstock shows better growth in old citrus soil than other seedlings included in replant problem study

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The citrus replant problem varies greatly in severity in different soils and areas. Part of that variation appears to be related to the rootstock originally grown on the soil and the nature of the rootstock used for replanting.

Greenhouse studies to gain more information on rootstock effects—as related to the citrus replant problem in general—are under way.

For one test, old citrus soils were obtained from two locations—Fullerton and Santa Paula. In previous studies, sweet orange and sour orange seedlings had grown very poorly in both soils. For comparative purposes, soil from a walnut grove near Santa Paula was used. The three soils were placed in three-gallon pots and each cropped for seven months to six different rootstock seedlings.

All the seedling varieties grew better in the walnut soil than in the old citrus soils. The relatively depressed growth in the old citrus soils was greatest with Cleopatra mandarin, Sampson tangelo, pink Shaddock, and sweet orange seedlings, and least with the Troyer citrange seedlings. Examination of the roots at harvest time indicated that all of the seedlings in the old citrus soils were heavily infested with the citrus root nematode.

Growth of Various Citrus Rootstock Seedlings in Old Citrus and Noncitrus Soils

Soil	Avg. dry wt. per pot of plants											
	Sour or.		Sweet or.		Sampson tang.		Cleopatra mandarin		Pink Shadd.		Troyer citrange	
	Wt.	Red.*	Wt.	Red.*	Wt.	Red.*	Wt.	Red.*	Wt.	Red.*	Wt.	Red.*
	g	%	g	%	g	%	g	%	g	%	g	%
Old citrus soil from Fullerton	30	30	19	60	13	54	9	62	11	71	11	42
Old citrus soil from Santa Paula	24	44	18	62	6	79	8	67	17	55	16	16
Walnut soil from Santa Paula	43	..	48	..	28	..	24	..	38	..	19	..

* Growth reduction based on weight of plants in walnut soil.

For a second test, soil from the Vista area, which had never before been planted to citrus, was obtained. Two eight-month crops of each of five rootstock seedlings were grown in different lots of the soil. Each portion of soil cropped to a particular variety was then mixed, repotted, and seedlings of all the varieties in the test planted—two seedlings per pot—in replicas of five. Inorganic nitrogen was adjusted to 100 parts per million—ppm—in the soil, and the plants grown for eight months. For com-

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Effect of previous cropping of a soil from Vista to Rangpur lime seedlings on growth of: *left*, sour orange seedlings; *Center*, Troyer citrange seedlings; and *Right*, Cleopatra mandarin seedlings.

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parative purposes, each seedling variety was grown in the original soil adjusted to 100 ppm inorganic nitrogen. The reduced growth effect of the previous cropping to citrus on the seedlings varied from 0% to 88%. The magnitude of growth reduction varied with the rootstock grown for both the final and the previous croppings.

Previous cropping to trifoliate orange seedlings exerted the least depressed growth effect, followed by Cleopatra mandarin, Troyer citrange, Rangpur lime, and sour orange in ascending order. Trifoliate orange also grew best—relative growth—as a replant. It was followed by Troyer citrange, sour orange, Rangpur lime, and Cleopatra mandarin. The third crop of trifoliate orange seedlings grew just as well in this soil as did the first crop. Except when following trifoliate orange, Cleopatra mandarin grew very poorly, especially following sour orange and Rangpur lime. At harvest time, the roots of Cleopatra mandarin showed considerable decay. The roots of other seedlings showed only slight to moderate root decay.

The second test was repeated using a walnut soil from Santa Paula. Trifoliate orange seedlings grew rather poorly in this soil and were therefore replaced by sweet orange seedlings. Previous cropping to Cleopatra mandarin exerted the least reduced growth effect on subsequent plantings of the other seedling varieties, but this rootstock made the poorest growth as a replant seedling. As in the previous soil, the roots of the Cleopatra mandarin showed considerable decay. The soil was examined for citrus root nematode and for *Phytophthora* spp. with negative results. Apparently other organisms caused the root rotting.

After the third cropping, the soil was mixed, repotted, and planted to a variety of crops. The original walnut soil was used as a check. All noncitrus crops grew just as well in the soil previously cropped to citrus seedlings as in the original walnut soil. Two crops—rye and brome grass—grew better in the old citrus soil. This indicates that the reduced growth factors were probably specific for citrus.

Leaf and feeder root analyses of the seedlings for nitrogen, calcium, magnesium, potassium, sodium, sulfur, chlorine, phosphorus and manganese showed no significant differences attributable to previous cropping history.

Observations

Trifoliate orange seedlings reduced growth of subsequent plantings of several seedling varieties less than did sour orange, Troyer citrange, Rangpur lime, or Cleopatra mandarin, and also grew better than these varieties as a replant. Troyer citrange grew relatively well as a replant but greatly reduced growth of the other seedlings planted following it. Cleopatra mandarin exerted less of a reduced growth effect on seedlings that followed than did sour orange, sweet orange, Troyer citrange, or Rangpur lime seedlings, but was itself the poorest replant seedling following all the seedling varieties tested.

These studies involved the use of rootstock seedlings only, but the nature and selection of the bud no doubt could exert marked effects on the performance of the rootstock.

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TOMATOES

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of the plant breeder, many of the undesirable or defective traits of the tomato behave as if completely or nearly completely recessive. If one line with a defect is crossed with another line in which the desired alternative trait is present, the hybrid usually bears the desired trait. This pattern of inheritance has been found in the following undesired traits: *1,* poor fruit-setting ability; *2,* large core; *3,* rough or grooved fruits; *4,* nipple formation at stylar end of fruit; *5,* softness of fruit; and *6,* susceptibility to blossom-end rot. On the contrary, a few traits, such as compact determinate habit, were observed to behave in opposite fashion. Disease resistance is often inherited as a dominant condition, thereby suggesting a way for improving future tomato hybrids. The F_1 hybrid breeding technique therefore provides a unique opportunity for achieving in one generation improvements that would require much more time and would be more difficult with other breeding methods.

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PACKING

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per season are increased. For example, in a plant of 40,000 pounds per hour capacity, costs with 100 hours of operation per season average about $10.80 per 1,000 pounds but drop to $6.50 per 1,000 pounds with 400 hours of operation per season. The decrease in average costs results from spreading the fixed costs of equipment over a larger annual volume as hours of operation per season are increased.

While substantial economies are indicated through increasing hours of operation per season, the possibilities of this kind of adjustment are limited in some respects. With no storage of field-run fruit—for later packing—the length of operating season is, for practical purposes, limited to the harvest period. Variation in season hours is then possible only through variation in hours of operation per day.

Extension of hours of operation beyond the customary eight hours per day is possible through operation on an overtime or double shift basis. If a 50% higher wage is paid for overtime work—as is required in many plants—costs will be higher than with straight-time operation unless the season is short—less than 25 days—and the season volume is less than five to seven million pounds. Double shift operation might be feasible in some areas. Even with the payment of a 10% higher wage for the second shift and allowance for increased storage costs for incoming fruit, potential savings for the industry with double shift operation would amount to approximately $160,000 per year.

While some of the potential savings could be achieved in the short run, most of them involve changes in durable facilities which would be economical only as existing facilities are worn out. As a practical matter, it is likely that only a part of the possible savings can be attained. However, a substantial cost reduction could be realized.

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