CITRUS ROOTSTOCK PROBLEMS IN FLORIDA

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TEN YEARS AGO we had no particular rootstock problem in Florida. Rough lemon was used almost exclusively for groves on deep sandy soils, and sour orange for groves on moist, heavy soils. Not everyone was wholly satisfied with this situation, especially as regarded Rough lemon, since it did not produce fruit of satisfactory quality for the fancy fruit trade in the case of the specialty fruits — Temple orange, Thornton and Minneola tangelo, etc. The sour orange stock which gave high quality did not produce satisfactory yields on the light sandy soils, while Rough lemon yielded well. Also, kumquats did not find sour orange a congenial stock. So there was a small usage of Cleopatra mandarin as a stock for kumquats on low ground and for Temples and tangelos on the sand hills. But for oranges, grapefruit, and tangerines, there was rarely any rootstock used except Rough lemon or sour orange, and these gave satisfactory fruit quality for the fresh market under proper fertilizing programs. Such problem as there was consisted in selection of a rootstock adapted to the scion variety and to the soil conditions.

Today the situation is radically different, and the old certainties are gone. We have no rootstock which is wholly satisfactory. Three factors have entered the picture since 1945 to cause this change: virus diseases, nematodes, and frozen concentrates. Not all virus diseases affect the choice of rootstocks, psorosis being the most prominent example of such independence, but tristeza, xyloporosis, and exocortis raise serious rootstock problems.

Tristeza first attracted attention in Florida in 1945, at which time there was no suspicion that this disease was present anywhere in the United States. By 1951 it was realized that the "quick decline" which had increasingly worried California orange growers for the past decade was

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the same as tristeza, but we still felt safe in Florida. In the spring of 1952 we were startled to learn that a mild form of tristeza had been found in Florida and it was soon evident that it was widely distributed although not virulent.

As you are well aware, the tristeza virus causes decline and eventually death of sweet orange, grapefruit and tangerine scions on certain rootstocks, notably sour orange. Thus far in Florida no harmful effects have been seen in trees of these scion types on any rootstock except sour orange, although the presence of the virus has been shown in trees on other stocks. However, some 25% of Florida citrus is budded to sour orange, indicating about one-fourth of the industry being located where this stock is best adapted, and now we hesitate to bud any more trees on it.

Rather complete information is now available on the suitability of various stocks for use with tristeza-infected scions. For oranges and mandarins, we know that sweet orange, mandarin, Rough lemon, sweet lime, Rangpur lime, trifoliate orange, and some tangelos are safe to use. Not all of these are adapted to the soil conditions where we need a substitute for sour orange, and only Cleopatra mandarin seems likely to be satisfactory thus. No stock has yet been found which is tolerant for tristeza virus in grapefruit scions, but the stocks which are tolerant for oranges and mandarins permit the grapefruit tops to live long, even though lacking vigor. Thus far there have no serious effects of tristeza in grapefruit trees on any stocks, but we do not know when the mild strain of tristeza now present in Florida may become more virulent or another and virulent strain may prove to be present.

Xyloporosis, also called cachexia, is a virus disease which has attracted less attention than tristeza because it has not wiped out citrus trees extensively anywhere. It was known only as a disease affecting oranges on sweet lime stock in Palestine in the 1930's, but later was found in Brazil when careful study was made of virus diseases there, and was discovered in Florida in 1950. Here it has been serious chiefly as a disease of the Orlando tangelo on any stock, but since this is a very minor variety, the disease has not caused much concern. Recently, however, it has been shown that the virus is widely present in sweet orange and grapefruit trees and that on some stocks it causes severe injury to these tops. Sweet lime (also called sweet lemon)

is the most important of these stocks, but most tangelos are also susceptible and so is calamondin.

Exocortis is a virus disease affecting only trees on trifoliate orange stock or some citranges. We know only rare cases of its presence in Florida now, but it has caused much injury in Australia and may be here unrecognized or may be introduced carelessly. Since trifoliate and its hybrids have value for clay soils chiefly, which are scarce in the citrus area of Florida, exocortis is less of a problem in Florida than in California.

It should be mentioned at this point that there is a way to avoid trouble from the last two virus diseases, xyloporosis and exocortis. They are transmitted only by buds, so far as we know, and if buds are taken only from trees known to be free of the virus, the disease cannot develop. A program of bud certification has been started in Florida. Unfortunately it is of little value for tristeza control.

The burrowing nematode is the latest of the serious citrus pests to be identified in Florida. Only last year was it finally discovered that the cause of the "spreading decline" which had been causing increasing concern for a decade was a nematode infesting the roots. It is widely distributed and so no sort of quarantine can be applied, except as efforts are successful to prevent further spread in individual groves by barriers of soil drenches. Thus far no rootstock has been found to be resistant to its attack, and so from one aspect this is the most serious rootstock problem of them all. I understand that one or two seedling citrus trees of uncertain classification have been found in healthy condition where other trees are dead or dying all around them from this pest, and this gives encouragement that eventually there may be found a rootstock which is both resistant to this nematode and otherwise satisfactory for use with commercial citrus varieties.

Lastly we come to the matter of concentrates. The development during the past decade of satisfactory methods of producing a frozen orange juice concentrate which closely resembled fresh juice when reconstituted with water was a great boon to the Florida citrus industry. Today about two-thirds of the orange crop goes into cans, and 70% of the canned juice is frozen concentrate. Now it costs more to concentrate juice of low solids content than juice of high

solids. This puts a premium on fruit of high solids content, and this in turn affects the choice of rootstock. For the fresh fruit market the fruit produced on Rough lemon stock properly fertilized is quite satisfactory, and the consumer is quite satisfied. But the slightly lower solids content of fruit on Rough lemon than on sour orange stock becomes important in terms of cost of processing. We really need to find a stock which will approximate the yields of Rough lemon on our prevailingly deep sands and yet will approach the fruit quality of sour orange stock. Cleopatra mandarin seems most likely to do this of any stock resistant to tristeza, although sweet orange gives almost as good results.

A brief summary of the good and bad points of the leading citrus rootstocks may be of interest. The percentage of nucellar seedlings is an indication of how little culling of off-type seedlings will be needed in the nursery row for uniformity.

ROUGH LEMON — from 90 to 100% nucellar; least hardy to cold; only a little less subject to gummosis diseases than sweet orange; fully resistant to tristeza, and xyloporosis; makes good union with all kinds of citrus scions; very rapid in growth and makes a large tree with heavy yields on light sandy soils; fruit quality lower than on any other stock, although satisfactory for fresh market under proper fertilization.

SOUR ORANGE — from 70 to 80% nucellar; quite hardy to cold; resistant to all gumming diseases and xyloporosis; subject to scab and very susceptible to tristeza; makes good union with orange, mandarin, and grapefruit, but overgrows scion often with lime and lemon, and does not unite well with kumquat; fruit quality is excellent for all kinds of citrus, but trees are small and yields poor on deep sands.

CLEOPATRA MANDARIN — from 80 to 100% nucellar; next to sour orange in cold hardiness; resistant to gumming diseases, scab, tristeza, and xyloporosis; makes good union with all kinds of citrus; slow growing in nursery and delayed in bearing somewhat, but within 10 years this has been overcome in both size and yield on deep sandy soil; fruit quality is very good, although there are some reports of small fruit size.

SWEET ORANGE — from 70 to 90% nucellar; between Cleo and Rough lemon in cold hardiness; quite subject to gumming diseases; resistant to scab, tristeza, and xyloporo-