ROOTSTOCK SHORT COURSE

11:30 & 1:00 Discussion
Tuesday, September 25

Questions for Dr. E. C. Calavan, Professor A. A. Salibe and Dr. S. Garnsey

question: E. C. Calavan: How much is known about alternate hosts for greening disease?

answer: I am afraid not very much is known. have heard that greening can affect other members of the *Rutaceae.*

question: E. C. Calavan: Is there much known about vectors which can transmit the disease?

answer: I was told that at one time in India there is a leaf hopper vector in addition to the regular insect vector. Also, I have heard the insect is able to transmit the South African type of greening. There may be other vectors but if so they haven't really been described.

question: E. C. Calavan: What do you consider to be the probability of moving some of these diseases that we apparently don't have now into our country with seed or ornamental plants?

answer: With seed it might be possible to bring in some of the diseases but the viruses do not go through the seeds, with the exception of some forms of psorosis. We have been working on the possibility that stubborn disease might be transmitted through the seed because it can be easily isolated from the seed coats. However, they have not found it in thousands of individual seedlings which have come from plants with the disease. As far as ornamentals are concerned, there really hasn't been much work done on this subject. To determine which ornamentals might carry citrus diseases, at the last IOCV conference there was a report from Brazil that showed that a species of *passiflora* can carry tristeza. But in general, there is not too much hazard. However, it has been shown that the exocortis of citrus is the same disease of spindle tuber of potato.

Dr. S. Garnsey also answers: We do know that many of the citrus viruses, at least the ones which are mechanically transmissible will go to herbaceous plants such as bean or tobacco and of course there is always the possibility of moving the disease in this fashion.

question: E. C. Calavan: Dr. Calavan showed us pictures of 'Troyer' citrange getting tristeza and Professor Salibe shows that it is resistant. Can you eliminate the confusion?

answer: That's correct. In Ventura county in California. 'Troyer' citrange does react to tristeza, but the virus is not going into the 'Troyer' too well. Apparently the disease only manifest itself under a particular set of environmental conditions.

Professor A. A. Salibe answers also: As you know, viruses can mutate from day to day and perhaps this will offer some explanations for the discrepancies. Therefore, what we list as tolerant today, tomorrow may not be.

question: Are there any biological enemies to tristeza or other virus diseases?

answer: E. C. Calavan: We don't have any predators or anything like that. Perhaps the best biological enemy is to use a mild strain of the tristeza for cross protection.

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answer: S. Garnsey — I think that is correct. We believe that not only can we use tristeza for cross protection but there is also a possibility of using mild strains of exocortis for this purpose also. However, you do not get strain interference with exocortis inoculation. That is to say that mild strains of exocortis will absolutely give no protection against inoculation of the severe strain of the disease.

question: A. A. Salibe: — Did I understand you to say that this mutated form of tristeza will attack sweet orange seedling,too?

answer: — Yes, this type of tristeza is specific for sweet orange but if you inoculate 'Mexican' lime you can get the same result as with the common strain of tristeza.

question: A. A. Salibe: — One of the audience wants to know about the cross-protection program that is being instituted in Brazil.

answer: — I feel that the cross-protection is one of the more important advances we have in virus disease control in the citrus industry in the world today. As you know, plants do not produce antibodies as such and is therefore impossible to vaccinate a tree against a given disease, however, we can use the interference mechanism whereby the cell invaded by a mild strain will prevent penetration of a severe strain. Personally I am afraid cross-protected trees may get infected during warm spells during the summer when flushes of growth are being produced which will not contain the mild strain of the virus disease. However, overall it is working beautifully and many groves in Brazil are being planted with the help of cross-protection techniques.

question: A. A. Salibe: — Are trees more susceptible to viruses which are nutritionally deficient or in other words does the disease manifest itself at an early age and nutrition deficient trees than it would in normal healthy trees which are in good nutritional status?

answer: — I can think only from what I have seen of tristeza in South America and generally speaking, the more fertilizer you apply the better the trees will look.

question: A. A. Salibe: — Do you feel that there is a chance that if we inoculate trees with a mild strain of a virus then it might later mutate within the plant and have a more virulent form?

answer: — I think that this possibility does exist but in the plantings we have cross-protected we have not observed any of this as of yet.

question: A. A. Salibe: — How long have cross-protected trees been used experimentally in your country?

answer: — We have had experimental plantings in now for between 10 and 12 years. The first commercial orchards have been planted now about 3 years.

question: S. Garnsey — Why have we in Florida not been able to obtain cross-protected trees as of yet?

answer: — We have done some work on cross-protection but there are some problems associated with it. One of the experiments that we had is now under a navy base exchange, in other words, the navy has taken over the property, bulldozed the grove and put buildings on the property, shortly after it became 4 years old. One of the problems we have in Florida is that it is difficult for us under our conditions to give these trees a severe challenge, in other words the inoculation of a really virulent form of the virus. Of course, in Brazil the severe strains is endemic and this is not a problem there. However, we are very hesitant to bring virulent forms of the virus into Florida for testing. We do have

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some strains in Florida that we feel like would give us protection but until we could bring in a severe strain of the virus to really test it this cross-protection factor will remain unknown.

question: S. Garnsey: How many strains of tristeza virus do we have in Florida, all 3 of them or another number?

answer: Apparently the strains exist in different proportions in different plants and if you want to count these different mixtures of strains there are an infinite number of strains of the virus disease.

question: E. C. Calavan: I'm not really clear on the status of tristeza as it relates to lemon on macrophylla rootstock.

answer: The problem occurs when the macrophylla rootstock is subjected to tristeza prior to placing the lemon bud on the rootstock.

question: S. Garnsey If the cross-protection program in Brazil is satisfactory, what sort of problems might we encounter trying to bring isolates of a good sound cross-protection strain into the United States?

answer: It is really not a question I can answer, it would have to be a decision of the Florida Department of Agriculture, but I believe it is possible if you could show that no harm would result from bringing the isolate in. The biggest problem comes in the hazard of moving the material (which would probably be present in citrus tissue) from one area to another, in bringing in some other sort of disease or insect pest that could cause serious problems. I really believe that we have all of the tristeza isolates that we need in Florida already.

question: A. A. Salibe: Can you explain why there is so little stem pitting in Argentine citrus although it has had tristeza as long as Brazil?

answer: It probably relates to the selection of budwood for the orchards in the different countries although I cannot say specifically this is probably the answer. I have reports that indicate stem pitting in grapefruit is just as bad in Argentina and Paraguay and Uruguay as it is in Brazil, however.

question: A. A. Salibe: Do you try to do anything in Brazil to control aphids to help prevent the spread of tristeza?

answer: No, some growers will spray but usually they will just pray for rain because usually after it rains the aphids will die. I don't know if it is the rain itself or some disease that comes up after the rains come but the rain will surely eliminate the population of aphids from young orchards.

question: S. Garnsey: With growers making rapid change from rough lemon to sour orange in light of the young tree decline situation just how much of a hazard do we in Florida have here from tristeza?

answer: There is definitely a hazard and this has been demonstrated in a few areas of Florida already. The first, of course, is around Elfers and the other in the Auburndale area. I would not recommend you use sour orange unless you just have to.

question: I can recall having set at a meeting similar to this in 1948 and having been told approximately the same thing. In other words, we are going to lose all of our trees on sour orange to tristeza, yet in Texas 99% of the trees are planted on sour orange there and in Florida better than 50%

are planted on sour orange and I still see no disaster. Do you think perhaps the people who did not listen to this and went ahead and planted their trees on sour orange might be making more money today as a result of this than did those growers who listened to this sort of talk? Recommendations have to be made very carefully upon the individual estimate of ones own risk. Do they not, Dr. Garnsey?

answer: S. Garnsey: I would agree with that. Everybody wants to get the perfect rootstock but unfortunately we don't have that kind of answer. There are certain good characteristics of each and certain bad characteristics of each and sometimes to get tolerance to a given disease we may swap this tolerance for several bad characteristics. It is just a matter of personal judgement.

answer: A. A. Salibe: In Texas they do not have a vector transmission of tristeza. In Florida we do have insect vector transmission and the larger the pool of inoculum that we accumulate the greater will be the risk of insect transmission and infection of non-infected trees. Also, young trees are far more apt to be susceptible because they are constantly growing and are under attack by aphids more frequently than are the older, mature trees which probably wouldn't be affected as seriously anyway if they did contract it. I would never plant trees on sour orange.

question: S. Garnsey: Do you feel we have over-reacted seriously to the young tree decline problem in virtually eliminating rough lemon from consideration as a citrus rootstock in Florida? As I understand the movements of the citrus nursery stock on the rough lemon is down to only about 4% of the total planting. To the individual grower the problem is quite severe but to the uninitiated it is difficult to see the impact of this disease.

answer: It is really hard to say because it is difficult to assess what this is going to do in the ridge area. However, in the flatwoods I have seen groves pretty well wiped out and I would be hesitant to recommend the use of this stock in that particular area. On the ridge where the rough lemon is well adapted you would have to weigh the positive benefits of using the rootstocks against the possibility of the disease before making a decision. Certainly you can make a stronger case of rough lemon on the ridge then you could in the flatwoods. Dr. Cohen added an additional comment: I think perhaps we have over extended a bit on rough lemon but certainly if I had a grove in Lake County that had to be replanted for some reason or another I would certainly consider planting at least a portion of the grove on rough lemon rootstock but I would be hesitant even then to place the entire grove on rough lemon.

question: I would like to ask each of the gentlemen what they would use for a rootstock if they planted 'Marsh' grapefruit on one each from California, Brazil and Florida?

answer: E. C. Calavan Will you speak for that question, Dr. Bitters? Dr. Bitters: We would probably recommend planting it on 'Troyer' citrange.

answer: A. A. Salibe: All Brazilians want to plant a little bit of 'Marsh' grapefruit so I'm asked this question almost every day. If we had a good nucellar line I would recommend planting it on 'Rangpur' lime but since we do not have a good nucellar line I would recommend the use of sweet orange as a rootstock. We have tried to use rough lemon but the fruit has been of very poor quality.

answer: S. Garnsey I would like to turn the question around and ask what would be wrong with Cleo? This variety has really no serious problems but from disease standpoint, however, it may have some problems with yield and fruit size.

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question: S. Garnsey: How extensively have you experimented with the old bittersweet orange?

answer: All of the true sour oranges, of which bittersweet is one, do not vary appreciably in their tolerance to tristeza. Certainly within the different groups or clones there are differences with disease tolerance, however, as far as classifying them this work has just not been done in Florida. Maybe one of the rootstock people would like to comment on that.

Dr. Cooper answers: As far as grapefruit on sour and bittersweet they are the same in Texas. There is no difference in quality or anything else.