problems in California. The quality of this research in citrus is probably unsurpassed in any other citrus producing area of the world. Our fruit producers are seeking better methods of production along with a demand of nurserymen to improve their product by maintaining trees which have true-to-type fruit characteristics and which are free of virus, mutation, disease and injurious nematodes.

We, as nurserymen have voluntarily instituted our present programs and will endeavor to exert progressive methods to produce pathogen — free and virus-free trees as present day practical research dictates. I have purposely refrained from explaining any details of the technical, operational aspects of the citrus certification program. However, if there is an interest among this group I will be happy to try giving an explanation of our program.

MODERATOR LUVISI: Thank you, Roger. Our last panel member was introduced earlier this morning. He is Mr. Herb Swim and I quickly conclude that he is the granddad of the panel with 33 years of experience. He will talk to you about the "Improvement Program for Roses". Herb.

IMPROVEMENT PROGRAM FOR ROSES

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We who are involved in a commercial breeding program for roses must be conscious of those factors which hinder the ever-widening use of roses. We also must be thinking about those qualities that may stimulate new interest among those who may or do use roses. All rose breeders are especially sensitive to such spectacular factors as a "new color break" because they know it will attract attention from those who already like roses.

We have become increasingly conscious in the last few years of a phrase which we now know is being uttered too often. The phrase goes something like this: "I don't like roses because they are too much trouble." When we get this clarified, we find that "trouble" means spraying for various types of pests, in about 90% or more cases. It seems dubious that the plant breeder can do much about breeding roses resistant to insect pests, but it certainly is feasible for us to consider and hope for results in breeding for disease resistance.

We have become increasingly aware that the rose varieties we get from the better European rose breeders for test in the United States show an increasing advance in resistance to powdery mildew (*Sphaerotheca pannosa rosae*). It is quite understandable that with their conditions of higher humidity and frequent rainfall throughout the growing season that European breeders and distributors would find powdery mil-

dew a most troublesome disease (one that they have had to do something about).

Looking backward to those varieties introduced 30 to 40 years ago, we become conscious of the progress made for mildew resistance as a result of selection, if not from a conscious design to breed resistance to powdery mildew into our rose strains. With the increasing variety of garden roses with proven ability to resist mildew, there is going to be less and less excuse for the rose breeder to produce varieties that are mildew susceptible 10 years hence. (One must remember that the breeding work done today can only result in an offering to the public 10 years away.)

A more difficult task is the breeding of acceptable modern day garden roses sufficiently resistant to blackspot (*Diplocarpon rosae*). Until recent years, there was little knowledge concerning the nature of this disease, its strains, varieties, and so forth, and even less knowledge about the possible species or varieties which might be useful in a breeding program aimed at the production of highly resistant varieties.

Fortunately, in about the last 10 years, work has been going on at the University of Maryland and at the USDA, at Beltsville, partly financed by a grant from the American Rose Foundation, which we believe will be very useful in an approach to breeding new varieties with blackspot resistance. Meaningful results are nevertheless certainly much further away in this area than they appear to be with regard to powdery mildew.

To the best of our knowledge, there has been little research work and rose breeding aimed at the production of rust (*Phragmidium mucronatum*) resistant varieties. Since there are many varieties that appear to be quite rust resistant, it would appear that this disease can be kept under reasonable control merely by careful selection of the introduction varieties. Fortunately, this disease appears not to be universal with us, and is usually troublesome only in the late spring and late fall in most of the areas where it is found at all.

We have no knowledge of how, or whether, it is possible to breed resistance to virus diseases of roses, but at this stage in the development of our knowledge we must be somewhat dubious about such a possibility. As many of you know, we do have virus diseases in roses. We know that there are virus diseases of roses that are a serious economic threat, but to the best of our knowledge, we do not as yet have rose viruses in this country that are generally recognized as serious economic pests, although there is some disagreement on this point.

I am somewhat concerned about some of the statements which I have read, from sources which I have always considered reliable, in effect, making claims that rose viruses now in the United Stated do affect the growth, flower quality and production. To the best of our knowledge, there is as yet no experimental data to support such a statement. We have found

this disturbing in the industry because we feel that the aim appears to be to excite the public, our customers, before we have knowledge that he is being shortchanged or before we can do anything about it even if he were. I should point out that even if we were to find that there is actually some economic significance to the viruses that we are able to eliminate, it seems rather nonsensical to tell the rose consumers that they are being hurt when they don't know about it until they are told, therefore, enjoying and having been satisfied with their virus-infected roses. This is not to say that we should not bend every effort to give the consuming public the cleanest and the best quality product we are capable of, but to paint a picture of the industry as irresponsible to its customers, without statistical evidence to prove it, would suggest that perhaps such writers may be more irresponsible than the people they are pointing the finger at. This type of publication can create the suspicion that such researchers have one eye on the future of their project and the other eye on a tax supported budget that must be forthcoming in order for them to eat. This is what I call "pocketbook science."

In this connection, I am reminded of the fact that I have been in the past both the breeder of stone fruits and of camellias. As some of you know, there are many camellia varieties that depend for their existence on the presence of a virus, much as is true of certain varieties of tulips. While in all seriousness we certainly know that the elimination of viruses is to the benefit of the nurserymen in stone fruits, we are reminded of a story which we picked up at Bordeaux, France, from the administrator at C.T.I.F.L. (an organization in charge of certification and control of virus diseases). One of my peach varieties called Springtime has achieved wide recognition in Southern Europe as a useful early-ripening peach. Before we became conscious of the presence of ringspot, we unfortunately introduced this disease with the variety 'Springtime' in Europe.

Dr. Labergere, in charge of C.T.I.F.L., told me that after they became informed about the heat treatment technique originated by Dr. Nyland, they subjected the 'Springtime' peach to heat treatment and separated it from its ringspot virus. He said that they found that the trees grew more vigorously, but that as a consequence (or so he speculated) all of the pits split at ripening time. In this case, it could not be said that the elimination of ringspot would provide a benefit for the fruit grower unless he were also provided with an antidote for the pit splitting. I did not ask if they had achieved that degree of sophistication.

Seriously, we are concerned as both breeders and nurserymen in continuing to provide our customers with the best quality of product that we can. While we believe that continuing research is indicated as a means of determining the economic significance of the virus diseases with which we are dealing,

we at the same time propose to eliminate these viruses to the best of our ability. I am of the opinion that all of the major rose nurserymen have availed themselves of heat-treated cuttings of various rose rootstocks from Foundation Plant Materials, and that it is their intent to clean up the commercial scion varieties through heat treatment, as rapidly as possible.

I was interested in observing that in Europe the practice of growing rose understocks from seed is so widespread as to be almost universal. With the possible exception of a small amount of *Rosa odorta* grown from cuttings for use with certain varieties under glass in the growing of cut flowers, nearly all the roses in Europe are budded on seedlings of *Rosa canina*. This latter species has a unique characteristic in that it produces, together with several of its close relatives, a high percentage of apomictic seedlings. I found in going from one country to another and from one area, or even from one grower to another, that they grew different selections of *Rosa canina*, but all of them from seed. As near as I could tell, there was a very uniform appearance and growth to these strains or varieties and, of course, they were free of virus.

Unfortunately, *Rosa canina* does not do well in most of the areas where rose nursery stock is grown in this country. I cannot imagine the rose budders in the United States tolerating this thorny variety, since they have become accustomed to relatively innocent understocks such as 'Dr. Huey' that is often nearly thornless in comparison. Possibly some day someone may produce a hybrid of *Rosa canina* that is relatively thornless and that can be grown from seed to produce a uniform rootstock adapted to the United States. This does not seem beyond the realm of possibility, although it is pretty far away at the vantage point from which I look now.

As you can see from all this, I feel that there is plenty of room for improvement in the field of rose breeding. When I think of all the exciting things that no doubt can and will be done in the future, it occurs to me that perhaps I was born 20 years too soon.

MODERATOR LUVISI: Thank you, Herb. This concludes the final part of the panel. Do you have any questions?

BARRY COATE: Are ornamental plants contaminated with viruses and if so what is the advantage in cleaning them up?

MODERATOR LUVISI: I am working with the rose industry to determine the incidence of viruses. We are establishing test plots as rapidly as material is available on clean root stocks. Preliminary results indicate that 85-95% of field run stock has virus in it.

GEORGE NYLAND: There is a program involving the California Department of Agriculture and the University of California and supported by the California Association of Nurserymen which is looking into the significance of viruses in vegetatively propagated ornamentals. We are looking for ef-

fects of viruses on propagation itself and on plant growth and quality.

MODERATOR LUVISI: I think the research on roses will show that viruses affect them adversely from a yield and quality standpoint. This will be particularly true for greenhouse grown roses. However, I think it would be very difficult to evaluate the effect of virus on roses sold to the homeowner. In this case they are subjected to a virus-loaded environment and a wide range of cultural conditions.

STAN MATHER: The research on viruses in roses will show that the virus disease situation does effect them from an economic standpoint. This is particularly true for a commercial crop of greenhouse roses. I think that roses for backyard gardening may also be adversely affected by virus diseases but the effect of viruses on garden roses will be difficult to evaluate.

By continually striving I think clean propagating material sources can be developed and this will help eliminate some viruses in ornamentals. Some virus diseases of ornamentals are too widespread or common for development of clean propagating stock to have much effect on elimination of the viruses.

BILL CURTIS: I am wondering if the virus in *Daphne odora* could be eliminated by heat treatment as has been done with some woody plants.

GEORGE NYLAND: It so happens that this is one of the plants that we have heat treated and we can eliminate virus from *Daphne odora*. There is a propagation problem after you eliminate the virus from plants in the heat room. Also it is very difficult to keep them from being reinfected because the two viruses that are most commonly found in *Daphne* are cucumber mosaic and alfalfa mosaic both of which are transmitted by aphids. We have lots of aphids.

RALPH SHUGERT: Are viruses transmitted through the seed in mazzard and mahaleb cherry root stocks?

GEORGE NYLAND: Unfortunately, ring spot virus is seed born in both mazzard and mahaleb. Incidence can be as high as 70% in mazzard and 50% in mahaleb, but usually it is 3 to 4% in mahaleb and 20 to 25% in mazzard provided the trees from which the seed was taken were infected.

In this connection, seed transmission of virus also appears in peach and some of the other stone fruits. It is a fairly common phenomenon.

GEORGE DANIELS: Are the viruses we are striving to clean up in nectarine and peach vector carried?

GEORGE NYLAND: Right now we are in the middle of an epidemic of western x yellow leaf roller and this disease is vectored by six or seven different species of leaf hoppers. At least one of the latent viruses of stone fruits is apparently vectored by pollen. That is, pollen from an infected tree can cause infection in another tree.

MODERATOR LUVISI: The importance of virus — and pathogen-free materials have been well established in many crops. Historically we can show many cases where the elimination of a virus disease has been life or death to the industry. But, does this indicate that elimination of virus in all plants is economically justified?

Today we have operational certification programs, and methods to index large quantities of plant material. Evaluation of this clean material and field run material should be made. This takes time, effort, and money, especially when we consider clonal selections of single varieties. As an example, on display are clones 1, 2, and 3 of 'Emperor' grapes. After this session, anyone interested in comparing the 3 clones may do so. It should be obvious which is the most desirable clone. How would you feel if you had a large acreage of clones 1 and 3?

This example should demonstrate the necessity for critical field evaluation of newly released materials. We have stubbed our toes in the past and will continue to trip in the future, but it is important to keep from tripping on the top step and falling all the way down.