so we don't get into each others hair too often. Dr. Ray Hasek has been in California for a number of years and has had wide commercial as well as educational experience. At this time I should like to have him discuss with you "Some Scion-Stock Interrelations".

## SOME SCION-STOCK INTERRELATIONS

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Much has been written about scion-rootstock relationships in commercial rose plant production. However, many instances of peculiar growth patterns or responses occuring in greenhouse cut flower plantings have been often talked about in the trade yet seldom mentioned in print. Entirely different growth requirements exist between outdoor roses grown for the home garden and greenhouse plants grown for cut flower production. Outdoor rose understocks should have such characteristics as drought resistance, cold resistance, exhibit good dormancy during the winter to prevent scion or understock growth and finally be easy to bud. In the greenhouse the rootstocks are pampered since they are usually subjected to very little drought or cold stress. Production of cut flowers goes on all year round; therefore, optimum growing conditions are maintained to assure continued growth and activity of the understock during the winter as well as the summer months.

At present, by far the most popular understock used for greenhouse roses is *Rosa x noisettiana* 'Manetti'. To a lesser degree *Rosa odorata* and *Rosa* x *sp.* 'Dr. Huey' (Schafter) are used. Usually, yellow flowered varieties have been budded on *Rosa odorata* although 'Dr. Huey' understock is becoming more commonly used. When *Rosa multiflora* is the understock, winter cut flower production is often greatly reduced.

Some of the reasons for differential responses of scion varieties to various understocks already have been reported. The selectivity of ion adsorption by various rootstocks has been explored (1) and it was shown that accumulation of chlorides and boron was less in the foliage of five seedling varieties when budded on *Rosa* x *sp.* 'Dr. Huey' than when the same varieties were budded on *Rosa multiflora*. This would indicate that under saline conditions the use of 'Dr. Huey' understock might be preferred unless adverse scion response of a particular variety to this understock is known.

The cultivar Happiness has been budded on both *Rosa* x *noisettiana 'Manetti'* and 'Dr. Huey' for commercial greenhouse cut flower production. Growth habits of the resulting plants are quite similar with a slight increase in overall stem length being evident in those with the 'Dr. Huey' understock.

However, the flower shape is substantially different. It is much smaller and has less petal development generally when 'Dr. Huey' is used as the understock. Commercially this is objectional since the stem length is definitely out of proportion to the flower size produced.

Many instances of flower color change have been noted in the cultivar 'Golden Rapture' when various understocks have been used. Holley (2) reported that a higher percentage of "off color" flowers were produced when 'Golden Rapture' was budded on *Rosa* x *noisettiana* 'Manetti'. The plants were more vigorous and stem length was longer on the average, but this lead to the production of a high percentage of greenish, rather than yellow flowers. Similar responses have been noted in many commercial greenhouse ranges in California. In spite of a slight loss in plant vigor, *Rosa odorata* is usually used as the understock for this cultivar because of the better flower color produced.

When new cultivars are introduced to the cut flower market, it is imperative that they have been budded on several understocks to avoid complications once full production is attained. The cultivar 'Golden Wave' first was propagated by budding on *Rosa* x *noisettiana* 'Manetti' because initial tests indicated that this understock produced satisfactory flower color and vigor. Unfortunately when the plants produced by this combination of rootstock and scion were grown in commercial greenhouses for nine months to a year, it was noted that a gradual decline in vigor and loss of plants occurred. At first verticillium wilt was suspected because of the presence of a black discoloration between the bud and understock, but no pathogen was found. Buds on *Rosa odorata* and Dr. Huey did not show this condition and grew normally. It was concluded, after much investigation, that under some circumstances there was incompatibility between scion and understock in the case of the *Rosa* x *noisettiana* 'Manetti'. Why it occurred at one time and not another is open to question.

The cultivar 'Rose Elfe' presented a problem in budding to many propagators. Although the compatibility of the bud with *Rosa* x *noisettiana* 'Manetti' understock was generally good for a few years, decline in growth often occurred before the usual four year planting schedule could be completed. The retailers demand for the cultivar was great enough to induce growers to produce it in spite of all difficulties. Early spring budding partially solved the problem. As growth decline became evident on two-year or older plantings, a sleeve of roofing material approximately 8″ in diameter placed around the bud union and filled with a good soil mix induced the scion to strike roots. This procedure was an effective stop-gap measure, but was not foolproof. If late budding was attempted with Rose Elfe, the understock development had progressed to such a degree that it became quite large in diameter. The scion eye had no chance to grow in the field. A large percent-

age of these plants were lost during the first few months in the greenhouse due to the "pinch-off" action at the bud union as described by Roberts (4).

More recently, a condition was noted in several California greenhouses wherein wilting occurred on young shoots of the cultivar 'Forever Yours for no apparent reason. This condition occurred when the plants produced a tremendous flush of growth following the first pinching of shoots arising from the original dormant plant. Roots on the understock were excellent, no incompatibility could be found at the bud union, soil-water conditions were good and soil tests eliminated possible nutrient deficiencies or excesses. Eventual cultural practices confirmed the suspicion that this cultivar produced such excessive top growth in a very short time after planting that the root system of the understock could not supply the water demands of the lush growing tops. Applying water to the soil was of no help and in fact often aggravated the situation. Increasing humidity by overhead sprinkling or humidifying systems readily eliminated wilting. In some cases this meant keeping humidity around the plant tops at near saturation for most of the daylight hours.

Serious wilting or "burning" of the foliage on new shoots of established plants of other cultivars was thought to be due to poor root activity of the understock, overwatering, high salts and a multitude of other causes. Investigation by members of the U. C. Agricultural Extension Service showed that a substantial part of this wilting was due to the presence of nematodes in the soil. During the past few years, the use of nematicides has greatly aided greeenhouse rose plant growth. Since nematode problems have been found to exist in many of the rose producing greenhouses throughout California, the curtailment of this pest's activities was extremely important.

Diseases have been shown to be transmitted from understock to scion and vice versa (3). Fortunately, the rootstock *Rosa* x *noisettiana* 'Manetti' is one of the more resistant ones to verticillium wilt. With proper care and stool block methods of rootstock production, verticillium wilt has been reduced for the most part to being introduced in the budwood. In their work, Raabe and Wilheim (3) showed that disease-free *Rosa* x *noisettiana* 'Manetti' sticks planted in verticillium infested soil showed little contamination even when disease spores were introduced into the irrigation water. They concluded that the important sources of infection occurred when diseased budwood was used or dirty tools were used for making the budding cuts and possibly during the top-lopping operation later on. By far the greatest chance for infection came about through the use of diseased budding eyes.

It is not enough, then, to consider bud union and compatibility of the grafted parts in themselves as being the answer to crop failure or success in cut flower rose production. Consideration must be given to the responses of the scion-root-

stock combinations when they are subjected to a multitude of cultural stresses in the producing greenhouse.


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MODERATOR FURUTA: Thank you, Ray. The third member of our panel is a commercial rose grower. It is kind of hard to keep up with him. I think he is finally going to stay home more often than not now. Mr. Walter Mertz with the Jackson and Perkins Company will discuss with us "Production of Field Grown Rose Plants." Walt.

## PRODUCTION OF FIELD GROWN ROSE PLANTS


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In the propagation of field grown roses the propagator's prime role is to physically and successfully join a selected scion or clone with a preferred rootstock so that a viable plant combining the best attributes of the two components results.

The techniques of rose propagation are basically simple, highly standardized, and for the most part are quite successfully accomplished by most of the rose growing firms. However, in California today it appears that the greatest emphasis, and the major problem solving requirements, center not so much on the art of propagation, as such, but rather in the field of production.

The basic difference between propagation and production is chiefly one of dimension. The production function, as I will define it for today's discussion, is the art of propagation performed on a large or massive scale. Production of field grown roses goes far beyond the individual propagator. Field production is chiefly the responsibility of a highly qualified professional production staff organization, not an individual. The role of this staff is not the simple and fundamental task of uniting several plant parts into a viable unit, but the successful propagation of millions of such plants to meet the expanding markets of its sales organizations and to achieve this function in a profitable manner.

During the few moments that I have, I will try to accomplish two goals. First, I will outline several major trends, or perhaps I should refer to them as revolutions, which are cur-