sidering such dwarf peach tree as possible units in hedgerows for mechanization.

DR. DALE KESTER: What experience have you had in overcoming incompatibility by double budding? The reason I ask is that I have seen different experiences or opinions in the literature whether it works or not.

DR. MAHLSTEDE: This technique, as you know, was described by Nicolierin in Germany about the same time Garner came out with his doubleshield method of budding. The techniques are essentially the same. We haven't run comparisons long enough to tell much about either technique. We've worked specificaly with apple using this intershield in dwarfing combinations. Clark Dwarf, being used as the intermediate originally was a fairly good dwarfing understock or inter-stock in our part of the country. Lately, however, it has proven to be either virus infected or having some other problem evidenced by stem cracking. Our thought here is that if we use a budless shield as an interstock that it will be eventually covered up. If it does the job, we are ahead of the game so far as dwarf production is concerned.

DR. ROBERTS: Along this line, I think it is important that we consider early work in England and a recent study in Germany with pear on quince, with various compatibility bridges. The response to interstocks whether used as compatibility bridges or as dwarfing stempieces seems to be influenced by the length of the insert. I think this has been overlooked by many of us. Some of our work and certainly that in England and Germany shows the length of the bridge to have a pronounced influence on the thriftiness of the combination and early flowering. We have a five-year old block of Starking and Golden Delicious apples with 3, 6 and 12 inch stempieces of Malling IX (dwarf) with Malling XVI (very vigorous) as roots. There is little difference in the size of these trees; if any, the longer stempieces have given us larger trees, but there is a great difference in flowering habit. In the early years the longer stempieces have given us more bloom.

III. Difficult to Root, General Ornamentals

MODERATOR: Mr. William Tomlinson

THE PROPAGATION OF DECIDUOUS AZALEAS FROM CUTTINGS

P. H. BRYDON
Director, Strybing Arboretum
Golden Gate Park, San Francisco, California

Today's discussion deals primarily with the propagation of Knaphill Azaleas Exbury strain, although I am sure the techniques described would prove successful with other deciduous azales. As a preface, it might be of interest to review the background of this particular strain.

The Exbury azaleas are predominantly North American in specific origin. Of the nine species involved in their background, the following are native Americans — *R. viscosum, R. nudiflorum, R. calendulaceum, R. speciosum, R. arborescens,* and *R. occidentale.* Of the remaining three, *R. molle* comes from China, *R. japonicum* from Japan, and *R. luteum* from Eastern Europe. In the latter part of the eighteenth century *R. viscosum, R. nudiflorum, R. calendulaceum* and *R. speciosum* were introduced into Europe when they were combined with the European *R. luteum* by Mortier of Belgium to produce the now famous Ghent azaleas. However, the real advance came about 1859 when Anthony Waterer of England recombined *R. calendulaceum* with the Ghents and added *R. molle.* Later he crossed the various progenies with *R. japonicum, R. arborescens,* and *R. ocidentale.* From these crosses Mr. Waterer obtained a race of azaleas which genetically possessed hardiness, fragrance, a color range from white through pastels to deep red, an extended flowering season and an increase in flower size and substance. In the 1920's some of Mr. Waterer's seedlings were sent to the late Lionel deRothschild at his estate in Exbury, England. From them he selected the very finest and in particular a variety called George Reynolds, which is a large flowered yellow with broad petals of excellent substance. This, among others, was crossed with a select form of *R. molle* to further improve the Knaphill strain.

As the new seedlings bloomed, Mr. Rothschild selected superior color forms and keeping the colors together crossed reds with reds, whites with whites and so on. He never kept a plant unless it was vastly superior to its parent stock and, as each succeding generation flowered, he consigned all but the best to the bonfire. His discerning eye and ruthless elimination of second rate plants has resulted in a superior strain of deciduous azaleas.

I began to import the named varieties of Exbury azaleas in 1949, and by 1952 had 72 varieties on hand. The problem was to increase these clones vegetatively for sale in this country. Layering is a slow process and propagation by this method produces plants which are awkward to handle. While it is much quicker than layering, grafting on *R. luteum* has its drawbacks, the principal one being that in many cases the understock overcomes the scion and the customer wonders why he now has a vigorous growing small flowered yellow azalea in place of the large flowered pink or red which he purchased. In the early 1950's, to my knowledge, no commercial propagator had succeeded in raising deciduous azaleas in quantities from cuttings. When doing some experimental work with the propagation of Rhododendrons from cuttings in 1934, I recalled that I had included a few *Azalea mollis* hybrids and they rooted with ease, but the following spring they failed to break into new growth and were discarded. This seemed to be a common experience with others who had tried to root deciduous azaleas from cut-

tings. The solution to the problem was suggested to me by Dr. Kraus of Oregon State College who told me that by increasing the day length this would assist in the formation of new growth and, furthermore, cuttings which made top growth before going dormant would "break" the following spring. This proved to be true, but while it was the most significant single factor in the success or rooting Exbury azaleas, there are other precautions and techniques which play an important part in obtaining high percentages of rooted cuttings. These are as follows:

Condition of Stock Plants: The proper care of stock plants is an important consideration and one which is frequently overlooked by many propagators. My stock plants were kept in a block by themselves and given at least three feedings in the spring months when growth was "making up." They were sprayed regularly with malathion to eliminate aphids and discourage leaf miners and caterpillars. Prior to taking cuttings, the stock plants were thoroughly soaked the previous day so that the wood would be turgid and crisp. Strong vigorous canes were headed back in early summer to promote shorter growths from auxillary buds. Older canes were removed completely to allow air and light to penetrate.

Take Cuttings: The wood was taken early in the morning and kept moist in a cool cellar until ready for insertion. The time of year varied with the weather conditions, but I would say that in the northwest it would be between June 15th and 30th, and in the San Francisco Bay Region about two weeks earlier. As most of you know, the maturity of the wood at time of taking is difficult to describe and the "feel" is only acquired after many years of practice. All I can say is that the wood should be green, taken before the lower portion becomes hard and brown, and before the apical bud is evident. Thin side growth with short internodes are much to be preferred over thick terminal shoots with long inetrnodes. It is easier to make a branched plant from the former. The cuttings were made about four inches long with the cut just below the node and all leaves except the top four removed. They were not pinched and as a general rule, the leaves were not reduced in length. A thin slice of wood was removed from the lower 1½ inches of the cutting prior to dipping them in Hormodin #3. The "wounding" of the cuttings aids considerably in reducing transplanting losses. In deciduous azaleas, the weight of the root ball is often such that unless there is a solid union of roots and stem, the two part company when being cut out of the bench. In a "wounded" cutting the roots originate from a wider area and are less liable to break off when being transplanted.

Rooting Medium: I have had most success with a medium composed of equal parts, Canadian Peat Moss, washed river sand, medium grade perlite. The peat was moistened and rubbed through the hands and long fibres and roughage removed. After thoroughly mixing the medium, the benches were filled to a depth of eight inches which allowed for 1½ inches at the bot-

tom for the heating cables. The cedar benches were cleaned out each year and the interior painted with copper naphthalene as a control for any injurious fungi which may have gained admittance.

Insertion of Cuttings: The cuttings were spaced two inches within the rows and three inches between the rows, lightly tamped, and watered into place. The bottom heat was set at 65° F. Lengths of heavy grade wire were bent at right angles to form a framework over the bench and polyethylene (4 mil grade) was placed over the top and sealed along the sides to prevent the escape of moisture. Unless some extraordinary occurrence took place within the closed frame, such as an insect infestation, or an unusually high percentage of wilting, the frames were left unopened for two or three weeks and when the cover was rolled back, the cuttings were examined and the medium flooded to the point where the water ran freely out of the bottom of the bench. This deep watering is beneficial in that it provides a change of air and water in the medium. Depending upon the variety, rooting commenced in about 4 to 6 weeks; however, the removal of the cuttings was delayed until they had a solid ball of roots. As a general rule, transplanting began in late August and continued through October, since some varieties will take up to three months to form a solid root ball. In the beginning the rooted cuttings were potted in 4″ pots, but the potting was subsequently eliminated and the cuttings were transplanted directly into peat beds, in benches under glass. By so doing, the plants made more than twice their growth than in pots and the root system was more extensive and plants became more quickly established when planted out of doors.

Increased Day Length: Perhaps the most critical factor in the successful propagation of deciduous azaleas is the increase in day length to initiate top growth prior to leaf drop. Once this growth has been made there is every chance that, after dormancy ,the rooted cutting will push new growth in the spring. My first installation was a row of 100 watt Mazda lamps, three feet apart, suspended three feet above the cutting bench. Beginning in August, the time switch turned them on at 5 p.m. and off at 12 midnight. To be perfectly sure that growth would be sustained throughout the shorter days of late fall and early winter, I left the lights going until Jan. 1st, after which most of the cuttings had lost their leaves and were in a dormant stage. Incidentally, as new growths were formed, four leaves were allowed to develop and then the cutting was pinched to promote a better shaped plant. In later installations, the Mazda lamps were replaced with Grow Lux lamps which, though more costly to install were cheaper to maintain.

Subsequent Care: Depending upon the weather, transplanting began about the last of March, or early April, when the plants were lined out in lath house beds. By then they were from 6 to 12 inches tall. By the fall of the same year the average plant would be a husky 10 - 12″ and have at least three

branches. In most cases, flower buds would form the second year after striking and the plants were sold in the fall as 12-15″ and 15-18″ grades.

MR. CARL SCHMIDT: Please repeat the time period of artificial light used while rooting deciduous azaleas.

MR. BRYDON: From five p.m. to twelve midnight August first to Janpary first.

DR. ANDREW LEISER: Have you tried interrupted or intermittent light?

MR. BRYDON: I'm sorry I have not.

DR. ANDREW LEISER: Are azaleas rooted before lights are on?

MR. BRYDON: As a general rule by August the first most of them are forming some roots at the end of the cutting and the lights are turned on August the first to January first. I was assuming that they are rooted before the lights are turned on.

CUTTAGE PROPAGATION OF *Xylosma congestum*

WESLEY P. HACKETT AND DAN GOLDMANN
Department of Floriculture & Ornamental Horticulture
University of California, Los Angeles, California

The basic requirements for the successful propagation of broad-leaved evergreen plants by stem cuttings are as follows:

1. The cutting must have the capacity to form roots when given the proper treatment and environmental conditions.
2. The rooted cuttings must have a viable bud or the capacity to form one.
3. The cutting must have enough leaf surface to promote rooting and the rooted cutting enough leaf surface to promote growth of the bud into a shoot.

If all three requirements are fulfilled a new plant will probably result. If one or more of these requirements is difficult to fulfill the plant will be difficult to propagate by stem cuttings. It is indicated by our general topic "Difficult to Root, General Ornamentals" that it is difficult to fulfill at least one of these requirements for the cuttage propagation of *Xylosma congestum.*

From personal experience and from observation of the results of other propagators it appears that there are two difficulties in the stem cuttage propagation of Xylosma. First of all it may be difficult to get rooting and secondly it is usually difficult to prevent the leaves from abscising during or after the rooting period.

We have been doing some experiments at U.C.L.A. in an effort to analyze these problems and possibly come up with some answers to them. I will present results of two of these experiments and then discuss the factors that seem to be most important for successful propagation of Xylosma by stem cuttings.

In one experiment we tested the effect of two factors, age