

course, the test of having the cutting bend neatly between the fingers — neither snapping because of being too immature nor breaking because of being too mature — is so fundamental that it should need no further discussion here. Time and again we read in the old propagators manuals the term, “firming at the base.”

While I assume that this group is mainly interested in soft-wood cuttings, I have devoted most of my time to this subject. However, if we were to consider timing as it applies to hardwood cuttings we would open up another whole range of discussion. One brief comment, however, concerning hardwoods — it is generally better to time the gathering as early in the Fall as the wood is mature, rather than to wait until the rigors of winter have had their effects. Certainly, in practically all cases, wood should be gathered before sap flow begins in the Spring.

To sum up, I wish to emphasize that one should devote a great deal of time to the study of “Timing” as it effects the potential success of propagation, no matter what subject he is working. Correct timing eases the task and produces better results.

MODERATOR JIM WELLS: Timing is one of the few procedures which we carry out in which the real skill of the propagator is called into full force. I would like to call next Mr. Dick Fillmore who will discuss the position of the cutting on the plant.

POSITION IN CUTTING SELECTION

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The position of the cutting in relation to the entire plant is always a consideration in the successful rooting of cuttings. This position may not only affect their potential ability to root but also the configuration and stature of the resulting plants.

Terminal tip cuttings are necessary for the development of properly shaped plants of certain clones of *Taxus spp.* In other instances, such as *Thuja spp.*, where apical dominance is apparently equally pronounced, normally shaped plants may arise regardless of the position from which cuttings are taken and cuttings from all positions may root with equal ease.

Success in rooting *Ulmus carpinifolia* cult. “Christine Buisman” is apparently almost absolutely dependent on the position from which the cuttings are taken.

If root cuttings are made in spring at almost the time when Norway maple blooms in the same area, they will form both roots and shoots concurrently. There will generally be several

shoots per root cutting. If these shoots are removed and treated as stem cuttings, they will also root satisfactorily.

If the tree trunks were pruned during the previous season, the short shoots which arise around these wounds will also root well. Apparently comparable short shoots taken from the main mass of the tree at the same time and placed in the same conditions will not root in reasonable percentages.

The author wishes to acknowledge the helpful advice of fellow-member Mr. Ralph Crawford concerning the propagation of the Christine Buisman elm.

MODERATOR JIM WELLS: Thank you very much, Dick. I would next like to call on Mr. James Kelley to discuss nutrition.

ROLE OF STOCK PLANT NUTRITION ON ROOTING RESPONSE OF CUTTINGS

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As we have just heard, many factors influence the rooting response of cuttings. Today, considerable evidence indicates that the nutrition of the stock plants exerts a strong influence on root initiation and development. This is particularly true in the case of nitrogen, and more recent findings indicate that zinc and boron also may play a role in rooting.

Kraus and Kraybill (8) as early as 1918 demonstrated the effect of the carbohydrate-nitrogen ratio on rooting of tomatoes. Cuttings high in carbohydrates but low in nitrogen produced many roots but weak shoots, whereas those high in carbohydrates and higher in nitrogen produced fewer roots but stronger shoots. Cuttings made from succulent stems, very low in carbohydrates but high in nitrogen, all decayed without producing shoots or roots. Subsequent experiments by others have shown that a high ratio of carbohydrates to nitrogen favor rooting (3, 13, 15) in tomatoes and grapes.

Winkler (19) showed that grape cuttings highest in starch rooted better than cuttings with a low starch content. More recent work (1, 4, 9) has re-emphasized the importance of a favorable carbohydrate-nitrogen balance using geraniums, azaleas, and roses as examples.

This favorable carbohydrate-nitrogen ratio in a cutting is regulated primarily by two things: 1) the amount of nitrogen applied to the plant, and 2) the stage of development of the current season's growth.

The commercial propagator achieves this condition by 1) reducing the nitrogen supply to the stock plant in order to allow carbohydrate accumulation, 2) allowing plants to have full sunlight in order that photosynthesis may be maximum, 3) by withholding water, and 4) by a combination of the above.