Propagation Methods of Fruit Tree Cultivars from Hardwood Cuttings

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Summary

Dormant stem cuttings from several fruit tree cultivars were subjected to rooting conditions during late fall, winter, and early spring. Bottom heat at 21°C and air temperature at 3°C were used. The cuttings were treated with IBA at different rates. The cultivar cuttings rooted with varying degree of success from good to poor as follows: 'Babygold,' 'Red Haven,' 'EM VII,' 'Montmorency,' 'Goldcot,' 'Red Delicious,' and 'Spartlet.' The most effective concentration of IBA varied between cultivars treated. The basal and median portion of the cuttings showed significantly greater rooting than the tip cuttings.

Introduction

Since the introduction of dwarfing apple rootstocks the general method of propagation has been the use of stool beds. This method has several disadvantages to the nurseryman in that it is costly, and in that the soil and the climatic conditions are not always suitable. For these reasons, propagation by the hardwood cutting method has been examined and practiced with certain plant materials. Success or failure on a commercial scale with hardwood cuttings often depends on the rooting conditions provided and on the cultivar used. If certain problems such as moisture and temperature could be solved, the method could have a wider use during the year. Furthermore, hardwood cuttings of fruit cultivars might be produced into trees from single clones without grafting in some instances.

To date considerable work in this area has been devoted to construction of the propagation bed, preparation of cutting hedges, and harvesting techniques (2, 3, 5, and 8). Chemical root stimulation and endogenous rooting factors have been studied (1, 4, and 7). Cutting type has been shown to influence rooting success (6, 9). Drawing on these ideas, an experiment was undertaken and designed to test the inherent rooting capacity of several fruit clones; to determine the relationships of IBA concentration, type of cutting, and collection date; and to improve the propagation bed system.

Methods

Cuttings were selected from vigorous current annual growth, from orchard trees of seven fruit cultivars during late fall, winter, and early spring. The cultivars used were 'Red Haven' and 'Babygold 5,' peach, 'Red Delicious' apple, 'Spartlet' pear, 'Montmorency' cherry, 'Goldcot' apricot and 'EM VII' rootstock. These shoots were cut into 12 inch sections designated as basal, median, and tip. Basal cuttings included a portion of the swollen heel of older cells. The cuttings were tied into bundles of 10 or more cuttings and treated with 0, 1000, 1500, or 2000 ppm IBA in 5% ethanol water solution, using a shallow, 10 second dip. The propagation benches were constructed in a 3°C cooler and a 1:1 mixture of peat and sawdust served as the rooting medium. The basal temperature of the cuttings was maintained at 21°C by heating mats composed of coils imbedded in rubber. Cutting bundles were either submerged in the medium or set on the tamped

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medium surface. The cuttings were collected after 6 weeks of treatment and percentage rooting calculated.

A minimum of 50 cuttings for each cultivar and treatment were used. The cuttings were placed in a randomized scheme so that each treatment of each cultivar was uniformly handled.

Results and Discussion

The capability to initiate roots by this method was best for 'Babygold 5' and 'Red Haven,' poor for 'Delicious,' and 'Spartlet' (Table 1 and Figs. 1, 2 and 3). The seasonal trend in rooting was in agreement with that reported by Garner and Hatcher (6) in that all clones, except 'Red Haven,' exhibited more rooting success in fall and spring than in winter. This apparently is a function of the internal condition of the cuttings of the different varieties. These predisposed conditions are factors in optimum rooting success.

The IBA concentrations used produced varying results as compared to control. There was a significant difference in percent root formation in the 1000 and 2000 ppm treatments (Table 2). The cultivars differed in sensitivity to IBA; namely that the 1000 and 1500 ppm rates were best for the peaches, while the other cultivars rooted best at 2000 ppm. The predominant use of difficult to root clones may explain the overall effect of the higher concentration (Table 2).

The basal and median cutting types rooted significantly better than the tip cuttings. Some controversy seems to exist as to whether the often-noted rooting superiority of the basal cutting is due to the inclusion of a heel of older cells, or a simple survival effect due to larger volume and decreased

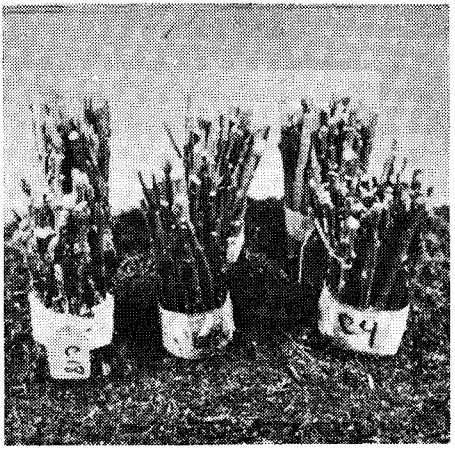

Fig. 1. Bundles of 20 cuttings of EM VII standing on tamped sawdust-peatmoss medium with heating elements 3" below.

Table 1. Capability of several cultivars to root from hardwood cuttings at 3 different times during the dormant period of these plants.*

Cultivars	Percent rooted cuttings**		
	Fall	Winter	Spring
Babygold 5	91.1	36.7	51.1
Red Haven	53.0	60.0	46.4
EM VI	30.6	19.4	26.1
Montmorency	20.4	18.9	20.0
Goldcot	8.8	5.5	5.8
Delicious	3.3	3.2	3.5
Spartlet	4.4	2.2	3.3

*Non-IBA treated cuttings were not included because very few rooted in any of the 3 seasons.

**Average over 4 IBA concentrations and 3 cutting types.

Table 2. Effect of IBA concentration on rooting of hardwood cuttings.

IBA Concentration	Percent Rooted*
0 ppm (ck)	0.3a**
1000 ppm	18.0 b
1500 ppm	23.6 bc
2000 ppm	28.2 c

*Average of 7 clones and 3 collection dates.

**Means in each column, followed by unlike letters differ significantly at 5% (Tukey's w Procedure).

Fig. 2. Callused and partially rooted hardwood cuttings of 'Red Delicious' (left) and EM VII (right).

sensitivity to the imposed environmental conditions. These data would tend to support the latter hypothesis (Table 3).

The hardwood cutting propagation process is composed of many interrelated factors which must be considered when attempting to propagate a given type of plant material. Imposed rooting conditions must be adjusted to fit the requirements of different plant materials. Several problems still remain in adjusting the requirement level of hardwood cutting of each cultivar. An improved moisture regulating system is needed because the basal moisture level is very critical to rooting success. One solution to this problem may be the use of larger bundles of shorter cuttings set on 3 inch medium above the heating mat with little or no covering of medium around the base. This would facilitate monitoring moisture and temperature without disturbing the cuttings and eliminate premature sprouting. The humidity in this case should be 85 to 90%.

Table 3. Effect of type of cutting on rooting of hardwood cuttings.

Cutting Type	Percent Rooted*
Tip	14.6aa**
Median	19.8 bb
Basal	21.1 bb

*Average of 7 clones and 3 collection dates.

**Means in each column, followed by unlike letters differ significantly at 1% (Tukey's w Procedure).

The transplanting of rooted cuttings to the field or greenhouse often results in loss of cutting viability. This may be partially due to nutrient depletion in the cutting from allowing too much root growth in the propagation bed, and to breakage of tender roots. An economical system of containerized cuttings would be an important advance in that it would not be necessary to disturb the fragile roots when transplanting.

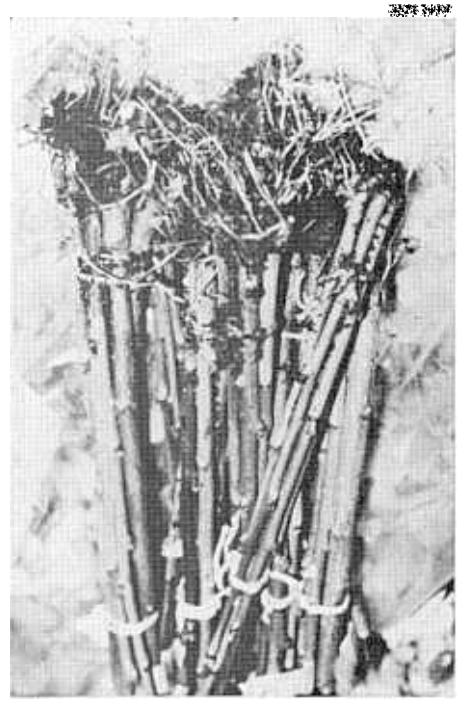

Fig. 3. Rooted hardwood cuttings of 'Babygold 5' peach following 35 days in the rooting bed.

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Book Review

Register of New Fruit and Nut Varieties (2nd Edition), 718 pages. By Reid M. Brooks and H. P. Olmo. University of California Press, 2223 Fulton Street, Berkeley, California 94720 and 50 East 42nd Street, Room 513, New York, N. Y. 10017. Price $12.50.

The Register of New Fruit and Nut Varieties presents a collection and publication of accurate information on the name, origin, parentage and most valuable characteristics of new fruits and nuts originating in North America since 1920. Twenty-five lists have been previously published in the Proceedings of the American Society for Horticultural Science from 1944 to 1970 and this present summary incorporates the published material that appeared in lists 1 through 25.

The text describes 3,897 varieties and may be located in the index by name, species or patent number. Plant introduction numbers are shown where appropriate. Only varieties which have shown promise of becoming important commercially or that appear to have unusual characteristics useful to the breeder are described.

This text will be useful to plant breeders and research workers for reference work on varieties. It will be an invaluable source of information for the hobbyist who is interested in fruit and nuts.

—R. K. Simons