Thursday Afternoon, December 8, 1983

The Thursday afternoon session convened at 1:30 p.m. with Clayton Fuller serving as moderator.

PROPAGATION OF *PRUNUS PERSICA* CULTIVARS BY CUTTINGS

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Abstract. Semi-hardwood cuttings of 6 cultivars of peach (*Prunus persica*) were successfully rooted by wounding, dipping in 2500 ppm IBA and misting. Cuttings of each cultivar were grown to 30 in trees and transplanted in the field for further study. Hardwood cuttings of 'Cresthaven' and 'Redhaven' were also successfully rooted by wounding and dipping in 250 and 500 ppm IBA. Although callus formation on 'Rio Oso Gem' was achieved with IBA treatments, no formation of callus or roots occurred with 'Loring'. Hardwood cuttings were not successfully transplanted.

INTRODUCTION

Most commercial nurseries propagate peach trees by budding on seedling rootstock. June-budded and dormant-budded trees are planted by peach growers in New Jersey. June-budded trees are less expensive to produce than dormant-budded trees. Both are generally offered to commercial orchardists for $2.25 to $5 per tree, depending on many factors.

Nursery stock purchased from commercial nurseries has not been of consistently high quality and has not always been true-to-name. Peach cultivars purchased on the preferred seedling rootstocks of 'Lovell' and 'Halford' are variable in performance and have been short-lived, particularly on old peach orchard sites. Growers are not satisfied with these rootstocks and others available from nurseries.

In recent years, growers and researchers have attempted to offset early tree loss by planting more trees per acre (high density) (4). The land area is covered with a tree canopy earlier in the orchard's life. This results in earlier economic peach yields (3). Growers want a less expensive tree to reduce these orchard establishment costs. Some growers would also prefer a system of producing trees that is easier and less costly so they can grow their own and have more direct control of quality and trueness-to-name.

Plant propagators and researchers have been testing and investigating the propagation of peach trees by cuttings for many years. Some of the earliest research was reported by Hartmann in California almost 30 years ago (7,8,9). Researchers in Georgia, Israel, California, Mississippi, and the southern hemisphere have successfully rooted peaches from semi-hardwood and hardwood cuttings (1,2,7,9,13). Plantings of self-rooted peaches have also done well. Some blocks are 15 years of age. Approximately 750,000 self-rooted peach trees were planted and are producing in New South Wales, Australia (5).

Based on research in Missouri (6) and the work of Marini in New Jersey (11,12) research and demonstrational plots were undertaken and established in Gloucester County, New Jersey in 1982 and 1983 to develop a system for the propagation of peach trees from cuttings on a commercial scale. Systems of propagating trees from both semi-hardwood and hardwood cuttings were researched. A hardwood system would be preferred because it would not be used during the harvest season. Plantings were established that could be studied and evaluated for tree efficiency and longevity.

MATERIALS AND METHODS

Experiment 1 — Semi-Hardwood Cuttings. Current season's growth from the terminal portion of shoots of mature, vigorous, healthy trees of 'Autumnglo', 'Loring', 'Redhaven', Jerseyqueen', 'M.A. Blake', and 'Rio Oso Gem' were collected on August 10, 11, and 12, 1982. Twelve hundred 8 to 10 in. cuttings were made from terminal shoots that were approximately 5/16 to 3/8 in diameter.

Shoots were soaked in water until all leaves were stripped except 3 to 5 on the terminal end. All cuttings were wounded on opposite sides, 1 in. from the basal end, submerged for 5 sec, 1½ in deep in a 2,500 ppm IBA solution (potassium salt in water), and planted in a prepared rooting medium. The rooting medium consisted of equal parts of peatmoss, perlite, and vermiculite. The medium was contained in 5 × 5 ft movable trays, 6 in. in depth. Cuttings were planted 1½ in deep and 4 in apart.

A pole shed was built in an outside location sheltered from the wind. Both tops and sides were covered with 6 mil poly. The polyethylene on the sides was rolled up on warm and still days. The top panel was also covered with lath.

Along the north side of the trays a misting system was constructed using split connector Mist-O-Matic nozzles on a ¾-in pipe. A timer opened and closed a solenoid valve to regulate misting.

Cuttings were misted starting with 5 sec of mist every 5 min during the day. Misting was discontinued after dark. The amount of water was gradually decreased as air temperatures were lowered and rooting progressed.

Misting was stopped on September 15, 1982, and occasional hand watering kept the cuttings and medium moist. The trays of cuttings were moved by forklift into a well ventilated apple storage room on November 20, 1982, and maintained until early February, 1983. The cuttings were watered as needed.

All cuttings were removed from storage on February 18 to 21, 1983, and planted in 1-gal plastic bags in a mix identical to the rooting medium plus a small amount of dolomitic limestone. Cuttings were watered by hand and fertilized every 10 days to 2 weeks with a water soluble fertilizer containing a balance of micro and macro nutrients.

Peach trees 26 to 30 in high were planted by hand in trenches plowed in an old apple orchard site on May 19 to 25, 1983. The 1-gal poly bags were split and removed during the planting operation. Measurements on tree height, diameter, trunk caliper, and leaf tissue analysis were taken during the summer of 1983.

Experiment 2 — Hardwood Cuttings. Hardwood cuttings of 'Cresthaven', 'Rio Oso Gem', 'Redhaven', and 'Loring' were taken on February 17, 1983, from vigorous, healthy peach trees. Cuttings 6 to 8 in long were selected from the past summer's growth. Cuttings from both the terminal and the basal portion of the shoot were used. Each cultivar was treated as follows:

1. Twenty-seven cuttings were tied, nine per bundle;
2. Twenty-seven cuttings were tied, nine per bundle and dipped 1½ in. deep in a 250 ppm IBA solution (potassium salt in water) for 10 sec;
3. Twenty-seven were wounded 1-in. in length on opposite sides of the basal portion of the cutting, tied in bundles of nine and dipped 1½ in deep in a 250 ppm IBA solution (potassium salt in water) solution for 10 seconds;
4. Twenty-seven cuttings were tied, nine per bundle, and dipped 1½ in deep in a 500 ppm IBA water solution (potassium salt in water) for 10 seconds;
5. Twenty-seven cuttings were wounded 1-in in length on opposite sides of the basal portion and tied in bundles of nine, and dipped 1½ in deep in a 500 ppm IBA solution (potassium salt in water).

All bundles were planted 1 ½ in deep and 8 in apart in a tray filled with a rooting medium of equal parts sand, peat-moss, and vermiculite. The tray was filled with 5 in of medium. Two electric heating cables were buried 4 in deep. Soil temperatures were maintained at 55 to 70°F. Cuttings were hand watered as needed to keep both soil and cuttings moist. Clear 6 mil polyethylene was used to cover the cuttings except on very hot days. Cuttings were removed, graded, and rated by root and callus development on March 12, 1983.

RESULTS

Semi-hardwood Cuttings. All cultivars rooted well from semi-hardwood cuttings. (See Table 1). 'Autumnglo' and 'Loring' had the highest rooting percentage. The root system was excellent with many fine, fibrous roots. Major causes of cutting loss were fungus infection identified as a *Pythium* and *Phytophthora* species. Most cuttings broke dormancy 2 weeks after transplanting. Cuttings grew rapidly in the greenhouse with temperatures maintained between 60 and 70°F. Lateral shoots were removed after a shoot broke dormancy to encourage strong, straight growth. Some tree loss occurred during the pruning process. This loss and further infection with a *Phytophthora* sp. was the cause of plant loss in the greenhouse. A manganese deficiency was corrected with additional applications of trace elements.

Table 1. Number and percent rooting and field planting of six cultivars of *Prunus persica* propagated as semi-hardwood cuttings.

Peach cultivar	Number of cuttings planted	Rooted cuttings transplanted to pots	Potted plants transplanted to field
'Autumnglo'	200	196 (98%)	191 (96%)
'M. A. Blake'	200	179 (90%)	169 (85%)
'Loring'	200	174 (87%)	154 (77%)
'Jerseyqueen'	200	178 (89%)	167 (84%)
'Redhaven'	200	199 (99%)	198 (99%)
'Rio Oso Gem'	200	178 (89%)	168 (84%)

Most trees from rooted cuttings exceeded 30 in in height and were ready for field planting on May 10, 1983, 81 days after potting. Planting was delayed until May 19, 1983, due to wet field conditions. Young, succulent trees were staked because of cool, wet, windy weather after planting. Thirty percent of some cultivars were lost during the early growing season with *Phytophthora* sp. root rot. Ridomil 2E at the rate of 2 qt/A was used to control the disease.

Trees of each cultivar were planted in a randomized block with the same cultivar on 'Lovell' seedling rootstock. After one

summer's growth, the surviving trees were similar in size to those on 'Lovell' roots. Nutrient leaf analysis has shown no difference between 'Lovell' budded trees and those on their own roots.

Approximately 18,000 semi-hardwood cuttings have been rooted by Gloucester County fruit growers during the summer of 1983. No data has been recorded on the rooting percentage to date.

Hardwood Cuttings. Harwood cuttings appeared to be more difficult to root than semi-hardwood cuttings. A higher percentage of 'Cresthaven' rooted when treated with IBA than any other cultivar. (Table 2). 'Redhaven' rooted better than 'Loring' and 'Rio Oso Gem' when wounded and treated with IBA. Wounding significantly improved the rooting percentage of both 'Redhaven' and 'Cresthaven'. The average of all showed a higher rooting percentage when wounded regardless of the IBA concentration.

Table 2. The effect of wounding and IBA treatment on the rooting of hardwood cuttings of *Prunus persica* cultivars.

	Percent rooted				
	'Cresthaven'	'Rio Oso Gem'	'Redhaven'	'Loring'	All cultivars
Control	0[z]a	0 NS	0 a	0 NS	0 a
250 ppm IBA	44 b	11	15 a	0	18 a
250 ppm IBA + wounding	93 c	4	48 b	15 b	40 b
500 ppm IBA	48 b	15	7 a	4	19 a
500 ppm IBA + wounding	96 c	4	59 b	11	43 b

[z] Means separated using Duncan's New Multiple Range Test, 5% level.

Table 3. The effect of wounding and IBA treatment on rooting and callus formation of hardwood cuttings of *Prunus persica* cultivars.

	Combined Percent Rooting and Callus Formation				
	'Cresthaven'	*'Rio Oso Gem'*	*'Redhaven'*	*'Loring'*	*All cultivars*
Control	0[z]a	0 a	0 a	0 NS	0 a
250 ppm IBA	86 b	70 b	86 b	38	70 b
250 ppm IBA + wounding	100 b	14 a	86 b	40	60 b
500 ppm	96 b	56 b	96 b	4	74 b
500 ppm IBA + wounding	96 b	14 a	92 b	52	64 b

[z] Means separated using Duncan's New Multiple Range Test, 5% level.

Callus formation appears to occur prior to rooting of peach cuttings. The effect of all treatments on combined callus formation and rooting was analyzed. (Table 3). All cultivars had significantly higher combined percent rooting and callus formation when treated with IBA. Wounding did not increase the combined percent callus and rooting on 'Redhaven' and 'Cresthaven', and reduced the percentage with 'Rio Oso Gem'.

'Loring' did not root or callus with any treatment under these conditions. Transplant survival of rooted cuttings was less than 10% and zero for those with callus.

DISCUSSION

The rooting of peach cultivars from semi-hardwood cuttings can be done cost-effectively by fruit growers, nurserymen, and others. Cost of rooting and growing trees was less than $1 per tree although this figure did not include greenhouse overhead and operation. After 7 years of testing and considering the work of Ernest Christ and Richard Marini in New Jersey and others, it appears the following peach cultivars can be rooted successfully from semi-hardwood cuttings: 'Redgold', 'Sunglo', Reliance', 'Burbank', 'July Elberta', 'Lovell', 'Autumnglo', 'Jefferson', Redhaven', 'Cresthaven', 'Rio Oso Gem', 'M.A. Blake', 'Loring', 'Early Loring', 'Slaybaugh', 'Special Jerseyqueen', 'Zee Rio', 'Casselloqueen', 'Springcrest', 'Bicentennial', 'Cardinal', 'Coronet', and 'Redskin'.

While the rooting of hardwood cuttings would be the preferred procedure to distribute labor requirements throughout the year more work is needed to increase rooting and increase transplant survivals before recommendations can be made. Based on a review of the literature, observations in grower orchards, and evaluation of older plantings in New Jersey, it appears that self-rooted trees are as long-lived and efficient as trees on available seedling rootstocks but more testing needs to be done.

Since certain rootstocks historically have had a profound and beneficial effect on the scion cultivar of most fruit types it is hoped that a beneficial peach rootstock can be developed that is propagated asexually and offered by commercial nurseries. The offering of quality peach trees that are true-to-name for the cultivar labeled will reduce the interest of fruit growers trying to become involved in this highly specialized enterprise.

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LEN STOLTZ: Did you try any other time than February with your hardwoods? From the Australian work it looks like January 15th to 30th, might be better.

JEROME FRECON: No.

CHARLIE PARKERSON: When did you harvest the cuttings?

JEROME FRECON: Six weeks after sticking.

BOB OSBORNE: Have you thought of the possibility of moving your hardwood cuttings directly to the field after callusing? Work from East Malling and some of ours indicates that you get a better take.

JEROME FRECON: That is being done in other parts of the world but I am afraid of soil temperature. Possibly it would work.

DAVE BAKKER: A suggestion that you might try which we use with *Prunus* × *cistena*. Make your cuttings before you have a severe frost and store at freezing in cold storage. In the spring, when the soil is warm enough, treat the cuttings with a No. 3 IBA powder plus Benlate and set on a heating table at 20°C. In 1 to 1½ weeks the cuttings will be well callused and when 1% are showing roots they can be dipped in a clay bath and planted with a mechanical planter.