Vegetative Propagation of Apricot (*Prunus armeniaca* L.) by Softwood Cuttings

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Apricot (*Prunus armeniaca* L.) cultivars were propagated by softwood cuttings in order to evaluate rooting ability. 'Heiwa' cuttings with IBA (indolebutyric acid) treatment inserted in June gave the highest rooting rate, while rooting did not occur in August or later. 'Heiwa' cuttings without IBA treatment did not root, regardless of the timing of cutting collection. Optimal IBA treatment for rooting of 'Heiwa' was investigated. The highest rooting rate and the largest number of roots per rooted cutting were obtained when the cuttings were soaked in 80 ppm IBA solution for 20 h. Cultivar difference in rooting ability was evaluated using five cultivars. Rooting rate varied from 63.3% for 'Shinshuohmi' to 96.7% for 'Alfred'. Larger numbers of roots were associated with the cultivars that had the higher rooting rates.

INTRODUCTION

Apricot cultivars are difficult-to-root from cuttings. Therefore, they have been propagated by grafting onto non-uniform seedling rootstocks. Propagation through cuttings is the most convenient, easy, rapid, and least expensive method. In addition, the problem of incompatibility due to poor graft union formation does not arise with the cutting method. In our previous study, apricot cultivars had very poor rooting ability as hardwood cuttings (Murai et al., 1994). However, propagation through softwood or semihardwood cuttings was often found to be successful with other difficult-to-root species, using mist and auxin treatments (Couvillon, 1982; Hartmann and Hansen, 1955a; 1958b; Sharma and Aier, 1989). However, there is only limited information on rooting softwood cuttings of apricot.

In the present study, we evaluated the rooting ability of softwood cuttings of apricot cultivars.

MATERIALS AND METHODS

Plant Materials. Donor plants of six cultivars ('Heiwa', 'Shinshuohmi', 'Niigataohmi', 'Bakuohjunkyou', 'Yamagata-3', and 'Alfred') were used and grown in an experimental field at Shizuoka University. They were healthy, uniform, and moderately vigorous trees.

Seasonal Changes in Rooting Response. 'Heiwa' cuttings were collected from 2 June to 3 Sept., 1994. Subterminal cuttings 12 cm long were collected from the upper parts of long shoots. All but the terminal three leaves were removed. All cuttings were soaked in distilled water for 20 h. The bases of half of them were dipped into 4000 ppm IBA (indolebutyric acid) solution for 10 sec, while the rest were left untreated. All cuttings were then inserted into coarse vermiculite under intermittent mist for 20 sec every 40 min. They were removed from the vermiculite after 40 days, and rooting was scored based on survival, rooting rate, and number of roots per rooted cutting.

Optimal IBA Treatment for Rooting. 'Heiwa' cuttings were collected from the upper parts of long shoots in early June and prepared as described above. The bases were soaked in 0, 20, or 80 ppm IBA solution for 20 h, or dipped into 4000 ppm for 10 sec. All cuttings were inserted into vermiculite, and rooting response was recorded as described above after 40 days.

Cultivar Difference in Rooting Ability. Cuttings were collected from the upper parts of long shoots of five cultivars ('Shinshuohmi', 'Niigataohmi', 'Bakuohjunkyou', 'Yamagata–3' and 'Alfred') on 3 June 1995. Cuttings for each cultivar were prepared as described above, and soaked in distilled water for 20 h. Then, the bases were dipped into 4000 ppm IBA solution for 10 sec, and inserted into vermiculite. After 40 days, rooting response was evaluated as described above.

RESULTS AND DISCUSSION

Table 1 shows changes in rooting response of 'Heiwa' apricot. Survival rates of cuttings ranged from 60% to 100% during this experiment. Cuttings collected in June (30.0%) and July (16.7%) rooted with the IBA treatment. Cuttings collected in August or later did not root. Without IBA treatment, cuttings did not root, regardless of the timing of collection. A larger number of roots occurred with the higher rooting rates. The rooting rates of deciduous trees increase from spring to summer, and then decrease from autumn to winter. It has been suggested that rooting is closely related to bud dormancy (Genma,1987; Fadl and Hartmann, 1967), therefore, rooting ability might reasonably be poor after August.

Table 1. Seasonal changes in rooting ability of 'Heiwa' apricot cuttings.

Date cuttings collected (month/day)	IBA treatment	Survival rate(%)	Rooting rate(%)	No. of roots per rooted cutting
6/2	+	80.0	30.0	15.6±2.0[y]
	-	70.0	0	-
7/3	+	60.0	16.7	4.2±1.0
8/2	+	63.3	0	-
	-	80.0	0	-
9/2	+	100	0	-
	-	90.0	0	-

[Z]The bases of each cutting were dipped into 4000 ppm IBA solution for 10 sec
[Y]Each value represents mean ± standard error.

Optimal IBA treatment for rooting was investigated. Table 2 shows the rooting response to various IBA treatments with 'Heiwa' apricot. The survival rate varied from 53.3% when soaked in 80 ppm IBA solution to 86.7% when dipped in 4000 ppm solution. The highest rooting rate was obtained with cuttings soaked in 80 ppm IBA solution, followed by 20 ppm IBA solution and then dipping in 4000 ppm solution. However, cuttings without IBA treatment did not root. Larger numbers of roots were associated with the treatment having the higher rooting rate. Based on the results in Table 1 and 2, it is evident that 'Heiwa' has a poor rooting ability. In addition, timing of cutting collection and IBA treatment are very important factors in rooting softwood cuttings.

Table 2. Rooting of 'Heiwa' apricot cuttings as affected by IBA concentration

IBA concentration (ppm)	Survival rate(%)	Rooting rate(%)	No.of roots per rooted cutting
0	83.3	0	-
20^{Z}	73.3	30.0	6.2 ± 1.0^{X}
80^{Z}	53.3	43.3	14.1±1.5
4000^{Y}	86.7	33.3	12.0±1.2

^{Z}Soaking in 20 ppm or 80 ppm IBA solution for 20 h.
^{Y}Dipping into 4000 ppm IBA solution for 10 sec.
^{X}Each value represents mean ± standard error.

Table 3. Cultivar difference in rooting ability of apricot cuttings^{Z}.

Cultivar	Survival rate (%)	Rooting rate (%)	No.of roots per rooted cutting
Bakuohjunkyou	93.3	16.7	4.6 ± 1.4^{Y}
Shinshuohmi	63.3	6.7	3.5±2.5
Niigataohmi	100	23.3	6.0±1.0
Yamagata-3	83.3	43.3	12.3±1.6
Alfred	96.7	86.7	10.4±1.4

^{Z}The base of each cutting for all cultivars was dipped into 4000 ppm IBA solution for 10 sec.
^{Y}Each value represents mean ± standard error.

The differences in rooting ability among five cultivars is shown in Table 3. Survival rates varied from 63.3% for 'Shinshuohmi' to 100% for 'Alfred'. 'Alfred' had a rooting rate of more than 80%, while, 'Niigataohmi', 'Bakuohjunkyou', and 'Shinshuohmi' had a rooting rate of less than 30%. Larger numbers of roots were associated with the better rooting rates as described above. Nemeth (1986) reported that rooting depended on genotype in many woody species in the Rosaceae. Therefore, similar results might occur in this experiment.

Based on the above results, further experiments are necessary to clarify the optimal conditions for the rooting of cuttings.

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