

EDITOR'S NOTE: Dr. H.S. Bhella of the Regional Plant Introduction Station at Iowa State University, Ames, Iowa presented a talk on the propagation of eastern white pine, *Pinus strobus* and ribber birch, *Betula nigra*. Papers have already been presented in *The Plant Propagator*, 22(4):8-10 and 23(2):5-7, respectively, and are, therefore, not repeated here.

PROPAGATION OF SELECTED MALUS TAXA FROM SOFTWOOD CUTTINGS

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Abstract. Cuttings of *Malus* × *atrosanguinea*, *M. floribunda*, *M. 'Hopa'*, *M. hupehensis*, *M. 'Selkirk'* and *M. siebodii zumi* var. *calocarpa* were collected at two week intervals from May 14 to August 6, 1976. IBA, NAA or a combination were applied at concentrations of 2500, 10000, 20000 or 30000 ppm as a 5 sec dip. Control was a 50% alcohol solution. Parameters used to evaluate rooting included root number, root length, degree of callus formation and rooting percentage. May and early June cuttings rooted in the highest percentages. The 2500 and 10000 ppm IBA treatments proved most effective. The two highest hormonal concentrations resulted in phytotoxicity. *M. × atrosanguinea*, *M. floribunda*, and *M. × z.* var. *calocarpa* exhibited the best rooting followed by *M. 'Selkirk'*, *M. 'Hopa'* and *M. hupehensis*.

Crabapples are commonly propagated by four methods: root grafting; top working; spring budding with dormant buds; and summer budding (16). Commercially crabapples are usually field-budded in August or benchgrafted during the winter months (6,8,12,13,14,16). However, many problems arise from these two propagation methods. Budding crabapples poses a number of problems. With many cultivars the wood is hard, the bark very thin or the scions very slender. Some crabapples have a hard hump beneath the bud making it difficult to complete a proper cut. Others have a depression beneath the bud so it is difficult to get enough tissue beneath the bud without cutting too much wood above and below the bud. Buds and leaf petioles vary greatly in size, making some very tedious to handle. Also, if budded early in the season some very crabapple cultivars start growth before winter, usually in a horizontal direction. This may produce crooked shanks the following year. Most budded crabapples must be staked from the time they are 12 to 14 inches high, because the stem stiffens rapidly behind the growing tip, long before a union is established at the base. Finally, production costs are very high with budded material (16,17).

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Grafting has the following disadvantages; the wood of some cultivars is very slender; others produce many spurs and only short terminal shoots; so ample scion wood may not be available; and some sucker prolifically from the rootstock. Viruses have become a very serious problem in clonal rootstocks, and the propagation method itself is conducive to a rapid spread of the disease. Incompatibility between scion and rootstock is another problem with the added possibilities of knot or gall infection at the graft union (1,2,3,8,11,15,16,17).

Budding is the preferred method (8,16,17), but grafting is also practiced (12,13,16,17). The principal advantages of budding are: much larger 1 or 2 year trees are possible; production of a better formed top and heavier rooted tree; and if scion wood is limited a tree may be produced from each good bud, whereas the normal graft requires a scion piece of at least three buds (17).

The advantages of growing crabapples on their own roots preclude suckering and incompatibility problems; plants do not need to be staked; the work is not as tedious as budding and grafting; and costs of propagation would be lowered by the practical nurseryman (18). Disadvantages include the increased time to produce a tree suitable for field or landscape planting (17). Also, specific recommendations must be developed for each crabapple taxon since individuals would respond differently.

Several individuals (4,9,13,16,17) have discussed putting crabapples on their own roots, but the commercial practice (4,10,13) is uncommon. *Malus* × *atrosanguinea*, *M.* × *arnoldiana*, *M. baccata* var. *mandschurica*, *M.* × *purpurea* 'Eleyi' *M.* × *purpurea* and *M. sylvestris* have been rooted from softwood cuttings (4,5,7,9) but the percentages were not high. Most of these studies employed low levels of rooting compounds applied as a soak over a 4 to 24 hour period (5) or used low concentrations of Hormodin #1, 2 or 3 (4,7,9). Brown and Dirr (2) showed that softwood cuttings of *Malus floribunda*, *M.* 'Hopa', *M.* 'Selkirk' and *M.* × *zumi* var. *calocarpa* could be effectively rooted if cuttings were collected early in the growing season and treated with high hormonal concentrations. In general, propagation of crabapples from hardwood cuttings has not proven successful (2,5,10,12,17).

This study was designed to determine if six commonly cultivated flowering crabapples (*Malus* × *atrosanguinea*, *M. floribunda*, *M.* 'Hopa', *M. hupehensis*, *M.* 'Selkirk', *M.* × *zumi calocarpa*) could be successfully rooted from softwood cuttings collected from mature trees using various hormonal concentrations on cuttings at selected periods throughout the growing season, so that specific recommendations could be made for

each taxon. This study was also undertaken to determine whether the effects of maturity could be overcome by high hormonal concentrations.

Softwood cuttings of the six previously mentioned crabapples were collected at approximately two week intervals from May 14 to August 6, 1976. The hormone treatments consisted of a 50% alcohol solution as control and 2500, 10000, 20000 and 30000 ppm IBA, NAA or a combination of the two, dissolved in a 50% ethanol solution. The cuttings were 4-6 inches long and consisted of the current season's growth. The basal portion of each cutting was stripped of foliage, given a 1 inch basal wound, and the remaining leaves cut in half to reduce the surface area. The cuttings were given a 5 sec dip in the hormonal solutions. Ten cuttings per treatment were used. Immediately after treatment the cuttings were placed in a 1 peat:1 perlite (v:v) medium to a depth of 3 to 4 cm with a spacing of 3 cm between cuttings and 6 cm between rows, and placed under intermittent systems which provided 6 sec of mist every 6 min during daylight hours. The temperature of the rooting medium was 25°C. The greenhouse temperature was maintained at 24°C day/20°C night. The photoperiod was natural and the greenhouse was given a medium shade.

Seven weeks from the date the cuttings were taken they were evaluated. The parameters used for evaluation were root number, length of the five longest roots, degree of callus and the rooting percentage. After evaluation the cuttings were transplanted to 4 inch pots and placed under intermittent mist for another 7 to 10 days. They were then moved to the greenhouse and kept under long days.

Malus × atrosanguinea. The optimum date for taking carmine crabapple cuttings was approximately May 14 (Table 1). Cuttings treated with 2500 ppm IBA rooted 100% had an average of 8.9 roots per cutting and the five longest roots average 45.2 cm. Cuttings taken June 24 and treated with 10000 and 20000 ppm IBA also rooted 100%. The average root numbers were 11.0 and 11.5, respectively, and the length of the five longest roots was 37.7 and 29.1 cm, respectively. Cuttings taken June 10 and treated with 2500 and 10000 ppm IBA rooted 100%, however, root numbers and lengths were not as great (5.9 and 7.5 roots per cutting, respectively, and 24.1 and 39.3 cm long, respectively).

Malus floribunda. Cuttings taken on May 27 and treated with 10000 and 30000 ppm IBA and those taken June 10 and treated with 30000 ppm IBA rooted 100% (Table 1). The root numbers were 19.6, 17.8 and 13.0, respectively, and the root lengths 38.6, 18.6 and 47.0 cm, respectively. Ninety percent rooting occurred on cuttings taken June 24. These cuttings were

treated with 20000 and 30000 ppm IBA. Root numbers and lengths were high (16.2 and 22.5 roots per cutting, respectively, and 35.2 and 47.3 cm, respectively).

Table 1. The most efficient hormonal concentrations for a given date and cultivar representing the best rooting percentage, number and length.

	Sampling Date	Hormonal Concentration (ppm)	Rooting Percentage	Root Number	Root Length (cm)
<i>Malus × atrosanguinea</i>	May 14	2500 IBA	100	8.9	45.2
	June 10	2500 IBA	100	5.9	24.1
	June 10	10000 IBA	100	7.5	39.3
	June 10	30000 IBA	100	7.4	18.7
	June 24	10000 IBA	100	11.0	37.7
	June 24	20000 IBA	100	11.5	29.1
<i>M. floribunda</i>	May 27	10000 IBA	100	19.6	38.6
	May 27	30000 IBA	100	17.8	18.6
	June 10	30000 IBA	100	13.0	47.0
	June 24	20000 IBA	90	16.2	35.2
<i>M. 'Hopa'</i>	June 24	30000 IBA	90	22.5	47.3
	May 14	2500 IBA	90	7.3	32.8
	May 14	10000 IBA	80	15.4	13.4
	May 14	20000 IBA	80	28.1	17.3
<i>M. hupehensis</i>	June 10	10000 IBA	90	4.5	7.9
	May 14	2500 IBA + NAA	90	2.3	6.4
	Aug. 6	2500 IBA	70	1.6	6.2
<i>M. 'Selkirk'</i>	Aug. 6	10000 IBA	60	2.5	6.0
	May 14	2500 NAA	100	9.3	32.0
<i>M. × z. var. calocarpa</i>	May 14	2500 IBA	90	6.7	32.1
	May 14	2500 IBA	90	9.7	43.4
	May 14	10000 IBA	80	17.7	34.3
	May 14	2500 NAA	80	6.9	31.5
	May 27	2500 NAA	100	8.3	39.9
	May 27	2500 IBA + NAA	80	3.5	15.2

Malus 'Hopa'. Hopa crabapple cuttings collected on May 14 and treated with 2500, 10000, and 20000 ppm IBA had the best rooting percentages (90, 80, and 80%, respectively) (Table 1). Root numbers were sufficient to allow transplanting (7.3, 15.4 and 28.1 roots per cutting, respectively). Root lengths were adequate (32.8, 13.4 and 17.3 cm in length, respectively). Although cuttings taken on June 10 rooted 90%, the root numbers (4.5) and length (7.9 cm) were not as well developed as the above mentioned.

Malus hupehensis. The best rooting percentage for the tea crabapple occurred on May 14 (Table 1). Cuttings treated with 2500 ppm combination rooted 90%. However, root numbers and lengths were sparse (2.3 and 6.4 cm, respectively). On August 6, cuttings treated with 2500 and 10000 ppm IBA rooted, but the percentages were not as high as commercial propagators would like (70 and 60%, respectively). Root numbers (1.6 and 2.5, respectively) and lengths (6.2 and 6.0 cm, respectively) were also minimal.

Malus 'Selkirk'. Maximal rooting (100%) was achieved on cuttings taken May 14 and treated with 2500 ppm NAA (Table 1). Root number and length were well developed (9.3 roots per cutting and 32.0 cm long, respectively). IBA at 2500 ppm was also effective on this date (90%). Root number was less than the NAA treatment, but length was comparable (6.7 roots per cutting and 32.1 cm long, respectively).

Malus × *zumi* var. *calocarpa*. Twenty-five hundred and 10000 ppm IBA-treated cuttings collected on May 14 had the greatest root numbers (9.7 and 17.7, respectively) and lengths (43.4 and 34.3 cm long, respectively) (Table 1). However, their rooting percentages were 90 and 80%, respectively. Twenty-five hundred ppm NAA treated cuttings collected May 14 and May 27 rooted 80 and 100%, respectively. But root numbers (6.9 and 8.3 roots per cutting) and lengths (31.5 and 39.9 cm long) were inferior to the previously mentioned treatments. Twenty-five hundred ppm combination cuttings collected on May 27 also rooted 80%. Root number was 3.5 per cutting and length was 15.2 cm.

Wide variances in rooting were observed among the selected crabapple taxa. Evaluation of rooting should be based on more than percentages. In many instances rooting percentages ranged from 80 to 100 yet the cuttings could not be effectively transplanted because only one or two short roots had formed. Cuttings which did not receive a hormonal treatment (control) showed limited rooting. The two highest concentrations often resulted in defoliation or death of the cuttings. Increasing the hormone concentrations did not result in increased rooting on cuttings collected later in the season. One nurseryman (4) noted that for cuttings made from the same shoots he adjusted the level of hormone according to the degree of maturation of the wood. The May and early June-collected cuttings continued to grow after transplanting while the late June, July and August cuttings either went dormant or died.

This study showed that crabapple cuttings collected in May or early June and treated with 2500 and 10000 ppm IBA could be effectively rooted in acceptable commercial quantities. The earliest-sampled cuttings were transplanted immediately after rooting and continued to grow thus facilitating field planting the spring following rooting.

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PROPAGATION OF HYBRID LILACS

DON WEDGE

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PROPAGATION BY GRAFTING

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