PROPAGATION OF THORNLESS-FRUITLESS SELECTIONS OF OSAGE ORANGE[1]

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ABSTRACT. Several clones of Osage orange were propagated using T-budding, softwood and hardwood cuttings from mature and from juvenile portions of male, thornless trees Most clones produced thorny juvenile growth especially when budded hardwood cuttings rooted 100% at 5,000 ppm IBA and produced thornless plants at moderate fertility levels

REVIEW OF LITERATURE

Osage orange, *Maclura pomifera* (Raf.) Schneid., is used primarily for hedges and windbreaks in the plains states, hence the name "hedge tree" is commonly applied (5). The tree has also been advocated for planting as an ornamental in difficult sites (3) and more recently as a possible urban tree, because it tolerates considerable pollution (1). The objectionable thorns and baseball-size fruit on female trees can be overcome by selecting and propagating superior male clones.

Although Rehder (4) lists a thornless variety, *M. pomifera var. inermis*, it is seldom found in nature and few have been commercially propagated. Old, "thornless" trees often produce thorns on vigorous, juvenile growth, although the trait disappears with maturity.

The general phenomenon of juvenility is well known and respected by propagators and is important in maintaining an easy-to-root, juvenile source of cuttings, or conversely, producing more mature wood for early flowering and fruiting. The changes in growth phases and their relation to vegetative propagation have been discussed by Stoutemyer (6).

The term topophysis applies to different parts of the same tree perpetuating particular growth phases (juvenile or mature) during propagation (2). Buds taken from lower, juvenile portions of such species as pear, citrus, or honeylocust often produce nursery trees that are vigorous, thorny, and slow to flower. Buds from the upper, more mature portion of the same tree produce thornless trees that flower more quickly.

In the past several years a search has been underway in several states to find a thornless Osage orange that can be easily propagated. Numerous clones have been evaluated at Kansas

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State University including 2 Kansas cultivars 'Pawhuska' and 'Chetopa', named for Osage Indian chiefs, that were released by the Kansas Agriculture Experiment Station in 1974. A third selection, 'Park', is being grown by Willis Nursery, Ottawa, Kansas. Others grown by Texas nurseries are 'Fan d'Arc' and 'Bois d'Arc Supreme.' The name Bois d'Arc refers to the Indians' use of its wood for bows Clones being evaluated from Iowa include 'Osage Chief', 'Keokuk', and 'Solomon', and a tree recently discovered near Wichita (referred to by that name) appears promising in preliminary tests.

MATERIALS AND METHODS

Objectives of this experiment were to determine the effects that various propagation techniques and nursery practices have on growth and thornlessness Compared were (1) T-budding, (2) softwood cuttings, and (3) hardwood cuttings, taken from mature and juvenile portions of mature trees.

Budding. Seed for producing understock were removed by soaking the large leathery fruit until fermentation allowed the seed to slip freely from the "mash". Seeds were then sown either in a cold frame or directly in a nursery row where budding was to be done

Fall sowing, to insure stratification, produced thorny seedlings large enough to bud by August or the following May. One year-old understock was lined out in the spring and budded as soon as the combium became active. Some T-budding was done in May but the best trees were produced from August buds froced the following spring.

Rooted Cuttings. Seedling understock could potentially produce thorny root sprouts, although this has not been observed to be a problem Nevertheless, a plant on its own roots avoids this and other incompatibility problems resulting from a graft union.

Softwood cuttings of 3 selections were compared for rootability and for growth and thornlessness when grown in a field soil or in containers. Cuttings taken June 13, 1979, and treated with Rootone F were placed in a sand medium with intermittent mist 10 seconds ever 6 minutes. After rooting, cuttings were potted in 4-inch pots, overwintered under a microfoam blanket, then lined out in a nursery row or potted in 1 gallon containers the next spring.

Hardwood cuttings were examined as a method of producing larger trees in a single season that could be overwintered more successfully than trees grown from softwood cuttings and potted late in the summer. Using dormant cuttings also eliminated the need for an intermittent mist system.

Two thornless male clones were chosen as a source of cuttings. Clone 1, discovered near Wichita, had been propagated previously by T-budding and thus provided a source of juvenile wood. Mature wood was also taken from upper protions of the parent tree. Cuttings were taken from both upper and lower portions of clone 2 from the Chisholm farm.

Cuttings were taken January 18, 1980, given a 5 second dip in IBA at concentrations of 0, 1,000, 5,000 and 10,000 ppm and placed in a medium of coarse perlite and sphagnum peat (70:30) over bottom heat. Temperature of the medium was maintained at 65-70°F. An opaque poly tent of milky plastic covered the propagation bed to maintain high humidity until it was removed when more light was needed for shoot development.

After rooting, cuttings were potted in 2¼ inch pots in early March, placed in an outdoor hotbed, and later shifted to 1-gallon containers using a medium of pine bark:peat:sand: (2:1:1) amended with Osmocote formulation 18-6-12 plus 2.5 lbs 0-20-0 superphosphate, 1 lb fritted trace elements and 10 lbs dolomitic lime per yd^3. Pots were treated with an additional ½ or 1 tbsp of surface-applied Osmocote, 18-6-12, on June 23, 1980. Growth and thornlessness were recorded at the end of the growing season.

RESULTS

Softwood cuttings, taken in June, rooted as high as 86% in 5 weeks, but at a lower percentage when cuttings taken in July, although the species can be rooted most months of the year.

Trees grown in the rich but unfertilized nursery soil grew best, but also produced more thorns (Table 1). This indicates the species is better suited to field production than containers. One-gallon containers, even with additional fertility supplied, restricted this vigorous tree species The number of thorns increased with the fertility level which favored vigorous, juvenile growth. Some plants grown at lower fertility levels were completely thornless.

Hardwood cuttings rooted nearly 100% at every level of IBA. Maximum rooting occurred at 5,000 ppm but distribution of rootings improved at 10,000 ppm (Table 2).

Cuttings from both upper and lower portions of clone 2 produced extremely thorny growth the first year. Trees grown from mature wood taken from the upper portion of the tree produced slightly fewer thorns (Table 3). Clone 1 proved quite thornless, and further testing is underway to compare it with others now being grown commercially. Only an occasional thorn could be found even under the highest fertility level tested. Vigorous whips 6 feet tall were also produced without thorns by budding on 2 year understock.

Table 1. Growth and thornlessness of Osage orange selections grown from softwood cuttings [1]

Osage orange selection	Treatment[2]	Season's growth (in)	No thorns per plant
	1 gal — no additional N	23	5
'Park'	1 gal + 5 gms 18-6-12	29	7
	Nursery — no additional N	44	37
	1 gal — no additional N	30	4
'Pawhuska'	1 gal + 5 gms 18-6-12	26	9
	Nursery — no additional N	34	27
	1 gal — no additional N	30	15
Clone No 2	1 gal + 5 gms 18-6-12	27	17
(Chisholm)	Nursery — no additional N	39	35

[1] Stuck 6/13/79, potted in 4" pots and shifted to 1 gal containers or lined out in nursery on 5/25/80

[2] Soil peat perlite (2 1 1) medium was amended with Osmocote 18-6-12 at 7½ lbs per yd[3]

[3] Half the containers recieved ½ tbsp additional surface-applied fertilizer after potting

Table 2. Effects of IBA concentrations on rooting hardwood cuttings of two Osage orange clones

Clone	Location of cutting[1]	IBA conc (ppm)	Percent rooted
Clone No 1	High	0	56
(Wichita)	(parent tree)	1,000	100
		5,000	100
		10,000	88
	Juvenile	0	29
	(Budded trees)	1,000	71
		5,000	100
		10,000	100
Clone No 2	High	0	11
(Chisholm)		1,000	55
		5,000	100
		10,000	89
	Low	0	0
		1,000	75
		5,000	100
		10,000	100

[1] For comparison of juvenile and mature wood, cuttings were taken from high or low on parent tree or from young vigorous trees in a nursery row

DISCUSSION

Osage orange can be rooted nearly any time of the year, although softwood cutings at the peak of juvenile growth, or hardwood cuttings in mid-winter rooted best. Hormone treatments greatly increased rooting percentages.

Growth in a rich, moist field soil was better than that in the containers although the number of thorns increased with vigor.

Thornless trees produced by T-budding provided a more acceptable nursery tree in one season.

Most so called "thornless" hedge trees may occasionally produce a few thorns on juvenile wood, but this trait can be overcome in time as wood gradually matures so the few thorns should not limit the use of this rugged species in areas nearly impossible for other species to succeed.

Through proper selection, propagation techniques, and moderate fertility levels, it is possible to produce thornless trees acceptable to the nursery trade. Osage orange is easy to propagate in a variety of ways and offers great potential as a tree for difficult sites.

Perhaps it is time to make increased use of this tough, insect and disease resistant species in pollution-clouded inner cities as well as on wind swept prairies and other places where few other tree species could survive.

Table 3. Growth and thornlessness of Osage orange clones as affected by location of cuttings and fertilizer treatments

Clone	Location of cutting[1]	Fertilizer treatment gms[2]	Season's growth (in)	No thorns per tree
Clone No 1	High	0	20 3	0
(Wichita)	(Parent tree)	5	19 2	1
		10	24 6	2
	Nursery trees	0	8 8	0
	(Juvenile)	5	16.5	1
		10	15 3	4
Clone No 2	High	0	16 9	18
(Chisholm)	(Parent tree)	5	20 1	14
		10	18 1	18
	Low	0	20 6	20
	(Parent tree)	5	21 0	20

[1] Only a small amount of cutting wood was suitable in the lower portions of both trees so young nursery trees were used as a juvenile wood source of the Wichita clone

[2] Original medium contained Osmocote 18-6-12 at 7½ lbs per yd³ Additional, surface-applied treatments of 0, ½, and 1 tbsp per gal container were made June 23, 1980

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BREEDING AND SELECTING CLONES OF RHODODENDRONS INCLUDING AZALEAS

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(See-Proc. Inter. Plant Prop. Soc. 29:431-436 1979).

Thursday Afternoon, December 11, 1980

The Thursday afternoon session convened at 2:15 p.m. with James Sabo serving as moderator.

MYCORRHIZAE AND THEIR USES IN THE NURSERY

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Symbiotic associations between certain soil fungi and plant roots constitute relationships termed "mycorrhizae". Mycorrhizal roots are observed in nearly all native stands of plants, in all parts of the world (4, 14). In climates ranging from tropical to arctic, woody and herbaceous plants are normally involved in this form of symbiosis. Fungal symbionts in mycorrhizal associations include members of the *Endogone, Ascomycetes and Basidiomycetes* (4, 13).

There are two major types of mycorrhizae, distinguished by the way in which the fungus attaches itself to the root (4, 6, 10). The first classification is the ectomycorrhizal group, and the second is the endomycorrhizal group. In ectomycorrhizal associations, a fungal sheath forms around the exterior of the root and is a distinctive visible feature (10). The fungal sheath consists of divided fungal hyphae, but appears superficially as though it were made of plant cells (6). From this outer sheath, hyphae extend outward into the soil, and also inward around the outer cortical cells of the root. The inward extension is termed a *Hartig*