"Nursery Propagation by Hardwood Cuttings" Question-Answer Period

No recording.

POSTER SESSION

Seasonal Changes in Adventitious Root Formation in Stem Cuttings of *Prosopis alba*

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Seasonality in rooting response of stem cuttings in relation to exogenously applied K-IBA was studied in nitrogen-fixing trees of genus *Prosopis* (mesquite). Cuttings of field-grown trees were successfully rooted using an intermittent mist propagation bench during a period of high temperature and relatively higher humidity levels (May to September) than in winter months. The adventitious root formation on cuttings was inhibited during the dormant period (November to February). The efficacy of exogenously applied K-IBA concentration varied with the position of cuttings on the stem. An increasing concentration of applied K-IBA appeared to be correlated with the apical and basal end of the cuttings for the optimum root initiation and development.

INTRODUCTION

Nitrogen-fixing trees of genus *Prosopis* are drought resistant and well adapted to poor soils of dry regions (National Academy of Sciences, 1979). Previous research has demonstrated considerable variation in tolerance to cold, salinity, and in pod production (Felker et al., 1981, 1982, and 1984). This variability can be attributed to the fact that several *Prosopis* species are self-incompatible (Simpson, 1977) and thus plants are obligate outcrossers that do not propagate true to type from seed. Cross-fertilization results in wide genetic variations in populations within species of *Prosopis chilensis* and *P. velutina* (Solbrig et al., 1977; Palacios and Bravo, 1981; Munziker et al., 1986). Inter- and intra-specific hybridization results in creation of new phenotypes with a wide range of characteristics such as growth rate, spines, growth habit, and frost tolerance. With respect to the landscape use of mesquite trees, desirable characteristics include: absence of spines, good growth form, frost tolerance, and insect resistance. The development of clonal propagation methods is necessary for large-scale production to be used in the nursery industry.

The purpose of this investigation is to develop a method for vegetative propagation and to relate the seasonal growth pattern of *P. alba* to its rooting ability using a misting propagation technique.

MATERIALS AND METHODS

Propagation of Field-grown Trees. Cuttings were collected monthly during 1993 and 1994 and were obtained from adult individuals over 4-5 years old grown around the Phoenix area. The branches selected were new growth during summer and fall. However, previous year's growth was used as cutting material during early spring.

Cutting Propagation. Each cutting consisted of 3 nodes with leaves removed from the lower nodes. All cuttings that consisted of entirely green stems came from the same trees for each treatment per season. Basal ends of cuttings were given a 5-sec dip in the hormone solution, air dried and then inserted 3 cm into a rooting medium consisting of a of medium grade vermiculite and perlite (1 : 1, v/v). The medium was drenched with 500 mg $liter^{-1}$ Banrot (Sierra Crop Protection Co., Milpitas, CA.) prior to sticking cuttings. The maximum light-intensity at each bench level was 500-550 $\mu mole\ m^{-2}\ s^{-1}$.

Intermittent mist was provided at an interval of 8 min for a duration of 8-10 sec for the first 3 weeks. The duration of mist was then gradually reduced. Soil temperature was maintained in the range of 30-35C. The rooting percentage was measured after 6 weeks.

Effect of Cutting Position and K-IBA Concentration. In this study, 20-25 cuttings were used per treatment and randomized in the greenhouse. Each experiment was repeated 2-3 times. Root quality determinations were not made in order to avoid root damage.

Preliminary experiments were conducted to determine a range of optimum conditions and K-IBA concentrations for root initiation. In later studies, K-IBA at concentrations of 200, 500, 1000, and 2000 ppm were examined for basal, middle and apical sections of the stem. K-IBA was used (Sigma Chemical Co., St. Louis, MO.). The apical cuttings consisted of the terminal 3 nodes of the stem (apex removed). Middle and basal cuttings consisted of the next 3-6 nodes down on the same stem.

Statistical analysis was performed using the MSTAT statistical program.

Serial Propagation of Rooted Field-grown Trees. The rooted cuttings were planted in 5-gal. containers and then transplanted to the field to be grown as adult trees. Cuttings were taken from field-grown clones and rooted as described earlier. The data provided in this communication is an average of 2 years of experiments.

RESULTS AND DISCUSSION

Preliminary Experiment. In this study a wide range of K-IBA concentrations (200-5000 ppm) were used for tip, middle, and basal sections of the stem. The results indicated that the base of cuttings treated with 5000 ppm K-IBA turned black within 48 h. Similarly, tip cuttings showed blackening at the base of cuttings treated with 1000 ppm or higher concentration of K-IBA. The fungal drenches of Banrot, Subdue and Domain did not affect rooting potential.

Effect of K-IBA Concentration and Stem Position. In the study started in April and May, K-IBA increased rooting on cuttings taken from apical, middle, and basal end of the cuttings. While apical and middle cuttings rooted better with 1000 ppm K-IBA, basal cuttings rooted better with 2000 ppm K-IBA than with other concentrations.

The maximum vegetative growth took place during the months of May through August. Apical, middle and basal cuttings rooted better in water during the months of June, July, and August as compared to those in April and May. Apical cuttings rooted better (86% to 90%) at 200 and 500 ppm K-IBA than at 1000 ppm K-IBA (53%). Higher concentrations (5000 ppm) of K-IBA inhibited rooting completely. Middle and basal cuttings responded better to higher concentrations of K-IBA than apical cuttings. K-IBA at 1000 and 2000 ppm produced maximum roots (96%) on cuttings taken from middle and basal portions of the stem, respectively.

Stem cutting material started to decline in condition during September and October. It is, however, interesting to note that apical cuttings rooted better with 500 and 1000 ppm (September and October) than with 200 ppm K-IBA. However, rooting response was lower in all K-IBA concentrations compared to those in May-August (Table 1).

Table 1. Effect of K-IBA concentrations on rooting stem cuttings of *Prosopis alba*[1,2].

Month	IBA concentration (ppm)					
Cutting position	0	200	500	1000	2000	5000
April-May						
Apical	16	40	56	77	0	0
Middle	20	43	43	77	43	0
Basal	10	46	57	90	87	23
June-July-August						
Apical	53	87	90	53	33	0
Middle	50	53	57	100	73	0
Basal	40	53	66	86	100	13
September-October						
Apical	23	50	73	66	13	0
Middle	16	46	43	76	53	0
Basal	23	33	43	63	73	6
November-December						
Apical	0	0	5	0	0	0
Middle	0	0	8	0	0	0
Basal	0	0	8	0	0	0

[1]Percent of cuttings rooted.
[2]Thirty cuttings per treatment.

In limited experiments conducted during November-January, a period corresponding with lowest bud activity, rooting was very poor. Maximum rooting achieved was only 5% with apical cuttings and 8% with basal and middle cuttings. Cuttings did not root without K-IBA application.

These seasonal variations in rooting response with K-IBA application indicate that internal physiological conditions of the stock plants are important factors during rooting of stem cuttings. During the period of high temperatures (35-40C) and high humidity (30% to 35% in Arizona), *Prosopis* species grow rapidly and cutting material produces the highest number of adventitious roots. Our results also indicate that very low concentrations of K-IBA are sufficient to produce maximum roots on the apical cuttings. However, the requirement of K-IBA increases with the increase in stem diameter and distance from the apex (basal and middle cuttings).

Earlier studies have reported a similar seasonal decline for *Prosopis* as rooting of six *Prosopis* species dropped from 60% to 100% in spring to only 15% in fall using greenhouse-grown clonal stock plants (Felker and Clark, 1981). Hormonal treatments were found to be ineffective in overcoming the seasonal influence on the rooting of cuttings (Klass et al., 1985).

The results indicate that *Prosopis* cuttings rooted better with K-IBA application throughout the year. However, high concentrations (5000 ppm) inhibited rooting. In general, K-IBA in the range of 200-1000 ppm in water appears to be a suitable level for cuttings taken from *P. alba* trees for root initiation and development. In contrast, studies in Texas of *P. alba* clone B2V50 found both rooting percentage and root number to be higher at 12,000 ppm than at 3000 and 36,000 ppm K-IBA in talc (Klass et al., 1987). A comparison of talc and ethanol showed that four and a half times as much IAA in talc as in ethanol was required to produce the same amount of roots on cuttings of *Ilex* (Heung and McGuire, 1973).

In the present study, rooting of *P. alba* is seasonal. The period of vigorous vegetative growth, flowering, and fruiting in the warm season is directly attributed to the highest rooting response with low auxin application. The very low rooting response in late fall and winter can be correlated with limited endogenous factors during the period of low vegetative activity. The rooted cuttings were planted and produced trees of a uniform height of 10 to 12 ft within 2 years.

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