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## VEGETATIVE PROPAGATION OF *PINUS* *MAXIMARTINEZII*

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### **Introduction**

*Pinus maximartinezii* Rzed. is a rare pinyon pine with a natural range restricted to one site, Cerro Piñones in southern Zacatecas, Mexico. The entire distribution of the species is reported to be approximately 400 hectares and the population size about 2000 mature individuals (Donahue and Mar-Lopez, 1995). Most of the population occurs in a band from 2100 to 2300 m elevation. *P. maximartinezii* has been considered one of the most rare and endangered of all pine species (Farjon, 1993, Perry, 1991).

*P. maximartinezii* is one of only two five-needled pinyon pines in North America. The remaining trees in the Zacatecas population grow on private property where landowners value them for their pine nuts (seeds) and therefore protect mature, fruiting trees. The Central America and Mexico Coniferous Resources Cooperative (CAMCORE) at North Carolina State University, and the Centro de Genética Forestal (CGF), Chapingo, Mexico initiated a gene conservation project in 1993. A population-wide seed collection was conducted and *ex situ* conservation banks were established (Donahue and Mar-Lopez, 1995). A second CAMCORE/CGF seed collection took place in November, 1998. Seed from this collection will be used to establish gene conservation banks, to continue with propagation research, and to better quantify the levels of genetic diversity, in the remaining population, using molecular markers.

The objective of the work presented by this poster is to develop a vegetative propagation protocol for *P. maximartinezii* as a component of the effort to increase the utilization and conservation of the species. The study, at North Carolina State University, will be divided into rooted cutting experiments and hedge management experiments.

### **Auxin and Substrate Experiment (Experiment 1)**

In an effort to learn about the effects of rooting hormones and substrates, on the rooting success of *P. maximartinezii* cuttings, a small trial was designed and established using cuttings obtained from potted plants. The cuttings were harvested from 3-year-old (potted) stool plants before the stool plants were hedged for Experiment 2 (hedging height and hedging intensity). Two containerized substrate mixes of peat and perlite are being examined (35% peat 65% perlite, vs. 65 % peat 35% perlite). Additionally, Jiffy pellets (peat pellets) have also been included as a substrate treatment (Table 1). The effects of the different substrates, coupled with the rooting hormones will be assessed for rooting success.

This experiment was established in the North Carolina State University Loblolly and Slash Pine Rooted Cutting Program's mist-house on September 21, 1998. Cuttings, approximately 8 to 10 cm in length, were harvested from the terminal shoots of stool plant

branches, from different regions of the stool plant, and have been managed as different treatments (Table 1). Cuttings came from either the top quarter of the plant, or the bottom third of the plant in order to assess possible differences in rooting potential due to cutting position on the stool plant. Prior to sticking, the cuttings were recut at the base and treated with auxins. The three auxin treatments were: 1) Rhizopon #3, a commercial rooting powder (0.8% indole-3-butyric acid), 2) 2.5 mM naphthalene acetic acid (NAA in liquid form), and 3) 10 mM naphthalene acetic acid (NAA in liquid form). After the auxin treatment, the cuttings were stuck in the substrates about 1.5 to 2 cm deep without removing any of their needles.

Although mortality has been low (6%), and many of the cuttings have visible signs of root formation, it is still too early to assess the rooting success of the cuttings. This first substrate and hormone trial should lead to the development of a rooting protocol to be used for future vegetative propagation work with this endangered species.

### **Hedging Height and Hedging Intensity (Experiment 2)**

Following the harvest of cuttings for Experiment 1, the *P. maximartinezii* stool plants were hedged at different heights; stool-plants were hedged to 15 cm, 30 cm, and 45 cm above the soil surface. In addition, the plants hedged to 30 cm were divided into two groups: one where all of the remaining branches were cut back to half of their original length, and the other where all the branches were left intact. The number of cuttings produced by each treatment, and the rooting success of those cuttings will be measured. The results from experiment 1 will be used to root the cuttings produced by the hedging treatments.

### **Discussion**

Vegetative propagation has become an important forestry tool used to propagate selected individuals, or families, in operational tree improvement programs worldwide. Programs that rely on hybrid crosses, or costly controlled crosses, now multiply the limited quantities of seed resulting from these crosses, through simple vegetative propagation techniques. There are limited amounts of *P. maximartinezii* seed available for research, conservation, and/or reforestation programs; vegetative multiplication techniques will most likely be required to produce the numbers of propagules needed for research with this species. We hope to refine, or develop, some simple rooted

Table 1. Treatments for Experiment 1 (Auxin and Substrate Experiment)

Variable	Treatment
Substrate	1) 65% perlite + 35% peat mix 2) 35% perlite + 65% peat mix 3) Jiffy Pellets (100% peat)
Auxin	1) Rhizopon (0.8 % IBA, powder) 2) 2.5 mM NAA (liquid) 3) 10 mM NAA (liquid) 4) None
Repetition	8 repetitions
Cutting Number/Treatment	6 cuttings/trtmt (1152 total cuttings)

cutting propagation techniques for this unique, endangered pine.

It may be possible to select and propagate heavy cone and seed producers to replant on the Cerro Piñones (Zacatecas) where several local families rely on seed (pine nut) sales to supplement their income. One kg of unshelled pine nuts, approximately 900 seeds/kg, can sell for US\$ 25 to 50 dollars in Pueblo Viejo, Zacatecas. Ease of propagation may lead to future widespread use of this beautiful, open-crowned, small, pine tree as an ornamental, especially around the tropics and subtropics. Increased awareness and use of this species may encourage further conservation efforts both *in situ* and *ex situ*.

### **Literature Cited**

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