EFFECTS OF SHEARING HEIGHT, PRUNING INTENSITY, SHOOT ORIGIN AND FAMILY ON SHOOT MORPHOLOGY AND THEIR EFFECTS ON ROOTING OF LOBLOLLY PINE STEM CUTTINGS

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INTRODUCTION

Large potential genetic gains in forestry have prompted the pursuit of cost-effective cloning methods and mass production of full-sib families. The utilization and capture of nonadditive gains can only be realized through the replication of clones or the multiplication of full-sib families. If vegetative propagation technologies are going to offer viable alternatives to other technologies such as control-pollinated seed production, then it is imperative to incorporate cost-effective techniques that maximize rooting percentages. Maximizing rooting of loblolly pine *(Pinus taeda* L.) stem cuttings could be enhanced by identifying the target cuttings and delineating hedge management practices that achieve target cutting production at the highest frequencies.

METHODS

To achieve these objectives, we conducted an experiment to test the effects of shearing height, pruning intensity and shoot origin on number of roots per rooted cutting, rooting percentage and shoot morphology. Twenty hedges each from three full-sib families were selected for use. Treatments consisted of two shearing heights, two pruning intensities (removal of all existing buds on the hedge (disbudded) or retention of a portion of existing buds on the hedge), and two shoot origins (newly formed cuttings and pre-formed cuttings). The cuttings resulting from the shearing and pruning treatments were collected and the following morphological attributes were assessed: shoot basal caliper, primary needle length, fascicle needle length, shoot shear strength and presence of cataphylls. The experiment was repeated twice, once in the spring of 1997 and in the spring of 1998. In addition to analyzing the main treatment effects on rooting and shoot morphology, the effects of shoot morphology on rooting percentage were analyzed.

RESULTS

Main Effects on Shoot Morphology

The height at which the hedges were sheared significantly affected shoot morphology. In both years, shearing height had a significant effect on shoot caliper. In 1997, the cuttings from the lower hedge height had a greater caliper, while in 1998, they had a smaller caliper. In both experiments, hedge height significantly affected primary needle length and fascicle needle length. Cuttings taken from the lower hedge height developed longer primary needles and shorter fascicle needles. Similarly, in both years, the cuttings from the lower shearing height were more succulent and had a significantly lower percentage of cataphylls.

Pruning intensity had a significant effect on shoot morphology. In both years, cuttings collected from disbudded hedges had larger calipers than cuttings collected from hedges with buds. Primary needle length and fascicle needle length were also significantly affected in both years. Cuttings from disbudded hedges developed longer primary needles and shorter fascicle needles. Shear force and the presence of cataphylls were also significantly affected by pruning intensity, in 1997 and 1998. Cuttings from disbudded hedges were more succulent and had significantly fewer cataphylls present.

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Shoot origin had a significant effect on shoot morphology. In 1997, newly formed cuttings had significantly larger calipers than pre-formed cuttings. Conversely, in 1998, newly formed cuttings had smaller calipers. Shoot origin had a significant effect on primary needle length and fascicle needle length in 1997 and 1998. Newly formed cuttings developed longer primary needles and shorter fascicle needles. Shoot origin also had a significant effect on shoot shear strength and the presence of cataphylls, in both years. Newly formed cuttings were more succulent and had a significantly lower percentage of cataphylls.

Family had a significant effect on shoot morphology. Family significantly affected shoot caliper in 1998, but not in 1997. However, family effects on primary needle length and fascicle needle length were significant in both years. The shear force necessary to sever a cutting was significantly affected by family in 1997, but not in 1998. The presence of cataphylls was similarly affected.

Main Effects on Rooting

The number of roots initiated was significantly affected by family in both years. In 1997, families A, B and C, across all treatments, initiated 1.05, 1.23, 1.79 mean roots per rooted cutting respectively. In 1998, respective mean number of roots initiated were 2.31, 3.05, and 3.43. In 1997, shearing height had a significant effect on the number of roots produced; cuttings collected from the lower hedge height initiated more roots than cuttings from the higher hedge height. In 1997, pruning intensity also had a significant effect on the number of roots initiated, cuttings collected from disbudded hedges produced a greater number of roots than cuttings collected from hedges with buds. Shoot origin had a significant effect on the number of roots produced in 1998. All newly formed cuttings initiated significantly more roots than pre-formed cuttings.

Rooting percentages were significantly affected by family, in both years. In 1997, families A, B and C, across all treatments rooted at 48%, 63%, and 75%, respectively. In 1998, respective rooting percentages were 78%, 88% and 82%. In 1997, shearing height had a significant effect on rooting percentage. Cuttings collected from the lower hedge height rooted at significantly higher frequencies than cuttings taken from the higher shear height. In 1998, shoot origin had a significant effect on rooting percentages. Newly formed cuttings rooted at significantly higher percentages than pre-formed cuttings.

Effects of Shoot Morphology on Rooting Percentage

A stepwise selection was used to determine which of the categorical or continuous variables had the greatest effect on rooting. Only the results of the continuous variables have been reported at this time. In 1997, shoot shear strength was negatively correlated to rooting. In both years, shoot caliper had a significant effect on rooting. In 1997, the response was linear and positively correlated, conversely, in 1998; shoot caliper was negatively correlated to rooting. Primary needle length was positively correlated to rooting in 1998 as well.

CONCLUSIONS

Hedging treatments moderately affected rooting. In both years, with one exception, the effects of shearing height, pruning intensity and shoot origin were consistent in their effects on shoot morphology. Due to inconsistent results between experimental years, there is insufficient evidence to conclude that the morphological attributes (shoot shear strength, shoot caliper and primary needle length), are indicators of rooting potential. There is, however, evidence that rigorous hedge management practices can increase rooting reliability.