

The Effects of Media, Hormones, and Stem Diameter on Adventitious Rooting of *Acacia confusa* Stem Cuttings



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Abstract: The Formosa Acacia (*Acacia confusa*) is a woody perennial species native to Southeast Asia. This tree has historically been used for teas, condiments, lumber, and traditional medicines. Seed propagation is common with *A. confusa*, but there is a lack of information regarding its potential for asexual propagation. Our investigation focused on the influence of media, hormones, and stem diameter of stem cutting rooting success. Cuttings were all selected from the same three-year old mother plant and randomly placed in four media treatments; 1) Pro-Mix BX commercial mix, 2) 1:1 ratio of Coir and Peat, 3) Perlite, and 4) 1:1 ratio of Peat and Perlite. In each media treatment, half of the cuttings were subjected to a 0.3% IBA (Indole-3-butyric Acid) treatment. All treatment combinations were placed on an automated misting bench with bottom heat in the greenhouse for eight weeks. This experiment was conducted twice, once in the fall and again in the spring. Upon data collection, cutting diameters were all measured directly above the second node. Each individual was assessed for the presence of rooting and the number of roots. The use of IBA significantly increased the presence of rooting and the number of roots per cutting in all media treatments. Media treatments containing perlite and peat produced fewer rooting individuals and reduced number of roots per cutting. Stem diameter influenced rooting success in the spring experiments but not in the fall. These data provide preliminary observations towards developing efficient asexual propagation protocol for *A. confusa*.

INTRODUCTION:

Introduction: The Formosa Acacia (*Acacia confusa* Merr) is a woody leguminous tree native to Taiwan. Historically, it has been used for feedstock, charcoal making, and lumber (Siao-Jong, 1978; Arumugam *et al*, 2009). Additionally, *A. confusa* is reputed to have medicinal properties and has been used in Taiwanese folk medicine for a variety of ailments (Siao-Jong, 1978; Arumugam *et al*, 2009). In recent years, research has demonstrated its utility as a soil stabilizer and nitrogen fixer in soil conservation efforts (Chan *et al*, 1999; Shangmiao, 1999) as well as its potential as grafting rootstock for a Hawaiian native Acacia (Nelson, 2006). Seed germination is the typical means of propagating *A. confusa* (Shengiong, 1992; Arumugam *et al*, 2009), but inherent seedling variation produces challenges related to the uniformity and quality of nursery stock (Siao-Jong, 1978; Arumugam *et al*, 2009). Tissue culture has been investigated as a means to propagate superior clones (Jinxiang *et al*, 2001). However, our extensive literature review revealed no studies on more widely applicable stem cutting propagation methods. Studies of other Acacia species demonstrate that cutting position on the stem, cutting maturity, and auxin application influenced rooting percentage, root number, and root length (Poupard *et al*, 1994). The objectives of our study were to investigate the effects of media, auxin, and stem diameter on rooting percentage and root number. We hypothesized that IBA treatments would significantly increase rooting percentage and the number of roots per cutting, that the Pro-Mix BX media would achieve the highest rooting success, and that increasing stem diameter would correlate with higher numbers of roots per cutting.

MATERIALS AND METHODS

Propagation Study

- Cuttings harvested from 3yr old seedling mother plant
 - Yielded a total of 128 cuttings, each with 4 nodes
 - Fall 2014 – 59 cuttings
 - Spring 2014 – 69 cuttings
- Phyllodes from bottom two nodes removed
- Two hormone treatments
 - No hormone
 - IBA - Hormodin 3 (0.3% IBA)
- Four media treatments
 - PBX - Pro-Mix BX commercial mix (Premiere Tech Horticulture)
 - C/P - 1:1 ratio of Coir and Peat
 - P - Perlite
 - P/P - 1:1 ratio of Peat and Perlite
- Cuttings randomly assigned to each hormone / media treatment
- Cuttings placed on automated mist bench in greenhouse
 - Mist cycle – 7 seconds every 10 minutes

Data Collection and Analysis

- Data collected after 8 weeks on mist bench
 - Presence or absence of rooting
 - Number of roots
 - Stem diameter at second node
- Data from each date analyzed separately
- Rooting and root number analyzed using PROC MIXED; SAS v. 9.3
- Means separation testing via Tukey-Kramer (P<.05) ; SAS v. 9.3
- Separate simple regression analyses (PROC REG; SAS)

RESULTS

Media and Hormone

- IBA increased rooting percentage in most media treatments (Fig. 4)
- The 1:1 Coir/Perlite combined with IBA yielded the highest rooting % (Fig. 4)
- The 1:1 Coir/Perlite combined with IBA produced the highest mean # of roots across both dates (Fig. 5)
- No statistical difference in the # of roots per cutting when analyzing only the rooted cuttings at both dates (Fig. 6)

Stem Cutting Diameter

- No statistical correlation between stem diameter and root number in the fall cuttings (Table 1)
- Stem diameter of cuttings taken in the spring had a positive effect on the number of roots per cutting (Table 1)

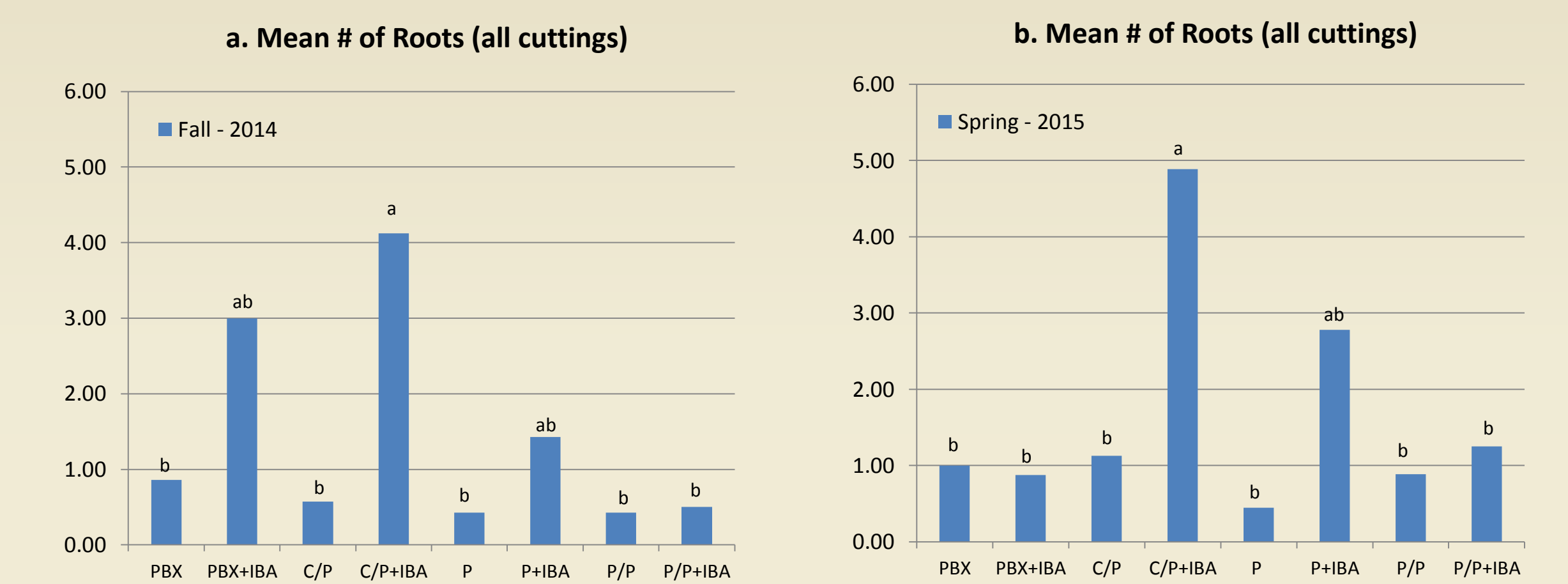


Figure 5. The mean number of roots per cutting among all cuttings, and across all treatments in experiments conducted in the a. fall of 2014, and the b. spring of 2015. Values denoted by a similar letter within each column were not significantly different at $\alpha=0.05$ (Tukey-Kramer).

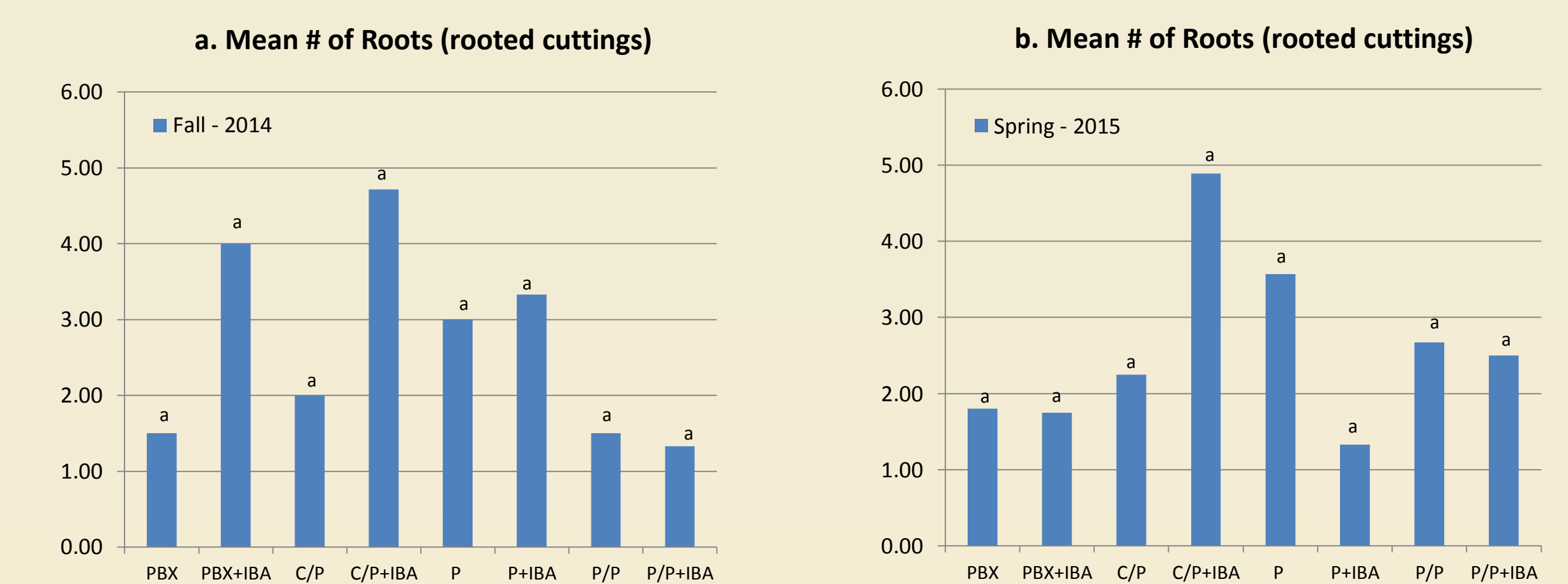


Figure 6. The mean number of roots per cutting among the rooted cuttings, and across all treatments in experiments conducted in the a. fall of 2014, and the b. spring of 2015. Values denoted by a similar letter within each column were not significantly different at $\alpha=0.05$ (Tukey-Kramer).

Table 1. Results of regression analysis investigating the relationship between cutting stem diameter and the number of roots that the cutting produced. Cutting stem diameters were measured above the second node. Significant P values are denoted with an asterisk(s).

Effects of Cutting Diameter on Root Number	Observations	Slope	Intercept	r ²	P Value
Fall 2014 (all cuttings)	59	-0.009	1.500	0.000	0.9668
Fall 2014 (rooted cuttings)	28	0.336	2.264	0.020	0.4775
Spring 2015 (all cuttings)	69	0.997	-0.244	0.160	0.0007***
Spring 2015 (rooted cuttings)	39	0.865	1.160	0.163	0.0107*

CONCLUSIONS:

Despite a fair amount of research into the propagation of *Acacia confusa* by germination and tissue culture, our work represents the first apparent experiment investigating propagation by cuttings. A high degree of success was realized by using a balanced coir/perlite medium as the rooting substrate. Interestingly, substrates containing peat showed a markedly lower rate of rooting and decreased number of roots. More studies are needed to ascertain why coir and peat have seemingly different effects on rooting in this species, particularly since these two substrates share similar physical and chemical properties. Further research is needed to build upon our preliminary work towards developing efficient propagation protocol for *A. confusa*.

Literature Cited:

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Figure 1. Rooted *Acacia confusa* cuttings from the experiment showing the variation in stem diameter and rooting. Photos were taken several weeks after data collection.



Figure 2. Photo depicts typical rooting in *A. confusa* with callus tissue and roots forming primarily on the cut basal end of the cutting.

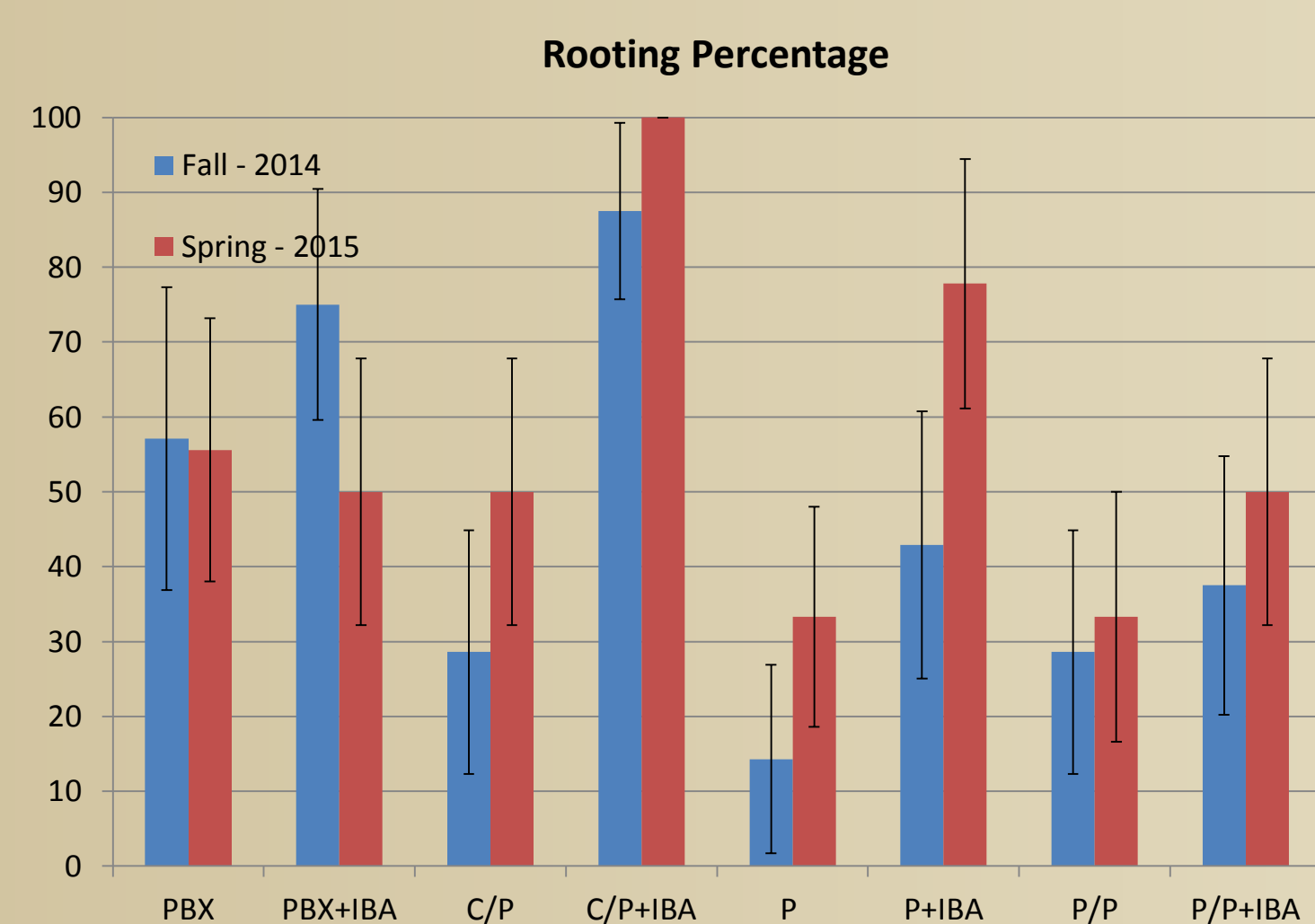


Figure 4. The percentage of *Acacia confusa* cuttings in each media* hormone treatment for both cutting harvest dates. Each treatment at each date consisted of between seven and nine cuttings. Standard error bars are shown.



Figure 3. The mother plant at 2 years old. The cuttings were taken the following year.