Propagation and Cross Compatibility of *Abutilon*©

Fanghua Niu, Donglin Zhang and John Ruter
Department of Horticulture, University of Georgia, Athens, Georgia 30602, USA
Email: niuniu@uga.edu

Zhihui Li
College of Forestry, Central South University of Forestry and Technology, Changsha, Hunan 410004, China

INTRODUCTION

Abutilon, flowering maple, is a large genus in the mallow family. The genus comprises of 100-150 species and is distributed in the tropics and subtropics (Servin et al., 2013). Leaves are lobed, maple-like, and light green. Flowers come in red, pink, yellow, white, and pastel shades (Kim and Suh, 2013). The diversified and long-lasting flowers are very attractive and have brought a lot of attention from all over the world (Matlawska and Sikorska, 2005), especially in the southeastern United State of America.

Flowering maple should be placed in areas of full sun to light shade in well-draining moist soil. Light shade will prevent wilting during the hottest parts of the day. A fast grower in warm climates, *Abutilon* is generally hardy in U.S.D.A. Zones 8 and 9 and thrives in the cooler temperatures of spring and fall. As for problems, flowering maple is sensitive to temperature fluctuations, which can cause leaves to drop. Higher temperatures experienced in some parts of southeastern USA can be detrimental to growth and development of flowering maple. In Georgia, temperatures can range from 27-38°C (80-100°F) in the summer. Consequently, wilting can happen to plants directly grown in the sun. This problem can be made worse if plants are grown in containers that hold small volumes of water and substrate (Yeager et al., 2010). Flower color, size, form, and longevity can also be compromised by extreme summer heat.

Due to the significance of *Abutilon* and increasing market demand, better cultivars that can survive summer heat without extra care and more efficient propagation techniques are required. *Abutilon* is mainly propagated from seeds and cuttings. Buckstrup (2005) reported that it was easier to develop new cultivars from mutations rather than hybridization. He noted that some cultivars appear to be self-sterile and did not form seeds easily.

In this research, 10 *Abutilon* clones were selected and propagated by cuttings with varying hormone treatments. Growth and development of rooted cuttings were also recorded after transplanting. We also investigated the cross-compatibility for breeding among the 10 clones.

MATERIALS AND METHODS

Plant Materials

Semi-hardwood terminal stem cuttings of 10 clones of *Abutilon* were collected from the Trial Garden at the University of Georgia on 18 Sept. 2012. They are A08-0401, A08-1603, A08-1607, A08-2110, A08-2112, A08-2114, A08-2121, A08-2125, A08-2127, and A08-2131. The cuttings were placed into black plastic bags and sprayed with water. In the greenhouse, each cutting was trimmed to approximately 10 cm (4 in.) in length and stripped from the bottom to 3-4 top leaves. To reduce respiration and transpiration, two-thirds of each remaining leaf on the cuttings was removed. The cuttings were rooted under different concentration and hormone treatments.

Experimental Treatments

Cuttings were treated with K-IBA (1000, 3000, and 8000 ppm) and Hormodin #1 (1,000 ppm IBA). Cuttings were dipped into the liquid K-IBA for about 10 s followed by at least 15 min of air-drying. For the Hormodin #1 treatments, cuttings were dipped in tap water

first and then dusted with the Hormodin #1 powder. Treated cuttings were inserted into 36-cell flat trays filled with a propagation substrate of milled peat moss and perlite (1:3, v/v). All cuttings were then placed on a mist bench. The mist system was set at an interval of 10 min for 15 s for the first week, then 20 min for 15 s thereafter.

The cuttings initiated rooting in about 2 weeks and were transplanted into 1 trade-gal pots (2.8 L) with soilless substrate (Fafard 1P; Fafard, Agawam, Massachusetts) after 4 weeks. All plants were fertilized using slow-release fertilizer at 15 g per pot after 2 weeks in the greenhouse. Six uniform plants were selected from each clone for observation of growth and development observation as well as cross-hybridization. All transplanted plants reached full bloom in about 2 months and reciprocal crosses were conducted among all 10 clones.

Data Collection

Rooting data were collected after 2 weeks of root initiation. Root quality was classified into six groups based on root length and quantity (Table 1). Plant height was recorded weekly. The total number of crosses, the number of successful crosses, fruit set, and seed set were documented.

Experimental Design and Data Analysis

A randomized complete block design was employed in this experiment. There were three replicates per treatment and six cuttings per replicate, n=3. The data were analyzed using SAS. The cross-compatibility among these ten clones was calculated as a percentage.

RESULTS AND DISCUSSION

Effect of Hormone on Rooting of Cuttings

The K-IBA and hormodin treatments significantly affected rooting quality of the 10 clones. Compared to control, the root quality of the cuttings with the four hormones was significantly higher. However, there were no significant differences among the four treatments (Fig. 1).

Rooting Quality

For the hormone treatments, rooting quality was different among clones (Fig. 2). The A08-2125 clone showed the best rooting quality and followed by A08-1607. However, the A08-0401 and A08-1603 clones had the lowest rooting quality ratings (<3).

Plant Height

After transplanting, plant growth of the ten clones varied. The rooted cuttings grew at the same rate for the first 7 weeks (Fig. 3). From the 8th week, growth rate diverged. A08-2127 showed a faster rate of growth than other clones. At the end of the experiment, A08-0401 and A08-1607 followed closely with a height increase ≥25 cm within 17 weeks. Clone A08-1603, A08-2112, and A08-2114 had the slowest growth rates. Their height increased less than 10 cm during the entire experiment. The growth rate of the four other clones ranged from 12.47 cm to 16.01 cm (Fig. 3).

Similar trends in height in both garden and greenhouse conditions (Fig. 4) suggest that the variability in height was genetically controlled with less influence of the environment. Abutilon being perennial plants grow bigger and faster over time after proper root establishment and this might also explain the variability observed between stock plants and rooted plant.

Hybridization

Successful crosses were only made among three clones: A08-1607, A08-2112, and A08-1603. The crossing percentage differed among different pairs of clones. A08-1607 X A08-2112 had 41.7% fruit set and produced seven seeds per fruit; while A08-2112 X A08-1607 had 1.96% fruit set with three seeds. A08-1603 X A08-2112 had 25.5% fruit set and

produced 14 seeds per fruit; while A08-2112 X A08-1603 had 4.4% fruit set with five seeds. A08-1603 X A08-1607 had 13.7% fruit set and produced six seeds per fruit; while A08-1607 X A08-1603 had no fruit (Fig. 5). A08-2112 performed better as a pollen donor and formed more fruits and seeds than A08-1607, A08-1603. In term of maternity, A08-1603 formed more fruit and seed than the other two clones (Fig. 5). The crossed hybrids were being grown in containers and had survived summer warm temperatures. They were showing mixed morphological features of both parents. Their growth is being monitored and will be reported in the future, as well as their ability to tolerate heat.

Literature Cited

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Table 1. Rooting classification according to length of longest root, average root length, root quantity, rooting height.

Root classification	Length of longest root (cm)	Avg. root length (cm)	Root quantity
0	1	0-1	1-2
1	1-2	1-2	2-5
2	2-3	2-3	5-10
3	3-5	3-4	10-25
4	5-10	4-5	25-40
5	>10	>5	>40

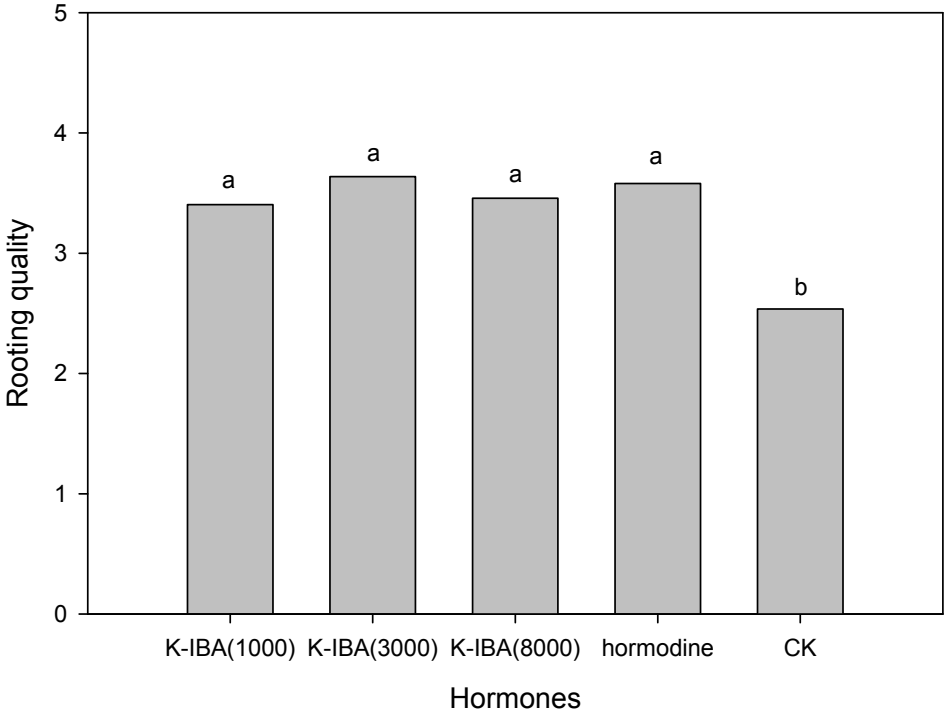

Fig. 1. Effect of hormone treatment on rooting quality. Different letters mean significant differences (α=0.05), (HSD).

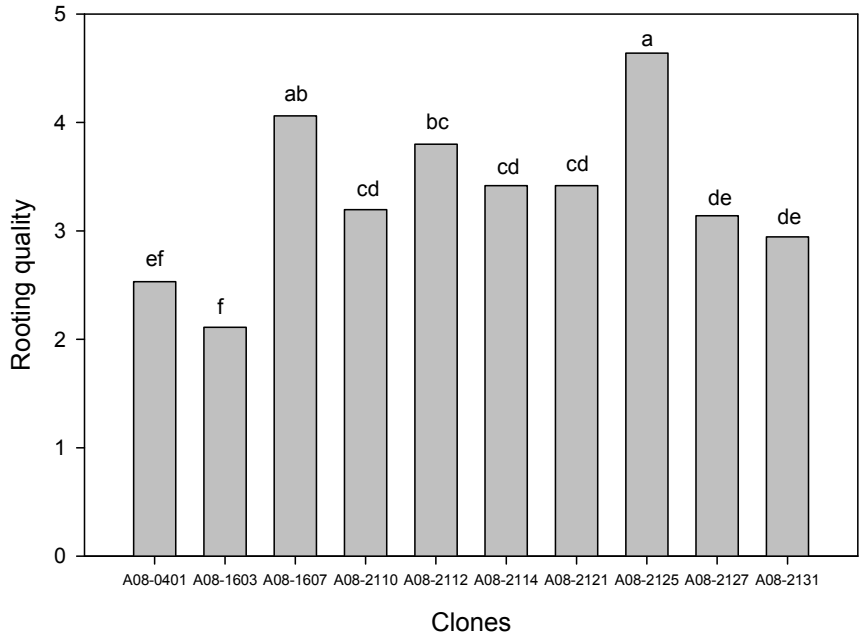

Fig. 2. Rooting quality of different clones. Rooting quality was graded in a scale of 0 to 5, 0 being the poorest root quality. Bars with different letters mean significant differences according to Turkey test (α=0.05).

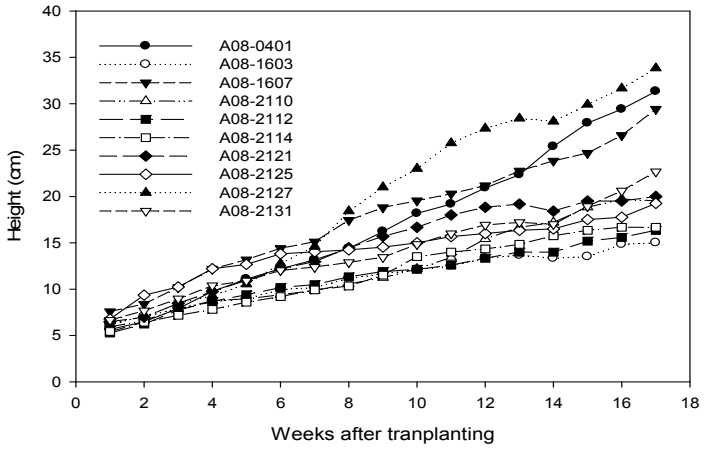

Fig. 3. The plant height growth (cm) after transplanting.

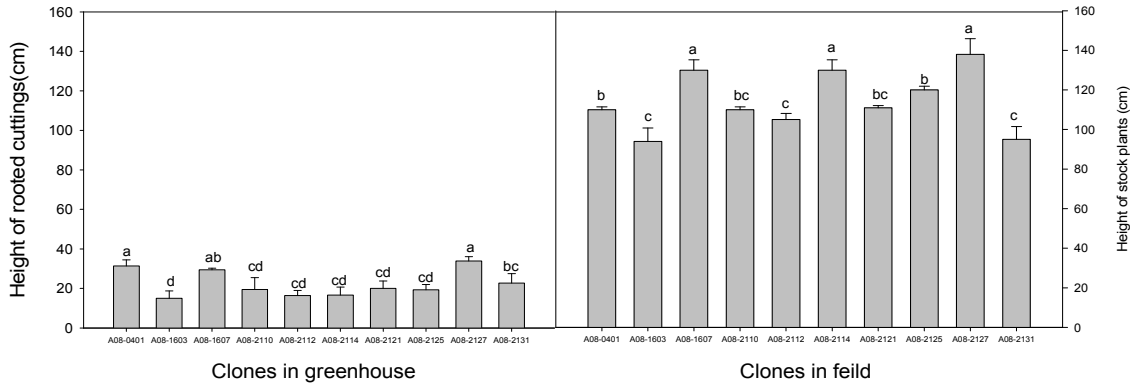

Fig. 4. Height of the ten clones both in greenhouse and garden. Different letters mean significant differences (α=0.05), (HSD).

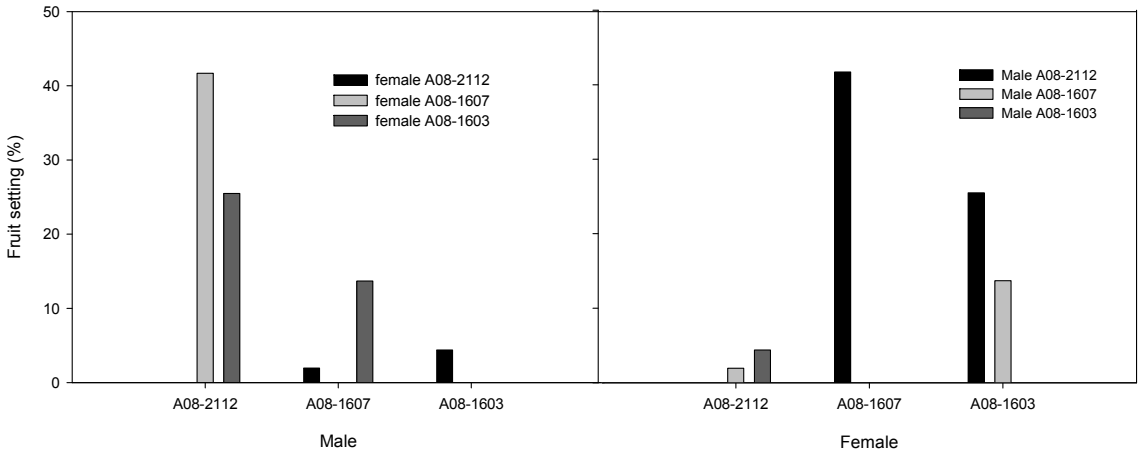

Fig. 5. Fruit setting percentage among the three clones: A08-1607, A08-2112, A08-1603.