Effects of an Eco-Friendly Pot Medium "Chaco Ball" on Cuttings of *Ficus benjamina*©

Wakanori Amaki and Soh Hatakeyama
Department of Agriculture, Tokyo University of Agriculture, 1737, Funako, Atsugi, Kanagawa 246-0034, Japan
Email: amaki@nodai.ac.jp

Mikihisa Kato and Susumu Kiryu
Ota Floriculture Research Institute Ltd. 2-2-1, Tokai, Ota-ku, Tokyo 143-0001, Japan

"Chaco Ball" (Japanese commercial name: Sumi-zutsumi) is an eco-friendly pot medium, and it has a structure of charcoal coated with porous ceramics. In this report, we examined its use as cutting medium. Tip cuttings of *Ficus benjamina* L. with 4 unfolded leaves were prepared from greenhouse-grown stock plants. The cut ends of cuttings were dusted with powder of 0.5% indole-3-butyric acid (IBA). The cuttings were inserted in three kinds of media: Chaco Ball, akadama-soil, and expanded-clay balls (7 mm). They were irrigated by overhead irrigation or subirrigation. Rooting and subsequent growth of cuttings when Chaco Ball medium was used were superior to the other media, regardless of the irrigation method. The cutting root system after 2 months in the Chaco Ball medium was more fibrous and higher in weight than in other media, especially in the case of the overhead irrigation.

INTRODUCTION

"Chaco Ball" (Japanese commercial name: Sumi-zutsumi, which the name means coated charcoal) is a medium developed jointly by Konishi Kohatsu Co. Ltd. (Kagawa, Japan) and Ota Floriculture Research Institute Ltd. (Tokyo, Japan). The Chaco Ball is an eco-friendly medium for pot culture and hydroculture. It was made from charcoal powder derived from saw waste of trees such as Japanese cedars and Japanese cypresses during thinning for forest management. More than 64% of it is carbon. Moreover the carbon was stably fixed in its granules. Therefore, the manufacture and use of Chaco Ball would contribute to reduce waste and carbon dioxide emission into the atmosphere. The charcoal in the Chaco ball is coated with porous ceramics. Their physical and chemical nature has been already examined and become clear—they have good properties such as aeration, drainage, absorption of water, and the ability to absorb toxic substances such as formaldehyde (<http://www.otalab.co.jp>). In this report, we examine the functionality of Chaco Balls as a cutting medium.

MATERIALS AND METHODS

Preparation of Cuttings and Media. Tip cuttings of *Ficus benjamina* with four unfolded leaves and about 6 cm long were prepared from stock plants grown in a greenhouse on 12 June 2011 (Hartmann et al., 1997). The cut end of cuttings was dusted with 0.5% IBA powder [Oxyberon 0.5 (commercial name), Shionogi

& Co., Ltd., Oosaka, Japan]. The respective cuttings were inserted at 2 cm deep in three kinds of media which were contained in 6-cm plastic pots (inner volume 120 mL). The three media were: Chaco Ball (the diameter of about 4 mm, Ota Floriculture Research Institute, Tokyo, Japan), akadama soil (a small granule with a diameter of approximately 5 mm), and expanded-clay balls [with a diameter of approximately 7 mm, Hydroculture (commercial name), Daiso-sangyo Co., Ltd., Hiroshima, Japan]. Akadama soil and expanded-clay balls are generally used in Japan as media for pot culture and hydroculture, respectively. All media were screened with a sieve (with 4 mm openings) to remove dust and small particles before use. One gram of mixed slow-release coated fertilizer [10N-10P_2O_5-10K_2O-10CaO : 10N-18P_2O_5-15K_2O + microelements (1 : 1, v/v), each of high-control, 70-day-release type (commercial name), Chisso Corp., Tokyo, Japan] was added to each potting medium immediately before cutting propagation.

Cultivation and Estimation of Establishment of Cuttings. At first, all potted cuttings were rooted on a greenhouse bench under a 50% shading to avoid excess drying of the cuttings. The shading curtain was removed after the first week. One half of each experimental plot was supplied water by overhead irrigation once or twice a day depending on surface drying of the media. The other half was continually supplied water by subirrigation using trays that maintained the water at a depth of 1 cm. All lateral shoots were removed immediately after visible confirmation during the experimental period in order to simplify the estimation of cutting growth. Two months after cutting insertion (9 Aug. 2011), all plants were harvested and measured for stem length, number and fresh weight of leaves, stem fresh weight, and root fresh weight.

RESULTS AND DISCUSSION

In the Chaco Ball plot, all cuttings rooted and grew regardless of the difference in irrigation method. In the akadama-soil and the expanded-clay ball plots under overhead irrigation 20% of cuttings were not rooted and dropped leaves, and finally died within 3 weeks (Table 1). In the case of subirrigation, there was no significant difference statistically on shoot length, number of leaves, fresh weight of leaves and fresh weight of stem, but the internodal length and leaf lamina in the expanded-clay ball plot were larger than in other plots. Rooted cuttings of the expanded-clay ball plot showed succulent growth to some extent (Fig. 1). Total root fresh weight in the Chaco Ball plot was heavier than in other media plots (Table 1) and the root system developed better than other media (Fig. 2). In the case of overhead irrigation plots, all growth parameters were the largest in the Chaco Ball plot (Table 1, Fig. 3), and its roots were more fibrous when compared with those in other media plots (Fig. 4). One of the main requirements of a cutting medium is that it should drain quickly to admit air to the rooting area but also should retain some moisture, because the property of medium will determine whether root will form and their quality (Rice and Rice, 2000). From the above mentioned results, it was shown that Chaco Ball can function well as a cutting propagation medium.

Table 1. Effercts of media and irrigation methods on the rooting and subsequent growth of *Ficus benjamina* cuttings.

(n = 9. Data were recorded on 57th day from cutting)

Irrigation method	Medium	Survival of cuttings (%)	Stem length (cm)	New growing after cutting		Fresh weight (g/plantlet)	
				Leaf no.	Leaf fr. wt. (g/plantlet)	Stem	Root
Subirrigation	Chaco Ball	100	25.1 a	8.2 a	2.95 a	1.33 a	1.87 a
	Akadama-soil	100	24.6 a	9.1 a	2.53 a	1.24 a	1.23 b
	Expanded-clay	80	23.8 a	7.8 a	2.23 ab	1.17 ab	0.72 cd
Overhead irrigation	Chaco Ball	100	18.9 b	8.0 a	1.79 b	0.86 b	0.86 c
	Akadama-soil	80	13.7 c	5.0 b	0.92 c	0.74 c	0.62 d
	Expanded-clay	80	10.8 d	4.4 b	0.51 d	0.41 d	0.33 e

Means followed by the same letter within column were not significant at 5% level by Turky's test.

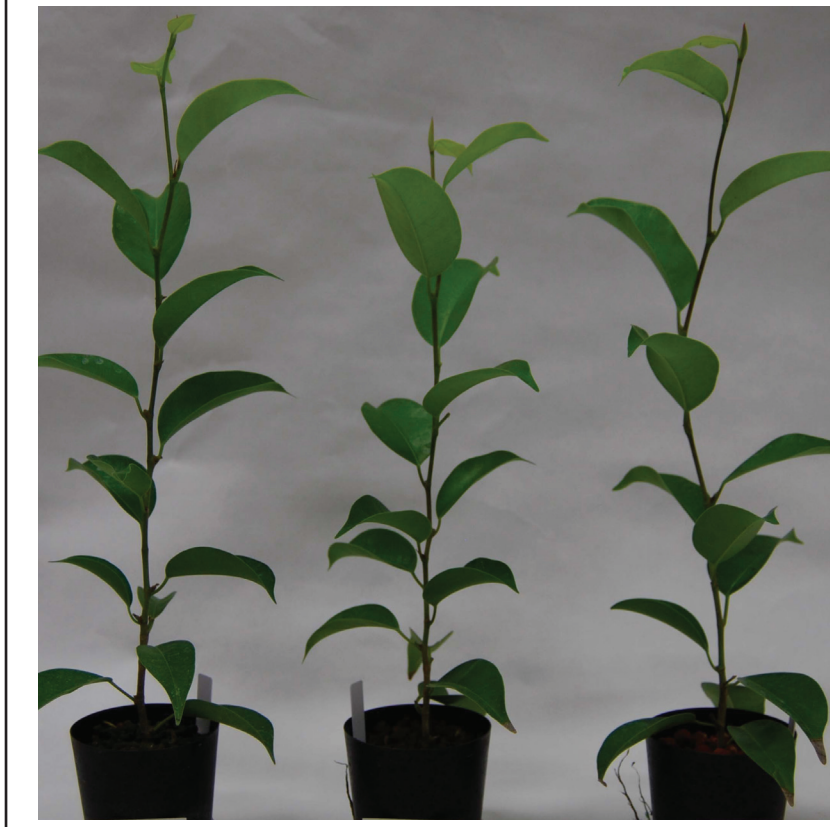

Figure 1. Growth of cuttings in the subirrigation plot (2 months after cutting). Left: Chaco Ball, Center: Akadama-soil, Right: Expanded-clay ball.

Figure 2. Root growth of cuttings in the subirrigation plot (2 months after cutting). Left: Chaco Ball, Center: Akadama-soil, Right: Expanded-clay ball.

Figure 3. Growth of cuttings in the overhead irrigation plot (2 months after cutting). Left: Chaco Ball, Center: Akadama-soil, Right: Expanded-clay ball.

Figure 4. Root growth of cuttings in the overhead irrigation plot (2 months after cutting). Left: Chaco Ball, Center: Akadama-soil, Right: Expanded-clay ball.

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