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Short Communication

Environmental conditions and type of cuttings on rooting and growth of vanilla (*Vanilla planifolia* Andrews)

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Abstract

The effects of environmental conditions (poly-house, greenhouse with mist, 50% shade net and natural shade) and type of cuttings (single, three, and five nodes) on rooting and growth of vanilla (*Vanilla planifolia* Andrews) were evaluated. Results show that greenhouse is more conducive for producing longer sprouts with greater number of leaves. It also resulted in early rooting and high rooting percentage. As regards to type of cuttings, five node cuttings were the best as it resulted in early sprouting and rooting, higher sprouting percentage, longer and thicker roots, and higher fresh and dry weight of shoot and roots compared to single and three node cuttings.

Keywords: Vegetative propagation, Length of cuttings, Propagation structure.

Vanillin, the popular flavouring material is extracted from the cured beans of the climbing orchid vanilla (*Vanilla planifolia* Andrews). The beans contain on an average 2 to 3% vanillin which is the world's most expensive spice after saffron (*Crocus sativus* L.) (Verma et al., 2009). During 2001, the global trade of natural vanilla accounted for US $ 103.18 millions. During that year, India imported synthetic vanillin worth Rs. 164.99 millions (Potty, 2003). Although the price of synthetic vanillin is much less than the natural product, the consumers prefer natural vanillin and its demand is increasing (Sinha et al., 2008). This increasing demand of vanillin could be met only through large scale cultivation of the vanilla crop. Although vanilla sets seeds, it is conventionally propagated through cuttings (Sasikumar, 2010) — due to difficulties in seed germination owing to lack of mature endosperm (Purseglove et al., 1981). Although plants raised from longer cuttings flower early and are superior in growth compared to plants raised from shorter cuttings, reports on the optimal length of cuttings to be used and also the influence of growing environments on rooting are scarce. Hence, an effort was made to standardize the length of cuttings and environmental conditions for propagating vanilla.

This investigation was carried out in *kharif* 2006 – 2007 at Bengaluru (12°58' N; 77°35' E; altitude 930 m). The experiment was laid out in a factorial RCBD with four environmental conditions [polyhouse (150 µm thickness), greenhouse with mist (one min misting at 15 min interval), 50% shade net, and natural shade of Singapore cherry (*Muntingia calubura* L.)] and three types of cuttings (single, three, and five node cuttings). Each treatment was repeated thrice with 50 cuttings per replication. Rooting medium was prepared from red earth, farm yard manure, and sand (2:1:1) and was thoroughly drenched with captan (0.2%). The planting material was obtained during September 2006 from vanilla gardens in Bengaluru. From the selected plants, mature stems were used to prepare single, three, and five node cuttings. The plants were sprayed with 0.3% copper-oxy-chloride at one month interval to avoid fungal

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infection and the cuttings were placed in the medium without any growth regulator treatments. Observations on shoot parameters were recorded from five labelled plants in each replication at 30, 40, 50, 60, 70, 80, and 90 days after planting. Rooting parameters such as days for rooting, rooting percentage, root length, and thickness were recorded trough destructive sampling. For this, five cuttings in each replication were randomly uprooted at 10 days after planting and thereafter at an interval of five days. The data was statistically analyzed using ANOVA with LSD at 0.05% probability level.

Among the different type of cuttings evaluated, five node cuttings were superior to others as it showed early sprouting (24.1 days), produced longer shoots (37.1 cm), and had higher dry weight (10.33 g; Table 1). Higher carbohydrate reserves in the longer cuttings may explain this (Ganesh, 2006). Similarly, 50% shade net gave the highest number of sprouted cuttings (87.6%) and longest internodes (5.39 cm), whereas, cuttings raised in polyhouse had the longest shoots (42.4 cm). Relatively higher temperature and relative humidity in the greenhouse compared to natural shade may have stimulated faster sprouting of the dormant buds in this treatment. Although polyhouse encouraged production of longer sprouts, they were skinnier, whereas, natural shade resulted in short and thick sprouts, implying a negative relationship between sprout thickness and length (Smitha, 2010). More number of leaves was produced when grown under greenhouse with misting followed by polyhouse and it was least under natural shade. Maximum dry weight of shoot (7.84 g) was recorded in misted greenhouse-raised cuttings, which differed significantly from the rest of the environmental conditions tried and was lowest in cuttings raised under natural shade. Higher photosynthetic efficiency in greenhouse with mist due to better light penetration (85%) and maintenance of optimum temperature and relative humidity are plausible explanations in this respect.

Root initiation also was faster in longer cuttings (17.2 days in three node and 17.8 days in five node cuttings; Table 2). Similarly, five node cuttings recorded maximum dry weight (0.83g). Regarding environmental conditions, rooting was delayed both under 50% shade net and natural shade (18.8 days). Thickness of the longest root was maximum (0.38 cm) in greenhouse with mist (Fig. 1) as this condition presumably enhanced photosynthetic efficiency and produced more number of leaves. Cuttings raised under natural shade resulted in maximum dry weight of roots (0.73 g) which may be related to longer roots produced under natural shade. Similar trends were reported by Senanayake and Kirtisinghe (1993) in black pepper also. Overall, five node cuttings kept for rooting in greenhouse showed better shoot and root parameters and is appropriate for commercial propagation of vanilla.

Table 1. Influence of environmental conditions and type of cuttings on shoot parameters of vanilla cuttings.

Treatments	Days for sprouting	% bud sprout	Sprout length (cm)	Thickness of sprout (cm)	Internodal length (cm)	Leaves per cutting (number)	Shoot dry weight (g)
Environmental conditions							
Polyhouse	25.0	81.6^{c}	42.4^{a}	0.63^{b}	4.7^{b}	9.4^{a}	6.3^{b}
Greenhouse with mist	25.0	84.7^{b}	37.6^{b}	0.60^{b}	4.7^{b}	9.4^{a}	7.8^{a}
50% shade net	25.1	87.6^{a}	27.1^{c}	0.75^{a}	5.4^{a}	7.3^{b}	6.1^{b}
Natural shade	25.2	60.9^{d}	14.9^{d}	0.78^{a}	4.0^{c}	5.5^{c}	6.2^{b}
Types of cuttings							
Single node	26.0^{c}	58.7^{c}	24.2^{c}	0.64	3.2^{c}	6.4^{c}	2.7^{c}
Three node	25.0^{b}	87.2^{b}	30.3^{b}	0.73	4.9^{b}	9.2^{a}	6.9^{b}
Five node	24.1^{a}	90.2^{a}	37.1^{a}	0.70	6.0^{a}	8.2^{b}	10.3^{a}

Means with same superscript do not differ significantly (5%).

Table 2. Influence of environmental conditions and type of cuttings on root parameters of vanilla cuttings.

Treatments	Days for rooting	Rooting %	Number of roots per cutting	Length of longest root (cm)	Thickness of longest root (cm)	Dry weight of root (g)
Environmental conditions						
Polyhouse	17.3[a]	98.4	1.70	16.9[c]	0.32[b]	0.46[c]
Greenhouse with mist	17.6[a]	97.1	1.59	28.1[a]	0.38[a]	0.43[c]
50% shade net	18.8[b]	96.2	1.40	23.9[b]	0.28[c]	0.61[b]
Natural shade	18.9[b]	97.3	1.44	29.2[a]	0.31[b]	0.73[a]
Types of cuttings						
Single node	19.5[a]	96.2	1.25[b]	24.2	0.29[c]	0.26[c]
Three node	17.2[c]	99.5	1.75[a]	25.2	0.32[b]	0.58[b]
Five node	17.8[b]	96.2	1.61[a]	24.3	0.35[a]	0.83[a]

Means with same superscript do not differ significantly (5%).

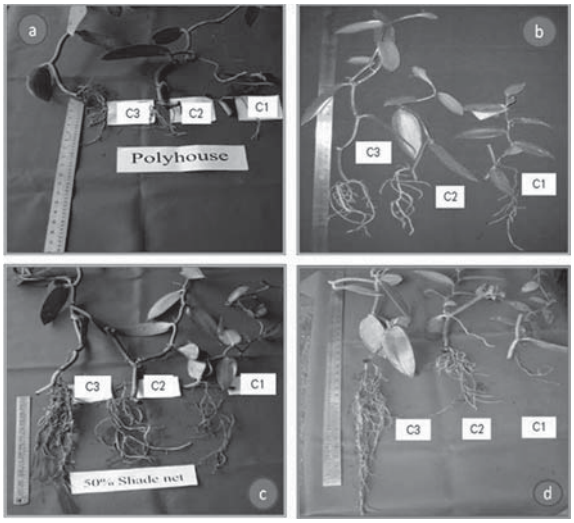

Figure 1. Rooting in vanilla cuttings as influenced by environmental conditions and type of cuttings: a. polyhouse; b. greenhouse with mist; c. 50% shade net; d. natural shade. C_1: single node cutting; C_2: three node cutting; C_3: five node cutting.

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