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Influence of different rooting media and number of nodes per cutting on vegetative propagation of vanilla

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ABSTRACT

The experiment was conducted at Horticulture Farm, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh, from September 2023 to December 2023. Nine rooting media (sand, garden soil, cocopeat, vermicompost, mixture of sand: vermicompost (1:1), mixture of garden soil: vermicompost (1:1), mixture of cocopeat: vermicompost (1:1), mixture of sand: cocopeat: vermicompost (1:1:1), mixture of garden soil: cocopeat: vermicompost (1:1:1) and three levels of node number (single, two, three nodes cutting) were used in this experiment. Twenty-seven treatments evaluated the combined effect of different rooting media and number of nodes per stem cutting on propagation of vanilla. Treatments were arranged in Completely Randomized Design (CRD) with three replications. Among all the parameters in vanilla propagation through stem cutting, propagation was significantly influenced by the type of rooting media and number of nodes per stem cutting. The highest root length was obtained from three node cuttings grown on a 1:1:1 mixture of sand: cocopeat: vermicompost (T_8N_3; 13.2 cm), except maximum root number of cuttings obtained from three node cuttings grown on a 1:1:1 mixture of garden soil: cocopeat: vermicompost (T_9N_3; 4.4) and maximum survival rate (100%) was found in (T_1N_2, T_1N_3, T_3N_2, T_6N_3, T_7N_3, T_8N_3, T_9N_2, T_9N_3), where is the lowest root length (1.1cm), root numbers (2.0) and survival rate (20%) were obtained from single nodal cuttings which were grown in vermicompost (T_4N_1). This research has identified the best rooting media for successful vanilla propagation. This study endeavors to contribute significantly to the advancement of vanilla cultivation practices in Bangladesh, fostering a thriving and sustainable industry.

Key Words: *Vanilla planifolia, Propagation, Rooting media and Vine cutting.*

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I. Introduction

Vanilla (*Vanilla planifolia*) is a tropical orchid which belongs to the family Orchidaceae and is native to southeastern Mexico (Purseglove et al., 1981). The leading producers of vanilla plants are Madagascar, Indonesia, Mexico, Tahiti and India (Shruthi and Naira, 2013). It is derived from the Spanish word "Vanilla" meaning little pod (James and Ackerman, 2003). It is a rich source of flavor as natural vanillin is the most cultivated species in India (Bory *et al*., 2008). Vanillin or vanilla essence is extracted after curing of beans and widely used as a flavoring agent in cakes, sweets, chocolates, ice creams, beverages and condiments as well as in the cosmetics and perfumery industries (Giridhar et al. 2001). It is the only orchid genus that makes its position into commercial trade as world's most expensive spice after saffron (Verma et al. 2009).

Vanilla is a new crop in Bangladesh. The cultivation of vanilla in Bangladesh has presented an exciting opportunity for commercial production. The most efficient propagation method, namely through stem cutting, has not yet been thoroughly investigated in Bangladesh. A critical gap exists in research pertaining to the choice of growing media and the ideal number of nodes for vanilla stem cuttings. This research aims to unveil the most suitable rooting media composition for successful vanilla propagation. Furthermore, the investigation delves into determining the optimal number of nodes per stem cutting, providing valuable insights for maximizing the efficiency of vanilla cultivation in Bangladesh.

II. Materials and Methods

The experiment was conducted in Horticulture Farm, Department of Horticulture, Sher-e-Bangla Agricultural University, Dhaka, during the period from September 2023 to December 2023 to study the influence of different rooting media and number of nodes per stem cutting on vanilla stem cutting propagation technique. The two factorial experiments provoked Completely Randomized Design (CRD) with three replications, thus comprising 81 pots in the experiment. Two factors in this experiment were as follows: Factor A: Rooting media compositions (T_1: Sand; T_2: Garden soil (Virgin soil); T_3: Cocopeat; T_4: Vermicompost; T_5: Sand: Vermicompost (1:1); T_6: Garden soil: Vermicompost (1:1); T_7: Cocopeat: Vermicompost (1:1); T_8: Sand: Cocopeat: Vermicompost (1:1:1); T_9: Garden soil: Cocopeat: Vermicompost (1:1:1) and Factor B: Number of nodes per cutting (N_1= Single node/ cutting; N_2= Two nodes/ cutting and N_3= Three nodes/ cutting (Plate 01).

Single node **Double nodes** **Triple nodes**

Plate 01. The picture indicates a single node per cutting, two and three nodes per cutting.

Rooting media were taken in plastic glasses according to the treatments. A hole was drilled in the bottom of each glass to allow proper drainage. The vanilla vines were cut exactly 1-inch below the node and given a little slanting cut when cutting. The cuttings were soaked with aloe vera before planting them in rooting media. A few days after placing the cutting in the rooting media all leaves were cut off using a sharp knife. Each cutting was tagged according to treatment and replications (Plate 2). Weeding and irrigation were done regularly as required. Data was collected when the cuttings started to grow leaves.

The statistical analyses were conducted using the STATISTIX 10 statistical program. The analysis of variance (ANOVA) was conducted to assess the differences between treatments. The Least Significance

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Difference (LSD) test, as Gomez and Gomez (1984) proposed, was employed at a significance level of 5%.

Planting the cuttings **Removing the leaves** **Tagging**

Plate 02. The picture shows the planting procedure, removal of leaves and tagging of the experiment.

III. Results and Discussion

Significant variation was observed with different planting media compositions on vanilla propagation. The maximum root numbers T_9 (3.0), highest root length (11.20 cm) T_8 (sand: cocopeat: vermicompost) and maximum survival rate (100%) was observed from T_1, T_3, T_7, T_8, T_9 growing media composition and the minimum root numbers (2.0), shortest root length (3.47 cm) and survival rate (20%) were observed from T_4 (Vermicompost) growing media composition (Table 01).

Table 01. Effect of different planting media composition on root numbers, root length and survival rate of vanilla propagation

Treatments	Root numbers	Root length (cm)		Survival rate (%)
T_1	2.2	5.21	ef	100.0
T_2	2.3	7.21	d	80.0
T_3	2.1	8.28	g	100.0
T_4	2.0	3.47	bc	20.0
T_5	2.5	4.76	f	80.0
T_6	2.0	8.98	b	60.0
T_7	2.4	5.8	c	100.0
T_8	2.7	11.2	e	100.0
T_9	3.0	8.26	a	100.0
LSD (5%)	ns	0.7		-
CV%		6.8		-

Here, T_1: Sand, T_2: Garden soil (Virgin soil), T_3: Cocopeat, T_4: Vermicompost, T_5: Sand: Vermicompost (1:1), T_6: Garden soil: Vermicompost (1:1), T_7: Cocopeat: Vermicompost (1:1), T_8: Sand: Cocopeat: Vermicompost (1:1:1), T_9: Garden soil: Cocopeat: Vermicompost (1:1:1)

The maximum root numbers (2.5), root length (8.2 b) and survival rate (100%) were observed from N_3 (three nodal cutting) and the minimum root numbers (2.1), shortest root length (5.0 cm) and survival rate (80%) were observed from N_1 (single nodal cutting) (Table 02).

Table 02. Effect of node per cutting on root numbers, root length and survival rate of vanilla propagation.

Treatments	Root numbers	Root length (cm)		Survival rate (%)
N_1	2.1	5.0	c	80.0
N_2	2.4	7.8	a	90.0
N_3	2.5	8.2	b	100.0
LSD (5%)	ns	0.6		-
CV%		6.8		-

Here, N_1, Single node/cutting; N_2, two nodes/cutting; and N_3, three nodes /cutting.

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In case of treatment combination, significant variation was observed within the treatment. Highest root length (13.2 cm) was found with T_8xN_3 (Sand: Cocopeat: Vermicompost (1:1:1) with three nodes per cutting), maximum root numbers (4.42) with T_9xN_3 [Garden soil: Cocopeat: Vermicompost (1:1:1) with three nodes per cutting] and maximum survival rate (100%) was found in T_1N_2, T_1N_3, T_3N_2, T_6N_3, T_7N_3, T_8N_3, T_9N_2, T_9N_3, as well as the minimum survival rate (20%) was found in T_4N_1.(vermicompost with single node per cutting) and where is the lowest root length (1.1cm), root numbers (2.0) and survival rate (20%) were obtained from single nodal cuttings which were grown in vermicompost (T_4N_1) (Table 03). Higher rooting percentage observed from longer cuttings could be linked to better initial carbohydrate reserves stored of longer cuttings. In addition, sand medium provides adequate aeration and drainage, leading to increased porosity to promote better root initiation (Dembele et al., 2011).

Table 03. Interaction effect of planting media and number of nodes per cutting on vanilla propagation.

Treatments	Root numbers	Root length (cm)		Survival rate (%)	Leaves grown
T_1N_1	2.0	5.1	lm	80.0	-
T_1N_2	2.0	1.7	f	100.0	-
T_1N_3	2.0	3.5	g	100.0	+
T_2N_1	2.0	13.1	lm	60.0	-
T_2N_2	2.0	1.8	cd	80.0	-
T_2N_3	3.0	5.9	f	80.0	+
T_3N_1	2.0	5.0	ijk	80.0	-
T_3N_2	2.6	3.3	kl	100.0	-
T_3N_3	2.0	9.4	ijk	80.0	+
T_4N_1	2.0	1.1	bc	20.0	-
T_4N_2	3.0	3.8	ef	40.0	-
T_4N_3	2.0	2.8	hij	60.0	-
T_5N_1	2.0	8.1	m	60.0	-
T_5N_2	3.0	8.9	ef	80.0	+
T_5N_3	2.0	12.9	hij	80.0	+
T_6N_1	2.0	4.8	g	80.0	-
T_6N_2	2.0	5.9	bc	60.0	-
T_6N_3	3.0	11.1	f	100.0	+
T_7N_1	2.0	5.7	gh	80.0	-
T_7N_2	2.0	7.9	ghi	80.0	-
T_7N_3	2.0	3.4	a	100.0	-
T_8N_1	2.0	4.2	jk	80.0	-
T_8N_2	3.0	4.2	g	80.0	+
T_8N_3	4.0	13.2	ef	100.0	+
T_9N_1	2.0	5.9	e	80.0	-
T_9N_2	2.5	8.1	d	100.0	+
T_9N_3	4.4	12.3	b	100.0	+
LSD (0.5%)	NS	1.3		NA	NA
CV %		6.8			

Here, T_1: Sand, T_2: Garden soil (Virgin soil), T_3: Cocopeat, T_4: Vermicompost, T_5: Sand: Vermicompost (1:1), T_6: Garden soil: Vermicompost (1:1), T_7: Cocopeat: Vermicompost (1:1), T_8: Sand: Cocopeat: Vermicompost (1:1:1), T_9: Garden soil: Cocopeat: Vermicompost (1:1:1), N1, Single node/cutting; N2, two nodes/cutting; and N3, three nodes/cutting. "+" leaves appearance; " -" not growing, NS- not significant, NA- not analyzed.

In addition, the treatments started to develop leaves after 60 days of placing the cuttings in the growing media, indicating the success of the cuttings. All compositions of growing media except vermicompost produced vanilla leaves on cutting with three nodes. But interestingly, vanilla cuttings with three nodes in T_8 [Sand: Cocopeat: Vermicompost (1:1:1)] and T_9 [Garden soil: Cocopeat: Vermicompost (1:1:1)] growing media compositions developed leaves as well as cuttings with two nodes (Table 03). Therefore, it was revealed that the vegetative propagation of vanilla could be successfully attained by raising three node cuttings on 1:1:1 mixture of sand: cocopeat: vermicompost and garden soil: cocopeat: vermicompost than the other seven treatments. T_8 or T_9 (mixture of sand: cocopeat: vermicompost or garden soil: cocopeat: vermicompost) could be recommended for the

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vegetative propagation of vanilla. The number of nodes per stem cutting is crucial, with a generally recommended minimum of two nodes. More nodes may improve the chances of successful propagation.

IV. Conclusion

The findings underscore the significant influence of both rooting media and the number of nodes on various parameters of vanilla propagation. Notably, the highest root length was observed in three-node cuttings grown in a 1:1:1 mixture of sand, cocopeat, and vermicompost (T_8N_3; 13.2 cm). Additionally, the maximum root number was obtained from three-node cuttings grown in a 1:1:1 mixture of garden soil, cocopeat, and vermicompost (T_9N_3; 4.4). The highest survival rate (100%) was recorded in several treatments (T_1N_2, T_1N_3, T_3N_2, T_6N_3, T_7N_3, T_8N_3, T_9N_2, T_9N_3). The recommendations from this study can guide farmers and researchers in optimizing vanilla propagation techniques, ultimately enhancing the overall success and sustainability of vanilla cultivation in the region.

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