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Influence of Plant Growth Promoting Substances on Rooting of Bush Pepper Cuttings

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A B S T R A C T

Bush pepper is a miniature black pepper (*Piper nigrum* L.) plant grown in the form of a bush as potted plant with decorative and economic value, raised from lateral branches (plagiotrops) of yielding vines. Growth hormones and plant growth promoting rhizo-microorganisms were evaluated for their effects on rooting of plagiotropic cuttings of black pepper. The fruiting branches of black pepper variety Panniyur 1 were employed for the study. There were totally nineteen treatments that included PGPRs *viz. Azospirillum lipoferum* and *Pseudomonas fleuroscens* and plant growth hormones *viz.* IBA, NAA and 2, 4D at different concentrations. The treatment T_8 (IBA 1000 ppm) proved to be the best for rooting by recording maximum values for percentage rooting (65.30), fresh weight (1.10 g),dry weight of root (0.53 g), per cent survival (54.04) followed by IBA 1250 ppm. The treatment also recorded maximum net income (Rs. 11492.00 / 1000 cuttings) and highest benefit cost ratio (1: 3.43).

Introduction

Black pepper (*Piper nigrum* L.) is a perennial woody vine native of Indian subcontinent. It has gained global recognition as the "king of spices" and "black gold" (Devasahayam *et al.*, 2010) due to its economical importance. Pepper berries are valued both as food flavourants and the medicine worldwide.

The vine can be propagated both by sexual as well as asexual means. The commercial method of propagation is through cuttings. The vine produces four types of shoots namely, orthotropic shoots, runner shoots, plagiotropic shoots and geotropic shoots. In India runner shoots are extremely employed for propagation. Two to three nodal cuttings are prepared out of the runner shoots and the rooted cuttings are usually trained on trees / standards to enable the plant to climb upwards and grow out into a vine. But when the laterals are used as planting material, the resultant plants grow like a bush.

Bush pepper is a miniature pepper plant in the form of a bush usually grown as a potted plant with decorative and economic value. The plant starts flowering during the same year of planting and goes on producing spikes from all its branches yielding berries throughout the year whereas, in vines they take three to four years. Though bush pepper is not comparable with vine pepper in terms of economic returns, it can be grown in the region where land is a limiting factor such as in apartments as a component in terrace garden, in nontraditional areas where black pepper is not cultivated and as an intercrop in coconut and arecanut orchards or any perennial orchards. It is also ideal in conservation and maintenance of black pepper germplasm in a limited area. Compared to runner shoots, the rooting percentage of laterals was found to be far less, that is less than 30 per cent (Sujatha *et al.*, 2009) which is a limiting factor in production of bush pepper. Hence the experiment was conducted to study the effect of growth promoting substances on rooting of lateral cuttings of black pepper.

Materials and Methods

The experiment was conducted in a naturally ventilated polyhouse at College of Horticulture, Mudigere. The healthy one-year-old plageotropic shoots of Panniyur-1 variety were collected and the three nodal cuttings of 10-15 cm long were prepared by giving a slant cut at the bottom. The cuttings were planted in polybags of 15 cm × 10 cm size filled with soil, sand and FYM in the ratio of 2:1:1.

The experiment was laid out in a completely randomized design with nineteen treatments including control. Growth hormones and plant growth promoting rhizo microorganism formulations were used at different concentrations. Each treatment was replicated thrice. The treatment details are as follows, T_1-Control, T_2-*Pseudomonas fluorescens* @ 5ml / polybag, T_3-*Pseudomonas fluorescens* @ 10ml / polybag, T_4-*Azospirillum lipoferum*@ 5ml / polybag, T_5-*Azospirillum lipoferum*@ 10ml / polybag, T_6-Keradix powder, T_7-IBA 1000 ppm, T_8-IBA 750 ppm, T_9-IBA 1250 ppm, T_{10}-NAA 200 ppm, T_{11}-NAA 400 ppm, T_{12}-NAA 600 ppm, T_{13}-2, 4 D 100 ppm, T_{14}-2, 4 D 200 ppm, T_{15}-2, 4 D 300 ppm, T_{16}-Cow dung slurry at dilution with water @ 1:1, T_{17}-Cow dung slurry at dilution with water @ 1:2, T_{18}-Tender coconut water @ 50 per cent dilution with water, T_{19}-Tender coconut water concentrated.

The basal end of the cuttings were dipped in different concentrations of IBA (750 ppm, 1000 ppm, 1250 ppm), NAA (200 ppm, 400 ppm, 600 ppm) 2,4-D (100 ppm, 200 ppm, 300 ppm) for 40-50 seconds and air dried. Liquid cultures of *Pseudomonas* and *Azospirillum* were applied to potting media at two different levels *i.e.*, 5ml/polybag and 10 ml/polybag. For keradix treatment, the basal end of the cuttings (2.5-3 cm) were dipped in water and later dipped in keradix powder taken in a beaker. The cuttings were tapped to the brim of the container to remove the excess powder. The cuttings were dipped in cow dung slurry and tender coconut water at different dilution levels for 10 minutes and planted in polybags containing rooting media up to a depth of one node.

The data pertaining to various root parameters were tabulated and statistically analyzed using Completely Randomized Design. The inference was drawn after comparing the calculated F values with the table F values at 5% (P= 0.05) level of significance.

Results and Discussion

The rooting percentage was significantly influenced by the different treatments (Table 1) and the treatment T_8 (IBA – 1000 ppm) recorded maximum rooting (65.30 %), which was on par with IBA 1250 ppm (63.52 %), IBA 750 ppm (61.20 %) and *Azospirillum lipoferum* 10 ml (61.84 %). Whereas, control recorded the minimum percentage of rooting (38.90).This might be due to the action of auxin in causing the hydrolysis and translocation of carbohydrates and nitrogenous substances at the base of cuttings, helped in better root initiation. The present results are in harmony with the findings of Polat and Caliskan (2009) in pomegranate stem cuttings, Bandi *et al.*, (2012) in guggal stem cuttings and Susaj *et al.*, (2012) in rose cutttings.

The treatment T_8 (IBA 1000 ppm) also recorded maximum fresh weight (1.10 g) and dry weight (0.53 g) of root,which was on par with IBA 1250 ppm (1.00 g of fresh weight and 0.50 g of dry weight respectively). While the minimum fresh weight (0.59 g) and dry weight (0.14 g) of roots was recorded in untreated control.This might be due to better mobilization of primary metabolites through increased root number resulting in higher accumulation of fresh and dry matter. The results are in agreement with the findings of Kaur *et al.*, (2002) in grapevine, Murthy *et al.*, (2010) in vanilla cuttings and Bhagya and Sreeramu (2013) in *Vitex nigundo.*

The maximum survival percentage of rooted cuttings was recorded in IBA 1000 ppm (54.04), as depicted in Figure 1 which was on par with IBA 1250 ppm (52.20). While minimum survival percentage of rooted cuttings (30.56 %) was recorded in control. The cuttings treated with IBA resulted in development of effective root system and increase in number and length of roots per cutting which might have influenced the uptake of nutrients and water. The overall performance in relation to growth parameters of root and shoots were comparatively better in this treatment which ultimately increased the survival percentage. The results are in conformity with Das *et al.*, (2006) in olive and Camellia *et al.*, (2009) in *Jatropha curcus.*

Fig.1 Effect of growth hormones and PGPRs on per cent survival of rooted cuttings

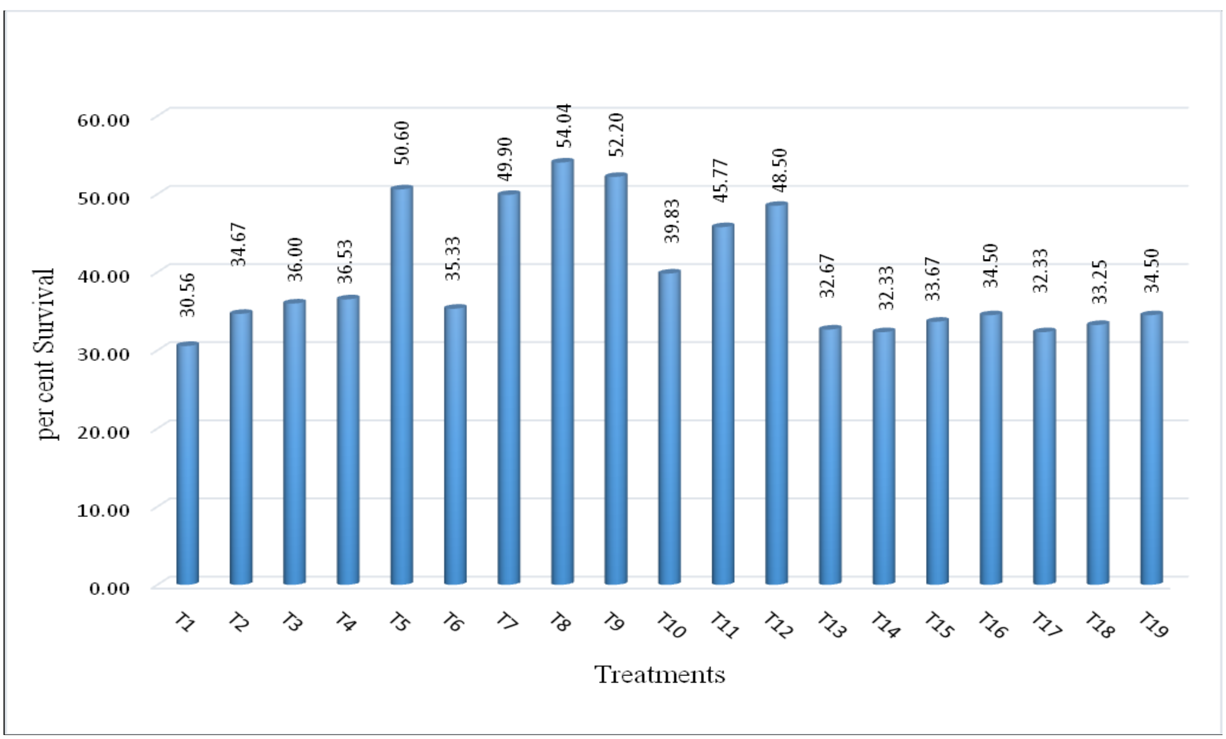

Table.1 Effect of growth hormones and PGPRs on various root parameters in Bush pepper cuttings

Treatments	Percentage of cuttings rooted (%)	Fresh weight of root (g)	Dry weight of root (g)
T_1 - Control	38.90	0.59	0.14
T_2 - *Pseudomonasfluorescens* 5ml	45.33	0.77	0.32
T_3 - *Pseudomonas fluorescens* 10ml	47.50	0.76	0.33
T_4 - *Azospirillumlipoferum*5ml	47.68	0.78	0.34
T_5 - *Azospirillumlipoferum* 10ml	61.84	0.89	0.48
T_6 - Keradix	44.17	0.77	0.32
T_7 - IBA 750 ppm	61.20	0.85	0.29
T_8 - IBA 1000 ppm	65.30	1.10	0.53
T_9 - IBA 1250 ppm	63.52	1.00	0.50
T_{10} - NAA 200 ppm	51.12	0.71	0.26
T_{11}- NAA 400 ppm	56.95	0.70	0.24
T_{12} - NAA 600 ppm	59.80	0.68	0.25
T_{13} - 2,4 D 100 ppm	44.17	0.66	0.21
T_{14} - 2,4 D 200 ppm	41.18	0.65	0.20
T_{15} - 2,4 D 300 ppm	40.95	0.64	0.19
T_{16} - Cow dung slurry 1:1	44.79	0.64	0.19
T_{17} - Cow dung slurry 1:2	43.40	0.61	0.18
T_{18} – Tender coconut water @ 50% dilution	42.50	0.63	0.19
T_{19} - Tender coconut water concentrated	45.34	0.60	0.18
S. Em. ±	**1.39**	**0.04**	**0.01**
CD @ 5%	**4.17**	**0.12**	**0.03**

Table.2 Economics of nursery production of bush pepper

Treatments	Total cost (₹)	Total number of saleable plants	Gross income (₹)	Net income (₹)	B : C Ratio
T_1 - Control	4500	305.60	9168	4668	2.04
T_2 - *Pseudomonasfluorescens* 5ml	4740	346.70	10401	5661	2.19
T_3 - *Pseudomonas fluorescens* 10ml	4980	360.00	10800	5820	2.17
T_4 - *Azospirillumlipoferum*5ml	4740	365.30	10959	6219	2.31
T_5 - *Azospirillumlipoferum* 10ml	4980	506.00	15180	10200	3.05
T_6 - Keradix	4640	353.30	10599	5959	2.28
T_7 - IBA 750 ppm	4665	499.00	14970	10305	3.21
T_8 - IBA 1000 ppm	4720	540.40	16212	11492	3.43
T_9 - IBA 1250 ppm	4775	522.00	15660	10885	3.28
T_{10} - NAA 200 ppm	4501	398.30	11949	7447	2.65
T_{11}- NAA 400 ppm	4503	457.70	13731	9227	3.05
T_{12} - NAA 600 ppm	4505	485.00	14550	10044	3.23
T_{13} - 2,4 D 100 ppm	4501	326.70	9801	5299	2.18
T_{14} - 2,4 D 200 ppm	4502	323.00	9699	5196	2.15
T_{15} - 2,4 D 300 ppm	4503	336.00	10101	5597	2.24
T_{16} - Cow dung slurry 1:1	4505	345.00	10350	5845	2.30
T_{17} - Cow dung slurry 1:2	4502	323.00	9699	5196	2.15
T_{18} – Tender Coconut water @ 50% dilution	4560	332.00	9975	5415	2.19
T_{19} - Tender Coconut water concentrated	4620	345.00	10350	5730	2.24

The economics of nursery production of bush pepper was worked out (Table 2). The treatment T_3 (*Pseudomonas fluorescens* 10ml) and T_4 (*Azospirillum lipoferum* 10ml) incurred in higher cost of production (₹ 4980.00 and ₹ 4980.00respectively).

The treatment T_8 (IBA 1000 ppm) recorded maximum gross income (₹ 16212.00 per 1000 cuttings) and net income (₹ 11492.00 per cuttings). The treatment T_8 (IBA 1000 ppm) also recorded maximum B: C ratio of 1:3.43 followed by T_9- IBA 1250 ppm (1:3.28). IBA 1000 ppm, IBA 1250 ppm have been found to induce better root system in plagiotropic black pepper cuttings.

The basis for this might be enhancement of hydrolysis of nutrient reserves (mainly starch) by auxin treatments. According to Nanda, (1975) enhanced hydrolysis activity in the presence of exogenously applied hormones was responsible for the increased rooting in auxin treated cuttings. These results were in the conformity with the findings of Nirupadi (2017).

The results of the study confirmed that, application of IBA at 1000 ppm proved to be beneficial in promoting better root growth and survivability of plagiotropic cuttings in black pepper.

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