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Effect of growth regulators on rooting of black pepper (*Piper nigrum*) Cuttings

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Abstract
In the present study 80 per cent rooting was obtained by favourable growth regulator treatment when raised in an ideal rooting medium under greenhouse conditions. The study pointed out that, among the different growth regulator formulations tried, IBA 1000 ppm formulation helped in better induction of rooting by over 70 per cent as against 43.33 per cent in the control. The next promotive effect in this regard was by treatment of IBA 500 ppm and NAA 250 ppm which recorded 66.67 and 63.33 per cent respectively. However, use of higher concentration of growth regulators, especially IBA at 1500 ppm and NAA at 1000 ppm and their combination at 1000 ppm adversely affected the rooting of cuttings indicating higher concentrations of growth regulators may become toxic to black pepper cuttings.

Keywords: Black pepper, growth regulators, concentration & rooting

Introduction
India is the land of spices. The flavour and fragrance of Indian spices had magic spell in human civilization and culture. India contributes about 40-50 percent of world's production of spices [4]. Black pepper (*Piper nigrum* L., Family: Piperaceae) popularly known as "king of spices", is the oldest and most important spice crop grown in India. It is native to Western Ghats and it is grown in 26 countries including India, Indonesia, Srilanka, Thailand, China, Vietnam, Cambodia, Brazil, Mexico and Guatemala.

Black pepper is widely used spice in the world and it is an indispensable item in the preparation of processed meat, sauces, soups, curry powders and pickles. From medicinal point of view it is used as a carminative, stomachic and febrifuge. The major economic products from pepper are black pepper and white pepper. Other value added products like pepper oil and oleoresin find increasing use in food industries of developed countries. Besides some new forms of pepper like preserve green pepper in brine, vinegar, dehydrated green pepper etc. are becoming more popular. Hence the black pepper is also called as 'Black gold' on account of its economic importance [1].

Black pepper can be propagated through seeds and vegetative methods. Owing to its heterozygous nature, seedlings do not breed true to type and known to have long pre-bearing period. Hence, vegetative propagation through cuttings is commercially adopted. Besides this grafting, budding and layering are also practiced. But propagation through cuttings is easier hence it is preferred for large scale multiplication. Cuttings taken from runners shoots (Creeping shoots on the ground) and orthotropic shoots (erect growing shoots) are used commercially for vegetative propagation.

Availability of adequate quantity of quality planting material for large scale multiplication is one of the major constraints in increasing the productivity of pepper in India. The recent developments like, use of growth regulators, media, greenhouse or mist technology, rapid multiplication techniques are found helpful in solving this problem to a greater extent. The conventional methods adopted for establishment of pepper have the disadvantage of false sprouting and poor root development coupled with high disease incidence which eventually leads to poor establishment. In this context plant growth regulators (PGRs) have great potential in increasing the agricultural production and help in removing the barriers imposed by genetic and environmental factors. Plant growth regulators play a vital role in improving the rooting in black pepper cuttings. The maximum rooting percentage found help to increase the establishment of cuttings in nurseries. Growth regulators such as auxins increase more percentage of success and number of roots in black pepper cuttings. This would improve the vigour of freshly transplanted plant material in the field, thus reduces the rate of mortality of

plants and helps to maintain adequate crop stand in the plantations. Hence there is an immense need to increase the area under pepper plantation to meet the domestic as well as export market is of greater importance. Therefore, the main objective is to study the effect of growth regulators on rooting of black pepper cuttings.

Material and Methods

The present investigations were carried out in naturally ventilated polyhouse with Completely Randomized Design at Regional Horticultural Research and Extention Centre, Mudigere during the period from February 2012 to June 2012. The healthy cuttings of Panniyur-1 variety were procured from the RHREC, Mudigere. The cuttings having two nodes with thickness of 0.8-1.0 cm diameter and 10 cm length were selected. For rooting media a potting mixture consists of jungle soil, sand and FYM in the ratio of 2:1:1 was filled into 20 × 12 cm sized perforated polythene bag of 200 micron thickness. Before planting the cuttings, media was drenched with Copper-oxy chloride (0.3 %) as a prophylactic measures against fungal diseases.

There were eleven treatments including control in which several growth regulator formulations were used at different concentrations. Each treatment was replicated thrice, with 100 cuttings per replication. The Growth regulator formulations are T 1 - Control (dipped in tap water), T 2 - IBA 500 ppm, T 3 -IBA 1000 ppm, T 4 - IBA 1500 ppm, T 5 - NAA 250 ppm, T 6 - NAA 500 ppm, T 7 - NAA 1000 ppm,T 8 - IAA 1000 ppm, T 9 - IBA + NAA 250 ppm, T 10 - IBA + NAA 500 ppm and T 11 - IBA + NAA 1000 ppm. Where, IBA = Indole Buteric Acid, IAA= Indole Acetic Acid and NAA=Naphthalene Acetic Acid.

Before preparing the stock solutions, IAA, IBA and NAA were dissolved in 0.1 N NaOH solutions. Required concentration of the growth regulator solution was taken and the cuttings were dipped upto 1.5 – 2.0 cm deep in the solution for one minute. Then they were air dried subsequently for few seconds and immediately two cuttings per polythene bag were planted and placed in naturally ventilated poly house.

Several Observations were recorded in this study like Root parameters (Days taken for root initiation, Percentage of cuttings rooted, Number of roots per rooted cutting, Length of the longest root, Fresh weight of roots per rooted cutting, Dry weight of roots per rooted cutting) and Shoot parameters(Number of days taken for sprouting, Per cent sprouting, Length of new shoot per cutting, Number of leaves on sprout per cutting at 30, 60 and 75 days after planting, Fresh weight of shoot per rooted cutting, Dry weight of shoot per rooted cutting).

Result and Discussion

Shoot parameters

The data (Table 1 and 2) clearly indicated the favourable and significant influence of growth regulators on all shoot parameters as compared to control. IBA was superior to NAA. The combination of IBA and NAA at different concentrations was not so effective in respect of shoot parameters studied. Cuttings treated with growth regulators recorded early sprouting only in lower or medium concentrations of growth regulators (IBA and NAA) indicating deleterious effect at higher concentration than optimum or threshold values of growth regulators. However IBA at 1000 ppm concentration recorded early sprouting, maximum per cent sprouting, length of shoot, number of leaves, fresh and dry weight of shoots as compared to control, [3] in long pepper and [2] in guggal.

Early sprouting (17.40 days) and highest percentage (82.67) of sprouting was recorded in the treatment IBA 1000 ppm (Table 1). This may be due to better utilization of stored carbohydrates, nitrogen and other factors with the aid of growth regulators. In all the growth regulators tested, linear increase in the parameters was observed in all the concentrations. However, linearity was more prominent with high values only at optimum concentration. Further, stored food materials with the aid of growth regulators have hastened the sprouting thereby enhancing the utilization of carbohydrates. With regard to number of leaves, cuttings treated with IBA at 1000 ppm and 500 ppm performed better (4.2 and 3.6 leaves per cutting, respectively) over other treatments and also attributed it to activation of shoot growth which probably might have increased number of nodes that led to development of more number of leaves under mist conditions.

Cuttings treated with IBA at 1000 ppm have recorded the maximum shoot length when compared to other treatments. Similar findings were also reported by [3] in long pepper and attributed it to the auxins activated shoot growth which might have resulted in elongation of stem through cell division accounting in higher number of leave and shoot length. Different concentrations of IBA cause significant difference over control with regard to fresh and dry weight of shoots. The maximum fresh and dry weight of shoots was recorded with IBA 1000 ppm. The results reported by [3] in long pepper followed the similar trend. This may be due to auxin activated the stem and leaf growth which might have resulted in elongation of stem and number of leaves through cell division and cell elongation accounting for higher fresh and dry weights.

Root parameters

An early root induction was observed in all the cuttings treated with growth regulators especially with IBA as compared to NAA, IAA and in combination of IBA and NAA. IAA was also quite helpful in inducing early rooting compared to control which took maximum number of days for root induction in black pepper cuttings. Similar trend was observed in respect of rooting percentage also. Earliest rooting (35.47 days) and maximum rooting (70 %) were observed when the cuttings were treated with IBA 1000 ppm, which differed significantly from rest of the treatments (Table 2). An early sprouting and higher shoot parameters at initial stages might have brought early and better rooting. Hormone like substances were formed in developing bud, which transfer through phloem to the base of the cuttings, where these stimulate rooting. Further, stored food materials with the aid of growth regulators might have hastened the rooting.

Significant effect of growth regulators has been observed on number and quality of roots produced in black pepper cuttings as compared to control (Table 2). Cuttings treated with IBA (1000 ppm) recorded the maximum number of roots (7.28) and length of the root (18.18 cm). It can be ascribed to enhanced hydrolysis of carbohydrates caused by auxin treatment. The better response to IBA (1000 ppm) may be attributed to increased rate of respiration, accumulation of higher level of amino acids at their bases, 48 hours after the treatment than untreated cuttings. Among different growth regulators IBA 1000 ppm showed better results followed by IBA 500 ppm with respect to various growth parameters that were under consideration. This effect may be due to its slow

translocation property or slow destruction by auxin destroying enzyme system. The beneficial effect of higher concentrations of IBA on rooting of cuttings is supposed to be due to its unstability at lower concentrations at the site of application in scented Geranium.

The growth regulator treatments increased the fresh and dry weight of induced roots. The maximum fresh and dry weight of roots (2.71 and 1.02 g, respectively) was observed in IBA 1000 ppm followed by IBA at 500 ppm each (Table 2) [5]. obtained higher fresh and dry weight in IBA treated cuttings of Indian lavender. The maximum fresh and dry weight of roots in cuttings treated with IBA 1000 ppm can be very well related to higher number of roots and root length obtained with the same treatment (Table 2). It is obvious that auxin treatment induced higher number of primary and secondary roots that might have also resulted in elongation of these roots through cell division and consequently accounting for higher fresh and dry weight of roots.

In general, IBA 1000 ppm and IBA 500 ppm have been found to induce significant rooting in black pepper cuttings. The basis for this may be enhanced hydrolysis of nutrient reserves (mainly starch) by auxin treatments. The cuttings which received IBA at 1000 ppm excelled over all the other treatments in all the root characters, and it was followed by IBA 500 ppm. In addition to growth regulators the better rooting can be attributed to the favourable conditions prevailing in poly houses like high temperature (30-35° C) and high relative humidity (85-90 %) and is responsible for reduced transpiration and respiration rate associated with higher photosynthetic activity which promoted better rooting in cuttings.

Table 1: Effect of growth regulators on shoot parameters at different time intervals (30, 60, 75 days after planting) of black pepper cuttings.

Treatment	Days to sprout	30 DAP			60 DAP			75 DAP		
		No. of leaves	Length of new Shoots (cm)	Percent of sprouting (%)	No. of leaves	Length of new Shoots (cm)	Percent of sprouting (%)	No. of leaves	Length of new Shoots (cm)	Percent of sprouting (%)
T1 - Control	24.47	0.40	2.10	12.33	1.40	4.44	30.33	2.20	6.17	49.00
T2 – IBA 500 ppm	19.27	1.13	3.38	30.33	2.07	7.57	57.67	3.60	9.10	73.00
T3 - IBA 1000 ppm	17.40	1.53	3.83	40.00	2.47	8.11	67.00	4.20	10.40	82.67
T4 - IBA 1500 ppm	19.93	0.80	3.13	28.67	1.87	6.39	55.67	3.13	8.42	71.33
T5 – NAA 250 ppm	19.60	1.07	3.40	31.33	2.00	7.15	64.67	3.47	8.96	73.67
T6 - NAA 500 ppm	19.80	0.87	3.16	24.33	1.93	6.47	49.00	3.20	8.53	69.00
T7 – NAA 1000 ppm	20.60	0.67	2.66	19.33	1.60	5.87	40.00	2.80	7.97	62.67
T8 –IAA 1000 ppm	19.80	0.93	3.20	28.33	1.93	6.93	52.00	3.27	8.70	71.00
T9 – NAA + IBA 250 ppm	20.13	0.73	3.10	27.00	1.73	6.38	50.00	3.07	8.16	70.67
T10 – NAA+ IBA 500 ppm	20.60	0.67	3.06	22.33	1.67	5.95	47.33	2.87	8.14	65.33
T11 – NAA+ IBA 1000 ppm	21.87	0.53	2.28	14.33	1.53	5.83	35.33	2.40	7.39	53.00
F –test	**	**	**	**	**	**	**	**	**	**
S Em±	0.61	0.06	0.09	1.54	0.08	0.26	2.37	0.13	0.22	2.06
C D 5%	1.78	0.18	0.25	4.51	0.24	0.77	6.96	0.38	0.63	6.04

** Highly Significant

Table 2: Effect of growth regulators on Root parameters at different time intervals (30, 60, 75 days after planting) of black pepper cuttings

Treatment	Shoots		Roots		Days taken to root initiation	Percentage of rooting	No. of Primary roots	Root length(cm)
	Fresh Weight (g)	Dry Weight (g)	Fresh Weight (g)	Dry Weight (g)				
T1 - Control	8.16	1.57	1.30	0.49	44.27	43.33	1.78	10.93
T2 – IBA 500 ppm	10.01	3.22	2.34	0.91	38.67	66.67	6.11	17.09
T3 - IBA 1000 ppm	11.00	3.52	2.71	1.02	35.47	70.00	7.28	7.28
T4 - IBA 1500 ppm	9.82	2.14	2.03	0.77	40.00	56.67	5.11	15.15
T5 – NAA 250 ppm	9.90	2.70	2.32	0.89	38.80	63.33	5.67	16.93
T6 - NAA 500 ppm	9.83	2.37	2.27	0.85	39.60	60.00	5.11	16.41
T7 – NAA 1000 ppm	9.10	2.04	1.67	0.68	40.27	43.33	3.33	14.55
T8 –IAA 1000 ppm	9.89	2.54	2.29	0.87	38.93	60.00	5.44	16.76
T9 – NAA + IBA 250 ppm	9.19	2.10	1.99	0.76	40.67	53.33	4.89	15.32
T10 – NAA+ IBA 500 ppm	9.19	2.08	1.80	0.76	41.07	50.00	4.00	14.85
T11 – NAA+ IBA 1000 ppm	8.68	1.86	1.41	0.54	42.67	43.33	1.89	12.27
F –test	**	**	**	**	**	**	**	**
S Em±	0.37	0.20	0.14	0.04	1.06	2.66	0.25	0.34
C D 5%	1.07	0.58	0.40	0.11	3.12	7.80	0.73	1.01

** Highly Significant

Conclusion

It was evident in the present study that the percentage of rooting of cuttings would be better if they are pre-treated with growth regulators and kept in better rooting media for favourable rooting. This indicates that cuttings need some physiological stimulation and better environment for favourable rooting. In the present study 80 per cent rooting was obtained by favourable growth regulator treatment when raised in an ideal rooting medium under greenhouse conditions. These technologies would go a long way in improving the turnover efficiency of availability of rooted cuttings per unit time to meet the increasing demands of growers. It may be summarized that the black pepper planting material can be raised with high success (80 %) by pre-treatment of cuttings with IBA (80 %) by pre-treatment of cuttings with IBA at 1000 ppm in polyhouse conditions. The use of higher concentration of growth regulators, especially IBA at 1500 ppm and NAA at 1000 ppm and their combination at 1000 ppm adversely affected the rooting of cuttings indicating higher concentrations of growth regulators may become toxic to black pepper cuttings.

References

1. Devasahayam S, Anandaraj M, Thankamani CK, Saji KV, Jayashree E. Black Pepper In: Parthasarathy, V. A. And Rajeev, P. A (Eds.) Major Spices- Production and

Processing. Indian Institute of Spice Research, Calicut, 2010, 15-61.
2. Diwaker. Studies on Vegetative Propagation of Guggul, (*Commiphora wightii* Arnott.) M.Sc. (Hort.) Thesis, University of Agricultural Sciences, Bangalore, 2010.
3. Kempe Gowda K, Ganesh, Mahendrakar P. Efficacy of growth regulators for rooting and sprouting of long peper cuttings (*Piper longum* Linn.). Journal of Plantation Crops. 2006; 34(3):650-651.
4. Parthasarathy VA, Madan MS. Spices Research and Development- An overview In: Parthasarathy, V. A. and Rajeev, P. A. (Eds.) Major Spices- Production and Processing. Indian Institute of Spice Research, Calicut, 2010, 1-14.
5. Swetha H. Propagation of Indian lavender (*Bursera delpechiana* Poiss. Ex Engl.) Through cuttings under mist. M.Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharwad, 2005.