Short Scientific Report

doi: 10.25081/jpc.2020.v48.i2.6375
Journal of Plantation Crops, 2020, 48(2):146-149

Enhancement of rooting and growth of bush pepper by *jeevamruthum* and tender coconut water

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(Manuscript Received: 31-08-2019, Revised: 30-04-2020, Accepted: 13-05-2020)

***Keywords*:** Bush pepper, enhancement, growth, rooting

Black pepper (*Piper nigrum* L.) known as the king of spices is one of the oldest spices known to the world. Presently black pepper is cultivated in 139487 ha area in India with a production of 64000 tonnes per year, but our productivity is very low (458 kg ha^{-1}). Since scope for area expansion is limited, especially in urban horticulture, cultivation of bush pepper in the terrace garden, coconut garden, orchards is some of the alternatives to increase the production to meet the growing demand.

Various methods to produce bush pepper from lateral cuttings have been reported (Sujatha, 2004; Sannidhi, 2018). A common problem associated with bush pepper raising has been very limited survival due to lack of root primordium in laterals resulting in poor rooting. A modified multiplication technique in bush pepper with a segment of orthotrop in laterals and treating with IBA 1000 ppm was suggested in Panniyur 1 (Sujatha, 2004) with a success rate of 74 per cent. The extraction of a large number of laterals with a segment of orthotrops for production of bush pepper required the destruction of pepper vines which will reduce the yield in the field. Another drawback of this method is the production of runner shoot from bush pepper which necessitates frequent pruning of runner shoot in pots, which is labour-consuming. Treating with IBA is inevitable for proper rooting due to presence of sclerenchymatous tissues in the shoots. Besides these, IBA is an expensive chemical which is not affordable to farmers and availability is restricted to a few chemical shops. Organic farming is gaining importance in view of sustained agriculture and maintaining ecological balance**.** In organic farming, planting material should be produced using organic substances**.** Hence proper rooting method is to be standardised using cheaper indigenous materials and also suitable sources has to be identified for collecting laterals for making bush pepper.

With these objectives, an experiment was conducted in a naturally ventilated polyhouse at ICAR-IISR, Experimental Farm, Peruvannamuzhi. The experiment was conducted on lateral shoots collected from two varieties (Panniyur 1 and Sreekara). Two sources of planting materials (vine pepper and laterals in pots) and three growth-enhancing substances *viz*., indole butyric acid (IBA), tender coconut water (TCW) and *Jeevamruthum* (JA) were used as variables to constitute 13 treatments including control. Seven-year-old black pepper varieties *viz.,* Panniyur 1 and Sreekara grown on *Ailanthus* as support tree and the same maintained as bush pepper in pots (seven-year-old) were used to collect laterals. These plants were maintained with the recommended package of practices of black pepper by ICAR-IISR (Devasahayam *et al*., 2006). The collected one-year-old laterals from both the sources and varieties were cut into three nodes (10-15 cm long) and used for planting in polythene bags after treating with respective growth-

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enhancing substances. Polythene bags were filled with a potting mixture containing soil, FYM and granite powder in 2:1:1 proportion. Nutrient content of the potting medium was analysed (available nitrogen 688 ppm, phosphorus 54.51 ppm, potash 774 ppm and pH 6.4).

Jeevamruthum was prepared by mixing jaggery (250 g), gram flour (250 g), fresh cow dung (10 kg), fertile soil (500 g) from the undisturbed area and cow urine (1 L) with 17.5 litres of water in a drum and the slurry was stirred thrice in a day for three consecutive days. On the fourth day, *jeevamruthum* was taken, and laterals from both the sources were dipped for 10 minutes and planted in polybags (25 x10 cm size) filled with potting mixture. *Jeevamruthum* was also applied to the potting media @ 10 mL per plant at the time of planting.

Tender coconut water was collected from 20-year-old WCT coconut tree at 7-8 months maturity. The basal end of the laterals from both the sources was dipped in tender coconut water for 10 minutes, and a similar set of laterals were dipped in 1000 ppm of IBA for 45 seconds and used for planting in polythene bags. The experiment was conducted in factorial CRD, and each treatment was replicated thrice. The number of laterals per each treatment was 15. The data pertaining to survival rate, number of roots and growth parameters were recorded at the end of three months (Table 1). Pre and post-treatment nutrient status in the potting medium and nutrient content of leaves of laterals from both the sources before the experiment were estimated.

The maximum survival percentage of rooted cuttings was recorded by laterals collected from vine pepper (51.2%) compared to those grown in pots (36%) (Table 1). Standard provides support to the black pepper plant and keeps the leaves in an erect position for tapping maximum solar radiation while in potted plants branches are extending from the center to side causing mutual shade which prevents full utilisation of solar energy which might have caused less photosynthesis and less storage of food. Moreover, forage zone of vine pepper is more compared to potted plants. More NPK content in leaves of vine pepper (NPK 2.4%, 0.27%, 2.43% respectively) were observed compared to leaves in potted bush pepper (NPK 2.3%, 0.20% and 1.49% respectively) indicating accumulation of nutrients. The growth depends on the capacity of the plants

Table 1. Effect of growth substance and source of laterals on survival and growth parameters of bush pepper

	Survival (%)	No. of primary roots	No. of secondary roots	Length of primary roots (cm)	Height (cm)	No. of leaves
Varieties						
Sreekara	41.88	2.79	23.63	6.46	11.50	1.67
Panniyur 1	47.30	3.42	20.21	11.60	12.50	1.71
CD (0.05)	NS	NS	NS	4.60	NS	NS
Source of laterals						
Pot	36.04	3.17	24.29	8.23	10.71	1.80
Tree	51.20	3.04	19.54	14.89	13.30	1.58
CD (0.05)	6.70	NS	NS	3.00	NS	NS
Growth substances						
IBA	43.94	2.00	16.17	9.03	12.93	1.80
TCW	53.90	3.08	19.33	10.93	13.36	2.00
JA	49.74	6.33	50.67	14.03	12.93	2.08
Control	30.75	1.00	3.50	3.00	8.81	1.17
CD (0.05)	8.29	1.32	9.40	3.60	1.78	0.50

to harvest solar energy and nutrients efficiently for metabolite production. Accumulation of nutrients in laterals raised from vine pepper helped better hydrolysis and transport of nutrients to the basal portion of laterals which would have helped for better root formation and better growth.

Jeevamruthum was found to be the best treatment which produced maximum number of primary roots, number of secondary roots and length of primary roots. *Jeevamruthum* is a growth-enhancing substance that provides all necessary nutrient requirements for growth of the crop. It contains a large number of favourable microorganisms such as nitrogen fixers, phosphorus solubilisers and actinomycetes, which convert unavailable nutrients to readily available form to plants (Palekar, 2008). Devakumar *et al.* (2008) reported that higher microbial load and growth hormones in *jeevamruthum* enhanced the soil biomass, thereby sustaining the availability of soil nutrients which ultimately resulted in better growth of the crops. This is in agreement with the findings of Rameeza and Usha (2016) who reported nutrient content in *jeevamruthum* as nitrogen 0.3 to 0.8 per cent, calcium 66.4 ppm, magnesium 50 to 62 ppm, zinc 0.4 -7.5 ppm, and manganese 1.7-26.9 ppm. Besides nutrients, microbes in *jeevamruthum* are capable of producing IAA, which belongs to the auxin group (Sariga, 2018). It has been documented that auxin promoted adventitious root development of stem cuttings, through their ability to promote the initiation of lateral root primordia and to enhance transport of carbohydrates to the cutting base (Hartmann *et al*., 2010).

Laterals treated with tender coconut water were found to have better survival and growth among the treatments. Use of coconut water for propagation is due to the presence of cytokinin and other hormones such as auxin and gibberellins (Ma *et al.,* 2008). According to Correa *et al*. (2005), auxins regulate the rooting process and carbohydrates increase the root growth. The external application of tender coconut water as growth-enhancing substances would have increased the meristematic activity and root differentiation. This was supported by the finding of Yong *et al*. (2009) who reported that tender coconut water (7-8 months) contains growth regulators *viz.,* auxins, cytokinins, gibberellic acids, sugars, amino acids, potassium, chlorine, sulphur, enzymes *etc.,* which are necessary for rooting and better growth of the plants. Tender coconut water is an important additive in tissue culture media of several plants, including orchids. The cytokinins signal the plants to divide cells into the roots and growing shoots equaling explosive growth (https://kitchenhomegardener.in.). The cytokinins, found in coconut water, support cell division and thus promote rapid growth of plants. Increased root number and root length by IBA treatment were reported in bush pepper (Sujatha *et al.,* 2004). It was noticed that the performance of untreated lateral cuttings was less in the present study. The result conforms with the findings of Sujatha *et al*. (2004) who observed the lowest survival rate (22%) in untreated Panniyur 1 cuttings propagated from laterals. The study indicated that treating three-node lateral cuttings from vine pepper with *Jeevamruthum* for 10 minutes and basal application of the same @10 mL or dipping basal portion of the laterals in tender coconut water for 10 minutes is beneficial for the production of organic planting material in bush pepper.

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