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Evaluation of nursery mixture for planting material production in black pepper (*Piper nigrum* L.)

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Abstract

An experiment was conducted at Peruvannamuzhi (Kerala) to study the feasibility of using soil-less medium containing coir pith compost and granite powder for raising black pepper (*Piper nigrum*) cuttings in the nursery. Plant height, leaf production, leaf area and total dry matter production were significantly higher in the medium consisting of coir pith compost and granite powder in 1:1 proportion along with *Azospirillum* sp. and phosphobacteria as nutrient sources whereas, the cost of production of rooted cuttings was cheaper in the medium consisting of coir pith compost, granite powder, and farmyard manure in 2:1:1 proportion compared to conventional potting mixture (soil: sand: farmyard manure in 2:1:1 proportion).

Keywords: black pepper, coir pith compost, granite powder, *Piper nigrum,* rooted cuttings.

Availability of quality planting material of black pepper (*Piper nigrum* L.) is a major production constraint in all black pepper growing countries. In the traditional method of production of cuttings in the nursery, soil and sand are essential components in potting mixture. However, if the mixture is not sterilized, there is the possibility of spread of soil-borne pathogens. Transportation of cuttings in bags containing conventional potting mixture to distant places is also difficult due to the bulky nature of soil and the cost involved. The availability of sand has become scarce in recent years. Granite powder, a cheaper material than sand was successfully used as one of the ingredients in potting mixture, for raising black pepper cuttings in the nursery (IISR 2005). Decomposed coir pith can also substitute soil or sand in conventional nursery mixture for raising black pepper cuttings (Srinivasan & Hamza 2000). In the present investigation different combinations of coir pith compost and granite powder were evaluated as rooting media for raising black pepper cuttings in the nursery.

The trial was conducted during 2005 at Indian Institute of Spices Research, Experimental Farm, Peruvannamuzhi (Kerala). Granite powder was obtained from local quarries. Raw coir pith was collected locally and converted to coir pith compost using *Pleurotus* sp. The potting mixtures for the trial were prepared by mixing coir pith compost and granite powder in different proportions. Farmyard manure and bio fertilizers such as *Azospirillum* sp. and phosphobacteria were the nutrient sources. The trial was laid out in completely randomized design (CRD) with the following treatments: 1. Conventional nursery mixture with soil (S), sand (SA) and farmyard manure (F) in 2:1:1 proportion (control) (SSAF 2:1:1); 2. Coir pith compost (C), granite powder (G) and farmyard manure (F) in 2:1:1 proportion (CGF 2:1:1); 3. Coir pith compost, granite powder, and farmyard manure in 1:1:1 proportion (CGF 1:1:1); 4. Coir pith compost and granite powder in 2:1 proportion with *Azospirillum* sp. and phosphobacteria as nutrient source (CG 2:1 (A+P)); 5. Coir pith compost and granite powder in 1:1 proportion with *Azospirillum* sp. and phosphobacteria as nutrient source (CG 1:1 (A+P)).

The potting mixture (as per treatment) was filled in polythene bags of 20 cm x 10 cm size, which had perforations at the bottom for drainage. Physicochemical properties of the medium and materials used are given in Table 1. Healthy rooted single node cuttings of black pepper *var*. Sreekara obtained from bamboo method of multiplication were used for planting in polythene bags. Nutrient solution (as per package of practice recommendations of IISR) was added to polythene bags at 1st, 2nd and 3rd month after planting (control) (Devasahayam *et al.* 2006). In the biofertilizer treatment, *Azospirillum* sp. and phosphobacteria (10^8 cfu ml^{-1}) were applied @ 50 ml bag^{-1} at the time of planting and 1st and 2nd month after planting in polythene bags. The plants were allowed to grow for 3 months after which observations on height and number of leaves $plant^{-1}$ were recorded. Destructive sampling was done 3 months after the experiment to record the length of roots and total biomass. Leaf area $plant^{-1}$ was estimated using the equation LA = L x W x 0.61 where LA=Leaf area, L=Length of leaves and W= Width of leaves (Ibrahim *et al.* 1985). Areas of individual leaves were added together and average was worked out. The dry weight of stem, leaves and roots were recorded separately and added together to record total biomass. Nutrient status of soil and leaves at 3 months after planting was estimated using standard procedures (Jackson 1973). The data were subjected to statistical analysis using the procedure of Panse & Sukhatme (1985).

The effect of different treatments on height, number of leaves, leaf area, dry weight of leaf, stem and dry matter production were significant. The treatment CG 1:1 (A+P) recorded significantly higher plant height, leaf production and leaf area than all other treatments. Leaf production and leaf area were on par with CG 2:1 (A+P) and CGF 2:1:1 (Table 2).

Dry weight of leaf and stem was significantly higher for the treatment CG 1:1 (A+P) and CGF 2:1:1 whereas dry weight of root did not differ significantly due to the application of different nursery mixtures. The data on total dry mater of the rooted black pepper cuttings indicated that the influence was maximum

Table 1. Physicochemical properties of potting mixtures

Treatment	pH	BD (g cc^{-1})	PD	WHC (%)	N	P	K	Ca	Mg
					(mg kg^{-1})				
CGF 2:1:1	5.7	1.25	1.24	63	228	55	670	690.0	430.0
CGF 1:1:1	5.8	0.83	0.73	42	215	60	765	841.0	428.0
CG 2:1 (A+P)	4.6	0.96	0.94	85	228	55	670	690.0	430.0
CG 1:1 (A+P)	4.8	0.61	0.66	57	136	15	622	409.0	320.0
SSAF 2:1:1	6.2	1.23	1.20	50	147	65	721	809.0	389.0
C	4.3	1.63	1.63	247	240	10	961	371.0	250.0
G	5.6	0.27	0.27	22	40	30	2440	0.1	0.1

BD=Bulk density; PD=Particle density; WHC=Water holding capacity; C=Coirpith compost; G=Granite powder; F = Farmyard manure; A=*Azospirillum* sp.; P=Phosphobacteria; S=Soil; SA=Sand.

Table 2. Effect of various media on growth of black pepper rooted cuttings (3 months after planting)

Treatment	Height (cm)	No. of leaves	Leaf area (cm^2)	Leaf dry wt. (g pl^{-1})	Stem dry wt. (g pl^{-1})	Root dry wt. (g pl^{-1})	Total dry matter (g pl^{-1})
CGF 2:1:1	34.90	5.4	123.3	1.63	2.28	0.84	4.8
CGF 1:1:1	24.45	4.2	89.0	1.10	1.13	0.80	3.0
CG 2:1(A+P)	29.75	5.6	98.5	1.23	1.70	0.82	3.7
CG 1:1(A+P)	39.18	5.7	125.0	1.63	2.43	0.89	5.0
SSAF 2:1:1	27.33	4.1	97.0	1.25	2.00	0.82	4.0
CD (P=0.05)	3.89	0.9	4.4	0.22	0.24	NS	0.4

C=Composted coir pith; G=Granite powder; F=Farmyard manure; A=*Azospirillum* sp.; P=Phosphobacteria; SSAF= Soil, sand, farmyard manure

with CG 1:1 (A+P) which was on par with CGF 2:1:1 (Table 2).

Total uptake of nitrogen in the plant was comparatively higher for the treatment CG 1:1 (A+P) followed by CGF 2:1:1. Higher uptake of phosphorous, potassium, calcium, and magnesium was observed for the treatment CGF 2:1:1 followed by CG 1:1 (A+P); however these values were on par with conventional potting mixture.

The production cost of cuttings was highest (Rs. 4.08 per cutting) for the treatment CG 1:1 (A+P) and lowest (Rs. 3.78 per cutting) for CGF 1:1:1. The cost (Rs. 3.84 per cutting) was less for the treatment CGF 2:1:1 compared to conventional potting mixture (control) (Rs. 4.05 per cutting).

The weight of polythene bags filled with potting mixtures such as SSAF 2:1:1, CGF 2:1:1, CGF 1:1:1, CGF 2:1 (A+P) and CG 1:1 (A+P) were 650 g, 425 g, 475 g, 450 g and 500 g, respectively. A weight reduction of 25% could be achieved using the media CG 2:1 (A+P) and CGF 2:1:1 compared to conventional potting mixture. Regarding the production cost, the medium consisting of CGF 2:1:1 was cheaper than CG (A+P) 1:1 and could be substituted for conventional potting mixture when soil and sand are scarce.

The higher biomass production in the treatment CG 1:1 (A+P) compared to conventional potting mixture (control) may be due to increased nutrient uptake especially nitrogen (Fig. 1). Better growth may also be due to the production of phytohormones like IAA, GA and cytokinin like substances by *Azospirillum* sp. (Govindan & Chandy 1985). Increased dry matter production in black pepper due to application of decomposed coir pith, sand and farmyard manure was reported by Srinivasan & Hamza (2000). Saravanan & Bhaskar (1997) also found improvement in

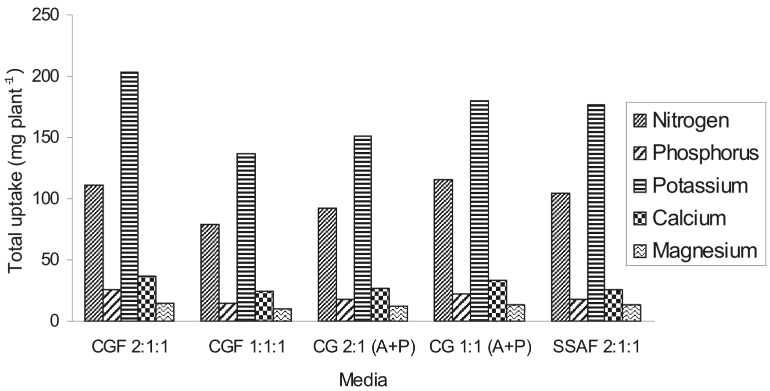

Fig 1. Effect of various media on total uptake of nutrients (CGF=Coir pith compost, granite powder, farmyard manure; CG=Coir pith compost, granite powder; SSAF=Soil, sand, farmyard manure; A=*Azospirillum* sp.; P=Phosphobacteria).

physicochemical properties of potting medium due to incorporation of coir pith in vegetable cowpea. Warrier *et al.* (1998) reported that composted coir pith could be successfully used as rooting medium for *Eucalyptus* sp. Savithri & Khan (1994) suggested that coir pith could serve as important source of organic manure for agricultural crops. Biofertilizers have also been reported to enhance the growth and biomass production and uptake of nutrients in black pepper (Kandiannan *et al.* 2000).

The study indicated that coir pith compost and granite powder in 1:1 proportion along with biofertilizers *Azospirillium* sp. and phosphobacteria is a good potting medium for production of rooted black pepper cuttings. This media and the media containing granite powder and farmyard manure in 2:1:1 proportion could be substituted for ordinary potting mixture where soil and sand are scarce.

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