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Short Communication

Effect of Plant Growth Promoting Microbes in Plant Health Management for Black Pepper

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ABSTRACT

Yellowing, foot rot disease and reduced spike length are the major limiting factors in production and productivity of Black Pepper. An assessment experiment to evaluate the performance of various plant growth promoting microbes for management of yellowing and foot rot disease in black pepper was carried out in Kodagu district of Karnataka. Four different microbial consortia were assessed during the year 2020-21 and 2021-22 in a randomized block design, replicated five times comprising of four treatments. The results revealed that drenching of Arka Microbial Consortium (20 g/l) applied at the rate of 4 l/ vine during June and September was found to be the best among treatment. It resulted reduced yellowing (6.25%), higher spike length (14.25 cm) and also resulted in early initiation of spikes as compared to other treatments. Hence, the technological package comprising of drenching with AMC was found to be highly effective for harnessing higher dry pepper yields (8.75 q/ha) and for maintaining good plant health in black pepper.

Key Words: Black pepper, Yellowing, Plant health management, foot rot disease.

INTRODUCTION

Black Pepper (*Piper nigrum L.*) the king of spices is one of the important spice commodities of commerce and trade in India since pre-historic period. It originated in the tropical evergreen forests of the Western Ghats of India. Pepper is used in food and drinks for imparting agreeable flavor and aroma and also used as a preservative (Veerendra *et al*, 2018). Pepper is rich in aroma and pungency, which are attributed to the presence of an alkaloid called piperine (Damanhouri and Ahmad, 2014). India is the largest producer of black pepper, growing in about 1.34 lakh hectares with annual production of 48,000 MT and productivity of 761 kg/ha.

Black pepper is cultivated to a large extent in the states of Karnataka and Kerala. Karnataka and Kerala account for 92 per cent of production of black pepper in the country (Anonymous, 2019). Low productivity in pepper is attributed to use of local varieties, lack in adoption of appropriate agronomic practice, poor uptake of nutrients due to soil acidity and losses due to incidences of biotic and abiotic stress (Hussain *et al*, 2017). The nutritional need of Black Pepper is unique for its spike setting, uniform berry formation etc. High rainfall in the black pepper growing areas made the soil less productive due to leaching and erosion loses of nutrient and has effect on growth of the crop (Sadananadan, 2000). The major problems in Black Pepper cultivation is nutrient imbalance between the soil and plant, which often predispose the pepper plants to diseases including spike shedding and yellowing of leaves (Srinivasan *et al*, 2012). Spike shedding occurs at various stages of flower and fruit development leading to yield loss of 40 % or even more (Kandiannan *et al,* 1994). Apart from nutrition imbalances, pathological attacks of fungi *Phytophthora capsici* caused foot

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Table1. Treatment details.

Treatment	Detail
T1	Soil application of FYM enriched with *Trichoderma* during June and September - Control
T2	Drenching of PGPR-II consortium (20 g/l). Drenching 4 l/plant during June and September
T3	Drenching of IISR Bio mix consortium (20 g/l). Drenching 4 l/plant during June and September
T4	Drenching of Arka Microbial Consortium (20 g/l). Drenching 4 l/plant during June and September

rot disease and nematodes either singly or in their combinations have been associated with yellowing and spike shedding (Thomas *et al*, 2017). Use of bio fertilizers and plant growth promoting microbes is now getting momentum as a part of nutrient management. Azospirillium, phosphate solubilizing bacteria (PSB), Arbuscular Mycorrhizal Fungi (AMF) *Bacillus subtilis*, *Micrococcus lutes* and *Enterobacter aerogens* and *Pseudomonas fluorescens* are some of the popularly used bio fertilizers and plant growth promoting microbes gaining popularity among plantation farmers. Use of bio agents and plant growth promoting microbes enhances the soil productivity through an uptake of available nutrients in the soil and air and also improving the soil fertility (Parthasarathy *et al,* 2008).

MATERIALS AND METHODS

On farm Technology assessment on effect of different plant growth promoting microbes for plant health management in black pepper was carried out at Cherandetti village of Madikeri Taluk, Kodagu District during the year 2020-21 and 2021-22. The treatments were imposed before onset of monsoon (June) and post monsoon (September) and the experiment was laid out in randomized block design with four treatments replicated five times (Table1).

For each treatment 50 Black pepper vines were taken in five farmer's fields. The observations on per cent yellowing, spike length, per cent disease index on foot rot disease and dry pepper yield (q/ha) were recorded. The per cent yellowing was calculated at three levels of plant canopy of 0.5 m^2 area, randomly selected, preferably each at lower, middle and upper level of the canopy. The per cent yellowing was computed using the formula given below:

$$\text{Per cent Yellowing} = \frac{\text{No. of leaves showing yellowing symptoms in 0.5 } m^2 \text{ area}}{\text{Total no. of leaves present in 0.5 } m^2 \text{ area}} \times 100$$

The data on the per cent disease index of foot rot disease was determined using descriptive type assessment key with a 0-4 score scale 0= 0%, 1= 1-30%, 2=31-50%, 3=50- 75%: 4=76-100% (Kim *et al,* 1992) and spike length was measured in cm.

RESULTS AND DISCUSSION

Different technologies assessed had a considerable influence on yellowing per cent of black pepper (Table 2). During each of the 2-year trial, yellowing per cent was significantly lower under T4, which was followed by T3, T2 and T1 in order. However, T1 resulted in higher yellowing per cent as compared to all other treatments. The pooled data showed the following trend for yellowing per cent T4<T3<T2<T1 (8.37<10.37<13.0<14.87 %), respectively. Spike length in black pepper showed an increasing trend each of the 2 years (T1>T2>T3>T4) respectively (Table 2). Pooled data of spike length also followed the same trend as mentioned above. The highest spike length of 14.0 cm was recorded in the treatment T4 which was followed by T3 and T2. The lowest spike length of 9.0 cm was recorded in the treatment T1 which was significantly lower as compared to all other treatments (Table 2). Foot rot disease incidence per cent was significantly lower under T4, which was followed by T3, T2 and T1 in order. T1 resulted in highest Foot rot

Table 2. Effect of plant growth promoting microbes in plant health management for Black Pepper

Treatment	Yellowing (%)			Spike length (cm)			Foot rot disease Incidence (%)			Dry Pepper Yield (q ha^{-1})		
	Year			Year			Year			Year		
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
T - 1	18.50	11.25	14.87	8.50	9.0	8.75	20.0	16.0	18.0	4.25	5.0	4.62
T - 2	16.50	9.5	13.0	11.0	11.50	11.25	17.0	13.0	15.0	5.50	6.80	6.15
T - 3	13.0	7.75	10.37	12.0	13.75	12.87	16.5	11.0	13.75	7.75	8.25	8.0
T - 4	10.5	6.25	8.37	13.75	14.25	14.0	12.0	8.5	10.25	8.0	8.75	8.37
SEM±	0.28	0.23	0.26	0.25	0.27	0.34	0.39	0.67	0.59	0.18	0.16	0.19
CD (*P*=0.05)	0.96	0.71	0.74	0.79	0.84	1.02	1.14	2.01	1.58	0.58	0.51	0.60

disease incidence per cent as compared to all other treatments. The pooled data showed the following trend for Foot rot disease incidence per cent T4<T3<T2<T1 (10.27<13.75<15.0<18.0%) respectively. Significantly highest dry pepper yield of 8.0 and 8.75 q ha^{-1} was recorded respectively during 2020-21 and 2021-22 also in treatment T4. The significantly highest and lowest pooled dry pepper yield of 8.37 and 4.62 q ha^{-1} was recorded under T4 and T1. The results are in conformity with the earlier finding that the soil application of Arka Microbial Consortium helps in fixation of atmospheric nitrogen, solubaliztion of native phosphorous and reduction of *phytophthora* disease incidence (Veerendra *et al*, 2018). This eventually resulted in early initiation of spike, reduced yellowing and thereby resulting in higher yield in Black pepper.

CONCLUSION

It was found that drenching of Arka Microbial Consortium (20 g/l) applied at the rate of 4 l/vine during June and September performed better in terms of reduction in yellowing per cent, highest spike length and also resulted in higher yield. The adoption of this technology also resulted in considerably less mortality of the vines. The health of the vines was also found to be better with less spike drop, reduced yellowing per cent and it also resulted in early initiation of spikes. Hence, T4 treatment comprising of the technology of drenching of Arka Microbial Consortium (20 g/l) applied at the rate of 4 l/vine during June and September has proved to be highly effective for harnessing higher yield and maintaining good plant health in black pepper vines.

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REFERENCES

Anonymous (2019). Area, production and productivity of Black Pepper. In http://www.ipcnet.org.

Damanhouri Z and Ahmad A (2014). A review on therapeutic potential of black pepper (*Piper nigrum* L.): the king of spices. *J Medicinal and Arom Pl* **3**(3): 161.

Hussain M D S, Hegde L and Sharatbabu A G (2017). Evaluation of local black pepper (Piper nigrum L.) genotypes for yield and quality under arecanut based cropping system. *Int J Pure and Appl Biosci* **5**(5): 1396–1400.

Kandiannan K, Sivaraman K, and Thankamani C K (1994). Growth regulators in black pepper production. *Indian Cocoa, Arecanut and Spices J* **18**(4): 119–123.

Kim E, BK Hwang (1992). Virulence to Korean pepper cultivars of isolates of Phytophthora capsici from different geographic areas. *Pl Dis* **76**:486–489.

Parthasarathy V A, Kandiannan K, Srinivasan V (2008). Organic Spices. *New India Publishing Agency*, New Delhi: 694-695.

Sadanandan A K (2000). *Agronomy and Nutrition of Black Pepper*. In: Black Pepper *Piper nigrum*, (Ed.) Ravindran P N. Harwood Academic Publishers, Amsterdam: 163-223.

Srinivasan V, Dinesh R, Krishnamurthy K S, and Hamza S (2012). *Nutrition and physiology,* In *Piperaceae Crops-Production and Utilization*. Westville Publishing House, Delhi, India:101–121,

Thomas L M and Naik B G (2017). Survey for the incidence of foot rot of black pepper caused by *Phytophthora capsici* leonian in shivamogga and chickmagaluru districts of Karnataka state. *Int J Pure and Appl Bioscience* **1**: 293–298.

Veerendra Kumar K V and Saju G (2018). Evaluation of Arka Microbial consortium technology in Black Pepper. *J Krishi Vigyan* **7**(1): 233-235.

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