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Effect of Integrated Nutrient management on Yield of Black Pepper

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ABSTRACT

The nutritional need of black pepper is unique for its proper spike setting, uniform berry formation, ripening etc. An experiment was conducted with the objective of studying the effect of integrated Nutrient management system on the yield of black pepper. The inorganic fertilizers *viz.,* urea, Rajphos, muriate of potash was used as source of nitrogen, phosphorus and potassium, respectively. The experiment was laid out in randomized block design with five treatments replicated four times. Results revealed that application of 100% Recommended dose of fertilizers (50:50:100 g NPK/ Vine/year) + Azospirillium + phosphate solubilizing bacteria (25g each) + Arbuscular Mycorrhizal Fungi (50 g) has showed a superior performance on yield and yield attributing components.

Key Words: Black Pepper, Bio-fertilizers, Nutrient management, yield.

INTRODUCTION

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). Soils of Black pepper growing areas are low in pH, high nitrogen, phosphorus and medium to low potassium (Patnaik, 1987). The intensive agriculture demands more use of fertilizers and chemicals, which are not only costly but also cause soil and water pollution. It is therefore, necessary to supply the plant nutrition in an integrated way and to maintain the overall balance, flow of nutrients, better productivity, ecological health, economics and sustainability. In Kerala the current nutritional recommendation is 50:50:100 g NPK/Vine in two splits during May-June and August-September.

The blanket recommendation for fertilizers across the growing areas without relevant soil and plant nutritional status may cause nutritional imbalance and deficiencies. Site specific management is suggested for refined fertilizer strategies like INM for sustaining yield and the environment as indicated by Srinivasan *et al* (2011). Use of bio fertilizers is now getting momentum as a part of nutrient management. Azospirillium, phosphate solubilizing bacteria (PSB) and Arbuscular Mycorrhizal Fungi (AMF) are some of the popularly used bio fertilizers. Integrated nutrient management (INM) enhances the soil productivity through a balanced use of soil nutrients, Chemical fertilizers combined with biofertilizers. INM including recommended dose of fertilizers and use of suitable biofertilizers will improve the soil fertility as indicated by Parthasarathy *et al* (2008).

MATERIALS AND METHODS

The inorganic fertilizers *viz.,* urea, Rajphos, Muriate of Potash were used as source of nitrogen, phosphorus and potassium, respectively. The experiment was laid out in randomized block design with five treatments replicated four times (Table1).

All the required inorganic and organic and inorganic manures were applied in two equal splits during May-June and September-October month (Table 2)

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Table1: Treatment details.

Treatment	Detail
T_1	100% Recommended dose of chemical fertilizers (50:50:100 g NPK /vine/year)- control
T_2	T_1+ Azospirillum (25 g/plant)+ Phosphate Solubilizing bacteria (25 g/plant)
T_3	T_2+ Arbuscular mycorrizhal fungi (50 g/plant)
T_4	75% Recommended dose of chemical fertilizers + Azospirillum (25 g/plant)+ phosphate Solubilizing bacteria (25 g/plant) + Arbuscular mycorrizhal fungi (50 g/plant)
T_5	50% Recommended dose of chemical fertilizers + Azospirillum (25 g/plant)+ Phosphate Solubilizing bacteria (25 g/plant) + Arbuscular mycorrizhal fungi (50 g/plant)

Table 2. Sources of Nutrients for Black pepper.

Treatment	**Sources of nutrients**
T1	50:50:100 g NPK /vine/year
T2	50:50:100 g NPK /vine/year + Biofertilizers (Azospirillum and PSB)
T3	50:50:100 g NPK /vine/year + Biofertilizers (Azospirillum ,PSB and AMF)
T4	37.5:37.5:75 g NPK /vine/year + Biofertilizers (Azospirillum ,PSB and AMF)
T5	25:25:50 g NPK /vine/year + Biofertilizers (Azospirillum ,PSB and AMF)

Observations were recorded on yield and yield attributing characters. Yield parameters were recorded in one meter column of vine at one meter above the ground. The harvested spikes were threshed , dried in open sun and dry weight was taken as yield per vine.

Soil samples were collected and air dried in shade, ground to pass through 2mm sieve and analysed for organic carbon, total nitrogen, available phosphorus, available potassium. Organic carbon of soil was analysed by Walkley and Black (1934) wet oxidation method. Total nitrogen by Macro Kjeldahl method, the available phosphorus was estimated (Bray-1) following the procedure outline by Jackson (1973) and available Potassium was determined in the 1N NH_4OAC Flame Photometrically

RESULTS AND DISCUSSION

Effect of INM on Yield attributes

The yield attributes were significantly influenced by different treatments Table 3. Treatment T_3 recorded highest yield of 2.5 kg /vine followed by T_2. Number of spikes ranged from 188 to 215, length of spike 14.9 to 16.5, number of berries/spike ranged from 81 to 85. The Arbuscular Mycorrhizal Fungi might have increased the availability and absorption of all essential nutrients which led to more uptake and accumulation of potassium in leaf tissues, thereby improving photosynthetic efficiency, translocation and accumulation of carbohydrates as reported by Morard (1974). Sadanandan and Hamza (1995) reported that fertility and productivity can be improved by use of bioinoculants.

Table 3. Results of yield and other parameters.

Treatment	Yield (kg/vine)	Yield parameters		
		Number of spikes	Length of spikes(cm)	Number of berries/spike
T1	2.3	188	14.9	81
T2	2.4	212	15.9	84
T3	2.5	215	16.5	85
T4	2.44	210	15.4	83
T5	2.43	192	15.2	82
C.D.(0.05)	0.036	1.678	0.261	1.119
SE(m)	0.012	0.555	0.086	0.37
SE(d)	0.017	0.785	0.122	0.523
C.V.	1.113	0.614	1.253	1.001

Effect of INM on soil analytical parameters

Significant difference was observed in nutrient management practice in organic carbon (%,), available potassium (kg/ha) and nitrogen. Organic carbon was more in T_3 (1.0%) as compared to T_2(0.9%), T_4(0.89%), T_5(0.87%) and T_1(0.69%). The increase in organic carbon was due to high amount of organic matter accumulation due to use of biofertilizers. The available nitrogen and potassium increased in T_3 as compared to other treatments (Table 4).

The average net return was high in T_3 (Rs.113678/ha/yr) followed by T_2 (112100/ha/yr), T4 (111000/ha/yr), T_5 (99900/ha/yr) and T_1 (930000/ha/yr). This implies that there was an advantage of yield increase, additional income and hence result in higher income.

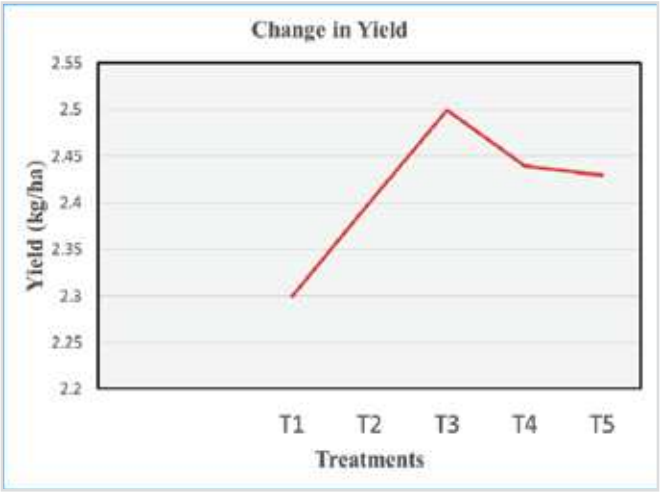

Fig.1 graph showing variation in yield level.

Table 4. Result of Soil components.

Treatment	Organic Carbon (%)	Available Nitrogen (Kg/ha)	Available Phosphorus (Kg/ha)	Available Potassium (Kg/ha)
T1	1.0	440	35	220
T2	0.9	561	21	248
T3	0.89	698	20	331
T4	0.87	555	22	245
T5	0.69	450	23	237

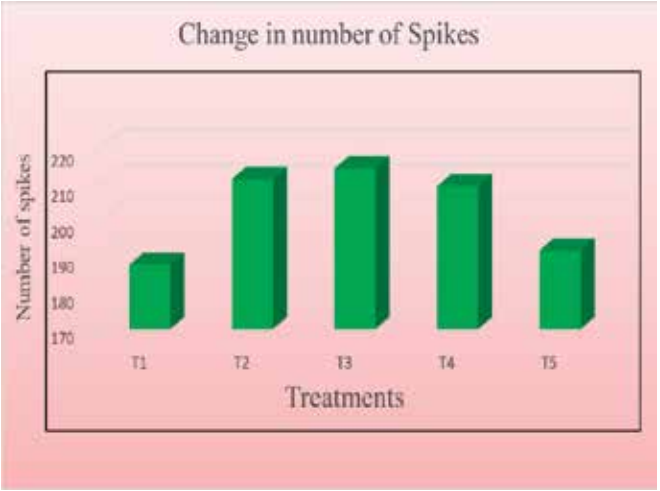

Fig. 2. Graph showing variation in number of spikes

Fig. 3. Graph showing variation in length of spikes

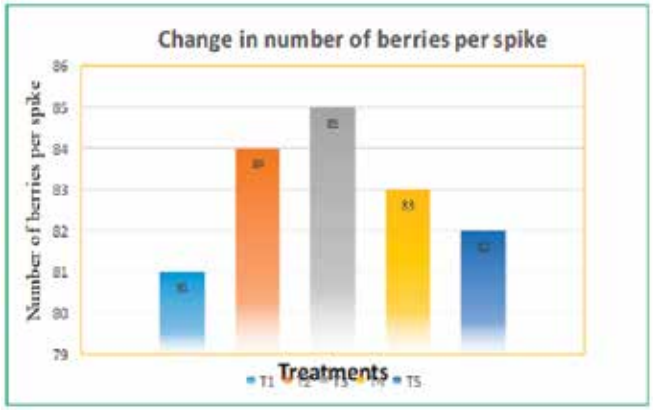

Fig. 4. Graph showing variation in number of berries per spike

CONCLUSION

The Present study indicated that yield and soil parameters differ significantly by use of different nutrient management treatments. Hence, farmers should follow integrated nutrient mnagement practices with all possible combinations in Black Pepper for better yield and returns

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