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Research Article

EFFECT OF PLANTING SYSTEMS AND SOURCES OF NUTRIENTS ON PRODUCTIVITY OF MEDICINAL COLEUS (*COLEUS FORSKOHLII*)

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ABSTRACT

Field experiments were carried out in the farmer`s field located at Danishpet village, Omalur Taluk (11°42' N latitude, 78°6' E longitude and 375 m above mean sea level) on sandy loam soil to assess the effect of planting systems (normal planting and paired row planting) and sources of nutrients on *Coleus forskohlii*. The results revealed that normal planting registered higher mean plant height (cm), laterals (No. /plant), plant spread (cm^2), tubers (No./plant), tuber length (cm), fresh tuber yield (t/ha) and dry tuber yield (t/ha). The higher tuber yield of medicinal coleus in normal planting led to higher nutrient uptake, however, post harvest available NPK status of soil did not vary among two planting systems. The application of 40:60:50 kg NPK/ha + 10 t FYM/ha recorded significantly higher growth and yield attributes and yield but on par with the application of poultry manure @ 3 t/ha. The higher yield led to higher NPK uptake by medicinal coleus. Further, the available post harvest soil nutrients decreased in the above treatments. Higher net returns and B: C ratio were obtained with normal planting of medicinal coleus and with the application of 40:60:50 kg NPK/ha + 10 t FYM/ha or application of poultry manure @ 3 t/ha.

Keywords: *Medicinal Coleus, Planting Pattern, Sources of Nutrients, Yield*

INTRODUCTION

Medicinal coleus (*Coleus forskohlii*) is an important medicinal crop credited with many medicinal properties. It contains a diterpene forskolin and possesses activities such as positive inotropic, antihypertensive, bronchopasmolytic, antithrombatic, platelet aggregation inhibition etc. (Ammon and Muller, 1985). As it possesses multifaceted activities, its cultivation is gaining importance in the rapidly expanding world trade of plant based drugs. Spacing is one of the pre requisite for crop growth. The growth parameters are widely influenced by the spacing levels (Pareek *et al.,* 2002). Further, it is influenced by various factors such as water management, nutrient management etc. For healthy growth and optimal yield, nutrients must be available to plants in correct quantity, proportion and in a usable form at right time. To fulfill these requirements, chemical fertilizers and organic manures are needed. Organic manures apart from improving physical and biological properties of soil, also helps in improving the use efficiency of chemical fertilizers (Gredom *et al.,* 2008). Organic manures such as farmyard manure, poultry manure, vermicompost usage is gaining momentum now a days are known to improve the physical, chemical and biological conditions of the soil and their application ensure soil health (Jauhri, 1998). Hence, the present investigation was undertaken to study the effect of planting systems and different sources of nutrients on growth, yield and economics of medicinal coleus.

MATERIALS AND METHODS

The field experiments were carried out in the farmer`s field located at Danishpet village, Omalur Taluk (11°42' N latitude, 78°6' E longitude and 375 m above mean sea level. The soil of the experimental field was sandy loam in texture with pH - 7.1, EC - 0.42 dS/m, available nitrogen - 212 kg/ha, available phosphorus - 11 kg/ha and available potassium - 290 kg/ha. The experiment was laid out in split plot design with four replications. The treatments consists of two planting system (normal planting with a spacing of 60X30 cm and paired row planting of 90-30X30 cm) in main plot and five fertility treatments

in sub plot *viz*., Recommended dose of fertilizer (40:60:50 kg NPK/ha + 10 t FYM/ha), Urban compost (6 t/ha), Poultry manure (3 t/ha), Vermicompost (3 t/ha) and Urban compost (2 t/ha) + Poultry manure (1 t/ha) + Vermicompost (1 t/ha). Organic manures such as farm yard manure, vermicompost, poultry manure and urban waste compost were applied on equal N basis. The size of each plot was 6x4.5 m. Terminal cuttings of 10-12 cm long with 3-4 pairs of leaves from six months old crop were used for planting in ridges and furrows. FYM contained 0.50: 0.20: 0.50% NPK, urban compost contained 1.50: 0.50: 0.50% NPK, poultry manure contained 3.03: 2.60: 1.40% NPK and vermicompost contained 3.00: 1.00: 1.50% NPK on dry weight basis. The required quantities of organic manures were applied as per the treatments one week before planting. Nitrogen, phosphorus and potassium were applied as per the treatment through urea, single superphosphate and muriate of potash. Fifty per cent nitrogen and entire quantity of single superphosphate and muriate of potash were applied at the time of planting. Remaining 50 per cent nitrogen was top dressed at 30 days after planting in the plot with recommended doses of fertilizer alone. All the recommended cultural practices were practiced as adopted in the crop production guide of Tamil Nadu Agricultural University. Plants were harvested by pulling out the plants. Growth attributes like plant height, laterals/plant and plant spread were recorded in five tagged plants of each plot. Yield attributes like number of tubers per plant, tuber length and tuber girth was recorded. Harvesting was done after six months of planting. Fresh tuber yield was recorded at the time of harvest and dry tuber yield was recorded after sun drying of tubers for three to four days to attain moisture content of 12%. The nutrient uptake of crops was obtained as product of nutrient concentration and yield. The soil samples from each plot were taken after harvesting medicinal coleus and analysed for available nitrogen, phosphorous and potassium.

RESULTS AND DISCUSSION

Growth and Yield Attributes

Growth and yield attributes were significantly higher in normal planting of *Coleus forskohlii* than paired row planting (Table 1). Normal planting of medicinal coleus recorded higher plant height, laterals per plant, plant spread, tubers per plant, tuber length and tuber girth. The higher growth and yield attributes of normal planting may be ascribed to higher dry matter production and better aeration near the root sysem causing less penetration impedance was responsible for better root development thereby producing higher yield attributes. Similar results have been reported by Umesha *et al.*, (1990) in ocimum. Significant influence was noticed with the application of various sources of nutrients. Application of 40:60:50 kg NPK/ha + 10 t FYM/ha resulted in higher growth and yield attributes of *Coleus forskohlii* but par with the application of poultry manure (Table 1). This is followed by the application of vermicompost and combination of urban manure, poultry manure and vermicompost. However, lower growth and yield attributes were recorded with the application of urban manure. The enhanced early vegetative growth in terms of plant height, number of laterals per plant and plant spread resulted in more number of tubers per plant, tuber length and thereby increased root weight and consequently increased root yield. Stimulated vegetative growth and prolonged supply of essential nutrients in treatments receiving recommended dose of fertilzers and poultry manure manifested itself in increased number of tubers and tuber length. However, tuber girth remain unaffected with different planting patterns and application of different sources of nutrients.

Yield

Tuber yield (fresh and dry) of medicinal coleus vary significantly due to different panting pattern (Table 1.). Normal planting of medicinal coleus registered higher tuber yield over paired row planting system. The increase in tuber yield could be attributed to higher plant height, plant spread and number of laterals per plant. Further, the better soil environment would have favoured the development tubers. This is in line with the findings of Bhan *et al.*, (1995). The data revealed that the treatment receiving 40:60:50 kg NPK/ha + 10 t FYM/ha recorded higher tuber yield followed by the application of poultry manure and application of vermicompost. However, the harvest index was not significant with system of planting but

different nutrient management treatments had influence on harvest index. The increase in tuber yield might be due to increased availability of essential nutrients and accumulation of more sugars in the vegetative parts for translocation of the tubers. This corroborates with the findings of Yamgar *et al.*, (2001) in turmeric.

Nutrient Uptake and Balance

Normal planting recorded significantly higher nutrient uptake by *Coleus forskohlii* as compared to paired row planting (Table 2.). This could be due to increased yields and enhanced fertilzer use efficiency in normal planting system. The nutrients (N, P and K) uptake by *Coleus forskohlii* was highest with the application of 40:60:50 kg NPK/ha + 10 t FYM/ha followed by the application of poultry manure and application of vermicompost. With the promotion of root growth due to the application of organic manures along with the inorganic fertilzers, the availability of nutrients might have increased and resulted in increased uptake of nutrients. This is in line with the findings of Das (2000). Further, higher uptake of nutrients might be favoured due to the synergistic effect of nutrient interaction (Srividhya, 2002).

Available N, P and K in the soil after the harvest of medicinal coleus were not significantly influenced by planting methods. However, application of different sources of nutrients had significant influence over available N, P and K. There was considerable depletion of these nutrients in all the treatments compared to the initial soil status. Soil available N, P and K was found higher with the application of urban compost. This might be due to slow release of nutrients from the organic manures added to the soil. This corroborates with the findings of Bhardwaj and Omanwar (1994).

Table 1: Effect of planting system and nutrient management on growth, yield attributes and yield of *Coleus forskohlii* (Mean data)

Treatment	Plant height (cm)	Laterals (No./ plant)	Plant spread (cm^2)	Tubers (No./ plant	Tuber length (cm)	Tuber girth (cm)	Fresh tuber yield (t/ha)	Dry tuber yield (t/ha)	Harvest Index
Planting system									
Normal planting (60X30 cm)	55.1	71.2	1783.4	20.4	18.9	2.44	17.0	1.61	0.238
Paired row planting (90-30X30 cm)	52.1	70.1	1646.9	19.2	17.6	2.33	15.6	1.39	0.234
CD (P=0.05)	0.6	1.8	48.2	1.0	1.0	NS	0.3	0.04	NS
Nutrient management									
40:60:50 kg NPK/ha + 10 t FYM/ha	59.4	76.0	2126.1	23.9	21.6	2.70	17.3	1.71	0.256
Urban compost	49.1	67.3	1467.3	17.3	16.4	2.20	12.0	1.01	0.233
Poultry manure	57.5	72.6	2060.7	22.9	20.6	2.58	15.8	1.51	0.238
Vermicompost	55.5	71.9	1609.5	20.0	17.4	2.37	14.5	1.25	0.235
Urban compost + Poultry manure + Vermicompost	50.2	68.2	1563.8	17.9	17.2	2.26	12.9	1.07	0.234
CD (P=0.05)	1.7	1.9	50.9	1.3	1.1	0.14	0.30	0.05	0.006

Table 2: Effect of planting system and nutrient management on nutrient uptake, nutrient content in soil and economics of *Coleus forskohlii* (Mean data)

Treatment	Nutrient uptake (kg/ha)			Available nutrient content in soil (kg/ha)			Cost of cultivation (Rs. /ha)	Net return (Rs. /ha)	B: C Ratio
	N	P	K	N	P	K			
Planting system									
Normal planting (60X30 cm)	106.9	16.8	108.8	188.4	8.8	275.3	23333	69463	3.98
Paired row planting (90-30X30 cm)	91.6	13.8	93.5	189.4	8.8	277.4	26438	69198	3.62
CD (P=0.05)	6.8	1.3	6.9	NS	NS	NS	-	-	-
Nutrient management									
40:60:50 kg NPK/ha + 10 t FYM/ha	113.2	19.3	116.7	174.8	7.7	270.1	20495	61252	3.99
Urban compost	62.3	8.8	64.7	199.2	9.5	283.5	18482	37893	3.05
Poultry manure	101.8	16.2	103.7	187.5	8.9	276.5	16322	55497	4.40
Vermicompost	84.4	12.8	85.9	191.4	9.3	279.2	24482	41745	2.71
Urban compost + Poultry manure + Vermicompost	67.9	10.2	71.3	196.0	9.3	280.8	19762	41763	3.11
CD (P=0.05)	6.3	1.4	7.4	10.6	0.5	15.4	-	-	-

Economics

The mean data reveals that the normal planting system registered higher net return and B: C ratio as compared to paired row planting (Table 2.). Higher net return was recoreded with the application of 40:60:50 kg NPK/ ha + 10 t FYM/ha, however, B: C ratio was higher with the application of poultry manure. This might be due to the lesser cost of cultivation incurred with the application of poultry manure.

Based on the above study, it is concluded that under normal planting of Coleus forskohlii, application of 40:60:50 kg NPK/ha + 10 t FYM/ha or application of poultry manure @ 3 t/ha is viable in producing higher yield, nutrient uptake and returns generation. Further, it reveals that the entire quantity of the recommended dose of fertilizers could be substituted by poultry manure for enhanced productivity and economic returns of medicinal coleus.

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