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Studies on the Effect of Plant Density, Type of Cutting and Method of Planting on Root to Shoot ratio of Medicinal Coleus [Coleus forskohlii (willd) Briq.]

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ABSTRACT

The results revealed that Root to shoot ratio was highest in wider spacing(60*30 cm). It might be due to wider spacing resulted in maximum utilization of inputs, that might have caused maximum bulking of root. Root to Shoot ratio was maximum in rooted cuttings could be due to the early established rooted cuttings increased the uptake of nutrients and water might have accumulated maximum dry matter .

Key words : Plant density, Medicinal coleus, Method of planting.

Coleus forskohill (Willd) Briq. (Synonym C.barbatus (Andr.) Benth) belongs to the family Labiatae (Lamiaceae) is an ancient root drug claimed to improve appetite, increase vitality and useful by curing the ailments like inflammation, flatulence, dropsy etc. Root juice is given to children for curing constipation (Singh et al., 1980) Pharmacological studies on *Coleus forskohill* observed on cardiovascular activity in the root extract (Bhakuni et al., 1971; De Souza 1977). Forskolin, an active diterpenoid in roots, possess multifaceted biological activities such as positive inotropic, anti-hypertensive, anti glaucoma (Rupp et. al., 1986). The novel feature of forskolin in tits unique mechanism of generating cyclic adenosine monophosphate in the cells through direct activation of the catalytic unit of adenylate cyclaze enzyme (Metzer and Lindner, 1981; Seaman et al., 1981; Seaman and Daly, 1981a).

For commercial cultivation of this crop optimization of plant population per unit area, method of planting and type of cutting are the prime factors in terms of root yield of medicinal coleus. The major problem confronting the commercial growers of coleus is optimum plant density, appropriate type of cutting, method of planting, and suitable cultivar. Most of the morphological characters governed by these factors are crucial, as they ultimately accounts for bulking of tubers through affecting photosynthetic surface area and quantum of photosynthates production and their translocation. Keeping these in view, the present investigation was undertaken.

MATERIALS AND METHODS

The field experiment was laid out in a Factorial Randomized Block Design (FRBD) with two replications at Herbal Gardens, Acharya NG Ranga Agricultural University, Hyderabad on red sandy loam. The studies were carried out in two cultivars of medicinal coleus with 24 treatments as below:

The varieties used for this present experiment were of Chintapalli local and K-8 variety, is a selection from Karnataka, which is under commercial cultivation in Andhra Pradesh .The terminal cuttings of 10-15 cm long with 3-4 pairs of leaves were planted, after attaining 7-8 pairs of leaves were transplanted to main field. Ridge and furrow method and flat bed method are used to study the effect of method of planting in the main field. Three different spacings between plant to plant viz.,20 cm ,30cm and 45 cm taken for study. Root yield was recorded at harvest by weighing the dried tubers (Excluding non tuberous) and computed per acre and expressed in Tonnes. The fresh weights of root (tuberous and non tuberous) and shoot were measured and ratios were worked out.

Table 1

Treatment	Description			
	Coleus line	Spacing	Type of cutting	Method of planting
T1	Local	60 x 20 cm	Rooted	Ridge and Furrow
T2	Local	60 x 20 cm	Rooted	Flat bed
T3	K-8	60 x 20 cm	Rooted	Ridge and Furrow
T4	K-8	60 x 20 cm	Rooted	Flat bed
T5	Local	60 x 20 cm	Un-rooted	Ridge and Furrow
T6	Local	60 x 20 cm	Un-rooted	Flat bed
T7	K-8	60 x 20 cm	Un-rooted	Ridge and Furrow
T8	K-8	60 x 20 cm	Un-rooted	Flat bed
T9	Local	60 x 30cm	Rooted	Ridge and Furrow
T10	Local	60 x 30cm	Rooted	Flat bed
T11	K-8	60 x 30cm	Rooted	Ridge and Furrow
T12	K-8	60 x 30cm	Rooted	Flat bed
T13	Local	60 x 30cm	Un-rooted	Ridge and Furrow
T14	Local	60 x 30cm	Un-rooted	Flat bed
T15	K-8	60 x 30cm	Un-rooted	Ridge and Furrow
T16	K-8	60 x 30cm	Un-rooted	Flat bed
T17	Local	60 x 45 cm	Rooted	Ridge and Furrow
T18	Local	60 x 45 cm	Rooted	Flat bed
T19	K-8	60 x 45 cm	Rooted	Ridge and Furrow
T20	K-8	60 x 45 cm	Rooted	Flat bed
T21	Local	60 x 45 cm	Un-rooted	Ridge and Furrow
T22	Local	60 x 45 cm	Un-rooted	Flat bed
T23	K-8	60 x 45 cm	Un-rooted	Ridge and Furrow
T24	K-8	60 x 45 cm	Un-rooted	Flat bed

RESULTS AND DISCUSSION

Plant density has significant effect with respect to root to shoot ratio at 60DAP. A spacing of 60 x 30 cm recorded higher root to shoot ratio (0.2937) compared to 60 x 20 cm spacing (0.2569) which was at par with 60 x 45 cm spacing (0.2887). (Table 2). Significant differences were also observed in root to shoot ratio due to plant density at 120 DAP. Spacing of 60 x 30 cm recorded highest root to shoot ratio (0.3275) over 60 x 45 cm spacing (0.3225) while the minimum root to shoot ratio was observed (0.3000) with 60 x 20 cm spacing (Table 3). Plant density had no significant effect on root to shoot ratio of coleus at 180 DAP (Table 4).

Significant differences were observed in root to shoot ratio due to type of cutting at 60DAP. Rooted cuttings observed the maximum root to shoot ratio (0.2917) compared to un rooted cuttings (0.2679) (Table 2). Type of cutting differed significantly with respect to root to shoot ratio 120 DAP. Rooted cuttings observed highest root to shoot ratio (0.3575) over un rooted cuttings (0.2763) at 120 DAP (Table 3). Type of cutting has significant effect with respect to root to shoot ratio of coleus at 180 DAP. Rooted cuttings recorded highest root to shoot ratio (0.3658) compared to un rooted cuttings (0.2783) (Table 4).

The interaction between plant density and type of cutting were significant at 60 DAP. Rooted cuttings planted at 60 x 30 cm observed the maximum root to shoot ratio (0.3212) followed by rooted cuttings planted at 60 x 45 cm (0.2987). Minimum root to shoot ratio was observed with rooted cuttings planted at 60 x 20 cm spacing (0.2550) (Table 2).The interaction effects between plant density and type of cutting were found to be non significant with respect to root to shoot ratio of

Table 2 .Effect to plant density, type of cutting on Root to Shoot ratio (60 DAP).

Plant Density (Spacing)	Type of cutting		Mean
	Rooted	Unrooted	
60*20cm	0.2550	0.2589	0.2569
60*30cm	0.3212	0.2663	0.2937
60*45cm	0.2987	0.2788	0.2887
Mean	0.2917	0.2679	
		Interaction	
	Plant Density	Type of cutting	Plant Density*Type of cutting
SEm	0.0101	0.0082	0.0143
CD (@at5%)	0.0209	0.0170	0.0295

Table 3. Effect to plant density, type of cutting on Root to Shoot ratio (120 DAP).

Plant Density (Spacing)	Type of cutting		Mean
	Rooted	Unrooted	
60*20cm	0.3362	0.2638	0.3000
60*30cm	0.3763	0.2788	0.3275
60*45cm	0.3587	0.2862	0.3225
Mean	0.3575	0.2763	
		Interaction	
	Plant Density	Type of cutting	Plant Density*Type of cutting
SEm	0.0079	0.0064	0.0111
CD (@at5%)	0.0163	0.0133	NS

Table 4. Effect to plant density, type of cutting on Root to Shoot ratio (180 DAP).

Plant Density (Spacing)	Type of cutting		Mean
	Rooted	Unrooted	
60*20cm	0.3650	0.2700	0.3175
60*30cm	0.37	0.2775	0.3237
60*45cm	0.3625	0.2875	0.3250
Mean	0.3658	0.2783	
		Interaction	
	Plant Density	Type of cutting	Plant Density*Type of cutting
SEm	0.0067	0.0055	0.0094
CD (@at5%)	NS	0.0113	NS

120 DAP (Table 3). The interaction effects between plant density and type of cuttings were found to be not significant with respect to root to shoot ratio at 180 DAP (Table 4).

Lesser plant densities recorded maximum root to shoot ratio. It might be due to wider spacing resulted in maximum utilization of space, water and sunlight, that might have caused maximum bulking of roots. At wider spacings, as the canopy exposed to sunlight was maximum resulted in production of maximum number of laterals, leaf area. This might have resulted into increased photosynthetic area and production of maximum photosynthates which encouraged the bulking of roots rapidly. The present findings of root and shoot ratio was maximum in wider spacings are in confirmity with the results of Veeraraghavathatham et al. (1985) reported in Coleus forskholii . The present results of higher

root to shoot raio in wider spacing due to maximum utilization of space, water and light are in conformity with Joy et al.,(2002) in Alpinia galangal, Patil et al.,(1992) Hamid and Sasaki (2001) in Sweet Potato. Rooted cuttings recorded higher root to shoot ratio , could be due to the early established rooted cuttings might have accumulated dry matter by virtue of more age and established root system. Increased uptake of nutrients and water due to these attributes might have made the rooted cuttings to record maximum root to shoot ratio..

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