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EFFECT OF PLANT DENSITY AND NUTRIENT LEVELS ON YIELD IN CARDAMOM

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Abstract : A field experiment was conducted over a period of five years to understand the tillering pattern and yield in cardamom as influenced by various nutrient combination levels and planting densities. At 22 and 45 months after planting, the bearing, non-bearing and total number of tillers showed significant differences due to nutritional as well as planting density levels. Increased level of nutrient combination improved the tillering and yield whereas increased planting density depressed the tillering but increased yield. The interaction effect of these two factors also caused significant differences in tillering. A nutrient combination level of 150:75:300 kg $N:P_2O_5:K_2O$ per ha and planting density of 5000 plants per ha at 2 m x 1 m were found to be ideal for optimum tillering and yield in cardamom.

Key words : Cardamom tillering, nutrient levels plant density.

INTRODUCTION

Low productivity in cardamom in India is mainly attributed to application of little or no external nutrient source like fertilizers. Due to heavy rainfall and undulating topography in the cardamom growing areas, leaching and run-off losses of nutrients are common in such soils. Besides, continuous cultivation on the same piece of land leads to depletion of nutrients resulting in poor growth and yield, thus necessitating the application of balanced dose of nutrients for realising sustained yield (Mohankumar and Hegde, 1983). In a perennial rhizomatous, psciophytic cardamom, planting density and planting geometry are very crucial non-cash inputs for maximum productivity and optimum longevity (Mayne, 1951). Hence, the present study was undertaken in order to understand the growth response of cardamom in terms of its tillering ability and yield to various nutrient levels and planting densities.

MATERIALS AND METHODS

The studies were carried at the Indian Institute of Spices Research, Cardamom Research Centre, Appangala situated in heavy rainfall region (2679 mm) at an elevation of 1006 m MSL. The soils are predominantly kaolinitic and clayey having a pH of 5.3. The organic carbon in top layer is high (3.86%) and it is generally low in available phosphorus and potassium. The experiment was laid out in split plot design with three levels of nutrient combinations in main plots (50:25:10, 100:50:200 and 150:75:300 kg $N:P_2O_5:K_2O$ ha^{-1}) and five planting densities in subplots (2 m x 2 m = 2500 plants ha^{-1}, 2 m x 1.5 m = 3333 plants ha^{-1}, 2 m x 1 m = 5000 plants ha^{-1}, 2 m x 0.75 m = 6666 plants ha^{-1} and 2 m x 0.5 m = 10,000 plants ha^{-1}) replicated twice, using the seedlings of PV_1 (Malabar prostrate type) on 28th September, 1983. The experimental plot was having a gradual slope of 5-8 per cent in north-south direction. Besides imposing fertilizer treatments as per the plan, other cultural operations and plant protection measures were carried out as per the improved package of practices.

RESULTS AND DISCUSSION

The results shown in Tables 1, 2 and 3 reveal that both the nutrient levels and planting density and significant influence on tillering and yield. Increased levels of nutrients

Table 1. Total number of tillers per plant of cardamom as influenced by planting density and fertilizer levels at 22 months after planting (MAPP)

Plant population per ha	Fertilizer level (NPK kg ha^{-1})			Mean
	50:25: 100	100:50: 200	150:75: 300	
2500	19.00	29.50	35.00	27.83
3333	15.50	25.50	33.50	24.83
5000	14.50	19.55	25.20	19.75
6666	12.15	14.65	17.50	14.77
10,000	8.00	10.55	13.57	10.71
Mean	13.83	19.95	24.95	-
For comparing the means of :	SEm±		CD (0.05)	
Fertilizer level (FL)	0.59		2.52	
Plant population (pp)	1.03		2.25	
pp at same FL	1.79		3.90	
FL at same or different pp	2.01		13.73	

improved the tillering whereas increased planting density depressed the tillering in cardamom. The treatment involving 150:75:300 kg NPK ha^{-1} resulted in significantly higher number of total tillers at both 22 and 45 months after planting and number of non-bearing tillers at 45 months after planting over other nutrient levels. However, productive tilers produced at highest level of nutrient combination did not differ significantly with the second level. Every increase in fertilizer combination level in significant increase in dry capsule yield per hectare. The highest level of fertilizer treatment imposed on cardamom resulted in highest per hectare yield of dried capsules (540.6 kg) and it was 49.9 per cent higher than the yield realised at lowest level of nutrient treatment. The available potassium content of cardamom growing area is intrinsically low and there is no buffering capacity for the soils to replenish the K removed either by crop or by leaching (Korikanthimath, 1994). Thus the application of adequate quantity of these three most essential nutrients resulted in an autocatalytic cycle, each enhancing productivity mutually, resulting in better tillering and yield. The study corroborated the earlier studies (Venkatesh *el al.*, 1992).

Table 2. Number of non-bearing tillers per plant of cardamom as influenced by planting density and fertilizer levels at 45 months after planting

Plant population per ha	Fertilizer level (NPK kg ha^{-1})			Mean
	50:25: 100	100:50: 200	150:75: 300	
2500	(10.15)	(11.15)	(15.15)	(12.15)
3333	(8.85)	(10.00)	(13.00)	(10.62)
5000	(8.20)	(10.40)	(12.35)	(10.32)
6666	(7.25)	(8.90)	(10.00)	(8.72)
10,000	(6.25)	(8.50)	(9.00)	(7.92)
Mean	(8.14)	(9.79)	(11.90)	-

Successive increase in planting density resulted in significant reduction in tillering at all the stages observed, both in case of bearing and non-bearing tillers as well as total tillers. The increase in plant density resulted in significantly increased dry capsule yield per hectare up to third level (5000 plants ha^{-1}). The increase in yield levels beyond this level was not significant. As the planting density increases, LAI and root density increase leading to mutual interferences in the absorption of one or more growth factors. This results in fall in the growth rate of individual plants below that obtained from plant grown in isolation without interference (Donald, 1962). The close proximity of neighbours causes sub-optimum absor-

Table 3. Bearing tillers and total number of tillers per clump at 45 months after planting and dry capsule yield of cardamom as influenced by fertilizer levels and plant density

Sl. No.	Treatment	Bearing tillers	Total tillers	Yield, kg ha^{-1}
1	Fertilizer levels NPK, kg ha^{1}			
	50:25:100	11.24	19.351	360.8
	100:50:200	13.79	23.58	485.4
	150:75:300	15.28	27.18	540.6
2	Plant density, plant ha^{1}			
	2500 (2 m x 2 m)	21.17	33.32	371.6
	3333 (2 m x 1.5 ra)	14.68	25.30	410.3
	5000 (2 m x 1 m)	13.28	23.60	468.2
	6666 (2 m x 0.5 *m)*	10.00	18.67	519.6
	10000 (2 ra x 0.5 ra)	8.05	15.97	541.6
For comparing the means of fertilizer levels (FL)				
	SEm ±	0.45	0.36	4.6
	CD (0.05)	1.95	1.55	19.9
Plant population (pp)				
	SEra ±	1.47	1.47	26.8
	CD (0.05)	3.22	3.20	58.5
PP at same FL				
	SEm ±	2.56	2.54	46.4
	CD (0.05)	NS	NS	NS
FL at same or different PP				
	SEm ±	1.21	1.08	17.3
	CD (0.05)	NS	NS	NS

NS = Not significant

ption of growth factors and so there is inequitable distribution of growth resources among the plants. However, at optimum planting density, the loss in per plant growth and yield is compensated for by the over all production from a large number of plants growing in an unit area. At this level the mutual interference is also kept at optimum level for our benefit. Hence, at the optimum plant density the production per plant is sub-optimal but the production per unit area is optimal. Here in the present study, the drop in the tillering beyond the third density (5000 plants ha^{-1} at 2 x 1 m) seemed to be drastic to affect the productivity as evident from the yield data.

The total number of tillers at 22 months stage and number of non-bearing tillers at 45 months stage got affected due to the interaction of nutrients and planting density (Tables 1 and 2). Thus at highest level of nutrient combination combined with lowest planting density showed highest number of tillers. When the plants arc given adequate spacing combined with the other most essential growth requirement i.e., nutrients in adequate quantity, one can expect optimum interference in the absorption of growth resources leading to healthy growth characteristics like tillering and yield.

Thus for an optimum tillering and yield in cardamom, application of 150:75:300 kg NPK ha^{1} and planting at a density of 5000 plants ha^{1} (2 m x 1 m) seemed to be ideal.

REFERENCES

Donald, C. M. 1962. In search of yield. *J. Aus. Inst. agric. Sci.* 29 : 171-178

Korikanthimath, V. S. 1994. Nutrition of cardamom. *Advances in Horticulture, Vol.9 Plantation and Spice Crops. Part I* (eds. Chadha, K. L. and Rethinam, P.) Malhotra Publishing House, New Delhi, p. 11-64

Mayne, W. W. 1951. *Report on Cardamom Cultivation in South India*, ICAR Bull. 50 : 52

Mohankumar, G. N. and Hegde, G. S. 1983. Nutrition of cardamom for better yields. *Cardamom J.* 15(10) : 3-10

Venkatesh, J., Pattanashetti, H. V. and Khan, M. M. 1992. Effect of NPK and mode of application on proliferation of suckers in cardamom. *J. Plant. Crops* 20:60-67