Journal of Medicinal and Aromatic Plant Sciences **20** (1998) 700-702.

Influence of major nutrients on the yield and yield parameters of cardamom grown under controlled shade

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Received 1st December, 1997

Abstract

A field investigation was undertaken at the Indian Institute of Spices Research, Cardamom Research Centre, Appangala, Madikeri, Kodagu, Karnataka, India to evaluate the effect of three major nutrients (NPK) on the yield and yield parameters of cardamom clones grown under controlled shade. Yield parameters like number of capsules per plant, fresh yield of capsules per plant, hundred capsule weight as well as per hectare yield of cardamom showed marked increase over that control with the application of nutrients.

Key words : Cardamom, yield parameters, test weight, nutrient levels, controlled shade.

Introduction

Low productivity of cardamom grown in India is mainly due to the little or no application of external source of nutrients like fertilizers. The pioneer cardamom plantations started on nutrient rich virgin forest soils have become the things of past. Cardamom growing areas receive heavy rainfall for about 4-5 months in a year and they are having highly undulating topography. Hence runoff as well as leaching losses of nutrients are very rampant in these areas. Cardamom being perennial in nature keeps removing the nutrients from the soil throughout the year. Therefore, for sustaining a desired level of productivity cardamom needs to be supplied with balanced amount of chemical fertilizers [2].

As the importance of cardamom in the international trade is increasing, for the high yield targets, application of fertilizers has gained impetus in recent years. Nearly 40 percent of the growers apply fertilizers to cardamom, but only about 6 percent of them apply recommended dose [5]. Cardamom is usually cultivated under partial shade. Shade trees comprise *Ficus gibbosa*, *Artocarpus hirsutus*, *Bioshofia javanica* etc. growing naturally in Western Ghat forests. Most of earlier studies were conducted under natural shade where there is a scope for differential light interception among the plants receiving various nutritional treatments. The current study was undertaken under controlled shade to determine the precise effect of three major nutrients NPK on the yield and yield attributes of cardamom.

Materials and methods

The studies were carried out at Indian Institute of Spices Research, Cardamom Research Centre, Appangala, situated in heavy rainfall region (2679 mm) at an elevation of 1006 M above MSL. The soils are predominantly kalolinitic clayey, having a pH of 5.5. The organic matter content in top layer was high (2.55%) and it was low in available phosphorus (4.9 mg/100 g) and medium in potash (17.8 mg/100 g). The water holding capacity of soils was 14 per cent.

The experiment was laid out in 3^3 confounded design with nitrogen ($N_1$0, $N_2$50, $N_3$100 kg/ha), phosphorus ($P_1$0, $P_2$25, $P_3$50 kg/ha) and potassium ($K_1$0, $K_2$100, $K_3$200 kg/ha) as nutritional treatments in three blocks and two replications. Fertilizers viz. nitrogen in the form of urea, phosphorus in the form of single superphosphate and potash as muriate of potash were applied in two splits, one before monsoon season (June) and second after the monsoon season (September). The crop was irrigated once in 10 days through *perfo system* and the amount of water given per irrigation was 2.5 cm. The spacing given was 1.8 x 0.6 cm (9259 plants/ha) with plot size of 3.6 x 3.0 m. The artificial controlled shade was created using coir mat at a height of 2.5 m. The controlled shade permitted 55 percent light infilteration and it was found to be ideal and comparable to natural shade. Clonal material of Mudigere-1 was planted on 14th February, 1985 in trench method. All the cultural operations as well as plant protection measures were carried out as per the recommended package of practices [1]. Harvesting was done once in 15 days starting from June last week upto last week of December.

Table-1. Yield and yield parameters of cardamom as influenced by NPK levels under artificial shade

Treatment	No. of capsules/ plant	Fresh weight of capsules (g/plant)	Hundred dry capsules weight(g)	Yield of dried capsules (kg/ha)
N_0	322.2	263.0	15.61	608.8
N_1	603.9	471.0	20.50	1090.2
N_2	802.3	608.6	21.28	1408.3
P_0	475.6	378.3	18.44	875.7
P_1	588.3	460.1	18.94	1064.8
P_2	664.5	504.1	20.00	1166.8
K_0	431.5	350.6	16.33	811.5
K_1	609.3	466.6	20.17	1080.1
K_2	687.6	525.3	20.88	1215.8
SemŁ	21.4	19.4	0.33	44.9
CD at 5%	76.9	69.8	1.16	161.6
CD at 1%	104.5	94.8	1.59	219.6

Note : Interaction effects are not significant

Results and discussion

Number of capsules per plant : The influences of treatment on this character were significantly different at all the levels of nutrients tried. In case of nitrogen, the increase in capsule number at N_2 level was 149 percent over control. At similar levels of P_2 and K_2 the increase were 39.71 and 59.35 percent, respectively over control.

Fresh capsule yield per plant : In case of nitrogen and phosphorus the highest level (100 : 50 kg/ha) tried also brought significant increase in fresh capsule yield. However in case of potassium, the increase in the level beyond K_1, (100 kg/ha), did not bring any significant increase in fresh capsule yield. Nitrogen at 50 kg/ha brought about 131 per cent increase over control. At similar level, phosphorus (P_2) resulted in 0.33 percent increase in capsule yield over control. In case of potassium, highest yield (525 g) was recorded in the second level and it was not significantly different from that at first level (466 g). The interaction effect were not significant.

Hundred dry capsule weight (*test weight*) : The first and the second level of N and K resulted in significantly higher hundred capsule weight over control. However, the differences between them were not significant with regards to this character. In case of phosphorus, second level (P_2) resulted in signicantly higher test weight over control and first level.

Dry capsule yield per hectare : It is evident from the data that various levels of NPK had significant influence on dry capsule yield. In case of nitrogen, the second level (N_2) resulted in significant increase in dry capsule yield. However, incase of phosphorus and potassium the first level (P_1K_1) brought significant improvement in yield over control and further increase beyond this level did not bring statistically significant increase in yield. The interaction effects were not significant.

The major nutrients are utilized almost throughout the year in cardamom as it is a perennial crop. Initiation and development of panicles and capsules in cardamom is spread over a period of eight to nine months in a year. Hence cardamom needs to be supplied with nurtients in a balanced way so as to meet the crop requirement and for enhancing the crop productivity [4]. It is a well established fact that nitrogen is an integral part of chlorophyll which is the primary absorber of light energy needed for photosynthesis. As the level of nitrogen availability increases, the formation of proteins conduces to greater synthesis of plant tissues resulting in better plant growth and yield.

Phosphorus has an important role in photosynthesis because of its participation in energy transfer system. Similarly, potassium has its crucial presence in the stomatal opening and closing, which in turn regulates the CO_2 supply for photosynthesis. The available potassium content of cardamom growing areas is intrinsically low (less than 10-12 mg/100 g soil) and there is no buffering capacity for soils to replenish the potassium removed either by crop or by leaching [3]. Due to these reasons

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cardamom plants showed better performance with availability of combined doses of major nutrients in adequate amount. From the studies it can be concluded that for cardamom clones grown under controlled shade 100 : 25 : 100 kg NPK per hectare must be supplied to realize optimum yield.

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