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Effect of different methods of planting and spacing on growth and yield of cardamom (*Elettaria cardamomum* Maton)

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Abstract

Experiments conducted at Sakaleshpur (Karnataka, India) to study the effect of different methods of planting and spacing on growth and yield of cardamom (*Elettaria cardamomum)* indicated that trench method of planting (60 cm x 30 cm) at 2 m x 1 m spacing resulted in significantly better growth and yield.

Key words : cardamom, *Elettaria cardamomum,* planting, spacing.

Introduction

Cardamom (*Elettaria cardamomum* Maton), being a shallow rooted crop, requires sufficient moisture in the upper layer of the soil for its growth and development. Planting cardamom in the trench system is reported to conserve soil moisture resulting in higher yields (NRCS 1991; Spices Board 1991). The present study was undertaken to study the effect of trench and pit methods of planting with two plant population levels on growth and yield of cardamom.

Materials and methods

The field experiment was conducted at the Regional Station of the Indian Cardamom Research Institute, Sakaleshpur (Karnataka, India) during 1991-96. The trial was conducted under rainfed conditions with protective irrigation. There were eight treatment combinations having two different dimensions for pits and trenches with two levels of spacing (Table 1). The trial was laid out in a Randomised Block Design with 3 replications and 12 plants per treatment.

The pits and trenches were opened in terraces of moderate to steep gradient land and were filled with 5 kg of farm yard manure and top soil. Ten month old seedlings of ICRI-3 (SKP-14) were planted in the trial. The plant population maintained was 5000/ha at a spacing of 2 m x 1 m and 2500/ha at a spacing of 2 m x 2 m. Farm yard manure @ 2.5 kg/plant was applied during

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Table 1. Influence of planting and spacing on growth attributes of cardamom

Treatment			No. of buds/plant				No. of young tillers/ plant				No. of mature tillers/ plant			
Method of planting	Size (cm)	Spacing (m)	1993	1994	1995	Pooled	1993	1994	1995	Pooled	1993	1994	1995	Pooled
Pit	60 x 60 x 30	2 x 1	0.0	2.3	1.0	1.1	4.0	3.2	7.3	4.8	7.9	5.8	5.7	6.5
Pit	60 x 60 x 30	2 x 2	0.1	2.9	2.3	1.8	5.3	3.5	7.3	5.3	7.8	6.3	6.7	6.9
Pit	60 x 60 x 45	2 x 1	0.5	2.6	1.3	1.4	2.9	4.0	5.0	4.0	9.9	6.3	5.7	6.8
Pit	60 x 60 x 45	2 x 2	0.4	3.0	2.0	1.8	6.8	4.8	8.3	6.6	11.1	7.1	6.3	8.2
Trench	60 x 15	2 x 1	0.1	3.2	1.0	1.4	3.6	4.5	8.0	5.2	11.9	6.7	9.3	9.3
Trench	60 x 15	2 x 2	0.1	3.7	1.7	1.8	8.2	4.8	9.0	7.3	11.5	6.7	10.0	9.2
Trench	60 x 30	2 x 1	0.3	3.5	1.0	1.7	5.9	5.0	9.0	6.6	13.3	6.6	9.7	9.8
Trench	60 x 30	2 x 2	0.3	3.6	1.3	1.8	7.2	6.4	10.0	7.9	13.4	8.1	10.3	10.7
C D (P = 0.05)			NS	0.4	NS	NS	2.1	0.9	2.0	1.0	2.0	1.1	2.6	1.2

May-June during all the years. A fertilizer dosage of 250:250:500 kg/ha and 125:125:250 kg/ha of NPK was applied for the plots with 5000 and 2500 plants, respectively. Fertilizers were applied in three split doses during May-June, September-October and January-February.

The soil was analysed for physical and physico-chemical conditions and chemical contents prior to imposition of treatments. The bulk density and particle density of the soil were 1.01 g/cc and 2.32 g/cm^3, respectively. The pore space and maximum water holding capacity were 51.9% and 49.2%, respectively; the volume of expansion was 2.53/cc/100 g. The soil was acidic in nature (pH 5.5). The organic carbon (2%), available phosphorous (1.2 mg/100 g) and available potash (12 mg/100 g) of the soil were in moderate levels.

Growth attributes such as number of vegetative buds, young and mature tillers and yield attributes such as number of panicles/plant and yield/ha were recorded during March and September (1991 to 1995). Soil samples (50 g) were collected between plants from soil surface up to 15 cm depth to determine moisture content on dry weight basis (Wright 1994). Soil moisture percentage was estimated during October of every crop season. The root proliferation pattern was studied during March of all crop seasons by excavating soil monoliths of 60 cm diameter with the plant in the centre to a depth of 60 m (Nelson & Almaras 1969) during the study period.

Results and discussion

Production of vegetative buds per plant was not significant between treatments during the crop seasons 1993 and 1995

and when the data was pooled. The trench method of planting produced more number of young tillers than the pit method. Trenches of 60 cm x 30 cm size and a spacing of 2 m x 2 m recorded maximum number of young tillers during 1994 and 1995 and in pooled data. The production of mature tillers was also higher under the trench method of planting when compared to the pit method. Through trenches of 60 cm x 30 cm size recorded more number of mature tillers at both the spacings, it did not differ significantly with that of 60 cm x 15 cm size and at both the spacings (Table 1).

There were significant differences among treatments for number of panicles per plant during different years. The trench method of planting resulted in production of more number of panicles/plant during all the years when compared to the pit method. Deeper trenches (60 cm x 30 cm) resulted in better production of panicles for the first two years than shallow trenches (60 cm x 15 cm).

In the case of spacing, no significant difference could be observed between 2 m x 2 m or 2 m x1 m spacing either with trenches of 60 cm x 30 cm or 60 cm x 15 cm size during all the years except for 1994, where trenches of 60 cm x 30 cm size at 2 m x 2 m spacing recorded more number of panicles/plant (Table 2).

The soil moisture percentage at the base was significantly higher in the trench method of planting. In the trench method of planting when the pooled data was considered, trenches of 60 cm x 15 cm size produced more number of roots. With regard to spacing, the highest number of roots per plant was produced at 2 m x 2 m spacing in trenches of 60 cm x 15 cm or 60 cm x 30 cm size. Soil moisture rentention and total number of roots per plant were positively correlated (0.734*) in the trench method of planting. Root distribution at 60 cm from the plant base was significantly higher in the treatment combinations involving trench method of planting (Table 3).

The yield differed significantly among various treatments. In general, higher yield was recorded in the trench method of planting. The yield was higher with deeper trench (60 cm x 30 cm) during all

Table 2. Influence of planting and spacing on panicles and yield of cardamom

Treatment			No. of panicles/plant				Yield/ha (kg)			
Method of planting	Size (cm)	Spacing (m)	1993	1994	1995	Pooled	1993	1994	1995	Pooled
Pit	60 x 60 x 30	2 x 1	16.6	7.7	6.8	10.3	481.4	264.0	135.5	293.6
Pit	60 x 60 x 30	2 x 2	16.0	9.6	8.1	11.2	263.8	169.0	74.4	169.1
Pit	60 x 60 x 45	2 x 1	20.3	10.3	6.9	12.5	680.5	388.0	167.6	412.0
Pit	60 x 60 x 45	2 x 2	22.7	11.7	7.7	14.0	321.7	183.0	82.6	195.8
Trench	60 x 15	2 x 1	24.4	10.5	11.3	15.4	869.2	454.0	203.9	509.0
Trench	60 x 15	2 x 2	24.7	10.7	11.1	15.5	459.1	219.0	111.6	263.2
Trench	60 x 30	2 x 1	26.8	10.9	11.8	16.5	924.7	498.0	209.1	543.9
Trench	60 x 30	2 x 2	27.1	13.8	12.6	17.9	444.3	223.0	136.4	267.9
C D (P= 0.05)			2.8	1.5	3.6	1.7	86.9	44.8	24.8	32.3

Table 3. Influence of planting and spacing on soil moisture and root proliferation of cardamom

Treatment			Soil moisture at plant base (%)			No. of roots/plant				Root distribution 60 cm from plant base (%)			
Method of planting	Size (cm)	Spacing (m)	1994	1995	Pooled	1993	1994	1995	Pooled	1993	1994	1995	Pooled
Pit	60 x 60 x 30	2 x 1	27.3	27.6	27.4	94.3	104.3	105.2	101.3	3.0	1.6	1.2	1.9
Pit	60 x 60 x 30	2 x 2	23.8	24.5	24.1	93.7	131.0	127.2	117.3	2.7	1.5	1.3	1.8
Pit	60 x 60 x 45	2 x 1	26.6	26.8	26.5	89.7	120.3	117.2	109.2	5.3	1.1	1.0	2.5
Pit	60 x 60 x 45	2 x 2	26.2	27.0	26.6	107.0	134.3	130.2	123.8	6.0	1.7	1.5	3.1
Trench	60 x 15	2 x 1	30.8	29.6	30.2	92.3	129.3	145.0	122.2	8.3	2.8	2.5	4.5
Trench	60 x 15	2 x 2	33.9	29.3	31.6	100.0	157.3	155.7	137.7	8.3	3.2	3.3	4.9
Trench	60 x 30	2 x 1	33.6	32.1	32.9	100.2	135.7	147.1	128.3	7.7	2.5	3.0	4.4
Trench	60 x 30	2 x 2	35.3	31.8	33.5	110.7	148.0	154.2	137.0	7.7	2.7	2.7	4.4
C D (P = 0.05)			4.5	2.7	2.6	11.4	11.0	5.6	6.3	1.8	1.2	0.9	0.7

the years and in pooled data. When an analysis of the influence of spacing on yield was made, it was evident that 2 m x 1 m spacing recorded a higher yield than 2 m x 2 m spacing at different sizes of trenches (Table 2).

Young and mature tillers, panicles and root production were significantly higher in the trench method of planting. This could be attributed to the higher soil moisture contents near the plant base in the trenches. The higher soil moisture would have also helped the growth of plants resulting in significantly higher yields in the trench method of planting. In closer spaced trenches, the yield was significantly higher due to higher population of plants.

Thus, planting cardamom in trench method (60 cm x 30 cm) at 2 m x 1 m spacing was ideal in terms of growth and yield in the low rainfall tracts of Karnataka and could be adopted on moderate to steep slopes. However, the cost involved in various systems of planting and their maintenance are to be worked out to determine the economic feasibility of the systems.

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