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Influence of planting material, plant population and organic manures on galangal (*Kaempferia galanga* L.) grown as intercrop in coconut (*Cocos nucifera* L.) garden[1]

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Abstract

Field experiments conducted at Kasaragod, India to study the influence of planting material, plant population and organic manures on galangal (*Kaempferia galanga*) grown as intercrop in coconut (*Cocos nucifera*) garden revealed that when mother rhizome was used as planting material significantly higher rhizome yield was achieved compared to finger rhizome. Plant population did not influence yield. Farm yard manure and major nutrient combinations recorded significantly higher yield compared to farm yard manure, vermicompost, composted coir pith and major nutrients applied alone.

Key words : galangal, intercropping, coconut, *Cocos nucifera*, *Kaempferia galanga*, organic manure, yield.

Abbreviations

CCP : Composted coir pith
FYM : Farm yard manure
HI : Harvest index
VC : Vermicompost

Introduction

Galangal or *kacholam* (*Kaempferia galanga* L.) (Zingiberaceae) is an important medicinal-cum-aromatic herbaceous plant, the rhizomes of which are used in ayurvedic medicines, perfumery and curry flavourings. The crop comes up well under shaded conditions (Rajagopalan *et al.* 1992). However, information on the effect of planting material, plant population and organic manures on yield components and yield of galangal grown as intercrop in coconut (*Cocos nucifera* L.) garden is meagre.

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Materials and methods

The field experiments were conducted during 1995-96 and 1996-97 at Central Plantation Crops Research Institute, Kasaragod (Kerala, India) (12°30' N; 75°00' E; 10.7 m above MSL). The soil of the experimental site was red sandy loam with a field capacity of 7.40 and 8.95% at 0-25 and 25-50 cm, respectively. The soil was low in available N and K and high in available P. The experiment was laid out in a split plot design with three replications. Types of planting material and population levels formed the main plot treatments namely, mother rhizome with 333000 population ha^{-1} (20 cm x 15 cm spacing) (S_1P_1), and 500000 population ha^{-1} (20 cm x 10 cm spacing) (S_1P_2); finger rhizome with 33 3000 population ha^{-1} (S_2P_1) and 500000 population ha^{-1} (S_2P_2). Organic manures, FYM : 24 t ha^{-1} (F_1), FYM : 32 t ha^{-1} (F_2), CCP : 29 t ha^{-1} (F_3), CCP : 39 t ha^{-1} (F_4), VC : 21 t ha^{-1} (F_5), VC : 28 t ha^{-1} (F_6), FYM (20 t ha^{-1}) + NPK (50: 50:50 kg ha^{-1}) (F_7), NPK alone (50: 50:50 kg ha^{-1}) (F_8) and control (F_9) (without any manures), formed the subplot treatments. The plot size was 20.0 m x 1.8 m. The rhizomes were planted on raised beds during first week of June during 1995-96 and second week of May during 1996-97 and harvested during first week of February during 1995-96 and third week of January during 1996-97. Duration of the crop was 8 months. The same treatments were superimposed in the same plot during the second year. The number, volume and fresh weight of rhizomes were recorded from five randomly selected plants at harvest.

Results and discussion

Yield components and yield

Yield components like number and volume of rhizomes were significantly superior when mother rhizome was planted compared to finger rhizome (Table 1). This is mainly attributed to better growth of the crop with mother rhizome. Plant population levels did not influence the number and volume of rhizomes.

Among organic manures, FYM+NPK, FYM and VC at both the levels had significantly more number of rhizomes and higher volume of rhizomes compared to CCP at both the levels and NPK alone. Increase in number and volume of rhizomes were mainly attributed to better growth of plants under these treatments.

Fresh rhizome yield was significantly higher when mother rhizome was planted during both the seasons (4.7 and 5.1 t ha^{-1} during 1995-96 and 1996-97, respectively) compared to finger rhizome (4.6 and 5.0 t ha^{-1} during 1995-96 and 1996-97, respectively). The pooled data also followed the same trend (Table 1). The per cent reduction in yield under finger rhizome treatment was only 2.04% compared to mother rhizome. Increase in yield was mainly attributed to more number of rhizomes and higher volume of rhizomes under mother rhizome treatment. Similar results of superior yield with mother rhizome has been reported earlier in galangal (Rajagopalan & Gopalakrishnan 1985) and turmeric (Patil & Borse 1981). In taro, Mohankumar & Sadanandan (1988) reported similar yields by planting side corms (cormel) or mother corms.

Fresh rhizome yield was significantly higher at 500000 ha^{-1} population level (4.8 and 5.2 t h^{-1} during 1995-96 and 1996-97, respectively). The per cent reduction in yield due to lower density

Table 1. Influence of planting material, plant population and organic manures on yield components and yield (t ha^{-1}) of galangal

Treatment	No. of rhizomes $plant^{-1}$			Vol. of rhizomes (ml $plant^{-1}$)			Fresh rhizome yield (t/ha)			Harvest Index		
	a	b	c	a	b	c	a	b	c	a	b	c
Planting material												
S_1- Mother rhizome	7.3	8.0	7.6	22.0	21.9	22.0	4.7	5.1	4.9	0.622	0.618	0.620
S_2- Finger rhizome	7.2	7.7	7.5	21.2	21.1	21.2	4.6	5.0	4.8	0.620	0.617	0.618
'F' test	*	*	*	*	*	*	*	*	*	*	*	*
SEm ±	0.01	0.01	0.01	0.06	0.13	0.08	0.03	0.03	0.02	0.0004	0.0004	0.0004
CD (P=0.05)	0.04	0.05	0.04	0.22	0.46	0.29	0.10	0.07	0.08	0.001	0.001	0.001
Plant population (ha^{-1})												
P_1- 333000	7.0	7.6	7.3	21.4	21.6	21.5	4.5	4.9	4.7	0.621	0.620	0.621
P_2- 500000	7.0	7.6	7.3	21.4	21.7	21.5	4.8	5.2	5.0	0.619	0.618	0.619
'F" test	NS	NS	NS	NS	NS	NS	*	*	*	*	*	*
SEm±	0.01	0.01	0.01	0.06	0.13	0.08	0.03	0.02	0.02	0.0004	0.0004	0.0004
CD (P=0.05)	-	-	-	-	-	-	0.10	0.07	0.08	0.001	0.001	0.001
Organic manure (t ha^{-1})												
F_1- FYM : 24	8.5	9.3	8.9	26.0	26.5	26.2	5.3	5.7	5.5	0.635	0.637	0.636
F_2- FYM : 32	8.6	9.3	8.9	26.0	26.0	26.0	5.3	5.7	5.5	0.634	0.638	0.636
F_3 - CCP : 29	5.1	5.1	5.1	17.2	17.2	17.2	3.5	4.1	3.8	0.589	0.588	0.588
F_4 - CCP : 39	5.3	5.8	5.6	16.7	16.7	16.7	3.6	4.1	3.9	0.588	0.589	0.588
F_5 - VC : 21	8.6	9.3	8.9	25.0	27.0	26.0	5.3	5.7	5.5	0.629	0.631	0.630
F_6 - VC : 28	8.6	9.3	8.9	26.2	26.2	26.2	5.3	5.7	5.5	0.630	0.628	0.629
F_7 - FYM (20 t ha^{-1}) + NPK (50:50:50 kg ha^{-1})	8.8	9.5	9.1	26.0	26.0	26.0	6.0	6.3	6.2	0.629	0.628	0.629
F_8 - NPK (50:50:50 kg ha^{-1})	7.6	8.6	8.1	26.0	26.0	26.0	4.9	5.2	5.1	0.635	0.634	0.634
F_9 - Control	4.2	4.2	4.2	13.5	13.5	13.5	2.7	3.1	2.9	0.590	0.589	0.589
'F' test	*	*	*	*	*	*	*	*	*	*	*	*
SEm ±	0.03	0.03	0.03	0.13	0.31	0.19	0.04	0.03	0.03	0.002	0.002	0.002
CD (P=0.05)	0.07	0.08	0.07	0.38	0.88	0.54	0.11	0.09	0.08	0.004	0.004	0.004

NS : Not significant; a : 1995-96; b : 1996-97; c : Pooled.

Table 1a. Interaction effects of S x F on fresh rhizome yield (t ha^{-1}) of galangal at harvest*

Treatment	F_1	F_2	F_3	F_4	F_5	F_6	F_7	F_8	F_9
S_1	5.6	5.6	3.8	3.9	5.6	5.6	6.3	5.1	2.9
S_2	5.4	5.4	3.8	3.9	5.4	5.4	6.1	5.0	3.0

CD (5%) for F at the same levels of S = 0.12
CD (5%) for S at the same or different levels of F = 0.14

*Pooled data
S = Planting material
F = Organic manure

Table 1b. Interaction effects of P x F on fresh rhizome yield (t ha^{-1}) of galangal at harvest*

Treatment	F_1	F_2	F_3	F_4	F_5	F_6	F_7	F_8	F_9
P_1	5.2	5.1	3.8	3.8	5.2	5.2	6.1	4.9	2.8
P_2	5.7	5.9	3.8	4.0	5.4	5.7	6.2	5.2	3.0

CD (5%) for F at the same levels of P = 0.12
CD (5%) for P at the same or different levels of F = 0.14

* Pooled data
P = Plant population
F = Organic manure

population was only 6%. The increase in yield under higher population was attributed to higher population per hectare. Even though growth components were superior with 333000 ha^{-1} population level, the yield components were on par at both the levels of population; therefore, 333000 ha^{-1} population level could not compensate the total yield that was realised in 500000 ha^{-1} population level. Randhawa *et al.* (1972) reported that the yield obtained under a spacing of 20 cm x 20 cm or 20 cm x 30 cm was optimum compared to lesser or wider spacings in ginger. Singh & Neopaney (1993) also reported maximum growth, yield components and yield of ginger with 20 cm x 20 cm spacing compared to 20 cm x 30 cm or 15 cm x 30 cm spacings.

Fresh rhizome yield was significantly superior under FYM+NPK (6.0 and 6.3 t ha^{-1} during 1995-96 and 1996-97, respectively) compared to other treatments. Combination of organic manure with chemical fertilizer resulted in better growth of the crop. FYM and VC at both the levels also recorded significanlty higher yield compared to CCP at both the levels, NPK alone and control. NPK alone recorded significantly higher yield compared to CCP at both the levels. The per cent reduction in yield under different organic manure treatments compared to FYM + NPK was 12% with FYM and VC at both the levels, 38.7% with F_3, 37.1% with F_4, 17.7% with NPK alone and 53.2% with control.

Interaction effects of mother rhizome with FYM+NPK recorded significanlty higher yield (6.3 t ha^{-1}) compared to other combinations (Table 1a & b). FYM+NPK treatment with both the levels of population recorded significantly higher yield compared to other combinations. With the combination of organic manures and chemical fertilizers, there was improvement in the available nutrients which might have resulted in better growth and yield components.

Increase in yield due to combined application of FYM and inorganic fertilizers has been reported in turmeric (Rao *et al.* 1975) and ginger (Pawar & Patil 1987). Application of FYM alone resulting in higher yield has been reported in turmeric (Balashanmugam *et al.* 1989). Application of VC alone or in combination with inorganic fertilizers was found to increase the yield of turmeric (Vadiraj *et al.* 1996a) and coriander (Vadiraj *et al.* 1996b).

Harvest Index

HI, which indicates the efficiency of accumulation of photosynthates in economic parts was significantly higher with mother rhizome (0.620) compared to finger rhizome (0.618) (Table 1). This indicates the higher capacity of partitioning of dry matter produced into rhizomes under mother rhizome treatment. Plant population of 333000 ha^{-1} had significantly higher HI (0.621) compared to 500000 ha^{-1} population level (0.619). This is mainly because, higher plant population generally decreases the proportion of total DM diverted into the rhizomes. Among organic manures, FYM+NPK, FYM and VC at both the levels had significantly higher HI compared to CCP at both the levels and NPK alone. Higher HI was mainly attributed to better translocation of dry matter into rhizomes. Control had significantly lower HI, which is attributed to lower dry matter production and its partitioning into rhizomes.

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