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Effect of spacing and manuring on growth, yield and nutrient content of *Alpinia galanga* (L.) Willd.

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Abstract

Experiment conducted at research farm of the Aromatic and Medicinal Plants Research Station, Odakkali during 1996-1999 to find out the effect of different spacings and manuring on growth, yield and nitrogen, phosphorus and potassium concentration in *Alpinia galanga* revealed that the optimum spacing for maximum rhizome and oil yields was 40 x 30 cm. Application of FYM at 20 t ha^{-1} $year^{-1}$ produced significantly higher rhizome yield, followed by NPK at 100 : 50 : 50 kg ha^{-1} $year^{-1}$. Oil recovery was unaffected by these treatments.

Key words: *Alpinia galanga*, essential oil, galangal, medicinal herb, yield.

Introduction

Alpinia galanga (L.) Willd. is a perennial herb cultivated in tropical areas of southern and eastern parts of India for its aromatic and medicinal rhizomes. It is commonly known as galangal; *rasna* in Sanskrit and *kulainjan* in Hindi. Rhizome and root contain tannins and flavonoids, some of which have been identified as kaempferide, galangin and alpinin (Sastry 1961). Green rhizomes on hydrodistillation yield a pale yellow oil with pleasant odour containing 48% methyl cinnamate and 20-30% cineole in addition to camphor and probably α-pinene (Chopra *et al.* 1957). Husain *et al.* (1992) reported 18 monoterpenoids of which α-pinene, β-pinene and limonene were the major compounds and 17 oxygen containing monoterpenoids with cineole, terpinen-4-ol, and α-terpineol as minor compounds. Itokowa *et al.* (1987) isolated two antitumour principles from *A. galanga*.

The rhizomes are used in the preparation of expectorants and carminatives and are useful in vitiated conditions of *vata* and *kapha*, rheumatoid arthritis, inflammations, stomatopathy, pharyngopathy, cough, asthma, hiccough, dyspepsia, stomachalgia, obesity, diabetes, cephalalgia, tubercular glands and intermittent fevers (Warrier *et al.* 1993). It is a major ingredient of *Rasnadi kashaya, Rasnadi churna, Rasnadi taila, Asvagandharishta* etc. (Sivarajan & Balachandran 1994).

Though the plant is adapted to tropical climate and large scale demand exists for its rhizome, no attempt has been made to develop cultivation technology to improve yield and quality. This study was taken up to work out the optimum spacing and manurial requirements of *A. galanga* for obtaining maximum rhizome and oil yields.

Materials and methods

The study was conducted at the Aromatic and Medicinal Plants Research Station (AMPRS),

Odakkali during 1996-1999. The soil of the experimental area had a pH of 5.5 and was low in available N, high in available P and medium in available K. The treatments comprised of 20 factorial combinations of 4 spacings (20 x 20, 30 x 20, 30 x 30, 40 x 30 cm) and 5 manurial treatments (FYM 20 t ha^{-1}; N, P_2O_5 and K_2O at 100 : 50 : 50 kg ha^{-1}; Green manuring *in situ; Azospirillum* (M/s Agrobiotech, Kottayam, Kerala) at 10 kg ha^{-1} and control) were replicated thrice in randomised block design.

The crop was planted with the onset of monsoon in May, raised as rainfed crop and harvested after two years. In the cowpea green manuring *in situ* treatment, cowpea seeds were sown at 25 kg ha^{-1} at planting and the plants were uprooted 30 days after planting and used as mulch. Organic manures and biofertilisers were applied as basal treatments. In the case of inorganic fertilisers, P was applied as basal while N and K in two equal splits at planting and two months after planting. Growth observations were recorded two months after planting and the yield observations at the time of harvest. Total N, P and K contents of rhizome and available N, P and K levels in soil were recorded after harvest. The plant materials were hydrodistilled for 5 h in Clevenger's apparatus for extracting the oil. The data were pooled and statistically analysed.

Results and discussion

The data on growth attributes of *A. galanga* showed that spacing and manure significantly influenced all the growth parameters (Table 1). Plant height was maximum (88.44 cm) with 40 cm x 30 cm spacing which was on par with that in 60 cm x 40 cm spacing. Number of suckers $clump^{-1}$ as well as number of leaves $sucker^{-1}$ increased with the increase in spacing from 30 cm x 20 cm to 60 cm x 60 cm. FYM application recorded maximum plant height, number of suckers $clump^{-1}$ and leaves $sucker^{-1}$. On an average, the plants grew to a height of 85 cm and produced 52 suckers $clump^{-1}$ and 11 leaves $sucker^{-1}$ over a period of two years.

With respect to the main effect, the rhizome yield was maximum at 30 cm x 20 cm spacing,

Table 1. Effect of spacing and manuring on the nutrient content, growth and yield parameters of *A. galanga*

Treatment	No. of clumps $plot^{-1}$	Plant height (cm)	No. of suckers $clump^{-1}$	No. of leaves $sucker^{-1}$	Fresh rhizome yield (t ha^{-1})	Oil yield (l ha^{-1})	Oil recovery* (%)	Nutrient content of rhizome (%)		
								N	P	K
Spacing (cm)										
30 x 20	37.47	82.59	38.13	8.48	47.29	91.29	0.19	0.05	0.07	0.56
40x 30	19.27	88.44	50.91	9.62	46.42	93.53	0.20	0.07	0.05	0.44
60 x 40	10.93	85.33	49.57	9.27	36.81	77.33	0.21	0.12	0.05	0.34
60 x 60	7.27	81.52	68.51	10.76	33.85	66.36	0.20	0.08	0.06	0.41
CD (0.05)	1.48	7.88	5.29	0.90	2.40	4.69	NS	0.022	NS	0.10
Manuring										
Control	19.08	79.90	53.15	9.23	36.63	75.78	0.21	0.09	0.04	0.36
FYM	19.17	90.18	57.10	10.23	45.14	94.80	0.21	0.06	0.06	0.43
NPK	19.00	89.48	55.06	9.03	44.86	86.73	0.19	0.10	0.05	0.49
GM	17.50	85.98	47.01	9.60	38.89	76.30	0.20	0.10	0.08	0.46
BF	18.92	76.81	46.60	9.57	39.93	74.91	0.19	0.05	0.06	0.44
CD (0.05)	NS	8.81	5.91	1.00	2.69	5.25	NS	0.025	0.015	NS
Interaction Sp.x Ma.	NS	17.62	11.81	2.01	5.38	10.50	NS	0.050	0.030	0.224

* Fresh weight basis; FYM-Farm yard manure; GM-Green manure; BF-Biofertilier

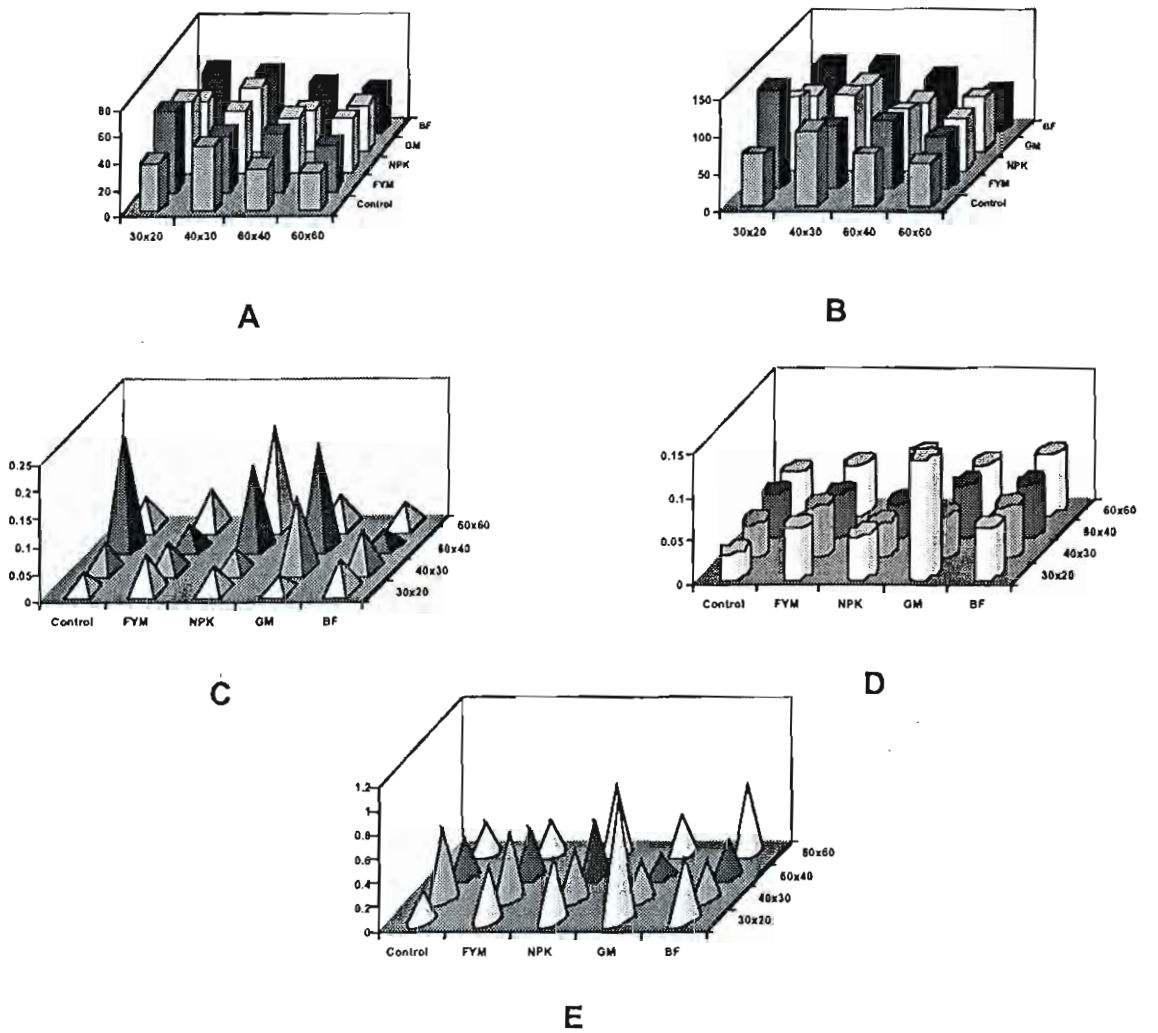

Fig. 1. Interaction effect of spacing and manuring in *Alpinia galanga*. A. Fresh rhizome yield B. Oil yield C. Nitrogen content in rhizome D. Phosphorus content in rhizome E. Potassium content in rhizome

which was on par with that in 40 cm x 30 cm spacing (Table 1). Yield was also maximum with FYM application, which was on par with NPK application. The higher yield resulting from FYM or NPK application was due to significantly higher number of suckers plant^{-1}, leaves sucker^{-1} and increased plant height. FYM application was significantly superior to all other manurial treatments with respect to oil yield. Application of biofertiliser, *Azospirillum* at 10 kg ha^{-1} and cowpea green manuring *in situ* were beneficial. The oil recovery did not vary significantly due to the treatments. The average yield was 41.07 t ha^{-1} of fresh rhizome or 11.49 t ha^{-1} of dry rhizomes. Fresh rhizomes gave 27.98% dry rhizomes. The mean oil recovery was 0.20% on fresh weight basis or 0.71% on dry weight basis.

The interaction effects of spacing and manuring treatments on the rhizome and oil yields were statistically significant. The fresh rhizome yield reached a maximum of 60.69 t ha^{-1} at 30 cm x 20 cm spacing with FYM application, followed by 53.30 t ha^{-1} at 30 cm x 20 cm spacing with

NPK application (Fig. 1 A). The effect of cowpea green manuring was maximum at 40 cm x 30 cm spacing (49.93 t ha^{-1}). Biofertiliser application recorded the highest rhizome yield (46.60 t ha^{-1}) at the closer spacing of 30 cm x 20 cm. The oil yield was maximum (133.52 l ha^{-1}) at 30 cm x 20 cm spacing with FYM application, followed by 103.36 l ha^{-1} at 40 cm x 30 cm spacing with NPK application (Fig. 1 B). The nitrogen content of rhizome increased with increase in spacing while that of K showed the reverse trend, except at the wider spacing of 60 cm x 60 cm (Table 1). The status of available NPK in soil did not vary significantly due to the treatments. In case of manuring treatments, N content in rhizome was highest with the application of NPK and green manure, whereas the P content was highest with the application of green manure. The interaction effects indicated that N contents in rhizome were higher at wider spacing (60 x 60 and 60 x 40 cm) with the application of NPK, whereas it was higher at medium spacing (60 x 40 and 40 x 30 cm) with the application of green manure (Fig. 1 C). At the narrowest spacing of 30 cm x 20 cm, cowpea green manuring resulted in the build up of available P and K in the soil (Fig. 1 D & E).

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