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Influence of nitrogen and potassium on growth, yield and oil content of *Kaempferia galanga* L.

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Abstract

An experiment to study the effect of nitrogen and potassium on growth and yield of kaempferia (*Kaempferia galanga* L.) under the shade of Arjun (*Terminalia arjuna*) plantation was carried out. Increased application of nitrogen and potassium significantly improved the leaf number, leaf area and dry matter accumulation. Higher dose of nitrogen (40 kg ha^{-1}) and potassium (20 kg ha^{-1}) significantly increased the rhizome yield and oil content. Amongst the various interactions, application of 40 kg nitrogen in combination with 20 kg potassium per hectare gave maximum yield (10.24 t ha^{-1}).

Key words: *Kaempferia galanga*, nitrogen, potassium.

Kaempferia galanga L. is a potential medicinal cum aromatic crop cultivated throughout the plains of India as an intercrop with tree species. The rhizomes are used in Eastern Asia for a wide range of medicinal applications (Seidemann 1992). The essential oil of the rhizome is used in perfumery and to flavour curries (Kurian *et al.* 1993). The rhizomes contain 2.4 to 3.9% oil (Seidemann 1992). Information on the effect of different nutrients on kaempferia is scanty. In the present work, attempt was made to study the effect of nitrogen and potassium on growth, rhizome yield and oil content of kaempferia.

A field experiment was conducted on kaempferia grown as an intercrop in *Terminalia arjuna* plantation during two successive years (1999-2000 and 2000-2001) at the Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia. The experiment was laid out in a factorial randomized block design with three levels of nitrogen (0, 20 and 40 kg ha^{-1}) and three levels of potassium (0, 10 and 20 kg ha^{-1}) with three replications. Phosphorus was applied at the rate of 40 kg ha^{-1}. Rhizomes (1.5 - 2.0 cm diameter) were planted at 20 cm x 25 cm spacing during first week of May in both the years. The soil analysis before planting revealed 0.76% organic carbon, 220 kg ha^{-1} available nitrogen, 52 kg ha^{-1} available phosphorus and 85 kg ha^{-1} of available potassium. The pH of the soil was 6.4. Full dose of phosphorus and half dose of nitrogen and potassium were applied at planting in the form of single super phosphate, urea and muriate of potash, respectively. Remaining quantity of nitrogen and potassium were top dressed, 60 days after planting. Crop was grown under rainfed condition and harvested 9 months after planting, when most of the leaves withered. Growth and yield parameters were recorded. Oil content of the rhizome was estimated through steam distillation by clevenger trap and the data were statistically analysed.

Number of leaves and individual leaf area of kaempferia increased significantly with increase in nitrogen fertilization. The highest number of leaves (18.90) and maximum average leaf area (200.10 sq. cm) were recorded in plots that received 40 kg ha^{-1} nitrogen (Table 1). Potassium application also significantly influenced the number of leaves and leaf area.

Number of rhizomes per clump and rhizome yield (fresh) increased steadily with increased nitrogen application. Maximum rhizome yield (9.3 t ha^{-1}) was obtained with 40 kg ha^{-1} nitrogen. Application of 20 kg ha^{-1} nitrogen also significantly increased rhizome yield over control. Application of potassium also significantly influenced the rhizome number clump^{-1} and rhizome yield. But application of potassium 20 kg ha^{-1} recorded highest yield (9.49 t ha^{-1}) compared to nitrogen application.

Maximum dry matter accumulation was obtained with the application of 40 kg ha^{-1} nitrogen. Potassium at 20 kg ha^{-1} resulted in increased dry matter yield over other treatments. The rate of dry matter accumulation was more with potassium application compared to nitrogen.

The percentage of oil recovery increased steadily with increase in nitrogen application. This yield component also increased significantly with potassium application. Both high and low doses of nitrogen and potassium resulted in significantly increased oil recovery over control.

The maximum number of rhizomes per clump (16.47), rhizome yield 10.24 t ha^{-1} (fresh) and dry

Table 1. Effect of nitrogen and potassium on growth, yield and oil content of *Kaempferia galanga*

Treatment	Leaf number (sq. cm.)	Average leaf area clump^{-1}	Number of rhizomes	Yield (fresh) (t ha^{-1}) (100 g fresh	Dry matter accumulation (g) weight weight basis)	Oil content (%) (dry basis)
Nitrogen						
N_0	13.33	166.71	12.67	7.81 (45.91)	38.70	2.47
N_{20}	16.00	188.23	14.44	8.90 (49.89)	40.47	2.72
N_{40}	18.90	200.10	15.56	9.30 (53.53)	42.06	2.85
S.Em (±)	0.62	2.95	0.10	0.03 (0.31)	0.20	0.03
C.D. at 5%	1.86	8.83	0.29	0.09 (0.92)	0.59	0.09
Potassium						
K_0	14.00	176.90	13.24	7.75 (45.08)	37.79	2.53
K_{10}	15.78	186.50	14.07	8.77 (50.33)	41.08	2.70
K_{20}	18.55	191.63	15.36	9.49 (53.94)	42.36	2.81
S.Em. (±)	0.62	2.95	0.10	0.03 (0.31)	0.20	0.03
C.D. at 5%	1.86	8.83	0.29	0.09 (0.92)	0.59	0.09
Interaction						
N_0K_0	11.67	162.54	11.40	6.97 (42.40)	35.21	2.32
N_0K_0	13.00	167.28	12.27	7.94 (46.33)	39.54	2.48
N_0K_{20}	15.67	170.31	14.33	8.52 (49.00)	41.36	2.62
$N_{20}K_0$	14.00	178.83	13.53	7.84 (44.50)	38.47	2.54
$N_{20}K_{10}$	15.67	190.70	14.53	9.04 (50.67)	40.75	2.75
$N_{20}K_{20}$	18.33	195.16	15.27	9.81 (54.50)	42.18	2.86
$N_{40}K_0$	16.33	189.34	14.80	8.44 (48.33)	39.68	2.73
$N_{40}K_{10}$	18.67	201.53	15.40	9.32 (54.00)	42.95	2.88
$N_{40}K_{20}$	21.67	209.42	16.47	10.24 (58.33)	43.54	2.94
S.Em. (±)	N.S.	N.S.	0.17	0.05 (0.53)	0.34	N.S.
C.D. at 5%	N.S.	N.S.	0.52	0.16 (1.59)	1.02	N.S.

N.S. – Not significant. Figures in parentheses indicate the yield clump^{-1} (g)

Table 2. Correlation co-efficient for different variables

X	Y Variable correlated	Correlation co-efficient (r^2)
Yield per hectare	Leaf number	0.948**
	Leaf area	0.898**
	Number of rhizomes per clump	0.933**
	Dry matter accumulation	0.940**
	Oil content	0.966**

** Significant at 1% level.

matter yield of 43.54 g (100 g fresh weight basis) were registered with the combination of 40 kg nitrogen and 20 kg potassium per hectare.

The correlation co-efficients between the rhizome yield per hectare and different growth characters (yield attributing characters) of kaempferia were worked out and were found to be positively correlated with the yield (Table 2).

The results of the study showed that planting of 1.5 - 2.0 cm diameter rhizome with nitrogen and potassium dressing of 40 kg and 20 kg ha^{-1}, respectively along with 40 kg ha^{-1} phosphorus may maximise rhizome yield of kaempferia in the alluvial zone of West Bengal.

References

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