RESEARCH ARTICLE

Effect of inorganic fertilizers on growth and yield of Red ginger grown as intercrop in Oil Palm gardens

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ABSTRACT

Oil palm cultivation assumes significance for augmenting the indigenous availability of edible oil as it is the highest oil yielding crop. Oil palm is perennial nature planted at a spacing of 9 m x 9 m and there is wide space available for growing intercrops in oil palm which can more than double the income. Ornamental red ginger *Alpinia purputa* (Vieillard) K. Schumann, is a shade loving crop, comes up well even in dense shade of (70-80%) in oil palm gardens. Nutrients N, P and K play key role in plant growth, flowering and yield of the crop. The field experiment was conducted to study the effect of primary nutrients (NPK applied in inorganic form) on growth and productivity of red ginger grown in mature oil palm at Horticultural Research station, Vijayarai during 2011- 2013. The experiment was laid in randomized block design with nine treatments and three replications. The results revealed that fertilizer treatment had significant effect on plant height, number of leaves, leaf length, number of spikes per clump and spike length and no effect on shoot girth and leaf breadth. Maximum plant height (124.14 cm) and maximum number of leaves per plant (39.33) were produced by the treatment T_4 (10:20:20 NPK/ clump) whereas maximum leaf length (38.38) was produced by the treatment T_5 (20:10:10 NPK/ clump). The highest spike length (20.29 cm) and maximum number of spikes per clump (18.29) were produced by treatment T_7 (20:10:20 NPK / clump) whereas the highest number of bracts per spike (16.95) were produced in T_4 (10:20:20 NPK/ clump). The fertilization dose 20:10:20 NPK/ clump *i.e.,* 88.8 - 44.4 - 88.8 kg NPK ha-1 was the best to favor red ginger yield.

Key Words: Chemicals and fertilizers, intercropping system, oil palm, red ginger, yield,

INTRODUCTION

Oil palm cultivation assumes significance for augmenting the indigenous availability of edible oil as it is the highest oil yielding crop. Oil palm is perennial in nature planted at a spacing of 9m x 9m. There is wide space of growing intercrops in oil palm which more than double the income. Ornamental red ginger *Alpinia purputa* (Vieillard) K. Schumann, is a shade loving crop, comes up well even in dense shade of 70-80% in oil palm gardens. Red ginger (*Alpinia purpurata)* is a tall, upright, herbaceous, evergreen plant from the South Pacific, with bright red floral bracts and inconspicuous white flowers. It is quite popular as an ornamental and cut flower, both for the domestic and for commercial use (Kepler, A.K. 1989). It is one of the most important and universal flower crop which is gaining importance in the floral decoration. Under congenial climatic conditions, flowering of red ginger occurs throughout the year (Kobayashi et al., 2007). Therefore, fertilization is essential for successful cultivation of red ginger as the crop exhaust nutrients from the soil, thereby causes decrease in yields. There are no specific rules for fertilizing tropical ornamentals since soil and climate conditions are different in each region. In Andhra Pradesh, red ginger is cultivated as intercrop in the inter spaces of oil palm garden. Hence, there is every need to standardize optimum growing condition and agro techniques with particular reference to fertilizer to obtain maximum number of spikes per unit area. The main objective of conducting this experiment is to study the effect of NPK fertilizers on

growth and yield of red ginger grown as an intercrop in oil palm.

MATERIALS AND METHODS

The experiment was conducted in a randomized block design with three replications at Horticultural Research Station, Vijayarai during 2011- 2012. The spacing adopted for red ginger was 1.5 m × 1.5 m and the plot size was 8 m × 8 m. The experimental soil was red sandy loam in texture, with pH 6.9, EC 0.080 mhos cm^{-1}, $CaCO_3$; 7.2, N 179, available P 12.4 and available K 134 kg ha^{-1}. Treatments imposed to the experiment are organic fertilizers *i.e.,* farm yard manure @ 2.5 kg/ m^2 and inorganic fertilizers - N_1: 10 g, P_1: 10 g; K_1: 10 g, N_2: 20 g, P_2: 20 g, K_2:20 g. A total of eight treatments along with control were imposed and the details are given below (Table 1).

The fertilizers used as the sources of NPK were urea (46% N), single super phosphate (16% P2O5) and muriate of potash (50 % K_20). Basal phosphate fertilization was by applying single super phosphate and mixed in the soil at the time of planting the clumps. Nitrogen and K fertilizers were in the form of urea and Muriate of potash respectively. N and K doses were divided into three equal splits and applied at 3, 6 and 9 months after the establishment of seedlings. The fertilizers were placed around the clump at a distance of 10 cm and 5 cm of depth. The data on plant height, number of leaves, pseudo shoot girth, leaf length, leaf breadth, spike length, number of spikes/ clump, number of bracts/ spike were recorded.

RESULTS AND DISCUSSION

According to the results of the analysis of variance (Table 2), there was significant difference among the treatments with respect to vegetative parameters *viz.,* plant height, number of leaves per plant, leaf length and yield parameters *viz.,* number of spikes/ clump, spike length and number of bracts per spike. The treatment application of 10:20:20 g NPK/ clump (T_4) recorded highest plant height (144.14 cm) closely followed by 10:10:10 g NPK / clump (T1) as against 81.89 cm in the control treatment (T_9 only FYM). Maximum leaves per plant (39.33) was recorded in treatment 10:20:20 g NPK/ plant (T4) closely followed by the treatment (39.20) and the lowest was recorded in control treatment (17.53). The leaf length of the red ginger was recorded highest (38.38 cm) in application of 20:10:20 g NPK/ plant and the lowest (22.62 cm) was recorded in control without fertilization. The shoot girth and leaf breadth were not affected with the application of different doses of fertilizers in red ginger grown as inter crop in oil palm. Although many plant characters are attributed to genetics, application of medium concentration of N, higher concentration P &K promoted the plant height, number of leaves whereas higher concentration of P & K promoted the leaf length in red ginger. The results are in conformity with the findings of Ana María *et al*. (2019) which could be attributed to the fact that N in *Zingiberaceae* plants, such as red ginger, N is the most important macro nutrient for growth and flowering. The lowest values of growth parameters in control suggest that the macro nutrient quantities available in FYM applied were not

Table 1: The number and dosage of treatments under the study

Treatments	Dosage (g/ clump)			Dosage (kg/ ha)		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O
T_1- N_1 P_1 K_1	10	10	10	44.4	44.4	44.4
T_2 - N_1 P_2 K_1	10	20	10	44.4	88.8	44.4
T_3- N_1 P_1 K_2	10	10	20	44.4	44.4	88.8
T_4 - N_1 P_2 K_2	10	20	20	44.4	88.8	88.8
T_5- N_2 P_1 K_1	20	10	10	88.8	44.4	44.4
T_6 – N_2P_2 K_1	20	20	10	88.8	88.8	44.4
T_7 – N_2 P_1 K_2	20	10	20	88.8	44.4	88.8
T_8 – N_2 P_2 K_2	20	20	20	88.8	88.8	88.8
T_9- Control	only farm yard manure			only farm yard manure		

sufficient for good growth, may be attributed to the absence of NPK macronutrients in the control since these elements are essential in the synthesis of molecules for growth (Morais et al. 2010). Castro et al. (2007) reported that N is the most important nutrient in growth and flowering of *Zingiberaceae* plants, and the N content in plants was 67% lower in plants without a complete fertilization. In *Tagetes* spp., higher N and P applications increase plant growth, flower yield and leaf nutrient content.

With regard to yield parameters, there was significant difference among the treatments (Table 3). The number of spikes per clump varied from 8.77 to 18.29. Maximum number of spikes per clump (18.29) and maximum spike length (20.29 cm) were observed in the treatment with 20:10:20g NPK/ clump (T7) whereas the highest number of bracts per spike (16.95) were recorded in 10:20:20 g NPK/ clump (T4) as against 8.77 spikes per clump, 10.91 cm spike length and 7.27 bracts per spike in control treatment. The results of the experiment are in agreement with the findings of the Attoe *et al.* (2013), who stated that the effect of nitrogen was more distinct than K. The combined effect of N and K had significantly increased the yield and other yield contributing characters of zinger. Asafa and Akanb (2018) reported that the rhizome yields of fertilizer applied plants were significantly higher than the control plants. Rhizome yields ranged from 1.67 t/ha in 80 kg N/ha to 3.71 t/ha in 140 kg N/ha.

CONCLUSION

The fertilizer dose 20:10:20 NPK/ clump *i.e.,*88.8 - 44.4 - 88.8 kg NPK ha-1 was the best to get higher yield in red ginger grown as an intercrop in oil palm gardens.

Table 2: Effect of NPK fertilizers on vegetative parameters of red ginger grown under oil palm

Treatment	Plant height (cm)	No. of leaves per clump	Shoot girth (cm)	Leaf length (cm)	Leaf breadth (cm)
T_1-10-10-10	123.00	39.00	2.79	33.47	10.92
T_2- 10-20-10	117.66	39.20	2.71	31.15	10.83
T_3- 10-10-20	116.85	37.40	2.71	31.00	10.18
T_4- 10-20-20	124.14	39.33	2.94	31.49	10.26
T_5- 20-10-10	119.80	38.60	2.64	38.38	10.09
T_6- 20-20-10	114.96	37.27	2.77	32.27	10.71
T_7- 20-10-20	116.69	38.07	2.64	34.41	12.05
T_8- 20-20-20	114.21	38.67	2.68	31.51	12.91
T_9- Control	81.89	17.53	2.75	22.62	8.38
CD P=0.05	8.21	1.66	NS	4.56	NS
SEM	6.05	0.72	0.25	1.93	0.51

Table 3: Effect of NPK fertilizers on yield parameters of red ginger grown under oil palm

Treatment	Spike length(cm)	Number of spikes/clump	Number of bracts/spike
T_1-10-10-10	17.04	17.13	14.55
T_2- 10-20-10	15.41	16.27	14.56
T_3- 10-10-20	16.34	16.77	16.37
T_4- 10-20-20	19.87	10.25	16.95
T_5- 20-10-10	13.99	17.99	16.13
T_6- 20-20-10	12.95	12.86	13.95
T_7- 20-10-20	20.29	18.29	15.91
T_8- 20-20-20	15.56	10.18	14.69
T_9- Control	10.91	8.77	9.27
CD P=0.05	1.32	0.63	0.56
SEM	0.44	0.21	0.18

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