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Effect Of Nitrogen And Potassium On The Yield And Quality Of Ginger In The Derived Savanna Zone Of Obubra, Cross River State, Nigeria.

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Abstract: *The field experiment on ginger was carried out at the Derived savanna zone of Obubra which lies within latitude $06^0 5^1$ and 06^0 10^1 North and longitude 08^0 21^1 and 08^0 25^1 of the Cross River State University of Technology experimental farm during the 2006 and 2007 cropping season to evaluate the response of ginger with different levels of nitrogen (N) (0,100, 200, 300 and 400kg/ha) and potassium (K) (0, 150, 100, 150 and 200kg/ha). It is revealed that combined application of N and K was found more pronounced than the single effect of N and K. It is also noticed 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 ginger. It was also observed that N_{300} and K_{150} kg/ha significantly augmented the ginger yield and other yield parameters. However, the highest plant height (69.3 cm and 63.7cm), maximum number of leaves (20.5 and 18.8), leaf area (39.7cm^3 and 36.3cm^3) and total number of shoot (5.5 and 7.3) were recorded at N_{400} K_{100} kg/ha and were significantly different over N_oK_o. Similarly, rhizome yield was also significantly influenced by combined application of N and K up to N_{300} K_{150} kg/ha. With highest yield (8.1 t/ha and 8.0 t/ha) and the two years mean yield of 8.0 t/ha were recorded during the trials.*

Key words: *Effect of N and K, ginger quality and yield.*

I. Introduction

Ginger (*Zingiber officinale*) a popular spice crop in Nigeria has become an integral part of daily culinary preparation for its aromatic pungency scent and tasty flavor. It was mostly grown in Northern part of Nigeria but has now spread into many South-Eastern and South-Western agricultural zones of Nigeria (Okwuowulu and Ene, 1988)[1]. Ginger can be grown in wide range of soils but prefers to grown in light textured and well drained soils as it cannot grow and sustain in water-logged conditions. However, in view of the low yields of ginger in the country (5 -12 t/ha) (Aliyu and Lagoke, 2000)[2] compared to 37t/ha obtained elsewhere (Whiley, 1974)[3], it is difficult to satisfy domestic consumption. Soil fertility management is a necessity in successful crop production. Therefore to increase yield of ginger, it would be necessary to supply adequate nutrients to the crop since it has a high nutrient demand.

Therefore, this study was initiated to evaluate the response of ginger to various levels of N and K for high yield potential of ginger in the Derived Savanna region, Obubra, Cross River State, Nigeria.

II. Materials and methods

The yield experiment was conducted at the research farm of the Cross River University of technology, Obubra Campus during the onset of the rains (April) in 2006 and 2007. The experiment location lies within latitude 06^0 5^1 and 06^0 10^1 North and longitude 08^0 21^1 and 08^0 25^1 East. The experiment was laid out in randomized block design with three replications. The unit plot size and planting distance were 3mx3m and 20cm x 20cm respectively. The UGI (yellow ginger)was taken as the test crop. There were twenty-five treatment combinations each of 5 levels of N (0, 100, 200, 300, and 400kg/ha) and 5 levels of K (0, 50, 100, 150 and 200kg/ha) in the field study. The fertilizer treatments were applied in two split doses, first at 30 days after planting and the second at 90 days after planting. Ginger rhizome (seeds) weighting between 20 – 25gms were used as planting materials were planted in April 2006 and 2007 and harvested on first week in December of the two seasons. Data on different yield parameters and yield were recorded from 6 tagged plants after a quadrant (net plot) have been drawn at the middle of plots and averages found. The collected data were analyzed statistically and adjusted with least significance (LSD) at 5% level of significance (Cochram and Cox, 1975)[4].

III. Results And Discussion

Effect of Nitrogen.

The means of observation of different parameters are presented in **TABLES 2a and 2b** respectively. It is revealed from the tables that N either in single or in combination had significant effect on the yield and other yield parameters of ginger. It is also evident that both N and K had positive impact on ginger production but the effect of N was found to be more distinct than the effect of K. However, with the increase of N levels, other field parameters of ginger linearly increased. The yield contributing parameters progressively increased with the increase rates of N up to 400kg/ha which was significantly different over N_o. Here 5 levels of N were used in treated plots but 300kg N/ha responded best and the highest plant height (63.7cm and 63.0cm), maximum leaves number (20.5 and 16.5 per plant), leaf area (34.7cm^3 and 36.3cm^3 per plant) and shoot number (5.5 and 7.3 per plant) respectively in the two years of planting. Weight of ginger per plant, and ginger yield also significantly increased with the same dose of N (N_{300}kg/ha). However, the highest ginger yield (5.7t/ha and 8.1 t/ha) were obtained at the same N rate (N_{300}kg/ha) in two consecutive years of study. This result was in conformity with the findings of Randhawa and Nandpori (1969)[5], Lee et al (1981)[6], and Musa (1985)[7] and the yield obtained by Orkwor et al (1988)[8] but higher than the yield reported by melifonwu and Orkwor (1988)[9]; Chuwku and Emehute (2001)[10].

Effect of Potassium

It is evident from **TABLES 2a and 2b** that ginger significantly responded to the different levels of K. It was also found that with the increase of K rates growth and other yield parameters progressively increased up to 150kgk/ha like N, K was also found responsive to ginger but effect of K was not as pronounced as N did. However K at 150kg/ha showed better result than that of other levels and K_o. The yield attributes of ginger increased positively when 50kgk/ha was applied in treated ginger plants. Plant height, number of leaves, number of shoot responded significantly to the K levels (0, 50, 100, 150 and 200kgk/ha).K at the highest level (200kgk/ha) produced the highest plant height (63.0cm and 66.3cm), maximum leaves number (21.8 and 18.8) plant leaf area (35.0cm^3 and 32.0cm^3), shoot number (5.2 and 7.5/plant) and ginger yield significantly increased by the same dose of K (150kg/ha) while k_o produced the lowest yield. However, the highest rhizome yield (5.0t/ha and 8.0 t/ha) and the mean yield (6.5 t/ha) of ginger was recorded at K_{150}kg/ha and significantly differed over K_o in two studied years.

Enwenzor *et al* (1990)[11] classified exchangeable K in Nigerian soils into low if K is less than 0.2cmol/hg, medium between 0.2 – 0.4cmol/Kg and high, above 0.4coml/kg. This trend is similar to the findings of Agbede (1996)[12], he attributed the trend to the nature of the parent materials of soils in Nigeria. This may have been the reason for the high level of K required for ginger production in the study area.

Interaction effect of N and K

Yield and yield, attributes of ginger are shown in **TABLES3a and 3b** respectively. The significance response on all the studied parameters where made by the combined application of N and K. The study revealed that N and K in combination made a significant contribution to ginger production. But N and K in single or in combination had exhibited significant influence on yield and other yield components of ginger. But it was evident that combine effect of N and K was found more reactive than N and K did in single application. However, it was observed from two years studies that with the increase doses of N and K, all the yield contributing characters increase significantly in linear way up to the level of N_{200} K_{150} kg/ha. The highest plant height (62.5cm and 63.7cm), maximum leaves number (15.6 and 16.8/plant) and number of shoot (5.5 and 7.9/plant) were recorded at the highest level of N_{300} K_{150} kg/ha. Other yield contributing parameters like number of shoot and ginger yield also significantly progressed by the same treatment combination (N_{300} K_{150}) of N and K. However, the highest rhizome yield (6.3t/ha and 7.8 t/ha) were obtained from (N_{200} K_{150} kg/ha) treatment combination whereas N_o K_o did not give optimum ginger yield. Venkatesh *et al*; 1998[13] found similar results in their observations. It was revealed from the two years study that N and K at N_{200} K_{150} kg/ha along with the blanket dose of other nutrients was found to be optimum for maximizing yield in the soils of Obubra, Cross – River State, Nigeria. So, it may be suggested that Nitrogen and Potassium at N_{200} K_{150} kg/ha can be suitable fertilizer package for ginger production in this region.

Table 1: Nutrient Status of Experiment Soil Prior to Fertilizer Application

Chemical properties	pH	OM	Ca	Mg	K	Total N g/kg	P		B	Cu	Fe	Mn	Zn
		g/kg	Cmol/kg				Mg/g						
Initial soil values	5.6	1.93	2.14	1.56	0.05	0.06	25.16		0.70	1.40	3.6	11.50	12.90
Critical	-	2.0	2.0	0.4	0.2	1.5	14.0		0.2	1.0	10.0	5.0	2.0

Table 2a: Main Effect of Nitrogen and Potassium on the Yield and Yield Attributes of Ginger at Obubra, Cross River State, Nigeria (2006)

Nitrogen level (kg/ha)	Plant height (cm)	No. Of leaves/plant	Leaf Area (cm^3)	No. Of shoot/plant	Ginger yield t/Ha
N_0	39.0	13.3	21.0	4.8	4.5
N_{100}	69.3	17.8	39.7	4.8	5.7
N_{200}	58.0	13.4	31.3	4.6	4.7
N_{300}	63.3	15.3	34.7	4.3	4.5
N_{400}	63.7	20.5	32.7	5.5	4.6
Mean	58.7	16.1	31.9	4.8	5.0
$LSD_{(0.05)}$	4.61	2.54	7.02	1.08	1.15
Effect of Potassium					
K_0	39.0	13.3	21.0	4.8	4.5
K_{50}	62.3	21.8	32.7	4.5	3.8
K_{100}	61.3	20.0	31.0	5.2	4.6
K_{150}	61.8	17.7	33.3	4.3	5.0
K_{200}	63.0	20.9	35.0	4.7	4.6
Mean	57.5	18.7	30.6	4.7	4.5
$LSD_{(0.05)}$	8.8	2.96	7.25	1.11	1.22

Table 2b:Main effect of Nitrogen and Potassium on the yield and yield attributes of ginger at Obubra, Cross River State, Nigeria (2007)

Nitrogen level (kg/ha)	Plant height (cm)	No. Of leaves/plant	Leaf Area (cm^3)	No. Of shoot/plant	Ginger yield(t/Ha)
N_0	50.0	18.7	21.3	5.5	4.8
N_{100}	60.3	15.6	19.3	5.7	6.2
N_{200}	46.0	13.3	22.0	4.5	8.1
N_{300}	63.0	16.5	22.0	7.3	8.0
N_{400}	63.7	10.4	36.3	5.8	6.2
Mean $LSD_{(0.05)}$	56.6	14.7	24.2	5.8	6.7
	5.12	2.61	4.81	1.12	1.52
Effect of Potassium					
K_0	50.0	18.8	21.3	5.5	4.8
K_{50}	64.0	11.7	31.3	9.4	6.5
K_{100}	62.0	10.8	26.0	7.5	6.4
K_{150}	63.0	12.6	32.0	5.9	8.0
K_{200}	66.3	14.1	30.3	7.3	6.2
Mean	61.0	13.6	29.2	7.1	6.4
$LSD_{(0.05)}$	10.24	4.68	5.68	1.04	1.82

Table 3a: Interaction effect of N and K on the yield and yield attributes of Ginger at Obubra, Cross River State, Nigeria in 2006

Nitrogen level (kg/ha)	K level (kg/ha)	Plant height (cm)	No. Of leaves/plant	Leaf Area (cm^3)	No. Of shoot/plant	Ginger yield(t/Ha)
N_0		29.6	9.7	20.8	4.6	4.5
N_{100}		28.2	11.2	36.7	4.5	3.8
N_{200}	K_0	50.0	12.8	32.4	4.8	4.6
N_{300}		54.7	14.1	30.1	4.8	5.0
N_{400}		58.5	14.5	32.7	4.9	4.6
N_0		33.8	10.3	19.6	4.5	4.8
N_{100}		43.1	11.8	22.3	4.6	4.6
N_{200}	K_{50}	49.9	11.2	30.5	4.6	4.4
N_{300}		51.2	13.5	31.8	4.7	4.0
N_{400}		54.1	14.2	33.1	4.5	4.2
N_0		28.6	9.8	21.8	4.3	3.8
N_{100}	K_{100}	40.7	11.4	24.6	4.5	4.1
N_{200}		59.9	13.7	32.3	4.0	4.0
N_{300}		62.5	14.1	32.8	5.2	4.6
N_{400}		60.2	15.6	33.5	5.2	6.1
N_0		40.7	11.2	20.3	4.7	5.5
N_{100}		46.2	12.8	28.9	4.8	5.7
N_{200}	K_{150}	50.6	12.6	33.8	5.0	5.1
N_{300}		51.3	11.7	31.2	5.0	5.2
N_{400}		48.1	12.4	29.1	4.8	3.9

N_0		38.1	10.5	21.5	4.6	5.1
N_{100}		43.6	9.9	20.4	4.6	5.4
N_{200}	K_{200}	40.1	9.4	25.8	4.0	5.4
N_{300}		47.3	10.8	30.1	4.5	5.6
N_{400}		39.1	9.6	27.6	4.1	4.8
$LSD_{(0.05)}$		1.68	1.53	1.73	0.21	0.57

Table 3b: Interaction Effect of N and K on the Yield and Yield Attributes of Ginger at Obubra, Cross River State, Nigeria in 2007

Nitrogen level (kg/ha)	K level (kg/ha)	Plant height (cm)	No. Of leaves/plant	Leaf Area (cm^3)	No. Of shoot/plant	Ginger yield (t/Ha)
N0		35.7	10.5	25.3	4.6	4.5
N100		49.9	10.6	32.1	5.4	5.7
N200	K_0	46.9	13.8	30.5	6.7	4.7
N300		54.6	15.3	31.7	5.9	4.5
N400		51.4	16.9	33.6	4.2	4.5
N0		29.5	12.1	21.3	5.5	4.6
N100		42.8	14.3	30.3	9.4	4.8
N200	K_{50}	58.7	15.1	26.1	7.5	4.1
N300		61.5	16.9	22.4	5.9	4.3
N400		62.8	16.5	30.5	7.3	3.9
N0		28.9	10.3	33.0	5.0	5.1
N100	K_{100}	47.5	13.4	31.3	7.4	8.5
N200		51.4	14.8	30.3	7.1	7.9
N300		51.8	15.1	32.7	5.9	6.0
N400		52.9	15.7	35.0	5.6	5.3
N0		40.3	11.5	21.0	5.1	5.6
N100		46.9	13.8	32.7	5.6	6.0
N200	K_{150}	55.1	14.0	31.0	6.1	6.5
N300		57.8	15.7	33.3	6.3	6.9
N400		61.9	16.8	35.0	6.5	6.0
N0		45.1	12.3	25.0	5.3	5.7
N100		58.6	12.6	34.0	5.3	5.4
N200	K_{200}	50.1	14.5	25.3	5.5	5.1
N300		52.7	16.3	23.3	5.6	5.2
N400		62.8	16.8	29.7	5.6	6.1
$LSD_{(0.05)}$		1.82	1.41	1.63	0.23	0.54

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