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EFFECT OF NITROGEN AND POTASSIUM ON THE YIELD AND QUALITY OF GINGER IN HILL SLOPE

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ABSTRACT

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The field experiment on ginger was carried out at South-Eastern Hilly region at Hill Tracts Agricultural Research Station, Ramgarh, Khagrachari during the seasons of 2004-2005 and 2005-2006 to evaluate the response of ginger with different levels of nitrogen (N) (0, 120, 150 and 180 kg/ha) and potassium (K)(0, 100, 130 and 160 kg/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 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 and K at highest rate N_{180} K_{160} kg/ha significantly augmented the ginger yield and other yield parameters. However, the highest plant height (63.7cm and 64.3cm), maximum number of leaves (19.2 and 19.7 /plant) and fingers numbers (16.3 and 16.6 /plant) were recorded at N_{180} K_{160} kg/ha and significantly different over N_0K_0. Similarly, other yield parameters like ginger weight and rhizome yield was also significantly influenced by combined application of N and K up to N_{180} K_{160} kg/ha. However, the highest yield (26.3 t/ha and 27.6 t/ha) and the two years mean yield 26.95 t/ha were recorded by said dose of N and K @ N_{180} K_{160} kg/ha.

Keywords: Effect of N and K, ginger yield and quality

INTRODUCTION

Ginger (*Zingiber Officinale*) is a very potential spice crop in Bangladesh. It has same versatileness in medicine, culinary preparation. It posses a special aromatic flavor and pungency. In Chittagong Hilly region, ginger is widely grown as a cash crop. It can no way be denied that Chittagong Hill Tracts is a potential for spices crop like ginger and turmeric. However, the hilly peoples follow the very traditional technique to grow this spice in different degrees of hill elevations following along the slope plantation system. Resulting, ignoramus soil erosion takes place during torrential rain in pick monsoon. This causes the soil fertility depletion. Besides this, the Jhumy people do not have any recommended dose of fertilizers and they were often use chemical fertilizers in spice crops. Micro-nutrients have special significance in spices production and on their post harvest life. It is evident that, micronutrients specially Zn and B can reduce the disease incidence and make the tough of the tissues. Resulting spice quality and post harvest duration can be enhanced by applying appropriate dosage of micro- nutrients. Among chemical fertilizers, N and K were highly responsive to ginger production. Turmeric and Ginger are both the two spice crops prefer shadow place and well drained light textured soils for boosting yield. Gowda *et al* 1989, Wilson and Ovid, 1993 and Sugtto and Mafzuchah, 1995 stated that N and K increased the quality of young ginger rhizome and produced average fresh yield of rhizome. Similar results were found in the findings of Babu *et al*, 1997 and Roy *et.al* 1992. However, very sporadic works have been done over chemical fertilization in ginger cultivation in our country. Therefore, such type of study has been initiated to evaluate the response of ginger to various levels of N and K for high yield potential of ginger in hill tracts region.

MATERIALS AND METHODS

The field experiment was conducted at Brown Hill Soils of South- Eastern Hilly region at Hill Tracts Agricultural research Station, Ramgarh, Khagrachari during the kharif season of 2004-2005 and 2005-2006. The experiment was laid out in randomized block design with three replications. The unit plot size and seed to seed distance were 4m x 5m and 50cm x 25cm respectively. Local cultivar of ginger was taken as a test crop. There were sixteen treatment combinations each of 4 levels of N (0, 120, 150 and 180 kg/ha) and 4 levels of K (0, 100, 130 and 160 kg/ha) in the field study. All fertilizers except N were applied at final land preparation. N was applied in ginger plots in three equal installments at 25, 45 and 60 days of sprouting. Ginger rhizome (seeds) were planted @ 2.5 t/ha on April 2004 and 2005 and harvested on first week and mid February 2005 and 2006 of late rabi seasons respectively. All necessary intercultural operations were done in time. Data on different yield and other yield parameters were recorded from 10 randomly selected plants from each treatment. The collected data were analyzed statistically and adjusted with least significance (LSD) at 5% level of significance.

Table 1. Nutrient status of experimental soil prior to fertilizer application

Chemical Properties	PH	OM	Ca	Mg	K	Total N%	P	S	B	Cu	Fe	Mn	Zn
		Meg/100g					mg/g						
Initial Soil Values	4.5	0.90	1.2	0.5	0.09	0.056	3.0	11	0.23	3.8	200	12	1.2
Critical level	_	_	2.0	0.8	0.2	_	14.0	14.0	0.2	1.0	10.0	5.0	2.0

RESULTS AND DISCUSSION

Effect of N

The means of observation of different parameters of ginger are presented in Table 2a and 2b respectively. It is revealed from Tables that N either in single or in combination had significant effect on the yield and other yield attributes 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 180 kg/ha which was significantly different over N_0. Here 4 levels of N was used in treated plots but 150 kg N/ha responded best and the highest plant height 56.3cm and 87.1cm), maximum leaves number (17.30 and 18.30 /plant and fingers number (27.8 and 14.5 /plant) respectively in both the years. Weight of ginger per plant, ginger size and ginger yield also significantly increased with the same dose of N (N_{180} kg/ha). However, the highest ginger yield (22.3 t/ha and 26.3 t/ha) and the mean yield 24.3 t/ha were obtained at the same N rate (N_{180} kg/ha) in two consecutive years of study. This result was in conformity with the findings of Gupta *et al*; 1998 and Gowda, 1999.

Effect of K

It is evident from the Tables 2a and 2b revealed that ginger significantly responded to the different levels of K. It is also found that with the increase of K rates, growth and other yield parameters progressively increased up to 160 kg K/ha. Like N, K was also found responsive to ginger but effect of K was not as pronounced as the N did. However, K at 160 kg/ha showed better result than that of other levels and K_0. The yield attributes of ginger increased positively when 100 kg K/ha was applied in treated ginger plants. Plant height, number of leaves, fingers number responded significantly to the K levels (0, 100, 130 and 160 kg K/ha). K at the highest level (160 kg K/ha) produced the highest plant height (44.6cm and 45.3cm) maximum leaves number (15.17 and 15.8 /plant) and fingers number (13.0 and 13.4 /plant) respectively. Other parameters like weight of ginger /plant and ginger yield significantly increased by the same dose of K (K_{100} kg/ha) while K_0 failed to produced optimum yield. However, the highest rhizome yield (21.6 t/ha and 23.8 t/ha) and the mean yield (22.7 t/ha) of ginger was recorded at K_{100} kg/ha and significantly differed over K_0 in two studied years. Sugtto *et al*; 1995 supported the above results and reported that K increased the plant growth and rhizome yield with increase of K levels.

Table 2a. Main effect of nitrogen and potassium on the yield and yield attributes of ginger at HARS, Ramgarh during 2004-05

Nitrogen level Kg/ha	Plant height (cm)	No. of leaves/ plant	Fingers No.			Wt. of fingers/ plant (g)	Wt. of corms/ plant (g)	Finger size (cm)		Ginger yield (t/ha)
			Primary fingers	Secondary fingers	Tertiary fingers			Length	Diameter	
N_0	20.1 d	8.8d	2.6d	3.6d	3.2d	201d	22.2d	3.7d	5.2d	11.7d
N_{120}	32.3 c	13.2c	3.2c	4.5c	3.6c	220c	31.3c	4.2c	6.0c	17.2c
N_{150}	48.2 b	15.3b	3.6b	5.2b	3.8b	240b	34.3b	4.6b	6.8b	20.0b
N_{180}	56.3 a	17.3a	3.9a	6.6a	3.9a	250a	37.2a	4.7a	7.3a	22.3a
LSD(0.05)	*	0.71	0.20	*	*	*	*	*	*	*
Effect of Potassium										
K_0	32.2d	12.3d	3.3d	4.2	3.2d	180d	29.3d	4.0d	5.8d	16.2d
K_{100}	39.3c	13.8c	3.5c	4.8	3.5c	203c	31.2c	4.2c	6.3c	17.3c
K_{130}	42.1b	14.0b	3.76b	5.2	3.6b	230b	34.26	4.66	6.7b	19.1b
K_{160}	44.6a	15.7a	3.8a	5.5	3.7a	239a	36.3a	4.9a	6.8a	21.6a
LSD(0.05)	*	0.71	0.26	*	*	*	*	*	*	*

Table 2b. Main effect of Nitrogen and Potassium on the yield and yield attributes of ginger at HARS, Ramgarh, Khagrachari during 2005-2006

N level (kg/ha)	Plant height (cm)	No. of leaves /plant	No. of fingers			Wt. of fingers /plant (g)	Wt. of corms /plant (g)	Ginger yield (t/ha)
			Primary fingers	Secondary fingers	Tertiary fingers			
N_0	21.2d	9.1d	2.7d	2.6d	3.3d	203d	20.2d	10.3d
N_{120}	33.0c	13.3c	3.3c	3.3c	3.7c	221c	22.3c	18.3c
N_{150}	48.3b	16.0b	3.7b	3.7b	3.9b	250b	24.3b	21.3b
N_{180}	57.1a	18.3a	3.7a	3.9a	6.8a	360a	33.0a	26.3a
LSD (0.05)	*	0.73	0.22	*	*	*	*	*
CV (%)	*	*	*	*	*	*	*	*
Effect of Potassium								
K_0	33.d	12.3d	3.3d	4.2d	3.3d	182d	27.3d	10.2d
K_{100}	39.6c	13.6c	3.6c	4.9c	3.6c	212c	33.3c	16.7c
K_{130}	43.0b	14.03b	3.8b	5.3b	3.7b	240b	35.2b	18.9b
K_{160}	45.3a	15.8a	3.9a	5.6a	3.9a	320a	37.0a	23.8a
LSD (0.05)	0.73	0.22	*	*	*	*	*	*
CV (%)	*	*	*	*	*	*	*	*

Interaction effect of N and K

Yield and yield attributes of ginger are shown in Table 3a and 3b respectively. The significance response on all the studied parameters were made by the combined application of N and K. It is early noticed in Tables revealed that N and K in combination made a significant contribution in ginger production. Both N and K, in single or in combination had exhibited significant influence on yield and other yield components of ginger. But it is evident that combined effect of N and K was found more reactive than N and K did in single application. However, it was observed from two years studied that with the increase doses of N and K, all the yield contributing characters increase significantly in liner way up to the level of N_{180} K_{100} kg/ha. The highest plant height (63.7cm and 64.3cm), maximum leaves number (19.2 and 19.7 /plant) and fingers number (16.3 and 16.6 /plant) were recorded at the highest level of N_{180} K_{100} kg/ha. Other yield contributing parameters like weight of ginger per plant and ginger yield also significantly progressed by the same treatment combination (N_{180} K_{100} kg/ha) of nitrogen and potassium. However, the highest fingers weight (270g and 273 g /plant) and rhizome yield (26.3 t/ha and 27.6 t/ha) were obtained from said (N_{180} K_{100} kg/ha) treatment combination where as N_0K_0 did not give optimum ginger yield. Venkatesh *et al*; 1998 found similar results in their observations.

Table 3a. Interaction effect of N and K on the yield and yield attributes of ginger at HARS, Ramgarh during 2004-2005

N level (Kg/ha)	K level (Kg/ha)	Plant height (cm)	No. of leaves/ plant	Fingers No.			Wt. of fingers / plant (g)	Wt. of corms/ plant (g)	Finger size (cm)		Ginger yield (t/ha)
				Primary fingers	Secondary fingers	Tertiary fingers			Length	Diameter	
N_0	K_0	12.2	7.0	2.3	2.7	2.9	143	20.6	3.1	4.4	11.5
N_{120}		23.2	10.3	3.2	4.3	3.3	172	25.7	4.2	6.2	16.7
N_{150}		37.1	12.2	3.6	4.8	3.4	187	33.1	4.3	6.6	19.3
N_{180}		47.2	15.3	3.7	6.3	4.1	220	36.6	4.8	7.3	23.6
N_0	K_{100}	20.3	8.8	2.8	3.4	3.2	153	22.3	4.0	5.3	11.8
N_{120}		32.2	11.3	3.0	4.1	3.5	170	29.2	4.2	6.2	17.2
N_{150}		44.3	14.4	3.5	5.0	3.6	189	35.2	4.5	6.6	20.1
N_{180}		59.1	15.3	3.6	6.4	4.2	220	39.1	5.6	7.4	22.8
N_0	K_{130}	20.3	10.2	3.1	4.1	3.2	160	28.1	4.0	6.1	13.1
N_{120}		33.7	11.3	3.2	4.5	3.4	170	32.3	4.3	6.3	18.2
N_{150}		46.1	14.3	3.7	5.2	3.6	201	34.4	4.5	7.2	21.0
N_{180}		57.3	16.6	3.8	6.3	4.2	253	37.3	5.5	7.8	23.3
N_0	K_{160}	21.7	10.2	3.2	4.3	3.1	160	30.1	4.1	6.2	14.1
N_{120}		39.2	12.3	3.3	4.7	3.6	170	32.2	4.3	6.3	18.2
N_{150}		51.6	16.3	3.6	5.2	3.7	210	36.2	4.6	7.2	22.3
N_{180}		63.7	19.2	4.4	7.1	4.8	270	41.3	5.8	8.1	26.3
LSD (0.05)		1.23	1.4	0.49	0.25	0.13	9.22	1.53	0.11	0.13	0.43
CV %		3.7	6.3	7.3	4.7	3.2	2.8	2.7	8.3	4.7	5.2

Table 3b. Interaction effect of N and K on the yield and yield attributes of ginger of HARS, Ramgarh, Khagrachari during 2005-2006

N Level (kg/ha)	K Level (kg/ha)	Plant height (cm)	No. of leaves/ plant	No. of fingers			Wt. of fingers /plant (g)	Wt. of corms /plant (g)	Finger size (cm)		Ginger yield (t/ha)
				Primary fingers	Secondary fingers	Tertiary fingers			Length	Diameter	
N_0		13.0	8.0	2.2	2.8	2.8	142	20.2	3.1	4.3	11.9
N_{120}		24.0	11.3	3.3	4.4	3.3	173	26.0	4.0	6.3	16.8
N_{150}	K_0	40.0	13.0	3.7	4.9	3.6	188	34.3	4.4	6.6	20.0
N_{180}		48.3	15.7	3.9	6.6	4.3	225	37.1	4.9	7.7	24.7
N_0		21.0	9.0	2.9	3.3	3.3	156	23.1	4.1	5.4	12.3
N_{120}		33.0	12.0	3.2	4.2	3.6	173	29.6	4.3	6.3	18.6
N_{150}	K_{100}	46.1	15.2	3.6	5.2	3.8	190	36.3	4.6	6.7	21.8
N_{180}		61.0	15.7	3.8	6.5	4.3	221	40.3	5.7	7.7	23.2
N_0		22.0	10.3	3.2	4.2	3.3	160	28.3	4.2	6.2	13.8
N_{120}		35.2	11.6	3.2	4.6	3.6	172	33.1	4.3	6.4	18.9
N_{150}	K_{130}	48.0	14.8	3.8	5.3	3.7	220	35.2	4.6	7.3	22.0
N_{180}		59.3	17.3	4.0	6.6	4.3	258	38.3	5.7	8.3	24.0
N_0		21.9	11.0	3.1	4.4	3.2	162	31.0	4.2	6.3	14.2
N_{120}		40.0	13.3	3.4	4.8	3.7	172	33.0	4.4	6.4	19.3
N_{150}	K_{160}	51.3	16.2	3.6	5.2	3.9	213	42.3	4.7	7.6	23.2
N_{180}		64.3	19.7	4.5	7.2	4.9	273	43.0	5.9	8.2	27.6
LSD (0.05		1.20	1.42	0.51	0.21	0.11	9.18	1.54	0.10	0.11	0.41
CV (%)		4.9	7.0	6.6	5.2	3.3	4.9	6.3	8.0	4.9	6.1

It was revealed from two years study that N and K @ N_{180} K_{160} kg/ha along with the blanket dose of other nutrients was found to be optimum for maximizing yield of ginger in South- Eastern hilly region. So, it may be suggested that Nitrogen and Potassium @ N_{180} K_{160} kg/ha can be suitable fertilizer package for ginger production in Chittagong Hill Tracts region.

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