

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

M. M. HAQUE<sup>1</sup>, A. K. M. M. RAHMAN<sup>2</sup>, M. AHMED<sup>1</sup>, M. M. MASUD<sup>3</sup> AND M. M. R. SARKER<sup>4</sup>

<sup>1</sup>Scientific Officer, Hill Tracts Agricultural Research Station, Ramgarh, Khagrachari, <sup>2</sup>Chief Scientific Officer, RARS, Hathazari, Chittagong,

<sup>3</sup>Scientific Officer, Soil Science Division, BARI, Gazipur, <sup>4</sup>Scientific Officer, OFRD, Sylhet, Bangladesh

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### ABSTRACT

**Haque M. M., Rahman A. K. M. M., Ahmed M., Masud M. M. and Sarker M. M. R. 2007.** *Effect of Nitrogen and Potassium on the Yield and Quality of Turmeric in Hill Slope.* Int. J. Sustain. Crop Prod. 2(6):10-14

A field study of nitrogen (N) and potassium (K) on turmeric was carried out at South-Eastern hill soils at Hill Tracts Agricultural Research Station, Ramgarh, Khagrachari to evaluate the response of turmeric to various levels of N and K. It is revealed that N and K both either in single or in combination had significant effect on yield and yield contributing characters of turmeric. It was also noticed that turmeric was found to be more responsive especially to N and K. However, the combined effect of N and K increased the yield and other yield parameters up to N<sub>180</sub> K<sub>100</sub> kg/ha and significantly differed over control (N<sub>0</sub>K<sub>0</sub>). The highest plant height (110.2cm and 107.3cm), maximum leaves number per plant (13.8 and 14.3 /plant) and number of fingers (55.10 and 46.8 /plant) were recorded with N<sub>180</sub> K<sub>100</sub> kg/ha. Similarly, finger size, finger weight and yield were also significantly influenced by applying N and K. The highest finger size (8.7cm x 8.3cm and 8.6cm x 8.7cm), maximum finger weight (450g and 457g /plant), the height turmeric yield (26.7 t/ha and 28.2 t/ha) and the mean yield 27.45 t/ha was recorded by said treatment combination of N<sub>180</sub> K<sub>100</sub> kg/ha which was highly differed over other treatment and control (N<sub>0</sub>K<sub>0</sub>).

**Keywords:** Turmeric yield, combined effect of N and P

### INTRODUCTION

Turmeric (*Curcuma Longa* L.) is a potential cash crop in Chittagong Hill Tracts Region. Spice like turmeric is an integral part of daily curry preparation for its typical color and flavor. Not only this, it is used in medicine and cosmetics and as dye in textile industries (Pruthi, 1976). The tribal and hilly farmers usually plant turmeric in hill slopes either in the form of shifting cultivation locally known as Jhum cultivation or in furrows after conventionally preparing the land with subsequent ridging. These methods of cultivation were very much hazardous for soil erosion due to excessive rainfall during monsoon months. Since most of the lands in this area are hilly and sloppy, no tillage or minimum tillage system of cultivation could be best suited for this area as they reduce soil erosion to almost zero (Van Doran, 1977). Though turmeric can be grown in a wide variety of soil but it prefers to grow in light textured soil under shadow place. Though the hilly farmers grow this spice crop extensively in hilly region, but they do not follow any fertilizing practice. That's why the Jhumy peoples are deprived of getting desired yield of turmeric. This broad leaved spice is highly responsive to chemical fertilizers. Specially N and K are two important fertilizers for boosting growth and field of turmeric. Banafor *et al* 1995 and Sugtto, *et.al* 1995 reported that with the increase in K levels growth, leaves number, tillers number and rhizome yield increased.

Similarly, Power *et. al* 1992 and Pandey, 1992 stated that increasing rates of N significantly progressed the yield and other yield contributing characters of turmeric. However, very limited works of fertilization on turmeric have been reported in Bangladesh. Therefore, from above points of view, this field study was initiated to evaluate the response of turmeric to different levels of N and K for maximizing yield of turmeric in hilly region.

### MATERIALS AND METHODS

The experiment was conducted at Brown Hill Soils of South-Eastern Hilly Region at Hill Tracts Agricultural Research Station, Ramgarh, Khagrachari during the kharif seasons of 2004-2005 and 2005-2006 respectively. The experiment was set up in randomized block design having replications three. Plot dimension and plot spacing were 4 x 5m and 50 x 25cm respectively. Sixteen treatment combinations each of 4 levels of N (0, 50, 100 and 150 kg/ha) and 4 levels of K (0, 40, 80 and 100 kg) along with confined blanket dose of P, S, Zn and CD @ 30: 25: 2 kg and 10 t/ha were taken in the study. All cowdung phosphorus (P), potassium (K), sulphur (S) and Zinc (Zn) were applied during final land preparation as basal. N was applied to the turmeric in three installments at 25, 45 and 65 days after sprouting by ring placement method. Turmeric seed (rhizome) were planted on 15 April 2004 and 2005 and harvested on first week of February and late February, 2005 and 2006. All necessary intercultural operations were done as needed by the experiment. Data on different parameters from 10 randomly selected plants from each treatment were recorded in time. The recorded data were analyzed statistically and adjusted with least significant difference (LSD) at 5% level of significance.

## RESULTS AND DISCUSSION

### Effect of N

The main effect of N on the yield and yield attributes of turmeric are presented in Tables 2a and 2b. It is evident from the Table observed that plant height, leaves number, finger weight, finger size and turmeric yield were influenced by N application. It was also found that with the increment of N levels, all the yield contributing parameters increased progressively. However, plant height, leaves number and finger number increased tremendously with the increased of N levels up to 150 kg/ha. The highest plant height (101cm and 102.3cm), maximum leaves number (9.9 and 10.9 /plant) and the highest fingers per plant (42.4 and 43.7) were recorded when 150 kg N was applied followed by N<sub>100</sub> kg/ha while N<sub>0</sub> failed to exert optimum number of leaves, finger numbers and plant height respectively. Similarly, other parameters like finger weight, finger size and turmeric yield increased significantly at the same dosage of nitrogen (N<sub>150</sub> kg/ha). Maximum finger weight (380g and 382g /plant), finger size (4.3 x 7.4cm and 7.4 x 7.6 cm) and highest turmeric yield (23.7 t/ha and 24.3 t/ha) were also obtained by said N dose (150 kg/ha) in both the years of study. Power *et al*; 1992 and Pandey, 1992 confirmed the present results and reported that highest rhizome yield (33.0 t/ha) was obtained at 160 kg/ha.

### Effect of K

It is also observed that K had significant effect on the yield and yield characters of turmeric. The evidence shows that with the increase of K levels, yield contributing characters of turmeric increased progressively. But the effect of N on turmeric was found more distinct than K. It is evident from Tables 2a and 2b reveals that all the parameters increased simultaneously with the increase of K up to 100 kg K/ha. Like N, K enhanced plant height, leaves number and finger number per plant. Among four K levels (0, 40, 80 and 100 kg/ha), 100 kg/ha was found to be optimum and the highest plant height (96.3cm and 93.7cm) fingers number per plant (42.3 and 46.2 /plant) were obtained at 100 kg K/ha followed K<sub>80</sub> and K<sub>40</sub> kg/ha respectively in studied years of 2004-2005 and 2005-2006. In the same manner, the maximum finger size (9.68 x 6.6cm and 6.9 x 6.7cm) and the highest turmeric yield (21.2 t/ha and 23.1 t/ha) use recorded with same K level (100 kg K/ha). This result was in agreement with the findings of Banafar *et al*; 1995 they also found rhizome yield 2259 kg/ha by applying 100 kg K.

### Interaction effect of N and K

The means of observation of yield and yield attributes of turmeric are shown in Tables 2a and 2b respectively. The significant influences on all the factors studied were made by the application of N and K. Data on different parameters like plant height, number of leaves and number of fingers /plant significantly affected with the increase of N and K levels. The yield contributing characters of turmeric increased with the increment of N and K up to N<sub>180</sub> K<sub>100</sub> kg/ha. However, the highest plant height (110cm and 107.3cm), leaves number (13.8 /plant and 14.3 /plant) and highest number of fingers per plant (55.10 and 46.8) were recorded with the increased dose N<sub>180</sub> K<sub>100</sub> kg/ha followed by N<sub>180</sub> K<sub>80</sub> kg/ha and significantly differed over control (N<sub>0</sub>K<sub>0</sub>) in two studied years of 2004-2005 and 2005-2006 respectively. It was also evident from the Tables that combined effect of N and K was more distinct and pronounced than the single effect of N and K. Similar trend was found in weight of fingers, finger size and yield of turmeric with successive addition of N and K levels. Maximum fingers weight per plant (450g and 457g), finger size (8.7 x 8.3cm and 8.6 x 8.7cm) and the highest turmeric yield (26.7 t/ha and 28.2 t/ha) and the two years mean yield 27.45 t/ha and more than 153% yield increased (over control) was recorded in said combination of N<sub>180</sub> and K<sub>100</sub> kg/ha which was highly differed over other treatment combinations.

Table 1a. Nutrient status of experimental soil prior to fertilizer application-2004

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

Source : Soil Science Laboratory, BARI.

Table 1b. Nutrient status of experimental soil prior to fertilizer application-2005

Chemical properties	PH	OM	Ca	Mg	K	Total N %	P	S	B	Cu	Fe	Mn	Zn
		Meg/100g				mg/g							
Initial Soil Values	4.7	0.93	1.2	0.53	0.08	0.059	4.0	10	0.23	3.9	202	13	1.3
Critical level	-	-	2	0.8	0.2	-	14.0	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 turmeric at HARS, Ramgarh during 2004-05

N 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 <sub>0</sub>	71.2d	6.6d	3.1d	17.2d	11.2d	312d	6.3d	4.3d	4.2d	13.2d
N <sub>120</sub>	86.3c	8.3c	4.2c	19.3c	13.3c	331c	7.2c	5.7c	5.8c	14.7c
N <sub>150</sub>	92.2b	8.76b	4.8b	20.3b	14.1b	362b	7.6b	6.6b	6.4b	18.2b
N <sub>180</sub>	10.18a	9.9a	5.7a	21.6a	15.1a	380a	8.2a	7.3a	7.4a	23.7a
LSD (0.05)	*	*	*	*	*	*	*	*	*	*

Effect of potassium

K <sub>0</sub>	82.3d	7.3d	4.4d	18.2d	13.1d	332d	7.1d	5.7d	5.3	15.3d
K <sub>40</sub>	85.2c	8.3c	4.6c	21.1c	14.0c	340c	7.2c	6.2c	6.2	18.2c
K <sub>80</sub>	91.3b	9.2b	4.8b	21.7b	14.3b	350b	7.4b	6.5b	6.3	19.3b
K <sub>100</sub>	93.7a	9.7a	5.1a	22.1a	15.1a	356a	7.5a	6.8a	6.6	21.2a
LSD (0.05)	*	*	0.26	*	*	*	*	*	*	*

Table 2b. Main effect of Nitrogen and Potassium on the yield and yield attributes of turmeric 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)	Finger size (cm)		Turmeric yield (t/ha)
			Primary fingers	Secondary fingers	Tertiary fingers			Length	Diameter	
N <sub>0</sub>	71.0d	6.6d	3.2d	17.8d	11.3d	313d	6.6d	4.3d	4.3d	13.4d
N <sub>120</sub>	86.1c	8.4c	4.3c	19.6c	13.2c	333c	7.3c	5.8c	5.9c	15.0c
N <sub>150</sub>	93.0b	8.9b	4.8b	21.0b	14.3b	363b	7.7b	6.7b	6.7b	18.7b
N <sub>180</sub>	102.3a	10.9a	5.8a	21.7a	16.2a	382a	8.2a	7.4a	7.6a	24.3a
LSD (0.05)	*	*	*	*	*	*	*	*	*	*

Effect of K

K <sub>0</sub>	82.0d	7.3d	4.6d	18.0d	13.2d	333d	7.1	5.6d	5.8d	15.3d
K <sub>40</sub>	85.2c	8.3c	4.7c	21.6c	16.3c	343c	7.3	6.3c	6.3c	18.6c
K <sub>80</sub>	91.3b	9.3b	4.9b	22.0b	17.8b	351b	7.5	6.7b	6.4b	20.0b
K <sub>100</sub>	96.3a	9.8a	5.2a	23.1a	17.9c	360a	7.6	6.9a	6.7a	23.1a
LSD (0.05)	*	*	*	*	*	*	*	*	*	*

\* Indicates significant at 5% level.

Table 3a. Interaction effect of nitrogen and potassium on the yield and yield attributes of turmeric at HARS, Ramgarh during 2004-05

N level K(g/ha)	P 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)		Turmeric yield (t/ha)
				Primary fingers	Secondar y fingers	Tertiary fingers			Len gth	Diameter	
N <sub>0</sub>	K <sub>0</sub>	57.0	5.0	3.6	15.0	11.3	310	5.0	4.0	3.3	10.1
N <sub>120</sub>		80.0	8.1	4.4	17.3	14.2	380	7.3	5.0	4.8	13.30
N <sub>150</sub>		87.0	9.3	4.7	18.8	13.7	407	7.7	6.2	5.3	15.2
N <sub>180</sub>		93.0	10.5	4.8	20.0	15.2	412	7.9	7.3	6.8	20.0
N <sub>0</sub>	K <sub>40</sub>	72.1	6.2	4.1	18.3	13.2	330	6.3	4.3	4.0	13.3
N <sub>120</sub>		83.3	8.3	4.7	19.6	13.8	380	7.4	5.2	5.6	15.2
N <sub>150</sub>		87.1	9.4	5.0	20.7	14.7	404	7.7	6.3	6.7	17.0
N <sub>180</sub>		94.3	11.7	5.3	21.8	15.0	413	8.0	7.2	7.3	22.7
N <sub>0</sub>	K <sub>80</sub>	76.3	6.3	4.3	19.0	13.3	360	6.7	5.3	4.7	14.0
N <sub>120</sub>		85.1	7.9	4.7	21.0	13.8	390	7.6	5.7	5.3	15.6
N <sub>150</sub>		94.3	1.3	4.9	21.6	14.2	403	7.7	6.8	6.8	17.3
N <sub>180</sub>		105.1	12.6	5.8	23.1	16.0	323	8.5	7.7	7.8	25.3
N <sub>0</sub>	K <sub>100</sub>	79.1	7.6	4.5	20.3	13.5	380	6.7	5.3	5.3	14.2
N <sub>120</sub>		91.2	10.1	4.7	21.7	13.8	390	7.8	6.2	6.2	16.2
N <sub>150</sub>		97.3	10.7	5.4	22.8	14.3	411	7.8	7.1	7.2	18.3
N <sub>180</sub>		110.2	13.80	5.7	23.6	15.8	450	8.6	8.7	8.3	26.7
LSD (0.05)		2.51	1.03	0.22	0.60	0.16	4.30	0.16	0.14	0.31	0.57
CV%		3.2	6.2	3.7	7.2	7.5	6.8	3.8	3.6	3.7	5.3

Table 3b. Interaction effect of Nitrogen and potassium on the yield and yield attributes of turmeric 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)		Turmeric yield (t/ha)
				Primary fingers	Secondary fingers	Tertiary fingers			Length	Diameter	
N <sub>0</sub>	K <sub>0</sub>	58.0	5.0	3.3	16.0	11.4	303	5.0	4.0	3.3	11.2
N <sub>120</sub>		82.3	8.3	4.5	16.0	14.3	370	7.6	5.3	4.9	16.3
N <sub>150</sub>		88.0	9.4	4.8	19.2	13.8	412	7.7	6.3	5.2	21.3
N <sub>180</sub>		94.3	11.0	4.9	21.3	15.3	420	7.9	7.8	6.9	20.7
N <sub>0</sub>	K <sub>40</sub>	73.0	6.6	4.3	18.3	13.4	320	6.4	4.3	4.1	13.7
N <sub>120</sub>		84.1	8.4	4.8	19.7	13.7	387	7.5	5.2	5.7	16.3
N <sub>150</sub>		88.3	9.6	5.3	20.0	15.2	412	7.8	6.3	6.9	17.9
N <sub>180</sub>		95.6	11.8	5.6	21.0	15.6	420	8.3	7.8	7.3	23.2
N <sub>0</sub>	K <sub>80</sub>	77.0	6.4	4.3	20.3	13.3	360	6.7	7.6	4.8	14.3
N <sub>120</sub>		78.2	8.0	4.8	21.0	13.9	393	7.7	7.8	5.2	16.2
N <sub>150</sub>		86.3	11.3	4.9	21.3	14.6	403	8.8	8.6	6.8	17.5
N <sub>180</sub>		95.3	13.3	6.0	22.3	16.5	408	6.9	8.9	7.8	25.3
N <sub>0</sub>	K <sub>100</sub>	80.0	8.0	4.6	20.4	14.2	380	7.7	7.7	6.3	14.3
N <sub>120</sub>		92.0	11.0	4.8	22.3	14.3	400	7.9	7.8	6.4	17.3
N <sub>150</sub>		98.0	11.3	5.3	23.2	16.2	410	8.3	8.0	8.0	19.8
N <sub>180</sub>		107.3	14.3	6.0	24.2	16.6	457	8.6	8.7	8.7	28.2
LSD (0.05)	-	2.49	1.02	0.20	0.61	0.17	4.3	0.17	0.18	0.33	0.60
CV (%)	-	6.2	7.3	6.3	7.3	5.9	5.6	6.2	6.2	6.4	4.9

It is summarized from two years observation that 150 kg N and 100 kg K/ha was found to be optimum for turmeric production. It may be concluded that N<sub>150</sub> K<sub>100</sub> kg/ha along with recommended doses of other nutrients can be prescribed for maximizing turmeric yield in Brown Hill Soils of hilly region.

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