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Effect of fertilizer and lime on the performance of turmeric-ghora neem based agroforestry system

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Abstract: The present study was conducted at farmer's ghora neem wood lot adjacent to HSTU research farm, Dinajpur during the period from April to December 2007, to investigate the effect of fertilizer and lime on the performance of turmeric-ghora neem (*Melia agedirach)* based agroforesrty system. The experiment consisted of four treatments i,e. T_1 (no fertilizer), T_2 (cowdung), T_3 (cowdung and dolo choon), T_4 (recommended dose of fertilizers, cowdung and dolo choon). The experiment was laid out in Randomized complete block design (RCBD) with 3 replications. The values of all growth parameters (plant height, number of leaves/plant, number of tillers/plant, Length of leaf blade) of Turmeric was found highest in application of balanced fertilizer + cowdung + dolo choon (T_4), which was fallowed by cowdung + dolo choon (T_3). Significantly the lowest values were observed in all above parameter in no fertilizer (T_1). The highest yield (42.40 t/ha) was recorded in cowdung + dolo choon treatment followed by balanced fertilizer + cowdung + dolo choon (40.7 t/ha) and the lowest yield was found in no fertilizer treatment (29.17 t/ha).The study revealed that for maximum production of turmeric under partial shade condition in slide acidic soil, application of dolo choon with cowdung is enough for fertilization.
Key words: Lime, turmeric, ghora neem and agroforestry system

Introduction

The people of Bangladesh irrespective of classes and races traditionally use different kind of species in making curries in their daily life. Among the different spices, turmeric (C*urcuma longa*) is the most important spices, which are not only used for making curries but also for medicine as a carminative and aromatic stimulant to the gastrointestinal tract (Purseglove, 1968) and many other purposes. It is traditionally known as shade tolerant spice crop and sometimes grown in the homestead, hill and forest area under shading conditions. It can be grown up to an altitude of 1220 m in the Himalayan foothills (Purseglove *et al.,* 1981). This spice crop is commonly used by the people of Bangladesh irrespective of classes and races in making curries in their daily life. It is also used in medicine for its antibiotic action. The demand of turmeric is increasing in home and abroad due to its multiple uses. Turmeric is a high value crop and has a good production and export potentials (Siddique,1995). In Bangladesh, total production of turmeric is 44 thousand metric ton in an area of 16 thousand hectare (BBS, 2003). We have no scope to increase the command area of turmeric by reducing other field crops because there is a strong limitation of cultivable lands, which are engaged for staple food production. Under these circumstances agroforestry is the main alternative and homestead is the suitable venue for this crop. Mango, litchi and timber orchards in the northern part of Bangladesh are the potential area for production of turmeric as agroforestry practice. Woodlot of ghora neem is increasing day by day in that area. Peoples are preferring Ghoraneem for its quick growing nature (short rotate timber), easy establishment and insect repellent timber properties. A few farmers using these orchards for turmeric production and the performance of turmeric is very poor due to lack of managemant. The manuring in the tropics is more important than the temperate region, due to excessive weathering and leaching, the tropical soil becomes seriously impoverished in plant nutrients and proper manuring can only play a vital role in crop improvement. Cowdung contains all plant nutrients in a relatively small amount. On the other hand, inorganic fertilizer contains large amount of specific plant nutrient in readily available form. Therefore, inorganic fertilizer in combination with cowdung may lead to better performance of turmeric. Nutrients requirement of this crop has not yet been standardized from the scientific point of view. So, it is needed to evaluate the growth and development of turmeric grown under agroforestry system with different nutrient status through applying different doses of fertilizer and manures. With this view, the present investigation was undertaken to know the growth and yield performance of turmeric under ghora neem trees with different fertilizer status.

Materials and Methods

The present research work was carried out at farmers' Ghora neem wood lot adjacent to the Hajee Mohammad Danesh Science and Technology University (HSTU) research farm, Dinajpur during the period from April to December 2007.The woodlot was three years old, the mean height and dbh (diameter at breast height) of ghora neem trees were 11.5 m and 37.5cm respectively. The available average sunlight for turmeric (under Ghora neem canopy) during study period was 31259 lux. The site of the experiment is situated between $25^0$13 latitude and $88^0$23 longitudes at the elevation of 40 m above the sea level. The experiment was laid out in a medium high land belongs to the AEZ of old Himalayan piedmont plain area. The soil texture was sandy loam with pH 5.0. The structure of the soil was fine and the organic matter, total N, P, K, S, Zn & B content was 1.20%, 0.06, 29.35, 0.21, 6.13, 0.73 & 0.27 respectively. The experiment consisted of Four treatments i,e. T_1 (no fertilizer), T_2 (Cowdung), T_3 (Cowdung and DoloChoon), T_4 (Recommended dose of fertilizers , Cowdung and Dolochoon) and the variety of turmeric used in this experiment was Dimla (T-027). The experiment was laid out in Randomized complete block

design (RCBD) with 3 replications. The land was opened in the first week of April, 2007 and then prepared thoroughly by spading and cross spading to obtain a good tilth. Each plot size was 2.5 m x 1.2 m and replication to replication distance was 2 m. The crop was established during the second week of April 2007. The seed rhizomes of turmeric were planted maintaining 50 x 25 cm spacing at a depth of 7.5-8 cm. All intercultural operations and management practices were done throw the growing season. Data on growth, yield contributing characters as well as yield of the studied crop was recorded. Data were analyzed using MSTAT and mean separation was performed followed by DMRT Gomez and Gomez, 1984.

Results and Discussion

Plant height: Plant height of turmeric is significantly influenced by the treatments (Table 1). The tallest plant (115.3 cm and 161.2 cm) was recorded at T_4 at the 120 and 180 DAP respectively, which was followed by T_3. The plant height of T_3 at 120 DAP (113.9 gm) was statistically similar to T_4 but the plant height at 180 DAP (153.6 cm) was not identical. On the other hand, significantly the smallest plants were observed (at 120 DAP and 180 DAP 81.29 cm and 110.9 cm, respectively) in T_1 (no fertilizer). Moderate plant height was recorded under T_2. This was happened due to balanced fertilizer + cowdung + dolo choon supplies more plant nutrients.

Table 1. Effect of fertilizer and lime on Plant height and Number of tiller/plant of turmeric at different DAP

Treatment	Plant height (cm)		Number of tiller/plant	
	120 DAP	180 DAP	120 DAP	180 DAP
T_1	81.29 c	110.9 d	1.200 c	2.543 c
T_2	92.13 b	125.6 c	2.193 b	3.020 b
T_3	113.9 a	153.6 b	3.130 a	4.370 a
T4	115.3 a	161.2 a	3.700 a	4.790 a
LSD (0.05)	1.649	2.097	0.6190	0.4512

T_1= No fertilizer, T_2 = Cowdung, T_3 = Cowdung + Dolo Choon, T_4 = Balanced fertilizer + Cowdung + Dolo Choon

Table 2. Effect of fertilizer and lime on leaf characters of turmeric at different DAP

Treatment	Number of Leaf/plant		Length of Leaf blade (cm)		Breadth of Leaf blade (cm)	
	120 DAP	180 DAP	120 DAP	180 DAP	120 DAP	180 DAP
T_1	6.167 b	11.37 c	57.04 c	59.33 d	15.66 b	15.90 c
T_2	7.367 a	20.30 b	62.26 b	68.10 c	15.86 b	17.33 b
T_3	7.533 a	24.34 a	62.83 b	68.90 b	17.97 a	20.02 a
T4	7.483 a	24.80 a	65.07 a	73.93 a	18.38 a	20.30 a
LSD (0.05)	0.4143	1.179	0.9929	0.5398	0.9665	0.3343

T_1= No fertilizer, T_2 = Cowdung, T_3 = Cowdung + Dolo Choon, T_4 = Balanced fertilizer + Cowdung + Dolo Choon.

Table 3. Effect of fertilizer and lime on number of finger and finger weight per plant of turmeric at different DAP

Treatment	Number of finger/plant			Finger fresh wt./plant (g)			Finger dry wt./plant (g)		
	120 DAP	180 DAP	240 DAP	120 DAP	180 DAP	240 DAP	120 DAP	180 DAP	240 DAP
T_1	8.432 b	13.22 c	20.47 c	50.02 c	60.08 c	238.4 c	8.653 c	17.12 b	46.51 b
T_2	9.203 b	14.88 b	27.43 b	50.94 b	64.20 b	352.7 b	10.58 b	17.41 b	68.15 a
T_3	13.23 a	20.60 a	32.15 a	60.19 a	70.71 a	361.6 a	15.33 a	21.05 a	68.42 a
T4	12.40 a	20.25 a	29.24 b	59.59 a	70.13 a	349.8 b	14.30 a	20.58 a	68.09 a
LSD 0.05)	1.078	0.3996	2.566	0.8238	0.7231	7.720	1.156	0.3159	0.7502

T_1= No fertilizer, T_2 = Cowdung, T_3 = Cowdung + Dolo Choon, T_4 = Balanced fertilizer + Cowdung + Dolo Choon.

Table 4. Effect of fertilizer and lime on weight of rhizome per plant of turmeric at different DAP

Treatment	Rhizome fresh wt./plant (g)			Rhizome dry wt/plant (g)		
	120 DAP	180 DAP	240 DAP	120 DAP	180 DAP	240 DAP
T_1	47.71 d	54.14 d	85.79 d	4.683 c	6.493 b	12.17 b
T_2	50.73 c	67.51 c	105.3 c	5.333 b	9.993 a	12.60 b
T_3	54.61 a	76.32 a	109.2 a	6.650 a	10.10 a	15.93 a
T4	54.10 b	70.27 b	108.1 b	6.377 a	10.05 a	15.50 a
LSD (0.05)	0.4934	0.6978	1.070	0.5133	0.1998	0.6027

T_1= No fertilizer, T_2 = Cowdung, T_3 = Cowdung + Dolo Choon, T_4 = Balanced fertilizer + Cowdung + Dolo Choon.

Table 5. Effect of fertilizer and lime on yield contributing characters of turmeric at different DAP

Treatment	Fresh yield (t/ha)			Dry yield (t/ha)		
	120 DAP	180 DAP	240 DAP	120 DAP	180 DAP	240 DAP
T_1	8.80 d	10.28 d	29.17 c	1.20 c	2.13 d	5.28 b
T_2	9.51 c	11.58 c	41.21 b	1.47 b	2.46 c	7.53 a
T_3	10.36 a	13.32 a	42.40 a	1.98 a	2.80 a	7.59 a
T4	10.13 b	13.19 b	40.70 b	1.86 a	2.76 b	7.52 a
LSD (0.05)	0.1413	0.06318	0.6834	0.1264	0.0199	0.4512

T_1= No fertilizer, T_2 = Cowdung, T_3 = Cowdung + Dolo Choon, T_4 = Balanced fertilizer + Cowdung + Dolo Choon.

Number of tiller: Number of tiller per plant was influenced significantly by the different fertilizers treatments. The highest number of tiller per plant (3.700) was obtained from T_4 treatment at the 120 DAP. Which was statistically similar to that of T_3 (3.13). The number of tiller per plant from T_2 was 2.193 and 3.020 at the 120 and 180 DAP, respectively. Significantly the lowest number of tiller per plant (1.200) was found in T_1 at 120 DAP. On the other hand at 180 DAP the highest number of tiller per plant (4.790) was obtain from T_4. Which was statistically similar to that of T_3 (4.370). The minimum number of tiller per plant (3.020) was obtaining from T_2 and the lowest number of tiller per plant (2.543) from T_1. More the nutrient present more the tiller.

Number of leave: Significantly, the lowest number of leaves per plant was found in T_1 at both 120 DAP and 180 DAP (6.16 and 11.37, respectively) but at 120 DAP all the treatments produced statistically similar number of leaves per plant, of which T_3 possessed numerically higher value (7.533) which was followed by T_4 (7.48). On the other hand at 180 DAP only T_3 and T_4 produced statistically similar no. of leaves per plant of which T_4 possessed numerically higher value (24.8)

Length of leaf blade: At 120 DAP, significantly the longest leaf blade (65.07 cm) was recorded in T_4, which was followed by T_3 (62.83). The value of length of leaf blade (62.26 and 68.10 cm, respectively) was found in T_2 was statistically similar to T_3 followed by T_4.

Breath of leaf blade: Breath of leaf blade was varied significantly by different treatments. The highest breath of leaf blade was observed 18.38 cm and 20.30 cm at 120 and 180 DAP, respectively in T_4. The smallest leaf blade was observed in T_1 (15.66 cm and 15.90 cm) similar to T_2 and values were 15.86 cm and 17.33 cm at 120 and 180 DAP respectively.

Number of finger: Number of finger per plant is an important yield contributing character. The highest number of finger per plant was found (13.23, 20.60 and 32.15) at 120, 180 and 240 DAP in T_3 respectively, which was followed by T_4. Significantly the lowest number of finger per plant was recorded (8.432, 13.22 and 20.47) at 120, 180 and 240 DAP in T_1. Up to 180 DAP, T_3 and T_4 produced statistically similar number of finger but at 240 DAP T_3 produced significantly higher than T_4.

Finger fresh weight: Fresh finger weight per plant was significantly influenced under different fertilizer treatment and the influence pattern was quite indistinguishable to number of finger (Table 3). The highest finger fresh weight per plant was recorded in T_3 (60.19, 70.71, and 361.6 gm) at 120, 180 and 240 DAP which was followed by T_4 (59.59, 70.13, and 349.8 gm at 120, 180 and 240 DAP, respectively). Significantly the lowest finger fresh weight per plant was observed in T_1 (50.02, 60.08 and 238.4 gm at 120, 180 and 240 DAP).

Finger dry weight: The highest finger dry weight per plant was found in T_3 (15.33, 21.05 and 68.42 gm at 120, 180 and 240 DAP) which was followed by T_4 (14.30, 20.58, 68.09 gm at 120, 180 and 240 DAP). The lowest finger dry weight per plant was found in T_1. (8.653, 17.12, and 46.51 gm at 120, 180 and 240 DAP).

Rhizome fresh weight: Rhizome fresh weight significantly influenced by the different treatments (Table 4). Significantly, the highest rhizome fresh weight was found in T_3 at each sampling dates (54.61, 76.32 and 109.2 gm) which was followed by T_4 (54.10, 70.27 and 108.1 gm). Significantly, the lowest rhizome fresh weight per plant was found in T_1 at each sampling date and the values were 47.71, 54.14 and 85.79 gm.

Rhizome dry weight: The highest rhizome dry weight per plant were recorded in T_3 (6.65, 10.1 and 15.93 gm at 120, 180 and 240 DAP) similar to that of T_4 (6.37, 10.05 and 15.5 gm). The lowest rhizome dry weight was found in T_1 (4.68, 6.49 and 12.17 gm at 120, 180 and 240 DAP respectively).

Fresh yield: Yield recorded per plant was expressed t/ha. Fresh yield significantly influenced by the different treatments (Table 5). Significantly the highest fresh yield was found in T_3 (10.36, 13.32 and 42.40 t/ha at 120, 180 and 240 DAP) which was followed by T_4 (10.13, 13.19 and 40.70 t/ha at 120, 180 and 240 DAP respectively). Significantly the lowest fresh yield of different sampling dates was found in T_1 (8.80, 10.28 and 29.17 t/ha respectively).

Dry yield: The highest dry yield was found in T_3 (1.98, 2.80 and 7.59 t/ha at 120, 180 and 240 DAP) which was followed by T_4. The lowest dry yield of different sampling dates was found in T_1 (1.20, 2.13 and 5.28 t/ha respectively).

All most all the vegetative parameters of turmeric gradually increased with the increase of fertilizer element at all the sampling dates. In case of yield contributing characters, yield of turmeric was found highest from the treatment of cow-dung + Dolo choon. For maximum yield of turmeric from such type of Agroforestry system, Dolo

choon + cow-dung will be more applicable than the chemical fertilizer.

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