J. Agrofor. Environ. 1(2): 139-142, 2007 ISSN 1995-6983

Effect of inorganic fertilizers on the initial growth of Goraneem (*Melia azedarach* L) seedling

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Abstract: The effect of two commonly used inorganic fertilizers (urea and TSP) on the initial growth of Goraneem (*Melia azedarach* L.) seedlings grown at pot yard of the Agroforestry Department, BAU, Mymensingh, during the period from 15 April to 15 September 2007 was studied to standardizing the optimum dose for raising quality seedlings. The experiment was carried out in a completely randomized design with three replications. There were 16 treatments including one control (N_0P_0). Seedlings were supplied with 0, 1, 1.5, 2g for both of urea and TSP /polybag soil during the polybag (12 × 17 cm size) preparation. Seedlings were evaluated at 150 days after planting. Seedling height, base diameter, root length, and other growth parameters were measured and variables were also calculated. Seedling growth was in general, markedly better in fertilized treatment compared to the control. Combined application of nitrogen and phosphorus was found significantly promoting the plant height, fresh weight and dry weight of stem, root and leaves, TDM, shoot-root ratio, number of leaves plant^{-1} and base diameter. The study suggests that application of 1.5 g urea in combination with 1.5g TSP/polybag soil ($N_2 \times P_2$) may be beneficial for raising quality polybag seedlings of Goraneem (*Melia azedarach* L.).

Key words : *Melia azedarach* L., Inorganic Fertilizers, Initial Growth.

Introduction

Bangladesh is an agricultural country; where forest area is not sufficient to balance the ecosystem. Moreover increasing deforestation has resulted not only in severe reduction of forest products but also has threatened the ecological balance of the country. Under this alarming situation massive afforestation program including first growing multipurpose trees can only help in increasing the forest coverage of the country. *Melia azedarach* L. (Goraneem) is an important multipurpose tree. It has great importance world wide because of its demand for medicinal and other bio-pesticide preparation. The uses of Goraneem roots, stems, barks, leaves, fruits, gum and sap particularly in the field of livestock health are reported by Sharma and Reddy (2002). Goraneem is a natural renewable resource producing extensive useful biomass, its propagation and economic exploitation will be beneficial, particularly to the 3rd world (Koul *et al.*, 1990). In recent years, growing of seedling in polybags in the nursery has been increased considerably, which require fertile soil as media for each seedling. The policy of a nursery manager is to raise good quality seedling at low cost. But growing good quality seeding with low cost is only possible through intensive research and development of all aspects of nursery production, especially on soil fertility and nutrition management. Maintenance of adequate fertility in nursery soils is important to assure production of high quality planting stock. Nitrogen and phosphorus are the nutrients that most commonly limit forest seedling growth (Graciano *et al.*, 2006). Afforestation with *Melia azedarach* need huge amount of quality seedlings raised in polybags. Application of nitrogen and phosphorus during seedling raising in polybag may help to produce good quality seedling. The research work was conducted to find out an optimum dose of urea and TSP for raising quality polybag seedlings of *Melia azedarach* L.

Materials and Methods

The polybag experiment was carried out at potyard of the Agroforestry Department, Bangladesh Agricultural University (BAU), Mymensingh during 15th April to 15th September, 2007. The soil for filling the polybag was collected from the field of the Agroforestry farm, BAU, Mymensingh from depth of 0-15cm and the soil was dried in the sun and roots of plants and pebbles were removed and mixed up with fertilizer as per treatment. The size of the polybag was 12 cm × 17 cm with 1.78kg dried soil holding capacity. The experiment comprised four doses of nitrogen viz. N_0 = 0, N_1 = 1, N_2 = 1.5 and N_3 = 2.0g, urea (46% nitrogen)/polybag soil; and four doses of phosphorus viz. P_0 = 0, P_1 = 1, P_2 = 1.5 and P_3 = 2.0g, TSP (48% P_2O_5)/polybag soil. The experiment was carried out in completely randomized design with three replications. One month old *Melia azedarach* L. seedling were collected from Sutiakhali nursery and planted in polybag on 15th April, 2007 in the afternoon. Watering was carried regularly by fine shower, which could not disturb the seedlings physically. After 150 days after planting (DAP) plant height, base diameter, stem fresh and dry weight, root length, root fresh and dry weight, leaves number plant^{-1}, total dry matter and shoot-root ratio were measured. Data collection on different parameters were compiled and tabulated in proper form for statistical analysis. Analysis of variance was done with the help of computer package MSTAT program. The mean differences among the treatments were compared with Duncan's Multiple Range Test (Gomez and Gomez, 1984).

Results and Discussion

Seedling height: Shoot length was significantly influenced by different levels of nitrogen, phosphorus and their interaction (Tables 1-3). It was observe that nitrogen at 1 g urea/polybag soil (N_2) gave the highest seedling height at 150 DAP (Table 1). Seedling height decreased with the increase of nitrogen dose. The lowest seedling height was obtained in the no nitrogen control treatment (N_0). In case of phosphorus the lowest seedling height was obtained in no phosphorus control treatment (P_0) and highest seedling height exhibited in 2 g TSP/polybag soil (P_3) treatment at 150 DAP. Seedling height was significantly affected by the interaction effect of nitrogen and phosphorus at 150 DAP. The highest seedling height was observe in N_3 ×

P_3 i.e. 2 g urea × 2 g TSP/polybag soil. In all the cases the control treatment i.e. N_0P_0 recorded the lowest seedling height (Table 3). Kamal (1992) and Gupta (1994) observed good growth of forest seedlings due to nitrogen and phosphorus application.

Base diameter: Base diameter was significantly affected by different doses of nitrogen (Table 1). Base diameter was found to increase progressively with the increase of nitrogen doses. Highest base diameter was obtain in N_3 i.e. 2 g urea/polybag soil. Base diameter was not significantly affected by different doses of phosphorus (Table 2). Base diameter was significantly affected by the interaction of nitrogen and phosphorus doses (Table 3). The highest base diameter was obtain in N_3P_1 i.e. 2 g urea and 1 g TSP/polybag soil. The lowest base diameter was obtained in N_0P_1 i.e. no nitrogen × 1 g TSP/polybag soil. Various studies on the effect of urea and TSP also reported that the shoot diameter growth was greater in fertilized plants compared to control plant (Tanner *et al.* 1990; Herbert and Fownes, 1995; Vitouesk and Farringtron, 1997).

Stem fresh weight: Stem fresh weight was significantly affected by nitrogen and phosphorus levels and their interaction effect. Two gram urea/polybag soil (N_3) and 2 g TSP/polybag soil (P_3) produce maximum stem fresh weight (Tables 1 & 2). Maximum stem fresh weight (14.37g) was recorded in N_3P_3 treatment and minimum (5.26g) was recorded in control (N_0P_0) treatment (Table 3). Kushalapa (1988) reported that phosphorus application increases the biomass content of Akashmoni and Ipil Ipil seedlings which support the findings of the present study.

Percent dry weight of stem: This parameter was significantly influenced by nitrogen and interaction of nitrogen and phosphorus. Maximum (62.23%) per cent dry weight at stem was recorded in no nitrogen × 1.2 g TSP/polybag soil (N_0P_2) treatment whereas minimum (47.05%) was in 2 g urea × no TSP/polybag soil (N_3P_0) treatment (Table 3). Percentage of dry weight of stem was decreased with increase of nitrogen level but phosphorus was insignificant on stem dry weight percentage (Table 2). Mehrog *et al.* (1994) also found the similar results.

Leaves number plant^{-1}: Leaves number plant^{-1} were not significantly affected by nitrogen, phosphorus and interaction of nitrogen and phosphorus. Maximum leaves number plant^{-1} (8.67) was recorded in 1.5 g for both of urea and TSP/polybag soil (N_2P_2) treatment compare to other treatment (Table 3).

Root length: Root length was not significantly affected by nitrogen leaves. Two g urea/polybag soil i.e. N_3 produce the maximum (16.92 cm) root length followed by N_0 recorded minimum (14.08 cm) root length (Table 1). Whereas root length was significantly affected by phosphorus. Two g TSP/polybag soil i.e. P_3 produce maximum (17.05 cm) root length followed by without TSP/polybag soil i.e. controls (Table 2). Interaction effect of nitrogen and phosphorus were insignificantly affected on root length (Table 3). Wright *et al.* (1991) observed that phosphorus application increase the root length which supports the present findings.

Root fresh weight: Root fresh weight was significantly influenced by individual and combined at all treatment. Individual 2 g urea/polybag soil (N_3) and 2 g TSP/polybag soil (P_3) produced maximum root fresh weight the values were 14.41g and 11.76g respectively followed by minimum was in both control nitrogen and phosphorus. It was clearly evident in Table 1 and 2. Maximum root fresh weight was recorded in 2 g urea × 2 g TSP/polybag soil i.e. N_3P_3 treatment the value was 15.73g followed by control treatment recorded the minimum root fresh weight compare to other treatment (Table 3). Shaukat (1994) reported that root fresh weight is increase with application of urea and TSP which partially support the present study.

Percent dry weight of root: This parameter was significantly influenced by nitrogen, phosphorus and interaction of them (Tables 1-3). Maximum percent dry weight of root was recorded in 1 g urea/polybag soil (N_1) compare to other doses of nitrogen (Table 1) whereas 1.5 g TSP/polybag soil (P_2) recorded the maximum percent dry weight of root and minimum was recorded in 2 g TSP/polybag soil (P_3) treatment (Table 2). Without urea and TSP/polybag soil (N_0P_0) recorded the maximum (65.11%) percent dry weight of root followed by 2 g urea × without TSP/polybag soil i.e. N_3P_0 treatment produced minimum (43.60%) percent dry weight of root. This was clear in the Table 3. These results partial agreed with Kornamik (1985).

Total dry matter (TDM): Total dry matter was significantly influenced by nitrogen, phosphorus and also their interaction (Tables 1-3). The maximum (14.28 g) TDM was produce by 2 g urea/polybag soil followed in order by 1.5 g, 1 g and 0 g urea/polybag soil (Table 1). Total dry matter showed increasing train with the increase of level of phosphorus. The maximum (16.21 g) TDM was obtain in 2 g TSP/polybag soil i.e. P_3 followed by 1.5, 1 and 0 g TSP/polybag soil (Table 2). The maximum TDM was produced in 2 g urea × 1.5 g TSP/polybag soil (N_3P_2) followed by 1.5 g both of urea and TSP/polybag soil (N_2P_2) and the lowest one was obtain in without urea × 1.0 g TSP/polybag soil. The improvement of seedling height, no of leaves plant^{-1}, root length and root fresh weight mainly responsible for the highest TDM production in N_3P_2 treatment combination (Table 3). Similar results were reported by Gupta (1991) who observed that TDM was increased with N and P application.

Shoot-root ratio: Shoot-root ratio was significantly influenced by both nitrogen and phosphorus and their interaction effect. The highest (2.73) ratio was recorded in N_2P_3 treatment. Seedling survival and growth will be best when the shoot-root ratio is between 1 to 3 (Ferdinand, 1972; Walkeley, 1954). This present finding is closely similar to the result of Wells (1970) who observed that nitrogen and phosphorus is important to optimum shoot-root ratio.

Table 1. Effect of nitrogen on seedling height and other growth parameters at 150 days after plant (DAP)

Nitrogen levels (g)	Seedling height (cm)	Base diameter (mm)	Stem fresh weight (g)	Percent dry weight of stem	No. of leaves plant^{-1}	Root length (cm)	Root fresh weight (g)	Percent dry weight of root	Total dry matter (TDM) (g)	Shoot-root ratio
N_0	44.45c	218.35d	4.48c	60.63a	5.33	14.08	4.29c	63.11a	9.8c	0.98c
N_1	57.75ab	223.27c	6.36b	57.29b	5.08	15.08	11.66b	60.98a	9.10c	0.85d
N_2	58.16a	227.35b	12.35a	52.29c	7.88	15.5	12.39b	49.55b	11.8b	1.38a
N_3	56.58b	229.94a	13.04a	48.10d	6.83	16.92	14.41a	47.77b	14.28a	1.25b
Level of significance	**	**	**	**	NS	NS	**	**	**	**
CV (%)	1.48	0.38	4.23	0.77	22.79	11.90	3.44	2.61	1.77	1.34

N_0= 0 g urea /polybag soil, N_1=1 g urea /polybag soil, N_2=1.5 g urea /polybag soil, N_3=2 g Urea /polybag soil.

Table 2. Effect of phosphorus on seedling height and other growth parameters at 150 DAP

Phosphorus levels (g)	Seedling height (cm)	Base diameter (mm)	Stem fresh weight (g)	Percent dry weight of stem	No. of leaves plant^{-1}	Root length (cm)	Root fresh weight (g)	Percent dry weight of root	Total dry matter (TDM) (g)	Shoot-root ratio
P_0	52.04c	225.13	7.69b	54.50	5.50	13.08b	8.84b	54.81ab	7.00d	0.82c
P_1	50.83c	224.68	9.25a	54.34	6.58	15.17ab	11.02a	56.40ab	7.90c	1.36b
P_2	55.29b	223.90	9.25a	54.66	6.42	15.83ab	11.14a	56.87a	13.10b	0.71d
P_3	58.79a	225.19	10.04a	54.81	6.58	17.5a	11.76a	53.33b	16.21a	1.57a
Level of significance	**	NS	**	NS	NS	**	**	**	**	**
CV (%)	1.48	0.38	4.23	0.77	22.79	11.90	3.44	2.61	1.77	1.34

P_0= 0 g TSP /polybag soil, P_1=1 g TSP /polybag soil, P_2=1.5 g TSP /polybag soil, P_3=2 g TSP /polybag soil.

Table 3. Interaction effect of nitrogen and phosphorus on seedling height and other growth parameters at 150 DAP

Interaction (N × P)	Seedling height (cm)	Base diameter (mm)	Stem fresh weight (g)	Percent dry weight of stem	No. of leaves plant^{-1}	Root length (cm)	Root fresh weight (g)	Percent dry weight of root	Total dry matter (TDM) (g)	Shoot- root ratio
$N_0 \times P_0$	41.83k	219.6h	5.26h	59.40b	5.00	12.00	3.66h	65.11a	7.34j	1.30e
$N_0 \times P_1$	43.67j	216.2i	4.18j	59.06bc	6.00	14.33	4.26gh	63.35ab	6.52k	1.05f
$N_0 \times P_2$	47.17i	217.1i	4.14j	62.23a	5.66	14.67	4.33gh	62.21abc	8.14i	0.91h
$N_0 \times P_3$	45.17j	220.6h	4.36ij	61.84a	4.67	15.33	5.00g	61.80abc	6.14l	0.68l
$N_1 \times P_0$	63.17bc	224.4fg	5.16hi	58.34cd	4.67	13.00	9.43f	65.30a	8.37i	0.98g
$N_1 \times P_0$	53.50f	220.7h	6.31g	57.81d	4.67	14.67	12.00e	61.56bc	7.20j	0.72k
$N_1 \times P_1$	51.33g	223.6g	6.46g	56.19e	5.00	15.00	12.20de	59.47cd	9.09h	0.87i
$N_1 \times P_2$	63.00bc	224.5fg	7.50f	56.85e	6.00	17.67	13.03cd	57.61de	7.05j	0.83j
$N_2 \times P_0$	55.33e	226.3ef	8.36e	53.25f	5.66	13.33	10.03f	45.25ij	13.03e	0.49n
$N_2 \times P_1$	56.83e	229.3bc	13.18bc	52.26g	8.33	14.00	13.33c	49.62fgh	10.33g	1.80d
$N_2 \times P_2$	58.67d	226.5de	13.90ab	52.27g	8.66	16.67	13.03cd	55.75e	19.08b	0.49n
$N_2 \times P_3$	61.83c	227.3cde	13.93ab	51.41g	8.67	18.00	13.27c	47.61ghi	10.16g	2.73a
$N_3 \times P_0$	47.83hi	230.2b	11.97d	47.05j	6.67	14.00	12.23de	43.61j	18.63c	0.51n
$N_3 \times P_1$	49.33h	232.6a	13.33bc	48.25hi	7.33	17.67	14.60b	51.11f	12.35f	1.88c
$N_3 \times P_2$	64.00ab	228.5bcd	12.49cd	47.96ij	6.33	17.00	15.10ab	50.03fg	20.07a	0.58m
$N_3 \times P_3$	65.17a	228.4bcd	14.37a	49.15h	7.00	19.00	15.73a	46.33hij	13.83d	2.03b
Level of significance	**	**	**	**	NS	NS	**	**	**	**
CV (%)	1.48	0.38	4.23	0.77	22.79	11.90	3.44	2.61	1.77	1.34

In a column, figures with same letters do not differ significantly as per DMRT.
** Indicates 1% Level of significance, NS=Indicates non significance, CV = Co-efficient of variation
N_0= 0 g urea /polybag soil, N_1=1 g urea /polybag soil, N_2=1.5 g urea /polybag soil, N_3=2 g Urea /polybag soil
P_0= 0 g TSP /polybag soil, P_1=1 g TSP /polybag soil, P_2=1.5 g TSP /polybag soil, P_3=2 g TSP /polybag soil.

Conclusion: Maximum plant height, base diameter, root length, all fresh weight, leaves plant^{-1} and TDM were obtained at 2 g urea and 2 g TSP/polybag individually which was statistically identical medium fertilizer level for about all parameters studied. Plant height, base diameter and root length, all fresh weight and TDM were the highest in $N_3 \times P_2$ treatment combination whereas $N_2 \times P_2$ treatment recorded maximum all dry weight percentage and optimum shoot-root ratio. Finally it may be concluded that 1.5 g urea in combination with 1.5 g TSP/polybag soil was

found optimum to produce quality seedlings of Goraneem *(Melia azedarach* L.).

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