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Pruning height and subsequent regeneration potentials of ipil-ipil *(Leucaena leucocephala)* hedges under alley cropping system

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Abstract: The experiment was conducted at the Field Laboratory of the Department of Agroforestry of Bangladesh Agricultural University, Mymensingh during the period from March to July 2014 the objectives of the study was to pruning height and subsequent regeneration potentials of ipil-ipil *(Leucaena leucocephala)* hedges under alley cropping system following a two factorial Randomized Complete Block Design (RCBD) with three replications. Factor A: five cutting height viz., T_0 = without or no pruning of Ipil-ipil tree, T_1= pruned at 1.5ft from the ground level of Ipil-ipil tree, T_2 = pruned at 2.0ft from the ground level of Ipil-ipil tree, T_3 = pruned at 2.5ft from ground level of Ipil-ipil tree and T_4 = pruned at 3.00ft from the ground level of Ipil-ipil tree, and Factor B: three fertilizer doses viz., F_0 = no fertilizer, F_1= full fertilizer dose (Urea - 130 kg/ha + TSP - 270 kg/ha + MoP - 270 kg/ha) and F_2 = half fertilizer dose (Urea - 65 kg/ha + TSP - 135 kg/ha + MoP - 135 kg/ha). The shoot development of Ipil-ipil was significantly affected by cutting height and fertilizer doses. The highest shoot (94.07 cm) was developed in treatment T_1F_1 and the lowest 55.02cm was found in treatment T_0F_2. The shoot of Ipil-ipil was gradually increased with increasing days after pruning and the lowest shoot was found where the cutting height was lowest and lowest shoot developed was seen in control.
Key words: Pruning height, regeneration potentials, ipil-ipil *(Leucaena leucocephala)*, hedgerows, alley cropping.

Introduction

Bangladesh is one of the most densely populated countries of the world struggling hard to feed her more than 150 million peoples. The current population growth rate is 1.30% and the density of human population is 1020 per sq. (UNFPA, 2011). The fertility and productivity of our land is decreasing day by day due to intensive cropping pattern and use of high input technologies.

Forestry plays an important role in maintaining environmental equilibrium and socio economic development of the people. A country needs 25% of forest land of its total area for ecological stability and sustainability. Unfortunately, Bangladesh is endowed with only 11% (FAO, 2011) of unevenly distributed forests. However, actual tree cover is less than 10% in FAO prediction (Akter *et al*., 1989). The central region where the population density is the highest, has the least forest resources substantial depletion of forest resources has occurred in the last few decades, and now it is reduced to less than 0.02 ha per person, one of the lowest ratio in the world (BBS, 2006).

Agroforestry, the integration of tree and crop or vegetable on the same area of land is a promising production system for maximizing, yield and maintaining friendly environment (Nair, 1990). In agroforestry systems, there are both ecological and economical interactions between the different components.

Among the different agroforestry systems, alley cropping is the typical one as organic farming. In alley cropping, hedgerow species are periodically pruned during the cropping season to prevent shading and to provide mulch and green manure for the companion crops (Wilson *et al*., 1986). *Leucaena leucocephala* (Ipil-ipil) is a fast growing tropical leguminous tree, originated in Central America that has multiple economic uses and locally termed as Ipil-ipil. It can survive in any areas with poor soils because of its nitrogen fixation ability (Cronk and Fuller, 1995). Considering the aforementioned facts and potentiality, a study was undertaken with the broad objective to examine the shoot growth of Ipil-ipil tree cutting at different pruning height.

Materials and Methods

Experimental site and season: The experiment was carried out at the experimental farm, Department of Agroforestry, Bangladesh Agricultural University, Mymensingh, during the period from 28th March 2014 to 28th June 2014. The place is geographically located at about 24°75" North latitude and 90°50' East longitudes (FAO, 1988).

Hedgerow and plant materials: In this study, two years old previously established four hedgerows of Ipil-ipil (*Leucaena leucocephala*) were used as tree component (Plate 1).

Description of hedge used in this study: The study was done in previously established two years old four hedges of *Leucaena leucocephala* tree. Four lines of hedges were made in North-South direction to establish thehedges (each hedge was 50ft × 1ft in size and distance between two hedges was 9ft). Thehedge materials were cut at different height on 28th March 2014. The cutting height was 1.5ft, 2ft, 2.5ft, and 3ft respectively from the ground level of hedges.

Plate 1. Initial experimental view of the study

Factors and treatment of this experiment: The study was carriedout following a two factorial Randomized Complete Block Design (RCBD) with three replications. Factor A: Cutting height, viz., (i) T_0 = No cutting or control, (ii)

T_1= At 1.5ft from the ground level, (iii) T_2 = At 2ft from the ground level, (iv) T_3 = At 2.5ft from the ground level, and (v) T_4 = At 3ft from the ground level. Factor B: Fertilizer dose, viz., (i) F_0 = No fertilizer, (ii) F_1 = Full dose (Urea - 130 kg/ha + TSP - 270 kg/ha + MoP - 270 kg/ha), and (iii) F_2 = Half dose (Urea - 65 kg/ha + TSP - 135 kg/ha + MoP - 135 kg/ha) (BARC 2005). Initial experimental view is shown in plate 1.

Fertilizer application: Fertilizer was applied in each hedge of Ipil-ipil trees and as respect of full dose, half dose and no fertilizer in control. In case of treatments T_0F_0, T_1F_0, T_2F_0, T_3F_0 and T_4F_0 no fertilizer was applied. In case of treatments T_0F_1, T_1F_1, T_2F_1, T_3F_1 and T_4F_1 full dose of fertilizer was applied. In case of treatments T_0F_2, T_1F_0, T_2F_0, T_3F_0 and T_4F_0 half dose of fertilizer was applied. The fertilizer was applied after pruning of hedges and removal of weeds from the ground level of these trees.

Data collection procedure for regeneration of Ipil-ipil hedges: Ten plants of Ipil-ipil trees were selected from each treatment for data collection. The parameters were studied such as no. of shoots per plant, length of shoot (cm), leaf length (cm), no. of leaves per shoot, no. of branches per shoot, no. of pinnate per leaf and length of pinnate (cm). The data was collected from Ipil-ipil tree at 15 days interval from pruning to harvesting.

Statistical analysis: The data were collected from the experiment at different stages of various growths and then analyzed statistically by using PC MA-STAT, MSTAT-C Package programmed (Russel, 1986) and wasp2 software package to find out the statistical significance of the experimental results. The mean differences were evaluated by Duncan's New Multiple Range Test (DMRT) (Gomez and Gomez, 1984) and also by Least Significant Difference (LSD) test.

Results and Discussion

Regeneration potentials of Ipil-ipil hedges on influenced by cutting height and fertilizer dose:

The research results obtained from Ipil-Ipil was observed as morphological characteristics and performance (Plate 2). Different morphological parameters viz. as no. of shoot per plant, shoot length (cm), leaf length (cm), no. of leaves, no. of branches per shoot, no. of pinnate per leaf and length of pinnate (cm) were recorded. All of these recorded data were significantly influenced by different cutting height (Table. 1) which was described under different head:

Plate 2. Different stages of shoot development in this study

No. of shoot per plant: No. of shoot per plant of Ipil-ipil was notably influenced by different cutting heights. Among five cutting heights, the highest no. of shoot (10.44) was obtained in cutting height T_0 at final observation. Which was statistically similar to all of these cutting height except $T_1$and the lowest no. of shoot (7.78) was obtained in cutting height T_1at 90 DAP (Table 1).

Table 1. Effect of cutting height of ipil-ipil at final harvest

Cutting height	Number of shoots	Shoot length (cm)	Leaf length (cm)	Number of leaves/shoot	Number of branches/shoot	Number of pinnate/leaf	Length of pinnate (cm)
T_0	10.44 a	56.57 d	30.96 c	10.19 bc	2.33	13.41	7.73 d
T_1	7.78 b	83.55 a	36.99 a	12.93 a	1.91	12.85	8.42 c
T_2	9.44 a	69.69 bc	33.35 b	11.26 b	2.17	12.67	9.03 c
T_3	9.78 a	63.86 c	30.96 c	8.814 c	2.41	12.15	10.15 b
T_4	9.89 a	74.08 b	34.06 b	11.67 ab	2.22	12.37	11.17 a
$LSD_{0.05}$	1.21	6.51	1.66	1.50	0.425	0.810	0.672
Level of sign.	**	**	**	**	NS	NS	**
CV (%)	15.35	6.16	4.57	12.86	13.91	4.66	5.18

** = Significant at 1% level of probability; NS= Not significant.

Shoot length: Shoot length (cm) of Ipil-ipil was notably influenced by different cutting heights. Among five cutting heights, the highest shoot length (83.55cm) was obtained in cutting height $T_1$and the lowest shoot length (56.57cm) was obtained in cutting height T_0 at 90 DAP (Table 1).. Such type of results also recorded (Islam, 2006) in case of cutting thickness and spacing on regeneration and development of shoots in *Leucaena leucocephala* (Ipil-ipil).

Leaf length: Leaf length (cm) of Ipil-ipil was notably influenced by different cutting heights. Among five cutting heights, the highest leaf length (36.99 cm) was obtained in cutting height $T_1$and the lowest leaf length (30.96cm) was obtained in cutting height T_0at 90 DAP

(Table)which was statistically similar to the cutting height T_3.

No. of leaves: No. of leaves of Ipil-ipil was notably influenced by different cutting heights. Among five cutting heights, the highest no. of leaves (12.93) was obtained in cutting height $T_1$and the lowest no. of leaves(8.814) was obtained in cutting height T_3 at 90 DAP (Table 1).

No. of branches: No of branches Ipil-ipil was notably influenced by different cutting heights. Among five cutting height, at final harvesting (90 DAP, Table 1) time the no. of branches was not significantly affected among different cutting height. Such type of results also recorded (Islam, 2006) in case of cutting thickness and spacing on regeneration and development of shoots in *Leucaena leucocephala* (Ipil-ipil).

No. of pinnate: No. of pinnate of Ipil-ipil was notably influenced by different cutting heights. Among five cutting heights, at 90 DAP (Table 1) the no. of pinnate was not significantly difference among five cutting heights.

Length of pinnate: Length of pinnate (cm) of Ipil-ipil was notably influenced by different cutting heights. Among five cutting height, the highest length of pinnate (11.17cm) was found in T_4 and the lowest pinnate length (7.73cm) was recorded in T_0 at final observation 90 DAP (Table 1).

Morphological characteristics of Ipil-ipil on fertilizer doses:

All of these recorded data were significantly influenced by different cutting height (Table 2) which was described under different head:

No. of shoot per plant: No. of shoot of Ipil-ipil was notably influenced by different fertilizer doses. Among three fertilizer doses, at the highest no. of shoot (10.33) was found in F_2 and the lowest no. of shoot (8.80) was found in F_0 at the final harvesting time at 90 DAP (Table 2).

Shoot length: Shoot length (cm) of Ipil-ipil was notsignificantly difference among three fertilizer doses at final observation (90 DAP) in Table 2.

Table 2. Effectof fertilizer doses of Ipil-ipil at final harvest

Fertilizer doses	Number of shoots	Shoot length (cm)	Leaf length (cm)	Number of leaves/shoot	Number of branches/shoot	Number of pinnate/leaf	Length of pinnate (cm)
F_0	8.80 b	68.74	33.09	12.36 a	2.13	13.35 a	8.76 b
F_1	9.27 ab	70.16	32.90	10.76 b	2.25	12.49 b	9.72 a
F_2	10.33 a	69.75	33.79	9.80 b	2.25	12.22 b	9.42 a
$LSD_{0.05}$	1.11	3.26	1.16	1.07	0.23	0.450	0.367
Level of sign.	*	NS	NS	**	NS	**	**
CV (%)	15.35	6.16	4.57	12.86	13.91	4.66	5.18

** = Significant at 1% level of probability, * = Significant at 5% level of probability, NS= Not significant.

Leaf length: Leaf length (cm) of Ipil-ipil was notsignificantly difference among three fertilizer doses at final observation (90 DAP) in Table 2.

No. of leaves: No. of leaves of Ipil-ipil was notably influenced by different fertilizer doses. Among three fertilizer doses, at final harvesting (90 DAP) time the highest no. of leaves (12.36) was obtained in fertilizer doses F_0 and the lowest no. of leaves (9.80) was recorded at F_2 (Table 2) which is statistically similar to the fertilizer dose F_1.

No. of branches: No of branches Ipil-ipil was notably influenced by different fertilizer doses. Among three fertilizer doses, at final observation the no. of branches was not significantly differ among three fertilizer doses (Table 2). Such type of results also recorded (Islam, 2006) in case of cutting thickness and spacing on regeneration and development of shoots in *Leucaena leucocephala* (Ipil-ipil).

No. of pinnate: No. of pinnate of Ipil-ipil was notably influenced by different fertilizer doses. Among three fertilizer doses, the highest no. of pinnate (13.35) was found in F_0 and the lowest no. of pinnate (12.22) was found in F_2 at 90 DAP (Table 2) which is statistically similar to the fertilizer dose F_1.

Length of pinnate: Length of pinnate (cm) of Ipil-ipil was notably influenced by different fertilizer doses. Among three fertilizer doses, at the final observation (90 DAP) the highest pinnate length (9.72cm) was obtained in fertilizer doses F_1 which was statistically similar to the fertilizer dose $F_2$and the lowest length of pinnate (8.76cm) was obtained in fertilizer doses F_0 (Table 2).

Interaction effects on cutting height and fertilizer doses of Ipil- ipil hedges:

All of these recorded data were significantly influenced by different cutting height (Table 3) which was described under different head:

No. of shoot per plant: No. of shoot of Ipil-ipil was notably influenced by different interaction level. Among fifteen interactions, at the highest no. of shoot (13.33) was found in T_0F_2 and the lowest no. of shoot (6.67) was found in T_1F_0 at the final harvesting time at 90 DAP (Table 3).

Shoot length: Shoot length (cm) of Ipil-ipil was notably influenced by different interaction level. Among fifteen interactions, atthe highest shoot length (94.07cm) was found in interaction level T_1F_1 and the lowest shoot length (55.02cm) was found in interaction level T_0F_2 at final observation at 90 DAP (Table 3). Such type of results also recorded (Islam, 2006) in case of cutting thickness and spacing on regeneration and development of shoots in *Leucaena leucocephala* (Ipil-ipil).

Leaf length: Leaf length (cm) of Ipil-ipil was notably influenced by different interaction level. Among fifteen interactions, at the final observation 90 DAP (Table 3) highest leaf length (38.41cm) was obtained in T_1F_0 and the lowest leaf length (29.26cm) was in interaction level T_0F_2.

No. of leaves: No. of leaves of Ipil-ipil was notably influenced by different interaction level. Among fifteen interactions, at t final harvesting (90 DAP) (Table 3) time the highest no. of leaves (15.22) was obtained in T_4F_0 which was statistically similar to T_1F_1 and the lowest no. of leaves (8.33) was recorded at T_3F_1 which was statistically similar to T_0F_2.

No. of branches: No of branches Ipil-ipil was notably influenced by different interaction level. Among fifteen interactions, at final observation (90 DAP) (Table 3) the highest no. of branches (2.89) was obtained in T_0F_1 and the lowest no. of branches (1.67) was recorded at T_1F_0. Such type of results also recorded (Islam, 2006) in case of cutting thickness and spacing on regeneration and development of shoots in *Leucaena leucocephala* (Ipil-ipil).

Table 3. Interaction effects of cutting height and fertilizer doses of Ipil-ipil at final harvest

Interaction effects	No. of shoots	Shoot length (cm)	Leaf length (cm)	No. of leaves per shoot	No. of branches per shoot	No. of pinnate per leaf	Length of pinnate (cm)
T_0F_0	9.33bcde	57.46fgh	30.65de	10.89bc	2.00bcd	13.33abc	6.57h
T_0F_1	8.67bcde	57.22gh	32.96cd	10.89c	2.89a	13.56ab	7.11gh
T_0F_2	13.33a	55.02h	29.26e	8.780c	2.11bcd	13.33abc	9.51e
T_1F_0	6.67e	82.50b	38.41a	13.56a	1.67d	13.00abc	8.04f
T_1F_1	7.33de	94.07a	36.59ab	15.00a	2.21bcd	13.78ab	9.66cde
T_1F_2	9.33bcde	74.08cd	35.97ab	10.22c	2.22bcd	11.78de	7.57fg
T_2F_0	9.33bcde	61.54efgh	32.58cd	13.33ab	2.11bcd	13.11abc	8.20f
T_2F_1	10.33bc	68.90de	31.36de	9.78c	2.17bcd	12.22cde	9.59de
T_2F_2	8.67bcde	78.64bc	36.10ab	10.66c	2.22bcd	12.67bcd	9.29e
T_3F_0	11.00ab	62.41efgh	29.38e	8.78c	2.45ab	13.33abc	10.43bcd
T_3F_1	8.67bcde	65.11efg	32.07cde	8.33c	2.50ab	11.33e	10.52bc
T_3F_2	9.67bcd	64.06efg	31.42de	9.33c	2.28bc	11.78de	9.51e
T_4F_0	7.67cde	79.81bc	34.43bc	15.22a	2.44ab	14.00a	10.57b
T_4F_1	11.33ab	65.50ef	31.54de	9.78c	1.83cd	11.56de	11.70a
T_4F_2	10.67ab	76.93bc	36.22ab	10.00c	2.39abc	11.55de	11.23ab
$LSD_{0.05}$	2.47	7.29	2.58	2.40	0.522	0.101	0.820
Level of sign.	**	**	**	**	**	**	**
CV (%)	15.35	6.16	4.57	12.86	13.91	4.66	5.18

** = Significant at 1% level of probability.

No. of pinnate: No. of pinnate of Ipil-ipil was notably influenced by different interaction level. Among fifteen interactions, the highest no. of pinnate (14.00) was found in T_4F_0 and the lowest no. of pinnate (11.33) was found in T_3F_1 at 90 DAP (Table 3).

Length of pinnate: Length of pinnate (cm) of Ipil-ipil was notably influenced by different interaction level. Among fifteen interactions, at the final observation at 90 DAP (table 3) the highest pinnate length (11.70cm) was obtained in interaction level T_4F_1 and the lowest length of pinnate (6.57cm) was obtained in interaction level T_0F_0.

The shoot development of Ipil-ipil was significantly affected by cutting height and fertilizer doses. The highest shoot (94.07 cm) was developed in treatment T_1F_1 and the lowest 55.02cm was found in treatment T_0F_2. The shoot of Ipil-ipil was gradually increased with increasing days after pruning and the shoot was found where the cutting height was lowest and lowest shoot developed was seen in control.

References

Akter, M.S., Abedin, M.Z. and Quddus, M.A. 1989. Why farmers grow trees in agricultural fields: some thoughts, some results. Research Report, 1988-89. On Farm Research Division, Joydebpur.pp. 40-75.

BARC (Bangladesh Agricultural Research Council) 2005. Fertilizer Recommendation Guide-2005, Pp -118.

BBS 2006. Statistical Year Book of Bangladesh, Bangladesh Bureau of Statistics (BBS). Ministry of Planning, Govt. of the people's Republic of Bangladesh, Dhaka, Bangladesh.

Cronk, Q.C.B. and Fuller, A. 1995. Plant Invaders, Chapman and Hall. London, **p.**241.

FAO. 1988. Land Resources Appraisal of Bangladesh for Agricultural Development Report 2: Agroecological Regions of Bangladesh. Food and Agricultural Organization, Rome, Italy.

FAO. 2011. Yearbook Production. FAO (Food and Agricultural Organization) Statistics Division.

Islam, S.M. 2006. Effect of cutting thickness and spacing onregeneration and development of shoots in Ipil-ipil *(Leucaena leucocephala).* M.S.thesis, Dept of Agroforestry, Bangladesh Agricultural University, Mymensingh. pp- 53.

Nair, P.K.R 1990. An introduction to agroforestry. Kluwer Academic publishers, ICRAF.

UNDP and FAO. 1988. Plant Resources Appraisal of Bangladesh for agricultural development. Rep. 2. Agro-ecological regions of Bangladesh UNDP, FAO, Rome, p. 116.

UNFPA. 2011. World Population Census Report.

Wilson, G.F., Kang, B.T.and Mulongoy, K. 1986. Alley cropping: trees as sources of green manure and mulch in the tropics. Wye, Kent, UK. pp. 165-181.