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PERFORMANCE OF TOMATO, BRINJAL AND CABBAGE IN ALLEY CROPPING SYSTEM AS AFFECTED BY FOUR TREE SPECIES AND LEVELS OF NITROGEN IN UPLAND ECOSYSTEM

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ABSTRACT

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The experiment was carried out at the Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU) research farm, Gazipur during the period from November 2002 to April 2003 to evaluate the productivity of three winter vegetables (tomato, brinjal and cabbage) as well as changes of soil properties at different nitrogen levels in alley cropping system. The experiment was conducted in a split plot design with three replications. Four tree species namely, *Gliricidia sepium, Indigofera tysmanii, Leucaena leucocephala* and *Cassia siamea* were arranged in the main plots while five nitrogen doses (0, 25, 50, 75 and 100% plus pruned material) were distributed to sub-plots. In the control plots, recommended N doses were used but no pruned materials were incorporated. The growth performance of four MPTS after pruning at different intervals showed that *Gliricidia sepium* maintained its superiority over the other tree species in terms of both tree height and number of branches per tree at all the measurement dates. The maximum amount of fresh pruned materials were produced and added to the soil by *Gliricidia sepium* (10.63 t ha $^{-1}$) which was followed by *Indigofera tysmanii* (10.48), *Cassia siamea* (7.73 t ha $^{-1}$) and *Leucaena leucocephala* (5.88 t ha $^{-1}$) species, respectively. Not all the studied parameters of tomato varied significantly between 100 and 75% N plus PM added treatments. In case of cabbage, number of outer leaves per plant, fresh weight of outer leaf, head length, head diameter, head weight and yield were the maximum at 75% N plus PM added treatment, which was statistically identical with 100% plus PM added treatment. In case of brinjal, studies parameters such as plant height, fruit diameter, fruit length, number of fruits per plant, fruit weight and yield were superior at 100% N plus PM added treatment, but all the values were very close to that of 75% N plus PM added treatment.

Key words: *alley cropping system, tomato, brinjal, cabbage, upland ecosystem, mpts, levels of nitrogen*

INTRODUCTION

The arable land is shrinking rapidly across the world due to high population growth and establishment of new industries, houses and infrastructures. In Bangladesh perspective, the situation is very worse, where arable land is reducing @ 86000 ha every year. On the other hand, food demand is increasing which forces the farmers to use their farmlands intensively. The extent of depletion of soil organic matter status in different agro-ecological regions of Bangladesh during the last 20 years is alarming. About 60% of the cropped land has organic matter less than critical level of 1%, which indicates poor soil health of Bangladesh (Hossain and Kashem, 1997). Different agro-eco systems describe Bangladesh as a plain alluvial land with a considerable area of high land, which is characterized by low soil fertility and poor productivity. Alley cropping is an agroforestry practice intended to place trees within agricultural cropland systems. In this system, arable crops are grown in between the hedges of woody shrubs and tree species, preferably legumes, that are regularly cut back to minimize tree-crop competition for light, water and nutrients (Tossah *et al*. 1999). The pruned materials are incorporated into soil at planting and/or during the cropping period so that pruned tree leaves release nutrients into the soil and improve the physico-chemical properties of soil; and ultimately improve the growth and development of the associated crops (Miah 1993). Therefore, investigation of the benefits of this system in terms of nitrogen saving, crop productivity and soil fertility in the flat land agro-environment of Bangladesh would be of immense value to the farmers as well as researchers. The vegetable growing areas in Bangladesh are low; unfortunately, these limited areas are also decreasing day by day. Again, vegetable production per unit area is also low compared to other countries. Moreover, vegetables are the chief source of vitamin and minerals and for balance diet every people need 237g of vegetable daily, whereas, our consumption is only 80 g per day. Since, alley cropping is usually practiced in upland condition, so, growing vegetables as alley cropping system may perform better as it requires much management practices. Among different vegetables, brinjal, tomato and cabbage are very popular in Bangladesh. These vegetables could be tested in alley cropping system for examines their productivity in compare to sole cropping.

MATERIALS AND METHODS

The materials and methods followed in conducting this study are discussed in this chapter as follows:

The experiment was carried out at the Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU) research farm, Gazipur during the period from November 2002 to April 2003. It was the sixth season trial of a long-term alley cropping experiment. The experimental site was located at $24^0 0^/$ N latitude and $90^0 25^/$ E longitude with a mean elevation of 8.4 meter from the sea level.

The experiment was conducted in a split plot design with three replications. Four tree species were arranged in the main plots, and five nitrogen doses were distributed to sub-plots. Tree species for the main plots were as follows: *Gliricidia sepium* (Gliricidia), *Leucaena leucocephala* (Ipil-ipil), *Cassia siamea* (Minjiri), *Indigofera tysmanii* (Indigofera).

The different nitrogen doses as sub-plots treatment were as follows:

N_0 (no nitrogen) + Pruned materials (PM), N_{25} (25% of recommended N dose) + Pruned materials (PM), N_{50} (50% of recommended N dose) + Pruned materials (PM), N_{75} (75% of recommended N dose) + Pruned materials (PM), N_{100} (100% of recommended N dose) + Pruned materials (PM). The control plots having recommended N doses but without incorporation of pruned materials were used for growing crops to compare the results with crop yields under alley cropping system.

Statistical Analysis

All the data relating to growth yield and yield contributing characters were analysed following the standard statistical procedure of IRRISTAT computer software. Duncan's Multiple Range Test (DMRT) was used to compare means of treatments.

RESULTS AND DISCUSSION

In Bangladesh, Rabi season is generally characterized as dry season. Tomato, cabbage and brinjal were transplanted in the month of November 2003. The monthly average temperature varied from 12.6 to 32.6 ^{0}C and the monthly average relative humidity ranged from 40.8 to 97.4% during the crop growing period. There were only 15 rainy days when 196.71 mm of rainfall was recorded of which 111.44 mm in the month of March 2003 and 61.14 was recorded in the month of April 2003. Tree species irrespective of species were heavily pruned on one meter above the ground level before starting the experiment (Table 1). Then the height growth of four MPT species was measured at 60, 90 and 120 days after pruning for evaluating their comparative performances. Results showed that tree height of all the species was increased gradually with the increase of time. However, irrespective of measuring date, *Gliricidia sepium* was the tallest tree, which was followed by *Leucaena leucocephala*, *Indigofera tysmanii* and *Cassia siamea* species. Like tree height, the maximum and the minimum number of branches per tree were recorded in *G. sepium* and *C. seamia* tree species, respectively, irrespective of sampling dates (Table 1). Results showed that the highest amount of fresh leaves (1058.00 g tree^{-1}) and (7.03 t ha^{-1}) were obtained from *G. sepium* which was closely followed by *I. tysmanii* (1040 g tree^{-1} and 6.92 t ha^{-1}), while, the lowest was obtained from *L. leucocephala* (489.25 g tree^{-1} and 3.31 t ha^{-1}). *C. seamia* produced intermediate amount of fresh leaf (780.00 g tree^{-1} and 5.19 t ha^{-1}).

Table 1: Fresh pruned materials obtained from different MPT species and added into the soil during experimentation

Tree species	Fresh Pruned materials produced and added to the soil					
	Per tree (g)			Per ha (ton)		
	Leaf	Branch	Total	Leaf	Branch	Total
G. sepium	1058	540.52	1598.52	7.03	3.60	10.63
I. tysmani	1040	532.26	1572	6.92	3.56	10.48
C. siamea	780	382.58	1162.58	5.19	2.54	7.73
L. leucocephala	489.25	386.20	884.45	3.31	2.57	5.88

Crop Performances

Performance of Tomato

Results revealed that tomato grown in *G. sepium* alley with 100% N plus PM produced the tallest plant (78.84 cm), while it grown in *C. seamia* alley with no N plus PM added treatment produced the shortest plant (60.18 cm). In case of *G. sepium* and *I. tysmanii* alleys, the maximum number of fruits per plant were recorded in 75% N plus

pruned materials added treatment and the values were 26.75 and 25.93, respectively, while, in case of *L. leucocephala* and *C. seamia* alleys, the highest values were 25.01 and 24.67, respectively, which were recorded in 100% N plus pruned materials added treatment (Appendic Table 1). No significant variation was recorded in between 100 and 75% N plus PM added treatments irrespective of tree alleys. In case of *L. leucocephala* alley, 75% N plus PM added treatment produced the highest fruit diameter (5.11 cm). In *G. sepium, I. tysmanii* and *L. leucocephala* alleys, 50, 75 and 100% N plus PM added treatments gave statistically identical fruit size, while, in *C. seamia* alley, 100 (5.03 cm) and 75% (5.00 cm) N plus PM added treatments produced statistically similar fruit size. Control treatment produced 4.89 cm sized fruit, which was lower than 50% N plus PM added treatment of *G. sepium* (5.17 cm) and *I. tysmanii* (4.92 cm) but higher than that of *L. leucocephala* (4.66 cm) and *C. seamia* (4.48 cm) (Appendix Table 2). On the other hand, the minimum fruit length (4.92 cm) was found when no N but only PM was applied. Similar trend of variations was observed in case of *I. tysmanii* alley (Appendix Table 3). The greater size of fruit was also observed by Palada *et al.* (1992) in tomato based alley cropping. Fruit weight was increased with the increase of N levels up to 75% N plus PM added treatment of *G. seamia, I. tysmanii* and *L. leucocephala* alleys and further increase of N levels fruit weight decreased slightly (Appendix Table 4). In all the alleys, significantly the lowest fruit yield were recorded when no N but only PM was applied. Control treatment where only 100% recommended dose of N was applied, produced 62.27 t/ha fruit yield, which was lower than that in 50% N plus PM added treatment of *G. sepium* (70.26 t/ha), *I. tysmanii* (68.18 t/ha) and *L. leucocephala* (63.11 t/ha) (Appendix Table 5).

Performance of Cabbage

Number of outer leaves increased with the increase of N levels up to 75% N plus PM added treatments in all alleys except *C. seamia* alley (Appendix Table 6). Islam (2002) found higher number of outer leaves per plant of cabbage at 25% of reduction of Nitrogen fertilizer in *G. sepium* and *L. leucocephala* alleys. Like number of outer leaves per plant, the highest fresh weight of outer leaf was recorded at 75% N plus PM added alley of *G. sepium, I. tysmanii* and *L. leucocephala* tree species (Appendix Table 7). However, in all the cases, 100, 75 and 50% N plus PM added treatments gave statistically similar fresh weight of outer leaf and the values decreased significantly when N levels were decreased further. Among the N levels plus PM added treatments, the longest head was recorded at 75% N plus PM added treatment in *G. sepium* alley, which was statistically similar with the 100% (15.47 cm) and 50% (14.92 cm) N plus PM added treatments (Appendix Table 8). Among the tree species, the highest and the lowest head length were noted in *G. sepium* and *C. seamia* alleys, respectively, irrespective of N plus PM added treatments. Islam (2002) showed the superior head production in *G. sepium* alley as compared to the other species. Different nitrogen levels performed similar manner in all alleys except *C. seamia*, where the maximum diameter 17.89, 17.11 and 15.92 cm in *G.sepium, I. tysmanii* and *L. leucocephala* alleys, respectively was recorded in 75% N plus PM added treatment, which was statistically similar with 100% N plus PM added treatment. (Appendix Table 9). In *G. sepium* alley, the maximum head weight (825.11 g) was recorded in 75% N plus PM added treatment, which was insignificantly followed by the head weight produced in 100% N (808.69 g) and 50% N (750.26 g) plus PM added treatments (Appendix Table 10).

Irrespective of tree alleys, higher yield was found at higher N levels. However, in *G. sepium* alley, though 75% N plus PM added treatment produced the maximum head yield (32.61 t/ha), but it was insignificantly followed by 100% (31.13 t/ha) and 50% (28.31 t/ha) N plus PM added treatments (Appendix Table 11).

Performance of Brinjal

The tallest (64.02 cm) and the smallest (51.11 cm) plants were recorded in 100% N plus PM of *G. sepium* alley and no N plus PM of *C. seamia* species alley, respectively. In *G. sepium* alley, though the tallest plant was recorded in 100% N plus PM added treatment, it did not vary much up to 50% N plus PM added treatment (Appendix Table 12). However, the maximum fruit diameter was recorded in 100% N plus PM added treatment, which was insignificantly followed by the fruit diameter produced in 75% N plus PM added treatment. Though the minimum fruit diameter was found in no N plus PM added treatment, it was also statistically similar with fruit diameter recorded in 25% N plus PM added treatment (Appendix Table 13). Fruit length of brinjal was increased with the increase of nitrogen doses. The highest fruit length (12.56 cm) was recorded in 100% N plus PM added treatment of *G. sepium* alley and the lowest 8.00 cm was in *C. seamia* alley where only pruned material was applied (Appendix Table 14). Among the tree species, *G. sepium* and *C. seamia* produced the highest and the lowest fruit length regardless of N levels. The number of fruits per plant was increased with the increase of N levels, but rate of increase from 50% to 100% N plus PM added treatment was insignificantly, irrespective of tree alleys. Among the tree species, irrespective of N levels, *G. sepium* and *C. seamia* produced the maximum and the minimum number of fruits per plant. Alleys (Appendix Table 15). Among the N levels plus PM added treatments, the highest and the lowest fruit weight were

recorded in the maximum and the minimum N level treatments, respectively, irrespective of tree alleys (Appendix Table 16). In *G. sepium* alley, however, 100, 75 and 50% plus PM added treatments gave statistically similar fruit weight. In *G. sepium* alley, the maximum yield (45.12 t/ha) was recorded at 100% N plus PM added treatment, which was statistically similar with that obtained at 75% N plus PM added treatment (42.99 t/ha). While, 75 and 50% N plus PM added treatments produced almost similar fruit yield (Appendix Table 17).

CONCLUSION

Following conclusions can be drawn from the result of the present experiment:

Among the tree species, *G. sepium* maintained its superiority in terms of tree height growth and number of branches per tree at all the measurement dates. The highest amount of fresh pruned materials was produced and added to the soil by *G. sepium* species, which was followed by and *I. tysmanii*, *C. siamea* and *L. leucocephala* alleys, respectively. *G.sepium* produced highest in terms of all measurement parameter probably dew to its (branches and leaves) quick growth rate.

The highest yield of tomato and cabbage were obtained at 75% N plus PM treatment, while brinjal produced maximum yield at full dose of N along with PM. However, tomato and cabbage can be grown up to 50% reduction of N level (50% of N) without significant yield loss at the three-year old alley cropping field if pruned materials are added to the soil in all the alleys except in *C. seamia* species. In case of *C. seamia* alley, similar trend of production was possible at 25% reduction of N. But in case of brinjal, 25% reduced N dose could produce fruit yield statistically similar to full dose of N in alley cropping system.

Among the alleys, the performance of all the tested crops were better in *G. sepium* alley, which was followed by *I. tysmanii, L. leucocephala* and *C. seamia* alleys, respectively.

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APPENDICES

Table 1. Number of fruits per plant of tomato grown in alleys consisting of four different tree species as affected by different nitrogen levels plus pruned materials during winter season, 2001-2002

Treatment	Tree species			
Nitrogen dose (%)+PM*	*G. sepium*	*I. tasmanii*	*L. leucocephala*	*C. siamea*
0+PM	20.28 d A	19.75 d A	18.09 d AB	16.69 d B
25+PM	22.87 c A	21.83 cd AB	21.17 c AB	20.11 c B
50+PM	24.08 bc A	22.89 bc A	22.38 bc A	22.08 bc A
75+PM	26.75 a A	25.93 a AB	24.99 a AB	24.01 ab B
100+PM	26.18 ab A	25.11 ab A	25.01 a A	24.67 a A
100 (control)**	24.57	24.57	24.57	24.57

Table 2. Fruit diameter (cm) of tomato grown in alleys consisting of four different tree species as affected by different nitrogen levels plus pruned materials during winter season, 2001-2002

Treatment	Tree species			
Nitrogen dose (%)+PM*	*G. sepium*	*I. tasmanii*	*L. leucocephala*	*C. siamea*
0+PM	4.61 c A	4.39 c AB	4.20 b AB	3.98 b B
25+PM	4.83 bc A	4.61 bc AB	4.31b AB	4.19 bB
50+PM	5.17 ab A	4.92 ab AB	4.66 ab AB	4.48 b B
75+PM	5.31 ab A	5.23 a A	5.11 a A	5.00 a A
100+PM	5.41 a A	5.29 a A	5.09 a A	5.03 a A
100 (control)**	4.89	4.89	4.89	4.89

Table 3. Fruit length (cm) of tomato grown in alleys consisting of four different tree species as affected by different nitrogen levels along with pruned materials during winter season, 2001-2002

Treatment	Tree species			
Nitrogen dose (%)+PM*	*G. sepium*	*I. tasmanii*	*L. leucocephala*	*C. siamea*
0+PM	4.82 c A	4.78 c A	4.59 b A	4.31 c B
25+PM	4.98 bc A	4.82 bc A	4.61 b AB	4.43 c B
50+PM	5.18 ab A	5.01ab A	4.87 a AB	4.61 b B
75+PM	5.21 a A	5.17 a A	4.99 a AB	4.78 ab B
100+PM	5.28 a A	5.20 a A	5.03 a AB	4.86 a B
100 (control)**	4.84	4.84	4.84	4.84

Table 4. Fruit weight (g) of tomato grown in alleys consisting of four different tree species as affected by different nitrogen levels plus pruned materials during winter season, 2001-2002

Treatment	Tree species			
Nitrogen dose (%)+PM*	*G. sepium*	*I. tasmanii*	*L. leucocephala*	*C. siamea*
0+PM	53.93 c A	52.82 c A	51.81c A	48.11 d B
25+PM	66.87 b A	65.38 b A	62.93 b B	59.20 c C
50+PM	78.11 a A	74.11 a B	73.38 a B	69.83 b C
75+PM	80.89 a A	78.20 a AB	76.12 a B	73.18 a C
100+PM	80.71 a A	77.17 a B	76.02 a B	73.20 a C
100 (control)**	73.11	73.11	73.11	73.11

Table 5. Fruit yield (t/ha) of tomato grown in alleys consisting of four different tree species as affected by different nitrogen levels plus pruned materials during winter season, 2001-2002

Treatment	Tree species			
Nitrogen dose (%)+PM*	*G. sepium*	*I. tasmanii*	*L. leucocephala*	*C. siamea*
0+PM	44.28 c A	40.18 c AB	34.89 c BC	30.17 d C
25+PM	59.87 b A	56.61 b AB	50.37 b BC	43.31 c C
50+PM	70.26 a A	68.18 a A	63.11 a AB	55.11 b B
75+PM	78.69 a A	76.89 a A	70.18 a AB	63.84 a B
100+PM	75.11 a A	74.67 a A	69.74 a AB	65.11 a B
100 (control)**	62.27	62.27	62.27	62.27

Table 6. Number of outer leaves per plant of cabbage grown in alleys consisting of four different tree species as affected by different nitrogen levels plus pruned materials during winter season, 2001-2002

Treatment	Tree species			
Nitrogen dose (%)+PM*	*G. sepium*	*I. tasmanii*	*L. leucocephala*	*C. siamea*
0+PM	14.58 c A	14.02 b AB	13.48 c AB	13.20 c B
25+PM	15.29 bc A	14.61 b AB	14.37 b AB	13.93 c B
50+PM	15.68 ab A	15.47 a A	15.21 a A	14.78 b A
75+PM	16.49 a A	16.11 a A	15.83 a A	15.52 a A
100+PM	16.38 a A	16.08 a A	15.70 a A	15.58 a A
100 (control)**	15.49	15.49	15.49	15.49

Table 7. **O**uter leaf fresh weight (g/plant) of cabbage grown in alleys consisting of four different tree species as affected by different nitrogen levels plus pruned materials during winter season, 2001-2002

Treatment	Tree species			
Nitrogen dose (%)+PM*	*G. sepium*	*I. tasmanii*	*L. leucocephala*	*C. siamea*
0+PM	342 c A	319 c A	269 c AB	201 d B
25+PM	470 b A	463 b A	418 b A	302 c B
50+PM	559 a A	542 a A	492 a AB	419 b B
75+PM	627 a A	593 a A	563 a A	522 a A
100+PM	619 a A	589 a A	539 a A	531 a A
100 (control)**	519	519	519	519

Table 8. Head length (cm) of cabbage grown in alleys consisting of four different tree species as affected by different nitrogen levels plus pruned materials during winter season, 2001-2002

Treatment	Tree species			
Nitrogen dose (%)+PM*	*G. sepium*	*I. tasmanii*	*L. leucocephala*	*C. siamea*
0+PM	11.89 c A	11.31 c AB	10.42 d AB	9.80 d B
25+PM	13.42 b A	13.13 b AB	11.76 c BC	10.89 c C
50+PM	14.92 a A	14.70 a A	12.92 b B	12.18 b B
75+PM	15.62 a A	15.12 a AB	14.11 a AB	13.60 a B
100+PM	15.47 a A	14.88 a AB	13.93 a AB	13.68 a B
100 (control)**	12.28	12.28	12.28	12.28

Table 9. Head diameter (cm) of cabbage grown in alleys consisting of four different tree species as affected by different nitrogen levels plus pruned materials during winter season, 2001-2002

Treatment	Tree species			
Nitrogen dose (%)+PM*	*G. sepium*	*I. tasmanii*	*L. leucocephala*	*C. siamea*
0+PM	13.93 c A	13.26 c AB	12.61 c B	11.27 d C
25+PM	14.87 c A	14.09 c AB	13.43 c BC	12.83 c C
50+PM	16.11 b A	15.42 b AB	14.78 b BC	13.69 b C
75+PM	17.89 a A	17.11 a A	15.92 a B	15.60 a B
100+PM	17.71 a A	16.76 a AB	15.83 a BC	15.73 a C
100 (control)**	15.26	15.26	15.26	15.26

Table 10. Head weight (g/head) of cabbage grown in alleys consisting of four different tree species as affected by different nitrogen levels plus pruned materials during winter season, 2001-2002

Treatment	Tree species			
Nitrogen dose (%)+PM*	*G. sepium*	*I. tasmanii*	*L. leucocephala*	*C. siamea*
0+PM	344.28 c A	300.18 d AB	274.89 d BC	230.17 d C
25+PM	509.87 b A	456.61 c A	380.37 c B	323.31 c C
50+PM	750.26 a A	667.18 b B	653.11 b BC	607.11 b C
75+PM	825.11 a A	804.67 a A	789.74 a A	723.84 ab B
100+PM	808.69 a A	796.89 a A	770.18 a AB	725.11 a B
100 (control)**	652.27	652.27	652.27	652.27

Table 11. Head yield (t/ha) of cabbage grown in alleys consisting of four different tree species as affected by different nitrogen levels plus pruned materials during winter season, 2001-2002

Treatment	Tree species			
Nitrogen dose (%)+PM*	*G. sepium*	*I. tasmanii*	*L. leucocephala*	*C. siamea*
0+PM	12.19 c A	10.92 c A	9.76 c AB	7.93 c B
25+PM	17.82 b A	16.09 b AB	14.13 c B	11.12 c C
50+PM	28.31 a A	27.01 a A	23.39 b B	20.17 b C
75+PM	32.61 a A	31.20 a A	30.11 a A	27.19 a B
100+PM	31.13 a A	30.03 a A	29.26 a AB	27.39 a B
100 (control)**	25.11	25.11	25.11	25.11

Table 12. Plant height (cm) of brinjal grown in alleys consisting of four different tree species as affected by different nitrogen levels plus pruned materials during winter season, 2001-2002

Treatment	Tree species			
Nitrogen dose (%)+PM*	*G. sepium*	*I. tasmanii*	*L. leucocephala*	*C. siamea*
0+PM	56.13 c A	54.38 c AB	53.03 c AB	51.11 c B
25+PM	58.08 bc A	56.29 c AB	54.27 c BC	52.82 c C
50+PM	61.72 ab A	60.01 b AB	58.12 b B	56.92 b B
75+PM	63.19 a A	62.78 ab A	60.18 ab AB	58.73 ab B
100+PM	64.02 a A	63.39 a AB	61.27 a AB	60.12 a B
100 (control)**	58.73	58.73	58.73	58.73

Table 13. Fruit diameter (cm) of brinjal grown in alleys consisting of four different tree species as affected by different nitrogen levels plus pruned materials during winter season, 2001-2002

Treatment	Tree species			
Nitrogen dose (%)+PM*	*G. sepium*	*I. tasmanii*	*L. leucocephala*	*C. siamea*
0+PM	8.61 c A	8.14 c AB	7.87 c AB	7.32 c B
25+PM	9.13 c A	8.90 c AB	8.31 c AB	8.03 c B
50+PM	11.23 b A	10.98 b AB	10.52 b AB	10.11 b B
75+PM	12.39 a A	12.01 a AB	11.60 a AB	11.26 a B
100+PM	12.46 a A	12.18 a AB	11.82 a AB	11.39 a B
100 (control)**	11.36	11.36	11.36	11.36

Table 14. Fruit length (cm) of brinjal grown in alleys consisting of four different tree species as affected by different nitrogen levels along with pruned materials during winter season, 2001-2002

Treatment	Tree species			
Nitrogen dose (%)+PM*	*G. sepium*	*I. tasmanii*	*L. leucocephala*	*C. siamea*
0+PM	9.08 c A	8.58 c AB	8.11 c B	8.00 c B
25+PM	9.84 c A	9.36 c AB	9.01 c B	8.92 c B
50+PM	11.38 b A	11.08 b AB	10.64 b AB	10.30 b B
75+PM	12.48 a A	12.12 a A	11.86 a AB	11.11 ab B
100+PM	12.56 a A	12.14 a A	11.98 a AB	11.26 a B
100 (control)**	11.01	11.01	11.01	11.01

Table 15. Number of fruits per plant of brinjal grown in alleys consisting of four different tree species as affected by different nitrogen levels plus pruned materials during winter season, 2001-2002

Treatment	Tree species			
Nitrogen dose (%)+PM*	*G. sepium*	*I. tasmanii*	*L. leucocephala*	*C. siamea*
0+PM	5.51 c A	5.00 c AB	4.59 c AB	4.21 c B
25+PM	6.18 bc A	6.01 bc A	5.81 bc A	5.28 bc A
50+PM	7.48 ab A	7.12 ab AB	6.69 ab AB	6.31 ab B
75+PM	8.18 a A	7.68 a A	7.48 a A	7.14 a A
100+PM	8.26 a A	7.81 a A	7.57 a A	7.22 a A
100 (control)**	7.02	7.02	7.02	7.02

Table 16. Fruit weight (g/fruit) of brinjal grown in alleys consisting of four different tree species as affected by different nitrogen levels plus pruned materials during winter season, 2001-2002

Treatment	Tree species			
Nitrogen dose (%)+PM*	*G. sepium*	*I. tasmanii*	*L. leucocephala*	*C. siamea*
0+PM	223 c A	203 b AB	181 c BC	163 c C
25+PM	256 bc A	234 b AB	210 c B	199 c B
50+PM	293 ab A	278 a AB	260 b AB	242 b B
75+PM	311 a A	301 a AB	289 ab AB	271 a B
100+PM	332 a A	313 a AB	301 a AB	286 a B
100 (control)**	270	270	270	270

Table 17. Fruit yield (t/ha) of brinjal grown in alleys consisting of four different tree species as affected by different nitrogen levels plus pruned materials during winter season, 2001-2002

Treatment	Tree species			
Nitrogen dose (%)+PM*	*G. sepium*	*I. tasmanii*	*L. leucocephala*	*C. siamea*
0+PM	23.59 d A	21.14 d A	18.39 d AB	15.29 d B
25+PM	30.95 c A	28.29 c A	25.41 c AB	21.89 c B
50+PM	38.65 b A	35.23 b AB	32.23 b B	30.89 b B
75+PM	42.99 ab A	39.15 ab AB	37.03 ab B	33.38 ab B
100+PM	45.12 a A	42.92 a A	40.46 a AB	36.01 a B
100 (control)**	34.48	34.48	34.48	34.48