Performance of sunflower in neem based road side Agroforestry system

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Abstract: An experiment was conducted at the road side of BINA and BAU farm area Mymensingh, during February to May 2006 to study the performance of sunflower under different range of cowdung and irrigation levels in neem based road side Agroforestry system. The experiment composed of three factors viz. without neem (T_0), with neem (T_1); three levels of cowdung viz. M_1 (5 t ha^{-1}), M_2 (10 t ha^{-1}), M_3 (15 t ha^{-1}) and three levels of irrigation viz. control irrigation (I_0), medium irrigation (I_1) and optimum irrigation (I_2). The maximum seed yield (1.52 t ha^{-1}) of sunflower was found without tree condition (T_0) followed by tree condition seed yield (1.43 t ha^{-1}). When plants were grown in different treatments of cowdung application, the maximum seed yield (1.60 t ha^{-1}) was found in M_3 (15 t ha^{-1}) treatment, whereas the minimum seed yield (1.36 t ha^{-1}) was found in M_1 (5 t ha^{-1}) treatment. In case of irrigation levels, the maximum seed yield of sunflower (1.64 t ha^{-1}) was observed from optimum irrigation (I_2), while the minimum (1.23 t ha^{-1}) was found from control irrigation (I_0). A non-significant interaction effect among tree, cowdung and irrigation were found from all studied parameters except plant height at 42 and 63 DAS. Regarding the interaction effect, maximum seed yield (1.83 t ha^{-1}) of sunflower was found in without tree (T_0) x M_3 (15 t ha^{-1}) x I_2 (optimum irrigation) combination, whereas the minimum seed yield of sunflower (1.11 t ha^{-1}) was found in with tree (T_1) x M_1 (5 t ha^{-1}) x I_0 (control irrigation) combination.

Keyword: Sunflower, Neem, Cowdung, Irrigation

Introduction

Agriculture contributes about 29.7% of the gross domestic product of Bangladesh. Of the total agricultural product about 70% comes from various crops, 4% from livestock, 5.6% from fishes and 3.2% from forests (BBS, 2004). The production of the forest is very meager. So, introducing tree cover with crop can help to ensure the sustained productivity. There is bright prospect of sunflower (*Helianthus annuus* L.) cultivation in Bangladesh to increase oilseed production. As sunflower is a short duration and photo-insensitive crop with wider adaptability, it can be cultivated both in spring and winter seasons. As edible oil, sunflower is superior to mustard in quality because of euracic acid is absent in this oil. As it content higher amount of linoleic acid that is beneficial to health (Haldar, 1995). The seed can be eaten raw or roasted. Moreover, sunflower oil cake is used as cattle feed and also as fertilizer (Kaul and Das, 1986). The oil can be extracted locally using ghani or by expellers (BARI, 1994). Recently, the government of Bangladesh is paying a great deal of attention to the introduction of sunflower through Crop Diversification Programme (CDP)

because of its potentiality as dry land crop. Organic manure releases plant nutrients slowly. Miah (1994) reported that only one fifth to one half of the nutrient supplied from manure is recovered and the remainder is released only by 24% per annum. Location specific information for sunflower cultivation like optimum irrigation requirement, organic manure and variety are needed to be available. To add sunflower as a new crop in the list of oilseed crop and its successful adoption by the farmers, appropriate cultivation techniques should be developed and disseminated among the farmers. Therefore, an experiment was conducted to study the effect of cowdung and irrigation on growth, yield and yield contributing parameters of sunflower (cv. Kironi) in neem based road side agroforestry system.

Materials and Methods

An experiment was conducted at the road side of Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh , during February to May 2006 to study the performance of sunflower under a variable range of cowdung application and different levels of irrigation in neem based road side Agroforestry system. The experiment composed of three different factors viz. Factor A:Tree condition i) without neem (T_0), ii)with neem (T_1); Factor B: Three levels of cowdung i) M_1 (5 t ha^{-1}), ii)M_2 (10 t ha^{-1}) & iii) M_3 (15 t ha^{-1}) and Factor C: Three levels of irrigation i) control irrigation (I_0), ii)minimum irrigation at 21 and 55 DAS (I_1) & iii) optimum irrigation at 21, 55 and 70 DAS (I_2). Sunflower (cv. Kironi) is the test crop. The experiment was laid out in three factorial Randomized Complete Block Design (RCBD) with three replications. Each replication was represented by a block, which was divided into 18 unit plots of size 1.50 m × 2.00 m.The land was fertilized with the recommended rate of chemical fertilizers. Cowdung was applied at the time of final land preparation and irrigation were maintaining according to the different DAS. Observations were taken on whole plot basis for selected characters. Before harvesting plant height and total number of leaves $plant^{-1}$ were recorded at 21, 42 and 63 DAS. After harvesting data on seed weight $plant^{-1}$, 1000-grain weight and grain yield ha^{-1} were recorded. The collected data were analyzed statistically using the analysis of variance technique with the help of computer package MSTAT and Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984) adjudged mean differences.

Results and Discussion

Effect of Tree on Growth and Yield of Sunflower:

Plant height: The maximum plant height (18.18 cm, 110.12 cm and 161.64 cm) were recorded at 21, 42 and 63 DAS respectively, when plants were grown under neem tree (T_1) . The minimum plant height (16.65 cm, 107.95 cm and 158.43 cm) were recorded at 21, 42 and 63 DAS respectively when plants were grown in without neem (T_0) condition (Table. 1).

Number of leaves $plant^{-1}$: Number of leaves $plant^{-1}$ was significantly affected at different DAS. At 42 DAS, the maximum number of leaves $plant^{-1}$ (23.15) was found from plants grown under neem condition. After that the number of leaves $plant^{-1}$

decreased gradually in without neem (T_0) condition (Table. 1).

Weight of 1000 seeds: Weight of 1000 seeds was significantly affected by tree factor. The highest 1000 seeds weight (34.13 g) was measured from without tree condition (T_0), while under neem condition 1000 seeds weight was lower (33.73 g) (Table 1).

Seed weight plant^{-1}: It was exhibited that seed weight plant^{-1} was significant at tree factor. Comparatively maximum seed weight plant^{-1} (18.99 g) was obtained from open without neem condition (T_0). Sunflower plants sown under neem condition produced lower (17.92 g) seed weight plant^{-1} (Table 1).

Seed yield ha^{-1}: Seed yield was also found significant in view of tree factor. Higher seed yield (1.52 t ha^{-1}) was found in without tree condition (T_0). The lower seed yield (1.43 t ha^{-1}) was recorded from the sunflower plants grown under neem condition (T_1) (Table 1).

Effect of Cowdung on Growth and Yield of Sunflower:

Plant height: The effect of cowdung was observed significant on plant height at different DAS. The highest plant height of 165.08 was recorded at 63 DAS when plants were grown with 15 t ha^{-1} (M_3) cowdung. The lowest plant height (154.98 cm) was recorded due to 5 t ha^{-1} (M_1) cowdung (Table 1).

Number of leaves plant^{-1}: Significant effect was noted in number of leaves plant^{-1} due to application of cowdung. The maximum number of leaves at 21, 42 and 63 DAS (9.39, 24.33 and 21.89) were recorded in M_3 (15 t ha^{-1} cowdung), whereas the minimum number of leaves at same DAS (7.89, 21.17 and 19.50) were observed from the M_1 (5 t ha^{-1} cowdung) treatment (Table 1).

Seed weight plant^{-1}: Seed weight plant^{-1} was significantly affected by cowdung. The highest seed weight plant^{-1} (19.99 g) was obtained from M_3 (15 t ha^{-1}) cowdung application whereas the lowest seed weight plant^{-1} (16.96 g) was obtained from M_1 (5 t ha^{-1}) cowdung (Table 1).

Weight of 1000 seeds: Different levels of cowdung exerted significant effect on 1000 seeds of sunflower. The maximum weight of 1000 seeds (34.24 g) was obtained from M_3 (15 t ha^{-1}) cowdung. The minimum weight of 1000 seeds (33.64 g) was obtained from M_1 (5 t ha^{-1}) cowdung (Table 1).

Seed yield ha^{-1}: Seed yield ha^{-1} was found to be significantly influenced by different levels of cowdung. The maximum seed yield (1.60 t ha^{-1}) was obtained from M_3 (15 t ha^{-1}) level of cowdung application, while the minimum seed yield (1.36 t ha^{-1}) was obtained from M_1 (5t ha^{-1}) level of cowdung (Table 1). Plant grown at M_2 (10 t ha^{-1}) level of cowdung gave the intermediate seed yield. Seed yield of sunflower increased with the increase of cowdung.

Effect of Irrigation on Growth and Yield of Sunflower

Plant height: Plant height was significantly influenced by different levels of irrigation. The tallest plants were obtained at different days (21,

42 and 63 DAS) from I_2 i.e., optimum irrigation (Table 1).

Number of leaves plant^{-1}: The results exhibited that the irrigation treatment played a significant role in respect of number of leaves plant^{-1} at different DAS (21, 42 and 63 DAS) by different levels of irrigation (I_0, I_1 and I_2). The maximum number of leaves plant^{-1} at different DAS (21, 42 and 63) was recorded from optimum irrigation treatment (I_2) (9.66, 24.22 and 22.33). The minimum number of leaves plant^{-1} was recorded (7.39, 20.67 and 18.61) from control (I_0) irrigation treatment (Table 1).

Weight of 1000 seeds: Irrigation level played a significant role in 1000 seed weight of sunflower. 1000-seed weight increased with the increase in the irrigation level up to optimum (I_2) irrigation treatment. The highest 1000-seed weight (34.42 g) was obtained from optimum (I_2) irrigation level and the lowest 1000-seed weight (33.18 g) was obtained from control (I_0) irrigation treatment (Table 1).

Seed weight plant^{-1}: Significant variations in seed weight plant^{-1} were recorded due to different irrigation level. From the Table 1 it is seen that I_2 irrigation treatment gave maximum seed weight plant^{-1} (20.54 g). The minimum seed weight plant^{-1} (15.39 g) was obtained from control irrigation (I_0) treatment.

Seed yield ha^{-1}: Seed yield ha^{-1} was significantly influenced by different levels of irrigation. The results revealed that seed yield ha^{-1} increased with the increasing irrigation level up to optimum (I_2). The maximum seed yield (1.64 t ha^{-1}) was obtained from optimum (I_2) irrigation treatment, which was higher in comparison with I_1 (1.56 t ha^{-1}) and I_0 (1.23 t ha^{-1}) irrigation treatments, respectively. The minimum seed yield (1.23 t ha^{-1}) was found from control irrigation (I_0) treatment (Table 1).

Interaction Effect of Tree, Cowdung and Irrigation on Growth and Yield of Sunflower:

Plant height: Results presented in Table 2 revealed that plant height had significantly influenced by the interaction of tree, cowdung and irrigation at different DAS (except 21 DAS). At 63 DAS the highest plant height (174.33 cm) was recorded from the $T_1 \times M_3 \times I_2$ treatment combination. The lowest plant height (150.06 cm) was recorded from the treatment combination of $T_0 \times M_1 \times I_0$, which was identical to $T_1 \times M_1 \times I_0$ treatment combination.

Number of leaves plant^{-1}: Experimental result revealed that number of leaves plant^{-1} was not statistically significant at different DAS due to tree, cowdung and irrigation interaction (Table 2).

Seed weight plant^{-1}: Seed weight plant^{-1} was also found not significant due to the interaction effect of tree, cowdung and irrigation (Table 2).

Weight of 1000 seeds: It was also exhibited from the experimental result that thousand seeds weight was not significant due to the interaction effect among tree, cowdung and irrigation treatment combination (Table 2)

Seed yield ha^{-1}: It was observed that seed yield of sunflower non significantly affected by the

interaction between tree, cowdung and irrigation (Table 2).

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Table 1. Effect of tree, cowdung and irrigation on the growth and yield of sunflower

Treatment	Plant height			No. of leaves plant^{-1}			Weight of 1000 seeds (g)	Seed weight plant^{-1} (g)	Seed yield (t ha^{-1})
	21DAS	42DAS	63DAS	21DAS	42DAS	63DAS			
Tree									
T_1	18.18 a	110.12 a	161.64 a	9 a	23 a	21 a	33.727 b	17.92 b	1.43 b
T_0	16.65 b	107.95 b	158.43 b	8 b	22 b	20 b	34.13 a	18.99 a	1.52 a
Cowdung Level									
M_1	15.16 c	102.02 c	154.98 c	8 b	21 c	20 c	33.64 c	16.96 c	1.36 c
M_2	17.23 b	109.37 b	160.03 b	9 a	23 b	21 b	33.91 b	18.42 b	1.47 b
M_3	19.87 a	115.66 a	165.08 a	9 a	24 a	22 a	34.24 a	19.99 a	1.60 a
Irrigation level									
I_0	13.93 c	96.52 c	151.67 c	7 c	21 c	19 c	33.17 b	15.39 c	1.23 c
I_1	18.51 b	113.53 b	162.70 b	9 b	23 b	21 b	34.19 a	19.43 b	1.56 b
I_2	19.83 a	117.01 a	165.63 a	10 a	24 a	22 a	34.41 a	20.54 a	1.64 a
Levels of signification	**	**	**	**	**	**	**	**	**

Table 2. Interaction effect of tree, cowdung and irrigation on the growth and yield of sunflower

Interaction (Tree × Cowdung x Irrigation)			Plant height (cm)			No. of leaves plant^{-1}			Weight of 1000 seeds (g)	Seed weight plant^{-1} (g)	Seed yield (t ha^{-1})
			21 DAS	42 DAS	63 DAS	21 DAS	42 DAS	63 DAS			
T_1	M_1	I_0	13.32	93.76 l	150.90 kl	7.33	20.00	17.66	32.81	13.88	1.11
		I_1	16.33	103.20 h	157.13 hi	8.33	21.66	20.66	33.64	17.12	1.37
		I_2	17.86	109.76 g	160.96 g	9.33	22.66	21.66	33.86	18.31	1.47
	M_2	I_0	14.23	97.43 k	154.13 j	7.33	20.66	19.33	32.94	14.84	1.19
		I_1	19.06	115.10 e	163.10 ef	9.66	24.33	21.66	34.04	18.95	1.52
		I_2	21.10	118.33 d	166.56 d	10.00	24.33	23.33	34.12	19.87	1.59
	M_3	I_0	15.50	101.26 j	155.70 i	7.66	21.66	19.66	33.16	15.93	1.28
		I_1	22.26	123.46 b	171.90 b	9.66	25.66	23.66	34.29	20.61	1.65
		I_2	23.96	125.74 a	174.33 a	10.66	27.33	24.33	34.66	21.80	1.74
T_0	M_1	I_0	12.64	91.06 m	147.56 m	6.66	19.66	17.33	33.22	14.88	1.19
		I_1	15.35	102.80i	155.60 ij	7.33	21.33	19.33	34.05	18.18	1.46
		I_2	15.44	108.50 g	157.73 h	8.33	21.66	20.33	34.27	19.39	1.55
	M_2	I_0	12.99	94.90 l	150.06 l	7.33	20.33	18.33	33.35	15.86	1.27
		I_1	17.25	113.40 f	162.26 fg	8.33	22.66	21.33	34.45	20.04	1.61
		I_2	18.73	117.06 d	164.06 e	9.33	23.66	21.66	34.53	20.97	1.68
	M_3	I_0	14.86	100.66 j	151.66 k	8.00	21.66	19.33	33.57	16.96	1.36
		I_1	20.76	120.20 c	166.73 d	10.00	24.00	21.66	34.70	21.72	1.74
		I_2	21.85	122.63 b	170.13 c	10.33	25.66	22.66	35.07	22.94	1.83
Levels of significance			NS	**	**	NS	NS	NS	NS	NS	NS

** Significant at 1 % level of probability, NS= Not significant.
T_0= Control (without tree), T_1= with tree (neem),
M_1= 5 t ha^{-1} cowdung, M_2= 10 t ha^{-1} cowdung and M_3 = 15 t ha^{-1} cowdung.
I_0= Control (no irrigation), I_1 = Medium irrigation and I_2= Optimum irrigation.