Eco. Env. & Cons. 30 (1) : 2024; pp. (353-355)

ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2024.v30i01.064

Effect of *Gmelina arborea* (Khamhar) bund based Agroforestry system on growth performance of paddy crop

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(Received 25 August, 2023; Accepted 31 October, 2023)

ABSTRACT

Present study describe the effect of *Gmelina arborea* bund based Agroforestry system on growth performance of paddy crop. An experiment was conducted on the farmer's field in the Rudri village of Dhamtari block of Dhamtari district (C.G.) during the kharif season (July-November) of the year 2022-23. Experiment was conducted in randomized block design (RBD). The biometry of trees were studied. DBH is 20.7, 23.68, 22.62 cm and crown width 3.22, 5.2, 4.26 m. Samples were taken at the distances of 1 m, 3 m, 5 m, 7 m, and 9 m from the tree trunk and >15 m for the control. The result indicated that the *Gmelina arborea* bund agroforestry had a negative impact on paddy growth, which varied depending on the DBH and crown width of the tree row and distance from the tree bund. The growth of paddy, as measured by the number of hills and the number of tillers was significantly stunted by the wider crown and proximity to the tree. The number of hills and tillers were lowest between 1-3 m. from the base of tree and the highest number of hills was (14 quadrate^{-1}) and number of tiller hill^{-1} were 9.58 and average shoot length was 99.33 cm, average ear length 25.29. Thus, it is concluded that *Gmelina arborea* trees with minimal crown width and increasing distance from the tree line had less harmful impact on the growth and production of paddy than trees with maximum crown width and close proximity to the tree or tree line.

Key word: *Agroforestry, Crown Width,* Gmelina arborea, *DBH, Yield.*

Introduction

Agroforestry is the deliberate integration of trees with agricultural crops and/or livestock on the same plot/unit of land, either simultaneously or sequentially (Nair, 1993). Agroforestry has the power to restore and maintain soil fertility, monitor and prevent soil erosion, manage and prevent water harvesting and eutrophication of streams and rivers, increase local biodiversity, minimise the process of soil becoming acidic (acidification), reduce the pressure of fuel on natural forests, provide feed for livestock, increase productivity, and strengthen as well as to boost people's living conditions in developed countries (Stadtmüller, 1994).

However, by adjusting the tree canopy, which benefits the associated crop, the crop's output can be increased. Pruning out the tree canopy, allowing more sunshine to enter. Reducing competition with related crops both above and below ground has become a necessity (Fownes and Anderson, 1991). Agroforestry systems have the potential to improve soil physical qualities, decrease runoff and erosion, maintain organic matter in the soil, increase nitrogen fixation, and encourage effective nutrient cycling (Nair, 1984).

Materials and Method

The present study was conducted during the kharif season of 2022 - 2023 on an agricultural farm of village Rudri in the Dhamtari district (C.G.).

Tree on bund were measured for diameter and crown width. The experiment was carried out in a randomized block design (RBD) with one control for the purpose of defining the precise paddy fields containing the tree species *Gmelina arborea* as a part of field bund agroforestry. A preliminary survey was carried out in the hamlet of Rudri in the Dhamtari Tehsil of the Dhamtari district. Rice variety of the cultivar Swarna (MTU-7029) was cultivated in rice fields. The trees on bunds' ranged from 8 to 10 years in age. Against each bund tree four perpendicular lines were drawn at 30^o as replicate and on each lines samples were taken at 1m, 3m, 5m, 7m, and 9m distances.

Using a quadrat of 0.25 m^2 in the middle of each distance mentioned above sample were collected. Distance beyond 9m was used as control presuming that trees do not affect beyond the canopy spread growth and yield of the crop in a control or open area.

Both the number of tillers and the number of hills were counted in each quadrat. To get the total number of tillers in the quadrat, the mean tiller value was multiplied by the number of hills. To quantify the 5 tillers were harvested at harvesting, time from each sampling point as described above. Samples were kept in labeled paper bags and brought to laboratory and kept in oven for drying at 60^{o}C till its constant weight.

All observations recorded from the study area were tabulated in a systemic manner. Values were given as means for their respective number of replications used. The data were statistically analyzed using ANOVA for randomized block design (RBD). The significant difference was tested through F test at a 5% level of significance. The standard error of means (SEm±) and CD were calculated where F-test was significant for comparing treatment means (Panse and Shukhatme, 1978).

Results and Discussion

Growth characteristics of *Gmelina arborea*.

Trees on bund were randomly spaced at 2 and 3 meters from each trees. Tree DBH and crown width varied is 20.7, 23.68, 22.62 cm and 3.22, 5.2, 4.26 m respectively (Table 1).

Table 1. Tree dimension of *Gmelina arborea*

Tree	Girth (cm)	DBH (cm)	Crown width (m)
T1	65 cm.	20.7cm.	3.22m.
T2	74.2 cm.	23.68 cm.	5.2m.
T3	71 cm.	22.62 cm.	4.26m.

Numbers of hills quadrat^{-1}

Number of hills are given in Table 2. The observations showed that the lowest number of hills was observed in the immediate vicinity of the tree, i.e. 1-3 m. As the distance from the tree line increased, the number of hills increased and the declining percentage decreased. A significant reduction in number of hills were observed which were maximum near the base of tree and minimum was away from the tree at 9 meter, i.e. tree 1 (14), tree 2 (12.5), tree 3 (14.5), respectively. Similar result are reported by Bargali *et al.,* (2009).

Table 2. Number of hill quadrate^{-1} of paddy grown

	Number of hill quadrate^{-1}		
Treatments with distance	Tree - 1 (65 cm.)	Tree - 2 (74 cm)	Tree - 3 (71 cm)
T1 = 1 m	9.5	8.75	8.25
T2 = 3 m	10.25	9.5	8.75
T3= 5 m	11.5	10.25	10.75
T4= 7 m	13.00	12.25	12.5
T5= 9 m	14.00	12.5	14.5
control	15.00	15.75	15.0
Mean	12.21	11.5	11.62
SEm±	1.02	0.90	1.06
CD (P=0.0 5)	3.12	2.75	3.22

Number of tillers hill^{-1}

Number of tillers are given in Table 3. The average number of tiller hill^{-1} observed in tree 1, which was maximum 9.58 at a distance of 9 m and the lowest tiller 7.83cm hill^{-1} was recorded in tree 4 at a distance of 1m. Similar result are reported by (Kiran and Agnihotri, 2001, McMaster *et at.* 1987).

Average shoot length (cm)

Table 4 shows that maximum shoot length (99.33 cm) was at a distance 1 m from the base of the tree 2 and minimum shoot length (91 cm) at a distance 1 m base of the tree 1.

Table 3. Number of tiller hill^{-1}.

Treatments with distance	Number of tiller hill^{-1} Tree -1 (65 cm)	Tree- 2 (74 cm)	Tree -3 (71 cm)
T1 = 1 m	9.16	7.83	9.95
T2 = 3 m	9.58	9.24	8.74
T3= 5 m	8.41	8.49	8.66
T4= 7 m	9.58	8.99	8.99
T5= 9 m	9.58	9.16	9.57
control	18.00	18.13	18.00
Mean	10.71	10.30	10.65
SEm±	0.57	0.46	0.43
CD(P=0.0 5)	1.74	1.42	1.33

Table 4. Average shoot length (cm).

Treatments with distance	Average shoot length(cm) Tree -1 (65 cm.)	Tree -2 (74 cm)	v (71 cm)
T1 = 1 m	99	99.33	97.67
T2 = 3 m	93	96.00	96.66
T3= 5 m	92	94.00	95.33
T4= 7 m	92.33	93.33	95.00
T5= 9 m	91	92.33	94.00
control	90.00	90.00	90.00
Mean	92.88	93.99	94.77
Sem±	1.02	1.15	0.94
CD (P=0.05)	3.25	3.67	3.00

Table 5. Average ear length/plant (cm)

Treatments with distance	Average ear length plant^{-1} (cm) Tree - 1 (65 cm)	Tree - 2 (74 cm)	Tree -3 (71 cm)
T1 = 1 m	22.86	23.6	22.61
T = 3 m	23.6	23.69	23.76
T3= 5 m	23.16	23.53	23.26
T4= 7 m	23.13	23.69	23.96
T5= 9 m	23.56	25.29	25.20
Control	26.00	26.00	26.00
Mean	23.71	24.3	24.13
SEm±	0.40	0.44	0.39
CD (P=0.05)	1.30	1.43	1.24

Average ear length (cm)

Table 5 shows that maximum ear length plant^{-1} (25.29 cm) was at a distance 9 m from the base of the tree 2 and minimum ear length (22.61 cm) was at a distance 1 m base of the tree 4.

Acknowledgement

Authors are thankful to the authorities of Indira Gandhi Krishi Vishwavidyalaya Raipur, for encouragement and providing facilities to carry out the work.

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