EFFECT OF INTEGRATED NUTRIENT MANAGEMENT OF CHICKPEA (*Cicer arietinum L.*) UNDER TEAK (*Tectona grandis*) BASED ON AGROFORESTRY SYSTEM

ABSTRACT

A field experiment was conducted in Rabi season during November 2022- March 2023 to find out the effect of integrated nutrient management of Chickpea (*Cicer arietinum L*.) at research field of College of Forestry, SHUATS, Prayagraj, UP. The experiment is laid out in Randomized Block Design (RBD) consisting of 7 treatments replicated thrice. Various treatments. Result revealed that at 30 DAS interval maximum plant height (19.80cm), at 60 DAS interval maximum plant height (46.43cm), at 90 DAS interval maximum plant height (52.51cm). at 30 DAS maximum number of branch (4.33), at 60 DAS maximum number of highest numbers of branch (8.67) and at 90 DAS maximum number of branches (12.33), the highest DAS to flowering (79.14), highest number of pods per plant (no.) (32.27), the highest number of seeds per pod (no.) (2.23), after harvesting the highest test weight (100 seed, hundred seed weight) (gm) (28.00), after harvesting highest grain yield q/ha (14.51). After harvesting highest straw yield q/ha (18.33), after harvesting the highest harvest index % (44.18) and maximum benefit cost ratio 2:91. While maximum gross return (154,855) and maximum net return (115,255). The highest recorded in the Treatment T_7 (0%NPK + 0%FYM + 100%VERMICOMPOST).

Keywords: Chickpea, NPK, FYM, VERMICOMPOST, Growth, Yield, Economics.

INTRODUCTION

In India 1950's, Green Revolution began with increased productivity of monocultures, however it has not solved the problem of food security of the indigenous people, which encouraged them for sustainable development to ensure food security. Traditional communities started following the agroforestry practices to grow more resilient, self-sufficient and to preserve bio-diversity (Goncalves *et. al.,* 2021). Further, the rise in the term 'Agroforestry 'was a form of ancient practices, where the trees were only the integral part of the farming system, the primary motive of these practices was food production not tree production (Nair, 1993). The term 'Agroforestry 'refers to cultivation of forest trees in combination with agricultural crops/livestock's or both with the beneficial effect of ecosystem. Agroforestry implies that where there is involvement of two or more species of plants/trees, animals and woody perennials (Nair, 1993).

As population increases, there is increase in pressure on food security paves the way for sustainable agricultural practices. Considering this realization in agricultural land use management along with better income, agroforestry came into existence (Rigueiro-Rodríguez *et. al.,* 2008). Then small landholders started reconsidering agroforestry as a dynamic, ecological and economical with the intention of developing sustainability along with improved farm productivity as well as welfare of their rural community (McMicken and Vergara, 1990). Unlike, other agricultural practices agroforestry is more knowledge intensive practice when compared to modern agricultural practices. Improved quality of seeds with good varieties, chemicals and various mechanical inputs are more considered in agroforestry practices (Mercer, 2004).

OBJECTIVES:

1. To study the effect of different nutrient management in the growth of Chickpea under teak based on agroforestry system.
2. To evaluate the economics of Chickpea under Teak based on agroforestry system.

MATERIALS AND METHODS

The materials, methodology and techniques adopted during the course of the investigation entitled, "Effect of Integrated nutrient management of Chickpea (*Cicer arietinum L.*) Under Teak (*Tectona grandis*) based Agroforestry System", Location: The experiment was carried out during Rabi season of 2022 at Crop Research Farm, Department of Silviculture & Agroforestry, College of Forestry SHUATS, Prayagraj (U.P.) which is located at geographical coordinates of 250 24' 42" N latitude, 810 50’ 56” E longitude and 98 m altitude above the mean sea level. This area is situated on the right side of the river Yamuna by the side of Prayagraj. Prayagraj is situated at an elevation of 25.26° N, 81.54 E, and 98 m above the mean sea level. It is located in the south-eastern part of Uttar Pradesh and has a tropical to sub-tropical climate with extremes of summer and winter. During winter month especially Dec- Jan temperature drops down to as low as 5° C while in summer, temperature reaches above 45° C. Hot scorching winds (commonly known as Loo) is regular feature during the summer whereas there may be an occasion's spell of frost during the winter. The annual rainfall is about1100 mm mostly during the monsoon autumn i.e. July- Nov with a few occasional showers during winter months.

Treatment combination details

TREATMENT	TREATMENT COMBINATION
T1	Absolute control
T2	@ 0%NPK+50%FYM+50%VERMICOMPOST
T3	@ 50%NPK+ 50%FYM+0% VERMICOMPOST
T4	@50%NPK+ 0%FYM+50% VERMICOMPOST
T5	@100%NPK+0%FYM+0% VERMICOMPOST
T6	@0%NPK+100%FYM+0% VERMICOMPOST
T7	@ 0%NPK+0%FYM+100% VERMICOMPOST

RESULTS AND DISCUSSION

The present investigation entitled "Effect of Integrated nutrient management of Chickpea (Cicer arietinum L.) under Teak based agroforestry system" was carried out at Forest Nursery and Research Centre, College of Forestry, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (UP) during Rabi during 2022- 2023. The experiment was laid out in randomized block design with seven treatments replicated thrice. The important findings of the experiment have been summarized below on the objectives undertaken.

♣ Plant height (52.51 cm) was recorded significantly higher with INM treatment combination of (0%NPK+0%FYM+100% VERMICOMPOST).

♣ Number of branches per plant (12.33) was recorded significantly higher with organic and in organic treatment combination of (0%NPK+0%FYM+100% VERMICOMPOST).

♣ Day to 50% flowering (75.14) was recorded significantly higher with organic and inorganic treatment combination of (0%NPK+0%FYM+100% VERMICOMPOST).

♣ Number of Pod per plant (32.27) was recorded significantly higher with organic and inorganic treatment combination of (0%NPK+0%FYM+100% VERMICOMPOST).

♣ Number of Seed per Pods (2.23) was recorded significantly higher with organic and inorganic treatment combination of (0%NPK+0%FYM+100% VERMICOMPOST).

♣ Test Weight (28.00) was recorded significantly higher with organic and inorganic treatment combination of (0%NPK+0%FYM+100% VERMICOMPOST).

♣ Grain Yield (14.51) was recorded significantly higher with organic and inorganic treatment combination of (0%NPK+0%FYM+100% VERMICOMPOST).

♣ Straw Yield (18.33) was recorded significantly higher with organic and inorganic application of (0%NPK+0%FYM+100% VERMICOMPOST).

♣ Harvest Index % (44.18) was recorded as Non-significant. • Higher Gross return (154855 /ha), Net return (115255 ha), Benefit cost ratio (2.91) obtained with the Treatment combination of (0%NPK+0%FYM+100% VERMICOMPOST).

Plant height (cm)

The data recorded on plant height have presented the analysis of data revealed that significant difference was found in plant height at 30,60 and 90 DAS The data maximum plant height at 30DAS was Recorded in T7 (19.80) followed by T_6(19.52) similarly, and minimum plant height was recorded in T_4(17.81) and at 60DAS The minimum was recorded in T_7 (46.43) followed by T_3(45.96) similarly, and minimum plant height was recorded in T_1(41.76) significant and at 90DAS The maximum plant was recorded in T_7(52.51) followed by T_6(52.01) similarly, and minimum plant height was recorded in T_1(48.10) data similarly Significant.

Plant height of Chickpea (*Cicer arietinum*) under Teak (*Tectona grandis*) based Agroforestry system at 30 DAS, 60DAS and 90 DAS.

Treatment	Plantheight(cm)30 DAS	Plant height (cm) 60 DAS	Plant height (cm) 90 DAS
T1	17.91	41.76	48.10
T2	18.80	43.76	49.72
T3	19.63	45.96	50.51
T_4	17.81	43.83	50.11
T_5	19.11	42.73	51.10
T_6	19.52	43.40	52.01
T_7	19.80	46.43	52.51
Significant	**S**	**S**	**S**
C.D.	0.89	2.46	1.92
SE(m)	0.28	0.79	0.62
SE(d)	0.40	1.12	0.88
C.V.	2.64	3.14	2.13

Number of branches

The data recorded on Number of branches have presented the analysis of data revealed that significant difference was found in Number of branches at 30,60 and 90 DAS. The data maximum Number of branches at 30DAS was Recorded in T_7(4.33) followed by T_6 (4.01) similarly, and minimum Number of branches was recorded in T_1 (2.34) and at 60 DAS The maximum Number of branches was recorded in T_7(8.67) followed by T_6(8.34) similarly, and minimum Number of branches was recorded in T_1 (5.33) significant and at 90DAS The maximum Number of branches was recorded in T_7 (12.33) followed by T_6 (12.20) similarly, and minimum Number of branches was recorded in T_1(9.33) data similarly Significant.

Number of Branches of Chickpea (*Cicer arietinum*) under Teak (*Tectona grandis*) based Agroforestry system at 30 DAS, 60DAS and 90 DAS.

Treatment	Number of branches 30 DAS	Number of branches 60 DAS	Number of branches 90 DAS
T1	2.34	5.33	9.33
T2	2.67	6.33	9.64
T3	3.63	6.66	10.33
T_4	3.01	7.01	11.33
T_5	3.33	7.33	12.01
T_6	4.01	8.34	12.20
T_7	4.33	8.67	12.33
Significant	**S**	**S**	**S**
C.D.	1.17	0.19	0.55

SE(m)	0.38	0.06	0.17
SE(d)	0.53	0.09	0.25
C.V.	20.68	1.55	2.81

Number of Days to Flowering of Chickpea (*Cicer arietinum*) under Teak (*Tectona grandis*) based Agroforestry system.

Treatment	Days to Flowering
T1	78.57
T2	79.03
T3	77.63
T4	78.03
T5	76.59
T6	77.05
T7	79.14
Significant	**S**
C.D.	3.87
SE(m)	1.25
SE(d)	1.77
C.V.	2.81

Number of Pods per Plant

The data recorded on Number of Pods per Plant at 70 DAS have presented the analysis of data revealed that significant difference was found in Number of As per Plant. The data maximum Number of Pods per Plant was Recorded in T_7 (32.27) lowed by T_6 (30.80) similarly, and minimum Number of Pods per Plant was recorded in T_1 (26.34) data similarly significant.

Number of Pods per Plant of Chickpea (*Cicer arietinum*) under Teak (*Tectona grandis*) based Agroforestry system.

Treatment	Number of Pods per Plant
T1	26.34
T2	27.65
T3	29.27
T_4	27.87
T_5	25.60
T_6	30.80
T_7	32.27
Significant	**S**
C.D.	19.25
SE(m)	6.24
SE(d)	8.83
C.V.	35.11

Number of Seeds per Pod

The data recorded on Number of Seeds per Pod have presented the analysis s of data revealed that significant difference was found in Number of Seeds per Pod. The data maximum Number of Seeds per Pod was Recorded in T_7 (2.23) followed by T_6 (1.91) similarly, and minimum Number of Seeds per Pod was recorded in T_1 (1.03) data similarly significant.

Number of Seeds per Pod of Chickpea (*Cicer arietinum*) under Teak(*Tectona grandis*) based Agroforestry system.

Treatment	Number of Seeds per Pod at 70 DAS
T1	1.03
T2	1.11
T3	1.23
T4	1.64
T5	1.76
T6	1.91
T7	2.23
Significant	**S**
C.D.	0.25
SE(m)	0.08
SE(d)	0.11
C.V.	9.32

Test Weight (100 seed, hundred seed weight) (No)

The data recorded on Test weight (100 seed, Hundred-Seed Weight) (No) after harvesting have presented the analysis of data revealed that significant difference was found in Test weight (100 seed, Hundred-Seed Weight) (No). The data maximum Test weight (100 seed, Hundred-Seed Weight) (No) was Recorded in T_7 (28.00) followed by (27.40) similarly, and minimum Test weight (100 seed, Hundred-Seed Weight) (No) was recorded in T_1 (22.00) data similarly Significant.

Test Weight of 100 seed Chickpea (*Cicer arietinum*) under Teak (*Tectona grandis*) based Agroforestry system.

Treatment	Test Weight (100 seed, hundred seed weight) (gm) after harvesting
T1	22.20
T2	23.10
T3	25.46
T4	26.33
T5	24.63
T6	27.40
T7	28.00
Significant	S
C.D.	0.97
SE(m)	0.31
SE(d)	0.44
C.V.	2.16

Grain Yield. q/ha.

The data recorded on Grain Yield. q/ha after harvesting have presented in table no 4.7 and fig 4,7 the analysis of data revealed that significant difference was found in Grain Yield. a. The data maximum Grain Yield. q/ha was Recorded in T_7 (14.51) followed by T_6 (13.76) similarly, and minimum Grain Yield. kg/ha was recorded in T_1 (9.38) data similarly Significant.

Grain Yield of Chickpea (*Cicer arietinum*) under Teak (*Tectona grandis*) based Agroforestry system.

Treatment	Grain Yield. q/ha. After harvesting
T1	9.38
T2	10.36
T3	11.02
T4	11.32
T5	12.66
T6	13.76
T7	14.51
Significant	**S**
C.D.	2.44
SE(m)	0.81
SE(d)	1.15
C.V.	8.81

Straw Yield q/ha

The data recorded on Straw Yield. q/ha after harvesting have presented the analysis of data revealed that significant difference was found in Straw Yield. 9h. The data maximum Straw Yield. q/ha was Recorded in T_7 (18.33) followed by T_6 (17.33) similarly, and minimum Straw Yield. q/ha was recorded in T_1 (12.00) data similarly Significant.

Straw Yield of Chickpea (*Cicer arietinum*) under Teak (*Tectona grandis*) based Agroforestry system.

Treatment	Straw Yield. q/ha. After harvesting
T_1	12.00
T_2	13.33
T_3	14.00
T_4	15.67
T_5	16.00
T_6	17.33
T_7	18.33
Significant	**S**
C.D.	**2.20**
SE(m)	**0.73**
SE(d)	**1.04**
C.V.	**7.28**

Harvest Index %

The data recorded on Harvest Index % have presented the analysis of data revealed that non-significant difference was found in Harvest Index %. The data maximum Harvest Index % was Recorded in T_7 (44.18) followed by T_6. (44.05) similarly, and minimum Harvest Index % was recorded in T_4 (42.24) data similarly non-Significant.

The Harvest index of Chickpea (*Cicer arietinum*) under Teak (*Tectona grandis*) based Agroforestry system.

Treatment	Harvest Index %
T_1	43.87
T_2	43.73
T_3	44.04
T_4	42.24

T_5	44.17
T_6	44.05
T_7	44.18
Significant	**NS**
C.D.	5.93
SE(m)	1.98
SE(d)	2.80
C.V.	7.14

Post-Harvest Observations:

Grain Yield. q/ha

The analysis of data revealed that significant difference was found in Grain Yield. q/ha maximum Grain Yield. q/ha was Recorded in T_7 (14.51) followed by T_6 (13.76) similarly, and minimum Grain Yield. q/ha was recorded in T_1 (9.38) data similarly Significant.

Straw Yield. q/ha

The analysis of data revealed that significant difference was found in Straw Yield. q/ha. The maximum Straw Yield. q/ha was Recorded in T_7 (18.33) followed by T_6 (17.33) similarly, minimum Straw Yield. q/ha was recorded In T_1 (12.00) data similarly Significant.

Harvest Index %

The analysis of data revealed that non-significant difference was found in Harvest Index %. The data maximum Harvest Index % was Recorded in T_7 (44.18) followed by T_6 (44.05) similarly, and minimum Harvest Index % was recorded In T_4 (41.72) data similarly non-Significant.

CONCLUSION

The experiment trail of my study entitled "Effect of Integrated nutrient management of Chickpea (Cicer arietinum L.) under Teak based agroforestry system" it was concluded that the treatment combination T_7 (0%NPK+0%FYM+100% VERMICOMPOST) was found to best in term of Growth and Yield. recorded significantly higher Gran yield (kg/ha), gross return (ha), net return (ha) and benefit cost ratio (2.91) It could be recommended for profitable cultivation of Chickpea

These findings are based on one season; therefore, further trail may be required for further confirmation.

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