International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(11): 590-593
www.biochemjournal.com
Received: 21-08-2025
Accepted: 24-09-2025

Bharti Gahel
Department of Forestry, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

RK Prajapati
Department of Forestry, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Sarita Bodalkar
Department of Forestry, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

DP Singh
Department of Agricultural Statistics & Social Science College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Birbal Sahu
Krishi Vigyan Kendra, Kanker, Chhattisgarh, India

Chandu Lal Thakur
Krishi Vigyan Kendra, Kanker, Chhattisgarh, India

Corresponding Author:
Bharti Gahel
Department of Forestry, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Impact of intercropping on productivity and economic evaluation of Bhringraj (*Eclipta alba*) under *Psidium guajava* based agroforestry system

Bharti Gahel, RK Prajapati, Sarita Bodalkar, DP Singh, Birbal Sahu and Chandu Lal Thakur

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i11Sh.6285

Abstract
The current research entitled "Impact of Intercropping on Growth and Productivity on BHRINGRAJ (*Eclipta alba*) Under *Psidium guajava* Based Agroforestry System at Kanker" was conducted during 2024-25 at Krishi Vigyan Kendra Kanker. The experiment was conducted using a Randomized Block Design (RBD) with eight treatments and three replications. The test plots were established within a mature *Psidium guajava* plantation. Each plot measured 2 x 3 meters, and plots designated for intercropping (T_1-T_7) were designed to have an equal number of trees, ensuring consistent shade and resource competition across treatments. The maximum fresh biomass yield was recorded in T_8 (100% RDF without tree) with 25.45 t ha^{-1}year^{-1}, which was significantly higher than all other treatments. Among all the treatments, T_6 (100% Mahua cake) had the greatest economic return, with a net return of ₹ 1,55,000 ha^{-1} from Bhringraj only and ₹ 2,75,000 ha^{-1} when planted along with guava, having a high B:C ratio of 4.50.The enhanced economic performance is contributed by the excellent yield potential of Mahua cake (8.6 t ha^{-1}), low cost of inputs (₹ 60,000 ha^{-1}), and synergy with guava plants, thereby being the most economical organic treatment in the agroforestry system. The maximum gross return (₹ 2,40,000 ha^{-1}) and net return (₹ 1,87,000 ha^{-1}) were obtained by T_8 (RDF without tree) because of its highest yield (9.6 t ha^{-1}). No guava returns, however, were accrued under this system.

Keywords: Bhringraj, *Psidium guajava*, treatment, intercropping, agroforestry

Introduction
livestock on the same land to maximize resource use efficiency and overall farm productivity. Among various forms, fruit tree-based agroforestry systems have gained wide recognition for their dual benefits enhancing soil fertility and improving farm income through diversified production. One of the most promising approaches within this system is the intercropping of medicinal plants, which offers both productivity and economic advantages. *Eclipta alba* (Bhringraj), a valuable medicinal herb from the Asteraceae family, is renowned in Ayurveda for its hepatoprotective, anti-inflammatory, and hair growth-promoting properties. The growth and productivity of *E. alba* are greatly influenced by environmental factors such as shade intensity, soil moisture, and nutrient availability. Integrating *E. alba* with *Psidium guajava* (guava) can provide synergistic ecological and economic benefits. Guava, an economically important and nutritionally rich fruit tree, is well adapted to a variety of climatic conditions. Its moderate canopy structure offers suitable light and space conditions for the cultivation of *E. alba* beneath it. Additionally, guava contributes to soil fertility enhancement through leaf litter decomposition and nutrient cycling, while also regulating microclimate and improving resource use efficiency. This integration not only supports the better growth and yield of *E. alba* but also enhances overall land productivity and profitability, making it a sustainable and economically viable agroforestry model.

Materials and Methods
The experiment was conducted using a Randomized Block Design (RBD) with eight treatments and three replications. The study investigated the effect of varying light conditions by growing Bhringraj (*Eclipta alba*) as an intercrop under the canopy of guava trees (*Psidium guajava*) and also as a monocrop in an open field without tree shelter.

The test plots were established within a mature *Psidium guajava* plantation. Each plot measured 2 x 3 meters, and plots designated for intercropping (T_1-T_7) were designed to have an equal number of trees, ensuring consistent shade and resource competition across treatments. Prior to sowing, all plots received their designated nutrient inputs, which were uniformly applied as a single basal application to ensure a consistent nutrient supply for the entire cropping season. The eighth treatment (T_8), serving as a control, was located in an open area to observe the growth of Bhringraj as a monocrop. After harvesting of crop, to the evaluation of economic includes cost of cultivation on each treatment, total cost of cultivation for each treatment combinations, mean yield (t ha^{-1}) and gross return (Rs ha^{-1}) in each treatment with details of economic and production of Bhringraj and guava. After post-harvest operations, the economic feasibility of each treatment was estimated to find cultivation, gross return, net profit and Benefit cost ratio, were computed with the help of following:

Net return (ha^{-1}) = Gross return (ha^{-1})-Cost of cultivation (ha^{-1})

Benefit: cost ratio = Net return (ha^{-1})/Total cost of cultivation (ha^{-1})

Table 1: Details of the treatments

S. No.	Treatment details	Notations used
1	FYM 100%	T_1
2	Vermicompost 100%	T_2
3	KOSAM Cake 100% *Schleichera oleosa*	T_3
4	JATROPA Cake 100% *Jatropha curcas*	T_4
5	KARANJ Cake 100% *Millettia pinnata*	T_5
6	MAHUVA Cake100% *Madhuca longifolia*	T_6
7	Jeevamrut Bio Fertilizer 100%	T_7
8	Sole Crop Without Tree 100% RDF	T_8

Results and Discussion

Productivity and economic analysis of Bhringraj results viz. yield parameter and economic parameter is explained in this section. The yield of Eclipta alba was greatly affected by the use of different combination and doses of organic manures and biofertilizers applied under guava-based agroforestry system. The biomass productivity of *Eclipta alba* was significantly influenced by the application of different organic manures under the guava-based agroforestry system, as indicated by the significant F-test for all parameters.

Yield parameter

Fresh biomass

The fresh biomass productivity of *Eclipta alba* was significantly influenced by the application of different organic manures under the guava-based agroforestry system, as indicated by the significant F-test for all parameters. The highest fresh biomass yield was observed in T_8 (100% RDF without tree), recording 25.45 t $ha^{-1}year^{-1}$, which was significantly superior to all other treatments. This may be attributed to the absence of tree canopy competition and the balanced nutrient supply from recommended doses of fertilizers, which together promoted luxuriant vegetative growth. Among the tree-based organic treatments, T_6 (100% Mahua cake) followed closely with 23.71 t $ha^{-1}year^{-1}$, while T_1 (100% FYM) yielded 21.83 t $ha^{-1}year^{-1}$, highlighting the beneficial effect of organic amendments on biomass accumulation under agroforestry conditions. In contrast, the lowest fresh biomass production was recorded under T_7 (100% Jeevamrut) with 16.15 t $ha^{-1}year^{-1}$, likely due to its lower nutrient density and slow nutrient mineralization rate compared to other organic inputs. These findings are consistent with those of Kumar *et al.* (2023) [1], who also reported enhanced herbaceous biomass in sole cropping systems due to better light interception and resource availability and also suggested by Nayak *et al.* (2022) [2] in related MAPs studies.

.

Dry biomass

The biomass productivity of *Eclipta alba* was significantly influenced by the application of different organic manures under the guava-based agroforestry system, as indicated by the significant F-test for all parameters. the highest observed in dry biomass yield, where T_8 again led with 9.6 t $ha^{-1}year^{-1}$, followed by T_6 (8.6 t $ha^{-1}year^{-1}$) and T_1 (7.7 t $ha^{-1}year^{-1}$). The lowest dry biomass was recorded in T_2 (100% Vermicompost) with 5.2 t $ha^{-1}year^{-1}$, despite its moderate fresh biomass yield. This discrepancy may indicate higher water content and lower dry matter accumulation in the vermicompost treatment. Regarding moisture content, significant variation was noted across treatments. similar result was found by Kumar *et al.* (2023) [1]

Moisture

Moisture contents were highest in T_8 (without tree with 100% RDF), followed by T_6 (100% mahuva cake); while the minimum moisture content recorded in T_2 (100% vermicompost). moisture percentage in harvested Bhringraj leaves ranged from 61% to 70% across treatments, consistent with optimum drying parameters. Moisture content was also highest under T_8 (69.34%), followed by T_6 (67.37%) and T_3 (66%), reflecting better water retention in plant tissues under these treatments. The lowest moisture content (62%) was recorded under T_2 (Vermicompost), possibly due to faster drying rates or lower tissue succulence. High moisture content in fresh biomass suggests vigorous and hydrated plant tissues, which are often linked to healthy growth and active physiological processes. similar result was found by Kumar *et al.* (2023) [1]

Harvesting of mature crop in different plots

Table 2: Effect of organic manure and inorganic fertilizer treatments on biomass of Bhringraj (*Eclipta alba*) intercropped under *Psidium guajava* based Agroforestry System at Kanker (C.G.)

Treatment	Fresh Weight (t/ha/yr)	Dry Weight (t/ha/yr)	Moisture Content%
T_1 FYM 100%	7.22	2.40	64.34
T_2 Vermicompost 100%	5.74	1.83	62
T_3 KOSAM Cake 100%	6.72	2.53	66
T_4 JATROPA Cake 100%	5.80	2.28	64.63
T_5 KARANJ Cake 100%	6.37	2.39	65.67
T_6 MAHUVA Cake 100%	7.90	2.86	67.37
T_7 Jeevamrut 100%	5.38	1.99	64.67
T_8 Without Tree With 100% RDF	8.48	3.11	69.34
F-test	S	S	S
SE(m)	0.43	3.096	0.19
SE(d)	0.61	4.378	0.13
CD(at 5%)	1.33	9.482	0.04
CV	6.47	3.58	0.35

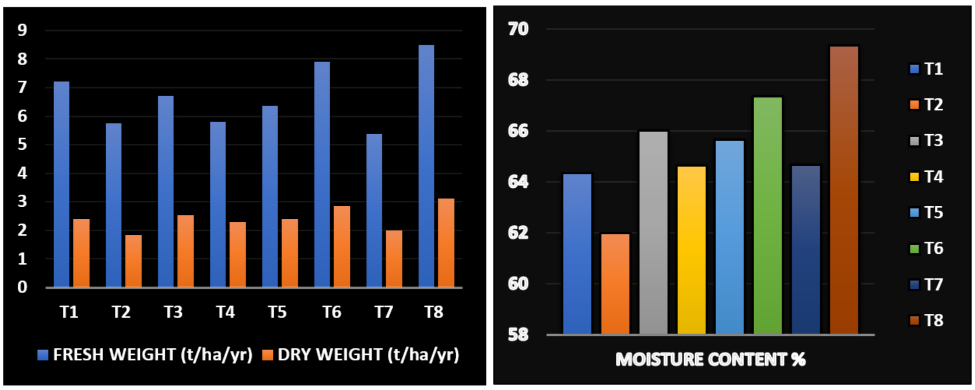

Fig 5: Effect of organic manure and inorganic fertilizer treatments on biomass of Bhringraj (*Eclipta alba*) intercropped under *Psidium guajava* based Agroforestry System at Kanker (C.G.)

Economic parameter

The economic performance of *Eclipta alba* under different organic nutrient management practices was assessed based on yield, gross return, cost of cultivation, net return, and B:C ratio. The analysis clearly reveals that organic treatments significantly influenced both profitability and return on investment when cultivated under guava-based agroforestry.

Gross return

The highest grosses return (₹ 2,40,000 ha^{-1}) was observed under T_8 (RDF), followed by T_6 (Mahuva cake 100%) (₹ 2,15,000 ha^{-1}) and T_1 (FYM 100%) (₹ 1,92,500 ha^{-1}), whereas the lowest gross return (₹ 1,30,000 ha^{-1}) occurred in T_2 (Vermicompost 100%). Similar result found by Kumar *et al.*, (2023) [1]

Net return

The maximum net return (₹ 1,87,000 ha^{-1}) was recorded under T_8 (RDF), followed by T_6 (Mahuva cake 100%) (₹ 1,55,000 ha^{-1}) and T_1 (FYM 100%) (₹ 1,22,500 ha^{-1}), while the minimum net return (₹ 68,000 ha^{-1}) was obtained from T_4 (Jatropha cake 100%). When guava was included, the highest combined net return (₹ 2,75,000 ha^{-1}) was found in T_6 (Mahuva cake 100%), followed by T_1 (FYM 100%) (₹ 2,42,500 ha^{-1}) and T_7 (Jeevamrut 100%) (₹ 2,18,000 ha^{-1}), whereas the lowest combined return (₹ 1,88,000 ha^{-1}) was noted under T_4 (Jatropha cake 100%). similar result found by Kumar and Sood (2020) [3] and Chahal *et al.*, (2025) [4]

B:C Ratio

For the benefit-cost (B:C) ratio, the maximum was observed in T_7 (Jeevamrut 100%) (4.90), followed by T_6 (Mahuva cake 100%) (4.50) and T_1 (FYM 100%) (3.46), while the minimum B:C ratio (2.16) was recorded under T_4 (Jatropha cake 100%). Similarly, the maximum BC ratio (1.22) was also found in T_5 and the minimum BC ratio (1.01) was found in T_3 under the sole cropping of Bhringraj as well. Kumar *et al.*, (2023) [1]

Table 4.7: Economic analysis of Bhringraj (*Eclipta alba*) intercropped under *Psidium guajava* based Agroforestry System at Kanker C.G.)

Treatment	Yield t/Ha	Selling price of Bhringraj (Rs t ha^{-1})	Gross Return (Rs t ha^{-1})	Cost of Cultivation (Rs t ha^{-1})	Bhringraj Net Return (Rs t ha^{-1})	Guava Net Return (Rs/t/ha	Bhringraj + Guava (Rs t ha^{-1})	B:C Ratio
T_1 FYM 100%	7.7	25,000	1,92,500	70,000	1,22,500	1,20,000	2,42,500	3.46
T_2 VERMICOMPOST 100%	5.2	25,000	1,30,000	60,000	70,000	1,20,000	1,90,000	3.16
T_3 KOSAM CAKE 100%	6.8	25,000	1,70,000	81,400	88,600	1,20,000	2,08,600	2.56
T_4 JATROPA CAKE 100%	5.6	25,000	1,40,000	72,000	68,000	1,20,000	1,88,000	2.16
T_5 KARANJ CAKE 100%	6.5	25,000	1,62,500	70,000	92,500	1,20,000	2,12,500	3.03
T_6 MAHUVA CAKE 100%	8.6	25,000	2,15,000	60,000	1,55,000	1,20,000	2,75,000	4.5
T_7 JEEVAMRUT 100%	5.7	25,000	1,42,000	44,000	98,500	1,20,000	2,18,000	4.9
T_8 Without With 100% RDF	9.6	25,000	2,40,000	53,000	1,87,000	-	-	3.5

Conclusion

Among all treatments, T_6 (100% Mahua cake) exhibited the highest economic return, recording a net return of ₹1,55,000/ha from *Bhringraj* alone and ₹ 2,75,000/ha when combined with guava, with a strong B:C ratio of 4.50. This superior economic performance can be attributed to the high yield potential of Mahua cake application (8.6 t ha^{-1}), relatively low input cost (₹ 60,000 ha^{-1}), and synergy with guava trees, making it the most cost-effective organic treatment in the agroforestry setup. Economic analysis revealed that the maximum net return was achieved in T_6 (mahuva) with guava tree but in open condition without tree T_8 achieved maximum net return. Minimum net return in T_4. B:C ratio was highest in T_7 due to lowest cost cultivation followed by T_6 and minimum B:C ratio in T_4. Overall, Mahuva cake (T_6) proved to be the superior treatment for maximizing biomass and profitability under guava-based agroforestry. However, Jeevamrut (T_7) and Vermicompost (T_2) offer sustainable, low-cost alternatives with considerable ecological and economic advantages. These findings support the promotion of organic nutrient management and agroforestry systems as viable models for enhancing the production and quality of medicinal plants like Bhringraj. This high demand medicinal plant can be cultivated as an intercrop under Guava orchards get high net return with 100% Organic crop as desired by the Ayurvedic pharma companies as compared to cultivated without intercrop and chemical cultivated crop.

Reference

1. Kumar J, Thakur CL, Bhardwaj DR, Kumar S, Dutt B. Effects of integrated nutrient management on performance of bhringraj (*Eclipta prostrata* L.) and soil fertility under *Grewia optiva* Drummond canopy in a mid-hill agroecosystem of north western Himalayas. Agrofor Syst. 2023;97(4):711-726.
2. Nayak MR, Sahoo B, Dash SR, Paramaguru S, Mishra PJ. Yield and economic evaluation of medicinal plants in hortisilvi agroforestry systems. 2022.
3. Kumar V, Sood M. The performances of *Linum usitatissimum* on different organic manures and fertilizers under peach based horti-medicinal system of agroforestry. IJCS. 2020;8(5):572-576.
4. Malek SS, Dobriyal MJ, Gunaga RP, Desai BS, Bhatt BK. Performance of *Coleus aromaticus* Benth. under sapota-jatropha based horti-medicinal agroforestry system. IJCS. 2020;8(5):2321-2325.