P-ISSN: 2618-0723
E-ISSN: 2618-0731

NAAS Rating (2025): 5.04
www.extensionjournal.com

International Journal of Agriculture Extension and Social Development

Volume 8; Issue 8; August 2025; Page No. 462-465

Received: 04-06-2025
Accepted: 07-07-2025

Indexed Journal
Peer Reviewed Journal

Influence of pruning level and nutrient sources on yield and economics of rice under agri silviculture system

[1]Sanjay Singh Jatav, [2]SB Agrawal, [3]R Bajpai, [4]Rahul Dongre, [5]Yashpal Singh, [6]Abhishek Sharma, [7]Sunil Upadhayay, [8]Abhishek Sharma, [9]Anjali Anand and [10]Siddarth Nayak

[1, 2, 3, 4, 5 & 9]Department of forestry, College of Agriculture, JNKVV, Jabalpur, Madhya Pradesh, India

[6 & 10] Department of Agronomy College of Agriculture, JNKVV, Jabalpur, Madhya Pradesh, India

[7 & 8]Department of Soil Science and Agricultural Chemistry, College of Agriculture, JNKVV, Jabalpur, Madhya Pradesh, India

DOI: https://www.doi.org/10.33545/26180723.2025.v8.i8g.2305

Corresponding Author: Sanjay Singh Jatav

Abstract

A field experiment was conducted during Kharif 2023-2024 at JNKVV, Jabalpur to assess the impact of *Dalbergia sissoo* Roxb. pruning intensities and nutrient sources on rice (*Oryza sativa* L.) yield and economics. Results showed significant effects of pruning × sources of nutrient. The lowest yield (22.80 and 39.70 q ha^{-1}) occurred under no pruning with 100% RDF, while the maximum (48.92 and 66.50 qha-^{1}) was obtained under open conditions with 75% RDF + VAM + foliar fulvic acid. Yields consistently improved from P_0 to P_3, with integrated nutrients (T_2) performing best. Economic evaluation revealed the highest gross (₹172501 ha^{-1}) and net returns (₹119753 ha^{-1}) along with maximum B:C ratio (3.27) under P_3xT_2, indicating the profitability of moderate pruning with integrated nutrient management. Thus, canopy reduction of *D. sissoo* combined with balanced nutrients enhances rice productivity and economic sustainability in agroforestry-based Agri silviculture systems.

Keywords: *Dalbergia sissoo*, pruning, sources of nutrients, rice yield, economics, Agri silviculture systems

Introduction

Shisham (*Dalbergia sissoo*) is a multipurpose agroforestry tree valued for timber, fodder, shade, and soil fertility enhancement through leaf litter and nitrogen fixation. However, its dense canopy and competitive root system suppress productivity of understory crop reduces solar radiation and increase competing space for water and nutrients (Chaturvedi and Das, 2002; FSI, 2023) [3, 6]. Pruning has been shown to mitigate these effects by improving light penetration and reducing tree and crop competition. Previous studies reported that 50% pruning of *D. sissoo* increased rice yield by 12 and 13% and improved tiller number and biomass accumulation (Singh *et al.*, 2015; Malviya *et al.*, 2019) [17, 13]. Since rice (*Oryza sativa* L.) is highly sensitive to in photosynthetically active radiation yield of rice. The radiation in radiation negatively affects the, with a 20 and 30% decline causing yield losses of 10 and 18% (Ghosh *et al.*, 2014) [8], hence the management of tree canopy and nutrients critical for improving both yield and profitability. Nutrient interventions particularly arbuscular mycorrhizal which root associated fungi along with humic substances (fulvic acid) productivity under shaded conditions. Are have enormous potential to sustain both are considered a biostimulant and enhancing root growth, nutrient uptake, chlorophyll content, and photosynthetic efficiency and leading to 10 and 15% higher grain yield under stress (Khan *et al.*, 2013; Verma *et al.*, 2020) [11, 20]. Keeping the above fact in view the present study was carried out with on objective to assess the impact of pruning and stimulant on productivity and profitability of *D. sissoo* Rice agrisiviculture system.

Materials and Methods

About the Experiment and experimental Site

A field experiment was conducted during Kharif 2023 and 2024 at the Agroforestry Research Farm, JNKVV, Jabalpur. The agrisiviculture system consist of 26-year-old *D. sissoo* trees. The experiment was conducted in strip plot design with three replications (0, 25, 50, 75%, and open) and four nutrient practices (100% RDF, 50% RDF + VAM + foliar fulvic acid, 75% RDF + VAM + foliar fulvic acid and 50% RDF + VAM + FA as soil inoculation + foliar fulvic acid0), giving 20 treatment combinations. Fulvic acid @ 2 kgha-^{1} at 5 DAT and 750 mlha-^{1} foliar spray at 25 and 45 DAT) and VAM were applied as per treatment. Data in relation to grain and straw yields computed the economics were recorded from the field experiment and in term of cost of cultivation from the field experiment and were analysed in terms of cost of cultivation, gross and net returns (GMR) Net Monetary Return (NMR) and benefits cost ratio.

Results and Discussion

The data pertaining to different yield and economic aspects are presented in (Table 1 and 2 as well as Figures 1 and 2.)

Yields

Different pruning intensities and nutrient sources had a significant influence on the grain and straw yield of rice (Table 1. And Figures 1.1 and 1.2). The increase in grain and straw yields were observed with increasing pruning intensity under all nutrient treatments. The lowest yield (22.80 and 39.70 q ha^{-1}) was recorded under without pruning and 100% RDF (control), Grain and straw yields progressively improved from P_0 to P_3 under all nutrient combinations, reflecting the significant effect of pruning. Among nutrient sources, T_2 Application of 75% RDF along with VAM @ 5 $kgha^{-1}$ as soil inoculation followed by 2 sprays of fulvic acid at 25 and 50 DAT exhibited markeable improvement in yield under all the pruning level. Similarly, these results are in close conformity with previous findings.

Cost of cultivation (Rs. ha^{-1})

The cost of cultivation (Table-2) remains unchanged under without pruning and open condition. The pruning at 75% possess higher cost of cultivation than without but lower to 50% and 75%. However integrated nutrient also increases the cost of cultivation. The highest cost of cultivation Rs 52799ha^{-1} was recorded under P_3T_3 closely followed by P_3 T_2 and P_2 T_3 while the lowest was RS 47299/ ha under P_0T_1 and P_4 T_1. These results are findings.

Gross monetary return (Rs. ha^{-1})

The gross monetary return (Table-1) Rs 172501 ha^{-1} was obtained under P_3 T_2 closely followed by Rs 167944 ha^{-1} under $P_3T_{3,}$ whereas the lower GMR of Rs 75245/ ha was obtained under P_0T_0. Islam *et al.*, 2006 [10].

Net monetary returns (Rs. ha^{-1}) and Benefit Cost ratio

NMR and BCR Similarly net monetary return of Rs 119753ha^{-1} was recorded from P_3 $_x$T2 followed by Rs 115145 ha^{-1} under $P_{3x}T_{3.}$ The treatment combination P_3 $_xT_2$ fetched the highest BC ratio of 3.27 however, treatment P_3 $_xT_3$, $P_{3x}T_1$, and $P_{4x}T_2$ are equally good and gave highest return/rupee investment. These results are in close conformity with previous findings (Thakur, 2013) [18].

Table 1: Interaction Effect of Pruning Intensities and Nutrient Sources on Grain and straw Yield (qha^{-1}) of Rice crop under *Dalbergia sissoo*-Based Agri silviculture Systems.

Interaction effect of pruning intensities and nutrient sources on grain and straw yield (qha^{-1}) of rice crop and tree.												
Sources Of nutrients	Pruning intensities											
	Grains yield ($kgha^{-1}$)						Grains yield ($kgha^{-1}$)					
	P_0=0%	P_1=25%	P_2=50%	P_3=75%	P_4= Without tree	Mean	P_0=0%	P_1=25%	P_2=50%	P_3=75%	P_4= Without tree	Mean
T0	22.80	23.67	25.83	34.00	39.00	29.06	39.70	44.25	47.00	55.00	62.17	49.62
T1	24.32	29.17	32.05	38.00	40.72	32.85	43.75	48.17	51.18	60.50	63.33	53.39
T2	27.48	33.53	39.06	41.83	48.92	38.16	49.70	51.33	60.33	65.33	66.50	58.64
T3	26.49	31.48	35.82	40.58	44.38	35.75	46.54	49.72	55.00	63.00	66.17	56.09
Mean	25.27	29.46	33.19	38.60	43.25	33.96	44.92	48.37	53.38	60.96	64.54	54.43
Treatment	Pruning intensities		Sources of Nutrient		Interaction (P x S)		Pruning intensities		Sources of Nutrient		Interaction (P x S)	
S.Em ±	3.20		1.93		1.68		3.62		2.16		1.85	
CD(P=0.05)	9.64		5.82		6.60		10.92		6.51		7.27	
Abbreviation: -Sources of nutrient												
T_0:100% RDF(Control), Recommended dose of fertilizer (RDF)												
T_1: Application of 50% RDF along with VAM @ 5 $kgha^{-1}$ as soil inoculation followed by 2 sprays of fulvic acid at 25 and 50 DAT												
T_2: Application of 75% RDF along with VAM @ 5 $kgha^{-1}$ as soil inoculation followed by 2 sprays of fulvic acid at 25 and 50 DAT												
T_3: Application of 50% (RD)NPK along with VAM @ 5 $kgha^{-1}$ as soil inoculation followed by fulvic acid @ 2$kgha^{-1}$ as soil application at 5 DAT as well as two sprays of fulvic acid at 25 and 50 DAT												

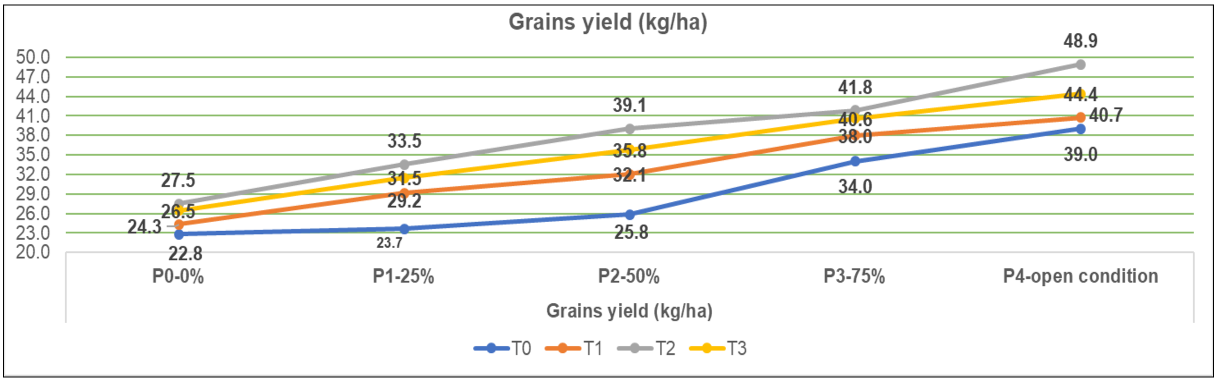

Fig 1: Interaction Effect of Pruning Intensities and Nutrient Sources on Grain Yield (qha^{-1}) o.

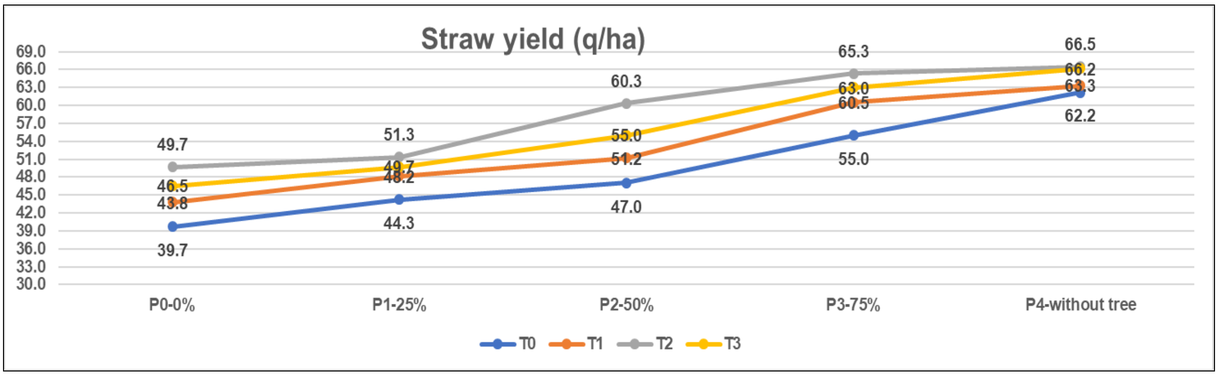

Fig 2: Interaction effect of pruning intensities and nutrient sources on grain yield (qha-¹) of rice crop and tree

Table 2: Effect of Pruning Intensities and Nutrient Sources on Cost of Cultivation, Gross and Net Monetary Returns, and Benefit: Cost Ratio in Rice and tree (2023, 2024 and Pooled)

Treatment	Cost of cultivation (Rs. ha-¹)			Gross monetary return (Rs. ha-¹)			Net monetary returns (Rs. ha-¹)			Benefit cost ratio (%)		
	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled
P_0T_0	46932	48068	47500	72430	78060	75245	25498	29992	27745	1.54	1.62	1.58
P_0T_1	46731	47867	47299	79085	82883	80984	32354	35016	33685	1.69	1.73	1.71
P_0T_2	48180	49316	48748	88952	94277	91614	40772	44961	42866	1.85	1.91	1.88
P_0T_3	48231	49367	48799	85378	89938	87658	37147	40571	38859	1.77	1.82	1.80
P_1T_0	48932	50068	49500	89310	95799	92554	40378	45731	43054	1.83	1.91	1.87
P_1T_1	48731	49867	49299	103075	112466	107771	54344	62599	58472	2.12	2.26	2.19
P_1T_2	50180	51316	50748	113930	126471	120200	63750	75155	69452	2.27	2.46	2.37
P_1T_3	50231	51367	50799	107735	120613	114174	57504	69246	63375	2.14	2.35	2.25
P_2T_0	49732	50868	50300	109313	113736	111525	59581	62868	61225	2.20	2.24	2.22
P_2T_1	49531	50667	50099	121770	135644	128707	72239	84977	78608	2.46	2.68	2.57
P_2T_2	50980	52116	51548	141748	159993	150871	90768	107877	99323	2.78	3.07	2.93
P_2T_3	51031	52167	51599	128615	151271	139943	77584	99104	88344	2.52	2.90	2.71
P_3T_0	50932	52068	51500	145955	148919	147437	95023	96851	95937	2.87	2.86	2.86
P_3T_1	50731	51867	51299	152010	168610	160310	101279	116743	109011	3.00	3.25	3.12
P_3T_2	52180	53316	52748	160840	184162	172501	108660	130846	119753	3.08	3.45	3.27
P_3T_3	52231	53367	52799	157100	178788	167944	104869	125421	115145	3.01	3.35	3.18
P_4T_0	46932	48068	47500	125220	124882	125051	78288	76814	77551	2.67	2.60	2.63
P_4T_1	46731	47867	47299	126420	134203	130312	79689	86336	83013	2.71	2.80	2.75
P_4T_2	48180	49316	48748	147433	155090	151262	99253	105774	102514	3.06	3.14	3.10
P_4T_3	48231	49367	48799	135057	145950	140504	86826	96583	91705	2.80	2.96	2.88

Abbreviation: Pruning intensities X sources of nutrient	
P_0: 0% no pruning	T_0:100% Recommended dose of fertilizer (RDF)(Control)
P_1: 25% pruning	T_1: Application of 50% RDF along with VAM @ 5 kgha-¹ as soil inoculation followed by 2 sprays of fulvic acid at 25 and 50 DAT
P_2: 50% pruning	T_2: Application of 75% RDF along with VAM @ 5 kgha-¹ as soil inoculation followed by 2 sprays of fulvic acid at 25 and 50 DAT
P_3: 75% pruning P_4: without tree	T_3: Application of 50% (RD)NPK along with VAM @ 5 kgha-¹ as soil inoculation followed by fulvic acid @ 2kgha-¹ as soil application at 5 DAT as well as two sprays of fulvic acid at 25 and 50 DAT

Conclusion

The study revealed that both pruning intensity and nutrient management exerted a significant influence on rice yields and profitability in Dalbergia sissoo-based Agri silviculture. Grain and straw yields consistently increased with higher pruning intensity, with the maximum recorded under open condition and integrated nutrient application (75% RDF + VAM + fulvic acid). Among nutrient sources, integrated use of RDF, VAM, and FA proved most effective across all pruning levels. Although the cost of cultivation was relatively higher under P_3T_3, the maximum gross monetary return (₹172501ha^{-1}), net monetary return (₹119753 ha^{-1}), and B:C ratio (3.27) were achieved under P_3T_2, closely followed by P_3T_3. These findings emphasize that 75% pruning combined with integrated nutrient management (RDF + VAM + FA) offers the most productive and economically viable option for sustaining rice cultivation in D. sissoo-based agroforestry systems.

Grain and straw yields increased with increasing pruning intensities. However, higher yield were recorded under open condition which fertilized application 75% RDF + VAM + fulvic acid). Among nutrient sources, integrated use of RDF, VAM, and FA proved most effective across all pruning levels. Although the cost of cultivation was relatively higher under P_3T_3, the maximum gross monetary return (₹172501ha^{-1}), net monetary return (₹119753 ha^{-1}), and B:C ratio (3.27) were achieved under P_3T_2, closely followed by P_3T_3. These findings emphasize that 75% pruning combined with integrated nutrient management (RDF + VAM + FA) offers the most productive and economically viable option for sustaining rice cultivation in D. sissoo-based agroforestry systems.

References

1. Agricultural Statistics at a Glance. Ministry of Agriculture and Farmers' Welfare, Government of India; 2025.
2. Ali MH, Islam MR, Rahman MS, Sarker JR. Effect of integrated nutrient management on rice yield under agroforestry system. Bangladesh Journal of Agricultural Research. 2009;34(1):123-134. doi:10.3329/bjar.v34i1.5757.
3. Chaturvedi OP, Das DK. Productivity and nutrient cycling in a Dalbergia sissoo based agroforestry system. Indian Journal of Agroforestry. 2002;4(2):71-76.
4. Chaturvedi OP, Das DK. Productivity and economics of rice (*Oryza sativa*) under *Dalbergia sissoo*-based agroforestry systems. Indian Journal of Agroforestry. 2002;4(2):81-85.
5. Chen Y, Aviad T. Effects of humic substances on plant growth. Soil Science Society of America Journal. 1990;54(5):1249-1256.
6. FSI (Forest Survey of India). State of Forest Report 2023. Ministry of Environment, Forest and Climate Change, Government of India; 2023.
7. Ghosh PK, Singh R. Agronomic and economic performance of rice under different nutrient management practices in an agroforestry system. Indian Journal of Agronomy. 2010;55(3):168-173.
8. Ghosh PK, Mohanty M, Bandyopadhyay KK, Painuli DK, Misra AK. Crop productivity and soil fertility under tree-based systems. Agroforestry Systems. 2014;88(4):881-893.
9. Hocking D, Islam KK. Effects of top- and root-pruning on growth of trees and crop yield in agroforestry systems. Agroforestry Systems. 1997;37(2):111-123. doi:10.1023/A:1005999225770.
10. Islam KK, Hoque ATMR, Mamun MF. Effect of different pruning treatments on the performance of rice (*Oryza sativa*) in agroforestry system. Asian Journal of Plant Sciences. 2006;5(1):13-20. doi:10.3923/ajps.2006.13.20.
11. Khan MA, Gaur RZ, Rizvi R. Role of fulvic acid in enhancing crop productivity under stress conditions. Journal of Plant Nutrition. 2013;36(9):1230-1240.
12. Malviya A, Sharma R. Effect of integrated nutrient management on growth, yield and economics of rice under rainfed conditions. Oryza. 2012;49(1):56-59.
13. Malviya A, Singh V, Patel R. Effect of pruning and nutrient management on growth and yield of rice under *Dalbergia sissoo*-based agroforestry system. Journal of Pharmacognosy and Phytochemistry. 2019;8(3):1871-1876.
14. Roy S, Kumar R, Tripathi S. Interactive effects of humic substances and arbuscular mycorrhizal fungi on nutrient uptake and productivity of rice. Applied Soil Ecology. 2021;157:103732.
15. Singh G, Gill AS. Long-term effect of integrated nutrient management on productivity and soil health under rice-wheat system. Journal of Applied and Natural Science. 2014;6(2):528-534. doi:10.31018/jans.v6i2.505.
16. Singh R, Prasad R. Response of rice to integrated use of organic manures and inorganic fertilizers under agroforestry system. Annals of Agricultural Research. 2007;28(4):312-317.
17. Singh R, Dhyani SK, Newaj R. Impact of pruning regimes on productivity of agricultural crops under tree-based systems. Indian Journal of Agroforestry. 2015;17(1):30-35.
18. Thakur R, Tiwari R, Dwivedi R. Effect of nutrient management practices on growth, yield and economics of rice under rice-wheat cropping system. International Journal of Chemical Studies. 2018;6(4):2218-2222.
19. Trevisan S, Francioso O, Quaggiotti S, Nardi S. Humic substances biological activity at the plant-soil interface: From environmental aspects to molecular factors. Plant Signaling & Behavior. 2010;5(6):635-643.
20. Verma RK, Mishra VK, Yadav J. Role of fulvic acid in crop production: A review. International Journal of Current Microbiology and Applied Sciences. 2020;9(6):1430-1440.
21. Yadav RS, Singh RS, Yadav BL. Influence of different pruning intensities of *Dalbergia sissoo* on crop yield and system productivity. Agroforestry Systems. 2011;82(2):215-221. doi:10.1007/s10457-010-9369-5.