E-ISSN: 2618-0618
P-ISSN: 2618-060X

NAAS Rating (2025): 5.20
www.agronomyjournals.com
2025; 8(8): 814-817
Received: 07-05-2025
Accepted: 09-06-2025

Sanjay Singh Jatav
College of Agriculture, Jabalpur, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh, India

R Bajpai
College of Agriculture, Jabalpur, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh, India

SB Agrawal
College of Agriculture, Jabalpur, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh, India

Somnath Sarvade
College of Agriculture, Jabalpur, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh, India

Abhishek Sharma
College of Agriculture, Jabalpur, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh, India

Rishikesh Tiwari
College of Agriculture, Jabalpur, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh, India

RP Dongre
College of Agriculture, Jabalpur, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh, India

Vishnu Solanki
College of Agriculture, Jabalpur, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh, India

Priya Jaiswal
College of Agriculture, Jabalpur, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh, India

Surbhi Jain
College of Agriculture, Jabalpur, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh, India

Corresponding Author:
Sanjay Singh Jatav
College of Agriculture, Jabalpur, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh, India

Effect of pruning and sources of nutrient on growth and yield of rice under *D. sissoo*

Sanjay Singh Jatav, R Bajpai, SB Agrawal, Somnath Sarvade, Abhishek Sharma, Rishikesh Tiwari, RP Dongre, Vishnu Solanki, Priya Jaiswal and Surbhi Jain

DOI: https://www.doi.org/10.33545/2618060X.2025.v8.i8l.3640

Abstract
This study evaluated the effects of *D. sissoo* pruning and sources of nutrient, including VAM and fulvic acid, on rice (*Oryza sativa L* JR-206) growth and yield, during Kharif 2023–2024 at JNKVV, Jabalpur. A strip plot design with five pruning levels (P_0-without pruning to P_3–75% and Open-without tree) and four nutrient treatments (T_0-100% RDF to T_3–50% RDF + VAM + soil-applied fulvic acid + 2 foliar sprays) was replicated three times. Maximum rice height (98.4 cm) and panicle length (26.3 cm) occurred under open conditions, while effective tillers (430.4) and panicle weight (7.93 g) were highest under 75% pruning. Grain and straw yields were maximized under 75% pruning and T2 nutrient treatments.

Keywords: *Dalbergia sissoo*, rice, pruning, fulvic acid, VAM, agroforestry

Introduction
D. sissoo, popularly known as Shisham, is a multipurpose tree species widely integrated into agroforestry systems for timber, fodder, shade, and soil fertility improvement through leaf litter decomposition and nitrogen fixation. Despite these benefits, its dense canopy and extensive root system often restrict crop productivity by intercepting solar radiation and competing for soil moisture and nutrients, which is particularly detrimental for shade-sensitive crops like rice (Chaturvedi & Das, 2002; FSI, 2023) [25, 5]. Pruning is an effective practice to reduce tree–crop competition. Regular pruning of *D. sissoo* improves light penetration and promotes crop growth. Studies have reported that pruning increased rice yield by 12–13% under 50% canopy removal and enhanced tillering and biomass accumulation in cereals (Malviya *et al*., 2019; Singh *et al*., 2015; Chaturvedi & Das, 2002) [15, 24, 25].

Rice (Oryza sativa L.) is a C3 and shade-sensitive crop, highly vulnerable to reduced photosynthetically active radiation (PAR), where a 20–30% reduction can decrease yield by 10–18% (Ghosh *et al*., 2014). In Madhya Pradesh, rice productivity remains below the national average, reflecting the need for improved canopy and nutrient management strategies under agroforestry systems (Agricultural Statistics at a Glance, 2025) [7].Fulvic acid (FA), the water-soluble fraction of humic substances, is an effective biostimulant that promotes root development, nutrient uptake, and photosynthesis (Chen & Aviad, 1990) [4]. In rice, FA can increase chlorophyll content by 12–18% and grain yield by 10–15% under stress conditions, while also mitigating oxidative stress in shaded environments (Khan *et al*., 2013; Verma *et al*., 2020; Trevisan *et al*., 2010) [10, 27, 26]. Arbuscular mycorrhizal fungi (AMF) form symbiotic associations with rice roots, improving phosphorus uptake, water relations, and yield, particularly under tree shade. The combined application of FA and AMF further enhances nutrient absorption and grain yield by 12–17% compared to fertilizers alone (Roy *et al*., 2021) [19]. However, FA and AMF alone cannot fully overcome the shading limitations in Dalbergia sissoo-based systems. Integrating moderate pruning with FA and AMF optimizes light and nutrient availability, providing a synergistic approach for sustainable rice production under agroforestry (Singh *et al*., 2015; Malviya *et al*., 2019) [21, 15].

Materials and Methods

The field experiment was conducted during Kharif 2023 and 2024 at the Dalbergia sissoo-based agroforestry system, Agroforestry Research Farm, JNKVV, Jabalpur, Madhya Pradesh, located in the Kymore Plateau and Satpura Hills agro-climatic zone. The experiment was laid out in a strip plot design with five main plot factors representing pruning intensities (P0 – no pruning, P1 – 25% pruning, P2 – 50% pruning, P3 – 75% pruning, and an open condition without trees) and four sub-plot factors representing nutrient management practices, replicated three times, giving a total of 20 treatment combinations.

The sub-plot treatments were T0: 100% RDF (control), T1: 50% RDF + VAM as soil inoculation + two foliar sprays of fulvic acid, T2: 75% RDF + VAM as soil inoculation + two foliar sprays of fulvic acid, T3: 50% RDF + VAM as soil inoculation + fulvic acid applied as soil amendment + two foliar sprays of fulvic acid.

The system consisted of 25-year-old Dalbergia sissoo trees planted at 5 × 5 m spacing with rice (Oryza sativa, variety JR-206) as the intercrop, along with control plots of sole tree and sole crop. JR-206 is a high-yielding, medium-duration indica rice variety (130–135 days), semi-dwarf (120–125 cm), with high tillering ability, long translucent grains, and moderate resistance to major pests and diseases. Fulvic acid was applied in powder form (2 kg/ha with FYM at 0-5 DAT) and liquid form (750 ml/ha as foliar spray at 20–25 and 40–45 DAT), while VAM inoculation was applied according to the treatment to enhance nutrient uptake and rice performance under the agroforestry system Okonji *et al.* (2018) [16] and (Lv *et al.*, 2024) [13].

Data pertaining to growth parameter of rice and tree gathered and was subject to statical analysis of variance such as growth and yield attributes.

Results and Discussion

Growth and yield attributes

Significant differences were observed due pruning with respect to growth and yield attributes (Table-1) Increasing pruning level increased height and panicle length of rice. Significantly the highest plant height (98.4 cm) and length of panicles (26.3cm) was record under open condition and proved at par to 75% without pruning, however it was, as well as 50% pruning.

The significantly effective tillers (430.4) and panicles weight (7.93 g) were observed under 75% pruning. However, numerically higher values were recorded under open. The total grains/panicle as well as test weight of rice significantly changed due to pruning intensity.

Among the sources of nutrient, growth parameters and yield attributes significantly change due to sources of nutrients. 75%RDF + VAM as soil inoculation +2 spray of fulvic acid proved its superiority over 100% RDF (control) with respect to plant height and yield attributes it found to be at par with 50% RDF + VAM as soil inoculation + fulvic acid as soil application + 2 spray of fulvic acid. Furthermore, 75% RDF + VAM as soil inoculation + 2 spray of fulvic acid and 50%RDF + VAM as soil inoculation + fulvic acid as soil application + 2 spray of fulvic acid proved superior 100% RDF (control) with respect growth and yield attributes. Similarly, results have been reported by Kumawat *et al.*, (2019) [12] Singh *et al.*, (2020) [22] Verma, *et al.*, (2020) [27] Malviya *et al.*, (2021) [14].

Yields

Different interaction of pruning levels and nutrient sources exerted a significant effect on rice yields (Table 2). Data indicate (table-2) that both grain and straw yields of rice increased significantly with increasing pruning intensity. The highest grain (38.60 q/ha) and straw (60.96 q/ha) yields were recorded under 75% pruning. While the lowest grain (25.27 q/ha) and straw (44.92 q/ha) yields were observed in plots without pruning. Regarding nutrient management, treatment in which 75% RDF + VAM followed by two foliar sprays of fulvic acid showed superiority over other treatments in terms of grain and straw yield. The treatment Half of RDF with VAM + fulvic acid followed by (soil amendment) + two foliar sprays of fulvic acid produced high grain and straw yields of 33.59 q/ha and 53.56 q/ha, respectively. A higher grain and straw greater production relative to total biomass. These results are in close conformity with previous findings.

The interaction of pruning x nutrients sources shown to be markeable effect on yield interaction of grains and straw during both the year as sell as pooled analysis. The pooled data reveal that 75% pruning with T_2 (41.83 and 65.33kg/ha) and 75% pruning with all the levels nutrient sources respected its superiority over P_1 and P_0 but at par to P_2.

Table 1: influence of pruning intensities and sources of nutrient on growth and yield attribute of rice under agroforestry

Treatment	Plant height (cm)	Effective tillers(m^2)	Total grains/ panicle	Panicle weight (g)	Length of panicles (cm)	Test weight 1000 grains(g)
Pruning intensities						
P_0: No pruning	88.7	357.9	299.0	7.62	23.5	24.5
P_1: 25% pruning	90.0	377.8	305.5	7.79	24.2	24.7
P_2: 50% pruning	93.0	407.5	308.0	7.85	24.8	24.9
P_3: 75% pruning	96.5	430.4	311.0	7.93	25.5	25.0
Open area no tree	98.4	460.8	314.9	8.03	26.3	25.4
S.Em ±	1.8	18.31	2.68	0.07	0.43	0.28
CD(P=0.05)	7.9	77.94	11.40	0.29	1.28	0.84
Sources of Nutrient						
T_0: Control 100% RDF	88.4	385.7	304.3	7.76	24.3	24.5
T_1: 50%RDF + VAM as soil inoculation + 2spray of fulvic acid	92.6	401.7	306.6	7.82	24.7	24.7
T_2: 75%RDF + VAM as soil inoculation +2 spray of fulvic acid	96.4	425.3	310.2	7.91	25.4	25.4
T_3: 50%RDF +VAM as soil inoculation + fulvic acid as soil application + 2 spray of fulvic acid	95.8	415	309.6	7.89	25.0	25.0
S.Em ±	1.8	8.57	1.37	0.04	0.26	0.22
CD(P=0.05)	7.8	36.47	5.85	0.15	0.81	0.65

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

Interaction effect of pruning intensities and nutrient sources on grain and straw yield (q/ha) of rice crop and tree.										
Sources of nutrient	**Grains yield (kg/ha)**					**Grains yield (kg/ha)**				
	Pruning intensities									
	P_0=0%	**P_1=25%**	**P_2=50%**	**P_3=75%**	**Sources of Nutrient mean**	**P_0=0%**	**P_1=25%**	**P_2=50%**	**P_3=75%**	**Sources of Nutrient mean**
T_0	22.80	23.67	25.83	34.00	26.58	39.70	44.25	47.00	55.00	46.49
T_1	24.32	29.17	32.05	38.00	30.88	43.75	48.17	51.18	60.50	50.90
T_2	27.48	33.53	39.06	41.83	35.48	49.70	51.33	60.33	65.33	56.68
T_3	26.49	31.48	35.82	40.58	33.59	46.54	49.72	55.00	63.00	53.56
Pruning intensities	25.27	29.46	33.19	38.60		44.92	48.37	53.38	60.96	
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 kg/ha 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 kg/ha 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 kg/ha as soil inoculation followed by fulvic acid @ 2kg/ha as soil application at 5 DAT as well as two sprays of fulvic acid at 25 and 50 DAT										

Conclusion

The study reveals that pruning intensity of Dalbergia sissoo and nutrient management significantly affected the growth and yield of rice. The highest plant height (98.4 cm) and panicle length (26.3 cm) were observed under open condition, while effective tillers (430.4) and panicle weight (7.93 g) were highest under 75% pruning. Total grains per panicle ranged from 299.0 to 314.9, and test weight varied from 24.5 to 25.5 g, increasing with pruning intensity. As regarded to the nutrient treatments, 75% RDF + VAM as soil inoculation + two foliar sprays of fulvic acid (T2) recorded the highest grain (38.60 q/ha) and straw (60.96q/ha) yields, while 50% RDF + VAM + fulvic acid as soil amendment + two foliar sprays (T_3) also produced comparable results.

References

1. Government of India Ministry of Agriculture & Farmers Welfare Directorate of Economics and Statistics. Agricultural Statistics at a Glance (2025). 2025.
2. Canellas LP, Olivares FL, Aguiar NO, Jones DL, Nebbioso A, Mazzei P, *et al*. Humic and fulvic acids as biostimulants in horticulture. Scientia Horticulturae. 2015;196:15-27.
3. Chaturvedi OP, Kaushal R, Alam NM, Tewari S. Productivity and profitability of rice (*Oryza sativa* L.) under different tree pruning regimes in an agrisiiviculture. Published 2014.
4. Chen Y, Aviad T. Effects of humic substances on plant growth. Plant and Soil. 1990;129(1):25-37.
5. FSI. India State of Forest Report 2023. Forest Survey of India, Ministry of Environment Forest and Climate Change, Government of India, Dehradun; 2023.
6. Ghosh S, Dhyani SK, Handa AK, Newaj R. Agroforestry for resource coriservation, environmental protection and enhanced productivity. Indian Journal of Agronomy. 2014;59(3):60-70.
7. Government of India. Agricultural Statistics at a Glance 2025. Directorate of Economics and Statistics, Department of Agriculture, Cooperation and Farmers Welfare Ministry of Agriculture and Farmers Welfare, Government of India, New Dethi; 2025.
8. Jat RS, Meena HN, Singh AL, Misra JB. Effect of pruning and nutrient management on growth and yield of intercrops in agroforestry systems. Joumal of Tropical Agriculture. 2012;50(1-2):45-49.
9. Kaushal R, Tewari S, Chaturvedi OP, Raza M, Alam NM. Effect of tree pruning on growth yield and carbon storage in agroforestry systems of Central Himalaya, India. Agroforestry Systems. 2017;91(4):637-648.
10. Khan M, Lone A, Rather AG. Influence of fulvic acid on growth and productivity of nice (*Oryza sativa* L) under stress conditions. International Journal of Agriculture and Biology. 2013;15(6):1029-1033.
11. Kumar BM, Nair PKR. Carbon Sequestration Potential of Agroforestry Systems Opportunities and Challenges. Springer Dordrecht; 2011.
12. Kumawat RN, Meena VS, Singh R. Fulvic acid as a bio-stimulant in agriculture Effects on crop growth, yield and soil health. Joumal of Plant Nutrition. 2019;42(20):2739.
13. Lv Y, Zhang J, Wang H, LI Y, Chen X. Fulvic acid as a multifunctional biostimulant: mechanisms and applications in sustainable agriculture. Journal of Soil Science and Plant Nutrition. 2024;24(3):1023-1038.
14. Malviya DR, Yadav RS, Singh R. Effect of humic substances and pruning management on rice yield and nutrient uptake in tree-based cropping systems. International Joumal of Current Microbiology and Applied Sciences. 2021;10(2):1120-1132.
15. Malviya S, Tiwari R, Khare R. Influence of canopy management practices on growth and yield of rice under *D. sissoo* based agnisilviculture system. Indian Journal of Agroforestry. 2019;21(2):45-52.
16. Olaetxea M, Mora V, Bacaicoa E, Garnica M, Fuentes M, Casanova E, *et al*. Root-shoot signaling in plants: Implications of humic substances as a biostimulant. Science of the Total Environment. 2018;643:1555-1562.
17. Pandey DN, Brown C. Buffer zone agroforestry in India. Policy lessons for sustaining rural livelihoods and biodiversity. International Journal of Sustainable Development & World Ecology. 2000;7(4):333-342.
18. Rose MT, Patti AF, Little KR, Brown AL, Jackson WR, Cavagnaro TR. A meta-analysis and review of plant-growth response to humic substances. Advances in Agronomy.

2014;124:37-89.
19. Roy M, Singh R, Pandey R. Synergistic effects of humic substances and arbuscular mycorrhizal fungi on phosphorus uptake and nice productivity. Journal of Plant Nutrition. 2021;44(8):1161-1172.
20. Sangeetha M, Singaram P. Effect of humic and fulvic acid on nutnent availability and yield of rice (*Oryza sativa* L.). Asian Journal of Soil Science. 2007;2(1):108-110.
21. Singh G, Bhatt RK, Sharma R. Effect of pruning in *Acacia nilotica* and *Dalbergia sissoo* based agroforestry systems on crop performance and light availability. Agroforestry Systems. 2015;89(5):869-880.
22. Singh S, Meena MD, Chaudhary RS, Sharma DK. Long-term effect of nutrient management practices on growth and productivity of rice under tree-based systems. Agroforestry Systems. 2020;94(6):2047-2058.
23. Singh R, Lal R. Carbon sequestration potential of agroforestry systems in India. Joumal of Environmental Quality. 2010;39(4):1547-1556.
24. Singh V, Dhyani SK, Dev 1. Effect of pruning of multipurpose trees on light availability and productivity of associated crops under agroforestry systems. Agroforestry Systerns. 2015;89(6):1001-1012.
25. Chaturvedi OP, Das DK. Productivity and nutrient cycling in *Dalliergia sissoo* Roxo based agroforestry system. Tropical Ecology. 2002;43(2):247-251.
26. 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.
27. Verma RK, Singh B, Meena VS. Role of humic and fulvic substances in improving soil health and crop productivity A review. Joumal of Plant Nutrition. 2020;43(14):2200-2212.
28. Viquez E, Pérez D. Effect of pruning on tree growth, yield, and wood properties of *Terminalia amazonia*. Forest Ecology and Management. 2005;213(1-3):349-358.