



Weed Management Practices in Organic Rice System (*Oryza sativa* L.): An Evaluation of Combining Cultural Practices for Improved Productivity and Sustainability

Rishabh Singh Chandel ^{a*}, Ankur Singh ^b,
Arushi Chandel ^c and Anshul Singh ^d

^a Division of Agronomy, ICAR- Indian Agricultural Research Institute, New Delhi- 110012, India.

^b Department of Agronomy, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh – 224229, India.

^c Department of Agronomy, Banda University of Agriculture and Technology, Banda, Uttar Pradesh -210001, India.

^d Department of Soil Science and Agricultural Chemistry, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh (208 002), India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: <https://doi.org/10.9734/ijpss/2025/v37i45411>

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://pr.sdiarticle5.com/review-history/134414>

Original Research Article

Received: 12/02/2025

Accepted: 14/04/2025

Published: 18/04/2025

*Corresponding author: E-mail: rishabhsingh0136@gmail.com;

ABSTRACT

A field experiment was conducted at Agronomy Research Farm of Narendra Deva University of Agriculture and Technology, Ayodhya (U.P.) during the *kharif* season of 2018–19 to evaluate effective weed management practices under organic systems in rice. In this experiment, seven treatments were examined in three replicates using Randomized Complete Block Design (RCBD). The soil of the experimental field was silty loam in texture. The rice variety NDR-2065 was transplanted. All nutrients were supplied through farm yard manure (75%) and vermicompost (25%). Results concluded that stale-seed bed+reduce spacing up to 25%+mulching with rice straw+1 hand-weeding at 50 days after transplanting (DAT) were most effective in controlling weeds, followed by hand-weeding at 25 and 50 DAT in rice. Grain (3.39 t ha⁻¹), straw (3.96 t ha⁻¹), and biological yield (7.35 t ha⁻¹) were increased significantly under stale-seed bed+reduce spacing-up to 25%+mulching with rice straw+1 hand-weeding at 50 DAT, which was statistically similar with treatment hand-weeding at 25 and 50 DAT. The combination of a stale-seed bed, 25% reduced spacing, rice straw mulch, and one hand-weeding at 50 DAT resulted in a significant grain yield increase of 87% ($p < 0.05$) compared to the control, achieving a weed control efficiency of 75%. Not only did this treatment produce the highest gross return (₹67518 ha⁻¹), net returns (₹33,907 ha⁻¹) and B:C ratio (1.01), it also showed that it was economically viable. Thus stale-seed bed+reduced spacing up to 25%+mulching with rice straw+1 hand-weeding at 50 days after transplanting was most effective at controlling the weeds and ultimately produced a more productive rice crop and proved to be more economically feasible than any other treatment.

Keywords: *Mulching; neem cake; organic farming; rice; weed management; stale-seed bed; hand-weeding.*

1. INTRODUCTION

Rice is arguably the most critical crop of the *kharif* season. It belongs to the *poaceae* family, and is extremely popular as a staple food throughout the world, resulting in the United Nations declaring 2004 the 'International Year of Rice' (Anonymous, 2003). 'Rice is life' is a very appropriate term for India since this crop plays a crucial role in the country's food security. Rice is cultivated on 47.83 mha in India and is produced in 135.76 mt, with a productivity of 2838 kg ha⁻¹. India's largest rice producing state is Uttar Pradesh, which has 5.90 mha area and a production of 16.14 mt. As compared with Punjab, Andhra Pradesh, West Bengal, Haryana and Tamil Nadu, Uttar Pradesh has a low rice productivity of 2737 kg ha⁻¹ (Anonymous, 2023).

Organic farming is “one of the broad spectrum of production systems that is supportive of the environment” (Durham and Mizik, 2021). “Organic farming systems largely depends on crop rotations, crop residues, animal manures, green manures, off-farm organic wastes, mechanical cultivation, mineral bearing rocks and aspects of biological pest control to maintain soil productivity, to supply plant nutrients and to control insects, pathogens and weeds” (Gamage et al., 2023). “Organic materials are the safer plant nutrients that do not adversely affect crops

and soil. Today, the awareness on organic agricultural produce is increasing and the demand for organic food is also rising, leading to increase in land area under organic farming” (Ferdous et al., 2021; Eynade et al., 2021). About 71.5 mha of land is devoted to organic farming worldwide with 2.8 million producers (Willer et al., 2020; Sailaja and Manohari, 2021).

The majority of cereal crops are severely infested with weeds. Uncontrolled weed growth in lowland and upland rice causes yield losses ranging from 12–81% (Berhan and Bekele, 2021; Yakadri et al., 2022; Kumar et al., 2023). Weeds are reported to be one of the key constraints in organic production system (Singh et al., 2012; Arlauskienė et al., 2021; Merfield, 2023). Weed management promotes weed suppression, rather than weed elimination, by enhancing crop competition and phytotoxic effects on weeds (Hasan et al., 2021; Scavo and Mauromicale, 2021; Nath et al., 2024). Under organic production, none of the cultural practices were found to be effective to control weeds in rice, and rice yields were reduced by 57–61% as a result of weed competition (Maimunah et al., 2021; Kushal et al., 2024). The practice of improving the competitive availability of the crop and weed can reduce the adverse effects of weeds on rice crops (Nazir et al., 2022).

In the early growing stage, stale-seed bed preparation might assist in minimizing weed populations (Sanbagavallis et al., 2016). Intercropping is a method of improving weed control by utilizing a large percentage of available resources to improve weed control (Gu et al., 2021). Due to the shade and allelopathic effect of sesbania, green manuring of rice significantly suppresses weed growth (Yadav et al., 2010). As a result of mulching rice straw, weed growth was successfully controlled and agronomic traits were enhanced (Wayayok et al., 2014). It has been reported that cultivating rice with narrow or close row spacing reduces weed growth and increases its yield (Chauhan and Johnson, 2011). In order to maintain a high level of production while cultivating crops organically, a great deal of effort is needed. Hence, the goal of the present study was to evaluate the effectiveness of suitable weed management practices under organic system in rice crop.

2. METHODS AND MATERIALS

The field experiment was conducted during the *khariif* (June to November, 2018) season at the Agronomy Research Farm of Narendra Deva University of Agriculture and Technology (Kumarganj) Ayodhya (U.P.). The experimental site falls under the subtropical climate with high humidity level and lies between 24.4° N latitude and 82.10° E longitude, at an altitude of about 113 m above mean sea level. The experimental plot had silty loam in texture, having basic in reaction (pH 8.6), and Ec of 0.34 dS m⁻¹, low in organic carbon (0.35%), available Nitrogen (140.34 kg ha⁻¹), available Phosphorous (14.50 kg ha⁻¹), and high in available Potassium (240.20 kg ha⁻¹). Seven treatments comprising of T₁-hand-weeding at 25 and 50 days after transplanting (DAT), T₂-ITK treatment on weed control practiced by farmer as mulching with *cassia tora*, T₃-inter cropping with dhaincha, T₄-stale-seed bed+reduce row x plant spacing up to 25% (from 20 cmx10 cm to 15 cm x 5cm) +mulching with rice straw+1 hand-weeding at 50 DAT, T₅-locally available weed mulch-*kanss*+1 hand pulling, T₆-incorporation of neem cake 15 days before transplanting @ 2 t ha⁻¹+one weeding, T₇-without weed control were assigned in a Randomized Complete Block Design (RCBD) replicated thrice. The rice variety NDR-2065 was transplanted on 9th July 2018. The cropping system was Rice-potato-okra and all nutrients were supplied through farm yard manure (75%) and vermicompost (25%). All the recommended agronomic practices were

adopted to raise the crop. The data on weed density, and dry weight were recorded at different growth stages of rice crop. These were subjected to square root transformation $\sqrt{X + 0.5}$ before statistical analysis to normalize their distribution. According to Abdullah et al., (2020), the weed control efficiency (%) of treatment was calculated by using following formula:

$$WCE (\%) = \frac{DWC - DWT}{DWC}$$

Where,

WCE = Weed Control Efficiency,
DWC= Weed dry weight in control plot,
DWT= weed dry weight in treated plot.

Grain and straw yield of rice were recorded at harvest along with different economic indices, viz. gross return, net return and benefit-cost ratio (BCR) were calculated based on prevailing market price of the input and output. The one season data was statistically analyzed as suggested by Gomez and Gomez (1984). Statistical significance was tested by F test at a critical difference (CD) of 0.05 level of probability.

3. RESULTS AND DISCUSSION

3.1 Effect on Weed

Ten weed species were recorded in the experimental field (Table 1). *Echinochloa colonum* (21.89%), *Cynodon dactylon* (20.82%), *Monochoria vaginalis* (12.80%), *Alternanthera sessilis* (11.62%), *Eclipta alba* (11.52%), and *Jussia suffruticosa* (10.19%) comprised the most dominant weed flora of the experimental field during the year of study. Besides these, *Echinochloa crsugali*, *Fibristylis dichotoma* and some other weeds were also found.

The lowest density (8.01 m⁻²) as well as dry weight (6.19 g m⁻²) of total weeds was recorded in T₄- stale-seed bed+reduce spacing up to 25%+mulch with rice straw+1 hand-weeding at 50 DAT followed by the T₁- Hand-weeding at 25 and 50 DAT. The highest weed density (12.85 m⁻²) and dry weight (12.36 g m⁻²) of total weed was observed in T₇ - Without weed control. This is mainly due to different weed management practices which resulted in reducing the weed density in respective plots during course of investigation. Similar findings were also reported by Murthy et al. (2012), Jadhav and Pawar (2013) Singh (2014), Aske et al., (2018), Choudhary et al., (2021), Nalayini et al., (2023).

Table 1. Effect of treatments on weed density, weeds dry weight and weed control efficiency of transplanted rice at harvest stages in organic production system

Treatment	Weed density (No. m ⁻²)							Total	weeds dry weight (g m ⁻²)	WEC (%)
	<i>Echinochloa colonum</i>	<i>Monochoria vaginalis</i>	<i>Cynodon dactylon</i>	<i>Jussia suffruticosa</i>	<i>Eclipta alba</i>	<i>Alternanthera sessilis</i>	Other			
T ₁ : Hand-weeding at 25 and 50 DAT	4.94 (24.00)	3.84 (14.30)	4.82 (22.80)	3.33 (10.60)	3.67 (13.00)	3.67 (13.00)	3.50 (11.80)	10.47 (109.50)	8.18 (66.52)	56.43
T ₂ : ITK treatment on weed control practiced by farmer as mulching with <i>Cassia tora</i>	5.85 (33.86)	3.91 (14.80)	5.62 (31.20)	3.37 (10.90)	3.87 (14.54)	3.88 (14.60)	3.78 (13.80)	11.57 (133.70)	9.06 (81.85)	46.39
T ₃ : Intercropping with Dhaincha (<i>Sasbania aculeate</i>)	5.20 (26.60)	4.03 (15.80)	5.09 (25.50)	3.53 (12.00)	3.83 (14.20)	3.86 (14.40)	3.68 (13.10)	11.04 (121.60)	8.88 (78.46)	48.61
T ₄ : Stale-seed bed+reduce spacing up to 25%+mulch with rice straw+one hand-weeding at 50 DAT	4.11 (16.40)	3.24 (10.00)	3.89 (14.70)	2.51 (5.80)	2.34 (5.00)	2.57 (6.10)	2.53 (5.90)	8.01 (63.90)	6.19 (37.92)	75.19
T ₅ : Locally available weed mulch- <i>kanss</i> +one hand pulling	5.17 (26.30)	4.03 (15.70)	5.04 (25.00)	3.49 (11.70)	3.82 (14.10)	3.84 (14.30)	3.67 (13.00)	10.96 (120.10)	8.76 (76.49)	49.90
T ₆ : Incorporation of neem cake 15 days before transplanting @ 2 t ha ⁻¹ +one hand-weeding	5.07 (25.20)	3.95 (15.10)	4.97 (24.20)	3.42 (11.20)	3.77 (13.70)	3.78 (13.80)	3.60 (12.50)	10.77 (115.70)	8.45 (71.01)	53.49
T ₇ : Without weed control	6.04 (36.10)	4.64 (21.10)	5.90 (34.34)	4.15 (16.80)	4.41 (19.00)	4.43 (19.16)	4.34 (18.40)	12.85 (164.90)	12.36 (152.67)	0.00
SEm±	0.19	0.13	0.18	0.11	0.12	0.12	0.13	0.38	0.31	-
C.D ($p \leq 0.05$)	0.59	0.40	0.55	0.35	0.37	0.38	0.40	1.18	0.94	-

*Figure in parenthesis are the original value. The data was transformed to $\text{SQRT} \sqrt{x + 0.5}$ before analysis.

Table 2. Effect of treatments on yield and economics of transplanted rice in organic production system

Treatment	Biological yield (t ha ⁻¹)	Grain yield (t ha ⁻¹)	Straw yield (t ha ⁻¹)	Gross return (₹ ha ⁻¹)	Net return (₹ ha ⁻¹)	B: C Ratio
T ₁ : Hand-weeding at 25 and 50 DAT	7.00	3.18	3.82	63600	28964	0.83
T ₂ : ITK treatment on weed control practiced by farmer as mulching with <i>Cassia tora</i>	5.06	2.11	2.95	42795	11759	0.37
T ₃ : Intercropping with Dhaincha (<i>Sasbania aculeate</i>)	5.48	2.46	3.02	49370	17934	0.57
T ₄ : Stale-seed bed+reduce spacing up to 25%+mulch with rice straw+one hand-weeding at 50 DAT	7.35	3.39	3.96	67518	33907	1.01
T ₅ : Locally available weed mulch- <i>kanss</i> +one hand pulling	5.76	2.60	3.16	52079	19243	0.58
T ₆ : Incorporation of neem cake 15 days before transplanting @ 2 t ha ⁻¹ +one hand-weeding	6.11	2.76	3.35	54977	15441	0.39
T ₇ : Without weed control	4.43	1.81	2.62	37445	7009	0.23
SEm±	0.26	0.13	0.12	-	-	-
C.D ($p \leq 0.05$)	0.87	0.39	0.36	-	-	-

Weed control efficiency (75.19 %) was recorded maximum in T₄- stale-seed bed+reduce spacing up to 25%+mulch with rice straw+1 hand-weeding at 50 DAT followed by T₁- hand-weeding at 25 and 50 DAT. Higher weed control efficiency under these treatments was reflected through lower dry weight of weeds. The increase in weed control efficiency was mainly due to different weed management practices i.e. hand-weeding, stale-seed bed, intercropping, space reducing, and ITK treatment which resulted in better availability of growth promoting factor and finally increased the weed control efficiency. Similar results are reported by Aske et al., (2018), Choudhary et al., (2021), Liu et al., (2023), Nalayini et al., (2023).

3.2 Effect on Yield and Economics

Grain, straw and biological yield was influenced significantly by different weed management practices (Table 2). The maximum grain yield (3.39 t ha⁻¹) and straw yield (3.96 t ha⁻¹) was recorded highest in T₄- stale-seed bed + reduce spacing up to 25% + mulch with rice straw+1 hand-weeding at 50 DAT which was statistically at par with the T₁- hand-weeding at 25 and 50 DAT and significantly superior over other weed management practices. This might be due to increase in panicle length, number of grains panicle⁻¹, tillers as well as rate of dry matter accumulation. These results are corroborated with the findings of Singh and Guru (2011), Choudhary et al., (2021), Uno et al., 2021, Liu et al., (2023), and Nalayini et al., (2023).

On the basis of data (Table 2) higher gross returns (67518 ₹ ha⁻¹) was obtained in T₄- stale-seed bed + reduce spacing up to 25%+mulch with rice straw+1 hand-weeding at 50 DAT, which was higher than other treatments. This might be owing to more seed yield and less weeds infestation. Net returns was influenced due to various weed management practices. The higher net return (33907 ₹ ha⁻¹) was observed in T₄- stale-seed bed+reduce spacing up to 25%+mulch with rice straw+1 hand-weeding at 50 DAT and the lowest in T₇- Without weed control. The highest value (1.01) of B: C ratio was obtained with T₄- stale-seed bed+reduce spacing up to 25%+mulch with rice straw+one hand-weeding at 50 DAT which was closely followed by T₁- hand-weeding at 25 and 50 DAT. This might be due lower cost of cultivation and higher net return. All these above treatments were most effective weed control treatments

recorded higher yield and weed control efficiency, and recorded higher benefit: cost ratio. Similar findings were reported by Choudhary et al., (2021), Dhaigude et al., (2021), and Nalayini et al., (2023).

4. CONCLUSION

It is extremely difficult to manage weeds in organic production systems especially in rice crops. Resulting from the present investigation, we may conclude that the stale-seed bed+reduced spacing up to 25%+mulching with rice straw+1 hand-weeding at 50 days after transplanting was most effective at controlling the weeds and ultimately produced a more productive rice crop and proved to be more economically feasible than any other treatment. It achieved 87% higher grain yield as compared to without weed control treatment.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

ACKNOWLEDGEMENT

I sincerely thank my co-authors for their invaluable contributions to this manuscript. This work would not have been possible without the collective efforts of everyone involved.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

- Abdullah, M. R., Zakaria, N., Ahmad-Hamdani, M. S., & Juraimi, A. S. (2020). Evaluation of herbicide efficacy on weed control and grain yield in rice field under flooded condition. *Plant Archives*, 20(2), 8163–8169.
- Anonymous. (2003). International Year of Rice, 2004. United Nations General Assembly Session 57 Resolution 162. Available at <https://documents-dds-ny.un.org/doc/UNDOC/GEN/N02/548/90/PDF/N0254890.pdf?OpenElement>. Accessed on 18.11.2007.

- Anonymous. (2023). Area, production and yield of India & state. In *Agricultural Statistics at a Glance* (pp. 87–89). Government of India Ministry of Agriculture & Farmers Welfare, Department of Agriculture, Cooperation & Farmers Welfare, Directorate of Economics and Statistics.
- Arlauskienė, A., Jablonskytė-Raščė, D., Šarūnaitė, L., Toleikienė, M., Masilionytė, L., Gecaitė, V., & Kadžiulienė, Ž. (2021). Perennial forage legume cultivation and their above-ground mass management methods for weed suppression in arable organic cropping systems. *Chemical and Biological Technologies in Agriculture*, 8, 1–13. <https://doi.org/10.1186/s40538-021-00228-5>
- Aske, S., Maurya, B., Monika, J., & Kurmvanshi, S. (2018). Weed management in organically grown scented rice. *Indian Journal of Weed Science*, 50(4), 391–394.
- Berhan, M., & Bekele, D. (2021). Review of major cereal crops production losses, quality deterioration of grains by weeds and its prevention in Ethiopia. *Asian Journal of Advances in Research*, 11(4), 93–104.
- Chauhan, B. S., & Johnson, D. E. (2011). Row spacing and weed control timing affect yield of aerobic rice. *Field Crop Research*, 121(2), 226–231.
- Choudhary, R., Verma, A., Sharma, S. K., Yadav, S. K., Jain, R. K., Jat, G., Choudhary, R. S., & Jain, D. (2021). Productivity enhancement of sweet corn (*Zea mays*) through organic weed management practices. *Indian Journal of Agricultural Sciences*, 91(7), 1052–1057. <https://doi.org/10.56093/ijas.v91i7.115128>
- Dhaigude, G. S., Dhonde, M. B., & Andhale, R. P. (2021). Study of economics and sequence evaluation of weed management practices under organic production system of soybean-wheat cropping sequence. *The Pharma Innovation Journal*, SP-10(8), 375–378.
- Durham, T. C., & Mizik, T. (2021). Comparative economics of conventional, organic, and alternative agricultural production systems. *Economies*, 9(2), 64. <https://doi.org/10.3390/economies9020064>
- Eyinade, G. A., Mushunje, A., & Yusuf, S. F. G. (2021). The willingness to consume organic food: A review. *Food and Agricultural Immunology*, 32(1), 78–104. <https://doi.org/10.1080/09540105.2021.1874885>
- Ferdous, Z., Zulfikar, F., Datta, A., Hasan, A. K., & Sarker, A. (2021). Potential and challenges of organic agriculture in Bangladesh: A review. *Journal of Crop Improvement*, 35(3), 403–426. <https://doi.org/10.1080/15427528.2020.1824951>
- Gamage, A., Gangahagedara, R., Gamage, J., Jayasinghe, N., Kodikara, N., Suraweera, P., & Merah, O. (2023). Role of organic farming for achieving sustainability in agriculture. *Farming System*, 1(1), 100005. <https://doi.org/10.1016/j.farsys.2023.100005>
- Gomez, K. A., & Gomez, A. A. (1984). *Statistical procedures for agricultural research* (2nd ed.). International Rice Research Institute, P.O. Box, Manila, Philippines, & John Wiley & Sons, New York, USA.
- Gu, C., Bastiaans, L., Anten, N. P., Makowski, D., & van der Werf, W. (2021). Annual intercropping suppresses weeds: A meta-analysis. *Agriculture, Ecosystems & Environment*, 322, 107658.
- Hasan, M., Ahmad-Hamdani, M. S., Rosli, A. M., & Hamdan, H. (2021). Bioherbicides: An eco-friendly tool for sustainable weed management. *Plants*, 10(6), 1212. <https://doi.org/10.3390/plants10061212>
- Jadhav, A. S., & Pawar, S. U. (2013). Time of sowing and influence of weed control methods on yield of direct seeded rice. *Journal of Agriculture Research and Technology*, 38(3), 466–469.
- Kumar, V., Mahajan, G., Sheng, Q., & Chauhan, B. S. (2023). Weed management in wet direct-seeded rice (*Oryza sativa* L.): Issues and opportunities. *Advances in Agronomy*, 179, 91–133. <https://doi.org/10.1016/bs.agron.2023.01.002>
- Kushal, Rao, G. E., Boraiah, B., Sanjay, M. T., & Araganji, S. (2024). A review on challenges and emerging opportunities for weed management in organic agriculture. *International Journal of Research in Agronomy*, SP-7(8), 859–869. <https://doi.org/10.33545/2618060X.2024.v7.i8Sk.1401>
- Liu, C., Yang, K., Chen, Y., Gong, H., Feng, X., Tang, Z., Fu, D., & Qi, L. (2023). Benefits of mechanical weeding for weed control, rice growth characteristics and yield in

- paddy fields. *Field Crops Research*, 293, 108852.
<https://doi.org/10.1016/j.fcr.2023.108852>
- Maimunah, M. A., Kautsar, V., Bimantara, P. O., Kimani, S. M., Torita, R., Tawaraya, K., Murayama, H., Utami, S. H. N., Purwanto, B. H., & Cheng, W. (2021). Weeding frequencies decreased rice–weed competition and increased rice N uptake in organic paddy field. *Agronomy*, 11(10), 1904.
<https://doi.org/10.3390/agronomy11101904>
- Merfield, C. N. (2023). Integrated weed management in organic farming. In *Organic farming* (pp. 31–109). Woodhead Publishing. <https://doi.org/10.1016/B978-0-323-99145-2.00004-5>
- Murthy, R. V. R., Reddy, D. S., & Reddy, G. P. (2012). Integrated weed management practices for rice under aerobic culture. *Indian Journal of Weed Science*, 44(2), 70–76.
- Nalayini, P., Blaise, D., & Mundafale, H. R. (2023). Stale seed bed technique and leguminous cover crops as components of integrated weed management in irrigated cotton. *Indian Journal of Weed Science*, 55(1), 46–49. <https://doi.org/10.5958/0974-8164.2023.00008.4>
- Nath, C. P., Singh, R. G., Choudhary, V. K., Datta, D., Nandan, R., & Singh, S. S. (2024). Challenges and alternatives of herbicide-based weed management. *Agronomy*, 14(1), 126.
<https://doi.org/10.3390/agronomy14010126>
- Nazir, A., Bhat, M. A., Bhat, T. A., Fayaz, S., Mir, M. S., Basu, U., Ahanger, S. A., Altaf, S., Jan, B., Lone, B. A., Mushtaq, M., El-Sharnouby, M., Skalicky, M., Brestic, M., & El Sabagh, A. (2022). Comparative analysis of rice and weeds and their nutrient partitioning under various establishment methods and weed management practices in temperate environment. *Agronomy*, 12(4), 816.
<https://doi.org/10.3390/agronomy12040816>
- Sailaja, A., & Manohari, P. L. (2021). *Organic farming for sustainable agriculture*. Extension Education Institute, Hyderabad, and National Institute of Agriculture Extension Management (MANAGE), Hyderabad, India. 40p.
- Sanbagavallis, S., Somasundaram, E., Marimuthu, S., & Ramesh Chelvi, (2016). Stale-seedbed technique of weed management: A review. *International Journal of Agriculture Science*, 8(61), 3490–3493.
- Scavo, A., & Mauromicale, G. (2021). Crop allelopathy for sustainable weed management in agroecosystems: Knowing the present with a view to the future. *Agronomy*, 11(11), 2104.
<https://doi.org/10.3390/agronomy11112104>
- Singh, A., Kaur, R., Kang, J. S., & Singh, G. (2012). Weed dynamics in rice-wheat cropping system. *Global Journal of Biology, Agriculture and Health Sciences*, 1(1), 7–16.
- Singh, P., & Guru, S. K. (2011). Effect of rice straw incorporation on weed management and crop growth in rice. *Indian Journal of Weed Science*, 43(3–4), 236–238.
- Singh, R. (2014). Weed management in major kharif and rabi crops. In *Proceedings of National Training on Advances in Weed Management* (pp. 14–23). The Directorate of Weed Science Research, Ministry of Agriculture and Farmers Welfare.
- Uno, T., Tajima, R., Suzuki, K., Nishida, M., Ito, T., & Saito, M. (2021). Rice yields and the effect of weed management in an organic production system with winter flooding. *Plant Production Science*, 24(4), 405–417.
<https://doi.org/10.1080/1343943X.2020.1865823>
- Wayayok, A., Soom, M. A. M., Abdan, K., & Mohammed, U. (2014). Impact of mulch on weed infestation in system of rice intensification (SRI) farming. *Agriculture and Agricultural Science Procedia*, 2, 353–360.
- Willer, H., Schlatter, B., Trávníček, J., Kemper, L., & Lernoud, J. (Eds.). (2020). *The World of Organic Agriculture: Statistics and Emerging Trends 2020* (21st ed.). Research Institute of Organic Agriculture (FiBL) and IFOAM – Organics International.
- Yadav, D. B., Yadav, A., & Punia, S. S. (2010). Long term effect of green manuring and herbicidal use on weed dynamics and productivity of rice–wheat cropping system. In *Proceedings of the National Symposium on IWM in the Era of Climate Change* (pp. 21–22). NAAS, New Delhi, 21–22 August.

Yakadri, M., Suvidh, M. S., & Vaishnav, S. (2022). A review on integrated weed management in transplanted rice. *International Journal of Plant & Soil Science*, 34(22), 238–247.
<https://doi.org/10.9734/IJPSS/2022/v34i2231374>

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of the publisher and/or the editor(s). This publisher and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

© Copyright (2025): Author(s). The licensee is the journal publisher. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<https://pr.sdiarticle5.com/review-history/134414>