

Plant Archives

Journal homepage: http://www.plantarchives.org DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2025.v25.no.1.217

IMPACT OF COW-URINE-BASED NEEM, NOCHI AND ADHATODA LEAF EXTRACTS ON YIELD AND ECONOMICS OF ORGANIC RICE

K. Ganesan¹, Bacham Anil Kumar^{1*}, M Suganthy¹, S.V. Sangeetha¹, M. Murugan¹, R. P. Soundararajan¹, V. Manivannan² and Ashvani Kumar¹

¹Department of Agrl. Entomology, Tamil Nadu Agricultural University, Coimbatore-641 003, India ²Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, India - 641 003 ^{*}Corresponding author E- mail: anilbacham6513@gmail.com (Date of Receiving-09-12-2024; Date of Acceptance-11-02-2025)

To overcome the yield loss by insect pests and indiscriminate use of synthetic pesticides in rice, botanicals offer a promising alternative. This study investigates the impact of cow-urine based neem (*Azadirachta indica* L.), nochi (*Vitex negundo* L.) and adhatoda (*Adhatoda vasica* N.) botanical leaf extracts on yield and economics of rice grown organically under System of Rice Intensification (SRI) in Wetland Paddy Fields, Tamil Nadu Agricultural University, Coimbatore during the *Rabi* 2023. Crop production package of practices developed by the Nammazhvar Organic Farming Research Centre, TNAU, Coimbatore was followed. Among the plant protection treatments designed for this study, application of neem, nochi and adhatoda (NNA) leaf extracts 15% significantly recorded the highest grain yields of 4996 kg ha⁻¹ followed by NNA 10% (4732 kg ha⁻¹) and NSKE 5% (4349 kg ha⁻¹) treatments. Economic analysis revealed that the net return was more (? 94925 ha⁻¹) in NNA 15% foliar spray followed by NNA 10% (86006 ha⁻¹) and NSKE 5% (75849 ha⁻¹). The highest BCR of 2.11 was registered in NNA 15% followed by NNA 10% (2.04) and NSKE 5% (1.96) when compared with the untreated control (1.12). The foliar spraying of cow-urine-based neem, nochi and adhatoda leaf extracts 10 or 15% could be one of the best alternatives to NSKE for the management of insect pests in organic rice with higher productivity and profitability.

Key words: Organic rice, cow-urine based neem-nochi-adhatoda leaf extracts, yield and economics

Introduction

Rice, *Oryza sativa* (L.) is one of the most staple food crops for half of the human population in the world with the production of 523.9 million tonnes from 166.31 million hectares. Asia accounts for nearly 90 % of the world's rice production (Cheng *et al.*, 2013). In India, 1308.37 lakh tons of rice was produced during 2023-24 only from 40 % of the total cultivable area (Faostat, 2023). More than 175 species of insect pests have been recorded on rice crops and among them nearly 20 insect species are known to be important in major rice growing regions of the world. In rice around 50% yield loss have been recorded due to the infestation of various kinds insect pests in different growth phases of the rice crop (Ali *et al.*, 2021). Rice farmers mostly prefer to use synthetic insecticides to control the insect pests. Continuous and indiscriminate use of insecticides leads to development of resistance and resurgence in insects in addition to insecticide residues in final consumable produces. Organic way rice cultivation overcome these problems exclusion of synthetic inputs. Among different inputs for pest management in organic rice cultivation, botanicals play a vital role due to their cost-effectiveness, targetspecific, biodegradable and environmentally friendly nature (Reddy and Chowdhary 2021). Botanicals may also be considered as a critical plant protection inputs for rice production in the future to ensure yield stability and ecological sustainability (Hajjar *et al.*, 2023).

Neem is considered as a universal botanical for pest

management in organic farming due to the presence of many active compounds like Azadirachtin, Melantriol, Nimbinin, Nimbidin, Salanin, Nimbin, Nimbolin A and Nimbolin B. The active principles exhibit broad spectrum of activities like antifeedant, repellent, oviposition deterrent, insect growth regulation, insecticidal properties (Misra 2014). Nochi commonly called as Vitex, contains active compounds such as vitexin and negundoside with pesticidal and pest repellent properties (Prasad 2011). Adhatoda contains potent active compounds like vasicine, vasicinone and adhatodin which exhibits both repellent and insecticidal properties (Nandre et al. 2012). Considering the importance of neem, nochi and adhatoda in pest management a study was designed to determine their efficacy against major insect pests of rice and their impact on yield and economics.

Material and Methods

One kilogram of fresh leaves of neem / nochi / adhatoda (1:1:1) were dipped in cow urine for one hour and ground in a grinder with two litre of fresh cow urine (1:2), allowed for fermentation for 10 days with intermittent stirring. After fermentation the extract was filtered through muslin cloth and used as stock solution for further use. Seeds rice variety CO 55 were soaked overnight in water containing *Bacillus subtills* @ 10g/kg + *Azospirillum* @ 30g/kg + *Phosphobacteria* @ 30g/kg. Well decomposed FYM @ 1.25kg/m² + neem cake @ 50 gm/m² + *Trichoderma viride* @ 4g/m² were applied to the nursery bed before sowing as basal. Seeds were sown uniformly over the raised seed bed. Gypsum @ 100gm/m² was applied 10 days before pulling of the seedlings to prevent root snapping.

Field experiment was conducted infield no. O1, Organic Block, Wetland Paddy Fields (11.002°N latitude and 76.923°E longitude), TNAU, Coimbatore during the *Rabi* 2023. The experimental field was laid out in Randomized Block Design (RBD) with three replications. Seedlings were transplanted in the main field under the System of Rice Intensification (SRI) at the recommended spacing of 25×25 cm. Before transplanting, green manure *Sesbania aculeate* (L.) was raised in the main field and incorporated during 50% flowering with rotovator. After decomposition 15 days old healthy rice seedlings were transplanted in the main field.

Before transplanting neem cake @ 250 kg/ha, gypsum @ 500 kg/ha, *Azospirillum* @ 2.5 kg/ha + *Phosphobacteria* 2.5 kg/ha were applied as basal. At the time of transplanting, the seedlings roots were dipped in *Azospirillum* and *Phosphobacteria* solution (each 1 kg in 40 litres of water) for 30 minutes Cono weeder weeding and hand weeding were done on 20 and 40 DAT, respectively. Foliar spraying of Panchagavya 3% was given twice at 30 and 45 DAT as growth promoter. Top dressing of vermicompost @ 1000kg/ha was applied each at active tillering and panicle initiation stages. The plant protection treatments of the experiment as detailed below were imposed twice for pest management.

T ₁	Neem leaf extract 10%
T ₂	Nochi leaf extract 10%
T ₃	Adhatoda leaf extract 10%
T_4	Neem + Nochi + Adhatoda extract 5%
T ₅	Neem + Nochi + Adhatoda extract 10%
T ₆	Neem + Nochi + Adhatoda extract 15%
T ₇	Cow urine alone 10%
T ₈	Neem Seed Kernel Extract 5% (std. check)
T ₉	Untreated check (water spray)

Sprayings were done twice with battery operated back pack sprayer when the initial pest population reached the ETL. The spray volume of 500 lit./ha was followed for the study.

Results and discussion

Effect of botanicals on insect pests of rice

The results of the study on the efficacy of cow urinebased extracts of neem, nochi and adhatoda (NNA) leaves against major insect pests of rice is given in Fig 1. For brown planthopper (BPH) and green leafhopper (GLH), the neem, nochi and adhatoda (NNA) leaf extract 15% was most effective, achieving the per cent reduction over control (PROC) of 70.23 and 72.48, respectively, which was on par with NNA 10% and the respective PROC values were 67.13 and 68.18. For leaf folders, the foliar spray of NNA leaf extract at 15% demonstrated the PROC of 72.96 and 76.73 for the first and second sprays, respectively. This was followed by NNA 10% (PROC of 69.52 and 73.42) and NSKE 5% (PROC of 68.24 and 70.09). The pooled mean PROC was highest for NNA 15% (74.84), followed by NNA 10% (71.49) and NSKE 5% (69.16). For stem borers, the NNA leaf extract 15% registered the highest PROC of 28.82 for dead hearts and 35.40 for white ears, followed by NNA 10% (PROC of 25.08 and 30.84) and NSKE 5% (PROC of 23.57 and 28.05). Regarding natural enemies, the NNA leaf extract 15% showed a moderate percent impact over control (PIOC) of 43.99% for ground beetles, 32.99% for coccinellid beetles, 27.70% for spiders, 19.95% for mirid bugs and 10.88% for rove beetles.

Grain and straw yields

Grain and straw yields of organic rice CO 55 was significantly influenced by different botanical extracts (Table 1). Among the treatments, the highest grain of



Fig. 1: Effect of treatments against major insect pests in organic rice (Mean of two seasons)

4996 kg ha-1 was recorded in foliar spraying of neem, nochi and adhatoda leaf extract 15% followed by NNA leaf extract 10% (4732 kg ha⁻¹) and NSKE 5% (4349 kg ha⁻¹) when compared to the lowest grain yield of 2408 kg ha-1 in untreated control. The results are corroborated with the findings of Singh et al. (2021) who found that application of neem, pungam and nochi leaf extracts at 10% in rice production system led to the highest grain yields of 4650 kg ha?1 when compared to the untreated control (2450 kg ha?¹). The straw yield also the highest (6898 kg ha⁻¹) in NNA 15% application followed by NNA 10% (6530 kg ha⁻¹) and NSKE 5% (6001 kg ha⁻¹) when compared to the lowest (3423 kg ha⁻¹) in control treatment. Patel et al. (2020) also found that application of NSKE 5% resulted in higher straw yield (6200 kg ha?¹) compared to the untreated control (3400 kgha?1). The results are in accordance with the findings of Rani et al. (2018) and Mishra et al. (2019).

Economics

The cost of cultivation was more (85691 ha^{-1}) in NNA leaf extract 15% application followed by NNA 10% (82691 ha^{-1}) and NSKE 5% (79191 ha^{-1}) when compared to the lowest (76691 ha^{-1}) in untreated control. The gross

return was the highest (180616 ha⁻¹) in NNA 15 % as foliar spray followed by NNA 10% (168694 ha⁻¹) and NSKE 5% (155041 ha⁻¹) when compared to the lowest (186095 ha⁻¹) in control treatment. The net return was also more (94925 ha⁻¹) in NNA 15 % as foliar spray followed by NNA 10 % (86006 ha⁻¹) and NSKE 5% (75849 ha⁻¹) when compared to the lowest (9404 ha⁻¹) in untreated control treatment. The highest BCR of 2.11 was registered in NNA 15 % application followed by NNA 10 % (2.04) and NSKE 5 % (1.96) when compared to the lowest (1.12) in control treatment. The results are in accordance with the findings of Gowdhaman (2014) and Reddy *et al.*, (2018).

Conclusion

The study concluded that, the use of cow-urine based neem, nochi and adhatoda leaf extracts significantly increased the grain and straw yields in organic production system. The economic analysis revealed that even though the total cost of cultivation was more in NNA 15% spray, the gross and net returns of this treatment were more with the highest BCR of 2.11. It has been suggested that application of NNA leaf extracts at 10 and 15% are effective and economically viable alternatives to NSKE (standard check) for the management of major insect pests in organic rice farming.

Acknowledgement

The authors are thankful to the Farm Professor, Farm Manager and Farm Labourers of the Central Farm, Department of Agronomy, Directorate of Crop Management, TNAU, Coimbatore for their extended support for successful conduct of field studies. We also express our thanks to the Nammazhvar Organic Farming Research Centre, TNAU, Coimbatore for providing laboratory and documentation facilities.

	Yield		Economics			
Treatments	Grain yield	Straw	Cost of	Gross	Net	B:C
	yield	yield	cultivation	Returns	returns	ratio
	(kg ha-1)	(kg ha ⁻¹)	(ha ⁻¹)	(ha-1)	(ha ⁻¹)	
T ₁ - Neem leaf extract 10%	3716	5327	78691	132973	54281	1.69
T ₂ - Nochi leaf extract 10%	3791	5442	78691	135675	56984	1.72
T ₃ - Adhatoda leaf extract 10%	3564	4918	78691	127056	48364	1.61
T_4 - Neem + Nochi + Adhatoda leaf extract 5%	3995	5513	79691	142421	62729	1.79
T_5 - Neem + Nochi + Adhatoda leaf extract 10%	4732	6530	82691	168694	86003	2.04
T_6 - Neem + Nochi + Adhatoda leaf extract 15%	4996	6898	85691	180616	94925	2.11
T ₇ - Cow urine alone 10%	2703	3730	77691	96361	18670	1.24
T_8 - Neem seed kernel extract 5% (standard check)	4349	6001	79191	155041	75849	1.96
T_9 - Control (untreated check)	2408	3423	76691	86095	9404	1.12

Table 1: Effects of treatments on yield and economics of organic rice

References

- Ali, M.P., Nessa, B., Khatun, M.T., Salam, M.U. and M.S. Kabir. 2021. A way forward to combat insect pest in rice. *Bangladesh Rice Journal*, **25** (1) : 1-22.
- Cheng, X., Zhu, L. and G. He. 2013. Towards Understanding of Molecular Interactions between Rice and the Brown Planthopper. *Molecular Plant*, 6 (3): 621–634. https:// doi.org/10.1093/mp/sst030
- Hajjar, M.J., Ahmed, N., Alhudaib, K.A. and H. Ullah. 2023. Integrated Insect Pest Management Techniques for Rice. *Sustainability*, **15** (5) : 4499. https://doi.org/10.3390/ su15054499
- Kumar, V., Sharma, R. and P. Yadav. 2020. Effect of neem and vitex extracts on yield attributes of rice in an organic farming system. *Journal of Agricultural Biotechnology* and Sustainable Development, **12** (6) : 89-96.
- Mishra, R., Singh, V. and M. Yadav. 2019. Influence of botanical extracts on the yield performance of organic rice. *Agricultural Research Journal*, **58** (4) : 392-398.
- Misra, H.P. 2014. Role of botanicals, biopesticides and bioagents in integrated pest management.CAB Digital Library, **12** (2) : 62-67.
- Nandre, B.N., Bakliwal, S.R., Rane, B.R. and S.P. Pawar. 2012. A review on Adhatoda vasica. Pharma Science Monitor, 3:12-17. https://doi.org/10.1007/springerreference_67982
- Pandey, R., Mishra, S. and A. Kumar. 2019. Influence of organic treatments on yield attributes of rice: A comparative study. *International Journal of Agricultural Sciences*, **11** (3) : 225-230.
- Patel, M., Kumar, S. and A. Sharma. 2020. Impact of neem and

other botanical extracts on yield and yield attributes of organic rice. *Journal of Organic Agriculture and Sustainable Development*, **14** (**3**) : 215-224.

- Prasad, T.V. 2011. Objective Entomology. New Vishal Publication, New Delhi, India. 277pp.
- Rani, P., Sreenivasulu, M. and K.R. Rao. 2018. Effect of neem and vitex leaf extracts on the yield of organic rice. *International Journal of Agricultural Sciences*, **10** (2) : 145-152.
- Rathika, S., Manikandan, R. and N. Natarajan. 2021. Effect of neem-based organic formulations on yield and yield attributes of rice under organic farming. *Journal of Organic Agriculture Research*, **15** (2) : 135-142.
- Reddy, D.S., Chowdary, N.M. 2021. Botanical biopesticide combination concept a viable option for pest management in organic farming. *Egyptian Journal of Biological Pest Control*, **31** : 1-10. https://doi.org/10.1186/s41938-021-00366-w
- Reddy, N.K., Rao, P.V. and A. Kumar. 2020. Economic performance of organic rice under different botanical extract treatments. *Agricultural Economics Research Review*, **32** (3): 145-151.
- Singh, P., Verma, R. and S. Chauhan. 2021. Yield enhancement in organic rice through the use of neem and pongamia extracts. *Journal of Agricultural Biotechnology and Sustainable Development*, **13** (5) : 102-109.
- Subramanian, R., Kannan, M. and R. Selvaraj. 2018. Impact of neem leaf extract on growth and yield attributes in organic rice cultivation. *Agricultural Research Journal*, **55** (4) : 387-394.