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DIFFERENT MOISTURE REGIMES AND WEED MANAGEMENT STRATEGIES TO IMPROVE PRODUCTIVITY AND PROFITABILITY OF DRUM SEEDED RICE IN EASTERN UTTAR PRADESH INDIA

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ABSTRACT

A field experiment was conducted during *Kharif* season of 2021 at Agronomy Research Farm of Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, (U.P.) to evaluate the different moisture regimes with weed management practices in drum seeded rice. The experiment was laid out in a split plot design with 3 moisture regimes options i.e., MR1: 6 cm at 1 DADPW (Days after disappearance of ponded water), MR2: 6 cm at 4 DADPW and MR3: 6 cm at 7 DADPW as main plots and 5 weed management practices viz. WM1: Weed free, WM2: Organic mulch (Rice straw@3 t/ha), WM3: Pretilachlor (PE) @0.75 kg a.i/ha+ Bispyribac sodium 10% SC @200 ml/ha (PoE), WM4: Two hand weeding (at 20-25 DAS and 40-45 DAS) and WM5: Weedy check were assigned in sub-plots with 3 replications. The MR1 recorded significantly higher yield and their efficiency, viz. grain yield (4.75 t/ha), straw yield (7.09 t/ha), total biomass (11.84 t/ha), harvest index (40.10%), production efficiency (36.5 kg/ha/day) and monetary efficiency (486 Rs./ha/day) over MR3 and did not show significant difference over MR2. The WM1 recorded significantly higher yield and their efficiency, viz. grain yield (5.01 t/ha), straw yield (7.43 t/ha), total biomass (12.44 t/ha), harvest index (40.30%) and production efficiency (36.5 kg/ha/day) over WM5 and WM2, while did not differ significantly over WM4 and WM3, monetary efficiency noted with WM3 (523 Rs./ha/day), grain: straw ratio did not differ from each other. Gross return, net return, B:C ratio was noted in MR1WM1 (Rs. 130672), MR1WM3 (Rș.80783), MR1WM3 (1.94) respectively than remaining other treatment. Overall, results revealed that drum seeded rice with MR1WM1 is a promising option for sustaining the productivity of DSR with sustainability grown in eastern part of Uttar Pradesh.

Keywords **:** Moisture regimes, monetary efficiency, organic mulch, production efficiency, weed management

Introduction

Rice (*Oryza sativa* L.) is a vital staple crop, contributing significantly to the overall food grain production. In India, it is grown over 43.90 million hectares, yielding 114.45 million tonnes with a productivity of 2.61 t/ha (Directorate of Economics and Statistics, 2022). A hot, humid climate is necessary for the rice cultivation, crop needs an average temperature between 21 °C and 37 °C during its growth and development (Mishra *et al.,* 2023). In eastern Uttar Pradesh, rice-based systems are vital for household food security, but their sustainability is increasingly threatened by labour scarcity, rising production costs, declining irrigation water availability, and delays in crop establishment. Direct-seeded rice requires less labor and provides several benefits, including faster and easier planting, improved tolerance to water scarcity, increased profitability, and reduced carbon footprints (Avasthe *et al.,* 2023; Yadav *et al.,* 2020). Drum seeding, in particular, offers multiple advantages, such as being lightweight, easily transportable, gender-neutral, and effective in addressing labor shortages. It enables faster sowing of larger areas, ensures uniform seed spacing, lowers production costs, and enhances returns on investment. Irregular drainage was shown to boost rice growth and grain output. In terms of plant height, dry matter accumulation and number of grains/panicle (Kumar *et al.,* 2013) found that 7 cm irrigation at one day after disappearance of ponded water (DADPW) was significantly superior to 7 cm irrigation at 3 and 5 DADPW respectively (Das *et al*., 2022). However, managing weeds in drum-seeded rice remains a significant challenge for ensuring successful crop production (Suganya *et al.,* 2022). In direct seeded rice, yield loss due to weeds ranges from 40 percent to 100 percent (Singh *et al.,* 2016). Integrated weed management (IWM) is a holistic strategy aimed at controlling weed populations while minimizing their negative impact on crop growth, particularly in direct-seeded rice systems, effectively reduces competition for vital resources such as sunlight, water, and nutrients allows rice plants to grow taller and accumulate more dry matter. Additionally, IWM enhances soil health by improving structure and fertility, which supports better root development and microbial activity, further facilitating nutrient uptake.

Material Methods

The experiment was carried out during Kharif season of 2021 at Agronomy Research Farm of Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, U.P (India). The soil of experimental field was slightly alkaline in reaction (9.2 pH), low in organic carbon (0.29 %) and available nitrogen (112.4 kg/ha), medium in phosphorus (14.8 kg/ha) and potassium (248.8 kg/ha). The experiment consisted in a split plot design with 3 moisture regimes options i.e., MR1: 6 cm at 1 DADPW (Days after disappearance of ponded water), MR2: 6 cm at 4 DADPW and MR3: 6 cm at 7 DADPW as main plots and 5 weed management practices viz. WM1: Weed free, WM2: Organic mulch (Rice straw@3 t/ha), WM3: Pretilachlor (PE) @0.75 kg a.i/ha+ Bispyribac sodium 10% SC @200 ml/ha (PoE), WM4: Two hand weeding (at 20-25 DAS and 40-45 DAS) and WM5: Weedy check were assigned in sub-plots with 3 replications. Rice variety "NDR 2065" was sown by manually operated rice drum seeder it drops the seeds at 20 cm apart in continuous row and 9 cm apart continuous to seed. Taking the weight of total biomass, the produce of each net plot was threshed separately and clean grains were sun dried to maintain the moisture content at standard level of 14% moisture, grain yield per plot was recorded and separating grain from total biomass straw yield was taken in kg/ha and converted in to t/ha by conversion factor. The Harvest index (H.I.) was calculated by dividing economical yield (% of grain yield) by the biological yield (grain and straw) and represented in percentage.

$$Harvest\ index = Grain\ yield\ (t/ha) \div Biological\ yield\ (t/ha)\ X\ 100$$

Cost of cultivation (CC) of different treatments was worked out by considering all the expenses and added with common cost due to various operations and inputs used. Gross return (GR) in rupees per hectare on the basis of current price of the produce was worked out by multiplying grain and straw yield separately under various treatment combinations. Net return (NR) was calculated by subtracting the cost of cultivation from the gross return of the individual treatment combination.

NR (Rs./ha) = GR (Rs./ha) – CC (Rs./ha)

Production efficiency (kg/ha/day) can be calculated by the total production of grain yield in kg/ha divided by the total number of days crop should be harvested. Monetary efficiency (Rs./ha/day) can be calculated by net return divided by the total number of days crop should be harvested. Statistical analysis of the data was carried out using standard analysis of variance (Gomez and Gomez, 1984).

Results and Discussions

Grain, straw, total biomass and grain: straw ratio was significantly ($p \leq 0.05$) influenced due to various moisture regimes and weed management practices in rice crop (table 1). Grain yield had significantly ($p \leq 0.05$) maximum noted with MR1 option (4.75 t/ha), which was significantly higher over MR3 (3.71 t/ha) while did not show significant difference over MR2 (4.57 t/ha) respectively. The magnitude of grain yield increase by ~3.78% and ~21.90% in MR1 over MR2 and MR3 options respectively. Meanwhile, maximum straw yield had recorded with MR1 (7.09 t/ha) as compare to MR3 (5.58 t/ha) but this was not differed significantly over MR2 (6.83 t/ha). Likewise, total biomass was seen highest in MR1 (11.84 t/ha), which was significantly higher over MR3 (9.29 t/ha) while did not differ significantly over MR2 (11.39 t/ha). The MR1 had increase the magnitude of total biomass yield by ~3.80 % and~21.53% over MR2 and MR3 options respectively. The grain: straw ratio was not differed significantly with MR1 (0.669), MR2 (0.669) and MR3 (0.664). Highest harvest index was recorded with MR1 (40.10%) and did not show significantly over MR2 (40.06%) and MR3 (39.85%).

Grain yield had significantly ($p \leq 0.05$) recorded maximum with WM1 option (5.01 t/ha), which was significantly higher over WM4 (4.82 t/ha), WM3 (4.69 t/ha), WM2 (3.81 t/ha) and WM5 (3.38 t/ha) respectively (table 1). The magnitude of grain yield increase by ~3.79%, ~6.38%, ~23.95% and ~32.53% in WM1 over WM4, WM3, WM2 and WM5 options respectively. Meanwhile, maximum straw yield had recorded with WM1 (7.43 t/ha) as compare to WM5 (5.21 t/ha) and WM2 (5.71 t/ha) but this was not differed significantly over WM3 (6.98 t/ha) and WM4 (7.16 t/ha) respectively. Likewise, total biomass was seen highest in WM1 (12.44 t/ha), which was significantly higher over WM5 (8.59 t/ha) and WM2 (9.52 t/ha), while did not differ significantly over WM4 (11.98 t/ha) and WM3 (11.67 t/ha). The WM1 had increase the magnitude of total biomass yield by ~3.69 %, ~6.18 %, ~23.47 % and~30.94% over WM4, WM3, WM2 and WM5 options respectively. The grain: straw ratio was recorded highest with WM1 (0.674) but did not differ significantly with WM4 (0.674), WM3 (0.671), WM2 (0.667) and WM5 (0.648). Highest harvest index was recorded with WM1 (40.30%) and did not show significantly over WM4 (40.21%), WM3 (40.19%), WM2 (39.98%) and WM5 (39.35%). The field water-use efficiency was the maximum with irrigation at 7-day interval (36.01 kg/ha-cm) which was at par with irrigation at 5-day interval (34.48 kg/ha-cm). With regards to N level, application of 80kg N/ha recorded significantly higher grain yield (3.58 t/ha), FWUE (40.55 kg/ha-cm) and benefit: cost ratio (1.48) than that of other N levels (Nayak *et al.,* 2016). The highest grain, straw, biological yield and harvest index was recorded with treatment weed free which was significant over the treatments This result was closely justified with our result of study (Yadav *et al*., 2019) and (Moossa *et al*., 2016).

Cost of cultivation, gross return, net return, benefit: cost ratio, Production efficiency and monetary efficiency varied depending on the deferent moisture regimes and weed management practices. Meanwhile, the highest cost of cultivation had noted with MR3WM1 (Rs. 70629) and lowest with MR1WM5 (Rs. 38265) treatment combination (fig.1a). It might be due to maximum labour required for weed management with MR3WM1 and lower input were use in MR1WM5 treatment respectively. Similarly, GR show the profit of crop by total biological production in terms of money MR1WM1 (Rs. 130672) recorded maximum net return due to maximum plant population and weed free condition maintain in the competition phase and give the maximum yield of crop and compared to other treatment combination (Fig. 1b). Likewise, NR shows the highest profitability of the individual treatment MR1WM3 (Rs. 80783) show the highest net return because in this treatment weed management done by chemical application therefore that treatment require minimum amount foe weed management and compared with other treatment combination (Fig.1c). Benefit cost ratio show the actual profit of individual treatment against too per Rs. investment, highest B:C ratio show with MR1WM3 (1.94), MR2WM3 (1.68), MR1WM5 (1.32) MR1WM4 (1.22), MR2WM5 (1.10), MR3WM3 (1.06), MR2WM4 (1.05), MR1WM2 (1.03), MR1WM1 (0.99), MR2WM1 (0.85), MR2WM2 (0.850), MR3WM5 (0.61), MR3WM4 (0.60), MR3WM2 (0.45), MR3WM1 (0.44) show with lowest profit due to low population and maximum cost use for weed free respectively (fig.1d). Production efficiency (kg/ha/day) for moisture regimes highest with MR1 (36.5 kg/ha/day) and significantly over to MR3 (28.5 kg/ha/day), and did not show significantly with MR2 (35.2 kg/ha/day) and in case of weed management practices WM1 (38.5 kg/ha/day) show the highest efficiency over WM4 (37.1 kg/ha/day), WM3 (36.1 kg/ha/day), WM2 (29.3 kg/ha/day) and WM5 (26.0 kg/ha/day) (fig.2a). Monetary efficiency (Rs./ha/day) for moisture regimes shows the highest with MR1 (486 Rs./ha/day) and significantly over to MR3 (259 Rs./ha/day), and did not show significantly with MR2 (434 Rs./ha/day) and in case of weed management practices WM3 (523 Rs./ha/day) show the significantly over to WM4 (430 Rs./ha/day), WM1 (395 Rs./ha/day), WM5 (312 Rs./ha/day), WM2 (304 Rs./ha/day) (fig.2b).

Conclusions

Based on a one-season study, it was determined that rice production efficiency, profitability, and productivity and yield parameters were improved that 1 day after the disappearance of ponded water, along with using Pretilachlor (PE) @ 0.75 kg a.i. ha^{-1} + Bispyribac sodium 10% SC @ 200 ml ha^{-1} (PoE) management practices. Implementing these practices has significantly enhanced rice production efficiency, profitability, and yield parameters, benefiting farmers in the eastern region of Uttar Pradesh. Pretilachlor with Bispyribac sodium and moisture management can enhance rice farmers' crop yield and profitability, but further research is needed to fully understand their impact on different regions.

Table 1 : Yield of drum seeded rice as affected by various treatments

Treatment	Grain Yield (t/ha)	Straw Yield (t/ha)	Total biomass (t/ha)	Grain: straw ratio	Harvest Index (%)
Moisture regimes (RM)					
MR1	4.75±0.447	7.09±0.623	11.84±0.106	0.669±0.013	40.10±0.209
MR2	4.57±0.430	6.83±0.598	11.39±0.103	0.669±0.014	40.06±0.216
MR3	3.71±0.349	5.58±0.472	9.29±0.821	0.664±0.010	39.85±0.252
SEm±	0.10	0.16	0.18	0.021	0.79
LSD (p≤0.05)	0.35	0.55	0.64	0.0567	NS
Weed management practices (WM)					
WM_1	5.01±0.371	7.43±0.544	12.44±0.916	0.674±0.013	40.30±0.025
WM_2	3.81±0.283	5.71±0.382	9.52±0.665	0.667±0.012	39.98±0.190
WM_3	4.69±0.348	6.98±0.505	11.67±0.853	0.671±0.014	40.19±0.048
WM_4	4.82±0.358	7.16±0.519	11.98±0.877	0.673±0.016	40.21±0.045
WM_5	3.38±0.250	5.21±0.371	8.59±0.622	0.648±0.015	39.35±0.077
SEm±	0.11	0.16	0.23	0.022	0.81
LSD (p≤0.05)	0.33	0.48	0.67	0.062	NS

Note: MR_1 :6 cm at 1 DADPW, MR2:6 cm at 4 DADPW, MR3:6 cm at 7 DADPW, WM_1: Weed Free, WM_2: Organic mulch (Rice straw @ 3t ha^{-1}), WM_3: Pretilachlor (PE)@0.75kg a.i ha^{-1} +Bispyribac sodium 10% SC @ 200 ml ha^{-1} (PoE), WM_4: Two hand weeding (at 20-25 DAS and 40-45 DAS) and WM_5: Weedy check.

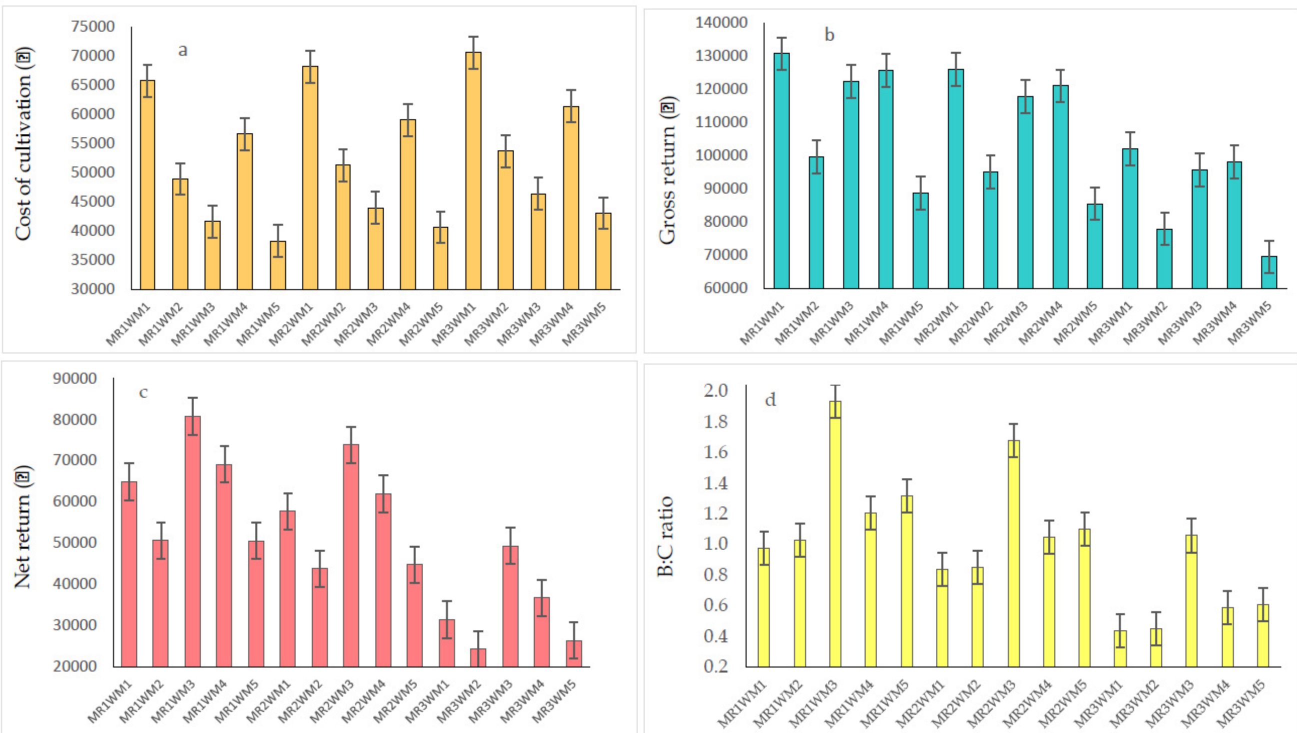

Fig. 1 : Effect of MR and WM on (1a) COC, (1b) GR, (1c) NR and (1d) B: C ratio of rice

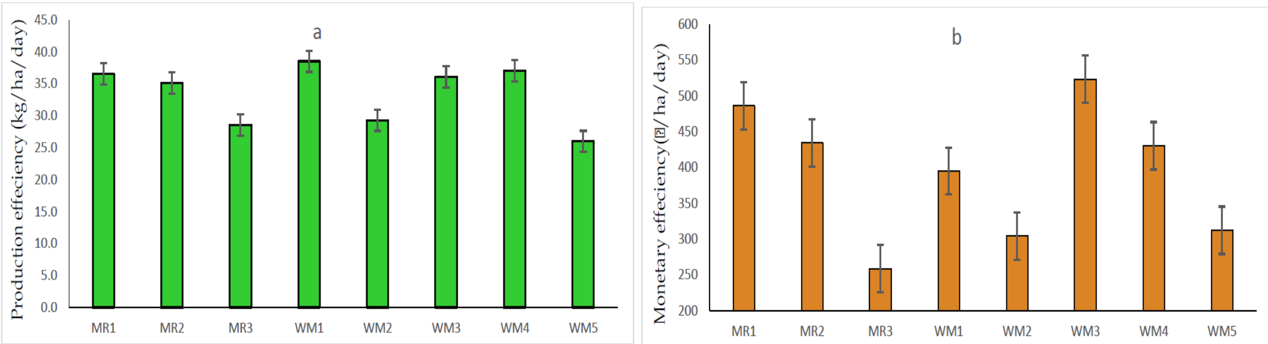

Fig. 2 : Effect of MR and WM on (2a) production efficiency and (2b) Monetary efficiency of rice

Note: MR_1 :6 cm at 1 DADPW, MR2:6 cm at 4 DADPW, MR3:6 cm at 7 DADPW, WM_1: Weed Free, WM_2: Organic mulch (Rice straw @ 3t ha^{-1}), WM_3: Pretilachlor (PE)@0.75kg a.i ha^{-1} +Bispyribac sodium 10% SC @ 200 ml ha^{-1} (PoE), WM_4: Two hand weeding (at 20-25 DAS and 40-45 DAS) and WM_5: Weedy check.

References

Avasthe, R.K., Devi, S.H., Bhupenchandra, I., Kumar, A., Chongtham, S.K., Babu, S., Singh, R., Das, A., Gudade, B.A. and Bora, S.S. (2023). Agro-tactics for reducing carbon footprint in agricultural production systems: A review. *Indian Journal of Agronomy* **68**(2): 115-125.

Das, N., Garnayak, L. M., Patra, A. K., Paikaray, R. K., Rath, B. S., Jena, S. N. and Chhatria, S. (2022). Growth and Yield of Rice as Influenced by Nitrogen and Water Management Approaches. *International Journal of Plant & Soil Science*, **34**(24):1144-1153.

DES. (2022). Agricultural Statistics at a Glance; Directorate of Economics and Statistics, Ministry of Agriculture, Cooperation and Farmers Welfare, Government of India: New Delhi, India, p. 24.

Kumar, S., Singh, R. S., Yadav, L. and Kumar, K. (2013). Effect of moisture regime and integrated nutrient supply on growth, yield and economics of transplanted rice. *ORYZA-An International Journal on Rice*, **50**(2): 189-191.

Mishra, A., Pandey, V., Nand, V., Singh, D., Kumar Shukla, V., and Yadav, A. (2023). Effect of Weed Control Methods on Weed Dynamics and Productivity of Transplanted Rice (*Oryza sativa* L.) in Eastern Uttar Pradesh. In *Biological Forum* (2249-3239).

Moossa, P. P., Thulasi, V., Raji, P. and Narayanankutty, M. C. (2016). Pre-seeded mulch technology for Direct Seeding in wet land rice. *International journal of innovative research and Development*, **5**: 10-14.

Nayak, B. R., Pramanik, K., Khanda, C. M., Panigrahy, N., Samant, P. K., Mohapatra, S. and Swain, S. K. (2016). Response of aerobic rice (*Oryza sativa*) to different irrigation regimes and nitrogen levels in western Odisha. *Indian Journal of Agronomy*, **61**(3): 321-325.

Singh, V., Jat, M. L., Ganie, Z. A., Chauhan, B. S. and Gupta, R. K. (2016). Herbicide options for effective weed management in dry direct-seeded rice under scented rice-wheat rotation of western Indo-Gangetic Plains. *Crop Protection*, **81**:168-176.

Suganya, R., Kumar, S. M. and Baradhan, G. (2022). Efficacy of new generation herbicidal combination for weed management in direct seeded rice (*Oryza sativa* L.). *Crop Research*, **57** (5and6): 297-303.

Yadav, D. B., Yadav, A. and Punia, S. S. (2019). Impact of long-term green manuring and herbicides on weed biomass, crop productivity and profitability in rice (*Oryza sativa*) wheat (*Triticum aestivum*) cropping system in Haryana. *Indian Journal of Agronomy*, **64**(2): 172-179.

Yadav, G.S., Babu, S., Das, A., Mohapatra, K.P., Singh, R., Avasthe, R.K. and Roy, S. (2020). No till and mulching enhance energy use efficiency and reduce carbon footprint of a direct-seeded upland rice production system. *Journal of Cleaner Production*. 122700.