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Effect of weed management practices and nitrogen levels on nutrient uptake of rice and weeds under drum seeded *rabi* conditions

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Abstract

Weed infestation and improper nitrogen management are major constraints affecting nutrient uptake and productivity in drum-seeded *rabi* rice. A field experiment was conducted during *rabi* 2020-21 and 2021-22 at college farm, Professor Jayashankar Telangana Agricultural University, Rajendranagar. The experiment consisted of four weed management treatments along with four nitrogen levels to assess their influence on crop nutrient uptake and weed nutrient depletion under drum-seeded *rabi* conditions. The results of two years (pooled mean) revealed that application of W_4 (Pretilachlor 6% + pyrazosulfuron-ethyl 0.15% GR as pre emergence followed by mechanical weeding at 25 and 50 days after sowing) proved most effective and remained comparable with W_2 (Pretilachlor 6% + Pyrazosulfuron-ethyl 0.15% GR 615 g ha⁻¹ as pre emergence fb Penoxsulam 1.02% + Cyhalofop butyl 5.1% OD 120 g ha⁻¹ as post emergence) with the maximum uptake of nitrogen, phosphorous and potassium nutrients by crop and the minimum depletion by weeds. Higher nitrogen levels 125% recommended dose of nitrogen (N_4) increased both nutrient uptakes by crop and nutrient depletion by weeds and lowest was recorded in control (N_1). It was also found that integration of effective weed management practices with optimum nitrogen levels is essential for enhancing nutrient uptake and minimizing nutrient losses through weeds in drum-seeded *rabi* rice.

Keywords: Drum seeded rice, nutrient removal, nutrient uptake, pre emergence and post emergence

Introduction

Rice is a major staple food crop and plays a vital role in food security and livelihood generation in India. Due to increasing scarcity of water and labour, drum-seeded rice is gaining importance as an alternative to conventional transplanting because of its lower labour requirement, reduced production cost and efficient resource utilization. However, severe weed infestation is a major constraint in drum-seeded rice, as weeds compete with the crop for nutrients, moisture, light and space, resulting in considerable yield reduction (Chauhan and Johnson, 2011 and Mahajan *et al.*, 2021) ^[1, 9]. Weeds grow rapidly and absorb nutrients more efficiently than rice during the early growth stages, leading to higher nutrient depletion and lower nutrient use efficiency (Rao *et al.*, 2017 and Yadav *et al.*, 2022) ^[15, 20]. Effective weed management practices, particularly integration of herbicides and mechanical weeding, help in reducing weed biomass, nutrient removal by weeds and improving nutrient uptake by the crop. Herbicides such as pretilachlor, pyrazosulfuron-ethyl, penoxsulam and cyhalofop-butyl are widely used for effective control of grasses, sedges and broad-leaved weeds in rice ecosystems (Kumar *et al.*, 2018 and Ramesha *et al.*, 2023) ^[7, 14]. Nitrogen, being the most important yield-limiting nutrient in rice, enhances the growth of both crop and weeds. Excess nitrogen application without proper weed control may increase weed growth and nutrient depletion, whereas optimum nitrogen management coupled with effective weed control improves crop competitiveness, nutrient uptake and productivity (Mahajan and Chauhan, 2015 and Singh *et al.*, 2021) ^[8, 17]. Several researchers have also reported increased uptake of nitrogen, phosphorus and potassium under efficient weed management and higher nitrogen levels due to better crop growth and dry matter accumulation (Nayak *et al.*, 2015, Reddy and Ameena, 2021 and Prakash *et al.*, 2022) ^[10, 16, 13]. However, information on the combined influence of weed management practices and nitrogen levels on nutrient removal by weeds and nutrient uptake by drum-seeded *rabi* rice is limited. Hence, the

present investigation was undertaken to study the effect of weed management practices and nitrogen levels on nutrient removal by weeds and nutrient uptake by drum-seeded *rabi* rice.

Materials and Methods

During *rabi* 2020-21 and 2021-22 at College farm, PJTAU, Rajendranagar an experiment was taken on loamy sand soil, which is slightly alkaline in reaction and non-saline, with low in organic carbon and available nitrogen, medium in phosphorus and high in potassium. The experiment treatments consists of four weed management practices (F1) viz., W₁: Unweeded (control), W₂: Pretilachlor 6% + Pyrazosulfuron-ethyl 0.15% GR 615 g ha⁻¹ as pre emergence (PE) fb Penoxsulam 1.02% + Cyhalofop butyl 5.1% OD 120 g ha⁻¹ as post emergence (POE), W₃: Pyrazosulfuron-ethyl 70% WDG 21 g ha⁻¹ as PE fb Penoxsulam 1.02% + Cyhalofop butyl 5.1% OD 120 g ha⁻¹ as POE, W₄: Pretilachlor 6% + Pyrazosulfuron-ethyl 0.15% GR 615 g ha⁻¹ as PE fb mechanical weeding at 25 and 50 DAS and four nitrogen levels (F2) viz., N₁-No nitrogen (control), N₂-75% recommended dose of nitrogen (RDN) (112.5 kg N ha⁻¹), N₃-100% RDN (150 kg N ha⁻¹), N₄-125% RDN (187.5 kg N ha⁻¹) replicated thrice in factorial randomized block design (FRBD). JGL-24423 variety was used for sowing with drum seeder having spacing of 20 × 8-10 cm after soaking in water for 24 hrs and incubating for 48 hrs. The recommended fertilizer dose of 60 kg P₂O₅ was applied to all the plots as basal dose in the form of single super phosphate and 40 kg ha⁻¹ K₂O in two equal splits viz., as basal at sowing and at panicle initiation stage in the form of muriate of potash. Nitrogen was applied in the form of urea as per treatments in three equal splits viz., as basal dose, tillering and panicle initiation stage. At 3 DAS, pre-emergence and at 2-3 leaf stage of weeds, post emergence herbicides were applied, while mechanical weeding was done at 25 and 50 DAS with conoweeder. Nitrogen content in plant and weed samples was estimated by the modified Kjeldahl method using an automatic Kjelplus distillation unit after digestion with concentrated H₂SO₄ and H₂O₂ as described by Jackson (1973)^[5] and Piper (1966)^[12]. Phosphorus and potassium contents were estimated after

digesting the samples with a di-acid mixture of HNO₃ and HClO₄ (9:4 ratio). Phosphorus content was determined using a spectrophotometer at 420 nm by the Vanado-Molybdo phosphoric yellow colour method, while potassium content was determined using a flame photometer following the procedures described by Piper (1966) and Jackson (1973), respectively. Nutrient uptake of N, P and K by crop and weeds at different growth stages was calculated by multiplying nutrient content (%) with respective dry matter production and expressed in kg ha⁻¹ using the following formula:

$$\text{Nutrient uptake (kg ha}^{-1}\text{)} = \frac{\text{Nutrient content (\%)} \times \text{Dry matter (kg ha}^{-1}\text{)}}{100}$$

Data was analyzed statistically applying analysis of variance technique for FRBD design. (Gomez and Gomez 1984)^[3]. Statistically significance was tested by F-value at 0.05% level of probability and critical difference was worked out where ever the effect were significant. Treatment differences that were non-significant were denoted as NS.

Results and Discussion

Nutrient removal by weeds

Nutrient removal by weeds increased progressively from tillering to harvest and was significantly influenced by weed management practices and nitrogen levels. The interaction effect between weed management practices and nitrogen levels was non-significant for phosphorus and potassium removal at all stages, but significant for nitrogen removal at tillering stage (Table 1). Among weed management practices, pretilachlor 6% + pyrazosulfuron-ethyl 0.15% GR @ 615 g ha⁻¹ as PE followed by mechanical weeding at 25 and 50 DAS (W₄) recorded the lowest N, P, and K removal by weeds and remained on par with pretilachlor 6% + pyrazosulfuron-ethyl 0.15% GR @ 615 g ha⁻¹ as PE followed by penoxsulam 1.02% + cyhalofop-butyl 5.1% OD @ 120 g ha⁻¹ as POE (W₂), whereas the unweeded treatment (W₁) recorded the highest nutrient removal.

Table 1: Pooled means of nutrient removal by weeds (kg ha⁻¹) at different stages in drum seeded *rabi* rice as influenced by weed management practices and nitrogen levels.

Treatments	Nitrogen				Phosphorous				Potassium			
	Tillering	Panicle initiation	Flowering	Harvest	Tillering	Panicle initiation	Flowering	Harvest	Tillering	Panicle initiation	Flowering	Harvest
Weed management practices												
W ₁	7.90	15.82	23.68	31.63	1.93	5.02	5.72	7.18	9.31	18.96	25.87	32.94
W ₂	1.88	4.50	6.22	7.14	0.34	1.03	1.31	1.64	2.24	5.08	6.65	7.36
W ₃	2.60	5.98	8.10	8.99	0.47	1.36	1.80	2.07	3.05	6.82	8.48	9.67
W ₄	1.80	4.02	5.85	6.48	0.31	0.92	1.22	1.48	2.05	4.82	6.06	6.84
SEm±	0.12	0.31	0.38	0.52	0.03	0.06	0.07	0.10	0.21	0.42	0.46	0.60
CD(P=0.05)	0.36	0.91	1.09	1.50	0.09	0.18	0.21	0.28	0.62	1.23	1.34	1.73
Nitrogen levels												
N ₁	2.08	4.79	7.09	9.6	0.58	1.63	1.96	2.35	2.58	5.91	7.73	9.91
N ₂	3.25	7.10	10.55	12.9	0.74	2.00	2.41	3.01	3.81	8.34	11.24	13.54
N ₃	4.01	8.42	11.99	14.78	0.81	2.22	2.69	3.33	4.62	9.73	12.93	15.43
N ₄	4.85	10.02	14.23	16.96	0.92	2.47	2.99	3.68	5.64	11.69	15.16	17.92
SEm±	0.12	0.31	0.38	0.52	0.03	0.06	0.07	0.10	0.21	0.42	0.46	0.60
CD(P=0.05)	0.36	0.91	1.09	1.50	0.09	0.18	0.21	0.28	0.62	1.23	1.34	1.73
Interaction												
SEm±	0.25	0.63	0.76	1.04	0.06	0.12	0.15	0.20	0.43	0.85	0.93	1.19
CD(P=0.05)	0.72	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Weed management (F ₁)	Nitrogen levels
W ₁ : Unweeded	N ₁ : No nitrogen
W ₂ : Pretilachlor 6% + pyrazosulfuron-ethyl 0.15% GR	N ₂ : 75% RDN
W ₃ : Pyrazosulfuron – ethyl 70% WDG 21 g/ha PE fb	N ₃ : 100% RDN
W ₄ : Pretilachlor 6% + Pyrazosulfuron-ethyl 0.15% GR	N ₄ : 125% RDN

Among nitrogen levels, application of 125% RDN (N₄) resulted in maximum nutrient removal by weeds, while the control treatment (N₁) recorded the minimum removal. The interaction effect revealed that W₁N₄ recorded the highest removal, whereas W₄N₁ recorded the lowest (Table 2). Lower nutrient removal by

weeds in weeded plots might be due to effective control of weeds during critical period which resulted in lesser weed dry matter production and lower NPK removal. Higher dry matter production and higher NPK removal by weeds in unweeded due to non adoption of weed control measures. Similar findings were reported by Gupta and Tomar (2019) ^[4] and Venkatesh (2020) ^[19]. Higher nutrient removal in 125% RDN treatment was due to higher weed dry matter. Lower removal was in no nitrogen plot, which revealed that the lower levels of nitrogen did not encourage weed growth and dry matter production. Similar results were reported by Subramanian and Martin (2007) ^[18].

Table 2: Pooled means interaction effect of weed management practices and nitrogen levels on nitrogen removal by weeds (kg ha⁻¹) at tillering in drum seeded *rabi* rice

Treatments	Tillering				
	N ₁	N ₂	N ₃	N ₄	Mean
W ₁	5.32	7.62	8.68	9.97	7.90
W ₂	0.89	1.58	2.13	2.93	1.88
W ₃	1.30	2.22	3.12	3.77	2.60
W ₄	0.80	1.58	2.09	2.72	1.80
Mean	2.08	3.25	4.01	4.85	
		W	N	W X N	
		0.12	0.12	0.25	
		0.36	0.36	0.72	

Nutrient Uptake by Crop

Nutrient uptake by crop increased progressively from tillering to harvest and was significantly influenced by weed management practices and nitrogen levels. Interaction effect was significant for nitrogen uptake at tillering, panicle initiation, flowering and grain stages, whereas it was non-significant for phosphorus and potassium uptake (Table 3). Among weed management practices, pretilachlor 6% + pyrazosulfuron-ethyl 0.15% GR @

615 g ha⁻¹ as PE followed by mechanical weeding at 25 and 50 DAS (W₄) recorded significantly higher N, P, and K uptakes by crop and remained comparable with pretilachlor 6% + pyrazosulfuron-ethyl 0.15% GR @ 615 g ha⁻¹ as PE followed by penoxsulam 1.02% + cyhalofop-butyl 5.1% OD @ 120 g ha⁻¹ as POE (W₂), while the unweeded treatment (W₁) recorded the lowest uptake

Table 3: Pooled means of nutrient uptake by crop (kg ha⁻¹) at different stages in drum seeded *rabi* rice as influenced by weed management practices and nitrogen levels

Treatments	Nitrogen uptake						Phosphorous uptake						Potassium uptake					
	T	PI initiation	F	G	S	TO	T	PI	F	G	S	TO	T	PI	F	G	S	TO
Weed management practices																		
W ₁	16.80	30.55	36.30	25.98	20.53	46.51	3.27	6.86	8.78	6.24	4.24	10.48	15.88	32.71	40.04	10.65	43.69	54.34
W ₂	27.62	65.98	82.03	63.35	38.85	102.19	5.08	12.59	15.23	11.42	6.73	18.15	25.34	62.34	77.94	24.96	84.04	109.00
W ₃	24.21	57.82	71.96	55.83	34.77	90.61	4.39	10.56	13.05	9.47	5.82	15.30	22.24	54.53	69.01	22.00	75.46	97.46
W ₄	29.08	69.10	86.33	66.45	40.17	106.64	5.32	13.41	16.67	11.57	7.15	18.72	27.10	66.70	82.63	26.17	86.42	112.59
SEm±	0.66	1.55	1.93	1.48	1.37	3.69	0.17	0.44	0.51	0.34	0.21	0.48	0.78	1.88	2.25	0.81	2.01	2.68
CD (P=0.05)	1.91	4.47	5.59	4.27	3.96	10.65	0.50	1.26	1.47	0.97	0.60	1.38	2.24	5.42	6.50	2.33	5.79	7.73
Nitrogen levels																		
N ₁	16.59	30.58	36.04	25.61	18.86	44.02	3.25	6.77	8.31	6.11	4.05	10.15	15.70	31.53	38.42	10.28	41.99	52.27
N ₂	23.71	55.22	72.03	52.52	33.49	86.02	4.23	10.76	13.32	9.32	5.82	15.14	21.74	52.59	68.9	20.39	74.31	94.69
N ₃	27.73	66.60	81.72	64.91	39.06	103.97	5.11	12.33	15.35	11.22	6.79	18.00	25.58	63.60	77.94	25.59	84.53	110.12
N ₄	29.68	71.04	86.85	69.03	42.92	111.94	5.48	13.55	16.74	12.06	7.30	19.36	27.54	68.56	84.37	27.52	88.79	116.31
SEm±	0.66	1.55	1.93	1.48	1.37	3.69	0.17	0.44	0.51	0.34	0.21	0.48	0.78	1.88	2.25	0.81	2.01	2.68
CD (P=0.05)	1.91	4.47	5.59	4.27	3.96	10.65	0.50	1.26	1.47	0.97	0.60	1.38	2.24	5.42	6.50	2.33	5.79	7.73
Interaction																		
SEm±	1.32	3.09	3.87	2.96	2.74	7.37	0.35	0.87	1.02	0.67	0.41	0.96	1.55	3.75	4.50	1.61	4.01	5.35
CD (P=0.05)	3.82	8.93	11.17	8.54	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

*Note= T-Tillering, PI-Panicle Initiation, F-Flowering, G-Grain, S-Straw, TO-Total uptake

Among nitrogen levels, application of 125% RDN recorded maximum nutrient uptake and remained on par with 100% RDN, whereas the control treatment recorded the minimum uptake. The interaction effect revealed that W₄N₄ recorded the highest nitrogen uptake, while W₁N₁ recorded the lowest (Table 4 and 5). Higher nutrient uptake under effective weed management

and higher nitrogen levels might be attributed to reduced crop-weed competition, improved nutrient availability, enhanced root growth, higher dry matter production, and better utilization of applied nutrients by the crop. Similar findings were reported by Reddy and Ameena (2021) ^[16], Devi *et al.* (2012) ^[2], Nayak *et al.* (2015) ^[11] and Kumar *et al.* (2016) ^[6].

Table 4: Interaction effect of weed management practices and nitrogen levels on nitrogen uptake (kg ha⁻¹) by drum seeded *rabi* rice (pooled mean)

Treatments	At Tillering					At Panicle Initiation				
	N ₁	N ₂	N ₃	N ₄	Mean	N ₁	N ₂	N ₃	N ₄	Mean
W ₁	12.58	16.04	18.83	19.74	16.80	17.13	29.95	36.08	39.05	30.55
W ₂	17.97	27.12	31.24	34.18	27.62	35.43	65.83	78.75	83.91	65.98
W ₃	17.49	22.71	27.13	29.51	24.21	33.76	55.62	68.39	73.5	57.82
W ₄	18.32	28.98	33.73	35.28	29.08	36.00	69.49	83.19	87.72	69.10
Mean	16.59	23.71	27.73	29.68		30.58	55.22	66.60	71.04	
		W	N	W x N			W	N	W x N	
		0.66	0.66	1.32			1.55	1.55	3.09	
		1.91	1.91	3.82			4.47	4.47	8.93	

Table 5: Interaction effect of weed management practices and nitrogen levels on nitrogen uptake (kg ha⁻¹) by drum seeded *rabi* rice (pooled mean)

Treatments	At Flowering					By Grain				
	N ₁	N ₂	N ₃	N ₄	Mean	N ₁	N ₂	N ₃	N ₄	Mean
W ₁	18.46	35.17	44.36	47.21	36.30	14.27	25.01	31.09	33.56	25.98
W ₂	42.58	86.37	96.28	102.89	82.03	28.97	63.47	77.87	83.1	63.35
W ₃	40.55	73.23	83.55	90.54	71.96	27.01	54.51	68.34	73.48	55.83
W ₄	42.56	93.33	102.67	106.75	86.33	30.42	67.11	82.3	86.00	66.45
Mean	36.04	72.03	81.72	86.85		25.16	52.52	64.91	69.03	
		W	N	W x N			W	N	W x N	
		1.93	1.93	3.87			1.48	1.48	2.96	
		5.59	5.59	11.17			4.27	4.27	8.54	

Weed management (F ₁)	Nitrogen levels (F ₂)
W ₁ :Unweeded	N ₁ : No nitrogen N ₁ : No nitrogen
W ₂ : Pretilachlor 6% + pyrazosulfuron-ethyl 0.15% GR 615 g/ha as PE fb penoxsulam 1.02% + cyhalofop butyl 5.1% OD 120 g/ha as POE	N ₂ : 75% RDN (112.5kg N/ha)
W ₃ :Pyrazosulfuron – ethyl 70% WDG 21 g/ha PE fb Penoxsulam 1.02% + Cyhalofop butyl 5.1% OD 120 g/ha POE	N ₃ : 100% RDN (150 kg N/ha)
W ₄ : Pretilachlor 6% + Pyrazosulfuron-ethyl 0.15% GR 615 g ha ⁻¹ PE fb mechanical weeding 25 and 50 DAS	N ₄ : 125% RDN (187.5 kg N/ha)

Conclusion

Application of pretilachlor 6% + pyrazosulfuron-ethyl 0.15% GR as PE followed by mechanical weeding at 25 and 50 DAS, or penoxsulam 1.02% + cyhalofop butyl 5.1% OD at 120 g ha⁻¹ as POE, enhanced nutrient uptake by crop and reduced nutrient removal by weeds. Higher nitrogen level (125% RDN) increased nutrient uptake by both crop and weeds. Overall, effective weed management with optimum nitrogen application improved nutrient use efficiency and crop performance in drum-seeded rice.

References

- Chauhan BS, Johnson DE. Row spacing and weed control timing affect yield of aerobic rice. *Field Crops Research*. 2011;121(2):226-231.
- Devi MG, Reddy ST, Sumati V, Pratima T, John K. Nitrogen management to improve the nutrient uptake, yield and quality parameters of scented rice under aerobic culture. *International Journal of Applied Biology and Pharmaceutical Technology*. 2012;3(1):340-344.
- Gomez KA, Gomez AA. Statistical procedures for agricultural research. 2nd ed. New York: John Wiley & Sons; 1984. p. 680.
- Gupta PK, Tomar AK. Weed management in transplanted rice with special reference to *Commelina benghalensis* in the Kymore Plateau Satpura Hills region of Madhya Pradesh. *Indian Journal of Weed Science*. 2019;51(3):236-239.
- Jackson ML. Soil chemical analysis. New Delhi: Prentice Hall of India Pvt. Ltd.; 1973.
- Kumar D, Uppal RS, Ram H, Dhaliwal SS. Effect of N, Zn and Fe application on N, P, K content and their total uptake in paddy rice (*Oryza sativa* L.). *Progressive Agriculture*. 2016;16(1):71-76.
- Kumar V, Ladha JK, Singh S. Weed management in direct-seeded rice systems. *Indian Journal of Weed Science*. 2018;50(1):1-12.
- Mahajan G, Chauhan BS. Weed management in dry direct-seeded rice using tank mixtures of herbicides in South Asia. *Crop Protection*. 2015;72:90-96.
- Mahajan G, Kumar V, Chauhan BS. Integrated weed management in direct-seeded rice systems: Current status and future research needs. *Crop Protection*. 2021;149:105742.
- Nayak BR, Pradhan S, Sahoo KC. Effect of integrated weed management and nitrogen levels on nutrient uptake and productivity of direct-seeded rice. *Oryza*. 2015;52(3):245-250.
- Nayak BR, Pramanik K, Panigrahy N, Dash AK, Swain SK. Yield, nitrogen uptake and nitrogen use efficiency indices of aerobic rice (*Oryza sativa* L.) under various irrigation regimes and nitrogen levels. *International Journal of Bio-Resource, Environment and Agricultural Sciences*. 2015;1(2):8-13.
- Piper CS. Soil and plant analysis. Bombay: Hans Publishers; 1966.
- Prakash C, Meena RK, Yadav GS. Influence of nitrogen levels and weed management practices on nutrient uptake and productivity of direct-seeded rice. *Pharma Innovation Journal*. 2022;11(5):1850-1854.
- Ramesha YM, Reddy VC, Kumar M. Bio-efficacy of sequential herbicide application on weed dynamics and nutrient uptake in drum-seeded rice. *Indian Journal of Agricultural Research*. 2023;57(4):512-518.

15. Rao AN, Johnson DE, Sivaprasad B, Ladha JK, Mortimer AM. Weed management in direct-seeded rice. *Advances in Agronomy*. 2007;93:153-255.
16. Reddy MM, Ameena M. Influence of weed management practices and nitrogen levels on nutrient uptake and yield of direct-seeded rice. *Indian Journal of Agronomy*. 2021;66(2):210-215.
17. Singh R, Kumar A, Singh VP. Effect of nitrogen scheduling and weed management on weed growth and nutrient removal in direct-seeded rice. *International Journal of Chemical Studies*. 2021;9(1):2100-2104.
18. Subramanian E, Martin GJ. Optimization of nitrogen dose for drum-seeded wet rice (*Oryza sativa* L.). *Oryza*. 2007;44(1):83-83.
19. Venkatesh B. Integrated weed management with herbicides and herbicide mixtures in transplanted rice. India: Professor Jayashankar Telangana State Agricultural University; 2020.
20. Yadav S, Kumar R, Singh B. Weed dynamics, nutrient depletion and productivity of direct-seeded rice under integrated weed management practices. *Indian Journal of Weed Science*. 2022;54(2):176-181.