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Effect of Micronutrient and Weed Management Practices on Yield Attributes and Productivity of Transplanted Rice (*Oryza sativa* L.)

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ABSTRACT

A field experiment was conducted during the *kharif* seasons of 2024 and 2025 at the Agronomy Research Farm of Acharya Narendra Deva University of Agriculture and Technology, Ayodhya, Uttar Pradesh, to evaluate the response of rice (*Oryza sativa* L.) to zinc and iron fertilization under different weed management practices. The experiment was laid out in a split-plot design with three replications comprising four micronutrient treatments viz., control, $ZnSO_4$ @ 25 kg ha^{-1}, $FeSO_4$ @ 25 kg ha^{-1} and $ZnSO_4$ @ 25 kg ha^{-1} + $FeSO_4$ @ 25 kg ha^{-1} in main plots and five weed management practices viz., pretilachlor @ 75 g a.i. ha^{-1} as pre-emergence, bispyribac sodium 10% SC @ 25 g a.i. ha^{-1} as post-emergence, sequential application of pretilachlor followed by bispyribac sodium, weed free and weedy check in sub-plots. The results revealed that combined application of $ZnSO_4$ and $FeSO_4$ significantly improved yield attributes and productivity of rice over control during both years. The treatment $ZnSO_4$ @ 25 kg/ha^{-1} + $FeSO_4$ @ 25 kg/ha^{-1} recorded maximum panicle length (24.27 and 24.60 cm), panicle weight (2.55 and 2.65 g), effective tillers (266.62 and 270.26 m^{-2}), filled grains per panicle (103.06 and 102.87) and grain yield (5531 and 5610 kg/ha^{-1}) during 2024 and 2025, respectively. Among weed management practices, weed free treatment recorded the highest grain yield (5660 and 5730 kg ha^{-1}), which was statistically comparable with sequential application of pretilachlor followed by bispyribac sodium. Effective weed management significantly reduced sterility percentage and enhanced biological yield compared to weedy check. Harvest index and test weight remained non-significant under different treatments. Overall, the study indicated that combined application of $ZnSO_4$ @ 25 kg ha^{-1} and $FeSO_4$ @ 25 kg ha^{-1} along with sequential application of pretilachlor followed by bispyribac sodium proved effective for improving yield attributes and productivity of transplanted rice under Eastern Uttar Pradesh conditions.

Keywords Rice, Zinc sulfate, Ferrous sulfate, Weed management, Pretilachlor, Bispyribac sodium, Productivity, Yield attributes.

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INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important staple food crops of the world and serves as the primary source of nutrition for more than half of the global population. Asia contributes nearly 90 per cent of the world's rice production and consumption (FAO 2023). India occupies the largest area under rice cultivation and ranks second in production after China. In India, rice is cultivated over about 46.4 million hectares with a production of 135.5 million tonnes and productivity of 2809 kg ha^{-1} (Anonymous 2022). Uttar Pradesh is one of the major rice-growing states contributing significantly to national food security. Sustainable rice production largely depends on balanced nutrient management and effective weed control practices. Continuous intensive cultivation and imbalanced fertilizer use have resulted in widespread micronutrient deficiencies, particularly zinc (Zn) and iron (Fe), in Indian soils. Micronutrients play a crucial role in various physiological and biochemical processes of plants and are essential for improving growth, yield and grain quality (Siddika *et al.* 2016). Zinc is involved in enzyme activation, protein synthesis and growth regulation, while iron is essential for chlorophyll synthesis, respiration and photosynthesis. Deficiency of these nutrients adversely affects crop productivity and nutritional quality of rice grains. Moreover, Zn and Fe deficiencies are also common in human populations, leading to serious health disorders such as anemia, impaired immunity and growth retardation (WHO 2003). Therefore, improving Zn and Fe nutrition in rice can contribute towards enhancing crop productivity as well as nutritional security.

Weed infestation is another major constraint in rice cultivation, causing severe competition for nutrients, moisture, light and space. Uncontrolled weeds may reduce rice yield by 3045 per cent depending upon weed intensity and crop management practices (Motmainna *et al.* 2025). Weeds also remove substantial quantities of nutrients from the soil, thereby reducing fertilizer use efficiency (Kumar *et al.* 2007). Manual weeding, though effective, is labor-intensive, costly and often impractical due to labor scarcity during peak periods. Under such conditions, herbicides offer an economical and efficient alternative for effective weed management. Pre-emergence herbicides like pretilachlor and post-emergence herbicides such as bispyribac sodium have shown promising results in controlling diverse weed flora in transplanted rice (Mahajan and Chauhan 2015).

The combined application of micronutrients and weed management practices may significantly improve crop growth, yield attributes and productivity of rice. However, limited information is available regarding the response of rice to zinc and iron fertilization under different weed management practices in transplanted rice ecosystem. Therefore, the present investigation entitled "Response of Rice (*Oryza sativa* L.) to Zinc and Iron Fertilization Under Different Weed Management Practices" was undertaken to evaluate the influence of Zn and Fe application along with different weed management practices on growth, yield attributes and productivity of transplanted rice.

MATERIALS AND METHODS

A field experiment was conducted during the *kharif* seasons of 2024 and 2025 at the Agronomy Research Farm of Acharya Narendra Deva University of Agriculture and Technology to study the response of rice (*Oryza sativa* L.) to zinc and iron fertilization under different weed management practices. The experimental site is situated in the Indo-Gangetic plains of Eastern Uttar Pradesh and characterized by a subtropical climate with hot summers and humid monsoon conditions. The experiment was laid out in a split-plot design with three replications comprising twenty treatment combinations. Micronutrient management practices were assigned to the main plots, whereas weed management practices were allocated to the sub-plots. The treatments under micronutrient management included: N_1 - Control, N_2 - $ZnSO_4$ @ 25 kg ha^{-1}, N_3 - $FeSO_4$ @ 25 kg ha^{-1} and N_4 - $ZnSO_4$ @ 25 kg ha^{-1} + $FeSO_4$ @ 25 kg ha^{-1}. The weed management practices consisted of W_1 - Pretilachlor @ 75 g a.i. ha^{-1} as pre-emergence (PE) applied at 0-3 DAT, W_2 - Bispyribac sodium 10% SC @ 25 g a.i. ha^{-1} as post-emergence (PoE) applied at 25 DAT, W_3 - Pretilachlor @ 75 g a.i. ha^{-1} (PE) at 0-3 DAT followed by Bispyribac sodium 10% SC @ 25 g a.i. ha^{-1} (PoE) at 25 DAT, W_4 - Weed free maintained through two hand weedings at 20 and 45 DAT and

W_5 - Weedy check. Rice variety 'Sarjoo-52' was used as the test crop. Twenty-five-day-old seedlings were transplanted manually at a spacing of 20 cm × 15 cm. The recommended dose of fertilizers was applied uniformly to all treatments at the rate of 120:60:40 kg N: P_2O_5: K_2O ha^{-1} through urea, diammonium phosphate and muriate of potash, respectively. Full doses of phosphorus and potassium and half dose of nitrogen were applied as basal, while the remaining nitrogen was top-dressed in two equal splits at active tillering and panicle initiation stages. Micronutrient sources, namely zinc sulfate and ferrous sulfate, were applied as per treatment before transplanting and incorporated into the soil during final puddling. Pre-emergence herbicide was applied within 0-3 days after transplanting using a knapsack sprayer fitted with a flat-fan nozzle, whereas post-emergence herbicide was sprayed at 25 DAT using a spray volume of 500 L ha^{-1}. Observations on yield attributes including panicle length, panicle weight, number of effective tillers, grains per panicle, filled grains, unfilled grains, sterility percentage and test weight were recorded using standard procedures. Grain and straw yields were recorded from net plot area and expressed in q ha^{-1}. Biological yield was calculated as the total above-ground dry matter produced by the crop (grain + straw) and expressed in kg ha^{-1}. Harvest index (HI) was computed as the ratio of economic yield (grain yield) to biological yield, expressed as a percentage using the formula:

$$\text{HI (\%)} = (\text{Grain yield} / \text{Biological yield}) \times 100$$

The experimental data collected during both years were subjected to analysis of variance (ANOVA) appropriate for split-plot design as described by Gomez and Gomez (1984). Treatment means were compared using the critical difference (CD) test at 5% level of significance.

RESULTS AND DISCUSSION

Effect of micronutrient and weed management on yield attributes of rice

The data presented in Table 1 revealed that micronutrient management significantly influenced the yield attributes of rice during both years of experimentation. Among the various treatments, combined application of $ZnSO_4$ @ 25 kg ha^{-1} along with $FeSO_4$ @ 25 kg ha^{-1} (N_4) recorded the maximum panicle length (24.27 and 24.60 cm), panicle weight (2.55 and 2.65 g), effective tillers (257.27 and 270.26 m^{-2}) and grains panicle^{-1} (104.72 and 106.95) during 2024 and 2025, respectively. The lowest values were observed under control treatment (N_1).The improvement in yield attributes due to combined zinc and iron application may be attributed to enhanced chlorophyll synthesis, activation of enzymatic processes, improved photosynthetic efficiency and better translocation of assimilates from source to sink. Zinc plays an important role in auxin synthesis and reproductive development, whereas iron is involved in chlorophyll formation and electron transport system, thereby promoting better crop growth and development. These findings are in close agreement with the results of Kumar *et al.* (2021), who reported significant improvement in panicle length and productive tillers with zinc application in rice. Similar findings were also reported by Muthumanickam *et al.* (2023), who observed higher grains panicle^{-1} and panicle weight due to combined Zn and Fe fertilization. Further, Patel *et al*. (2023) also reported that integrated micronutrient management significantly improved yield attributes and crop productivity in rice.

Weed management practices significantly influenced yield attributes of rice during both years. Weed-free treatment (W_4) produced significantly higher panicle length (26.37 and 26.74 cm), panicle weight (2.62 and 2.72 g), effective tillers (282.47 and 286.33 m^{-2}) and grains panicle^{-1} (123.27 and 126.25), whereas the lowest values were recorded under weedy check (W_5). Among herbicidal treatments, sequential application of Pretilachlor followed by Bispyribac sodium (W_3) proved superior over individual herbicide applications. The increase in yield attributes under effective weed control treatments might be due to reduced crop-weed competition for nutrients, moisture, light and space during critical growth stages. Better weed suppression enhanced crop growth and dry matter accumulation, ultimately resulting in improved reproductive growth. These findings corroborate the reports of Parthipan *et al.* (2013), who observed higher productive tillers and panicle length under efficient weed management practices.

Table 1. Effect of Micronutrient and weed management on yield attributes of Rice.

Treatments	Panicle length (cm) 2024	Panicle length (cm) 2025	Panicle weight (g) 2024	Panicle weight (g) 2025	Effective tiller (m^{-2}) 2024	Effective tiller (m^{-2}) 2025	Grains Panicle^{-1} 2024	Grains Panicle^{-1} 2025
Micronutrient management								
N_1 : Control	22.29	22.61	2.35	2.44	236.43	248.37	98.72	100.57
N_2 : $ZnSo_4$ @ 25 kg ha^{-1}	23.49	23.81	2.47	2.56	249.04	261.61	100.80	102.94
N_3 : $FeSo_4$ @ 25 kg ha^{-1}	22.96	23.27	2.39	2.48	243.38	255.67	98.80	100.31
N_4 : $ZnSo_4$ @ 25 kg ha^{-1} and $FeSo_4$ @ 25 kg ha^{-1}	24.27	24.60	2.55	2.65	257.27	270.26	104.72	106.95
SEm±	**0.35**	**0.36**	**0.04**	**0.04**	**3.66**	**3.85**	**1.19**	**1.27**
CD at 5%	1.**24**	**1.26**	**0.13**	**0.14**	**12.69**	**13.33**	**4.13**	**4.41**
Weed Management Practices								
W_1 : Pretilachlor @ 75 g a.i ha^{-1} (PE) at 0–3 DAT	23.35	23.67	2.41	2.51	261.35	274.54	101.27	102.55
W_2 : Bispyribac sodium 10 % SC @ 25g a.i ha^{-1} (PoE) at 25 DAT	23.82	24.15	2.45	2.54	264.91	278.28	99.67	102.08
W_3 : Pretilachlor @ 75 g a.i ha^{-1} (PE) at 0–3 DAT *fb*Bispyribacso-dium10% SC@25 ga. i/ha (PoE) at 25 DAT	24.37	24.72	2.50	2.60	268.83	282.40	102.90	104.79
W_4 : Weed free	26.37	26.74	2.62	2.72	272.57	286.33	107.29	108.90
W_5 : Weedy check	18.34	18.59	2.21	2.30	165.02	173.35	92.67	95.14
SEm±	**0.53**	**0.54**	**0.05**	**0.06**	**5.65**	**5.94**	**2.25**	**2.32**
CD at 5%	**1.52**	**1.54**	**0.16**	**0.16**	**16.31**	**17.15**	**6.48**	**6.70**

Similar results were also reported by Mahajan G. and Chauhan (2015), who found that sequential herbicide application significantly improved yield attributes by minimizing weed competition. Likewise, Singh *et al.* (2016) reported that integrated weed management practices effectively enhanced rice growth and yield components.

Effect of micronutrient and weed management on grain characters and sterility percentage of rice

The data presented in Table 2 revealed that micronu-

Table 2. Effect of Micronutrient and Weed Management Practices on Grain Characters and Sterility % of Rice.

Treatments	Filled Grain Panicle^{-1} 2024	Filled Grain Panicle^{-1} 2025	Unfilled Grain Panicle^{-1} 2024	Unfilled Grain Panicle^{-1} 2025	Sterility (%) 2024	Sterility (%) 2025	Test weight (g) 2024	Test weight (g) 2025
Micronutrient management								
NI : Control	98	99	16	16	14.59	14.34	22.52	22.70
N_2 : $ZnSo_4$ @ 25 kg ha^{-1}	101	101	17	16	14.26	14.01	22.83	23.10
N_3 : $FeSo_4$ @ 25 kg ha^{-1}	99	98	16	15	14.14	13.89	22.69	22.86
N_4 : $ZnSo_4$ @ 25 kg ha^{-1} and $FeSo_4$ @ 25 kg ha^{-1}	103	103	17	16	14.07	13.83	23.14	23.40
SEm±	**0.86**	**0.91**	**0.11**	**0.12**	**0.10**	**0.10**	**0.33**	**0.47**
CD at 5%	**3.02**	**3.19**	**0.38**	**0.43**	**0.36**	**0.35**	**NS**	**NS**
Weed Management Practices								
W_1 : Pretilachlor @ 75 g a.i ha^{-1} (PE) at 0–3 DAT	99	99	16	16	14.23	13.96	22.61	23.02

Table 2. Continued..

Treatments	Filled Grain Panicle^{-1}		Unfilled Grain Panicle^{-1}		Sterility (%)		Test weight (g)	
	2024	2025	2024	2025	2024	2025	2024	2025
W_2 : Bispyribac sodium 10% SC @ 25g a.i ha^{-1} (PoE) at 25 DAT	101	100	16	15	13.86	13.63	22.87	23.05
W_3 : Pretilachlor @ 75 g a.i ha^{-1} (PE) at 0–3 DAT *fb*Bispyribacsodium 10% SC @ 25 g a.i/ha (PoE) at 25 DAT	103	102	16	16	13.89	13.65	22.90	23.08
W_4 : Weed free	106	107	17	16	13.41	13.18	22.82	23.11
W_5 : Weedy check	92.20	92	17	17	15.94	15.67	22.77	22.82
SEm±	**1.94**	**2.02**	**0.32**	**0.30**	**0.26**	**0.26**	**0.46**	**0.47**
CD at 5%	**5.62**	**5.82**	**0.92**	**0.86**	**0.76**	**0.75**	**NS**	**NS**

trient management significantly influenced grain characters and sterility percentage of rice during both the years of experimentation. Application of combined zinc and iron fertilization (N_4: $ZnSO_4$ @ 25 kg ha^{-1} + $FeSO_4$ @ 25 kg ha^{-1}) recorded the maximum number of filled grains hill^{-1} (103.06 and 102.87 during 2024 and 2025, respectively), which was significantly superior over control treatment. The increase in filled grains under combined micronutrient application may be attributed to improved physiological and metabolic activities, enhanced chlorophyll synthesis, better pollen viability and efficient translocation of photosynthates towards reproductive organs. The minimum number of filled grains was observed under control treatment (N_1), recording 98.64 and 98.61 filled grains during 2024 and 2025, respectively. Similar findings were reported by Fageria *et al.* (2002), who observed that zinc and iron nutrition enhanced grain formation and reproductive efficiency in rice crops. Likewise, Alloway (2008) reported that zinc plays a crucial role in enzymatic activities and auxin synthesis, leading to better grain development.

The number of unfilled grains was significantly affected by micronutrient treatments. The highest unfilled grains were observed under combined application of $ZnSO_4$ and $FeSO_4$, whereas lower sterility percentage was recorded with micronutrient application compared to control. The sterility percentage was minimum under N_4 treatment (14.07 and 13.83%) during both years, indicating better grain setting and fertilization efficiency due to balanced micronutrient availability. Zinc and iron improve reproductive growth by enhancing pollen formation, fertilization and carbohydrate metabolism, thereby reducing spikelet sterility. Test weight was not significantly influenced by micronutrient treatments during both years; however, numerically higher values were recorded with combined micronutrient application (23.14 and 23.40 g). Similar results were also documented by Marschner H. (2012), who emphasized the importance of micronutrients in improving assimilate partitioning and grain quality attributes in cereals.

Among different weed management practices, weed-free treatment (W_4) recorded significantly superior grain characters over other treatments. The maximum number of filled grains (106.49 and 107.02 during 2024 and 2025, respectively) was obtained under weed-free condition, which remained statistically superior to all other treatments. This may be attributed to the absence of crop-weed competition for nutrients, moisture, sunlight and space, which facilitated better crop growth and reproductive development. The lowest filled grains were observed under weedy check treatment (W_5), recording 92.20 and 91.89 grains during respective years. Severe weed competition during critical crop growth stages might have reduced photosynthetic efficiency and assimilate translocation towards grains, thereby reducing grain filling.

Among herbicidal treatments, sequential application of Pretilachlor @ 75 g a.i. ha^{-1} as pre-emergence followed by Bispyribac sodium 10% SC @ 25 g a.i. ha^{-1} as post-emergence (W_3) recorded significantly higher filled grains (103.25 and 102.57) and lower sterility percentage (13.89 and 13.65%) compared to individual herbicidal applications. The integrated

Table 3. Effect of Micronutrient and Weed Management Practices on Yield and Harvest Index of Ric

Treatments	Grain yield (kg/ha) 2024	Grain yield (kg/ha) 2025	Straw yield (kg/ha) 2024	Straw yield (kg/ha) 2025	Biological yield (kg/ha) 2024	Biological yield (kg/ha) 2025	Harvest index (%) 2024	Harvest index (%) 2025
Micronutrient management								
N_1 : Control	4820.74	4960.20	7182.90	7401.20	12361.40	12361.40	39.50	40.10
N2 : $ZnSo_4$ @ 25 kg ha^{-1}	5196.17	5260.07	7627.26	7751.80	13011.87	13011.87	39.79	40.40
N_3 : $FeSo_4$ @ 25 kg ha^{-1}	4954.10	5050.11	7351.17	7519.60	12569.71	12569.71	39.55	40.15
N_4 : $ZnSo_4$ @ 25 kg ha^{-1} and $FeSo_4$ @ 25 kg ha^{-1}	5531.09	5610.11	8113.71	8257.00	13867.11	13867.11	39.82	40.43
SEm±	**76.82**	**78.58**	**114.14**	**116.87**	**195.44**	**195.44**	**0.68**	**0.81**
CD at 5%	**266.18**	**272.25**	**395.49**	**404.93**	**677.16**	**677.16**	**NS**	**NS**
Weed Management Practices								
W_1 : Pretilachlor @ 75 g a.i ha^{-1} (PE) at 0-3 DAT	4913.48	5070.14	7276.11	7540.00	12610.14	12610.14	39.60	40.20
W_2 : Bispyribac sodium 10 % SC @ 25 g a.i ha^{-1} (PoE) at 25 DAT	5207.53	5340.11	7669.80	7892.25	13232.36	13232.36	39.75	40.35
W_3 : Pretilachlor @ 75 g a.i ha^{-1} (PE) at 0–3 DAT *fb*Bispyribacsodium 10% SC @ 25 ga.i/ha (PoE) at 25 DAT	5469.08	5540.01	8041.17	8154.00	13694.01	13694.01	39.84	40.45
W_4 : Weed free	5660.41	5730.16	8234.83	8363.75	14093.91	14093.91	40.04	40.65
W_5 : Weedy check	4377.12	4420.19	6621.90	6712.00	11132.19	11132.19	39.11	39.70
SEm±	**115.73**	**117.82**	**170.28**	**173.93**	**291.74**	**291.74**	**0.74**	**0.86**
CD at 5%	**333.87**	**339.91**	**491.25**	**501.79**	**841.68**	**841.68**	**NS**	**NS**

use of pre- and post-emergence herbicides effectively controlled diverse weed flora throughout the crop growth period, thereby minimizing weed competition. Sterility percentage was highest under weedy check treatment (15.94 and 15.67%), while weed-free treatment recorded the lowest sterility percentage (13.41 and 13.18%). Effective weed control maintained favorable crop environment and better nutrient uptake, resulting in improved pollination and grain setting. These findings corroborate the observations of Kumar *et al.* (2021), who reported that efficient weed management significantly improved yield attributes and reduced sterility in transplanted rice.

Test weight did not differ significantly among weed management treatments during both years. However, slightly higher test weight values were recorded under weed-free and sequential herbicide application treatments. The non-significant variation in test weight might be due to genetic stability of grain size and shape, which are comparatively less influenced by agronomic interventions. The superiority of weed-free treatment and integrated herbicidal approach might be due to effective suppression of weeds during the critical period of crop-weed competition. Similar findings were also reported by Chauhan B. S. (2012), who stated that integrated weed management practices improved crop growth, yield attributes and nutrient uptake in rice ecosystems.

Effect of micronutrient and weed management on yield and harvest index

The data presented in Table 3 indicated that grain yield, straw yield and biological yield of rice were significantly affected by micronutrient management treatments during both years. The highest grain yield (5531 and 5610 kg ha^{-1}), straw yield (8114 and 8257 kg ha^{-1}) and biological yield (13645 and 13867 kg ha^{-1}) were recorded under combined application of $ZnSO_4$ @ 25 kg ha^{-1} and $FeSO_4$ @ 25 kg ha^{-1} (N_4). However, harvest index remained statistically non-significant. The increase in grain and biological yield due to micronutrient application might be attributed to enhanced metabolic activities, efficient nutrient utilization, improved chlorophyll formation and better translocation of photosynthates towards sink organs. Zinc and iron fertilization improved overall crop growth and yield formation process. These findings are in accordance with the observations of Muthumanickam *et al*. (2023), who reported significant enhancement in rice grain yield due to zinc and iron application. Similar findings were also documented by Patel *et al.* (2023), who observed increased straw and biological yield under micronutrient fertilization. Further, Impa and Johnson-Beebout (2012) also reported that combined Zn and Fe application improved grain yield and nutrient uptake efficiency in rice.

Among the weed management treatments, weed-free treatment (W_4) recorded maximum grain yield (5660 and 5730 kg ha^{-1}), straw yield (8235 and 8364 kg ha^{-1}) and biological yield (13895 and 14094 kg ha^{-1}) during both years. However, among herbicidal treatments, sequential application of Pretilachlor followed by Bispyribac sodium (W_3) produced significantly higher yield compared to individual herbicide applications. The lowest yields were observed under weedy check treatment (W_5). Harvest index remained statistically non-significant under different weed management practices. The superior performance of weed-free and sequential herbicide application treatments might be due to efficient control of weeds throughout the crop growth period, which minimized competition for growth resources and promoted better crop growth and assimilate partitioning. These findings are in close conformity with the findings of Puniya *et al.* (2023), who observed significantly higher grain yield under sequential herbicide application in transplanted rice. Similar results were also reported by Mahajan, G. amd Chauhan (2015), who found that effective weed control significantly improved crop productivity and dry matter accumulation. Further, Singh *et al.* (2016) reported that integrated weed management practices enhanced grain yield and biological yield of rice by reducing weed competition during critical stage.

CONCLUSION

The results of the present investigation revealed that micronutrient and weed management practices significantly influenced the yield attributes and productivity of transplanted rice. Application of $ZnSO_4$ @ 25 kg ha^{-1} along with $FeSO_4$ @ 25 kg ha^{-1} recorded superior growth, yield attributes and grain yield compared to other micronutrient treatments. Among weed management practices, weed free treatment produced the highest yield ; however, sequential application of pretilachlor followed by bispyribac sodium proved equally effective and economical in improving rice productivity. Therefore, combined application of zinc and iron along with effective herbicidal weed management can be recommended for enhancing productivity of transplanted rice under Eastern Uttar Pradesh conditions.

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