sustainability. Herbicide selection should therefore be integrated with cultural and mechanical practices and should account for application safety, crop tolerance, resistance risk, and local label recommendations (Kaur and Singh, 2017; Gyawaly et al., 2021; Shekhawat et al., 2020).

4.5 Limitations and future research

This study has three important limitations. First, weed density, species composition, and weed biomass were not measured, so treatment effects on the weed community cannot be quantified directly. Second, the experiment was conducted at one location in one season with one rice variety and three replications, which limits generalization to other environments. Third, no economic analysis was conducted, so the relative profitability of the single and combination herbicide treatments is unknown. Multi-location and multi-season trials should include direct weed measurements, treatment-by-environment assessment, crop-safety observations, herbicide-resistance considerations, and partial-budget or full economic analysis.

5 Conclusion

The present study demonstrated that weed-management treatment affected the growth, yield attributes, and productivity of direct-seeded rice under the conditions of Chitwan in 2024. Bispyribac sodium alone and bispyribac sodium + 2,4-D produced the greatest numerical grain yields, 6.1 and 6.0 t/ha, respectively, and both were statistically comparable with the weed-free treatment. Because the two bispyribac sodium treatments did not differ significantly in grain yield, the present data do not justify recommending the combination as superior to the single herbicide. Bispyribac sodium alone may be considered an effective option, while the choice between treatments should consider weed spectrum, label compliance, resistance management, crop safety and cost.

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