application timing and weed spectrum. Pre-emergence herbicides such as pendimethalin, pretilachlor, and oxadiargyl and post-emergence bispyribac sodium have therefore been evaluated in different DSR systems (Mahajan et al., 2014; Selvaraj and Hussainy, 2020; Shekhawat et al., 2020; Dangol et al., 2020). Integrated weed management remains important because combining preventive, cultural, mechanical, and chemical practices can reduce weed shifts and delay herbicide resistance (Kaur and Singh, 2017; Gyawaly et al., 2021).

Previous studies in Nepal and elsewhere have reported treatment-specific effects of herbicides on weed management and rice productivity, but results from other locations or varieties do not directly establish the best option for Hardinath-5 under Chitwan conditions. Studies in Nepal have also demonstrated that weed-management practices can substantially influence weed dynamics and grain productivity in dry direct-seeded rice (Marasini et al., 2020).

A field comparison of pre-emergence and post-emergence treatments within the same RCBD was therefore needed. The objectives of this study were to: (i) compare the effects of selected herbicides and herbicide combinations on plant height, dry matter production, and CGR; (ii) evaluate their effects on effective tillers, panicle length, grain filling, sterility, test weight, grain yield, straw yield, and harvest index; and (iii) compare treatment performance with weedy-check and weed-free conditions using weed index. The study was intended to provide location-specific evidence for selecting herbicide treatments for DSR, while recognizing that broader recommendations require validation across seasons, locations, and production costs.

2 Materials and Methods

2.1 Experiment sites and conditions

The field experiment was conducted during the 2024 rice-growing season at Rampur, Chitwan District, Nepal, located in the Inner Terai region. The experimental site was situated at 27° 39′ 15″ N and 84° 21′ 17″ E at an elevation of 210 m above sea level. The soil at the experimental site was classified as sandy loam, with a pH of 6.4, organic matter content of 5.43% and total N, available P and K contents of 0.27%, 26.5 kg/ha and 30.5 g/ha respectively. The experimental field had been under a rice-fallow-wheat cropping sequence during the preceding two years (2022 and 2023). The field was relatively uniform in fertility and suitable for field experimentation.Weather conditions during the experimental period, including mean temperature and total rainfall, were 27 °C and 1,500 mm.

2.2 Experiment design and treatments

The experiment was conducted using a single-factor Randomized Complete Block Design (RCBD) with nine treatments and three replications (Table 1).

Table 1 Different treatments used in experiment

S.N.	Treatments	Symbol	Rate/ha (a.i.)
1	Weedy check	T1	-
2	Weedfree	T2	-
3	Pendimethalin (PE)	T3	1 kg
4	Pretilachlor (PE)	T4	0.75 kg
5	Bispyribac sodium (PoE)	T5	25 g
6	Pendimethalin +2,4-D	T6	1 kg + 0.5 kg
7	Pretilachlor+2,4-D	T7	0.75 kg +0.5 kg
8	Oxadiargyl (PE)	T8	90 g
9	Bispyribac Sodium+ 2,4-D (PoE)	T9	25 g + 0.5 kg

2.3 Crop establishment and field management

Nitrogen, phosphorus, and potassium were applied at 100:30:30 kg N:P_2O_5:K_2O per hectare. Half of the nitrogen and the full doses of phosphorus and potassium were incorporated as basal fertilizer during final land preparation;