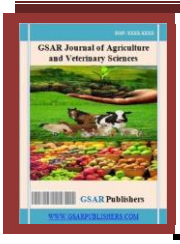

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Evaluation of broad-leaved herbicides for the management of Tarkandi Palak *(Emex spinosa* L.) in wheat (*Triticum aestivum* L.) crop

By

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Abstract

Broad-leaved weeds significantly constrain wheat productivity by competing for nutrients, water, and light. A field experiment was conducted to evaluate the efficacy of different post-emergence herbicides against a broad-leaved weed local known as palaki pakhra or tarkandi palak in wheat. Six treatments including fluroxypyr-based mixtures, sulfonylurea herbicides, and bromoxynil combinations were tested in a randomized complete block design (RCBD) with three replications. Results indicated that herbicide treatments significantly reduced weed density ($P < 0.05$) but had a non-significant effect on yield ($P > 0.05$). The treatment bromoxynil + MCPA (T5) produced the highest yield (468 g m^{-2}) and maximum weed reduction (61.11%). Herbicide mixtures proved more effective than single active ingredients. These findings support integrated weed management strategies for sustainable wheat production.

Keywords: *wheat weeds management, Emex spinosa, herbicidal control, tarkandi palak, herbicide efficacy, palaki pakhera,*

INTRODUCTION

Wheat (*Triticum aestivum* L.) Is one of the most important cereal crops worldwide. It is a staple food and plays a key role in food security for the people of Pakistan. However, its productivity is severely affected by weed narrow and broadleaved weeds infestation (Arshad *et al*., 2020; Arshad *et al*., 2025), Among the broadleaved weeds a special weed has been observed in some areas of rice wheat agroecosystem which is locally known as palaki pakhra *or* tarkandi palak *(Emex spinosa)*, which not only compete aggressively for nutrients, moisture and light but also troublesome in agronomic operations (Zand *et al*., 2003; Waheed *et al*., 2009; Bastiaans and Kropff, 2017). Yield losses due to weeds on an average in wheat have been reported to range from 30% to 50% under severe infestation (Oad *et al*., 2007) depending upon duration of weeds in wheat crop and density of weeds.

There are various methods for the management of weeds. But due to non-availability of labor for manual hoeing the farmers have to rely solely on their chemical control. Therefore, in the present agrochemical era the chemical weed control using herbicides remains the most effective and economical approach for weeds control (Gonzalez, 2023; Manibharathi, 2023; Rajender *et al*., 2012). Most of the farmers in this region remained unable to use pre-emergence herbicides due to application of irrigation late due to heavy moisture in soil owing to irrigated rice crop sown previously. Therefore, for the control of broadleaved weeds the post-emergence herbicides such as fluroxypyr, metsulfuron-methyl, MCPA, tribenuron-methyl and bromoxynil are widely used alone or pre-formulated mixtures due to their selectivity and effectiveness (Chhokar *et al*., 2012). However, continuous reliance on single herbicides could result in the evolution of herbicide-resistant weed populations (Heap, 2013).

Recent research highlights that herbicide mixtures can broaden the weed control spectrum and delay resistance development (Manibharathi, 2023; Barbieri, 2022). Furthermore, integrated weed management (IWM) strategies

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combining chemical and agronomic practices have been recommended by Abdullah *et al*., 2024 and Hussain *et al*., 2024.

Indeed, weed management is an important and continuous process throughout crop cultivation to ensure quality and higher production. Among the various weed control techniques, herbicidal weed management is quick, more effective and reliable to the farmers. Therefore, this study was conducted to evaluate the efficacy of different available herbicide combinations for the control of Palaki Pakhra and their impact on wheat yield.

Materials and Methods

The experiment regarding Evaluation of broad-leaved herbicides for the management of Tarkandi Palak (*Emex spinosa* L.) In wheat (*Triticum aestivum* L.) Crop was conducted under farmers' field conditions in traditional area of rice wheat agroecosystem also known as "Kallar tract" during the two consecutive wheat growing seasons using standard agronomic practices of the area. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications consisting of herbicides given in Table 1.

The crop with heavy infestation of Palaki Pakhra was selected for the purpose and sprayed with knap sack spray machines by following all the recommended protective measures during and after spray. For each treatment the clean and fresh water was used @ 250 l ha^{-1}. Just before spray of herbicides the weed density per m^2 was recorded. Three weeks after spray the data were recorded for weed control/mortality and the data regarding yield (g m^{-2}) was also recorded at harvest of the wheat crop.

Table 1: Herbicide with doses used in the experiment

Treatment#	Description	Dose ha^{-1}
T1	Control	
T2	Fluroxypyr + Aminopyralid	800 ml
T3	Fluroxypyr + MCPA	750 ml
T4	Metsulfuron + Tribenuron methyl	35g
T5	Bromoxynil + Heptanoate + MCPA	333ml
T6	Mesosulfuron + Iodosulfuron	400g

The data pertaining to all response variables under investigation were recorded and subjected to statistics using Statistix 8.1 software. Consequently, data were averaged across replications for clarity in treatment comparisons. Data were subjected to analysis of variance (ANOVA), and treatment means were compared using the least significant difference (LSD) test at the 5% probability level ($p \leq 0.05$) for detailed treatment mean comparisons.

Results and Discussion

The results in Table 2 indicates that almost all the herbicide treatments controlled the weeds and resultantly contributed towards increase in yield compared to control. The differences were statistically significant at $P < 0.05$.

From the results showed in Table 2 it is clear that highest yield and weed control efficiency (WCE) was observed in T5 (Bromoxynil + Heptanoate + MCPA) followed by Mesosulfuron + Iodosulfuron (T6) and Fluroxypyr + Aminopyralid (T2) with the lowest in Control (T1) where no herbicide was applied. This could be attributed to effectiveness of herbicide treatments in improving plant health and thus reduced competition with wheat crop. Such results have also been reported by, as also reported by Amanullah, 2001; Hassan *et al*., 2003; Waheed *et al*., 2004; Tunio *et al*., 2011; Marketa *at al*., 2018; Ishtiaq *et al*., 2024).

Table 2: Effect of herbicidal treatments on wheat yield and weed control efficiency (WCE)

Treatment #	Yield (g/m^2)	Increase in yield over control	Weeds/m^2 before spray	Weeds/m^2 after spray	Reduction in weeds (%)	Weed control efficiency (WCE) (%)
T1	358	0d	10.40	12.00	-15.38	-15.38
T2	435	77b	10.62	2.15	79.75	79.75b
T3	397	39c	10.41	2.50	75.99	75.99c
T4	398	40c	10.55	2.35	77.73	77.73c
T5	485	127a	10.70	0.33	96.96	96.96a
T6	435	77b	10.11	1.99	80.32	80.32b

Note: Note: The means with similar letters in a column are not significantly different at p□0.05

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Conclusion

Herbicide mixtures significantly improved weed control and thus contributes in obtaining higher yields of wheat crop. Among tested treatments, Bromoxynil + Heptanoate + MCPA (T5) proved the most effective one followed by Mesosulfuron + Iodosulfuron (T6) and Fluroxypyr + Aminopyralid (T2). Therefore, these herbicides can safely be recommended for efficient control of Tarkandi palak or Palaki pakhra in rice wheat agroecosystem for sustainable wheat crop production.

Competing Interest Declaration

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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