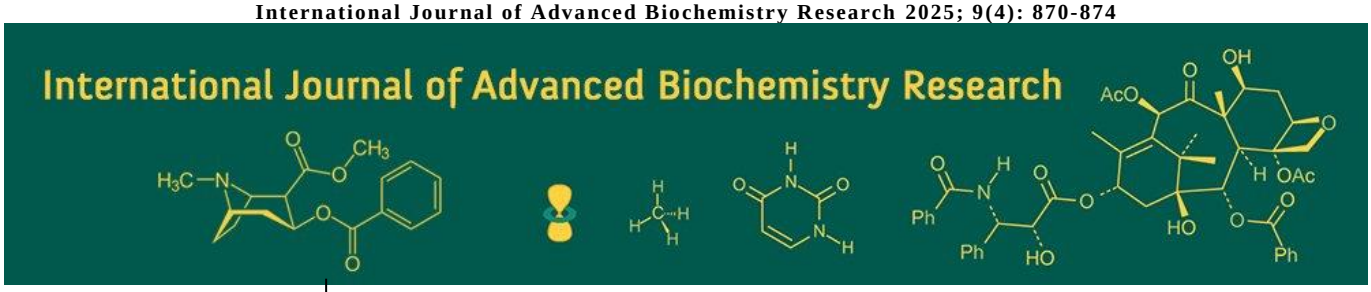

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Influence of sowing dates and integrated weed management strategies on weed dynamics in irrigated wheat (*Triticum aestivum*)

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Abstract
A field experiment was conducted during rabi 2020-2021 and 2021-2022 at the research farm of S.D.J. Post Graduate College Chandeswar, Azamgarh (U.P.), to study the effect of sowing dates and weed management practices on the productivity of wheat (*Triticum aestivum* L.). Among sowing dates, the 25th October sown crop recorded the lowest total weed density and dry weight of weeds compared to the crop sown in a later period. Significantly low weed density and dry matter of weeds were recorded with one-hand weeding at 20 DAS *fb* a combination of Sulfosulfuron at 25 g a.i. and Metsulfuron methyl at 6 g a.i. Maximum weed control efficiency and the lowest weed index were observed with the one-hand weeding at 20 DAS *fb* a combination of Sulfosulfuron at 25 g a.i. and Metsulfuron methyl at 6 g a.i. Therefore, wheat sown on 25th October, coupled with one-hand weeding at 20 DAS *fb* a combination of Sulfosulfuron at 25 g a.i. and Metsulfuron methyl at 6 g a.i., proved lowering the wed density and better weed control efficiency.

Keywords: Sowing, weed, weed density, weed index, wheat

Introduction
Wheat (*Triticum aestivum* L.) is a significant cereal crop cultivated in India and is a food source for billions globally. India ranks among the top ten wheat producers worldwide; it is cultivated over approximately 30.73 million hectares, resulting in a total production of around 110.56 million tonnes (PSD, 2025) [10]. The quality and productivity of wheat are influenced by environmental conditions and agronomic practices, particularly the timing of sowing and strategies for managing weeds, which are crucial for enhancing wheat crop yields. The full yield potential of wheat is not being realized due to various biotic and abiotic factors. Among these factors, the timing of sowing and weed presence are the primary limitations affecting crop yield. A significant drop in wheat yield has been observed when sowing is delayed beyond the ideal timeframe. The timely sowing of wheat is deemed essential for achieving higher yields and productivity (Mukherjee, 2012) [7].

Aside from the timing of sowing, the presence of weeds in a crop negatively impacts production in various ways. Weeds compete with crops for available moisture, nutrients, space, and sunlight while also providing a habitat for harmful insect pests, leading to a decrease in yield. Depending on the density of the weeds and the type of weed species present, yield reductions can range from 15% to 50%, along with the duration of infestation (Kumar *et al.*, 2011) [5]. Chemical methods of weed control are often preferred because of the limited and expensive labour available, as well as the decreased practicality of mechanical or manual weeding.

Consequently, a comprehensive investigation into weed behaviour in crops is necessary for effective weed management strategies. Prompt planning and efficient weed control are crucial and can be accomplished through the application of herbicides in wheat, which is influenced by different weed densities based on the diversity of the weed seed bank in the soil. Therefore, this study was conducted to evaluate the impact of planting dates and weed management techniques on the yield and profitability of wheat in eastern Uttar Pradesh.

Materials and Methods

A field experiment was conducted during rabi 2020-2021 and 2021-2022 at the research farm of S.D.J. Post Graduate College Chandeswar, Azamgarh (U.P.) (26°40'N and 83°1'E at an altitude of 77.36 m AMSL). The soil was sandy clay loam in texture, slightly alkaline in reaction (pH 7.81) with electrical conductivity of 0.63 dS/m, low in organic carbon (0.46%), nitrogen (219.76 kg/ha) and phosphorous (11.28 kg/ha) and medium in available potassium (193.82 kg/ha). The experiment was laid out in a split-plot design with three replications. The treatments consisted of three sowing dates, *viz*. 25th October and 1st November and 7th November. The four weed management practices include HW at 20 DAS + Sulfosulfuron @ 25 g a.i./ha on 35 DAS, HW at 20 DAS + Metsulfuron methyl @ 6g a.i./ha on 35 DAS, HW at 20 DAS + Mixture of Sulfosulfuron @ 25 g a.i./ha + Metsulfuron methyl @ 6g a.i./ha on 35 DAS weed free and weedy check. Wheat cultivar 'HD 2967' was sown at a row-to-row spacing of 20 cm. The crop was fertilized with 120:60:40 kg of N-P_2O_5-K_2O/ha. Full doses of phosphorus and potassium, along with one-third of nitrogen, were applied as basal dose at the time of sowing. The remaining half of nitrogen was applied in two equal splits-at the crown root initiation stage and just before the ear initiation stage. All the herbicides were sprayed at 30 DAS by knapsack sprayer fitted with flat fan T-jet nozzle using a spray volume of 500 l/ha. Weedy check plots remained infested with the native population of weeds till harvest. The weed count and weed dry matter accumulation were recorded using a quadrate of 1 m^2 size. The weeds were dried in an oven till a constant weight was observed and then transformed into g/m^2 by using the appropriate formula. The data on weed count and weed dry weight were subjected to square root transformation ($\sqrt{X+1}$) to normalize their distribution (Gomez and Gomez 1984) [3]. Weed control efficiency (WCE) and weed index (WI), were worked out by the formula given by Mishra and Mishra (2016) [6] and Walia (2010) [13].

Results and Discussion

Weed Flora

The study observed a diverse array of weed species prevalent in the wheat crops, categorized into different groups based on their botanical characteristics. The grassy weeds identified included *Phalaris minor*, *Cynodon dactylon, and Avena fatua*, which are commonly found in agricultural fields and can compete with crops for nutrients and resources.

Additionally, a variety of broadleaf weeds were noted, such as *Anagallis arvensis L., Chenopodium album L., Fumaria parviflora, Cirsium arvense, Vicia hirsuta, Convolvulus arvensis L., Melilotus alba, Phyllanthus niruri L., and Rumex densiflora* (Table 1). Each of these species can contribute to reduced crop yields by inhibiting growth and affecting the efficacy of agricultural practices. Furthermore, the sedge group was represented by C*yperus rotundus, Cyperus difformis, and Fimbristylis miliacea*, which are particularly noteworthy due to their perennial nature and ability to thrive even in challenging conditions.

Importantly, similar weed assemblages in wheat crops under both standard growing conditions and those sown later in the season have been documented in previous studies by Bharat *et al.* (2012) [1], Bhullar *et al*. (2012) [2], and Singh *et al*. (2017) [11], underscoring the persistence and adaptability of these weed species across varying agricultural practices.

Table 1: Weed flora of experimental crop

	Botanical name	English name	Family	Habitat
A.	**Grasses**			
1.	*Phalaris minor*	Canary grass	Poaceae	Annual
2.	*Cynodon dactylon*	Bermuda grass	Poaceae	Perennial
3.	*Avena fatua*	Wild oat	Poaceae	Annual
B.	**Sedges**			
1.	*Cyperus rotundas*	Nut grass	Cyperaceae	Perennial
C.	**Broadleaf weeds**			
1.	*Anagallis arvensis L.*	Blue pimpernal	Primulaceae	Annual
2.	*Chenopodium album L.*	Lambs quarters	Chenopodiaceae	Annual
3.	*Fumaria parviflora*	Fumitory	Papaveraceae	Annual
4.	*Cirsium arvense*	Creeping Thistle	Asteraceae	Annual
5.	*Vicia hirsuta*	Hairy vetch	Fabaceae	Annual
6.	*Convolvulus arvensis L.*	Field binder	Convolvulaceae	Perennial
7.	*Melilotus alba*	Sweet clover	Fabaceae	Annual
8.	*Phyllanthus niruri L.*	Anwla	Euphorbiaceae	Annual
9.	*Rumex densiflora*	Dock	Polygonaceae	Perennial

Total Weed Density

Data on the density of total weeds recorded on days 30, 60, and 90 DAS were influenced by different sowing dates and weed management practices during both years of study, as presented in the Table 2.

The differences in total weed density attributed to the date of sowing and weed management practices were statistically significant at all stages in both years. The wheat crop sown on October 25 exhibited a significantly lower density of total weeds compared to other sowing dates throughout all growth stages. The lower weed density associated with the October 25 sowing date can be attributed to several factors. Firstly, planting the wheat crop earlier allows it to establish itself in conditions that are less favourable for weed growth. Early germination enables the wheat plants to exploit available resources, such as light and nutrients, before weeds can become competitive. Additionally, the vigorous growth of wheat plants, which occurs when sown at this optimal date, leads to taller crop stands that can effectively overshadow and suppress the emergence of weeds, creating a more weed-free environment. Overall, these findings suggest that careful consideration of sowing dates is crucial in managing weed populations in wheat cropping systems. The same result was also corroborated by Ona *et al.* (2018)

[9] and Nath *et al*. (2024) [8]. It is clear from the data that all weed management practices resulted in significantly lower total weed density compared to a weedy control at all observation stages in both years. Furthermore, the data showed that among the various weed management practices, one-hand weeding at 20 DAS *fb* a combination of Sulfosulfuron at 25 g a.i. and Metsulfuron methyl at 6 g a.i., resulted in the lowest total weed density, which was statistically significant compared to other practices. This was followed by one-hand weeding at 20 DAS *fb* Sulfosulfuron at 25 g a.i./ha applied at 35 DAS. In contrast, one-hand weeding at 20 DAS *fb* the application of Metsulfuron methyl at 6 g a.i., alone demonstrated less effectiveness, resulting in higher total weed density at all crop stages in both years. The results underscore the necessity of selecting the right combinations of herbicides to achieve optimal outcomes in agricultural weed management practices. These results are in close conformity with those reported by Bhullar *et al*. (2012) [2] and Jat *et al*. (2014) [4].

Total Dry Matter Production of Weed

The findings from the study revealed that when wheat was sown on October 25, the overall weed density was reduced, leading to a much lower production of dry matter from weeds in contrast to other sowing dates. This suggests that timing plays a crucial role in managing weed growth. Furthermore, the results indicated a consistent trend where the dry weight of total weeds tended to increase as sowing was delayed across all growth stages in both years of the study (Table 3). This underscores the importance of early sowing as a strategy for minimizing weed competition and promoting healthier crop yields.

Throughout the study, all implemented weed management practices showed a marked reduction in the dry weights of total weeds when compared to the untreated weedy check, which consistently recorded the highest dry weights at each observation point over both years. Among the various methods tested for weed control, the combination treatment of one-hand weeding at 20 DAS *fb* Sulfosulfuron applied at a rate of 25 grams of active ingredient (a.i.) per hectare, alongside Metsulfuron methyl at 6 grams a.i., emerged as the most effective strategy. This powerful combination achieved the lowest dry weight of total weeds at all assessment intervals.

In addition to the combination treatment, one-hand weeding at 20 DAS *fb* application of Metsulfuron methyl alone at a rate of 6 grams a.i. per hectare also proved effective in reducing weed biomass at the observation stage designated as 30 DAS. Conversely, during the 60-day interval and the stage marked as 90 DAS, Sulfosulfuron was applied at 25 grams a.i. per hectare was the recommended approach, again highlighting its utility in managing weed growth. These findings indicate that the effectiveness of herbicide application varies significantly based on timing and specific environmental conditions, emphasizing the need for careful planning in weed management practices. These results are in close conformity with those reported by Bhullar *et al*. (2012) [2] and Jat *et al*. (2014) [4].

Table 2: Effect of date of sowing and weed management practices on total weed density at different stages of wheat in 2020-21 and 2021-22

Treatment		30 DAS		60 DAS		90 DAS	
		2020-21	2021-22	2020-21	2021-22	2020-21	2021-22
A. Date of sowing							
D_1-October 25		10.10 (115.44)	9.53 (102.46)	9.04 (93.51)	8.66 (88.01)	8.39 (87.35)	7.89 (78.36)
D_2-November 01		10.47 (123.77)	9.90 (110.26)	9.32 (98.40)	8.79 (88.36)	8.47 (88.77)	8.00 (79.57)
D_3-November 07		10.81 (129.97)	10.33 (117.25)	9.55 (103.79)	9.07 (94.81)	8.69 (95.08)	8.22 (84.74)
SE(m)±		0.01	0.01	0.01	0.01	0.01	0.02
CD (p=0.05)		0.05	0.04	0.05	0.04	0.02	0.08
B. Weed management practices*							
W_1-Sulfosulfuron @ 25 g a.i./ha on 35 DAS		12.67 (147.72)	11.99 (131.15)	10.69 (102.48)	10.24 (93.41)	9.42 (84.71)	8.82 (74.74)
W_2-Metsulfuron methyl @ 6g a.i./ha on 35 DAS		12.69 (151.35)	12.07 (134.67)	10.90 (113.69)	10.39 (104.26)	9.80 (96.40)	9.33 (88.01)
W_3-Mixture of W_1 and W_2		11.98 (137.12)	11.11 (117.09)	9.60 (87.71)	9.06 (79.38)	8.69 (76.36)	8.07 (66.79)
W_4-Weed free		1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
W_5-Weedy check		13.95 (179.13)	13.43 (167.03)	14.31 (188.95)	13.51 (174.92)	13.67 (194.53)	12.96 (174.91)
SEM±		0.02	0.02	0.02	0.02	0.02	0.02
CD (p=0.05)		0.05	0.05	0.04	0.06	0.06	0.05
Interaction A × B							
Factor(B) at same level of A	SEM±	0.03	0.02	0.03	0.02	0.03	0.04
	CD (p=0.05)	0.10	0.09	0.08	0.11	0.10	0.09
Factor(A) at same level of B	SEM±	0.03	0.03	0.03	0.03	0.03	0.03
	CD (p=0.05)	0.09	0.09	0.08	0.10	0.10	0.10

Original values are in parentheses, and data subjected to square root (√x+1) transformation

*One hand weeding was done on 20 DAS in all the treatments except the Weedy check

Table 3: Effect of date of sowing and weed management practices on total dry matter production of weed at different stages of wheat in 2020-21 and 2021-22

Treatment		30 DAS		60 DAS		90 DAS	
		2020-21	2021-22	2020-21	2021-22	2020-21	2021-22
A. Date of sowing							
D_1-October 25		3.04 (9.43)	2.83 (8.03)	3.19 (10.70)	2.95 (8.99)	3.35 (12.36)	3.22 (11.34)
D_2-November 01		3.33 (11.55)	3.07 (9.59)	3.33 (11.74)	3.18 (10.64)	3.38 (12.54)	3.26 (11.63)
D_3-November 07		3.44 (12.45)	3.21 (10.62)	350 (13.06)	3.26 (11.20)	3.46 (13.22)	3.36 (12.32)
SE(m)±		0.01	0.01	0.01	0.01	0.02	0.01
CD (p=0.05)		0.04	0.04	0.02	0.03	0.06	0.03
B. Weed management practices*							
W_1-Sulfosulfuron @ 25 g a.i./ha on 35 DAS		3.74 (13.03)	3.47 (11.06)	3.57 (11.80)	3.30 (9.93)	3.40 (10.54)	3.31 (9.96)
W_2-Metsulfuron methyl @ 6g a.i./ha on 35 DAS		3.61 (12.08)	3.30 (9.95)	3.89 (14.17)	3.54 (11.57)	3.57 (11.72)	3.47 (11.05)
W_3-Mixture of W_1 and W_2		3.47 (11.12)	3.17 (9.13)	3.32 (10.05)	3.08 (8.52)	3.37 (10.33)	3.16 (9.02)
W_4-Weed free		1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
W_5-Weedy check		4.52 (19.50)	4.23 (16.93)	4.91 (23.15)	4.73 (21.36)	5.65 (30.96)	5.46 (28.78)
SEM±		0.01	0.01	0.01	0.01	0.01	0.01
CD (p=0.05)		0.04	0.04	0.04	0.04	0.04	0.04
Interaction A × B							
Factor(B) at same level of A	SEM±	0.02	0.02	0.01	0.02	0.03	0.02
	CD (p=0.05)	0.07	0.07	0.07	0.06	0.08	0.07
Factor(A) at same level of B	SEM±	0.02	0.02	0.02	0.02	0.03	0.02
	CD (p=0.05)	0.07	0.07	0.07	0.06	0.08	0.07

Original values are in parentheses and data subjected to square root (√x+1) transformation
*One hand weeding was done on 20 DAS in all the treatments except the Weedy check

Weed Control Efficiency

The study indicates that sowing the wheat crop earlier, specifically on October 25th, could greatly enhance weed control efficiency (Table 4). This improvement in management practices can be attributed to the accelerated growth rate of the wheat plants, which allows them to establish themselves before the weeds have a chance to proliferate. Typically, most weed species emerge around the second week of November. By sowing the wheat crop earlier in October, farmers enable the wheat plants to grow robustly and cover the soil adequately before the weeds start to sprout. Consequently, this early planting strategy not only promotes healthier wheat development but also minimizes the opportunities for weeds to thrive in the field, leading to more effective overall weed management.

This study focused on effective weed management and observed that the highest weed control efficiency was observed with one-hand weeding at 20 DAS *fb* application of a mixture of post-emergence application of Sulfosulfuron combined with Metsulfuron methyl. This herbicide mixture was particularly notable for its ability to reduce weed dry weight substantially compared to other treatments. The reduced weed biomass demonstrated by this combination suggests a strong herbicidal activity, which aligns with findings from previous research conducted by Tomar and Tomar (2014) [12]. Their studies support the efficacy of these herbicides in managing weed populations effectively.

Weed Index

The weed index serves as a critical metric for assessing the impact of weed infestation on crop yield, specifically reflecting the extent of yield reduction attributable to the presence of weeds. This index is closely correlated with two primary factors: weed density and the dry matter of the weeds present in the area. A lower weed index signifies a higher degree of benefit for the crop, indicating less competition from weeds and, consequently, better potential yields.

Research suggests that sowing wheat crops on October 25th can lead to increased grain yields while simultaneously reducing the weed index (Table 4). This phenomenon may be attributed to the fact that earlier sowing allows wheat crops to establish themselves before weeds can proliferate, thereby creating a weed-free environment. Such conditions promote optimal growth, enabling the wheat plants to flourish and ultimately produce a higher yield.

One-hand weeding at 20 DAS *fb* application of a herbicide mixture, consisting of Sulfosulfuron @ 25 grams of active ingredient (a.i.) and Metsulfuron methyl @ 6 grams a.i., resulted in a strikingly low weed index, highlighting the effectiveness of these herbicides in controlling and suppressing unwanted weed growth. In stark contrast, the control group, which received no intervention for weed management, exhibited alarmingly high weed indices. This significant disparity underscores the vital role that herbicide application plays in maintaining healthy plant growth by effectively managing weed populations. The lowest weed index in efficient herbicidal treatments can probably be ascribed to minimized weed density but also averted weed dry matter and reduction in crop-weed competition. These results conformed with the findings of Jat *et al*. (2014) [4] and Bhullar *et al*. (2012) [2].

Table 4: Effect of date of sowing and weed management practices on weed control efficiency (%) at different stages of wheat and weed index (%) in 2020-21 and 2021-22

Treatment	Weed Control Efficiency (%)						Weed Index %	
	30 DAS		60 DAS		90 DAS		2020-21	2021-22
	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22		
A. Date of sowing								
D_1-October 25	59.85	61.61	67.08	71.15	75.79	76.08	6.26	6.65
D_2-November 01	50.80	54.17	63.85	65.88	75.44	75.47	6.39	6.74
D_3-November 07	46.97	49.26	59.79	64.06	74.12	74.01	6.47	6.80
B. Weed management practices*								
W_1-Sulfosulfuron @ 25 g a.i./ha on 35 DAS	44.53	47.16	63.69	68.14	79.37	78.99	7.43	6.94
W_2-Metsulfuron methyl @ 6g a.i./ha on 35 DAS	48.57	52.44	56.38	62.89	77.06	76.69	4.67	5.16
W_3-Mixture of W_1 and W_2	52.64	56.38	69.07	72.66	79.77	80.97	0.81	2.36
W_4-Weed free	100.00	100.00	100.00	100.00	100.00	100.00	0.00	0.00
W_5-Weedy check	0.00	0.00	0.00	0.00	0.00	0.00	18.95	19.18

* One hand weeding was done on 20 DAS in all the treatments except the Weedy check

Conclusion

Based on two years of study, it was concluded that wheat crop sown on 25th October along with One-hand weeding at 20 DAS *fb* application of a herbicide mixture, consisting of Sulfosulfuron @ 25 grams of active ingredient (a.i.) and Metsulfuron methyl @ 6 grams a.i., was found effective in reducing weed population and greater weed control efficiency.

References

1. Bharat R, Kachroo D, Sharma R, Gupta M, Sharma AK. Effect of different herbicides on weed growth and yield performance of wheat. Indian Journal of Weed Science. 2012;44(2):106-109.
2. Bhullar MS, Shergill LS, Kaur R, Walia US, Kaur T. Bio-efficacy of herbicides in relation to sowing methods in wheat. Indian Journal of Weed Science. 2012;44(4):214-217.
3. Gomez KA, Gomez AA. Statistical procedures for agricultural research. 2nd ed. New York: John Wiley and Sons; 1984. p. 1-680.
4. Jat SL, Nepalia V, Choudhary J, Singh D. Effect of nitrogen and weed management on productivity and quality of durum wheat (*Triticum durum*). Indian Journal of Agronomy. 2014;59(2):281-285.
5. Kumar S, Angiras NN, Rana SS. Bio-efficacy of Clodinafop-propargyl + metsulfuron methyl against complex weed flora in wheat. Indian Journal of Weed Science. 2011;43(3&4):195-198.
6. Mishra M, Misra A. Weed persistence, crop resistance and phytotonic effects of herbicides in direct-seeded rice. Indian Journal of Weed Science. 2016;48(1):13-16.
7. Mukherjee D. Effect of sowing dates on growth and yield of wheat (*Triticum aestivum*) cultivars under mid-hill situation of West Bengal. Indian Journal of Agronomy. 2012;57(2):152-156.
8. Nath CP, Singh RG, Choudhary VK, Datta D, Nandan R, Singh SS. Challenges and alternatives of herbicide-based weed management. Agronomy. 2024;14(1):126.
9. Ona A, Grazina K, Birute J. The influence of crop density and sowing delay on weed germination in winter wheat. Journal of Plant Diseases and Protection. 2018;458:278-281.
10. PSD. Website accessed from: https://ipad.fas.usda.gov/countrysummary/Default.aspx?id=IN&crop=Wheat. Accessed 2025.
11. Singh PK, Sondhia S, Dubey RP, Kumar S, Kumar B, Gharde Y, *et al*. Adoption and impact assessment of weed management technologies in wheat and green gram under conservation agriculture system in central India. Indian Journal of Weed Science. 2017;49(1):23-28.
12. Tomar SK, Tomar TS. Effect of herbicides and their tank mix mixture on weed dynamics and yield of zero-tilled wheat (*Triticum aestivum*) under rice-wheat cropping system of eastern Uttar Pradesh. Indian Journal of Agronomy. 2014;59(4):624-628.
13. Walia US, Kaur T, Nayyar S, Singh K. Performance of carfentrazone-ethyl 20% + sulfosulfuron 25% WDG-A formulated herbicide for total weed control in wheat. Indian Journal of Weed Science. 2010;42:155-158.