E-ISSN: 2618-0618
P-ISSN: 2618-060X
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NAAS Rating (2025): 5.20
www.agronomyjournals.com
2025; SP-8(8): 550-552
Received: 02-05-2025
Accepted: 05-06-2025

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Effect of different pre and post emergence herbicides on yield and economics of soybean (*Glycine max* L. Merrill)

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DOI: https://www.doi.org/10.33545/2618060X.2025.v8.i8Sh.3664

Abstract
A field study was conducted during the kharif season of 2024 at the Agronomy Farm, College of Agriculture, Nagpur, Maharashtra, India, to evaluate the impact of various pre- and post-emergence herbicides on soybean yield and economic returns. The experiment followed a randomized block design with eight treatments: T1 (unweeded control), T2 (completely weed-free), T3 (Sulfentrazone 28% + Clomazone 30% PE WP at 750 g a.i ha^{-1} followed by Fluazifop-p-butyl 11.1% + Fomesafen 11.1% POE SL at 25 g a.i ha^{-1} at 25 DAS), T4 (Sulfentrazone 28% + Clomazone 30% PE WP at 750 g a.i ha^{-1} followed by Propaquizafop 2.5% + Imazethapyr 3.75% POE ME at 125 g a.i ha^{-1} at 25 DAS), T5 (Sulfentrazone 28% + Clomazone 30% PE WP at 750 g a.i ha^{-1} followed by manual hoeing and weeding at 25 DAS), T6 (Pendimethalin 38.7% PE CS at 580 g a.i ha^{-1} followed by Fluazifop-p-butyl 11.1% + Fomesafen 11.1% POE SL at 25 g a.i ha^{-1} at 25 DAS), T7 (Pendimethalin 38.7% PE CS at 580 g a.i ha^{-1} followed by Propaquizafop 2.5% + Imazethapyr 3.75% POE ME at 125 g a.i ha^{-1} at 25 DAS), and T8 (Pendimethalin 38.7% PE CS at 580 g a.i ha^{-1} followed by one hoeing and hand weeding at 25 DAS). Each treatment was replicated three times.
The findings indicated that among all herbicidal treatments, T3 (application of Sulfentrazone + Clomazone followed by Fluazifop-p-butyl + Fomesafen) resulted in significantly higher seed yield, straw yield per hectare, gross monetary returns, net monetary returns, and benefit-cost ratio. However, T5 (Sulfentrazone + Clomazone followed by hoeing and weeding) and T6 (Pendimethalin followed by Fluazifop-p-butyl + Fomesafen) were statistically at par with T3 in terms of performance.

Keywords: Soybean, weed management, herbicide, POE, PE, yield, economics, Sulfentrazon, clomazone, Fluazifop-p-butyl, fomesafen

Introduction
Soybean (*Glycine max* L. Merrill) is recognized as a vital crop serving both as a pulse and an oilseed. Often referred to as the "golden bean" of the 20th century, it holds the distinction of being the world's most important leguminous oilseed crop. Compared to other legumes, soybean has a significantly higher productivity potential. It is also a highly nutritious source of protein, making it valuable in addressing protein-calorie malnutrition. The seeds contain approximately 20% oil and 40-42% high-quality protein, which surpasses the 20-25% protein content typically found in other legume species (Agarwal *et al*., 2013) [1].
As of 2022, global soybean production was estimated at 348.86 million tonnes (Mt) over an area of 133.79 million hectares (mha). Brazil topped global production with 120.70 Mt, followed by the United States (116.38 Mt), Argentina (43.86 Mt), China (20.29 Mt), and India (12.99 Mt). In terms of cultivated area, India ranked fourth with 12.14 mha (29.99 million acres), accounting for 9.07% of global soybean acreage, while ranking fifth in production. According to the Government of India's third advance estimates for 2023-24, soybean output stood at 130.54 lakh tonnes, which was a decline from 149.85 lakh tonnes in 2022-23. Among Indian states, Madhya Pradesh led production with 54.72 lakh tonnes, followed by Maharashtra (52.33 lakh t), Rajasthan (11.70 lakh t), Karnataka (4.13 lakh t), Gujarat (3.78 lakh t), and Telangana (2.69 lakh t) (Anonymous, 2024) [3].

Despite India's status as a major soybean-producing country, its national productivity remains lower than the global average. Several biotic and abiotic constraints contribute to this, with early-stage weed infestation being a major biotic factor. Weed competition during the initial 30-45 days after sowing is particularly detrimental, leading to yield losses ranging from 35% to 50%, depending on weed species and their density (Rupareliya *et al*., 2020) [9]. Weeds compete for essential resources such as moisture, light, nutrients, and space, and also interfere with farm operations, harbor pests, and lead to seed contamination at harvest.

Frequent weed species in soybean fields include *Lagasia mollis*, *Euphorbia hirta*, *Digera arvensis*, *Tridax procumbens*, *Parthenium hysterophorus*, *Celosia argentea*, and *Alternanthera triandra*. Common monocot weeds include *Dinebra arabica*, *Poa annua*, *Echinochloa crus-galli*, *Eragrostis major*, *Cynodon dactylon*, and *Cyperus rotundus*, all of which can contribute to reduced seed yield (Prachand *et al*., 2015) [8]. Therefore, adopting effective and timely weed management strategies is essential for enhancing soybean productivity. Integrated approaches that combine herbicide application with manual weeding have been found to be more effective than using either method alone. However, rising labor costs and labor shortages often make manual weeding impractical, even though it provides good control. Thus, the use of pre- and post-emergence herbicides offers a more practical and efficient alternative. In light of these considerations, a field experiment was conducted to evaluate the performance of different combinations of pre- and post-emergence herbicides for effective weed management in soybean cultivation.

Material and Methods

The field experiment was carried out during the kharif season of 2024 at the Agronomy Farm, College of Agriculture, Nagpur, Maharashtra, India. The soil at the experimental site was clayey in nature, with medium nitrogen levels, low phosphorus content, and high potassium availability. The pH of the soil was found to be neutral to slightly alkaline, measuring around 7.65. The trial was designed using a randomized block design (RBD) with three replications and eight treatments: T1 (weedy check), T2 (weed-free check), T3 (Sulfentrazone 28% + Clomazone 30% PE WP at 750 g a.i ha^{-1} followed by Fluazifop-p-butyl 11.1% + Fomesafen 11.1% POE SL at 25 g a.i ha^{-1} applied at 25 DAS), T4 (Sulfentrazone 28% + Clomazone 30% PE WP at 750 g a.i ha^{-1} followed by Propaquizafop 2.5% + Imazethapyr 3.75% POE ME at 125 g a.i ha^{-1} at 25 DAS), T5 (Sulfentrazone 28% + Clomazone 30% PE WP at 750 g a.i ha^{-1} followed by manual hoeing and weeding at 25 DAS), T6 (Pendimethalin 38.7% PE CS at 580 g a.i ha^{-1} followed by Fluazifop-p-butyl 11.1% + Fomesafen 11.1% POE SL at 25 g a.i ha^{-1} at 25 DAS), T7 (Pendimethalin 38.7% PE CS at 580 g a.i ha^{-1} followed by Propaquizafop 2.5% + Imazethapyr 3.75% POE ME at 125 g a.i ha^{-1} at 25 DAS), and T8 (Pendimethalin 38.7% PE CS at 580 g a.i ha^{-1} followed by one hoeing and hand weeding at 25 DAS).

Herbicide applications (both pre-emergence and post-emergence), as well as cultural practices, were implemented according to the respective treatment protocols. All other recommended agronomic practices for soybean were followed uniformly across the field. The soybean variety PDKV Amba was sown on July 3, 2024, with a spacing of 45 cm × 5 cm. Observations were taken from the net plot area and converted to per hectare values using standard conversion factors. The collected data were subjected to statistical analysis, and the cost of cultivation was calculated using the prevailing market rates of inputs and soybean during the cropping season.

Results and Discussion

Seed yield (q ha^{-1})

The data related to seed yield (Table 1) indicated that soybean seed yield was significantly affected by the different treatments applied. Among all the treatments, the weed-free check (T2) produced the highest seed yield at 21.14 q ha^{-1}, showing statistically significant superiority over the rest. Among the herbicide-based treatments, the application of Sulfentrazone 28% + Clomazone 30% WP as pre-emergence @ 750 g a.i ha^{-1} followed by Fluazifop-p-butyl 11.1% + Fomesafen 11.1% SL as post-emergence @ 25 g a.i ha^{-1} at 25 DAS (T3) recorded a significantly higher seed yield of 18.97 q ha^{-1}. This treatment was statistically at par with T5 (Sulfentrazone + Clomazone followed by manual hoeing and weeding at 25 DAS) and T6 (Pendimethalin followed by Fluazifop-p-butyl + Fomesafen at 25 DAS).

In contrast, the weedy check (T1) recorded the lowest seed yield of 9.86 q ha^{-1}, likely due to intense weed competition during the critical early growth stages of the crop for essential resources such as moisture, light, nutrients, and space. All weed management treatments showed a significant improvement in yield over the untreated control. This can be attributed to better weed suppression, which ultimately reduced competition and enhanced crop growth and productivity. Comparable findings have been documented by Koturwar *et al*. (2022) [6], Aher *et al*. (2023) [2], and Patidar *et al*. (2023) [7].

Straw yield (q ha^{-1})

The data presented in the table clearly indicate that different weed management strategies had a significant effect on the straw yield of soybean. Among all the treatments, the weed-free check (T2) recorded the highest straw yield of 34.47 q ha^{-1}, which was statistically superior to the rest. Among the herbicide-based treatments, the combination of Sulfentrazone 28% + Clomazone 30% WP as a pre-emergent @ 750 g a.i ha^{-1}, followed by Fluazifop-p-butyl 11.1% + Fomesafen 11.1% SL as post-emergent @ 25 g a.i ha^{-1} at 25 DAS (T3), produced a significantly higher straw yield of 34.08 q ha^{-1} compared to the other herbicidal treatments.

However, this treatment (T3) was found statistically at par with T5 (Sulfentrazone + Clomazone followed by one hoeing and weeding at 25 DAS) and T6 (Pendimethalin followed by Fluazifop-p-butyl + Fomesafen at 25 DAS), indicating comparable performance. The lowest straw yield of 20.15 q ha^{-1} was observed in the weedy check (T1). All other treatments performed significantly better than T1.

The increased straw yield under effective weed control treatments may be attributed to reduced weed competition during the early growth stages, which likely allowed the soybean plants to accumulate more biomass and favorable yield components. These findings are consistent with the results reported by Bushara *et al*. (2024), Das and Samui (2024) [5], and Shivani *et al*. (2025) [10].

Table 1: Effect of different pre and post emergence herbicide on yield and economics of soybean

Treatments		Seed yield (q ha-1)	Straw yield (q ha-1)	GMR (Rs. ha^{-1})	COC (Rs. ha^{-1})	NMR (Rs. ha^{-1})	B:C ratio
T_1	Weedy check	9.86	20.15	50250	26290	23960	1.91
T_2	Weed free check	21.14	34.47	106881	29890	76991	3.58
T_3	Sulfentrazone 28% + Clomazone 30% WP PE @750 g a.i ha-1 *fb* Fluazifop-p-butyl 11.1% + Fomesafen 11.1% SL POE @ 25 g a.i ha-1 at 25 DAS	18.97	34.08	96193	33809	62384	2.85
T_4	Sulfentrazone 28% + Clomazone 30% WP PE @ 750 g a.i ha-1 *fb* Propaquizafop 2.5% + Imazethapyr 3.75% ME POE @ 125 g a.i ha-1 at 25 DAS	16.64	31.18	84521	34202	50319	2.47
T_5	Sulfentrazone 28% + Clomazone 30% WP PE @750 g a.i ha-1 *fb* one hoeing and weeding at 25 DAS	17.52	32.44	88968	33002	55966	2.70
T_6	Pendimethalin 38.7% CS PE @ 580 g a.i ha-1 *fb* Fluazifop-p-butyl 11.1% + Fomesafen 11.1% SL POE @ 25 g a.i ha-1 at 25 DAS	17.26	32.08	87644	31172	56472	2.81
T_7	Pendimethalin 38.7% CS PE @ 580 g a.i ha-1 *fb* Propaquizafop 2.5% + Imazethapyr 3.75% ME POE @ 125 g a.i ha-1 at 25 DAS	15.72	31.10	79996	31565	48431	2.53
T_8	Pendimethalin 38.7% CS PE @ 580 g a.i ha-1 *fb* one hoeing and one hand weeding at 25 DAS	16.30	31.39	82878	30365	52513	2.73
	S.E.(m) ±	0.72	0.67	3489	-	3489	-
	C.D. 5%	2.17	2.02	10583	-	10583	-
	GM	16.68	30.86	84666	31287	53379	2.70

Economics

In terms of economics, different weed management practices had a notable impact on both gross monetary return (GMR) and net monetary return (NMR). The weed-free check (T2) treatment yielded the highest economic returns, recording a GMR of ₹1,06,881 ha^{-1} and NMR of ₹76,991 ha^{-1}, which were significantly superior to all other treatments evaluated.

Among the herbicide-based approaches, the application of Sulfentrazone 28% + Clomazone 30% WP as pre-emergence @ 750 g a.i ha^{-1}, followed by Fluazifop-p-butyl 11.1% + Fomesafen 11.1% SL as post-emergence @ 25 g a.i ha^{-1} at 25 DAS (T3), recorded a GMR of ₹96,193 ha^{-1} and an NMR of ₹62,384 ha^{-1}. These returns were statistically at par with T5 (Sulfentrazone + Clomazone followed by one hoeing and weeding at 25 DAS) and T6 (Pendimethalin followed by Fluazifop-p-butyl + Fomesafen at 25 DAS).

The highest benefit-cost (B:C) ratio of 3.58 was achieved under the weed-free check (T2), followed closely by T3, which recorded a B:C ratio of 2.85, indicating the profitability of these treatments. WP PE @ 750 g a.i ha^{-1} *fb* Fluazifop-p-butyl 11.1% + Fomesafen 11.1% SL POE @ 25 g a.i ha^{-1} at 25 DAS (T_3) (2.85).

Conclusion

The treatment involving the application of Sulfentrazone 28% + Clomazone 30% WP as a pre-emergence at 750 g a.i ha^{-1} followed by Fluazifop-p-butyl 11.1% + Fomesafen 11.1% SL as a post-emergence at 25 g a.i ha^{-1} at 25 DAS (T3) resulted in significantly higher seed yield (q ha^{-1}), straw yield (q ha^{-1}), gross monetary return (GMR), net monetary return (NMR), and benefit-cost (B:C) ratio. This was followed by the treatments involving Sulfentrazone 28% + Clomazone 30% WP pre-emergence at 750 g a.i ha^{-1} followed by one hoeing and weeding at 25 DAS (T5) and Pendimethalin 38.7% CS pre-emergence at 580 g a.i ha^{-1} followed by Fluazifop-p-butyl 11.1% + Fomesafen 11.1% SL post-emergence at 25 g a.i ha^{-1} at 25 DAS (T6).

Acknowledgement

I acknowledge my sincere thanks to Dr. V. S. Khawale, Chairman of advisory committee and Professor of Agronomy, Agronomy Section, College of Agriculture Nagpur and also I extent my sincere gratitude to towards Associate Dean, College of Agriculture, Nagpur, Maharashtra.

References

1. Agarwal DK, Billore SD, Sharma AN, Dupare BU, Srivastava SK. Soybean: Introduction, improvement, and utilization in India - Problems and Prospects. Agricultural Research. 2013;2:293-300.
2. Aher KP, Pawar SU, Syed S, Gokhale DN. Broad spectrum post emergence herbicide combinations for weed control in soybean (*Glycine max* L. Merrill). The Pharma Innovation Journal. 2023;12(1):1511-1513.
3. Anonymous. Soybean Outlook - April, 2024. Agricultural Market Intelligence Centre, PJTSAU; 2024.
4. Ahmed B, Chitale S, Tiwari N, Kumar N. Effect of pre-emergence herbicides on weed dynamics and productivity of soybean [*Glycine max* (L.) Merill]. International Journal of Research in Agronomy SP. 2024;7(9):252-255.
5. Das SK, Samui S. Chemical weed management in soybean with early post-emergence herbicides. Indian Journal of Weed Science. 2024;56(3):283-289.
6. Koturwar MR, Pawar SU, Aher KP, Awasarmal VB. Weed management in soybean (*Glycine max* L. Merrill) under varied weather conditions. The Pharma Innovation Journal. 2022;11(12):3714-3717.
7. Patidar J, Kewat ML, Sondhia S, Jha AK, Gupta V. Bio-efficacy of fomesafen + fluazifop-p-butyl mixture against weeds and its effect on productivity and profitability of soybean (*Glycine max*) in Central India. Indian Journal of Agricultural Sciences. 2023;93(7):750-755.
8. Prachand S, Kalhapure A, Kubde KJ. Weed management in soybean with pre and post-emergence herbicides. Indian J. Weed Sci. 2015;47(2):163-165.
9. Rupareliya VV, Mathukia RK, Gohil BS, Javiya PP. Effect of post emergence herbicides and their mixture on growth, yield and quality of soybean (*Glycine max* L.). Journal of Pharmacognosy and Phytochemistry. 2020;9(6):1161-1164.
10. Sharma S, Kumar S, Manuja S, Chopra P, Bhushan L, Shivalika. Evaluation of herbicide combinations for effective weed management in soybean {*Glycine max* (L.) Merrill}. Himachal Journal of Agricultural Research. 2025;51(1):128-132.