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# Impact of various weed control techniques on weed flora and wheat (*Triticum aestivum* L.) yield in an agroforestry system based on citrus

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**Abstract**
At Sam Higginbottom University of Agriculture, Technology & Science, Prayagraj, the current study, "Impact of various weed control techniques on weed flora and wheat (*Triticum aestivum* L.) yield in an agroforestry system based on citrus," was conducted in the *rabi* season of 2017–2018. The best method for controlling all species of weeds, according to the results, was post-emergence treatment of Sulfosulfuron + Metsulfuron@30+2g/plot, followed by Isoproturon + 2,4-D@1000+500g/plot. When compared to other weed management methods, the post-emergence application of Sulfosulfuron + Metsulfuron @30+2g/plot resulted in noticeably higher wheat growth, yield, and quality. It was also noted that the wheat crop showed no signs of phytotoxicity from any pesticides. Sulfosulfuron + metsulfuron@30+2g/plot was the most successful weed control treatment after emergence in terms of yielding a higher economic return, followed by isoproturon + 2,4-D@1000+500g/plot.

**Keywords:** Weed density, weed index, gross and net returns, agroforestry, herbicides

## Introduction
The term "agroforestry" refers to a group of land use practices and technologies that combine crops and trees on one land management unit. It is a system that combines water and soil degradation with agricultural and tree crops of different longivities, ordered either spatially or temporally, to maximize and sustain agricultural productivity. There are several weed management techniques used, but none are perfect. Hand weeding is more costly and labor-intensive; it cannot be done until the weeds have produced enough vegetative growth. With the advent of herbicides, a broad range of weed flora in wheat may now be effectively controlled. The best herbicides for controlling Phalaris minor and dicotyledonous weeds (*Chenopodrium anagalis*, etc.) in wheat were metribuzin @ 210 g a.i./ha or Sulfosulfuron @ 25–30 g a.i./ha, administered either at early post emergence (15 DAS) or at post emergence (30–42 DAS) (Chhokar *et al*., 2006) [2]. With these considerations in mind, the current study was conducted in the *rabi* season.

## Materials and Methods
Sam Higginbottom University of Agriculture, Technology & Science, Prayagraj undertook a field experiment in 2017–18 to investigate the Impact of various weed control techniques on weed flora and wheat (*Triticum aestivum* L.) yield in an agroforestry system based on citrus. Pendimethalin at 75 g/plot, Metribuzin at 210 g/plot, Clodinofop at 60 g/plot, Sulfosulfuron at 25 g/plot, Metsulfuron at 24 g/plot, Sulfosulfuron + Metribuzin at 25 + 200 g/plot, Sulfosulfuron + Metsulfuron at 30 + 2 g/plot, Isoproturon + 2,4-D at 1000 + 500 g/plot, and Weedy check are the ten treatments. Three replications and a randomized block design were used to set up the experiment. The experimental field's soil had a clay loam texture, was medium in potash content, and had low levels of accessible nitrogen and phosphorus. The soil had an organic carbon content of 0.32% and a pH of 8.0.

Fertilizers were applied @ 120 kg N, 60 kg $P_2O_5$ and 40 kg $K_2O$ $ha^{-1}$ to the crop. The half dose og N and full dose of phosphorous and potash was applied as basal dressing and remaining half dose of nitrogen was applied as a standing crop in two equal splits. The sowing of wheat variety NW-1014 @ 125 kg $ha^{-1}$ was done in lines 20 cm apart on 9th Dec, 2017. In all four irrigations (including pre-sowing irrigation) were applied to the crop as per its need. Winter showers at appropriate timing compensated the requirement of 3 irrigations as evident from meteorological data. The weed management practices were applied in the field as per different weed management treatments. The harvesting of wheat crop was done when the crop attained physiological maturity.

## Results and Discussion

### Weed studies

The main weed species found in the trial field were broad leaf weeds such as *Chenopodium album, Anagallis arvensis, Convolvulus arvensis, Melilotus alba, Rumex spp.,* and sedges like *Cyperus rotundus* and grassy weeds including *Phalaris minor, Cynodon dactylon,* and *Avena fatua.* Sulfosulfuron+Metsulfuron@ 30+2g/plot applied post-emergence demonstrated its advantages over other herbicides. At all crop growth stages, post-emergence treatment of Isopruturon + 2,4-D@1000+500g/plot is much more effective at reducing the number and dry weight of weeds (Table 1). The maximum weed control efficiency of 82.27% was achieved by post-emergence treatment of Sulfosulfuron+Metsulfuron@30+2g/plot. This was followed by Isopruturon + 2,4-D@1000+500g/plot (79.11%) and Clodina fop @ 60g/plot (74.69%). Grain yield was lost due to weed infestation by 31.16%, which was reduced by post-emergence applications of Sulfosulfuron + Metsulfuron@30+2g/plot, Sulfosulfuron + Metsulfuron @ 30 + 2g/plot recoreded minimum weed index (2.809%), Isopruturon+2,4-D@1000+500g/plot (5.36%), and Sulfosulfuran + Metribuzin @25+200g/plot (6.50%). Several researchers have also observed that the number and dry weight of weeds were effectively reduced with the application of post-emergence herbicides (Chippa *et al*., 2005, Chhokar *et al*., 2006 and Pandey *et al*., 2006) [1, 2, 3].

### Crop studies

The post-emergence application of Sulfosulfuron +metsulfuron @30+2g/plot (38.05q/$ha^{-1}$) and Isopruturon + 2,4-D @1000+500g/plot (37.05 q$ha^{-1}$) and Sulfosulfiran + Metribuzin @ 25+200g/plot (36.60 q/$ha^{-1}$) produced the significantly largest grain yield (39.15 q$ha^{-1}$). Significantly lower straw yield (38.05 q/$ha^{-1}$) of wheat was recorded in the weedy check plot. The highest straw yield of 52.85 q $ha^{-1}$ was recorded with the weed free plot, which was comparable to the results of Sulfosulfuron + metsulfuron @30+2g/plot (51.75 q/$ha^{-1}$) and Isoproturon +2,4-D@1000+500 g/plot (50.25 q $ha^{-1}$). The various weed control techniques had no discernible impact on the wheat harvest index. According to reports by Malik *et al.* (2013) [5] and Malekian *et al.* (2014) [4], the application of post-emergence herbicides reduces the amount of weed flora in the crop field while simultaneously increasing wheat crop output.

Following post-emergence application of Isopruturon+2,4-D@1000+500g/plot, which registered benefits such as a cost ratio of 1.66 and net income of Rs. 41335 $ha^{-1}$, Sulfosulfuron+metsulfuron@30+2g/plot yielded the maximum benefits, with a cost ratio of 1.70 and net income of Rs. 42930 $ha^{-1}$. Comparable outcomes support the conclusions made by Sharma *et al.* (2001) [6].

**Table 1:** Effect of weed control treatments on weeds density, dry matter, weed control efficiency and weed index

| Treatments | Weed density (No. $m^{-2}$) | Dry matter accumulation of weeds | Weed control efficiency (%) | Weed index (%) |
|---|---|---|---|---|
| Pendimethalin @ 75g/plot | 6.65 (43.80) | 6.01 (35.60) | 65.51 | 13.53 |
| Metribuzin @ 210g/plot | 8.33 (69.10) | 12.45 (155.0) | 28.57 | 20.17 |
| Clodinafop @60g/plot | 5.17 (26.30) | 4.41 (18.96) | 74.69 | 6.130 |
| Sulfosulfuron @ 25g/plot | 5.97 (35.20) | 5.53 (30.20) | 68.27 | 11.74 |
| Metsulfuron @ 24 g/plot | 5.72 (32.30) | 5.07 (25.30) | 70.91 | 9.323 |
| Sulfosulfuron+Metribuzin@25+200 g/plot | 5.38 (28.50) | 4.65 (21.20) | 73.32 | 6.5 |
| Sulfosulfuron+Metsulfuron@30+2 g/plot | 3.56 (12.20) | 3.09 (9.10) | 82.27 | 2.809 |
| Isopruturon +2,4-D @ 1000+500g/plot | 4.63 (21.00) | 3.64 (12.75) | 79.11 | 5.36 |
| Weed check | 13.93 (194.0) | 17.43 (303.95) | 0.00 | 31.16 |
| S.Em ± | 0.24 | 0.26 | | |
| CD at 5% | 0.71 | 0.77 | | |

* The value in parentheses is original value.

** Value transformed by $\sqrt{x+1}$

**Table 2:** Effect of weed control treatments on grain yield and straw yield and economics of wheat

| Treatments | Grain yield (q plot) | Straw yield (q plot) | Harvest index (%) | Gross return (Rs plot) | Net return (Rs plot) | B:C ratio |
|---|---|---|---|---|---|---|
| Pendimethalin @ 75g/plot | 33.85 | 45.35 | 42.72 | 60420 | 36400 | 1:51 |
| Metribuzin @ 210g/plot | 31.25 | 43.55 | 41.80 | 56200 | 32134 | 1:34 |
| Clodinafop @60g/plot | 36.75 | 50.85 | 41.99 | 66000 | 41030 | 1:64 |
| Sulfosulfuron @ 25g/plot | 34.55 | 47.95 | 41.94 | 62085 | 37515 | 1:52 |
| Metsulfuron @ 24 g/plot | 35.50 | 48.85 | 42.12 | 63687 | 39357 | 1:61 |
| Sulfosulfuron+Metribuzin@25+200 g/plot | 36.60 | 49.45 | 42.55 | 65432 | 40516 | 1:63 |
| Sulfosulfuron+Metsulfuron@30+2 g/plot | 38.05 | 51.75 | 42.40 | 68110 | 42930 | 1:70 |
| Isopruturon +2,4-D @ 1000+500g/plot | 37.05 | 50.25 | 42.82 | 66285 | 41335 | 1:66 |
| Weed check | 26.95 | 38.05 | 41.48 | 48590 | 24870 | 1:04 |
| S.Em ± | 1.61 | 2.02 | 1.75 | - | - | - |
| CD at 5% | 4.77 | 6.02 | N. S | - | - | - |

## Conclusion

The weed studies conducted in the trial field revealed significant insights into the efficacy of various herbicides in controlling weed infestation and improving crop yield. Post-emergence treatments, particularly Sulfosulfuron+Metsulfuron@30+2g/plot and Isopruturon+2,4-D@1000+500g/plot, demonstrated notable advantages in reducing weed density and dry weight, consequently enhancing grain yield. These findings align with previous research highlighting the effectiveness of post-emergence herbicides in weed management and crop productivity. Additionally, the economic analysis showed favorable cost ratios and net incomes for treatments such as Sulfosulfuron+Metsulfuron@30+2g/plot, emphasizing their potential for economic viability and sustainable weed control strategies in agricultural practices.

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