Studies on Chemical Weed Control in Wheat (*Triticum aestivum* L.) - A Review

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**Abstract**

Wheat (*Triticum aestivum* L.) is one of the main cereal crop cultivated in India. It is widely cultivated, produced and used throughout the world. Wheat is the most popular staple food for human consumption. Separate application of herbicide is not effective control grassy and broadleaf weeds are but the combination of herbicides which give better result to control mixed weed flora in wheat crops. The continuous use of herbicides such as Isoproturon has caused resistance to the herbicides in *Phalaris minor* in Punjab and Haryana but, it has also effectively control by rotations of herbicides (Tank mix).

**Keywords**

Weed flora, Weed management practices, weed density

**Introduction**

Wheat (*Triticum aestivum* L.) is one of the main cereal crops in India. It is widely cultivated, produced and used throughout the world. Of all grain crops, wheat is the most popular staple food for human consumption. Belonging to the family of the Poaceae, it is an annual crop of self-pollination.

It is a photographic crop having periodically long day scenario. It is grown during the Rabi season in temperate regions and also at high altitudes in tropical climatic zones in winter. It is a cereal of choice that is considered the backbone of food security for a large number of countries. Wheat is sown from the month of September to December in various states of India and harvesting is done from February to May. The winter temperature when the Sowing is to be done should range from 10 to 15 degree Celsius and at the time of harvesting it should be from 21 to 26 degree Celsius. Wheat is considered as a cash crop because gives very good yield.

**Weed flora associated with wheat**

Amare *et al.*, (2014) observed weed flora 83.3% were broadleaved while 16.6% were
grasses. The grasses like Avena Fatua L., Phalaris para a L. and Broad leaf weed like Caylusea byssinica Meisn, C. trigyna L, Chenopodium album L., Corroigoialac apensis Wild, Guizotia scabra(Vis)Chiov, Oxalis latifolia HBK, Polygonumnne palenseL., Rapahhanus raphanistrum L., spergula arvensis L., Taget esminuta L.

Jabran et al., (2012) at Pakiatan observed the weed flora of the experimental site comprised of both narrow and broad leaved weeds such wild oat (Avena fatua L.), canary grass (Phalaris minor Retz.), lambsquarters (Chenopodium album L.), fathen (Chenopodium murale L.), blue pimpernel (Anagallis arrensis L.) and swine cress (Cronopus didymus L.).

Punia et al., (2017) at Hisar was observed weed flora in all, 21 weed species (4 grassy and 17 broad-leaf) were found to infest wheat fields in Haryana. In grassy weeds like Phalaris minor, Avena ludoviciana, Poa annua, Polypon monspiensis and broad leaf weeds like Chenopodium album, Chenopodium murale, Rumex dentatus, Rumex spinosus, Coronopus didymus, Anagallis arvensis, Medicago denticulate, Melilotus indica, Malva parviflora, Convulculus arvensis, Cirsium arvense, Vicia sativa, Trigonella polycerata. Asphodelus tenuifolius, Fumaria parviflora, Pluchea lanceolata, Carthamus oxycantha.

Chenopodium, Medicago denticulata and Melilotus alba among broad-leaf and Avena sp. ( wild oat) and Phalaris minor among grasses.

Sahu et al., (2018) at Krishi Vigyan Kendra, Banka, Bihar was reported that weed density of two grassy weeds, viz. Phalaris minor and Cynodonactylon and five broad-leaved weeds, viz. Chenopodium album, Oxalis purpurea, Anagallis arvensis, Medicago denticulata and Rumex dentatus.

Yadav et al., (2019) at Hisar was observed Weed flora of the experimental field mainly included Phalaris minor Retz. among grassy weeds, and Lathyrus aphaca L., Coronopus didymus L., Vicia sativa L., Medicago denticulate L., Melilotus indica L. and Anagallis arvensis L. among broad leaf weeds.

Mitra et al., (2019) Uttar Banga Krishi Viswavidyalaya, Pundibari, Coochbehar, West Bengal was observed that weeds found in the field were Polygonum persicaria, Polygonum pensylvanicum, Polygonum hydropiper, Polygonum orientale, Chenopodium album, Physalis minima, Oxalis corniculata, Portulaca oleracea, Gnaphalium luteo-album, Centella asiatica and Cronopus didymus. Various species of Polygonum was dominant in all the stages of crop growth.

Crop weed competition

Singh et al., (2013) The crop weed competition was markedly reduced by weed control treatments as is evident from the significant decrease in weed population, dry matter accumulation, weed killing efficiency, weed control efficiency and weed control index by 6.1%, 41g/m², 38.1%, 67.4%, -23.5% respectively (Singh and Saxena, 2013).

Plots kept weed free up to 30, 45 and 60 DAS and weedy check up to 15 DAS also resulted
in significant improvement in all growth and yield attributes and recorded at par with that of weed free check up to harvest. Weedy check for initial 30, 45 and 60 DAS and weed free up to 15 DAS recorded at par with weedy check up to harvest. This indicated that unchecked weeds beyond 15 DAS and weed free condition at early stage (up to 15 DAS) failed to check crop weed competition, which was detrimental to cumin growth.

Sandhu et al., (2016) the increase in yield was due to less weed competition among these treatments are reduced weed population 2.2 weeds /m².

Saha et al., (2016) to attain economic wheat yield, weeds must be removed during critical period of competition which falls in between 0 to 30 days of sowing.

Galon et al., (2019) the weed control methods of the crop weed competition in the period between 11 to 21 days of crop emergence which is wheat grain yield loss competing with ryegrass reached 59 % when grown with ryegrass.

Hussein et al., (2020) a weed control percentage of 88.35% and gave the lowest dry weight for the weed reached 35.6 g.m⁻² compared with the comparison treatment, which reflected positively on increasing the average plant height(102.3 cm), number of tillers (146.8 tillers m⁻²), and the spike length (10.1 cm), which caused an increase in the grain yield by 26%.

**Yield reduction in wheat due to weeds**

Khan and Haq, (2002) Weeds can incur a grain yield loss of 48% in wheat.

Hussain et al., 2015; Fahad et al., 2015) However, the magnitude of weed-related losses depends on the type and density of a particular weed species, its time of emergence, and the duration of the interference.

Oad et al., (2007) the weeds exhibit the economic yield losses to the wheat crop which may range from 24-39.95 %.

Kumar et al., (2011) Weeds caused 55.7% reduction in wheat grain yield.

Kumar et al., (2013) Weeds reduced grain yield of wheat by 59.3%.

Bharat et al., (2012) weeds growth caused 40.3% reduction in grain yield of wheat.

Malik and Yadav (2013) Weeds allowed growing throughout the crop seasons resulted into 42.9 to 45.1% reduction in the grain yield of wheat.

Amare (2014) weed growth throughout the crop growth caused a yield reduction 57.6 to 73.2%.

Singh et al., (2015) The average yield losses caused by weeds in different wheat growing zones ranged from 20 to 32%.

Amare et al., (2016) weed growth throughout the crop growth period caused a yield reduction of 72% in both cropping seasons.

Kaur et al., (2017) reported that the season long growth of weeds reduced wheat yield up to 38.5%.

Pawar et al., (2017) Weeds caused 55.7 and 52.2% reduction in grain yield of wheat.

Chandra et al., (2018) the grain yield of wheat was reduced by 30.7 % due to weeds.

Yadav et al., (2018) Weeds growing throughout the crop season caused 68.8% and 45.8% reduction in the grain yields.
**Weed management practices**

**Cultural control**

Surin et al., (2013) from Bihar, reported that hand weeding at 25 DAS in wheat crop recorded higher yield attributing parameters like 31.3% higher productive tillers/m², 5.3% higher spike length and 8.6% higher straw yield compared to weedy check.

Amare et al., (2016) manual hand weeding + 2, 4-D at 2.0 kg ha⁻¹ highest grain yield 4.3 t ha⁻¹ of wheat.

Safina and Absy (2017) herbicides and hand weeding twice) increases wheat yield 11.8 t ha⁻¹ and yield components significantly compared to weedy check.

Rasool et al., (2017) Manual hand weeding increases wheat grain yield 4.98 t ha⁻¹ as compare to weedy check.

Sasode et al., (2017) Manual two hand weeding @ 30 and 60 DAS resulted in increased grain yield of Wheat 4.66 t ha⁻¹.

**Chemical control**

Pawar et al., (2017) post-emergence application of pinoxaden 2.53% + clodinafop-propargyl 2.53% at 60 g ha⁻¹ resulted as produced highest grain yield (4.5-4.6 t ha⁻¹) of wheat.

Yadav et al., (2018) application of post-emergence Pinoxaden + clodinafop 60 g ha⁻¹ resulted as maximum grain yield (5.7 t ha⁻¹) of wheat crop.

Kumar et al., (2019) post-emergence application of markcloclodina @ 0.060 kg ha⁻¹ resulted as increased grain yield of wheat 4.2 t ha⁻¹.

Sareta et al., (2016) post-emergence application of mesosulfron methyl +Idosulfuron methyl sodium at a rate of 1 lit ha⁻¹ as results in maximum wheat grain yield 5 t ha⁻¹.

Meena et al., (2017) Post-emergence application of metsulfuron + sulfosulfuron (0.003 and 0.02 kg ha⁻¹) results in increased grain yield of wheat 4.98 t ha⁻¹.

Singh et al., (2017) Post-emergence application of metsulfuron + clodinafop (4 + 60 g/ha) ready mixture applied at 25 DAS results increased grain yield of wheat 5.37 t ha⁻¹.

Devi et al., (2018) Post-emergence application of carfentrazone and metsulfuron-methyl (25 g/ha) results in increased increased grain yield of wheat 5.4 t ha⁻¹.

Patil et al., (2018) hoeing at 20 DAS with combination of metasulfuron methyl @ 4 g a.i. ha⁻¹ as post-emergence at 30 DAS resulted as increased grain yield in wheat 2.9 t ha⁻¹.

Chandra et al., (2018) post emergence application of isoproturon + 2, 4-D at 0.5 kg a.i./ha at 30 days after sowing resulted in increased grain yield of wheat 3.8 t ha⁻¹.

Kaur and kaur (2019) application of post-emergence of highest dose 2, 4-D sodium salt (500 g/ha) resulted as increased grain yield and straw yield in wheat 4.52 t ha⁻¹ and 8.63 t ha⁻¹.

Chandra et al., (2018) post emergence application of isoproturon + 2,4-D at 0.5 kg a.i./ha at 30 days after sowing followed proved most economic for controlling weeds in wheat field under Jhansi conditions.

Kaur and kaur (2019) application of post-emergence of highest dose2, 4-D sodium salt (500 g/ha) adversely affected growth of both the weed species at 21 DAT in wheat crop.
Kaur et al., (2019) Pre-emergence application of pyroxasulfone at 127.5 g/ha recorded effective control of *P. minor* of wheat crop.

Bayat and Zarger (2020) Application of post-emergence of pyroxasulfone @ 120 g ha\(^{-1}\) as resulted good control of field bindweed (*Convovulas arvensis*) of wheat.

Johnson et al., (2018) Pre-emergence application of pyroxasulfone @ 112 g ha\(^{-1}\) as resulted maximum grain yield 5.47 t ha\(^{-1}\) of wheat.

Kaur et al., (2019) Pre-emergence application of pyroxasulfone at 127.5 g/ha recorded maximum biomass and gave the highest wheat grain yield (4.87, 4.80 and 5.43 t/ha) of wheat crop.

### Influence of weed management practices on weed characteristics and weed control efficiency

**Weed density**

Patel et al., (2017) Application of pre-mix sulfosulfuron (75%) + metsulfuron-methyl (5%) 32 g/ha as post-emergence was recorded reduced the density and biomass of both monocot as well as dicot weeds of wheat crop.

Kaur et al., (2017) reported that post-emergence application of pre-mixture of pinoxaden plus clodinafop at 50-60 g/ha recorded effective control of *P. Minor*.

Kaur et al., (2017) notice that Pendimethalin (PE) fb sulfosulfuron (PoE) 1.0 fb 0.018 kg/ha 1.9 g m\(^{-2}\) reduced weed density in wheat field.

Shakya et al., (2017) recorded that at25 DAS minimum population of weeds (1.33/m\(^2\)) was registered in pendimethalin 1.0 kg/ha + metribuzin 0.018 kg/ha in wheat crop.

Punia et al., (2017) reported that Sulfosulfuron + metsulfuron 32 g ha\(^{-1}\) was recorded less weed density *Phalaris minor* 3.9 m\(^2\) and broad leaf weed 2.9 m\(^2\) in wheat field.

Devi et al., (2018) reported that application of pinoxaden 50 g ha\(^{-1}\)+RM of carfentrazone and metsulfuron @ 25 g ha\(^{-1}\) recorded lowest total weed density in wheat crop.

Kaur et al., (2018) Reported that the application of Pendimethalin @ 3.75 L ha\(^{-1}\) was recorded lowest weed density of narrow leaf weeds and broad leaf weeds (2.4 m\(^2\) and 2.5 m\(^2\)) in wheat crop.

Kumar et al., (2019) Application of Markcodina @ 60 g ha\(^{-1}\) as post-emergence was recorded lowest weed weeds density of 2.2 m\(^2\) under the wheat crop.

Meena et al., (2019) Reported in wheat field that the application of Sulfosulfuron + metsulfuron (30 +2 g ha\(^{-1}\)) as post-emergence at 5 Week After Sowing was recorded lowest weed weeds density of 4.85 m\(^2\).

Al-khafji et al., (2020) Reported that the application of Atlantis WG 20 g ha\(^{-1}\) was recorded lowest weed weeds density of 12 m\(^2\).

**Weed dry weight**

Shakya et al., (2017) minimum weed dry weight 11 g m\(^{-2}\) was recorded under the treatment at pendimethalin 0.75 kg/ha in wheat crop.

Devi et al., (2017) noticed that tank mixed application of pinoxaden 50 g/ha + RM of carfentrazone and metsulfuron 25 g/ha applied at 35 days after sowing (DAS) controlled weeds effectively with lower values of weed dry matter accumulation (7.67 g/ha).
Hundal and Dhillon (2018) noticed that application of Pendimethalin (PE) fb clodinafop @ 0.75+0.06 g ha\(^{-1}\) as was recorded lowest dry weight of *Phalaris minor* is 3.78 g m\(^{-2}\) at the time of harvesting under the wheat crop.

Kumar *et al.*, (2018) Application of Sulfosulfuron+metsulfuron @ 32 g ha\(^{-1}\) as post-emergence was recorded lowest weed dry weight of 2.59 g m\(^{-2}\) under the wheat crop.

Kaur *et al.*, (2018) Reported that the application of Pendimethalin @ 3.75 L ha\(^{-1}\) was recorded lowest weed dry weight of narrow leaf weeds and broad leaf weeds (3.2 g m\(^{-2}\) and 4.1 g m\(^{-2}\)) in wheat crop.

Kumar *et al.*, (2019) Application of Markcodina @ 60 g ha\(^{-1}\) as post-emergence was recorded lowest weed dry weight of 2.6 g m\(^{-2}\) under the wheat crop.

Mitra and Mondal (2019) noticed that the application of metsulfuron (4 g ha\(^{-1}\)) + carfentrazone (20 g ha\(^{-1}\)) + surfactant was recorded lowest weed dry weight of 2.9 g m\(^{-2}\) under the wheat crop.

Ahmed *et al.*, (2020) Reported that the application of 2, 4-D amine plus ethoxysulfuron (1.2 kg a.i. ha\(^{-1}\)) applied at 10 DAS surfactant was recorded lowest weed dry weight of 12 g m\(^{-2}\) under the wheat crop.

**Weed control Efficiency**

Singh *et al.*, (2010) reported that highest weed control efficiency (100% and 87.3%) of wheat recorded as weed free plot followed by XDE 742 3% OD+Intron @ 18+300 g ha\(^{-1}\) as post-emergence.

Dhyani *et al.*, (2010) post-emergence application of sulfosulfuron at 25 g/ha recorded as highest weed control efficiency 94 % in wheat field.

Khokhar and Nepalia (2010) Maximum weed control efficiency 93.58% by wheat crop was in plots treated with tank mixture of isoproturon at 500 g/ha + sulfosulfuron at 15 g/ha as post-emergence application.

Sen *et al.*, (2010) two hand weeding at 30 and 50 DAS resulted as maximum weed control efficiency 97.8 % by wheat.

Tiwar *et al.*, (2011) the weed control efficiency was maximum (80.4%) in the treatment 2, 4-D 0.75 kg/ha + isoproturon 1.0 kg ha\(^{-1}\) at 50 DAS by wheat.

Bharat *et al.*, (2012) post-emergence application of sulfosulfuron + 2, 4-D 25 + 500 g ha\(^{-1}\) resulted as maximum weed control efficiency 93.2 % by wheat.

Kumar *et al.*, (2012) post-emergence application of clodinafoppropargyl + metsulfuron-methyl @ 60+4 g ha\(^{-1}\) resulted as increased weed control efficiency 84.7 % by wheat.

Singh and Verma (2013) post-emergence application of carfentrazone + sulfosulfuron with surfactant at 45 g/ha recorded as increased weed control efficiency 66.75 % by wheat.

Kumari *et al.*, (2013) Post-emergence application of Sulfosulfuron + metsulfuron 32 g ha\(^{-1}\) resulted as increased weed control efficiency 84.5 % by wheat.

Pisal *et al.*, (2013) two hand weeding at 20 and 40 DAS resulted as increased weed control efficiency 87.87 % by wheat.

Yadav and Dixit (2014) two hand weeding at 30 and 60 DAS resulted as increased weed control efficiency 92.2 % by wheat.

Vyavahare and Bhilare (2014) Post-emergence application of sulfosulfuron 16.5 g/ha + 2, 4-D
563 g/ha at 30 DAS resulted as maximum weed control efficiency 64.4 % by wheat.

Kaur et al., (2015) post-emergence application of clodinafop 60 g ha⁻¹ and metsulfuron 4 g ha⁻¹ resulted as maximum weed control efficiency 78.1 % by wheat.

Kien et al., (2016) post-emergence application of metsulfuron + sulfosulfuron @ 3 g ha⁻¹ + 20 g ha⁻¹ resulted as maximum weed control efficiency 84.75 % by wheat.

Bhoir et al., (2016) Manual three hand weeding at 20, 40, 60 DAS resulted as highest weed control efficiency 97.72 % by wheat.

Sudha and Biradar (2016) Sulfosulfuron + metsulfuron 25@ g ha⁻¹ + 4 g ha⁻¹ recorded as highest weed control efficiency 81.62 % by wheat.

Kaur et al., (2017) Pendimethalin (PE) fb sulfosulfuron (PoE) 1.0 fb 0.018 kg ha⁻¹ recorded as highest weed control efficiency 95.6 % by wheat.

Devi et al., (2018) post-emergence application of pinoxaden (50 g ha⁻¹) + ready mix of carfentrazone and metsulfuron (25 g ha⁻¹) recorded as highest weed control efficiency 95.09 % by wheat.

Kumar et al., (2018) post-emergence application of sulfosulfuron+metsulfuron (32 g ha⁻¹) recorded that highest weed control efficiency 83.6 % by wheat.

Kumar and Singh (2018) post-emergence application of sulfosulfuron + metsulfuron-methyl 30 g ha⁻¹ + 2 g ha⁻¹ recorded that highest weed control efficiency 84.3 % by wheat.

Kumar et al., (2019) post-emergence application of markclodina @ 60 g ha⁻¹ recorded that highest weed control efficiency 80.5 % by wheat.

Meena et al., (2019) post-emergence application of sulfosulfuron + metsulfuron @ 30 +2 g ha⁻¹ recorded that highest weed control efficiency 95.36 % by wheat.

Mitra and Mondal (2019) post-emergence application of metsulfuron (4 g ha⁻¹) + carfentrazone (20 g ha⁻¹) + surfactant recorded that highest weed control efficiency 99% @ 60 DAS by wheat.

The applications of pre-emergence and post-emergence herbicides are successfully control weed flora in wheat field. As compare other methods of weed control chemical weed management is better control of narrow leaf and broad leaf weeds in wheat field. The applications of herbicides to reduce weed density, weed dry weight and maximum weed control efficiency are obtained.

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