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Herbicide Resistance Management in Wheat (*Triticum aestivum*)

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INTRODUCTION

Wheat is second most important grain crop of the India after rice and thus plays a crucial role in food security of the country. In India, wheat is cultivated on an area of 31.35 mha with production of 107.86 million tonnes in year 2019-20 (July-June). It is estimated that a production of 111.32 million tonnes in the 2021-22 crop year on the back of good rains, according to latest government data. Among various wheat based cropping system, rice-wheat occupies the most area of about 11 mha. This system is prevalent in Indo-Gangetic Plains (IGP) and is predominant in Haryana, Punjab, Uttar Pradesh, Madhya Pradesh, Bihar, West Bengal etc. It has been estimated that on an average, weed infestation causes 25% yield reduction in least developed countries, 10% in developing countries and only 5% in developed countries (Oerke, 2006). In India, Bhan *et al.* (1999) estimated and suggested that weeds in India reduce crop yields by 31.5% (22.7% in winter and 36.5% in summer and *Kharif* seasons). In India, losses due to weed infestation in wheat varies from 10 to 60% (Rao *et al.* 2014). The reason behind loss in yield is mainly due to reduction in tillering.

Herbicide Resistance

Herbicide resistance is the inherited ability of a weed biotype to survive and reproduce after being exposed to rate of herbicide which would normally give effective control of wild type or to which the original population was susceptible. It was first reported in 1957 against 2, 4-D from Hawaii (Hilton, 1957). In India, it was first reported in 1993 in *Phalaris minor* due to continuous use of isoproturon which resulted resistant biotypes. Later it was observed in sulfosulfuron, fenoxaprop-p-ethyl and clodinafop. Due to continuous use these herbicides for 6-7 years problem of cross resistance emerged.

According to International Survey of Herbicide-Resistant Weeds approximately 11 new biotypes is being discovered each year. The number of resistant biotypes has increased from 396 in 2012 to 480 in 2019. Some of the most important herbicide-resistant species are given in Table 1.

Table 1: Most important herbicide-resistant species

Sr. No.	Common Name	Scientific Name
1	Rigid Ryegrass	*Lolium rigidum*
2	Wild Oat	*Avena fatua*
3	Redroot Pigweed	*Amaranthus retroflexus*
4	Common Lambsquarters	*Chenopodium album*
5	Green Foxtail	*Setaria viridis*
6	Barnyard grass	*Echinochloa crus-galli*
7	Goose grass	*Eleusine indica*
8	Kochia	*Kochia scoparia*
9	Horseweed	*Conyza canadensis*
10	Smooth Pigweed	*Amaranthus hybridus*

Herbicide resistance in wheat

Herbicide resistance development in weeds is the most concerning issue in rice-wheat cropping system. The number of herbicide-resistant weeds in wheat is 77 which is higher than any other crop (Ian Heap, 2019). It includes species like *P. minor*, *Avena fatua*, *Amaranthus sp.* and *Chenopodium sp.* Some herbicide resistant weeds found in India are given in Table 2.

Table 2. Herbicide resistance weeds in India

Sr. No.	Species	Comman name	Year	Site of action
1	*Phalaris minor*	Little seed canary grass	1991	PSII inhibitor
2	*Phalaris minor*	Little seed canary grass	1994	ACCase inhibitors
3	*Phalaris minor*	Little seed canary grass	2006	**Multiple Resistance: 3 Sites of Action** - ACCase inhibitors - ALS inhibitors - PSII inhibitor
4	*Phalaris minor*	Little seed canary grass	2013	ALS inhibitors
5	*Rumex dentatus*	Toothed Dock	2014	ALS inhibitors

Herbicide characteristics that affect herbicide resistance

- Herbicides that acts on single site of action
- Herbicides that are applied multiple times during the growing season
- Repeated application of herbicides with single mode of action
- Use of only herbicides for control of weeds

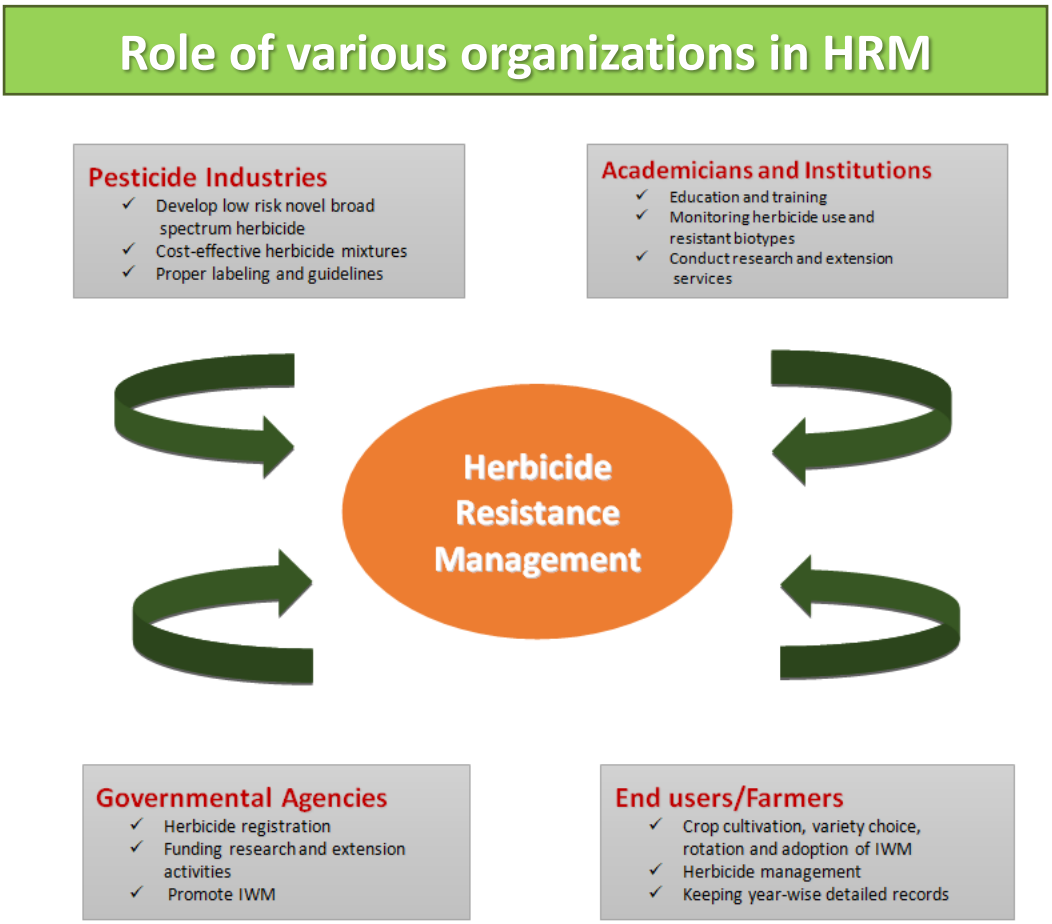
Farming practices that increase the risk of resistance

- Use of herbicides by farmers at low or high dose than recommended
- Use of herbicides with single mode of action

- Monoculture and crop rotations that rely on the same herbicide mechanism of action for weed control.
- Lack of non – chemical weed control practices such as stale seed bed, high seed rate, cover crop etc.

Prevention and Management of Herbicide-Resistant Weeds

- Herbicide rotation
- Fallow tillage
- Prevention of weed seed spread through use of clean equipment.



- Monitoring the initial evolution of resistance by recognizing patterns of weed escapes typical of resistant plants.
- Control of weeds suspected of herbicide resistance before they can produce seed.
- Design of specific chemicals with broad selectivity for crops
- Development of crop cultivars with tolerance to already existing
- Use of effective broad spectrum herbicide
- Growing crops resistant to herbicides

Advantages of using herbicide resistant herbicides

- Facilitate low or no tillage
- Broader spectrum of weeds controlled
- Reduced crop injury
- Reduced herbicide carry-over
- Use of herbicides that are more environmentally friendly
- New mode of action for resistance management
- Crop management flexibility and simplicity

CONCLUSION

Herbicide resistance is real, evolutionary action and is increasing threat to continued economic weed control. Early sowing of wheat *i.e.* last week of October, narrow planting (18 cm), zero tilled wheat with residue retention from 5 to 7.5 t/ha and using crop rotations helps to manage herbicide resistance. Pre emergence herbicide *i.e.* pendimethalin, pyraxosulfone, flumioxazin etc., herbicide mixture *i.e.* mesosulfuron + iodosulfuron and rotations - clodinafop and sulfosulfuron can used to reduce the risk of resistance.

REFERENCES

Bhan, V.M., Sushilkumar and Raghuwanshi, M.S. 1999. Weed management in India. *Indian J. Plant Prot*., 17:171-202.

Heap, I. 2011. *International Survey of Herbicide Resistant Weeds.* Available on *http://www.weedscience.org.*

Hilton, H. W. 1957. Herbicide tolerant strains of weeds. Hawaiian Sugar Planters' Association Annual Report. 69 p. Honolulu, HI: University of Hawaii, Manoa Library.

Oerke, E.C. 2006. Crop losses to pests: Centenary review. *J. Agric. Sci*. 144: 31-43.

Rao, A.N., Wani, S.P. and Ladha, J.K. 2014. Weed management research in India – an analysis of the past and outlook for future. Pp. 1-26. *In*: Souvenir (1989-2014). DWR publication No. 18. Directorate of Weed Research, Jabalpur, India