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Weed Shifts And Weed Resistance In Cropping Systems And Their Management

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Abstract

Weeds are considered an economically important pest in agriculture, increasing production costs and have always escaped management or control practices.These have distinguished characteristics from other plants, such as adaptation to a wide range of environmental conditions, prolific seed producers, rapid growth rapidly and changing species composition according to management practices, such as herbicide application, tillage practices, and crop rotations, which makes them effectively compete with crop plants for growth resources like light, nutrients, water and space.Weed dynamics may be altered by soil fertility and disturbance. Invasive and weedy species can swiftly adjust to modifications in production methods to exploit the available niches.According to Heap (1997) and Koning et al. (2019), new weed species that have become resistant to herbicides are reported annually because of the improper application of these weed control agents.Understanding diverse weed flora composition and weed shift in conservation agriculture is important to identify weed management components to increase agro-ecosystem sustainability.

Introduction:

Weed shifts occur when natural or man-made environmental changes in an agricultural system cause a change in the relative frequencies or composition of weeds in a community (all plant populations) or weed population (all individuals of a single species) in a specific area. Any agronomic activity, such as crop rotation, tillage, frequent harvesting, or a specific herbicide, can cause weed shifts; ongoing herbicide treatment is the only way weed resistance evolves. A weed shift can be caused by any cultural, physiological, biological, or chemical approach that alters the growing environment without evenly regulating all species. The mix of weed species may change due to switching from conventional to conservation tillage. Changes in weed flora composition over time are referred to as weed shifts. Weedy and invasive species can quickly adapt to changes in production practices to take advantage of the available niches.In contrast to weed shift, weed resistance is a change in susceptible weed populations to an herbicide, where that herbicide no longer controls the same species.Singleherbicide application continuously leads to selection pressure, soresistant weeds survive and reproduce while susceptible weeds ones are eliminated.

Examples of weed shifts and weed resistance

In cropping systems of crop rotation and cereal monoculture, quantitative changes in the weed species predominated in each system were examined for 30 years. Rotations from 1989–1992 and 1993–1996 concentrated on winter triticale weed infestation, whereas rotations from 1997–2000 and 2001–04 focused on winter wheat weed infestation, and rotations from 2005–08, 2009–12, 2013–15, and 2016–18 focused on spring wheat weed infestation. The winter cereals were dominated by Apera spica-venti, whereas the spring cereals were dominated by *Avena fatua*. Compared to the crop rotation, the monoculture had multiple times

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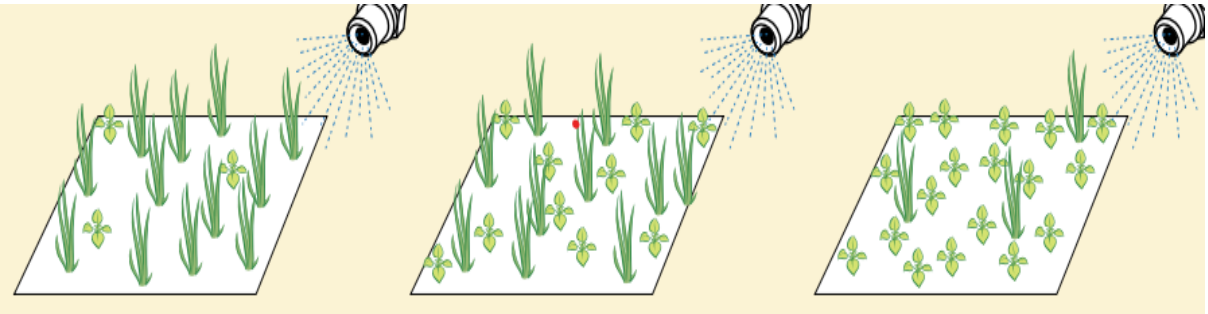
as many A. spica-venti and *A. fatua* plants. When spring cereals were grown instead of winter, the population of A. spica-venti in the spring cereals declined. In contras t, the population of *A. fatua*, especially in the monoculture, grew.

In maize-wheat cropping systems of different tillage and weed management, annual weed species were dominant in conventional tillage. In contrast, in zero tillage, perennial weeds were dominant.In the *Kharif* (rainy) season, maize, *Echinochloa colona*, and *Panicum dichotomiflorum* were observed in 2014, 2018, and 2019 and were not recorded during Kharif 2016.*Cynodon dactylon* was the new invasion and *Cyperus iria, Digitaria sanguinalis* and *Cynodon dactylon* constituted 11, 10 and 9%, respectively, of the total weed flora in 2016.In *Rabi*wheat 2013-14, *Avena ludoviciana, Coronopusdidymus* and *Phalaris minor* were major weeds with relative densities of 41, 20 and 18%, respectively,while *Erodium cicutarium, Euphorbia hirta* and *Oxalis corniculata* were dominant during 2016-17 with higher relative densities of 38, 17 and 17%, respectively of the total weed flora.

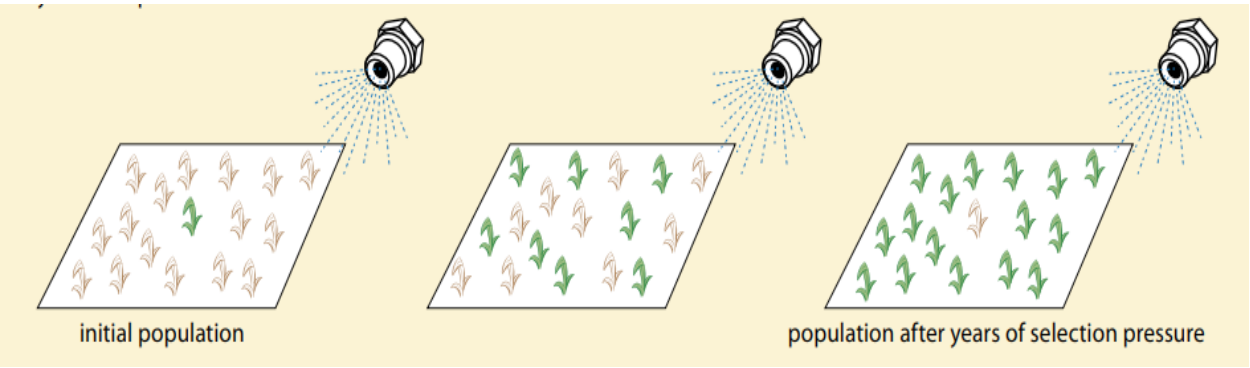


Weed shifts due to herbicide application

When tolerant and sensitive weed species coexist in a field, weed species shift takes place. After a single herbicide is used consistently, the sensitive weed species is almost completely eradicated, and the resistant weed species endure, grow, and finally take over as the dominant species. In this instance, using a grass pesticide promotes a shift to a broadleaf weed.

Development of herbicide resistance

Herbicides control susceptible weeds, which prevents reproduction, while only resistant weeds, which have resistant genes, can multiply and reproduce. Only very few plants in the population have resistant genes initially due to the continuous application of herbicides. These resistant genes carrying plants multiply and evolve as dominant weeds, leading to weed shift.



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Continuous application of similar modes of action herbicides in wheat led to developingmultiple herbicide resistance in Phalaris minor.

Herbicide resistance in *Phalaris minor* inIndia to different herbicides

Herbicide	Incidenceofresistance
Isoproturon	,Malik and Singh, 1993
Sulfosulfuron	Bhullar*etal*.,2014
Fenoxaprop	Chhokar and Sharma, 2008
Pinoxaden	Kaur*etal*.,2015
Tralkoxydim	Yadav*etal*.,2002

Preventing weed species shifts and herbicide-resistant weeds

- Use mixtures or sequential treatments of herbicides that each control the weeds in question but have a different site of action.
- If a potentially resistant weed or weed population has been detected, use available control methods to avoid seed deposition in the field.
- Rotate herbicides (sites or modes of action)
- Crop rotation, with different life cycles
- Clean equipment fields infested with or suspected to have resistant weeds before leaving.

Management practices to reduce weed shifts and weed resistance

- Weed identification of invasive weeds new to the locality
- Frequent monitoring for weed escapes
- Herbiciderate and time of application
- Crop rotation
- Agronomic practices
- Rotation of herbicides with different modes of action

Conclusion

Weedy and invasive species can easily adapt to changes in production practices. Weeds are genetically diverse and easily adapt to the conditions of the crop production systems. Consequently, increasing the variety of crops grown within the cropping system, or at the very least, the variety of weed management techniques used within the cropping system, is one way to lessen the dominance of any particular weed species.

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