

WEED MANAGEMENT -A PARADIGM SHIFT

Article Id: AL202136

Dhiman Mukherjee

Bidhan Chandra Krishi Viswavidyalaya, Department of Agronomy, Directorate of Research,
Kalayani, IndiaEmail: dhiman_mukherjee@yahoo.co.in

Weeds are a major concern in agricultural production as these cause up to one-third of total losses in yield, reduce produce quality and impose various hazards, to both health and environment. Among all the pests, weeds cause about 33% loss in crop production. Besides crop losses, they also harm the non-crop situations, aquatic bodies and interfere with human activity. Weed management is a multi-disciplinary task. Understanding the weed biology, ecology and developing environment friendly control technologies are key to modern crop production. Weed management under different cropping system or crops is an important ingredient of crop cultivation, which desires to develop by moving away from its single disciplinary approach to multidisciplinary methodology for weed control. Sometime verreliance on few single herbicide such as Isoproturon etc leads to develop herbicide resistant problem to few specific weed species. Various weedicide become and effective tools for various weed control measures, however due to change in weed phenotype or genetic characters leads to evolve herbicide resistant problem now. This can be sorted out based on ecological principles and nonconventional weed control options. The “many little hammers” concept and the “use of technological advancement” are two vital comprehensive weed suppression mechanism that are gaining impetus. Weed management under vegetable crops and organic cultivation, through automated robotic system becoming gaining important day by day in developed country. Further, use of cover crop, crop rotation and weed seed destruction technique are becoming popular in farming community. In future, RNAi expertise, robotics and gene editing will capitulate new technique for weed management. Proper crop management under various integrated farming system is moving into a new era of big data or “digital farming. This approaches will be very effective and become challenging to weed control under new era of crop cultivation, which will allow more intellectual use and modern tools and technique for precise weed management under diverse crop ecosystem.

One of the major challenge that is being confronted by food growers in the 21st century is producing sufficient foodstuff to match the mounting requirements of our burgeoning population, while safeguarding the agro-ecosystem and protecting the rural community and socioeconomic well-being of food producers (Nave *et al.*, 2010). One of the major challenge is effective and timely weed management under different cropping sequence/system. Weeds can compete with crop ecosystem for light, water and nutrients, which leads to noteworthy plant loss and decline in yields in every year (Mukherjee, 2018). For decades, worldwide, food growers heavily depend on use of various herbicide for effective weed management. This become quite effective option after the Second World War (Gianessi, 2013). Herbicides replace a series of more difficult weed control methods, such as manual weeding, ensuing in lower labour and time inputs for the farmer's, abridged energy or fuel expenses as well as augmented yield potential. Heavy dose of herbicide imbalance our ecosystem and affect livelihood of common people.

Worry of weeds and control measures

Weed interference in crop ecosystem is challenging to the growers because it reduce crop yield and also mixed with grain, which reduce market value of crop in international marker. Approximately 37 to 61 % yield reduction observed in cereals and pulse due to weed problem. Use of various weedicide is the main weed control strategy under present context. Dependence on this limited number of herbicide or mono cropping pattern vehemently has led to the development of herbicide-resistant weeds. While many farmers are incorporate unlike herbicides, this is likely to have only temporary success. As a consequence, herbicides or chemical weed control are in need of additional support to continue to ensure proper weed control. Integrated Weed Management (IWM) strategy is multiple weed control tactics help to control wide range of weed population in an effective way. Using non-herbicide approaches under different organic crop cultivation with numerous, effective sites of action is needed for long-term success under different weed control programme. Various IWM plans can be integrated without considerable change to present management programs, while others require more wide planning and execution. Few measures that we can adopt under different weed management programme are altering herbicide tank mixes, equipment cleaning etc. while more broad option comprise of cover cropping, changing crop rotation, altering tillage options, and harvest time mixing of weed seed to the economic produce.



Fig. 1: Manual weeding in crop field- labour intensive process **Fig.2:** Study on weed population in crop field

Herbicide resistance in weeds

It's an established fact that certain prominent weeds have got resistance to one or more herbicides. It has been found to have resistance to isoproturon. It is also reported that it is getting resistance to sulfosulfuron or even clodinafop in few cases in Haryana. If in the cropping season you happen to visit different wheat growing areas in West Bengal, UP, Haryana etc., you will find that almost all fields are infested with vigorously though the crop has been treated with existing herbicides. One may say that this situation might be due to use of spurious herbicides but in research experiments the resistance has also been observed in Hissar and Jabalpur, etc. Glyphosate, a prominent herbicide, does not control many weeds as per records available. Genetically modified herbicide resistant crops may lead to development of super weeds which may create a challenge if the cultivation of such crops comes into existence. Therefore, it would be a great challenge to develop molecules which can break the resistance. Under intensive crop cultivation practice our emphasis mainly confined to high input systems, such as more irrigation, fertilizer etc which create more weed problem in crop field. Awareness of unfavourable effects of various chemical residues on human and animal health, ecosystem damage, development of herbicide-resistant weed biotypes, a noteworthy focus within weed science has now shift to the development of eco-friendly technology with

less dependence on herbicides (Fig.3). Further, under changing climate pattern weed shifting become a multi-faceted challenge for weed scientist.



Fig. 3: Awareness campaign against herbicide resistant problem

Table 1. Herbicide resistance in different weed species

Herbicide	Weed species	Crop	Country
Trifluralin	<i>Eleusine indica</i>	Cotton	USA
	<i>Setaria viridis</i>	Cotton	Canada
Chlorsulfuron	Five species	Wheat	USA
Paraquat	<i>Conyza sp.</i>	-	— Australia
	<i>Epilobium ciliatum</i>		USA
	<i>Poa annua</i>		
	<i>Lolium perenne</i>		
2,4-D	<i>Sinapsis sp.</i>	Wheat	New Zealand
	<i>Ranunculus acris</i>		
MCPA	<i>Cardus nutans</i>		
Cholrotoluron	<i>Alopecurus myosuroides</i>	Wheat	England
Diclofop-methyl	<i>Lolium rigidum</i>	Wheat	Australia
Isoproturon	<i>Phalaris minor</i>	Wheat	India

Weed management under present crop scenario become very tough and it should be done with proper knowledge of field and seed bank nature in the surrounding area. Few control practices are discussed here as per recent research and experience.

1. Prevention of entry: Entry of any weed seed either from crop field or from outside source should be avoid. This mainly includes keeping weeds out of the field or spreading within a field.

2. Cultural practice : Proper and good management of crop is one of the important aspect of cultural measures. practice. Adoption of various cultural measures help farmers to more cut-throat against any unwanted plant or weeds (Mukherjee, 2020). This mainly includes, maintain best field nutrient accessibility, reducing row spacing and selecting suitable cultivars under weed-free environment.



Fig. 4: Weed management vs. weedy field under Field Level Demonstration programme.



Fig. 5: Improved weed management result in farmer's field (FLDs)

3. Herbicide efficacy : Herbicides use pattern is one of the most vital factor under present context, as this is labour saving and timely management is possible. Herbicide efficiency can be increase by timely scouting, proper dose of herbicide application, weed identification and awareness of what herbicide-resistant weeds are in the area etc. Some time efficiency of herbicide increase with the tank mix use of different herbicide which have synergistic effect on crop health. Observation on field level data revealed that, proper and timely management of weed increase wheat yield 33 to 56 % under different FLDs. programme in wheat. Proper and timely weed management at critical crop growth phase become a very challenging and crucial task for our farming community.

4. Mechanical approach : This mainly include various physical approach with advance tools and technique mainly by disrupt germination and destroy plant tissue (Mukherjee, 2019). This can be possible with the tillage, hand-pulling, burning of crop residue, mowing, robotic weeding machines etc.

4. Natural control : This mainly include biological measures, which includes uses of living organisms to against different weeds and other microbe effect. One major drawback in this approach is location specific. Many of biological strain become ineffective under varied situation.

To overcome various technical challenges, recent decades have witnessed significant progress in the form of site-specific weed management systems, herbicide-resistant transgenic crops, drones to monitor weed population dynamics, omics, novel herbicides, molecular biology tools, nanoherbicides, and simulation and decision support modeling. The human dimension is somewhat more difficult, and weed management has to grapple with issues such as farmers' failure to appreciate the extent of weed menace, especially where the damage and losses are not apparent. Assessment of the environmental impact of weed management practices has formed a new and a relevant area of research in weed science. Against the backdrop of precision agriculture, advancements in the field of engineering and computer sciences can help quickly identify and control weeds with precise recognition and application modules. For weed science to thrive and respond to future weed problems, greater global collaboration will be required between this discipline and biological science, computer science, engineering, economics, and sociology. Combating with various weed flora challenges, recently site-specific weed management systems along with precision agriculture

practice become getting paramount importance. Further, our advance research programme should be focus on drones to monitor weed population dynamics study technology, herbicide-resistant transgenic plants, nano-herbicides, omics, new herbicides formulation, molecular biology tools, and simulation and decision support modeling. Channelizing and harnessing interdisciplinary teamwork and education of farmer's, coupled with information exchange, could help solve multifaceted challenge with more varied and flexible approach, and accomplish greater harmony – so avoid doubts and critique.

Conclusion

Weed problem is becoming a very challenging field, not only for scientist but also for farming community too. Weed control aspect, change manifold during last decade, however sometime unsafe to our ecosystem and farming community. Proper and timely weed management play significant role for higher productivity of crop per unit area and benefit:cost ratio. .

Reference

Gianessi, L. P. 2013. The increasing importance of herbicides in worldwide crop production. *Pest Management Science*, 69 (10) : 1099-1105.

Mukherjee, D. 2018. Effect of various weed management practices on wheat productivity under new alluvial zone. *Journal of Crop and Weed*, 14(2): 188-194.

Mukherjee, D.2019. Enhancement of productivity potential of wheat (*Triticum aestivum*) under different tillage and nitrogen-management strategies. *Indian Journal of Agronomy*, 64 (3) : 348-353.

Mukherjee, D.2020. Herbicide combinations effect on weeds and yield of wheat in North-Eastern plain. *Indian Journal of Weed Science*, 52 (2) : 116–122.

Neve, P., Vila-Aiub, M., Roux, F. (2009). Evolutionary-thinking in agricultural weed management. *New Phytology*. 184 : 783–793.