

Effect of Integrated Weed Management in Wheat (*Triticum aestivum* L.)

Dr. Shrish Kumar Singh¹, Veerendra Kumar Verma²

Associate Professor & Head of Department-Agronomy, TDPG College, Jaunpur, Uttar Pradesh, India¹

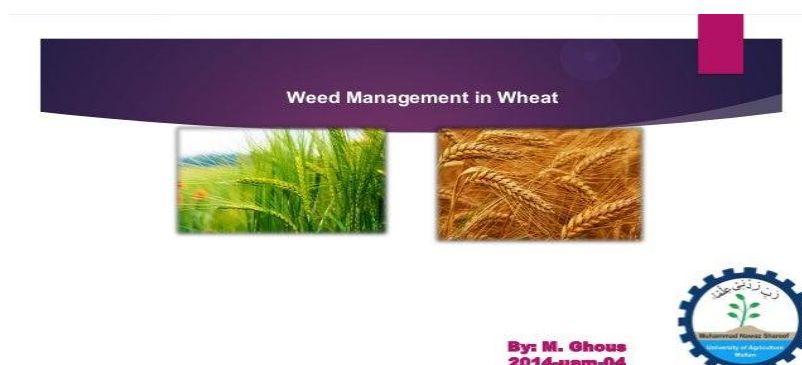
M.Sc (Ag) Agronomy Student, TDPG College, Jaunpur, Uttar Pradesh, India²

ABSTRACT: Weed infestation is one among the most important biotic constraints in wheat production. Wheat is infested with diverse style of weed flora, because it is grown under diverse agro atmospheric condition, different cropping sequence, and tillage and irrigation regimes. For controlling weeds in wheat, growers mostly depend on herbicides because of cost and time effectiveness. For control of diverse weed flora in wheat combination of herbicides or as sequential, if not compatible are required. However, sole dependence on herbicides is additionally not desirable because it contributes to shift towards difficult-to-control weeds and therefore the rapid evolution of herbicide resistance, which may be a threat for sustainable wheat production. For efficient weed management, the non-chemical weed management tactics should be adopted in conjunction chemically (like herbicide mixture and rotation, optimum spray time, dose and methods). A number of the non-chemical agronomic strategies like tillage, sowing time, sowing methods, competitive crop cultivars, higher crop density, closer spacing, irrigation, fertilization and crop rotation is adjusted and adopted in such a fashion that they supply the competitive edge to the crop over weeds. Integration of information of weed biology and non-chemical methods of weed control with chemical methods will help in increasing the lifetime of existing herbicides and make the weed management cost-effective and efficient.

KEYWORDS: Wheat, Integrated, Weed, Management, Agonomic, Crop Rotation

I. INTRODUCTION

Wheat (*Triticum aestivum* L.) belongs to family "Poaceae" and genus "*Triticum*".

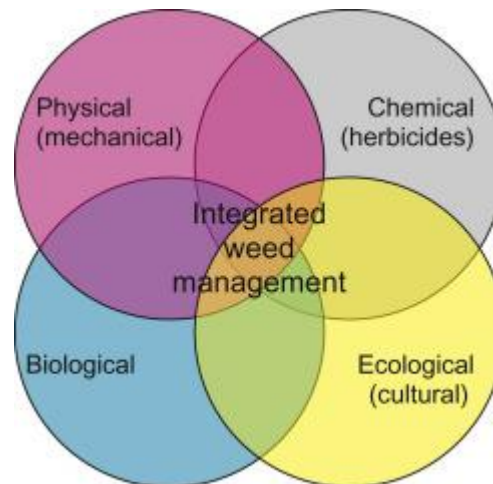


It is a crop of temperate zone with cool winters and hot summers being very conducive for its growth. Among the food crops, wheat is one of the most abundant sources of energy and proteins for the world population and its increased production is essential for food security. It is necessary to sustain the wheat crop production for meet the demand of wheat in India as well as world. Weed infestation during the early stages of crop growth is one of the major factors responsible for low productivity of wheat.

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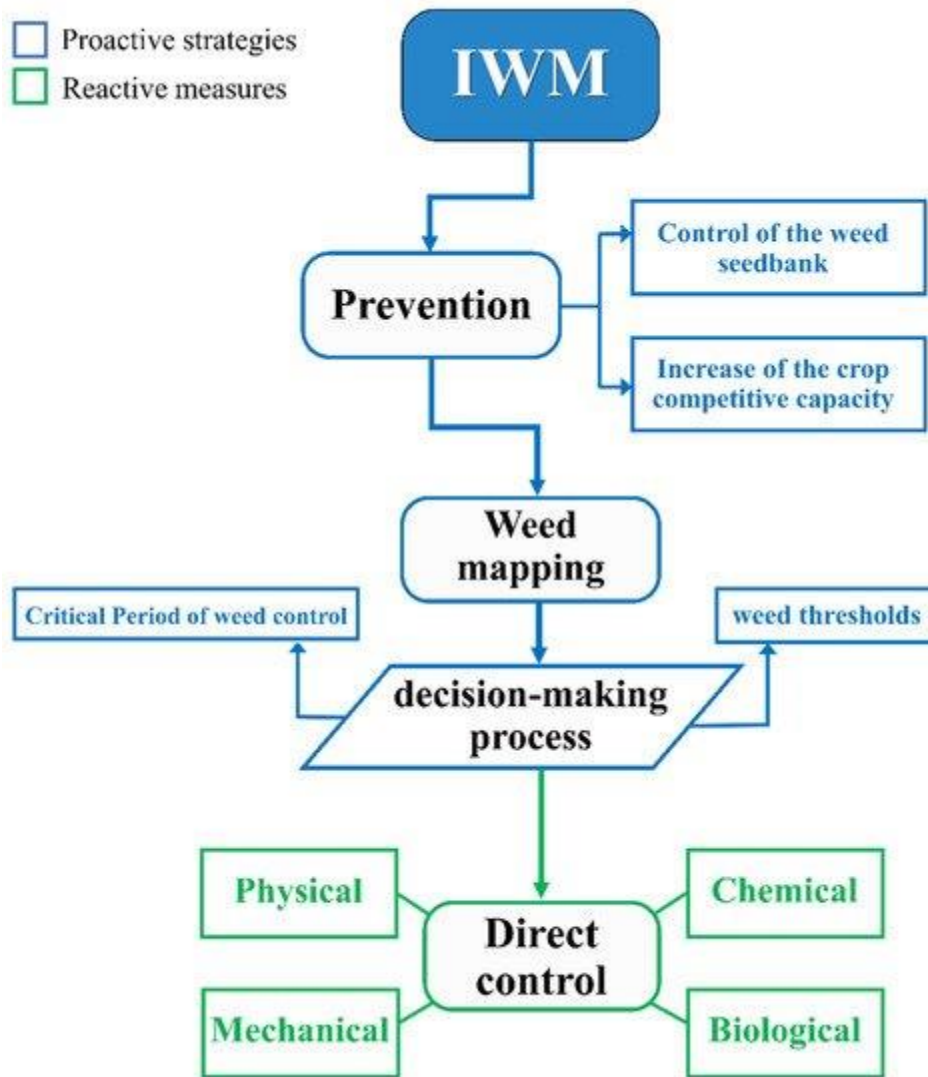
The untimely and poor weed management adversely affects proper growth and yield of wheat. Integration of weed controls methods are effective and workable practices that may be used ecologically and economically viable to the farmer. Herbicides have benefited the agricultural community in many ways. However, heavy application of herbicides creates an environment favorable for weed resistance to herbicides, shifts weed flora and off-site movements of herbicides. Under such conditions, integration of hand weeding, hoeing and weed control through herbicides remains the choice for controlling weeds. [1,2] Traditional methods of weed control such as crop rotation, manual hoeing or tractor drawn cultivator and costly labour have made the use of herbicides more popular among the Indian farmers. The herbicide like Metribuzine, Metasulfuron methy reported to be promising against weeds in wheat at different locations in India. Wheat (*Triticum* spp.) is one of the most important cereal crops worldwide in total production and use. The domestication of wheat, more than any other plant, has allowed food to be produced in sufficient quantities to support community settlement, religious or cultural development, and continuing population growth. Its importance derives from the properties of wheat gluten, a cohesive network of tough endosperm proteins that stretch with the expansion fermenting dough, yet coagulate and hold together when heated to produce a risen loaf of bread. The diversity of uses, nutritive content, and storage qualities has made wheat a staple food for more than one third of the world's population. It is utilized for making bread, flour confectionery products (cakes, cookies, and pretzels), unleavened bread, semolina, bulgar, and breakfast. In this country, wheat is used to prepare various traditional food items alone or in mixture with other cereals and/ or legumes.[3,4]

Globally, it is the most important food grain and ranks second in total production as a cereal crop behind maize; the third being rice. It is reported that per 100 g of wheat grain contains 326-335 calories, 11.57-14.0 g water, 9.4-14.0 g protein, 1.2-2.5 g fat, 69.1-75.4 g total carbohydrate, 1.8-2.3 fiber, 1.7 g ash, 36-46 mg calcium, 354- 400 mg phosphorus, 3.0-4.3 mg iron, 370-435 mg potassium, 0.43-0.66 mg thiamine, 0.11-0.12 mg riboflavin and 4.3-5.3 mg niacin.

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Wheat is poorly adapted to warm or moist climates unless there is a comparatively cool dry season that favors plant growth and retards plant pathogens and the development of respective disease. According to these authors the wheat crop is grown in temperate regions where the annual rainfall averages between 254 to 1780 mm, with the exception of drier irrigated areas; and it is mostly grown in regions with annual precipitation of 380 to 1140 mm. The ideal daily temperature for different stages of wheat growth and development varies from 20 to 25 °C for germination, 16 to 20 oC for good tillering, and 20 to 23 oC for proper plant development . High rainfall, especially when accompanied by high temperatures, is unfavorable for wheat because these conditions promote development of wheat diseases .[5,6]

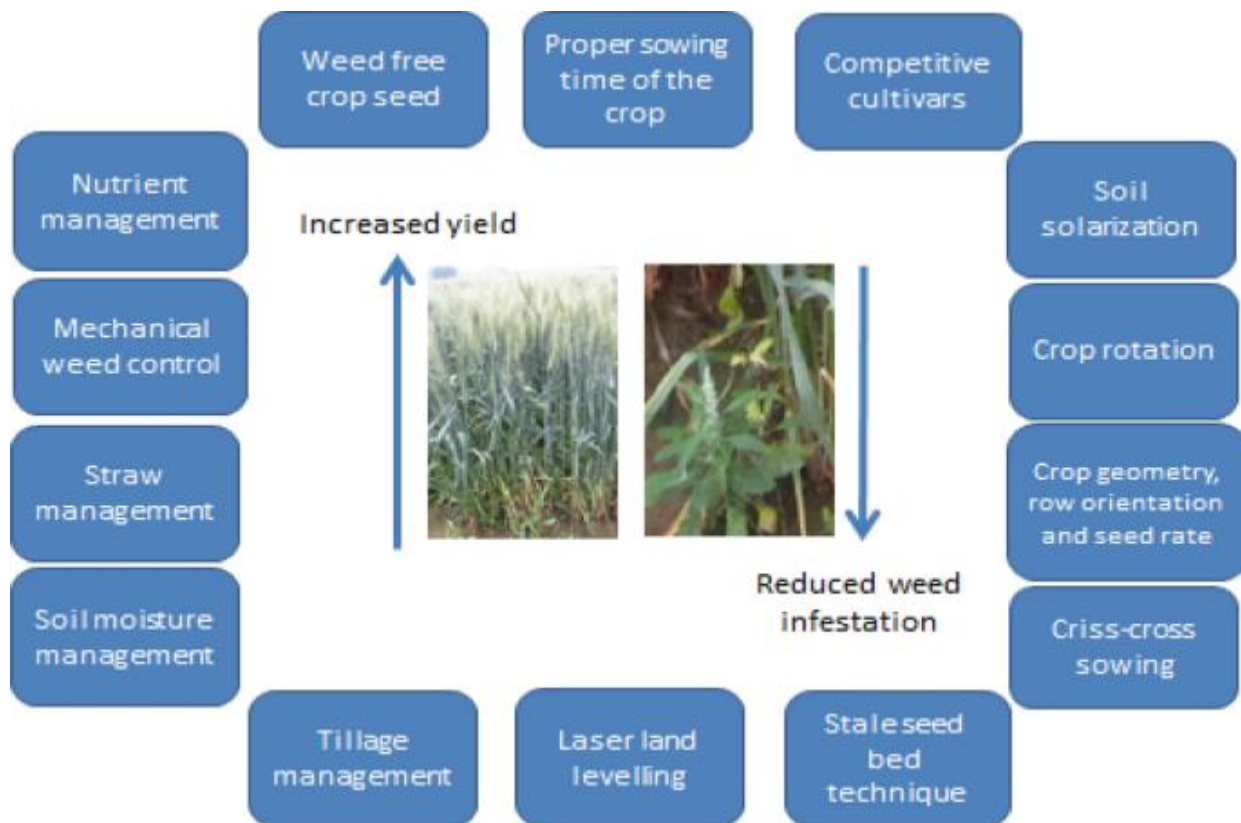
II. DISCUSSION

The crop weed competition was markedly lowest 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 wheat (6.1%, 41g m⁻² , 38.1%, 67.4%, -23.5%).

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This indicated that unchecked weeds beyond 15 DAS and weed free 10 condition at early stage (up to 15 DAS) failed to check crop weed competition, which was detrimental to cumin growth. 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. 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%. [7,8]

Pendimethalin 0.9 kg ha⁻¹ as pre-emergence + HW at 40 DAS proved greater to rest of the treatment by recording reduced dry weight of weeds. Among herbicides treatments, application of pendimethalin @ 0.9 kg ha⁻¹ as pre-emergence resulted in maximum control of monocot and dicot weeds. Combination of one hand weeding with pendimethalin 0.9 kg ha⁻¹ as preemergence, pendimethalin at 0.9 kg ha⁻¹ as pre emergence + clodinafop as post emergence proved more effective in reducing the weed population at harvest in comparison to herbicides applied singly. The application of 2, 4-D @ 625 g ha⁻¹ was found effective in controlling majority of dicot weeds thereby decreasing weed density and weed dry weight. Post-emergence application of 2, 4-D amine salt @0.9 kg ha⁻¹ at 25-30 days effected on grassy and broad leaf weeds. Metsulfuron methyl at 2 g ha⁻¹ had recorded higher plant dry matter than 2, 4-D @ 625 g ha⁻¹. Post-emergence application of Metsulfuron methyl controls braod leaf weeds efficiently and recorded maximum weed control efficiency. Readymix of clodinafop+ Metsulfuron at 75 g ha⁻¹ + 0.2% surfactant recorded effective control of grass and broadleaf weeds. Post-emergence application of Sulfosulfuron + Metribuzin 25 + 105 g a.i ha⁻¹ recorded reduced the weed population (4.1 m⁻²), dry weight of weed (9.20 g m⁻²), highest weed control efficiency (89.89%) and minimum loss of nutrient in wheat field. The tank mix application of pinoxaden (50 g ha⁻¹)+RM of carfentrazone and Metsulfuron (25 g ha⁻¹) recorded lowest total weed density (3.47 m⁻²), weed index (2.72%) and weed persistence index (0.17), and highest value of weed control efficiency (95.03) in wheat crop. Pre-

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Vol. 5, Issue 1, January 2016

emergence application of pendimethalin (30 EC) 2.5 L ha⁻¹ along with the post emergence application of Atlantis 400 g resulted in the reduced weed density and weed dry matter. Post-emergence application of Pinoxaden at 352.94 g/ha in wheat crop at 45 day after application was recorded minimum weed population in *Phalaris minor* (1.56 m⁻²) and *Avena ludoviciana* (1.34 m⁻²), dry weight in *Phalaris minor* (6.1 g m⁻²) and *Avena ludoviciana* (6.3 g m⁻²), higher weed control efficiency in *Phalaris minor* (81.70%) and *Avena ludoviciana* (80.80%). Post-emergence application of 2,4-D + ethoxy at 1288+ 18 g a.i ha⁻¹ at 10 DAS was recorded reduced mean weed density (229 m⁻²), weed biomass (12 g m²) and higher weed control efficiency in wheat crop (84%). Post-emergence application of clodinafop + metsulfuron 60 + 4 g ha⁻¹ was recorded reduced mean weed density (1 m⁻²), weed dry weight (1 g m⁻²), weed index (0.00%) and higher weed control efficiency in wheat.[9,10]

III. RESULTS

The dependence on single method of weed control cannot give the desired results in all situations.



The best approach is integrated weed management in which all suitable methods of weed control are used in a compatible manner to reduce weed population and maintain them at levels below the threshold causing economic injury. Plant density, time of sowing, variety, seed rate, spacing, tillage practices, quantity and time of fertilizer and irrigation water are some of important factors, which influence the weed-crop competition. Regulation of these factors should be such that they give the competitive edge to crop over weeds. The integration of these factors with chemical measure is advisable to avoid the ill effects caused by the sole dependence on the herbicides. Some of the negative impacts of sole dependence on herbicides are evolution of herbicide resistance, weed flora shift and soil and environmental pollution. Also, the continuous dependence on single method of weed control leads to shift of weed flora in favour of more tolerant and difficult to control species and to tackle this problem, there is need to adopt integrated weed management practices. The rising cost of labour and input will wipe out the profits of farmers unless an integrated approach with focused attention of ecology and herbicides is adopted.[11]

Wheat infested by multifarious weed flora comprising both grassy as well as broad leaf weeds causing yield reduction of 15- 40 % depending upon type and intensity of their infestation. Herbicides continue to be the most powerful, economically effective and reliable way to control weeds in wheat. Over the years, the efficacy of herbicides has started declining and there is possibility of development of cross resistance. An

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integrated approach, where herbicide plays a pivotal role is the only way ahead for effective weed management. Use of weed free seed, use of well rotten farm yard manure, method of sowing, seed rate, sowing time, varietal selection, amount of fertilizer application, proper herbicide selection, proper dose, time and method of herbicide application, herbicide rotation and mixture, use of adjuvant, mechanical weeding and crop rotation are the major constituents of integrated weed management. Thus, integrated weed management practices should be location and time specific by considering the weeds in a broader ecological and management context.[12,13]

Integrated weed management for crops is a concept that combines weed control principles, practices, materials, and strategies to maintain plant health by minimizing damage from weeds. It is very clear that herbicide alone will not be the solution for weed problem in wheat. Therefore, perfect sowing techniques that allow integration of mechanical methods with herbicides or cultural methods require urgent attention. Weed intensity and dry matter of weeds at harvest were significantly lower in weed free followed by pendimethalin pre emergence @ 1.0 kg/ha + hand weeding and was maximum in weedy check . Integration of isoproturon @ 0.75 kg/ha + 2,4-D @0.5 kg/ha with one inter culture at 30 DAS was the best treatment in terms of reducing weed population and dry weight at different stage of crop growth . Post emergence application of metsulfuron (6 g ha⁻¹) and 2, 4-D (500g ha⁻¹) at 30-35 days after sowing in wheat recorded higher weed killing efficiency (38.1 %), weed control efficiency (78.3 %), lower weed index (23.5 %) and reduced their dry matter accumulation by 67.4 % as compared to farmer's practice.[14,15]

IV. CONCLUSIONS

Weed infestation is one the most biotic constraints in wheat production and productivity. Wheat is infested by different weed flora comprising grasses and broad leaved weeds. For weed control most the wheat producer farmers depends on herbicides because of cost and time effectiveness compared to manual weeding. However continuous use of the identical herbicide or herbicide of the identical mode and mechanism of action leading to the buildup of resistance and tolerant weed variety. Integration of herbicides with hand weeding attributed to efficient and prolonged weed control. Herbicide supplemented with hand weeding for the control lately emerging weeds. An integrated approach, where herbicide plays a pivotal role is that the only way ahead for effective weed management. Use of weed free seed, use of well rotten farm yard manure, method of sowing, seed rate, sowing time, varietal selection, amount of fertilizer application, proper herbicide selection, proper dose, time and method of herbicide application, herbicide rotation and mixture, use of adjuvant, mechanical weeding and crop rotation are the key constituents of integrated weed management.[16]

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Vol. 5, Issue 1, January 2016

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