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Integrated weed management in wheat (*Triticum aestivum* L.) -A Review

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Abstract
Wheat (*Triticum aestivum* L.) is important cereal crops in India. It is belong to Poaceae family. It is widely cultivated, produced and used throughout the world and India. Wheat is staple food in all grain crops. Yield reduction in wheat crop due to weeds are 30 to 80% (Amre *et al.*, 2016, Kaur *et al.*, 2017; Chandra *et al.*, 2018) [15, 26]. The combination of grassy and non-grassy leaf herbicides was found maximum output as compare to single herbicide spray in wheat crops. The combination of herbicide with cultural and mechanical method are the better way to reduced weed population in wheat field. The long-time use one herbicide gives resistance in weeds. Integrated weed management approach have use to control long time weed population in wheat field and ultimately increase yield under wheat field.

Keywords: herbicides, weed index, weed flora, weed control efficiency, weed population and weed dry weight.

1. Introduction
Wheat (*Triticum aestivum* L.) is one of the most important staple food crop cultivated in almost all countries in the world. One of major *rabi* crops cultivated in India is wheat specially Punjab and Haryana, it's like a backbone of food security of nation as evident from its contribution to nearly one third of total food grain productions. Wheat positions second next to rice in area and production, but first in productivity among all the cereals. In India is grown in an area of 29.58 Million ha with a production of 99.70 Million Tonnes. The productivity of wheat in India is about 3371 kg ha^{-1} (Anon., 2018) [1, 2]. In Punjab wheat grown in an area of 3480 thousand ha with a production of 16360 thousand tonnes. The productivity of wheat in Punjab is about 4700 kg ha^{-1} (Dept. of agriculture and Govt. of Punjab 2018).

The weed flora associated with wheat in Punjab during 2008-2018 ten new weed species namely *Galium spurium*, *Geranium nepalense*, *Lamium amplexicaule*, *Evolvulus nummularius*, *Euphorbia thymifolia*, *Oenothera laciniata*, *Soliva anthemifolia*, *Verbesina encelioides*, *Nicotiana plumbaginifolia* and *Portulaca oleracea* (Kaur *et al.*, 2018) [14, 26].

Again, weeds have a habit to shift with the alteration in tillage, agronomic management, and cropping system although there are other factors that govern the alterations in the weed flora. Although being a serious problem in crop field, this problem always remains under-estimated although they cause higher reduction in economic yield of crops than other pests and diseases. The critical period of crop weed competition is 11- 21 days after crop emerged (Galon *et al.*, 2019) [8] and reduction of grain yield in late sown wheat was reported up to 34.3% due to mixed weed flora (Meena *et al.* 2017a) [19]. Integrated weed management (IWM) involves deployment of different methods of weed prevention and control in right proportion and at appropriate time against the target weeds (Gupta *et al.*, 2008) [9]. Popular of the research in India on integrated weed management was herbicide-based. However, majority of the farmers have not been benefitted by herbicides in India. Herbicides must be made economically and ecologically affordable to farmers by creatively integrating with other components of integrated weed management. Usage of some herbicides has led to development of resistant weeds and has worsened weed problems. For example, in rice-wheat cropping system of Punjab and Haryana, *Phalaris minor* (Wild oat) has developing resistance against isoproturon.

2. Review of literature
2.1 Weed flora
Tuti and Das (2011) at New Delhi (IARI) observed that major weed flora at the wheat

experimental field comprised of *Chenopodium album. Melilotus indica. Avena sterilis ssp Iudoviciana* (Dur) among grasses, and *Cyperus rotundus* among sedges.

Pisal and Sagarka (2013) [24] at Gujarat observed among the monocot weeds such as, *Brachiaria serrata, Echinochloa colonum* and dicot weeds *Amaranthus viridis, Digera arvensis, Chenopodium album*, *Euphorbia hirta* and *sedges Cyperus rotundus*. (Pisal *et al.*, 2013) [24] from Kharagpur West Bengal the predominant weeds flora recorded on the experimental site were *Brachiaria serrata*. *Echinochloa colonum, and Cyperus roudus*.

The occurrence of weeds at Tucuman, Argentina were *Avena sps*. *Bromos sp, Parietaria debilis, Bowlesia incana, Hybanthus parviflora* (Olea *et al.*, 2011) [21].

Kaur and Walia (2015) [12] From Punjab experimental field was infested with grass weed *Phalaris minor* and few broad-leaved weeds, *viz*. *Chenopodium album, Anagallis arvensis, Medicago denticulata, Rumex dentatus* and *Coronopus didymus*.

Kumar *et al.*, (2018) from Bihar was found that grassy weeds *Avena fatua* was most dominant and among the non-grassy weeds, *Chenopodium album* and *Fumaria parviflora, Melilotus indica, Coronopus didymus* and *Chenopodium album in* wheat field.

Kumar and Singh (2018) at Uttarakhand among monocot weeds were *Phalaris minor*, *Avena fatua*, *Cynodon dactylon* in grassy, *Melilotus alba, Chenopodium album, Anagallis arvensis, Convolvulus arvensis* and *Fumaria indica* among dicot weeds whereas *Cyperus rotundus* in sedges group in wheat field.

Kumar *et al.*, (2019) [16, 17] the flora was dominated by grassy weeds *Avena ludoviciana* (34.30%), *Phlaris minor* (25.26%), *Lolium temulentum* (15.14%), *Vicia sativa* (10.79%), *Anagallis arvensis* (9.80%), *Coronopus didymus* (4.71%).

Banerjee *et al.*, (2019) [5] at West Bengal Weed flora in the wheat experimental field was dominated by *Phalaris minor* and *Avena ludoviciana.*

Ahmed *et al.*, (2020) [4] from Bangladesh the common weed species found at the experimental site were *Amaranthus spinosus* L., *Anagalis arvensis* L., *Celosia argentea* L., *Chenopodium album* L., *Cleome rutidosperma* DC., *Cynodon dactylon* (L.) Pers., *Cyperus rotundus* L., *Digitaria ciliaris* (Retz.) Koel. *Echinochloa colona* (L.) Link, and *Phyllanthus niruri* L.in wheat field.

2.2 Crop weed competition

(Singh *et al.*, 2013) [28] 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%).

Nanher *et al.*, (2015) [20] 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.

Galon *et al.*, (2019) [8] 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) [10] 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%.

2.3. Effect of Integrated weed management on weed growth

(Pisal and Sagarka, 2013) [24] Pendimathalin 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.

Pisal *et al.*, (2013) [24] from Gujarat reported that among herbicides treatments, application of pendimethalin @ 0.9 kg ha^{-1} as pre-emergence resulted in maximum control of monocot and dicot weeds

Pisal and Sagarka (2013) [24] found that combination of one hand weeding with pendimethalin 0.9 kg ha^{-1} as pre-emergence, pendimethalin at 0.9 kg ha^{-1} as pre emergence + clodinofop as post emergence proved more effective in reducing the weed population at harvest in comparison to herbicides applied singly.

Meena and Singh (2011) [18] from a field experiment conducted at Uttar Pradesh, India found that 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 (Pisal *et al.*, 2013) [24].

Metsulfuron methyl at 2 g ha^{-1} had recorded higher plant dry matter than 2, 4-D @ 625 g ha^{-1} (Meena and Singh, 2011) [18].

Pisal *et al.*, (2013) [24] reported that post-emergence application of Metsulfuron methyl controls braod leaf weeds efficiently and recorded maximum weed control efficiency.

Kaur and Walia (2015) [12] the results to be found that ready-mix of clodinafop+ Metsulfuron at 75 g ha^{-1} + 0.2% surfactant recorded effective control of grass and broadleaf weeds.

Nanher *et al.*, (2015) [20] 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.

Devi *et al.*, (2018) 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.

Sharma *et al.*, (2018) Pre-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.

Banerjee *et al.*, (2019) [5] 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* (81.70g%) and *Avena ludoviciana* (80.80%).

Ahmed *et al.*, (2020) [4] 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 m^{-2}) and higher weed control efficiency in wheat crop (84%).

Patel *et al.*, (2021) [25] 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 crop (100%).

2.4. Effect of Integrated weed management on crop growth

Application of pendimethalin @ 0.7 kg ha^{-1}, decreased the density of *Chenopoduim album, Melilotus indica*, grasses and total weed density at 60 DAS, (Tuti and Das, 2011).

Pisal and Sagarka, (2013) [24] at Junagadh, Gujarat noticed that significantly higher number of effective tillers, spikelets per spike and grain weight per plant were recorded under weed free condition over weedy check which was closely followed by treatment of pendimethalin 0.9 kg ha^{-1} as pre emergence.

2, 4-D .Na. Salt @625g ha^{-1} was found effective on plant height ear head length compared to an weeded check, (Meena and Singh, 2011) [18].

Application of 2, 4-D in wheat was recorded 24.5% higher productive tillers m^{-2}, 3.4% higher spike length and 7.2% higher filled grains/panicle with enhanced grain yield (31.4%) and straw yield (31.4%) compared to weedy check, (Surin *et al.*,. 2013) [29].

Metribuzin had the positive influence on plant height, effective tiller m^{-2}, spikelet number ear^{-1}, and ear length as compared to farmer practice (Singh *et al.*, 2010) [27].

Singh *et al.*, (2013) [28] pointed out increased crop growth under herbicide spray (metsulfuron + 2, 4-D) which was significantly superior to farmer's practices.

Application of metsulfuron @6 g ha^{-1} as post-emergence, at 25 - 30 DAS increased number of tillers m^{-2}, plant height than the weedy check, (Pisal *et al.*, 2013) [24].

Kaur and Walia (2015) [12] the results indicated that ready-mix of clodinafop+ metsulfuron at 75 g ha^{-1} + 0.2% surfactant recorded higher panicle length and effective tillers plant^{-1} (11.2 cm and 351.65 tillers plant^{-1} in wheat field.

Nanher *et al.*, (2015) [20] post-emergence application of sulfosulfuron + metribuzin 25 + 105 g a.i ha^{-1} recorded plants height (110 cm), maximum number of tillers m^{-2} row length (110.18 tillers m^{-1}row length), dry matter accumulation (148.17 g m^{-1}row length) in wheat.

Devi *et al.*, (2018) The tank mix application of pinoxaden (50 g/ha) +RM of carfentrazone and metsulfuron (25 g ha^{-1}) recorded higher Crop Resistance Index (22.83%), NAR (6.23 g^{-1} m^{-2} day^{-1}) and LAD (113.03 Days) in wheat.

Sharma *et al.*, (2018) among the herbicidal treatments the highest number of grains per spike (43) were observed with combination of pre-emergence application of pendimethalin (30 EC) 2.5 L ha^{-1} along with post-emergence application of atlantis 400 g ha^{-1}.

Kumar *et al.*, (2019) [16, 17] post-emergence application of marck clodina at 60 g ha^{-1} recorded total weed population (5.17 m^{-2}), total weed dry weight (6.09 g ha^{-1}) and weed control efficiency (86.3%) in wheat crop.

Ahmed *et al.* (2020) [4] post-emergence application of ethoxy at 10 DAS was recorded higher mean plant density (370.5 m^{-2}) and plant biomass in wheat field (147 g m^{-2}).

2.5. Effect of Integrated weed management on yield and yield attributes

Tuti and Das (2011) positive influence on grains ear^{-1}, and 1,000 grain weights and grain yield in wheat crop were observed in the Pre-emergence application of pendimethalin @ 0.75 kg ha^{-1} had Pre-emergence application of pendimethalin was found equally effective and significantly better over mechanical weeding and unweeded control in higher the earheads m^{-2}, earhead length, grains per head and 1000 grain weight (Singh *et al.*, 2011).

Pisal *et al.*, (2013) [24] from Junagadh Agricultural University Gujrat, observed that pendimethalin as pre emergence + one hand weeding at 40 DAS produced the maximum grain yield.

Application of the pendimethalin enhanced seed yield which was closely followed by pendimethalin @0.9 kg ha^{-1} as pre-emergence + 1 HW at 40 DAS (Pisal and Sagarka, 2013) [24].

Pendimethalin @0.9 kg ha^{-1} as pre-emergence enhanced the wheat seed yield (3723 kg ha^{-1}) (Pisal *et al.*, 2013) [24].

The higher seed (3.8 t ha^{-1}) and straw yield (4.4 t ha^{-1}) was recorded with pendimethalin @ 0.9 kg ha-1 pre-emergence plus one hand weeding at 40 DAS (Tuti and Das, 2013).

2, 4-D .Na. salt @625 g ha^{-1} was found to be maximum on plant height, ear head length, number of grains ear^{-1} head compared with unchecked weed (Meena and Singh, 2011).

2, 4-D had positive effect on effective tillers m^{-2} , spikelet number ear^{-1}, and ear length as compared to unchecked weed, at BAU, Ranchi, Jharkhand, (Surin *et al.*,. 2013) [29].

2, 4-D Na Salt (500-750 g ha^{-1}) resulted in significantly minimum yield compared to all other herbicidal treatments (Malik *et al.*, 2008).

Application of metribuzin at 250 g ha^{-1} had improved the number of effective tillers m^{-2} ear length, number of grains ear head^{-1} and 1,000-grain weight (Dev *et al.*, 2013) [7].

Meena and Singh (2011) [18] noticed that metrsulfuron methyl at 2 g ha^{-1} recorded better performance of yield attributes in comparison to 2, 4-D @625 g ha^{-1} alone with respect to number of ear head m^{-2}, ear head length, number of grains ear^{-1} head and test weight, increased grain yield 2.9 t ha^{-1} than 2, 4-D Na, salt.

Kaur and Walia (2015) [12] the results indicated that ready-mix of clodinafop+ metsulfuron at 75 g ha^{-1}+ 0.2% surfactant recorded maximum grain yield (5.6 t ha^{-1}).

Nanher *et al.*, (2015) [20] post-emergence application of sulfosulfuron + metribuzin 25 + 105 g a.i ha^{-1} recorded higher grain and straw yield in wheat crop (5.5 t and 7.8 t ha^{-1}).

Devi *et al.*, (2018) the tank mix application of pinoxaden (50 g/ha) +RM of carfentrazone and metsulfuron (25 g ha^{-1}) recorded maximum seed yield (5.3 t ha^{-1}).

Kumar *et al.*, (2018) post-emergence application of 2, 4-D @0.5 kg a.i ha^{-1}at 30 DAS recorded higher ear length (9.7 cm), no. of spiklet per ear (15.2), no. of grains per ear (37.7), grain weight per ear (1.50 g), 1000- grain weight (42.8), seed and straw yield (3.7 t and 5.2 t ha^{-1}) in wheat crop.

Sharma *et al.*, (2018) highest grain yield (5773 kg ha^{-1}) was recorded with pre-emergence application of pendimethalin 2.5 L ha^{-1} *fb* post-emergence application of atlantis 400 g ha^{-1}.

Kumar *et al.*, (2019a) [16, 17] post-emergence application of marck clodina at 60 g ha^{-1} recorded higher no. of effective tillers (216 m^{-2}), no. of spikelets per spike (15.7), spike length (2.9 cm), 1000-grain weight (48.1), grain yield and straw yield (4.2 t 5.4 t ha^{-1}) in wheat crop.

Kumar *et al.*, (2019 b) [16, 17] Hand weeding twice at 30 and 60 DAS was recorded higher seed and straw yield in wheat crop (4.9 t and 6.64 t ha^{-1}).

Banerjee *et al.*, (2019) [5] post-emergence application of Pinoxaden at 352.94 g ha^{-1} was recorded higher mean no. of effective tillers (355.4 m^{-2}), ear length (12.5 cm), no. of grain ear^{-1} (42.2), test weight (74 g) and grain yield (3.24 t ha^{-1}) in wheat crop.

Patel *et al.*, (2021) [25] post-emergence application of clodinafop + metsulfuron 60 + 4 g ha^{-1} was recorded higher mean seed and straw yield in wheat crop (5.80 t and 8.55 t ha^{-}

[1]).

2.6 Effect of integrated weed management on nutrient uptake on crop

The weed free treatment recorded significantly higher uptake of N, P and K by crop (86.1, 19.1, 68.7 kg^{-1} and lower N,P and K uptake by weeds which was followed by pendimethalin 0.9 kg ha^{-1}+ 1HW at 4 DAS superior to other at par with treatments (Pisal *et al.*,. 2013) [24].

Singh *et al.*, (2015) [30] post-emergence application (30 DAS) of sulfosulfuron + metsulfuron 32 g ha^{-1}recorded higher nutrient uptake Nitrogen (118.7 kg ha^{-1}), Phosphorus (22 kg ha^{-1}) and potash (114 kg ha^{-1}) in wheat crop.

2.7 Effect of Integrated weed management on Economics.

Post-emergence + 2, 4-D @ 0.5kg ha-1 in wheat crop recorded 62.5% higher gross returns, 94.2% higher net returns as well as 51.9% higher B:C ratio compared to weedy check in wheat crop, (Pandey *et al.*, 2012) [22].

Nanher *et al.*, (2015) [20] post-emergence application of sulfosulfuron + metribuzin 25 + 105 g a.i ha^{-1} recorded maximum gross return (₹ 90,362.05), net return (₹ 63,453.59) and B: C ratio in wheat crop (2.48).

Patil *et al.*, (2018) [23] weeding at 20 DAS and + metasulfuron methyl @ 4 g a.i. ha-1 ha^{-1} as PoE at 30 DAS recorded maximum net monetary returns (₹ 49,865) and higher B: C ratio (2.26) of wheat crop.

Kumar *et al.*, (2019a) [16, 17] post-emergence application of marckclodina at 60 g ha^{-1} recorded maximum net returns (₹36,163) and higher B: C ratio (2.09) of wheat crop.

Kumar *et al.*, (2019 b) [16, 17] post-emergence application of Halauxifen – methyl 6.95% + Pyroxsulam 25% without surfactant @ 23.96 a.i g ha^{-1} to be found in maximum gross return (₹ 93,045), net return (₹ 60,572) and B: C ratio in wheat crop (2.9).

Banerjee *et al.*, (2019) [5] post-emergence application of Pinoxaden at 352.94 g ha^{-1} was recorded maximum mean gross return (₹49,330), net return (₹ 18,980) and B: C ratio in wheat crop (2.65).

Patel *et al.*, (2021) [25] post-emergence application of clodinafop + metsulfuron 60 + 4 g ha^{-1} was recorded maximum mean gross return (₹ 1, 24,641), net return (₹90,336) and B: C ratio in wheat crop (3.64).

Conclusion

Integrated weed management is the approach to reduce effect of weed density in wheat field. Integrated weed management methods used to control maximum quantity of weed in wheat field and hence ultimately increase grain and straw yield under wheat crop.

Reference

1. Anonymous. Department of agriculture and government of India 2018.
2. Anonymous. Department of agriculture and government of Punjab 2018**.**
3. Amare T, Raghavaiah CV, Takele Zeki. Productivity, Yield Attributes and Weed Control in Wheat (*Triticum aestivum* L.) as Influenced by Integrated Weed Management in Central High Lands of Ethiopia, East Africa. Advances in Crop Science and Technology 2016;4(1):206 2016**.**
4. Ahmed S, Alam MJ, Awan TH, Chauhan BS. Effect of application timings and tank mixture of herbicides on weed suppression, crop growth and yield of wheat. Journal of Research in Weed Science 2020;3(2):214-229.
5. Banerjee H, Garai S, Sarkar S, Ghosh D, Samanta S, Mahato M. Efficacy of herbicides against canary grass and wild oat in wheat and their residual effects on succeeding greengram in coastal Bengal. Indian Journal of Weed Science 2019;51(3):246-251.
6. Chhokar RS, Sharma RK, Sharma I**.** Weed management strategies in wheat-A Review**.** J Wheat Res 2012;4:1-21.
7. Dev D, Singh A, Pal S, Kumar R. Weed management studies in wheat (*Triticum aestivum*). Indian Journal of Agronomy 2013;58(2):215-219.
8. Galon L, Basso FGM, Chechi L, Pilla TP, Santin CO, Maico Andre Michelon, Bagnara MAM, *et al.* Weed interference period and economic threshold level of ryegrass in wheat**.** Bragantia, Campinas 2019;78(3):409-422**.**
9. Gupta HS, Gopinath K, Pandey AK. Integrated weed management in wheat (Triticum aestivum) Indian Journal of Weed Science 2008;25(3):112-116.
10. Hussain S, *et al.* Interference and economic threshold level of little seed canary grass in Wheat under different sowing times. Environ Sci Poll Re 2015;22:441-9.
11. Hooda VS, Kamboj NK, Singh J. Bioefficacy of Herbicides in Relation to Planting Techniques in Wheat. Chemical Science Review and Letters 2018;7(25):77-82.
12. Kaur T, Bhullar MS, Walia US. Bio-efficacy of ready-mix formulation of clodinafop-propargyl + metsulfuron for control of mixed weed flora in wheat. Indian Journal of Weed Science 2015;47(2):121-124.
13. Kaur S, Kaur T, Bhullar M. Control of mixed weed flora in wheat with sequential Application of pre-and post-emergence herbicides. Indian Journal of Weed Science 2017;49(1):29-32.
14. Kaur E, Sharma R, Singh ND**.** Efficacy of Pre-Emergence and Post-Emergence Herbicides on Weed Control and Yield in Wheat, International Journal of Current Microbiology and Applied Sciences 2018;7(2):883-887.
15. Chandra S, Kumar S, Acharya S, Kumar P, Tyagi S. Effect of Different Weed Management Practices on Growth and Yield of Wheat and Associated Weeds. International Journal of Current Microbiology and Applied Sciences 2018;7:3859-3865.
16. Kumara S, Ranaa SS, Badiyalaa D, Kumara S, Sharmab N. Bioefficacy of post-emergence herbicide Prioxofop-Propanyl (Markclodina) against weeds in wheat. Journal of Research in Weed Science 2019;2:141-148.
17. Kumar S, Agrawal KK, Kewat ML, Kumhar BL. Effect of post emergence herbicides on yield and economics of wheat. The Pharma Innovation Journal 2019;8(7):602-604.
18. Meena SR, Singh MK. Weed management in late sowing zero-till wheat (*Triticum aestivum*) with varying seed rate. Indian Journal of Agronomy 2011;56(2):127-132.
19. Meena V, Kaushik MK, Meena SK, Bhimwal JP**,** Chouhan BS**.** Influence of pre and post- emergence herbicide application on weed growth and nutrient removal in wheat (*Triticum aestivum* L.). Journal of Pharmacognosy and Phytochemistry 2017;6(6):2413-2418.
20. Nanher AH, Singh R, Yadav S, Tyagi S. Effects of Weed Control Treatments on Wheat Crop and Associated Weeds. Trends in Biosciences 2015;8(2):0974-8, 421-

428.
21. Olea I, Gambua D, Devani M. Weed control in wheat crop. Agricultural tecnica Santiago 2011;24(1):3-4.
22. Pandey H, Gopinath KA, Kumar N, Bisht JK. Bio efficiency of herbicides in wheat under zero and conventional tillage systems. Indian Journal of Weed Science 2012;52(2):112-115.
23. Patil SK, Suryavanshi GB, Patil JB, Kusale SP. Effect of integrated weed management on growth, yield and economics of wheat (*Triticum aestivum* L.). International Journal of Chemical Studies 2018;6(6):51-54.
24. Pisal RR, Sagarka RK. Integrated weed management in wheat with new molecules (*Triticum aestivum* L). India Journal of Weed Science 2013;45(1):25-28.
25. Vipul Y, Patel VY, Patel BD, Patel VJ, Viradiya MB, Sodavadiya HB. Management of Complex Weed Flora through Herbicide Combinations in Irrigated Wheat (*Triticum aestivum* L.). International Journal of Current Microbiology and Applied Sciences 2021;10(01):3437-3444.
26. Kaur E, Sharma R, Singh ND. Evaluation of herbicides and their combinations for weed control in wheat (*Triticum aestivum* L.). International Journal of Environment, Agriculture and Biotechnology (IJEAB) 2018;3(4):2456-1878.
27. Singh G, Singh OP, Singh S, Prasad K. Weed management in late sown wheat (Titicum aestivum) low land. Indian Journal of Agronomy 2010;55(2):83-88.
28. Singh RK, Verma SK, Singh RP. Bio-efficacy of carfentrazoneethyl + Sulfosulron in wheat. Indain Journal of Weed Science 2013;45(4):243-246.
29. Surin SS, Singh MK, Upasani RR, Thakur R, Pal SK. Weed management in rice (Oryza sativa)-Wheat (Triticum aestivum) cropping system under conservation tillage. Indian Journal of Agronomy 2013;58(3):288-29.
30. Singh M, Singh MK, Singh SP, Raghuvar Sahu R. Herbicide and nitrogen application effects on weeds and yield of wheat. Indian Journal of Weed Science 2015;47(2):125-130.