The Pharma Innovation Journal 2023; 12(4): 1755-1759

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(4): 1755-1759

www.thepharmajournal.com
Received: 09-01-2023
Accepted: 13-02-2023

Abhimanyu Kumar Ram
M.Sc. Scholar, Department of Agronomy, National Post Graduate College, Barhalganj, Gorakhpur, Uttar Pradesh, India

Prabhat Kumar Chaturvedi
Head, Department of Agronomy, National Post Graduate College, Barhalganj, Gorakhpur, Uttar Pradesh, India

Corresponding Author:
Abhimanyu Kumar Ram
M.Sc. Scholar, Department of Agronomy, National Post Graduate College, Barhalganj, Gorakhpur, Uttar Pradesh, India

Evaluation of different herbicides on weed management in wheat (*Triticum aestivum* L.) under Gorakhpur region

Abhimanyu Kumar Ram and Prabhat Kumar Chaturvedi

Abstract
A field experiment on "evaluation of different herbicides on weed management in wheat (*Triticum aestivum* L.) under Gorakhpur region''. was conducted at Crop Research Farm of National Post Graduate College, Barhalganj, Gorakhpur, (U.P.) during rabi season of 2021-22. The experiment comprised of five post emergence herbicides application along with weed free and weed cheek treatments. Maximum weed control efficiency was observed in T_2 weed free (20+40 DAS) treatment followed by T_6 Sulfosulfuron 75% WG + Metsulfuron-methyl 5% WG 40 g/ha^{-1}, T_7 Clodinofop- propargyl 15% + Metsulfuron-methyl 1% WP 400 g/ha^{-1} (30 DAS), T_5 Sulfosulfuron 75% WG 33.3 g/ha (30 DAS) and T_4 Metsulfuron-methyl 20% WP 20 g/ha (25 DAS). T_6 Sulfosulfuron 75% WG + Metsulfuron-methyl 5% WG 40 g/ha-1 recorded lowest lowest weed index. The minimum weed dry weight was recorded T_2 Weed free (20+40 DAS) treatment but was at par treatment with T_6 Sulfosulfuron 75% WG + Metuslfuron-methyl 5% WG @ 40 g/ha (25 DAS) and T_7 (Clodinofop- propargyl 15% + metsulfuron-methyl 1% WP @ 400 g/h (30 DAS). The maximum grain and straw yield was observed in T_2 weed free (20+40 DAS) which was statically at par with that observed with application T_6 Sulfosulfuron 75% WG + Metsulfuron-methyl 5% WG 40 g/ha^{-1} T_7 Clodinofop- propargyl 15% + Metsulfuron-methyl 1% WP 400 g/ha^{-1} (30 DAS), T_5 Sulfosulfuron 75% WG 33.3 g/ha (30 DAS) and T_4 Metsulfuron-methyl 20% WP 20 g/ha (25 DAS). The lower grain and straw yield was recorded under T_1 weedy check which was significantly inferior to rest of the treatments. The harvest index was in the range of 36.08 to 44.99% under different weed control treatments. The maximum gross return of wheat (₹ 1,27,565.95 ha-1) was observed in plots treated with T_2 weed free (20+40 DAS), and it was followed by plots T_6 Sulfosulfuron 75% WG + Metsulfuron-methyl 5% WG 40 g/ha^{-1} (₹ 1,25,064.00 ha^{-1}). The maximum net return of wheat (₹89,533.00 ha^{-1}) and benefit ratio (2.51) was observed in plots had plots treated with T_6 Sulfosulfuron 75% WG + Metsulfuron-methyl 5% WG 40 g/ha^{-1}, and it was followed by plots T_7 Clodinofop-propargyl 15% + Metsulfuron- methyl 1% WP 400 g/ha^{-1} (₹ 84,781.55 ha^{-1}) and benefit ratio (2.39). The results indicate the application of Sulfosulfuron 75% WG + Metsulfuron-methyl 5% WG 40 g/ha^{-1} or Clodinofop-propargyl 15% + Metsulfuron-methyl 1% WP 400 g/ha^{-1} (30 DAS) are most remunerative and effective herbicides for weed management in irrigated wheat under sandy loam soils of eastern Uttar Pradesh.

Keywords: Weed control efficiency, weed index, weed dry weight, grain and straw yield, harvest index, gross and net return, benefit ratio

Introduction
Wheat (*Triticum aestivum* L.) is the second most important cereal crop next to rice in India occupying about 29-million-hectare area and contributing 37% to the total national food grain production. Wheat, the "King of all cereals'', occupied 17% of the word′s cropped area which adds 35% of the staple food and 20% of the calories. Wheat ranks first in area and production at global level, among major cereals and it contributes more calories and proteins to the word′s human diet.

According to APEDA; Area of cultivated major wheat growing states in India are Uttar Pradesh, Panjab, Haryana, Madhya Pradesh, Rajasthan, Bihar and Gujarat. India facts and figures world trade in wheat is greater than for all other crops combined. Demand of India's wheat in the world shows a rising trend. The country has exported 20,88,48.66 MT of wheat to the word for the worth of Rs. 4,037.60 crores/549.70 USD Millions during the year of 2020-21. Major export destinations (2020-21) Bangladesh, Nepal, U Arab Emts, Sri Lanka Dsr, Yemen republic. Tank mix combinations or ready mixtures are advantageous over sequential application due to saving in application timing and cost. The effectiveness of grass herbicides is generally reduced when mixed with broad-leaved herbicides (Damalas and Eleftherohorinos, 2001) [16]. Synergism/ compatibility have been found to occur more frequently in mixtures

where the companion herbicides belong to the same chemical groups (Meena *et al*., 2020) [7]. Sulfosulfuron + Metsulfuron are compatible (Kumari *et al*., 2018) [5] but tank mix application of grass herbicides (Clodinafop, Fenoxaprop, Tralkoxydim and Pinoxaden) with either 2, 4 - D or Metsulfuron is antagonistic (Kumar *et al*. 2021) [6]. To avoid antagonism, the grassy and broadleaved herbicides should be applied sequentially.

For controlling broadleaved weeds along with grasses, application of Isoproturon in combination of 2,4-D, Sulfosulfuron and Metsulfuron-methyl (MSM) are recommended (Pandey *et al*., 2006, Singh and Singh, 2002) [25-26]. The application of isoproturon + 2,4-D at 1.0 + 0.5 kg/ha produced significantly higher grain yield. Metribuzin has been found effective against associated weeds of wheat (Dixit and prinsa *et al*., 2018) [12].

Continuous use of Isoproturon led to the development of evolutionary resistant biotype and shift in weed flora (Malik and Singh, 1995) [17]. A number of herbicides are, therefore, necessary to be evaluated for controlling weeds from the point of eco-safety and cost effective as the manual weeding or through animal drawn are costly. Keeping the above points in view, an experiment was conducted to evaluate herbicides for control of weeds in wheat (*Triticum aestivum* L) during rabi season of 2015-16.

Weeds lead to yield reduction of 15% to 50% or higher depending upon the weed density and dynamics (Punia *et al*. 2017) [18]. Weeds like *Phalaris minor*, *Avena fatua*, *Digitaria sanguinalis*, *Polygonum plebeium*, *Rumex spinosus*, *Gnaphalium indicum*, Spilanthes calva and Cyperus rotundus become predominant weed flora in wheat (Rahaman and Mukherjee, 2009; Prasad *et al*., 2012 and Joshi *et al*., 2017) [19-20, 7].

Weeds are the most omnipresent class of pests that interfere with crop plants through competition and allelopathy, resulting in direct loss to quality and quantity of the product (Gupta, 2004) [21] and indirectly increasing production costs including costs of labour, equipment, chemical and other management input (Singh *et al*., 2011) [22] Numerous approaches have been in practice for handing the problem of weed infestation such as hoeing, weeding, tillage, harrowing, crop rotation biological chemical control. The weed management are critical to improve the wheat production, productivity and income of the farmers. Therefore, this study was conducted to understand the weed management relationship in field condition and identify suitable wheat control methods for optimal wheat production.

Materials and Methods

The experiment was carried out to study the "Evaluation of different herbicides on weed management in Wheat (*Triticum aestivum* L.) under Gorakhpur region'' in the Crop Research farm of the National Post Graduate College Barhalganj Gorakhpur during, rabi season 2021-22. The experiment was conducted at the Crop Research Farm of National Post Graduate College, Barhalganj, Gorakhpur, during the rabi season of 2021-22. This farm is located at a distance of 65 km away from Gorakhpur at Gorakhpur Varanasi Road. The experimental site falls under sub- tropical zone in Indo-Gangetic plains and lies between 26.280 north latitude and 83.500 east longitude at an altitude 71.0 meter from mean sea level and is subjected to extremes of weather conditions. The soil type of experimental field was sandy loam in nature with pH of 7.3 and EC 0.26 dsm^{-1}, 45 kg available nitrogen, 18 kg available phosphorus, 112.50 kg available potassium per hectare.

During the crop growth period, the maximum temperature varied between 16.3 °C in January second week to 38.4 °C April fourth week and minimum temperature ranged from 8.1 °C in first week January to 17.3 °C in second week of April.

The experiment comprised of five treatments of post emergence herbicides and their combinations along with weed free and weedy check (control) (Table 1). The experiment was laid out in randomized block design with three replications.

The experimental field and when it came in the condition, twice ploughings and levelling was done. The plots were prepared by forming channels and bunds and leveled.

Wheat variety PBW-373 was sown by using seed rate of 100 kg/ha^{-1} on 30 November 2021 with funnel attached desi plough by maintaining row to row distance of 22.5 cm. the crop harvested on April 29, 2022. Frist weeding was done at 20 days after sowing and second at 40 days after sowing hand weeded plot. The quantity of herbicides as per treatments was sprayed by knap-sack sprayer with flat fan nozzle and the quantity of water used was 600 Lit/ha^{-1}.

The nutrients were applied at 120 kg N, 60 kg P_2O_5 and 40 kg K_2O ha^{-1}. The full dose of P_2O_5 and K_2O and half dose of nitrogen were drilled at 7 cm deep in the time of sowing basal dose. Remaining half dose of nitrogen was applied in two equal splits after first and second irrigation. The nitrogen was applied through urea, P_2O_5 through single super phosphate (SSP) and K_2O through Mureate of potash (MOP). All the agronomic management practices were done uniformly in all the treatments. Five irrigations were given during the entire period of crop, besides pre irrigation. The observations on weed population and weed dry weight were recorded at 30, 60 and 90 days after sowing and the weed control efficiency, weed index were estimated by using the formulae as given below.

Weed control efficiency (%)

The weed control efficiency of the different treatment was determined from the weed control dry weight calculated the following formula.

$$\text{Weed control efficiency} = \frac{W1 - w2}{w1} \times 100$$

Where,
W1 = Weed dry weight of weedy plot.
W2 = Weed dry weight of treated plots.
Weed index (%)

The weed index (WI) was calculated by using the following formula (Gill and Vijay kumar, 1969) [27].

$$(W.I.\ \%) = \frac{X-Y}{X} \times 100$$

Where,
X= yield from maximum weed free plot.
Y= yield from others treated plot.

The data on plant height was recorded on five plants which were tagged randomly in each treatment from each replication. The observations on number of tillers per plant,

length of spike, number of spikelets per-spike, test weight of 1000 grains, biological yield, grain and straw yield were recorded.

The data obtained on various observations were subjected to statistical analysis by using the techniques of the analysis of variance (ANOVA) and the treatment was tested by F-test and Critical difference (CD) at 5% level of significance (Panse and Sukhatme, 1989) [23] for each character to compare the differences among treatment means.

Table 1: Details of treatments and their symbols

S. No	Treatments	Dosage/ha-1		Symbols
		a.i. (g/ha)	Product dose(g/ha)	
1.	Weedy check	_	_	T_1
2.	Weed free (20 + 40 DAS)	_	_	T_2
3.	Metribuzin 70% WP (30 DAS)	175	250	T_3
4.	Metsulfuron-methyl 20% WP (25 DAS)	4	20	T_4
5.	Sulfosulfuron 75% WG (30 DAS)	25	33.3	T_5
6.	Sulfosulfuron 75% WG + Metsulfuron- methyl 5% WG 25DAS)	(30+2)	40	T_6
7.	Clodinofop-propargyl 15% + Metsulfuron- methyl 1% WP (30 DAS)	(60+4)	400	T_7

Result and Discussion

Weed flora

The weed community comprised both broad-leaved and narrow- leaved weeds.

Weed dry weight (g m^{-2})

At 30 DAS, significantly lower weed dry weight was recorded under the (T_2) Weed free (20+40 DAS) treatment (Table 2). Whereas, maximum dry weight was found under (T_1) weedy check. At this stage, the weed dry matter in all weedicide treatments was comparable. At 90 DAS, all the weed control treatments resulted significantly lower weed dry weight as compared to weedy cheek. The minimum weed dry weight was recorded under (T_2) Weed free (20+40 DAS) treatment but at par with (T_6) Sulfosulfuron 75% WG + Metsulfuron-methyl 5% WG 40 g/ha (25DAS), (T_7) Clodinofop-propargyl 15% + Metsulfuron- methyl 1% WP 400 g/ha (30 DAS), and (T_5) Sulfosulfuron 75% WG 33.3 g/ha (30 DAS), treatments. The maximum weed dry weight recorded in weedy check.

The application Sulfosulfuron 75% WG + Metsulfuron-methyl 5% WG, Clodinofop-propargyl 15% + Metsulfuron-methyl 1% WP, and Sulfosulfuron 75% WG was effective in controlling weeds as compared to rest of the treatments as the sherbicides controlled both narrow and broad leaf weeds (Kaur *et al*., 2018 and Gupta *et al*., 2019) [3, 1] owing to synergetic enhancement. Herbicidal combinations in general were better than sole application of herbicides in efficiency reducing the total weed dry weight.

Weed control efficiency (%)

At 90 DAS, maximum weed control efficiency (99.00%) was recorded in (T_2) Weed free (20+40 DAS) treatment (Table 2). Under different weedicides treatments, maximum weed control efficiency was noted with (T_6) Sulfosulfuron 75% WG + Metsulfuron-methyl 5% WG 40 g/ha (25 DAS) an it was followed by (T_7) Clodinofop-propargyl 15% + Metsulfuron-methyl 1% WP 400 g/ha (30 DAS), (T_5) Sulfosulfuron 75% WG 33.3 g/ha (30 DAS) and (T_4) Metsulfuron-methyl 20% WP 20 g/ha (25 DAS) 94.9, 92.9, 84.8 and 81.8 percent weed control efficiency, respectively. Because of better control of weeds under the herbicide mixture, weed control efficiency under these treatments was comparable to weed free. Meena *et al*., (2017) [2] reported that application of tank mixed Sulfosulfuron 75% WG + Metsulfuron-methyl 5% WG mixture provided maximum percent reduction in density and dry matter (90.05 & 95.35%) of total weeds over unweeded control followed by metsulfuron + iodosulfuron, clodinofop + metsulfuron and pinoxaden+ metsulfuron (88.8, 88.0 and 87.4& 94.7,94.4 and 94.2%) at 60 DAS which resulted into highest weed control efficiency (95.4, 94.7, 94.4 and 94.2%) and proved significantly superior over rest of the herbicidal treatments. Application of herbicide alone gave poor control of weeds, therefore hand lower weed control efficiency.

Weed index (%)

The weed index ranged from 2.27 to 47.45% under different treatments (Table 2). The treatment (T6) Sulfosulfuron 75% WG + Metsulfuron-methyl 5% WG 40 g/ha (25DAS), recorded lowest weed index (2.27%). Application of (T_7) Clodinofop-propargyl 15% + Metsulfuron- methyl 1% WP 400 g/ha (30 DAS) and (T_5) Sulfosulfuron 75% WG 33.3 g/ha (30 DAS) observed 6.95 and 10.45% weed index. Whereas, (T_1) weedy check showed maximum weed index (47.45%).

Table 2: Effect of different treatments on Weed dry weight g m^{-2} and Weed control efficiency, (%) and Weed index, (%) in wheat

Treatments	Weed dry weight g m-2 Days after sowing		Weed control efficiency, %	Weed index, %
	30	90	90 DAS	
Weedy check	17.00	33.00	0.0	47.45
Weed free	0.32	0.33	99.00	0.00
Metribuzin 70% WP	3.67	6.67	79.78	25.13
Metsulfuron-methyl 20% WP	3.67	6.00	81.81	12.06
Sulfosulfuron 75% WG	3.33	5.00	84.84	10.45
Sulfosulfuron 75% WG + Metsulfuron-methyl 5% WG	1.25	1.67	94.93	2.27
Clodinofop-propargyl 15% + Metsulfuron- methyl 1% WP	1.33	2.33	92.93	6.95
S.E.m. (±)	0.50	0.98		
C.D. at 0.5%	1.55	3.02		

Yield attributes Yield

Significantly effect on wheat grain yield was noticed among various herbicide treatments (table 3). The maximum grain yield (49.73 q/ha^{-1}) was obtained in (T_2) Weed free treatment which was statistically at par with (T_6) Sulfosulfuron 75% WG + Metsulfuron-methyl 5% WG herbicide treatment. The grain observed with application of (T_7) Clodinofop-propargyl 15% + Metsulfuron- methyl 1% WP and (T_5) Sulfosulfuron 75% WG were also statistically comparable to each other. The lowest wheat grain yield (26.13 q/ha^{-1}) was recorded in the (T_1) weedy check plot.

It is an agreement with findings of rani *et al*., 2020 [13] and Patel *et al*., 2021 [9]. The use of T_2 Weed free (20 +40 DAS) controls the weeds at early stage of crop growth and maintains relatively low weed infestation till the harvest of crop and growth, more nutrient uptake and subsequently increases the grain yield. It is agreement with the views of (Kumari *et al*., 2018 Meena *et al*., 2020 and Singh *et al*., 2020) [5, 7, 24].

All weed control treatments significantly increased the straw yield over (T_1) weedy check (Table 3). Highest straw yield (60.80 q/ha^{-1}) was recorded in (T_2) Weed free plot which was statistically at par with that of (T_6) Sulfosulfuron 75% WG + Metsulfuron-methyl 5% WG, (T_7) Clodinofop-propargyl 15% + Metsulfuron- methyl 1% WP, (T_5) Sulfosulfuron 75% WG and (T_4) Metsulfuron-methyl 20% WP treated plot. The lower straw yield (46.07 q/ha^{-1}) was recorded under (T_1) weedy check which was significantly inferior to that under rest of the treatments. The highest straw yield could be owing to the better management of mono and dicot weeds by herbicidal treatments and thus the crop was capable to make use of the available resources more proficiently. The similar findings were reported previously by researchers (Kumari *et al*., 2018 Meena *et al*., 2020 and Singh *et al*., 2020) [5, 7, 24].

The harvest index was in the range of 36.08 to 44.99% under different weed control treatments. Maximum harvest index (44.99%) was observed under (T_2) Weed free treatment which was comparable with (T_6) Sulfosulfuron 75% WG + Metsulfuron-methyl 5% WG, (T_7) Clodinofop- propargyl 15% + Metsulfuron- methyl 1% WP and (T_5) Sulfosulfuron 75% WG treatments. Minimum harvest index (36.08%) was observed under (T_1) weedy check treatment.

Table 3: Effect of different treatments on grain, straw yield (kg ha^{-1}) and harvest index (%) of wheat

Tr. No.	Treatments	Grain yield (q/ha^{-1})	Straw yield (q/ha^{-1})	HI (%)
T_1	Weedy check	26.13	46.07	36.08
T_2	Weed free	49.73	60.80	44.99
T_3	Metribuzin 70% WP	37.23	52.10	41.69
T_4	Metsulfuron-methyl 20% WP	43.73	59.27	42.45
T_5	Sulfosulfuron 75% WG	44.53	59.63	42.74
T_6	Sulfosulfuron 75% WG + Metsulfuron- methyl 5% WG	48.60	60.30	44.63
T_7	Clodinofop-propargyl 15% + Metsulfuron- methyl 1% WP	46.27	59.73	43.67
	S.E.m. (±)	1.04	1.10	1.22
	C.D. at 0.5%	3.21	3.40	3.76

Table 4: cost of cultivation, gross and net return and benefit ratio in wheat as in influenced by different treatments

Treatments	Cost of cultivation (₹/ha^{-1})	Gross return (₹/ha^{-1})	Net return (₹/ha^{-1})	B:C ratio
Weedy check	34,631.00	73,383.45	38,752.45	1.11
Weed free (20 + 40 DAS)	48,631.00	1,27,565.95	78,934.95	1.62
Metribuzin 70% WP 250 g/ha	35,031.00	98,463.45	63,432.45	1.81
Metsulfuron-methyl 20% WP 20/ha	34,906.00	1,14,787.45	79,881.45	2.28
Sulfosulfuron 75% WG 33.3 g/ha	35,371.00	1,16,561.45	81,190.45	2.29
Sulfosulfuron 75% WG + Metsulfuron-methyl 5% WG 40 g/ha	35,531.00	1,25,064.00	89,533.00	2.51
Clodinofop-propargyl 15% + Metsulfuron- methyl 1% WP 400 g/ha	35,331.00	1,20,112.55	84,781.55	2.39

Economics

Among the various herbicidal treatments, highest gross return, net return and B:C ratio was recorded by (T_6) Sulfosulfuron 75% WG + Metsulfuron-methyl 5% WG, At 25 DAS (Rs. ha^{-1} 125064, 89533 and 2.51, respectively) followed by (T_7) Clodinofop-propargyl 15% + Metsulfuron- methyl 1% WP ha-1 at 30 DAS (Rs. ha^{-1} 120112.55, 84781.55 and 2.39 respectively) (Table 4). Lowest returns and B: C was reported from weedy check. Due to better weed control minimum loss of yield was reported from plots where post emergence herbicides were applied sequentially and that was reflected in higher net return and B: C. higher net return were reported by (Kumari *et al*., 2018, Gupta *et al*., 2019 Meena *et al*., and Singh *et al*., 2020) [5, 7, 1, 24] due to herbicides application.

Conclusions

From present study, it can be conducted that Sulfosulfuron 75% WG + Metsulfuron-methyl 5% WG (30+2 g ha^{-1}) or Clodinofop-propargyl 15% + Metsulfuron- methyl 1% WP (60+4 g ha^{-1}) are most remunerative and effective herbicides for weed management in irrigated wheat under sandy loam soils of eastern Uttar Pradesh.

References

1. Gupta Anshul, Yadav SS, Yadav LR, Gupta AK. Weed Management and Fertility Levels Influence on Weed Growth and Performance of Wheat (*Triticum aestivum* L.). Int. J Curr. Microbiol. App. Sci. 2019;8(4):2038-2044.
2. Jena Twinkle, Babu Lal Meena. weed management options in conservation Agriculture. Int. J Curr. Microbiol. Appl. Sic. 2017;6(12):1232-1244.
3. Kaur Ekamdeep, Rakesh Sharma, Singh ND. Efficacy of Pre-Emergence and Post-Emergence Herbicides on Weed Control and Yield Wheat. Int. J Microbiol. App. Sci. 2018;7(2):883-887.

4. Kumari Priyanka JP, Saini R Kumar, Pankaj Chopra, Sharma RP. Impact of Seed Bed Manipulations and Weed Management Practices on Growth, Yield and Economics of Wheat under Organic Conditions. Int. J Curr. Microbiol. App. Sci. 2019;8(8):2889-2897.
5. Kumari Sunita, Singh KK, Amarjeet Kaujur, Manoj Kumar. Productivity and Profitability of Wheat (*Triticum aestivum* L.) as Influenced by Weed Management Practices under Iregated Condition. Int. J Microbiol. App. Sci. Special. 2018;;7:2824-2827.
6. Kumar Dinesh, Vivek S Kumar, Virendra Kumar. Integrated nutrient and weed-management practices on productivity and profitability in wheat (*Triticum aestivum* L.). Int. J Curr. Microbiol. App. Sci. 2021;10(02):3433-3443.
7. Meena BL, Singh RK, Meena RS, Kumawat N, Neeshu Joshi. Effect of Rice Residue and Weed Management Practices on Growth and Yield of Wheat. Int. J Curr. Microbiol. App. Sci. 2020;9(6):2361-2367.
8. Nekhat AF, Dhaka AK, Singh B, Amit Kumar, Axay Bhuker. Influence of herbicides and their mixture on growth, yield attributes productivity and economics of wheat. Journal of Pharmacognosy and Phytochemistry. 2020;9(5):258-262.
9. Patel Vipul Y, Patel BD, Patel VJ, Viradiya MB, Sodavadiya HB. Management of complex weed flora through herbicide combinations in irrigated Wheat (*Triticum aestivum* L.). Int. J Curr. Microbiol. App. Sci. 2021;10(01):3437-3444.
10. Paliwal Arunima, Singh VP, Tej Pratap, Singh SP, Guru SK, Joshi N, *et al*. Tillage and Weed Control Effect on weeds and Wheat Productivity. Int. J Curr. Microbiol. App. Sci. 2020;52(2):132-137.
11. Pisal RR, Sagarka BK. Integrated weed management in wheat with new molecules. Indian Journal of weed science. 2013;45(1):25-28.
12. Prinsa Hem, Joshi C, Guru SK. Evaluation of Herbicidal Efficacy for Management of Isoproturon-Resistant *Phalaris minor*. Int. J Microbiol. App. Sci. 2018;7(12):1067-1077.
13. Rani SP, Duary B, Sidhartha Priyanatam. Effect of Tillage and Weed management Practices on Weed Control and Yield in Wheat. Int. J Curr. Microbiol. App. Sci. 2020;9(6):2328-2335.
14. Rani Sarita, Kumar S, Hoonda VS, Jagdish Parshad. Influence of Varieties and Herbicides Mixture on Wheat Based Cropping System in Relation to Phytotoxicity and Residual Soil Nutrients. Int. J Microbiol. App. Sci. 2018;7(6):3573-3581.
15. Yadav HL, Gupta AK, Kumar S, Shweta Gupta. Comparative Efficacy of Herbicides Applied in Wheat and their Residual Effect on the Succeeding Crops. Int. J Curr. Microbiol. App. Sci. 2019;8(4):1866-1874.
16. Damalas CA, Eleftherohorinos IG. Dicamba and atrazine antagonism on sulfonylurea herbicides used for johnsongrass (*Sorghum halepense*) control in corn (*Zea mays*). Weed Technology. 2001 Mar;15(1):62-67.
17. Malik RK, Singh S. Littleseed canarygrass (*Phalaris minor*) resistance to isoproturon in India. Weed technology. 1995 Sep;9(3):419-425.
18. Punia R, Raina K, Agarwal R, Singh RP. Acacetin enhances the therapeutic efficacy of doxorubicin in non-small-cell lung carcinoma cells. PLoS One. 2017 Aug 31;12(8):e0182870.
19. Rahaman S, Mukherjee PK. Effect of herbicides on weed-crop association in wheat. Journal of Crop and Weed. 2009;5(2):113-116.
20. Prasad TN, Sudhakar P, Sreenivasulu Y, Latha P, Munaswamy V, Reddy KR, *et al*. Effect of nanoscale zinc oxide particles on the germination, growth and yield of peanut. Journal of plant nutrition. 2012 Apr 1;35(6):905-927.
21. Gupta S, Lehmann DR, Stuart JA. Valuing customers. Journal of marketing research. 2004 Feb;41(1):7-18.
22. Singh J, Mishra NS, Banerjee S, Sharma YC. Comparative studies of physical characteristics of raw and modified sawdust for their use as adsorbents for removal of acid dye. bioresources. 2011 Aug 1;6(3).
23. Panse VS, Sukhatme PV. Stastical method for agriculral workers. ICAR, New Delhi. 1989:70-2.
24. Singh N, Tang Y, Zhang Z, Zheng C. COVID-19 waste management: Effective and successful measures in Wuhan, China. Resources, conservation, and recycling. 2020 Dec;163:105071.
25. Pandey MR. Use of medicinal plants in traditional Tibetan therapy system in upper Mustang, Nepal. Our Nature. 2006;4(1):69-82.
26. Singh N, Singh RK, Bhunia AK, Stroshine RL. Efficacy of chlorine dioxide, ozone, and thyme essential oil or a sequential washing in killing Escherichia coli O157: H7 on lettuce and baby carrots. LWT. 2002 Dec 1;35(8):720-729.
27. Dua R, Sunkaria A, Kumar V, Gill KD. Impaired mitochondrial energy metabolism and kinetic properties of cytochrome oxidase following acute aluminium phosphide exposure in rat liver. Food and Chemical Toxicology. 2010 Jan 1;48(1):53-60.