International Journal of Agriculture and Food Science

ISSN Print: 2664-844X
ISSN Online: 2664-8458
NAAS Rating (2025): 4.97
IJAFS 2025; 7(8): 244-252
www.agriculturaljournals.com
Received: 07-07-2025
Accepted: 09-08-2025

Deepa Kushwaha
M.Sc., Agriculture,
Department of Agronomy,
Tilak Dhari P.G. College,
Jaunpur Uttar Pradesh, India

Shrish Kumar Singh
Professor and HOD,
Department of Agronomy,
Tilak Dhari P.G. College,
Jaunpur, Uttar Pradesh, India

Corresponding Author:
Deepa Kushwaha
M.Sc., Agriculture,
Department of Agronomy,
Tilak Dhari P.G. College,
Jaunpur Uttar Pradesh, India

Studies on native weed species with their weed density and dry weight at various stages of crop growth

Deepa Kushwaha and Shrish Kumar Singh

DOI: https://www.doi.org/10.33545/2664844X.2025.v7.i9c.752

Abstract
Wheat occupies about 17% of the world's cropped land and contributes 35% of the staple foods so its increased production is essential for food security. Weeds are one of the major constraints in wheat production as they reduce productivity due to competition, allelopathy, by providing habitats for pathogens as well as serving as alternate host for various insects and fungi and increase harvest cost. Weeds of experimental field were identified and classified into broad leaf weeds, grasses & sedges at 30, 60, 90 and 120 days after sowing. Weed count was taken in each plot at different stages of the crop using 0.5m × 0.5m quadrate and was expressed as number m^{-2}. The major grassy weed taken into account were *Cynodon dactylon* and broad leaf weeds were *Anagallis arvensis, Chenopodium album* and *Parthenium hysterophorus* and sedges weed was *Cyperus rotundus.* Rest of the weeds were taken as other weeds. All the weed falling, within the quadrate were cut close to the ground surface, separated species-wise and dried in hot air oven at a temperature of 85^0C till constant weight was achieved. Total weed dry matter was computed and expressed as g m^{-2}. The experimental field was infested with all three type of natural weeds (grassy, non - grassy and sedges) but non - grassy was dominated over grassy and sedges. The weed free condition produced highest grain yield (2677 kg ha^{-1}) which was at par with Sulfosulfuron + metsulfuron @ 32 g ha^{-1} and on par with rest applied herbicide. The higher grain yield ha^{-1} in weed free and Sulfosulfuron + metsulfuron @ 32 g ha^{-1} treated plot were mainly due to higher yield attributing character and harvest index has proved most effective herbicide for natural weed control of wheat crop.

Keywords: Wheat crop, weed, weed density

Introduction
Wheat occupies about 17% of the world's cropped land and contributes 35% of the staple foods so its increased production is essential for food security. Wheat is one of the major cereal crops grown in the Ethiopian highlands. Despite its importance Ethiopia, the mean national yield is 1.3 tons ha^{-1} which is 24% below the mean yield of Africa and 48% below the global mean yield of wheat Anonymous, (2018). Weeds are one of the major constraints in wheat production as they reduce productivity due to competition, allelopathy, by providing habitats for pathogens as well as serving as alternate host for various insects and fungi and increase harvest cost. Studies indicated that crop losses due to weed competition throughout the world as a whole, are greater than those resulting from combined effect of insect pests and diseases. It causes yield reduction in wheat from 10- 65% this more than eight-fold increase in wheat production was mainly due to the adoption of short stature high yielding varieties, increased fertilizers use, irrigation and herbicides. The high nutrient and water requirements along with less competitive nature of these high yielding dwarf varieties have provided the conducive environment for increased weed infestation. Weeds are regarded as most disdain to crop production and account for about one third of total losses caused by all the pests. Among various wheat based cropping system, rice-wheat is major one, occupying about 10.0 million hectare in India and worldwide this system occupies about 24 million hectare area Abbas *et al.*, (2009) [1]. Weeds cause significant annual regional productivity losses in rice-wheat system.
Weed infestation is one of the major factors limiting crop productivity. For realizing full genetic yield potential of the crop, the proper weed control is one of the essential ingredients. Weeds not only reduce the yield but also make the harvesting operation difficult.

Therefore, for sustaining food grain production to feed ever-increasing population and ensuring food security, effective weed management is very essential.

Materials and Methods

The present investigation entitled "Influence of Broad Leave Management on Growth and Yield of Wheat Crop" was carried out during *rabi* seasons of 2018-19 at Crop Research Farm (Pili Kothi) of Agronomy Department, Tilak Dhari Post Graduate College, Jaunpur. The materials used and methods employed in field experimentation, laboratory techniques and statistical procedures have been described in succeeding paragraphs:

Observations and sampling procedure

On one side in each plot, one meter length of the crop in the second row was marked for observation on plant height, number of shoot and post-harvest studies on the crop. On the other side of the plots, leaving the one border row, the area of second and third row used for observation on weeds and crop dry matter. The weed sample were taken by placing quadrate at marked area of each plot, whereas the crop samples were taken from the selected rows and recorded the reading according to the characters one fourth meter row of both the sides of the all plots were kept as border.

Studies on weeds

Observations on weeds were recorded at 30, 60, 90 and 120 days after sowing stages in the area marked for the purpose.

Weed flora

Weeds of experimental field were identified and classified into broad leaf weeds, grasses & sedges at 30, 60, 90 and 120 days after sowing.

Weed population

Weed count was taken in each plot at different stages of the crop using 0.5m × 0.5m quadrate and was expressed as number m^{-2}. The major grassy weed taken into account were *Cynodon dactylon* and broad leaf weeds were *Anagallis arvensis, Chenopodium album* and *Parthenium hysterophorus* and sedges weed was *Cyperus rotundus.* Rest of the weeds were taken as other weeds.

Dry matter of weed

All the weed falling, within the quadrate were cut close to the ground surface, separated species-wise and dried in hot air oven at a temperature of 85^0C till constant weight was achieved. Total weed dry matter was computed and expressed as g m^{-2}.

Crop studies

A separate area was marked for recording various growth observation on crop. Growth observations were recorded at 30, 60, 90, 120 days and at harvest stages of the crop and yield and yield attributes were recorded at harvest. Methodology adopted for recording various parameters follows here under. Number of shoot falling in one meter row length in net plot were counted and expressed as number of shoot m^{-2}.

Results and Discussion

Studies on weeds

The results obtained in the experiment have been described in terms of cause and effect relationship. Besides the main effects there may be interaction also, but an attempt has been made to discuss the meaningful and relevant factors, keeping in view the objectives set for the study and the reference evidences available on the subject.

Weed species

Weed-flora of the experimental field was collected, identified and classified in to three groups *viz.* grassy, non-grassy and sedges. In all there were seventeen weed species out of them three grassy weed, thirteen non-grassy weeds and one sedges (Table-1). As per weed density non-grassy weed dominated over grassy weeds as well as sedges, whereas density of sedges was higher than grassy weeds at all stages of crop growth (Table-2).

Out of seventeen weed species only five predominantly infested the experimental crop field that were *Cyperus rotundus*, *Anagallis arvensis, Chenopodum album, Cynodon dactylon, and Parthnium hysterophorus.*

Cyperus rotundus was the most dominant weed which constitute more than 30 per cent of total weed density. Other dominated weeds were *Anagallis arvensis*, *Chenopodum album*, *Cynodon dactylon* and *Parthenium hysterophorus*. All dominated weeds in aggregate contribute more than 88 per cent of total weed density at all stages of crop growth under weedy check. *Cyperus rotundus* contribute near.

Dominancy of *Chenopodium album, Anagallis arvensis, Cynodon dactylon* and *Cyperus rotundus* under wheat experimental field at Faizabad were also reported by Singh *et al.*, (2014). Relative density of non-grassy weeds were comparatively higher than grassy weeds and sedges during crop growth period (Table-10). The crop rotation, tillage and herbicides have pronounced effect on the type of weed flora (Anderson and Beck 2007 [2], Chhokar *et al.*, 2007a) [3]. Reduced tillage or no till wheat with high moisture in rice-wheat system favours infestation of *Rumex dentatus* L. and *Malva parviflora* L. (Chhokar *et al.*, 2007a) [3].

Table 1: Weed flora of the experimental field during crop season

Group No.	S. No.	Botanical Name	English name	Common Hindi Name	Family
	Grassy weeds				
I.	1.	*Cynodon dactylon*	Bermuda grass	Doob	Poaceae
	2.	*Avena Fatua*	Wild oat	Jangali jai	Poaceae
	3.	*Phalaris minor*	Little seed canary grass	Gehun ka mama, Gulli danda	Poaceae
II.	Non-grassy weeds				
	1.	*Anagallis arvensis*	Scortlet pimpernel	Krishnaneel	Primulaceae
	2.	*Asphodellus tenuifolius*	Wild onion	Piazi	Asphodeliaceae
	3.	*Chenopodium album*	Common lambsquarter	Bathua	Chenopodiaceae
	4.	*Convolvulus arvensis*	Field bind weed	Hirankhuri	Convolvulaceae
	5.	*Coronopus didymus*	Lesser swine-cress	Pitpapra	Brassicaceae
	6.	*Fumaria parviflora*	Indian fumitory	Ban soya	Fumariaceae
	7.	*Lathyrus aphaca*	Wild pea	Matri	Fabaceae

	8.	*Melilotus indica*	Yellow sweet clover	Peeli senji	Fabaceae
	9.	*Parthenium hysterophorus*	Carrot grass/Congress grass	Gajar ghass/Chandni	Compositae
	10.	*Rumex acetocella*	Red sorrel	Khatta palak	Polygonaceae
	11.	*Solanum nigrum*	Niught angle sedge	Makoi	Solanaceae
	12.	*Spergulla arvensis*	Corn spurry	Jangali dhania	Caryophallaceae
	13.	*Vicia sativa*	Common vetch	Akra	Fabaceae
III.	Sedges				
	1.	*Cyperus rotundus*	Purple nut sedge	Motha	Cyperaceae

About 37 per cent of total weed density at 30 days, where as its per cent density remain static at 60 and 90 days after sowing but again its relative density increased up to near about 40 per cent at 120 days stage of crop growth. *Anagallis arvensis* was recorded as second most dominated weed under weedy check, which maintain increasing trend of their density up to 90 days, thereafter drastic reduction was noticed under weedy check.

Table 2: Per cent composition of grassy weeds, non-grassy weeds and sedges at different stage in weedy check

Days after sowing	Grassy weeds	Nongrassy weeds	Sedges
30	17.32	46.23	37.12
60	16.43	51.34	32.07
90	13.23	55.00	33.02
120	17.10	41.34	40.24

The per cent relative density of *Chenopodium album* was increased with advancement of crop growth up to 90 days, thereafter it decreased at 120 days after sowing of crop. The per cent relative density of *Cynodon dactylon* was maximum at 30 days after sowing which was decreased at two successive observation dates i.e 60 and 90 days after sowing but lastly higher per cent density was recorded at 120 days after sowing of wheat crop. The *Parthenium hysterophorus* was a such dominant weed which per cent density increased with advancement of crop growth with effect from 30 days to 120 days of crop growth. Higher relative density of *Cyperus rotundus*, *Parthenium hysterophorus* and *Cynodon dactylon* were noticed at 120 days when compared with 90 days stage while relative density of other dominated weeds *viz. Anagallis arvensis* and *Chenopodium album* were decreased from 90 to 120 days after sowing (Table-11).

Table 3: Per cent composition of major weed species at 30, 60, 90 and 120 days stage after sowing in weedy check

Weed species	Days after sowing			
	30	**60**	**90**	**120**
Cyperus rotundus	34.65	33.24	34.12	41.25
Anagallis arvensis	20.32	21.22	22.45	08.34
Chenopodium album	17.43	19.45	21.65	22.59
Cynodon dactylon	16.45	14.23	12.65	13.09
Parthenium hysterophorus	07.21	10.31	09.34	15.34
Other weed species	06.92	08.34	07.34	12.06

Density of Total weed

The total weed density at 30, 60, 90 and 120 days after sowing under different treatment are presented in table-12 and depicted in fig-4. Their analyses of variance are given in appendix.

Density of total weeds were significantly influenced due to application of different weed control measures at all stage of crop growth. Total weed population per unit area was increased up to 90 days stage of crop growth, thereafter decreased at 120 days stage in weedy check.

None of the weeds recorded in weed-free plot at all stage of crop growth. Among the chemical weed control measures, minimum weed density was recorded by Pendimethalin @ 1.25 kg ha^{-1} treated plot, which was significantly superior as compare to weedy check at 30 days stage of crop growth, but application of Pendimethalin @ 1.25 kg ha^{-1} was unable to check the growth of weed completely as noticed in weed-free plot at this stage.

At 60 days stage of crop growth, Sulfosulfuron + metsulfuron @ 32 g ha^{-1} was most effective herbicide which resulted significantly lower population of total weed per unit area as compare to Metsulfuron + methyl @ 0.006 kg ha^{-1}, sulfosulfuron at 0.025 kg ha^{-1} and Metribuzin @ 0.2 kg ha^{-1} but remain at par with 2,4-D @ 0.500 kg ha^{-1} and Pendimethalin @ 1.25 kg ha^{-1}. Least effective herbicide was Metsulfuron + methyl @ 0.006 kg ha^{-1}, which recorded significantly high total weed density as compared to all other applied herbicides. Application of all herbicides, except Metsulfuron + methyl @ 0.004 kg ha^{-1} resulted significantly lower total weed density as compared to weedy check but none herbicide was effective as weed -free condition in respect to total weed density.

At 90 days, lowest total weed density was recorded by weed-free plot followed by clodinafop + metsulfuron @ 60 +4 g ha treated plot. Application of herbicides resulted relatively lower density of total weeds when compare to weedy check but none of them were able to reduce the density of total weeds up to tune of weed-free situation. Clodinofop + metsulfuron @ 60 + 4 g ha^{-1} treated plot resulted.

Table 4: Population of total weeds (No. m^{-2}) as affected by weed management practices in wheat

Treatment	Days after Sowing			
	30	**60**	**90**	**120**
T_1 *Weedy check*	17.12 (271.97)	18.32 (362.43)	19.16 (383.12)	13.45 (185.00)
T_2 *Weed free*	1.00 (00)	1.00 (00)	1.00 (00)	1.00 (00)
T_3 *Metsulfuron + methyl @ 0.004 kg ha^{-1}*	16.98 (262.97)	13.07 (133.97)	11.08 (139.54)	8.99 (97.65)

T4 *Metsulfuron + methyl @ 0.006 kg ha-1*	17.23 (268.97)	14.65 (177.27)	13.99 (195.36)	11.65 (135.97)
T5 *Pendimethalin @ 1.25 kg ha-1*	10.98 (118.15)	12.36 (161.86)	13.51 (181.39)	11.97 (123.83)
T6 *Sulfosulfuron @ 0.025 kg ha-1*	16.58 (264.92)	13.67 (203.51)	14.27 (223.79)	13.12 (147.48)
T7 *Metribuzin @ 0.2 kg ha-1*	14.78 (120.54)	13.27 (165.24)	12.09 (180.36)	11.97 (125.83)
T8 *2,4-D @ 0.500 kg ha-1*	16.36 (269.87)	12.31 (152.97)	12.85 (165.21)	10.58 (112.32)
T9 *Sulfosulfuron + metsulfuron @ 32 g ha-1*	17.21 (278.98)	14.75 (158.56)	14.04 (167.45)	12.97 (116.98)
T10 *Clodinofop + metsulfuron @ 60 + 4 g ha-1*	16.08 (262.75)	17.62 (313.00)	18.22 (331.25)	13.11 (171.76)
SEm ±	0.56	0.46	0.47	0.51
CD at 5%	1.45	1.25	1.02	1.09

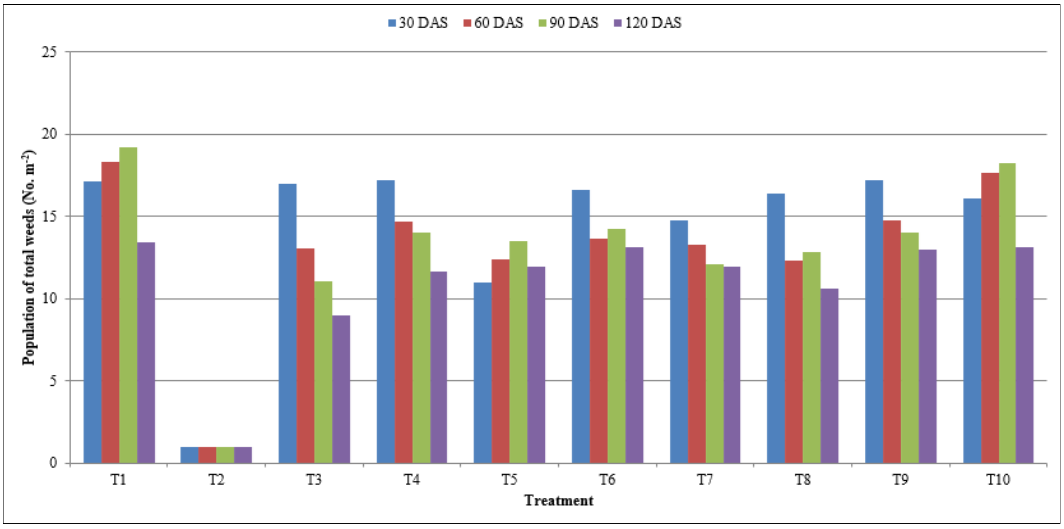

Fig 1: Population of total weeds (No. m^{-2}) as affected by weed management practices in wheat

Significantly lower total weed population per unit area as compared to sulfosulfuron at 0.025 kg ha^{-1}, Metribuzin @ 0.2 kg ha^{-1} and Metsulfuron + methyl @ 0.006 kg ha^{-1}, treated plot but remain statistically similar with 2,4-D @ 0.500 kg ha^{-1} and Pendimethalin @ 1.25 kg ha^{-1}. Metsulfuron + methyl @ 0.006 kg ha^{-1}, was found least effective herbicide to check the growth of total weed and it remains ineffective when compared with weedy check. The second top most effective herbicide was 2,4-D @ 0.500 kg ha^{-1} which resulted significantly lower density of total weeds as comapare to sulfosulfuron at 0.025 kg ha^{-1} and Metsulfuron + methyl @ 0.006 kg ha^{-1}, treated plot and remain at par with top most herbicide i.e Clodinofop + metsulfuron @ 60 + 4 g ha^{-1}, Pendimethalin @ 1.25 kg ha^{-1} and Metribuzin @ 0.2 kg ha^{-1} treated plot.

Among the herbicidal treatment, minimum total weed density was recorded by Clodinofop + metsulfuron @ 60 + 4 g ha^{-1} treated plot which was significantly superior than metribuzin at 0.2 kg ha^{-1}, sulfosulfuron at 0.025 kg ha^{-1} and Metsulfuron + methyl @ 0.006 kg ha^{-1}, treated plot and at par with 2,4-D @ 0.500 kg ha^{-1} and pendimethalin at 1.25 kg ha^{-1} treated plot in respect to total weed density at 120 days stage of crop growth.

Density of *Anagallis arvensis*

The mean value for density of *Anagallis arvensis* recorded at 30, 60, 90 and 120 days stage of wheat crop are compiled in table- 11 and their analyses of variance are given in appendix-III.

Population of *Anagallis arvensis* per unit area was influenced significantly due to weed control measures at all stages of crop growth. Density of *Anagallis arvensis* was incrased up to 90 days, thereafter it decreased at 120 days stage of crop growth under weedy check. Maximum and minimum density of *Anagallis arvensis* were noticed in weedy check and weed free condition, respectively at 30, 60, 90 and 120 days stage of crop growth.

Table 5: Population of *Anagallis arvensis* (No. m^{-2}) as affected by weed management practices in wheat

Treatment	Days after Sowing			
	30	60	90	120
T1 *Weedy check*	9.07 (59.87)	9.67 (70.43)	8.09 (79.85)	5.76 (13.86)
T2 *Weed free*	1.00 (00)	1.00 (00)	1.00 (00)	1.00 (00)
T3 *Metsulfuron + methyl @ 0.004 kg ha-1*	9.08 (46.75)	7.34 (21.52)	6.31 (27.12)	3.26 (6.09)
T4 *Metsulfuron + methyl @ 0.006 kg ha-1*	8.24 (46.86)	6.87 (15.86)	4.34 (12.87)	2.98 (8.65)
T5 *Pendimethalin @ 1.25 kg ha-1*	3.87 (8.45)	4.45 (19.00)	4.60 (20.25)	2.23 (4.00)
T6 *Sulfosulfuron @ 0.025 kg ha-1*	7.00 (49.06)	4.93 (23.50)	5.55 (30.00)	2.95 (7.75)
T7 *Metribuzin @ 0.2 kg ha-1*	6.81 (45.75)	4.79 (20.25)	4.98 (25.00)	2.32 (5.75)
T8 *2,4-D @ 0.500 kg ha-1*	8.41 (53.65)	4.28 (17.50)	4.19 (16.75)	1.92 (2.75)
T9 *Sulfosulfuron + metsulfuron @ 32 g ha-1*	7.86 (49.34)	5.67 (21.34)	4.67 (26.70)	2.87 (6.05)
T10 *Clodinofop + metsulfuron @ 60 + 4 g ha-1*	7.32 (51.57)	7.96 (59.50)	8.46 (62.50)	3.11 (8.75)
SEm ±	0.45	0.47	0.56	0.42
CD at 5%	0.98	0.99	1.13	0.87

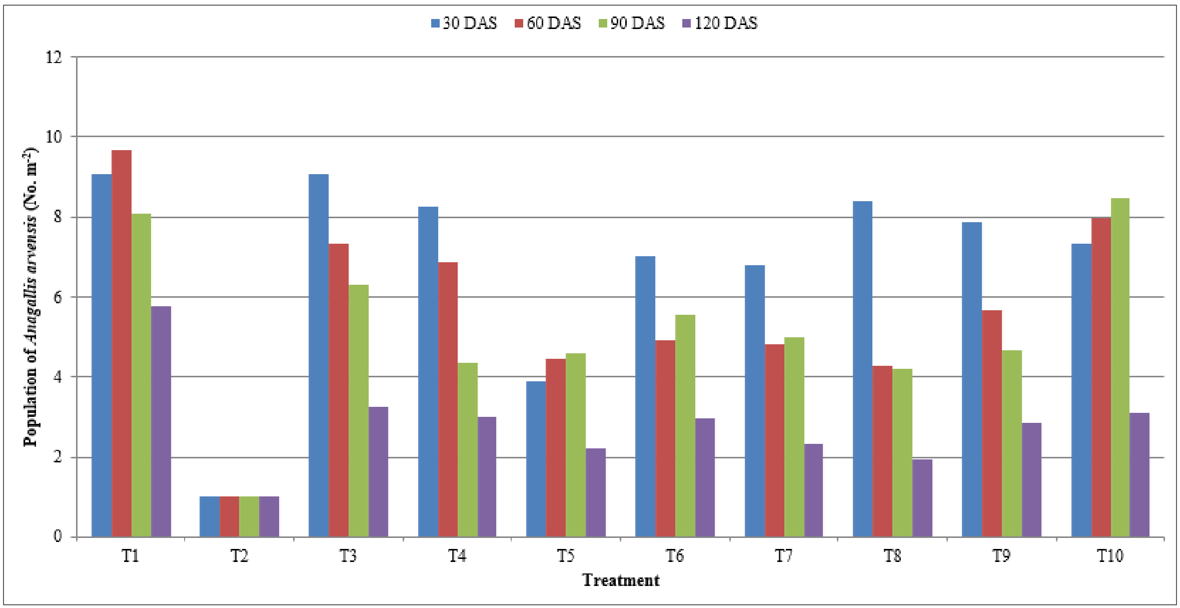

Fig 2: Population of *Anagallis arvensis* (No. m^{-2}) as affected by weed management practices in wheat

At 30 days stage of crop growth, the significant reduction in total count of *Anagallis arvensis* with in one metre square area of experimental crop was registered under weed-free and Pendimethalin @ 1.25 kg ha^{-1} treated plot when compared to weedy check. Pre-emergence application of Pendimethalin @ 1.25 kg ha^{-1} resulted significantly less density of *Anagallis arvensis* but it was not effective as weed-free treatment.

At 60 days stage of crop growth, application of Clodinofop + metsulfuron @ 60 + 4 g ha^{-1} was significantly superior than sulfosulfuron at 0.025 kg ha^{-1}, Metsulfuron + methyl @ 0.006 kg ha^{-1}, and remain at par with other applied herbicides in respect to control of *Anagallis arvensis*. None of the herbicide could not able to reduce the density of *Anagallis arvensis* up to tune of weed-free situation. 2,4-D @ 0.500 kg ha^{-1} have identified second most effective herbicide for reduction of density of *Anagallis arvensis* which was significantly superior than Metsulfuron + methyl @ 0.006 kg ha^{-1}, and weedy check but remain at par with all other applied herbicides. Least effective herbicide noticed under the experiment was Metsulfuron + methyl @ 0.006 kg ha^{-1} treated plot which registered statistically similar density of *Anagallis arvensis* as recorded under weedy check.

At 90 days stage of wheat crop, Clodinofop + metsulfuron @ 60 + 4 g ha^{-1} registered lowest population of *Anagallis arvensis* per unit area whereas highest density of *Anagllis arvensis* was recorded in Metsulfuron + methyl @ 0.006 kg ha^{-1} treated plot, among various applied herbicides. All herbicides treated plots resulted significantly less number of *Anagallis arvensis* when compared with weedy check. Clodinofop + metsulfuron @ 60 + 4 g ha^{-1} was most effective herbicide and recorded significant less density of *Anagallis arvensis* as compared to all other applied herbicides, except post emergence application of 2,4-D @ 0.500 kg ha^{-1}.

Application of Clodinofop + metsulfuron @ 60 + 4 g ha^{-1} resulted lowest density of *Anagallis arvensis* when compared among various applied herbicide treated plot and it was on par with all other herbicide. All herbicide were not able to reduce the density of *Anagallis arvenis* when compared with weedy check but none of the herbicide was effective as weed-free condition at 120 days stage of crop growth.

Density of *Chenopodium album*

The observation pertaining to the density of *Chenopodium album* at 30, 60, 90 and 120 days stages under different weed control measures are presented in table-14 and their analyses of variance are given in appendix-.

The number of *Chenopodium album* per unit area was influenced significantly due to weed control measured at all stages of crop growth. The maximum number of *Chenopodium album* per unit area was recorded in weedy check whereas minimum from weed-free plot at 30, 60, 90 and 120 days stage of crop growth. Population of *Chenopodium album* per unit area were towards increasing way up to 90 days of crop growth thereafter it decreased at 120 days under weedy check condition.

At 30 days stage of crop growth, pre-emergence application of Pendimethalin @ 1.25 kg ha^{-1} resulted significant reduction in population of *Chenopodium album* per unit area when compare to weedy check but this herbicide was not effective as weed-free in respect to density of *Chenopodium album.*

Among the various herbicides, maximum and minimum density of *Chnopodium album* were recorded in Metsulfuron + methyl @ 0.006 kg ha^{-1}, and Clodinofop + metsulfuron @ 60 + 4 g ha^{-1} treated plot, respectively at 60, 90 and 120 days of crop growth. Application of Clodinofop + metsulfuron @ 60 + 4 g ha^{-1} resulted significantly lower density of *Chenopodium album* as compared to Metribuzin @ 0.2 kg ha^{-1}, Pendimethalin @ 1.25 kg ha^{-1}, sulfosulfuron at 0.025 kg ha^{-1} and Metsulfuron + methyl @ 0.006 kg ha^{-1} but this herbicide was at par with 2,4-D @ 0.500 kg ha^{-1}. The second top most effective herbicide in reduction of *Chenopodium album* density was 2,4-D @ 0.500 kg ha^{-1} which was superior than sulfosulfuron @ 0.025 kg ha^{-1} and Metsulfuron + methyl @ 0.006 kg ha^{-1} bur it was at par with Pendimethalin @ 1.25 kg ha^{-1} and Metribuzin @ 0.2 kg ha^{-1} at 60 days stage of crop growth.

At 90 days stage of crop growth, Clodinofop + metsulfuron @ 60 + 4 g ha^{-1} recorded lowest population of *Chenopodium album* per unit area whereas highest

Table 6: Population of *Chenopodium album* (No. m^{-2}) as affected by weed management practices in wheat

Treatment	Days after Sowing			
	30	60	90	120
T_1 *Weedy check*	8.97 (52.98)	9.76 (65.98)	6.98 (70.65)	5.46 (30.97)
T_2 *Weed free*	1.00 (00)	1.00 (00)	1.00 (00)	1.00 (00)
T_3 *Metsulfuron + methyl @ 0.004 kg ha^{-1}*	8.56 (44.65)	5.25 (15.25)	4.27 (13.86)	3.03 (8.36)
T_4 *Metsulfuron + methyl @ 0.006 kg ha^{-1}*	7.56 (39.86)	4.76 (7.98)	3.76 (9.42)	1.98 (3.76)
T_5 *Pendimethalin @ 1.25 kg ha^{-1}*	3.45 (7.75)	2.76 (14.25)	3.82 (13.75)	2.96 (8.00)
T_6 *Sulfosulfuron @ 0.025 kg ha^{-1}*	7.34 (45.76)	4.54 (19.75)	5.29 (27.25)	3.59 (12.25)
T_7 *Metribuzin @ 0.2 kg ha^{-1}*	7.32 (43.65)	4.17 (16.50)	3.92 (14.50)	3.19 (9.25)
T_8 *2,4-D @ 0.500 kg ha^{-1}*	6.36 (40.65)	3.60 (12.25)	3.57 (12.00)	2.67 (6.25)
T_9 *Sulfosulfuron + metsulfuron @ 32 g ha^{-1}*	7.45 (44.78)	4.63 (19.67)	5.32 (27.57)	3.62 (12.14)
T_{10} *Clodinofop + metsulfuron @ 60 + 4 g ha^{-1}*	7.34 (45.67)	7.42 (54.50)	8.18 (66.25)	3.67 (20.75)
SEm ±	0.23	0.40	0.43	0.56
CD at 5%	0.76	0.83	0.89	1.23

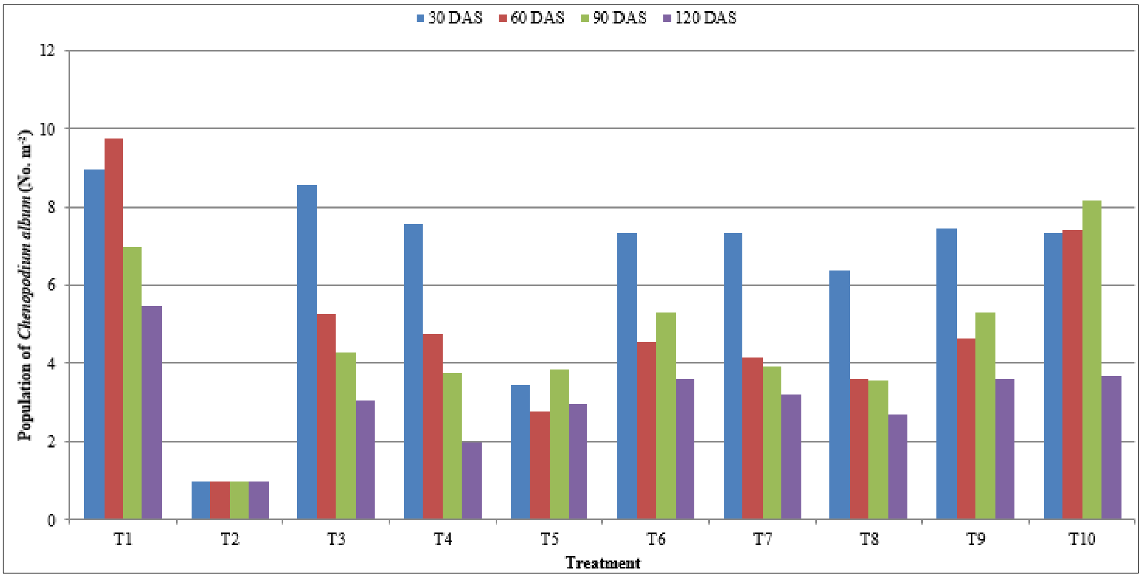

Fig 3. Population of *Chenopodium album* (No. m^{-2}) as affected by weed management practices in wheat

density of *Chenopodium album* was noticed in Metsulfuron + methyl @ 0.006 kg ha^{-1}, among various applied herbicide. None of the herbicidal treatment become able to provide same response as noticed under weed-free condition. Application of Clodinofop + metsulfuron @ 60 + 4 g ha^{-1} has resulted significantly lower density of *Chenopodium album* as compared to Metribuzin @ 0.2 kg ha^{-1}, Pendimethalin @ 1.25 kg ha^{-1}, sulfosulfuron at 0.025 kg ha^{-1} and Metsulfuron + methyl @ 0.006 kg ha^{-1}, and at par with 2,4-D @ 0.500 kg ha^{-1} treated plot. Metsulfuron + methyl @ 0.006 kg ha^{-1}, was least effective herbicide of experiment which could not control the growth and development of *Chenopodium album* as noticed under other applied herbicides at all stages of crop growth.

The study of table-14 indicated that herbicidal treatment particularly Clodinofop + metsulfuron @ 60 + 4 g ha^{-1} was most effective herbicide in respect to reduction of *Chenopodium album* while other herbicide recorded significantly higher density of *Chenopodium album* than Clodinofop + metsulfuron @ 60 + 4 g ha^{-1}, except 2,4-D @ 0.500 kg ha^{-1} treated plot at 120 days stage of crop growth. At this stage none of the herbicide could not reduce the density of *Chenopodium album* as recorded in weed-free condition.

Density of *Cynodon dactylon*

The mean value for density of *Cynodon dactylon* recoded under various weed control measures at 30, 60, 90 and 120 days stage of crop growth are compiled in table-15 and their analyses of variance are given in appendix-.

Population of *Cynodon dactylon* per unit area was influenced significantly due to weed control measure at all stage of wheat crop. Density of *Cynodon dactylon* was increased up to 60 days thereafter it decreased in succession of crop growth period under weedy check. Maximum and minimum number of *Cynodon dactylon* per unit area were noticed in weedy check and weed-free condition, respectively at 30,60,90 and 120 days stage of wheat crop.

Table 7: Population of *Cynodon dactylon* (No m^{-2}) as affected by weed management practices in wheat

Treatment	Days after Sowing			
	30	60	90	120
T_1 *Weedy check*	7.56 (45.09)	7.32 (49.45)	6.98 (44.76)	4.78 (23.67)
T_2 *Weed free*	1.00 (00)	1.00 (00)	1.00 (00)	1.00 (00)
T_3 *Metsulfuron + methyl @ 0.004 kg ha^{-1}*	7.98 (35.76)	6.87 (32.97)	5.78 (29.98)	3.09 (15.38)
T_4 *Metsulfuron + methyl @ 0.006 kg ha^{-1}*	7.76 (40.76)	6.65 (31.87)	5.34 (27.98)	3.00 (13.97)
T_5 *Pendimethalin @ 1.25 kg ha^{-1}*	6.71(24.75)	5.43 (28.75)	5.52 (29.75)	4.25 (17.25)

T_6 *Sulfosulfuron @ 0.025 kg ha^{-1}*	6.21 (38.75)	6.16 (37.25)	5.84 (33.50)	4.78 (22.00)
T_7 *Metribuzin @ 0.2 kg ha^{-1}*	6.43 (37.25)	5.84 (33.25)	5.65 (31.25)	4.44 (18.75)
T_8 *2,4-D @ 0.500 kg ha^{-1}*	6.65 (38.32)	5.22 (26.50)	5.36 (28.00)	4.19 (16.75)
T_9 *Sulfosulfuron + metsulfuron @ 32 g ha^{-1}*	6.09 (36.34)	5.45 (32.47)	5.78 (30.56)	3.97 (18.75)
T_{10} *Clodinofop + metsulfuron @ 60 + 4 g ha^{-1}*	6.24 (36.25)	6.40 (40.25)	6.02 (35.50)	5.01 (24.25)
SEm ±	0.54	0.56	0.45	0.53
CD at 5%	1.23	1.12	0.95	1.03

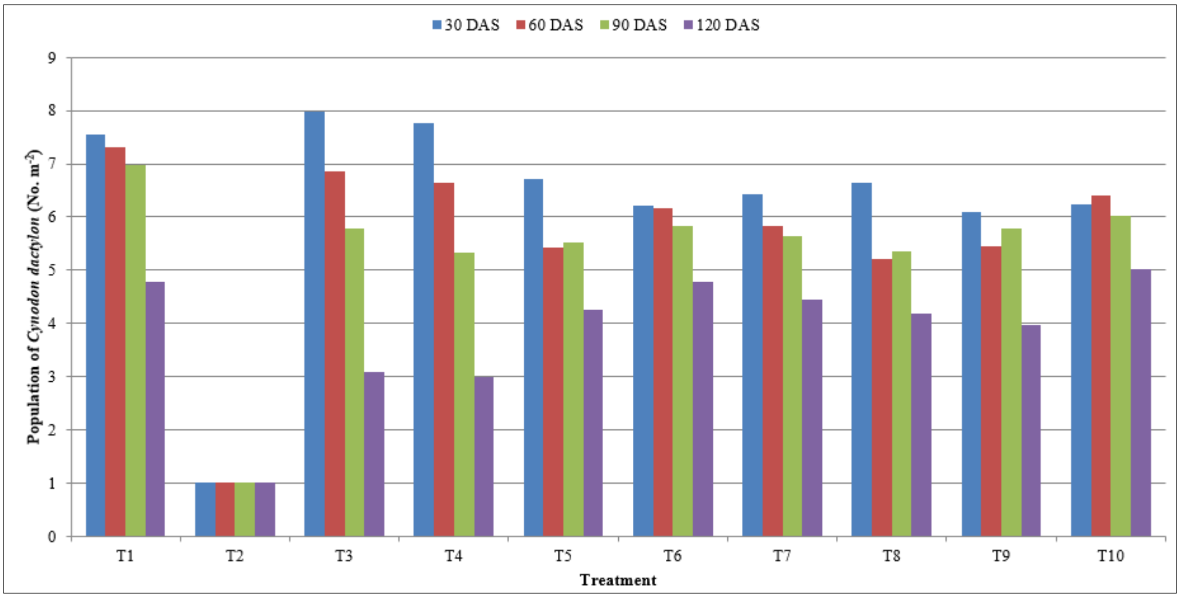

Fig 4: Population of *Cynodon dactylon* (No m^{-2}) as affected by weed management practices in wheat

At 30 days stage of crop growth, the significant reduction in density of *Cynodon dactylon* was registered under weed-free and Pendimethalin @ 1.25 kg ha^{-1} treated plot when compared to other treatments. Pre-emergence application of Pendimethalin @ 1.25 kg ha^{-1} resulted significantly less density of *Cynodon dactylon* but it was not effective as weed-free treatment.

At 60 days stage of wheat crop, application of Clodinofop + metsulfuron @ 60 + 4 g ha^{-1} was proved as most effective herbicide and registered significantly lower density of *Cynodon dactylon* as compared to Metribuzin @ 0.2 kg ha^{-1}, sulfosulfuron at 0.025 kg ha^{-1} and Metsulfuron + methyl @ 0.006 kg ha^{-1} but remain at par with 2,4-D @ 0.500 kg ha^{-1} and Pendimethalin @ 1.25 kg ha^{-1} treated plot in respect to control of *Cynodon dactylon*. None of the herbicide could not able to reduce the population of *Cynodon dactylon* per unit area up to the tune of weed-free condition. Second most effective herbicide as noticed under experiment was 2,4-D @ 0.500 kg ha^{-1} which was significantly superior than sulfosulfuron at 0.025 kg ha^{-1} and weedy check, but remain at par with all other applied herbicides in respect to density of *Cynodon dactylon*. Least effective herbicide registered under the experiment was Metsulfuron + methyl @ 0.006 kg ha^{-1}. The density of *Cynodon dactylon* under Metsulfuron + methyl @ 0.006 kg ha^{-1} and weedy check plot were statistically similar as 60 days stage of crop growth.

Among the various applied herbicides Clodinofop + metsulfuron @ 60 + 4 g ha^{-1} resulted lowest density of *Cynodon dactylon* whereas highest density of *Cynodon dactylon* was noticed under Metsulfuron + methyl @ 0.006 kg ha^{-1} treated plot at 90 days stage of crop growth. All herbicide treated plots recorded significantly lower density of *Cynodon dactylon* when compared with weedy check, except Metsulfuron + methyl @ 0.006 kg ha^{-1}. Clodinofop + metsulfuron @ 60 + 4 g ha^{-1} was most effective herbicide and recorded significant less density of *Cynodon dactylon* as compared to sulfosulfuron at 0.025 kg ha^{-1} and Metsulfuron + methyl @ 0.006 kg ha^{-1} treated plot at 90 days after sowing of the crop seed.

Application of Clodinofop + metsulfuron @ 60 + 4 g ha^{-1} resulted maximum suppression of *Cynodon dactylon* when compared among various applied herbicides treated plot and it was on par with sulfosulfuron at 0.025 kg ha^{-1} and Metsulfuron + methyl @ 0.006 kg ha^{-1} for the density of recorded *Cynodon dactylon*. All herbicide were able to reduce the density of *Cynodon dactylon* when compared with weedy check but none of them was not effective as weed free condition at 120 days stage of crop growth.

Density of *Parthenium hysterophorus*

The mean value for density of *Parthenium hysterophorus* at 30, 60, 90 and 120 days stage of crop growth are presented in table-16 and their analysis of variance are given in appendix-.

Population of *Parthenium hysterophorus* per unit area was influenced significantly due to weed control measures at all stages of crop growth. Density of *Parthenium hysterophorus* was increased up to 90 days thereafter it decreased at 120 days under weedy check. Maximum and minimum density of *Parthenium hyterophorus* were recorded in weedy check and weed-free plot, respectively at 30, 60, 90 and 120 days stage of crop growth. Various applied herbicide treated plot registered lesser density of *Parthenium hysterophorus* when compared to weedy check at 60, 90 and 120 days stage of crop growth.

At 30 days stage of crop growth, maximum suppression of *Parthenium hysterophorus* was noticed under weed-free plot which registered significantly lesser density of *Parthenium hysterophorus* when compared to other treatment including weedy check. Pre-emergence application of Pendimethalin

@ 1.25 kg ha^{-1} resulted significantly lower density of *Parthenium hysterophorus* as compared to weedy check but it was not effective as weed-free condition.

Among the various applied herbicide maximum suppression of *Parthenium hysterophorus* growth was registered under Clodinofop + metsulfuron @ 60 + 4 g ha^{-1} treated plot. The reduction in density of *Parthenium hysterophorus* due to application of Clodinofop + metsulfuron @ 60 + 4 g ha^{-1} was significantly less when compared to weedy check, Metribuzin @ 0.2 kg ha^{-1}, sulfosulfuron at 0.025 kg ha^{-1} and Metsulfuron + methyl @ 0.006 kg ha^{-1} treated plot but remain at par with Pendimethalin @ 1.25 kg ha^{-1} and 2,4-D @ 0.500 kg ha^{-1} treated plot at 60 days stage of crop growth. Though the combine application of Clodinofop + metsulfuron @ 60 + 4 g ha^{-1} has proved most effective against density of *Parthenium hysterophorus* but not up to tune of weed-free condition. The second top most effective herbicide was 2,4-D @ 0.500 kg ha^{-1}, which was on par with Metribuzin @ 0.2 kg ha^{-1}, sulfosulfuron at 0.025 kg ha^{-1} and Metsulfuron + methyl @ 0.006 kg ha^{-1} but at par with Pendimethalin @ 1.25 kg ha^{-1} and most effective herbicide in respect to density of *Parthenium hysterophorus* at 60 days stage of crop growth.

Table 8: Population of *Parthenium hysterophorus* (No. m^{-2}) as affected by weed management practices in wheat

Treatment	Days after Sowing			
	30	60	90	120
T_1 *Weedy check*	6.03 (21.54)	5.32 (41.53)	6.26 (38.35)	4.98 (29.98)
T_2 *Weed free*	1.00 (00)	1.00 (00)	1.00 (00)	1.00 (00)
T_3 *Metsulfuron + methyl @ 0.004 kg ha^{-1}*	5.09 (25.88)	4.76 (18.97)	2.78 (13.98)	3.56 (14.87)
T_4 *Metsulfuron + methyl @ 0.006 kg ha^{-1}*	5.47 (36.87)	4.07 (23.46)	5.56 (19.27)	3.28 (13.56)
T_5 *Pendimethalin @ 1.25 kg ha^{-1}*	2.78 (8.54)	3.54 (11.75)	4.54 (19.75)	4.64 (20.75)
T_6 *Sulfosulfuron @ 0.025 kg ha^{-1}*	6.09 (38.75)	6.16 (37.25)	5.84 (33.50)	4.78 (22.00)
T_7 *Metribuzin @ 0.2 kg ha^{-1}*	4.65 (20.98)	4.02 (15.25)	4.76 (21.75)	4.72 (21.50)
T_8 *2,4-D @ 0.500 kg ha^{-1}*	4.87 (18.45)	3.32 (10.25)	4.23 (17.00)	4.42 (18.75)
T_9 *Sulfosulfuron + metsulfuron @ 32 g ha^{-1}*	4.87 (23.67)	4.54 (19.75)	5.06 (24.75)	5.02 (24.25)
T_{10} *Clodinofop + metsulfuron @ 60 + 4 g ha^{-1}*	5.09 (19.25)	5.51 (29.50)	5.73 (32.00)	5.44 (28.75)
SEm ±	0.35	0.45	0.44	0.41
CD at 5%	0.79	0.98	0.91	0.89

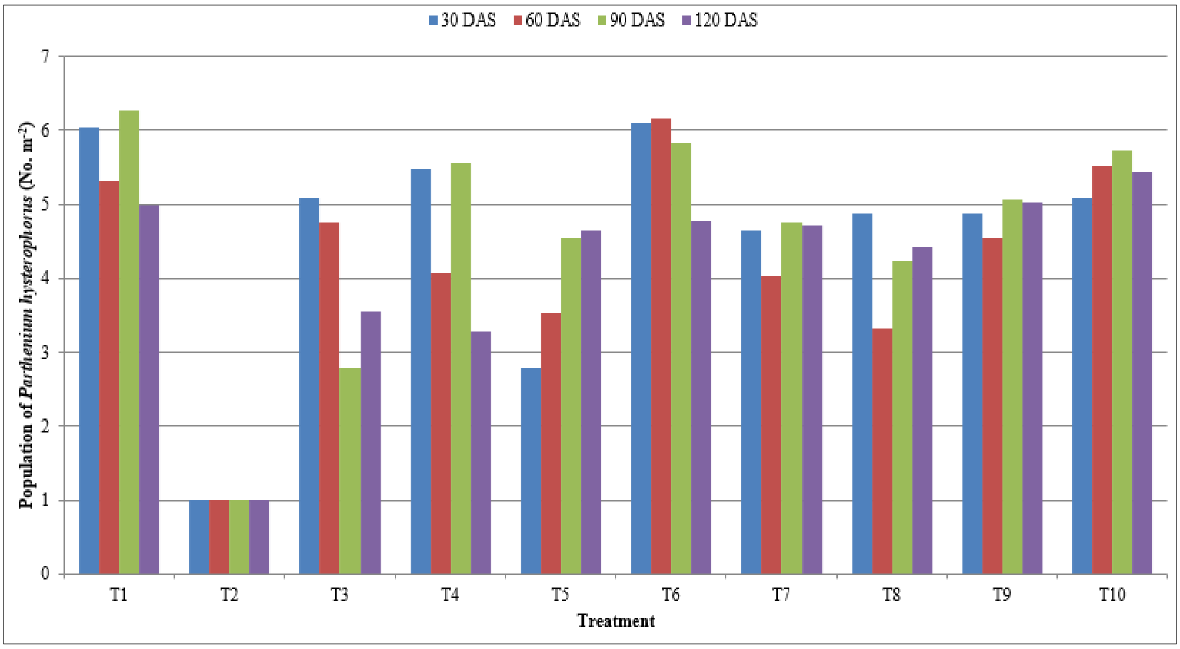

Fig 5: Population of *Parthenium hysterophorus* (No. m^{-2}) as affected by weed management practices in wheat

References

1. Abbas SH, Saleem M, Maqsood M, Mujahid MY, Mahmood-ul-Hassan, Saleem R. Weed density and grain yield of wheat as affected by spatial arrangements and weeding techniques under rain fed conditions of Pakistan. Journal of Agricultural Science. 2009;46(4):354-359.
2. Anderson RL, Beck DL. Characterizing weed communities among various rotations in central south Dakota. Weed Technology. 2007;21:76-79.
3. Chhokar RS, Sharma RK, Jat GR, Pundir AK, Gathala MK. Effect of tillage and herbicides on weeds and productivity of wheat under rice-wheat growing system. Crop Protection. 2007;26:1689-1696.
4. Cochran WG, Cox GM. Experimental Design. Asia Publication House; 1963.
5. Ekka V, Tiwari N, Kujur S, Nayak D, Jha MK. Effect of quinchlorac herbicide on weed indices on yield attributes and yields of transplanted rice. The Pharma Innovation Journal. 2020;9(4):79-83.
6. Jaiswal RK, Panday D, Agrwal HP, Gilhare L. Effect of broad leaf herbicides on yield and yield attributes of irrigated wheat. International Journal of Chemical Studies. 2020;8(2):1705-1707.

7. Jat RK, Banga RS, Yadav A. Resource conservation techniques and pendimethalin for control of weeds in durum wheat cultivars. Indian Journal of Weed Science. 2013;45(2):93-98.
8. Willey RW. Intercropping its importance and research needs, part-I, competition and yield advantages. Field Crop Abstract. 1997;32:1-10.
9. Yadav NS, Dixit A. Bioefficiency of some herbicides and their mixtures against complex weed flora in wheat. Indian Journal of Weed Science. 2014;46(2):180-183.