www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(4): 1066-1069

www.thepharmajournal.com
Received: 08-01-2023
Accepted: 13-03-2023

PK Mishra
JNKVV- College of Agriculture, Ganjbasoda, Vidisha, Madhya Pradesh, India

Vinita Parte
JNKVV- College of Agriculture, Ganjbasoda, Vidisha, Madhya Pradesh, India

Ashish Shrivastava
JNKVV- College of Agriculture, Ganjbasoda, Vidisha, Madhya Pradesh, India

OP Dhurve
JNKVV- College of Agriculture, Ganjbasoda, Vidisha, Madhya Pradesh, India

RK Bhatnagar
JNKVV- College of Agriculture, Ganjbasoda, Vidisha, Madhya Pradesh, India

Corresponding Author:
PK Mishra
JNKVV- College of Agriculture, Ganjbasoda, Vidisha, Madhya Pradesh, India

Efficiency of pre-emergence herbicide Flurochloridone against complex weed flora in chickpea and their residual effect on soybean crop

PK Mishra, Vinita Parte, Ashish Shrivastava, OP Dhurve and RK Bhatnagar

Abstract
The field experiment was conducted at Farm B of College of Agriculture- Ganjbasoda, Vidisha during 2019-20 and 2020-21. The purpose of the experiment was to study the effect of pre emergence herbicide against complex weed flora in chickpea. The experiment was laid out in a randomized block design with six treatments, *viz*., T_1- Flurochloridone 20% CS @ 500 g a.i/ha, T_2- Flurochloridone 20% CS @ 625 g a.i/ha, T_3- Flurochloridone 20% CS @ 750 g a.i/ha, T_4- Pendimethalin 30% EC @ 1000 g a.i/ha, T_5- Weed free check and T_6- Weedy check with four replication. Dominant broad leaf weeds that invade the field were *Anagallis arvensis, Chenopodium album* and *Argemone maxicana.* Besides, *Parthenium hysterophorous, Sinapsis arvensis* and *Amranthus retroflexus* were also observed. Among the herbicidal treatments, Flurochloridone 20% CS @ 750 g a.i/ha registered higher weed control efficiency and showed minimum weed index during both the years followed by T_2 (11.08 and 10.73%).Weed free plot produced maximum yield of chickpea closely followed by Flurochloridone 20% CS @ 750 g a.i/ha which was at par to Flurochloridone 20% CS @ 625 g a.i/ha. Phytotoxicity on succeeding crop soybean was not observed during the course of investigation and this crop registered almost similar plant population and yield under all herbicidal treatments.

Keywords: Pre emergence, herbicide, weed control efficiency, chickpea, soybean

Introduction
India is the major pulse growing country in the world accounting for one third of the acreage under pulses and one fourth to the world production. Among all the pulses, chickpea is a vital pulse in India mostly grown in *rabi* season. It also called as gram, chana etc. Chickpea has high nutritive value among pulses and mostly contains 20.6% protein, 61.2% carbohydrate and 2.2% fat. Besides, it is rich in malic acid and mineral like calcium, iron and phosphorous. Chickpea occupies a prominent place and is gaining importance with increasing popularity due to its high nutritional value, high tonnage capacity, low cost of cultivation and it can withstand drought season and cold climate efficiently. Chickpea has the capacity to fix the atmospheric nitrogen up to 180 kg ha^{-1} to the soil and play an important role in sustaining soil productivity (Baldev *et al*., 1988) [1].

Among states, Madhya Pradesh shared around 40 percent in total production followed by Uttar Pradesh and Rajasthan contributing only 16 and 14 percent, respectively. Chickpea is short stature crop with slow initial growth and therefore, heavily infested with wide spectrum of weeds. The critical period of crop weed competition for chickpea is up to 40 days. The early emergence and fast growth of the weeds lead to severe crop weed competition for light, moisture, nutrients and space, which culminates in heavy reduction in growth and yield of chickpea and lessens the profitability (Chopra *et al*., 2003) [4]. About 40-45 percent reduction in yield of chickpea due to severe infestation of weeds is estimated. If proper control measures are not taken, then the loss in terms of yield may increase up to 75 percent in chickpea (Chaudhary *et al*., 2005) [3]. The best method of weed control is traditional method, but it is costlier and time consuming. Therefore, it is necessary to develop cheaper method of weed control, which is none other than herbicidal method. Chemical method of weed control can be very effective in killing the weeds before their emergence as well as after emergence. The use of herbicides has assumed a great significance particularly in intensive agriculture due to their ability of providing quick, effective, selective and economic weed management in term of time, money and labour.

Suitable herbicide for effective control of mixed weed flora is required for better adoption in this crop by farmers. Hence, present investigation was carried out to study the efficiency of pre emergence herbicide flurochloridone against complex weed flora in chickpea and their residual effect on succeeding soybean crop.

Material and Methods

The field experiment was conducted at farm B of College of Agriculture, Ganjbasoda (230 85'N Latitude, 770 92'E Longitude) during *rabi* season in year of 2019-20 and 2020-21 to study the effect of pre emergence herbicide in chickpea. The experiment was laid out in a randomized block design with six treatments, *viz*., T_1- Flurochloridone 20% CS @ 500 g a.i/ha, T_2- Flurochloridone 20% CS @ 625 g a.i/ha, T_3- Flurochloridone 20% CS @ 750 g a.i/ha, T_4- Pendimethalin 30% EC @ 1000 g a.i /ha, T_5- Weed free check (Hand Weeding twice) and T_6- Weedy check with four replications. Chickpea, *cv*. JG 12 was sown at 20th November during both the years i.e 2019-20 and 2020-21. The fertilizer dose 20:60:20 kg/ha of N, P and K was applied as basal and thoroughly mixed with the soil. The seeds were inoculated with *rhizobium* culture and sown at 80 kg/ha by keeping 30 x 10 cm spacing at a depth of 5 cm. As per treatments, pre emergence application of Flurochloridone and Pendimethalin were applied next day of sowing. Foliar herbicides spray was done with knap-sack sprayer using flat-fan nozzle in 500 litre of water/ha. The population of all associated weeds was recorded at 15, 30 and 45 days after application (DAA) by quadrate count method in each plot. The quadrate (0.5 m x 0.5 m) was randomly placed at four places in each plot and then the total as well as species wise weed count was recorded. The data was thus obtained were transformed and expressed in no./m^2. Weed dry matter of all weed species (grasses, broad leaved and sedges) was collected from net plot area were first sun dried and then kept in an electric oven at 70^0C for 48 hours for drying till to reach at a constant weight. After this, dry weight was recorded treatment wise and expressed in kg/ha. The data on total weed count was subjected to square root transformation (x + 0.5) to normalize their distribution (Gomez and Gomez, 1984). Weed control efficiency was measured as a percentage reduction in weed dry weight under different treatments compared to weedy check. The weed control efficiency (WCE) was calculated using the formula (Mani *et al*., 2015) [9] as given below:

$$WCE\ (\%) = \frac{\text{Dry weight of weeds in weedy check- Dry weight of weeds in treated plot}}{\text{Dry weight of weeds in weedy check}} \times 100$$

The weed index was calculated as per formula suggested by Gill and Kumar (1969) [5]. After harvesting of crop, cleaned seeds were weighed to record seed yield per plot and then it converted in q/ha. All the data were statistically analyzed to draw a valid conclusion. To find out the residual effect of herbicides application in succeeding soybean crop which was applied during *rabi* season 2019 and 2020 on chickpea was done during *rabi* season on the treated plots without disturbance. Succeeding soybean was sown in each plot. Soybean, *cv*. JS 20 34 was sown at 25th June during *kharif* 2020 and 22nd June during *kharif* 2021. The germination percentage, plant population and yield of soybean crop were recorded and data were used for analysis.

Results

Major weed flora in experimental field

The experiment field was infested with grassy, broad leaf weeds and sedges. Among the grassy weeds, *Asphodelus tenuifolius* and *Cynodon dactylon* was most dominant weed. Dominant broad leaf weeds that invade the field were *Anagallis arvensis*, *Chenopodium album* and *Argemone maxicana*. Besides, *Parthenium hysterophorous*, *Sinapsis arvensis* and *Amranthus retroflexus* were also observed. Chickpea crop field was also invaded by sedges i.e *Cyperus rotundus.*

Weed control efficiency

The weed control efficiency showed the efficacy of herbicides with respect to controlling weeds over weedy check. Data related to weed control efficiency under different treatments are given in Table 1 and 2. The maximum WCE was noticed under weed free plot (T_5) during both the years. Among the herbicidal treatments, maximum WCE was found with the application of Flurochloridone 20% CS @ 750 g a.i/ha (T_3) closely followed by Flurochloridone 20% CS @ 625 g a.i/ha (T_2). The minimum WCE found with the application of Flurochloridone 20% CS @ 500 g a.i/ha (T_1). The same trend was also found in second year.

Table 1: Effect of pre emergence herbicide Flurochloridone on weed control efficiency (%) at 30 DAA during *rabi* 2019-20

Treatment details	Grasses		Broad leaf weeds				Sedges
	Asphodelus tenuifolius	*Cynodon dactylon*	*Anagallis arvensis*	*Chenopodium album*	*Argemone maxicana*	Other BLW	*Cyperus rotundus*
T_1- Flurochloridone 20% CS @ 500 g a.i/ha	77.85	73.79	72.39	75.86	77.14	68.10	79.44
T_2- Flurochloridone 20% CS @ 625 g a.i/ha	90.64	92.13	89.43	90.86	91.17	84.71	91.35
T_3- Flurochloridone 20% CS @ 750 g a.i/ha	92.29	93.31	90.37	91.34	91.59	85.54	91.90
T_4- Pendimethalin 30% EC @ 1000 g a.i/ha	85.23	86.27	82.96	83.24	83.74	76.05	85.91
T_5- Weed free check (Hand weeding twice)	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T_6- Untreated control (Weedy check)	-	-	-	-	-	-	-

Table 2: Effect of pre emergence herbicide Flurochloridone on weed control efficiency (%) at 30 DAA during *rabi* 2020-21

Treatment details	Grasses		Broad leaf weeds				Sedges
	Asphodelus tenuifolius	*Cynodon dactylon*	*Anagallis arvensis*	*Chenopodium album*	*Argemone maxicana*	Other BLW	*Cyperus rotundus*
T_1- Flurochloridone 20% CS @ 500 g a.i/ha	79.06	75.11	73.48	75.79	77.19	71.09	78.67
T_2- Flurochloridone 20% CS @ 625 g a.i/ha	91.05	91.34	90.08	89.74	91.49	85.85	91.39
T_3- Flurochloridone 20% CS @ 750 g a.i/ha	92.18	92.14	90.97	91.04	91.79	86.86	92.19

T_4- Pendimethalin 30% EC@ 1000 g a.i/ha	86.49	85.56	83.90	84.61	85.82	77.62	85.13
T_5- Weed free check (Hand weeding twice)	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T_6- Untreated control (Weedy check)	-	-	-	-	-	-	-

Weed index: Data pertaining to weed index (%) are presented in Table 3 and 4. Weed index was computed as the yield reduction comparative to highest yielding treatment. Among the herbicidal treatments, T_3 showed minimum weed index (6.32 and 5.56%) during both the years followed by T_2 (11.08 and 10.73%).The maximum weed index (51.15 and 52.45%) was recorded under weedy check indicating the reduction in chickpea yield due to presence of weeds throughout crop growth period. Lower weed index in herbicidal treatments might be due to better weed control which provided favorable conditions for crop growth, which ultimately increased the seed yield of chickpea crop as compared to weedy check treatment. Similar results also reported by Chandel and Saxena (2001) [2].

Table 3: Effect of pre emergence herbicide Flurochloridone on weed index and chickpea yield during *rabi* 2019-20

Treatment details	Weed index (%)	Yield (q/ha)
T_1- Flurochloridone 20% CS @ 500 g a.i/ha	34.65	8.79
T_2- Flurochloridone 20% CS @ 625 g a.i/ha	11.08	11.96
T_3- Flurochloridone 20% CS @ 750 g a.i/ha	6.32	12.60
T_4- Pendimethalin 30% EC @ 1000 g a.i/ha	29.52	9.48
T_5- Weed free check (Hand weeding twice)	-	13.45
T_6- Untreated control (Weedy check)	51.15	6.57
S.Em+	-	0.54
CD	-	1.62

Table 4: Effect of pre emergence herbicide Flurochloridone on weed index and chickpea yield during *rabi* 2020-21

Treatment details	Weed index (%)	Yield (q/ha)
T_1- Flurochloridone 20% CS @ 500 g a.i/ha	33.38	10.06
T_2- Flurochloridone 20% CS @ 625 g a.i/ha	10.73	13.48
T_3- Flurochloridone 20% CS @ 750 g a.i/ha	5.56	14.26
T_4- Pendimethalin 30% EC @ 1000 g a.i/ha	22.65	11.68
T_5- Weed free check (Hand weeding twice)	-	15.10
T_6- Untreated control (Weedy check)	52.45	7.18
S.Em+	-	0.58
CD	-	1.76

Chickpea yield

Seed yield is an important parameter which decides the efficiency and superiority of a particular treatment over other treatments. Data pertaining to chickpea yield (q/ha) as affected by different treatments are given in Table 3 and 4. Chickpea yield (q/ha) significantly varied due to different treatments. All the treated plots receiving either hand weeding or pre emergence application of herbicides significantly produced higher yields than weedy check (T_1). Weed free (T_5) plot produced maximum yield closely followed by Flurochloridone 20% CS @ 750 g a.i/ha (T_3) and Flurochloridone 20% CS @ 625 g a.i/ha (T_2) during both the years. The next best treatment was Pendimethalin 30% EC @ 1000 g a.i/ha (T_4) and it was at par to Flurochloridone 20% CS @ 500 g a.i/ha (T_1). Weedy check (T_1) produced the lowest chickpea yield.

Residual effect of herbicides on succeeding crop

The residual effect of different herbicides on soybean crop were recorded in terms of germination percent, plant population and yield. The results revealed that germination percentage of soybean was not significantly differed with herbicide treatments imposed in the previous chickpea crop. The plant population of soybean crop at 30 DAS ranged from 37.2 to 39.1 during *kharif* 2020 and 38.1 to 39.9 during *kharif* 2021 under all the treatments. Yield of soybean showed no distinct variation due to different dose of herbicides (Table 5 and 6).The residual effects of herbicides depend upon soil texture, soil reaction, organic matter content and climatic conditions of a place. A long time gap between application of herbicides and crop harvest, microbial degradation and precipitation cause the degradation and leaching down of the herbicide (Idapuganti *et al*., 2005) [7]. Pendimethalin @ 1000 g/ha remained biologically active upto 25 to 26 days in sandy loam soil; 75% pendimethalin was lost in 45 days (Kewat, 1998) [8]. In the present study, there was long time gap between the application of herbicide to chickpea crop to sowing of succeeding crop, which seemed to be sufficient for degradation of the herbicides. The result indicated that both the herbicides used for weed control in chickpea are safe for raising of soybean in rotation with chickpea.

Table 5: Residual effect of chickpea herbicide on germination, plant population and yield of succeeding crop soybean during *kharif* 2020

Treatment details	Germination (%)	Plant population (no./m^2) at 30 DAS	Soybean yield (q/ha)
T_1- Flurochloridone 20% CS @ 500 g a.i/ha	87.20	37.9	9.22
T_2- Flurochloridone 20% CS @ 625 g a.i/ha	85.52	38.3	9.88
T_3- Flurochloridone 20% CS @ 750 g a.i/ha	84.58	38.4	10.05
T_4- Pendimethalin 30% EC @ 1000 g a.i/ha	85.47	37.9	9.87
T_5- Weed free check (Hand weeding twice)	86.24	39.1	10.19
T_6- Untreated control (Weedy check)	86.14	37.2	9.20
CD	NS	NS	NS

Table 6: Residual effect of chickpea herbicide on germination, plant population and yield of succeeding crop soybean during *kharif* 2021

Treatment details	Germination (%)	Plant population (no./m^2) at 30 DAS	Soybean yield (q/ha)
T_1- Flurochloridone 20% CS @ 500 g a.i/ha	86.23	38.1	10.57
T_2- Flurochloridone 20% CS @ 625 g a.i/ha	86.54	39.2	9.89
T_3- Flurochloridone 20% CS @ 750 g a.i/ha	86.64	39.9	10.25
T_4- Pendimethalin 30% EC @ 1000 g a.i/ha	86.78	38.4	9.98
T_5- Weed free check (Hand weeding twice)	86.74	38.9	9.59
T_6- Untreated control (Weedy check)	86.19	38.7	9.87
CD	NS	NS	NS

Conclusion

Based on the study of two year experiment it can be concluded that among herbicidal treatments, application of Flurochloridone 20% CS @ 750 g a.i/ha provide better weed control, maximum weed control efficiency, lower weed index and higher seed yield. It also concluded that germination of succeeding soybean crop was not significantly affected by residual effect of herbicide applied to chickpea.

References

1. Baldev B, Ramanujan S, Jain HK. Nutritive value of pulses. Pulses crops (Ed) Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi; c1988. p. 561-593.
2. Chandel AS, Saxena SC. Effect of some new post emergence herbicide on weed parameter and seed yield of soybean. Indian Journal of Agronomy. 2001:46(2):332-338.
3. Chaudhary BM, Patel JJ, Delvadia DR. Effect of weed management practices and seed rates on weeds and yield of chickpea. Indian journal of Weed Science. 2005;37(3&4), 271-272.
4. Chopra N, Chopra NK, Singh HP. Loss in seed yield and quality due to weed stress in chickpea (*Cicer arietinum* L.). Indian Journal of Agricultural Sciences. 2003;73(6):350-351.
5. Gill GS, Kumar V. Weed index-a new method for reporting weed control trials. Indian Journal of Agronomy. 1969;14(2):96-98.
6. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research (2nd edition). A Wiley- Inter science publication. John Wiley and Sons, Newyork, USA; c1984. p. 316-55.
7. Idapuganti RG, Rana DS, Sharma R. Influence of integrated weed management on weed control and productivity of soybean (*Glycine max*). Indian Journal of Weed Science. 2005;37:126-128.
8. Kewat ML. Direct and residual effect of herbicides on soybean-wheat sequence. Ph.D. thesis. Indian Agricultural Research Institute, New Delhi; c1998.
9. Mani VS, Pandita ML, Gautam KC, Bhagwandas. Weed killing chemicals in potato cultivation. Indian Farm. 2015;23:7-13.