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## Effect of pre emergence herbicide Flurochloridone against weed complex in chickpea

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#### Abstract

A field experiment was conducted during two consecutive (*Rabi*) winter seasons (2019-20 and 2020-21) at Farm b of College of Agriculture, Ganjbasoda, Vidisha (Madhya Pradesh), to study the effect of pre emergence herbicide in chickpea. Result indicated that all weed species was minimum under weed free treatment at all the growth stages. Among the herbicidal treatments, the lowest density of all weeds was recorded under Flurochloridone 20% CS @ 750 g a.i/ha which was at par to Flurochloridone 20% CS @ 625 g a.i/ha during both the years. The weed control efficiency was maximum under weed free plot during both the years. All the treated plots receiving either hand weeding or pre emergence application of herbicide significantly produced higher yields than weedy check.

**Keywords:** Pre emergence, herbicide, weed density, weed control efficiency, chickpea

#### Introduction

Chickpea (*Cicer arietinum* L.) is one of the most important *rabi* pulse crop of India and occupies first position among the pulses. It was grown in an area of 8.4 million hectare and producing 10.13 million tones with productivity of 1.07 t/ha during 2019-20 in India (Anonymous, 2019) [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 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) [3]. 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) [2]. The initial 60 days period considered to critical for weed crop competition in chickpea (Singh and Singh, 2000) [6], but continuously facing of the scarcity of labour and increase in labour cost, manual weed control has become a difficult task. 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 evaluation of Flurochloridone on mixed weed flora and their effect on yield of chickpea.

#### Material and Methods

The field experiment was conducted at farm B of College of Agriculture, Ganjbasoda (23° 85'N Latitude, 77° 92'E Longitude) during *rabi* season in year of 2019-20 and 2020-21 to study the effect of Flurochloridone herbicide in chickpea.

The experiment was laid out in a randomized block design with six treatments, viz., T<sub>1</sub>- Flurochloridone 20% CS @ 500 g a.i/ha, T<sub>2</sub>- Flurochloridone 20% CS @ 625 g a.i/ha, T<sub>3</sub>- Flurochloridone 20% CS @ 750 g a.i/ha, T<sub>4</sub>- Pendimethalin 30% EC @ 1000 g a.i/ha, T<sub>5</sub>- Weed free check (Hand Weeding twice) and T<sub>6</sub>- Weedy check with four replications. Chickpea, cv. JG 12 was sown at 20<sup>th</sup> 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 within three days 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 45 days after application (DAA) by quadrat count method in each plot. The quadrat (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<sup>2</sup>. Weed dry matter of all weed species (grasses, broad leaved and sedges) was collected from net plot area at 45 DAA were first sun dried and then kept in an electric oven at 70 °C 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) [4]. 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) [5] as given below:

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

After harvesting of crop, cleaned seeds were weighed to record seed yield per plot and then it converted in kg/ha. All the data were statistically analyzed to draw a valid conclusion.

## 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 hysterophorus*, *Sinapsis arvensis* and *Amranthus retroflexus* were also observed. Chickpea crop field was also invaded by sedges i.e *Cyperus rotundus*.

## Density of weeds

The population of weeds differed significantly due to weed control treatments (Table 1 and 2). The lowest density of weeds was recorded under weed free. Among herbicidal treatments, the lowest density of all weeds (grassy, broad leaf weeds and sedges) was recorded under application of Flurochloridone 20% CS @ 750 g a.i/ha (T<sub>3</sub>) which was at par to Flurochloridone 20% CS @ 625 g a.i/ha (T<sub>2</sub>) during both the years. Both treatments i.e T<sub>3</sub> and T<sub>2</sub> were superior to Pendimethalin 30% EC @ 1000 g a.i/ha (T<sub>4</sub>) and Flurochloridone 20% CS @ 500 g a.i/ha (T<sub>1</sub>). The intensity of all weeds was recorded maximum in weedy check (T<sub>6</sub>), which differed significantly with all remaining treatments.

**Table 1:** Effect of Flurochloridone on weed density (no./m<sup>2</sup>) at 45 DAA during *rabi* 2019-20

Treatment details	Grasses		Broad leaf weeds				Sedges
	<i>Asphodelus tenuifolius</i>	<i>Cynodon dactylon</i>	<i>Anagallis arvensis</i>	<i>Chenopodium album</i>	<i>Argemone maxicana</i>	Other BLW	<i>Cyperus rotundus</i>
T <sub>1</sub> -Flurochloridone 20% CS @ 500 g a.i/ha	4.12 (2.15)	5.21 (2.39)	5.50 (2.45)	4.21 (2.17)	4.13 (2.15)	7.61 (2.85)	3.71 (2.05)
T <sub>2</sub> -Flurochloridone 20% CS @625 g a.i/ha	2.03 (1.59)	1.97 (1.57)	2.25 (1.66)	1.91 (1.55)	2.07 (1.60)	3.97 (2.11)	1.89 (1.55)
T <sub>3</sub> -Flurochloridone 20% CS@ 750 g a.i/ha	1.91 (1.55)	1.85 (1.53)	2.03 (1.59)	1.68 (1.48)	1.86 (1.54)	3.70 (2.05)	1.71 (1.49)
T <sub>4</sub> -Pendimethalin 30% EC @ 1000 g a.i/ha	2.85 (1.83)	2.74 (1.80)	3.46 (1.99)	2.92 (1.85)	2.91 (1.85)	5.69 (2.49)	2.69 (1.79)
T <sub>5</sub> -Weed free check (Hand weeding twice)	1.58 (1.44)	1.63 (1.46)	1.79 (1.51)	1.36 (1.36)	1.58 (1.44)	3.70 (2.05)	1.43 (1.39)
T <sub>6</sub> - Weedy check (Untreated control)	15.52 (4.00)	17.23 (4.21)	15.61 (4.01)	13.08 (3.69)	14.73 (3.90)	18.95 (4.41)	15.07 (3.95)
S.Em+	0.09	0.08	0.09	0.08	0.07	0.10	0.07
CD	0.27	0.24	0.27	0.25	0.23	0.31	0.22

Figures in parenthesis are square root transferred  $\sqrt{x+0.5}$  values

**Table 2:** Effect of Flurochloridone on weed density (no./m<sup>2</sup>) at 45 DAA during *rabi* 2020-21

Treatment details	Grasses		Broad leaf weeds				Sedges
	<i>Asphodelus tenuifolius</i>	<i>Cynodon dactylon</i>	<i>Anagallis arvensis</i>	<i>Chenopodium album</i>	<i>Argemone maxicana</i>	Other BLW	<i>Cyperus rotundus</i>
T <sub>1</sub> -Flurochloridone 20% CS @ 500 g a.i/ha	4.09 (2.14)	5.45 (2.44)	5.96 (2.54)	4.46 (2.23)	4.39 (2.21)	7.97 (2.91)	4.02 (2.13)
T <sub>2</sub> -Flurochloridone 20% CS @625 g a.i/ha	2.13 (2.36)	2.19 (1.64)	2.48 (1.73)	1.87 (1.54)	2.20 (1.64)	4.14 (2.15)	2.11 (1.62)
T <sub>3</sub> -Flurochloridone 20% CS@ 750 g a.i/ha	1.96 (1.57)	1.97 (1.57)	2.19 (1.64)	1.61 (1.45)	1.92 (1.56)	3.89 (2.10)	1.94 (1.56)
T <sub>4</sub> -Pendimethalin 30% EC @ 1000 g a.i/ha	2.94 (1.85)	3.14 (1.91)	3.68 (2.04)	2.98 (1.87)	3.09 (1.89)	5.96 (2.54)	2.94 (1.85)
T <sub>5</sub> -Weed free check (Hand weeding twice)	1.40 (1.38)	1.67 (1.47)	1.96 (1.57)	1.38 (1.37)	1.59 (1.45)	3.42 (1.98)	1.52 (1.42)
T <sub>6</sub> - Weedy check (Untreated control)	17.14 (4.20)	19.09 (4.43)	17.12 (4.20)	14.99 (3.94)	16.46 (4.12)	21.46 (4.69)	16.88 (4.17)
S.Em+	0.08	0.08	0.10	0.10	0.09	0.10	0.09
CD	0.26	0.25	0.31	0.30	0.28	0.31	0.28

Figures in parenthesis are square root transferred  $\sqrt{x+0.5}$  values

### Total dry weight of weeds

Data pertaining to dry weight of dominant weeds and other minor weeds recorded at 45 DAA as influenced by different treatments are given in Table 3 and 4. The dry weight of all weeds was significantly varied due to different treatments. It is evident from the data that all the treated plots significantly reduced the weed dry weight over weedy check. The dry weight was significantly maximum under weedy check ( $T_6$ ).

The biomass of all weeds significantly reduced under all treated plots. The minimum dry weight of weeds was recorded under weed free ( $T_5$ ) at the stage of 45 DAA. Among the herbicidal treatments, minimum dry matter of weed was recorded under Flurochloridone 20% CS @ 750 g a.i/ha ( $T_3$ ) which was significantly superior over all treatments except Flurochloridone 20% CS @ 625 g a.i/ha ( $T_2$ ) during both the years.

**Table 3:** Effect of Flurochloridone on weed dry matter ( $\text{g}/\text{m}^2$ ) at 45 DAA during *rabi* 2019-20

Treatment details	Grasses		Broad leaf weeds				Sedges
	<i>Asphodelus tenuifolius</i>	<i>Cynodon dactylon</i>	<i>Anagallis arvensis</i>	<i>Chenopodium album</i>	<i>Argemone maxicana</i>	Other BLW	<i>Cyperus rotundus</i>
T <sub>1</sub> -Flurochloridone 20% CS @ 500 g a.i/ha	4.16 (2.16)	5.24 (2.40)	5.23 (2.39)	3.91 (2.10)	4.19 (2.17)	7.09 (2.75)	3.72 (2.05)
T <sub>2</sub> -Flurochloridone 20% CS @ 625 g a.i/ha	1.85 (1.53)	1.72 (1.49)	2.07 (1.60)	1.54 (1.43)	1.82 (1.52)	3.69 (2.05)	1.62 (1.46)
T <sub>3</sub> -Flurochloridone 20% CS @ 750 g a.i/ha	1.63 (1.46)	1.56 (1.44)	2.00 (1.58)	1.40 (1.38)	1.75 (1.50)	3.43 (1.98)	1.59 (1.45)
T <sub>4</sub> -Pendimethalin 30% EC @ 1000 g a.i/ha	2.75 (1.80)	2.87 (1.84)	3.33 (1.96)	2.69 (1.79)	3.01 (1.87)	5.43 (2.44)	2.64 (1.77)
T <sub>5</sub> -Weed free check (Hand weeding twice)	1.29 (1.34)	1.27 (1.33)	1.49 (1.41)	1.07 (1.25)	1.30 (1.34)	3.09 (1.89)	1.18 (1.30)
T <sub>6</sub> - Weedy check (Untreated control)	16.97 (4.18)	19.30 (4.45)	17.61 (4.26)	14.68 (3.90)	16.57 (4.13)	21.76 (4.72)	16.35 (4.10)
S.Em+	0.08	0.08	0.07	0.09	0.08	0.09	0.08
CD	0.24	0.24	0.21	0.28	0.24	0.28	0.26

Figures in parenthesis are square root transferred  $\sqrt{x}+0.5$  values

**Table 4:** Effect of Flurochloridone on weed dry matter ( $\text{g}/\text{m}^2$ ) at 45 DAA during *rabi* 2020-21

Treatment details	Grasses		Broad leaf weeds				Sedges
	<i>Asphodelus tenuifolius</i>	<i>Cynodon dactylon</i>	<i>Anagallis arvensis</i>	<i>Chenopodium album</i>	<i>Argemone maxicana</i>	Other BLW	<i>Cyperus rotundus</i>
T <sub>1</sub> -Flurochloridone 20% CS @ 500 g a.i/ha	4.47 (2.23)	5.47 (2.44)	5.62 (2.47)	4.30 (2.19)	4.62 (2.26)	7.78 (2.88)	4.07 (2.14)
T <sub>2</sub> -Flurochloridone 20% CS @ 625 g a.i/ha	2.01 (1.58)	1.92 (1.56)	2.31 (1.68)	1.82 (1.52)	1.95 (1.57)	4.26 (2.18)	1.89 (1.55)
T <sub>3</sub> -Flurochloridone 20% CS @ 750 g a.i/ha	1.80 (1.52)	1.74 (1.50)	2.12 (1.62)	1.75 (1.50)	1.78 (1.51)	3.98 (2.12)	1.76 (1.50)
T <sub>4</sub> -Pendimethalin 30% EC @ 1000 g a.i/ha	2.92 (1.85)	2.78 (1.81)	3.48 (1.99)	2.80 (1.82)	3.07 (1.89)	5.85 (2.52)	2.87 (1.84)
T <sub>5</sub> -Weed free check (Hand weeding twice)	1.38 (1.37)	1.39 (1.37)	1.72 (1.49)	1.28 (1.33)	1.57 (1.44)	3.49 (2.00)	1.39 (1.37)
T <sub>6</sub> - Weedy check (Untreated control)	19.42 (4.46)	17.85 (4.28)	19.46 (4.47)	16.62 (4.14)	18.73 (4.39)	24.37 (4.99)	17.92 (4.29)
S.Em+	0.08	0.08	0.09	0.09	0.10	0.10	0.08
CD	0.25	0.24	0.29	0.27	0.32	0.30	0.24

Figures in parenthesis are square root transferred  $\sqrt{x}+0.5$  values

### 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 5 and 6. The WCE was maximum under weed free plot ( $T_5$ ) during both the years. Among the

herbicidal treatments, maximum WCE was noticed under 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 5:** Effect of Flurochloridone on weed control efficiency (%) at 45 DAA during *rabi* 2019-20

Treatment details	Grasses		Broad leaf weeds				Sedges
	<i>Asphodelus tenuifolius</i>	<i>Cynodon dactylon</i>	<i>Anagallis arvensis</i>	<i>Chenopodium album</i>	<i>Argemone maxicana</i>	Other BLW	<i>Cyperus rotundus</i>
T <sub>1</sub> -Flurochloridone 20% CS @ 500 g a.i/ha	75.49	72.85	70.30	73.37	74.71	67.42	77.25
T <sub>2</sub> -Flurochloridone 20% CS @625 g a.i/ha	89.10	91.09	88.25	89.51	89.02	83.04	90.09
T <sub>3</sub> -Flurochloridone 20% CS@ 750 g a.i/ha	90.39	91.92	88.64	90.46	89.42	84.24	90.28
T <sub>4</sub> -Pendimethalin 30% EC @ 1000 g a.i/ha	83.79	85.13	81.09	81.68	81.83	75.05	83.85
T <sub>5</sub> -Weed free check (Hand weeding twice)	92.34	93.42	91.52	92.71	92.15	85.80	92.78
T <sub>6</sub> - Weedy check (Untreated control)	-	-	-	-	-	-	-

**Table 6:** Effect of Flurochloridone on weed control efficiency (%) at 45 DAA during *rabi* 2020-21

Treatment details	Grasses		Broad leaf weeds				Sedges
	<i>Asphodelus tenuifolius</i>	<i>Cynodon dactylon</i>	<i>Anagallis arvensis</i>	<i>Chenopodium album</i>	<i>Argemone maxicana</i>	Other BLW	<i>Cyperus rotundus</i>
T <sub>1</sub> -Flurochloridone 20% CS @ 500 g a.i/ha	76.98	69.36	71.12	74.13	75.33	68.08	77.29
T <sub>2</sub> -Flurochloridone 20% CS @625 g a.i/ha	89.65	89.24	88.13	89.05	89.59	82.52	89.45
T <sub>3</sub> -Flurochloridone 20% CS@ 750 g a.i/ha	90.73	90.25	89.11	89.47	90.50	83.67	90.18
T <sub>4</sub> -Pendimethalin 30% EC @ 1000 g a.i/ha	84.96	84.43	82.12	83.15	83.61	76.00	83.98
T <sub>5</sub> -Weed free check (Hand weeding twice)	92.89	92.21	91.16	92.30	91.62	85.68	92.24
T <sub>6</sub> - Weedy check (Untreated control)	-	-	-	-	-	-	-

### 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 7. 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<sub>1</sub>). Weed free (T<sub>5</sub>) plot produced maximum yield closely followed by Flurochloridone 20% CS @ 750 g a.i/ha (T<sub>3</sub>) and Flurochloridone 20% CS @ 625 g a.i/ha (T<sub>2</sub>) during both the years. The next best treatment was Pendimethalin 30% EC @ 1000 g a.i/ha (T<sub>4</sub>) and it was at par to Flurochloridone 20% CS @ 500 g a.i/ha (T<sub>1</sub>). Weedy check (T<sub>1</sub>) produced the lowest chickpea yield.

**Table 7:** Effect of Flurochloridone on chickpea yield during *rabi* 2019-20 and *rabi* 2020-21

Treatment details	Yield (q/ha)	Yield (q/ha)
	2019-20	2020-21
T <sub>1</sub> -Flurochloridone 20% CS @ 500 g a.i/ha	8.79	10.06
T <sub>2</sub> -Flurochloridone 20% CS @625 g a.i/ha	11.96	13.48
T <sub>3</sub> -Flurochloridone 20% CS@ 750 g a.i/ha	12.60	14.26
T <sub>4</sub> -Pendimethalin 30% EC @ 1000 g a.i/ha	9.48	11.68
T <sub>5</sub> -Weed free check (Hand weeding twice)	13.45	15.10
T <sub>6</sub> - Weedy check (Untreated control)	6.57	7.18
S.Em+	0.54	0.58
CD	1.62	1.76

### 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 and higher seed yield.

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