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Evaluation of Post-emergence Herbicides in Chickpea (*Cicer arietinum*)

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Chickpea (*Cicer arietinum* L.) is one of the most important pulse crops of India grown both under conserved soil moisture and irrigated situations. Among various barriers, poor weed management is one of the most important yield limiting factors in chickpea. Generally, for the control of weeds farmers do manual weeding. But with the increase in labour cost and scarcity of labour, manual weed control has become a difficult task in chickpea. Chickpea, being slow in its early growth and short stature plant, is highly susceptible to weed competition and causes 75% yield loss (Chaudhary *et al*., 2005). The initial 60 days period is considered to be the critical for weed-crop competition in chickpea (Singh and Singh, 1992). The application of herbicides in chickpea is generally not recommended in rainfed conditions because of poor soil moisture in top soil, which results in poor efficacy of herbicide. Use of pre-plant and pre-emergence herbicides under irrigated conditions also does not control weeds later in the season, but there is no post-emergence herbicide recommended in chickpea. Recently, some of the post-emergence herbicides have been found effective in controlling weeds in soybean and field pea. Taking into consideration the above facts and availability of new herbicides, it becomes imperative to find out the suitable dose and time of application of post-emergence herbicide for weed control in chickpea.

A field experiment was conducted during 2008-09 at the Research Farm of the CCSHAU, Hisar located at $29^0 10'$ N, $75^0 48'$ E, and 215.2 m above mean sea level. The soil of the experimental field was sandy loam in texture having pH 7.8 and electrical conductivity of 0.25 dS/m. The soil was medium in organic C (0.45%), low in available N (161 kg/ha), medium in available P (18 kg/ha) and high in available K (306 kg/ha). The major weed flora of experimental field consisted of *Chenopodium album*, *Fumaria purviflora* and *Phalaris minor*. The other minor weed species infesting field were *Convolvulus arvensis*, *Anagalis arvensis*, *Melilotus alba*, *Coronopus didymus* and *Spergula arvensis*. A total of 13 treatments (Table 1) comprising various doses of quizalofop-P-ethyl, imazethapyr and chlorimuron-ethyl were compared with untreated and weed free checks in a randomized block design replicated thrice. The field

Table 1. Effect of post emergence herbicides on yield attributes, yield of chickpea, weeds dry weight and economics

Treatments	Dose (g/ha)	Application stage (DAS)	Pods/ plant	Grains/ pod	100-grain weight (g)	Biological yield (kg/ha)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index (%)	Weed dry weight (g/m^2)	Net returns (Rs./ha)
Weedy	-	-	19.45	1.33	13.28	2691	683	2008	25.38	183.07	-2154
Weed free	-	-	45.00	1.73	14.13	8509	2156	6353	25.34	2.23	16760
Hand weeding	-	30 & 60	43.78	1.73	13.89	7953	1998	5955	25.12	32.17	19529
Quizalofop	40	20	26.56	1.53	13.96	4532	1158	3374	25.55	143.13	6967
Quizalofop	40	30	38.34	1.60	12.98	5579	1369	4210	24.54	126.27	11662
Quizalofop	50	20	39.78	1.67	12.64	5800	1472	4328	25.38	117.93	13578
Quizalofop	50	30	41.22	1.60	13.09	6423	1595	4828	24.83	112.83	16331
Imazethapyr	25	20	23.45	1.40	13.36	3665	917	2748	25.02	113.33	2031
Imazethapyr	25	30	24.34	1.47	13.56	4044	1079	2965	26.68	108.63	5105
Imazethapyr	40	20	27.34	1.40	13.01	4345	1096	3249	25.22	96.10	5732
Imazethapyr	40	30	28.78	1.53	12.37	4523	1212	3311	26.80	89.07	7816
Chlorimuron	4	20	17.00	1.27	13.71	1157	285	872	24.63	154.66	-11255
Chlorimuron	4	30	16.78	1.40	12.96	928	232	696	25.00	164.10	-12391
S. Em±	-	-	1.16	0.17	0.35	153	52	152	0.50	4.89	-
LSD (P=0.05)	-	-	3.40	NS	1.04	449	152	446	NS	14.36	-

NS–Not Significant.

was uniformly fertilized with 20 kg N and 40 kg P_2O_5/ ha. Chickpea variety HC-1 was sown on November 5, 2008 at a row spacing of 30 cm. All the herbicides were applied with knapsack sprayer using 625 l water per hectare.

Weed free treatments recorded the highest values of pods/plant, 100-grain weight, grain, straw and biological yield followed by two hand weeding treatments. The higher values of these attributes are the indirect effect of better plant growth in weed free treatment during the critical stages of crop growth. Mishra *et al*. (2005) also reported reduction in grain yield (68.3%) in weedy check which was mainly due to 56.8% reduction in number of pods and 23.1% reduction in grains/pod. Chaudhary *et al*. (2005) also reported 75% chickpea yield reduction due to weeds. Among the chemical weed control treatments, highest yield of chickpea was recorded in quizalofop @ 50 g/ha applied 30 DAS, however, it was 26.7% lower than the weed free treatment, this reduction in grain yield was mainly due to the 8.4, 7.5 and 7.3% reduction in pods/plant, grains/pod and 100-grain weight, respectively. Moreover, two hand weedings at 30 and 60 days after sowing (DAS) gave 20.2% higher grain yield than quizalofop @ 50 g/ ha applied at 30 DAS. All the doses of quizalofop i. e. 40 and 50 g/ha applied at 20 and 30 DAS produced significantly higher values of yield as compared to treatments of imazethapyr except quizalofop @ 40 g/ha applied at 20 DAS. Imazethapyr treatments recorded significantly higher values of yield than chlorimuron-ethyl. The lowest values of yield among all weed control treatments were recorded from chlorimuron-ethyl. This was due to severe phytotoxicity of this herbicide on chickpea crop resulting in complete mortality of chickpea and finally resulting in lower values of yield. Banga *et al*. (2003) also reported the lowest grain yield and highest crop injury in chlorimuron-ethyl treated plots in chickpea.

Imazethapyr applied @ 40 g/ha produced higher chickpea yield irrespective of the time of application which might be due to better control of weeds than its lower dose (25 g/ha) as is evident from lower weeds dry weight in higher dose of imazethapyr. Imazethapyr application at either of the dose irrespective of the time of application resulted in lower chickpea yield as compared to quizalofop treatments because application of imazethapyr changed the plant architecture and plants became bushy with small size of leaves which resulted in poor development of source and ultimately affected the chickpea grain yield.

The weeds in chickpea caused 68.2% reduction in grain yield. Two hand weedings at 30 and 60 DAS gave 82.4% weed control efficiency. Among the chemical weed control treatments, quizalofop @ 50 g/ha applied at 30 DAS gave best result with only 38.4% weed control efficiency and 26.0% reduction in chickpea yield. The economics in terms of net profit indicates that chemical weed control in chickpea is not the alternative of physical and mechanical method of weed control.

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