

Effect of herbicides on biochemical and growth parameters of chickpea (*Cicer arietinum*)*

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Chickpea (*Cicer arietinum* L.) is one of the important pulse crops grown in India for their economic importance and nutritive value besides maintaining soil fertility. Cultivation of chickpea is, however, threatened by infestation of divergent weed flora causing 75% reduction in yield (Chaudhary *et al.* 2005). Herbicides, viz pendimethalin, fluchloralin and metolachlor have been found promising to control weeds and enhance crop yield. Besides providing good control of weeds, these herbicides may also affect the growth and other physiological parameters of the crop in which the herbicides are applied due to their toxic nature. The literature related to effect of herbicides on growth and other physiological parameters of chickpea is, however, quite meagre. Hence an effort has been made to determine the effect of herbicides on biochemical and growth parameters of chickpea.

A field experiment was conducted during *rabi* season of 2001-2002 at Students' instructional farm of the University, Faizabad (UP). The soil was sandy loam in texture with pH of 7.8. The experiment was laid out in a randomized block design with 3 replications. 'Avarodhi' chickpea was sown @ 80 kg seeds/ha in rows 30 cm apart on 2 November 2001. Fluchloralin was applied as pre-plant incorporation in soil (ppi) at 1.0, 1.5 and 2.0 kg/ha while pendimethalin and metolachlor were applied as pre-emergence each at 1.0, 1.5 and 2.0 kg/ha. Herbicides were sprayed with the help of Knapsack sprayer with a spray volume of 500 litres/ha. Water sprayed plots served as control. All the plots were kept weed free throughout the growing season to avoid crop weed-competition for different growth factors. The total chlorophyll content in the third fully expanded leaf from the top was estimated by the method as suggested by Arnon (1949) at 30, 45, 60 and 75 days after sowing. The nitrate reductase activity was assayed at different stages (30, 45, 60 and 75 days after sowing) by the method as suggested by

Jaworski (1971). The total insoluble protein content in grain was estimated by the procedure as described by Lowery *et al.* (1951). The observations on growth parameters were recorded at 3 stages, ie 30–45, 45–60 and 60–75 days after sowing. Net assimilation rate was calculated by the method as described by Gregory (1926) and leaf area ratio by Radford (1967).

The results (Table 1) revealed that application of herbicides at lower dose (1.0 kg/ha) significantly increased the total chlorophyll content over untreated check at 30 days after sowing. However the effect of herbicides at higher doses (1.5 and 2.0 kg/ha) were at par with untreated check. In the later stage, no significant differences in total chlorophyll content were observed between the untreated check and herbicides. Ram Murti *et al.* (2004) have also reported that application of pendimethalin and fluchloralin each at 0.75 kg/ha significantly increased chlorophyll content in urdbean.

The activity of nitrate reductase decreased with the advancement of plant age in treated and untreated check (Table 1). The activity of enzyme nitrate reductase decreased with the increase in doses of herbicides from 1.0 to 2.0 kg/ha. This, result is corroborated with the results obtained by Kalpana *et al.* (2003) in cowpea [*Vigna unguiculata* (L.) Walp].

Different treatments did not cause significant variations in protein content of grain.

In general leaf area ratio decreased with the advancement of crop age (Table 2). Application of pendimethalin 2.0 kg/ha being at par with metolachlor 2.0 kg/ha registered significantly higher values of leaf area ratio than rest of the herbicidal treatments and untreated check at 45–60 days after sowing and 60–75 days after sowing while, in early stages, non-significant variation was observed between herbicide treatments and untreated check. Net assimilation rate increased up to 45–60 days after sowing and thereafter it decreased. The maximum values of net assimilation rate were recorded with the application of fluchloralin 1.0 kg/ha which was significantly greater than all the treatments at 45–60 days after sowing. However it was at par with pendimethalin 1.0 kg/ha and metolachlor 1.0 kg/ha at 60–75 days after sowing. At 30–45 days after sowing, application of fluchloralin (2.0 kg/ha) decreased net assimilation rate

*Short note

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Table 1 Effect of herbicides on total chlorophyll content, nitrate reductase activity in leaves and protein content in grains of chickpea

Treatment	Total chlorophyll content (mg/g fresh wt.)				Nitrate reductase activity (μ mol/hr/g fresh wt.)				Protein content in grain (%)
	DAS				DAS				
	30	45	60	75	30	45	60	75	
T ₁ , Pendimethalin 1.0 kg/ha pre-emergence	0.367	0.550	0.852	1.140	40.76	42.89	32.41	20.90	20.24
T ₂ , Pendimethalin 1.5 kg/ha pre-emergence	0.341	0.533	0.835	1.080	38.27	39.10	29.76	18.40	21.10
T ₃ , Pendimethalin 2.0 kg/ha pre-emergence	0.326	0.521	0.821	1.020	30.27	33.59	26.26	13.40	21.47
T ₄ , Fluchloralin 1.0 kg/ha	0.381	0.563	0.858	1.160	42.85	44.64	33.08	21.50	20.13
T ₅ , Fluchloralin 1.5 kg/ha	0.352	0.540	0.839	1.090	35.45	37.72	30.11	19.50	21.01
T ₆ , Fluchloralin 2.0 kg/ha	0.342	0.525	0.825	1.040	31.77	34.89	27.41	14.30	21.38
T ₇ , Metolachlor 1.0 kg/ha pre-emergence	0.364	0.547	0.850	1.130	38.98	40.89	31.96	18.50	20.20
T ₈ , Metolachlor 1.5 kg/ha pre-emergence	0.337	0.531	0.831	1.060	36.50	37.09	29.50	16.20	21.05
T ₉ , Metolachlor 2.0 kg/ha pre-emergence	0.322	0.515	0.817	1.000	29.96	31.59	26.15	13.16	21.50
T ₁₀ , Untreated check	0.323	0.522	0.818	1.070	34.11	35.50	28.50	16.50	18.76
CD ($P = 0.05$)	0.034	NS	NS	NS	3.54	3.74	2.91	1.72	NS

DAS, Days after sowing; NS, non-significant

Table 2 Effect of herbicides on leaf area ratio, net assimilation rate at crop growth stages and seed yield of chickpea

Treatment	LAR (cm ² /g)			NAR (g/cm ² /day)			Seed yield (tonnes/ha)
	DAS			DAS			
	I	II	III	I	II	III	
T ₁ , Pendimethalin 1.0 kg/ha pre-emergence	152.08	101.96	67.68	0.272	0.696	0.523	2.27
T ₂ , Pendimethalin 1.5 kg/ha pre-emergence	161.21	120.77	93.02	0.263	0.523	0.376	2.18
T ₃ , Pendimethalin 2.0 kg/ha pre-emergence	165.70	144.50	108.91	0.256	0.362	0.366	2.01
T ₄ , Fluchloralin 1.0 kg/ha	137.00	83.20	59.68	0.276	0.913	0.555	2.30
T ₅ , Fluchloralin 1.5 kg/ha	154.45	110.24	82.77	0.251	0.533	0.502	2.31
T ₆ , Fluchloralin 2.0 kg/ha	160.62	129.74	98.40	0.229	0.404	0.494	2.00
T ₇ , Metolachlor 1.0 kg/ha pre-emergence	155.54	101.36	70.48	0.273	0.710	0.523	2.27
T ₈ , Metolachlor 1.5 kg/ha pre-emergence	161.18	123.79	87.12	0.261	0.508	0.389	2.17
T ₉ , Metolachlor 2.0 kg/ha pre-emergence	162.86	139.67	107.62	0.254	0.364	0.360	2.05
T ₁₀ , Untreated check	158.64	87.95	65.79	0.243	0.786	0.441	2.12
CD ($P = 0.05$)	NS	11.31	8.34	0.025	0.059	0.045	NS

LAR, Leaf area ratio; NAR, net assimilation rate

significantly as compared to other treatments. Different treatments did not show significant variation in grain yield.

SUMMARY

Field trial was conducted during winter (*rabi*) season of 2001–02 to study the effect of herbicides on biochemical and growth parameters of chickpea (*Cicer arietinum* L.). All the herbicides promoted various biochemical parameters at 1.0 kg/ha. Chlorophyll content was found higher due to application of herbicide as compared to untreated check. These herbicides applied at 1.0 or 1.5 kg/ha increased the activity of nitrate reductase except at a dose of 2.0 kg/ha. Application of herbicides increased protein content. The results revealed that application of pendimethalin and metolachlor each 2.0 kg/ha proved promising to recorded higher values of LAR at 45–60 and 60–75 days after sowing but did not have any effect at early stage (30–45 days after sowing). Application of fluchloralin, pendimethalin and metolachlor each 1.0 kg/ha have been found promising to

enhance the values of net assimilation rate at 45–60 and 60–75 days after sowing.

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