

Clethodim for grasses control in blackgram (*Vigna mungo*) and its residual effect on succeeding maize (*Zea mays*)

A.S. RAO

Acharya N.G. Ranga Agricultural University, Regional Agricultural Research Station, Lam Guntur, Andhra Pradesh 522 034

Received : July 2012; Revised accepted : April 2013

ABSTRACT

A field experiment was conducted during rainy seasons of 2009–10 and 2010–11 at Guntur, Andhra Pradesh, to evaluate the bio-efficacy of clethodim against grassy weeds in blackgram (*Vigna mungo* (L.) Hepper) and its residual effect on succeeding maize (*Zea mays* L.) during winter. Post emergence application of clethodim at 96 g/ha with 0.25% non-ionic surfactant (NIS) at 20 days after sowing (DAS), significantly reduced weed growth of grasses and recorded higher crop dry weight, yield components and seed yield (0.49 t/ha) over its lower dose of 36 and 48 g/ha, but was on par with its next higher dose of 60 g/ha with 0.25% NIS + 0.04% ammonium sulphate (AMS). Clethodim did not cause any crop injury even at 96 g/ha. There was no residual effect of clethodim on succeeding maize crop. Among the clethodim treatments, post emergence application of clethodim at 96 g/ha + 0.25% NIS recorded maximum net returns (₹8,795/ha) and benefit:cost ratio (BCR) of 0.66 and this was closely followed by its next lower dose of 60 g/ha + 0.25% NIS + 0.04% AMS with net returns of 7,445/ha and BCR of 0.64.

Key words : Blackgram, Clethodim, Grassy weeds, Maize, Residual effect

Blackgram, an important pulse grown in rainy season, faces severe weed competition due to its initial slow growth and lack of effective weed control measures. Yield losses due to weeds upto 87% have been reported depending upon type and intensity of weed flora (Singh *et al.*, 2002). Due to shortage of labour and increased cost of labour wages, farmers are repeatedly asking for selective post emergence herbicides. Though information on selectivity of some of the herbicides like fenoxaprop ethyl, quizalofop ethyl, cyhalofop butyl *etc.* is available (Rao and Rao, 2003; Rao, 2005; Rao, 2008 and Rao, 2011) the information pertaining to bio-efficacy of clethodim ((E,E)-(±)-2-(1-(((3-chloro-2-propenyl)oxy)imino)propyl)-5-(2-(ethylthio)propyl)-3-hydroxy-2-cyclohexen-1-one) on blackgram is scanty, particularly under local conditions of Andhra Pradesh. Keeping this in view, the present investigation was undertaken to evaluate the bio-efficacy of clethodim at different doses against grassy weeds in comparison with present recommended herbicides like fenoxaprop ethyl and quizalofop ethyl and its residual effect on succeeding maize crop

MATERIALS AND METHODS

A field experiment was conducted consecutively for two years during rainy and winter seasons of 2009–10 and 2010–11 at Acharya N.G. Ranga Agricultural University, Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh, India. The soil of the experimental field was clay loam with pH 7.7, medium in available nitrogen and phosphorus and high in available potassium. The experiment consisting of eleven treatments as per detail in table 1, was laid out in a randomized block design with three replications. Blackgram 'LBG-752' was sown at a spacing of 30 × 10 cm during 3rd week of July 2009 and 2nd week of June, 2010. Crop survived on the rainfall received during the crop seasons. During second year, water logging due to an excessive rainfall (843.3 mm in 39 rainy days compared to 416.6 mm in 20 rainy days in the first year) was harmful to the crop and reduced the yield. All the locally recommended package of practices except weed control were followed to raise the blackgram crop. All the post emergence herbicides were sprayed with knapsack sprayer fitted with flat fan nozzle at 20 DAS as per schedule using a spray volume of 500 litres/ha. Before spraying the herbicides, all the broad leaf weeds were removed, allowing only the grassy weeds to remain. The

data on density of grassy weed species and weed dry weight/unit area were recorded at 30 days after application (DAA) of herbicides. The data on weed density and dry weight were subjected to square root $\sqrt{x+0.5}$ transformation before statistical analysis to normalize their distribution (Panse and Sukhatme, 1978). Economics of different treatments were calculated taking into prevailing market prices of inputs and out put.

The residual effect of clethodim at different doses was studied on the succeeding maize '30V92 hybrid'. All the recommended package of practices were followed to raise the maize crop and the crop was irrigated as and when needed. The data on maize population per unit area was recorded at ten days interval upto 30 DAS. The yield attributes and yield were recorded at the time of maturity.

RESULTS AND DISCUSSION

Effect on Weeds

The experimental field was dominated by the natural infestation of *Echinochloa colonum* (L.) Link, *Dinebra retroflexa* Jacq, *Panicum repens* (L.) and *Cynodon dactylon* (L) Pers., which consisted of more than 90% of the total weed population. Other weeds like *Digera arvensis* Forsk, *Cleome viscosa* (L.), *Trianthema portulacastrum* (L.) were also present but their population was negligible and therefore removed before the herbicide spray.

The density and dry weight of grassy weeds were significantly reduced by all the weed control treatments compared to weedy check (Table 1). Among the different

doses, post emergence application of clethodim 60 g/ha + 0.25% NIS + 0.04% AMS was found effective in reducing the density and dry weight of grasses with 46% weed control efficiency (WCE) and was found to be on par with its all other doses of clethodim except with its lowest dose (36 g/ha + 0.25% NIS + 0.04% AMS). Further, the highest WCE of 86 % was observed with the highest dose of clethodim (96 g/ha + 0.04% AMS), which was found to be on par with the existing recommended grassy herbicides, fenoxaprop ethyl, quizalofop ethyl as well as with hand weeding at 15 and 30 DAS in reducing the weed growth. The increased weed control in these treatments might be due to effective control of the grassy weeds in these treatments during the critical period of crop growth.

Effect on blackgram

Clethodim at all doses (36 to 96 g/ha) did not cause any injury to blackgram. Crop dry weight, yield components (except 100 seed weight) and yield were significantly influenced by the different treatments under study over weedy check (Table 2). Among the clethodim treatments, post emergence application of clethodim at 96 g/ha + 0.25% NIS recorded maximum crop dry weight, number of pods per plant, number of seeds per pod and seed yield (0.49 t/ha). This treatment was on par with other grassy herbicides like quizalofop ethyl 50 g/ha (0.46 t/ha) and fenoxaprop ethyl 67.5 g/ha (0.41 t/ha). The increased yield in these treatments might be due to effective control of weeds at critical period as evidence by higher WCE, which favoured the increased crop growth and ultimately

Table 1. Density of different weeds and total dry weight of weeds as influenced by different treatments (Pooled mean of two years)

Treatment	Dose (g ai/ha)	Time of application (DAS)	Weed density (No/m ²) at 30 DAA				Total weed dry weight (g/m ²) At 30 DAA	WCE (%)
			<i>Echinochloa colonum</i>	<i>Dinebra retroflexa</i>	<i>Panicum repens</i>	<i>Cynodon dactylon</i>		
Clethodim + 0.25% NIS + 0.04% AMS	36	20	5.79 (33.7)	2.42 (5.7)	1.92 (3.7)	2.42 (5.5)	13.92 (224.5)	15
Clethodim + 0.25% NIS + 0.04% AMS	48	20	4.48 (20.5)	1.50 (2.0)	1.47 (1.8)	2.10 (4.2)	11.31 (142.9)	31
Clethodim + 0.25% NIS + 0.04% AMS	60	20	2.97 (8.5)	1.03 (0.7)	0.94 (0.5)	1.80 (2.9)	8.76 (103.1)	46
Clethodim + 0.25% NIS	48	20	4.19 (17.9)	1.55 (2.0)	1.57 (2.2)	2.17 (4.3)	9.61 (118.3)	41
Clethodim + 0.04% AMS	48	20	5.11 (26.0)	1.38 (1.7)	1.98 (3.5)	2.17 (4.3)	10.68 (130.5)	35
Clethodim	48	20	5.65 (28.7)	2.63 (7.0)	1.86 (3.0)	2.37 (5.2)	11.59 (152.4)	29
Quizalafop ethyl	50	20	1.69 (2.8)	1.03 (0.7)	1.00 (0.7)	1.55 (4.4)	2.85 (4.4)	83
Fenoxaprop ethyl	67.5	20	2.65 (13.7)	1.22 (1.2)	1.38 (1.7)	1.87 (3.2)	3.29 (3.2)	80
Hand weeding	–	15 & 30	3.94 (15.4)	2.08 (3.5)	2.10 (5.0)	1.26 (1.4)	2.59 (7.2)	84
Weedy check	–	–	13.87 (26.2)	4.51 (20.0)	5.73 (38.0)	3.07 (9.3)	16.30 (282.3)	–
Clethodim + 0.25% NIS	96	20	1.43 (1.7)	0.80 (0.2)	0.86 (0.4)	1.43 (1.8)	2.30 (5.0)	86
SEm±			0.97	0.20	0.40	0.17	1.26	–
CD (P=0.05)			2.71	0.56	1.12	0.46	3.48	–

DAS–Days after sowing; Data transformed to $\sqrt{x+0.5}$ transformation; Figures in parenthesis are original values; DAA–Days after application; WCE–Weed control efficiency; NIS–Non ionic surfactant; AMS–Ammonium sulphate

on yield components and yield. None of the treatments could reach the level of hand weeding at 15 and 30 DAS, which recorded the highest seed yield (0.68 t/ha). The uncontrolled weed growth during the crop season reduced the seed yield to the extent of 82% corroborating with those reported by Singh *et al.*, 2002.

Economics

All the weed control treatments recorded higher net returns and B:C ratio over weedy check (Table 2). Among the clethodim treatments, post emergence application of clethodim at 96 g/ha + 0.25% NIS recorded maximum net returns ₹8,795/ha and B:C ratio of 0.66 due to effective control of grasses without any crop injury. This was

closely followed by post emergence application of clethodim at 60 g/ha + 0.25% NIS + 0.04% AMS net returns ₹7,445/ha and B:C ratio of 0.64. Among other treatments, hand weeding resulted in higher net returns ₹17,645/ha with a B:C ratio of 1.36 despite the higher cost involved. Uncontrolled weed growth resulted in negative returns and B:C ratio.

Residual effect on succeeding maize

Post emergence application of clethodim at different doses ranging from 36 to 96 g/ha with or without NIS or AMS had no adverse effect on plant population, yield components and yield of succeeding maize crop (Table 3). The maize yield in clethodim treatments ranged from 8.9

Table 2. Effect of weed control treatments on crop dry weight, yield and yield parameters of blackgram (Pooled mean of two years)

Treatment	Dose (gai/ha)	Time of application (DAS)	Crop dry wt at maturity (g/m ²)	Pods/plant	Seeds/pod	100-seeds wt. (g)	Grain yield (t/ha)			Cost of cultivation (× 10 ³ ₹/ha)	Net returns (× 10 ³ ₹/ha)	B:C ratio
							2009-10	2010-11	Pooled			
Clethodim + 0.25% NIS + 0.04% AMS	36	20	200	10.6	6.1	4.56	0.40	0.11	0.26	10.35	1.18	0.11
Clethodim + 0.25% NIS + 0.04% AMS	48	20	225	11.9	6.5	4.80	0.56	0.15	0.35	10.90	5.30	0.46
Clethodim + 0.25% NIS + 0.04% AMS	60	20	271	15.0	6.9	4.40	0.65	0.19	0.42	11.50	7.45	0.64
Clethodim + 0.25% NIS	48	20	213	13.4	6.5	4.63	0.47	0.18	0.32	10.90	3.64	0.33
Clethodim + 0.04% AMS	48	20	209	12.2	6.1	4.60	0.44	0.14	0.27	10.65	1.64	0.15
Clethodim	48	20	211	11.0	5.7	4.92	0.38	0.13	0.25	10.65	0.74	0.07
Quizalafop ethyl	50	20	292	17.8	6.6	4.87	0.67	0.24	0.46	9.85	10.63	1.08
Fenoxaprop ethyl	67.5	20	280	17.6	6.8	4.73	0.61	0.21	0.41	9.15	9.12	0.99
Hand weeding	-	15 & 30	296	20.5	7.2	4.99	0.83	0.53	0.68	13.00	17.65	1.36
Weedy check	-	-	173	9.3	5.5	4.35	0.20	0.05	0.13	8.00	-2.33	-0.29
Clethodim + 0.25% NIS	96	20	275	15.2	7.1	4.87	0.78	0.20	0.49	13.30	8.80	0.66
SEm±			9.6	0.67	0.22	0.18	0.04	0.02	0.03	-	-	-
CD (P=0.05)			26.6	1.87	0.62	NS	0.11	0.05	0.09	-	-	-

DAS—Days after sowing; NIS—Non ionic surfactant; AMS—Ammonium sulphate; Price of grain (₹/kg)—45

Table 3. Residual effect of weed control treatments on succeeding maize (Pooled mean of two years)

Treatment	Dose (gai/ha)	Time of application (DAS)	Maize population (No/plot) at			Rows/cob	Grains/cob	100-grain weight (g)	Grain yield (t/ha)
			10 DAS	20 DAS	30 DAS				
Clethodim + 0.25% NIS + 0.04% AMS	36	20	146	142	138	13.9	492	32.7	9.1
Clethodim + 0.25% NIS + 0.04% AMS	48	20	138	141	140	14.7	508	32.6	9.5
Clethodim + 0.25% NIS + 0.04% AMS	60	20	145	144	143	14.0	512	32.1	9.7
Clethodim + 0.25% NIS	48	20	144	143	143	14.2	487	31.4	9.5
Clethodim + 0.04% AMS	48	20	144	139	138	13.7	468	31.5	9.5
Clethodim	48	20	141	140	140	13.7	482	32.0	8.9
Quizalafop ethyl	50	20	147	139	140	14.1	517	30.3	9.7
Fenoxaprop ethyl	67.5	20	135	141	139	13.9	489	31.9	9.5
Hand weeding	-	15 & 30	143	140	139	14.1	473	31.7	10.5
Weedy check	-	-	142	139	139	14.7	502	28.5	8.8
Clethodim + 0.25% NIS	96	20	142	137	137	14.0	484	29.7	9.4
SEm±			4.5	1.7	1.8	0.26	19.4	0.8	0.4
CD (P=0.05)			NS	NS	NS	NS	NS	NS	NS

DAS—Days after sowing; NIS—Non ionic surfactant; AMS—Ammonium sulphate

to 9.7 t/ha.

Based on the present study, it was concluded that post emergence application of clethodim at 96 g/ha + 0.25% NIS was found to be effective in controlling grassy weeds without any crop injury in blackgram and residual effect on succeeding maize. Based on the findings, clethodim can be used an alternative to the existing post emergence herbicides fenoxaprop ethyl and quizalofop ethyl.

REFERENCES

- Panse, V.G. and Sukhatme, P.V. 1978. Statistical Methods for Agricultural Workers. Indian Council Agricultural Research, New Delhi, pp. 152.
- Rao, A.S. 2005. Effect of fenoxaprop ethyl on *Echinochloa spp.* control in blackgram grown as relay crop. In: *Extended Summaries of National Biennial Conference of Indian Society of Weeds Science*, PAU, Ludhiana, April 6–8, 2005. pp. 88–89.
- Rao, A.S. 2008. Effect of time and dose of post emergence herbicides on *Echinochloa spp.* control in blackgram grown as relay crop. *Indian Journal of Weed Science* **48**(3&4): 165–68.
- Rao, A.S. 2011. Bio-efficacy of quizalofop ethyl on *Echinochloa colona* control in rice fallow blackgram. *The Andhra Agricultural Journal* **58**(2): 130–32.
- Rao, A.S. and Rao, R.S.N. 2003. Bioefficacy of clodinafop propargyl on *Echinochloa spp.* in blackgram. *Indian Journal of Weed Science* **35**: 251–52.
- Singh, V.R, Gautam, C. and Singh, V.K. 2002. Effect of row spacing and weed management practices on the productivity of late planted urdbean. *Indian Journal of Pulses Research* **15**: 185.