



Efficacy of Post Emergence Herbicides on Weed Control and Yield of Blackgram (*Vigna Mungo* (L.) Hepper)

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A Field experiment was conducted to study the effect of post emergence herbicides on weed control and yield of blackgram, to find out its effective concentration along with the proper stage of spraying in improving weed control, yield parameters and yield of blackgram plants. Present investigation was under taken with post emergence herbicides viz., imazethapyr @ 50g and combined use of acifluorfen sodium 16% EC + clodinafop propargyl 8% EC (24%EC) @ 180, 240 and 300g a.i ha⁻¹ applied at 15 and 25 DAS, weed free check (hand weeding at 15 and 30 DAS) and weedy check were tested in three replicate under RBD design. Treatment of weed free check was found best by recording highest weed control efficiency, plant dry weight, yield parameters and yield of blackgram. It was at par with acifluorfen sodium + clodinafop propargyl @ 300g a.i ha⁻¹ at 15 DAS closely followed by acifluorfen sodium + clodinafop propargyl @ 240g a.i ha⁻¹ at 15 DAS. An application of acifluorfen sodium + clodinafop propargyl @ 300g a.i ha⁻¹ at 15 DAS was found most effective in reducing weed population (viz., monocots and dicots weeds) and resulted in less dry weight of weeds, higher weed control efficiency (70.63%) and it was closely followed by acifluorfen sodium + clodinafop propargyl @ 240g a.i ha⁻¹ at 15 DAS. The highest grain yield recorded in acifluorfen sodium + clodinafop propargyl @ 300g a.i ha⁻¹ at 15 DAS (1050.20 kg ha⁻¹) followed by acifluorfen sodium + clodinafop propargyl @ 240g a.i ha⁻¹ at 15 DAS (1001.60 kg ha⁻¹) than other doses and control. The favourable economic benefit interms of benefit-cost ratio was observed by the application of acifluorfen sodium + clodinafop propargyl @ 240g a.i ha⁻¹ at 15 DAS.

Key words: *Post emergence herbicides, RBD (Randomised Block Design), Weed control and Yield.*

Blackgram [*Vigna mungo* (L.) Hepper] is an important legume crop cultivated worldwide in tropical and subtropical regions with high protein in its seeds. India is the largest producer and consumer of blackgram in the world. Blackgram is the fourth important pulse crop in India and second most important in Andhra Pradesh in terms of extent of cultivation.

In Andhra Pradesh, blackgram is grown during *Kharif* season. It is cultivated an area of 0.25 lakh ha, producing 0.17 lakh tonnes with a productivity of 676 kg ha⁻¹ (Department of Agriculture and Co-operation, Government of A.P, 2014-15).

Blackgram plays an important role in Indian diet. It contains about 26 per cent protein, 57 per cent carbohydrate and 1.2 per cent fat. It is a good source of phosphoric acid, calcium and vitamins like thiamine (B₁), riboflavin (B₂) and niacin (B₃), grown primarily for its protein rich seeds, used as dhal.

The protection of crops from weeds and other vegetation which inhibit crop growth is a

constantly recurring problem in agriculture. In blackgram, an average yield reduction of 30-50 per cent has been reported due to crop weed competition (Mishra, 1997). Controlling the weeds at optimum time is a necessary for improving the yield of blackgram. The chemical weed control methods are being easy, economics and time saving process.

The use of herbicides, even in tolerant cultivars, can generate stress conditions, evidenced by the increase in phytotoxicity, which affects growth, development and productivity. The negative effect of stress is often mediated by the oxidative damage initiated by reactive oxygen species (ROS). The herbicides selectivity can be visually assessed by means of the phytotoxicity symptoms in plants, and also by the change in growth and yield parameters

Recently, some new post emergence herbicides viz., imazethapyr, acifluorfen sodium and clodinafop propargyl etc. are being marketed with the assurance of selective control of weeds in blackgram. Although these are recommended for

blackgram, there are field reports of phytotoxicity in the crop after the application of imazethapyr, acifluorfen sodium and clodinafop propargyl. Therefore, the present investigation was undertaken to study the efficacy of post emergence herbicides on weed control and yield of blackgram.

MATERIAL AND METHODS

A field experiment was conducted at “Northern” block of Agricultural College Farm, Bapatla, on sandy clay loam soil during *Kharif* season, 2015. The experiment was laid out in a Randomized Block Design with three replications. The crop was fertilized with nitrogen and phosphorus @ 20 kg N ha⁻¹ in the form of urea and 50 kg P₂O₅ ha⁻¹ in the form of single super phosphate before sowing of crop. The post emergence herbicides viz., imazethapyr 10% EC @ 50 g a.i ha⁻¹ and acifluorfen sodium 16% EC + clodinafop propargyl 8% EC (24% EC) @ 180, 240 and 300 g a.i ha⁻¹ were sprayed at 15 and 25 DAS using knapsack sprayer fitted with flat fan nozzle at spray volume of 500 L ha⁻¹.

The observations on weed density and drymatter were recorded with different combination of herbicides at 60 DAS. Total dry matter production of blackgram and yield parameters like number of pods per plant, number of seeds per pod, pod weight per plant, 100 seed weight and yield were taken at harvest.

RESULTS AND DISCUSSION

Weed density

The data related to the effect of post emergence herbicides on weed density are presented in Table 1. The major weed flora observed in experimental plot include both monocots (grassy weeds) and dicots (broad leaved weeds). The density of grassy weeds (viz., *Echinochloa colonum*, *Sorghum halopense*, *Cyperus rotundus*, *Cynodon dactylon* and *Digitaria sanguinalis*) was higher than the density of broad leaved weeds (viz., *Trianthema portulacastrum*, *Phyllanthus niruri*, *Celosia argentic*, *Aristolochia indica*, *Amaranthus viridis*, *Commelina bengalensis* and *Euphorbia hirta*). Among different weed control treatments, at 60 DAS, weed free check recorded significantly minimum number of grassy weeds (20.1 m⁻²) and

broad leaved weeds (9.3 m⁻²) over un weeded control and other treatments. Among the herbicidal treatments, post emergence application of acifluorfen sodium + clodinafop propargyl @ 300 g a.i ha⁻¹ at 15 DAS recorded lower weed density (48.1 grassy and 28.2 broad leaf weeds m⁻²) at 60 DAS, which was statistically at par with post emergence application of acifluorfen sodium + clodinafop propargyl @ 240 g a.i ha⁻¹ at 15 DAS and significantly superior to other herbicide treatments.

Weed drymatter

The extent of drymatter production of weeds denotes the competition offered by them. During the crop growth period, higher the drymatter production by weeds greater is the competition between crop plant and weeds. The yield reduction of the crop was directly related to the drymatter production of weeds rather than density of weeds alone. The data recorded on drymatter accumulation of weeds at 60 DAS are presented in Table 1 revealed that all the weed control treatments significantly reduced the drymatter of weeds compared to weedy check.

At 60 DAS, weed free check recorded significantly lower weed drymatter (8.48g - grasses and 6.35g-broad leaf weeds m⁻²) over un weeded control and it was statistically at par with post emergence application of acifluorfen sodium + clodinafop propargyl @ 300 and 240g a.i ha⁻¹ at 15DAS. Imazethapyr at 50 g ha⁻¹ sprayed at 15 and 25 DAS recorded comparatively higher weed drymatter (i.e. both monocots and dicots) over acifluorfen sodium + clodinafop propargyl @ 300 g a.i ha⁻¹ at 15DAS. This was due to low rates of application could not control the weed population.

In the present study, weed free check and post emergence application of acifluorfen sodium + clodinafop propargyl @ 300 and 240 g a.i ha⁻¹ at 15 DAS reduced the weed population by 78, 48 and 43.7 per cent (monocot weeds) and 95, 84 and 83.7 per cent (dicot weeds) and the weed drymatter by 77.8, 61.4 and 57.9 per cent (monocot weeds) and 87, 77.9 and 75.9 per cent (dicot weeds), respectively, over un weeded control at 60 DAS, and registered higher weed control efficiencies i.e. 83, 70.6 and 68 per cent, respectively. Such variations in the efficiency of different herbicides

Table 1. Effect of post emergence herbicides on density of weeds (60 DAS), dry weight of weeds (g m⁻²) (60 DAS) and drymatter (At harvest) blackgram.

Treatments	Weed density (no. of plant m ⁻²)		Weed dry weight (g m ⁻²)		Weed control efficiency (%)	Total dry matter (g plant ⁻¹)
	monocots	dicots	monocots	dicots		
T1 Imazethapyr 10% EC @ 50g a.i ha ⁻¹ at 15 DAS	77.5	52.2	24.37	18.73	50.48	15.55
T2 Imazethapyr 10% EC @ 50g a.i ha ⁻¹ at 25 DAS	90.5	68.4	27.68	23.18	41.56	14.64
T3 Acifluorfen Sodium 16%EC + Clodinafop propargyl 8%EC (24%EC)@180g a.i ha ⁻¹ at 15DAS	87.2	50.7	25.16	18.87	49.41	15.28
T4 Acifluorfen Sodium 16%EC + Clodinafop propargyl 8%EC (24%EC)@180 g a.i ha ⁻¹ at 25DAS	87.4	61.3	25.32	19.13	48.93	14.82
T5 Acifluorfen Sodium 16%EC + Clodinafop propargyl 8%EC (24%EC)@240g a.i ha ⁻¹ at 15DAS	52.1	28.8	16.12	11.76	67.96	17.53
T6 Acifluorfen Sodium 16%EC + Clodinafop propargyl 8%EC(24%EC)@240g a.i ha ⁻¹ at 25DAS	62.1	38.2	24.35	18.21	51.10	15.22
T7 Acifluorfen Sodium 16%EC + Clodinafop propargyl 8%EC (24%EC)@300g a.i ha ⁻¹ at 15DAS	48.1	28.2	14.78	10.78	70.63	17.96
T8 Acifluorfen Sodium 16%EC + Clodinafop propargyl 8%EC(24%EC)@300g a.i ha ⁻¹ at 25DAS	82.1	48.2	25.53	19.28	48.51	14.38
T9 Weed free check (Hand weeding at 15and 30 DAS)	20.1	9.3	8.48	6.35	82.96	18.16
T10 Un weeded control	92.5	176.3	38.26	48.78	0	11.65
SEm±	4.4	3.7	1.826	1.217	1.72	0.769
CD	10.2	10.8	9.425	7.149	5.20	2.286
CV (%)	11.1	11.4	14.4	12.0	7.80	8.8

Table 2. Effect of post emergence herbicides on yield components, yield and economics of blackgram.

Treatments	No. of pods plant ⁻¹	No. of seeds Pod ⁻¹	Pod weight (g plant ⁻¹)	100 Seed weight (g)	Seed yield (kg ha ⁻¹)	B:C Ratio
T1 Imazethapyr 10% EC @ 50g a.i ha ⁻¹ at 15 DAS	23.4	3.4	15.55	3.81	740.74	1.04
T2 Imazethapyr 10% EC @ 50g a.i ha ⁻¹ at 25 DAS	19.2	3.5	14.64	3.95	768.25	1.12
T3 Acifluorfen Sodium 16%EC + Clodinafop propargyl 8%EC (24%EC)@180g a.i ha ⁻¹ at 15DAS	25.6	4.2	15.28	4.34	771.60	1.08
T4 Acifluorfen Sodium 16%EC + Clodinafop propargyl 8%EC (24%EC)@180 g a.i ha ⁻¹ at 25DAS	18.7	4.4	14.82	4.23	632.09	0.70
T5 Acifluorfen Sodium 16%EC + Clodinafop propargyl 8%EC (24%EC)@240g a.i ha ⁻¹ at 15DAS	27.8	4.8	17.53	4.51	987.60	1.59
T6 Acifluorfen Sodium 16%EC + Clodinafop propargyl 8%EC(24%EC)@240g a.i ha ⁻¹ at 25DAS	24.6	4.3	15.22	4.18	925.90	1.43
T7 Acifluorfen Sodium 16%EC + Clodinafop propargyl 8%EC (24%EC)@300g a.i ha ⁻¹ at 15DAS	28.9	4.9	17.96	4.92	1001.60	1.56
T8 Acifluorfen Sodium 16%EC + Clodinafop propargyl 8%EC(24%EC)@300g a.i ha ⁻¹ at 25DAS	23.4	4.1	14.38	4.53	655.50	0.68
T9 Weed free check (Hand weeding at 15and 30 DAS)	30.2	5.2	18.16	4.92	1050.20	1.37
T10 Un weeded control	18.2	3.0	11.65	3.59	591.23	0.73
SEm±	0.5	0.04	0.769	0.02	41.13	
CD	1.5	0.12	2.286	0.06	123.4	
CV (%)	2.8	2.05	8.8	1.01	11.6	

were because of their chemical structure and mode of action (Vyas and Jain, 2003; Kalpana and Velayutham, 2004). These results were in confirmation with the findings of Jha *et al.* (2014).

Total drymatter of blackgram

Total drymatter production and its partitioning are the key factors in determining the economic yield of the crop. Weed free check (T₉) registered higher amount of total drymatter (18.16 g plant⁻¹) which was statistically at par with T₇ (17.96g plant⁻¹) and T₅ (17.53g plant⁻¹), and significantly superior over control and other treatments. Un weeded control accumulated lesser drymatter (11.65 g plant⁻¹) due to severe weed competition. All other treatments were significantly higher over control.

In the present study, two hand weedings at 15 and 30 DAS (weed free check) and post emergence application of acifluorfen sodium + clodinafop propargyl @ 300 and 240g a.i ha⁻¹ at 15DAS increased the total drymatter of blackgram by 55.9, 54.2 and 50.5 per cent, respectively, over un weeded control because of better weed control. This better weed control resulted in

favourable environment to have higher nutrient uptake reflected on higher leaf area index and better source sink relationship for accumulating higher drymatter. On the other hand, un weeded control recorded lower total drymatter due to severe weed competition at all stages of crop growth. Whereas imazethapyr @ 50 g a.i ha⁻¹ at 15 and 25 DAS increased the total drymatter of blackgram by 33.5 and 25.7 per cent, respectively, over un weeded control and decreased the total drymatter by 15.5 and 22.7 per cent, respectively, over higher doses of acifluorfen sodium + clodinafop propargyl i.e. 300g a.i ha⁻¹ at 15 DAS. This is due to lower dose of imazethapyr (i.e. 50 g ha⁻¹) at 15 and 25 DAS could not able to control the weed population, which resulted in higher weed drymatter in these plots and ultimately recorded lesser drymatter of blackgram.

Yield attributes and yield

Different weed control treatments increased the number of pods per plant from 2.7 to 65.9 per cent compared to weedy check (Table 2). Weed free check and post emergence application of acifluorfen sodium + clodinafop propargyl @ 300 and 240 g a.i ha⁻¹ at 15 DAS

increased the pods per plant by 65.9, 58.8 and 52.7 per cent, respectively, over un weeded control. The highest number of seeds per pod (5.2) was recorded under hand weeding twice at 15 and 30 DAS, followed by post emergence application of acifluorfen sodium + clodinafop propargyl @ 300 (4.9) and 240 (4.8) g a.i ha⁻¹ at 15 DAS.

Post emergence application of acifluorfen sodium 16% EC + clodinafop propargyl 8% EC (24% EC) @ 240, 300 g a.i ha⁻¹ at 15 DAS and weed free treatment increased the pod weight by 40.0, 41.6 and 42.6 per cent , respectively, over un weeded control. There was a significant increase in 100 seed weight (test weight) due to weed control treatments. The maximum 100- seed weight observed was 4.92g versus control (3.50g) as a result of combined application of acifluorfen sodium + clodinafop propargyl @ 300 g a.i ha⁻¹ at 15 DAS and this treatment is at par with weed free check (4.92 g) and superior over other herbicidal treatments. These two treatments increased the 100- seed weight by 37 per cent over un weeded control.

The highest seed yield was recorded with weed free check (T₉ – 1050.20 kg ha⁻¹), where yield attributes were also higher. Among different herbicides, post emergence application of acifluorfen sodium 16% EC + clodinafop propargyl 8% EC (24% EC) @ 300g a.i ha⁻¹ at 15 DAS recorded higher seed yield (T₇ – 1001.60 kg ha⁻¹) which was statistically at par to its 240g ha⁻¹ at 15 DAS (T₅ – 987.60kg ha⁻¹) due to better yield attributes. These two treatments were at par with weed free check. This significant increase in yield due to these treatments may be because of reduced crop-weed competition at critical stages as reflected by significantly low weed population and drymatter, resulting in better accumulation of photosynthates. Remaining herbicidal treatments (i.e. T₁, T₂, T₃, and T₆) were significantly superior over un weeded control. Weedy check (T₁₀) recorded lowest seed yield (591.23 kg ha⁻¹) due to heavy infestation of weeds. All the weed control treatments increased the seed yield of blackgram by 6.9 to 77.6 per cent over weedy check (Table 2). Weed free check and post emergence application of acifluorfen sodium 16% EC + clodinafop propargyl 8% EC (24% EC) @ 300 and 240 g a.i ha⁻¹ at 15 DAS increased the

seed yield by 77.6, 69.4 and 67.8 per cent, respectively, over un weeded control. Though, imazethapyr @ 50 g ha⁻¹ at 15 and 25 DAS recorded significant increase in yield (25.3 and 29.9 per cent, respectively) over un weeded control, but these two treatments were inferior over the combined use of acifluorfen sodium + clodinafop propargyl at 240 and 300g a.i ha⁻¹ at 15 DAS.

Benefit : Cost Ratio

The highest benefit cost ratio was recorded with acifluorfen sodium + clodinafop propargyl @ 240g a.i ha⁻¹ (i.e. 1.59) and this was closely followed by acifluorfen sodium + clodinafop propargyl @ 300g a.i ha⁻¹ (i.e. 1.56) and hand weeding at 15 and 30 DAS with 1.37 indicating the cost effectiveness of herbicides, whereas weed free treatment involved highest labour cost and cost cultivation, which leads decreased net returns.

Conclusion

From this study, it can be concluded that post emergence application of acifluorfen sodium + clodinafop propargyl @ 240g a.i ha⁻¹ at 15 DAS is recommended for weed control in blackgram as it improved the growth, physiological parameters and yield of blackgram.

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