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Flauazifop-p-butyl against grasses in cotton and its residual effect on succeeding blackgram

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ABSTRACT

A field experiment was conducted during rainy seasons of 2010-11 and 2011-12 at Guntur, Andhra Pradesh, India to evaluate the bio-efficacy of fluazifop-p-butyl against grassy weeds in cotton and its residual effect on succeeding crop of blackgram during the winter season. Results revealed that among different doses of fluazifop-p-butyl, post-emergence application of fluazifop-p-butyl 167 g/ha reduced grassy weed growth and recorded higher crop dry weight, yield components and seed cotton yield (1915 kg/ha) over its lower doses (100 and134 g/ha) but was on par with the highest dose of 335 g/ha in both the years. None of the doses of fluazifop-p-butyl including the highest dose (335 g/ha) did not cause any injury to cotton. In a field experiment, residual carry over effect of fluazifop-p-butyl at different doses of 100 to 335 g/ha was studied using blackgram as a succeeding crop. Differences were non-significant on plant population, plant height, crop dry weight and seed yield of blackgram indicating that there was no residual effect of fluazifop-p-butyl in the soil after harvesting of the cotton crop. It was concluded that the post- emergence application of fluazifop-p- butyl 167 g/ha was effective in controlling grassy weeds in cotton without any crop injury and residual effect on succeeding crop.

Cotton being a wide row spaced and initial slow growth crop weeds effectively compete for the crop for nutrients, water etc. and reduce the yield to an extent of 74% depending upon type and intensity of weed flora (Rao *et al.* 2007, Madhu *et al.* 2014, Rao and Ratnam 2015). Further, during rainy season due to incessant rains, intercultivation is not possible which also results in severe weed competition. 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 2011, Madhu *et al.* 2014 and Rao 2014) the information pertaining to bioefficacy of fluazifop-p-butyl (butyl 2-(4-{[5-(trifluoromethyl) pyridin-2-yl]oxy}phenoxy) propanoate) on cotton is scanty, particularly under local conditions of Andhra Pradesh, India. Keeping this in view, the present investigation was undertaken to evaluate the bio-efficacy of fluazifop-butyl at different doses against grassy weeds in comparison with presently recommended herbicides like pendimethalin and paraquat and its residual effect on succeeding blackgram crop

A field experiment was conducted consecutively for two years during rainy and winter seasons of 2010-11 and 2011-12 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 a pH of 7.9, with low in available nitrogen (230 kg/ha) and phosphorus (10 kg/ha) and high in available potassium (350 kg/ha). The experiment consisting of eight treatments (fluazifop-p-butyl 100, 134, 167, 335 g/ha, paraquat 600 g/ha, pendimethalin 750 g/ha, hand weeding at 20, 40, 60 DAS along with weedy check) was laid out in a randomized block design with three applications. Cotton variety *Mallika Bt.* was sown by adopting a spacing of 90 x 60 cm during the 1st week of August 2010 (first year) and 1st week of July 2011 (second year). The crop survived mostly on the rainfall received during both the years (1084.1 mm in 48 rainy days during the first year and 568.8 mm in 38 rainy days during the second year). All the locally recommended package of practices except weed control was followed to raise the cotton crop. All the post- emergence herbicides were sprayed with knapsack sprayer fitted with a flat fan

nozzle at 23 DAS as per schedule using a spray volume of 500 l/ha. Before spraying the post-emergence herbicides, all the sedges and broad-leaf weeds were removed, allowing only the grassy weeds to remain. The data on the density of grassy weed species and weed dry weight per unit area were recorded at 40 days after application (DAA) of herbicide and at final picking. The data on weed density and dry weight were subjected to square root 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 output.

The residual effect of fluazifop-p-butyl at different doses was studied on the succeeding blackgram (cv. '*PU31*'). All the recommended package of practices except chemical weed control was followed to raise the blackgram crop. The crop was irrigated as and when needed. The data on blackgram population per unit area was recorded at 10 DAS. The yield attributes and yield were recorded at the time of maturity.

Effect on weeds

The experimental field was dominated by the natural infestation of *Echinochloa colona* (L.) Link, *Dinebra retroflexa* Jacq, *Panicum repens* L., *Dactyloctenium aegyptium* L., *Leptochloa chinensis* and *Cynodon dactylon* (L.) Pers., which consisted of more than 90% of the total weed population. Other weeds like *Phyllanthus niruri* L., *Digera arvensis Forsk, Cleome viscose* 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 fluazifop-p-butyl treatments compared to weedy check (**Table 1** and **2**) at both stages of observation. At 40 DAA, among the different doses, post-emergence application of fluazifop-p-butyl at 167 g/ha was found effective in reducing the density and dry weight of grasses with 67% weed control efficiency (WCE) and was found to be on par with its all other doses of fluazifop-p-butyl. Among the individual species, the density of *Echinochloa colonum* was effectively reduced (71%) followed by *Dactyloctenium aegyptium* (68%) and *Panicum repens* (66%) at 40 DAA. Further, the highest WCE of 71% was observed with the highest dose of fluazifop-p-butyl (335 g/ha) and none of the treatments could reach to the level of the hand weeding at 15 and 30 DAS in reducing the weed growth which recorded the highest WCE of 82% at 40 DAA. An almost a similar trend was observed at final picking stage. The increased weed control in these treatments might be due to effective control of the grassy weeds during the critical period of crop growth.

Effect on cotton crop

Fluazifop-p-butyl at all doses (100 to 337 g/ha) did not cause any injury to cotton. Crop dry weight, yield components, and yield were significantly influenced by the different treatments under study over a weedy check (**Table 2**). Among the fluazifop-p-butyl treatments, post-emergence application of fluazifop-p-butyl at 167 g/ha recorded maximum crop dry weight, number of bolls per plant, boll weight and seed cotton yield (1915 kg/ha).This treatment was on par to its next lower (134 g/ha) and

Table 1. Density of different weed species as influenced by different treatments in cotton (pooled data)

Treatment	Dose (g/h)	Time of application (DAS)	*Echinochloa colonum* (no./m^2)		*Panicum repens* (no./m^2)		*Cynodon dactylon* (no./m^2)		*Leptochloa chinensis* (no./m^2)		*Dactyloctenium aegyptium* (no./m^2)		*Dinebra retroflexa* (no./m^2)	
			40 DAA	Final picking	40 DAA	Final picking	40 DAA	Final picking	40 DAA	Final picking	40 DAA	Final picking	40 DAA	Final picking
Weedy check	-	-	6.21 (34.50)	4.0 (16.85)	3.02 (9.18)	2.41 (5.5)	2.01 (4.33)	2.01 (4.83)	2.18 (4.68)	2.10 (4.0)	3.63 (13.68)	3.58 (12.67)	4.45 (19.82)	3.85 (15.67)
Fluazifop-p-butyl	100	23	3.26 (10.17)	1.89 (3.33)	1.9 (6.18)	1.43 (1.88)	0.97 (0.50)	1.12 (0.90)	0.94 (0.68)	0.97 (0.48)	1.59 (3.35)	1.91 3.30)	2.34 (5.34)	1.41 (1.85)
Fluazifop-p-butyl	134	23	2.47 (5.67)	2.2 (4.82)	1.48 (1.83)	1.05 (0.67)	0.88 (0.33)	1.03 (0.67)	0.80 (0.16)	0.97 (0.48)	1.61 (2.18)	1.60 (2.15)	1.78 (3.52)	1.31 (1.50)
Fluazifop-p-butyl	167	23	1.82 (2.83)	1.85 (3.32)	1.03 (0.65)	0.88 (0.32)	0.71 (0.00)	0.88 (0.33)	0.80 (0.16)	1.10 (0.83)	1.18 (1.0)	1.16 (1.15)	1.58 (2.52)	1.12 (1.50)
Fluazifop-p-butyl	335	23	1.23 (1.17)	1.83 (3.68)	0.94 (1.70)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	1.12 (1.17)	0.97 (0.50)	1.27 (1.50)	1.03 (0.82)	1.14 (1.00)
Paraquat	600	23	5.20 (26.68)	3.71 (13.82)	2.30 (5.18)	1.84 (3.02)	1.49 (1.82)	1.53 (0.82)	1.61 (2.67)	1.53 (2.15)	2.28 (5.00)	2.28 (4.85)	3.67 (13.17)	2.69 (7.17)
Pendimethalin	750	1	3.22 (10.15)	2.21 (4.17)	1.78 (3.05)	1.32 (1.35)	1.11 (0.85)	1.38 (1.48)	1.50 (2.00)	1.11 (0.82)	1.26 (1.30)	1.22 (1.17)	2.25 (5.00)	2.02 (3.85)
Hand weeding	-	20,40&60	1.54 (2.33)	1.52 (2.01)	1.36 (0.33)	0.80 (0.15)	1.03 (0.62)	1.11 (0.83)	1.16 (0.98)	1.08 (0.85)	1.09 (0.82)	1.29 (1.17)	1.37 (1.50)	1.51 (1.82)
LSD (P=0.05)	-	-	0.94	0.94	0.63	0.46	0.61	0.55	0.75	0.64	0.70	0.80	0.86	0.89

Data transformed to transformation. Figures in parenthesis are original values. DAA-days after application

Table 2. Effect of different treatments on weed growth, yield components and yield of cotton (pooled data)

Treatment	Dose (g/ha)	Time of application (DAS)	Weed dry weight (g/m^2)		Crop dry weight (g/m^2)		No. of bolls/ plant	Boll weight (g)	Seed cotton yield (t/ha)		
			40 DAA	Final picking	40 DAA	Final picking			2010-11	2011-12	Pooled
Weedy check	-	-	15.3(238.2)	13.6(195.9)	20.7	243.3	10.76	4.56	0.88	0.63	0.76
Fluazifop-butyl	100	23	6.8(51.1)	8.3(71.9)	49.8	320.7	17.40	4.97	1.44	0.98	1.21
Fluazifop-butyl	134	23	5.9(38.6)	7.2(52.2)	62.4	416.3	19.00	5.29	1.82	1.26	1.54
Fluazifop-butyl	167	23	5.1(31.1)	6.4(41.7)	68.3	447.3	24.80	5.39	2.31	1.51	1.91
Fluazifop-butyl	335	23	4.4(22.3)	5.2(29.2)	56.1	430.0	19.90	4.92	1.88	1.32	1.60
Paraquat	600	23	9.2(88.8)	10.7(116.7)	36.9	304.3	16.40	4.74	1.04	0.98	1.01
Pendimethalin	750	1	8.3(71.4)	8.2(73.3)	53.9	399.7	19.33	5.20	1.64	1.01	1.32
Hand weeding	-	20, 40 and 60	2.8(9.8)	5.9(35.5)	72.8	472.2	31.97	5.72	2.47	2.10	2.28
LSD (p=0.05)	-	-	2.1	2.7	15.0	90.7	5.65	0.96	0.44	0.29	0.38

In case of weed dry\weight data transformed to $\sqrt{x}+½$ transformations. Figures in parenthesis are original values. DAA-days after application

Table 3. Effect of different treatments on plant population, growth and yield of succeeding blackgram (pooled data)

Treatment	Dose (g/ha)	Time of application (DAS)	Plant population/ m length at 10 DAS	Plant height (cm) at harvest	Crop dry weight (g/m^2) at harvest	No. of branches/ plant	No. of pods/ plant	No. of Seeds/ pod	100 seed weight (g)	Seed yield (kg/ha)		
										2010-11	2011-12	Pooled
Weedy check	-	-	14.3	17.1	134.5	3.4	25.4	5.6	3.45	442	439	441
Fluazifop butyl	100	23	14.2	15.9	143.5	3.2	28.3	5.7	3.34	480	482	481
Fluazifop butyl	134	23	14.2	16.2	146.2	3.5	25.7	5.6	3.35	535	510	523
Fluazifop butyl	167	23	13.8	16.7	166.8	3.5	30.5	5.7	3.60	566	539	553
Fluazifop butyl	335	23	13.0	19.0	150.7	3.6	29.1	5.5	3.46	504	482	493
Paraquat	600	23	13.5	16.1	147.0	3.5	29.3	5.8	3.41	514	496	505
Pendimethalin	750	1	13.6	17.6	153.3	3.9	27.3	5.6	3.56	501	496	433
Hand weeding	-	20,40&60	14.3	16.8	155.8	3.9	25.5	5.6	3.68	503	553	528
LSD (p=0.05)	-	-	N S	NS	NS	NS	NS	NS	NS	NS	NS	NS

the highest dose (335 g/ha) of fluazifop-p-butyl and also with hand weeding at 15 and 30 DAS which recorded the highest seed yield (2.28 t/ha). The increased yield in these treatments might be due to effective control of weeds at critical period as evidenced by higher WCE, which favoured the increased crop growth and ultimately on yield components and yield. The uncontrolled weed growth during the crop season reduced the seed cotton yield to the extent of 74% corroborating with those reported by Rao and Ratnam (2015).

Residual effect on succeeding blackgram crop

Post-emergence application of fluazifop-p-butyl at different doses ranging from 100 to 335 g/ha had no adverse effect on plant population, plant height, yield components and yield of succeeding blackgram crop (**Table 3**). The blackgram yield in fluazifop-p-butyl treatments ranged from 481 to 553 kg/ha.

It was concluded that post-emergence application of fluazifop-p-butyl 167 g/ha was found to be effective in controlling grassy weeds with out any crop injury in cotton and residual effect on succeeding blackgram crop.

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