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Integrated weed management in *Kharif* blackgram

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ABSTRACT

A field experiment was conducted on medium black calcareous clayey soil at Pulses Research Station, Junagadh Agricultural University, Junagadh during three seasons of 2011-12, 2012-13 and 2014-15 to study the efficacy of pre-and post-emergence herbicides in *Kharif* blackgram (*cv. GU-1*). The quizalofop-ethyl 40 g/ha as post-emergence (PoE) at 20 days after seeding (DAS) + hand weeding (HW) at 40 days after seeding (DAS) and pendimethalin 900 g/ha as pre-emergence (PE) + hand weeding (HW) at 40 DAS were found equally effective to the weed-free check in controlling weeds and improving growth and yield attributes and ultimately seed yield (1.14 and 1.13 t/ha) and straw yield (1.26 and 1.33 t/ha) of blackgram. These treatments also recorded higher weed control efficiency (65.3 - 63.1%), herbicide efficiency index (81.1 - 82.3%), lower weed index (9.1 - 9.7%) and minimum weed dry biomass (273.9 - 291.7 kg/ha) and higher net returns (` 21,230 and ` 21,162 /ha). Integrated weed management practices with herbicides as a component were found effective and economical under south Saurashtra agro-climatic conditions of Gujarat.

Key words: Blackgram. Economics, Herbicides, Integrated weed management, Weed control efficiency

Cultivation of pulses in coastal areas of Gujarat is a common practice in *Kharif* and semi-*Rabi* seasons. In Gujarat, blackgram is grown in almost all the districts as a *Kharif* crop with 9.44 lakh ha area with 5.96 lakh tonnes production and 631 kg/ha productivity. In South Saurashtra region of Gujarat, blackgram is cultivated in 16.8 lakh ha with a production of 7.1 lakh tonnes and productivity of 2.48 t/ha (DAG, 2015). Among the different constraints in cultivation of *Kharif* blackgram, weed menace is major as weeds cause the yield reduction upto 53% (Appanna *et al.* 1998). Further, initial slow growth of blackgram seedlings makes itself poor competitor with more vigorous weeds. The normal methods of weed management like hand weeding is not practiced by farmers in blackgram cultivation because of the higher labour wages, problem of heavy rains and chances of trampling of crop during the weeding, which leads to loss of crop stand. Hence, selective herbicides use can be one of the best alternatives for economic and timely weed control in *Kharif* blackgram. Scanty scientific information is available regarding weed management in blackgram especially for South Saurashtra region of Gujarat. Hence, present experiment on bio-efficacy of different herbicides was undertaken to find out an appropriate integrated weed management practice for *Kharif* blackgram.

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MATERIALS AND METHODS

A field experiment was carried out at Junagadh Agricultural University, Junagadh (Gujarat) on medium black calcareous soil during *Kharif* seasons of 2011-12, 2012-13 and 2014-15. The soil was clayey in texture and slightly alkaline in reaction (pH 7.8 and EC 0.35 dS /m), low in available nitrogen (203.5 kg N/ha), while medium in available phosphorus (81.9 kg P_2O_5/ha) and potash (215.7 kg K_2O/ha). Twelve treatments comprising of weed management practices, *viz.* pendimethalin 900 g/ha as pre-emergence (PE), oxyfluorfen 240 g/ha PE, pendimethalin 900 g/ha PE + hand weeding (HW) at 40 days after seeding (DAS), oxyfluorfen 240 g/ha PE + HW at 40 DAS, quizalofop-ethyl 40 g/ha post-emergence (POE) at 20 days after seeding (DAS), imazethapyr 75 g/ha PoE at 20 DAS, quizalofop-ethyl 40 g/ha PoE at 20 DAS + HW at 40 DAS, imazethapyr 75 g/ha PoE at 20 DAS + HW at 40 DAS, fenoxaprop 100 g/ha at 20 DAS + HW at 40 DAS, two hand weeding (HW) at 20 and 40 DAS, weed-free and unweeded control were evaluated in randomized block design replicated thrice. The gross and net plot sizes were 5.0 x 2.7 and 4.0 x 1.8 m, respectively. The blackgram variety '*GU-1*' was sown at 45 cm row spacing with standard package of practices. The crop was fertilized with 20-40-0 kg N-P_2O_5-K_2O/ha. Herbicides were applied as per treatments using manually operated knapsack sprayer fitted with flat fan nozzle using spray volume of 500 L/ha. Weed density (no./m² area) were recorded at 20 and 40

DAS. Economics was worked out as per the prevailing market price.

RESULTS AND DISCUSSION

The weed flora of experimental field mainly comprised of *Cyperus rotundus*, *Commelina nudiflora*, *Cynodon dactylon*, *Digitaria sanguinalis*, *Digera arvensis*, *Trianthema portulacastrum*, *Euphorbia hirta* and *Physalis minima*. *Cyperus rotundus* was the major dominant sedge weed throughout the growing season.

Effect on weeds

The pooled data over three years indicated that different weed management treatments exerted their significant effect on weed density at 20 and 40 DAS and weed biomass at harvest. Next to weed-free, significantly the lowest weed density (2.68 /m²) at 20 days crop growth was recorded with oxyfluorfen PE at 240 g/ha and with quizalofop-ethyl 40 g/ha post-emergence (PoE) at 20 DAS + HW at 40 DAS. At 40 days crop growth stage, two HW (20 and 40 DAS) recorded significantly lowest weed density (5.39/m²) and statistically remained at par with all other herbicide treatments except quizalofop-ethyl applied at 40 g/ha PoE of 20 days crop growth. Significantly the lowest weed biomass (273.9 kg/ha) was recorded with application of quizalofop-ethyl 40 g/ha PoE at 20 DAS + HW at 40 DAS and closely followed by pendimethalin 900 g/ha as PE + HW at 40 DAS (291.7 kg/ha). However, both the treatments maintained statistical equivalence with oxyfluorfen 240 g/ha PE + HW at 40 DAS, imazethapyr 75 g/h PoE at 20 DAS alone or integrated with one HW at 40 DAS (**Table 1**) and hand weeding twice (20 and 40 DAS).

Mean data of weed control efficiency (WCE) and herbicide efficiency index (HEI) showed that next to weed-free check, application of quizalofop-ethyl at 40 g/ha PoE (20 DAS) + HW at 40 DAS recorded the highest WCE and HEI of 65.3 and 82.3%, respectively followed by treatment pendimethalin 900 g/ha PE + HW at 40 DAS (63.1 and 81%) (**Table 1**). Similarly, treatments, *viz*. quizalofop-ethyl PoE 40 g/ha at 20 DAS and pendimethalin 900 g/ha PE both integrated with one HW at 40 DAS recorded the lowest weed index (WI) of 9.1 and 9.7%, respectively that resulted in lower weed biomass production and higher crop yield. The results corroborate the findings of Appanna *et al*. (1998). Weedy situation witnessed the highest weed density, weed index and weed dry biomass owing to uncontrolled condition, which favored luxurious weed growth and resulted in 50% less seed yield over the weed free situation.

Effect on crop

Pre-emergence application of oxyfluorfen 240 g/ha caused phytotoxic effect on emerging blackgram seedlings resulting in moderate stunting growth of seedling and discoloration of developing leaves with negligible loss of crop stand. However, these symptoms were slowly recovered within a week and no abnormality was observed during the crop growth period. Gunsolus and Curran (2002) reported that oxyfluorfen treated potato plants do not die but may be stunted for a week or more and then recovered but was found highly toxic for onion crop (Sathya Priya 2013).

Various weed management practices significantly influenced growth and yield attributes of blackgram

Table 1. Effect of integrated weed management on weed parameters in *Kharif* blackgram (pooled over three years)

Treatment	Dose (g/ha)	Weed density (no./m²)		Weed biomass (kg/ha) at harvest	Weed index (%)	Wed control efficiency (%)	Herbicide efficiency index (%)
		20 DAS	40 DAS				
Pendimethalin	900	2.56 (7.62)	2.64 (7.25)	22.32 (510.0)	19.8	35.4	60.7
Oxyfluorfen	240	1.74 (2.68)	3.08 (10.94)	24.91 (622.4)	26.5	21.2	47.4
Pendimethalin + HW at 40 DAS	900	2.32 (5.37)	2.67 (7.61)	16.04 (291.7)	9.7	63.1	81.0
Oxyfluorfen + HW at 40 DAS	240	2.56 (7.66)	2.50 (6.31)	17.35 (347.1)	25.8	56.1	48.7
Quizalofop-ethyl PoE at 20 DAS	40	2.47 (6.13)	3.27 (12.69)	23.29 (551.9)	17.8	30.1	64.7
Imazethapyr PoE at 20 DAS	75	2.68 (8.00)	2.71 (8.41)	19.15 (367.9)	22.5	53.4	55.4
Quizalofop-ethyl + HW at 40 DAS	40	2.69 (7.94)	2.35 (5.24)	16.04 (273.9)	9.1	65.3	82.3
Imazethapyr + HW at 40 DAS	75	2.40 (6.09)	2.34 (5.51)	16.55 (310.8)	21.6	60.7	57.2
Fenoxaprop at 20 DAS	100	2.56 (7.30)	2.92 (9.09)	21.77 (476.1)	22.9	39.7	54.5
Two HW at 20 and 40 DAS	-	2.57 (7.39)	2.24 (5.39)	16.98 (306.3)	19.8	61.2	
Weed free	-	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.0	100.0	
Weedy	-	3.69 (15.07)	4.13 (17.92)	28.11 (789.9)	50.1		
LSD (p=0.05)		0.95	0.95	5.04			

$\sqrt{x+0.5}$ Transformation (figure in parentheses are original values); PE - Pre-emergence; PoE - Post-emergence

Table 2. Effect of integrated weed management on growth, yield and economics of *Kharif* blackgram (pooled over 3 years)

Treatment	Dose (g/ha)	Plant height (cm)	Branches/ plant	Pods/ plant	Seeds/ pod	Yield (t/ha)		Cost of cultivation (x10³ `/ha)	Net return (x10³ `/ha)	B: C ratio
						Seed	Straw			
Pendimethalin	900	58.6	4.1	29.4	5.1	1.01	1.27	23.15	19.00	1.82
Oxyfluorfen	240	56.8	3.8	34.9	5.3	0.92	1.11	22.78	15.80	1.69
Pendimethalin +HW at 40 DAS	900	58.9	3.5	34.8	5.2	1.13	1.33	26.15	21.16	1.80
Oxyfluorfen +HW at 40 DAS	240	58.2	3.7	34.7	5.0	0.93	1.19	25.78	13.25	1.51
Quizalofop-ethyl PoE at 20 DAS	40	61.0	3.9	32.8	5.1	1.03	1.15	23.30	19.67	1.84
Imazethapyr PoE at 20 DAS	75	58.0	3.5	28.9	4.9	0.97	1.13	23.25	17.37	1.74
Quizalofop-ethyl + HW at 40 DAS	40	60.7	3.6	37.4	5.2	1.14	1.26	26.30	21.23	1.80
Imazethapyr + HW at 40 DAS	75	56.4	3.7	30.8	5.3	0.98	1.18	26.25	13.44	1.51
Fenoxaprop at 20 DAS	100	61.5	3.4	31.7	5.1	0.97	1.19	23.25	17.21	1.74
Two HW at 20 and 40 DAS	-	59.3	3.6	32.7	5.1	1.01	1.22	27.55	14.56	1.52
Weed free	-	61.8	4.5	42.1	5.6	1.25	1.42	32.05	20.27	1.63
Weedy	-	53.2	2.4	19.5	4.3	0.63	0.78	21.55	4.66	1.21
LSD (p=0.05)		NS	0.75	7.69	0.36	0.12	0.14			

(**Table 2**). Significantly, the highest number of branches/plant, pods/plant and seeds/pod were recorded under the weed-free check, however it remained at par with either pre-emergence application of pendimethalin at 900 g/ha or post-emergence of quizalofop-ethyl at 40 g/ha both integrated with one HW (40 DAS) in most of the cases. Significantly the lowest values of these growth and yield attributes were registered under the weedy check. Periodical control of weeds by hand weeding or herbicide application supplemented with hand weeding suppressed weeds, which in turn provided better weed-free environment to the crop during critical period of growth and development. Mundra and Maliwal (2012) also reported similar results.

Different weed management treatments significantly influenced the seed yield of blackgram. The weed-free check yielded by producing significantly the highest seed and straw yield of 1.25 and 1.42 t/ha, respectively and statistically remained at par with quizalofop-ethyl 40 g/ha PoE + HW at 40 DAS. The next best treatment in this regard was pendimethalin 900 g/ha PE + HW at 40 DAS. The better growing condition prevailed in weed-free situation significantly increased the seed yield of 629 kg/ha (100.5%) over unweeded check. Significantly the lowest seed and straw yield (626 and 779 kg/ha, respectively) was observed under the unweeded control which were due to uncontrolled weed growth and severe crop-weed competition (Naidu *et al.* 2012).

Economics

The quizalofop-ethyl 40 g/ha PoE + HW at 40 DAS recorded maximum net returns of ` 21,230/ha, closely followed by pendimethalin 900 g/ha PE + HW at 40 DAS and weed-free which gave net returns of ` 21,162 and ` 20,274/ha, respectively. Unweeded control recorded the lowest net returns (` 4,658/ha). The higher B:C ratio of 1.82 to 1.84 (**Table 2**) was accrued with application of either pendimethalin as pre-emergence or quizalofop-ethyl as post-emergence without hand weeding due to higher prevailing labour wages and closely followed by integration of hand weeding with these herbicides in blackgram.

It was concluded that in *Kharif* blackgram, effective control of weeds, higher yield and net returns could be achieved by application of quizalofop-ethyl 40 g/ha PoE at 20 DAS + HW at 40 DAS or pendimethalin 900 g/ha PE + HW at 40 DAS under south Saurashtra agro-climatic conditions of Gujarat.

REFERENCES

Appanna G, Rao AS, Rao RSN and Ravikumar A. 1998. Evaluation of herbicides for weed management in rice-fallow blackgram. *The Andhra agricultural Journal* **45**: 116-18.

DAG. 2015. *District-wise Area, Production and Yield of Important Food and Non-food Crops in Gujarat State, Year: 2010-11 to 2012-13*. Directorate of Agriculture, Gujarat State, Gandhinagar.

Gunsolus JL and Curran WS. 2002. Herbicides mode of action and injury symptoms. pp. 16. In: *North Central Region Publication No. 377*. University of Minnesota. St Paul.

Mundra SL and Maliwal PL. 2012. Influence of quizalofop-ethyl on narrow-leaved weeds in blackgram and its residual effect on succeeding crops. *Indian Journal of Weed Science* **44**(4): 231–234.

Naidu KRK, Ramana AV and De B. 2012. Bio-efficacy and economics of herbicides against weeds of blackgram grown in rice-fallow. *Journal of Crop and Weed* **8**(1): 133-136.

Sathya Priya R, Chinnusamy C, Manickasundaram P and Murali AP. 2013. Evaluation of new formulation of oxyfluorfen (23.5% EC) for weed control efficacy and bulb yield in onion. *American Journal of Plant Sciences* **4**: 890-895.