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Short communication

Integrated weed management in blackgram

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Blackgram (*Vigna mungo* L.) is one of the important pulse crops grown in India, which belong to the family "Leguminoseae". It is consumed in various forms as whole or split, husked and unhusked. It is rich in protein (24%), carbohydrate (60%), fat (1-5 %), amino acids, vitamins and minerals and much richer than most of grains used as concentrate. In India, blackgram producing states are Andhra Pradesh, Bihar, Madhya Pradesh, Maharashtra, Uttar Pradesh, West Bengal, Punjab, Haryana, Tamil Nadu, Karnataka, Odisha and Gujarat. It is grown in an area of about 3.06 million ha with a total production of 1.70 million tones with average productivity of 555 kg/ha (AICRP on MULLaRp, 2014-15). The area under summer blackgram is increasing by leaps and bounds in South Gujarat, where perennial irrigation facilities are available from Ukai-Kakarapar irrigation project. The area and production of this crop is about 1.09 lakh hectares and 0.73 lakh million tones, respectively with productivity of 672 kg/ha in the state (Anon. 2014).

Amongst the various factors known to augment the crop production, weeds form a single negative factor, which play key role against achieving full yield potential of the crop. The critical period of crop weed competition in blackgram crop is from 15 to 45 DAS (Vats and Sawhney 1980). Use of herbicides has become imperative due to costly labour and their unavailability. The use of herbicides can be reduced if used in integrated manner. This work was done to find out suitable integrated method for the weed control in blackgram besides other suitable method.

The experiment was carried out during summer season of 2014 at Navsari Agricultural University, Navsari (Gujarat) with 10 treatments in three replication. The soil popularly known as "Deep Black" soil with pH 7.98, EC 0.36 dS/m, available N 230 kg/ha, P 38 kg/ha, K 379 kg/ha. Summer blackgram variety *"T-9"* was sown at 20 kg/ha at 30 cm row spacing on February 15, 2014. Crop was grown with recommended package of practices except weed management. Inter-culturing operation was carried out in inter row space through bullock drawn implement and simultaneous removal of weeds manually in intra row space. All the herbicide were applied with manually operated knapsack sprayer fitted with flat fan nozzle at a spray volume of 500 l/ ha. Weed count was recorded at 30, 60 DAS and at harvest. Dry weight of weeds was recorded at harvest. Data were subjected to square root ($\sqrt{x + 0.5}$) to transformation.

Experimental field was infested with *Cyperus rotundus*, *Echinochloa crusgalli*, *Digitaria sanguinalist, Sorghum halepense*, *Cynodon dactylon*, *Amaranthus viridis*, *Alternanthera sessillis*, *Digera arvensiss* and *Convolvulvulus arvensis.*

All herbicidal and integrated treatments significantly reduced the weed density and their biomass over weedy check. The lowest dry weight of weeds was found in pendimethalin 1.0 kg/ha as PE + hand weeding at 30 DAS and highest dry weight of weeds was recorded in plot treated with oxyfluorfen 0.18 kg/ha PE + imazethapyre 1.0 kg/ha at 30 DAS as post-emergence (POE). The lowest weed index of 2.07% and the highest weed control efficiency (80.96%) was registered under pendimethalin 1.0 kg/ ha PE + HW at 30 DAS, which was closely followed by oxyfluorfen 0.18 kg/ha as pre-emergence + HW at 30 DAS (79.2%) and pendimethalin 1 kg/ha as pre-emergence + IC at 30 DAS (77.3%). The finding matched with the results of Vivek *et al.* (2008) and Kaur *et al.* (2009).

The results indicated that different weed control treatments exerted their significant influence on plant growth characters. Among all weed control treatments, plant height and branches/plant were significantly higher in weed free, which was followed by pendimethalin 1.0 kg/ha as PE + hand weeding at 30 DAS, oxyfluorfen 0.18 kg/ha PE + hand weeding

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Table 1. Effect of weed-control treatments on weed index, weed control efficiency, dry weight of weeds growth and yield attributes of blackgram

Treatment	Weed index (%)	Weed control efficiency (%)	Dry weight of weeds (kg/ha)	Plant height (cm)	Pods/ plant	Test weight (g)	Grain yield (t/ha)	Stover yield (t/ha)	Net returns (x10^3 `/ha)	B:C ratio
Weedy check	26.4	0	143.7	17.7	15.6	29.2	0.55	1.22	17.3	2.35
Weed free	0.0	100.0	0.0	28.2	23.1	36.8	1.25	2.67	52.5	4.43
Pendimethalin 1 kg /ha as PE + IC at 30 DAS	3.7	77.3	32.6	26.7	20.5	35.3	1.10	2.34	45.0	3.96
Pendimethalin 1 kg /ha as PE + hand weeding at 30 DAS	2.1	81.0	27.3	27.9	22.2	36.0	1.22	2.61	50.4	4.18
Pendimethalin 1 kg /ha as PE + imazethapyre 0.1 kg/ha at 30 DAS (PoE)	17.2	70.0	43.1	19.8	18.2	32.1	0.74	1.62	23.7	2.43
Pendimethalin 1kg /ha asPE+ quizalofop-p-ethyl at 0.05 kg/ha at 30 DAS (PoE)	13.6	73.7	37.8	23.1	18.9	33.5	0.77	1.70	25.9	2.60
Oxyfluorfen 0.18 kg/ha PE + IC at 30 DAS	11.7	75.5	35.2	26.3	19.9	34.7	0.86	1.90	32.4	3.23
Oxyfluorfen 0.18 kg/ha PE+ hand weeding at 30 DAS	3.6	79.2	29.9	27.6	21.7	35.8	1.19	2.44	49.1	4.24
Oxyfluorfen 0.18 kg/ha PE + imazethapyre 0.1 kg /ha at 30 DAS (PoE)	18.1	68.2	45.8	18.5	17.1	30.3	0.64	1.40	19.0	2.19
Oxyfluorfen 0.18 kg/ha PE + quizalofop-p-ethyl 0.05 kg/ha at 30 DAS (PoE)	15.5	71.8	40.5	21.6	18.8	32.6	0.75	1.66	25.2	2.62
LSD (P=0.05)	9.6	3.9	5.8	2.6	2.5	4.8	0.17	0.39	-	-

at 30 DAS, pendimethalin1.0 kg/ha as PE + IC at 30 DAS and oxyfluorfen 0.18 kg/ha PE + IC at 30 DAS (Table 1).Test weight (g), increased significantly with pendimethalin 1.0 kg/ha as PE + hand weeding at 30 DAS (35.97 g). Significantly maximum number of pods/plant (23.09) was recorded in weed free, but it was found at par with pendimethalin 1.0 kg/ha as PE + hand weeding at 30 DAS and oxyfluorfen 0.18 kg/ ha PE + hand weeding at 30 DAS. The increase in growth attributes under these treatments might be attributed due to the reduction in weed competitiveness with the crop, which ultimately favored better environment for growth and development of crop. Similar findings were reported by Kaur *et al.* (2009).

Effect of integrated weed management was found on seed yield significantly (Table 1). Pendimethalin 1.0 kg/ha as PE + hand weeding at 30 DAS produced highest grain and stover yield of 1.22 and 2.61 t/ha, respectively, and closely followed by oxyfluorfen 0.18 kg/ha PE + hand weeding at 30 DAS with seed and stover yield of 1.19 t/ha and 2.44 t/ha; pendimethalin 1.0 kg/ha as PE + IC at 30 DAS seed and stover yield of 1.11 t/ha and 2.34 t/ha. However, all these treatments were at par with weed free treatment. Higher grain yield under integrated weed control treatments (herbicide + hand weeding) may be attributed mainly to the better control of weeds during different stages, manual removal of emerging weedsby hand by herbicides and thereby providing better yield attributes. (Chhodavadia *et al.* 2013).

Weed-free treatment recorded significantly higher uptake of N, P and K by crop and remained at par with pendimethalin 1.0 kg/ha as pre-emergence + HW at 30 DAS, oxyfluorfen 0.18 kg/ha as pre-emergence + HW at 30 DAS and pendimethalin 1.0 kg/ha as pre-emergence + IC at 30 DAS. It can be explained in the light of the facts that these treatments controlled the weeds effectively, might have made more nutrients available to crop and consequently encouraged higher concentration of nutrients and more yield and thereby higher uptake of nutrients by the crop.

Significant increase in protein content in weed free (25.70%) was followed by pendimethalin 1.0 kg/ ha as PE + hand weeding at 30 DAS, oxyfluorfen0.18 kg/ha PE+ hand weeding at 30 DAS, pendimethalin1.0 kg/ha as PE + IC at 30 DAS, pendimethalin 1.0 kg/ha as PE + quizalofop-p-ethyl 0.05 kg/ha at 30 DAS (POE), oxyfluorfen 0.18 kg/ha PE + IC at 30 DAS and oxyfluorfen at 0.18 kg/ha PE+ hand weeding at 30 DAS (Table 2). This can be ascribed to better control of weeds by manual weeding and integration with herbicidal method as compared to unweeded condition, which might have increased uptake of nutrients and water.

Maximum gross and net return of ₹ 67846 and ₹ 52533/ha, respectively were realized under weed free which was closely followed by pendimethalin 1.0 kg/ha as PE + hand weeding at 30 DAS, oxyfluorfen 0.18 kg/ha PE + hand weeding at 30 DAS and pendimethalin 1.0 kg/ha as PE + IC at 30 DAS.

Table 2. Effect of weed-control treatments on protein content and nutrient uptake by blackgram and weeds

Treatment	Protein content in (%)	Nutrient uptake (kg/ha)					
		Crop			Weed		
		N	P	K	N	P	K
Weedy check	23.4	20.7	5.25	16.8	26.4	2.45	16.8
Weed free	25.7	51.3	7.50	23.7	0.0	0.00	0.0
Pendimethalin 1 kg/ha as PE + IC at 30 DAS	24.9	44.2	6.75	21.4	15.1	1.40	8.4
Pendimethalin 1 kg/ha as PE + hand weeding at 30 DAS	25.4	49.7	7.25	22.9	11.3	1.05	5.6
Pendimethalin 1 kg/ha as PE + imazethapyr 0.1 kg/ha at 30 DAS (PoE)	23.9	28.3	5.75	18.3	22.6	2.10	14.0
Pendimethalin 1 kg/ha asPE+ quizalofop-p-ethyl at 0.05 kg/ha at 30 DAS (PoE)	24.4	30.2	6.25	19.8	18.8	1.75	11.2
Oxyfluorfen 0.18 kg/ha PE + IC at 30 DAS	24.7	34.0	6.50	20.6	17.0	1.57	9.8
Oxyfluorfen 0.18 kg/ha PE+ hand weeding at 30 DAS	25.2	47.8	7.00	22.1	13.2	1.22	7.0
Oxyfluorfen 0.18 kg/ha PE + imazethapyr 0.1 kg /ha at 30 DAS (PoE)	23.6	24.3	5.50	17.5	24.5	2.28	15.4
Oxyfluorfen 0.18 kg/ha PE + quizalofop-p-ethyl 0.05 kg/ha at 30 DAS (PoE)	24.1	28.9	6.00	19.1	20.7	1.93	12.6
LSD (P=0.05)	1.49	7.43	1.19	3.66	3.68	0.32	1.68

SUMMARY

Weed free treatment produced highest seed yield which was at par with pendimethalin 1.0 kg/ha as pre-emergence (PE) + hand weeding at 30 DAS and oxyfluorfen 0.18 kg/ha PE + hand weeding at 30 DAS. However, among the other treatments, pendimethalin 1.0 kg/ha as PE + hand weeding at 30 DAS was found superior in controlling weeds and increasing seed yield.

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