



## Performance of ready-mix herbicides for weed control in blackgram

N. Ram Mohan Reddy, D. Subramanyam\*, V. Sumathi, V. Umamahesh and G. Karuna Sagar

Department of Agronomy, S. V. Agricultural College, Tirupati, Andhra Pradesh 517 502, India

\*Email: [subbuagro37@gmail.com](mailto:subbuagro37@gmail.com)

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### ABSTRACT

A field experiment was conducted during *Kharif* (rainy season), 2019 at S.V. Agricultural College, Tirupati, Andhra Pradesh to find out the best chemical weed management practice for blackgram. Results revealed that pre-emergence application of diclosulam 20 g/ha supplemented with HW at 30 DAS resulted in lower density and dry weight of weeds with higher weed control efficiency, and it was closely followed by pre-emergence application of pendimethalin + imazethapyr 1000 g/ha supplemented with HW at 30 DAS. Heavy weed infestation of weeds in unweeded check reduced the seed yield by 58.4% compared to pre-emergence application of pendimethalin + imazethapyr 1000 g/ha supplemented with HW. All the pre-and post-emergence herbicides did not show inhibitory effect on succeeding fodder sorghum.

Blackgram (*Vigna mungo* L.) is an important legume crop grown in tropical and sub-tropical regions of the world and it has high protein in its seeds. India is the largest producer and consumer of blackgram in the world. In Andhra Pradesh, blackgram is cultivated in an area of 4.03 lakh hectares with a total production of 3.70 lakh tonnes with an average productivity of 920 kg/ha during 2017-18. Rainy season blackgram is severely infested with diversified weed flora because of good amount of rainfall received during the crop period. The competition offered by weeds is severe in blackgram due to its slow initial growth and short statured growth habit particularly in recently released varieties of blackgram than greengram. The loss of seed yield in blackgram due to weeds range from 50-87% (Sukumar *et al.* 2018) and critical period for crop weed competition is around 15 to 45 DAS (Khot *et al.* 2016). Generally, pendimethalin 1000 g/ha is recommended to control the weeds, but it is not effective in controlling certain broad-leaved weeds and perennial sedges. Continuous use of pendimethalin resulted in weed shift towards broad-leaved weeds. The late coming weeds are controlled by post-emergence application of imazethapyr 75 g/ha, but it has carryover effect on succeeding cereal crops due to its higher half-life period (Sondhia *et al.* 2015). Thus, there is need to have alternate herbicides with different modes of action and leaching behaviour for obtaining broad-spectrum weed control. Low-dose high-efficacy herbicide, diclosulam and ready-mix herbicide combinations are available in the market for control of mixed weed flora in pulse crops.

Keeping these facts in view, the present investigation was undertaken to know the performance of ready-mix combination of pre-and post-emergence herbicides for broad-spectrum weed control in *Kharif* (rainy season) blackgram.

A field experiment was conducted during *Kharif*, 2019 at wetland farm of S.V. Agricultural College, Tirupati campus of Acharya N.G. Ranga Agricultural University, Andhra Pradesh. The soil of experimental site was sandy loam soils having 0.21% organic carbon, 244, 26 and 289 kg/ha available N, P and K, respectively. The total rainfall received during crop period was 79.24 mm with 29 rainy days. The experiment was laid out in a randomized block design with 10 weed management practices. The treatments consisted of pendimethalin + imazethapyr (ready-mix) 1000 g/ha, diclosulam 20 g/ha and pendimethalin 1000 g/ha as pre-emergence; and propiquizaop + imazethapyr (ready-mix) 127 g/ha, sodium acifluorfen + clodinafop-propargyl (ready-mix) 180 g/ha and imazethapyr 70 g/ha as post-emergence including standard checks (**Table 1**). Blackgram was sown at 30 x 10 cm spacing on 3<sup>rd</sup> July, 2019. Pre-emergence herbicides were applied at 1 DAS and post-emergence herbicides were applied at 15 DAS with the help of knap-sack sprayer fitted with flat-fan nozzle and spray volume of 500 L/ha. The crop was fertilized with 20 and 50 kg/ha of nitrogen and phosphorous, respectively. Weed density and dry weight was recorded at 45 DAS and at harvest by using standard procedures. The data on weed density and dry weight were subjected to square root

transformation to normalize their distribution. Weed control efficiency was computed as per the method suggested by (Mani *et al.* 1973). Dry matter production and yield components were recorded at harvest. Seed and haulm yield were recorded based on the yield obtained from net plot. Net returns were calculated by subtracting the cost of cultivation from gross returns. Benefit-cost ratio was calculated after dividing gross returns with cost of cultivation. The crop was harvested on 18<sup>th</sup> September, 2019. A residual crop of fodder sorghum was raised in plastic pots after filling the soil collected from respective treatments where blackgram was grown to know the residual effect of herbicides applied to blackgram. Germination per cent and seedling vigour index of fodder sorghum was computed at 15 DAS as per the method suggested by Abdul Baki and Anderson (1973).

The predominant weed flora associated with blackgram was *Digitaria sanguinalis* (L.) Scop. (42%), *Cyperus rotundus* L. (22%), *Euphorbia thymifolia* L. (9%), *Boerhavia erecta* L. (6%), *Borreria hispida* (L.) K. Schum. (5%), *Cynodon dactylon* (L.) Pers. (5%), *Commelina benghalensis* L. (3%), *Cleome viscosa* L. (3%) and others (5%). Different weed management practices significantly influenced the density of all categories of weeds at 45 DAS. The lowest density of sedges, broad-leaved weeds and total weeds were registered with pre-emergence (PE) application of diclosulam 20 g/ha supplemented with HW at 30 DAS followed by PE application of pendimethalin + imazethapyr 1000 g/ha supplemented with HW at 30 DAS. However, the latter weed management practice recorded significantly lesser density of grasses than former weed management practice. Both the weed management practices were significantly superior in suppressing the total weed density compared to HW

twice at 15 and 30 DAS (**Table 1**). Total weed dry weight was reduced significantly at 45 DAS with HW twice at 15 and 30 DAS, which was comparable with PE application of diclosulam supplemented with HW at 30 DAS. However, latter treatment registered significantly lower weed dry weight at harvest. Similar results were also reported by Naveen *et al.* (2019) with diclosulam 20 g/ha supplemented with HW at 20 DAS in groundnut on sandy loam soils. Diclosulam might have readily available at lethal dose in the soil at weed seed zone due to its low absorption coefficient and better leaching potential, which in turn aided better distribution of diclosulam in soil solution compared to pendimethalin (Hornsby *et al.* 1996). Among the post-emergence herbicides, propiquizaop + imazethapyr 127 g/ha was effective in suppressing total density and dry weight at 45 DAS and at harvest compared to rest of the post-emergence herbicides due to its dual mode of action in controlling weeds. Hand weeding twice resulted in higher weed control efficiency at 45 DAS while PE application of diclosulam supplemented with HW obtained higher weed control efficiency at harvest. It clearly indicates that diclosulam 20 g/ha extended its activity for longer period due to higher half-life period (Lavorenti *et al.* 2003). Among the herbicidal treatments, lower weed control efficiency was calculated with imazethapyr 75 g/ha due to its poor control of weeds, at both the stages of observations.

Different weed management practices had significant and positive influence on yield components, yield and economics of blackgram (**Table 2**). Significantly higher number of seeds/plant and test weight were recorded under PE application of pendimethalin + imazethapyr 1000 g/ha supplemented with HW at 30 DAS due to reduced competition for growth resources, which in turn increased the translocation of photosynthates to

**Table 1. Weed density, weed dry weight and weed control efficiency as influenced by different weed management practices at 45 DAS and at harvest in blackgram**

Treatment	Dose (g/ha)	Time of application (DAS)	Weed density at 45 DAS (no./m <sup>2</sup> )				Total weed dry weight (g/m <sup>2</sup> )		Weed control efficiency (%)	
			Grasses	Sedges	BLWs	Total	At 45 DAS	At harvest	At 45 DAS	At harvest
Diclosulam	20	1	4.39(18)	3.21(9)	2.58(6)	5.85(33)	3.51(11)	3.77(13)	74.76	54.66
Pendimethalin + imazethapyr	1000	1	4.54(20)	3.69(13)	3.21(9)	6.52(42)	4.28(17)	7.49(55)	61.55	38.84
Diclosulam <i>fb</i> HW	20	1 <i>fb</i> * 30	2.82(7)	2.42(5)	1.70(2)	3.84(14)	2.36(5)	3.55(12)	89.79	66.92
Pendimethalin + imazethapyr <i>fb</i> HW	1000	1 <i>fb</i> 30	2.65(6)	2.89(7)	2.19(4)	4.27(17)	2.48(5)	5.31(27)	88.44	65.84
Propaquizafop + imazethapyr	127	15	4.64(21)	3.84(14)	3.55(12)	6.85(46)	4.65(21)	5.79(33)	54.27	34.76
Sodium acifluorfen + clodinafop-propargyl	180	15	5.22(26)	4.82(22)	3.91(14)	7.99(63)	5.40(28)	6.87(46)	37.70	26.28
Pendimethalin	1000	1	4.71(21)	4.54(20)	3.41(11)	7.24(52)	5.11(25)	7.77(60)	44.39	27.65
Imazethapyr	75	15	5.42(29)	5.12(25)	4.61(20)	8.66(74)	5.78(33)	7.08(49)	28.30	13.52
HW twice	-	15 <i>fb</i> 30	2.80(7)	2.46(5)	2.19(4)	4.10(16)	2.55(6)	5.20(26)	87.65	65.23
Unweeded check (control)			5.76(32)	6.13(37)	4.86(23)	9.62(92)	6.80(45)	7.90(62)	-	-
LSD (p=0.05)			0.13	0.25	0.11	0.22	0.09	0.16		

The figures in parentheses are original values; *fb*: followed by

**Table 2. Yield and economics of blackgram as influenced by different weed management practices**

Treatment	Dose (g/ha)	Time of application (DAS)	Dry matter production (t/ha)	No. of pods/plant	Test weight (g)	Seed yield (kg/ha)	Haulm yield (t/ha)	Net returns (x10 <sup>3</sup> /ha)	B:C ratio	Fodder sorghum (succeeding crop)	
										Germination (%)	Seedling vigour index
Diclosulam	20	1	1.76	16.3	38.8	634	1.01	16.32	1.78	93.21	1647
Pendimethalin + imazethapyr	1000	1	1.94	17.2	41.1	715	1.13	19.57	1.88	95.10	1659
Diclosulam <i>fb</i> HW	20	1 <i>fb</i> 30	2.10	16.7	41.3	730	1.23	18.92	1.79	93.20	1748
Pendimethalin + imazethapyr <i>fb</i> HW	1000	1 <i>fb</i> 30	2.11	17.4	41.6	796	1.25	21.24	1.84	94.15	1676
Propaquizafop + imazethapyr	127	15	1.73	15.8	38.0	618	1.00	15.55	1.75	95.51	1612
Sodium acifluorfen + clodinafop-propargyl	180	15	1.68	15.5	37.9	586	0.99	14.09	1.69	97.12	1804
Pendimethalin	1000	1	1.77	16.1	38.2	628	1.03	15.38	1.72	95.32	1884
Imazethapyr	75	15	1.67	15.4	36.8	582	0.98	13.10	1.62	93.51	1547
HW twice	-	15 <i>fb</i> 30	2.10	17.3	41.3	789	1.24	16.95	1.58	97.35	1933
Unweeded check (control)			1.20	12.7	34.3	331	0.79	0.43	1.02	97.21	1924
LSD (p=0.05)			0.08	0.94	1.55	78	0.21	1.97	0.044	2.06	79.93

developing seeds. Pre-emergence application of pendimethalin + imazethapyr supplemented with HW produced significantly higher seed yield and haulm yield which was at par with HW twice at 15 and 30 DAS. The decrease in seed yield due to heavy weed infestation in unweeded check was 58.4 per cent compared to best treatment. Among all the weed management practices, the highest gross and net returns were obtained with PE application of pendimethalin + imazethapyr 1000 g/ha supplemented with HW at 30 DAS. However, higher benefit-cost ratio was realized with PE application of pendimethalin + imazethapyr 1000 g/ha. Hand weeding twice at 15 and 30 DAS lag behind compared to PE application of pendimethalin + imazethapyr 1000 g/ha, with respect to net returns and benefit-cost ratio of blackgram cultivation. Higher net returns and benefit-cost ratio were computed with post-emergence application of propaquizafop + imazethapyr 127 g/ha at 15 DAS than rest of the post-emergence herbicides.

Germination per cent and seedling vigour index of residual fodder sorghum was not affected by pre- and post-emergence herbicides applied to preceding blackgram. Kumar *et al.* (2015) reported that pre-emergence application of pendimethalin applied to blackgram did not affect the succeeding crops like wheat, mustard and gram. However, pre-emergence application of diclosulam 20 g/ha to blackgram showed marginal decrease in germination per cent of fodder sorghum. Among the herbicidal treatments, maximum seedling vigour was computed with PE application of pendimethalin 1000 g/ha. Significantly higher germination per cent and seedling vigour index of fodder sorghum was obtained with post-emergence application of sodium acifluorfen + clodinafop-propargyl 180 g/ha than propaquizafop + imazethapyr 127 g/ha, applied to preceding blackgram.

Thus, it can be concluded that pre-emergence application of pendimethalin + imazethapyr (ready-mix) 1000 g/ha supplemented with HW resulted in higher seed yield and monetary returns, apart from broad-spectrum weed control in *Kharif* blackgram on sandy loam soils.

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