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Efficacy of certain Herbicidal combinations in *Rabi* Blackgram

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ABSTRACT

A field experiment was conducted during *rabi*2016 at Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh to evaluate the efficacy of herbicides. The pre emergence application of pendimethalin @ 0.75 kg ha^{-1} followed by intercultivation at 20 DAS and hand weeding at 30DAS significantly reduced the weed growthand recorded the higher yield components and seed yield over sequential application of herbicides as pre and post emergence.Among herbicide treatments, pre emergence application of pendimethalin@0.75kg ha^{-1} followed by post emergence application of imazethapyr@ 50g ha^{-1} recorded the highest seed yield. Highest benefit cost ratio was obtained with pendimethalin@0.75kg ha^{-1} followed by post emergence application of imazethapyr @ 50g ha^{-1}closely followed by pendimethalin @ 0.75kg ha^{-1} fb acifluorfen + clodinafop propargyl @124 + 60 g ha^{-1} with benefit cost ratio of 4.0.

Blackgram is an important pulse crop grown in India and was grown in an area of 24.85 and 7.61 lakh hectares, respectively during *kharif* and *rabi* seasons during the year 2014-15. Blackgram considered as a prized pulse crop of Andhra Pradesh, is cultivated in 3.15 lakh hectares with a production of 2.98 lakh tons and an average yield of 946 kg ha^{-1}(www.indiastat.com, 2015 -16). Cultivation under poor and marginal soils with low input management, biotic and abiotic stresses which include severe weed competition are the important reasons for the low yields in blackgram in spite of the high yield potential of the crop. The yield losses in blackgram due to uncontrolled weeds could be upto 63.8 % (Mishra and Bhanu, 2006). Blackgram is grown at a row spacing of 30 cm and the crop takes 35-40 days for covering the inter row space, which makes the crop highly prone to weed competition upto 30-45 days after sowing which is considered to be critical for weed control(Vivek *et al*., 2008).

MATERIAL AND METHODS

A field experiment was conducted during *rabi* season 2016 at Regional Agricultural Research Station, Lam, Guntur. The soil of the experimental field was clay with pH 7.8, low in available nitrogen, medium in phosphorous and high in available potassium. The experiment consisting of 10 treatments as detail in Table 1, was laid in randomized block design with three replications blackgram GBG-1 was sown at a spacing of 30 ×10 cm during the fourth week of September, 2016. All the recommended packages of practices were followed for proper establishment of crop except weed management practices. All pre and post emergence herbicides are sprayed with knapsack sprayer fitted with flood jet nozzle as per schedule using spray volume of 500 l ha^{-1}. The data on density of sedges, grasses, broad leaved weeds and weed dry weight per m^2 were recorded at different stages of crop growth. The data of weed density and dry weight are subjected to square root transformation ("x+ 0.5) before statistical analysis to normalise their distribution (Panse and Sukhatme, 1978). Economics of different treatments were calculated taking in to consideration of all output and input market prices.

RESULTS AND DISCUSSION

The field experiment was dominated by the natural infestation of *Cynodon dactylon, Dactyloctenium aegyptium* (L.)*, Echinochloa colona* (L.)*, Dinerba retroflexa(L.)*, one sedge viz., *Cyperus rotundus* and broad leaved weed species viz., *Abutilon indicum* (L.)*, Acalypha indica, Cynotis axillaris, Commelina benghalensis* (L.), *Celosia argentea, Chorchorus trilocularis, Digera arvensis, Eclipta alba, Cleome viscosa, Physalis minima, Portulaca quadrifida, Trianthema decendra*.

Table 1:Density of grassesas influenced by weed management treatments at different stages in *rabi* blackgram

Treatments	Density of grasses(No. m^{-2}) at		
	20 DAS	40 DAS	Harvest
T_1: Pendimethalin @0.75kgha^{-1}(PE) fb one intercultivation at 20 DAS fb hand weedingat 30DAS	3.50* (12.0)	3.34 (10.7)	4.52 (20.0)
T_2: Pendimethalin @0.75kgha^{-1}(PE) fb Quizalofop ethyl@50g ha^{-1}(PoE) at 20 DAS	4.38 (18.7)	3.13 (9.3)	7.94 (62.7)
T_3 : Pendimethalin @ 0.75 kg ha^{-1}(PE) fb Imazethapyr @50gha^{-1}(PoE) at 20 DAS	4.06 (16.0)	3.34 (10.7)	6.36 (40.0)
T_4 : Pendimethalin @ 0.75 kg ha^{-1}(PE) fb Acifluorfen + Clodinafop propargyl @124+60 g ha^{-1} (PoE) at 20 DAS	4.06 (16.0)	3.71 (13.3)	7.24 (52.0)
T_5 : Alachlor @1.0 kg ha^{-1}(PE) fb one intercultivation 20 DAS fb hand weeding at 30DAS	4.52* (20.0)	2.40 (5.3)	5.70 (32.0)
T_6 : Alachlor @1.0 kg ha^{-1} (PE) fb Quizalofop ethyl@50g ha^{-1}(PoE) at 20 DAS	5.07 (22.3)	4.06 (16.0)	(72.0) 8.51
T_7 : Alachlor @1.0 kg ha^{-1} (PE)fb Imazethapyr @50gha^{-1}(PoE) at 20 DAS	5.33 (18.0)	3.53 (12.0)	6.76 (45.3)
T_8: Alachlor @1.0 kg ha^{-1} (PE) fb Acifluorfen + Clodinafop propargyl @124+60 g ha^{-1} (PoE) at 20 DAS	5.41 (19.3)	4.38 (18.7)	7.69 (58.7)
T_9 : Hand weeding twice at 20 and 40 DAS	8.51* (72.0)	3.13* (9.3)	8.97 (80.0)
T_{10} : Weedy check	8.74 (76.0)	12.72 (161.3)	16.46 (270.7)
S.Em±	0.48	0.26	0.45
CD (P=0.05)	1.14	0.80	1.34
CV (%)	16.3	10.7	9.8

Data were subjected to square root transformation $\sqrt{x+0.5}$. Figures in parenthesis are original values.
*Weed data was collected before the hand weeding at 20 DAS and 40 DAS in T_9 and after intercultivation in T_1 and T_5.

At 20 DAS, the treatments that received the pre emergence application of pendimethalin @ 0.75 kg ha^{-1} and alachlor @ 1.0 kg ha^{-1} significantly reduced the grassy weed population when compared to weedy check (76.0) and hand weeding (72). The higher weed density in$T_{10,}$ because of the fact that the weed sampling was done before first hand weeding at 20 DAS (Table 1).

At 40 DAS, the lowest grassy weed density (9.3)was with hand weeding (T_9) and was on par with the treatments receiving post emergence application of quizalofop ethyl @ 50 g ha^{-1} at 20 DAS(T_2 and T_6) and that may be due to effective control of grassy weeds by quizalofop ethyl. All the other treatments recorded significantly low grassy weed density as compared with weedy check

At the time of harvest significantly lowest number of grassy weed population was recorded with pre emergence herbicide application of either pendimethalin @ 0.75 kg ha^{-1} or alachlor @1.0 kg ha^{-1}fb intercultivation at 20 DAS and hand weeding at 30 DAS ($T_1$and T_5).

Table 2: Density of sedges as influenced by weed management treatments at different stages in *rabi* blackgram

Treatments	Density of sedges(No. m^{-2}) at		
	20DAS	40DAS	Harvest
T_1: Pendimethalin @0.75kgha^{-1}(PE) fb one intercultivation at 20 DAS fb hand weedingat 30DAS	0.71* (0.0)	3.89 (14.7)	5.33 (28.0)
T_2: Pendimethalin @0.75kgha^{-1}(PE) fb Quizalofop ethyl@50g ha^{-1}(PoE) at 20 DAS	3.34 (10.7)	3.13 (9.3)	5.81 (33.3)
T_3 : Pendimethalin @ 0.75 kg ha^{-1}(PE) fb Imazethapyr @50gha^{-1}(PoE) at 20 DAS	2.68 (6.7)	4.81 (22.7)	6.04 (36.0)
T_4 : Pendimethalin @ 0.75 kg ha^{-1}(PE) fb Acifluorfen + Clodinafop propargyl @124+60 g ha^{-1} (PoE) at 20 DAS	2.68 (6.7)	4.38 (18.7)	5.33 (28.0)
T_5 : Alachlor @1.0 kg ha^{-1}(PE) fb one intercultivation 20 DAS fb hand weeding at 30DAS	3.34* (10.7)	3.71 (13.3)	5.58 (30.7)
T_6 : Alachlor @1.0 kg ha^{-1} (PE) fb Quizalofop ethyl@50g ha^{-1}(PoE) at 20 DAS	2.91 (8.0)	5.07 (25.3)	6.26 (38.7)
T_7 : Alachlor @1.0 kg ha^{-1} (PE)fb Imazethapyr @50gha^{-1}(PoE) at 20 DAS	4.06 (16.0)	4.06 (16.0)	4.94 (24.0)
T_8: Alachlor @1.0 kg ha^{-1} (PE) fb Acifluorfen + Clodinafop propargyl @124+60 g ha^{-1} (PoE) at 20 DAS	3.13 (9.3)	5.21 26.7)	5.95 (35.0)
T_9 : Hand weeding twice at 20 and 40 DAS	3.34* (10.7)	4.06 (16.0)	5.21 (26.7)
T_{10} : Weedy check	4.38 (18.7)	3.34* (10.7)	7.12 (50.3)
S.Em±	0.33	0.44	0.37
CD (P=0.05)	0.47	0.62	1.12
CV (%)	19.3	18.5	11.40

Data were subjected to square root transformation $\sqrt{x+0.5}$.
Figures in parenthesis are original values.
*Weed data was collected before the hand weeding at 20 DAS and 40 DAS in T_9 and after intercultivation in T_1 and T_5.

At 20 DAS, all the weed control treatments significantly reduced the sedge population(Table 2) as compared to weedy check (4.38), except T_7 i.e. alachlor @ 1.0 kg ha^{-1} (PE) fb post emergence imazethapyr @ 50g ha^{-1}(4.06).

At 40 DAS, comparatively lower sedge population was recorded in treatments with pre emergence application of pendimethalin @ 0.75 kg ha^{-1} and alachlor @1.0 kg ha^{-1} fb intercultivation at 20 DAS and hand weeding at 30 DAS(T_1 and T_5).

The data on sedge population at harvest stage was significantly highest in weedy check (7.12) as compared to all other treatments which did not differed much in respect of sedge population.

Table 3:Density of broad leaved weeds as influenced by weed management treatments at different stages in *rabi* blackgram

Treatments	Density of broad leaved weeds (No.m^{-2}) at.		
	20 DAS	40 DAS	Harvest
T_1: Pendimethalin @ 0.75 kg ha^{-1}(PE) fb one intercultivation at 20 DAS fb hand weeding at 30 DAS	8.03* (64.00)	5.09 (26.70)	5.69 (34.3)
T_2: Pendimethalin @ 0.75 kg ha^{-1}(PE) fb Quizalofop ethyl @ 50 g ha^{-1}(PoE) at 20 DAS	7.05 (49.3)	10.20 100.00)	13.14 (172.3)
T_3 : Pendimethalin @ 0.75 kg ha^{-1}(PE) fb Imazethapyr @ 50 g ha^{-1}(PoE) at 20 DAS	8.68 (74.70)	5.44 (29.30)	8.60 (75.0)
T_4 : Pendimethalin @ 0.75 kg ha^{-1} (PE) fb Acifluorfen + Clodinafop propargyl @ 124+60 g ha^{-1} (PoE) at 20 DAS	5.45 (29.30)	6.87 (46.70)	8.97 (80.3)
T_7 : Alachlor @1.0 kg ha^{-1} (PE) fb Imazethapyr @ 50 g ha^{-1} (PoE) at 20 DAS	8.87 (108.00)	5.75 (33.30)	10.02 (100.3)
T_8 : Alachlor @1.0 kg ha^{-1} (PE) fb Acifluorfen + Clodinafop propargyl @ 124+60 g ha^{-1} (PoE) at 20 DAS	9.25 (85.30)	7.33 (53.3)	11.80 (124.7)
T_9 : Hand weeding twice at 20 and 40 DAS	13.68* (186.70)	9.15* (84.00)	0.85 (117.3)
T_{10} : Weedy check	16.08 (258.70)	15.51 (240.0)	15.58 (243.3)
S.Em±	1.10	0.66	0.60
CD (P=0.05)	3.28	1.97	1.81
CV (%)	19.40	14.2	10.10

Data were subjected to square root transformation $\sqrt{x+0.5}$. Figures in parenthesis are originalvalues.
*Weed data was collected before the hand weeding at 20 DAS and 40 DAS in T_9 and after intercultivation in T_1 and T_5.

Table 4:Weed dry matter as influenced by weed management treatments at different stages in *rabi* blackgram

Treatments	Weed dry matter (g m^{-2}) at		
	30 DAS	60 DAS	Harvest
T_1: Pendimethalin @ 0.75 kg ha^{-1}(PE) fb one intercultivation at 20 DAS fb hand weeding at 30 DAS	5.21 (26.7)	6.67 (44.0)	23.59 (556.0)
T_2: Pendimethalin @ 0.75 kg ha^{-1}(PE) fb Quizalofop ethyl @ 50 g ha^{-1}(PoE) at 20 DAS	6.51 (42.0)	32.03 (1025.00)	5 1.64 (2667.00)
T_3 : Pendimethalin @ 0.75 kg ha^{-1}(PE) fb Imazethapyr @ 50 g ha^{-1}(PoE) at 20 DAS	5.55 (30.7)	15.15 229.00)	26.64 (709.00)
T_4 : Pendimethalin @ 0.75 kg ha^{-1} (PE) fb Acifluorfen + Clodinafop propargyl @ 124+60 g ha^{-1} (PoE) at 20 DAS	4.67 (21.3)	17.56 (308.00)	28.03 (785.00)
T_5 : Alachlor @ 1.0 kg ha^{-1}(PE) fb one intercultivation 20 DAS fb hand weeding at 30 DAS	6.87 (46.9)	8.20 (67.00)	24.75 (612.00)
T_6 : Alachlor @ 1.0 kg ha^{-1} (PE) fb Quizalofop ethyl @ 50 g ha^{-1} (PoE) at 20 DAS	7.60 (57.6)	38.16 (1456.00)	54.92 (3016.00)
T_7 : Alachlor @1.0 kg ha^{-1} (PE) fb Imazethapyr @ 50 g ha^{-1} (PoE) at 20 DAS	9.75 (94.7)	19.21 (387)	28.33 (804.00)
T_8 : Alachlor @1.0 kg ha^{-1} (PE) fb Acifluorfen + Clodinafop propargyl @ 124+60 g ha^{-1} (PoE) at 20 DAS	8.35 (70.0)	28.32 (801.00)	41.58 (1728.00)
T_9 : Hand weeding twice at 20 and 40 DAS	5.79 (33.3)	9.69 (93.00)	43.57 (1899.00)
T_{10} :Weedy check	15.46 238.7)	5 3.45 (2856.00)	57.77 (3337.00)
S.Em±	0.32	1.77	1.99
CD (P=0.05)	0.95	5.26	5.93
CV (%)	7.3	13.50	9.20

Data were subjected to square root transformation $\sqrt{x+0.5}$. Figures in parenthesis are originalvalues. *Weed data was collected before the hand weeding at 20 and 40 DAS in T_9 and after intercultivation in T_1 and T_5.

Pre emergence application of both pendimethalin @ 0.75 kg ha^{-1} and alachlor @ 1.0 kg ha^{-1} recorded the significantly lowest broad leaved weeds when compared to weedy check (Table 3).

At 20 DAS, significantly lower weed population of broad leaved weeds was recorded with the pre emergence application of pendimethalin @ 0.75 kg ha^{-1} (T_1,T_2,T_3 and T_4) when compared to alachlor @ 1.0 kg ha^{-1} (T_5,T_6,T_7 and T_8).

At 40 DAS, pre emergence application of pendimethalin @ 0.75 kg ha^{-1} and alachlor @1.0 kg ha^{-1} followed by intercultivation at 20 DAS and hand weeding at 30 DAS treatments (T_1 and T_5) recorded the lowest broad leaved weed density and were on par with the other treatments receiving post emergence application of imazethapyr @ 50 g ha^{-1} (T_3 and T_7). Broad leaved weed population is significantly higher in post emergence application of quizalofop ethyl @ 50 g ha^{-1} when compared to all other post emergence herbicides.

Almost a similar trend was observed at harvest. At all growth stages, the maximum broad leaved weed count was recorded with weedy check (T_{10}).

The extent of dry matter production of weeds denotes the competition offered by them. In general, the dry matter production increased with the advancement of crop growth upto harvest in all the treatments. At all the stages of crop growth, the maximum dry matter production was observed with weedy check (T_{10}) recording 239, 2856, 3337 g m^{-2}, respectively at 30,60 DAS and at harvest.

Significantly lowest dry matter recorded with pendimethalin @ 0.75 kg ha^{-1} (PE) fb one intercultivation at 20 DAS fb hand weeding at 30 DAS (T_1) at all the growth stages (Table 4).

At 30 DAS, pendimethalin @0.75 kg ha^{-1}(PE) fbacifluorfen + clodinafop propargyl (PoE) @ 124+60 g ha^{-1}(T_4) at 20 DAS recorded lowest dry weight (21.3 gm^{-2}) which was on a par with T_1,T_3 and T_9.

At 60 DAS, significantly lowest weed dry matter was recorded with pendimethalin @ 0.75 kg ha^{-1} fb intercultivation at 20 DAS and hand weeding at 30 DAS i.e. T_1 (44 g m^{-2}) and was on a par with T_5 (67 g m^{-2}) and T_9 (93 g m^{-2}). Among post emergence herbicides the treatment receiving pendimethalin @ 0.75 kg ha^{-1}fb imazethapyr @50g ha^{-1}(T_3) recorded significantly lowest weed dry weight (229 g m^{-2}) than post emergence quizalofop ethyl @ 50g ha^{-1}(T_2 and T_6) and was on par with T_4 i.e. pendimethalin @ 0.75 kg ha^{-1} (PE) fb acifluorfen + clodinafop propargyl (PoE) @ 124+60 g ha^{-1}(308 g m^{-2}).

At harvest, the lowest weed dry matter(556 g m^{-2})with pendimethalin @ 0.75 kg ha^{-1} (PE) fb one intercultivation at 20 DAS fb hand weeding at 30 DAS (T_1) and was on a par withT_3, T_5,T_4 and T_7.Weed dry matter was highest in treatments with post emergence application of quizalofop ethyl @ 50 g ha^{-1}(T_2 and T_6) which was on par with weedy check which recorded the highest weed dry matter accumulation (3337 g m^{-2}).

Pre emergence application of herbicides along with intercultivation at 20 DAS fb hand weeding at 30 DAS resulted in lower weed dry matter as compared to sequential application of PE and PoE. The reduced weed dry weight in these treatments could be due to effective control of broad leaved weeds, grasses and sedges at critical stage of crop growth. Among the herbicide treatments a significant reduction inweed dry weight was recorded with sequential application pre emergence herbicide fb imazethapyr @ 50 g ha^{-1}at 20 DAS which may be due to broad spectrum of weed control with imazethapyr. These results are in agreement with the findings of Balyan *et al*., 2016. The herbicidal treatment with acifluorfen + clodinafop propargyl @ 124+60 g ha^{-1} (T_4) at 20 DAS was effective when sprayed along with pre emergence application of pendimethalin than alachlor.

An examination of the datapertaining to number of pods $plant^{-1}$ (Table 5)indicated that all the weed control treatments recorded significantly higher number of pods per plant as compared with the weedy check (T_{10}). Pre emergence application of pendimethalin @ 0.75kg ha^{-1} fb intercultivation at 20 DAS and hand weeding at 30 DAS (T_1) was found superior in registering significantly highest number of pods $plant^{-1}$ and was on par with T_5, T_3 and T_9. Weedy check (T_{10}) recorded lowest number of seeds per pod which was on par with T_2 and T_6. This might be due to severe competition from weeds for soil nutrients. All other treatments recorded seed number on par with each other. Numerically highest value is in T_1. Similarly, significantly higher test weight was recorded in all the treatments as compared with weedy check. All the other treatments were on par with each other except T_6.

Among all the weed control treatments, pendimethalin @ 0.75 kg ha^{-1} fb intercultivation at 20 DAS and hand weeding at 30 DAS(T_1) was superior in registering significantly higher seed yield(1132 kg ha^{-1}) and was on parwith pre emergence application of alachlor @1.0 kg ha^{-1} fb one intercultivation at 20 DAS and hand weeding at 30 DAS (T_5) and hand weeding twice at 20 and 40 DAS (T_9)recording 1054 and1010kg ha^{-1}, respectively (Table 6).Low weed density, weed dry matter and well formed pods recorded with the treatments might have resulted in higher seed yield. Intercultivation at 20 DAS in T_1 and T_5 might have helped the crop in conserving soil moistureas there was no rain after 15DAS and supplemental irrigation was not given up to pod filling stage.

Table 5:Yield attributes as influenced by different weed management treatments in *rabi* blackgram

Treatments	PodsPlant^{-1}	Seeds pod^{-1}	Test weight(g)
T_1: Pendimethalin @ 0.75 kg ha^{-1}(PE) fb one intercultivation at 20 DAS fb hand weeding at 30 DAS	21.8	7.3	4.8
T_2: Pendimethalin @ 0.75 kg ha^{-1}(PE) fb Quizalofop ethyl @ 50 g ha^{-1}(PoE) at 20 DAS	15.1	5.3	4.3
T_3 : Pendimethalin @ 0.75 kg ha^{-1}(PE) fb Imazethapyr @ 50 g ha^{-1}(PoE) at 20 DAS	19.5	6.7	4.8
T_4: Pendimethalin @ 0.75 kg ha^{-1} (PE) fb Acifluorfen + Clodinafop propargyl @ 124+60 g ha^{-1} (PoE) at 20 DAS	18.6	6.3	4.6
T_5 : Alachlor @ 1.0 kg ha^{-1}(PE) fb one intercultivation 20 DAS fb hand weeding at 30 DAS	20.6	6.8	4.9
T_6 : Alachlor @ 1.0 kg ha^{-1} (PE) fb Quizalofop ethyl @ 50 g ha^{-1} (PoE) at 20 DAS	15.4	5.2	4.0
T_7 : Alachlor @1.0 kg ha^{-1} (PE) fb Imazethapyr @ 50 g ha^{-1} (PoE) at 20 DAS	19.2	6.3	4.7
T_8: Alachlor @1.0 kg ha^{-1} (PE) fb Acifluorfen + Clodinafop propargyl @ 124+60 g ha^{-1} (PoE) at 20 DAS	18.7	6.0	4.7
T_9: Hand weeding twice at 20 and 40 DAS	19.9	7.0	4.6
T_{10} : Weedy check	10.6	5.3	3.8
S.Em±	0.82	0.44	0.19
CD (P=0.05)	2.5	1.3	0.6
CV (%)	8.0	12.4	7.2

Table 6:Seed yield, haulm yield and harvest index as influenced by different weed management treatments in *rabi* blackgram

Treatments	Seed yield (kg ha^{-1})	Haulmyield (kg ha^{-1})	Harvest index (%)
T_1: Pendimethalin @ 0.75 kg ha^{-1}(PE) fb one intercultivation at 20 DAS fb hand weeding at 30 DAS	1132	2875	28.3
T_2: Pendimethalin @ 0.75 kg ha^{-1}(PE) fb Quizalofop ethyl @ 50 g ha^{-1}(PoE) at 20 DAS	639	2270	22.0
T_3: Pendimethalin @ 0.75 kg ha^{-1}(PE) fb Imazethapyr @ 50 g ha^{-1}(PoE) at 20 DAS	990	2695	26.9
T_4: Pendimethalin @ 0.75 kg ha^{-1} (PE) fb Acifluorfen + Clodinafop propargyl @ 124+60 g ha^{-1} (PoE) at 20 DAS	905	2497	26.6
T_5: Alachlor @ 1.0 kg ha^{-1}(PE) fb one intercultivation 20 DAS fb hand weeding at 30 DAS	1054	2973	26.2
T_6: Alachlor @ 1.0 kg ha^{-1} (PE) fb Quizalofop ethyl @ 50 g ha^{-1} (PoE) at 20 DAS	565	2568	18.0
T_7: Alachlor @1.0 kg ha^{-1} (PE) fb Imazethapyr @ 50 g ha^{-1} (PoE) at 20 DAS	983	2628	27.2
T_8: Alachlor @1.0 kg ha^{-1} (PE) fb Acifluorfen + Clodinafop propargyl @ 124+60 g ha^{-1} (PoE) at 20 DAS	889	2504	26.2
T_9: Hand weeding twice at 20 and 40 DAS	1010	2775	26.3
T_{10}: Weedy check	394	1971	16.7
S.Em±	46	202	1.8
CD (P=0.05)	137	601	5.3
CV (%)	9.3	13.5	12.4

Table7:Economics of *rabi*blackgram as influenced by different weed management treatments

Treatments	Seed yield (kg ha^{-1})	Gross returns (ha^{-1})	Weed management cost (ha^{-1})	Total cost of cultivation (ha^{-1})	Net returns (ha^{-1})	Benefit cost ratio
T_1	1132	96220	11025	29510	66710	3.26
T_2	639	54315	3600	22285	32030	2.44
T_3	990	84150	2715	21400	62750	3.93
T_4	905	76925	3825	22510	54415	3.42
T_5	1054	89590	11075	29560	60030	3.03
T_6	565	48025	3650	22335	25690	2.15
T_7	983	83555	2765	21450	62105	3.90
T_8	889	75565	3875	22560	53005	3.35
T_9	1010	85350	18000	36285	47565	2.37
T_{10}	394	33490	—	18285	15205	1.83

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