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Effective weed management strategy for blackgram (*Vigna mungo* L. Hepper) under north hill situation of Chhattisgarh

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Abstract
A field experiment was conducted to study the effective weed management strategy for blackgram (*Vigna mungo* L. Hepper) under north hill situation of Chhattisgarh at Rajmohini Devi College of Agriculture and Research Station, Ambikapur, IGKV, Raipur, Chhattisgarh during *kharif*, 2020. The experiment was laid out in randomized block design with three replication having seven treatment *viz.*, T_1: weedy check, T_2: two hand weeding at 15 and 30 DAS, T_3: oxyfluorfen @ 120 a.i./ha as pre emergence T_4: quizalifop-p-ethyl @ 37.5 g a.i./ha as post emergence, T_5: oxyfluorfen @ 120 g a.i./ha as pre emergence *fb* imazethapyr @ 40 g a.i./ha as post emergence, T_6: oxyfluorfen @ 120 g a.i./ha pre emergence *fb* quizalifop-p-ethyl @37.5 g a.i./ha as post emergence and T_7: imazethapyr @ 40 g a.i./ha + quizalifop-p-ethyl @37.5 g a.i./ha as post emergence. Among herbicide weed control treatments, the lowest weed density and dry matter, highest yield attributes and seed yield was recorded with two hand weeding at 15 and 30 DAS and it was statistically at par with, oxyfluorfen @ 120 g a.i./ha pre emergence *fb* imazethapyr @ 40 g a.i./ha as post emergence, oxyfluorfen @ 120 g a.i./ha pre emezethapyr *fb* quizalifop-p-ethyl @ 37.5 g a.i./ha as post emergence and imazethapyr @ 40 g a.i./ha + quizalifop-p-ethyl @ 37.5 g a.i./ha as post emergence. Maximum net return and B:C ratio was recorded with oxyfluorfen @ 120 g a.i./ha pre emergence *fb* imazethapyr @ 40 g a.i./ha as post emergence and it was statistically at par with, oxyfluorfen @ 120 g a.i./ha pre emergence *fb* quizalifop-p-ethyl @37.5 g a.i./ha as post emergence, imazethapyr @ 40 g a.i./ha + quizalifop-p-ethyl @37.5 g a.i./ha as post emergence and with two hand weeding at 15 and 30 DAS. All herbicide treatments reduced weed biomass and improved seed yield and yield attributing parameters as compared to weedy check. Weedy check registered the highest value of weed count and biomass and lowest seed yield and yield attributing characters.

Keywords: Blackgrm, oxyfluorfen, imazethapyr, pre and post-emergence

Introduction

Blackgram is one of the important pulse crops in India. Blackgram (*Vigna mungo* L. Hepper), a dicotyledonous plant belongs to family leguminosae. It is basically a tropically crop and mostly cultivated during summer as well as in *kharif* season (Kondagari *et al.*, 2017) [3]. It is annual legume and self- pollinated crop having chromosome no 2n= 22.

Globally pulse crops are grown in area of 76 m ha with a production of about 68 million tons. The average productivity at the global level is about 895 kg/ha. India is the largest producer, 25 per cent of world's production, and consumer of 27 per cent of total pulses of the world. In India, the total pulse area is about 23.10 m ha with production of about 17.19 million tons and average productivity of 744 kg/ha (Pankaj *et al.*, 2020) [16]. Whereas Chhattisgarh it occupies 0.10 million ha area with total production of 0.03 million tones and productivity 304 kg/ha (Sai *et al.*, 2017). The major districts growing blackgram in Chhattisgarh area are Bastar (41.6%), Jashpur (30.17%), Surguja (28.73%) and Raigarh (18.47%) (Anonymous, 2005) [3].

The major problem in blackgram production, particularly in *kharif* season, is infestation of weeds. The weeds compete for nutrient, water, light and space with crop plant during early growth period. Yield losses in blackgram due to weeds have been estimated to range between 30-50% (Bhan and Singh, 1991) [6]. Weeds allowed to grow throughout the crop season caused 63.8% reduction in summer blackgram yield (Mishra and Chandrabhanu, 2006) [15]. The critical period of crop-weed competition in blackgram crop is from 15 to 45 DAS (Vats and Sawhney, 1980, Singh *et al*, 2016, Choudhary *et al.*, 2012) [23, 20, 9]. In blackgram, weeds could be controlled by hand weeding (Chand *et al.*, 2004) [7] however, it is laborious, time consuming, costly and tedious. Moreover, many times labour is not available at the critical period of crop weed competition. Furthermore, during rainy season weather conditions do not permit timely hand weeding due to wet field conditions. Hence, use of herbicides offers an alternative for possible effective control of weeds. Therefore, the present study was conducted to study the pre and post emergence herbicides for weed control in *kharif* blackgram.

Materials and Methods

A field experiment was conducted at research cum instruction farm of RMD College of Agriculture and Research Station, Ambikapur, Chhattisgarh during *kharif* season 2020, which was located at latitude of 23°10' N, longitude of 83°15' and an altitude of 623m mean sea level. Treatment were evaluated in randomized block design with three replications in blackgram using variety Indira Urd Pratham with the plot size of 3m × 2.4m. The herbicide were applied by knapsack sprayer fitted with flat nozzle using 500 liters of water per hectare. All the other recommended agronomic and plant protection measures were adopted to raise the crop and the intercultural practices were taken as need based recorded and calculated all the data of growth parameters, yield attributes and yield and economics of crop. The data on total weed count and weed dry matter were subjected to square root transformation ($\sqrt{x+0.5}$) normalize their distribution (Gomez and Gomez 1984).

Results and Discussion

Effect on weeds

The highest weed density (6.05 and 7.81 m^{-2} at 30 and 60 DAS) were recorded in weedy check (Table 1). Among herbicide, two hand weeding at 15 and 30 DAS was significantly lowest weed density (2.79 and 3.13 m^{-2} at 30 and 60 DAS) which was significantly lower than weed control treatments oxyfluorfen @ 120 g a.i./ha as pre emergence *fb* imazethapyr @ 40 g a.i./ha as post emergence, oxyfluorfen @ 120 g a.i./ha as pre emergence *fb* quizalifop-p-ethyl @37.5 g a.i./ha as post emergence and oxyfluorfen @120 a.i./ha as pre emergence, but significantly superior over rest of the treatments. The maximum density of total weeds might be due to the more favorable environmental available for growth and development of weeds Results were in conformity with the Tan *et al.*, (2005) [21]

At 30 and 60 DAS, Maximum weed fresh and dry weight (10.39, 4.28 g and 13.24, 5.37 g m^{-2} respectively) was recorded under weedy check (Table 1). Minimum weed fresh and dry weight (4.41, 2.22 and 4.97, 2.47g m^{-2} respectively) was recorded in under 2 hand weeding at 15 and 30 DAS which was significantly lower than rest of the treatments. In case of herbicidal treatments oxyfluorfen @ 120 g a.i./ha as pre emergence *fb* imazethapyr @ 40 g a.i./ha as post emergence recorded lower fresh and dry weight and which was at par with oxyfluorfen @ 120 g a.i./ha as pre emergence *fb* quizalifop-p-ethyl @ 37.5 g a.i./ha as post emergence (55.98 and 10.15 g m^{-2}) and oxyfluorfen @ 120 g a.i./ha as pre emergence but superior to rest of the treatments. The data reveal that all weed were controlled effectively by hand weeding during all stages of crop growth. All type of herbicide applied in this trial were found effective to control different types of weeds might be because of its nature of selectivity as well as appropriate dose of application. The variations in dry matter production of weeds at different period was observed due to effect of different weed management practices which influenced weed density and ultimately dry matter production of weeds. Begum and Rao (2006) [5] and Ali *el al.*, (2011) [2] also reported that hand weeding at 15 and 30 DAS was effective to reduce the dry weight of all weeds.

At 30 and 60 DAS (Table 1), the highest value of weed control efficiency (75.05 and 80.97%) was recorded under 2 hand weeding at 15 and 30 DAS and next superior herbicidal treatments were oxyfluorfen @ 120 g a.i./ha as pre emergence *fb* imazethapyr @ 40 g a.i./ha as post emergence, oxyfluorfen @ 120 g a.i./ha as pre emergence *fb* quizalifop-p-ethyl @ 37.5 g a.i./ha as post emergence than imazethapyr @ 40 g a.i./ha + quizalifop-p-ethyl @ 37.5 g a.i./ha as post emergence. Lowest value of weed control efficiency was recorded under treatment quizalofop-p-ethyl @ 37.5 g a.i./ha as post emergence (11.20 and 28.89% at 30 and 60 DAS respectively). Highest value of weed control efficiency might be due to the grater reduction of wide spectrum of weeds at early stages of crop growth, which reduced the weed biomass. Similar finding was reported by Rai *et al.*, (2016) [18].

The minimum value of weed index 5.29% was recorded under application of oxyfluorfen @ 120 g a.i./ha as pre emergence *fb* imazethapyr @ 40 g a.i./ha as post emergence than oxyfluorfen @ 120 g a.i./ha as pre emergence *fb* quizalifop-p-ethyl @ 37.5 g a.i./ha as post emergence (6.73%), imazethapyr @ 40 g a.i./ha + quizalifop-p-ethyl @ 37.5 g a.i./ha as post emergence (7.22%), oxyfluorfen @ 120 g a.i./ha as pre emergence (22.14%) and quizalofop-p-ethyl @ 37.5 g a.i./ha as post emergence (23.09%). This might be due to effective weed control during critical stage of crop growth periods which gave congenial environment for better growth and development of crop plant which in turn resulted in optimum grain yield and the maximum weed index under weedy check because of severe crop weed competition during critical period of crop growth this is in agreement with finding of Yadav *et al.*, (1997) [25], Vivek *et al.*, (2008) [24].

Table 1: Effect of weed management practices on weed density, fresh and dry weight weed control efficiency and weed index in blackgram

Treatment	Total weed density (no. m^{-2})		Total weed fresh weight (g m^{-2})		Total weed dry weight (g m^{-2})		Weed control efficiency (%)		Weed index (%)
	30 DAS	60 DAS	30 DAS	60 DAS	30 DAS	60 DAS	30 DAS	60 DAS	
T_1	6.05 (36.28)	7.81 (60.58)	10.39 (107.49)	4.28 (17.80)	13.24 (175.47)	5.37 (30.74)	-	-	58.29
T_2	2.79 (7.33)	3.13 (9.53)	4.41 (18.93)	2.22 (4.44)	4.97 (24.34)	2.47 (5.85)	75.05	80.97	0.00
T_3	3.06 (9.05)	5.82 (33.67)	7.60 (58.43)	3.71 (13.42)	10.41 (107.91)	4.06 (16.33)	24.65	46.89	22.14
T_4	5.58 (30.67)	6.22 (38.34)	9.61 (91.85)	4.04 (15.82)	11.10 (122.86)	4.73 (21.86)	11.20	28.89	23.09
T_5	2.87 (7.80)	3.81 (14.50)	7.16 (50.76)	3.00 (8.53)	8.17 (68.48)	3.55 (12.66)	51.95	58.83	5.29

T_6	3.00 (8.70)	4.92 (23.83)	7.49 (55.98)	3.25 (10.15)	8.51 (74.63)	3.76 (13.64)	42.83	55.63	6.73
T_7	5.15 (26.17)	5.46 (29.84)	9.39 (88.68)	3.89 (14.63)	9.47 (98.97)	3.78 (14.04)	17.70	54.32	7.22
S.Em±	0.22	0.27	0.38	0.16	0.64	0.49			
CD (P = 0.05)	0.63	0.79	1.11	0.48	1.89	1.46			

*Figures in without parenthesis indicates the transformed value. $\sqrt{X+0.5}$

T_1: weedy check, T_2: two hand weeding at 15 and 30 DAS, T_3: oxyfluorfen @120 a.i./ha as pre emergence T_4: quizalifop-p-ethyl @37.5 g a.i./ha as post emergence, T_5: oxyfluorfen @ 120 g

a.i./ha as pre emergence *fb* imazethapyr @ 40 g a.i./ha as post emergence, T_6: oxyfluorfen @ 120 g a.i./ha as pre emergence *fb* quizalifop-p-ethyl @37.5 g a.i./ha as post emergence and T_7: imazethapyr @ 40 g a.i./ha + quizalifop-p-ethyl @37.5 g a.i./ha as post emergence.

Yield attributes

The yield parameters (Table 2) *viz.*, number of pod plant^{-1} (31.04), Length of pod (4.67 cm), pod weight (14.20 g plant^{-1}), number of seeds pod^{-1} (7.55) and 1000-seed weight (42.90 g) of blackgram was found maximum in two hand weeding at 15 and 30 DAS and which was found statistically at par with oxyfluorfen @ 120 g a.i./ha pre emergence *fb* imazethapyr @ 40 g a.i./ha as post emergence, oxyfluorfen @ 120 g a.i./ha pre emergence *fb* quizalifop-p-ethyl @37.5 g a.i./ha as post emergence and imazethapyr @ 40 g a.i./ha + quizalifop-p-ethyl @37.5 g a.i./ha as post emergence. Minimum number of pod plant^{-1}(19.59), Length of pod (4.33 cm), pod weight (8.16 g plant^{-1}), number of seeds pod^{-1} (6.17) and 1000-seed weight (40.03 g) was recorded in weedy check due to reduction of weed competition in the early stages of crop growth with the simultaneous increase in the uptake of nutrients by the crop which favoured taller plants, increased leaf area of assimilation surface which enhanced the crop dry matter production. The better and effective growth with source of assimilation area prompted for the favourable sink capacity reflected in the various yield attributing characters. Similar observations were made by Patel *et al.*, (2011) [17] and Chhodavadia (2014) [8].

Table 2: Effect of weed management practices on yield attributes and yield of blackgram

Treatment	Number of pod plant^{-1}	Length of pod (cm)	Pod weight plant^{-1} (g)	Number of seed pod^{-1}	Test weight (1000 seeds, g)	Seed yield (q ha^{-1})	Stover yield (q ha^{-1})
T_1	19.59	4.33	8.16	6.17	40.03	4.02	15.37
T_2	31.04	4.67	14.20	7.55	42.90	9.63	26.62
T_3	28.99	4.47	11.80	6.63	41.70	7.50	18.94
T_4	24.89	4.40	10.19	6.28	41.13	7.41	17.88
T_5	30.72	4.63	13.77	7.40	43.57	9.12	26.57
T_6	30.44	4.57	13.60	7.32	43.13	8.98	24.31
T_7	29.33	4.53	13.26	7.15	42.37	8.94	23.84
S.Em±	1.00	0.16	0.83	0.41	0.83	0.34	1.76
CD (P = 0.05)	2.96	NS	2.44	1.22	2.44	1.06	5.44

T_1: weedy check, T_2: two hand weeding at 15 and 30 DAS, T_3: oxyfluorfen @120 a.i./ha as pre emergence T_4: quizalifop-p-ethyl @37.5 g a.i./ha as post emergence, T_5: oxyfluorfen @ 120 g a.i./ha as pre emergence *fb* imazethapyr @ 40 g a.i./ha as post emergence, T_6: oxyfluorfen @ 120 g a.i./ha as pre emergence *fb* quizalifop-p-ethyl @37.5 g a.i./ha as post emergence and T_7: imazethapyr @ 40 g a.i./ha + quizalifop-p-ethyl @37.5 g a.i./ha as post emergence.

Yield and economics: Maximum seed yield and stover yield (Table 3) was significantly higher under all the weed control practices over weedy check. Two hand weeding at 15 and 30 DAS recorded the highest seed yield and stover yield (9.63 q ha^{-1}and 26.62 q ha^{-1}) which was at par with treatment oxyfluorfen @ 120 g a.i./ha pre emergence *fb* imazethapyr @ 40 g a.i./ha as post emergence, oxyfluorfen @ 120 g a.i./ha pre emergence *fb* quizalifop-p-ethyl @37.5 g a.i./ha as post emergence and imazethapyr @ 40 g a.i./ha + quizalifop-p-ethyl @37.5 g a.i./ha as post emergence superior to rest of the treatments. Minimum seed yield and stover yield (4.02 q ha^{-1}and 15.37 q ha^{-1}). This was achieved by the way of effective early and later weed control through pre and post emergence herbicides which might have reduced the crop-weed competition. The increase in yield was mainly attributed to better control of weeds through out the crop growth resulting in better availability of nutrients, moisture and light to the crop growth. Earlier findings by Kumar *et al.*, (2015) [14] and Teja *et al.*, (2016) [22] agreed with the present findings.

The highest gross return was (Rs 63101.85/ha) recorded under two hand weeding at 15 and 30 DAS followed by oxyfluorfen @ 120 g a.i./ha as pre emergence *fb* imazethapyr @ 40 g a.i./ha as post emergence, oxyfluorfen @ 120 g a.i./ha as pre emergence *fb* quizalifop-p-ethyl @37.5 g a.i./ha as post emergence and imazethapyr @ 40 g a.i./ha + quizalifop-p-ethyl @37.5 g a.i./ha as post emergence. Minimum gross return was recorded under weedy check (Rs. 27174.07/ha). Similarly result was shown by Aggarwal *et al.*, (2014) [1] and Balyan *et al.*, (2016) [4]. But the highest net monetary return and B:C ratio was recorded under oxyfluorfen @ 120 g a.i./ha as pre emergence *fb* imazethapyr @ 40 g a.i./ha as post emergence (Rs 34010.57/ha and 1.31) followed by oxyfluorfen @ 120 g a.i./ha as pre emergence *fb* quizalifop-p-ethyl @37.5 g a.i./ha as post emergence due to reduced cost of weeding were reason behind higher net return similar magnitude of higher return due to pre emergence and post emergence herbicides has been reported by Komal *et al.*, (2015) [12] and Kalhapure *et al.*, (2013) [11].

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Table 3: Effect of weed management practices on economics of blackgram

Treatment	Gross return (Rs ha^{-1})	Net return (Rs ha^{-1})	B:C ratio
T_1	27174.07	3141.67	0.15
T_2	63101.85	23719.45	0.60
T_3	48775.56	23261.09	0.91
T_4	48787.04	22222.10	0.86
T_5	60037.04	34010.57	1.31
T_6	58750.00	32088.03	1.20
T_7	58379.63	32073.73	1.22
S.Em±	2095.72	2095.72	0.08
CD (P = 0.05)	6461.08	6461.08	0.24

T_1: weedy check, T_2: two hand weeding at 15 and 30 DAS, T_3: oxyfluorfen @120 a.i./ha as pre emergence T_4: quizalifop-p-ethyl @37.5 g a.i./ha as post emergence, T_5: oxyfluorfen @ 120 g a.i./ha pre emergence *fb* imazethapyr @ 40 g a.i./ha as post emergence, T_6: oxyfluorfen @ 120 g a.i./ha pre emergence *fb* quizalifop-p-ethyl @37.5 g a.i./ha as post emergence and T_7: imazethapyr @ 40 g a.i./ha + quizalifop-p-ethyl @37.5 g a.i./ha as post emergence.

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