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Field efficacy of different doses of Propaquizafop 5.2% herbicides against grassy weeds, growth and yield of Blackgram (*Vigna mungo* L.)

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Abstract

A field experiment was conducted at JNKVV – Zonal Agricultural Research Station, Powarkheda, Narmadapuram during summer 2018. The experiment comprised of seven treatments viz Propaquizafop 5.2% @ 1000 g ha⁻¹, Propaquizafop 5.2% @ 1250 g ha⁻¹, Propaquizafop 5.2% @ 1500 g ha⁻¹, Propaquizafop 10% EC @ 1000 g ha⁻¹, Propaquizafop 2.5% + Imazethaypr 3.75% ME @ 2000 g ha⁻¹, hand weeding check at 20 and 40 DAS and untreated control was laid out in randomized block design with three replications. Post emergence application of Propaquizafop 5.2% @ 1000 ml ha⁻¹ caused appreciable reduction in the density of *Echinochloa crusgalli*, *Cyperus rotundus* and *Cynodon dactylon*. Hand weeding at 20 and 40 DAS had lowest weed density. Post emergence application of Propaquizafop 5.2% herbicide 1500 ml ha⁻¹, in black gram attained higher value of plant height and number of branches/plant, pods plant⁻¹, seeds pod⁻¹ and seed index (100 seeds), seed yield and stover yield.

Keywords: Black gram, efficacy, grassy weeds, growth, yield

Introduction

Blackgram [*Vigna mungo* (L.) Hepper] is one of the important nutritive pulse crops. India is the largest producer and consumer of blackgram in the world. In India, it is mostly grown in summer and rainy seasons, Total production of black Gram is about 23 lakh tonnes on an area of 40 lakh hectare with the average productivity of 598 kg ha⁻¹ in 2022-23 in India (Anonymous 2023-24) ^[1]. In India, the important blackgram growing states are Madhya Pradesh, Rajasthan, Andhra Pradesh, Uttar Pradesh, Tamil Nadu, Maharashtra, Jharkhand, Gujarat, Karnataka and West Bengal. In Madhya Pradesh Black gram (Urad) grown on 13.09 lakh hectares with the production of 8.50 lakh metric tonnes an average productivity 649 Kg ha⁻¹ (Anonymous 2023-24) ^[1]. Blackgram is usually accompanied by luxuriant weed growth during the rainy (Kharif) season owing to abundant rainfall received during monsoons leading to serious crop losses. Unchecked weeds have been reported to cause a considerable reduction in the grain yield of blackgram ranging from 35.2 to -87% (Chand *et al.* 2004 ^[3], Singh 2011^[7], Sukumar *et al.* 2018) ^[9]. and critical period for crop weed competition is around 15 to 45 DAS (Khot *et al.* 2016) ^[5]. Weeds compete with crop in initial stages for limited essential resources and seriously depress the crop growth and development (Singh *et al.*, 1984) ^[8]. Weeds increase cost of cultivation and deplete resource base (Buriro *et al.*, 2003) ^[2]. Blackgram is not a very good competitor against weeds (Choudhary *et al.* 2012) ^[4]. and is mostly susceptible to weed infestation during the first four weeks of its growth period (Randhawa *et al.* 2002) ^[6]. Therefore, adequate weed management is essential, particularly during critical period of crop weed competition, to ensure optimal crop growth. The majority of farmers use hand weeding, which requires a lot of labours, time and is also less cost effective under rainfall condition. Pre-emergence herbicides only control weeds for a short period of time and there after late-emerging weeds begin to compete with crops. Hence, in order to keep free from weed competition, the use of post-emergence herbicides in sequence to manage late emerging weeds may be essential. Hence, the present investigation was undertaken to determine the efficacy of different doses of Propaquizafop 5.2% herbicides against grassy weeds, growth and yield of blackgram.

Materials and Methods

A field experiment was conducted at JNKVV – Zonal Agricultural Research Station, Powarkheda, Narmadapuram during summer 2018. The experiment comprised of seven treatments viz Propaquizafop 5.2% @ 1000 g ha⁻¹, Propaquizafop 5.2% @ 1250 g ha⁻¹, Propaquizafop 5.2% @ 1500 g ha⁻¹, Propaquizafop 10% EC @ 1000 g ha⁻¹, Propaquizafop 2.5% + Imazethaypr 3.75% ME @ 2000 g ha⁻¹, hand weeding check at 20 and 40 DAS and untreated control. The experiment was laid out in randomized block design with three replications. Blackgram variety 'Azad 1' was fertilized with 20 kg N, 60 kg of P₂O₅ and 20 kg K₂O ha⁻¹ through urea, SSP and MOP respectively. The entire dose of NPK was applied as basal. Hand operated knapsack sprayer fitted with a flat fan type nozzle was used for spraying the herbicides by adopting a spray volume of 500 litres ha⁻¹. All the recommended agronomic and plant protection measures were adopted to raise the crop. The density of grassy weeds were recorded at 15, 30 and 45 DAA by placing a quadrat of 50×50 cm from the marked sampling area of 1.0 m² in each plot. These were subjected to square root transformation to normalize their distribution. Five random plants were selected from each plot to record observations on plant growth and yield parameters, viz. plant height (cm), no. of branches per plant at maturity, no. of pods per plant, number of seeds per pod, test weight (g), seed and stover yield (kg ha⁻¹) were recorded at harvest. Seed yield of blackgram was recorded at harvest and statistically analyzed at 5% level of significance.

Results and Discussion

Grassy weeds

The data recorded on density of associated weeds viz., *Echinochloa crusgalli*, *Cyperus rotundus* and *Cynodon dactylon*, at before application, 15, 30 and 45 days after application (DAA) as influenced by different weed control treatments are presented in Table 2. The comparison among the treatments means have been made on the basis of transformed values in case of weed parameters only.

Echinochloa crusgalli

The density of *Echinochloa crusgalli* at before application 15, 30 and 45 days after application is presented in Table 2. The density of *Echinochloa crusgalli* was maximum (13.68 m⁻²) under weedy check plots at 45 DAA. It was affected significantly when weed control measures were adopted in different plots. Post emergence application of Propaquizafop 5.2% @ 1000 ml ha⁻¹ caused appreciable reduction in the density (6.38 m⁻²) of *Echinochloa crusgalli* over weedy check plots. However, the efficacy of Propaquizafop 5.2% was further improved with the corresponding increase in the rates of application from 1250 to 1500 ml ha⁻¹. Hand weeding at 20 and 40 DAS had lowest weed density (1.91 m⁻²).

Cyperus rotundus

Density of *Cyperus rotundus* was recorded at before application, 15, 30 and 45 days after application under different weed control treatments and are presented in Table 2. It is obvious from the data that all the herbicidal treatments including hand weeding had lowered the density (1.91 m⁻²) of *Cyperus rotundus* significantly at 45 DAA as compared to weedy check plots (7.79 m⁻²). Post emergence application of Propaquizafop 5.2% at the rate of 1000 ml ha⁻¹ caused appreciable reduction (3.71 m⁻²) in the density of *Cyperus rotundus* over weedy check plots. The effect was further increased with the corresponding

increase in application rates of Propaquizafop 5.2% from 1250 to 1500 ml ha⁻¹.

Cynodon dactylon

The density of *Cynodon dactylon* as affected by different weed control treatments at before application, 15, 30 and 45 days after application has been given in Table 2. It is obvious from the data that the weed control treatments caused significant influence on the density of *Cynodon dactylon* at 15, 30 & 45 DAA. The density of *Cynodon dactylon* was maximum (7.17 m⁻²) under weedy check plots at 45 DAA. There was identical reduction in the density of *Cynodon dactylon* when herbicidal weed control measures were adopted. The application of Propaquizafop 5.2% at 1000 ml ha⁻¹ as post emergence caused significant reduction (3.30 m⁻²) in the density of *Cynodon dactylon* over weedy check plots. The efficacy of Propaquizafop 5.2% was increased appreciably with the increase in application rates from 1250 to 1500 ml ha⁻¹.

Effect on plant population: Plant population of black gram was not influenced due to different weed control treatments at 15 DAS and at harvest stages (Table 3) and it was statistically at par under all the treatments at including hand weeding twice and weedy check plots. It indicates that post emergence application of Propaquizafop 5.2% herbicide in different doses against weeds did not cause any adverse effect on germination, emergence, seedling growth and development of black gram.

Effect on growth parameters

It is obvious from the Table 3 that the plant height and number of branches/plant were influenced due to different weed control treatments and they were significantly superior over weedy check plots. Among the herbicidal treatments, post emergence application of Propaquizafop 5.2% herbicide at 1500 ml ha⁻¹ attained superior values of growth parameters being at par to the values under Propaquizafop 5.2% @ 1250 ml ha⁻¹ but significantly higher over other treatments and weedy check. However, none of the herbicidal treatments surpassed the hand weeding twice which had excellent values of growth parameters and proved significantly superior over all the treatments.

Effect on yield attributing characters

The data presented in Table 3 revealed that all the yield attributing characters viz; pods plant⁻¹, seeds pod⁻¹ and seed index (100 seeds) were significantly influenced due to various weed control treatments. Post emergence application of Propaquizafop 5.2% @ 1500 ml ha⁻¹ attained significantly superior values of yield attributes closely followed by the values under Propaquizafop 5.2% @ 1250 ml ha⁻¹, in comparison to other treatments. However, the hand weeding twice had the highest values of yield attributing traits and proved significantly superior over other treatments.

Effect on seed yield

It is obvious from the data given in Table 3 that post emergence application of Propaquizafop 5.2% herbicide 1500 ml ha⁻¹ attained significantly higher seed yield which has at par to that under Propaquizafop 5.2% @ 1250 ml ha⁻¹ because of relatively low competition at stress and resulted in better yield and proved significantly superior over other herbicidal treatments. Lower dose of post emergence application of Propaquizafop 5.2% at 1000 ml ha⁻¹ was comparatively less effective in curbing the weed menace, and thereby produced lower yield attributing traits and ultimately the seed yield. However, none of the herbicidal

treatments out yielded the hand weeding twice which gave the highest seed yield and proved significantly superior over other treatments.

Effect on Stover yield

Application of Propaquizafop 5.2% herbicide as post emergence at 1500 ml ha⁻¹ in black gram attained higher value of stover yield (Table 3) being at par Propaquizafop 5.2% @ 1250 ml ha⁻¹ including check herbicides and proved significantly superior over Propaquizafop 5.2% herbicide applied at lower rates (1000 ml ha⁻¹). However, none of the herbicidal treatments surpassed the hand weeding twice which gave highest stover yield and

proved significantly superior over other treatments.

Table 1: Weed flora of black gram in grassy weeds

S. No.	Weed flora	Density/m ²			Mean	Relative Density (%)
		15 DAA	30 DAA	45 DAA		
Grassy Weeds						
1.	<i>Echinochloa crusgalli</i>	115.75	145.25	170.45	143.82	38.98
2.	<i>Cyperus rotundus</i>	25.65	40.25	49.85	38.58	10.46
3.	<i>Cynodon dactylon</i>	16.85	30.35	39.85	29.02	7.86
	Sub Total				211.42	57.30

DAA: Days after application

Table 2: Density of weeds at different intervals as influenced by weed control treatments

Treatment	Doses (g or ml ha ⁻¹) Formulation	<i>Echinochloa crusgalli</i> (m ⁻²)				<i>Cyperus rotundus</i> (m ⁻²)				<i>Cynodon dactylon</i> (m ⁻²)			
		Before application	15 *DAA	30 DAA	45 DAA	Before application	15 DAA	30 DAA	45 DAA	Before application	15 DAA	30 DAA	45 DAA
Propaquizafop 5.2%	1000	10.76	9.94	7.42	6.38	5.07	4.54	3.87	3.71	4.09	3.87	3.39	3.30
		*115.25	98.25	54.50	40.15	25.20	20.15	14.45	13.25	*16.25	14.50	11.00	10.40
Propaquizafop 5.2%	1250	10.76	9.55	6.52	5.54	5.09	4.31	3.58	3.25	4.10	3.38	2.75	2.58
		115.3	90.65	42.05	30.15	25.45	18.10	12.35	10.05	16.35	10.95	7.06	6.15
Propaquizafop 5.2%	1500	10.76	8.77	6.36	5.09	5.08	4.18	3.32	3.11	4.12	3.04	2.42	2.20
		115.35	76.50	40.00	25.45	25.30	17.00	10.50	9.15	16.45	8.75	5.33	4.35
Propaquizafop 10% EC	1000	10.76	9.04	6.86	5.24	5.11	4.54	3.57	3.32	4.11	5.10	5.98	6.78
		115.25	81.25	46.50	27.00	25.60	20.10	12.25	10.50	16.4	25.50	35.25	45.50
Propaquizafop 2.5% + Imazethapyr 3.75% ME	2000	10.77	9.58	7.15	5.71	5.11	4.65	3.69	3.31	4.14	3.81	3.58	3.28
		115.55	91.35	50.65	32.12	25.65	21.15	13.15	10.45	16.65	14.00	12.35	10.25
Weed free check (Hand weeding)	20 & 40 DAS	10.76	3.26	2.44	1.91	5.09	2.86	2.47	1.91	4.10	3.57	3.40	3.29
		115.35	10.15	5.45	3.15	25.40	7.67	5.60	3.15	16.35	12.25	11.05	10.30
Untreated control (Weedy check)	-	10.78	12.07	13.07	13.68	5.11	6.38	7.10	7.79	4.12	1.96	1.87	1.58
		115.75	145.25	170.45	186.55	25.65	40.25	49.85	60.15	16.45	3.33	3.00	2.00
S.Em±		0.36	0.14	0.22	0.24	0.62	0.07	0.08	0.14	4.17	5.55	6.35	7.17
CD (p=0.05)		NS	0.42	0.66	0.73	NS	0.21	0.24	0.42	16.85	30.35	39.85	50.85
										0.33	0.07	0.05	0.13
										NS	0.21	0.015	0.39

* DAA – days after application

*Bold figures are the original values

Table 3: Effect of different treatments on plant growth, yield attributes and yields of black gram

Treatment	Doses (g or ml ha ⁻¹) Formulation	Plant population (m ⁻²)		Plant height (cm)	Branches plant ⁻¹	Pods plant ⁻¹	Seeds pod ⁻¹	Seed index (g)	Seed yield (kg/ha ⁻¹)	Stover yield (kg/ha ⁻¹)
		At 15 DAS	At harvest							
Propaquizafop 5.2%	1000	65.75	65.35	32.30	2.65	18.90	3.50	5.05	578	1235
Propaquizafop 5.2%	1250	65.65	65.30	33.50	2.72	23.55	3.80	4.98	786	1751
Propaquizafop 5.2%	1500	65.70	65.35	33.60	2.75	24.60	3.90	4.99	825	1876
Propaquizafop 10% EC	1000	66.15	65.95	33.45	2.69	23.52	3.70	4.97	656	1641
Propaquizafop 2.5% + Imazethapyr 3.75% ME	2000	65.75	65.30	33.45	2.68	23.50	3.70	4.96	691	1726
Weed free check (Hand weeding)	20 & 40 DAS	65.55	65.25	33.50	2.90	28.60	4.50	5.00	971	2150
Untreated control (Weedy check)	-	65.45	65.30	30.50	1.80	15.20	2.50	3.00	244	550
SEm±	-	0.32	0.31	0.34	0.02	1.20	0.08	0.25	38.53	99.50
CD at 5%	-	NS	NS	1.02	0.06	3.60	0.24	0.75	115.59	298.50

Conclusion

From the results obtained under present study indicate that post emergence application of Propaquizafop 5.2% @ 1000 ml ha⁻¹ caused appreciable reduction in the density of *Echinochloa crusgalli*, *Cyperus rotundus* and *Cynodon dactylon*. Hand weeding at 20 and 40 DAS had lowest weed density. post emergence application of Propaquizafop 5.2% herbicide 1500 ml ha⁻¹, in black gram attained higher value of plant height and number of branches/plant, pods plant⁻¹, seeds pod⁻¹ and seed index (100 seeds), seed yield and stover yield.

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