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POTENTIAL OF DIFFERENT POST-EMERGENCE HERBICIDES AGAINST COMPLEX WEED FLORA IN MUNG BEAN (*Vigna radiata*)

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ABSTRACT

A field experiment was conducted in randomized block design for three consecutive years (2021-23) at Agricultural Research Sub-Station, Nagaur, Agriculture University, Jodhpur during rainy season to evaluate the efficacy of different post-emergence herbicides for complex weed flora, growth and yield of mung bean with twelve treatments and three replications. The results revealed that the lowest density (No./m²) of *Rhinchosia minima* (11.5), *Digera arvensis* (5.7), *Celosia argentea* (16.3), *Cyperus rotundus* (6.7), *Dactyloctenium aegyptium* (6.3), other broad leaves & grassy weeds (5.7), total weed dry weight (25.0 g/m²) and highest weed control efficiency (82.4%) was recorded under sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC 220 g/ha that was closely followed by fomesafen 11.1% + fluazifop - P-butyl 11.1% SL 220 g/ha. Ready mix application of sodium acifluorfen + clodinafop-propargyl resulted in significant improvement in number of seeds per pod (13.6), 1000 grain weight (44.6 g), mean grain yield (12.3 q/ha), gross returns (₹1,04,310/ha), net returns (₹72,310/ha), BC ratio (2.1) and weed index (9.0). These similar treatments also resulted in 16.5 % more weed reduction and 20.5 % seed yield enhancement over the imazethapyr application. It was concluded that application of sodium acifluorfen 16.5%+ clodinafop-propargyl 8% EC (Ready-mix) or fomesafen 11.1% w/w + fluazifop-P-butyl 11.1% (Ready-mix) @ 220 g/ha can be used at 20-25 days after sowing for the control of complex weed flora in mung bean with higher yields and returns.

Keywords: Economics, Fomesafen + Fluazifop-P-Butyl, Sodium acifluorfen + Clodinafop-propargyl, Weed control efficiency, Yield

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Mung bean (*Vigna radiata* L.) alternatively known as green gram, green bean, moong bean, golden gram belongs to the leguminaceae family. It is an important pulse crop in India and believed to be originated from India. It plays an important role as a food security crop because of its nutritional quality as well as ability to survive in harsh environmental conditions such as arid and semiarid lands. It is mainly grown for human food and flour while sprouts and immature pods are used as a vegetable. The grains contain approximately 25-28% protein, 3.5-4.5% fiber, 4.5-5.5% ash and 60-65% carbohydrates on dry weight basis. The grains also contain vitamin-A (94 mg), Vitamin-C (8 mg), iron (7.3 mg), calcium (124 mg), magnesium (189 mg), phosphorus (367 mg) and folate (549 mg) (Muchomba *et al*., 2023). Besides being a rich source of protein, green gram also fixes atmospheric nitrogen through nitro-bacter bacteria. The crop has the ability to add about 30-40 kg N/ha in a single season. The vegetative parts, stocks and husks are also useful sources of leguminous fodder for livestock. The crop also serves as an important cover and a rotation crop.

India is the highest producer as well as consumer of pulses in the world. Mung bean with 31.94 lakh ha area is the third important pulse crop of India grown in nearly 10 per cent of the total pulses area of the country. In India, total production of mung bean is 15.06 lakh tonnes (Anonymous 2023-24a). Rajasthan is the dominant contributor to mung bean cultivation in terms of area (about 70%) and production (about 75%). This state has the highest area (about 22.12 lakh hectare), production (10.56 lakh tonnes) and yield (477 kg/ha) of mung bean (Anonymous 2023-24b). Nagaur, Jodhpur and Pali, together contribute more than 50% of the total area under mungbean cultivation in Rajasthan (Sharma *et al*., 2017). Nagaur, Pali, Jodhpur, Jalore, Ajmer, Jaipur and Tonk districts covered the maximum area in Rajasthan. The maximum area under mung bean cultivation was covered by Nagaur (27%), followed by Jodhpur (13.57%) and Pali (12.18%) districts of Rajasthan.

Mung bean is recommended for cultivation mainly in *kharif* season under arid conditions of nagaur,

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Rajasthan. But weed infestation is one of the major constraints in mung bean cultivation and causes 50 to 90% yield loss (Mishra *et al*., 2017). The highest losses of total annual agriculture production are caused by weeds (45%) followed by insects (30%), diseases (20%) and other causes (5%) (Rao, 2000). Weeds compete with crops for resources such as nutrients, water, light and space, thus reducing their yield. The presence of weeds not only reduces grain yield, but it also influences the quality of seed. The major weed flora of mung bean is *Rhinchosia minima*, *Digera arvensis*, *Celosia argentea*, *Cyperus rotundus*, *Dactyloctenium aegyptium,* other broad leaved and grassy weeds. Weeds are present throughout the crop growth, yet there is a need to find out the exact time during which weeds cause the highest yield reductions. The critical period of weed competition is defined as the shortest period during crop growth in which weed management results in almost similar yield as that in weed free conditions throughout crop growth. A first period of 20-40 days after sowing is crucial for crop-weed competition in mung bean (Pankaj *et al*., 2017). Mechanical practices such as hand weeding and inter-culturing are effective but unavailability of labour and incessant rains during the early crop season normally limit the weeding operations. Therefore, chemical weeding under such circumstances becomes indispensable and can be a cost-effective alternative.

Application of pendimethalin and imazethapyr during pre-emergence (PE) and post-emergence (PoE), respectively, has shown promising results in green gram (Singh *et al*., 2015). However, narrow time window of application often makes the PE herbicides less preferred choice among the farmers. Also, application of a single herbicide is often ineffective in controlling diverse weed flora. On the contrary, either ready or tank mixes of compatible herbicides with varying modes of action may ensure effective control of diverse weed flora and check shifting of weed flora complex and herbicide resistance (Banerjee *et al*., 2018). In general, there is lack of information on the impact of new ready-mix herbicides available in Indian market on the performance of monsoon mung bean. Given this, the present study was formulated to evaluate the efficacy of different post-emergence herbicides for complex weed flora, growth, yield potential and economics of mung bean.

MATERIALS AND METHODS

A field experiment was conducted during *Kharif* (Rainy) seasons of 2021, 2022 and 2023 at the Research farm of Agricultural Research Sub-Station, Nagaur, Agriculture University, Jodhpur, Rajasthan situated at 27° 12' 7.24" N latitude, 73° 44' 2.18 E longitude, at an altitude of 302 m above the mean sea level. This location falls within agro-climatic zone II A, characterized as arid and semi-arid transitional plain of inland drainage zone in Rajasthan. The climate of this region is distinctly arid and semi-arid marked by significant temperature fluctuations throughout the year. Average annual rainfall is 385 mm, about 80% of which falls during July-September from the southwest monsoon while the rest is more or less equally distributed during the rest of the year. Weather data during the whole experimental period was recorded and presented as follows :

Month	Mean monthly maximum temperature (˚C)			Mean monthly minimum temperature (˚C)			Total monthly rainfall (mm)		
	2021	2022	2023	2021	2022	2023	2021	2022	2023
July	37	34	35	29	27	28	130	270	233
August	36	33	35	28	26	26	126	216	16
September	33	36	37	26	27	27	175	54	46

The soil samples were drawn from top 15 cm soil depth. The soil in the experimental field is classified as loamy sand and slightly alkaline in reaction (pH 8.2) and with EC of 0.35 dS/m. The soil was low in organic carbon (0.15%), available N (219 kg/ha), available P_2O_5 (15 kg/ha) and available K_2O (217 kg/ha). Twelve treatments (T_1: imazethapyr 50 g/ha, T_2: imazethapyr 70 g/ha, T_3: fomesafen 11.1% w/w + fluazifop-P-butyl 11.1% 220 g/ha, T_4: fomesafen 11.1% w/w + fluazifop-P-butyl 11.1% 250 g/ha, T_5: sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC 220 g/ha, T_6: sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC 250 g/ha, T_7: imazethapyr 35% + imazamox 35% WG 40 g/ha, T_8: imazethapyr 35% + imazamox 35% WG 60 g/ha PoE, T_9 : quizalofop ethyl 7.5 % + imazethapyr 15 % EC 80 g/ha, T_{10}: quizalofop ethyl 7.5 % + imazethapyr 15% EC 100 g/ha, along with weed free (T_{11}) and weedy (T_{12}) were laid out in randomized block design with three replications. Seeds of Mung bean variety “MH-421” were sown manually with 30 cm × 10 cm planting geometry in a plot size of 4m × 3m with seed rate of 15 kg/ha on 11 July, 08 July and 18 July during 2021, 2022 and 2023, respectively. The crop was grown under totally rainfed conditions. Thinning and gap filling were done manually to maintain optimum plant population. A recommended dose of fertilizer (40:20 kg N: P_2O_5/ha) was applied as basal application through urea and di-ammonium

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phosphate (DAP) as per package of practices of crop for the area. Herbicides were applied as spray in an aqueous medium at the rate of 500 liter water/ha for post-emergence herbicides at 23 days after sowing (DAS), using a knapsack sprayer fitted with flat-fan nozzle. Data on weed count and weed biomass from an area enclosed in a quadrate of one m^2 at one place under different treatments were recorded at 45 DAS. The sampled weeds were then categorized into grasses, broad-leaved and sedges. Category-wise weed density was first determined by counting and then weed dry weight was measured after sun-drying for two days followed by oven-drying at 80 °C for 48 hours (h). Data on individual weed and total weed density and weed dry weight were subjected to square root transformation ($\sqrt{X+1}$). Weed control efficiency (WCE) was estimated at 45 DAS by using the formula:

$$\text{Weed control Efficiency \%)} = \frac{\text{Dry weight of weeds in - Dry weight of weeds in control plot treated plot}}{\text{Dry weight of weeds in control plot}} \times 100$$

Weed control efficiency was calculated on dry matter basis and yield recorded in kg per plot was standardized to 12-14 % moisture and then weight was converted into kg/ha. Weed index was calculated by using grain yield in treatment plots and control plots. The important growth parameters, yield attributes and yield were recorded as per standard procedures. In order to calculate the net returns for each treatment, total cost of cultivation was subtracted from the gross returns. Total cost of cultivation and gross returns were estimated as per the prices prevailing at the time of conduct of experiment and benefit-cost ratio was calculated from gross return to cost of cultivation. The experimental data were subjected to statistical analysis employing standard techniques of analysis of variance (ANOVA). Pooled analysis of the data was conducted, adhering to the methodology outlined by Gomez and Gomez (1984). Furthermore, mean comparison was carried out based on critical differences at the 5% probability level.

RESULTS AND DISCUSSION

Effect of herbicides on weed flora and weed density

The different weed flora and density (No./m^2) were observed in control plots like *Rhinchosia minima* (36.3), *Digera arvensis* (66.8), *Celosia argentea* (29.7), *Cyperus rotundus* (26.7), *Dactyloctenium aegyptium* (14.3), other broad leaves and grassy weeds (11.7) at 45 DAS under rainfed condition. All the weed control treatments significantly reduced the weed density at 45 DAS of crop growth as compared to weedy check (Table 1). The efficacy of application of imazethapyr 50 g/ha and higher dose 70 g/ha controlled grassy and broad-leaved weeds but its efficacy was low against *Rhinchosia minima* and *Cyperus rotundus.* The significant lowest weed density (No./m^2) of different weeds like *Rhinchosia minima* (11.5), *Digera arvensis* (5.7), *Celosia argentea* (16.3), *Cyperus rotundus* (6.7), *Dactyloctenium aegyptium* (6.3), other broad leaved and grassy weeds (5.7) were observed under sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC at the rate of 220 g/ha closely followed by fomesafen 11.1% w/w + fluazifop-P-butyl 11.1% (Ready-mix) at the rate of 220 g/ha. However, it was statistically on par with the treatments of sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC and fomesafen 11.1% w/w + fluazifop-P-butyl 11.1% (Ready-mix) at the rate of 250 g/ha. Efficacy of imazethapyr + imazamox 40 g/ha and quizalofop ethyl + imazethapyr 80 g/ha and higher dose was observed very low against broad leaved weeds and *Cyperus rotundus.* Due to their complementary effects on weed control and multiple modes of action, it might have been proven to be beneficial in reducing weed density. These results are in line with the findings of Singh and Singh (2020) and Singh *et al*. (2022).

Effect of herbicides on weed dry weight and control efficiency

Application of various herbicides had significant effect on dry weight and weed control efficiency at 45 DAS (Table 1). All the weed control treatments observed lower weed dry weight compared with untreated check. The efficacy of imazethapyr 50 g/ha had significant effect to reduce the dry weight of weeds (41 g/m^2) and weed control efficiency (70.7 %) but its efficacy was low against *Rhinchosia minima* and *sedges* at 45 DAS over the weedy check. Application of sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC at the rate of 220 g/ha observed the lowest total dry weight of weeds (25 g/m^2) and weed control efficiency (82.4 %) closely followed by fomesafen 11.1% w/w + fluazifop-P-butyl 11.1% (Ready-mix) at the rate of 220 g/ha over the weedy check (140 g/m^2) at 45 DAS (fig. 1.). However, sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC and fomesafen 11.1% w/w + fluazifop-P-butyl 11.1% (Ready-mix) at the rate of 250 g/ha observed the statistically at par dry weight (27 & 26 g/m^2) and weed control efficiency (80.8 & 82.3 %), respectively (Fig. 1.). Efficacy of imazethapyr + imazamox 40 g/ha and quizalofop ethyl + imazethapyr 80 g/ha and their higher dose

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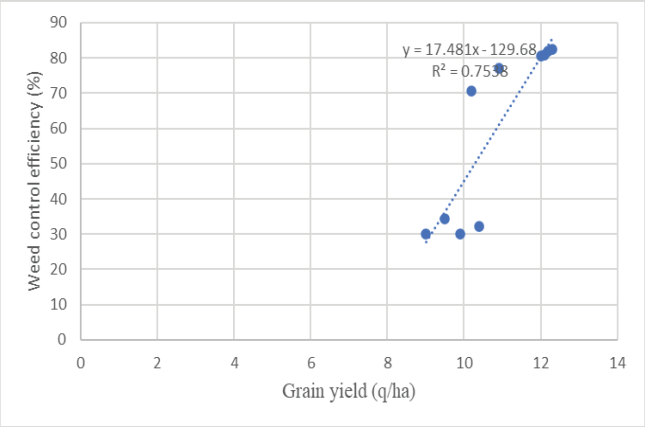


Fig. 1. Regression analysis between weed control efficiency and grain yield by herbicides application

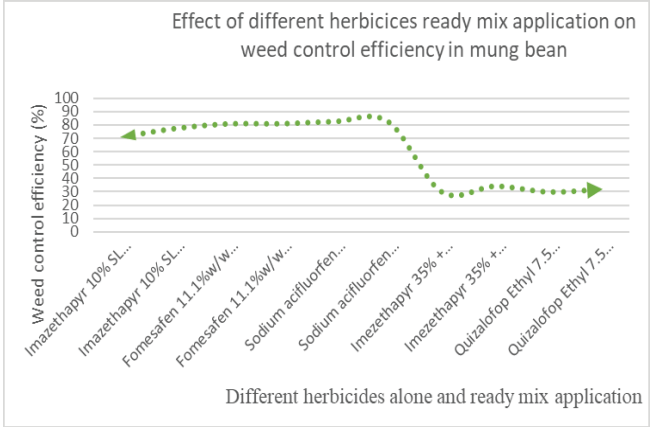


Fig. 2. Weed control efficiency affected by herbicides alone and ready-mix application

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recorded low dry weight and weed control efficiency due to density of grassy, broad leaved weeds and sedges being low over the weedy check. The better performance of combination of herbicides was due to its synergistic effect in controlling population as well as dry matter accumulation of different complex weed flora. These results are in tune with the findings of Katoch *et al*. (2023) in case of pendimethalin and diclosulam in *rabi* greengram. Poornima *et al*. (2018) reported similar results in case of pendimethalin + imazethapyr and Singh *et al*. (2015) in case of cultural operation.

Effect of herbicides on yield attributes, yield and weed index

Yield and yield attributing characters in treated plots were found significantly superior to weedy check (Table 2). Among the different weed control treatments, application of imazethapyr 50 g/ha resulted in higher number of seeds/pods (13.2), test weight (43.2 g), mean grain yield (10.2 q/ha), straw yield (18.9 q/ha) harvest index (34.9%), B:C ratio (1.6) and weed index (24.2) over the weedy check conditions. The sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC at the rate of 220 g/ha registered the highest number of seeds/pods (13.6), test weight (44.6 g), grain yield in *kharif* 2021 (12.4 q/ha), *kharif* 2022 (10.8 q/ha), *kharif* 2023 (13.8 q/ha) and mean grain yield (12.3 q/ha), straw yield (21.7 q/ha), harvest index (36.2%), B:C ratio (2.1) and weed index (9.0) closely followed by fomesafen 11.1% w/w + fluazifop-P-butyl 11.1% (Ready-mix) at the rate of 220 g/ha, However, yield attributes, yield and weed index were statistically at par with application of higher dose of sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC and fomesafen 11.1% w/w + fluazifop-P-butyl 11.1% (Ready-mix) at the rate of 250 g/ha. The application of sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC and fomesafen 11.1% w/w + fluazifop-P-butyl 11.1% (Ready-mix) at the rate of 220 g/ha exhibited a considerable increase of 21.1% and 18.0 % in mungbean seed yield compared to that by application of imazethapyr at the rate of 50 g/ha (Fig. 2.). The higher yield attributes and seed yield might be due to least competition from weeds for nutrients, light, space and other above-and below-ground resources, which in turn led to effective weed control, reduced crop weed competition and provided almost weed-free environment, caused significant increase in growth and yield characters ultimately led to higher seed yield of mungbean. The results were in agreement with the earlier findings of Katoch *et al*. (2023); Poornima *et al*. (2018) and Singh *et al*. (2022). Efficacy of imazethapyr + imazamox 40 g/ha and quizalofop Ethyl + Imazethapyr 80 g/ha observed numerically high values of yield attributes, yield and weed index over the weedy check conditions. These results agree with those of Kumar *et al.* (2017) and Kumar and Hiremath (2018).

Economics

The highest gross returns (₹1,04,310/ha) were recorded in post-emergence application of sodium acifluorfen 16.5%+ clodinafop-propargyl 8% EC closely followed by gross returns (₹ 1,02,173/ha) under fomesafen 11.1% w/w + fluazifop-P-butyl 11.1% at the rate of 220 g/ha and the lowest value (₹45828/ha) in weedy check and net returns were recorded with post–emergence application of sodium acifluorfen 16.5%+ clodinafop-propargyl 8% EC (₹ 72,310/ha) closely followed by fomesafen 11.1% w/w + fluazifop-P-butyl 11.1% @ 220 g/ha (₹ 68,173/ha). However, it was statistically at par with higher dose (250 g/ha) of sodium acifluorfen 16.5%+clodinafop-propargyl 8% EC (₹72,062/ha) and fomesafen 11.1% w/w + fluazifop-P-butyl 11.1% (₹69,370/ha). Application

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Table 1. Effect of different post emergence herbicides on the density, weed dry matter and weed control efficiency (WCE) at 45 DAS in mungbean (Pooled data of three years)

Treatment	Density* of different weeds (No./m²) at 45 DAS						Total weed dry matter at 45 DAS (g/m²)	WCE (%) at 45 DAS
	Rhinchosia minima	*Digera arvensis*	*Celosia argentea*	*Cyperus rotundus*	*Dactyloctenium aegyptium*	Other BLW & grassy weeds		
Imazethapyr 10% SL @ 50 g/ha	(5.3) 27.7	(3.1) 9.3	(4.4) 19.0	(3.1) 9.3	(2.7) 7.0	(2.5) 6.0	(6.4) 41	70.7
Imazethapyr 10% SL @ 70 g/ha	(4.9) 23.7	(2.8) 7.3	(4.3) 17.7	(2.7) 6.7	(2.5) 5.7	(2.5) 5.7	(5.7) 32	77.1
Fomesafen 11.1%w/w + fluazifop -P-butyl 11.1% SL @ 220 g/ha	(3.6) 12.3	(2.5) 6.0	(4.1) 16.0	(2.9) 8.0	(2.5) 6.0	(2.5) 5.8	(5.2) 27	80.7
Fomesafen 11.1%w/w + fluazifop -P-butyl 11.1% SL @ 250 g/ha	(3.6) 12.2	(2.5) 5.9	(4.1) 16.0	(2.5) 6.0	(2.5) 5.7	(2.5) 5.9	(5.2) 27	80.8
Sodium acifluorfen 16.5%+ clodinafop-propargyl 8% EC @ 220 g/ha	(3.5) 11.5	(2.5) 5.7	(4.2) 16.3	(2.7) 6.7	(2.6) 6.3	(2.5) 5.7	(5.0) 25	82.4
Sodium acifluorfen 16.5%+ clodinafop-propargyl 8% EC @250 g/ha	(3.5) 11.5	(2.4) 5.6	(4.0) 15.7	(2.9) 7.7	(2.7) 7.0	(2.5) 5.8	(5.1) 26	82.0
Imazethapyr 35% + imazamox 35% WG @ 40 g/ha	(5.0) 24.7	(2.5) 6.0	(5.1) 25.3	(2.9) 7.7	(2.6) 6.3	(2.5) 6.0	(9.9) 98	30.0
Imazethapyr 35% + imazamox 35% WG @ 60 g/ha	(5.1) 25.7	(2.5) 6.0	(4.9) 24.0	(3.2) 9.7	(2.7) 6.7	(2.5) 6.0	(9.6) 92	34.3
Quizalofop Ethyl 7.5 %+ imazethapyr 15 % EC @ 80 g/ha	(4.2) 17.0	(2.7) 6.7	(4.9) 24.0	(2.9) 7.7	(2.5) 5.7	(2.5) 5.7	(9.9) 98	30.0
Quizalofop Ethyl 7.5 %+ imazethapyr 15 % EC @ 100 g/ha	(3.8) 14.3	(2.4) 5.3	(4.8) 23.0	(2.9) 8.0	(2.5) 6.0	(2.3) 5.0	(9.8) 95	32.1
Weed free	(2.5) 6.0	(2.1) 4.0	(3.1) 9.0	(0.7) 0.0	(2.1) 4.0	(2.1) 4.0	(0.7) 0.0	100.0
Weedy check	(6.1) 36.3	(8.2) 66.8	(5.5) 29.7	(5.2) 26.7	(3.8) 14.3	(3.5) 11.7	(11.9) 140	0.0
SEm±	**3.8**	**3.0**	**4.2**	**2.2**	**1.5**	**1.4**	**2.4**	**-**
CD (*p*=0.05)	**11.1**	**8.8**	**12.2**	**6.3**	**4.5**	**3.9**	**7.0**	**-**

*Original figures in parenthesis were subjected to square root transformation (√ X+1)

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Table 2. Effect of different post emergence herbicides on yield attributes, yield, harvest index, economics and weed index in mung bean (Pooled data of three years)

Treatment	Number of seeds/ pods	1000 grain weight (g)	Grain yield (q/ha)				Straw yield (q/ha)	Gross returns (₹/ha)	Net returns (₹/ha)	B:C	Harvest index (%)	Weed index (%)
			2021	2022	2023	Mean						
Imazethapyr 10% SL @ 50 g/ha	13.2	43.2	10.4	8.2	12.0	10.2	18.9	86868	52868	1.6	34.9	24.2
Imazethapyr 10% SL @ 70 g/ha	13.1	43.6	11.5	8.9	12.4	10.9	19.9	92853	58853	1.7	35.3	19.0
Fomesafen 11.1%w/w + fluazifop -P-butyl 11.1% SL @ 220 g/ha	13.3	44.1	12.6	10.2	13.3	12	21	102173	68173	2.0	36.3	10.8
Fomesafen 11.1%w/w + fluazifop -P-butyl 11.1% SL @ 250 g/ha	13.4	44.0	12.1	10.4	13.8	12.1	21.8	103370	69370	2.0	35.6	9.8
Sodium acifluorfen 16.5%+ clodinafop-propargyl 8% EC @ 220 g/ha	13.6	44.6	12.4	10.8	13.8	12.3	21.7	104310	72310	2.1	36.2	9.0
Sodium acifluorfen 16.5%+ clodinafop-propargyl 8% EC @250 g/ha	13.5	44.6	12	10.5	14.0	12.2	21.8	103162	72062	2.1	36.1	8.9
Imazethapyr 35% + imazamox 35% WG @ 40 g/ha	12.8	42.1	10.2	7.6	9.2	9.01	17.1	76523	42523	1.3	34.4	33.2
Imazethapyr 35% + imazamox 35% WG @ 60 g/ha	12.6	42	10.2	7.8	10.4	9.5	17.7	81567	47567	1.4	35.0	28.8
Quizalofop Ethyl 7.5 %+ imazethapyr 15 % EC @ 80 g/ha	12.8	43.1	10.4	8.8	10.6	9.9	18.6	84816	50816	1.5	34.8	26.0
Quizalofop Ethyl 7.5 %+ imazethapyr 15 % EC @ 100 g/ha	12.4	43.6	10.8	9.3	11.1	10.4	19.8	88835	54835	1.6	34.4	22.5
Weed free	14.3	45.1	13.1	12	15.1	13.4	23.8	114570	74570	1.9	36.0	0.0
Weedy check	11.6	41.4	5.4	4.4	6.4	5.4	13.2	45828	17828	0.6	28.9	60.0
SEm±	**0.2**	**0.3**	**0.36**	**0.24**	**0.34**	**0.35**	**0.51**	**1706**	**1140**	**-**	**-**	**-**
CD (*p*=0.05)	**0.6**	**1.0**	**1.08**	**0.74**	**0.99**	**1.01**	**1.62**	**5124**	**3466**	**-**	**-**	**-**

of sodium acifluorfen 16.5%+ clodinafop-propargyl 8% EC and fomesafen 11.1% w/w + fluazifop-P-butyl 11.1% were found as effective as weed free treatment. However, Net returns produced numerically higher with application of imazethapyr 50 g/ha (₹52868/ha), imazethapyr + imazamox 40 g/ha (₹42523/ha) and quizalofop ethyl + imazethapyr 80 g/ha (₹50816/ha) over the weedy check conditions (₹17828/ha). The results are in agreement with Poornima *et al.* (2018).

CONCLUSION

The study clearly indicates that weeds can be effectively controlled by post-emergence application of sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC 220 g/ha or fomesafen 11.1% + fluazifop-P-butyl 11.1% at the rate of 220 g/ha at 20-25 DAS. These were the best herbicidal combination for effective control of complex weed flora in mungbean with improved yields, net returns and B-C ratio.

Conflicts of interest

Authors declare that there are no conflicts of interest.

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