WEED DYNAMICS, GROWTH AND PRODUCTIVITY OF GREENGRAM (*VIGNA RADIATA*) AS INFLUENCED BY DIFFERENT HERBICIDES AND THEIR COMBINATIONS

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ABSTRACT: A field experiment was conducted during *kharif* season of 2012 and 2013 at Chitrakoot, Satna (Madhya Pradesh) to study weed dynamics, growth and productivity of greengram (*Vigna radiata*) as influenced by different herbicides and their combinations. Among weed control methods pre-emergence herbicides (pendimethalin and oxiflourfen), post-emergence herbicide (imazethapyr) and their combinations were tested at recommended doses. All the growth and productivity parameters were influences significantly due to single and double herbicidal applications to control the existing weed flora. The dual herbicides comprising pendimethalin + imazethapyr (W_5) brought about significantly higher seed yield (6.40 q/ha), straw yield (17.79q/ha) and harvest index (26.45%) of greengram.

Keywords: *Greengram, imazethapyr, oxiflourfen, pendimethalin, weeds*

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Greengram [*Vigna radiata* (L.) Wilczek] or mungbean is one of the shortest duration pulse crop grown in 17 percent (3.44 m ha) of gross cropped area under the pulses and contributes 11 percent (1.24 m tonnes) of the total pulse production in the country and has many specialties. It contains about 25% easily digestible protein, which is almost three-times that of cereal. The biological value of food improves greatly, when wheat or rice is combined with greengram because of the complementary relationship of the amino acids. However, the average productivity of greengram in the country and also in the state of Madhya Pradesh is very poor which needs proper attention to increase its production. Besides other factors, weed problem during *kharif* is the main reason for lower productivity. Therefore, inadequate control of weeds is one of the limiting factor for low productivity of pulse crops. Among all the crop pests in India, weeds alone are responsible for one-third loss of crop production (Bhan et al., 1998). In the crop of *kharif* greengram, yield losses due to weeds have been observed from 31.6% to 66.8% by Balyan *et al.* (1988), Singh et al. (1996) Kumar et al. (2005) and Yadav and Singh (2005). These reports show that if weeds are properly and timely controlled in greengram crop, yield can substantially be increased upto great extent. Weeds can successfully be controlled through mechanical weeding or through the use of suitable selective herbicide with proper dose of application. Mechanical method is labour and time consuming, thus costly while herbicide use is cheaper and time saving but technical which require skillness. The performance of mechanical and chemical weed control was compared in field crops by Brar and Walia (1989). Now a days a number of selective herbicides are available to control weeds in pulse crops. Among those, pendimethalin and oxiflourfen are most popular as pre-emergence herbicides while imazethapyr as post-emergence herbicide. Therefore, it was considered to compare effectiveness of these herbicides and their combinations.

MATERIAL AND METHODS

The field experiment was conducted at the Rajola Farm, MGCGVV, Chitrakoot, Satna (M.P.) during *Kharif* season of 2012 and 2013. The soil of the experimental field was sandy clay loam with pH value 7.44 to 7.46, electrical conductivity 0.32 to 30 dSm^{-1}, organic carbon 2.9 to 2.4 g kg^{-1}, available N, 193.42 to 201.6 kg ha^{-1}, available P_2O_5 16.72 to 20.11 kg ha^{-1} and available K_2O 207.28 to 201.5 kg ha^{-1}. The treatments comprised six weed control methods (W_1: weedy check, W_2: pendimethalin 1 kg /ha PE, W_3: oxiflourfen 0.2 kg /ha PE, W_4: imazethapyr 0.1 kg /ha POE, W_5: pendimethalin + imazethapyr and W_6: oxiflourfen + imazethapyr). The experimental was carried with three replications. Greengram variety 'Samrat' was taken for the experiment. Pre-emergence herbicides (pendimethalin and oxyflourfen) were applied on the second day after

sowing of the crop while post-emergence herbicide (imazethapyr) was applied 25 days after sowing the crop with the help of knapsack sprayer fitted with flat-fan nozzle using 500 liters of water per hectare. No any weed control practice was applied in weedy check (control) plot that means weeds are allowed to grow freely in the control plots. Recommended dose of N, P_2O_5 and K_2O (20- 40- 20 kg/ha) was applied equally in all plots through inorganic fertilizers as basal. The optimum plant population was maintained by thinning and gap filling 10 days after germination to ensure the uniform plant population. All the data pertaining to the present investigation were statically analyzed as per the methods described by Panse and Sukhatme (1967). The treatment differences were tested for significance by 'F' test and the data in which the treatment effects were found significant the appropriate standard error of mean and the critical different (C.D.) were worked out at 5% level of significance.

RESULTS AND DISCUSSION

Weed dynamics

Weed density and weed biomass

Weed density and weed biomass was found minimum under W_5 (pendimethalin @ 1.0 kg ai + imazethapyr @ 0.1 kg a.i./ha). Weed densities under W_5 treatment were 9.89, 10.73 and 8.29/m^2 at 25, 50 and 75 DAS respectively) while weed biomass was 6.37, 7.05 and 6.75 g/m^2 at respective days of observations. All the single and double herbicide combinations suppressed to weeds significantly as compared to weedy check which recorded highest weed infestation (151.4, 164.94 and 152.47 at 25, 50 and 75 DAS of observation respectively) with maximum weed biomass (70.99, 89.65 and 85.87g/m^2 at 25, 50 and 75 DAS respectively).

Weed control efficiency

Both the dual herbicides (pendimethalin or oxiflourfen as pre emergence followed by post emergence application of imazethapyr) proved equally superior than other single herbicides in respect to weed control efficiency (89.55 to 92.05%). While among single herbicides pendimethalin recorded 82.58, 85.23 and 84.86% weed control efficiency at 25, 50 and 75 DAS and proved as superior herbicide over pre emergence oxiflourfen and post emergence imazethapyr.

Growth parameters

Plant growth

The plant growth parameters viz. plant height, branches, trifoliate and dry matter per plant of greengram were recorded significantly higher from W_5 (pendimethalin @ 1.0 kg ai + imazethapyr @ 0.1 kg a.i./ha) as compared to the remaining weed control treatments. However, the second best treatment was W_6 (oxyfluofen @ 0.2 kg a.i./ha PE + imazethapyr @ 0.1 kg a.i./ha post emergence). At harvest stage, W_5 treatment recorded maximum plant height (62.69cm), number of trifoliate (19.17/plant), primary branches (6.88/plant), secondary branches (17.38/plant), and plant dry matter (13.10g/plant). This may be due to maximum weed control from dual herbicides application, thereby created the least crop weed competition for space, light, nutrients and soil moisture and providing better soil properties for favorable crop growth. However, these favorable conditions were not available under weedy check; these parameters were reduced significantly because of heavy weed occurrence and competition with the crop plants.

Root growth

The root growth parameters of greengram viz. root length, root width and root dry weight and root nodulation viz. number of root nodules and dry weight /plant of greengram intercrops were recorded significantly higher from W_5 (pendimethalin + imazethapyr treatment) as compared to the remaining weed control treatments (W_1 to W_4 and W_6). At harvest stage W_5 recorded maximum root length (19.57cm), root width (27.28cm), root dry weight (1.85g), root nodules (18.99/plant) and nodules dry weight (0.15 g/plant).

Productivity parameters

Yield attributes

The data from Table 2 indicates that the yield attributes viz. pods/plant, pod length, seeds/pod, seed weight/plant and 1000 seed weight of greengram were increased significantly due to all the herbicides over weedy check. Application of dual herbicides as in W_5 (pendimethalin @ 1.0 kg ai + imazethapyr @ 0.1 kg a.i./ha) produced significantly higher pods (24.89/plant), pod length (6.73 cm), seeds (10.49/pod), seed weight (5.69 g/plant) and 1000 seed weight (36.67 g) over the remaining weed control treatments and it was closely followed by W_6 (oxyfluorfen @ 0.1 kg a.i./ha + imazethapyr @ 0.1 kg a.i./ha) which recorded 23.05 pods/plant, 6.53 cm pod length, 9.59 seeds/pod, 5.40 g seed weight/plant and 35.79 g test weight. These parameters were found to decrease significantly with the application of single herbicides (W_2, W_3 and W_4).

However all the herbicidal treatments proved significantly superior to weedy check treatment (W_1). Thus, the lowest yield attributes viz. pods/plant (9.50), pod length (5.31 cm), seeds/pod (7.98), seed weight/plant (2.73 g) and test weight (32.40 g) were recorded in case of weedy check. This increase in yield attributes was ascribed due to greater growth parameter, better root development and nodule formation which might have promoted for greater formation of yield attributes.

Yield

The dual herbicidal comprising pendimethalin + imazethapyr (W_5) brought about significantly higher seed yield (6.40 q/ha), straw yield 17.79 q/ha) and harvest index (26.45%) of greengram closely followed by W_6 having Oxyflourfen + imazethapyr for all these parameters. This might be owing to significantly higher yield attributes as a result of W_5 and W_6 dual herbicidal treatments. Both these treatments proved significantly superior to the single applied herbicides as in W_2 to W_4 treatments. In fact, all the herbicidal treatments (W_2 to W_6) proved significantly superior to weedy check (W_1) having no herbicidal application which resulted in significantly lowest seed yield (3.48 q/ha), straw yield (18.85 q/ha) and harvest index (19.10%). The increased productivity parameters might be attributed to lower crop weed competition that favoured better crop growth and make available more light space, nutrients and moisture. Similar are the findings as reported by Nirala and Dewangan (2012), Sukhadia *et al.* (2000), Rathod *et al.* (2004), Kumawat *et al.* (2012), Talnikar *et al.* (2008) and Sharma and Guled (2012).

Table 1: Weed dynamics of greengram as influenced by weed management practices (pooled for 2 years), DAS= days after sowing

Treatments	Weed density/m^2			Weed biomass/m^2			Weed control efficiency %		
	25 DAS	50 DAS	75 DAS	25 DAS	50 DAS	75 DAS	25 DAS	50 DAS	75 DAS
W_1: Weedy check (control)	151.40	164.94	152.47	70.99	89.65	85.87	0.00	0.00	0.00
W_2:Pendimethalin (1 kg ai/ha)	15.23	17.64	17.28	12.14	12.98	12.68	82.58	85.23	84.86
W_3: Oxyfluorfen (0.2 kg ai/ha)	16.49	25.19	22.39	18.21	19.22	18.63	73.97	78.27	77.84
W_4: Imazethapyr (0.1 kg ai/ha)	22.35	16.70	18.69	22.52	24.75	24.25	67.92	72.13	71.59
W_5 Pendimethalin+Imazethapyr	9.89	10.73	8.29	6.37	7.05	6.75	90.93	92.05	92.02
W_6: Oxyflourfen + Imazethapyr	11.40	11.79	11.41	7.33	7.91	7.58	89.55	91.10	91.05
Mean	37.79	41.16	38.42	22.92	26.92	25.96	67.49	69.79	69.56
S.Em ±	1.901	2.055	1.884	0.808	1.047	0.994	1.084	1.109	1.108
C D (P=0.05)	5.490	5.936	5.441	2.334	3.024	2.870	3.132	3.204	3.199

Table 2: Growth parameters of greengram as influenced by weed management practices (pooled for 2 years)

Treatments	Plant height (cm)				Trifoliate /plant				Primary branches / plant	Secondary branches/ plant	Dry weight/plant (g)			
	30 DAS	45 DAS	60 DAS	At harvest	30 DAS	45 DAS	60 DAS	At harvest			30 DAS	45 DAS	60 DAS	At harvest
W_1: Weedy check (control)	24.97	40.22	54.46	56.39	5.77	8.87	9.70	10.70	3.55	8.11	0.78	2.32	5.00	5.34
W_2:Pendimethalin (1 kg ai/ha)	30.85	41.70	57.60	61.00	8.90	12.07	14.63	16.07	5.61	14.33	2.70	4.84	10.65	10.98
W_3: Oxyfluorfen (0.2 kg ai/ha)	29.04	42.62	56.75	59.45	7.33	12.23	14.90	16.03	4.66	13.66	2.39	3.63	10.07	11.28
W_4: Imazethapyr (0.1 kg ai/ha)	29.03	42.99	57.76	59.34	7.10	12.57	15.80	17.00	5.11	13.72	1.90	3.96	10.32	10.64
W_5 Pendimethalin + Imazethapyr	33.33	45.65	60.53	62.69	10.30	16.10	18.37	19.17	6.88	17.38	2.93	6.81	12.83	13.10
W_6: Oxyflourfen + Imazethapyr	32.22	44.30	59.28	62.05	9.17	14.90	16.97	17.87	5.72	15.94	2.35	5.93	12.15	12.61
Mean	29.91	42.91	57.73	60.15	8.09	12.79	15.06	16.14	5.26	13.86	2.17	4.58	10.17	10.66
S. Em ±	0.096	0.062	0.151	0.080	0.134	0.215	0.126	0.173	0.156	0.288	0.016	0.021	0.058	0.095
C D (P=0.05)	0.278	0.180	0.435	0.230	0.386	0.620	0.363	0.499	0.452	0.830	0.045	0.060	0.168	0.273

Table 3: Root growth parameters of greengram as influenced by weed management practices (pooled for 2 years)

Treatments	Root growth			Root nodulation	
	Root length(cm)	Root width(cm)	Root dry weight (g)	Root nodules/ plant	Nodules dry weight (g)
W_1: Weedy check (control)	24.97	40.22	54.46	5.77	8.87
W_2:Pendimethalin (1 kg ai/ha)	30.85	41.70	57.60	8.90	12.07
W_3: Oxyfluorfen (0.2 kg ai/ha)	29.04	42.62	56.75	7.33	12.23
W_4: Imazethapyr (0.1 kg ai/ha)	29.03	42.99	57.76	7.10	12.57
W_5 Pendimethalin + Imazethapyr	33.33	45.65	60.53	10.30	16.10
W_6: Oxyflourfen + Imazethapyr	32.22	44.30	59.28	9.17	14.90
Mean	17.91	24.64	1.47	16.34	0.13
S. Em ±	0.084	0.235	0.019	0.242	0.003
C D (P=0.05)	0.241	0.678	0.055	0.699	0.008

Table 4: Productivity parameters of greengram as influenced by weed management practices (pooled for 2 years)

Treatments	Pods/ plant	Pod length (cm)	Seeds / pod	Seed weight / plant (g)	Test weight (g)	Seed yield (q/ha)	Straw yield (q/ha)	Harvest index (%)
W_1: Weedy check (control)	24.97	40.22	54.46	56.39	5.77	8.87	9.70	10.70
W_2:Pendimethalin (1 kg ai/ha)	30.85	41.70	57.60	61.00	8.90	12.07	14.63	16.07
W_3: Oxyfluorfen (0.2 kg ai/ha)	29.04	42.62	56.75	59.45	7.33	12.23	14.90	16.03
W_4: Imazethapyr (0.1 kg ai/ha)	29.03	42.99	57.76	59.34	7.10	12.57	15.80	17.00
W_5 Pendimethalin + Imazethapyr	33.33	45.65	60.53	62.69	10.30	16.10	18.37	19.17
W_6: Oxyflourfen + Imazethapyr	32.22	44.30	59.28	62.05	9.17	14.90	16.97	17.87
Mean	18.07	6.13	8.73	4.54	34.28	5.13	16.44	23.59
S. Em ±	0.159	0.047	0.197	0.033	0.245	0.048	0.265	0.197
C D (P=0.05)	0.459	0.137	0.569	0.096	0.709	0.138	0.764	0.570

CONCLUSION

Growth and productivity of greengram crop differed significantly due to different pre and post emergence herbicides and their combinations. Dual herbicides (pre-emergence application of pendimethalin or oxiflourfen combined with post-emergence application of imazethapyr) proved superior in controlling weeds over single pre or post-emergence herbicides. Pre-emergence application of pendimethalin coupled with post-emergence application of imazethapyr proved best weed control treatment closely followed by pre emergence oxiflourfen coupled with post emergence application of imazethapyr in terms of growth and productivity parameters.

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