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PRODUCTIVITY ENHANCEMENT OF IRRIGATED GREENGRAM (*VIGNA RADIATA* L.) THROUGH INTEGRATED WEED MANAGEMENT

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Abstract

A field investigation was carried out during *Rabi* seasons of 2014 at Agricultural College and Research Institute, Tamil Nadu Agricultural University, Killikulam to study the Integrated weed management in greengram (*Vigna radiata* L.) Co 6 (Gg) under irrigated condition. The experiment was laid out in randomized block design with three replications. The treatments consisted at three different spacing *viz.*, (25 × 25cm, 30 × 30cm and 30 × 10cm) weed free plot and an weeded control. The results revolved that integration of chemical, mechanical and cultural methods of weed control markedly influence the yield and economics of green gram. The analysis of grain yield data revealed that $\mathbf{T}_8$ pre-emergence application of pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) followed by early post-emergence application of quizalofop-ethyl and imazethapyr @ 50 g a.i. ha^{-1} (15 DAS) in 30 × 30cm higher grain yield of 1006 kg ha^{-1} and highest benefit cost ratio respectively.

Key words: Greengram, PE-Pendimethalin, EPOE-Quizalofop-ethyl and Imazethapyr, Rotary weeding, Hand weeding, weed dry matter, yield attributes and Yield.

Introduction

Weed management at early stages of crop growth is essential emerging weeds in pulses begins simultaneously with the crop, leading to severe competition between the crop and weeds (Kandasamy, 2000). When pulses are raised during monsoon season, weeds emerge in succession almost throughout the crop seasons because of favourable environmental condition and frequent rains (Govindra Singh, 1993). Weeds not only reduce the yield but also act as silent robbers of scare and essential nutrients and moisture. Weeds reduce grain yield of chickpea up to 60 per cent (IIPR, 1997). Weed infestation causes around 50 per cent yield reduction in blackgram (Sumachandrika *et al.,* 2002) Hence, there is a need to study the effect of integrated weed management practice. (Sheoran *et al.,* 2008) reported that the weed infestation if not checked after 20 DAS there would be a severe yield reduction to an extent of 38 per cent in contrast to 20 per cent yield reduction with unchecked weed infestation till 20 DAS in greengram.

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Materials and methods

A field experiment was conducted on integrated weed management in Irrigated Greengram (*Vigna radiata* L.) during *Rabi* seasons of 2014 at Agricultural College and Research Institute, Tamil Nadu Agricultural University, Killikulam. The soil of the experimental field is sandy clay loam, slightly alkaline in reaction pH of 8.0, EC 0.47 organic carbon 0.52% low in available N and high in available P and K nutrients. The experiment was laid out in randomized block design with three replications. The treatments included were; closer spacing of 25 × 25 cm $\mathbf{T}_1$ PE- Pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) *fb* One Hand Weeding (25 DAS), $\mathbf{T}_2$ PE- Pendimethalin @ 1.0 kg a.i. ha^{-1}(3 DAS) *fb* EPOE Quizalofop-ethyl and Imazethapyr @ 50 g a.i. ha^{-1} (15 DAS), $\mathbf{T}_3$ PE-Pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) *fb* Rotary Weeding (15-20 DAS), $\mathbf{T}_4$ EPOE- Quizalofop-ethyl and Imazethapyr @ 50 g a.i. ha^{-1} (15 DAS) *fb* Rotary Weeding (30 DAS), $\mathbf{T}_5$ Hand Weeding twice at 15 and 30 DAS,

T_6 Rotary Weeding twice at 15 and 30 DAS, same treatment followed in wider spacing 30 × 30 cm T_7 to T_{12}, normal recommended spacing 30 × 10 cm T_{13} Farmers practice: PE- Pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) *fb* One Hand Weeding (25 DAS), T_{14} Weed free plot and T_{15} Weedy check. The recommended dose of fertilizer *viz.*, 25:50:25 NPK kg/ha was applied as basal application. The weed control treatments were imposed as per the schedule. The crop was irrigated at critical stages. Need based plant protection measures were given as per the Crop production Guide (2012). The data on grain yield were recorded and analysed. The economic implication of integrated weed management practices was evaluated using benefit cost ratio is calculated by taking ratio of gross return to total cost of cultivation the BC ratio to compare the economic benefits arising from weed management treatments.

Result and discussion

The results obtained from the present investigation are summarized below:

Weed flora and weed dry matter:

Weeds by virtue of their high adaptability and faster growth dominate the crop habitat and reduce the yield potential. About 33 per cent of the yield losses are caused by weed alone. Hence, a common knowledge of weed flora, their time of emergence, density and growth duration is essential for formulating sound weed control measures, Raman *et al*. (2005); Malliswari *et al.* (2008) and Patel *et al.* (2011). The common weed flora of the experimental field consisted of grasses, sedges and broadleaved weeds which were observed from the unweeded check plot at flowering stage of the weeds. The major grass weeds were *Dactyloctenium aegyptium*, *Chloris barbata*, *Cynodon dactylon* and the sedge was *Cyperus rotundus*. Among the broad-leaved weeds *Phyllanthus niruri, Boerhavia diffusa*, *Cleome viscosa, Trianthema portulacastrum*, *Digera muricata* and *Tridax procumbens* were the prominent species. Such a wide spectrum of weeds in greengram and pulses cropping system was reported by many workers *viz.,* Natarajan *et al.* (2003); Punia *et al.* (2004); Kaur *et al.* (2009); Ali *et al*. (2011); Velmurugan (2012); Thirumalaivasan, (2013).

Weed dry weight is one of the most important parameter to assess the weed competitiveness over the crop growth and productivity. Sparse weeds with high biomass might be more competitive to the crops than dense weeds with lesser dry matter production (DMP). Significant variations were observed due to various weed management practices on total weed DMP at 15, 30 and 45 DAS. Considerable reduction in weed dry weight was recorded with treatments (T_8 & T_2) with pre-emergence application of pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) followed by early post-emergence herbicide quizalofop-ethyl and imazethapyr @ 50 g a.i. ha^{-1} (15 DAS) against weedy check (T_{15}). Similar observations of reduced dry matter with same herbicides in blackgram and greengram were reported by Begum and Rao (2006) and Ali *et al.* (2011) and also with other pre-emergence herbicide for pulses were reported by Mishra *et al.* (2004); Kushwah and Vyas (2005); Patel *et al.* (2011). This might be due to effective control of weed seeds germination in the early stages of crop growth followed by the distinctive effect of early post-emergence herbicide logged with less density as well as by the domination of crop over weed in a weed free situation which is in line with the findings of Dhaker *et al.* (2009) and Dhaker *et al.* (2010).

Yield attributes:

The different weed management practices significantly influenced the yield attributes of greengram (table 1). Weed free treatment (T_{14}) recorded higher values of yield components *viz*., number of pod cluster plant^{-1} (6.27), number of pods per cluster^{-1} (5.67), number of seeds pod^{-1} (9.28) and 100 seed weight (3.40 g). Comparable result were produced by the treatment (T_8) 30 × 30 cm spacing pre-emergence application of pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) followed by early post-emergence herbicide quizalofop-ethyl and imazethapyr @ 50 g a.i. ha^{-1} (15 DAS) followed by the same treatment (T_2) under 25 × 25 cm spacing, with regard to yield components. This might be 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 DMP. 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 Vyas and Kushwah (2008); Shete *et al*. (2008); Kaur *et al.* (2009); Patel *et al*. (2011) and Chhodavadia., (2014). Further it also reflected in increasing values of all yield attributes of irrigated greengram with the above promising pre and post emergence herbicides by effective check on the weed and promoting the crop growth. The increase in yield attributes with the post emergence application of imazethapyr was also reported by Rao *et al.* 2001. The lowest number of pods plant^{-1} and number of seeds pod^{-1} were recorded in weedy check treatment (T_{15}). This clearly indicated the severe competition exerted by weeds on the crop which resulted in such reduction as

Table 1: Effect of weed management practices on yield attributes of irrigated greengram.

T.No.	Spacing	Treatments	No. of pod clusters plant^{-1}	No. of pods cluster^{-1}	No. of Seeds pod^{-1}	100 seed weight (g)
T_1	25×25 cm	PE- Pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) *fb* One Hand Weeding (25 DAS)	5.27	4.74	7.92	3.34
T_2		PE- Pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) *fb* EPOE Quizalofop-ethyl and Imazethapyr @ 50 g a.i. ha^{-1} (15 DAS)	5.98	5.38	8.87	3.40
T_3		PE- Pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) *fb* Rotary Weeding (15-20 DAS)	5.25	4.72	7.90	3.33
T_4		EPOE- Quizalofop-ethyl and Imazethapyr @ 50 g a.i. ha^{-1} (15 DAS) *fb* Rotary Weeding (30 DAS)	4.23	3.64	6.41	3.24
T_5		Hand Weeding twice at 15 and 30 DAS	4.60	4.11	6.99	3.28
T_6		Rotary Weeding twice at 15 and 30 DAS	4.59	4.00	6.97	3.27
T_7	30×30 cm	PE- Pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) *fb* One Hand Weeding (25 DAS)	5.30	4.76	7.95	3.35
T_8		PE- Pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) *fb* EPOE Quizalofop-ethyl and Imazethapyr @ 50 g a.i. ha^{-1} (15 DAS)	6.12	5.48	8.96	3.40
T_9		PE- Pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) *fb* Rotary Weeding (15-20 DAS)	5.29	4.75	7.93	3.35
T_{10}		EPOE - Quizalofop- ethyl and Imazethapyr @ 50 g a.i. ha^{-1} (15 DAS) *fb* Rotary Weeding (30 DAS)	4.25	3.65	6.49	3.25
T_{11}		Hand Weeding twice at 15 and 30 DAS	4.58	3.96	6.94	3.26
T_{12}		Rotary Weeding twice at 15 and 30 DAS	4.61	4.12	7.01	3.30
T_{13}	30×10 cm	Farmers practice: PE- Pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) *fb* One Hand Weeding (25 DAS)	4.93	4.11	6.21	3.31
T_{14}		Weed free plot	6.27	5.67	9.28	3.40
T_{15}		Weedy check	3.90	3.32	5.25	3.29
		SEd	**0.14**	**0.13**	**0.19**	**0.04**
		CD (P=0.05)	**0.31**	**0.29**	**0.43**	**NS**

reported by Vyas and Kushwah (2008).

Grain yield:

Adoption of different weed management practices significantly influenced the grain, bhusa and haulm yields of greengram (table 2). The grain yield increased from 410 kg ha^{-1} in weedy check (T_{15}) to 1048 kg ha^{-1} in weed free check (T_{14}). With respect to haulm yield it was increased from 1560 kg ha^{-1} (T_{15}) to 3982 kg ha^{-1} (T_{14}) (fig. 14). Among the weed control treatments, pre-emergence application of pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) followed by early post-emergence herbicide quizalofop-ethyl and imazethapyr @ 50 g a.i. ha^{-1} (15 DAS) under both 30 × 30and 25 × 25 cm (T_8 & T_2) registered a grain yield of 1006 and 992 kg ha^{-1} respectively and a haulm yield of 3895 and 3860 kg ha^{-1} respectively and comparable with weed free condition. This might be due to reduced weeds and competition free environment at the critical stages of crop favoured the crop to utilize the factors for crop growth and production and enhanced the well balanced source sink capacities which attributed to the production of more branches and DMP, number of pod cluster plant^{-1}, number of pods plant^{-1} and number of seeds pod^{-1} compared to all other treatments and responsible for higher yield. These were in accordance with the earlier findings of Tewari *et al.* (2004); Singh *et al.* (2006); Dhaker *et al*. (2009); Dhaker *et al*. (2010); Patel *et al.* (2011).

The reason for better yield under herbicides and also the integration of herbicides with other methods might be due to better control of all categories of weeds compared to manual or mechanical method alone. In addition to that a uniform and good stand of the crop due to application

Table 2 : Effect of weed management practices on grain yield, bhusa yield and haulm yield (kg ha^{-1}) and harvest index of irrigated greengram.

T.No.	Spacing	Treatments	Grain Yield	Bhusa Yield	Haulm Yield	Harvest Index
T_1	25×25 cm	PE- Pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) *fb* One Hand Weeding (25 DAS)	825	381	3443	0.22
T_2		PE- Pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) *fb* EPOE Quizalofop-ethyl and Imazethapyr @ 50 g a.i. ha^{-1} (15 DAS)	992	471	3860	0.23
T_3		PE- Pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) *fb* Rotary Weeding (15-20 DAS)	817	372	3421	0.22
T_4		EPOE- Quizalofop-ethyl and Imazethapyr @ 50 g a.i. ha^{-1} (15 DAS) *fb* Rotary Weeding (30 DAS)	578	249	2512	0.21
T_5		Hand Weeding twice at 15 and 30 DAS	674	296	2993	0.20
T_6		Rotary Weeding twice at 15 and 30 DAS	689	291	2984	0.21
T_7	30×30 cm	PE- Pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) *fb* One Hand Weeding (25 DAS)	842	400	3466	0.22
T_8		PE- Pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) *fb* EPOE Quizalofop-ethyl and Imazethapyr @ 50 g a.i. ha^{-1} (15 DAS)	1006	486	3895	0.23
T_9		PE- Pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) *fb* Rotary Weeding (15-20 DAS)	839	392	3451	0.22
T_{10}		EPOE - Quizalofop- ethyl and Imazethapyr @ 50 g a.i. ha^{-1} (15 DAS) *fb* Rotary Weeding (30 DAS)	590	254	2561	0.21
T_{11}		Hand Weeding twice at 15 and 30 DAS	658	286	2976	0.20
T_{12}		Rotary Weeding twice at 15 and 30 DAS	680	308	3005	0.21
T_{13}	30×10 cm	Farmers practice: PE- Pendimethalin @ 1.0 kg a.i. ha^{-1} (3 DAS) *fb* One Hand Weeding (25 DAS)	790	340	3212	0.22
T_{14}		Weed free plot	1048	493	3982	0.23
T_{15}		Weedy check	410	193	1560	0.23
		SEd	**28**	**12**	**93**	**-**
		CD (P=0.05)	**62.4**	**27**	**201**	**-**

of pre and post emergence herbicides. This resulted in lower nutrient depletion and DMP of weeds and thereby increasing the nutrient uptake of crop with more growth and favourable yield attributes contributed the higher seed and haulm yield of irrigated greengram. The unweeded check showed the real picture of the aggressive nature of weeds on the growth of irrigated greengram. The lowest grain and haulm yield were recorded in unweeded check. This was due to severe competition between crop and weed for different resources *viz.,* light, moisture, space and nutrients. Yield losses of similar magnitude due to the weed competition have been reported by Raman *et al*. (2005); Adpawar *et al.* (2011); Naidu *et al.* (2011).

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