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Integrated weed management on growth and yield of green gram (*Vigna radiata* L.)

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Abstract
A field experiment was conducted on "Integrated weed management on growth and yield of green gram (*Vigna Radiata* L.)", an experiment was conducted at Instructional Farm of Department of Agronomy, Faculty of Agriculture, AKS University, Sherganj, Satna (M.P.) during *Kharif* season of 2021-2022. The experiment consisted of randomize block design having with three replications. Weed free treatment (T_2) registered significantly higher plant height at harvest (55.80 cm), number of leaves per plant at harvest (22.73), yield and yield attributing characters viz., number of pods per plant (22.07) respectively. The significantly higher seed yield (12.92 q/ha) and Stover yield (26.67 q/ha, respectively) were recorded in weed free treatment. Effective weed control in green gram can be achieved with an alternative is application of Pendimethalin 30 EC 850 ml/ha + hand weeding.

Keywords: Green gram, integrated weeds management and yield components

Introduction
Pulses or grain legumes, being an important source of vegetable proteins, are easily digestible under normal condition, possess good cooking quality and also help in decreasing the blood cholesterol level as compared to animal proteins, the consumption of which causes atherosclerosis (Khanna and Gupta, 1988). Pulses containing high protein content (20-30%) are enormously utilized in covering widespread protein-calorie-malnutrition problem of the underdeveloped and developing countries including India. It plays a very important in Indian agriculture both in terms of enriching soil health and food and nutritional security of country's ever-growing population. Pulses being predominantly rainfed crop are grown in constrained and limiting factor environment, due to which increase in productivity has remained a major challenge for several decades.

Among the various factors responsible for the low yield of green gram, weeds have been considered to be of prime importance. The losses caused by weeds exceeds the losses from any other category of agricultural pests like insect, disease, nematodes, rodents etc. Weed has been observed to cause losses in a silent and unnoticed manner. Weeds compete for water, nutrients and space and cause 27 to 64 per cent yield loss in green gram depending on the types and intensity of weed flora (Bhowmick *et al*., 2015) [1].

Generally, weeds are controlled by mechanical or cultural or chemical or biological methods either alone or in combination of more than one method. Weed management through manual weeding and hoeing, effective in reducing the weed competition are not free from several limitations such as availability of sufficient man power during the peak period and high labour cost. More over on large holding it is impossible to get enough labour to complete weeding at the right time.

Hand weeding is laborious, time consuming, costly and tedious. Moreover, many times labour is not available at the critical period of weed removal. Furthermore, weather conditions may not permit timely hand weeding due to wet field conditions. Delayed removal of weeds is not as effective in controlling weeds and obtaining higher yields as the timely removal of weeds. In agriculture, labour component is becoming scarce, not available at time and prohibitively costly. Chemical control of weeds is an excellent alternative to manual weeding.

Materials and Methods
"Integrated weed management in green gram (*Vigna radiata* L.)" was carried out in the research farm, Faculty of Agriculture, AKS University, Sherganj, Satna (M.P.) during the year

2021- 22. The details of the experimental site, climatic conditions, material used, procedures and techniques.

Representative soil samples were taken randomly from 0-30 cm soil profile from the experimental site before sowing and were analysed for various physico-chemical properties. Soil of the experimental site was clayey in texture (clay % - 32.24) estimated by using Standard international Pipette method (Piper, 1966) [5], low in available nitrogen (177.4 kg ha^{-1}) estimated by using alkaline potassium per magnate method (Subbiah and Asija, 1956) [8] and low in available phosphorus (12.85 kg ha^{-1}) estimated by using Olsen's method (Jacksan, 1973), very high in available potash (200.00 kg ha^{-1}) estimated by using flame photometer (Jackson, 1973).

Organic carbon content was medium (0.41%) estimated by using Walkey and Black method (Jackson, 1973) and soil reaction was slightly alkaline (PH- 7.4) estimated by using glass electrode pH mater (Jackson, 1973). The experiment was laid out in Randomized Block Design (RBD) with 12 treatments with net plot of 5.0 m x 3.0 m.

Results and Discussion

An examination of data showed positive effect of integrated weed management treatments application on plant height of green gram at harvest stage. The integrated weed management treatments significantly enhance plant height of crop. The highest plant height (55.80 cm) was recorded under the weed free treatment under hand weeding (T_2) which was significantly better than weedy check control plot (T_1, 39.05 cm), while the plot was not treated any weed control practices. Integrated weed management treatment of T_2 was found statistically at par with Fenoxaprop- p- ethyl 9% EC @ 33.75 ml/ha + 1 hand weeding (T_{12}) and Pendimethalin 30 EC 850 ml/ha + hand weeding (T_3) with the respective values of 53.71 cm and 52.76 cm, respectively.

Integrated weed management treatments of Fenoxaprop- p- ethyl 9% EC @ 33.75 ml/ha + 1 hand weeding (T_{12}) was found significantly better than T_3 (Pendimethalin 30 EC 850 ml/ha + hand weeding) of 52.76 cm but at par with Diclosulam 80 g @ 22 g/ha + hand weeding (T_4) of 52.06 cm and Chlorimuron -p- Ethyl 25% WP @ 9.37 g/ha + Fenoxaprop- p- ethyl 9% EC @ 67.5 ml/ha (T_7, 47.64 cm). The magnitude of increase due to integrated weed management treatments of weed free plot by hand weeding (T_2, weed free) was 3.75, 5.45, 6.70, 14.62 and 30.02 per cent over Fenoxaprop- p- ethyl 9% EC @ 33.75 ml/ha + 1 hand weeding (T_{12}), Pendimethalin 30 EC 850 ml/ha + hand weeding (T_3), Diclosulam 80 g @ 22 g/ha + hand weeding (T_4), Chlorimuron -p- Ethyl 25% WP @ 9.37 g/ha + Fenoxaprop- p- ethyl 9% EC @ 67.5 ml/ha (T_7) and weedy check plot (T_1), respectively. The similar results were given by Ramesh and Rathika (2015) [6] and Tamang *et al*. (2015).

An examination of data showed positive effect of integrated weed management treatments application on number of branches per plant of green gram at harvest stage. The integrated weed management treatments significantly enhance number of branches per plant of crop. The maximum number of branches per plant (11.00) was recorded under the weed free treatment under hand weeding (T_2) which was significantly better than weedy check control plot (T_1, 4.53), while the plot was not treated any weed control practices. Integrated weed management treatment of T_2 was found statistically at par with Fenoxaprop- p- ethyl 9% EC @ 33.75 ml/ha + 1 hand weeding (T_{12}) and Pendimethalin 30 EC 850 ml/ha + hand weeding (T_3) with the respective values of 8.00 and 7.67, respectively. Similar results were also reported by Ram *et al*., (2013) and Satish *et al*. (2018).

Effect of integrated weed management treatments application on number of leaves per plant of green gram at harvest stage. The integrated weed management treatments significantly enhance number of leaves per plant of crop. The maximum number of leaves per plant (22.73) was recorded under the weed free treatment under hand weeding (T_2) which was significantly better than weedy check control plot (T_1, 9.87), while the plot was not treated any weed control practices. Integrated weed management treatment of T_2 was found statistically at par with Fenoxaprop- p- ethyl 9% EC @ 33.75 ml/ha + 1 hand weeding (T_{12}) and Pendimethalin 30 EC 850 ml/ha + hand weeding respectively. Similar results were also reported by Ram *et al*., (2013) and Satish *et al*. (2018).

An examination of data showed positive effect of integrated weed management treatments application on root length of green gram at 60 DAS stage. The integrated weed management treatments significantly enhance root length of crop. The highest root length (22.89 cm) was recorded under the weed free treatment under hand weeding (T_2) which was significantly better than weedy check control plot (T_1, 16.63 cm), while the plot was not treated any weed control practices. Integrated weed management treatment of T_2 was found statistically at par with Fenoxaprop- p- ethyl 9% EC @ 33.75 ml/ha + 1 hand weeding (T_{12}) and Pendimethalin 30 EC 850 ml/ha + hand weeding respectively.

An examination of data showed positive effect of integrated weed management treatments application on number of pods per plant, Length of pod (cm) and Number of grains per pod of green gram. The integrated weed management treatments significantly enhance number of pods per plant, Length of pod (cm) and Number of grains per pod of crop. The maximum number of pods per plant, Length of pod (cm) and Number of grains per pod (22.07, 10.37 cm and 11.87) was recorded under the weed free treatment under hand weeding (T_2) which was significantly better than weedy check control plot (T_1, 9.67, 3.03 cm and 3.47), while the plot was not treated any weed control practices. Integrated weed management treatment of T_2 was found statistically at par with Fenoxaprop- p- ethyl 9% EC @ 33.75 ml/ha + 1 hand weeding respectively. Similar results were observed by Ram *et al*., (2013), Ramesh and Rathika (2015) [6] and Tamang *et al*. (2015).

An examination of data showed positive effect of integrated weed management treatments application on grain yield and Straw yield per hectare of green gram. The integrated weed management treatments significantly enhance grain yield per hectare of crop. The highest grain and Straw yield per hectare (12.92 and 26.67 q/ha) was recorded under the weed free treatment under hand weeding (T_2) which was significantly better than weedy check control plot (T_1, 2.53 and 9.39 q/ha), while the plot was not treated any weed control practices. Integrated weed management treatment of T_2 was found statistically at par with Fenoxaprop- p- ethyl 9% EC @ 33.75 ml/ha + 1 hand weeding (T_{12}) and Pendimethalin 30 EC 850 ml/ha + hand weeding respectively. These results were in conformity with the findings of Naidu *et al*. (2012), Ram *et al*., (2013) and Satish *et al*. (2018).

Table 1: Growth parameters of green gram as affected by integrated weed management practices

Tr. No.	Treatment Combination	Plant height (cm) at harvest	Number of branches per plant at harvest	Number of leaves per plant at harvest	Root length (cm) at 60 DAS
T_1	Control	39.05	4.53	9.87	16.63
T_2	Weed Free (hand weeding)	55.80	11.00	22.73	22.89
T_3	Pendimethalin 30 EC 850 ml/ha + hand weeding	52.76	7.67	20.13	19.79
T_4	Diclosulam 80 g @ 22 g/ha + hand weeding	52.06	7.53	18.67	18.14
T_5	Chlorimuron- p – ethyl 9% EC @ 67.5 ml/ha	44.45	5.73	13.07	17.22
T_6	Fenoxaprop- p- ethyl 9% EC @ 67.5 ml/ha	45.71	6.07	13.20	17.39
T_7	Chlorimuron -p- Ethyl 25% WP @ 9.37 g/ha + Fenoxaprop- p- ethyl 9% EC @ 67.5 ml/ha	47.64	7.40	17.20	18.12
T_8	Quizalofop-p-ethyl 5% EC	46.68	6.73	14.53	17.82
T_9	Imazethapyr 5% SL @ 50 ml/ha	46.09	6.27	13.40	17.60
T_{10}	Chlorimuron 25% WP @ 2 kg/ha	43.10	5.60	12.33	17.16
T_{11}	Propaquizafop + Imazethapyr	47.11	7.07	14.87	18.10
T_{12}	Fenoxaprop- p- ethyl 9% EC @ 33.75 ml/ha + 1 hand weeding	53.71	8.00	21.87	20.15
S. Em±		0.78	0.33	0.52	0.40
C.D. (P=0.05)		2.26	0.96	1.52	1.17

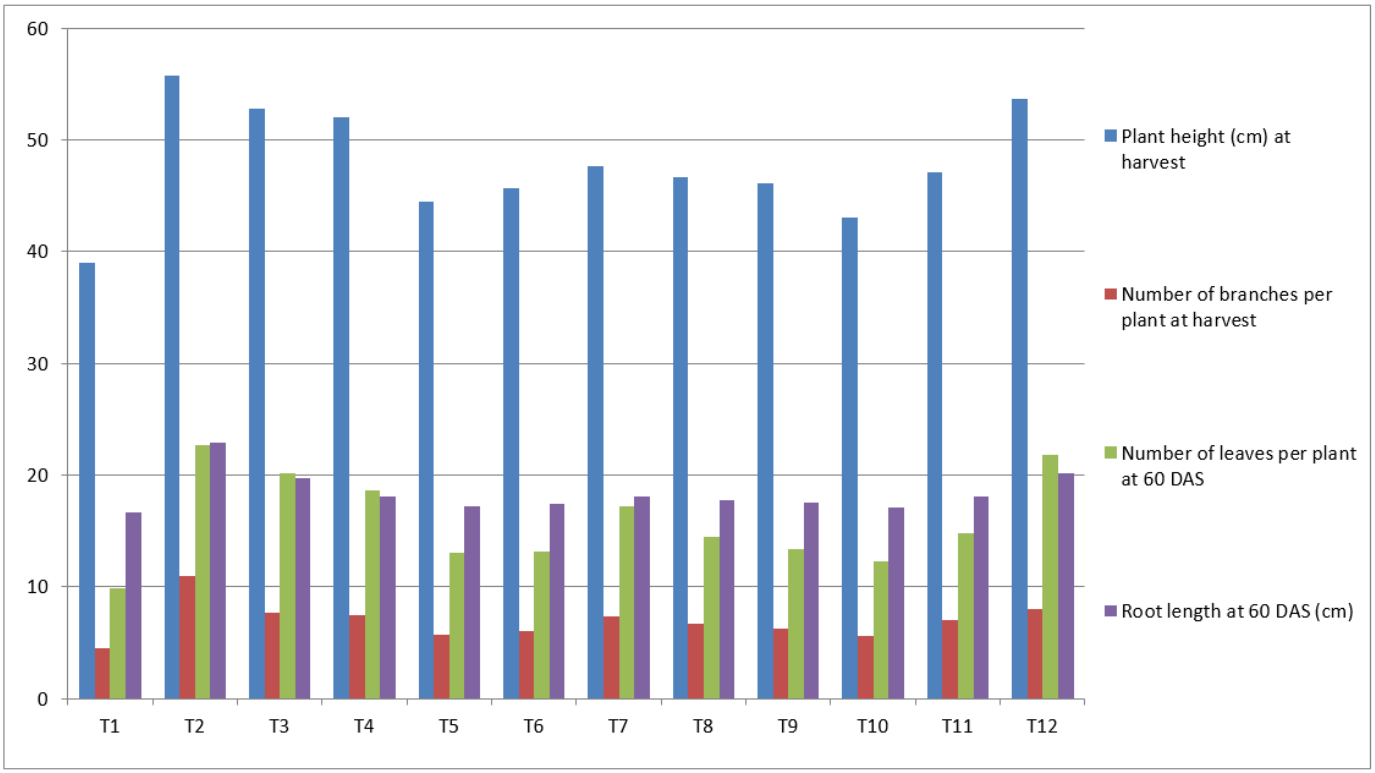

Fig 1: Growth parameters of green gram as affected by integrated weed management practices

Table 2: Yield parameters of green gram as affected by integrated weed management practices

Tr. No.	Treatment Combination	Number of Pods per plant	Length of pod (cm)	Number of grains per pod	Grain yield per hectare (q/ha)	Stover yield per hectare (q/ha)
T_1	Control	9.67	3.03	3.47	2.53	9.39
T_2	Weed Free (hand weeding)	22.07	10.37	11.87	12.92	26.67
T_3	Pendimethalin 30 EC 850 ml/ha + hand weeding	18.60	7.59	9.33	8.81	25.70
T_4	Diclosulam 80 g @ 22 g/ha + hand weeding	18.33	7.58	9.18	7.86	22.74
T_5	Chlorimuron- p – ethyl 9% EC @ 67.5 ml/ha	12.53	4.66	6.47	3.19	9.68
T_6	Fenoxaprop- p- ethyl 9% EC @ 67.5 ml/ha	14.27	5.10	6.80	4.78	17.62
T_7	Chlorimuron -p- Ethyl 25% WP @ 9.37 g/ha + Fenoxaprop- p- ethyl 9% EC @ 67.5 ml/ha	17.27	6.52	8.73	6.97	21.58
T_8	Quizalofop-p-ethyl 5% EC	15.27	5.80	7.80	5.53	19.40
T_9	Imazethapyr 5% SL @ 50 ml/ha	14.87	5.57	7.00	5.42	18.64
T_{10}	Chlorimuron 25% WP @ 2 kg/ha	11.67	4.12	4.17	2.92	9.63

T_{11}	Propaquizafop + Imazethapyr	16.33	6.02	8.27	5.92	19.74
T_{12}	Fenoxaprop- p- ethyl 9% EC @ 33.75 ml/ha + 1 hand weeding	19.27	9.69	10.13	12.47	26.49
S. Em±		0.68	0.49	0.30	0.40	0.73
C.D. (P=0.05)		1.97	1.44	0.89	1.18	2.13

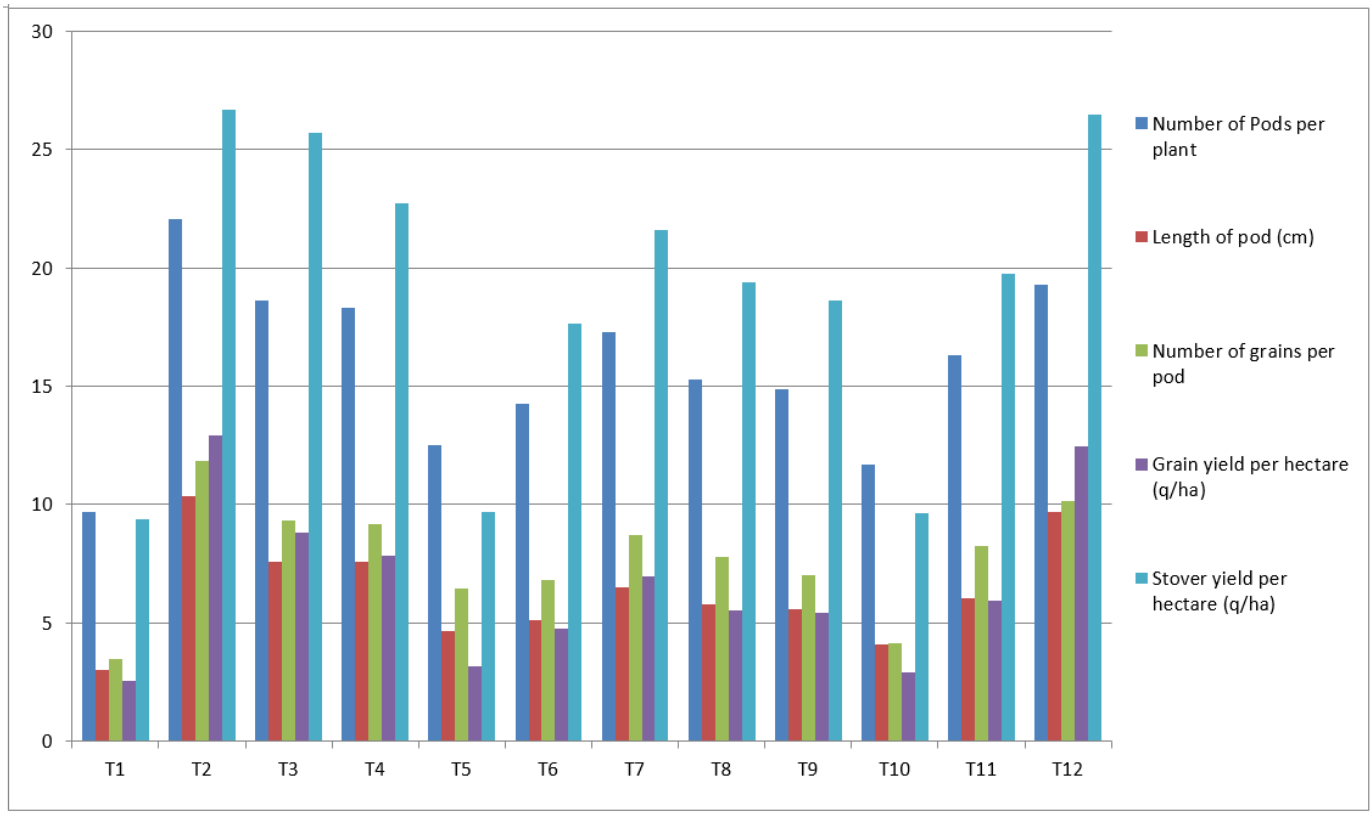

Fig 2: Yield parameters of green gram as affected by integrated weed management practices

Conclusion

Based upon this experiment it is concluded that weed free treatment recorded the maximum and significantly higher growth, yield and yield attributing characters. Among the integrated weed management treatment of Fenoxaprop- p-ethyl 9% EC @ 33.75 ml/ha + *fb* one hand weeding significantly maximum grain yield (12.47 q/ha), gross return (₹ 96191.00/ ha), net returns (₹ 73466.00/ ha) as well as highest B: C ratio of 3.23:1. Hence, it can be concluded that this IWM treatment with B:C ratio >3, can be used as an effective weed management in integrated manner to chemical treatment subjected to unavailability and insufficient of labour. Application of Fenoxaprop- p- ethyl 9% EC @ 33.75 ml/ha + *fb* one hand weeding, can also be adopted as remunerative strategies according to unavailability of labours, resources and circumstances.

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