RESEARCH ARTICLE Agricultural Scinece Digest, Volume 39 Issue 4: 320-323 (October-December 2019)

Effect of Land Configuration and Weed Management on Yield and Yield Attributes of Green Gram (*Vigna radiata* L)

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10.18805/ag.D-5025

ABSTRACT

To study the effect of land configuration and weed management on yield and yield attributes of green gram, a field experiment was conducted at Hisar during *kharif* 2016 in strip plot design with four replications. Ridge method of planting recorded significantly higher number of branches plant^{-1}, seeds pod^{-1}, 100 seed weight and seed yield in comparison to flat method of planting. Among the weed management practices, application of pendimethalin 30 EC @ 1.0 kg/ha-PE fb imazethapyr 10 % SL @ 55 g/ha at 15-20 DAS recorded significantly higher number of branches plant^{-1}, seeds pod^{-1}, pods plant^{-1} and 100 seed weight compared to weedy check. Similarly the same treatment recorded higher yield to the tune of 236, 48 and 18 % over weedy check, pendimethalin 30 EC @ 1.0 kg/ha-PE and Imazethapyr 10 % SL@ 55 g/ha at 15-20 DAS, respectively. Highest net returns (` 24632/ha), BC ratio (2.15) and weed control efficiency (94 %) was also recorded when pendimethalin 30 EC @ 1.0 kg/ha-PE fb imazethapyr 10 % SL @ 55 g/ha at 15-20 DAS of green gram crop was applied.

Key words: BC ratio, Green gram, Land configuration, Seed yield, Weed management, Yield attributes.

INTRODUCTION

Green gram [*Vigna radiata* (L.) Wilczek] is a warm season pulse legume. It is currently cultivated on about six million hectares worldwide, most of which are located in Asia. As a legume, the crop fixes most of its own nitrogen requirement and contributes significantly for improving soil fertility and sustainability of farming systems. It is one of the important pulse crops in Haryana and plays a major role in augmenting the income of small and marginal farmers of the state. Green gram contains 25 per cent of highly digestible protein and is consumed both as whole grain as well as dal. Among the various constraints responsible for low yield of green gram like scarcity of water, delayed sowing, inadequate seed replacement rate, lack of transfer of technology, traditional cultivation practices, improper weed management, poor post-harvest management, indeterminate growth habit, unsuitable climatic factors etc. Method of planting and weed management holds an utmost importance as weeds harbor insect-pest and act as an alternate and secondary source for the dispersal and persistence of diseases and insect pest complex. However, weed infestation is one of the major constraints in green gram cultivation. The loss of yield due to weeds is quite high, ranges from 40-68%. In view of severe infestation of annual and perennial weeds in green gram, the potential yield is generally not realized. The available pre and post emergence herbicide are able to check the emergence and growth of annual grasses and broadleaved weeds. Method of planting and weed management practices increased the seed yield of green gram along with maximum monetary returns (Bahar *et al*., 2017). In present study, land configuration and weed management practices were tested in green gram crop. The experiment was under taken during *Kharif* season of 2016 with the objective to study the effect of land configuration and weed management practices on yield and yield attributes of green gram crop.

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How to cite this article: S.K. Sharma, A. Kumar, K. Singh and N. Kumar (2019). Effect of Land Configuration and Weed Management on Yield and Yield Attributes of Green Gram (*Vigna radiata* L), Agricultural Science Digest. 39(4): 320-323.

Source of support: Nil

Conflict of interest: None

Submitted: 27-08-2019 **Accepted:** 05-10-2019 **Published:** 09-12-2019

MATERIALS AND METHODS

A field experiment was conducted at Pulse Research Farm, Department of Genetics and Plant Breeding, Chaudhary Charan Singh Haryana Agricultural University, Hisar, located at latitude of 20°-10′ N and longitude of 75°-46′ E with a mean height of 215.2 meters above mean sea level. A rainfall of 75.6 mm was received in the third week of June and after that 93.5 mm rainfall occurred during the first week of July which was found to be sufficient for sowing of green gram crop. The total rainfall received during the month of June, July, August and September 2016 were 111.2 mm, 244.8 mm, 80.4 mm and 2.8 mm, respectively. Thus a total of 439.2 mm rains were received during June to September 2016 against the average normal rains intensity of 400 mm. The monsoon was very good and well distributed during the crop growing season. Overall, the weather remain hot and humid during the whole of the cropping season. The soil of the experimental field was sandy loam in texture having low organic carbon, low available N, medium available P and high available K with 7.9 pH. The experiment was laid out in strip plot design with four replications. The land configuration (flat bed method and ridge method) and

weed management weedy check, pendimethalin 30 EC @ 1.0 kg/ha-PE, imazethapyr 10 % SL @ 55g/ha at 15-20 DAS and pendimethalin 30 EC @ 1.0 kg/ha-PE fb imazethapyr 10% SL @ 55 g/ha at 15-20 DAS were kept in main and sub plots, respectively. Green gram 'MH 318' was sown on July 12, 2016 and harvested on September 21, 2016. Seed rate and fertilizer dose was common for all the treatments. The growth and yield parameters were recorded at harvest and weed dry weight was recorded at 30 and 60 DAS as per standard formation. The economics of the system was worked out considering the prevailing cost of inputs and outputs. All the results were then analyzed statistically for drawing conclusion using Analysis of Variance (ANOVA) procedure.

Results and Discussion

Growth and yield attributes

Land configuration had a significant effect on number of branches plant^{-1}, number of seeds pod^{-1} and 100 seed weight, while the effects were non-significant on plant height and number of pods plant^{-1} (Table 1). Significantly higher number of branches plant^{-1}, number of seeds pod^{-1} and 100 seed weight were recorded in ridge method compared to flatbed method. The various weed management practices produced significant improvement in number of branches plant^{-1}, number of seeds pod^{-1} and 100 seed weight of green gram over the weedy check and maximum values of yield attributes was obtained in treatment receiving the application of pendimethalin 30 EC @ 1.0 kg/ha-PE fb imazethapyr 10 % SL @ 55 g/ha at 15-20 DAS followed by imazethapyr 10 % SL @ 55 g/ha at 15-20 DAS. In pulse crops number of pods plant^{-1} is the most important determinant of seed yield. The number of pods plant^{-1} ranged from 12.0 in uncontrolled weedy check to 22.8 in pendimethalin 30 EC @ 1.0 kg/ha-PE fb imazethapyr 10 % SL @ 55 g/ha at 15-20 DAS. This may be attributed to better crop growth environment along with less crop weed competition in these treatments than weedy check.The results confirm the findings of Bahar *et al*. (2017).

Number of seeds pod^{-1} is another important yield component of green gram. The weed management practices had significant effect on number of seeds pod^{-1}. The number of seeds pod^{-1} varied from 7.80 in weedy check to 9.46 in pendimethalin 30 EC @ 1.0 kg/ha-PE fb imazethapyr 10 % SL @ 55 g/ha at 15-20 DAS treatment, however, treatments imazethapyr 10% SL @ 55 g/ha at 15-20 DAS and pendimethalin 30 EC @ 1.0 kg/ha-PE were statistically at par with each other (Table 1). Variation in 100 seed weight of green gram from 2.81 to 3.60 g was also recorded from different weed management practices. Increase in number of seeds pod^{-1} and number of pods plant^{-1} was also recorded when pendimethalin 30 EC @ 1.0 kg/ha-PE fb imazethapyr 10 % SL @ 55 g/ha at 15-20 DAS of green gram was applied (Singh *et al*., 2015).

Nodule count and weeds dry weight

Nodule count (Table 2) recorded at 60 DAS indicated that nodule formation was more favored with the non-herbicide plots than sole chemical and chemical-chemical combination treated plots. Highest nodules were recorded under ridge method than flat bed method. Among the weed management practices, weedy check recorded the highest nodule count (37) than rest of the treatments. However, pendimethalin, imazethapyr and pendimethalin fb imazethapyr treated plots registered least nodule as the herbicide is believed to interfere in the rhizobium plant relationship. Strong nodulation either in chemical free treatment could be due to direct or indirect effect of herbicides to the symbiotic association of green gram and rhizobium thereby inhibiting nitrogenase activity (Lhungdim *et al*., 2014).

There were non-significant differences between different crop establishment methods with respect to weeds dry weight at 30 and 60 DAS of green gram. Although, numerically lower weeds dry weight was observed under ridge method than flat method. All weed management practices resulted into significant reduction in the dry weight of weeds. The treatment having, application of pendimethalin 30 EC @ 1.0 kg/ha-PE fb imazethapyr 10 % SL @ 55 g/ha at 15-20 DAS recorded least and significantly lower weeds dry weight at 30 and 60 DAS over imazethapyr 10 % SL @ 55 g/ha at 15-20 DAS, pendimethalin 30 EC @ 1.0 kg/ha-PE and weedy check, respectively. Highest weed control efficiency (WCE) of 94.4 and 88.3; 94.0 and 90.4 % were

Table 1: Effect of land configuration and weed management practices on growth and yield attributes of green gram.

Treatments	Plant Height (cm)	Number of branches plant^{-1}	Number of pods plant^{-1}	Number of seeds pod^{-1}	100 seed weight (g)
Land Configuration					
Flat bed	67.75	2.32	17.54	8.53	3.24
Ridge method	70.61	2.60	19.40	9.16	3.46
SEm ±	0.69	0.02	0.64	0.10	0.03
CD at 5 %	NS	0.07	NS	0.33	0.09
Weed management					
Weedy check	65.12	1.42	12.0	7.80	2.81
Pendimethalin 30 EC @ 1.0 kg/ha-PE	69.48	2.69	18.5	8.92	3.45
Imazethapyr 10 % SL@ 55 g/ha at 15-20 DAS	70.62	2.80	20.6	9.20	3.54
Pendimethalin 30 EC @ 1.0 kg/ha-PE fb imazethapyr 10 % SL @ 55 g/ha at 15-20 DAS	71.50	2.96	22.8	9.46	3.60
SEm ±	1.27	0.06	0.27	0.12	0.07
CD at 5 %	NS	0.16	0.70	0.32	0.18

Table 2: Effect of land configuration and weed management practices on weed control efficiency, seed yield and economic returns of green gram.

Treatments	Nodule count plant^{-1} at 60 DAS	Weeds dry weight (g m^{-2}) at 30 DAS	Weeds dry weight (g m^{-2}) at 60 DAS	Weed control efficiency (%) at 30 DAS	Weed control efficiency (%) at 60 DAS	Seed yield (kg ha^{-1})	Cost of cultivation (`ha^{-1})	Net returns (`ha^{-1})	BC ratio
Land Configuration									
Flat bed	33	23.7	111.5	-	-	576	20400	9696	1.47
Ridge method	36	23.4	106.7	-	-	665	20400	14346	1.70
SEm ±	-	0.42	2.62	-	-	5	-	-	-
CD at 5 %	-	NS	NS	-	-	17	-	-	-
Weed management									
Weedy check	37	64.3	241.9	0	0	262	18400	-4711	0.74
Pendimethalin 30 EC @ 1.0 kg/ha-PE	27	18.8	86.8	70.7	64.1	594	20800	10236	1.49
Imazethapyr 10 % SL@ 55 g/ha at 15-20 DAS	23	7.5	23.5	88.3	90.4	746	21000	17978	1.85
Pendimethalin 30 EC @ 1.0 kg/ha-PE fb imazethapyr 10 % SL @ 55 g/ha at 15-20 DAS	17	3.6	14.7	94.4	94.0	881	21400	24632	2.15
SEm ±	-	1.17	1.92	-	-	18	-	-	-
CD at 5 %	-	3.01	4.95	-	-	46	-	-	-

recorded in pendimethalin 30 EC @ 1.0 kg/ha-PE fb imazethapyr 10 % SL @ 55 g/ha at 15-20 DAS and imazethapyr 10 % SL @ 55 g/ha at 15-20 DAS respectively, at 30 and 60 DAS of green gram. Herbicides showed significant reduction in weed growth thereby facilitated vigorous crop growth, increased photosynthesis and biomass accumulation and ultimately helped to smother weeds resulted in higher WCE (Naidu *et al.,* 2012).

Seed yield

Land configuration had a significant effect on seed yield of green gram (Table 2). Ridge method of planting recorded significantly 15.45 % higher seed yield over flat method of planting. All weed management practices had significant effect on seed yield of green gram compared to weedy check. There were 236, 126 and 184 per cent improvement in seed yield with the application of pendimethalin 30@ 1.0 kg/ha-PE fb imazethapyr 10 % SL @ 55 g/ha, Pendimethalin 30 EC @ 1.0 kg/ha-PE and Imazethapyr 10 % SL@ 55 g/ha at 15-20 DAS applicationover the weedy check, respectively. Similar results were also reported by Lhungdim *et al.* (2014) and Chauhan *et al.* (2012). Crop performance was poor in weedy check thus the yield recorded per hectare was lower than that obtained in other treatments. The results were in conformity with the findings of Malik *et al.* (2005) and Veeraputhiran (2009). Ridge method of sowing recorded higher net returns (`14346/ha) and BC ratio (1.70) as compared to the flat bed method (net returns ` 9696/ha and BC ratio1.47) in green gram. Among the various weed management practices, application of herbicides alone or in combinations recorded higher net returns and BC ratio over the weedy check. The treatment having application of pendimethalin 30 EC @ 1.0 kg/ha-PE fb imazethapyr 10 % SL @ 55 g/ha at 15-20 DAS recorded the highest net returns (`24632/ha) and BC ratio (2.15) compared to all other treatments. Application of herbicide resulted into low crop weed competition and low weeds dry weight with higher seed yield as compared to the uncontrolled weedy check. The weedy check treatment had negative monetary returns and BC ratio (`4711 and 0.74) due to the heavy weed infestation in the weedy check treatment which, drastically reduce the seed yield of the green gram. The results were in conformity with the findings of Poornima *et al*. (2018) and Tamang *et al.* (2015). The interaction effect of land configuration and weed management was found non-significant.

Conclusion

Based on the experimental findings it can be concluded that planting of green gram on ridges recorded significantly higher seed yield in comparison to flat planting. Application of pendimethalin 30 EC @ 1.0 kg/ha-PE fb imazethapyr 10% SL @ 55 g/ha at 15-20 DAS helped in increasing growth, yield attributes and seed yield of green gram.

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ISSN: 0976-0547 (Online), 0253-150X (Print), Naas Rating: 4.21