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Original Research Article

Effect of Mulching Practices, Varieties and Fertility Levels on Physiological Growth Parameters of Clusterbean

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Keywords

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A B S T R A C T

A field experiment was conducted during the *kharif* season of 2013 and 2014 to evaluate the effect of mulching practices, varieties and fertility levels on physiological parameters of clusterbean at the Research Farm, College of Agriculture, Gwalior. The results revealed mulching practices, varieties and fertility levels on physiological parameters of clusterbean that increased the value of CGR, AGR and LAI up to 90 DAS, RGR up to 60 DAS and LAR up to 30 DAS growth stage and then decline up to maturity. The values of dry matter, CGR, RGR, AGR and leaf area index were recorded higher with plastic mulch, HG-563 and 75% RDF +VC 5t/ha. over remaining mulch, varieties and fertility levels. While leaf area ratio (LAR) was recorded maximum in Control ($N_0P_0K_0$) over other fertility levels at all growth stages.

Introduction

Clusterbean (*Cyamopsis tetragonoloba*), commonly known as guar, is cultivated mainly as rainfed crop in arid and semi-arid regions during rainy (*kharif*) season. It is used as vegetable, forage, green manure and also for the water soluble gum (a major part of the seed). Seeds contain 29 to 31.4 per cent gum (Kumar, and Rodge, 2012). The crop has got an industrial status due to galactomannan gum (Joshi and Arora 1993).

India is one of the main producers of cluster bean accounting 80% of the total production of the world, and the same is grown in the north-western states of India, namely, Rajasthan, Gujarat, Haryana, Punjab and some parts of Uttar Pradesh and Madhya Pradesh. In India, it is grown on an area of 2.4 million hectare with the production of 1.71 million tonnes and the productivity is 491 kg/ha (C.L.R.S. 2013). In M.P., guar is cultivated as a pure crop in 12576 ha, production 8860 tonnes and its productivity 705 kg/ha. Cultivated as a mixed crop in an area of 54782 ha and its productivity 316 kg/ha (C.L.R.S. 2013). About 80% area of state is in Gird zone which consist of Bhind, Morena, Shivpuri, Guna and Gwalior District.

Several attempts have been made to increase the yield potential of clusterbean by they are primarily concerned with the use of fertilizer, pesticides and other better management practice coupled with genetic improvement. But, very little attention has

been given to the physiological processes, nutrient uptake, organic manure and moisture conservation etc. which limit the crop productivity. Hence, there is a need to study the effect of mulching, newly release varieties and nutrients on physiological, morphological parameters and yield components in clusterbean.

Materials and Methods

A field experiments was carried out during *kharif* seasons of 2013 and 2014 at College of Agriculture farm, Gwalior. The experimental crop of clusterbean received 594 mm rains in 30 days and 484 mm rains in 14 days, during 2013 and 2014 respectively. The soil of the experimental field was sandy clay loam in texture, neutral in reaction (pH 7.9) and low in available N (189.5kg/ha), medium in available P (17 kg/ha) with low organic carbon (0.43%) but high in available K (238 kg/ha). The soil moisture content at field capacity was 21%, having bulk density and infiltration rate 1.4mgm^{-3} and 2.2 mm/hr. The experiment was laid out in split-plot design with three replications. The treatment combinations comprised three mulching (No mulching, Plastic mulching and Weed biomass mulching); and two varieties (RGC–1055 and HG–563) in main plots; and four fertility levels (Control, 50% RDF + Vermicompost 5 t/ha, 75% RDF + Vermicompost 5 t/ha and 100% RDF (20: 40: 20 NPK kg/ha) in subplots. The vermicompost used in the experiment analysed 1.52% nitrogen, 1.12% Phosphorus and 0.86% Potassium. The crop were sown on 11th July 2013 and 18th July 2014. The clusterbean seeds were sown @ 20 kg/ha by line sowing. The spacing between row to row in clusterbean was maintained at 40 cm. Other management practices were adopted as per recommendations of the crop under irrigated conditions. The economics was calculated on the basis of prevailing market rates of agriculture produced and cost of cultivation treatments wise.

Results and Discussion

Effect of mulch

The results revealed mulching practices on physiological parameters of clusterbean that increased the value of CGR, AGR and LAI up to 60-90 DAS, RGR up to 30-60 DAS and LAR up to 0-30 DAS growth stages and then decline up to maturity. Plant dry weight, AGR, CGR and Leaf area index were significantly affected by mulching at all stages of crop growth except at 30 DAS. It may be due to the fact that mulching practices were done at 30 days after sowing resulting in non-significant effect. Plastic mulch (M_1) shows significantly greater Plant dry weight, AGR, CGR and Leaf area index than rest of the treatments at 60, 90 DAS and maturity stage in both the years and pooled except in case of Leaf area index at 60-90 DAS. However, weed biomass mulch also noted significantly greater Plant dry weight, AGR, CGR and Leaf area index over no mulch. RGR and Leaf area Ratio were found non-significant at all growth stages except RGR at 60-90 DAS. It may be possible due to the beneficial role of moisture in maintaining the turgidity of the cell, cell emanation, cell division, photosynthesis, respiration, uptake of water and essential nutrients, translocation of photosynthates from one organ to another biochemical process of the plant and lesser weed competition resulting in higher CGR, AGR and LAI under these treatments. The results are in line with Rahman *et al.,* (2013) who indicated that number of leaves at different days after transplanting and dry weight of leaf of onion significantly increased with the application of mulching (M).

Table.1 Effect of different Mulching practices, Varieties and Fertility levels on Plant dry weight, Absolute growth rate and Crop growth rate of clusterbean at successive stages

Treatments	Plant dry weight (g)				Absolute growth rate(mg/day)				Crop growth rate(g/m^2/day)			
	0-30 DAS	30-60 DAS	60-90 DAS	90-maturity	0-30 DAS	30-60 DAS	60-90 DAS	90-maturity	0-30 DAS	30-60 DAS	60-90 DAS	90-maturity
Mulching												
No mulching	2.33	10.90	33.10	49.28	77.59	285.81	739.79	539.31	2.30	8.45	21.88	15.94
Plastic mulching	2.33	12.34	38.93	59.87	77.83	333.55	886.38	697.87	2.28	9.79	26.00	20.48
Weed biomass	2.33	11.55	36.19	54.79	77.67	307.24	821.56	619.79	2.26	8.95	23.91	18.05
SE (m)±	**0.07**	**0.20**	**0.62**	**0.71**	**2.49**	**4.49**	**17.15**	**18.25**	**0.07**	**0.13**	**0.72**	**0.53**
CD (P=0.05)	**NS**	**0.58**	**1.84**	**2.08**	**7.35**	**13.24**	**50.59**	**53.84**	**NS**	**0.39**	**1.49**	**1.57**
Variety												
RGC-1055	2.16	10.60	32.68	49.18	71.94	281.44	736.05	549.88	2.13	8.34	21.79	16.28
HG-563	2.50	12.59	39.47	60.11	83.44	336.30	895.77	688.10	2.43	9.79	26.07	20.03
SE (m)±	**0.06**	**0.16**	**0.51**	**0.58**	**2.03**	**3.66**	**14.00**	**14.90**	**0.06**	**0.11**	**0.58**	**0.43**
CD (P=0.05)	**0.18**	**0.48**	**1.50**	**1.70**	**6.00**	**10.81**	**41.30**	**43.96**	**0.18**	**0.32**	**1.22**	**1.28**
Fertility level												
Control ($N_0P_0K_0$)	2.03	9.62	29.18	43.63	67.80	252.99	651.93	481.73	1.99	7.44	19.17	14.16
50% RDF +VC 5t/ha.	2.24	11.25	35.15	52.78	74.78	300.36	796.38	587.65	2.18	8.78	23.25	17.15
75% RDF +VC 5t/ha.	2.66	13.42	42.78	65.49	88.73	358.49	978.70	757.13	2.62	10.57	28.83	22.31
100% RDF ($N_{20}P_{40}K_{20}$)	2.38	12.09	37.19	56.68	79.47	323.62	836.63	649.44	2.33	9.47	24.47	19.00
SE (m)±	**0.04**	**0.11**	**0.36**	**0.41**	**1.28**	**2.91**	**10.38**	**13.33**	**0.04**	**0.09**	**0.43**	**0.39**
CD (P=0.05)	**0.11**	**0.30**	**1.03**	**1.17**	**3.61**	**8.21**	**29.29**	**37.64**	**0.11**	**0.24**	**0.86**	**1.10**

Table.2 Effect of different Mulching practices, Varieties and Fertility levels on Relative growth rate, Leaf area index and Leaf area Ratio of clusterbean at successive stages

Treatments	Relative growth rate(mg/g/day)				Leaf area index				Leaf area Ratio			
	0-30 DAS	30-60 DAS	60-90 DAS	90-maturity	0-30 DAS	30-60 DAS	60-90 DAS	90-maturity	0-30 DAS	30-60 DAS	60-90 DAS	90-maturity
Mulching												
No mulching	27.69	51.43	36.92	13.23	0.500	2.180	3.446	0.501	0.991	0.953	0.696	0.262
Plastic mulching	27.76	55.58	38.23	14.32	0.506	2.460	4.105	0.537	0.996	0.953	0.695	0.261
Weed biomass	27.77	53.39	37.88	13.82	0.511	2.315	3.902	0.517	1.002	0.957	0.703	0.269
SE (m)±	**1.01**	**0.59**	**0.49**	**0.43**	**0.015**	**0.042**	**0.099**	**0.011**	**0.047**	**0.028**	**0.013**	**0.009**
CD (P=0.05)	**NS**	**1.75**	**NS**	**NS**	**NS**	**0.123**	**0.292**	**0.032**	**NS**	**NS**	**NS**	**NS**
Variety												
RGC-1055	25.30	53.00	37.33	13.60	0.476	2.222	3.553	0.493	1.008	0.981	0.726	0.272
HG-563	30.18	53.94	38.02	13.99	0.535	2.415	4.082	0.544	0.985	0.927	0.670	0.256
SE (m)±	**0.83**	**0.48**	**0.40**	**0.35**	**0.012**	**0.034**	**0.081**	**0.009**	**0.039**	**0.023**	**0.011**	**0.007**
CD (P=0.05)	**2.44**	**NS**	**NS**	**NS**	**0.036**	**0.100**	**0.238**	**0.026**	**NS**	**NS**	**0.032**	**NS**
Fertility level												
Control ($N_0P_0K_0$)	23.30	51.90	36.79	13.43	0.470	2.136	3.434	0.482	1.057	1.032	0.772	0.293
50% RDF +VC 5t/ha.	26.50	53.92	37.86	13.58	0.503	2.283	3.753	0.516	1.031	0.975	0.702	0.265
75% RDF +VC 5t/ha.	32.42	53.94	38.61	14.17	0.535	2.508	4.180	0.553	0.915	0.880	0.643	0.240
100% RDF ($N_{20}P_{40}K_{20}$)	28.73	54.11	37.44	14.00	0.514	2.346	3.903	0.524	0.983	0.930	0.676	0.258
SE (m)±	**0.60**	**0.41**	**0.33**	**0.34**	**0.005**	**0.023**	**0.057**	**0.005**	**0.021**	**0.012**	**0.007**	**0.005**
CD (P=0.05)	**1.68**	**1.17**	**0.92**	**NS**	**0.013**	**0.064**	**0.162**	**0.013**	**0.059**	**0.035**	**0.019**	**0.013**

These results also corroborate the finding of Alloli *et al.,* (2008); Saren *et al.,* (2008) and Nalayini *et al.,* (2009).

Effects of Varities

Variety, 'HG-563' registered significantly greater Plant dry weight, AGR, CGR and LAI at all the growth stages. RGR and Leaf area Ratio were found non-significant at all growth stages except RGR at 0-30 DAS and LAR at 60-90 DAS. These results confirm the finding of Scott and Batchelor (1979). Kumar (2008) reported that higher leaf area index, crop growth rate (CGR), relative growth rate (RGR) and absolute growth rate (AGR) was significantly recorded in high yielding genotype of mothbean. These results also corroborate with the finding of Rawat (2013) and Rajput *et al.,* (2014). The varietal differences amongst these growth analysis parameters attributed to the variability in the genetic inheritance among the varieties. This has been supported by Talwar *et al.,* (2004).

Effects of Fertility levels

Fertility levels caused a marked variation in growth parameters of clusterbean at most of the crop growth stages. The growth analysis parameters, *viz.,* LAI, LAR, CGR, RGR, AGR had a direct relationship with the fertility levels. The maximum values of these growth parameters were recorded with the 75% RDF ($N_{15}P_{30}K_{15}$) + vermicompost 5 t/ha except in case of Leaf area ratio. The overall improvement in the growth of clusterbean at higher level of fertility could be ascribed to their pivotal role in several physiological and biochemical processes, *viz.,* root development, photosynthesis, energy transfer reactions and symbiotic biological N-fixation process. These observations are in line with the findings of Sammauria *et al.,* (2009) who reported that increase availability of nutrient through fertilizer might have increase the growth of crop. Similar finding have been reported by Rajput (1985); Dash *et al.,* (2005); Ayub *et al.,* (2012) and Tak (2013). Leaf area ratio indicates the size of assimilatory surface area in relation to total dry matter accumulation. The LAR was more during early stages of crop growth and decreased towards maturity. Kalubarme and Pandey (1979) reported that leaf area ratio attained its peak between 21 and 28 days after sowing and declined thereafter steadily up to harvest in greengram. Among the treatments at 90-maturity stages, higher LAR was recorded in control plot and the lowest was noticed in 75% RDF ($N_{15}P_{30}K_{15}$) + vermicompost 5 t/ha. Similar result was also obtained by Rawat (2013) in clusterbean and Sharma (2014) in wheat. In the present study, it was concluded that the application of mulching practices, varities and fertility levels facilitate almost all the physiological growth parameters. The maximum CGR, RGR, AGR and LAI, as well as dry matter were recorded in plastic mulch, varities and 75% RDF ($N_{15}P_{30}K_{15}$) + vermicompost 5 t/ha at all the growth stages except LAR. However, the minimum values of LAR were found in plastic mulch, varities and 75% RDF ($N_{15}P_{30}K_{15}$) + vermicompost 5 t/ha at all the growth stages.

References

Allolli, T.B.; Hulihalli, U.K. and Athani, S.I. 2008. Influence of in situ Moisture Conservation Practices on the Performance of Dryland Clusterbean. *Karnataka J. Agric. Sci.* 21(2)*:* 250-252.

Ayub, M.; Nadeem, M.A; Naeem, M.; Tahir, M.; Tariq, M. and Ahmad, W. 2012. Effect of different levels of P and K on growth, forage yield and quality of clusterbean (*Cyamopsis*

tetragonoloba L.). *The J. Ani. Plant Sci.* 22 (2): 479 – 483.

C.L.R.S. 2013. Published by *Commissioner Land Record and Settlement, Madhya Pradesh, Gwalior (M.P.).*

Dash, A.C.; Tomar, G.S. and Katkar, P.H. 2005. Effect of integrated nutrient management on growth and dry matter accumulation of soybean (*Glycine max* (L.) Merrill). *J. Soils Crops,* 15(1): 39-45.

Joshi, UN and Arora, SK. 1993. Recent advances in guar gum chemistry and utilization- a review. Forage Research 19 (2): 310-328.

Kalubarme, M.H. and Pandey, R.K. 1979. Growth analysis of greengram genotypes. *Indian J. Agric. Sci.* 49: (8) 975-977.

Kumar, D. and Rodge, A.B. 2012. Status, scope and strategies of arid legumes research in India- A review. *J. Food Leg.* 25(4): 255-272.

Kumar, Mohan K.G. 2008. Seasonal influence on productivity potential in mothbean genotypes [*Vigna aconitifolia* (Jacq.) Marechal]. Ph.D. (Agronomy) Thesis. University of Agricultural Sciences, Dharwad.

Nalayini, P.; Anandham, R.; Sankaranarayanan, K. and Rajendran, T.P. 2009. Polyethylene mulching for enhancing crop productivity and water use efficiency in Cotton (*Gossypium hirsutum)* and maize *(Zea mays*) cropping system. *Indian J. Agron.* 54(4): 409-414

Rahman, M.A.; Mahmud, J.A. and Islam, M.M. 2013. Influence of mulching on the growth and yield of onion. *Technical J. Engineering and Applied Sci. 3*(24):3497-3501.

Rajput, Beerbal Singh; Bhadauria, U.P.S. and Rajput, R.L. 2014. Study on specific leaf area and its relation with leaf area, leaf dry weight and seed yield in mungbean. *Bioinfolet* 11(1B): 247-250.

Rajput, O.P. 1985. Effect of different levels of phosphorus on the growth, yield and quality of soybean. *M.Sc. (Ag.) Thesis, JNKVV,* College of Agriculture, *Jabalpur (M.P.).*

Rawat, Upma 2013. Effect of varieties and nutrient management on productivity, profitability and nutrient uptake of clusterbean [*Cyamopsis tetragonoloba* (L.) Taub.]" Ph.D. *(*Agronomy) Thesis, RVSKVV, College of Agriculture, Gwalior (M.P.).

Saren, B.K.; Mandal, K. and Bag, N. 2008. Effect of mulching and row spacing on growth, seed yield and oil yield of Rainfed Niger (*Guizotia abyssinica*) in red and lateritic acid belt of West Bengal. *Indian J. Agric. Sci.* 78(6): 557-559.

Scott, H.D. and Batchelor, A. 1979. Dry weight and leaf area production rate of irrigated determinate Soybean. *Agron. J.* 71 (10): 776-782.

Sharma, Janmejay 2014. Management of Weed flora in wheat (*Triticum aestivum* (L.)) under various fertility levels in different combinations of herbicides. Ph.D. *(*Agronomy) Thesis, RVSKVV, College of Agriculture, Gwalior (M.P.).

Tak, Sitaram; Sharma, S. K.; Reager, M.L. 2013. Growth attributes and nutrient uptake of green gram as influenced by vermicompost and zinc in arid western Rajasthan. Adv. Res. J. Crop Improv. 4(1):65-69.

Talwar, H.S.; Soni, M.L. and Beniwal, B.K. 2004. Evaluation of crop physiological traits in cluster bean (*Cyamopsis tetragonoloba* L.) and Mothbean (*Vigna aconitifolia* Ja (q.). Proceedings of National Seminar of Plant Physiology held on Dec. 27-29, Pune 121.