RESEARCH ARTICLE Legume Research- An International Journal, Volume 45 Issue 7: 860-865 (July 2022)

Residual Effect of Fertility Levels, Biofertilizer and Foliar Nutrition on Yield and Yield Attributes of Summer Blackgram (*Vigna mungo* L.) in Wheat-blackgram Cropping System under Subtropical Conditions in Jammu

R.S. Bochalya, A.K. Gupta, N.P. Thakur, R. Puniya, P. Kumar, Deepak Kumar, Swati Mehta 10.18805/LR-4843

ABSTRACT

Background: Blackgram (*Vigna mungo* L.), commonly known as urdbean, mash, black mapte and other names, is a popular short-season pulse crop farmed throughout India. This crop is extensively sown in conjunction with various cropping systems under residual moisture conditions after wheat harvest as summer crops under irrigated conditions and due to its high protein and carbohydrate content, as well as its short duration crop, it is suitable in summer crop grown between wheat and rice.

Methods: Field experiments was carried out during two consecutive *summer* seasons of 2018-19 and 2019-20 to study residual effect of biofertilizer and foliar nutrition on plant height and yield attributes of summer blackgram (*Vigna mungo*) under different fertility levels at the Research Farm, Division of Agronomy, SKUAST-J, Chatha. The experiment was laid out in split-split plot design with three factors replicated thrice.

Result: Maximize residual effect of nutrients on blackgram after raised wheat as a major crop among the fertility levels including biofertilizer and foliar application, recommended dose fertilizer achieved, growth parameters *viz*, yield attributing characters, number of pods/plants, number of grains /plants, 1000-grains weight, seed yield, stover yield and harvest index as compared to 75% of RDF. However, control recorded lowest values of all growth, yield attributing parameter and yield of blackgram crop. Whereas, soil application of biofertilizer consortium recorded higher plant height and yield attributing characters of blackgram in comparison to seed treatment with biofertilizer consortium applied in wheat as main crop. Among the foliar application of 2% of NPK (19:19:19) higher values of growth character, yield and yield attributing parameters of blackgram were recorded in foliar application of 2% NPK (19:19:19) at flowering stage as compared to tillering and tillering + flowering stages of wheat crop during both the years. Economics of blackgram in terms of net return and B:C ratio was influenced by residual effect of various applied in wheat crop and recorded higher in RDF fertility, soil application of biofertilizer consortium and foliar application of 2% NPK at flowering stage.

Key words: Blackgram, Fertility levels, RDF, Residual effect, Wheat.

INTRODUCTION

Cereals play an important part of our food system next to that pulse come in the line to stabilize nutritional base. India is the largest producer and consumer of pulses in the world but the per capita availability of pulses has been declining adversely. Wheat (*Triticum aestivum* L.) has the highest importance among cereal crops grown for the grain purpose worldwide. It is the most important rabi crop of India moreover and improvement in its productivity has played a key role in making the country self-sufficient in food grain. Although, India is well placed in meeting its needs for food grains the major objective of food and nutritional security for its entire population has not been achieved. The demand for food grains is expected to rise not only as a function of population growth but also as more and more people cross the poverty line with economic and social development. It supplies 21 per cent of the capita food energy and 18 per cent of dietary protein in the country (Dar *et al.,* 2018).

The demand for food grains is proposed to rise not only as a function of population growth but also as more and more people cross the poverty line with economic and social advancement (Gangwar *et al*., 2018). Blackgram (*Vigna mungo* L.) also known as urdbean, mash, black mapte *etc*., is an important short duration pulse crop grown in many parts of India. This crop is widely sown in combination with different cropping systems under residual moisture conditions after the harvest of wheat as summer crops under

Sher-e-Kashmir University of Agricultural Science and Technology, Chatha-180 009, Jammu and Kashmir, India.

Corresponding Author: R.S. Bochalya, Sher-e-Kashmir University of Agricultural Science and Technology, Chatha-180 009, Jammu and Kashmir, India. Email: rbochalya651@gmail.com

How to cite this article: Bochalya, R.S., Gupta, A.K., Thakur, N.P., Puniya, R., Kumar, P., Kumar, D. and Mehta, S. (2022). Residual Effect of Fertility Levels, Biofertilizer and Foliar Nutrition on Yield and Yield Attributes of Summer Blackgram (*Vigna mungo* L.) in Wheat-blackgram Cropping System under Subtropical Conditions in Jammu. Legume Research. 45(7): 860-865. DOI: 10.18805/LR-4843.

Submitted: 02-12-2021 **Accepted:** 06-04-2022 **Online:** 07-06-2022

irrigated conditions and due to its high protein and carbohydrate content and because of its short duration crop, it is suitable in summer crop grown in between wheat and rice. Apart from this, black gram forms excellent forage and it gives a profuse vegetative growth and covers the ground so well that it checks the soil erosion. Black gram roots noodles have efficient to fix atmospheric nitrogen about 22.10 kg ha^{-1} (Jat *et al.,* 2017). Currently in India pulses cultivated area and production is 29.28 million hectares and 22.40 million tons, respectively and overall productivity of pulse crop in India is about 7.65 q ha^{-1} (Kachave *et al.,* 2018). India has a largest producer as well as consumer of blackgram. An estimate about 70% blackgram produced by Indian farmers. It produces annually 24.5 lakh tonnes from 4.6 million hectares, with an average productivity of 5.33 q ha^{-1} (agricoop.nic.in). In case of India blackgram contributes 23% of total pulse production and area is about 19% total pulse acreage. In Jammu and Kashmir, total area under blackgram is 12,955 hectares with an annual production and productivity of 57,077 thousand quintals and 3.85 q ha^{-1}, respectively (Anonymous, 2017). Keeping in view of the low productivity of blackgram in Jammu and Kashmir to optimise the residual effect of fertilizers and application of biofertilizers along with exogenous nutrient for enhancing the yield. The study concluded to evaluate the residual effect of fertilizer applied to main preceding crop wheat on the succeeding crop blackgram.

MATERIALS AND METHODS

Field experiments was carried out during two consecutive Summer seasons of 2018-19 and 2019-20 to study residual effect of biofertilizer and foliar nutrition on plant height and yield attributes of summer blackgram (*Vigna mungo*) under different fertility levels at the Research Farm, Division of Agronomy, SKUAST-J, Chatha. The experimental site is situated at 32.39°N latitude and 74.58° longitude at an elevation of 332 meters above mean sea level. Meteorological data of the experiment has been given in Fig 1 and 2. The soil of the experimental site was sandy clay loam in texture, slightly alkaline in reaction, low in organic carbon and available nitrogen but medium in phosphorus and potassium. The experiment was laid out in split-split plot design with three factors replicated thrice. Eighteen treatment combinations comprising of three fertility levels, *viz.* Control, RDF and 75% of RDF were taken as main plot treatments, two subplot treatment comprising of biofertilizer consortium *viz.,* seed treatment (1.25 kg/ha) and soil application (1.25 kg/ha) and three foliar applications of 2% NPK (19:19:19) *viz.,* at tillering, flowering and tillering+ flowering stage as sub-sub-plot treatments. Wheat crop was sown at spacing of 20 cm with seed rate of 100 kg/ha. Half dose of nitrogen as per the treatment combination and uniform basal application of 50 kg P_2O_5 and 25 kg K_2O per hectare was applied to all the treatments through urea, DAP and MOP and the remaining nitrogen was top dressed in two equal splits at CRI and before booting stages. However, blackgram was sown after wheat to study the residual effect of treatment applied to wheat crop at spacing 30 cm with seed rate of 20 kg/ha. The recommended dose of NPK was 100:50:25 kg/ha for wheat crop and the sources of nitrogen, phosphorus and potassium were urea, diammonium phosphate and muriate of potash, respectively. The experiment was conducted on same site without changing the randomization of the treatment for the successive year to assess the residual effects.

Wheat cv. HD-3086 was sown with spacing 20 cm × 5 cm in the third week of November and harvested in fourth week of April during both the years. The Blackgram cv Pant Urd 31 was sown with spacing 30 cm ×10 cm.

All the observations are statistically analysed by using the analysis of variance. The results were tested for the treatments mean by applying F-test of significance on the basis of null hypothesis (Cochran and Cox, 1957). Wherever necessary, standard errors along with critical difference at 5 per cent of significance were computed for discriminating the treatment effects for chance effects. The key for degrees of freedom used in analysis of variance (ANOVA).

RESULTS AND DISCUSSION

The data presented in Table 1 revealed that number of pods/ plants, number of grains/pods, 1000-grains weight (g), seed yield (kg/ha), stover yield (kg/ha) and harvest index (%) was found to be statistically non-significant. Yield attributes *viz*. number of pods/plants, number of grains/pods, 1000-grains weight (g), seed yield (kg/ha), stover yield (kg/ha) and harvest index (%) have been depicted in Table 1 were found statistically non significant with different fertility levels, bio-fertilizer consortium and foliar application of 2% NPK. Among fertility level, the highest number of pods/plants (27.26 and 29.32), number of grains/pods (7.20 7.24), 1000-grains weight (31.89 33.06 g), seed yield (710.22 727.72 kg/ha), stover yield (2418.76 2463.76 kg/ha) and harvest index (22.73 22.84%) were recorded under 100% RDF followed by 75% RDF and control. Which indicates that the grain yield of blackgram was recorded upto 7.7% higher under residual effect of 100% of RDF treatment over control, where low fertilizer was applied during first and second year of study. Similarly foliar application of 2% NPK during flowering stage of blackgram also enhanced 3% blackgram seed yield over foliar application of 2% NPK at tillering stage however in over all the residual effect of all treatment found at non significant might be due to inherent capacity of soil.

The increased yield and yield attributes of blackgram due to higher fertility levels to preceding *rabi* wheat might be due to build up in heavy fertility of soil which contribute good crop growth resulted into maximum values of yield attributes, ultimately it influences positively on yield, as growth and yield parameters. Patel *et al*. (2014) reported that increase in grains and straw yield might be due to inorganic nutrients helped in improvement in nutrient status in the soil, as well as availability of nutrients resulted in better growth of the crop and increasing the seed yield and stover yield of succeeding green gram crop.

Soil application of bio-fertilizer consortium (1.25 kg/ha) recorded number of pods/plants (26.41 28.47), number of grains/pods (7.12 7.19)1000-grains weight (31.58 32.77 g), seed yield (702.39 719.61 kg/ha), stover yield (2416.34 2456.12 kg/ha) and harvest index (22.53 22.67%) as compared to the seed application with bio-fertilizer consortium due to higher fertility levels to preceding *rabi* wheat might be due to good crop growth resulted into maximum values of yield attributes, ultimately it influences positively on yield, as growth and yield parameters. It was possible due to conjunctive use of bio fertilizer and fertilizer NPK of nutrient applied to wheat enhanced the yield of wheat and succeeding blackgram under residual condition. It was in agreement with the findings of Meena *et al.* (2012). It may be ascertained to the increased availability of nutrients due to mineralization of organic materials, release of CO_2 increasing fertilizer use efficiency, accumulation of organic carbon and improvement in soil structure which reduced the soil crusting and also serves as a source of energy for soil microflora which resulted in better root nodulation and nitrogen fixation. Similar results reported earlier by Singh *et al.* (2001) in rice-lentil, Gawai and Pawar (2006) in sorghum-Chickpea, Gudadhe (2008) in cotton-chickpea and Sindhi *et al.* (2016) in summer green gram under maize-green gram cropping sequence.

The foliar application of 2% NPK (grade of 19:19:19) recorded highest number of pods/plants, number of grains/pods, 1000-grains weight (g), seed yield (kg/ha), stover yield (kg/ha) and harvest index (%) of black gram at flowering stage as compared to the foliar application of 2% NPK at tillering stage and tillering + flowering stage might be due to the improvement inherent soil fertility little bit with addition of NPK through its foliar application along with biofertilizer consortium in previous main crop hence, yield was recorded numerically higher yield of blackgram but found statistically non significant (Patel *et al.,* 2017).

Economics

Relative economics of blackgram, presented in Table 2, calculated on grain and straw basis revealed that all the

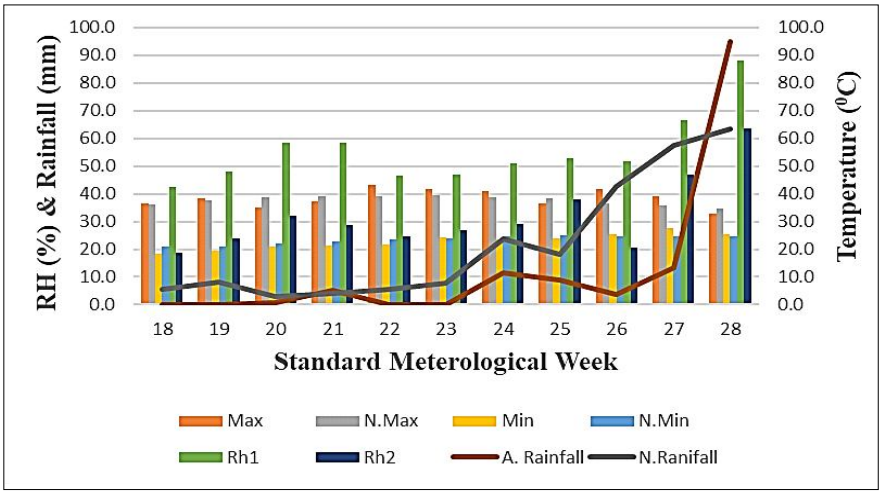

Fig 1: Meteorological weekly data observed during blackgram crop season 2018-19.

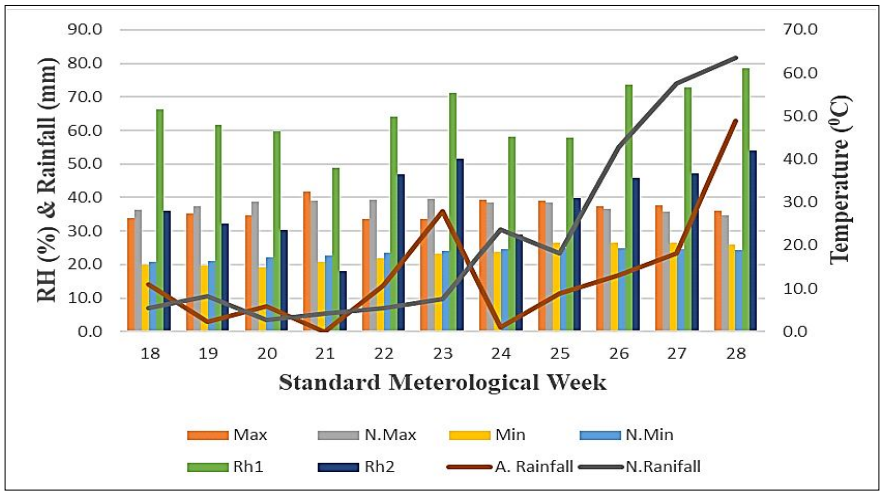

Fig 2: Meteorological weekly data observed during blackgram crop season 2019-20.

Table 1: Residual effect of fertility levels, biofertilizer consortium and foliar nutrition on yield attributes and yield of blackgram.

Treatment	Yield attributes and yield of blackgram											
fertility	No. of pods/plant		No. of grains/pod		1000-grains weight (g)		Seed yield (kg/ha)		Stover yield (kg/ha)		Harvest index (%)	
levels	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
N1= Control	24.02	26.08	6.57	6.64	28.98	30.06	661.64	677.52	2312.98	2353.05	22.25	22.36
N2= RDF (100:50:25)	27.26	29.32	7.20	7.24	31.89	33.06	710.22	727.72	2418.76	2463.76	22.73	22.84
N3= 75%RDF	26.94	28.53	7.00	7.17	31.79	32.94	690.08	706.41	2405.10	2442.15	22.29	22.43
SEm (±)	0.72	0.70	0.17	0.15	0.69	0.70	10.70	10.72	33.44	33.31	0.250	0.236
CD (%)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Sub plots: Bofertilizer consortium												
C1= Seed treatment (1.25 kg/ha)	25.74	27.49	6.73	6.84	30.19	31.27	672.23	688.16	2341.55	2383.18	22.31	22.41
C2= Soil application (1.25 kg/ha)	26.41	28.47	7.12	7.19	31.58	32.77	702.39	719.61	2416.34	2456.12	22.53	22.67
SEm (±)	0.41	0.40	0.17	0.20	0.62	0.66	9.69	9.68	22.37	22.39	0.29	0.29
CD (%)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Sub sub plots: Foliar application (2% NPK)												
F1= Tillering stage	26.14	27.88	6.93	7.03	30.97	32.07	681.14	697.64	2362.15	2402.15	22.42	22.54
F2= Flowering stage	26.20	28.14	6.99	7.04	31.18	32.39	702.71	719.37	2429.29	2469.33	22.44	2.56
F3= Tillering stage + Flowering stage	25.88	27.91	6.84	6.98	30.51	31.60	678.08	694.64	2345.41	2387.47	22.41	22.5
SEm (±)	0.33	0.33	0.18	0.20	0.40	0.39	9.56	9.57	24.08	23.67	0.28	0.28
CD (%)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2: Residual effect of fertility levels, biofertilizer consortium and foliar nutrition on relative economics of summer blackgram.

Fertility levels	Cost of cultivation (Rs/ha)		Gross return (Rs/ha)		Net return (Rs/ha)		B:C ratio	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
N1= Control	13968	13968	46315	47427	32346	33458	2.32	2.40
N2= RDF	13968	13968	49715	50940	35747	36972	2.56	2.65
N3= 75%RDF	13968	13968	48305	49449	34337	35480	2.46	2.54
Sub plots: Bofertilizer consortium								
C1= Seed treatment (1.25kg/ha)	13968	13968	47056	48171	33088	34202	2.37	2.45
C2= Soil application (1.25kg/ha)	13968	13968	49167	50373	35199	36404	2.52	2.61
Sub sub plots: Foliar application (2% NPK)								
F1= Tillering stage	13968	13968	47680	48835	33711	34866	2.41	2.50
F2= Flowering stage	13968	13968	49190	50356	35221	36388	2.52	2.61
F3= Tillering stage + Flowering stage	13968	13968	47466	48625	33497	34656	2.40	2.48

fertility levels recorded higher B:C ratio of 2.56, 2.65 witnessed in RDF during both the years of experimentation. Among the various treatments applied to the preceding wheat crop, application of RDF through inorganic fertilizer recorded maximum net monetary returns with B:C ratio of summer blackgram compared to rest of treatments. This was due to higher gross yield of Blackgram. Similar benefits of residual effect of inorganic fertilizer were reported earlier by Gudadhe (2008) under cotton-chickpea, Shanwad *et al.* (2010) in maize-Bengal gram, Imade (2014) in rice-green gram and Sindhi (2016) in maize green gram cropping sequence.

Under bio fertilizer consortium, highest B:C ratio was obtained in soil application of bio fertilizer 2.52, 2.61 during both the years of experimentation this was mainly attributed to the higher system yield obtained through improvement in soil health by judicious integrated nutrient management approach using RDF with biofertilizer consortium. Similar favourable effect inorganic and organic nutrient applied to baby corn and potato and green gram grown under residual fertility condition in baby corn-potato-green gram sequence was recorded by Meena *et al*. (2012). Among all the foliar application recorded higher B:C ratio of 2.52, 2.61 at flowering stage during both the years of experimentation due to less uptake of nutrients by the preceding crop (Mahapatra *et al.,* 2018).

CONCLUSION

Based on the experimental results obtained from two years of study, it may be inferred that application of 100% RDF along with bio-fertilizer consortium at the rate 1.25 kg/ha in soil and foliar spray of 2% solution of NPK at flowering stage to wheat showed better residual effect with the respect to yield of succeeding black crop gram which was statistically non-significant.

Conflict of interest: None.

REFERENCES

Cochran, W.G. and Cox, G.M. (1957). Experimental Designs. Asia Publishing House, Bombay, India.

Dar, S.B., Kanth, R.H., Raja, W., Bangroo, S.A.and Mir, S.A.(2018). Performance of wheat in relation to sowing dates and nitrogen levels under rainfed conditions of Kashmir. International Journal of Current Microbiology and Applied Science. 7: 2600-2608.

DAFW. (2021). Blackgram Outlook Report January to May (2021). Available at: www.agricoop.nic.in. accessed on 20 September 2021.

Gawai, P.P. and Pawar, V.S. (2006). Integrated nutrient management in sorghum (*Sorghum bicolor)*-chickpea *(Cicer arietinum*) cropping sequence under irrigated conditions. Indian Journal of Agronomy. 51: 17-20.

Gangwar, R.M., Pandove, G., Brar, S.K., Sekhon, K.S., Kaur, S. and Kumar, R. (2018). Integrated nutrient management in wheat by use of *Azotobacter sp*. and *Streptomyces badius*. International Journal of Agriculture Innovation and Research. 6(4): 2319-1473.

Gudadhe, N.N. (2008). Effect of integrated nutrient management system in cotton-chickpea cropping sequence under irrigated conditions Ph.D. thesis submitted to M.P.K.V. Rahuri (Maharashtra).

Imade, S.R. (2014). Effect of integrated nitrogen management in rice -green gram cropping sequence under south Gujarat condition. Ph.D thesis submitted to NAU, Navsari.

Kachave, R.R., Indulkar, B.S., Vaidya, P.H., Ingole, A.J. and Patil, N.M. (2018). Effect of phosphorus and PSB on growth, yield and quality of blackgram (*Vigna mungo* L.) in Inceptisol. International Journal of Current Microbiology Applied Sciences. 7: 3359-3365.

Jat, S., Dangi, K.L. and Kumhar, B.L.(2017). Constraints in adoption of improved cultivation practices of blackgram. International Journal of Current Microbiology Applied Sciences. 6: 1820-1824.

Mahapatra, A., Mishra, G.C. and Barik, A.K. (2018). Integrated nutrient management in baby cornand its residual effect on green gram under rainfed ecosystem of Odisha. International Journal of Agriculture, Environment and Biotechnology. 11: 433-438.

Meena, S.R, Kumar, A., Jat, B.P., Meena, B.P., Rana, D.S. and Idanani, L.K. (2012). Influence of nutrient sources on growth, productivity and economics of baby corn (*Zea mays*)-potato (*Solanum tuberosum*)-mung bean (*Vigna radiata*) cropping system. Indian Journal of Agronomy. 57: 217-221.

Patel, H.K., Sadhu, A.C., Lakum, Y.C. and Suthar, J.V. (2014). Response of integrated nutrient on wheat (*Triticum aestivum*) and its residual effect on succeeding crop. International Journal of Agricultural Sciences and Veterinary Medicine. 2: 47-52.

Patel, T.G., Khushvadan, C.P. and Patel, V.N. (2017). Effect of integrated nutrient management on yield attributes and yield of wheat (*Triticum aestivum* L.). International Journal of Chemical Studies. 5: 1366-1369.

Shanwad, U.K., Aravind., Kumar, B.N., Hulihalli, U.K., Ashok, M.R., Surwenshi, M.R. and Jalageri, B.R. (2010). Integrated nutrient management (INM) in maize-bengal gram cropping system in Northern Karnataka. Research Journal of Agriculture Science. 1: 252-254.

Sindhi, S.J. (2016). Effect of integrated nitrogen management in maize-green gram cropping sequence under south Gujarat condition. Ph.D. Thesis submitted to NAU, Navsari. (Gujarat).

Sindhi, S.J., Thanki, J.D., Mansuri, R.N. and Desai, L.J. (2016). Residual effect of integrated nutrient management in *rabi* maize on growth and yield parameters of summer green gram under maize- green gram cropping sequence. International Journal of Agricultural Sciences. 8: 2626-2630.

Singh, S.K., Varma, S.C. and Singh, R.P. (2001). Effect of integrated nutrient management on yield, nutrient uptake and changes in soil fertility under rice (*Oryza sativa*)-Lentil (*Lens culinaris*) cropping system. Indian Journal of Agronomy. 46: 191-197.