www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(11): 908-911

www.thepharmajournal.com
Received: 18-09-2022
Accepted: 21-10-2022

Dr. Ganesh K Gaikwad,
Assistant Professor of SSAC, Department of SSAC, Collage of Agriculture, Badnapur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani Maharashtra, India

Akash P Gawade
Assistant Professor of SSAC, Department of SSAC, Collage of Agriculture, Khandala, under Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani Maharashtra, India

Kishor A Kavar
Assistant Professor, Department of Extension Education, Collage of Agriculture, Khandala, under Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani Maharashtra, India

Corresponding Author:
Dr. Ganesh K Gaikwad,
Assistant Professor of SSAC, Department of SSAC, Collage of Agriculture, Badnapur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani Maharashtra, India

Effect of foliar nutrition of water soluble fertilizer and growth regulator on major nutrients content and uptake by Black gram (*Vigna mungo* L. Hepper)

Dr. Ganesh K Gaikwad, Akash P Gawade and Kishor A Kavar

Abstract
The experimental soil was clay texture, moderately calcareous in nature and slightly alkaline in reaction and normal in salt content. A field experiment was conducted to study the "Effect of water soluble fertilizer with growth regulator on growth, yield and quality of black gram grown on Vertisol" at the farm of Department of Soil Science and Agril. Chemistry, College of Agriculture, Badnapur during *kharif* 2019-2020. The experiment comprised of ten treatments with three replication which included the foliar spray of water soluble fertilizer and growth regulator and RDF application through soil at the time of sowing. The results emerged out clearly indicated that application of RDF + 00:52:34 @ 0.5%+ GA + SA @ 50 ppm each 27 DAS significantly increases growth parameters, such as plant height, leaf area and number of root nodules of black gram. The application of foliar nutrition helps to overcome the specific occurrence of stress and as a result of maximum vegetative growth due to optimized nutrition of the plant. Application of RDF + 13:00:45 @ 0.5% + GA @ 50 ppm 27 DAS significantly increases nutrient uptake of nitrogen and application of RDF + 00:52:34 @ 0.5%+ GA + SA @ 50 ppm each 27 DAS significantly increases nutrient uptake of phosphorus and potassium.

Keywords: Black gram, water soluble fertilizer, growth regulator, vertisol, major nutrient and uptake

Introduction
Black gram (*Vigna mungo* L. Hepper) is one of the most important pulse crop grown throughout the India. Black gram is excellent source of protein as well as carbohydrates. It is also known as "Mash bean and urdbean". Black gram is probably native of India as is seen from the Vedic literature. Black gram is third important pulse crop of India which is cultivated all over a wide range of agro-climatic zones of the country. It is mainly grown in semi-arid to sub-humid low land tropics and sub- tropics. In India, black gram traditionally grown in *Kharif* season, but in south it also grown as *Rabi* crop. Potential of black gram is very low because the fact that the crop is mainly grown as subsidiary crop on residual soil moisture in rain fed condition with poor management practices. Black gram producing major states in India are Madhya Pradesh, Rajasthan, Uttar Pradesh, Andhra Pradesh, Tamilnadu and Maharashtra (Anonymous, 2017) [2]. Black gram protein content is more than twice that of cereals reported by Thesiya *et al*. 2013 [9]. The crop improves soil fertility by symbiotic fixation of atmospheric nitrogen in root nodules.

Yield is the culmination of several comprehensive phases which starts at germination and end at harvest, encompassing through shoot growth, leaf development, photosynthesis, flowering, pollination and seed set. Better vegetative growth of a crop is largely responsible for higher seed yield because number of photosynthesizing sites *i.e*. number of vegetative branches is affected by initial growth stage. Two sequential steps are necessary for a blackgram plant to produce pods, a sink of pollination pods capable of further development must be created and this must be supplied with photosynthesis over subsequent period of development. Foliar application is regarded as preferred solution when quick supply of nutrient is hindered or the soil condition is not conductive for the absorption of nutrient (Salisbury and Ross (1985) [7]. Apart from the genetic makeup, the physiological factor *viz*., insufficient portioning assimilates, poor pod setting due to the flower abscission and lack of nutrients during critical stage of crop growth, coupled with a number of disease and pest constitute the major constraints for the poor yield. Foliar nitrogen nutrition may induce drought tolerance in crop. Increase in plant height was due to availability of nitrogen and potassium to plants through foliar spray. Potassium regulates the osmotic turgor of cells and water balance which is driving force for cell division and elongation.

Potassium nitrate (KNO3) be consider the best option because it also provide potassium which influence water economy and crop growth, through its effect on water uptake, root growth, maintenance of turgor pressure, transpiration and stomata behavior.

The productivity of black gram in our country is low. Hence, there is need for enhancement of the productivity of black gram by proper agronomic and nutrient management practices. One among them is foliar application of organic and inorganic sources of nutrients for exploiting genetic potential of the crop. This is considered to be an efficient and economic method of supplementing part of nutrients requirements at critical stages. Foliar application is credited with the advantage of quick and efficient utilization of nutrients, elimination of losses through leaching, fixation and regulating the uptake of nutrients by plant (Manonmani and Srimathi 2009) [5]. Foliar application of nutrient and growth regulator at pre flowering and post flowering stage was seen on reduction in flower drop percentage in black gram. Foliar spray of nutrients mixture with salicylic acid 100 ppm at 20, 30 and 40 DAS proved to be the best treatment to improve Leaf area index, Leaf area duration, specific leaf weight, total dry matter accumulation and seed yield of urd bean. (Amutha *et al*. 2012) [1], for sorghum crop Pawar *et al*. 2015 [6].

Materials and Methods

A field experiment was conducted during *Kharif*, 2019-2020 in Vertisol at departmental farm of Soil Science and Agril. Chemistry, College of Agriculture, Badnapur. The experimental soil was clay texture, moderately calcareous in nature and slightly alkaline in reaction and normal in salt content. At sowing of experiment the soil exhibit pH 7.86 (slightly alkaline in reaction), electrical conductance 0.23 dSm^{-1}, organic carbon content 0.75% (moderately high) and free $CaCO_3$ content was 5.22% respectively. The soil sample was low in available nitrogen (180.36 kg ha^{-1}), moderate in available phosphorus (14.36 kg ha^{-1}), and high in available potassium (460.59 kg ha^{-1}). The experimental design used was Randomized Block design (RBD) with three replications consisting ten different treatments *viz*. T1= Control, T2 =RDF, T3=RDF + 00:52:34 @ 0.5% +GA @ 50 ppm 27 DAS, T4=RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 27 DAS, T5 = RDF + 00:52:34 @ 0.5% + GA @ 50 ppm 45 DAS, T6 = RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 45 DAS, T7 = RDF + 13:00:45 @ 0.5% + GA @ 50 ppm 27 DAS, T8= RDF + 13:00:45 @ 0.5% + SA @ 50 ppm 27 DAS**,** T9= RDF + 00:52:34 @ 0.5%+ GA + SA @ 50 ppm each 27 DAS and treatment T10= RDF + 13:00:45 @ 0.5%+ GA + SA @ 50 ppm each 45 DAS.

Result and Discussion

Effect of water soluble fertilizer and growth regulator on plant nutrient concentration (at harvest)

Total nitrogen content and total uptake at harvest

The effects of foliar application of water soluble fertilizer and growth regulator spray on nitrogen content and uptake by black gram grain and straw are presented in table 01. The foliar application of water soluble fertilizer and growth regulator significantly influenced the nitrogen concentration in black gram grain. Total nitrogen concentration in grain was significantly higher in the treatment T_{10} RDF + 13:00:45 @ 0.5%+ GA + SA @ 50 ppm each 45 DAS (4.52%) and statistically at par with treatment T_7 RDF + 13:00:45 @ 0.5% + GA @ 50 ppm 27 DAS (4.51%) and T_8 RDF + 13:00:45 @ 0.5% + SA @ 50 ppm 27 DAS (4.51%). The treatment T_{10} RDF + 13:00:45 @ 0.5%+ GA + SA @ 50 ppm each 45 DAS was significantly superior over the treatments T_1 control (4.08%), T_2 RDF (4.22%), T_3 RDF + 00:52:34 @ 0.5% +GA @ 50 ppm 27 DAS (4.35%), T_4 RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 27 DAS (4.37%), T_5 RDF + 00:52:34 @ 0.5% + GA @ 50 ppm 45 DAS (4.34%), T_6 RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 45 DAS (4.49%) and T_9 RDF + 00:52:34 @ 0.5%+ GA + SA @ 50 ppm each 27 DAS (4.45%) respectively.

Table 1: Effect of water soluble fertilizer and growth regulator on content and total uptake of nitrogen in Black gram

Treatments	N content (%)		Total Uptake N (kg ha^{-1})
	Seed	Straw	
T_1: Control	4.08	1.23	35.40
T_2: RDF	4.22	1.37	44.68
T_3:RDF + 00:52:34 @ 0.5% +GA @ 50 ppm 27 DAS	4.35	1.38	61.31
T_4: RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 27 DAS	4.37	1.34	60.93
T_5:RDF + 00:52:34 @ 0.5% + GA @ 50 ppm 45 DAS	4.34	1.64	51.15
T_6: RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 45 DAS	4.49	1.67	66.70
T_7: RDF + 13:00:45 @ 0.5% + GA @ 50 ppm 27 DAS	4.51	1.93	70.62
T_8: RDF + 13:00:45 @ 0.5% + SA @ 50 ppm 27 DAS	4.51	1.92	61.11
T_9: RDF + 00:52:34 @ 0.5%+ GA + SA @ 50 ppm each 27 DAS	4.45	1.64	67.16
T_{10}: RDF + 13:00:45 @ 0.5%+ GA + SA @ 50 ppm each 45 DAS	4.52	1.95	58.27
SEm±	0.02	0.04	5.24
C.D.@5%	0.06	0.12	15.74

Similarly the nitrogen concentration in black gram straw was significantly higher in the treatment T_{10} RDF + 13:00:45 @ 0.5%+ GA + SA @ 50 ppm each 45 DAS (1.95%) and statistically at par with treatment T_7 RDF + 13:00:45 @ 0.5% + GA @ 50 ppm 27 DAS (1.93%) and T_8 RDF + 13:00:45 @ 0.5% + SA @ 50 ppm 27 DAS (1.92%). The treatment T_{10} RDF + 13:00:45 @ 0.5%+ GA + SA @ 50 ppm each 45 DAS was significantly superior over the treatments T_1 control (1.23%), T_2 RDF (1.37%), T_3 RDF + 00:52:34 @ 0.5% +GA @ 50 ppm 27 DAS (1.38%), T_4 RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 27 DAS (1.34%), T_5 RDF + 00:52:34 @ 0.5% + GA @ 50 ppm 45 DAS (1.64%), T_6 RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 45 DAS (1.67%), and T_9 RDF + 00:52:34 @ 0.5%+ GA + SA @ 50 ppm each 27 DAS (1.64%) respectively. The increased nitrogen supply through potassium nitrate may be the possible reasons for increased nitrogen concentration in grain and straw of blackgram with increasing levels of potassium nitrate spray.

The foliar application of water soluble fertilizer and growth regulator significantly influenced the nitrogen uptake in black

gram grain. The highest nitrogen uptake was observed in treatment T_7 RDF + 13:00:45 @ 0.5% + GA @ 50 ppm 27 DAS (70.62 kg ha^{-1}) which were and at par with treatment T_3 RDF + 00:52:34 @ 0.5% +GA @ 50 ppm 27 DAS (61.31 kg ha^{-1}), T_4 RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 27 DAS (60.93 kg ha^{-1}), T_6 RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 45 DAS (66.70 kg ha^{-1}), T_8 RDF + 13:00:45 @ 0.5% + SA @ 50 ppm 27 DAS (61.11 kg ha^{-1}), T_9 RDF + 00:52:34 @ 0.5%+ GA + SA @ 50 ppm each 27 DAS (67.16 kg ha^{-1}) and T_{10} RDF + 13:00:45 @ 0.5%+ GA + SA @ 50 ppm each 45 DAS (58.27 kg ha^{-1}) respectively. The treatment T_7 RDF + 13:00:45 @ 0.5% + GA @ 50 ppm 27 DAS was significantly superior over the treatments T_1 control (35.40 kg ha^{-1}), T_2 RDF (44.68 kg ha^{-1}) and T_5 RDF + 00:52:34 @ 0.5% + GA @ 50 ppm 45 DAS (51.15 kg ha^{-1}) respectively. Presented data indicates the effect of foliar application of calcium nitrate and potassium nitrate on increase nitrogen uptake. *et al*. (2018) [4] reported that potassium nitrate increased the concentration of nitrogen in crops, similarly reported by Pawar *et al*. 2015 [6] sorghum crop.

Total Phosphorus content and total uptake at harvest

The effects of foliar application of water soluble fertilizer and growth regulator spray on phosphorous content and uptake by black gram grain and straw are presented in table 02. The significant effect of water soluble fertilizer and growth regulator was observed on phosphorous concentration. Phosphorus concentration in grain and straw ranged between 0.45 to 0.59% and 0.15 to 0.21% respectively. The highest phosphorus concentration in black gram grain and straw was observed in treatment T_9=RDF + 00:52:34 @ 0.5%+ GA + SA @ 50 ppm each 27 DAS (0.59%) and (0.21%) respectively which was at par with treatment T_4 RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 27 DAS and T_5 RDF + 00:52:34 @ 0.5% + GA @ 50 ppm 45 DAS (0.57% and 0.58%) in seed phosphorus content and T_3 RDF + 00:52:34 @ 0.5% +GA @ 50 ppm 27 DAS (0.19%), T_4 RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 27 DAS (0.18%), T_5 RDF + 00:52:34 @ 0.5% + GA @ 50 ppm 45 DAS (0.20%) and T_6 RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 45 DAS (0.19%) in straw phosphorus content. Slightly increasing phosphorus concentration was observed with increasing level of water soluble fertilizer and growth regulator. *et al*. (2018) [4] reported that potassium nitrate increased the concentration of Phosphorus, similarly reported by Pawar *et al*. 2015 [6] sorghum crop.

Table 2: Effect of water soluble fertilizer and growth regulator on content and total uptake of phosphorus in Black gram

Treatments	P content (%)		Total Uptake P (kg ha^{-1})
	Seed	Straw	
T_1: Control	0.45	0.15	4.03
T_2: RDF	0.48	0.16	5.12
T_3: RDF + 00:52:34 @ 0.5% +GA @ 50 ppm 27 DAS	0.54	0.19	7.89
T_4: RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 27 DAS	0.57	0.18	8.02
T_5: RDF + 00:52:34 @ 0.5% + GA @ 50 ppm 45 DAS	0.58	0.20	6.62
T_6: RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 45 DAS	0.53	0.19	5.87
T_7: RDF + 13:00:45 @ 0.5% + GA @ 50 ppm 27 DAS	0.47	0.16	6.76
T_8: RDF + 13:00:45 @ 0.5% + SA @ 50 ppm 27 DAS	0.45	0.17	5.83
T_9: RDF + 00:52:34 @ 0.5%+ GA + SA @ 50 ppm each 27 DAS	0.59	0.21	8.79
T_{10}: RDF + 13:00:45 @ 0.5%+ GA + SA @ 50 ppm each 45 DAS	0.48	0.16	5.63
SEm±	0.01	0.01	0.48
C.D.@5%	0.03	0.03	1.44

The effect of foliar application of water soluble fertilizer and growth regulator on total uptake of phosphorus was significant. The highest phosphorus uptake was observed in the treatment T_9 RDF + 00:52:34 @ 0.5%+ GA + SA @ 50 ppm each 27 DAS (8.79 kg ha^{-1}) which was at par with treatment T_3 RDF + 00:52:34 @ 0.5% +GA @ 50 ppm 27 DAS (7.89 kg ha^{-1}) and T_4 RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 27 DAS (8.02 kg ha^{-1}). The phosphorous lowest uptake was noticed with the treatment T_1 control (4.03 kg ha^{-1}). Shelake *et al*. (2011) [8] also reported that the foliar application of potassium nitrate and calcium nitrate decreases the total nutrient uptake of phosphorus by chickpea.

Total Potassium content and total uptake at harvest

The significant effect of water soluble fertilizer and growth regulator was observed on potassium concentration. The grain and straw concentration of black gram ranged between 1.55% to 1.98% and 1.46 to 1.78% respectively. Among the treatment tested, comparatively increased level of potassium content in grain and straw was observed more due to water soluble fertilizer and growth regulator. The potassium concentration in black gram grain and straw was observed to be higher in treatment T9 RDF + 00:52:34 @ 0.5%+ GA + SA @ 50 ppm each 27 DAS (1.98% and 1.78%) and the lowest potassium content in black gram grain and straw was observed in treatment T1 control (1.55% and 1.46%) respectively. Aslihan *et al*. (2011) [3] also reported that foliar application of potassium nitrate increased the concentration of potassium in plants under salinity stress.

The significant effect of water soluble fertilizer and growth regulator was observed on potassium uptake. Among the all treatments, foliar application of water soluble fertilizer and growth regulator (T_1 to T_{10}) enhance potassium uptake by black gram. The highest potassium uptake was observed in treatment T_9 RDF + 00:52:34 @ 0.5%+ GA + SA @ 50 ppm each 27 DAS (45.19 kg ha^{-1}) followed by treatment T_4 RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 27 DAS (40.05 kg ha^{-1}) and the lowest potassium uptake by black gram observed in treatment T_1 control (22.31 kg ha^{-1}). The increased potassium concentration may be attributed to the increased potassium nitrate and mono potassium phosphate concentration in the plant which may have particularly minimized the salt induced potassium stress in the plant leading to higher uptake of potassium. *et al*. (2018) [4] reported that potassium nitrate increased the concentration of potassium. The higher potassium uptake in the potassium nitrate treatments may be attributed to the potassium supply through potassium nitrate.

Grain yield: Grain yield was significantly influenced by different water soluble fertilizer and growth regulator. The significantly highest grain yield (972.09 kg ha^{-1}) was observed in treatment T_9 RDF + 00:52:34 @ 0.5%+ GA + SA @ 50 ppm each 27 DAS whereas the lowest grain yield (598.38 kg ha^{-1}) was observed in treatment T_1 control.

Straw yield: Straw yield was also significantly influenced by different water soluble fertilizer and growth regulator. The highest straw yield was observed due to different concentration foliar spray of water soluble fertilizer and growth regulator. The significantly highest straw yield (1457.92 kg ha^{-1}) was observed in treatment T_9 (RDF + 00:52:34 @ 0.5%+ GA + SA @ 50 ppm each 27 DAS). The lowest grain yield was observed in treatment T_1 (893.43 kg ha^{-1}) (Control).

Table 3: Effect of water soluble fertilizer and growth regulator on content and total uptake of potassium in Black gram

Treatments	K content (%)		Total Uptake K (kg ha^{-1})
	Seed	Straw	
T_1: Control	1.55	1.46	22.31
T_2: RDF	1.63	1.49	27.52
T_3: RDF + 00:52:34 @ 0.5% +GA @ 50 ppm 27 DAS	1.74	1.51	38.39
T_4: RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 27 DAS	1.86	1.55	40.05
T_5: RDF + 00:52:34 @ 0.5% + GA @ 50 ppm 45 DAS	1.91	1.67	33.21
T_6: RDF + 00:52:34 @ 0.5% + SA @ 50 ppm 45 DAS	1.84	1.54	29.91
T_7: RDF + 13:00:45 @ 0.5% + GA @ 50 ppm 27 DAS	1.81	1.60	40.18
T_8: RDF + 13:00:45 @ 0.5% + SA @ 50 ppm 27 DAS	1.63	1.58	33.04
T_9: RDF + 00:52:34 @ 0.5%+ GA + SA @ 50 ppm each 27 DAS	1.98	1.78	45.19
T_{10}: RDF + 13:00:45 @ 0.5%+ GA + SA @ 50 ppm each 45 DAS	1.95	1.66	34.75
S.Em±	0.02	0.04	2.26
C.D.@5%	0.08	0.13	6.72

Conclusion

Application of RDF + 00:52:34 @ 0.5%+ GA + SA @ 50 ppm each 27 DAS significantly increases growth parameters, such as plant height, leaf area and number of root nodules of black gram. The application of foliar nutrition helps to overcome the specific occurrence of stress and as a result of maximum vegetative growth due to optimized nutrition of the plant. Application of RDF + 13:00:45 @ 0.5% + GA @ 50 ppm 27 DAS significantly increases nutrient uptake of nitrogen and application of RDF + 00:52:34 @ 0.5%+ GA + SA @ 50 ppm each 27 DAS significantly increases nutrient uptake of phosphorus and potassium.

Reference

1. Amutha R, Nithila S, Kumar ST Management of source limitation by foliar spray of nutrients and growth regulators in black gram. Internat. J Plant Sci. 2012;7(1):65-68(2012).
2. Anonymous. Annual Research Report, ARS Badnapur, 2017. Report on pigeon pea research, ARS, Badnapur; c2017.p. 55.
3. Aslihan Esringü, Canan Kant, Ertan Yildirim, Huseyin Karlidag, Metin Turan. Ameliorative effect of foliar nutrient supply on growth, inorganic ions, membrane permeability and leaf relative water content of Physalis plants under salinity stress. Comm. Soil Sci. and Pl. Anay. 2011;42(4):408-423.
4. Lakshmi KV, Sree PS, Lakshmi VN, Vani MP, Chandrasekhar K. Effect of irrigation and foliar nutrition on growth, yield and nutrient uptake of black gram. International Journal of Current Microbiology and Applied Sciences; c2018, 7(6). ISSN: 2319-7706.
5. Manonmani V, Srimathi P. Influence of mother crop nutrition on seed and quality of blackgram. Madras Agric. J. 2009;96(16):125-128.
6. Pawar Anuradha PB, Adsul, Ganesh K, Gaikwad. Nutrient content, uptake and biochemical composition on kharif sorghum affected by soil and foliar zinc and iron in drought prone Marathwada area of Maharashtra. Indian Journal of Dryland Agricultural Research and Development. 2015;30(02):74-83.
7. Salisbury FB, Ross CW. Plant Physiology. 3rd ed. Wadsworth, Belmont, CA. 1985.p. 540.
8. Shelake SR, Takate AS, Kadlag AD, Kadam JR. Effect of foliar application of potassium nitrate and diammonium phosphate on moisture use efficiency, nutrient uptake and yield of chickpea under dry land condition. State level seminar on Potassium for better production and higher quality of crops at MPKV, Rahuri; c2011.
9. Thesiya MN, Chovatia PK, Kikani VL. Effect of potassium and sulphur on growth and yield of black gram [*Vigna mungo* (L.) hepper] under rainfed condition. Leg. Res. 2013;36(3):255-258.