The Pharma Innovation Journal 2022; 11(2): 3025-3029

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(2): 3025-3029

www.thepharmajournal.com
Received: 11-12-2021
Accepted: 15-01-2022

Mahesh
Department of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, Raichur, Karnataka, India

Sangeeta I Macha
Department of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, Raichur, Karnataka, India

NM Shakuntala
Department of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, Raichur, Karnataka, India

SR Doddagoudar
Department of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, Raichur, Karnataka, India

MV Ravi
Department of Soil science and Agricultural Chemistry, College of Agriculture, University of Agricultural Sciences, Raichur, Karnataka, India

Corresponding Author:
Mahesh
Department of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, Raichur, Karnataka, India

Effect of nutrients and growth regulator on growth, yield and economics of black gram in paddy fallow (*Vigna mungo* L.)

Mahesh, Sangeeta I Macha, NM Shakuntala, SR Doddagoudar and MV Ravi

Abstract
A field experiment was conducted during *Rabi* 2019-20 at farmer field kasbe camp, Raichur, Karnataka to assess the effect of foliar application of nutrients and growth regulator on growth, yield and economics of black gram. The experiment was conducted in RCBD (Randomized Complete Block Design) with three replications and eight treatments. The results revealed that foliar spray of T_6 {DAP (2%) + $ZnSO_4$ (0.5%) + $FeSO_4$ (0.5%) NAA + (40ppm)} has registered higher growth parameters *viz.*, plant heightand number of branches per plantat 30, 60 DAS and at harvest. Similarly the same treatments also recorded significantly highestseed yield parameters *viz.*, clusters per plant, pods per cluster, pods per plant, pod length, seeds per pod, seed yield per plant, seed yield per plot, seed yield per hectare. Whereas cost of cultivation, gross returns, net returns and B:C ratio were significantly highest at T_6 {DAP (2%) + $ZnSO_4$ (0.5%) + $FeSO_4$ (0.5%) NAA + (40ppm)} compared to control and other treatments.

Keywords: Foliar spray, blackgram, zinc, iron, DAP, growth regulator

Introduction
Black gram (*Vigna mungo* L.) is one of the important pulse crop grown throughout the country, also known as black matpe bean, urid, urd bean, udad dal, urad dal or urad. The crop is resistant to adverse climatic conditions and improves the soil fertility by fixing atmospheric nitrogen in the soil. It has been reported that crop produces equivalent to 22.10 kg of nitrogen per hectare, which has been estimated to be supplement of 59000 tons of urea annually. Black gram plays an important role in Indian diet, as it contains vegetable protein and supplement to cereal based diet. It is favourable short duration pulse crop as it thrives better in all seasons either as sole or as an intercrop.

India is the largest producer of black gram accounting for about 10 per cent of world black gram production. It is cultivated in an area of 50.31 lakh ha with a productivity of 500 kg ha^{-1}.Important states producing blackgram are Madhya Pradesh, Maharashtra, Rajasthan, Karnataka and Bihar. Karnataka ranks eighth in cultivation with an area of 1.38 lakh ha and productivity of 507 kg ha^{-1} (Anon, 2018) [2].

Due to uncertain monsoon, rice cultivation is not profitable as most of the fields are lying vacant after harvest of traditional long duration rice and before the sowing or the rainy season rice crop in the following year. The only option available to the farmers is to explore the pulse cultivation under poor soil fertile and moisture stress condition. Among the pulses, blackgram grows well in dry and moisture stress conditions, as it can be cultivated during December to April, Hence, black gram could be well fitted in regular sequential cropping system on the development of appropriate production technology. Several factors may be taken into account for increasing productivity of the crop. For maximizing the growth and seed yield, the eventual plant nutrient must be supplied in balanced form. The productivity of black gram is not sufficient enough to meet the domestic demand of the Indian population. Hence, there is a need for enhancement of the productivity of black gram by proper agronomic practices.

Several strategies have been initiated to boost the productivity of black gram. The promising one among them is foliar application of nutrients and growth regulators for exploiting genetic potential of the crop. Foliar application with micronutrient is credited with the advantage of quick and efficient utilization of nutrients, elimination of losses through leaching, nutrient fixation and regulation in uptake of nutrient by plants (Manonmani and Srimathi, 2009) [11].

This is considered to be an efficient and economic method of supplementing part of the nutrients requirements during critical stages. Diversion of food from sink to source and arresting of vegetative growth in blackgram is an essential criteria to obtain higher seed yield and quality (Chandrasekhar and Bangarusamy, 2003) [6].

Hence, there is an immediate need to study the influence of macro, micronutrient and growth regulator on growth, yield and seed quality components in blackgram to boost its productivity.

Material and Methods

A field experiment was conducted during *Rabi* 2019-20 at farmer field, Kasbe camp, Raichur, Karnataka. The experiment was carried out in Randomized Completely Block Design (RCBD) and replicated thrice. Experiment consists of eight treatments with different nutrients and growth regulator *viz.*, T_1: Control, T_2: Foliar spray of urea (1%) + DAP (2%), T_3: Foliar spray of DAP (2%) + $ZnSO_4$ (0.5%), T_4: Foliar spray of DAP (2%) + $FeSO_4$ (0.5%), T_5: Foliar spray of DAP (2%) + NAA (40ppm), T_6: Foliar spray of DAP (2%) + $ZnSO_4$ (0.5%) + $FeSO_4$(0.5%) + NAA (40ppm), T_7: Foliar spray of waste decomposer (20%), T_8: Foliar spray of pulse magic (10g/litre). Genetically pure seeds of blackgram cv. DU-1 was obtained from University of Agricultural Sciences, Dharwad, Karnataka, are used in the present investigation. The seeds were soaked in panchagavya solution (3%)for 5 hours then air dried to normal moisture at room temperature before one day of sowing then treated with *Rhizobium* culture half an hour before sowing. The treated seeds were sown at 30 cm between rows and 10 cm between plants to maintain optimum plant population. The recommended fertilizer dose of 25 N, 50 P_2O_5, and 25 K_2O kg ha^{-1} were applied as basal through urea, single super phosphate and muriate of potash in lines and incorporated at the time of sowing. Foliar application was done at flowering and pod filling stages of crop growth. The statistical analysis was done as per the procedure described by Panse and Sukhatme (1985) [14].

The price of the inputs prevailing during the experimental period was considered for working out the cost of cultivation and gross income. Gross return (Rs ha^{-1}) was obtained from the income realized from sale of seed and straw of blackgram based on current market rate. Net returns was worked out by subtraction of total cost of production from the gross returns.

Net returns (Rs. ha^{-1}) = Gross returns (Rs. ha^{-1}) - Cost of cultivation (Rs. ha^{-1}).

Benefit-cost ratio was worked out using the below formula.

$$\text{B: C ratio} = \frac{\text{Gross returns (Rs.ha}^{-1}\text{)}}{\text{Cost of cultivation (Rs.ha}^{-1}\text{)}}$$

Results and Discussion

Foliar spray of nutrients and growth regulator had a significant influence on plant growth, yield, yield attributing characters and economics of blackgram in paddy fallow. Plant height (cm) and number of branches $plant^{-1}$ are important determinants that decide the yield potential of crop plant. Foliar spray of nutrients and growth regulator had significantly influenced the plant height (cm) at 30, 60 DAS and at harvest. Among the various treatments T_6 (Foliar spray of DAP (2%) + $ZnSO_4$ (0.5%) + $FeSO_4$(0.5%) + NAA (40ppm) recorded significantly higher plant height (27.05 cm, 49.45 cm and 53.21 cm) at 30, 60 DAS and at harvest respectively. Among the treatments T_6 has recorded significantly higher number of branches $plant^{-1}$ (3.18, 5.59 and 6.93) at 30, 60 DAS and at harvest respectively, compared to control T_1 (26.25 cm, 38.17 cm, 42.41 cm, 2.95, 4.15 and 5.20 and respectively). It is evident from the results that foliar spray of T_6 improved growth parameters this variation in plant height may be due to foliar spray of NAA which promoted the growth of the plant by increasing plasticity of the cell wall followed by hydrolysis of starch to sugars and lowers the water potential of cell resulting in the entry of water into the cell causing elongation (Aucharmal *et al*., 2007) [4]. Increase in plant height also might be due to additional supply of major, minor nutrients and growth hormones through foliar spray collaborate with results of Dixit *et al*. (2008) [7]. Foliar spray of micronutrients (Fe and Zn) may improves the uptake of nutrients from soil that might have helped in enhancing plant growth, higher number of branches and enhanced growth due to increased cell division and other metabolic processes (Hugar and Kurdikeri, 2000) [8].

Among the various foliar sprays imposed to blackgram, T_6 recorded significantly highest seed yield parameters *viz.*, clusters $plant^{-1}$ (6.80), pods $cluster^{-1}$ (6.40), pods $plant^{-1}$ (31.40), pod length (6.20 cm), seeds pod^{-1} (6.80), seed yield $plant^{-1}$ (6.10 g), seed yield $plot^{-1}$ (0.853kg) and seed yield $hectare^{-1}$ (1016 kg/ha) compared to control (T_1) which recorded lowest seed yield parameters (4.80, 4.40, 22.60, 4.50 cm, 4.80, 4.65 g, 0.594 kg and 710.64 kg/ha kg respectively). The increased value for yield components like number of clusters per plant, pods per cluster, pods per plant were observed in plants sprayed with combination of DAP, NAA, $ZnSO_4$ and $FeSO_4$ might be due to adequate supply of nutrients at critical stages without physiological stress and fulfilment of the demand of the crop by higher assimilation and translocation of photosynthesis from source to sink might have increased number of branches per plant and dry matter per plant (Muthal *et al*., 2016) [13]. Similarly foliar spray of NAA also prevents premature dropping of flowers and pods, formation of adventitious root, helps in active growth of plants was noticed by Jeyakumar *et al*. (2008) [9] in blackgram. Our study indicated that foliar spray of nutrients and growth regulator in paddy fallow may enhanced the number of floral buds and prevents the floral shedding by maintaining optimum bio-physiological conditions in plants thus increases the number of clusters per plant and number of pods per cluster (Dixit and Elamathi 2007) [7]. The foliar spray of NAA and zinc sulphate aids plant growth hormones and enzyme system, which is necessary for chlorophyll production and leads to increased accumulation of carbohydrate and starch which in turn helps in seed formation (Ali *et al.* 2014) [1]. Foliar application of macro and micro nutrients at reproductive stage increases the translocation of photosynthates and ultimately helps in better filling of seeds in pods (Thakur *et al.* 2017) [22]. Increase in seed yield per plant, per plot and per hectare may be due to increase in yield attributes like higher number of clusters per plant, number of pods per plant and seed yield per plant. Application of DAP, $ZnSO_4$, $FeSO_4$ and NAA enhanced the growth parameters (plant height, number of leaf and number of branches) and there by increased the photosynthetic rate and translocation of metabolites to the reproductive sink thus, resulted in increased seed yield per. Similar results were observed in common bean by Muharrem Kaya *et al*. (2005) [12]. Increase in seed yield might be due to adequate supply of nutrients at different growth stages of the crop which helped in better absorption and translocation into the plant system more efficiently contributing to developing pods and proper filling up of seeds

thereby resulting in higher seed yield was reported by Shashikumar *et al.* (2013) [19] in blackgram. Micronutrients application enhances the uptake of nutrients like N, P, K and S was also reported by Ramesh *et al*. (2007) [16] in rice fallow blackgram. Foliar spray of nutrients and growth regulator influenced the cost of cultivation, net returns, gross returns and B:C ratio of blackgram. Among the treatments T_6 significantly recorded higher cost of cultivation (Rs. 22600 / ha), gross returns (Rs. 74981/ ha), net returns (Rs. 52381/ ha) and B:C ratio (1:3.32). However, The least cost of cultivation (Rs, 21415./ ha), gross returns (Rs. 52894 / ha), net returns (Rs. 31479 /ha) and B:C ratio (1:2.47) were observed in control. Despite the additional input cost involved, the substantial yield increment obtained with combined foliar spray resulted in higher net returns and gross returns. The higher gross returns, net returns and B:C ratio may be due to higher production and productivity in terms of yield (Shashikumar *et al*., 2013) [19]. Some of the early study also reported that the foliar spray of DAP, NAA and micronutrients significantly improved seed yield and highest benefit cost ratio was reported by Dixit and Elamathi (2007) [7] in blackgram. These results were in confirmity with Kunjammal and Sukumar (2019) [10] in greengram and Thakare *et al*. (2006) [21] in soybean.

Table 1: Effect of nutrients and growth regulator on plant height at different growth stages of paddy fallow blackgram cv. DU-1

Treatments	Plant height (cm)		
	30 DAS	60 DAS	At Harvest
T_1: Control	26.25	38.17	42.41
T_2: Foliar spray of urea (1%) +DAP (2%)	26.50	41.23	45.74
T_3: Foliar spray of DAP (2%) + $ZnSO_4$ (0.5%)	26.65	43.55	47.97
T_4: Foliar spray of DAP (2%) + $FeSO_4$ (0.5%)	26.72	45.48	49.65
T_5: Foliar spray of DAP (2%) + NAA (40ppm)	26.85	47.46	52.19
T_6: Foliar spray of DAP (2%) + $ZnSO_4$ (0.5%) + $FeSO_4$ (0.5%) + NAA (40ppm)	27.05	49.45	53.21
T_7: Foliar spray of waste decomposer (20%)	26.35	40.81	44.33
T_8: Foliar spray of pulse magic (10g/l)	26.90	49.24	52.68
Mean	26.65	44.42	48.52
S.Em. ±	0.01	0.68	0.74
C.D. @ 5%	NS	2.07	2.27

NS- Non significant
DAS- Days after sowing
DAP- Diamonium phosphate
NAA- Napthalene acetic acid

Table 2: Effect of nutrients and growth regulator on number of branches per plant at different growth stages of paddy fallow blackgram cv. DU-1.

Treatments	Number of branches per plant		
	30 DAS	60 DAS	At Harvest
T_1: Control	2.95	4.15	5.20
T_2: Foliar spray of urea (1%) +DAP (2%)	3.10	5.12	6.17
T_3: Foliar spray of DAP (2%) + $ZnSO_4$ (0.5%)	3.12	5.20	6.32
T_4: Foliar spray of DAP (2%) + $FeSO_4$ (0.5%)	3.14	5.31	6.44
T_5: Foliar spray of DAP (2%) + NAA (40ppm)	3.15	5.43	6.61
T_6: Foliar spray of DAP (2%) + $ZnSO_4$ (0.5%) + $FeSO_4$ (0.5%) + NAA (40ppm)	3.18	5.59	6.93
T_7: Foliar spray of waste decomposer (20%)	3.08	5.04	6.12
T_8: Foliar spray of pulse magic (10g/l)	3.16	5.51	6.72
Mean	3.11	5.17	6.31
S.Em. ±	0.01	0.08	0.09
C.D. @ 5%	NS	0.23	0.29

NS- Non significant
DAS- Days after sowing
DAP- Diamonium phosphate
NAA- Napthalene acetic acid

Table 3: Effect of nutrients and growth regulator on number of clusters per plant, pods per cluster and pods per plant of paddy fallow blackgram cv. DU-1.

Treatments	Clusters per plant	Pods per cluster	Pods per plant
T_1: Control	4.80	4.40	22.60
T_2: Foliar spray of urea (1%) +DAP (2%)	5.40	5.00	25.80
T_3: Foliar spray of DAP (2%) + $ZnSO_4$ (0.5%)	5.60	5.20	27.20
T_4: Foliar spray of DAP (2%) + $FeSO_4$ (0.5%)	5.90	5.50	28.10
T_5: Foliar spray of DAP (2%) + NAA (40ppm)	6.20	5.70	29.40
T_6: Foliar spray of DAP (2%) + $ZnSO_4$ (0.5%) + $FeSO_4$ (0.5%) + NAA (40ppm)	6.80	6.40	31.40
T_7: Foliar spray of waste decomposer (20%)	5.50	5.20	24.50
T_8: Foliar spray of pulse magic (10g/l)	6.50	6.20	30.80
Mean	5.80	5.40	27.50
S.Em. ±	0.087	0.081	0.41
C.D @5%	0.27	0.25	1.26

DAP- Diamonium phosphate
NAA- Napthalene acetic acid

Table 4: Effect of nutrients and growth regulator on pod length and seeds per pod of paddy fallow blackgram cv. DU-1.

Treatments	Pod length (cm)	Seeds per pod
T_1: Control	4.50	4.80
T_2: Foliar spray of urea (1%) +DAP (2%)	5.20	5.30
T_3: Foliar spray of DAP (2%) + $ZnSO_4$ (0.5%)	5.30	5.70
T_4: Foliar spray of DAP (2%) + $FeSO_4$ (0.5%)	5.40	5.90
T_5: Foliar spray of DAP (2%) + NAA (40ppm)	5.80	6.30
T_6: Foliar spray of DAP (2%) + $ZnSO_4$ (0.5%) + $FeSO_4$ (0.5%) + NAA (40ppm)	6.20	6.80
T_7: Foliar spray of waste decomposer (20%)	5.20	5.20
T_8: Foliar spray of pulse magic (10g/l)	6.10	6.50
Mean	5.50	5.80
S.Em. ±	0.082	0.09
C.D. @5%	0.25	0.27

DAP- Diamonium phosphate
NAA- Napthalene acetic acid

Table 5: Effect of nutrients and growth regulator on seed yield per plant, seed yield per plot and seed per hectare of paddy fallow blackgram cv. DU-1.

Treatments	Seed yield per plant (g)	Seed yield per plot (kg)	Seed yield per hectare (kg/ha)
T_1: Control	4.65	0.594	710.64
T_2: Foliar spray of urea (1%) +DAP (2%)	5.14	0.686	835.42
T_3: Foliar spray of DAP (2%) + $ZnSO_4$ (0.5%)	5.22	0.708	843.48
T_4: Foliar spray of DAP (2%) + $FeSO_4$ (0.5%)	5.38	0.729	868.48
T_5: Foliar spray of DAP (2%) + NAA (40ppm)	5.74	0.780	928.64
T_6: Foliar spray of DAP (2%) + $ZnSO_4$ (0.5%) + $FeSO_4$ (0.5%) + NAA (40ppm)	6.10	0.853	1016
T_7: Foliar spray of waste decomposer (20%)	5.10	0.694	826.32
T_8: Foliar spray of pulse magic (10g/l)	5.90	0.832	990.56
Mean	5.40	0.734	877.44
S.Em. ±	0.01	0.011	12.98
C.D. @5%	0.03	0.033	39.77

DAP- Diamonium phosphate
NAA- Napthalene acetic acid

Table 6: Effect of nutrients and growth regulator on cost of cultivation, gross returns, net returns and benefit cost ratio of paddy fallow blackgram cv. DU-1

Treatments	Cost of Cultivation (Rs ha^{-1})	Gross Returns (Rs ha^{-1})	Net returns (Rs ha^{-1})	Benefit cost Ratio (Rs ha^{-1})
T_1: Control	21415	52894.87	31479.87	2.47
T_2: Foliar spray of urea (1%) +DAP (2%)	22085	61931.33	39846.33	2.80
T_3: Foliar spray of DAP (2%) + $ZnSO_4$ (0.5%)	21890	62579.60	40689.60	2.86
T_4: Foliar spray of DAP (2%) + $FeSO_4$ (0.5%)	21715	64413.60	42698.60	2.97
T_5: Foliar spray of DAP (2%) + NAA (40ppm)	22245	68795.73	46550.73	3.09
T_6: Foliar spray of DAP (2%) + $ZnSO_4$ (0.5%) + $FeSO_4$ (0.5%) + NAA (40ppm)	22600	74981.00	52381.00	3.32
T_7: Foliar spray of waste decomposer (20%)	22305	61332.47	39027.47	2.75
T_8: Foliar spray of pulse magic (10g/l)	22515	73160.20	50645.20	3.25
Mean	22096.25	65011.10	42914.85	2.93

DAP- Diamonium phosphate
NAA- Napthalene acetic acid

Conclusion

From the above results it is concluded that foliar spray of T_6 (DAP (2%) + $ZnSO_4$ (0.5%) + $FeSO_4$(0.5%) + NAA (40ppm) at before flowering and pod filling stage was best over other treatments for improving crop growth, yield and economics of blackgram.

References

1. Ali B, Asghar A, Muhammad T, Shafaqat A. Growth, seed yield and quality of mungbean as influenced by foliar application of iron sulphate. Pak. J life soc. Sci. 2014;12(1):20-25.
2. Anonymous. Food and Agriculture organization, 2018.
3. Ashok Basave Gowda, Doddagoudar SR, Vasudevan SN, Patil MG, Arunkumar H. Effect of foliar spray of micronutrients and growth regulators on seed quality of onion. Int. J Curr. Microbiol. Appl. Sci. 2019;8(4):337-345.
4. Aucharmal SM, Bhosale SG, Pawar HD, Karanjkar PN. Growth and yield of black gram (*Vigna mungo*) as influenced by growth regulators. J Soil Crops. 2007;17(1):82-85.
5. Bhuker A, Singh N, Malik A, Mor VS, Bishnoi D. Effect of pinching and foliar sprays on seed yield and quality of dhaincha (*Sesbania aculeate*). Agronomy New Zealand, 2019, 49.
6. Chandrasekhar CN, Bangarusamy U. Maximizing the yield of mung bean by foliar application of growth

regulating chemicals and nutrients. Madras Agric. J 2003;90(1-3):142-145.
7. Dixit PM, Elamathi S. Effect of foliar application of DAP, micronutrients and NAA on growth and yield of green gram (*Vigna radiata* L.). Legume Res. 2007;30:305-307.
8. Hugar AB, Kurdikeri MB. Effect of application methods and levels of zinc and molybdenum on field performance and seed yield in soybean. Karnataka. J Agril. Sci. 2000;13(2):439-441.
9. Jeyakumar P, Velu G, Rajendiran C, Amutha R, Savery JR, Chidambaram, S. Varied responses of black gram (*Vigna mungo*) to certain foliar applied chemicals and plant growth regulators. Legume Res. 2008;31(2):110-113.
10. Kunjammal P, Sukumar J. Effect of foliar application of nutrients and growth regulator on growth and yield of green gram (*Vigna radiate* L.) Madras Agric. J 2019;10(12):106.
11. Manonmani V, Srimathi, P. Influence of mother crop nutrition on seed and quality of black gram. Madras Agril. J. 2009;96(16):125-128.
12. Muharrem Kaya, Mehmet Atak, Cemalettin Y, Ciftci Sebahattin Ozcan. Effect of pre-sowing seed treatment with zinc and foliar spray of humic acid on yield of common bean. Int. J Agril. Biol. 2005;7(6):875-878.
13. Muthal YC, Deshmukh SL, Sagvekar VV, Shinde JB. Response offoliar application of macro and micronutrients on growth, yield on quality of*kharif*reen gram (*Vigna radiate* L.) Int. J Trop. Agril. 2016;34(7):2137-2141.
14. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers, ICAR-New Delhi (India)., 1985, 167-174.
15. Parimala K, Anita G, Vishnuvardhan Reddy A. Effect of nutrient sprays on yield and seedling quality parameters of chickpea (*Cicer arietinum* L.) Plant Archives. 2009;13(2):735-737.
16. Ramesh N, Baradhan G, Ganapathy M. Effect of foliar nutrition on reproductive efficiency and grain yield of rice fallow pulses. Plant Archives. 2007;7(2):665-667.
17. Rathinavel K, Dharmalingam C, Selvan SP. Effect of seed pelleting on the productivity of rice fallow cotton (*Gossypium hirsutum*) cv. MCU-7. Adv. Plant. Sci. 2000;13(1):213-217.
18. Sharma P, Sardana V, Sukhvinder SK. Dry matter partitioning and source–sink relationship as influenced by foliar sprays in groundnut. The Bioscan. 2013;8:1171-1176.
19. Shashikumar RB, Salakinkop SR, Manjunatha Hebbar, Patil HY. Influence of foliar nutrition on performance of blackgram (*Vigna mungo* L.), nutrient uptake and economics under dry land ecosystems. Legume Res. 2013;36(5):422-428.
20. Sohrabi Y, Habibi A, Mohammadi K, Sohrabi M, Heidari G, Khalesro S, Khalvandi M. Effect of nitrogen fertilizer and foliar applied iron fertilizer at various stages on yield, yield component and chemical composition of soybean (*Glycine max* L. Merr.) seed. African journal of biotechnology. 2012;11(40):9599-9605.
21. Thakare KG, Chore CN, Deotale DD, Kambale PS, Lende SR. Influence of nutrients and hormones on biochemical and yield and yield contributing parameters of soybean. J. Soils Crops. 2006;16(1):210-216.
22. Thakur VS, Patil RP, Patil JR, Suma TC, Umesh MR. Influence of foliar nutrition on growth and yield of blackgram under rainfed condition. J Pharmacognosy Phytochem. 2017;6(6):33-37.
23. Vishnu R, Doddagoudar SR, Vasudevan SN, Basavegouda, Mallikarjun K. Influence of foliar spray of boron and plant growth regulators on hybrid seed yield and quality of bottle gourd. J Farm. Sci. 2019;32(3):274-277.