Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2020; 9(1): 627-630
Received: 01-11-2019
Accepted: 03-12-2019

Rahul Kumar Raushan
M.Sc. Scholar, Department of Agronomy, Dr. Rajendra Prasad Central Agricultural University Pusa, District- Samastipur, Bihar, India

Harendra Singh
Uni. Professor- Cum- Chief Scientist, Department of Agronomy, Tirhut College of Agriculture, Dr. Rajendra Prasad Central Agricultural University, Pusa, District- Samastipur, Bihar, India

Chandini
PhD. Scholar, Department of Agronomy, Bihar Agricultural University, Sabaur, District- Bhagalpur, Bihar, India

Bharati Upadhaya
Farm Manager, KVK, Birauli Dr. Rajendra Prasad Central Agricultural University Pusa, District- Samastipur, Bihar, India

Kaushal kishor
Assistant Professor cum Scientist, Department of Agronomy, Dr. Rajendra Prasad Central Agricultural University Pusa, District- Samastipur State- Bihar, India

Randhir Kumar
Ph.D. Scholar, Department of Agronomy, SHUATS, Uttar Pradesh, India

Corresponding Author:
Rahul Kumar Raushan
M.Sc. Scholar, Department of Agronomy, Dr. Rajendra Prasad Central Agricultural University Pusa, District- Samastipur, Bihar, India

Effect of foliar application of nutrients on yield and yield attributes of black gram (*Vigna mungo* L.) under rainfed condition

Rahul Kumar Raushan, Harendra Singh, Chandini, Bharati Upadhaya, Kaushal kishor and Randhir Kumar

Abstract
A field experiment was carried out during *kharif* season of 2018 at Research farm of Tirhut College of Agriculture, Dholi under Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur (Bihar) to study the "Effect of foliar application of nutrients on yield and yield attributes of black gram (*Vigna mungo* L.) under rainfed condition". The experiment was laid out in randomized block design with eight treatments and replicated thrice. Among the different foliar application of nutrients, NPK (18:18:18) @ 2% spray at flower initiation recorded significantly higher number of pods/plant, pod length, grain and straw yield compared to rest of the treatments. However, number of grains/pod, 100-seed weight and harvest index were not significantly influenced by foliar application of nutrients.

Keywords: Black gram, foliar spray of nutrients, yield and yield attributes

Introduction
Blackgram (*Vigna mungo* L.) is one of the important pulse crop grown throughout the country. It is popularly known as '*Urd bean'*. It needs hot and humid climate for its proper growth and development, hence, grown mainly in *kharif* season. Black gram is having perfect combination of all nutrients, which includes protein (25-26%), carbohydrate (60%), fat (1.5%), minerals, amino acids as well as vitamins (Jadhav *et al*., 2017) [3]. It is used as nutritive fodder especially for milch cattle. It is also used as a green manuring crop. In India, it is mainly grown in Andhra Pradesh, Madhya Pradesh, Maharashtra, Tamilnadu, Bihar, Uttar Pradesh, West Bengal, Odisha, Punjab, Haryana and Karnataka. The total area under black gram cultivation in India, is about 4.50 million hectares with a production of 2.93 million tonnes and productivity of 651 kg/ha during 2016-17(Anonymous, 2017a) [1]. In Bihar, the total area under black gram is 12983 hectares with a production of 11491 tonnes and productivity of 885 kg/ha during 2016-17 (Anonymous, 2017b) [2]. The yield potential of black gram is very low because of the fact that the crop is mainly grown in rainfed condition with poor management practices and also due to various physiological, biochemical as well as inherent factors associated with the crops. Apart from the genetic makeup, the physiological factors *viz.*, insufficient partitioning of assimilates, poor pod setting due to the flower abscission and lack of nutrients during critical stages at crop growth coupled with a number of pests and diseases (Mahala *et al*., 2001) [4] constitute the major constraints for the poor yield. As the productivity of black gram in our country is very low, there is need for enhancement of its productivity with proper agronomic practices. One among them is foliar application of nutrient sources for exploiting genetic potential of the crop. Several nutrient elements are readily absorbed by leaves when they are dissolved in water and sprayed on them. But the concentration of the nutrient solution has to be controlled, otherwise serious damage may results due to scorching of leaves. This is considered to be an efficient and economic method of supplementing part of nutrients requirement at critical stages. Zinc is one of the essential micronutrients needed by plants in small amount for its proper development. Sometimes, deficiency of zinc might result in significant reduction in crop yield and quality. Boron is also one of the critical micronutrient for the growth and health of all crops. It plays an important role in a diverse range of plants functions including movement of sugar or energy into growing parts of plants and pollination. Adequate boron is also required for effective nitrogen fixation and nodulation in legume crops. Foliar application is credited with the advantage of quick and efficient utilization of nutrients eliminating the losses through leaching, fixation and regulating the uptake of nutrients by plants (Manonmani and Srimathi, 2009) [5]. Salicylic acid is colourless crystalline organic acid widely used in organic synthesis and functions as a plant hormones.

It plays exclusive role in plant growth, flower induction and uptake of ions. It affects ethylene biosynthesis, stomatal movement and also reverses the affects of abscissic acid (ABA) on leaf abscission. In addition to this, it also enhances the level of photosynthetic pigments, photosynthetic rate and modifies the activity of some of the important enzymes as well. Therefore, keeping the above facts in view, the present investigation entitled "Effect of foliar application of nutrients on yield and yield attributes of black gram (*Vigna mungo* L.) Under rainfed condition" was conducted.

Material and Methods

The field experiment was conducted during *kharif* season of 2018 at the research farm of Tirhut College of Agriculture, Dholi, Dr. Rajendra Parsad Central Agricultural University, Pusa, Samastipur, Bihar. The experimental area falls under humid sub-tropical climatic zone, which is greatly influenced by monsoon. It is situated on the southern bank of the river *Burhi Gandak* at an altitude of 52.18 meter above mean sea level and lies at $25^0$39' N latitude and $85^0$40' E longitude.The experiment was laid out in randomized block design with eight treatments and replicated thrice. The treatment comprised as T_1-Control (water spray at flower initiation), T_2-NPK (18:18:18) @ 2% spray at flower initiation, T_3-Neem coated urea @ 2% spray at flower initiation, T_4-Neem coated urea @ 2% + salicylic acid @ 75 ppm spray at flower initiation, T_5-$ZnSO_4$ @ 0.5% spray at flower initiation, T_6-$ZnSO_4$ @ 0.5% spray at flower initiation followed by neem coated urea @ 2% after 7 days of first spray, T_7-Boron @ 0.25 ppm spray at flower initiation and T_8-Boron @ 0.25 ppm spray at flower initiation followed by neem coated urea 2% spray 7 days after first spray. The soil of experimental plot was alluvial and calcareous in nature and low in fertility status having pH-8.1, with low in available nitrogen (182.8 kg/ha) and available P_2O_5 (18.82 kg/ha) and medium in available K_2O (120.81 kg/ha). The basal dose of 20 kg N and 40 kg P_2O_5 and 20 kg K_2O was applied at the time of sowing. The agronomic ally popular black gram variety 'Pant U-31' was sown on 2nd August, 2018. A plot having uniform fertility and even topography was selected for the experiment. A pre-sowing irrigation was given before field preparation to obtained proper germination and establishment of the crop. Black gram variety 'Pant U -31' was sown in the *kharif* season, 2018 using the seed rate of 20 kg/ha. Seed was treated with fungicide, Thiram @ 2 g/kg of seed before sowing against fungal diseases. Plant to plant distance of 10 cm was maintained by thinning after 15 days of sowing. The recommended dose (20:40:20 kg N:P_2O_5:K_2O/ha) of fertilizer was applied. The required quantity of foliar nutrients and water for each plot were calculated to prepare the solution and sprayed uniformly by hand sprayer using conical shaped nozzle as per treatments. Two pickings were done by hand for complete harvest of mature pod per plot. The weight of grains and straw were recorded treatment wise and converted into quintal per hectare. Length of pods in cm in sampled five plants were recorded from base of pod to the tip of the pod with the help of metre scale and then averaged out. Number of pods in sampled five plants were counted. The average number were computed and expressed as number of pods per plant. A representative sample of 100-grains of black gram was sun dried at 15% moisture level from each plot and weighed in gram. Grain yield after threshing, cleaning and sun drying were taken and finally recorded in quintal per hectare. After picking the pods, the remaining portion of the plant was harvested. The straw yield was calculated after the plant was completely dried. For obtaining the final straw yield, weight of straw of the sampled plants were also added in the corresponding figures. The yield was then converted into quintal per hectare. The harvest index was calculated as the ratio of economic yield (grain) to biological yield (grain + straw). Its value was expressed in percentage, using the following formula.

$$\text{H.I. (\%)} = \frac{\text{Grain yield (kg/ha)}}{\text{Grain yield + Straw yield(kg/ha)}} \text{X100}$$

Result and Discussion

Yield attributes

The analysis of yield components help to understand better on the physiological basis and source-sink relationship of crop due to the effect of different foliar nutrition treatments adopted. The yield attributes of blackgram in this experiment includes *viz.*, number of pods/plant, number of seeds /pod, length of pod and 100-seed weight. However, application of NPK (18:18:18) @ 2% spray at flower initiation resulted in significantly higher number of pods per plant than other foliar spray treatments. It might be due to availability of nutrients through foliar application to the black gram crop which increased number of pods/plant. This might have significantly increased the number of pods/plant. Similar results were also reported by Venkatesh and Basu (2011) [8] for number of pods of chickpea. Among all the treatments, foliar application of NPK (18:18:18) @ 2% spray at flower initiation (T_2) was resulted in significantly higher length of pod followed by application of neem coated urea @ 2% spray + salicylic acid @ 75 ppm spray at flower initiation (T_4) while the least length of pods was recorded in control (T_1). It might be due to the application of nutrients at reproductive stage which helped in more translocation of photosynthetic from source to the developing pods which increased length of pod (5.61 cm). Similar result was found by Thakur *et al.* (2017) [7].The result showed that seeds/pod and hundred grain weight was not significantly influenced by the foliar application of different treatments. Since, number of seeds per pod and 100-seed weight is mainly governed by the inherent genetic makeup of cultivar, no significant variation among the treatments were noticed.

Table 1: Effect of foliar application of nutrients on yield attributes of black gram

Treatments	Yield attributes			
	pods/plant	Length of pod(cm)	grains/pod	100-seed weight (g)
T_1: Control (water spray at flower initiation)	30.38	4.11	5.48	4.32
T_2: NPK (18:18:18) 2% spray at flower initiation	37.21	5.12	7.16	5.41
T_3: Neem coated urea 2% spray at flower initiation	32.08	4.85	6.71	4.54
T_4: Neem coated urea 2% + salicylic acid 75 ppm spray at flower initiation	36.83	5.08	7.03	5.27
T_5: $ZnSO_4$ @ 0.5% spray at flower initiation	32.56	4.36	6.75	4.63
T_6: $ZnSO_4$ @ 0.5% spray at flower initiation followed by neem coated urea 2% spray 7 days after first spray	35.84	4.48	6.92	4.96

T_7: Boron 0.25 ppm spray at flower initiation	31.09	4.27	6.58	4.82
T_8: Boron 0.25 ppm spray at flower initiation followed by neem coated urea 2% spray 7 days after first spray	36.16	5.00	6.84	5.10
SEm±	1.38	0.19	0.31	0.23
CD (P=0.05)	4.24	0.57	NS	NS

Table 2: Effect of foliar application of nutrients on grain yield, straw yield and harvest index of blackgram

Treatments	Grain yield (q/ha)	Straw yield (q/ha)	Harvest index (%)
T_1: Control (water spray at flower initiation)	10.05	21.02	32.44
T_2: NPK (18:18:18) 2% spray at flower initiation	12.89	23.87	35.42
T_3: Neem coated urea 2% spray at flower initiation	11.27	21.53	33.65
T_4: Neem coated urea 2% + salicylic acid 75 ppm sprayat flower initiation	11.83	22.35	35.08
T_5: $ZnSO_4$ @ 0.5% spray at flower initiation	10.59	21.20	33.37
T_6: $ZnSO_4$ @ 0.5% spray at flower initiation followed by neem coated urea 2% spray 7 days after first spray	11.48	21.95	34.34
T_7: Boron 0.25 ppm spray at flower initiation	10.42	21.10	34.28
T_8: Boron 0.25 ppm spray at flower initiation followed by neem coated urea 2% spray 7 days after first spray	11.75	22.32	34.52
SEm±	0.34	0.49	0.88
CD (P=0.05)	1.05	1.51	NS

Effect on yield

Foliar application of nutrients had significant effect on the seed yield of black gram. The increase in yield was due to better growth of plant as evidenced by more number of branches/plant, number of pods/plant and more number of grains/pod. Among all the treatments, foliar application of NPK (18:18:18) @ 2% spray at flower initiation (T_2) recorded significantly higher grain yield (12.89 q/ha) as compared to rest of the treatments. It might be due to constant supply of nutrients due to foliar spray at reproductive stage of the crop and enhanced the yield components like number of pods/plant, number of seeds/pod, pod length and 100-seed weight, which had direct influence on the grain yield. It also might be due to increased uptake of nutrients by black gram by effective translocation of nutrients from source to reproductive area of crop. The lowest grain yield was recorded under control (T_1) which might be due to lack of adequate supply of phosphorus and nitrogen to the crop which in turn affected the growth and yield components of the crop and ultimately reduced the yield. The findings are in agreement with earlier findings of Shashi Kumar *et al.*, (2013) [6]. The increase in straw yield directly depends on vegetative growth of the plants. Application of NPK (18:18:18) @ 2% spray at flower initiation recorded significant superior straw yield over other treatments. It is mainly due to the higher plant height as well as dry matter accumulation. The maximum harvest index was recorded by application of NPK (18:18:18) @ 2% spray at flower initiation. It might be due to presence of nitrogen and phosphorus in NPK (18:18:18) @ 2% spray which were responsible in influencing the yield attributing characters like number of pods per plant and number of seeds per pod, which ultimately influenced the grain yield and hence harvest index increased.

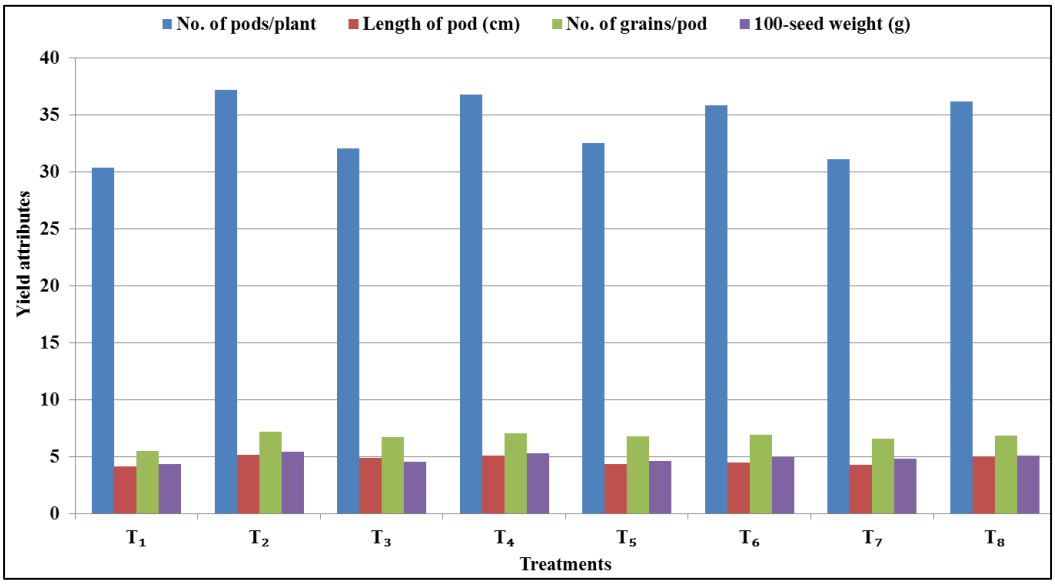

Fig 1: Effect of foliar application of nutrients on yield attributes of black gram

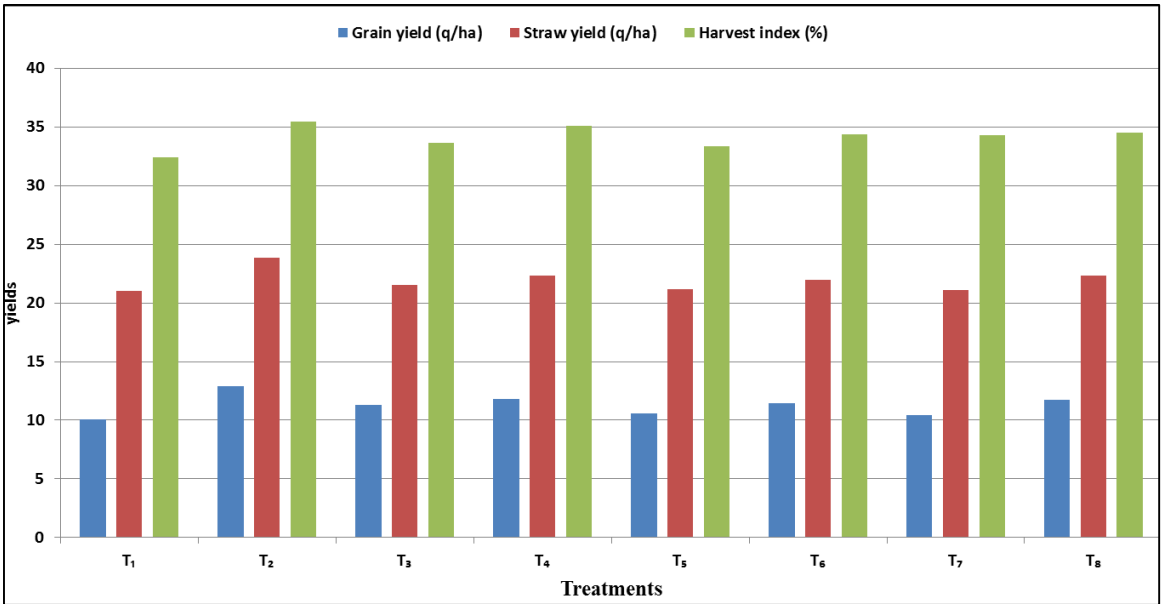

Fig 2: Effect of foliar application of nutrients on grain yield, straw yield and harvest index of black gram

Conclusion

It can be concluded that foliar application of NPK (18:18:18) @ 2% at flower initiation significantly increased yield and yield attributing characters of black gram *i.e.*, number of pods/plant, number of grains/pod and 100-seed weight, which results in higher grain and straw yield.

References

1. Anonymous. Ministry of Agriculture and Farmers Welfare, Govt. of India, 2017a.
2. Anonymous. Directorate of Economics and Statistics. Krishi.bih.nic.in, 2017b.
3. Jadhav SM, Takankhar VG, Raja D, Kumbhar CS. Influence of foliar nutrition on growth characters of black gram (*Vigna mungo* L.) under rainfed condition. Agriculture update. 2017; 12(8):2015-2020.
4. Mahala CPS, Dadheech RC, Kalahari RK. Effect of plant growth regulators and yield of black gram at varying levels of phosphorus. Crop Research. 2001; 18(1):163-165.
5. Manonmani V, Srimathi P. Influence of mother crop nutrition on seed and quality of black gram. Madras Agricultural Journal. 2009; 96(16):125-128.
6. Shashi kumar, Basavarajappa R, Salakinkop SR, Manjuuntha Hebber, Basavarajappa MP, Patil HY. Influence of foliar nutrition on performance of black gram (*Vigna mungo* L.), nutrient uptake and economics under dry land ecosystems. Legume Research. 2013; 36(5): 422-428.
7. Thakur V, Patil RP, Patil JR, Suma TC, Umesh MR. Influence of foliar nutrition on growth and yield of black gram under rainfed condition. Journal of Pharmacognosy and Phytochemistry. 2017; 6(6):33-37.
8. Venkatesh MS, Basu PS, Effect of foliar application of urea on growth, yield and quality of chickpea under rainfed conditions. Journal of Food Legumes. 2011; 24(2):110-112.