Influence of foliar application of nutrients on yield and yield attributesof Black gram (*Vigna mungo* L.)

ABSTRACT

The present experiment was laid out at research farm of R.A.K. College of Agriculture, Sehore (M.P.) during Kharif season of 2022.The experiment was laid out in a randomized complete block design with 8 treatments and each treatment replicated three times. The Blackgram (cv. Pratap -1) was sowing with a seed rate of 15 kg $ha^{-1}$and with a spacing of 30 cm x 10 cm . The recommended dose of chemical fertilizer viz. 20:40:20 kg ha^{-1}N: P_2O_5: K_2O, respectively was applied to the crop.Results revealed that foliar spray application of nutrient shows significant effect on yield and yield attributes. Treatment T_7(2% Spray of DAP + 0.5% Spray of $ZnSO_4$ at pre-flowering and pod initiation stage) found higher for yield and yield attributes *i.e.* number of pods/plant (13.67), number of seeds/pods (6.15), seed index (4.76 g), seed yield/plant (2.21 g), seed yield/plot (836 g), seed yield/ha (786 kg), straw yield (1730 kg/ha), biological yield (2516 kg/ha), harvest index (31.21 %). While, minimum values found with T_1(Water spray at pre-flowering stage and pod initiation stage).

Keywords: Black gram, foliar spray, harvest index, seed, yield.

Introduction:

Black gram (*Vigna mungo* L.) is commonly known as "Urad" in India. It is an annual pulse crop, widely grown grain legume and belongs to the family Fabaceae/ leguminaceae and assumes considerable importance from the point of food and nutritional security in the world. Black gram is native of India. It has been originated from *Phaseolussublobatus* a wild plant. It is one of the most highly prized pulse crops. It needs hot and humid climate for its proper growth and development hence grown mainly in Kharif season. It has been introduced to other tropical areas mainly by Indian immigrants. It has inevitably marked itself as the most popular pulse crop and can be most appropriately referred to as the "King of the pulses" due to its mouth watering taste and numerous other nutritional qualities (Jadhav *et al*., 2017). Black gram grain contains about 25.21% protein, 60% carbohydrates, 1.64% fat (USDA nutrition resources).

"About 70% of world's black gram production comes from India. In India, its total area, production and productivity is 4.63 million ha, 2.70 million tones and 570.27 kg/ha

respectively" (Agristats, 2022). "In India blackgram is very popularly grown in Andhra Pradesh, Bihar, Madhya Pradesh, Maharashtra, U.P., West Bengal, Punjab, Haryana, and Karnataka .It is used as nutritive fodder especially for milch cattle. In Madhya Pradesh its total area, production and productivity is 130.7 lakh ha, 43.937 lakh tonnes and 341 kg/ha respectively" (Anonymous 2022).

Foliar application is advantageous than soil application as it is most efficient way to feed the crop and stimulates root development and increases the resistance of the plant. Nutrients applied to the foliage are generally absorbed more rapidly and effectively than soil feeding. Foliar application provides a means of quickly correcting plant nutrient deficiencies, when identified on the plant. It often provides a convenient method of applying fertilizer materials especially those which are required in very small amounts and are highly soluble. When plant nutrients are applied straight to the foliage of plant, smaller quantities of the fertilizer material are required than when applying to the soil.

Materials and Methods:

Experimental site

The present experiment was laid out at research farm of R.A.K. College of Agriculture, Sehore (M.P.) during Kharif season of 2022. The experimental area having fairly uniform topography, normal fertility status and soil homogeneity.

Climate and weather condition

"Sehore is situated in the eastern part of Vindhyan Plateau in subtropical zone at the latitude of 23.1876° North and longitude of 77.0646° East at 498.77 m above mean sea level in Madhya Pradesh. The average rainfall varies from 1000 to1200 mm concentrated mostly from June to September. The mean annual maximum and minimum temperature are 31.16℃ and 18.50℃, respectively. The summer months are hot and May is the hottest month having a maximum temperature up to 45.60℃. Winter month experienced mild cold with an average temperature from 16.56℃ to 8.74℃, December is the coldest month as temperature reaches up to 5℃.The weekly meteorological data viz., rainfall, temperature, relative humidity and number of rainy days during crop season were recorded in meteorological observatory of R.A.K., College of Agriculture, Sehore. The data indicated that during the crop season total rainfall was 1771.5 mm concentrated in 57 rainy days with maximum and minimum rainfall, ranged from 399.3 mm to 9.0 mm was observed in $34^{th}$and 35^{th}standard meteorological week, respectively". [25] The maximum temperature ranged from 33.10^0C to 27.48^0C was observed

in 36thand 33thstandard meteorological week, respectively, and the minimumtemperature ranged from 20.84^{0}C to 24.27^{0}C was observed in 41th and 37rd meteorological standard week, respectively.

Treatment details T_1:- Water spray at pre-flowering stage and pod initiation stage, T_2:- 2% Spray of Urea at pre-flowering stage and pod initiation stage (N), T_3:- 2% Spray of DAP at pre-flowering stage and pod initiation stage (N, P), T_4:- 2% Spray of NPK (18:18:18) at pre-flowering stage and pod initiation stage(N, P, K), T_5:- 0.5% Spray of $ZnSO_4$ at pre-flowering stage and pod initiation stage (Zn, S), T_6:- 2% Spray of Urea + 0.5% Spray of $ZnSO_4$ at pre-flowering stage and pod initiation stage (N, Zn, S), T_7:- 2% Spray of DAP + 0.5% Spray of $ZnSO_4$ at pre-flowering and pod initiation stage (N,P, Zn, S), T_8:- 2% Spray of NPK (18:18:18) + 0.5% Spray of $ZnSO_4$ at pre-flowering and pod initiation stage (N,P,K, Zn, S).

Statistical analysis

The data obtained on various parameters were tabulated and subjected to statistical analysis by the method suggested by Fisher (1921).

Results and Discussion

Effect of foliar application of nutrients on yield and yield attributes

In general, crop yield depends on the accumulation of photo assimilates during the growing period and the way they are partitioned between desired storage organs of plant. In the present study, it was revealed that the application of nutrients significantly increased the test weight (g), seed yield plant^{-1} (g), seed yield plot^{-1} (kg), seed yield ha^{-1} (q) and finally harvest index (%) over control.

Maximum number of pods per plant (31.33) was obtained with the application of 2% Spray of DAP + 0.5% Spray of ZnSO4 at pre-flowering and pod initiation stage (T_7). While the lowest number of pods plant^{-1} (11.40) was recorded under control treatment- water spray at pre-flowering stage and pod initiation stage. 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) for number of pods of chickpea. Decrease in the flower drop due to prolonged assimilatory activity of leaves might be another possible reason for higher number of pods/plant. Further, the foliage applied nitrogen and phosphorus at the initial stages, might have been effectively absorbed and translocated to the pods resulting in

more number of pods per plant. The results obtained by Solaiappan*et al*. (2002) in red gram are concomitant to the present finding.

Seed index (4.76 g) recorded under 2% Spray of DAP + 0.5% Spray of $ZnSO_4$ at pre-flowering and pod initiation stage (T_7) was found maximum and minimum seed index (3.95 g) was recorded under control treatment- water spray at pre-flowering stage and pod initiation stage. It may be due to greater assimilating surface at reproductive development results in better grain formation because of adequate production of metabolites and their translocation towards grain. The improvement in nutrient concentration and their uptake in case of foliar spray is also indicative of similar influence. This might have resulted in increased weight of individual grain as expressed in terms of seed index. The results of present investigation are in close conformity with findings of Mandre *et al*. (2020), Mondal *et al*. (2011), Sritharan *et al*. (2007), Sritharan *et al*. (2005) and Reddy *et al*. (2005).

Maximum seed yield plant^{-1} (2.21 g) recorded under 2% Spray of DAP + 0.5% Spray of $ZnSO_4$ at pre-flowering and pod initiation stage (T_7) was found statistically similar with treatment T_8- 2% Spray of NPK (18:18:18) + 0.5% Spray of $ZnSO_4$ at preflowering and pod initiation i.e. 2.07 g. Minimum seed yield plant^{-1} (1.64 g) was recorded under control treatment- water spray at pre-flowering stage and pod initiation stage. "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". [25] The findings are in agreement with earlier findings of Shashikumar *et al*., (2013) and Ramesh *et al*. (2016).

It was observed from the results that the treatment T_7 (2% Spray of DAP + 0.5% Spray of $ZnSO_4$ at pre-flowering and pod initiation stage) recorded significantly higher grain yield (834 g plot^{-1}) which was statistically similar with treatment T_8 (2% Spray of NPK (18:18:18) + 0.5% Spray of $ZnSO_4$ at pre-flowering and pod initiation) (804 g plot^{-1}). The lowest grain yield was recorded by treatment T_1 (Water spray at pre-flowering stage and pod initiation stage) i.e. 619 g plot^{-1}. 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 findings are in agreement with earlier findings of Shashikumar *et al*., (2013) and Ramesh *et al*. (2016).It might be due to the fact that DAP application contributed towards overall biomass production under rainfed condition and it also might be due to the enhancement in growth and yield parameter as well as uptake of nutrients by crop. Obviously, cumulative effects of these parameters might have contributed to increased grain yield potential of the black gram. This confirms the finding of Mondal *et al*. (2011), Sritharan *et al*. (2007), Sritharan *et al*. (2005), Bhowmick *et al*. (2014), Venkatesh *et al*., (2012), Mondal *et al*., (2012), Rajavel and Vincent (2009), Jeyakumar *et al*. (2008) and Malay and Bhowmick (2008). The similar results are also reported by Anu Lavanya (2011) in green gram, Sengupta *et al*. (2011) in soybean and Tahir *et al*. (2014) in mash bean.

Straw yield

Data on straw yield of black gram is affected by different foliar treatments. Straw yield is directly related with increase in vegetative growth of the plant. It was observed from the data that the treatment T_7 recorded significantly higher straw yield (1730 kg ha^{-1}). The treatment T_8 (1718 kg ha^{-1}) and T_6 (1654 kg ha^{-1}) were found at par with treatment T_7 and rest of treatments found significantly lower straw yield. However, the lowest straw yield was recorded with treatment T_1 (1445 kg ha^{-1}) which was significantly inferior to the rest of the treatments. It mainly due to the higher plant height as well as dry matter accumulation. The increase in straw yield is directly related mainly to increase in the vegetative growth of the plant. It was mainly due to the maximum plant height. It might be due to continuous supply of nutrients as basal and as nutrient spray which in turn increased the leaf area and dry matter accumulation resulting in higher straw yield. This is also attributed to higher nutrient uptake throughout the crop growth period. Similar finding is confirmed with the report of Mondal *et al*. (2011), Sritharan *et al*. (2007), Sritharan *et al*. (2005), Mondal *et al*., (2012), Rajavel and Vincent (2009) and Malay and Bhowmick (2008).

Table 1:- Effect of foliar application of nutrients on yield attributes, yield and harvest index in black gram

Treatment	Number of pods plant^{-1}	Number of seeds pod^{-1}	Seed index (g)	Seed yield plant^{-1} (g)	Seed yield (g plot^{-1})	Straw yield (Kg ha^{-1})	Biological yield (Kg ha^{-1})	Harvest Index (%)
T_1	9.20	4.39	3.95	1.64	619	1445	2026	28.77
T_2	10.40	4.83	4.46	1.90	721	1581	2258	30.04
T_3	11.40	4.88	4.50	1.95	749	1592	2294	30.68
T_4	9.47	5.02	3.99	1.87	681	1440	2080	30.77
T_5	10.20	5.30	4.44	1.89	705	1543	2204	30.04
T_6	11.73	5.40	4.54	1.95	761	1654	2367	30.10
T_7	13.67	6.15	4.76	2.21	836	1730	2516	31.21
T_8	12.60	5.69	4.55	2.07	804	1718	2474	30.54
S.Em (±)	**0.28**	**0.15**	**0.05**	**0.06**	**0.02**	**36.96**	**53.59**	**0.36**
CD (5%)	**0.86**	**0.44**	**0.16**	**0.17**	**0.06**	**112.10**	**162.54**	**NS**

Biological yield

The biological yield of black gram was significantly affected due to different foliar nutrition treatments. The foliar nutrition with of treatment T_7 recorded significantly higher biological yield (2516 kg ha^{-1}) which was statistically at par with the treatment T_8 (2474 kg ha^{-1}) and T_6 (2367 kg ha^{-1}) and rest of treatments found significantly lower biological yield. However, the lowest straw yield was recorded with treatment T_1 (2026 kg ha^{-1}) which was significantly inferior to the rest of the treatments. "The increased haulm yield might be due to continuous supply of nutrients which could have increased the leaf area and dry matter resulting in higher haulm yield" (Kuttimani and Velayutham, 2011).

Harvest index (%)

It is revealed from the data that non-significant variation was observed in harvest index due to different foliar nutrition. Harvest index varied from 28.77 % to 31.21 %. The higher harvest index (31.21 %) was observed in treatment T_7 -2% Spray of DAP + 0.5% Spray of $ZnSO_4$ at preflowering and pod initiation stage. While the lowest harvest index (28.77 %) was obtained within control plot (Water spray at pre-flowering stage and pod initiation stage). This could be due to nitrogen and phosphorous influencing yield-attributing characteristics such as pods per plant and seeds per pod, which in turn influenced grain yield and straw output.**Conclusion**

Blackgram is the most important pulse crop cultivated in India. It is cultivated majorly under rainfed condition in energy starved situation. Hence there is a need to increase the production potential of blackgram under rainfed condition. From the present investigation application of 2% Spray of DAP + 0.5% Spray of $ZnSO_4$ at pre-flowering and pod initiation stage (T_7) can be recommended to produce the economically sound yield under rainfed condition.

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