International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(4): 1329-1332

Received: 03-05-2020
Accepted: 07-06-2020

R Shalem Raju
Department of Crop Physiology, Agricultural College, Bapatla, Acharya N.G. Ranga Agricultural University, Bapatla, Andhra Pradesh, India

DP B Jyothula
Department of Crop Physiology, Agricultural College, Bapatla, Acharya N.G. Ranga Agricultural University, Bapatla, Andhra Pradesh, India

P Steffi
Department of Crop Physiology, Agricultural College, Bapatla, Acharya N.G. Ranga Agricultural University, Bapatla, Andhra Pradesh, India

V Dinesh Rahul
Department of Crop Physiology, Agricultural College, Bapatla, Acharya N.G. Ranga Agricultural University, Bapatla, Andhra Pradesh, India

Corresponding Author:
R Shalem Raju
Department of Crop Physiology, Agricultural College, Bapatla, Acharya N.G. Ranga Agricultural University, Bapatla, Andhra Pradesh, India

Yield and yield contributing components of Urdbean as influenced by boron molybdenum and nickel

R Shalem Raju, DP B Jyothula, P Steffi and V Dinesh Rahul

DOI: https://doi.org/10.22271/chemi.2020.v8.i4l.9784

Abstract
A field experiment was conducted on Yield and yield Contributing Components of Blackgram as influenced by boron molybdenum and nickel at Agricultural college farm, Bapatla during *rabi*, 2017-18. It consisted of eight treatments of micronutrient application *viz.*, control (T_1), B (T_2), Mo (T_3), Ni (T_4), B+Mo (T_5), B+Ni (T_6), Mo+Ni (T_7) and B+Mo+Ni (T_8) with randomized block design concept and replicated thrice. The results revealed that combined soil application of boron, molybdenum and nickel as basal resulted in the significantly increased and effected yield and yield contributing characters like Number of branches, Number of flowers plant^{-1}, Number of pods plant^{-1}, Pod length, number of seeds pod^{-1}, Pod weight plant^{-1}, test weight and seed yield ha^{-1} all the characters were timely recorded and the maximum increase in yield was obtained with B+Mo+Ni (T_8) (2144.5 kg ha^{-1}) application followed by B+Mo (T_5) (1973.0 kg ha^{-1}), Mo+Ni (T_7) (1912.7 kg ha^{-1}) and B+Ni (T_6) (1892.3 kg ha^{-1}). Ni application alone had no increasing effect on yield, while B (1389.7 kg ha^{-1}) and Mo (1526.0 kg ha^{-1}) application alone increased the yield.

Keywords: Blackgram, Micronutrients, Number of branches, Number of flowers plant^{-1}, Number of pods plant^{-1}, Pod length, number of seeds pod^{-1}, Pod weight plant^{-1}, test weight and seed yield ha^{-1}

Introduction
Pulses are one of the important groups of food crops in Indian agriculture after cereals and oilseeds, which also responsible for yielding large financial gains by amounting for a large part of the exports. Pulses are the important source of dietary protein with a protein content nearly twice as high as that of in cereals. They are also rich in iron, thiamine, riboflavin and niacin. Each plant of pulse crop is virtually a nature's mini nitrogen fertilizers that enable to meet its own requirements and benefit the succeeding crop. Black gram (*Vigna mungo* L. Hepper) also known as urdbean, urd and urad, is an important pulse crop grown throughout India.

Micronutrients play an important role in black gram production. Micronutrients are essential elements that are used by plants in small quantities to orchestrate a range of physiological functions. Boron plays a key role in sugar translocation, nitrogen fixation, protein synthesis, sucrose synthesis, cell wall composition, membrane stability and K+ transporter. In crop quality and yield, the role of boron in pollen germination and pollen tube growth is more important molybdenum is important for good foliage growth of higher plants. It involved in the process in nitrogen fixation, nitrate reduction and nitrogen metabolism. Molybdenum acts in enzyme system which brings about oxidation-reduction reactions, especially the reduction of nitrate to ammonia prior to amino acids and protein synthesis in the cells of plant besides activator of dehydrogenases and co-factor in the synthesis of ascorbic acid. Singh *et al*. (2014) [15] Nickel is an essential micronutrient for plant growth as a constituent of several metallo-enzymes such as urease, Ni deficiency in plants reduces urease activity, disturbs nitrogen assimilation, (Welch, 1991) [19]. When boron was supplied as foliar application at a concentration of 0.1% in greengram increase in yield was observed (Rajeev and Dinesh, 2014) [13]. (Alam *et al.*, 2017) [1] reported that application of B, Mo and Ni helps in the increase in yield and yield attribute characters.

Materials and Methods

A field experiment was conducted to the Yield and Yield Contributing Components of Urdbean as Influenced by Boron Molybdenum and Nickel at Agricultural College Farm, Bapatla during *Rabi* season of 2017-18. The experiment consisted of 8 treatments *viz.*, T_1- no micronutrient application (control), T_2- Borax @ 2.5 kg ha^{-1}, T_3- Ammonium molybdate @ 1.5 kg ha^{-1}, T_4- Nickel chloride @1 kg ha^{-1}, T_5- Borax @ 2.5 kg and Ammonium molybdate @ 1.5 kg ha^{-1}, T_6- Borax @ 2.5 kg and Nickel chloride @1 kg ha^{-1}, T_7- Ammonium molybdate @ 1.5 kg and Nickel chloride @1 kg ha^{-1}, T_8- Borax @ 2.5 kg, Ammonium molybdate @ 1.5 kg and Nickel chloride @1 kg ha^{-1} and applied as basal. It was laid in randomized block design and replicated thrice. The soil was neutral in reaction, low in salinity and nitrogen, medium in available phosphorus and organic carbon and very high in potassium. The standard packages of cultural practices were followed throughout crop growth period. Number of branches counted from 20 DAE to harvest at 20 days interval, number flowers were counted plant^{-1} at 4 DAE and yield attributes were recorded at harvest for every net plot five individual plants selected, tagged and collected data from them only. The crop was harvested at physiological maturity and the number of seed collected from the pods obtained from five tagged plants were collected, weighed and expressed as seed yield plant^{-1} in grams. Harvested plants were kept in the field for drying. After drying the pods, total pods from a plot were threshed and the resulted seed yield was calculated for a net plot area and it was computed and analyzed as per the statistical procedures given by Panse and Sukhatme (1985) [12] to hectare and expressed as kg ha^{-1}.

Results and Discussion

Number of Branches

The influence of boron, molybdenum and nickel basal application on number of branches plant^{-1} in blackgram at different DAE was found significant increase in branch number Table 1. At 20 DAE, the number of branches recorded varied from 1.0 to 2.0, high in the treatment of B+Mo+Ni which showed parity with B+Mo application and low in control. The next in order were T_6 (B+Ni) and T_7 (Mo+Ni) which showed parity with T_2 (B) and T_3 (Mo) and differed with nickel application and control. At 40 DAE, the number of branches recorded varied from 5.5 to 8.5 plant^{-1}. All treatments significantly increased the branch number over control, which resulted in less. Among the treatments, branch number was found paramount in plants supplied with three micronutrients (T_8) and less in T_2 and T_4. The branch number in other treatments was superior to T_2, T_4 and inferior to T_8. At 60 DAE, the least number of branches was observed in control, which was on par with that found in application of T_2, (T_3) and T_4 alone. The highest was observed in application of three nutrients, followed by T_5, which showed parity with T_6 and T_7. Finally at harvest, branch number was found less in control which showed parity with many of the treatments except T_8 (B,Mo and Ni), that showed the paramount value (9.5) followed by T_5(B and Mo-8.5).

To summarise based on the above results, it is clear that B, Mo and Ni application in blackgram increases the number of branches. The impact of independent application of these three micronutrients on branch number was on par with control. The combination application (T_5 to T_8) increased the branch number by 34.9, 19.0, 20.6 and 50.8 percent respectively. This greater increase in branch number with B, Mo and Ni application in combinations could be attributed to the increase in plant height caused by the three nutrients. These results were in concurence with the findings of Alam *et al.* (2017) [1] Devi *et al.* (2012) [4] and Malik *et al.* (2015) [8].

Number of Flowers Plant^{-1}

Application of B, Mo and Ni significantly influenced the number of flowers plant^{-1} in blackgram Table 1. The data collected on number of flowers at peak flowering stage i.e, at 40 DAE, showed significant differences among treatments. The flowers were less in control, found on par with boron (T_2) and nickel (T_4) application alone. More number of flowers were observed in the plants treated with three nutrients, significantly higher than the other treatments. The treatment T_5 showed more number of flowers after T_8 and then followed by T_6, T_7 and T_3 in the order. Besides this these treatments were found on par with one another.

In summary, these results indicated that application of B, Mo and Ni has the impact on flower formation in blackgram. The effect was greater when three nutrients were applied in combination compared to its individual application. B and Ni application didn't show remarkable increase in number of flowers over control, while Mo application increased it by 1.4 folds. Application of these nutrients in combination B+Mo, B+Ni, Mo+Ni and B+Mo+Ni increased the flower number plant^{-1} by 1.5, 15, 1.4 and 1.8 folds respectively. It is evident with the increase in number of flowers, that boron, nickel and molybdenum has positive effect on flowering. It might due to the involvement of boron in the induction of early flowering, restricting the problem of flower drop, flower abortion, increased photosynthetic efficiency and increased translocation of sugars, pollen germination and pollen tube growth. The results were in compliance with the findings of Suganiya *et al.*, 2015 [16] and Surendran (2015) [17].

Number of pods plant^{-1}

Application of B, Mo and Ni significantly influenced and increased the number of pods plant^{-1} in blackgram Table 1. The number of pods were less in control and the significantly higher pod number was observed in combined application of B+Mo+Ni (T_8) followed by (B+Mo), which showed parity with T_7 (Mo+Ni) and T_6 (B+Ni). The pod number noted in application of Mo (T_3) showed parity with T_6 (B+Ni) and T_2 (B) and superior to that obtained with nickel application.

In summary, these results indicated that application of B, Mo and Ni has the impact on pod number in blackgram. The effect was greater when these three nutrients were applied in combination compared to its individual treatments. The treatments T_2 to T_4 increased the number of pods by 21.6, 32.5 and 17.8 percent respectively and in combinations from T_5 to T_8 the increase in pod number was 53.8, 44.4, 50.6 and 64.3 percent respectively. These results suggested that among individual application, Mo showed greater impact, while in combination treatments B+Mo+Ni and B+Mo showed greater impact. These results were in concurrence with the findings of Rathi. (2016) [14] and Bagewadi *et al*. (2003) [3].

Pod length (cm)

Application of three micronutrients (B, Mo and Ni) also showed influence on pod length Table 2. The short pod length was observed in control. The significantly higher length was observed in T_8 (B+Mo+Ni) and next longer pod length was noticed in T_5 (B+Mo) which showed parity with T_7 (Mo+Ni), T_6 (B+Ni). Individual application resulted in pod length on par with each other, longer length was oserved in T_3 (Mo) which showed parity also with B+Ni application.

In summary these results indicated that application of B, Mo and Ni could result in production of longer pods. Individual application T_2 to T_4 increased the length by 1.06, 1.08, and 1.04 folds and combinations T_5 to T_8 increase the pod length by 1.13, 1.10, 1.12 and 1.18 folds, respectively. These findings were similar to that reported by many researchers Alam *et al.* (2017) [1] and Tahir *et al.* (2014) [18] who also observed the increased in pod length when micronutrients were applied in combination.

Pod weight plant^{-1}

Effect of B, Mo and Ni on pod weight in blackgram Table 2 was found significant. The lower pod weight plant^{-1} was observed in control which showed parity with B (T_2) and Ni (T_4) alone applications. The higher pod weight was noticed in T_8 (B+Mo+Ni), which showed parity with combined application of B+Mo (T_5), Mo+Ni (T_7) and the effect of T_6 was on par with T_5 and T_7. Mo individual application increased the pod weight over control.

Finally, these results suggested that application of B, Mo and Ni in blackgram as basal application increases the pod weight. Compared to individual treatments, combination treatments resulted in better effect. The application of B+Mo+Ni, B+Mo, Mo+Ni and B+Ni increased the pod weight by 57.1, 46.4, 42.8 and 41.4 percent respectively; Mo application increased it by 21.4 percent while the remaining T_2 and T_4 had no effect. This increase in pod weight can be attributed to the reason that increased photosynthetic efficiency increased the number and size of the pods and that resulted in increased pod dry matter. The similar results were reported by Alam *et al.* (2017) [1], Singh *et al.* (2014) [15] and Gad and Moez (2013) [5].

Number of seeds pod^{-1}

Number of seeds pod^{-1} significantly influenced by B, Mo and Ni Table 2 Number of seeds pod^{-1} recorded in T_2, T_3 and T_4 was found on par with control. All combination treatments increased the seed number over control and found on par with one another. It is evident from results that B, Mo and Ni increase the number of seeds pod^{-1} in blackgram. The increase in seed number was more in T_5 to T_8, which showed 1.32, 1.30, 1.30 and 1.36 folds increase, respectively. The increase in seed number could be due to the increase in pod length caused by the three nutrients. The results of the present investigation were in conformity with the findings of Alam *et al.*, 2017 [1], Pandey and Gupta, (2012) [11] and Alam and Islam, (2016) [2] who reported these three nutrients increased seed number pod^{-1}.

100 Seed weight (g)

The data presented in Table 1 indicted that the 100 seed weight obtained in all treatments was on par with control. This suggests that B, Mo and Ni had no remarkable effect on 100 seed weight. The results of present investigations in contrasting with the findings of Alam and Islam, (2016) [2] and Monem *et al.* (2009) [9] who reported B, Mo influenced the 100 seed weight.

Seed yield: kg ha^{-1}

The influence of micronutrient as basal application on seed yield of blackgram was found significant increased effects was observed Table 1. The lower seed yield was noticed in control and it showed parity with alone application of Ni (T_4) and the significantly higher seed yield was noticed in T_8 (B+Mo+Ni). The next higher seed yield was noticed in T_5 treatment (B+Mo) which showed parity with other combination treatments Mo+Ni (T_7) and B+Ni(T_6). Both Mo and B individual treatments increased the seed yield over control, higher in Mo treatment.

In summary, the results showed that application of micronutrients B, Mo and Ni improve the seed yield. The maximum yield was observed in combined application of three micronutrients by 1.6, 1.5 and 1.5 folds respectively, where as B and Mo individual application increased the yield by 1.1 and 1.2 folds, respectively. Ni application alone had no increasing effect on seed yield. The synergetic influence of these micronutrients help in augmenting nitrogen fixation and thus growth and yield of the crop. Working with different crops other researchers have also reported increased yield with application of B; Rajeev and Dinesh, 2014 [13] and other micronutrients Mo (Kumar *et al.*, 2018 [7]; Malik *et al.*, 2015 [8] and Ni (Gautam *et al.*, 2014 [6] and Naz *et al*, 2018 [10].

Table 1: Effect of micronutrients (B, Mo & Ni) on Number of Branches and number of flowers in Blackgram

Treatments	Number of Branches				Number of flowers plant^{-1}	No of Pods Plant^{-1}
	20 DAE	40 DAE	60 DAE	At harvest	40 DAE	At harvest
T1: Control	1.0	5.5	6.1	6.3	31.3	28.60
T2: Borax @ 2.5 Kg ha^{-1}	1.2	6.2	6.4	6.6	35.3	34.80
T3: Ammonium molybdate @ 1.5Kg ha^{-1}	1.2	6.4	6.6	6.8	44.6	37.90
T4: Ni Cl_2. $6H_2O$ @1.0 Kg ha^{-1}	1.1	6.1	6.3	6.4	33.9	33.70
T5: Borax @ 2.5 & Ammonium molybdate @ 1.5 Kg ha^{-1}	1.8	7.5	8.2	8.5	48.0	44.00
T6: Borax @ 2.5 & Ni Cl_2. $6H_2O$ @1.0 Kg ha^{-1}	1.4	6.8	7.6	7.5	45.7	41.30
T7: Ammonium molybdate @ 1.5 & Ni Cl_2. $6H_2O$ @1.0 Kg ha^{-1}	1.4	7.2	7.5	7.6	45.1	43.10
T8: Borax @ 2.5 & Ammonium molybdate @ 1.5 & Ni Cl_2.$6H_2O$ @1.0 Kg ha^{-1}.	2.0	8.5	9.0	9.5	55.6	47.00
SE(m)+	0.1	0.1	0.4	0.6	2.2	1.21
CD(0.05)	0.3	0.3	1.3	1.8	6.6	3.67
CV (%)	12.1	2.4	10.0	14.0	8.8	5.42

Table 2: Effect of micronutrients (B, Mo & Ni) on yield and yield components in Blackgram

Treatments	Pod weight per plant^{-1}	Pod length (cm)	No of seeds pod^{-1}	100 Seed weight (g)	Seed yield plant^{-1}(g)	Seed Yield (kg ha^{-1})
T1: Control	14.00	4.33	5.00	4.19	3.77	1257.1
T2: Borax @ 2.5 Kg ha^{-1}	16.00	4.58	5.20	4.22	4.17	1389.7
T3: Ammonium molybdate @ 1.5Kg ha^{-1}	17.00	4.69	5.40	4.24	4.58	1526.0

T4: Ni $Cl_2.6H_2O$ @1.0 Kg ha^{-1}	15.50	4.51	5.15	4.18	4.02	1341.5
T5: Borax @ 2.5&Ammonium molybdate @ 1.5 Kg ha^{-1}	20.50	4.93	6.60	4.27	5.92	1973.0
T6: Borax @ 2.5 & Ni $Cl_2.6H_2O$ @1.0 Kg ha^{-1}	19.80	4.80	6.50	4.26	5.68	1892.3
T7: Ammonium molybdate @ 1.5 & Ni $Cl_2.6H_2O$ @1.0 Kg ha^{-1}	20.00	4.87	6.50	4.27	5.74	1912.7
T8: Borax @ 2.5 & Ammonium molybdate @ 1.5 & Ni $Cl_2.6H_2O$ @1.0 Kg ha^{-1}.	22.00	5.13	6.80	4.30	6.43	2144.5
SE(m)+	0.69	0.06	0.14	0.05	0.12	40.4
CD(0.05)	2.09	0.17	0.43	0.16	0.37	122.6
CV (%)	6.60	2.00	4.16	2.15	4.20	4.2

Conclusions

Based on the results obtained in the present investigation it can be concluded that application of B, Mo and Ni improves the yield in blackgram. The maximum increase in yield was obtained with B+Mo+Ni (T_8) (2144.5 kg ha^{-1}) application followed by B+Mo (T_5) (1973.0 kg ha^{-1}), Mo+Ni (T_7) (1912.7 kg ha^{-1}) and B+Ni (T_6) (1892.3 kg ha^{-1}). Ni application alone had no increasing effect on yield, while B (1389.7 kg ha^{-1}) and Mo (1526.0 kg ha^{-1}) application alone increased the yield.

References

1. Alam MS, Ali KJ, Hoque A. Yield and Yield Component of Chickpea as Affected by Boron Application. Journal of Experimental Agriculture International. 2017; 15(2):1-9.
2. Alam MS, Islam MF. Effect of zinc and boron on seed yield and yield contributing traits of mungbean in acidic soil. Journal of Bioscience and Agriculture Research. 2016; 11(02):941-946.
3. Bagewadi PC, Ramaiah H, Krishnappa N, Balakrishna. Effect of nutrition and season on pod yield and seed quality of groundnut. Proceeding of National Workshop on Groundnut Seed Technology of Groundnut of RARS Raichur. 2003; 1:77-88.
4. Devi KV, Singh MS, Singh SB, Singh KK. Influence of Sulphur and Boron Fertilization on Yield, Quality, Nutrient Uptake and Economics of Soybean (Glycine max) under Upland Conditions. Journal of Agricultural Science. 2012; 4(4):1-10.
5. Gad N, Moez MRAE. Influenced of Molybdenum on nodulation, Nitrogen fixation and yield of Cowpea. Journal of Applied Sciences Research. 2013; 9(3):1498-1504.
6. Gautam S, Pandey SN, Srivastava MN. Effect of Ni on seedling growth, physiological attributes in black gram (*Vigna mungo*) in leaves. International Journal of Current Research. 2014; 6(9):8673-8676.
7. Kumar R, Tomar GS, Kumawat N, Singh SP. Effect of varieties, plant density and molybdenum on yield and economics of blackgram under rainfed condition of Chhattisgarh. International Journal of Chemical Studies. 2018; 6(1):1867-1870.
8. Malik K, Kumar S, Arya KPS. Effect of zinc, molybdenum and urea on growth and yield of mungbean (*Vigna radiata* L. Wilczek). Advance research journal of crop improvement. 2015; 6(1):59-65.
9. Monem AE, Sharaf M, Ibrahim I, Farghal, Sofy MR. Response of Broad Bean and Lupin Plants to Foliar Treatment with Boron and Zinc. Australian Journal of Basic and Applied Sciences. 2009; 3(3):2226-2231.
10. Naz H, Naz A, Ayesha, Ashraf S, Khan HH. Effect of Heavy Metals (Ni, Cr, Cd, Pb and Zn) on Nitrogen Content, Chlorophyll, Leghaemoglobin And Seed Yield In Chickpea Plants in Aligarh City, U.P., India. International Journal of Current Microbiology and Applied Sciences. 2018; (7):4387-4399.
11. Pandey N, Gupta B. The impact of foliar boron sprays on reproductive biology and seed quality of blacjgram. Journal of trace elements in Medicine and biology. 2012; 27(1):58-64.
12. Panse M, Sukhatme K. Statistical methods for Agricultural Workers. Indian Council of pearlmillet (*Pennisetum glaucum* (L.). Effect on yield and yield components. Annals of Arid Zone. 1978; 37(1):59-67.
13. Rajeev Padbhushan, Dinesh Kumar. Influence of Soil and Foliar Applied Boron on Green Gram in Calcareous Soils. International Journal of Agriculture, Environment & Biotechnology. 2014; 7(1):129-136.
14. Rathi BK. Effect of rhizobium, sulphur and micronutrients on the nodulation in black gram. Research front. 2016; (1):209-212.
15. Singh AK, Khan MA, Srivastava A. Effect of boron and molybdenum application on seed yield of mungbean. Asian Journal of Bio Science. 2014; 9(2):169-172.
16. Suganiya S, Kumuthini, Harrisb D. Effect of Boron on flower and fruit set and yield of ratoon Brinjal crop. International Journal of Scientific Research and Innovative Technology. 2015; 2(1):135-141.
17. Surendran U, Marimuthu S. Effect of nutrients and plant growth regulators on growth and yield of black gram in sandy loam soils of Cauvery new delta zone, India. Cogent Food & Agriculture. 2015; 1(1):1-9.
18. Tahir M, Sher A, Majeed MA. Effect of Molybdenum on yield and quality of blackgram (*Vigna mungo* (L.) Hepper). Pakistan journal of life and social sciences. 2014; 12(2):101-105.
19. Welch RM. Micronutrients in Agriculture (2nd Edn.). Soil Science Society of America Book Series, Madison, WI, 1991, 703–724.