RESEARCH ARTICLE

RESPONSE OF DIFFERENT LEVELS OF ZINC AND MOLYBDENUM ON GROWTH AND YIELD OF BLACKGRAM (*VIGNA MUNGO* L.) UNDER AGRO-CLIMATIC EAST UTTAR PRADESH

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Abstract: A field experiment was conducted during the *Zaid* season 2016 at the Crop Research farm of Agronomy, Naini Agricultural Institute, SHUATS, Allahabad (U.P.) to Field evaluatation of blackgram (*Vigna mungo* L.) under Agro-climatic zone of Allahabad. The experiment was conducted to find out the effect of different levels of zinc and molybdenum on growth and yield of blackgram (*Vigna mungo* L.) laid out in RBD with 9 treatment and 3 replications. The treatment consisted of three levels of zinc (0, 5 and 7.5 kg ha^{-1}), three levels of molybdenum (0, 0.5 and 1.0 kg ha^{-1}). results revealed that the maximum plant height (9.76 and 15.11 cm at 15, 30 DAS), number of branch (4.33 and 7.40 at 30 and 45 DAS), dry weight(0.80, 3.10, 6.73 and19.73 g at 15, 30, 45 and 60 DAS), test weight (40.23gm), harvest index (23.49 %) and grain yield(1.18 t ha^{-1}), However significantly the highest straw yield (4.14 t ha^{-1}) in (T_6) R.D.F + Zinc 5 kg ha^{-1} + Molybdenum 1.0 kg ha^{-1}.

Keywords: Blackgram, Zinc, Molybdenum

INTRODUCTION

Black gram (urdbean) is one of the important pulse crops grown throughout India. It is consumed in the from food 'dal' (whole or split, husked and unhusked) or parched. It is used as a nutritive folder especially for milch cattle .It is also used as a green manuring crop. Urd plant possesses deep root systems which binds soil particles and thus prevent soil erosion. Urad grain contains about 24 per cent protein, 60 per cent carbohydrates, 1.3 per cent fat, and is the richest among the various pulses in phosphoric acid, being five to ten times riche than in others. Black gram contributes 13% in total pulses area and 10% in total pulses production of India.

Urdbean [*Vigna mungo*(L.)Hepper] is an important *kharif* food legume, generally grown under marginal land by resource-poor farmers in west Bengal. Molybdenum is one of the most recognized nutrient elements considered to be essential for the growth of plant. Food insecurity in the 21st century will even increase due to heat and drought strees induced by the climate change, particularly in tropical and subtropical regions. Legumes are good and relatively cheaper source of proteins, carbohydrates and minerals for developing countries including India**.**

Pulses are one of the important segments of Indian agriculture after cereals and oilseeds. The split grains of the pulses called dahl are excellent source of high quality protein, essential amino acids, fatty acids, fibres, minerals and vitamins. Pulses also render improvement in soil health by enriching its N status, long term fertility and sustainability of the cropping systems. It meets up to 80% of its N requirement by biological/symbiotic nitrogen fixation (BNF) from air and leaves behind substantial amount of residual N and organic

matter for subsequent crops. Black gram (*Vigna mungo* L. Hepper) is an important pulse crop grown throughout India where micronutrients play an important role in its production.

Micronutrients play an important role in increasing yield of pulses and oilseed legumes through their effects on the plant itself and on the nitrogen fixing symbiotic process. Besides this, zinc is involved in auxin formation, activation of dehydrogenase enzymes and stabilization of ribosomal fractions while molybdenum is required for growth of most of the biological organisms including plants and animals (Shanti *et al.*, 2008), (Khan and Ved Prakash 2014)

MATERIAL AND METHOD

This experiment was conducted in the year 2016 during *Zaid* season at Crop Research Farm (CRF), Naini Agricultural Institute, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad. The geographical co-ordinates of Allahabad are $25^0 57^0$ N latitude and 87^0 19^0 E longitude and an altitude of 98 m above mean sea level. The area is situated on the south of the Allahabad (U.P.) on the side of the Yamuna River at Rewa road at a distance of about 5.0 km away from Allahabad city. All the facilities required for crop cultivation are available.

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The soil is experimental plot was sandy loam in texture having pH of 7.60 with low level of organic carbon 00.34 %, available medium level of P (13.5 kg ha^{-1}) and higher level of K (336 kg ha^{-1}). The experiment was laid out randomized block design, comprising of sixteen treatment combinations each replicated thrice.

The treatments consisted of three Zinc levels (0, 5 and 7.5 kg ha^{-1}) and three levels of molybdenum (0, 0.5 and 1.0 kg ha^{-1}) with recommended dose 20:60:20 NPK kg ha^{-1}. Total nine treatment combinations *viz.*, T_1 : R.D.F + Zinc 00 kg ha^{-1} + Molybdenum 00kg ha^{-1}, T_2 : R.D.F + Zinc 00 kg ha^{-1} + Molybdenum 0.5kg ha^{-1}, T_3: R.D.F + Zinc 00 kg ha^{-1} + Molybdenum 1.0 kg ha^{-1}, T_4 : R.D.F + Zinc 5 kg ha^{-1} + Molybdenum 00 kg ha^{-1}, T_5 : R.D.F+ Zinc 5 kg ha-1 + Molybdenum 0.5 kg ha^{-1}, T_6 : R.D.F + Zinc 5 kg ha^{-1} + Molybdenum 1.0kg ha^{-1}, T_7 : R.D.F+ Zinc 7.5 kg ha^{-1} + Molybdenum 00 kg ha^{-1}, T_8 : R.D.F+ Zinc 7.5 kg ha^{-1} + Molybdenum 0.5 kg ha^{-1}, T_9 : R.D.F+ Zinc 7.5 kg ha^{-1}+ Molybdenum 1.0 kg ha^{-1} . Five plants were taken from each plot to measure the plant height and yield attributes.

Statistical analysis

The value of table 'F at 5% level significance, where the treatment difference between were found significant the value of CD and CV % were also worked out to compare the treatment mean (Snedecor and Cochran 1967). At initial stage select random five plants from net plot area for further recording observations.

RESULT AND DISCUSSION

Effect of growth parameters on blackgram

Data presented in (Table-1) plant height at 15 DAS significantly higher in treatment (T_9): R.D.F+ Zinc 7.5 kg ha^{-1}+ Molybdenum 1.0 kg ha^{-1} with 9.76 cm. However at par with treatment (T_6): R.D.F + Zinc 5 kg ha^{-1} + Molybdenum 1.0kg ha^{-1}, (T_7): R.D.F+ Zinc 7.5 kg ha^{-1} + Molybdenum 00 kg ha^{-1} and (T_8): R.D.F+ Zinc 7.5 kg ha^{-1} + Molybdenum 0.5 kg ha^{-1}.

At 30 DAS, significantly the highest value of plant height (15.11 cm) in treatment (T_9) R.D.F+ Zinc 7.5 kg ha^{-1}+ Molybdenum 1.0 kg ha^{-1}. The increased in plant height under zinc treatment be due to its effect in the metabolism of growing plants, which may effectively explain the observed response of zinc application. Favorable response of zinc application on plant height has also been reported.

Significantly the highest plant dry weight at (15, 30, 45 and 60 DAS) was observed value (0.80, 3.10, 6.73 and 19.73 g $plant^{-1}$) in treatment (T_9) R.D.F+ Zinc 7.5 kg ha^{-1}+ Molybdenum 1.0 kg ha^{-1} respectively.

The increase in nodulation was observed as a result of enhanced and established root system following application of zinc (Pavadai *et al.* 2004).

With the respect significantly the highest number of branches at 30 and 45 DAS was observed value (4.33 and 7.40 plant $^{-1}$) in treatment (T_9) R.D.F+ Zinc 7.5 kg ha^{-1}+ Molybdenum 1.0 kg ha^{-1} respectively. It might be due to primary & secondary branches due to the its effect on structural component of nitrogenase, the enzyme activity involved in nitrogen fixation by root nodule bacteria of leguminous crops.

Yields attributes and yield of blackgram

The results indicated that treatment (Table-2) the effect of different levels of zinc and molybdenum on the significantly the highest value recorded in treatment (T_9) R.D.F + Zinc 7.5 kg ha^{-1}+ Molybdenum 1.0 kg ha^{-1} *viz.*, Grain yield (1.18 t ha^{-1}), and harvest index (23.49 %) with significantly higher test weight (40.23 g) same treatment. In case of test weight treatment (T_9) R.D.F + Zinc 7.5 kg ha^{-1}+ Molybdenum 1.0 kg ha^{-1} at par with treatment (T_4) R.D.F + Zinc 5 kg ha^{-1} + Molybdenum 00 kg ha^{-1}, (T_5) R.D.F+ Zinc 5 kg ha-1 + Molybdenum 0.5 kg ha^{-1}, (T_6) R.D.F + Zinc 5 kg ha^{-1} + Molybdenum 1.0kg ha^{-1}, (T_7) R.D.F+ Zinc 7.5 kg ha^{-1} + Molybdenum 00 kg ha^{-1} and (T_8) R.D.F+ Zinc 7.5 kg ha^{-1} + Molybdenum 0.5 kg ha^{-1} respectively. However significantly the highest straw yield (4.14 t ha^{-1}) was recorded in treatment (T_6) R.D.F + Zinc 5 kg ha^{-1} + Molybdenum 1.0kg ha^{-1} respectively.

The increased in yield might be due to positive effect of zinc on yield attributes as it plays an important role in metabolic process (Shanti *et al.* 2008 and Ahmed *et al.* 2013).

The increase in seed yield might be due to application of molybdenum enhancing nodule formation and thus, seed yield of the crop (Singh *et al.* 2008)

This might be attributed due to the active role of molybdenum in regulating synthesis and activity of nitrogenase enzyme and thereby governing nitrogen fixation in urdbean. Beneficial effect of B, Mo and Zn in french-bean (Kushwaha,1999), and Mo in soybean (Kumar and Singh, 1980) and urdbean (Mevada *et al.*, 2005 Chaudhary and Das,1996), Biswas *et al.*, (2009) was also reported earlier.

Table 1. Effect of different levels of zinc and molybdenum on growth attributes of blackgram (*Vigna mungo* L.)

Treatment combinations	Plant height (cm)		Dry weight (g) plant^{-1}				Number of branches plant^{-1}	
	15 DAS	30 DAS	15 DAS	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS

T_1 : R.D.F + Zinc 00 kg ha^{-1} + Molybdenum 00kg ha^{-1}	9.35	11.72	0.72	1.65	4.17	16.17	2.40	4.53
T_2 : R.D.F + Zinc 00 kg ha^{-1} + Molybdenum 0.5kg ha^{-1}	9.35	11.97	0.73	1.83	5.10	16.77	2.60	5.73
T_3 : R.D.F + Zinc 00 kg ha^{-1} + Molybdenum 1.0 kg ha^{-1}	9.33	12.49	0.74	2.59	5.63	18.37	3.47	6.80
T_4 : R.D.F + Zinc 5 kg ha^{-1} + Molybdenum 00 kg ha^{-1}	9.09	12.28	0.73	2.36	5.00	16.67	2.67	5.47
T_5 : R.D.F+ Zinc 5 kg ha^{-1} + Molybdenum 0.5 kg ha^{-1}	9.33	12.69	0.75	2.64	5.47	17.23	2.93	6.60
T_6 : R.D.F + Zinc 5 kg ha^{-1} + Molybdenum 1.0kg ha^{-1}	9.61	13.30	0.76	2.86	6.10	19.00	3.40	7.00
T_7 : R.D.F+ Zinc 7.5 kg ha^{-1} + Molybdenum 00 kg ha^{-1}	9.43	13.56	0.75	2.86	5.50	17.10	2.87	6.20
T_8 : R.D.F+ Zinc 7.5 kg ha^{-1} + Molybdenum 0.5 kg ha^{-1}	9.66	14.16	0.77	2.89	5.63	18.87	3.73	6.80
T_9 : R.D.F+ Zinc7.5 kg ha^{-1}+ Molybdenum 1.0 kg ha^{-1}	**9.76**	**15.11**	**0.80**	**3.10**	**6.73**	**19.73**	**4.33**	**7.40**
F test	S	S	S	S	S	S	S	S
SEd(_+)	0.16	0.07	0.01	0.04	0.05	0.12	0.14	0.09
CD (P=0.05)	0.35	0.15	0.01	0.08	0.11	0.25	0.29	0.19

Table 2. Effect of different levels of zinc and molybdenum on yield attributes of blackgram (*Vigna mungo* L.)

Treatment combinations	Test weight (g)	Harvest Index in %	Grain yield t ha^{-1}	Straw yield t ha^{-1}
T_1 : R.D.F + Zinc 00 kg ha^{-1} + Molybdenum 00kg ha^{-1}	39.17	21.38	1.01	3.71
T_2 : R.D.F + Zinc 00 kg ha^{-1} + Molybdenum 0.5kg ha^{-1}	39.27	22.55	1.10	3.80
T_3 : R.D.F + Zinc 00 kg ha^{-1} + Molybdenum 1.0 kg ha^{-1}	39.57	23.17	1.15	3.81
T_4 : R.D.F + Zinc 5 kg ha^{-1} + Molybdenum 00 kg ha^{-1}	39.87	22.57	1.08	3.71
T_5 : R.D.F+ Zinc 5 kg ha^{-1} + Molybdenum 0.5 kg ha^{-1}	39.87	21.98	1.11	3.96
T_6 : R.D.F + Zinc 5 kg ha^{-1} + Molybdenum 1.0kg ha^{-1}	40.17	22.03	1.17	**4.14**
T_7 : R.D.F+ Zinc 7.5 kg ha^{-1} + Molybdenum 00 kg ha^{-1}	39.97	21.98	1.09	3.87
T_8 : R.D.F+ Zinc 7.5 kg ha^{-1} + Molybdenum 0.5 kg ha^{-1}	40.00	22.94	1.13	3.84
T_9 : R.D.F+ Zinc7.5 kg ha^{-1}+ Molybdenum 1.0 kg ha^{-1}	40.23	23.49	1.18	3.84
F test	S	S	S	S
SEd(_+)	0.18	0.07	0.003	0.01
CD (P=0.05)	0.39	0.16	0.010	0.03

CONCLUSION

From the above findings it is concluded that among all the treatment combination of T_9 (R.D.F + Zinc7.5 kg ha^{-1} + Molybdenum1.0 kg ha^{-1}.) was found to be the best for obtaining maximum growth, yield and yield attributes of Blackgram.

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