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Effect of different levels of zinc and molybdenum on Crop Growth Rate and Protein content 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}). The Crop growth rate (g m^{-2}day^{-1}) and Protein Content (%) was recorded as 24.70 of black gram increased significantly and progressively with increase in different levels of zinc and molybdenum. Crop growth rate (g m^{-2}day^{-1}) at 15 DAS, 30 DAS, 45 DAS and 60 DAS was to be significant. The increased treatment T_9 = R.D.F+ Zinc7.5 kg/ha + Molybdenum1.0 kg ha^{-1} of maximum Crop growth rate (g m^{-2}day^{-1}) was recorded as 0.30, 0.85, 1.35, and 4.91, at 15 DAS, 30 DAS, 45 DAS and 60 DAS respectively, while minimum Crop growth rate (g m^{-2}day^{-1}) were T_1 = R.D.F + Zinc 00 kg/ha + Molybdenum 00 kg ha^{-1} Crop growth rate (g m^{-2}day^{-1}) was recorded as 0.27, 0.34, 0.93, and 4.45, at 15 DAS, 30 DAS, 45 DAS, and 60 DAS respectively and maximum Protein Content (%) was recorded as 24.70 in T_9 = R.D.F+ Zinc7.5 kg ha^{-1} + Molybdenum 1.0 kg ha^{-1} respectively, while minimum Protein Content (%) were T_1 = R.D.F + Zinc 00 kg ha^{-1} + Molybdenum 00 kg/ha Protein Content (%) was recorded as 23.80 respectively.
Key words: *Blackgram, zinc and molybdenum.*

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Blackgram crop grown in many part of India. This crop is grown in the cropping systems as a mixed crop, catch crop, sequential crop besides growing as sole crop under residual moisture conditions after the harvest of other summer crops under semi- irrigated and dry land conditions. Its seeds are highly nutritious with protein (25-26%), carbohydrates (60%), fat (1.5%), minerals, amino acids and vitamins. Seed are used in the preparation of many popular dishes. it is one of the most important components in the preparation of famous south Indian dishes, *e.g.,* dosa, idli, vada etc, besides, it adds about 42 kg nitrogen per hectare in soil. [1]. A large section of the people is vegetarian and they require a good supplement of protein in their diet. Pulse are richest in protein among the vegetarian food and they form a very important source of protein. Among the micro plant nutrients zinc plays a vital role in the synthesis of protein and nucleic acid and helps in the utilization of nitrogen and phosphorus in plant. Black gram and green gram in an important pulse crop grown throughout India where micronutrients play in important role in its production. [2, 3].

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.

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. The protein content of seed was estimated by the Lowry method.

The Crop growth rate (g $m^{-2}day^{-1}$) of black gram increased significantly and progressively with increase in different levels of zinc and molybdenum at 15 DAS, 30 DAS, 45 DAS and 60 DAS was to be significant. The increased treatment T_9 = R.D.F+ Zinc7.5 kg/ha + Molybdenum1.0 kg/ha of maximum Crop growth rate (g $m^{-2}day^{-1}$) was recorded as 0.30, 0.85, 1.35, and 4.91, at 15 DAS, 30 DAS, 45 DAS and 60 DAS respectively, while minimum Crop growth rate (g $m^{-2}day^{-1}$) were T_1 = R.D.F + Zinc 00 kg/ha + Molybdenum 00 kg/ha Crop growth rate (g $m^{-2}day^{-1}$) was recorded as 0.27, 0.34, 0.93, and 4.45, at 15 DAS, 30 DAS, 45 DAS, and 60 DAS respectively. The probable reason for dry matter accumulation $plant^{-1}$ may be due to beneficial effect of zinc and molybdenum. However the essential role of zinc has been established as a component of several enzymes concerned with carbohydrate and nitrogen metabolism, in addition to its involvement directly or indirectly in regulating the various physiological processes of plants[6-8]. Protein Content (%) of black gram increased significantly and progressively with increase in different levels of zinc and molybdenum was to be significant. The increased treatment T_9 = R.D.F+ Zinc7.5 kg/ha + Molybdenum1.0 kg/ha of maximum Protein Content (%) was recorded as 24.70 respectively, while minimum Protein Content (%) were T_1 = R.D.F + Zinc 00 kg/ha + Molybdenum 00 kg/ha Protein Content (%) was recorded as 23.80 respectively. The probable reason for Protein Content (%) may be due to beneficial effect of zinc and molybdenum. Similar finding for beneficial effects of applied Zn and Mo were also reported by Ram *et al.* [5].

Table 1: Effect of different levels of zinc and molybdenum on Crop growth rate (g $m^{-2}day^{-1}$) 15, 30,45 and 60 Days after sowing of blackgram (*Vigna mungo* L.)

Treatments Combination	0-15 DAS	15-30 DAS	30-45 DAS	45-60 DAS
T_1= R.D.F + Zinc 00 kg ha^{-1} + Molybdenum 00 kg ha^{-1}	0.27	0.34	0.93	4.45
T_2=R.D.F + Zinc 00 kg ha^{-1} + Molybdenum 0.5 kg ha^{-1}	0.27	0.41	1.21	4.32
T_3= R.D.F + Zinc 00 kg ha^{-1} + Molybdenum 1.0 kg ha^{-1}	0.27	0.69	1.13	4.72
T_4 = R.D.F + Zinc 5 kg ha^{-1} + Molybdenum 00 kg ha^{-1}	0.27	0.61	0.98	4.32
T_5 = R.D.F+ Zinc 5 kg ha^{-1} + Molybdenum 0.5 kg ha^{-1}	0.28	0.70	1.05	4.36
T_6 = R.D.F + Zinc 5 kg ha^{-1} + Molybdenum 1.0 kg ha^{-1}	0.28	0.78	1.20	4.78
T_7= R.D.F+ Zinc 7.5 kg ha^{-1} + Molybdenum 00 kg ha^{-1}	0.28	0.78	0.98	4.30
T_8= R.D.F+ Zinc 7.5 kg ha^{-1} +Molybdenum 0.5 kg ha^{-1}	0.28	0.79	1.02	4.82
T_9 = R.D.F+ Zinc7.5 kg ha^{-1} + Molybdenum1.0 kg ha^{-1}	0.30	0.85	1.35	4.91
f-test	**S**	**S**	**S**	**S**
S.E.D	**0.001**	**0.01**	**0.01**	**0.04**
C.D.	**0.01**	**0.03**	**0.45**	**0.08**

Table 2 : Effect of different levels of zinc and molybdenum on Protein Content (%) plant Days after sowing of blackgram (*Vigna mungo* L.)

Treatments Combination	Protein Content in %
T_1= R.D.F + Zinc 00 kg ha^{-1} + Molybdenum 00 kg ha^{-1}	23.80
T_2=R.D.F + Zinc 00 kg ha^{-1} + Molybdenum 0.5 kg ha^{-1}	23.90
T_3= R.D.F + Zinc 00 kg ha^{-1} + Molybdenum 1.0 kg ha^{-1}	23.80
T_4 = R.D.F + Zinc 5 kg ha^{-1} + Molybdenum 00 kg ha^{-1}	24.40
T_5 = R.D.F+ Zinc 5 kg ha^{-1} + Molybdenum 0.5 kg ha^{-1}	24.40
T_6 = R.D.F + Zinc 5 kg ha^{-1} + Molybdenum 1.0 kg ha^{-1}	24.30
T_7= R.D.F+ Zinc 7.5 kg ha^{-1} + Molybdenum 00 kg ha^{-1}	24.70
T_8= R.D.F+ Zinc 7.5 kg ha^{-1} +Molybdenum 0.5 kg ha^{-1}	24.60
T_9 = R.D.F+ Zinc7.5 kg ha^{-1} + Molybdenum1.0 kg ha^{-1}	24.70
f-test	**S**
S.E.D	**0.10**
C.D.	**0.21**

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