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Effect of different levels of n p k and molybdenum on soil Physico chemical properties and yield attribute of black gram (*Vigna mungo* L.) VAR. TAU-1

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Abstract
A field experiment was conducted during the *kharif* season of 2017 in black gram (var. TAU-1) at Research farm, Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, SHUATS, Allahabad (U.P.). The experiment was laid out in a Randomized Block Design with nine treatment combinations, consisting of three N P K levels (0, 25 and 50%) and Molybdenum (0, 25 and 50%). The treatment T_8 [50% NPK ha^{-1} + 50% Molybdenum] showed that plant height (40.80 cm), no. of leaves plant^{-1} (30.10) and pod length (9.90 cm), no. of seed pod^{-1} (10.10) and it also gave highest yield (6.80 q ha^{-1}). Also in post soil analysis, Organic carbon (0.55%), available nitrogen (340.23 kg ha^{-1}), phosphorus (30.80 kg ha^{-1}), potassium (205.83 kg ha^{-1}) and Molybdenum (0.30 ppm ha^{-1}) respectively were found significantly higher as compared to other treatment combination. The economy of different treatment concerned, the treatment T_6 provides highest net profit (₹ 19804.56) with cost: benefit ratio (1: 1.94).

Keywords: Black gram, NPK Levels, molybdenum, soil parameters

1. Introduction
Black gram (*Vigna mungo* L.) is one of the important pulse crops grown throughout India. Proper fertilization is essential to improve the productivity of black gram. It can meet its nitrogen requirements by symbiotic fixation of atmospheric nitrogen. It is a short duration crap and adaptability to off season, it fits well in many intensive crop rotation. Pulses are one of the second most important segments of Indian agriculture after cereals as they rich in protein and play vital role in human diet. In India, production of pulses is around 19.3 million tonnes with a very low average productivity of 764 kg ha^{-1}. Pulses are least preferred by farmers because of high risk and less remunerative than cereals; consequently, the production of the pulses is sufficiently low. Among pulses, black gram has increased from 1.87 m ha in 1971–72 to 3.11 m ha during 2012-13 with production level of 1.90 million tonnes by ESI, 2015.
Urdbean [*Vigna mungo* (L.)] is among the major pulses grown throughout the country during both in summer and rainy season. It is a self pollinated leguminous crop containing 24% protein, 60% carbohydrate, 1.3% fat, 3.2% minerals, 0.9% fibre, 154 mg calcium, 385 mg phosphorus, 9.1 mg iron and small amount of vitamin B-complex.
Urdbean contributes about 13 per cent of total area and 10 per cent production of pulses in our country. This crop is extensively grown in the states of Maharashtra (23.36%), Andhra Pradesh (18.50%), Uttar Pradesh (12.29%), Madhya Pradesh (11.86%), Tamil Nadu (8.64%) and Rajasthan (4.29%). It can be grown on all type of soils ranging from sandy loam to heavy clay except alkaline and saline soils. However, it does well on heavier soils such as black cotton soils which retain higher moisture for longer time.

Materials and Methods
The experiment was conducted in the research farm of Department of Soil Science and Agricultural Chemistry, SHUATS, Allahabad. The experimental site is located in the sub–tropical region with 25^0 28'46.14" N latitude, 81^0 54'49.95" E longitude and 98m above the mean sea level altitudes. The experiment was laid out in a Randomized Block Design with nine treatment combinations, consisting of three N P K levels (0, 25 and 50%) and Molybdenum (0, 25 and 50%). The Allahabad will be situated in South east of Uttar Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of

the location reaches up to 46 ^{0}C – 48 ^{0}C and seldom falls as low as 4 ^{0}C – 5 ^{0}C. The relative humidity ranged between 20 to 94 percent. The average rainfall in this area is around 1100 mm annually. The recommended dose of fertilizers such as Nitrogen (20 kg ha^{-1}), Phosphorus (40 kg ha^{-1}), Potassium (20 kg ha^{-1}) and Molybdenum (1 kg ha^{-1}) respectively were applied into the field. Half dose of nitrogen and full dose of phosphorus and potassium were applied before sowing of black gram. The Black gram Var. TAU-1 was sowing on 25th August, 2017. The data was calculated with their formula.

Results and discussions effect on growth and yield attributes

Among NPK and Molybdenum levels in blackgram, application of 50% NPK + 50% Molybdenum produced significantly higher growth attributes characters, i.e. plant height (40.80 cm), No. of leaves plant^{-1} (30.10), No. of pod plant^{-1} (30.80), No. of seed pod^{-1} (10.10), No. of nodules plant^{-1} (22.98), Plant Dry weight (11.70 g), Test weight (47.01 g) and Seed yield (6.80 q ha^{-1}) respectively. The increase in nodulation and nitrogen fixation leads to more plant height and Increase in number of leaves may be due to adequate nutrients supply which enhanced the vegetative growth of plant and subsequently the number of leaves. Similar findings were reported by Jat *et al.* (2012) [8].

Adequate supply of NPK and Molybdenum, which in turn help in vigorous vegetative growth of plants and subsequently increase the number of seed pod^{-1}, No. of nodules plant^{-1}, Plant Dry weight and Test weight through cell elongation, cell expansion, cell division, photosynthesis and turbidity of plant cell. Similar findings were also reported by Liu *et al*. (2005) and Meenu (2010) [10]. Application of NPK increased supply of major assimilated as well as micro nutrient to plants, Molybdenum also perform better when soil is well applied with nutrients. Similar results were also reported by Singh *et al.* (2016) [6] and Saravanan *et al*, (2013) [12]

Effect on soil parameters

The higher Organic carbon (0.74%), Nitrogen (340.23 kg ha^{-1}), Phosphorus (30.80 kg ha^{-1}), Potassium (205.83 kg ha^{-1}), Molybdenum (0.3 ppm ha^{-1}) respectively higher with application of 50% NPK + 50% Molybdenum. The increase in available Nitrogen in soil after crop harvest by N P K and Molybdenum might be due to increased efficiency of Nitrogen fixing capacity and nodule formation. Legumes have potential to improve soil nutrients status through biological nitrogen fixation and incorporation of biomass in to the soil as green manure. Similar findings were also recorded by Kumar *et al.,* (2008) [9] and Takase *et al.* (2011) [17]

On the basis of above findings it can be concluded that for obtaining higher seed yield, number of pod plant^{-1} and other growth and yield attributes were found to be the best treatment 50% NPK + 50% Molybdenum with blackgram variety TAU-1. These findings are based on 1 season; therefore, further trials may be required for considering it for recommendation.

Table 1: Effect of Different Levels of NPK and Molybdenum on their interaction on Growth and Yield attributes on Blackgram (*Vigna mungo* L.) Var. TAU-1

	Treatments	Growth attributes (65 DAS)					Yield attributes			
		Plant height (cm)	No. of leaves plant^{-1}	No, of pod plant^{-1}	No. of seed pod^{-1}	No. of nodules plant^{-1}	Fresh weight plant^{-1} (g)	Dry weight plant^{-1} (g)	Test weight plant^{-1} (g)	Seed yield (q ha^{-1})
T_0	0% NPK + 0% Mo	35.80	21.80	25.02	5.70	13.05	12.10	8.10	39.20	3.50
T_1	25% NPK + 0% Mo	35.90	22.50	25.73	6.10	14.90	13.90	8.60	39.97	4.05
T_2	50% NPK + 0% Mo	36.90	23.90	26.25	6.40	18.12	14.50	9.57	41.35	4.60
T_3	0% NPK + 25% Mo	38.70	25.05	27.02	7.43	19.50	15.10	9.92	42.40	5.20
T_4	25% NPK + 25% Mo	39.22	25.80	27.80	8.45	19.99	15.98	10.17	42.75	5.15
T_5	50% NPK + 25% Mo	40.40	27.00	28.72	8.80	20.80	17.05	10.75	43.60	5.35
T_6	0% NPK + 50% Mo	40.37	29.00	30.01	9.25	22.10	17.99	10.67	45.01	5.33
T_7	25% NPK + 50% Mo	39.10	29.90	30.45	9.30	22.70	19.10	11.01	45.85	6.08
T_8	50% NPK + 50% Mo	40.80	30.10	30.80	10.10	22.98	20.70	11.70	47.01	6.80
	SEd (±)	0.78	0.56	0.53	0.23	0.38	0.42	0.25	0.34	0.13
	CD (P=0.05)	1.66	1.19	1.13	0.48	0.80	0.90	0.53	0.72	0.28

Table 2: Effect of Different Levels of NPK and Molybdenum on their interaction on different Soil Observations after harvesting on Blackgram (*Vigna mungo* L.) Var. TAU-1

	Treatments	Soil Observations (After harvesting)											
		pH	EC (dSm^{-1})	% OC	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})	Mo (ppm ha^{-1})	B.D. (g/cm^3)	P.D. (g/cm^3)	% P.S.	% WHC
T_0	0% NPK + 0% Mo	7.00	0.16	0.55	295.55	20.90	130.98	0.05	1.17	2.23	45.72	56.28
T_1	25% NPK + 0% Mo	7.03	0.18	0.58	286.22	24.11	145.95	0.05	1.19	2.54	45.82	58.03
T_2	50% NPK + 0% Mo	7.00	0.18	0.64	286.20	27.50	153.43	0.05	1.22	2.30	49.00	53.56
T_3	0% NPK + 25% Mo	7.01	0.20	0.60	295.50	27.40	157.18	0.20	1.17	2.52	47.05	51.38
T_4	25% NPK + 25% Mo	6.80	0.22	0.64	284.26	27.90	168.40	0.20	1.18	2.32	50.80	54.81
T_5	50% NPK + 25% Mo	7.01	0.21	0.69	319.45	29.25	172.14	0.20	1.20	2.50	48.89	50.27
T_6	0% NPK + 50% Mo	6.62	0.20	0.67	320.65	29.05	190.86	0.29	1.07	2.40	49.02	53.27
T_7	25% NPK + 50% Mo	7.16	0.20	0.73	326.93	29.20	197.27	0.29	1.16	2.52	50.00	54.21
T_8	50% NPK + 50% Mo	7.20	0.24	0.74	340.23	30.80	205.83	0.30	1.19	2.31	48.18	59.05
	SEd (±)	0.12	0.04	0.02	1.55	0.55	1.61	0.001	0.07	0.17	1.3	2.5
	CD (P=0.05)	NS	NS	0.05	3.29	1.16	3.44	NS	NS	NS	2.7	5.2

Note: EC- Electronic Conductivity; OC- Organic Carbon; N-Nitrogen; P-Phosphorus; K-Potassium, Mo-Molybdenum; BD- Bulk Density, PD-Particle Density; PS - Pore Space; WHC- Water Holding Capacity

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