

Original Research Article

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Effects of Different Levels of NPK and Molybdenum on Soil Physico - Chemical Properties of Black Gram (*Vigna mungo* L.) Var. Shekhar-2

Amrita Markam*, Narendra Swaroop, Tarence Thomas and Soman Singh Dhruw

Department of soil science and Agricultural Chemistry, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, 211 007 (U.P.) India

*Corresponding author

ABSTRACT

The experiment was carried out at Department Soil Science and Agricultural Chemistry research farm SHUATS, Allahabad during *summer season* 2016-2017. The experiment was laid out in 3×3 factorial randomized block design with three replications, consisting of nine treatments. Treatment T₈ @ (25:40:40 kg NPK ha⁻¹ + 100g Molybdenum ha⁻¹) was to be best in data were recorded in post harvest soil as pH, EC (dSm⁻¹), O.C (%), Pore space (%), Bulk density (g/cm³), particle density (g/cm³), water holding capacity (%), nitrogen (kg ha⁻¹), phosphorus (kg ha⁻¹), potassium (kg ha⁻¹) and molybdenum (g ha⁻¹) which were as 7.39, 0.21, 0.77, 50.33, 1.19, 2.44, 59.14, 345.93, 32.10, 661.41, 15.81 respectively. Treatment T₆ @ (25:40:40 kg NPK ha⁻¹ + 0g Molybdenum ha⁻¹) was to be best in pore space (%) which were as 52.00. The treatment T₂ was to be best in particle density as 2.47 (g/cm³). Soil chemical properties as available N, P, K, S, EC and O.C were found to be significant but pH was non-significant. Soil physical properties as bulk density (g/cm³), particle density (g/cm³), pore space (%) and water holding capacity (%) were found to be significant.

Keywords

NPK, Molybdenum, Soil physico-chemical properties, Black gram.

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Introduction

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. Pulses improve soil health by enriching nitrogen status, long-term fertility and sustainability of the cropping systems. It meets up to 80% of its nitrogen requirement from symbiotic nitrogen fixation from air. 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. Black gram (*Vigna Mungo* L.), is one of

the important pulses crop, grown throughout the country. 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 MT (ESI 2015). This increase in production is mainly attributed to additional area brought under the crop as well as productivity gains (from 0.5 to 1.3 t ha⁻¹). Summer cultivation in northern India and winter cultivation in rice fallows in southern and coastal areas of the country also added to additional acreage. Black grams are widely considered as an excellent source of high quality protein with good digestibility and also contain water soluble vitamins and

minerals of dietary significance. The factors attributed for low yields of pulses in India as compared to the world productivity are non-availability of quality seeds of improved and short duration varieties, growing of pulses under marginal and less fertile soil with low inputs and without pest and disease management, growing of pulses under moisture stress, unscientific post harvest practices and storage under unfavourable conditions. Hence, there is a scope for improving the production potential of this crop by use of organic manures, inorganic manures and biofertilizers (Shrikant Vadgave, 2010). Integrated nutrient management includes the intelligent use of organic, inorganic, and on-line biological resources so as to sustain optimum yields, improve or maintain the soil physical and chemical properties, and provide crop nutrition packages which are technically sound, economically attractive, practically feasible and environmentally safe. The existing state blanket recommendation for crops does not ensure efficient and economic use of fertilizers, as it does not take into account the fertility variations resulting in imbalanced use of fertilizer nutrients. Among the various methods of fertilizer recommendations, the soil test based fertilizer recommendations is also appropriate practices to improve yield as well as soil nutrient status (Gayathri *et al.*, 2009). The present investigation was therefore initiated to work out the response of FYM, soil test based NPK, Sulphur and Mo along with Rhizobium on yield and yield attributes of black gram.

Urdbean [*Vigna mungo* (L.) Hepper] 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. Being a short duration crop, it fits well in various

multiple and intercropping systems. After removing pods, its plant may be used as good quality green or dry fodder or green manure. Being a legume, it also enriches soil by fixing atmospheric nitrogen. Urdbean contributes about 13 per cent of total area and 10 per cent production of pulses in our country. It is grown on 3.06 m ha area with a production of 1.70 m t and productivity of 555 kg ha⁻¹ in the country (DAC, 2014). 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 during *summer* season of 2016 at research field of Department of Soil Science and Agricultural Chemistry, Allahabad School of Agriculture SHUATS Allahabad. The experimental site is located in the sub-tropical region with 25° 27' N latitude 81° 51' E longitudes and 98 meter above sea level altitudes. The experiment was laid out in a 3×3 RBD factorial design with each three levels of NPK and Molybdenum with nine treatments, each consisting of three replicates. The total number of plots was 27 Black gram (*Vigna mungo* L.) were sown in *summer* season plots of size 2 x 2 m in order of Inceptisol and is alluvial in nature, both the mechanical and chemical analysis of soil was done before starting of the experiment to ascertain the initial fertility of the soil. The soil samples were randomly collected from 0-15 cm depths at randomly prior to tillage operations. The treatment consisted of nine combination of inorganic source of fertilizers T₀.@ (0:0:0 kg NPK ha⁻¹ + 0g M ha⁻¹), T₁.@ (0:0:0 kg NPK ha⁻¹ + 50g M ha⁻¹), T₂.@

(0:0:0 kg NPK ha⁻¹ + 100g M ha⁻¹), T₃.@ (12.5:20:20 kg NPK ha⁻¹ + 0g M ha⁻¹), T₄.@ (12.5:20:20 kg NPK ha⁻¹ + 50g M ha⁻¹), T₅.@ (12.5:20:20 kg NPK ha⁻¹ + 100g M ha⁻¹), T₆.@ (25:40:40 kg NPK ha⁻¹ + 0g M ha⁻¹), T₇.@ (25:40:40 kg NPK ha⁻¹ + 50g M ha⁻¹), T₈.@ (25:40:40 kg NPK ha⁻¹ + 100g M ha⁻¹).The source of NPK and Molybdenum as Urea, SSP, MOP and Sodium molybdate (Na₂MoO₄.2H₂O) respectively.

Results and Discussion

Physical properties

The result depicted in table 3 shows that the maximum bulk density of soil (g/cm³), was

found in T₆ which was 1.20 and minimum was found in T₇ which was 1.14 (g/cm³). The interaction effects of NPK and Molybdenum on bulk density (g/cm³) of soil were found significant. The results shows that the maximum particle density of soil (g/cm³), was found in T₁ which was 2.51 and minimum was found in T₀ which was 2.21 (g/cm³). The interaction effect of NPK and Molybdenum on particle density (g/cm³) of soil was found non-significant. The results shows that the maximum pore space (%) of soil, was found in T₄ which was 52.00 and minimum was found in T₀ which was 47.33 The interaction effect of NPK and Sulphur on pore space (%) of soil were found significant (Table 1).

Table.1 Physical analysis of soil

Particulars	Method employed	Results
Sand (%)	Bouyoucous Hydrometer	62.71
Silt (%)	method Bouyoucous (1927)	23.10
Clay (%)		14.19
Textural class	Core method	Sandy loam
Bulk density (g/cm ³)	Core method Muthuaval (1992)	1.23
Particle density (g/cm ³)	Graduated measuring cylinder Muthuaval (1992)	2.27
Pore Space (%)	Graduated measuring cylinder Muthuaval (1992)	48.53
Water holding capacity (%)	Graduated measuring cylinder Muthuaval (1992)	53.53

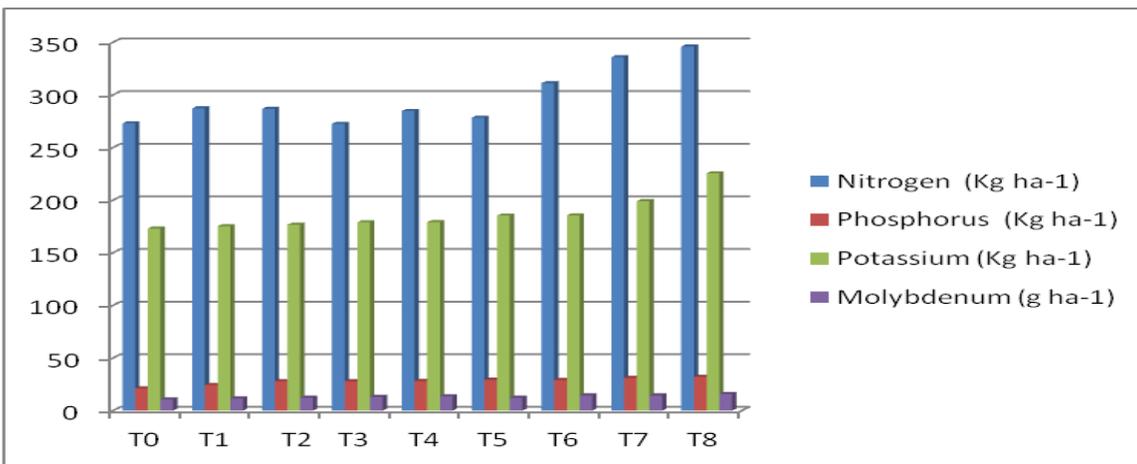
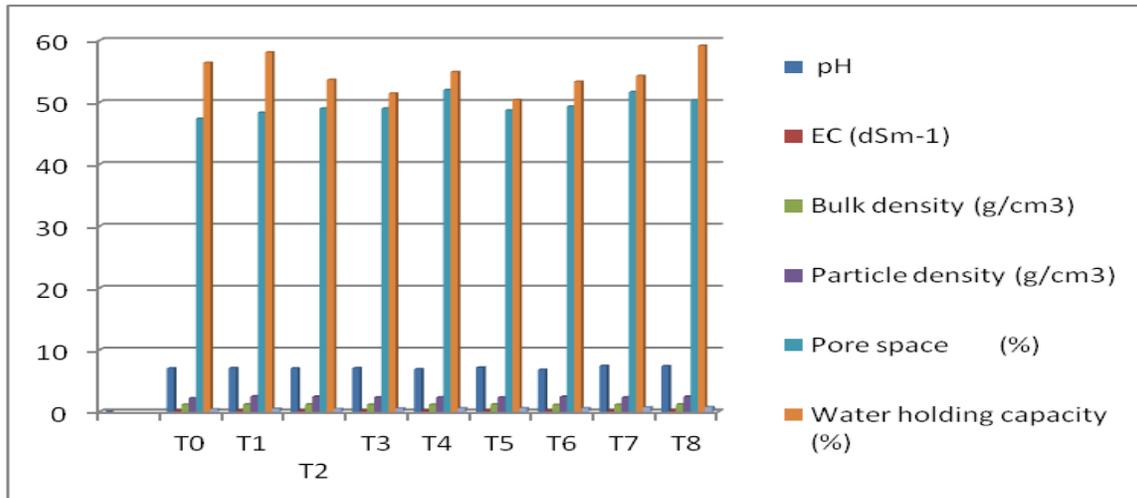
Table.2 Chemical analysis of soil

Particulars	Method employed	Results
pH (1:2)	Digital pH meter (Jackson, 1958)	7.59
EC (dSm ⁻¹)	EC meter (Digital Conductivity Meter) (Wilcox, 1950)	0.17
Organic Carbon (%)	(Walkley and Black's method, 1947)	0.48
Available Nitrogen (kg ha ⁻¹)	Alkaline potassium permanganate method (Subbiah and Asija, 1956).	215.23
Available Phosphorus (kg ha ⁻¹)	Colorimetric method (Olsen <i>et al.</i> , 1954)	20.33
Available Potassium (kg ha ⁻¹)	Flame photometric method (Toth and Prince, 1949)	126.65
Available Molybdenum (kg ha ⁻¹)	Colorimetric method (C.H Williams, 1955)	11.25

Table.3 Soil properties

Treatment	pH (w/v)	EC (dSm ⁻¹)	Bulk density (g/cm ³)	Particle density (g/cm ³)	Pore space (%)	Water holding capacity (%)	Organic Carbon (%)	Nitrogen (Kg ha ⁻¹)	Phosphorus (Kg ha ⁻¹)	Potassium (Kg ha ⁻¹)	Molybdenum (g ha ⁻¹)
T₀	7.00	0.18	1.17	2.21	47.33	56.38	0.40	272.99	21.15	173.03	10.70
T₁	7.05	0.19	1.19	2.51	48.33	58.08	0.50	287.22	24.34	175.27	11.54
T₂	7.00	0.19	1.20	2.47	49.00	53.64	0.47	286.82	28.00	176.73	12.34
T₃	7.05	0.20	1.18	2.34	49.00	51.42	0.53	272.52	27.96	179.06	13.16
T₄	6.88	0.18	1.18	2.33	52.00	54.89	0.57	284.68	28.07	179.18	13.65
T₅	7.16	0.18	1.20	2.33	48.67	50.37	0.60	278.35	29.30	185.35	12.27
T₆	6.82	0.20	1.14	2.44	49.33	53.34	0.60	311.17	29.11	185.49	14.54
T₇	7.41	0.20	1.16	2.33	51.67	54.29	0.70	335.83	31.10	199.14	14.48
T₈	7.39	0.21	1.19	2.44	50.33	59.14	0.77	345.93	32.10	225.53	15.81
F-test	NS	NS	S	NS	S	S	S	NS	S	S	S
S.Ed. (±)	0.258	0.011	0.045	0.165	0.614	0.729	0.027	5.251	1.008	6.380	0.428
C.D. (at 5%)	0.546	0.024	0.096	0.351	1.301	1.546	0.058	11.133	2.138	13.525	0.907

Graph.3 Soil properties



The results shows that the maximum water holding capacity (%) of soil, was found in T₈ which was 59.14 and minimum was found in T₁ which was 51.42. The interaction effect of NPK and Molybdenum on water holding capacity (%) of soil was were found significant.

Chemical properties

Response on pH and EC of soil after crop harvest

The result depicted in table 3. shows that the pH and EC shows that the maximum pH and EC of soil was found in T₇ which were 7.41 and 0.20 and minimum was found in T₀ which

were 7.00 and 0.18. The interaction effect of NPK and Molybdenum on pH and EC was found non-significant (Table 2).

Response of organic carbon, available nitrogen, phosphorus, potassium and molybdenum

(kg ha⁻¹, g ha⁻¹) of soil after crop harvest

The result depicted in table 3 shows that the maximum O.C. of soil was found in T₈ which was 0.77 and minimum was found in T₀ which was 0.40. The interaction effect of NPK and Molybdenum on O.C. of soil was found significant.

The available nitrogen, phosphorus, potassium and molybdenum (kg ha^{-1} , g ha^{-1}) in soil were found maximum in T_8 which were 362.80, 32.10, 661.41, 15.81, kg ha^{-1} and minimum was found in T_0 which were 272.52, 21.15, 169.13, 10.70, kg ha^{-1} respectively.

The interaction effect of NPK and Molybdenum on available nitrogen, potassium and molybdenum was found significant and available phosphorus, was found non-significant. Combined application of NPK and Molybdenum brings significantly increase in available Nitrogen, Potassium and molybdenum. The results are conformity with the finding of Khambalkar *et al.*, (2012).

It is concluded that Treatment combination T_8 was to be best in pH, EC (dSm^{-1}), O.C (%), and pore space (%) bulk density (g/cm^3), particle density (g/cm^3), water holding capacity (%) available nitrogen (kg ha^{-1}), phosphorus (kg ha^{-1}), potassium (kg ha^{-1}) and molybdenum (g ha^{-1}) which were as 7.39, 0.21, 0.77, 50.33, 1.19, 2.44, 59.14, 345.93, 32.10, 661.41, 15.81 respectively. Treatment T_6 was to be best in pore space (%) which were as 52.00 and treatment T_2 was to be best in particle density (g/cm^3) as 2.47. Soil chemical properties as available N, K, M and O.C. were found to be significant but pH, EC and available P, were found to be non-significant. Soil physical properties as bulk density (g/cm^3), particle density (g/cm^3) and percent pore space (%) were found to be significant

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