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EFFECT OF RHIZOBIUM, SULPHUR AND MICRONUTRIENTS ON THE NODULATION IN BLACKGRAM

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ABSTRACT

A field experiment was conducted to find out the effect of Rhizobium, sulphur and micronutrients on the nodulation in blackgram. Seed were first treated with Rhizobium while sulphur and micronutrients were applied at the time of sowing. The application of Rhizobium with sulphur and micronutrients (Zn, Mo & B) resulted in higher nodule weight as compared to control or any other combination. Use of Rhizobium, sulphur and micronutrients thus helped in increasing nitrogen content in pulses which ultimately increase protein content in pulses.

Key word- Blackgram, *Rhizobium*, Sulphur, Micronutrients, Nodulation.

INTRODUCTION

Pulses have been in focus in recent times due to the continuous upswing in their prices. Stagnant productivity coupled with declining availability has created substantial demand supply gap, forcing heavy import bill on the exchequer and affecting nutritional security of majority of the population for whom pulses are the one of the cheapest sources of protein. Besides serving as an important source of protein for a large portion of the global population, pulses contribute to healthy soils and climate change mitigation through their nitrogen-fixing properties (Mohanty and Satyasai, 2015).

Pulses have captured the attention of the United Nations and General Assembly of the UN has voted to declare 2016 as the 'International Year of Pulses'. The Food and Agriculture Organization of the United Nations (FAO) has been nominated to facilitate the implementation of the Year in collaboration with Governments, relevant organizations, non-governmental organizations and all other relevant stakeholders. The Year provides a unique opportunity to encourage connections throughout the food chain that would better utilize pulse-based proteins, further global production of pulses, better utilize crop rotations and address the challenges in the trade of pulses.

India is the largest producer (25% of global production), consumer (27% of world consumption) and importer (14%) of pulses in the world. Pulses account for around 20 per cent of the area under food grains and contribute around 7-10 per cent of the total food grains production in the country.

Among the pulses, blackgram is one of the important tropical grain legumes. It is used as a major source of protein, essential amino acid carbohydrate and fats. Its seed coat is rich in crude fibre and calcium whereas cotyledons have abundance of starch and protein.

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Moreover blackgram has unique characteristic of maintaining and restoring soil fertility with deep and well spread root system and biological nitrogen fixation.

Rhizobium leguminosarum are employed as inoculants for biofertilization. It is used to improve nutritive value of pulses by enhancing root nodulation and nitrogen fixation. The nodules formed by the bacteria are agronomically significant, as they provide an alternative use for chemical fertilizer which are expensive and not within the reach of every farmer. The nutritional quality, yield and other characters of blackgram are affected by macro and micronutrients. Sulphur is necessary in a balanced fertilizer programme for achieving sustainable yield in blackgram. Zinc is involved in many ways in the metabolism of higher plants, moreover it involved in the synthesis of various enzymes. Boron affect the catalase activity in plants, it has positive correlation with nitrogen fixation. Likewise Mo acts as an activator for enzyme nitrate reductase which is involved in nitrogen metabolism.

The objective of the present work was to study the effect of *Rhizobium leguminosarum* inoculation with the application of S, Zn, Mo and B on nodulation and nitrogen fixing ability of blackgram and also to find the ways and means to improve the seed quality through better nodulation by promoting the use of biofertilizer along with S, Zn, Mo and B as a balanced nutrition.

MATERIALS AND METHOD

The study was carried out during Rabi season at the research farm of J V college Baraut distt- Baghpat (UP). The region has an average rainfall of about 63 cm; mean maximum and minimum temperature of 38º and 18º C, maximum and minimum relative humidity of 70% and 42% respectively. The uniform basal dosage of nitrogen in the form of urea (20 kg/ha) and potassium in the form of potash (40 kg/ha)were applied before sowing while sulphur, Zn, Mo and B @ 60, 4, 0.1 and 0.6 kg/ha were applied at the time of sowing.
Both blackgram seeds and *Rhizobium* inoculums were obtained from IARI, New Delhi. The seeds were first smeared with these inoculums and were spread on blotting paper in shade to get rid of extra moisture before sowing. Seeds were sown in rows. Row to row distance was 30 cm and plant to plant distance was 15 cm. There were 10 rows in each plot and were ten plants in each row.

EXPERIMENTAL FINDING

Inoculation of *Rhizobium* attained significantly higher nodules weight/plant than the uninoculated control. Inoculation of *Rhizobium* along with all the micronutrients was significantly effective over *Rhizobium* alone and uninoculated control. *Rhizobium* with sulphur application was significantly better than the *Rhizobium* alone and uninoculated control, but was non-significant over *Rhizobium* with all micronutrients. The plants receiving the combined application of *Rhizobium*, sulphur and all the micronutrients attained significantly higher nodule weight than any other treatment.

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Table-1

Effect of *Rhizobium*, sulphur and micronutrients on nodule weigh in blackgram.

Treatment	30 days			40 days			50 days		
	V1	V2	Mean	V1	V2	Mean	V1	V2	Mean
Control	12.11	11.38	11.74	21.42	20.34	20.88	40.22	38.49	39.35
Rhizobium	21.28	21.11	21.19	39.92	38.40	39.16	80.18	75.21	77.69
R+Mo+B	22.31	22.34	22.32	40.62	39.38	40.00	81.42	76.84	79.13
R+Zn+Mo	22.49	22.67	22.58	41.28	40.76	41.02	82.45	77.72	80.08
R+Zn+B	23.57	23.83	23.70	42.18	41.88	42.03	83.82	78.67	81.24
R+Zn+Mo+B	24.73	24.53	24.63	43.42	42.48	42.95	84.38	80.45	82.41
R+S	25.32	24.41	24.86	44.57	43.29	43.93	85.40	83.52	84.46
R+S+Mo	26.54	25.67	26.10	45.76	44.18	44.97	86.34	85.28	85.81
R+S+B	27.41	26.31	26.79	46.95	45.91	46.43	88.21	87.69	87.95
R+S+Zn	27.84	26.38	27.36	47.67	46.26	46.96	90.46	91.93	91.19
R+S+Mo+B	28.75	27.27	28.01	48.34	46.70	47.52	93.92	92.78	93.35
R+S+Zn+Mo	29.32	27.58	28.45	48.69	47.52	48.10	96.73	94.18	95.45
R+S+Zn+B	29.89	28.92	29.40	49.18	48.62	48.90	98.89	96.42	97.65
R+S+Zn+Mo+B	30.19	29.42	29.80	50.55	49.20	49.87	99.38	97.12	98.25
Mean	25.12	24.44	-	43.61	42.49	-	85.13	82.59	-
CD at 5%									
Variety	0.396			0.774			1.075		
Treatment	1.049			2.049			2.845		
V × T	1.483			2.898			4.024		

V1- PU19 variety of blackgram V2- PDU1 variety of blackgram

R- *Rhizobium*, S- Sulphur, Mo- Molybdenum, Zn- Zinc, B- Boron

RESULT AND DSCUSSION

Inoculation of *Rhizobium* increased the nodules weight due to higher number of bacteria present under inoculated condition. Sulphur and micronutrients also promote nodules weight in legumes. Zinc had favourable effect on nodules weight due to its direct influence on auxin production which promotes the elongation of cells in root nodules. Mo, which is a part of nitrogenase and nitrate-reductase, had spectacular effect on dry weight of nodules and it indirectly reflects the increase in the capacity for nitrogen fixation. Boron also had a positive correlation with nitrogen fixation and nodule weight. Due to the more translocation of elements to nodule, boron promotes the merestamatic and vascular development of root nodules.

The result of the study reveal that the application of *Rhizobium* with sulphur and micronutrients increase the nodule weight and nitrogen fixation capability of blackgram which in turn increase the nitrogen content and protein percentage in pulses.

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These results were in conformity of the result obtained by Skoog (1940), Sprent (1981), Marschner (1986), Lehri et al (1993), Biswas et al (2004) and Singh (2004).

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