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Effect of chemical fertilizers, rhizobium and micronutrients on nodulation of French bean (*Phaseolus vulgaris* L.)

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Abstract

The present experiment entitled "Effect of chemical fertilizer, rhizobium and micronutrients on nodulation of French bean (*Phaseolus vulgaris* L.)" was carried out during Rabi, 2018-19 at Instructional Farm-II of Institute of Agricultural Sciences, Bhubaneswar. The recommended dose of fertilizer (RDF) used for French bean was 50:75:75 NPK kg ha⁻¹ along with FYM @ 15 ton ha⁻¹. The chemical fertilizers were applied in three levels i.e. 50 %, 100 % and 150 % of the RDF with various combinations of rhizobium culture and micronutrients. The experiment consisted of twelve treatments in various combinations of different levels of fertilizer with or without rhizobium culture (30 g kg⁻¹ of seed) and micronutrients (0.1 %). The results obtained from the present investigation indicated that the treatment receiving 50:75:75 NPK kg ha⁻¹ (100 % RDF) along with FYM @ 15 t ha⁻¹, rhizobium culture (30 g kg⁻¹ of seed) and micronutrients (0.1%) recorded significantly maximum number of nodules in T11 (99.07), which was at par with T12 (90.23) receiving 150 % of RDF with Rhizobium culture and micronutrient. However, least number of nodules was recorded in T1 (43.30) receiving 50 % of the recommended dose of fertilizer only without rhizobium and micronutrient. Thus, it may be suggested that RDF with rhizobium culture and micronutrients application increases number of nodules in case of French bean.

Keywords: Legume, French bean, NPK, rhizobium, micronutrients, nodulation

Introduction

French bean (*Phaseolus vulgaris* L.) is one of the most important leguminous vegetables in India. It is a short duration high yielding legume crop which can be used both as pulse and vegetable. It is the most important dinitrogen fixation system in nature. Its green pods are cooked as a vegetable, being rich in protein and vitamins, calcium and iron. Unlike other pulses, Rajmash is inefficient in symbiotic nitrogen fixation (Ali and Lal, 1992) [1] as it lacks nodulation due to the absence of NOD gene regulator (Kushwaha, 1994) [5] even with native Rhizobia and commercially produced cultures. Hence, application of nitrogen is imperative for exploiting its yield potential. As nodulation is poor in French bean, it requires more nitrogen and phosphorus for root development, nodulation and better plant growth and hence responds even to application of fertilizer phosphorus (Ssali and Keya, 1986) [7]. Ahmed *et al.* (2016) studied the influence of Rhizobium inoculation on nodules, growth and yield of three different cultivars of french bean i.e. 'Evergreen', 'Komal green' and 'Winner'. Rhizobium inoculation significantly enhanced the growth and yield parameters of French bean cultivars. All the parameters of growth and yield showed best results for synthetic rhizobium inoculation of seeds. Alsina *et al.* (2016) [2] reported that during flowering stage number of nodules was evaluated. Singer *et al.* (1998) [6] reported that bio-fertilizers significantly enhanced nodule formation, especially in the presence of decreased doses of chemical fertilizers. In Odisha, very meagre research work has been conducted with reference to application of rhizobium and micronutrients in French bean. Hence, this experiment was undertaken to observe the effects of macronutrients and micronutrients along with rhizobium culture on production of nodules in French bean.

Materials and Methods

The present research entitled "Effect of chemical fertilizers, rhizobium and micronutrients on nodulation of French bean (*Phaseolus vulgaris* L.)" was conducted during Rabi, 2018-19 at Instructional Farm-II of Institute of Agricultural Sciences, Bhubaneswar. The experiment was carried out to study the effects of rhizobium culture and micro-nutrient at different levels of levels of fertilizer on nodulation of French bean. Variety Harsh was taken for the purpose. Twelve treatments were evaluated in randomized block design with 3 replications.

Spacing of 30 cm x 15 cm was adopted. From each plot, five plants were tagged randomly for calculating the number of nodules per plant in French bean.

The details of the treatments applied in this experiment are given below.

Table 1: The experiment comprised of the following treatments.

Treatments	Treatment details
T1	50 % of RDF
T2	100 % of RDF
T3	150 % of RDF
T4	50 % of RDF + Rhizobium culture
T5	100 % RDF + Rhizobium culture
T6	150 % of RDF + Rhizobium culture
T7	50 % of RDF + Micronutrient
T8	100 % of RDF + Micronutrient
T9	150 % of RDF + Micronutrient
T10	50 % of RDF + Rhizobium culture + Micronutrient
T11	100 % of RDF + Rhizobium culture + Micronutrient
T12	150 % of RDF + Rhizobium culture + Micronutrient

Results and Discussion

After harvest of the pods, observations were recorded on number of nodules plant-1 and are presented in Table 2. Number of nodules plant-1 ranged from 43.30 to 99.07. Significantly maximum number of nodules were recorded in T11 (99.07) receiving 100% of RDF along with Rhizobium

and Micronutrient, which was at par with T12 (90.23) receiving 150% of RDF with Rhizobium culture and micronutrient. However, least number of nodules was recorded in T1 (43.30) receiving 50 % of the recommended dose of fertilizers only without rhizobium and micronutrient.

Table 2: Effect of fertilizer levels, rhizobium and micronutrient on nodulation of French bean var. Harsh

Treatment	Treatment detail	No. of nodules / plant
T1	50 % of RDF	43.30
T2	100 % of RDF	53.63
T3	150 % of RDF	53.70
T4	50 % of RDF + Rhizobium culture	73.70
T5	100 % RDF + Rhizobium culture	70.20
T6	150 % of RDF + Rhizobium culture	71.73
T7	50 % of RDF + Micronutrient	68.60
T8	100 % of RDF + Micronutrient	71.57
T9	150 % of RDF + Micronutrient	76.40
T10	50 % of RDF + Rhizobium culture + Micronutrient	77.17
T11	100 % of RDF + Rhizobium culture + Micronutrient	99.07
T12	150 % of RDF + Rhizobium culture + Micronutrient	90.23
	S.Em (±)	7.125061
	CD 5%	20.89521
	CV %	17.4369
	„F” test	S

As far as combinations of different levels of NPK along with rhizobium and micronutrient application is concerned, maximum number of nodules per plant (99.07) was obtained with the treatment T11 i.e. 100 % RDF along with rhizobium and micronutrient which was closely followed by T12 (90.23) in 150 % RDF along with rhizobium and micronutrient. The increase in nodule number in T11 might be due to combined

application of rhizobium along with recommended FYM that influenced the physical, chemical and biological properties of soil through supplying macro and micro nutrients leading to maximum nodule formation and better growth and development of the plant. Similar findings were also recorded by Dwivedi GK (2007) [3], Garg *et al.* (2008) [4], Alsina *et al.* (2016) [2] and Tiwari *et al.* (2017) [8].

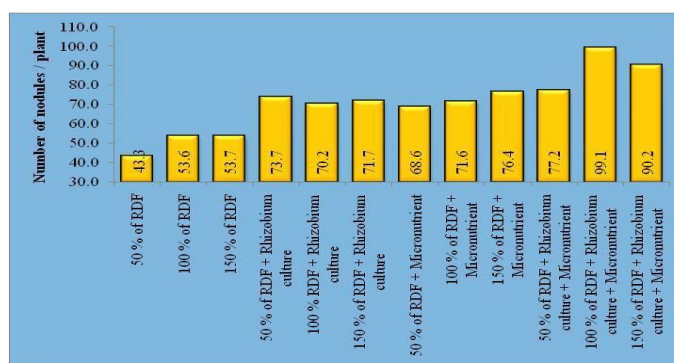


Fig 1: Effect of levels of fertilizer, rhizobium and micronutrient on number of nodules plant-1 of French bean var. Harsh



Fig 2: Nodulation in French bean var. Harsh in various treatments

Conclusion

The salient findings of the present study, entitled “Effect of chemical fertilizers, rhizobium and micronutrients on nodulation of French bean (*Phaseolus vulgaris* L.)” clearly indicated significant variations among the treatments and maximum nodulation of 99.7 per plant was recorded in the treatment receiving 100% RDF (50:75:75 NPK kg ha⁻¹) in combination with rhizobium culture (30g/kg seed) and micronutrients (Multiplex) @ 0.1% spray and in turn expressed as maximum number of nodules formation in French bean. Which was at par with T12 (90.23) receiving 150% of RDF with Rhizobium culture and micronutrient. However least number of nodules was recorded in T1 (43.30) receiving 50% of the recommended dose of fertilizer only without rhizobium and micronutrients.

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