

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; SP-8(11): 590-592
www.biochemjournal.com
Received: 13-09-2024
Accepted: 16-10-2024

VR Khot

MSc Agriculture, Department
of Soil Science, College of
Agriculture, Dhule,
Maharashtra, India

KB Patil

Assistant Professor,
Department of Soil Science,
College of Agriculture, Dhule,
Maharashtra, India

Dr. VP Bhalerao

I/c Professor and Head of
Section, Department of Soil
Science, College of Agriculture,
Dhule, Maharashtra, India

Effect of bio-NPK consortia along with iron on quality of *kharif* soybean (*Glycine max*) in inceptisol

VR Khot, KB Patil and VP Bhalerao

DOI: <https://doi.org/10.33545/26174693.2024.v8.i11Sh.2999>

Abstract

A field experiment entitled "Effect of Bio-NPK consortia along with Iron on growth, yield, nutrient uptake and quality of *kharif* soybean in Inceptisol" was conducted during *kharif*, 2023 at Krishi Vigyan Kendra, College of Agriculture, Dhule. The field experiment consisted of eight treatments viz., T₁ (Absolute control), T₂ (GRDF: (50:75:45 N: P₂O₅: K₂O kg ha⁻¹ + 10 t FYM ha⁻¹), T₃ (GRDF 100% + FeSO₄ @ 25 kg ha⁻¹ and 4 ml bio-NPK consortia), T₄ (GRDF 100% + FeSO₄ @ 25 kg ha⁻¹ and 6 ml bio-NPK consortia), T₅ (GRDF 100% + FeSO₄ @ 25 kg ha⁻¹ and 8 ml bio-NPK consortia), T₆ (GRDF 75% + FeSO₄ @ 25 kg ha⁻¹ and 4 ml bio-NPK consortia), T₇ (GRDF 75% + FeSO₄ @ 25 kg ha⁻¹ and 6 ml bio-NPK consortia) and T₈ (GRDF 75% + FeSO₄ @ 25 kg ha⁻¹ and 8 ml bio-NPK consortia). The application of bio-NPK consortia (4, 6, 8 ml) and FeSO₄ (25 kg ha⁻¹) were applied as per the treatments. These treatments were evaluated with soybean variety *Phule Kimaya* (KDS-753) in Randomized Block Design with three replications. The result of the present investigation indicated that, in order to assure a higher yield and improve the quality of the seed, the seed should be treated with bio-NPK consortia at a dose of 8 ml kg⁻¹ seed and additionally fertilized with RDF (50:75:45 N: P₂O₅: K₂O kg ha⁻¹) in Inceptisol. This treatment also showed the highest B:C ratio (3.00) as compared to the other treatments.

Keywords: Soybean, iron, quality

Introduction

Soybean is an important food legume and plays a vital role in human livelihood. Soybean is known as "poor man's meat" because, it is packed with protein, which is very similar to the protein in meat, dairy products, and eggs which can be used for alleviating protein calorie malnutrition (Chavan *et al.*, 2022) [5]. Soybean is primarily grown in the states of Madhya Pradesh, Maharashtra, Rajasthan, Karnataka, Telangana and Chhattisgarh. These states contribute to about 98% of total production in India (Kumar *et al.*, 2016) [10]. During *kharif* 2022, the total area under soybean crop in India was 12.07 million hectares, with a production of 13.98 million tons and a productivity of 1158 kg ha⁻¹ (Anonymous, 2023) [2]. In Maharashtra, total area under soybean crop was 5.085 million hectares, with a production of 4.607 million tons and productivity of 1299 kg ha⁻¹ (Anonymous, 2024) [3].

Iron is very important micronutrient for the normal growth and development of soybean. (Fageria, 2007) [6]. It also plays a considerable role in the formation of some nodule proteins (Moran *et al.*, 1997) [12]. Iron deficiency symptoms appear on younger leaves, indicating yellowish interveinal areas of leaves commonly referred to as iron chlorosis. In case of severe deficiency, leaves appear pale-white due to loss of chlorophyll. In pulses, alternate yellow and green stripes along the length of the leaf blade may be observed. At later stages, complete leaf fall occurs and shoot may die also (Trivedi *et al.*, 2011) [16].

Materials and Methods

The field experiment was conducted during *kharif* 2023 at Krishi Vigyan Kendra, College of Agriculture, Dhule, Maharashtra to evaluate effect of Bio-NPK consortia and iron on Soybean. The soil pH of the experimental plot was slightly alkaline (7.73), low in available nitrogen (161.12 kg ha⁻¹), low in available phosphorus (13.53 kg ha⁻¹), very high in potassium (324.73 kg ha⁻¹) and deficient in DTPA-Fe (4.12 mg kg⁻¹). The field experiment was conducted for one season by taking soybean crop in randomized block design with eight treatments viz., T₁ (Absolute control), T₂ (GRDF: (50:75:45 N: P₂O₅: K₂O kg ha⁻¹ + 10 t

Corresponding Author:**VR Khot**

MSc Agriculture, Department
of Soil Science, College of
Agriculture, Dhule,
Maharashtra, India

FYM ha⁻¹), T₃ (GRDF 100% + FeSO₄ @ 25 kg ha⁻¹ and 4 ml bio-NPK consortia), T₄ (GRDF 100% + FeSO₄ @ 25 kg ha⁻¹ and 6 ml bio-NPK consortia), T₅ (GRDF 100% + FeSO₄ @ 25 kg ha⁻¹ and 8 ml bio-NPK consortia), T₆ (GRDF 75% + FeSO₄ @ 25 kg ha⁻¹ and 4 ml bio-NPK consortia), T₇ (GRDF 75% + FeSO₄ @ 25 kg ha⁻¹ and 6 ml bio-NPK consortia) and T₈ (GRDF 75% + FeSO₄ @ 25 kg ha⁻¹ and 8 ml bio-NPK consortia). The application of bio-NPK consortia (4, 6, 8 ml) and FeSO₄ (25 kg ha⁻¹) were applied as per the treatments. Five plants were randomly selected from each plot to calculate the quality parameters viz., protein and oil content after drying and grinding these samples. Protein content of the seed was worked out by multiplying nitrogen content in the seed (per cent) with the factor 6.25 (A.O.A.C, 1960) [4]. Oil content in seed was determined by Soxhlet's Ether extraction method (A.O.A.C, 1960) [4]. All the data recorded were analysed with the help of statistical analysis technique for Randomized block design (Panse and Sukhatme, 1985) [14].

Results and discussion

1. Effect of Bio-NPK and iron on test weight (100 grain weight) g

The data of 100 grain weight of soybean as influenced by bio-NPK consortia and FeSO₄ are presented in Table 1

Table 1: Effect of Bio-NPK consortia and FeSO₄ on test weight (g) of *kharif* soybean

Treatments	Test weight (g)
T ₁ : Absolute control	13.06
T ₂ : GRDF (50:75:45 N: P ₂ O ₅ :K ₂ O) and 10 t FYM kg ha ⁻¹	14.49
T ₃ : GRDF 100% + FeSO ₄ @ 25 kg ha ⁻¹ and 4 ml bio-NPK consortia	17.11
T ₄ : GRDF 100% + FeSO ₄ @ 25 kg ha ⁻¹ and 6 ml bio-NPK consortia	17.77
T ₅ : GRDF 100% + FeSO ₄ @ 25 kg ha ⁻¹ and 8 ml bio-NPK consortia	18.01
T ₆ : GRDF 75% + FeSO ₄ @ 25 kg ha ⁻¹ and 4 ml bio-NPK consortia	15.02
T ₇ : GRDF 75% + FeSO ₄ @ 25 kg ha ⁻¹ and 6 ml bio-NPK consortia	15.56
T ₈ : GRDF 75% + FeSO ₄ @ 25 kg ha ⁻¹ and 8 ml bio-NPK consortia	15.90
S.E. ±	0.45
C.D. @ 5%	1.36

2. Effect of Bio-NPK and iron on protein content in grain (%)

The data pertaining to the effect of seed treatment of bio-NPK consortia and FeSO₄ on protein content in *kharif* soybean are presented in Table 2. It showed that the T₅ treatment significantly enhanced protein content (33.65%) of *kharif* soybean than rest of treatment, which was at par with treatment T₄ (33.60%).

Protein content seems to be increased due to increase in the availability of nitrogen to the plant through the process of atmospheric nitrogen fixation, higher microbial activity and more solubilization of phosphorus and potassium. Thus increase in nitrogen content in grain resulted in increased protein content in grain, as nitrogen is basic constituent of amino acids, which are building block of protein molecule. These results have cognizance with the findings of Alam *et al.*, (2009) [1], Navasare *et al.*, (2019) [13], Jaga and Sharma, (2015) [8] and Kumar and Sharma, (2018) [11].

showed that the 100 grains weight of soybean was significantly superior in treatment T₅ (GRDF 100% + FeSO₄ @ 25 kg ha⁻¹ and 8 ml bio-NPK consortia) (18.01 g) and statistically at par with the treatment T₄ (17.77 g) and T₃ (17.11 g) while absolute control found with lowest 100 grain weight (13.06 g).

The increase in test weight might be associated with bio-consortia which influence the availability of nutrients, specially nitrogen and phosphorous for the better filling of grains which resulting into bold sized seeds and consequently higher test weight. This may also be due to rapid mineralization of chemical fertilizers increased availability and uptake of nutrients during the critical physiological growth stages, resulting in higher test weight. The similar results were also found by Navasare *et al.*, (2019) [13], Jaga and Sharma, (2015) [8], Ghadge and Murumkar, (2020) [7] and Thite and Murumkar (2023) [15].

The reason for recording maximum test weight might be due to the presence of iron application which stimulates the metabolic processes in seed besides its involvement in enzyme activation and photosynthetic activity which increases the chlorophyll content in leaves. This might have resulted in production and accumulation of carbohydrates in 100 grain weight development. The similar result observed by Kamble *et al.* (2021) [9] in soybean.

al., (2009) [1], Navasare *et al.*, (2019) [13], Jaga and Sharma, (2015) [8] and Kumar and Sharma, (2018) [11].

Iron enhances the absorption of essential plant nutrients. It shows synergistic effect with nitrogen because nitrogen uptake is improved with increase in iron level in root zone. Iron is required as structural and catalytic components of protein or amino acids which helps in increment of protein in seed of soybean. The similar results were also confirmed by the findings of Trivedi *et al.*, (2011) [16] and Chavan *et al.*, (2022) [5] in soybean.

3. Effect of Bio-NPK and iron on oil content in grain (%)

The data in respect with oil content in soybean are presented in Table 2, were influenced non-significantly by the different seed inoculation treatments. Nevertheless, treatment receiving iron fertilisation along with major nutrients revealed slight increase in oil content.

Table 2: Effect of Bio-NPK consortia and FeSO₄ on protein content (%) and oil content (%) in grain of *kharif* soybean

Treatments	Oil (%)	Protein (%)
T ₁ : Absolute control	18.32	32.344
T ₂ : GRDF (50:75:45 N: P ₂ O ₅ :K ₂ O) and 10 t FYM kg ha ⁻¹	18.73	33.56
T ₃ : GRDF 100% + FeSO ₄ @ 25 kg ha ⁻¹ and 4 ml bio-NPK consortia	19.10	33.60
T ₄ : GRDF 100% + FeSO ₄ @ 25 kg ha ⁻¹ and 6 ml bio-NPK consortia	19.31	33.63
T ₅ : GRDF 100% + FeSO ₄ @ 25 kg ha ⁻¹ and 8 ml bio-NPK consortia	19.37	33.65
T ₆ : GRDF 75% + FeSO ₄ @ 25 kg ha ⁻¹ and 4 ml bio-NPK consortia	18.90	33.50
T ₇ : GRDF 75% + FeSO ₄ @ 25 kg ha ⁻¹ and 6 ml bio-NPK consortia	18.96	33.52
T ₈ : GRDF 75% + FeSO ₄ @ 25 kg ha ⁻¹ and 8 ml bio-NPK consortia	19.07	33.53
S.E. ±	0.65	0.01
C.D. @ 5%	NS	0.03

Conclusion

Based on experimentation, it may be concluded that application of GRDF 100% + FeSO₄ @ 25 kg ha⁻¹ and 8 ml bio-NPK consortia showed significant increase in quality parameters viz., test weight, protein content and oil content which was remained at par with GRDF 100% + FeSO₄ @ 25 kg ha⁻¹ and 6 ml bio-NPK consortia.

References

1. Alam MA, Siddiqua A, Chowdhary MA, Prodhan MY. Nodulation, yield and quality of soybean influenced by integrated nutrient management. Journal of Bangladesh Agricultural University. 2009;7(2):229-234.
2. Anonymous. Directorate of Economics and Statistics, Department of Agriculture and Farmers Welfare; 2023.
3. Anonymous. Soybean statistics. ICAR-Indian Institute of Soybean Research, Indore, Madhya Pradesh; 2024.
4. AOAC. Official method for analysis. 21st ed. Washington, D.C.: Association of Official Analytical Chemists (AOAC) International; 1960.
5. Chavan NS, Adsul PB, Kadam DM, Lingayat NR, Jaybhaye BB. Effect of iron and zinc on growth, yield and quality of *Glycine max* L. in Inceptisol. The Pharmaceutical Innovation Journal. 2022;11(12):1823-1830.
6. Fageria NK. Micronutrient's influence on root growth of upland rice, common bean, corn, wheat, and soybean. Journal of Plant Nutrition. 2007;25(3):613-622.
7. Ghadge JR, Murumkar DR. Inoculation effect of consortium of *Rhizobium*, PSB and KMB on the growth and yield of soybean. International Journal of Current Microbiology and Applied Sciences. 2020;9(9):1979-1993.
8. Jaga PK, Sharma S. Effect of biofertilizer and fertilizers on productivity of soybean. Annals of Plant and Soil Research. 2015;17(2):171-174.
9. Kamble BM, Meena R, Gajbhiye BN. Effect of iron nutrition on growth, quality and yield of *Glycine max* L. grown on problematic Inceptisol. International Journal of Experimental Agriculture. 2021;43(12):20-28.
10. Kumar BK, Ismail S, Manasa K, Pawar A. Effect of zinc solubilizing microbial culture on yield, nutrient uptake and quality of soybean. Ecology Environment and Conservation. 2016;22:339-346.
11. Kumar P, Sharma HB. Effect of integrated nutrient management on yield, quality and nutrient uptake of *Glycine max*. Annals of Plant and Soil Research. 2018;20(1):57-60.
12. Moran FJ, Robert VK, Grayer RJ, Joaquin A, Manuel B. Complexes of iron with phenolic compounds from soybean nodules and other legume tissues: Prooxidant and antioxidant properties. Free Radical Biology and Medicine. 1997;22(5):861-870.
13. Navasare GJ, Aglave BN, Sathe RK. Effect of nodulation and quality of *Glycine max* (L.) Merrill as influenced by biofertilizers. Indian Journal of Crop Science. 2019;7(2):670-672.
14. Panse VG, Sukhatme PV. Statistical method for agricultural workers. Revised ed. New Delhi: Indian Council of Agricultural Research (ICAR); 1985.
15. Thithe AS, Murumkar DR. Inoculation effect of consortium of *Rhizobium*, PSB and KMB on growth and yield of chickpea. The Pharma Innovation Journal. 2023;12(12):2660-2667.
16. Trivedi AK, Hemantaranjan A, Pandey SK. Iron and sulphur application may improve growth and yield of soybean. Indian Journal of Plant Physiology. 2011;16(3-4):309-313.