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Effect of inorganic and organic nutrients on quality and soil parameters of summer green gram (*Vigna radiata* L. Wilczek)

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Abstract

A field experiment was carried out during the summer season of the year 2019 at the College Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand (Gujarat), with a view to study the inorganic and organic nutrients on growth and yield of summer green gram (*Vigna radiata* L. Wilczek). The experiment was laid out in a Randomized Block Design with eight treatments and four replications.

Keywords: Field experiment, summer season, 2019, college agronomy farm

Introduction

Green gram is a tremendous source of high quality protein. It can be boiled or eaten whole and contains about 25% protein. It also comprises high quality of lysine (4600 mg g⁻¹ N) and tryptophan (60 mg g⁻¹ N) and consumed as whole grain or as well as in the form of dal for table purposes.

Across the larger part of the world excess and unsustainable use of chemical fertilizers has led to several issues of environmental pollution and land degradation. The land is losing its fertility subsequently forcing farmers to use higher doses of such chemicals and this coupled with the scramble in cost of chemical fertilizers and the monetary constraints of farmers, especially in a developing country like India, has aggravated the complications and is making agricultural systems unsustainable. In this context there is an urgent need to develop and advance economic and sustainable technologies and practices on alternative organic sources of plant nutrients such as organic manures and bio-fertilizers to reduce the dependency on synthetic sources of plant nutrients. Organic nutrient sources such as vermicompost, BioNP (*Rhizobium* + PSB) consortium, jeevamrut add organic matter to the soil, improve the soil properties, conserve the nutrients in soil and increase the soil microbial activity and diversity thereby improving soil quality and fertility and ecosystem sustainability. Organic manures increases soil structure, increase organic matter content, encourages nutrient mobilization, increase water holding capacity of the soil, stimulates formation of soil aggregates, overwhelms certain plant diseases and soil borne pathogens and encourage the growth of beneficial microorganisms (Chen, 2006) [3]. Organic manures like vermicompost, BioNP (*Rhizobium* + PSB) consortium, jeevamrut etc. helps in the improvement of soil structure, aeration and water holding capacity of soil. Further, they proliferation the availability of macro and micronutrients to the plants through enhanced biological processes, increases solubility of nutrients and modifies soil salinity, sodicity and pH (Alabadian *et al.* 2009) [1]. *Rhizobium* and Phosphate Solubilizing Bacteria (PSB) are bio-fertilizers, which enrich biochemical processes of nitrogen fixation and phosphorus solubilization, enhancing and promoting plant growth. Bio-fertilizers provide economically judicious and ecologically sound means of fertilization (Patel *et al.* 2013) [12] and are significant components in sustainable agriculture. Besides, these organic fertilizers are cost effective and do not leave toxic residues in the environment and are thus perfect components for developing economically sound and eco-friendly practices and packages for sustainable crop production.

Although intensive farming practices, which produce high yields and quality, require extensive use of chemical fertilizers which are costly and create environmental problems. Therefore, there has been a recent resurgence of interest in environmentally friendly, sustainable and organic agricultural practice (Esitken *et al.* 2005 and Orhan *et al.* 2006) [7, 11]. Use of organic manures and bio-fertilizers instead of synthetic chemical fertilizer is known to improve plant growth through supply of plant nutrients and may help to sustain environmental health and soil productivity. Thus, it is necessary to supply the plant nutrient requirement through proper on farm management practices. Hence, keeping in view the above facts, the present investigation was conducted to study the performance of green gram under different sources of inorganic and organic nutrients in order to evolve optimized practices under summer conditions.

Materials and Methods

A field experiment was carried out during the summer season of the year 2019 at College Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat. The soil of experimental site was loamy sand in texture, having low in organic carbon (0.29) and available nitrogen (219.50 kg ha⁻¹) and medium in available P₂O₅ (35.45 kg ha⁻¹) with slightly alkaline (pH 7.96) in reaction. Green gram variety Gujarat Anand Mungbean 5 (GAM 5) was used as a test crop in the study. Crop was sown on 7th march, 2020. The experiment was arranged in randomized block design with four replications, consisting of eight treatments viz., T₁ [100% RDF (20-40-00 kg NPK ha⁻¹)], T₂ [50% RDF (10-20-00 kg NPK ha⁻¹) + 0.5 t ha⁻¹ vermicompost], T₃ [Seed treatment with BioNP @ 5 ml kg⁻¹ seed (*Rhizobium* + PSB)], T₄ [Jeevamrut spraying at 30 & 45 DAS (500 lit ha⁻¹)], T₅ [T₃ + T₄], T₆ [T₂ + T₃], T₇ [T₂ + T₄], T₈ [T₂ + T₅], each plot being 3.60 m × 5.00 m. Inorganic sources of N & P is urea and DAP respectively, while organic sources are vermicompost, BioNP (*Rhizobium* + PSB) and jeevamrut. The seeds were inoculated with respective strains of *Rhizobium* + PSB according to the treatment. Crop was harvested (3 consecutive picking of pods) on 10th, 18th and 25th May, 2020. The data recorded during the course of investigation were subjected to statistical analysis as per method of analysis of variance (Cochran and Cox, 1957) [14].

Results and Discussion

Effect on quality parameter

Protein Content in Seed (%)

A scrutiny of data presented in Table 1 revealed that different treatments exerted their non-significant influence on protein content in seed.

Effect on soil parameters

Soil physico-chemical properties

Soil pH

An examination of data presented in Table 1 indicated that different treatments did not exert their significant influence in soil pH after harvest of the crop.

Electrical conductivity (EC)

A perusal of data presented in Table 1 showed that no significance effect on EC (dS m⁻¹) of soil after harvest of the crop.

Soil Chemical Properties

Organic carbon (%)

An inspection of data presented in Table 1 showed that different treatments had a no significant effect on O.C content (%) of the soil after harvest of the crop. The data indicated that organic carbon content of soil was found in the range of 0.31 to 0.34% in the soil.

Available nitrogen (kg ha⁻¹)

Mean data on available nitrogen (kg ha⁻¹) status of soil after harvest of the crop as influenced by different treatments utilized their significant influence on available nitrogen (kg ha⁻¹) status of soil. Significantly higher available nitrogen (270.20 kg ha⁻¹) was observed under treatment T₈. Increase in available N might be due to combine application of organic and inorganic nutrient sources in which application of organic manure *i.e.*, vermicompost was decomposed slowly and release nutrient during the crop as well as due to bio-fertilizer application increase *Rhizobium* root nodule which fix the more atmospheric nitrogen into soil, which stimulates root development and growth of green gram Naik *et al.* (2022) [5]. Further, direct addition of nitrogen through inorganic fertilizers and inoculation with BioNP (*Rhizobium* + PSB) consortia and jeevamrut enhanced the activity of nitrogenase and nitrate reductase enzyme in the soil foremost to greater biological nitrogen fixation (BNF) by *Rhizobium* bacteria and helped in the mineralization of soil nitrogen leading to higher buildup of available N in soil. These results were in close conformity with results reported by Choudhary *et al.* (2010) [4], Arsalan *et al.* (2016) [2], Dhakal *et al.* (2016) [6], Gohain and Kikon (2017) [8], Khan *et al.* (2017) [9], Saha *et al.* (2017) [13], and Naresh *et al.* (2018) [10].

Available phosphorus (kg ha⁻¹)

Data furnished in Table 1 indicated that different treatments exerted their non-significant effect on available phosphorus content of soil after harvest of the crop.

Table 1: Effect of inorganic and organic nutrients on quality and soil parameters of summer green gram (*Vigna radiata* L. Wilczek)

Treatment	Quality Parameter	Soil physico-chemical parameters		Soil chemical properties	Available N (kg ha ⁻¹)	Available P ₂ O ₅ (kg ha ⁻¹)
	Protein content (%)	pH	EC (dS m ⁻¹)	Organic carbon (%)		
T ₁	22.35	8.08	0.267	0.31	250.39	46.05
T ₂	22.14	8.00	0.273	0.32	245.75	45.13
T ₃	20.69	8.06	0.310	0.31	232.90	41.50
T ₄	21.75	8.09	0.310	0.31	234.73	43.03
T ₅	22.10	8.04	0.293	0.31	243.25	44.02
T ₆	23.28	8.08	0.267	0.34	261.98	48.03
T ₇	22.97	8.09	0.277	0.34	257.23	47.00
T ₈	23.59	8.06	0.270	0.34	270.20	49.11
S. Em. ±	0.74	0.31	0.01	0.01	8.25	1.66
C.D. at 5%	NS	NS	NS	NS	24.26	NS
C.V.%	6.63	7.65	7.91	5.71	6.61	7.31

Initial value in soil	-	7.96	0.25	0.29	219.50	35.45
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Conclusion

In light of results obtained from the ongoing field experiment, it could be concluded that the crop should be fertilized with 50% RDF + 0.5 t ha⁻¹ vermicompost + seed treatment with BioNP + Jeevamrut spraying securing the higher protein content (%) and soil parameters of summer green gram.

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