

**EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON
NODULATION, YIELD AND QUALITY OF SOYBEAN**

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ABSTRACT

*In the alluvial soil of Navsari (Gujarat), a field experiment was conducted in summer season to study the nodulation, yield and quality of summer soybean (*Glycine max* L.) as affected by integrated nutrient management during two consecutive years 2011 and 2012. The three treatments consisted combinations of organic and inorganic along with alone application of organic and inorganic as check. The results revealed that total number and dry weight of root nodules/plant was increased up to 60 days after sowing and recorded significantly higher with integrated use of bio compost (25 % N) + inorganic (75 % RDF). Similarly, seed (2251 kg/ha) and stover (4734 kg/ha) yield of soybean was significantly higher under application of 75 % RDF + 25 % N through Bio-compost. Protein (39.9 %) and oil (20.5 %) content was also significantly higher in soybean grain in combined application of organic and inorganic (25 % RDN +75 % RDF).*

KEY WORDS: *Bio-compost, Integrated Nutrient Management, nodulation, oil, protein, soybean.*

INTRODUCTION

Cultivation of soybean has been increasing rapidly and now it is the first in area and second in production among oilseed crops grown in the country. Being oilseed and pulse crop, proper nutrient management is one of the crucial factors in giving optimum yield. The crop responds well to integrated nutrient sources. Soybean, being an important pulse as well as oilseed crop, needs special mention to overcome crisis in edible oil production in the country. It is also called as “Gold of Soil”. Soybean (*Glycine max* (L.) Merrill) accounts for nearly 50 per cent of total production

of oilseed crop in the world. Its seed, which contains about 40 per cent protein and 20 per cent oil, provides approximately 60 per cent of the world supply of vegetable protein and 30 per cent of the oil (Anonymous, 2015). Soybean is an energy rich crop and hence the requirement of major nutrients including secondary and micronutrients is high for soybean. Continuous use of inorganic fertilizer plays a vital role in reducing the soil fertility. Integration of organic and inorganic sources of nutrients along with biofertilizers is found to give higher productivity and monetary returns in soybean. Integrated

Nutrient Management (INM) involves the use of manures, biofertilizers and chemical fertilizers to achieve sustained crop production and maintain better soil health. INM is best approach for better utilization of resources and to produce crops with less expenditure. However, meagre work has been done on effect of integrated nutrient management on quality and yield of soybean, hence above experiment was conducted.

MATERIAL AND METHODS

A field experiment was conducted during 2011 and 2012 at the Research Farm of Navsari Agricultural University, Navsari (20°57' N latitude, 72°54' E longitude), Gujarat. The soil was clay in texture, having 0.48 % organic C, medium in available nitrogen (221 kg/ha), phosphorus (45 kg/ha), available sulphur (22.10 ppm), fairly rich in available potassium (419 kg/ha) and slightly alkaline in reaction (pH 7.6) with normal electrical conductivity. The experiment comprising total five treatments involving: T₁: 100 % RDF (20-40-0 NPK kg/ha), T₂: Bio-compost @ 10 t/ha, T₃: Bio-compost @ 10 t/ha + PSB, T₄: 75 % RDF + 25 % N through Bio-compost and T₅: 50 % RDF + 50 % N through Bio-compost + PSB. The experiment was laid out in Randomized Block Design with four replications. Slurry of PSB inoculant was made in concentrated Gur solution (20 %t) which was prepared by boiling and subsequent cooling before adding PSB. The seeds were treated with PSB inoculant, as per the treatments, were thoroughly mixed with inoculant slurry in such a way that all the seeds were uniformly coated with PSB inoculant, and then allowed to dry in the shade before sowing. The PSB was applied at the rate of 10 g/kg seed. A basal dose of P (40 kg/ha) applied through single super phosphate was

drill uniformly at the time of sowing. Nitrogen was applied as per treatments. Besides a light irrigation was given just after sowing, and five post sowing irrigation were given to crop. The crop was raised as per the recommended package of practices except the treatments.

RESULTS AND DISCUSSION

Number and dry weight of root nodules per plant of soybean

In general, there was a significant increase in the number and dry weight of root nodules/plant up to 60 DAS only, later on it decreased (Table 1). Treatment receiving 75 % RDF along with 25 % N through bio-compost (T₄) remarkably increased number of root nodules per plant and dry weight of root nodules per plant at 30 and 60 DAS over rest of the treatments. The next best treatment with regards to growth attributes is 50 % RDF + 50 % N through bio-compost + PSB (T₅). The results are in conformity with those of Solanki (2003), Talati (2004) and Thenua *et al.*, (2010), who reported significantly higher number of root nodules and dry weight of root nodules, due to soybean seed inoculations with PSB.

Seed and stover yield (kg/ha)

Integrated application of 75 % RDF along with 25 % N through bio-compost (T₄) significantly increased the seed (2251 kg/ha) and stover (4734 kg/ha) yield of soybean (Table 2) over rest of the treatments. The magnitude of increase in yield of soybean in treatment T₄ (75 % RDF + 25 % N through bio-compost) was to the tune of 24.71, 24.66 and 24.71 per cent for seed yield; and 31.06, 31.10 and 31.06 per cent for stover yield over T₁ (100 % RDF) and 47.42, 49.38 and 48.38 per cent higher for seed yield and 54.58, 54.63 and 54.60 per cent higher stover yield over T₂ (Bio-compost 10 t/ha) during 2011, 2012 and in pooled

data, respectively. The results get support from the findings of Shivran *et al.* (2012) and Chaturvedi *et al.* (2012). Thus, the results clearly showed that 75 % RDF with 25 % N through bio-compost (T₄) appeared to be adequate dose for obtaining higher seed and stover yield per hectare from summer soybean crop.

Protein and oil content (%)

Protein and oil content in seed was increased perceptibly due to the application of 75 % RDF with 25 % N through bio-compost (T₄). These results are in agreement with the results those obtained by Rooge *et al.* (1998), Kumavat *et al.* (2000) and Solanki (2003).

CONCLUSION

On the basis of experimentation, it was concluded that integrated use of bio compost (25 % N) + inorganic (75 % RDF) is more effective, as it produced higher yield of soybean crop through production of higher number of root nodules per plant and dry weight of root nodules per plant and it also improves the protein and oil content.

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Table 1: Number and dry weight of root nodules per plant of soybean at various growth stages as influenced by different integrated nutrient management treatment

Treatments	Number of Root Nodules / Plant						Dry Weight of Root Nodules /Plant (mg)					
	30 DAS		60 DAS		90 DAS		30 DAS		60 DAS		90 DAS	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
T₁ :100 % RDF (20-40-0 NPK kg/ha)	14.10	14.35	24.80	23.25	13.63	12.78	4.38	4.47	15.98	15.01	8.33	7.83
T₂ :Bio-compost @ 10 t/ha	12.25	12.20	19.60	19.25	10.75	10.60	3.79	3.80	12.63	12.42	6.58	6.49
T₃ :Bio-compost @ 10t/ha + PSB	12.50	12.55	20.20	20.55	11.10	11.33	3.88	3.90	13.02	13.26	6.69	6.94
T₄ :75 % RDF + 25 % N through Bio-compost	17.80	17.93	29.80	30.05	16.40	16.53	5.52	5.56	19.21	19.41	10.03	10.13
T₅ :50 % RDF + 50 % N through Bio-compost + PSB	16.25	16.35	27.35	28.30	15.05	15.58	5.03	5.08	17.65	18.25	9.21	9.54
S. Em. ±	0.60	0.58	0.89	0.71	0.50	0.42	0.19	0.18	0.57	0.55	0.33	0.34
C. D. at 5 %	1.85	1.78	2.75	2.20	1.53	1.30	0.60	0.54	1.77	1.70	1.02	1.05
C. V. %	8.22	7.85	7.33	5.88	7.40	6.29	8.60	7.74	7.32	7.03	8.11	8.34

Table 2: Seed and stover yield (kg/ha) and protein and oil content of soybean at various growth stages as influenced by different integrated nutrient management treatment

Treatments	Seed Yield (kg/ha)			Stover Yield (kg/ha)			Protein Content (%)			Oil Content (%)		
	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled
T₁ :100 % RDF (20-40-0 NPK kg/ha)	1785	1825	1805	3609	3614	3612	37.10	37.14	37.12	19.49	19.51	19.50
T₂ :Bio-compost @ 10 t/ha	1510	1523	1517	3060	3064	3062	35.54	35.59	35.57	19.07	19.08	19.08
T₃ :Bio-compost @ 10t/ha + PSB	1731	1803	1767	3272	3276	3274	36.53	36.55	36.54	19.38	19.40	19.39
T₄ :75 % RDF + 25 % N through Bio-compost	2226	2275	2251	4730	4738	4734	39.90	39.93	39.92	20.45	20.47	20.46
T₅ :50 % RDF + 50 % N through Bio-compost + PSB	2000	2053	2027	4036	4043	4040	37.96	38.00	37.98	20.04	20.07	20.06
S. Em. $\pm$	66.83	71.98	51.00	200.09	204.30	148.00	0.48	0.49	0.35	0.21	0.21	0.15
C. D. at 5 %	230.25	247.98	147.70	689.37	703.89	428.66	1.66	1.67	1.03	0.71	0.72	0.44
C. V. %	8.08	8.49	8.29	11.96	12.19	12.08	2.89	2.90	2.89	2.34	2.38	2.36

[MS received: February 23, 2017]

[MS accepted: March 18, 2017]