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Effect of different organic formulations on yield and quality of soybean

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Abstract

A field experiment was conducted during *kharif* season 2017 to Study the effect of organic formulations on growth, yield and soil nutrient dynamics in soybean at experimental farm, Department of Soil Science and Agricultural Chemistry, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The experiment was laid out with twelve treatments replicated three times in randomized block design. The treatment consisted of T₁- RDF (100% NPK through fertilizer), T₂- Panchagavya only, T₃-Jeevamruth only, T₄-Beejamruth only, T₅-Panchgavya + Beejamruth, T₆- Beejamruth + Jeevamruth, T₇ - Panchgavya + Jeevamruth, T₈-RDF + Beejamruth + Panchgavya, T₉ - RDF + Beejamruth + Jeevamruth, T₁₀ - RDF+ Beejamruth + Jeevamruth+ Panchgavya, T₁₁ - Beejamruth + Jeevamruth+ Panchgavya and T₁₂ - 100% N through FYM. The growth and yield attribute like plant height, leaf area, number of nodules per plant, seed yield and straw yield were significantly improved by application of RDF+ Beejamruth + Jeevamruth+ Panchgavya. The test weight and seed protein content increased by application of RDF+ Beejamruth + Jeevamruth+ Panchgavya.

Keywords: Organic formulations, yield, quality, soybean

Introduction

Soybean (*Glycine max* L. Merrill) is an important oilseed pulse crop of the world. It became miracle crop of 20th century and designated as "Golden Bean". Soybean is the cheapest source of protein and it is called "Poor man's meat". Soybean crop was introduced in sixties as supplementary oilseed crop to overcome the edible oil shortage in the country. Among all oilseeds crops, soybean occupied third position in the edible oil scenario of India. Nutritional point of view, soybean is an excellent source of protein and oil. It contains high amount of protein (43.2%) and oil (19.5%). It is also a rich source of vitamin A, B and D. It contains 38-43 percent minerals and 2 per cent phospholipids. In addition, soybean is legume crop and having considerable potential to fix atmospheric nitrogen.

It is grown throughout the world with the largest production in United States, China, Brazil, Indonesia, Japan, Korea, and Argentina. In India, the area under soybean is 101.83 lakh ha with total production as 83.504 lakh MT and productivity of 822 kg ha⁻¹ (Anonymous, 2017) ^[1]. Madhya Pradesh, Maharashtra and Rajasthan are the major soybean growth states. In Maharashtra, it is grown over an area of 34.00 lakh hectares with total production of 29.00 lakh MT with an average productivity of 841 kg ha⁻¹ (Anonymous, 2017) ^[1].

Any improvement in agricultural system that results in higher production should reduce the negative environment impact of agriculture and enhance the sustainability of the system. One such approach is the effectiveness of conventional mineral fertilizers. Some organic formulations like Panchagavya, Beejamruth, Jeevamruth, Amritmitti and Amritjal obtained from cow and plant are used in agricultural and horticultural crop and many beneficial effect in the term of enhancement of yield and quality of have been reported (Gore and Shreenivasa, 2011) ^[2].

Material and Methods

A field experiment was conducted during *kharif* season 2017 to study the effect of organic formulations on growth, yield and soil nutrient dynamics in soybean at Research Farm of Soil Science and Agricultural Chemistry, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The initial soil pH was 7.91, EC-0.24 dSm⁻¹, Organic Carbon- 4.10 g kg⁻¹, Calcium carbonate -4.05%, available nitrogen-151.00 kg ha⁻¹, Phosphorus -12.51, Potassium- 510.18 kg ha⁻¹. The initial micronutrient status was DTPA Copper-1.12, Manganese-5.43, Zinc-0.52 and

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Ferrous – 3.10 mg kg⁻¹. The soil was clayey in texture, moderately alkaline in reaction, medium in available nitrogen, phosphorus and sufficient in available potassium and low in sulphur and iron.

The field experiment was carried out on soybean crop (Variety MAU-158) in kharif season during year 2017-18. After completion of preparatory tillage operations, the experiment was laid out in randomized block design comprising (12) treatments and replicated (3) times. Twelve treatments were formulated to evaluate the effect of organic formulations on growth, yield and soil nutrient dynamics in soybean. The details of treatment are as follows T1 RDF (100% NPK through fertilizer), T2 Panchagavya only, T3Jeevamruth only, T4 Beejamruth only, T5 Panchgavya + Beejamruth, T6 Beejamruth + Jeevamruth, T7Panchgavya + Jeevamruth, T8RDF + Beejamruth + Panchgavya, T9 RDF + Beejamruth + Jeevamruth, T10 RDF+ Beejamruth + Jeevamruth+ Panchgavya, T11 Beejamruth + Jeevamruth+ Panchgavya, T12100% N through FYM.

Results and Discussion

Effect of organic formulations on yield of soybean.

Seed yield

The data on seed yield of soybean (kg ha⁻¹) as influenced by different treatments are synthesized in Table 1. There was significant increase in the seed yield of soybean due to application of organic formulations along with recommended dose of fertilizer as compared to RDF and application of only organic formulations. The results revealed that the seed yield of soybean varied in the range of 1344.54 to 2368.38 kg ha⁻¹. Significantly highest soybean seed yield was obtained with treatment T₁₀ receiving RDF + Beejamruth + Jeevamruth + Panchagavya (2368.38 kg ha⁻¹) followed by treatment T₈ receiving RDF + Beejamruth + Panchagavya (2139.76 kg ha⁻¹) and lowest was found in T₄ treatment (1289.17 kg ha⁻¹). However, the magnitude of increase grain yield under treatment T₁₀ receiving RDF+ Beejamruth + Jeevamruth + Panchagavya being about 13.79 percent over only RDF. Significantly higher seed yield of soybean was observed in application of Beejamruth + Jeevamruth +Panchagavya along with RDF due to adequate supply of required nutrient through chemical fertilizer at early stage of plant growth and also due to overall improvement in soil Physico- chemical and biological properties due to combined application of organic formulations and inorganic fertilizers. The better nutrient availability and nutrient uptake increased the growth and yield of crop. These results are in compliance with the finding of Gore and Sreenivasa (2011)^[2], Yadhav *et al* (2017), Patil and Padmani (2007)^[4], Patel *et al* (2013)^[3] and Patil and Udmale (2016)^[5].

Straw yield

The data on straw yield of soybean are presented in Table 2 . The Straw yield of soybean ranged from 1223.60 to 2152.00 kg ha⁻¹. The straw yield was highest (2152.00 kg ha⁻¹) with the treatment T₁₀ (RDF + Beejamruth + Jeevamruth + Panchagavya). The lowest straw yield was (1223.60 kg ha⁻¹) was recorded in treatment T₄ (Beejamruth). The application of Beejamruth + Jeevamruth + Panchagavya might have resulted in the better availability of nutrient throughout the crop growth. This is mediated through biological processes as noticed by higher microbial activity; soil enzymatic activity

and plant growth promoter present it. These result are in combination with the finding of Gore and Sreenivasa (2011)^[2], Sahay *et al* (2016)^[6], Zadode *et al* (2014)^[8], Yadav *et al* (2017)^[7] and Patil and Udmale (2016)^[5].

Effect of organic formulations on quality parameters of soybean.

Test weight

The test weight of soybean was significantly affected due to different organic formulations with RDF are presented in Table 10. The data revealed that the test weight of soybean though slightly improved with combined application of RDF and organic formulations but treatment were found to be statistically at par with each other and did not reach to the level of significance. Similar findings were also reported by Shariff *et al*. (2017), Patil and Udmale (2016)^[5] and Yadav *et al* (2017)^[7].

Protein content

The data pertaining to protein content in seeds of soybean as influenced by organic formulations are narrated in Table 11. The protein content of soybean seed varied in the range of 31.75 to 35.12 percent. There was increase in protein content of seeds of soybean due to combined application of chemical fertilizer and organic formulations. The highest protein content (35.12%) in seeds of soybean obtained in treatment receiving RDF + Beejamruth + jeevamruth + Panchagavya (T₁₀) treatment. The lowest protein content of seed was registered in treatment receiving Beejamruth only (T₄). The increase in protein content with combined application of recommended dose of fertilizer with organic formulations confirms the result recorded by Choudhary *et al*. (2017)^[10] and Aziz *et al*. (2016)^[9].

Conclusion

The Applications of organic formulations RDF+ Beejamruth + Jeevamruth + Panchagavya significantly enhanced growth, yield and quality parameters of soybean.

Table 1: Effect of organic formulations on seed yield of soybean

Treatments detail	Seed yield (kg ha ⁻¹)	% increase over only RDF
T ₁ : RDF (100% NPK through fertilizer)	2081.93	-
T ₂ : Panchagavya only	1378.72	-
T ₃ : Jeevamruth only	1344.54	-
T ₄ : Beejamruth only	1289.17	-
T ₅ : Panchgavya + Beejamruth	1844.21	-
T ₆ : Beejamruth + Jeevamruth	1618.09	-
T ₇ : Panchgavya + Jeevamruth	1776.85	-
T ₈ : RDF + Beejamruth + Panchgavya	2139.76	2.78
T ₉ : RDF + Beejamruth + Jeevamruth	2095.88	0.67
T ₁₀ : RDF+ Beejamruth + Jeevamruth+ Panchgavya	2368.38	13.79
T ₁₁ : Beejamruth + Jeevamruth+ Panchgavya	1892.45	-
T ₁₂ : 100% N through FYM	1888.88	-
Grand mean	1809.90	
SE ±	65.16	
CD at 5%	191.13	
CV	6.23	

Table 2: Effect of organic formulations on straw yield of soybean

Treatments detail	straw yield (kg ha ⁻¹)	% increase over control
T ₁ : RDF (100% NPK through fertilizer)	1999.20	-
T ₂ : Panchagavya only	1288.36	-
T ₃ : Jeevamruth only	1272.40	-
T ₄ : Beejamruth only	1223.60	-
T ₅ : Panchgavya + Beejamruth	1748.00	-
T ₆ : Beejamruth + Jeevamruth	1544.00	-
T ₇ : Panchgavya + Jeevamruth	1698.00	-
T ₈ : RDF + Beejamruth + Panchgavya	2063.00	3.20
T ₉ : RDF + Beejamruth + Jeevamruth	2003.00	0.20
T ₁₀ : RDF+ Beejamruth + Jeevamruth + Panchgavya	2152.00	7.67
T ₁₁ : Beejamruth + Jeevamruth+ Panchgavya	1720.40	-
T ₁₂ : 100% N through FYM	1748.30	-
Grand mean	1705.02	
SE ±	59.39	
CD at 5%	174.19	
CV	6.03	

Table 3: Effect of organic formulations on test weight of soybean

Treatments detail	Test weight (gm)
T ₁ : RDF (100% NPK through fertilizer)	10.88
T ₂ : Panchagavya only	10.07
T ₃ : Jeevamruth only	10.06
T ₄ : Beejamruth only	10.04
T ₅ : Panchgavya + Beejamruth	10.18
T ₆ : Beejamruth + Jeevamruth	10.22
T ₇ : Panchgavya + Jeevamruth	10.23
T ₈ : RDF + Beejamruth + Panchgavya	10.36
T ₉ : RDF + Beejamruth + Jeevamruth	10.33
T ₁₀ : RDF+ Beejamruth + Jeevamruth+ Panchgavya	10.88
T ₁₁ : Beejamruth + Jeevamruth+ Panchgavya	10.34
T ₁₂ : 100% N through FYM	10.22
Grand mean	10.31
SE ±	0.55
CD at 5%	NS
CV	9.47

Table 4: Effect of organic formulations on protein content in soybean seed

Treatments detail	Protein content (%)
T ₁ : RDF (100% NPK through fertilizer)	33.68
T ₂ : Panchagavya only	31.87
T ₃ : Jeevamruth only	31.93
T ₄ : Beejamruth only	31.75
T ₅ : Panchgavya + Beejamruth	33.56
T ₆ : Beejamruth + Jeevamruth	33.00
T ₇ : Panchgavya + Jeevamruth	33.25
T ₈ : RDF + Beejamruth + Panchgavya	34.50
T ₉ : RDF + Beejamruth + Jeevamruth	34.18
T ₁₀ : RDF+ Beejamruth + Jeevamruth+ Panchgavya	35.12
T ₁₁ : Beejamruth + Jeevamruth+ Panchgavya	33.25
T ₁₂ : 100% N through FYM	32.62
Grand mean	33.21
SE ±	0.74
CD at 5%	2.19
CV	3.91

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