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NUTRIENT UTILIZATION AND YIELD OF SOYBEAN APPLIED WITH JEEWAMRIT FORTIFIED WITH BANAN PEEL, SLACKED LIME AND BIOFERTILIZERS IN BLACK SOIL.

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ABSTRACT

A field experiment was conducted consecutively during *kharif* season of 2018 and 2019 at the Research Farm, RAK College of Agriculture, Sehore (M.P.), India to study on nutrient utilization Nutrient utilization and yield of soybean applied with Jeewamrit fortified with slacked lime and biofertilizers biofertilizers. The combined application of 50 % RDF + *Rhizobium* + PSB @ 4 kg ha^{-1} as soil application + Jeewamrit 500 lit ha^{-1} 30 DAS + Slacked lime @ 25 kg ha^{-1} (T_7), followed by T_6 significantly enhanced the N, P, K, S, Zn and Fe contents and their uptake in seed and straw of soybean over control T_1). The available nutrient balance of N, P, K, S, Zn and Fe in post-harvest soil was found significantly higher under T_7 treatment, followed by T_6 treatment. Thus the treatment T_7 producing maximum total biomass (grain + straw) up to 29.0 q/ha significantly increased the total uptake of nutrients (109, 11.7, 51.27 and 8.0 kg/ha N, P, K, and 3.89 and 165.63 q/ha Zn and Fe, respectively). All these nutrients were also found significantly higher in the post-harvest soil, the values being 241 kg N, 13 kg P, 419 kg K, 10.3 ppm S, 0.56 ppm Zn and Fe. The second best treatment was T_6 with respect to all these nutrients.

Key words: Jeewamrit, slacked lime, biofertilizers, soybean

INTRODUCTION

The yield level of soybean is generally low because it is less cared crop and mostly grown in poor soils under rainfed conditions without manures and fertilizers. Regular depletion of nutrient resources of soils has led to emergence of several nutrients deficiencies in many crops including soybean. This is because the greater is the production, the higher and faster are the rates of nutrient exhaustion from the soil.

There is immense scope for improving the production of this crop by use of organic manures, inorganic manures and biofertilizers (Verma *et al.*, 2017). Although, chemical fertilizers are playing a crucial role to meet the nutrient requirement of the crop, persistent nutrient depletion is posing a greater threat to the sustainable agriculture. Therefore, there is an urgent need to reduce the usage of chemical fertilizer and in turn, increase in the usage of organics and other products. Use of organics alone does not result in spectacular increase in crop yield. Therefore, the foresaid consequences have paved way to grow soybean using organic manures and inorganic fertilizers along with biofertilizers. The existing blanket recommendation for crops does not ensure efficient and economic use of fertilizers, as it does not take into account of the fertility. The integrated nutrient management ensures higher productivity, minimizes expenditure on costly fertilizer inputs, improves physical properties of soil, efficiency of added nutrients and at the same time ensures good soil health and is also an environment friendly approach (Jyagi and Singh, 2019).

It is reported that organic liquid formulation like panchagavya, cow urine and Jeevamrit are rich sources of organic nutrients. Jeevamrit is a plant growth promoting substance containing beneficial microorganisms which promotes availability of nutrients and improves the rhizospheric activities physico-chemical properties of soil and thus, growth and yield of crop in the soil (Basavaraj *et al*. 2015). The soybean productivity is low in M.P. and in India. The research work done on Jeevamrit together with biofertilizers and slacked lime in soybean cultivation is scanty. Therefore considering all these facts the present study was taken up.

MATERIALS AND METHODS

The field experiment was conducted consecutively during *kharif* season 2018 and 2019 at the Research Farm, RAK College of Agriculture, Sehore (M.P.), India. The soil of the experimental field was medium black (Vertisol) having clay-loam texture, low in available nitrogen (202.24 N kg/ha), medium in available phosphorus (12.16 P kg/ha), high in available potassium (425.25 kg k/ha) and normal in available sulphur (8.87 ppm) and available Zn (0.39 ppm) with pH of 7.55. The experiment consisted of 7 treatments laid out in randomized block design keeping 3 replications. The treatment included absolute control (T_1), 50% RDF + *Rhizobium* + PSB @ 4 as kg ha^{-1} soil application (T_2), 50 % RDF + Jeewamrit @ 500 lit ha^{-1} 30 DAS (T_3), 50 % RDF + *Rhizobium* + PSB @ 4 kg ha^{-1} soil application + Jeewamrit @ 500 lit ha^{-1} 30 DAS (T_4), 50 % RDF + *Rhizobium* + PSB @ 4 kg ha^{-1} + Slacked lime @ 25 kg ha^{-1} (T_5), 50 % RDF + Jeewamrit @ 500 lit ha^{-1} 30 DAS + Slacked lime @ 25 kg ha^{-1} (T_6), 50% RDF + Rhizobium + PSB @ 4 kg ha^{-1} as soil application + Jeewamrit 500 lit ha^{-1} 30 DAS + Slacked lime @ 25 kh ha^{-1} (T_7). The soybean var. RVS-24 was sown on 7th and 3rd July in 2018 and 2019, respectively. The Jeewamrit is composed of 5 kg of cow dung+ 5 Liters of Cow Urine+2 kg of Banana Peel+ 1 kg Jaggery + 1 kg Chickpea flour+ 01 kg Soil found under the banyan tree+5 Liters of water which was kept for decomposition for 7 days in a 200 Liter's capacity drum by mixing the material every day after which it was sieved through 2 mm sieve and 5 percent of this jeewamrit solution used to make desired dose of jeewamrit application. The farm made Jeewamrit contain Nitrogen content (0.92 percent) , Phosphorus content (0.11 percent), Potassium content (0.78 percent) Sulphur content (0.79 percent), Magnesium (0.94 percent), Zinc (40 ppm), Iron (50 ppm). More over to this the Jeewamrit also contain the microbial population in CFU per ml on nutrient Agar at 28 degrees Celsius for 48 hours respectively of bacteria (24×10^5), fungi (15.8×10^5) and Actinomycetes (6.4×10^5). The 50 percent recommended doses of fertilizers were applied as per package of practices of soybean @ 20:60:20:20 kg/ha N, P_2O_5, K_2O and S respectively. The crop was grown as per recommended package of practices. The crop was harvested on 3rd October, 2018 and 17th October, 2019. The available N, P_2O_5, K_2O and S were determined by standard procedure.

Nitrogen Content (%) through Micro Kjeldahl method as described by Jackson, 1973, Phosphorus content (%) by Vanadomolybdo Yellow Colour Method (Koeing and Johnsons, 1942, Potassium content (%) by Di-acid digestion method by Flame photometer (AOAC, 1984), Sulphur cotent (%) by Turbidimetric Method (AOAC, 1984), Zn and Fe content through Di-acid digestion using AAS as described by Tandon, 1993.

RESULTS AND DISCUSSION

Nitrogen content in seed, straw and total its uptake

The scrutiny of data in Table 1 and 2 reveal that the N-content (%) in seed and straw of soybean was found significantly higher under 50 % RDF + *Rhizobium* + PSB @ 4 kg ha^{-1} + Jeewamrit @ 500 lit ha^{-1} + Slacked lime @ 25 kg ha^{-1} (T_7) over rest of the treatments. The second best treatment was T_6. This increase was ascribed owing to combined organic formulations together with other applied inputs available to the growing plants. The same treatment (T_7) recorded the highest total N-uptake (119.4 kg ha^{-1}) being significantly superior to rest of the treatments. The increase in uptake of nitrogen could be the results of enhanced physiological and microbial processes within the plant system due to better availability of nitrogen in the soil. The similar results have also been reported by *et al*. (2010), Ashokbhai (2014), Jain (2015), and Mohammad *et al*. (2017).

Phosphorus content in seed, straw and total uptake

The same treatment 50 % RDF + *Rihizobium* + PSB @ 4 kg ha^{-1} + Jeewamrit @ 500 lit ha^{-1} + Slacked lime @ 25 kg ha^{-1} (T_7) recorded the highest P-content in seed (0.70 %) and straw (0.16 %), which was significantly higher to rest of the treatments which was due to higher availability of phoshorus nutrient in the soil. Thus the treatment T_7 brought about the highest total P-uptake (12.84 kg ha^{-1}) in seed + straw which was significantly superior to rest of the treatments. The increase in uptake could be the results of enhanced physiological processes due to fair availability of nutrients in the soil and thus enhanced P absorption and uptake by plants. The similar results have also been reported by, Kumawat *et al*. (2010), Ashokbhai (2014), and Mohammad *et al*. (2017).

Potassium content in seed, straw and total uptake

The K-content straw and seed was influenced significantly by different treatments. The application of 50 % RDF + *Rhizobium* + PSB @ 4 kg ha^{-1} + Jeewamrit @ 500 lit ha^{-1} + Slacked lime @ 25 kg ha^{-1} (T_7) resulted in significantly higher K-content in seed (2.89 %) and straw (1.50 %) as compared to rest of the treatments. The second best treatment was T_6. The trend of such results could be attributed to the higher availability of potassium in the soil indicating the higher absorption of potassium by the plants.

The total K-uptake by soybean was also increased significantly with different residual treatments of organic formulation and inorganic sources together with beiofertilizers. Therefor the use of 50 % RDF + *Rhizobim* + PSB @ 4 kg ha^{-1} + Jeewamrit @ 500 lit ha^{-1} + Slacked lime @ 25 kg ha^{-1} (T_7) brought about the highest total K-uptake (67.64 kg ha^{-1}) in seed + straw which was significantly superior to rest of the treatments. The reason being the enhancement of K absorption by plants and increased yield attributes due to different treatments. These results corroborate with the findings of Kumawat *et al*. (2010), Ahokbhai (2014), Jain (2015), Mohammad *et al*. (2017) and Jain (2019).

Sulphur content in seed, straw and total uptake

The use of 50 % RDF + *Rhizobium* + PSB @ 4 kg ha^{-1} + Jeewamrit @ 500 lit ha^{-1} + Slacked lime @ 25 kg ha^{-1} (T_7) recorded significantly higher S-content in seed (0.32 %) and straw (0.23 %) over rest of the treatments. This was followed by T_6 treatment. The trend of such results could be attributed to the fair availability of sulphur to the plants.

The total S-uptake was also improved significantly with the same treatment T_7 having 50 % RDF + *Rhizobium* + PSB @ 4 kg ha^{-1} + Jeewamrit @ 500 lit ha^{-1} + Slacked lime @ 25 kg ha^{-1}. The highest total S-uptake was 8.90 kg ha^{-1} in seed + straw which was significantly superior to other treatments. The reason being the enhanced the availability of essential nutrients to the plant growth their by the increased absorption of sulphur. These results are in close conformity with these of Kumawat *et al*. (2010, Ashokbhai (2014), and Jain ((2019).

Zn-content in seed, straw and total uptake

Application of 50 % RDF + *Bhizobium* + PSB @ 4 kg ha^{-1} + Jeewamrit @ 500 lit ha^{-1} + Slacked lime @ 25 kg ha^{-1} (T_7) recorded significantly higher Zn- content in seed (46.38 mg kg^{-1}) and in straw (29.1 mg kg^{-1}) over the rest of the treatments. This was followed by T_6 treatment. The trend of such results could be attributed to the fair availability of Zn in the soil for plant growth.

consequently the total Zn-uptake was improved significantly with the same treatment T_7 having 50 % RDF + *Rhizobium* + PSB @ 4 kg ha^{-1} + Jeewamrit @ 500 lit ha^{-1} + Slacked lime @ 25 kg ha^{-1} which resulted in the highest total Zn uptake (117.26 g ha^{-1}) in seed + straw being significantly superior to the remaining treatments. This was due to increased availability of essential plant nutrients for the plant growth thereby increased absorption of Zn and its total uptake /ha. These results are in close conformity with these of Ravikumar *et al.* (2009), Kumawat *et al*. (2010), and Jain (2019).

Fe-content in seed, straw and total uptake

The application of 50 % RDF + *Rhizobium* + PSB @ 4 kg ha^{-1} + Jeewamrit @ 500 lit ha^{-1} + Slacked lime @ 25 kg ha^{-1} (T_7) recorded significantly higher Fe-content in seed (61.31 mg kg^{-1}) and in straw (44.4 mg kg^{-1}) over rest of the treatments. This was followed by T_6 treatment. The trend of such results could be attributed to the fair availability of Fe in the soil for growing plants.

Ultimately the total Fe-uptake was improved significantly with the different treatments. The use of 50 % RDF + *Rhizobium* + PSB @ 4 kg ha^{-1} + Jeewamrit @ 500 lit ha^{-1} + Slacked lime @ 25 kg ha^{-1} (T_7) brought about the highest total Fe-uptake (164.93 g ha^{-1}) in seed + straw being significantly superior to other treatments. This was due to increased absorption of Fe and its uptake /ha. These results are in close conformity with those of Shwetha (2008), Ravikumar *et al*. (2009), Kumarwat *et al*. (2010), and Jangir *et al.* (2017).

The findings conclude that application of 50 % RDF + *Rhizobium* + PSB @ 4 kg ha^{-1} + Jeewamrit @ 500 lit ha^{-1} + Slacked lime @ 25 kg ha^{-1} (T_7) equally followed by T_6 resulted in maximum N, P, K, S, Zn, and Fe nutrient contents in seed and straw as well as their total uptake/ha by soybean. The nutrient balance of these nutrients was also found highest under T_7 equally followed by T_6 treatments.

REFERENCES

Jackson, M.L. (1973). *Soil Chemical Analysis,* Prentice Hall of India Pvt. Ltd., New Delhi.

Jain, R.C. (2015). The response of soybean (*Glycine max* (L.) Merrill) to lime-based integrated nutrient management and mulching on nodulation, nutrient contents and yield in clay loam soil. *Current World Environment,* **10** (2): 707-709.

AOAC (1984). *Official Methods of Analysis of Analytical Chemists* (W. Hartwitz, Ed.). 14th Ed. AOAC Washington DC, U.S.A.

Jain, R.C. and Singh (2018). Residual Effect of Arbuscular Mycorrhizal Fungi and PGPR on Nodulation, Growth, Nutrient uptake and Yield of Soybean (*Glycine max* (L.) Merrill) in Black Soil, M.Sc. (Ag) *Thesis* RVSKVV Gwalior (M.P.).

Koeing, R.A. and Johnson, C.R. (1942). Colorimetric determination of biological material. *Industrial and Engineering Chemistry* (Analytical Edition) **14**:155-164.

Tyagi, P.K. and Singh, V.K. (2019). Effect of integrated nutrient management on growth, yield and nutrients uptake of summer blackgram (*Vigna mungo*) Annals of Plant and Soil Research **21**(1): 30-35

Verma, S.N., Sharma, N. and Verma, A. (2017). Effect of integrated nutrient management on growth, quality and yield of soybean (Glycine max). Annals of plant and Soil Resarch **19** (4): 372-376.

Singh, S. (2018). Effect of balanced use of nutrients on yield, quality and uptake of nutrients by greengram (Vigna radiata). *Annals of plant and soil Research* **20**(2):191-196.

Tandon, H. L. S. (1993). Methods of analysis of soils, plants, waters and fertilizers. Fertilizer Development and Consultation Organizations, New Delhi (India).

Basavraj, K., Devkumar, N., Latha, B. And Somanatha, A. C.(2015). Effect of organic liquid manure, jeevamrut and panchagavya on yield of Frenchbean (Phaseolus vulgaris L.).Proc. Nation. Symp. Organic Agric., Tamil Nadu, p. 111.

Kumawat, A.,pareek,B.L.andyadav R.S.(2010) Response of green gram (Vigna radiate L) to biofertilizer under different fertility levels. Indian J.Agric.Sci., 80(7): 655-657.

Mohammad I, Yadav B.L and Ahmad A. (2017) Effect of phosphorus and bio-organics on yield and soil fertility status of Mungbean (Vigna radiata L.) under semi-arid condition of Rajasthan, India. International Journal of Current Microbiology and Applied Sciences.6(3):1545-1553.

Jain,R.C. (2015). Response of soybean (Glycine max(L.)Merrill) to lime based integrated nutrient management and mulching on nodulation, nutrient contents and yield in clay loam soil. Current World Environment 10(2): 707-709.

Jain,R.C. and Singh S. B. P. (2019). Response of soybean (Glycine max (L.) Merrill) to biofertilizer and Jeevamrit fortified with slacked lime in vertisol. M.sc. (Agriculture) thesis, Department of Soil Science and Agriculture Chemistry.R.A.K. college of Agriculture Sehore (RVSKVV) M. P.

Ravi kumar, H. S., (2009) Comparative performance of integrated organic nutrient supply systems on growth and yield of groundnut (Arachis hypogaea L.) M.Sc. Thesis (Unpub.), Univ. Agric. Sci., Bengaluru, Karnataka, India.

Shwetha, B. N., (2008) Effect of nutrient managent through organics in soybean -wheat cropping system. M. Sc. Thesis (Unpub.), Univ. Agric. Sci., Dharwad.

Jangir C.K, Singh D.P, Meena R.H and Yadav M. (2017) Effect of fertility levels and biofertilizers on physical and chemical properties of soil under blackgram (Vignamungo L.).International Journal of Current Microbiology and Applied Sciences.6 (3):223-228.

Table 1. Nutrient contents in seed and straw of soybean and influenced by different treatments (Pooled for 2 years)

Treatments	N-content (%)		P-content (%)		K-content (%)		S-content (%)		Zn-content (mg/kg)		Fe-content (mg/kg)	
	Seed	Straw	Seed	Straw	Seed	Straw	Seed	Straw	Seed	Straw	Seed	Straw
T_1	6.29	0.945	0.6	0.08	1.88	1.225	0.245	0.135	32.765	20.585	44.33	29.52
T_2	6.4	1.075	0.615	0.09	1.91	1.245	0.255	0.155	34.4	21.785	48.77	33.72
T_3	6.5	1.125	0.625	0.1	1.95	1.26	0.265	0.17	35.98	23.905	51.42	36.42
T_4	6.595	1.15	0.645	0.11	2.025	1.28	0.14	0.185	38.385	25.00	55.90	39.48
T_5	6.685	1.175	0.67	0.13	2.075	1.295	0.29	0.195	40.705	26.13	58.53	41.57
T_6	6.735	1.205	0.68	0.14	2.135	1.31	0.3	0.21	44.325	27.09	59.55	44.56
T_7	6.805	1.235	0.70	0.16	2.19	1.34	0.315	0.225	46.855	28.555	61.05	45.38
S.Em±	**0.045**	**0.01**	**0.0065**	**0.004**	**0.015**	**0.008**	**0.16**	**0.0245**	**0.84**	**1.01**	**1.135**	**0.280**
C.D. (P=0.05)	**03.15**	**0.045**	**0.0205**	**0.01**	**0.06**	**0.025**	**0.015**	**0.015**	**2.595**	**3.13**	**3.49**	**0.863**

Table 2. Total uptake of nutrients in seed + straw of soybean as influenced by different treatments (Pooled for 2 seasons)

Treatments	Total uptake by seed + straw of soybean (kg/ha)						Available nutrient balance in post-harvest soil (kg/ha)					
	Nitrogen	Phosphorus	Potassium	Sulphur	Zinc (g/ha)	Fe (g/ha)	Nitrogen	Phosphorus	Potassium	Sulphur (ppm)	Zinc (ppm)	Fe (ppm)
T_1	68.45	6.43	32.785	4.00	1.925	82.23	192.06	9.09	878.02	8.86	0.43	0.045
T_2	78.65	7.365	36.06	4.70	2.50	99.17	203.49	10.07	389.6	9.18	0.44	0.46
T_3	85.83	8.14	39.19	5.39	2.74	114.43	219.86	10.755	403.32	9.38	0.48	0.48
T_4	91.69	8.96	42.21	5.83	2.99	130.76	235.55	12.62	415.46	10.11	0.52	0.51
T_5	97.76	10.04	45.12	6.48	3.22	144.86	237.67	12.57	414.94	10.27	0.53	0.52
T_6	102.01	10.62	47.75	7.03	3.62	155.06	240.03	12.72	417.72	10.305	0.54	0.54
T_7	108.96	11.71	51.27	8.02	3.89	165.63	241.3	13.00	418.82	10.29	0.56	0.56
S.Em±	**3.31**	**0.345**	**1.65**	**0.285**	**0.155**	**2.69**	**1.92**	**0.31**	**2.33**	**0.16**	**0.009**	**0.008**
C.D. (P=0.05)	**10.2**	**1.065**	**5.085**	**0.895**	**0.49**	**8.31**	**8.515**	**0.955**	**7.21**	**0.525**	**0.02**	**0.02**