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Short Communication

Effect of organic sources of nutrients on growth parameters of soybean (*Glycine max* L. Merr.)

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Abstract

A field experiment was conducted at Integrated Research Farm, Department of Organic Agriculture and Natural Farming, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur during *Kharif* 2022, to evaluate the effect of organic sources of nutrients on growth of soybean. The experiment was laid out in randomized block design comprising of eight treatments [*Beejamrit* (200 ml/kg seed) + *Jeevamrit* (175 l/ha), *Beejamrit* (200 ml/kg seed) + *Ghanjeevamrit* (500 kg/ha), *Beejamrit* (200 ml/kg of seed) + *Jeevamrit* (175 l/ha)+ *Ghanjeevamrit* (500 kg/ha), Farm yard manure (10 t/ha), Farm yard manure (10 t/ha) + *Ghanjeevamrit* (500 kg/ha), Biofertilizers (*Rhizobium* + PSB) + Farm Yard Manure (10 t/ha) + Vermiwash (225 l/ha), Biofertilizers (*Rhizobium* + PSB) + Vermicompost (5 t/ha) + Vermiwash (225 l/ha) and Absolute control] replicated thrice. The results revealed that biofertilizers (*Rhizobium* + PSB) + Vermicompost (5 t/ha) + vermiwash (225 l/ha) recorded the tallest plants and the highest primary and secondary branches which was statistically similar to biofertilizers (*Rhizobium* + PSB) + farm yard manure (10 t/ha) + vermiwash (225 l/ha). Biofertilizers (*Rhizobium* + PSB) + vermicompost (5 t/ha) + vermiwash (225 l/ha) being statistically at par with biofertilizers (*Rhizobium* + PSB) + farm yard manure (10 t/ha) + vermiwash (225 l/ha) and farm yard manure (10 t/ha) + *Ghanjeevamrit* (500 kg/ha) resulted in higher dry matter accumulation, absolute growth rate and nodules per plant.

Key words: Growth, growth parameters, organic, soybean

Soybean (*Glycine max* L. Merr.), a leguminous crop, belongs to the family Fabaceae, sub-family Faboideae. It is a self-fertilizing crop with white or slightly purple flowers. It contains about 40 per cent protein and 20 per cent oil content (Singh and Chung 2007). Its protein is rich in lysine and its oil is rich in essential fatty acids like Omega-3 and Omega-6 (Thakur and Dhiman 2016). In India, area, production and productivity of soybean is 12.19 million ha, 11.23 million ton and 921 kg/ha, respectively (Anonymous 2020a). In Himachal Pradesh, area, production and productivity of soybean is 600 ha, 1000 ton and 1710 kg/ha, respectively (Anonymous 2020b). It is mainly grown in *Kharif* season as monoculture or as intercrop or mixed crop with crops like maize and millets in Himachal Pradesh.

Use of chemical fertilizers in imbalanced and indiscriminate manner has developed many problems like decline of soil organic matter, deterioration of soil health, increase in salinity and sodicity, deterioration in the quality of crop produce and increase in hazardous pests and diseases (Ahmed *et al*. 2017). In such a situation, a renewable, eco-friendly farming practice that is organic/natural farming has emerged as a sustainable alternative. There are different concepts of chemical free farming which include organic farming, natural farming, etc. Organic farming is based on various composts, biofertilizers and other cultural practices in crop production. It helps to maintain the

ecology and productivity of systems for future generations along with improving the physical, chemical, and biological qualities of the soil (Yadav *et al*. 2016). Natural farming is another way of sustainable farming which is supported by our rich traditional knowledge. It is based on the use of different formulations like *Jeevamrit, Beejamrit,* etc. *Jeevamrit* promotes growth, improves yield and quality of crops and enhances the soil physico-chemical and biological properties.

The experiment was conducted at Integrated Research Farm, Department of Organic Agriculture and Natural Farming, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur. The farm is situated at 32° 11´ N latitude, 76° 32´ E longitude and an elevation (altitude) of 1290 m above mean sea level in Palampur, Kangra district of Himachal Pradesh. The experiment was laid out in Randomized Block Design (RBD) with eight treatments [T_1 - *Beejamrit* (200 ml/kg of seed) + *Jeevamrit* (500 l/ha), T_2 – *Beejamrit* (200 ml/kg of seed) + *Ghanjeevamrit* (500 kg/ha), T_3 - *Beejamrit* (200 ml/kg of seed) + *Jeevamrit* (500 l/ha)+ *Ghanjeevamrit* (500 kg/ha), T_4 - Farm Yard Manure (10 t/ha), T_5 - Farm Yard Manure (10 t/ha) + *Ghanjeevamrit* (500 kg/ha), T_6 - Biofertilizers (*Rhizobium* + PSB) + Farm Yard Manure (10 t/ha) + Vermiwash (225 l/ha), T_7 - Biofertilizers (*Rhizobium* + PSB) + Vermicompost (5 t/ha) + Vermiwash (225 l/ha), T_8 - Absolute control] replicated thrice. Experimental site was acidic in reaction with 5.5 pH, 0.61 per cent OC, 217.4 kg/ha available nitrogen, 19.5 kg/ha available phosphorus and 235.7 kg/ha available potassium content.

Plant height was significantly influenced by different treatments at 30, 60, 90 days after sowing and at harvest. The tallest plants were observed in T_7 (Biofertilizers + Vermicompost + Vermiwash) while the shortest plants were in T_8 (Absolute control) at all growth stages. The plant height recorded in T_6 (Biofertilizers + FYM + Vermiwash) was at par with T_7 at all growth stages (Table 1). This might be due to more nutrient availability in treatment T_7 as compared to others. The addition of biofertilizers enhances the availability of N and P to the plants. Vermicompost adds nutrients like N, P, K whereas, vermiwash enhances growth as it contains several enzymes, plant growth hormones like, cytokinins, gibberlins and vitamins along with micro and macro nutrients (Buckerfield *et al*. 1999). Similar results were reported by Awasthi *et al*. (2020).

Dry matter accumulation was the highest in T_7 (Biofertilizers + Vermicompost + Vermiwash) which was at par with T_6 (Biofertilizers + FYM + Vermiwash)

Table 1. Effect of organic nutrient sources on plant height

	Treatment	Plant height (cm)			
		30 DAS	60 DAS	90 DAS	Harvest
T_1	*Beejamrit* + *Jeevamrit* (175 l/ha)	29.4	68.4	103.4	133.4
T_2	*Beejamrit* + *Ghanjeevamrit* (500 kg/ha)	31.0	69.4	104.4	134.4
T_3	*Beejamrit* + *Jeevamrit* (175 l/ha) + *Ghanjeevamrit* (500 kg/ha)	33.4	72.8	107.8	137.8
T_4	FYM (10 t/ha)	32.8	71.9	106.9	136.9
T_5	FYM (10 t/ha) + *Ghanjeevamrit* (500 kg/ha)	33.4	72.7	107.7	137.7
T_6	Biofertilizers (*Rhizobium* & PSB) + FYM (10 t/ha) + vermiwash (225 l/ha)	35.7	75.8	110.5	140.5
T_7	Biofertilizers (*Rhizobium* & PSB) + vermicompost (5 t/ha) + vermiwash (225 l/ha)	38.7	85.1	121.4	153.4
T_8	Absolute control	26.8	61.1	92.1	122.1
	SEm±	1.3	3.1	4.1	4.9
	CD (P=0.05)	4.1	9.3	12.4	14.9

Jeevamrit applied @ 5%, 10%, 10% and 10 % at time of sowing, 21, 42 and 63 DAS, respectively; Vermiwash (10%) applied at 15, 30 and 45 DAS

and T_5(FYM + *Ghanjeevamrit*) and it was the lowest in T_8 (Absolute control) (Table 2). Earthworm casts contain certain growth promoters (Esakkiammal *et al*. 2015) and biofertilizers increased the nutrient content in soil. These might be the reasons for higher values of dry matter in T_7. Absolute growth rate varied significantly at 30 and 60 DAS whereas it was non-significant at 90 DAS. At 30 and 60 DAS, the highest value of absolute growth rate was recorded in T_7 (Biofertilizers + vermicompost + vermiwash) which was at par with T_6(Biofertilizers + FYM + vermiwash) and T_5(FYM + *Ghanjeevamrit*) and it was the lowest in T_8 (Absolute control) (Table 2). Higher values of absolute growth rate in T_7 might be due to high dry matter accumulation in this treatment. Number of primary branches was significantly affected by different treatments. The highest number of primary branches was recorded in T_7 (Biofertilizers + vermicompost + vermiwash) and the lowest was recorded in T_8 (Absolute control). Number of secondary branches was also the highest in T_7 (Biofertilizers + vermicompost + vermiwash). T_6 (Biofertilizers + FYM + vermiwash) was similar to T_7 (Biofertilizers + vermicompost + vermiwash). The lowest number of secondary branches was recorded in T_8(Absolute control). The nodule count was the highest in T_7 (Biofertilizers + vermicompost + vermiwash) which was at par with T_6 (Biofertilizers + FYM + vermiwash) and T_5(FYM + *Ghanjeevamrit*), and it was the lowest in T_8 (Absolute control) (Table 3).

Table 2. Effect of organic nutrient sources on dry matter accumulation and absolute growth rate

	Treatment	Dry matter accumulation (g/plant)				Absolute growth rate (g/day)		
		30 DAS	60 DAS	90 DAS	Harvest	30 DAS	60 DAS	90 DAS
T_1	*Beejamrit* + *Jeevamrit* (175 l/ha)	0.69	15.07	41.90	48.97	0.023	0.479	0.894
T_2	*Beejamrit* + *Ghanjeevamrit* (500 kg/ha)	0.77	15.83	43.30	52.83	0.026	0.502	0.916
T_3	*Beejamrit* + *Jeevamrit* (175 l/ha) + *Ghanjeevamrit* (500 kg/ha)	0.79	16.37	43.93	52.97	0.026	0.519	0.919
T_4	FYM (10 t/ha)	0.78	16.23	43.37	52.90	0.026	0.515	0.904
T_5	FYM (10 t/ha) + *Ghanjeevamrit* (500 kg/ha)	0.84	18.23	46.00	54.30	0.028	0.580	0.926
T_6	Biofertilizers (*Rhizobium* & PSB) + FYM (10 t/ha) + vermiwash (225 l/ha)	0.86	19.40	46.23	54.80	0.029	0.618	0.894
T_7	Biofertilizers (*Rhizobium* & PSB) + vermicompost (5 t/ha) + vermiwash (225 l/ha)	0.98	21.63	50.57	59.30	0.033	0.689	0.964
T_8	Absolute control	0.59	10.47	36.63	46.43	0.020	0.329	0.872
	SEm±	0.06	1.67	2.08	1.97	0.002	0.055	0.078
	CD (P=0.05)	0.17	5.08	6.31	5.98	0.006	0.167	NS

Jeevamrit applied @ 5%, 10%, 10% and 10 % at time of sowing, 21, 42 and 63 DAS, respectively; Vermiwash (10%) applied at 15, 30 and 45 DAS

Table 3. Effect of organic nutrient sources on primary and secondary branches and nodules per plant

	Treatment	Primary branches	Secondary branches	Nodules per plant
T_1	*Beejamrit* + *Jeevamrit* (175 l/ha)	9.9	8.8	44.3
T_2	*Beejamrit* + *Ghanjeevamrit* (500 kg/ha)	11.4	10.7	45.3
T_3	*Beejamrit* + *Jeevamrit* (175 l/ha) + *Ghanjeevamrit* (500 kg/ha)	11.6	11.1	45.7
T_4	FYM (10 t/ha)	11.7	9.6	46.3
T_5	FYM (10 t/ha) + *Ghanjeevamrit* (500 kg/ha)	12.1	11.1	56.0
T_6	Biofertilizers (*Rhizobium* & PSB) + FYM (10 t/ha) + vermiwash (225 l/ha)	12.7	12.4	56.3
T_7	Biofertilizers (*Rhizobium* & PSB) + vermicompost (5 t/ha) + vermiwash (225 l/ha)	14.5	13.7	58.3
T_8	Absolute control	8.8	8.0	35.3
	SEm±	0.6	0.5	2.5
	CD (P=0.05)	1.7	1.5	7.5

Jeevamrit applied @ 5%, 10%, 10% and 10 % at time of sowing, 21, 42 and 63 DAS, respectively; Vermiwash (10%) applied at 15, 30 and 45 DAS

Vermicompost supplies essential nutrients and acts as a store house of beneficial microorganisms hence enhances the symbiotic relationship with micro-organism in the soil increasing in the number of nodules in the roots (Rajkhowa *et al*. 2003). According to Manivannan *et al*. (2009) and Singh and Chauhan (2009), working with legumes, the number of nodules was the highest in vermicompost treatment than in compost and control. Similar results were reported by Lyngdoh *et al*. (2017) in cowpea.

The present study inferred that biofertilizers (Rhizobium + PSB) + Vermicompost (5 t/ha) + Vermiwash (225 l/ha) proved to be the best treatment in improving the growth and growth parameters of soybean.

Conflict of interest: The authors declare that there is no conflict of interest in this research paper.

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