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Effect of organic sources and inorganic nutrients on growth of *kharif* soybean

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Abstract
An experiment was conducted on sandy clay loam soil of Western Ghat region to study the Effect of organic sources and inorganic nutrients on growth of *kharif* soybean during *kharif* 2016 and 2017 at Post Graduate Research Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar (M.S.). The experiment was laid out in randomized block design with three replication. The treatments consists of T_1- Farmyard manure @ 10 t ha^{-1}; T_2- Farmyard manure @ 5 t ha^{-1}; T_3- Vermicompost @ 5 t ha^{-1}; T_4- Vermicompost @ 2.5 t ha^{-1}; T_5- Poultry manure @ 5 t ha^{-1}; T_6- Poultry manure @ 2.5 t ha^{-1}; T_7- GRDF (50: 75: 40 kg N: P_2O_5: K_2O ha^{-1} with 5 t FYM ha^{-1}); T_8- Absolute control. All the growth parameters noticed significantly higher when crop was fertilized with (50: 75: 40 kg N: P_2O_5: K_2O ha^{-1} with 5 t FYM ha^{-1}) during both the years.

Keywords: Soybean, organic sources, inorganic nutrients, yield

Introduction
Soybean (*Glycine max* L.) is known as Chinese pea and Manchurian bean which belongs to the family fabaceae, subfamily fabiodeae. It is major oil seed crop in world, accounting for nearly 50 per cent of total oil seeds acreage as well as production. It ranks third in vegetable oil economy in India, after groundnut and rapeseed. It is miracle crop and has witnessed phenomenal growth in production and also called as gold of America. India has revolutionized rural economy and improved socio-economic status of farmers since last five years. Soybean has not only gained vital importance in Indian agriculture, but also plays a decisive role in oil economy of India.

Use of chemical fertilizers in imbalanced and indiscriminate manner has created many problems like decline of soil organic matter, increase in salinity and sodicity, deterioration in the quality of crop produce, increase in hazardous pests, diseases and soil pollutant problems. Continuous use of inorganic fertilizers has not only brought loss of vital flora and fauna but also resulted in loss of secondary and micro-nutrients (Chakarborti and Singh, 2004) [1]. Therefore, integrated use of all the sources such as chemical fertilizers and organic manures are needed to check the depletion of soil health. Though enhanced yield levels can be obtained within a short period through the use of inorganic fertilizers, but the greater importance of organic manures in improving soil health and better plant nutrition has started receiving much recognition in the world complementary use of organic manures along with chemical fertilizers, besides improving physico–chemical properties of soil also improves the nutrient use efficiency of applied fertilizers.

Material and Methods
The field experiment on Soybean (*Glycine max* L.) was conducted during *kharif* season of 2016 and 2017 at the Post Graduate Institute Research Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (M.S.). The soil of experimental plot was sandy clay loam in texture and alkaline in reaction (pH 8.19) with organic carbon (0.52%). It was low in available nitrogen (179.58 kg ha^{-1}) and medium in available phosphorus (19.63 kg ha^{-1}) and very high in available potassium (354.13 kg ha^{-1}). The experiment was laid out in randomized block design with three replication. The treatments consists of T_1- Farmyard manure @ 10 t ha^{-1}; T_2- Farmyard manure @ 5 t ha^{-1}; T_3- Vermicompost @ 5 t ha^{-1}; T_4- Vermicompost @ 2.5 t ha^{-1}; T_5- Poultry manure @ 5 t ha^{-1}; T_6- Poultry manure @ 2.5 t ha^{-1}; T_7- GRDF (50: 75: 40 kg N: P_2O_5: K_2O ha^{-1} with 5 t FYM ha^{-1}); T_8- Absolute control. The gross plot size was 4.2 x 3.6 m^2 and net plot sizes was 3.00 x 2.80 m^2. The crop was sown at spacing of 30 cm X 10 cm.

Healthy, unbroken and well developed seeds of soybean of variety Phule Agrani (KDS-344) were treated with fungicide and inoculated with biofertilizer (Rhizobium and PSB @ 25 g kg^{-1} seeds) before sowing of the seeds. The periodical growth observations were recorded at an interval of 28 days and crop was harvested at physiological maturity and data on yield were recorded.

Result and Discussion

Effect of organic sources and inorganic nutrients on growth parameters of soybean

The data presented in Table 1 showed that application of general recommended dose of fertilizer (50: 75: 40 kg N: P_2O_5: K_2O ha^{-1} with 5 t FYM ha^{-1}) to *kharif* soybean recorded maximum plant height at the time of harvest. The higher plant height in general recommended dose of fertilizer was possibly attributed to internode elongation and synthesis of higher photosynthesis due to optimum dose of fertilizer and availability of energy sources from integrated sources of nutrients. The results observed under number of branches per plant, number of leaves per plant, leaf area per plant was significantly maximum with application of general recommended dose of fertilizer (50: 75: 40 kg N: P_2O_5: K_2O ha^{-1} with 5 t FYM ha^{-1}) to *kharif* soybean during 2016 and 2017. This might be due to combined application of organic and inorganic nutrients which helps to improve use efficiency of added nutrients and supply it continuously to the plant throughout the crop growth period and promoted various physiological activities in plant for proper growth and development. These results are confirmatory with those reported by Maruthi *et al*. (2014) [6], Changkija and Gohain (2018) [3] and Ghodke *et al*. (2018) [4].

Among the organic sources, the treatment with application of poultry manure @ 5 t ha^{-1} recorded maximum plant height, number of leaves per plant, number of branches per plant and leaf area per plant followed by application of vermicompost @ 5 t ha^{-1} which were at par with each other during both the years. As the poultry manure and vermicompost contains all the essential nutrients which are necessary to increase yield and improve fertility of soil reported by Haj *et al*., 2011 [5].

Table 1: Effect of organic sources and inorganic nutrients on growth of *kharif* soybean at harvest

Tr. No.	Treatments	Plant height (cm)		Number of branches $plant^{-1}$		Number of leaves $plant^{-1}$		Leaf area $plant^{-1}$ (dm^2)		Dry matter $plant^{-1}$ (g)	
		2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
T_1 :	FYM @ 10 t ha^{-1}	61.64	63.62	7.73	8.48	11.90	12.84	15.93	16.83	55.99	57.41
T_2 :	FYM @ 5 t ha^{-1}	58.67	59.74	6.87	7.75	10.89	11.94	14.43	15.40	50.91	52.68
T_3 :	VC @ 5 t ha^{-1}	62.89	64.60	7.93	8.68	12.20	13.33	16.13	17.30	57.49	58.96
T_4 :	VC @ 2.5 t ha^{-1}	59.45	60.69	7.10	7.88	11.36	12.28	14.87	15.80	52.82	53.89
T_5 :	PM @ 5 t ha^{-1}	64.02	66.07	8.37	9.28	12.74	13.98	16.53	17.93	58.24	60.04
T_6 :	PM @ 2.5 t ha^{-1}	60.31	62.16	7.31	8.11	11.55	12.63	15.20	16.43	54.92	55.52
T_7 :	GRDF	66.97	69.25	9.44	10.34	14.53	16.02	20.03	21.86	62.81	63.44
T_8 :	Absolute control	56.42	54.33	5.88	4.68	9.16	8.41	11.93	10.07	33.27	32.60
	S. Em. ±	0.45	0.51	0.35	0.34	0.38	0.36	0.36	0.35	0.74	0.64
	C.D. at 5%	1.37	1.55	1.05	1.04	1.18	1.09	1.12	1.06	2.24	1.94
	General mean	61.30	62.56	7.58	8.15	11.79	12.68	15.63	16.45	53.31	54.32

Effect of various nutrient sources on dry matter of *kharif* soybean

The different nutrient sources affected the dry matter accumulation significantly at all the growth stages during both year of experiment. At harvest, treatment T_7 (GRDF) recorded significantly highest dry matter per plant (62.81 g and 63.44 g) than rest of the treatment during both the year of crop, whereas lowest dry matter was recorded under treatment without any nutrient sources (T_8). Among organic sources, application of poultry manure @ 5 t ha^{-1} found with higher dry matter followed by application of vermicomost @ 5 t ha^{-1} which were at par with each other during both the year. The production of more number of branches coupled with higher number of compound leaves and leaf area due to application of general recommended dose of fertilizer were greatly contributed towards higher dry matter accumulation $plant^{-1}$. Moreover, poultry manure supplied the nutrients in balanced proportion and improved the soil physical characters, which might have increased the availability of nutrients which indirectly increased dry matter $plant^{-1}$. Similar results have also been reported by Chandarvanshi (2014) [2], Rana and Badiyala (2014) [8], Mehetre (2015) [7] and Ransing (2016) [9].

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