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Effect of different solid and liquid forms of organic manure on growth and yield of soybean [*Glycine max* (L.) Merrill]

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ABSTRACT : Field experiment was carried out during the *Kharif* season of 2012-13 at the Crop Research Farm, Department of Agronomy (SHIATS Model Organic Farm, Block-E) Allahabad School of Agriculture, SHIATS, Allahabad (U. P.) to evaluate the effect of different solid and liquid forms of organic manure on growth and yield of soybean. The experiment was laid out in Randomized Block Design with three replications. The treatment consisted of three sources of solid (Vermicompost 2.6 t ha^{-1}, Farm yard manure 16 t ha^{-1} and Poultry manure 2.2 t ha^{-1}) and liquid (*Panchgavya* and fish amino acid) forms of organic manures and two cultivars (JS 335 and JS 95-60). The experimental results revealed that FYM + *Panchgavya* + variety JS 335 recorded at all stages (growth stages) maximum plant height (47.26), number of branches $plant^{-1}$(10.46), dry weight (21.33), crop growth rate (44.43) and stover yield (3876.66 kg ha^{-1}). There were significant difference between treatments, except relative growth rate (0.03) at 60-75 days interval and seed yield (2198.33 kg ha^{-1}).

KEY WORDS : Organic farming, Farm yard manure, Vermicompost, *Panchgavya*, Variety JS 335, CGR

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Soybean (*Glycine max* L.) is considered as a wonder crop of 21st century which is the top oil seeds in the world production. It is an important oil seed crop in addition to source of food, feed and nutrition. (Imkongtoshi and Gohain, 2009). It is an excellent health food and contains about 44 per cent good quality protein, 20 per cent cholesterol free oil, 20 per cent carbohydrate and 0.69 per cent phosphorus (Gahukar, 1997). The major constraint affecting the productivity is the adequate availability of suitable genotype and nutrients (Venkateswarlu, 1987). Choosing and cultivation of suitable genotype that adapts itself under the peculiar climatic condition of the Allahabad region is a necessity for soybean sustainability. Concomitantly, adoption of appropriate agronomic operations may result in acceptable phenotypical characteristics, *viz*., plant height, number of branches $plant^{-1}$, dry matter production, nodulation and ultimate enhancement of productivity of the crop. One of the feasible solutions for addressing the imbalanced nutrient and related constrains, is the foliar spray of *Panchgavya*, which promote growth and vigour of plant and improves productivity (Pathak and Ram, 2002). The management of manures within a crop rotation can have large effects on yields and crop quality (Stein-Bachinger

and Werner, 1997). Organic farming plays greater role in maintaining soil health and reducing the risk of soil erosion when compared to chemical farming (Reganold and Palmer, 1995). There is need to refining and standardized package of practices for important crop under organic farming system. Nutrient imbalance is also one of the important constraints of soybean productivity. Therefore, in the present investigation the effect of various of solid and liquid organic manure on growth and yield of soybean was carried out.

RESEARCH PROCEDURE

The soil of the experimental field was shallow in depth (30 cm) having 0.34 per cent organic carbon, 13.50 kg ha^{-1} available P_2O_5, 257.00 kg ha^{-1} available K_2O, pH 7.5 and EC (0.13 dS m^{-1}). The experiment was laid out in Randomized Block Design with three replications. The treatment combinations in the experiment comprised of 3 sources of solid organic manures *viz*., farmyard manure, poultry manure and vermicompost which were calculated on the basis of 40 kg ha^{-1} phosphorus equivalency (Farmyard manure 16 t ha^{-1}, poultry manure 2.2 t ha^{-1} and vermicompost 2.6 t ha^{-1}), 2 cultivars (JS 335, JS 95-60) and 2 sources of liquid manures (*Panchgavya* 3% and fish amino acid 3%). These sources of foliar application were applied during grand growth (30 DAS), branching (45 DAS) and flowering (60 DAS). *Panchgavya* was prepared with a mixture of five components in the ratio of 5:4:3:2:1, *viz.*, cow dung, cow urine, milk, curd, cow ghee and six ripe bananas, respectively, which was fermented for 21 days. Fish amino acid was prepared with a mixture of two components in the ratio of 1:1, *viz.*, fish waste and jaggery which was fermented for 21 days.

RESEARCH ANALYSIS AND REASONING

There was progressive increase in plant height, number of branches plant^{-1} and dry weight at 60 DAS significantly higher values (47.26, 10.46 and 21.33 g, respectively) observed in treatment T_{10} (Farmyard manure + *Panchgavya* + Variety JS 335). However, plant height and number of branches plant^{-1} in treatment T_1 (Vermicompost + Fish amino acid + Variety JS 335), T_2 (Vermicompost + *Panchgavya* + Variety JS 335), T_5

Table 1 : Effect of solid and liquid forms of organic manures on growth, yield attributes, economics and post-harvest soil status of phosphorus of two cultivars of soybean

Treatments		60 DAS			60-75 DAS growth interval					
		Plant height (cm)	Number of branches plant^{-1}	Dry weight (g)	CGR (gm^{-2} day^{-1})	RGR (gg^{-1} day^{-1})	Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})	*Net return (Rs. ha^{-1})	*B:C ratio
T_1	Vermicompost + Fish amino acid + Variety JS 335	44.26	9.33	19.00	12.58	0.01	1504.33	2314.33	36840.35	1.94
T_2	Vermicompost + *Panchgavya* + Variety JS 335	45.20	10.06	14.66	37.76	0.05	1677.66	3240.00	45732.35	2.17
T_3	Vermicompost + Fish amino acid + Variety JS 95-60	34.46	6.33	14.00	14.06	0.03	1157.33	1967.00	16263.66	1.41
T_4	Vermicompost + *Panchgavya* + Variety JS 95-60	35.33	7.20	11.66	14.81	0.03	1214.66	2198.33	22239.00	1.57
T_5	Poultry manure – Fish amino acid + Variety JS 335	43.33	9.46	17.00	30.36	0.04	1793.66	3009.00	31869.66	2.34
T_6	Poultry manure – *Panchgavya* + Variety JS 335	44.13	8.86	16.00	17.02	0.09	1793.66	2198.66	52013.66	2.35
T_7	Poultry manure – Fish amino acid + Variety JS 95-60	37.40	7.26	13.00	14.06	0.11	1446.33	2082.66	34209.66	1.88
T_8	Poultry manure – *Panchgavya* + Variety JS 95-60	38.13	7.53	16.33	11.10	0.02	1909.33	2082.66	57685.00	2.49
T_9	Farmyard manure + Fish amino acid + Variety JS 335	42.73	9.66	16.00	25.91	0.03	1851.33	2719.66	49450.35	2.12
T_{10}	Farmyard manure + *Panchgavya* + Variety JS 335	47.26	10.46	21.33	44.43	0.03	2198.33	3876.66	72925.66	2.66
T_{11}	Farmyard manure + Fish amino acid + Variety JS 95-60	35.33	7.66	12.00	21.47	0.15	1388.33	2320.66	25057.00	1.55
T_{12}	Farmyard manure + *Panchgavya* + Variety JS 95-60	35.76	6.53	11.66	19.99	0.04	1562.00	2372.33	34849.00	1.79
	S.E.±	3.88	1.05	2.26	5.21	0.07	412.02	409.55	-	-
	C.D. (P= 0.05)	8.05	2.18	4.69	10.80	NS	NS	849.35	-	-
	C.V. (%)	11.80	15.41	18.19	29.04	152.20	31.06	19.81	-	-

VC: Vermicompost (2.6 t ha^{-1}) *Panchgavya* (3%) FYM: Farmyard manure (16 t ha^{-1}) FAM: Fish amino acid (3%) PM: Poultry manure (2.2 t ha^{-1}) *Data was not subjected to statistical analysis

(Poultry manure + Fish amino acid + Variety JS 335), T_6 (Poultry manure + *Panchgavya* + Variety JS 335) and T_9 (Farm yard manure + Fish amino acid + Variety JS 335), were found to be statistically at par with T_{10} (Farmyard manure + *Panchgavya* + Variety JS 335). Further dry weight in treatment T_1 (Vermicompost + Fish amino acid + Variety JS 335) and T_5 (Poultry manure + Fish amino acid + Variety JS 335), was found to be statistically at par with T_{10} (Farmyard manure + *Panchgavya* + Variety JS 335) (Table 1). Application of organic formulation may have supplied sufficient quantity of phosphorus and other essential nutrient. The phosphorus has specific role to play in root development which result in shoot biomass and hence the number of branches plant^{-1} and ultimately affecting the crop growth. Similar finding were reported by Abbas *et al*. (1994) and Chiezy *et al*. (1992).

Another aspect is the increase of microbial population in soil because of the application of organic matter, which might have improved biological nitrogen fixation, greater release of phosphorus and synthesis of growth promoting hormones (Dubey, 1997 and Baskar *et al*., 2000).

Significantly higher crop growth rate (CGR 44.43) was recorded in treatment T_{10} (Farmyard manure + *Panchgavya* + Variety JS 335). However, crop growth rate in T_2 (Vermicompost + *Panchgavya* + Variety JS 335) was found statistically at par with T_{10} (Farmyard manure + *Panchgavya* + Variety JS 335). Organic manures gradually release nitrogen and other essential nutrients in a slow pattern. Further, organic matter and ammonium ions are released after their decomposition and these are inhibitory to the nitrate reductase (NR) activity, which is highly desirable. Similar finding was reported by Claussen and Lenz (1999). Thus the results clearly showed that all the organic manures used in the study played an important role to increase biomass of soybean crop.

Significantly higher stover yield was recorded in treatment T_{10} (Farmyard manure + *Panchgavya* + Variety JS 335). The maximum seed yield, net return and B: C ratio (2198.33 kg ha^{-1}, Rs. 72925.66 ha^{-1} and 2.66, respectively) were recorded in treatment T_{10} (Farmyard manure + *Panchgavya* + Variety JS 335). The beneficial effects to regulate balanced supply of nutrient including primary, secondary and micronutrients, tilting microbial dynamics and modifying soil environment favourably for crop growth is another phenomenon worthwhile mentioning (Nehra *et al*., 2001). Further, it was also observed that *Panchgavya* besides supplying N, P and K also possessed insecticidal property and controlled *Spodoptera litura*. Application of organic sources releases essential macro and micronutrients over a long period, leading to increased vegetative growth and thus augmented stover yield (Patel *et al*., 2007).

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