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Effect of Panchagavya, Humic Acid and Micro herbal Fertilizer on the Yield and Post Harvest Soil of Soya Bean (*Glycine max* L.)

[1]B. Vijayakumari, [2]R. Hiranmai Yadav, [1]P. Gowri and [2]L.S. Kandari
[1]Department of Botany, Avinashilingam University for Women, Coimbatore-641 043, Tamil Nadu, India
[2]School of Natural Resources Management and Environmental Sciences, College of Agriculture and Environmental Sciences, Haramaya University, P. Box No. 337, Dire-Dawa, Ethiopia

Abstract: Higher uses of fertilizers reduce the quality of food produced as well as soil fertility. However, combination of inorganic and organic will reduce the environmental hazard due to higher fertilizer use efficiency as well as improvement of the quality of crops. Current status of lack of availability of organic substances makes us to think the other cheap organic resources. The organic matter stimulates plant growth, improves plant resistance under unfavourable condition. A study was conducted to assess the influence of few organic fertilizers to observe their influence on yield and quality of soya bean and the impact of the manures on post harvest soil. The yield obtained on 90 DAS was found to be the maximum in plants applied with panchagavya, humic acid and micro herbal fertilizer (T_3). The maximum pods (10.5), number of seeds (25 seeds plant^{-1}), ascorbic acid (0.72 mg g^{-1}) and protein (1.37 mg g^{-1}) content of the harvested seeds were significantly increased due to the combined inoculation of panchagavya, humic acid and micro herbal fertilizer. The physical characters and macro nutrient contents of the post harvested soil (N (88), P (8.6) and K (325) kg ha^{-1}) were higher in panchagavya, humic acid and micro herbal fertilizer treated soil compared to other treatments.

Key words: Soya bean (*Glycine max* L.), organic manure, panchagavya, micro herbal fertilizer, yield

INTRODUCTION

The Rio de Janerio Earth Summit in 1992, incited everyone's attention on sustainable development. Sustainable development helps in all respects, i.e., to reduce poverty in order to improve human well-being and to address environmental issues. The sustainability in agriculture sector could be brought by introducing modern agrotechnology and organic farming. Organic farming involves scientific knowledge of ecology and modern technology with traditional farming methods. The application of organic fertilizers, cover crop and compost to crops enhances soil fertility which will ultimately result in increased yield. Although, organic farming systems cannot influence the crop yield in short term, in the long term it will improve soil fertility and establish sustainability (Mirzaei *et al*., 2007). Application of organic materials to nutrient depleted or poorly buffered tropical soil is useful in enhancing the physical, chemical and biological properties of soil (Chukwuka and Omotayo, 2009). Krishnakumar *et al*. (2005) also reported that various organic manures and their combinations are beneficial for soil physical properties, biological properties and yield characters of rice.

The principal elements to be considered while practicing organic farming are creating a healthy soil, making nutrient and energy flows in the soil ecosystem, keeping the biological life in the cycle, providing sustainable yield. Organic farming had a greater role in maintaining soil health and reducing the risk of soil erosion when compared to chemical farming (Reganold and Palmer, 1995). At the ecosystem levels, organic farming also benefits arable land by promoting greater densities and species diversity in weed flora, lower concentration of aphids, greater number of beneficial insects and bigger population of birds. Application of organic manures helped to sustain crop productivity besides maintaining the soil health (Khatik and Dikshit, 2001).

According to Mahmood and Rizvi (2010), the arbuscular mycorrhizal fungi are widespread in agricultural system and are relevant for organic farming as they act as natural fertilizers and enhance plant yield. Phosphate solubilising bacteria solubilises the phosphorus and promotes the plant growth (Vikram and Hamzehzarghani,

Corresponding Author: L.S. Kandari, School of Natural Resources Management and Environmental Sciences, College of Agriculture and Environmental Sciences, Haramaya University, P. Box No. 337, Dire-Dawa, Ethiopia

2008). Baharuddin *et al.* (2009) has reported from their studies that decomposed products can be used as an effective source of organic manure for oil palm plantation. Organic materials like biofertilizers and botanicals could be utilized as a good source for seed pelleting which improves the seedling quality characters in mustard (Geetha and Balamurugan, 2011). As per the results of Nakhro and Dkhar (2010), organic carbon in paddy fields was maximum in organically treated plots (mixture of farmyard manure, rock phosphate and neem cake) which in turn improved the microbial biomass of the soil. Therefore, present study was carried out to assess the efficacy of panchagavya (comprises cow dung, cow's urine, cow's milk, curd and ghee), micro herbal fertilizer (leaf extracts of *Cajanus cajan*, *Azadirachta indica* and *Moringa oleifera)*, biofertilizer (*Rhizobium*), humic acid (microbial degradation of plant and animal debris) on the yield attributes and quality of soya bean and to evaluate the nutrient status of post-harvested soil.

MATERIALS AND METHODS

The experiment was conducted at Avinashilingam University for Women, Coimbatore, Tamil Nadu, India, to analyse the efficacy value of panchagavya, humic acid and micro herbal fertilizer on the test crop soya bean. Seeds were soaked in the combination of organic manures for 8 h and sown in the pots.

Panchagavya: Panchagavya consists of five products namely cow dung, cow's urine, milk, curd and ghee. Cow dung (175 kg) and cow ghee (250 g) were added to wide mouthed plastic can and mixed the two ingredients thoroughly both in morning and evening h and incubated for three days. After three days, cow's urine (2.5 L) and water (2.5 L) were mixed into the can and incubated for 15 days, with regular mixing both in morning and evening hours. After 15 days, cow milk (0.75 l), cow curd (0.50 l), tender coconut water (0.75 L), jaggery (750 g) and well ripened poovan banana (3 No.) were added to the plastic can and mixed well. The content was stirred twice a day both in morning and in evening. The panchagavya stock solution was ready after 30 days. It was placed in shade and covered with a wire mesh or plastic mosquito net to prevent houseflies from laying eggs and the formation of maggots in the solution.

Humic acid: Humic acids are the end product of microbial degradation of plant and animal debris and are one of the most important constituents of fertile soils. Humic acid contains Sulfur, Nitrogen and Phosphorus in varying amounts. It also contains metals such as Ca, Mg, Cu, Zn etc. The application of humic acid favourably influences the soil enzymic activity and ultimately leads to increased soil fertility and better crop growth.

Micro herbal fertilizer: In order to give direct feeding of major nutrients of nitrogen, phosphorus and potassium (NPK) for the crops, leaf extracts, of the following commonly grown manure crops were selected. *Cajanus cajan* for nitrogen, *Azadirachta indica* for phosphorus and *Moringa oleifera* for potassium content (Gopalan *et al*., 2000) were used for herbal fertilizers.

Design and layout of the experiment: The study was laid out in a completely randomized design, consisting of eight treatments. All the treatments were replicated three times.

Treatment details:

T_0: Control
T_1: Panchagavya 10%+Humic acid 2% per pot
T_2: Panchagavya 10%+Microbial fertilizer 10 g per pot
T_3: Panchagavya 10%+Humic acid 2% + Micro herbal fertilizer 10 g per pot
T_4: Seeds were soaked in distilled water for 8 h and sown
T_5: Seeds were soaked in panchagavya 1%+Humic acid 1% for 8 h and sown.
T_6: Seeds were soaked in panchagavya 1%+micro herbal fertilizer 1% for 8 h and sown
T_7: Seeds were soaked in panchagavya 1%+humic acid 1%+micro herbal fertilizer 1 % for 8 h and sown

Biochemical parameters: Protein were analysed by using the Lowry *et al.* (1951) method and ascorbic acid by Sadasivam and Theymoli (1987) method.

Data analysis: Data were analysis using GenStat and excel. However, significant different means were separated using Duncan's multiple rank test at 0.05 level of significance.

RESULTS AND DISCUSSION

Protein and ascorbic acid contents of harvested seeds: Table 1 indicates the protein content and ascorbic acid content of harvested seeds. Among all the treatments protein contents and ascorbic acid were maximum in T_3 treated seeds (panchagavya+humic acid+micro herbal fertilizer) as 1.37 and 0.72 mg g^{-1}, respectively. All the other treatments were on par with each other. Minimum protein content and ascorbic acid were observed in control plants (T_0) as 1.09 and 0.24 mg g^{-1} tissue (Table 1). Similarly experiments conducted by Medhi *et al.* (2007) on *Citrus reticulata* with integrated use of organic manures, biofertilizers and inorganic NPK revealed high content of ascorbic acid. The above results are in corroboration with the findings

Table 1: Effect of panchagavya, humic acid and micro herbal fertilizer on protein and ascorbic acid contents of harvested seeds of soya bean

Treatments	Protein content of harvested seeds on 90th day (mg g^{-1} tissue)	Ascorbic acid content of harvested seeds on 90th day (mg g^{-1} tissue)
T_0	1.09	0.24
T_1	1.26	0.24
T_2	1.33	0.48
T_3	1.37	0.72
T_4	1.12	0.24
T_5	1.25	0.48
T_6	1.36	0.24
T_7	1.23	0.48
SED	0.06	0.12
CD (0.05)	0.11	0.18
CD (0.01)	0.20**	0.26*

SED: Standard error deviation, CD: Critical difference, The values indicate average of three replications. *Significant, **Highly significant

Table 2: Effect of panchagavya, humic acid and micro herbal fertilizer on pods per plant and seeds per plant on 90th day of soya bean (*Glycine max* L.)

	Yield parameters	
Treatments	Pods per plant in 90th day	Seeds per plant in 90th day
T_0	5.0	7
T_1	6.2	12
T_2	7.1	17
T_3	10.5	25
T_4	5.2	10
T_5	7.8	14
T_6	8.3	19
T_7	9.7	21
SED	1.87	1.0
CD (0.05)	5.96	3.12
CD (0.01)	5.46*	4.93*

SED: Standard error deviation, CD: Critical difference, the values indicate average of three replications, *Significant

of Shinde *et al*. (1996) who recorded a significant increase in protein content in soya bean due to the application of sulphur and phosphorous.

Yield parameters: On 90 DAS, maximum pods were observed in T_3 treated plants (10.5) and minimum number were indicated by control plants (5.0). The number of seeds were also more in T_3 plants (25 seeds $plant^{-1}$) and minimum number of seeds was indicated by control plants (7.0) (Table 2).

The result is in accordance with the findings of Somasundaram *et al*. (2007) who recorded a higher yield of maize and sunflower under biogas slurry with panchagavya treatment. Sivakumar *et al*. (2007) also revealed that soil application of humic acid along with *Azospirillum* increased the yield parameters of pearl millet. Vetayasuporn (2006) observed 16% increased yield of ears of glutinous corn by application of a biological fertilizer.

Post harvested soil analysis: The physicochemical characters and macro nutrients status of soil varied

Table 3: Physicochemical characters of post harvested soil

Treatments	pH	Electrical conductivity (dS m^{-1})	Macronutrients (kg ha^{-1}) N	P	K
T_0	8.30	0.14	70	5.8	195
T_1	8.65	0.27	76	8.4	245
T_2	9.10	0.19	78	6.8	3.5
T_3	8.73	0.26	88	8.6	325
T_4	8.35	0.14	71	6.4	230
T_5	8.54	0.40	77	5.8	240
T_6	8.86	0.16	73	8.2	250
T_7	9.04	0.26	83	8.5	245
Soil before sowing	7.52	0.08	67	6.2	180

significantly (Table 3). The pH of the soil before the experiment was 7.52 and it varied from 8.30 (T_0) to 9.10 (T_2). All the other treated soil was on par with each other. Electrical conductivity was 0.08 dS m^{-1} for the red loamy soil and maximum EC was noticed in T_5 treated soil (0.40 dS m^{-1}). The NPK content of the soil before the experiment was 67, 6.2 and 180 kg ha^{-1} and in the post harvested soil more content of NPK was observed in T_3 treated soil as 88, 8.6 and 325 kg ha^{-1}, respectively (Table 3).

Application of organic manure improves soil fertility at desired levels (Singh *et al*., 1997). Uptake of major nutrients increased with higher levels of organic amendments application. The organic manures help to improve soil fertility. Adequate and timely application of organic manure is most essential for proper growth of the crop. Higher uptake of nutrients in organic amendments applied pots might also be due to greater availability of nutrients contributed by the organic amendments. The organic manure apart from supplying major nutrients also supplies secondary and micro nutrients. Those also produce alkaloids, gums and resins which bind the soil particles and improve the aggregation. This in turn improves the water holding capacity, percolation and rescued the bulk density (Channabasavanna and Shivakumar, 2001).

CONCLUSION

From the above study, it can be inferred that a panchagavya, humic acid and micro herbal fertilizer could be ideal and suitable organic mixture for better production of soya bean. Maintaining and improving soil fertility for sustainable agriculture is becoming more crucial due to increasing complexity of the nutritional problems. Since organic substances are constantly undergoing changes in the tropical soils, it must be replenished. The sources of organic matter for incorporation in to the soil are becoming scarce. Hence, the alternate sources have to be found out as substitute for organic sources.

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