STUDIES ON INFLUENCE AND IMPACT OF ORGANIC FOLIAR SPRAY PACKAGES ON BEETROOT (*Beta valgaris*) CULTIVATED SOIL

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ABSTRACT

This study was carried out to evaluate the effect of organic foliar sprays on the growth of *Beta valgaris* (Beetroot) plants cultivated soil. Organic foliar sprays were prepared by fermenting method. After 15 days, the fermented liquid was filtered and used as liquid manure. Beetroot seeds were sown in different plots based on randomized block designed method the plots were mark and used by the name as C_1 (control), C_2 (Chemical) and organic foliar sprays uses different combination like E1, E2, E3 plots. Application of organic foliar sprays shows the impact of decreased the soil pH and enhanced the exchangeable cation levels, organic matter and humic acids and the essential plant nutrients like nitrogen, phosphorus and potassium it's improved by the OFS. Improvement in the growth traits of Beetroot plants like were observed when compared with water control and chemical fertilized treatment groups. The results indicated that organic foliar sprays packages combination of E3 it shows a valuable resource for enhancing the soil health & fertility and growth root vegetables like beetroot. This study indicated the potential for the reclamation of organic waste as a useful liquid fertilizer for agricultural purposes.

Key words: Beta valgaris (Beetroot), organic foliar sprays, Experimental (E1, E2, E3), Control (C1), Chemical (C2), OFS (organic foliar sprays).

INTRODUCTION

After the initiation of green revolution the crop productivity has increased manifold to meet the demand of ever growing population the world over. But the use of these chemicals have caused great damage to the environment in the form of pollution to air, water and soil and also led to various diseases to human beings, animals and plants.

Green revolution had lead to intensified agriculture to meet the ever increasing demand for food and fibre. The extensive use of chemical fertilizers in different combinations increased the crop yield many folds as compared to the earlier local farming practices. Although green revolution has met the needs of food, it has its own inherent side effects like ecological degradation, high rate of pollution of air water and soil ultimately leading to overall health problems to the population, organisms and plants (Elham *et al.*, 2013). The indiscriminate use of chemical pesticides in modern agriculture resulted in the development of several problems such as development of pesticide resistant insects, resurgence of target and non target pests, eutrophication of soil and water, destruction of beneficial organisms. The use of pesticides has lead to the contamination of food, feed and fodder. This awareness has resulted in the development of Integrated Pest Management (IPM). Organic farming has developed very rapidly in recent years. (Allah *et al.*, 2013, Samaddar *et al.*, 2014). Indian agriculture has better chance to convert itself towards organic mode of farming because in India the use of chemical fertilizers and pesticides is still lower compared to the global standards. Cattle, particularly the cow is considered to be an indispensible animal for any Indian agriculturist. The traditional Vedic formulation, Gunapaselam, Panchagavya, is being used by some farmers with certain modifications. These modifications

particularly in south India have shown very effective crop yields, better quality and less pest infestation (Sieglinde, 2011).

Pachagavya contain growth regulatory substances such as IAA, GA, Cytokinin and essential plant nutrients. Panchgavya is also known to contain some microorganisms like lactic acid bacterium, yeast and Actinomycetes. It also contains bio fertilizing microorganism like Acetobactor, Azospirillum, and Phosphobacterium. These fertilizers are produced by simple fermentation processes using organic wastes as carbon substrates. Liquid organic fertilizers consist of essential plant nutrients and beneficial microorganisms, which recycle organic matter. Microorganisms have an important role on the degradation of substrates in the fermentation process. At the end of the fermentation process, phytohormones such as auxin and cytokinin, organic acids and plant growth promoters are present in the liquid organic fertilizers. However, it is a rich source of nutrients (nitrogen, phosphorus and potassium).

The aim of this study was to use agricultural residues and wastes from farm and farmers to produce organic foliar sprays and to evaluate the effectiveness of the OFS on the enhance soil health and plant growth in beetroot cultivated soil.

MATERIALS AND METHODS

The experiment was carried out in a Randomized Complete Block Design (RCBD) at the experiments were conducted during 2011-2012 at Ambasamuthuram village (10’28’ N and 78’29’ E; soil type: red laterite soil), Theni district, Tamilnadu, India. The mean annual temperature at this location is maximum 34.5°C, mean annual rain fall is 829.8mm, and relative humidity (RH) is 67.9.

Partition of the field

The land measures 172.5 m^2 was sub divided into 25 partitions of 3m L x 2.3m B each. These partitions were used for experimental field trials. To each partitions a defined mixture of biofertilizers (Vermicompost, Panchagavya, Gunapaselam, Egg lime formulation) and bio pest repellent (NCBT- 01) of five different combinations were used according to Randomized Complete Block Designed (RCBD) (Mendenhall *et al.*, 1993).

Table – 1. Application of fertilizer and organic foliar sprays on Beetroot cultivated soil

PLOT C_1	Plot was applied with only water on 15th day (C_1)
C_2	2.5 kg NPK (Complex 20:20), and 2.5kg Ammonium phosphate (NH4 SO4) were applied, to the chemical plot (c_2)
E_1	5 kg of Vermicompost and 10% of 1.5 liters NCBT-01was added to experiment plot (E_1)
E_2	5% egg lime formulation (50ml Elf + 950ml water), 5% vermiwash , 10% NCBT01 (150ml NCBT 01+1350ml water) were added to experiment plot (E_2)
E_3	5 kg of vermicompost , 5% egg lime formulation,5% gunapaselam ,5% panchakavya, 10% NCBT-01 were added to experimental plot (E_3)

Plot size: 2.3m x 3 m Interspace: 50 cm, Crop details: Test crop – Beetroot (*beta vulgaries*) Variety – Beetroot (tractor) Total capacity of the plot plant: Beetroot 85no’s.

Soil analysis:

Soil samples collected from the cabbage and Beetroot of each plot at 15 cm depth, for all treatments, were dried and then sieved through at 2 mm mesh and stored in a zip lock bag before analysis. Soil pH and Exchangeable cations were determined from the saturated extract (l: 5, soil: water) of soils (Surange *et al.*, 1997; Mathowa *et al.*, 2012). Organic matter and organic carbon were estimated by Walkley and Black method (Surange *et al.*, 1997; Vimalendran 2013). The levels of available nitrogen by alkaline permanganate method, phosphorus by Olsen's method and potassium by Flame photometer method were estimated by standard procedures (Vimalendran 2013; Yadav 2013). The above said parameters were analyzed before and after the application of organic foliar sprays in the experimental field.

Microbiological Analysis:

The enumeration of total bacteria by pour plate method was done by using soil extract agar Medium (Aneja, 1996**)** for soil bacteria isolation respectively. Viable count method in pour plate techniques were used to enumerate the microbial load and isolate the soil microorganisms.

The microorganism were calculated by

$$\text{CFU} = \frac{\text{No of colonies X dilution factor}}{\text{Weight of air dried soil or sample}}$$

Isolation of some soil beneficial microorganisms by using special medium Stephenson's medium (Aneja, 1996) for *Nitromonas bacteria,* Pikovskaya's Agar (Surange et al. 1997) for PSB (phosphate solubilizing bacteria), Kosmachev Medium (Kosmachev, 1960) *Actinomycetes.*

Statistical analysis:

The statistical analyses were performed using SPSS package (IBM SPSS: version – 20).

RESULT AND DISCUSSION

Soil analysis in beetroot cultivated soil field. Shows Based on Tukey's honestly significantly different (HSD) multiple comparison test between treatments the higher values, pH could be ranked in the following order in C1>C2>E2> E1> E3.

EC ranged between 0.19 to 0.52 dsm-1 in all treatments. EC was maximum in C1 followed by C2, E1= E2 and E3 all treatments showed statistically no significance values when compared with the control. EC values could be ranked in the following orderC1>C2>E1= E2>E3.

Organic carbon was high in E1 followed by E2, E3. There was significant change in the organic carbon content in cabbage field soil and it was significant in E2 and E3 at P<0.05, E1at P< 0.01 level when compared with theC1. Organic carbon levels could be ranked in the following orderE1>E2>E3>C1>C2.

Nitrogen level was highest in treatment E3 followed by C2, E1, E2 and C1. In all the treatments there was a significant changes in the nitrogen content in cabbage cultivated soil and it was significant in E1and E2 at P<0.01, E3 and C2 at P<0.001 level when compared with the C1. Total nitrogen could be ranked in the following orderE3>C2>E1>E2>C1.

Phosphate level was highest in treatment E3 followed by C2, E1, E2 and C1. In all treatments there was no significant change when compared with the C1. Total phosphate content could be ranked in the following order E3>C2>E1>E2>C1.

Potassium level was highest in treatment E2 followed by E3, E1, C2 and C1. In all treatments there was significant changes in the potassium content of cabbage cultivated soil and it was significant in C2 and E1 at P<0.05, E3 at P< 0.01, E2 at P< 0.001 level when compared toC1. Based on Tukey's honestly significantly different (HSD) multiple comparison test between treatments, potassium could be ranked in the following orderE2>E3>E1>C2>C1.

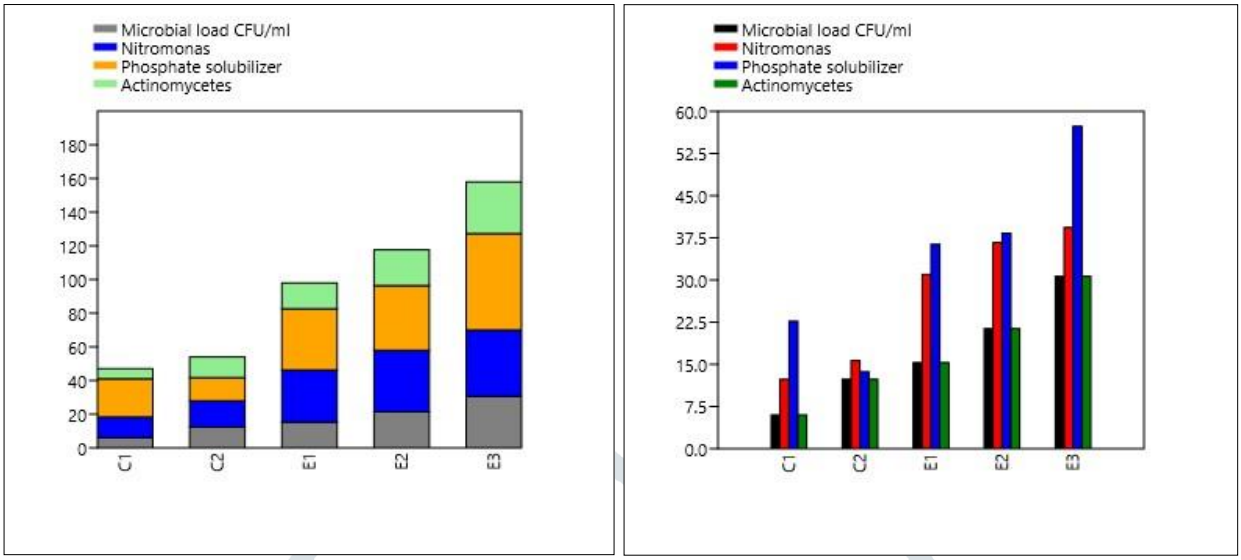
Humic acid level was highest in treatmentE1followed byE2, E3, C2andC1.Inall the treatment there was significant change in the humic acid level in cabbage cultivated field soil and it was significant in E3 at P<0.01, E1 and E2 at P<0.001 level when compared with the C1. Based on Tukey's honestly significantly different (HSD) multiple comparison test between treatments, humic acid could be ranked in the following order E3>C2>E1>E2>C1.

Table – 2. Study parameter of Beetroot cultivation soil

	pH	EC	OC %	N (Kg/Acer)	phosphorous	K	HA
C_1	7.60 ± 0.29^{ab}	0.52 ± 0.04^{a}	1.02 ± 0.08^{b}	142.64 ± 1.13	16.17 ± 2.16	126.50 ± 1.14	74.02 ± 11.06
C_2	$7.62 \pm 0.69^{a**}$	0.36 ± 0.08^{bNS}	0.96 ± 0.07^{cNS}	$166.03 \pm 2.49^{***}$	12.67 ± 3.07^{NS}	$137.39 \pm 4.58^{*}$	97.90 ± 6.03^{NS}
E_1	7.53 ± 0.13^{bcNS}	0.24 ± 0.04^{bcNS}	$1.30 \pm 0.20^{a**}$	$161.0 \pm 3.26^{**}$	16.28 ± 6.02^{NS}	$143.27 \pm 1.13^{*}$	$233.18 \pm 14.06^{***}$
E_2	7.58 ± 0.09^{bNS}	0.24 ± 0.04^{bcNS}	$1.19 \pm 0.03^{ab*}$	$154.80 \pm 5.96^{**}$	16.14 ± 1.16^{NS}	$193.20 \pm 3.67^{***}$	$136.17 \pm 5.12^{***}$
E_3	$7.46 \pm .45^{cNS}$	0.19 ± 0.06^{cNS}	$1.13 \pm 0.13^{ab*}$	$162.14 \pm 1.29^{***}$	17.22 ± 0.23^{NS}	$164.0 \pm 4.86^{**}$	$108.04 \pm 6.03^{*}$

(Mean ±S.D) NS- Non Significant, *P<0.05, **P<0.01, ***P<0.001.

Fig.1. Impact of Organic Foliar spray of Beetroot cultivated Soil.



Microbial load estimation on beetroot cultivated soilMaximum numbers of colonies were present in E3 compared to control and differnce is signifficant at P<0.05 level. E2 and E1 plot showed modrate microbial load when compared to C2 plot C2, E1, E2 showed non significant results, but E3 showed maximum no of microbial load when compared with the all the plots tested with organic foliars sprays & this results is significant at P<0.05. The Average of microbes present is ranked in the order of E3>C1>E2>C2>E1.

The *Nitromonas* bacteria present in soil during 20^{th}, 40^{th} & 60^{th} day of beetroot cultivation It may to be pointed out that the pattern of *Nitromonas* growth inwas showing (C1 & C2), wavery pattern but the *Nitromonas* bacteria in E1 & E2 during 20^{th}, 40^{th}, & 60^{th} day showed a constant increase of microbial load during 20^{th} , 40^{th}& 60^{th} day indicating that E1, E2 contained sufficient nutrients for the growth of microbes which may helps in the size of the beetroot. While E3 during 20^{th}& 40^{th} day showed good growth of beetroot. Which was ststically significant but on 60^{th} day there was slight decrease in the growth which may be due to alternate of nutrients in sub soil. 20^{th} day E3>E1>E2>C2>C1, 40^{th} day E3>E1>E2>C2>C1 60^{th} day E3>E1>E2>C2>C1.

The *posphate solublizing* bacteria present in soil during 20^{th}, 40^{th}& 60^{th} day of beetroot cultivation soil. It may to be pointed out that in C1 & C2 the pattern of *posphate solublizing* bacteria, showed a unfurling pattern which was similar to cabbage cultivated soil , but the *posphate solublizer* in E1, E2 & E3 during 20^{th}, 40^{th} , & 60^{th} day showed a stepwise increase was significant in all the three levels such as P<0.05, P<0.01, P<0.001 level. 20^{th} day E3>E2>E1>C1>C2 40^{th} day E3>E2>E1>C1>C 60^{th} day E3>E2>E1>C1>C2.

The *Actinomycetes* present in soil during 20^{th}, 40^{th}& 60^{th} day of beetroot cultivation soil. It may be pointed out that in C1 & C2 the pattern of *Actinomycetes*, showed a wavery pattern , but in E1, E2 & E3 during 20^{th}, 40^{th}, & 60^{th} day showed a constant moderate intial increase and a stable gradully decrease load during 20^{th}, 40^{th}& 60^{th} day indicates that E1, E2 &E3 contained sufficient nutrients and source for the growth of microbes &*Actinomycetes* was good & thus the growth of microbes in their was showing increases as the days prsent. 20^{th} day E3>E2>E1>C1>C2 40^{th} day E3>E1>E2>C1>C2 60^{th} day E3>E2>E1>C1>C2.

Fig. 2: Chemical Treated Beetroot Soil

Fig.3: Organic Foliar Package Treated Beetroot Soil

CONCLUSION

From the above discussion it is very clear that the use of Vermicompost and panchagavya, Egg lime formulation, Gunapaselam and NCBT-01 have produced better results as compared to other plots like chemical and control other combinations OFS in beetroot cultivated soil . Our strategy aims at using organic manure and the combination of OFS to get better results, stopping the use of chemicals as fertilizers and pesticides, thus giving a richer, healthier and economically feasible alternative traditional farming is organic farming. It is concluded that with the use of Vermicompost, Panchagavya, Egg lime formulation, Gunapaselam and NCBT-01 was improved microorganisms load and considerably enhanced Soil health. The use of Vermicompost, panchagavya, Egg lime formulation, Gunapaselam and NCBT-01 has enhanced not only the quantity of the yield but also increase soil health and fertility. "**Earthworms are pulse of the soil, Healthier the pulse, healthier the soil"** is slogan andthe word emphasized by Ismail, (1997).

It is suggested that by using these Organic foliar sprays a natural products the Indian farmer will be benefitted financially and the people will be benefitted by getting organically produced vegetables without any harmful effects.

Earthworms are the "pulse" of soil health (Ismail, 1997)

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