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Research Article

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EXPLOITATION OF *Bacillus tequilensis AND Bacillus altitudinis* AS BIO FERTILIZER IN SUSTAINABLE SOIL MANAGEMENT

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ABSTRACT

Prior to sustainable agricultural soil management, our present study was to focus on the role of soil inhabiting microbes on soil health. Introducing of Bacillus tequilensis (T,KP202397) and Bacillus altitudinis (E,KP145676) in soil reflects the remarkable increase of soil organic carbon(SOC), SOM, Electrical conductivity (EC) and N.P.K. in soil. Treated soil showed greater yield than control soil of Spinach plant. SOC- EC and EC-NPK status is very closely interrelated to each other.

INTRODUCTION

Soil, one of the three major resources alongside air and water, acts as the matrix of Life in this blue planet of ours bearing a high repository of life forming elements thereby nourishing us all, both by its organic and inorganic contents. From the Neo-lithic Age when men first learned how to show the crop seeds, the exploitation of soil has been a constant feature of human civilization everywhere and it is still continuing as a top priority of our global society (1). As the foundation of Agriculture, soil plays important role on crop growth, by its fertility status (1). Soil fertility influenced by five major factors like parent materials, time, climate, edaphic organism and topography (2). Basically 17 essential elements required for plant growth among which N, P, K, plays the major role. Some other trace element required in little amount in this respect. All these element present in soil both soluble or in soluble from but plant can intake only in the soluble part from the soil (3). Soil biota basically bacteria and fungi plays important role in conversion of insoluble minerals to its soluble from (2). Though plant growth directly depends on the availability with soil material so unorganized agricultural process alters natural cycling of nutrient in soil (1). Researchers have estimated that 0.025 to 0.125mm of soil is produced annually by soil forming process (4, 5). So best management practice is to be needed in that respect to protect soil exploitation in sustainable development.

Soil organic carbon (SOC) can improve soil health and also help to mitigate climatic change (6). SOC help to retain normal soil P^H (7) and maintain carbon: nitrogen ratio in agricultural soil (8). SOC also plays important role in mineralization of soil insoluble component by accommodating bacterial growth and retaining nutrient cycle and mineral release.

Soil organic C has been estimated that 1-6% in surface soil (9) estimated that less than 1% may be decreases the agricultural yield (10). The amount of SOM influenced by directly particulate organic matter (POM), tillage practice, agricultural practice, land type and soil type etc. (3).

Electrical conductivity (EC) or cation exchange capacity (CEC) is a very common test to measure the soil fertility directly. It directly depict the nutrient availability in ionized from (11).

In the era of globalization and population explosion, the deforestation and alteration of agricultural land occur rapidly but to ensure the food security according to the global demand and to reduce the agriculture related pollution, now a days scientist in that field soughting for sustainable soil management. Bacteria can play important role in that sustainable soil management by increase SOM , EC and also solubilize soil insoluble nutrient.

MATERIALS AND METHODS

Collecton of Sample: Samples were collected randomly from different locations of Nadia district of West Bengal . At each

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sites, the soil dug to a 0-20cm was scooped into sterilize polythene bags, labeled and brought to laboratory for analysis.

Isolation of Bacteria

The bacteria were isolated from the collected sample by serial dilution method employing pouring as well as spread plating technique on isolation media (12). For enumeration of total bacterial load in the samples, 100µl of each dilution was spread on pre-sterilized agar plates, incubated and observed for the appearance of the colony. For cellulolytic bacterial isolation, the aliquots were plated on Carboxy methyl cellulose-Congo red-Agar media, incubated at 30^{o}C for 24-48 hours, incubated at 28o C for 3-5 days.

Maintenance of The Culture

Glycerol stocks were prepared and stored at -80^{o}C for long term preservation. Pure cultures of the bacterial isolates were incubated at 30^{o}C for 24 hours in LB broth. Then 0.5 ml of each of the cultures was transferred into cryotubes and 0.5 ml broth containing 40% glycerol was added. The samples were mixed gently and stored at -80^{o}C.

Morphological characterization

The culture and morphological features were studied by adopting methods of (13) and (14). Being able to visibly differentiate bacteria based on the appearance of their colonies in crude, but essential first step in isolating the different types of bacteria in the sample. Description of a colony's morphology included its shape, the margins or edges of colony, the colony's color, as well as surface features (15).

Identification of bacteria

Identification of bacterial strain on the basis of 16s r RNA gene sequencing was conducted with collaboration of SciGenom Laboratory Pvt. Ltd. Ernakulam KL. The result , which is not attached herewith, will be included in another paper of being a different topic of regard.

Estimation of soil

Estimation of agricultural parameter was conducted from Institute of Agricultural Science, 35, Ballygange Circular Road, Ballygange,Kol-19.

Collection of Soil

Soil was collected from a sterile agricultural land from Kalyani, Nadia by standard technique.

Soil inoculation technique: sterile soil was inoculated by our desired bacteria by 1:10(W/V) bacterial suspension. And put into a sterile bag then stay for a month. After that Spinach seed was sowed.

RESULT AND DISCUSSION

Impact on Soil Fertility, Plant Growth & Development

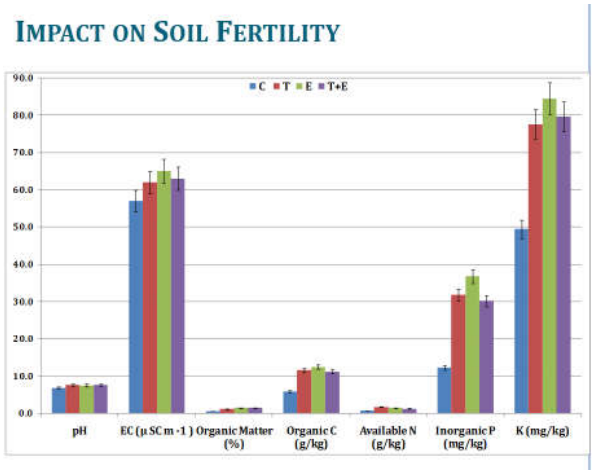

Fig 1 Changes of soil fertility status with control vs treatments

On Spinach Plants

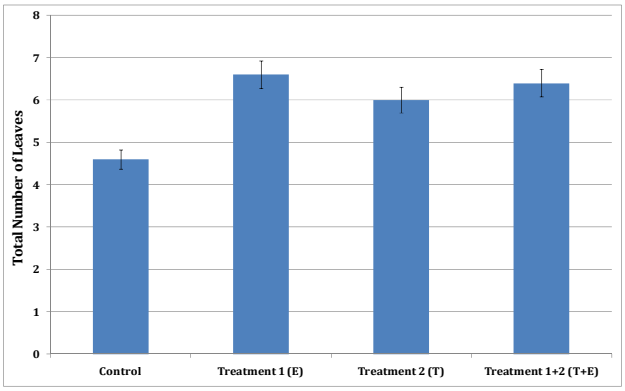

Fig 2 Total No. of leaves in different treatments.

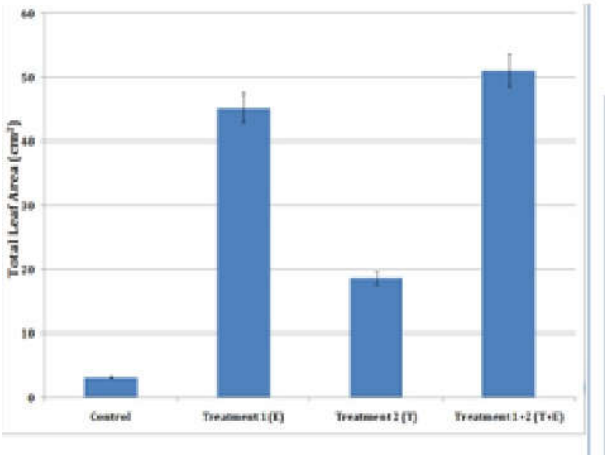

Fig: 3 Leaf area in different treatment.

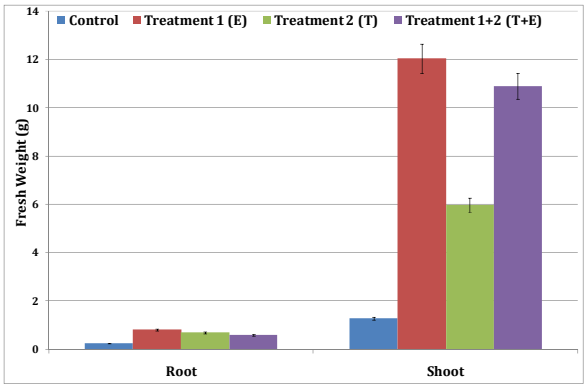

Fig 4 Fresh weight in different Treatments.

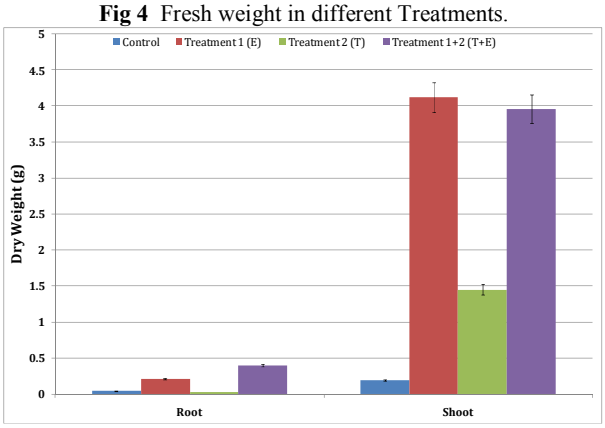

Fig: 5 Dry weight in different Treatments.

Fig 6 Plant Health in different treatments of soil

DISCUSSION

Treatment of soil with T.E. and their combination shows a remarkable variation on agricultural soil fertility status and also on plant growth.

Treatment with 'E' showed a remarkable increase in soil electrical conductivity and SOM,SOC ratio as well as NPK availability followed by T+E and T in respect to control set, which indicated the improvement of soil health without employing any chemical fertilizer(Fig:1).

Plant growth was significantly improved by the introduction of those bacteria. In that respect total number of leaves (Fig:2), total leaf area (Fig:3) and root-shoot ratio i.e yield were significantly increased with the treatment 'E' followed by the T+E and T in that order respectively in respect of control set.

The potency of this two bacteria in relation to the increase in soil fertility and plant growth has been first noticed by the present team and there is further scope of intense research in the regard.

CONCLUSION

Increasing SOC level and EC value in soil signifies the positive fertility rate of agricultural soil. Both B.tequilensis and B.altitudinis have the potential to increase SOC level and EC value in agricultural soil and also involving N.P.K solubilization. Soil inoculated with our experimental bacteria depict a remarkable variation with control set on Spinach plant. So both B.tequilensis and B.altitudinis, can be used as bio fertilizer in sustainable soil management programme and also an important issue for further research.

Acknowledgement

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Reference

1. Parikh, S.J. & James, B.R. Soil: The Foundation of Agriculture. Nature Education Knowledge 2012; 3(10): 2.
2. Jenny, H. (1941), Factors of Soil Formation. McGraw-Hill.
3. Laura, F. Jodi De jong- Huges (2009). The importance of soil organic matter in cropping system of the northern great plains. University of Minnesota. 41273,
4. Lal, R Soil-erosion from tropical arable lands and its control. Advances in Agronomy 1984; 37: 183-248.
5. Montgomery, D.R. (2007) Dirt: The Erosion of Civilizations. University of California Press.
6. Yin Chan(2008), Increasing soil organic carbon of agricultural land, Primefacts 735.
7. Hawin, J.L. et al (2005). Soil Fertility and Fertilizer. 7th ed.
8. Yan, J. G, Li. L and Quan. G(2009). Cellulase activity in physically isolated fractions of Paddy soil. International conference on Environmental Science and information Application Technology.
9. Bradly, N.C. & Well, R.R. (2002), The Nature and Properties of Soil, 13th ed. Prentice Hall.
10. Key, B.D. and D.A. Angers. Soil Structure. In Handbook of Soil Science. M.E.Sumner, ed. 1999; A-229-A276. CRC Press. Boca Raton.
11. Coleman, D.C.:D.A. Crossley, Jr.: and P.F. Hendrix. 2004. Fundamentals of soil Ecology, 2nd Ed. Elsevier, Inc.
12. Aneja, K.R. Experiment in Microbiology, Plant pathology and Biotechnology. New Age Publishers, 2005; 69-115.
13. Collins, C.H. and Lyne, P.M. (1989). Microbiological methods, 6th Ed: Butterworth and co. Ltd. London.[14] Goodfellow, M. (1989). Bergy's Manual of systemic Bacteriology. Williams and Wilkins, Baltimore, USA.
14. Leboffe, M.J. and Pierce, B.E. (2010). Microbiology Laboratory-Theory and Applications, 3rd Ed. Morton Publishing Company.

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