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Survey on crop varieties and agricultural practices of Karnataka

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Abstract

Soil biota helps the soil in carrying out multiple functions. Non sustainable agricultural practices over years degrade the soil quality. Continuous application of chemical fertilizers in order to expect more profit in terms good harvest leads to the degradation of soil. It also cause an adverse effect on soil by favoring the selective growth of microorganism which lead to the elimination of the beneficial organisms. The study was carried out to isolate and enrich the beneficial soil microorganisms and formed as a consortium of bio-fertilizer to ameliorate the soil of barren land. After the systematic application of the formulated bio-fertilizers, the quality parameters of soil has slowly improved, evident with the soil physicochemical characteristics and the yield of the selected crops.

Keywords: Soil, sustainable agriculture, biofertilizer

1. Introduction

Soil is a natural resource base which sustains life on earth. It is a dynamic system that performs many functions and ecosystem services and highly heterogeneous. Soil resource is the biological universe which helps the soil in carrying out its functions. Global pollution is a burning topic of the day. Soil bears the greatest burden and is getting polluted in a number of ways. There is an emergency in controlling the soil pollution in order to preserve the soil fertility and increase the productivity.

Visualizing the adverse spoil of chemicals based modern agriculture, the concept of organic agriculture is gaining momentum has emerged as an important priority area globally in view of the growing demand for safe and healthy dietary supplements with long term sustainability and concerns on environmental pollution associated with more use of agrochemicals. By continuous application of hazardous chemical inputs in agriculture, it is unavoidable to meet the growing demand for food in world, there are opportunities in selected crops and niche areas where organic production can be encouraged to export market. Natural based farming can solve many of these problems as this farming helps to maintain and to enhance the soil productivity and effectively provide pest control by enhancing plant defence mechanisms naturally with environment.

Bio-fertilizer contains living soil beneficial microorganisms which, when coated to seed cotyledon, plant surfaces, or soil, colonizes the rhizosphere or colonizing endophytically promotes plant growth. By increasing the practice or availability of soil nutrients to the host plant with the intention of increasing the soil beneficial microbiota to increase the microbial processes which augment the availability of nutrients that can be easily intake by plants. Bio-fertilizers play an important role in improving soil fertility by adding nutrients through the natural mechanisms of nutrient cycling, solubilization, mobilization, nitrogen fixation, solubilizing phosphorus, and stimulating plant growth by synthesizing plant growth-promoting substances in the soil. They promote natural harvest of available, biological system of nutrient mobilization. Using bio fertilizers, healthy plants can be grown, while enhancing the sustainability and health of the soil can be restored respectively. The use of bio fertilizers is one of the most important components of nutrient management, they are cost effective and sources of plant nutrients to supplement with crop plants are exploited in the production of bio fertilizers

In today's scenario organic based farming primarily aims at agricultural practices to raise crops in such a way, as to keep the soil alive and in good health by use of organic wastes and other biological materials along with beneficial microbes to grow and protect the crops for increased sustainable production in an eco-friendly pollution free environment. Bio fertilizers are important because they are enhancing biomass production, useful in sustainable agriculture, provide protection against droughts, restore soil fertility, replace use of chemical fertilizers, Cost- effective, Eco-friendly. Besides above facts, it is accessible to marginal and small farmers over chemical fertilizers.

2. Methodology

Field site

The study was carried out in barren land of Alamba Charitable trust, an NGO near Gubbi cross, Kothanur, Bangalore in randomized block design during the month from September to December 2020.

Isolation of beneficial bacteria

Beneficial soil bacterial genus of *Rhizobium sp.,* was isolated from root nodules of legume plant. Similarly, *Azotobacter sp., Acetobacter sp*. and Phosphobacteria

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were isolated from soil sample collected from Kristu Jayanti College campus in Microbiology Laboratory using specific isolation media - Rose Bengal agar, Ashby's agar, Mannitol agar, Pikovskaya's Agar respectively.

Preparation of Bioinoculants

Bacterial cultures were recognized morphologically from specific agar media and were multiplied in large quantity (1 Litre of each culture) in respective broths and stored in refrigerated for further study

Biofertilizer preparation

To make the prepared bioinoculants as granular biofertilizer for further application in the soil, carrier material peat was chosen to carry the microbial population for long time storage and application. The carrier material peat was neutralized in order to avoid P^H fluctuations, packed in clean heat resistant polythene bag, sterilized in an autoclave and cooled in room temperature by spreading it manually in a sterilized plastic tray.

The prepared beneficial bacterial cultures in broth were mixed separately with equal proportion of carrier material until it holds maximum moisture content by manually. The prepared biofertilizers were packed individually in sterilized low grade polythene cover, sealed properly, labelled with date and strain and stored in room temperature for soil application in the experimental plot

Field experimental design

The selected barren field for this study was watered, weeded and ploughed thoroughly to loosen the soil three days before the application of bioinoculants. The plot was divided into five blocks for the following treatments

- Block 1 (B1) - *Rhizobium sp.* bioinoculant with Beans seedlings
- Block 2 (B2) - *Azotobacter sp*. bioinoculant with Tomato seedlings
- Block 3 (B3) - *Acetobacter sp*. bioinoculant with Chilli seedlings
- Block 4 (B4) – Phosphobacteria bioinoculant with Brinjal seedlings
- Block 5 (B5) – Control (Only available soil nutrients) Spinach seedlings

Soil Physicochemical Property Analysis

Soil samples were collected from each experimental plot and brought to the laboratory following the standard operating procedure. The soil samples, 5 grams each, were analyzed for its moisture content, conductivity, nutritional status and microbial load. Micro and macronutrients were analyzed to observe the initial status of the barren soil as a comparative study before the application of prepared bio-inoculants.

The soil nutrients were tested by NICE NPK – P^H soil testing kit in the laboratory, Kristu Jayanti College.

Vegetable crops tested

Based on the initial nutritive value observed in the selected site, which was an abandoned barren land, it was proposed to test the efficacy of prepared bio-inoculants to improve the fertility of the soil. Certain short life span vegetable crops were introduced to the site in order to analyze the amelioration of the site for a continuous sustainable agronomical practice.

Vegetable saplings of Tomato, Chilli, Brinjal, Spinach and Beans were procured from University of Agricultural Sciences, *GKVK*, Bengaluru. The saplings were maintained two days in Biotechnology laboratory, Kristu Jayanti College before the inoculation of prepared bio-fertilizer and planting to the selected site. The control experimental blocks were also maintained without the application of bio-fertilizer.

3. Results

Estimation of Soil Nutrients (Table: 1)

The initial physicochemical analysis revealed that the soil in all the selected blocks were high acidic in nature. The soil macro nutrients, Nitrogen, phosphorous and potassium essentially support the plant growth also showed a limited range.ie. Nitrogen - M1:100-200, Phosphorous - H1:11-15 and Potassium - M2:81-120 was observed respectively.

In order to ascertain the role of bio-fertilizer application, the soil sample were analyzed after its introduction. In the control block (B5) with spinach seedlings, the soil was observed slight increase in pH and the macronutrients compared to the experimental blocks. The nutrient level is, N –M1: 104 -200, Phosphorous – H1: 11.8 - 15.5 and Potassium – M2: 84 -126.

The readings from the block where bio-fertilizers were applied along with the seedling were a shown a noticeable increase in the analyzed macronutrients. It was observed that in Block 1 (B1) - *Rhizobium sp.* bioinoculants with Beans seedlings, p^H was noticed

Treatments	Before Biofertilizer Application				With Biofertilizer			
	P^H	N	P	K	P^H	N	P	K
B1	Strongly Acidic	M1:100-200	H1:11-15	M2:81-120	Slightly Acidic	H1: 180-210	M1: 18:20	M2:15:18
B2	Strongly Acidic	M1:100-200	H1:11-15	M2:81-120	Slightly Acidic	M1: 100-200	M2: 13:18	H1: 110:190
B3	Strongly Acidic	M1:100-200	H1:11-15	M2:81-120	Slightly Acidic	H1: 100-200	M1: 11:18	M2: 81:120
B4	Strongly Acidic	M1:100-200	H1:11-15	M2:81-120	Slightly Acidic	M1:110-192	H1:160:210	M2: 17: 23
B5 (Control)	Strongly Acidic	M1:100-200	H1:11-15	M2:81-120	Slightly Acidic	M1: 104 -200	H1: 11.8 - 15.5	M2: 84 -126

slightly acidic and the macronutrients N – H1: 180-210, Phosphorous – M1: 18:20 and Potassium – M2:15:18. The result supports the literatures that the inoculation of nitrogen fixer, *Rhizobium sp.* helps in contributing addition of Nitrogen in soil as there was a sharp increase in soil nitrogen content followed by medium availability of potassium and phosphorous contents respectively.

In Block 2 (B2) - *Azotobacter sp*. bioinoculant with Tomato seedlings, p^H was marked slightly acidic and the macronutrients N – M1: 100-200, Phosphorous – M2: 13:18, Potassium – H1: 110:190 were detected. Potassium content of soil was observed maximum in the block followed by nitrogen and phosphorous

In Block 3 (B3) - *Acetobacter sp*. bioinoculant with Chilli seedlings, soil p^H was detected as slightly acidic and an increased level of the macronutrients compared with the control i.e., N – H1: 100-200, Phosphorous – M1: 11:18, Potassium – M2: 81:120. The Nitrogen content

Fig: 1 Biofertilizer Consortium

Fig: 2 Packing of Biofertilizer

Fig: 3 Field Site

Fig: 4 Planting of vegetable saplings

Fig: 5 After a Month

Fig: 6 During Harvest

Survey on crop varieties and agricultural practices of Karnataka was observed maximum in the block with *Acetobacter* compared to other two macronutrients.

In Block 4 (B4) – Phosphobacteria bioinoculant with Brinjal seedlings, it was observed that soil p^H was slightly acidic as noticed in the other blocks and the macronutrients profile was in accordance with the specialized function of the bacterial inoculant. The nutrients were tabulated as Nitrogen – M1:110-192, Phosphorous - H1:160:210, Potassium – M2: 17: 23 (Table No. 1). The Phosphobacterial culture solubilizes of insoluble phosphate available in the experimental site, contributed to the increase in Phosphorus content compared to other macronutrients ie., Nitrogen and Potassium.

3.2. Vegetative and yield parameters of vegetable crops

The present study envisaged the amelioration of the selected barren land in order to convert it for agricultural purposes using formulated bio-fertilizers. As a part of the experiment vegetables were grown supplemented with beneficial bacterial bio fertilizers to compare the state of the suitability of land for agro farming. The soil porosity and water holding capacity were also observed good enough compared to before ploughing after watering and maintenance for this study

The vegetable crops planted in all the five experimental plots including control were observed for their growth parameters, incidents of pest, flowering pattern and productivity. It was observed that the bio-fertilizers have visual impact on the growth of the tested plants supported with the definite measurements of parameters that were analyzed.

It was observed that in the experimental Bock 1, where *Rhizobium sp*. containing bio-fertilizer added to its specific host, beans. The plant height was noticed maximum, flowering was clustered and it yielded about 1.3 Kg of beans. Similarly, in Block 2, *Azotobacter sp*. biofertilizer with tomato seedlings, plant height and flowering were noticed better and yielded almost 2 kg of tomatoes. *Acetobacter sp.* biofertilizer inoculated with Chilli in Block 3 was observed vigorous growth compared next to Block 1 with *Rhizobium sp.* followed by other blocks.

Shoot elongation in the plants was fast compared to the other blocks, flowers noticed clustered and yielded about 800 grams of chilly pods. Phospho-bacterial bio-fertilizer inoculated with brinjal seedlings in Block 4 showed stunted growth, flowering was observed better and yielded 1 kg of brinjal fruits. Control block without the bio-fertilizer application had only the native soil organisms in Block 5, yielded the minimum of spinach leaves, compared to other bio-fertilizer inoculated blocks yielded around 3 handful of greens.

From these observations, it can be concluded that the experimental space was unproductive land left initially without cultivation. The prevailed soil nutrients and other soil properties were not suitable for any tilling. After these experimental observations, the practices like weeding, watering, ploughing and application of organic microbial bio-fertilizer in right combinations and continuous agro practices, the land became productive with proven results with vegetable cultivation. It can be concluded that, if any impoverished land is properly utilized and used for tillage, which will be surely remain fertile and suitable for habitation and cultivation.

Conclusion

Although biological fertilizers have significant potential in integrated nutrient management techniques for sustainable agricultural productivity and a non-hazardous environment, there require a necessity to improve the awareness and use of biofertilizers among farmers and growers. Extensive research is required to achieve appropriate, site adapted and crop specific strains for maximizing its benefits. Biofertilizers have their own beneficial activities over chemical fertilizers and are economically and environmentally friendly as well. There is a growing demand for microbial inoculants-based fertilizers as alternatives to agrochemicals. This study also suggests that a better understanding of the role of these nitrogen-fixers would be helpful in the development of biofertilizer using these indigenous bacterial strains that have best economic value.

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References

1. Anandaraj B. and Delapierre L.R.A., Studies on influence of bioinoculants (*Pseudomonas fluorescens, Rhizobium sp., Bacillus megaterium*) in green gram, J. of Biosci. Tech., 1(2), 95-99 (2010)

2. Anshu Sibbal, Chatli, Srishty, Irandeep Kaur, Parminder Kaur. Plant Growth Promoter: A root Army. International Journal of Advance research in Biological Sciences. 2017; 7(1): 76-81

3. Arafat Y, Wei X, Jiang Y, Chen T, Saqib HAS, Lin S, et al. Spatial distribution patterns of root-associated bacterial communities mediated by root exudates in different aged ratooning tea monoculture systems. Int. J. Mol. Sci. 2017; 18:1727

4. Barman M, Paul S, Choudhury AG, Roy P, Sen J. Biofertilizer as prospective input for sustainable agriculture in India. International Journal of

Vol. 15 (5) 406-410, ISSN 0973-8916 (Print), 2230-7303 (Online)
10.5530/ctbp.2021.3s.33

Current Microbiology and Applied Sciences. 2017; 6(11):1177-1186.

5. Bhardwaj, M.W. Ansari, R.K. Sahoo, N. Tuteja. Biofertilizers function as key player in sustainable agriculture by improving soil fertility, plant tolerance and crop productivity**.** Microbial. Cell Fact., 13 (66) (2014), pp. 1-10

6. Chang KH, Wu RY, Chuang KC, Hsieh TF, Chung RS. Effects of chemical and organic fertilizers on the growth, flower quality and nutrient uptake of *Anthurium andreanum*, cultivated for cut flower production. Sci. Hortic-Amsterdam. 2010; 125:434–441

7. Deepali Chittora, Mukesh Meena, Tanuskh Barupal, Prashant Wsapnil, Kanika Sharma. Cyanobacteria as a source of Biofertilizers for sustainable agriculture. Biochemistry and Biophysics Reports, 2020; Volume 22

8. Filho, Cavazzana J. F., Heinrichs R., Vendramini J. M. B., Lima G. C., and Moreira A., "The impact of organic biofertilizer application in dairy cattle manure on the chemical properties of the soil and the growth and nutritional status of Urochroa grass," *Communications in Soil Science and Plant Analysis*, vol. 49, no. 3, pp. 358–370, 2018.

9. Horrigan L, Lawrence RS, Walker P. How sustainable agriculture can address the environmental and human health harms of industrial agriculture. Environ Health Persp. 2002; 110: 445–456

10. Kamlesh Kumar Yadav and Smriti kana Sarkar. Biofertilizers, Impact on Soil Fertility and Crop Productivity under Sustainable Agriculture Environment and Ecology Environment tandecology.com. 2019; 7 (1): 89-93

11. Li Y, Li Z, Arafat Y, Lin W, Jiang Y, Weng B, et al. Characterizing rhizosphere microbial communities in long-term monoculture tea orchards by fatty acid profiles and substrate utilization. Eur. J Soil Biol. 2017; 81:48–54.

12. Li YC, Li Z, Li ZW, Jiang YH, Weng BQ, Lin WX. Variations of rhizosphere bacterial communities in tea (*Camellia sinensis* L.) continuous cropping soil by high-throughput pyro sequencing approach. J. Appl. Microbiol. 2016; 121:787–799.

13. Li YC, Li ZW, Lin WW, Jiang YH, Weng BQ, Lin WX. Effects of biochar and sheep manure on rhizospheric soil microbial community in continuous ratooning tea orchards. Chin J. Appl. Ecol. 2018; 29:1273–1282

14. Miroslav Rusko, Jozef Sablik, Petra Markov, Manfred Lach, Stefan Friedrich. Sustainable Development, Quality Management System and Environmental Management System in Slovak Republic. 2014; Proceedia Engineering 9; 486-491

15. Singh, A K Upadhyay, T W Al-Tawaha, A R Al-Tawaha, S N Sirajuddin. Biofertilizer as a tool for soil fertility management in changing climate. International Conference of Animal Science and Technology. 2020; 492 (2020) 012158

16. Sun QR, Xu Y, Xiang L, Wang GS, Shen X, Chen XS, et al. Effects of a mixture of bacterial manure and biochar on soil environment and physiological characteristics of *Mals huupehens* seedlings. Chin Agric. Sci. Bull. 2017; 33:52–59.

17. Sun R, Zhang XX, Guo X, Wang D, Chu H. Bacterial diversity in soils subjected to long-term chemical fertilization can be more stably maintained with the addition of livestock manure than wheat straw. Soil Biol. Biochem. 2015; 88:9-18

18. Tauseef Bhat, Latif Ahmed, Ganai, Owais Khan. Nitrogen Fixing Biofertilizers; Mechanism and Growth Promotion: A Review. Journal of Pure and Applied Microbiology. 2015;9(2):1675-1690

19. Umesha, M. Srikantaiah, K. S. Prasanna, K.R. Sreeramulu, M. Divya and R.n. Lakshmipathi.

20. Comparative effect of organics and biofertilizers on growth and yield of maize (Zea mays. L.). Current Agriculture Research Journal. 2014; Vol. 2(1), 55-62

21. Wang W, Niu J, Zhou X, Wang Y. Long-term change in land management from subtropical wetland to paddy field shifts soil microbial community structure as determined by PLFA and T-RFLP. Pol J Ecol. 2011; 59:37–44

22. Xu HQ, Xiao RL, Xiang ZX, Huang Y, Luo W, Qin Z, et al. Effects of different ecological management on the soil microbial biomass and microbial population of tea plantation in hilly red soil region. Chin J Soil Sci. 2010; 41:1355–1359.

23. Zhang QC, Shamsi IH, Xu DT, Wang GH, Lin XY, Jilani G, et al. Chemical fertilizer and organic manure inputs in soil exhibit a vice versa pattern of microbial community structure. Appl. Soil Ecol. 2012; 57:1