

Received: 29th April-2013Revised: 06th May-2013Accepted: 07th May-2013

Research article

INVESTIGATION OF PHYSICOCHEMICAL AND MICROBIOLOGICAL PROPERTIES OF SOIL FROM SELECTED REGIONS AROUND SANGLI DISTRICT, MAHARASHTRA¹Kedar Rokade and ²Chandrakant Mane.^{1,2} Shri Vijaysinha Yadav Arts and Science College, Peth Vadgaon, Dist. Kolhapur (MS) India 416112

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ABSTRACT: The soil fertility depends upon various physicochemical and microbiological properties therefore its analysis become necessary to study more economical gain from the suitable cash crops. The physicochemical and microbiological studies of soil from villages like Bagni, Koregaon, Dhavli and Nagaon were carried out. Most of the soil region of these villages shows the good soil quality index. The rhizospheric bacterial diversity was observed amongst these area as well as chemical analysis of these soil sample shows high fertility in terms of organic carbon and organic matter content of soil. Amongst the isolated microbial strains most of them shows rapid rate of phosphate solubilization. Nitrogen fixing ability of these strains were also been studied. This investigation brought to the limelight that the agriculture regions of the studied areas are suitable for agricultural purposes and the isolated strains can be used as effective bioinoculants to increase the fertility of soil.

Keywords: Soil, Physicochemical parameters, Microbiological parameters

INTRODUCTION

Soil is one of the important and valuable natural resource whose quality has vital concern for the human welfare. Soils are vital for the existence of many forms of life that have evolved on our planet (Pidwirny, 2006). Soil is a natural body comprised of solids, liquids, and gases that occurs on the land surface, occupies space, and is characterized by soil horizons (Gardiner and Miller, 2004). Soil support the growth of number of microorganisms which plays important role in the degradation of various complex compounds like organic matter, insecticide residues, lignin and tannin like compounds which will make the soil more fertile in nature. Soil organic carbon is an important soil constituent that frequently attenuates microbial degradation. Insecticide degradation rates have been found to be positively correlated to soil organic carbon as well as to microbial plate counts (Veeh et al., 1996). Soil organic matter is closely associated with microbial activity as it serves as substrates and energy sources for soil microbes (Magdoff and Weil, 2004). Soil pH represents a major determinant of soil microbial distribution and activity as microbes have different pH requirements (Elsas et al., 2006). Soil biological investigations can give information on the presence of viable microorganisms as well as on the effects of pollutants on the metabolic activity of soil (Margesin, 2000). Clay or organic soils are more adsorptive than coarse, sandy soil due their increased surface areas (Johnson et al., 2007).

Soil fertility get affected due to unscientific management including use of excess fertilizers, insecticides etc. Additions of insecticides affect the microbial components of an ecological niche and thus a simultaneous effect is observed on biotransformation reaction occurring in soil (Bhardwaj and Garg, 2012).. Increasing use of different pesticides and its additives plays important role in deteriorating the quality of soil (Rokade and Mali, 2012). Insecticide additives shows a marked effect on the growth of soil microorganisms they not only reduces their number but also responsible for inhibition of germination of seeds. The insecticides that tend to have non target effect are those that are most mobile in soil or plant environment. Certain fungicides and insecticides are readily translocated by plants and affect the microbial population and activities of rhizosphere (Aziz et al., 1997). The growth of symbiotic nitrogen fixing bacteria is also getting hampered due to the excessive use of insecticide in the agriculture field (Lakshmikantha, 2000).

Due to extreme use of these compounds it resulted into a new problem concerning with harmful effect on non target economical insects like silkworm, honeybee, and on earthworms too (Liu et al., 2007). By considering these points related with the soil fertility and ecotoxicity it is very important to know the properties of soil. We investigate here the soil properties in various regions of Sangli district.

MATERIALS AND METHODS

Collection of soil samples

Soil samples from rhizosphere regions of four different villages of Sangli district of western Maharashtra. The villages from where the soil samples were collected include Bagni, Koregaon, Dhavli and Nagaon.

Physicochemical analysis

Physicochemical analysis were carried out as per the methods described (Maiti, 2001).

Microbiological analysis

To study and isolate the microbial diversity among the collected soil samples we take 1gm of soil and dissolved in nutrient broth. It was allowed to incubate at room temperature on a rotary shaker at 120rpm for 24 hrs. After incubation different dilutions of the microbial enriched nutrient broth were carried out. The dilution scheme used for the study include 10^{-1} , 10^{-2} , 10^{-3} upto 10^{-10} . To study the microbial diversity 0.1ml of each dilution was spread on Nutrient agar. Also, so as to isolate the effective phosphate solubilizing and nitrogen fixing microorganisms 0.1 ml of different dilutions was spread on Pikovskaya's agar and Congo red yeast extract agar. After incubation at 37°C for 24hrs the isolated colonies of different bacteria were studied by subculturing them on respective culture medium.

Isolation of Microorganisms

All the isolates were studied as per the methods mentioned in Bergeys Manual of Systematic bacteriology (Williams *et al.*, 1989). The phosphate solubilizing ability of the isolated microbial strains were studied by growing them on Pikovskaya's agar and nitrogen fixation by Acetylene reduction assay (Dobereiner, 1997).

Statistical analysis

All the experiments were carried out in triplicate. Analysis of the variants was carried out on all data at $P < 0.05$ using Graph Pad software. (Graph Pad Instat version 3.00, Graph Pad software, San Diego, CA, USA)

RESULTS AND DISCUSSION

Table 1 indicates the physicochemical properties of soil.

Table 1 Physicochemical properties of soil

S.No	Village	pH	Moisture (%)	Organic Carbon (%)	Organic matter(%)	N (%)	P (%)	K (%)	Leachability (ppm)	
									Ca ²⁺	Mg ²⁺
1	Bagni	7.6 ±0.333	10.7 ±0.333	0.82 ±0.333	1.41 ±0.333	0.56 ±0.333	0.40 ±0.577	20.6 ±0.01	0.07 ±0.333	0.04 ±0.333
2	Koregaon	7.5± 0.333	10.8 ±0.333	0.75 ±0.333	1.29 ±0.333	0.58 ±0.333	0.38 ±0.577	20.8 ±0.01	0.08 ±0.333	0.03 ±0.333
3	Dhavli	7.7 ±0.333	10.5 ±0.333	0.78 ±0.333	1.34 ±0.333	0.60 ±0.333	0.38 ±0.577	20.5 ±0.01	0.08 ±0.333	0.02 ±0.333
4	Nagaon	7.6 ±0.333	10.7 ± 0.333	0.76 ± 0.333	1.31 ± 0.333	0.56 ±0.333	0.39 ±0.577	20.5 ±0.01	0.09 ±0.333	0.02 ±0.333

-Values are mean of ±SEM of three experiments. N- Nitrogen, P-Phosphorus, K-Potassium.

Microbiological analysis

Microbial diversity was observed in the soil of selected areas, the average population of nitrogen fixing bacteria was found to be $4 \times 10^5 \text{g}^{-1}$. The soil samples collected from Dhavli and Nagaon areas were found to contain highest $4.6 \times 10^5 \text{g}^{-1}$ microbial count of nitrogen fixing bacteria. Similar results were observed in case of phosphate solubilizing bacteria. However, lowest amount of microbial count with respect to nitrogen fixing and phosphate solubilizing microorganisms was observed in soil sample collected from Bagni area. Microorganisms like *Bacillus*, *Pseudomonas*, *Azotobacter*, *Rhodopseudomonas*, *Aceinetobacter* are responsible for the phosphate solubilization in the rhizospheric region of soil (Kennedy and Islam, 2001). The role of plant growth promoting Rhizobacteria was also studied previously (Reis et al., 2000). The agriculture soil properties with respect to ecotoxicity of insecticide additives in soil was previously get studied (Ghosh and Rokade, 2012). Presence of soil microflora in soil contributes to maintain fertility in the rhizospheric region of soil however such delicate balance is get disturbed due to the presence of residues of insecticides (Rokade and Mali, 2013). Due to these all parameters, study of physicochemical and microbiological properties of soil in the localized region gain an interest today in the field of environmental microbiology.

CONCLUSION

Presence of xenobiotic and recalcitrance compounds in the soil leads to decrease in fertility of soil. By studying the different physicochemical parameters of soil improvement in the agriculture practices with respect to application of fertilizers and pesticides in soil is possible. Microbiological parameters are useful in agriculture practices, as microorganisms are responsible to increase the fertility of soil. Presence of nitrogen fixing and phosphate solubilizing bacteria in soil is very necessary to increase the fertility of soil. There is scope for using the nitrogen fixing and phosphate solubilizing bacteria as effective inoculants for agriculture practices.

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