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Significance and Benefits of Plant Growth Promoting Rhizobacterium in Techniques of Composting

Dipankar Paul
Research Scholar, Department of Microbiology, Shri Venkateshwara University, Gajraula, Uttar Pradesh
Dr. Dhanendra Kumar Rai
Associate Professor, Department of Microbiology, Shri Venkateshwara University, Gajraula, Uttar Pradesh

Abstract
Composting is a biological process in which numerous indigenous microbe species work in compost mixtures to humify and degrade organic waste. A biological process of decomposing organic materials is composting. Microorganisms are crucial to the composting process. Via a number of direct and indirect actions, a genus of bacteria known as PGPR colonizes plant roots and supports plant growth and disease control. PGPRs are recognized as soil efficient microorganisms, which can aid in the faster growth of a variety of crops as well as the management of soil illnesses. By lowering the prevalence of illness concluded biological controller mechanisms such antibiosis, the formation of complete confrontation, and competition for nutrients, rhizobacteria can indirectly enhance plant growth. Isolation of Rhizobacterium was done from ground-nut plant and studied for its beneficiary effects in composting of humus matter. The rhizosphere of plants is home to a vast range of microorganisms (a variety of mustard & ground nut plant). For isolation of PGPR, morphological and biochemical characterization was used to distinguish their properties such as shape, size, texture, etc. Pour plate method and sprinkle method was performed for isolation and identification was done by Gram staining and bio-chemical tests. A fresh inoculum was prepared in sterile medium and the PGPR was used for composting. While degradation of the humus matter and to enhance, the quality of compost it was made sure that no pathogens were present in the sample or the prepared compost. After proper degradation of the humus matter the compost was utilized for cultivation of plants. The required parameters and most importantly N: P: K ratio was also maintained by the PGPR microbial strain and the compost was free from any pathogens.
Key Words: Compost, Pathogen, Plant Growth Promoting Rhizobacteria, Organic fertilizer, Humus matter.

1. Introduction:

Rhizosphere is the name for the area of soil that surrounds a plant's roots. In comparison to bulk soil, the rhizosphere contains a variety of microorganisms that are 10-100 times more numerous.It has been determined that these rhizosphere microorganisms have a positive, negative, or neutral effect on plant health. Yet, PGPR that have a positive impact on their host plant are crucial. *Kloepper* and *Schroth* are the authors of the phrase "PGPR." Around 2-5% of the rhizosphere bacteria are thought to be PGPR. The ability to colonize roots, high survival and multiplicity inthe root environment, which promotes plant growth, and the inhibition of phytopathogens are the three main characteristics of PGPR. For instance, farmers were aware from experience that combining the soil for non-legume crops with the soil for planting legumes boosted crop yield. Rhizobium fertilizers were originally used to inoculate legumes in many different nations after the first license for the manufacturing of a biological fertilizer known as Nitragin was granted in the late 19th century.

Rhizobacteria are known as "plant growth boosting rhizobacteria" and are located in the rhizosphere, a small area ofsoil that surrounds and affects plant radicle. Rhizobacteria have a important impact on plant development, nutrition, and health (PGPR). Food quality and supply will be significant problems in the future. More agricultural products must be produced in order to keep up with population growth, which necessarily leads to higher productivity per unit of land. This cannot be done without the use of fertilizers, either chemical orbiological. As nutrient management is one of the essential elements of sustainable agriculture, biological fertilizers will eventually replace chemical fertilizers due to their advantages and

affordability. It has long been a practice to inoculate plants with helpful microorganisms.

For agriculture to be sustainable and to provide for global food security, fertile soil is crucial. Despite the fact that both have come a long way, there is a rising need for natural resources. Chemical fertilizers and pesticides are largely employed to combat pathogenetic diseases and to

deliver indispensable nutrients to the soil-plant system, respectively. In place of toxic chemical fertilizers and pesticides, —Plant Growth Promoting Rhizobacteria (PGPR) is utilized in cultivation as a more ecologically friendly unusual. The quality of plant growth can be improved directly or indirectly by a variety of bacteria collectively referred to as PGPR, which can be found in the rhizosphere, on root surfaces, and in interaction with roots. In recent decades, a wide range of microorganisms have been shown to support plant development. PGPR are free-living soil bacteria that have been isolated from the rhizosphere and are employed as a seed or cropinoculant. They assist plants in growing and generating more by producing phytohormones, releasing nitrogen through biological nitrogen fixation, releasing phosphorus through phosphate solubilization, and controlling phytopathogens.

2. Materials And Methods:

2.1.1 Sample collection:

In the present study, isolation of microorganisms was done from soil and root samples. Sugarcane bagasse was collected from sugar manufacturing industry for the preparation of Bio-compost. The leguminous roots were dipped in Ethanol for few minutes and then wiped with tissue paper to remove any foreign particles. Microbes were isolated in Buffered Peptone Water. Serial dilution technique was performed from 10^{-1} – 10^{-7} dilution to isolate the micro-organisms. Sprinkle method and Pour plate method was performed to isolate the Rhizobium sp. from roots and soil sample respectively. Pure cultures of Rhizobium species were isolated in Soya bean Casein Digest Agar and Nutrient Agar. Microscopic examination was done by Gram staining for identification of morphology of the colonies. After proper identification & confirmation by bio-chemical tests the isolated pure culture was preserved on tightly sealed Nutrient Agar slants.

2.2.2 *Sample preparation:*

The isolated microorganisms preserved in slant were further processed for Microbial Consortium in double stranded Soya bean Casein Digest Medium. The bagasse was laid on the plot scale trial in Windrows. The Microbial Consortium was diluted with sugarcane treated effluent water to check controlled growth of Microbes and to prevent the growth of any pathogenic micro-organisms such as Escherichia coli species, Salmonella species, Pseudomonas species, and Staphylococcus species. Windrow was sprayed by the diluted Microbial Consortium and tumbling was done by Aero tiller. The windrow was turned on a regular basis to improve the oxygen content, distribute heat to regulate temperature and to distribute moisture equally in the windrow.

Methodology for Microbiological Analysis: -

Enumeration of Total Bacterial Count:

- Homogenized the sample manually then took 10g of the sample in 90 ml diluents (0.1 % Buffered Peptone Water) to make initial dilution (1: 10).
- Transferred 1 ml of the above stock to 9 ml of the diluents making it to 10^{-2} dilution repeated same procedure up-to 10^{-7} dilution.
- Transferred 1 ml from each dilution to sterile Petri plate.
- Poured about 15-20 ml of melted Nutrient Agar media into the Petri plates.
- Mixed the inoculums with media by gentle rotation and allowed to solidify.
- Incubated the plates in inverted position at 37º C for 24 – 48 hours for bacterial isolation.
- Recorded the observation of the appeared colonies in the petri plates.
- Counted the number of colonies in the range of 10-100 colony forming units by using Quebec Colony Counter and report in Cfu/g.

3. Results and Discussion:

The prepared bio-compost was analysed microbiologically to determine Total Viable Count, Cfu/g including TBC (Total Bacterial Count) and Pathogens were also tested to determine the biological properties of the sugar-cane press-mud. The plants were observed to grow well and yield in the plants were also observed to be quite productive.

A. Microbiological analysis results of Sugarcane press-mud: -

S. No.	Microbiological parameters	Obtained Values "0" day	"15" day	"30" day	"45" day	Specified/ Desired Limits	Comments
01	Total Bacterial Count, cfu/g	25 $x10^7$	45 x 10^7	46 x 10^7	80 x 10^7	NLT 50 X 10^7	Complies
02	Yeast & Mould Count, cfu/g	10 x 10^7	70 x 10^7	55 x 10^7	60x 10^7		
03	Escherichia coli/25g	Absent	Absent	Absent	Absent	Absent	Complies
04	Pseudomonas aeruginosa/25g	Absent	Absent	Absent	Absent	Absent	Complies
05	Staphylococcus aureus/25g	Absent	Absent	Absent	Absent	Absent	Complies
06	Salmonella/25g	Absent	Absent	Absent	Absent	Absent	Complies
07	Isolation and Identification of Bacteria	Rhizobacterium species Isolated & Identified	-	-	-	-	Isolated from the soil sample

The prepared bio-compost was analysed to determine the physico-chemical properties were experimented to determine the chemical properties of the manure up-to 45 days at different time intervals i.e. 0, 15, 30 & 45 days finally. Temperature was monitored in regular intervals to understand the metabolic activity in the press-mud.

Conclusion: -

After completion of 45 days, pathogens were found to be absent in the press-mud and complied within the specified and desired range, as prescribed for Organic manure. After completion of the 45 days, it was observed that the Total Bacterial Count increased from 25x10^7 to 80 x10^7.

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