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Agro Wastes as Good Sources for Production of Biofertilizers

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ABSTRACT

In the past centuries, the farmers were eager in the usage of chemical fertilizers as it yielded great number of crops. But eventually, they realized that chemical fertilizers affects the soil fertility and chemical fertilizers not only affected the soil but human beings as well. To overcome this problem faced by farmers, Bio fertilizers came as the solution. It is an eco friendly method both toe environment and farmers. The Biofertilizer and biological waste are used to replace the usage of chemical fertilizers as it does not contain any toxic substance and makes the soil enriched. Use of such natural products like biofertilizers in crop cultivation will help in safeguarding the soil health and also the quality of crop products. Solid State Fermentation has been defined as a fermentation process which is used in cultivation of microorganisms under controlled conditions in the absence or near absence of free water. It is a potential technology that is used in the production of microbial products such as feed, fuel, food, chemical and pharmaceutical products. Solid substrate generally provides a good environment to the microbial flora containing bacteria, fungi and yeast. The present study is aimed at producing Biofertilizers from Agro - wastes using Solid State Fermentation.

Keywords: Chemical Fertilizers, Bio fertilizers, Microbial Products, Agro-wastes and Solid State Fermentation.

INTRODUCTION

Biofertilizers are defined as preparations containing living cells or latent cells of efficient strains of microorganisms that help crop plants' uptake of nutrients by their interactions in the rhizosphare when applied through seed or soils (Laditi et. al 2022). They accelerate certain microbial processes in the soil which augment the extent of availability of nutrients in a form easily assimilated by plants (Moola Ram 1 et. al. 2014). Very often microorganisms are not as efficient in natural surroundings as one would expect them to be and therefore artificially multiplied cultures of efficient selected microorganisms play a vital role in accelerating the microbial processes in soil. Use of bio fertilizers is one of the important components of integrated nutrient management, as they are cost effective and renewable source of plant nutrients to supplement the chemical fertilizers for sustainable agriculture (Bakonyi et. al. 2013). Several microorganisms and their association with crop are being exploited in the production of biofertilizers (Rakesh Kumar Meena et. al 2017). They can be grouped in different wasy based on their nature and function. (Table 1).

India's agriculture is composed of many crops especially besides wheat and rice besides pulses, potatoes, sugarcane, coffee, oil seeds and jute (Shah Alam and Rajendra Kumar Seth, 2012; Dumitrescu et. al., 2009). Currently, the total agricultural output is lost due to inefficiencies in harvesting, transport and storage of government subsidized crops. (Abdullahi et. al,. 2012). Decline of agriculture is due to depletion of soil fertility and also partially associated with unfavourable distrubition of rainfall, dgrought, storm and floods. The major problem faced by the farmers are high cost of inorganic fertilizers require for the plant growth (Anita Khanafari et. al. 2012). The chemical fertilizer pollutes the air, soil and water polluting agents during the production of crops. In the present study, different fruits are used as bio fertilizers to check the efficiency in improving plant growth (Soh-Fong Lim and Sylvester Usam Matu, 2015). The microorganisms present in various fertilizers which benefits the plant growth have also been studied (Muhammad Yasin et. al., 2012).

Table 1: Types of Biofertilizers

S. No.	Groups	Examples
N2 fixing Biofertilizers		
1.	Free-living	*Azotobactor, Beijerinkia, Clostridium. Klebsiella, Anabaena, Nostoc,*
2.	Symbiotic	*Rhizobium, Frankia, Anabaena azollae*
3.	Associative Symbiotic	*Azospirillum*
P Solubilizing Biofertilizers		
1.	Bacteria	*Bacillus megaterium var. phosphaticum, Bacillus subtilis Bacillus circulans, Pseudomonas striata*
2.	Fungi	*Penicillium sp, Aspergillus awamori*
P Mobilizing Biofertilizers		
1.	Arbuscular mycorrhiza	*Glomus sp., Gigaspora sp., Acaulospora sp., Scutellospora sp. & Schlerocystic sp.*
2.	Ectomycorhiza	*Laccaria sp., Pisolithus sp., Boletus sp., Amanita sp.*
3.	Ericoid mycorrhizae	*Pezizella ericae*
4.	Orchid mycorrhiza	*Rhizoctonia solani*
Biofertilizers for Micro nutrients		
1.	Silicate and Zinc solubilizers	*Bacillus sp.*
Plant Growth Promoting Rhizobacteria		
1.	Psedomonas	*Pseudomonas fluorescents*

METHODS AND MATERIALS

COLLECTION OF SAMPLES

Agro- wastes (rotten fruits) were collected from the fruit market near CMBT. The five different fruits used for the present study are watermelon, papaya, pine apple, custard apple and guava. Fruits were cut into small pieces and smashed. They were used for Solid-State Fermentation (SSF). The soil samples were collected from Kanchipuram and Kokathur.

PREPARATION FOR FERMENTATION PROCESS

Two batch of fermentation process were carried out- BATCH- I&II

MATERIALS REQUIRED

1. Polythene bottle

2. Fruit wastes (rotten)

3. Distilled water

BATCH- 1

Five hundred grams of water melon wastes was placed in a polythene bottle which has a capacity of 2.5 L. Hundred of water added to it. The bottle was kept undisturbed for 30-40 days until the soluble product was formed. This soluble product was filtered with a fabricated filter. The fermented solution is the first batch water melon biofertilisezer.

BATCH- II

Hundred milliliters of this filtered solution was used as inoculums precursor to the next SSF process. 500 g of new water melon wastes were placed in a polythene bottle. The precursor increases the rate of fermentation and minimizes the duration of SSF process. The bottle was kept undisturbed for 20-30 days at room temperature until the soluble product was formed. This soluble product was filtered with a fabricated filter. This filtered solution is called second batch water melon biofertilizer. Agro- wastes from pine apple, papaya, and custard apple were also used to produce first and second batches of biofertilizer.

APPLICABILITY OF THE BIOFERTILIZER IN VEGETABLE PLANTATION

The biofertilizers were applied on the various seeds samples of 2 weeks of age in order to determine the effectiveness of the biofertilizer. Each batch of the biofertilizers were applied on 100 plant samples. At the same time, another 100 samples were planted in the absence of any fertilizer.

Experimental Design- Pot Culture

350 g of soil was taken in empty box which has a capacity of 600 gm. 60 g of Combu seeds were taken. 6 ml of watermelon fertilizer and 6 ml of water were mixed and applied to the soil. the procedure was followed for the rest of the fruits as well. At regular intervals, the fertilizer was sprinkled on the soil.

RESULTS AND DISCUSSION

Solid State Fermentation

The fermented solution from Batch II is used to check the efficiency of vegetation plantation.

Pot Culture (Soil Sample- Muzaffar Nagar)

600 g of soil sample from M. Nagar was weighed and taken in tray. 60 g of seeds |(Combu) was taken. 6 ml of the biofertilizer (watermelon) and 6 ml of wate is taken and mixed well. The fertilizer is applied daily to the soil. The following method is carried out for other fertilizers. The growth of the plants was observed periodically and the height was noted.

Pot Culture (Soil Sample Saharanpur)

600g of soil sample from Saharanpur was weighed and taken in a tray. 60 g of seeds (Cumbu) was taken. 6 ml of the biofertilizer (watermelon) and 6 ml of water is taken and mixed well. The fertilizer is applied daily to the soil. The following method is carried out for other fertilizers. The growth of the plants was observed periodically and the height was noted.

Quantitative Analysis of Plant Growth- Soil Sample (Saharanpur)

Each fruits unique in its nutritional elements which make the plant growth differ in their morphological characters such as length of root, shoot and height of plant and seed germination Muskmelon, watermelon and guava shows better growth in plant rate with reference to the height of plant, length of root, shoot and seeds germinated in soil sample. The soil sample taken from Muzaffarnagar and Saharanpur showed better seed germination. (Table 2).

Table 2: Quantitative Analysis of Plant growth (Soil Sample Saharanpur)

S. No.	AGRO-WASTE (ROTTEN FRUITS)	TOTAL HEIGHT OF PLANT	ROOT LENGTH	SHOOT LENGTH	NO. OF SEEDS GERMINATED
1	CONTROL PLANT	3-40 cm	3cm	4cm	30-45%
2	MUSKMELON	8-12cm	3-5cm	8-9cm	70-85%
3	WATERMELON	12-15cm	8-10cm	8-10cm	80=-90%
4	GUAVA	18-20cm	10-15cm	8-20cm	80-95%
5	LITCHI	7-9cm	4-8cm	4-7cm	60-75%
6	PAPAYA	8-10cm	4-9cm	5-8cm	40-50%

Quantitative Analysis of Soil Sample- Muzaffarnagar

Each fruits unique in its nutritional elements which make the plant growth differ in their morphological character such as length of root, shoot and height of plant and seed germination muksmelon, watermelon and guava shows better growth in plant rate with reference to the eight of plant, length of root, shoot and seeds germinated in soil sample. The soil sample taken from Muzaffarnagar and Saharanpur showed better seed germination (Table 3).

Table 3: Quantitative Analysis of Plant growth Soil Sample Muzaffarnagar

S. No.	Agro-Waste (Rotten Fruits)	Total Height of Plant	Root Length	Shoot Length	No. of Seeds Germinated
1	CONTROL PLANT	8cm	3cm	3 cm	20-45%
2	MUSKMELON	20-25cm	17-22cm	10-20 cm	75-80%
3	WATERMELON	30-35cm	15-20 cm	20-25 cm	80-85%
4	GUAVA	25-30cm	20-25 cm	10-20 cm	75-85%
5	LITCHI	8-12cm	2-3 cm	4-8 cm	60-65%
6	PAPAYA	8-10cm	4-9 cm	5-8 cm	50-60%

CONCLUSION

The study aimed at producing Biofertilizers from Agro-wastes. Agro wastes are defined as waste which is formed from various agricultural activities. The agro-wastes are usually fruits, vegetables, weed and organic manure. The collected Agro- wastes subjected to Solid State Fermentation process to produce soluble fermented solution. The Agro- wastes used were water melon, guava, papaya, musk melon litchi. Solid State Fermentation aided in the formation of soluble product and helped to produce the microorganism such as bacteria, fungi and yeast. The fermented solution was applied to vegetation to check the efficiency of the biofertilizer. The soil was collected from two different location. Saharanpur and Muzafffarnagar to compare the presence of soil nutrient between two locations. Cumbu (Pennisetum Glaucum) seeds were tested using the biofertilizer. The elongation of root, shoot and germination of seeds were compared. Watermelon, Muskmelon and Guava fertilizer showed the best efficiency in comparison to other.

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