



**FORMULATION OF VEGETABLE COMPOST FOR GROWTH
ENHANCEMENT OF VIGNA RADIATA - A SUSTAINABLE APPROACH
TOWARDS ORGANIC FARMING**

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Abstract

*Environmental pollution is the major threat confronting the world and the rampant use of chemical fertilizers and pesticides can contribute to the deterioration of the environment. This ill-practice can lead to loss of soil fertility which may have a huge impact on agricultural productivity. Vegetable wastes provide a good amount of nutrients for inhabiting microbes and thus can be a potential alternative for transforming into an organic biofertilizer. Therefore the present research work was undertaken to formulate the vegetable waste compost in association with microorganisms (*Rhizobium spp.*, *Azotobacter spp.* and *Lactobacillus spp.*) and *Spirulina* that can act as a potential biofertilizer and its comparative assessment with synthetic fertilizer. The formulated compost mixtures were inoculated with variant combinations of organisms, Test Control and Control. These microbial cultures were combined with different combinations of vegetable wastes like corn and cabbage, cabbage and onion, corn and onion with soil which were utilized to formulate into a potential biofertilizer. It was observed that there was increase in shoot length (24.4cm) and root length (6.0cm) in the consortium treated plant in combination with corn+onion. The comparative assessment undertaken in the current study gave the major outcome that the formulated biofertilizer was better than the synthetic fertilizer and hence can serve as the potential substitute to the hazardous chemical or synthetic fertilizer. Towards the end the positive outcome substantiated that microbial biotechnology can be a powerful tool for the decomposition of kitchen waste into a value added material.*

Keywords- Microbial Compost, Vegetable waste, Biofertilizer

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I. INTRODUCTION

Environmental spoliation has the great potential to be a huge threat to the survival of mankind. The high usage of synthetic fertilizers and pesticides can be a major contributor in deteriorating the environment [1]. Spoliation can affect the soil fertility leading to its integrity and productivity damage and this impact has led to the adoption of alternative sustainable farming practices [2, 3]. In day to day life a huge amount of organic waste is generated and thus poses a challenge for its safe disposal. However, there are various microorganisms that have the capability of converting organic wastes into valuable resources providing a better alternative for its safe disposal. Vegetable wastes provide a good amount of nutrients for inhabiting microbes and thus can be a potential alternative for transforming into an organic biofertilizer.

Fertilizers are organic or inorganic, natural or synthetic substances that added to soil to accelerate plant growth and production. Fertilizers are used to improve the soil's growing potential because fertilizers are able to provide a better growing condition for plants as compared to natural soil. Organic fertilizers are natural fertilizers that are made up from animals, plants and minerals through the process of composting. Composting is a favorable and ecofriendly process whereby certain organic wastes are reduced to organic fertilizers through biological activity [3].

Organic fertilizers formulated from the vegetable wastes can reduce the misuse of conventional fertilizers that may be detrimental to the environment and mankind. Fermentation and composting are the potential alternative approaches to manage biological materials and such processes convert the vegetable waste into useful materials such as organic fertilizers for farming. Therefore the present research work was undertaken to formulate the vegetable waste compost in association with microorganisms and *Spirulina* that can act as a potential biofertilizer and its comparative assessment with synthetic fertilizer.

II. MATERIALS AND METHODS

2.1 Isolation of *Rhizobium* spp. from root nodules:

Healthy and nodulated *Vigna radiata* plants were carefully up rooted and the root system was washed in running water to remove adhering soil particles. However healthy, unbroken and pinkish nodules were selected and washed in tap water. They were immersed in 5% Hydrogen Peroxide (H₂O₂) solution for 5 minutes. Nodules which were surface sterilized with Hydrogen Peroxide were washed repeatedly with sterile water and dipped in 70% ethyl alcohol followed by more washing with sterile water. The nodules were crushed in a small aliquot of sterile water with the help of sterile glass rod. A suspension was made of the crushed nodules, plated on Yeast Extract Mannitol Agar (YEMA) plates containing 1% Congo-red dye and incubated at 28°C for 24 hours [4].

2.2 Isolation of *Azotobacter* spp. from soil:

The soil sample was collected from the rhizosphere soil of *Vigna radiata* plant. One gram of soil sample was dissolved in 9ml of sterile distilled water. Up to 10⁻⁶ dilution was made and a loopful of soil suspension was plated on Ashby's medium. The plates were incubated at 28°C for 7 days [5, 6].

2.3 Isolation of *Lactobacillus* spp. from curd sample:

A loopful of household curd sample was streaked on de Man Rogosa Sharpe medium (MRS agar medium) and the plates were incubated at 37°C for 24 hours [7].

After incubation, all the isolated colonies were identified on the basis of morphological, cultural and biochemical characteristics [8, 9].

2.4 Collection of *Spirulina*:

Spirulina powder was procured from local market of Nagpur City and was further used.

2.5 Formulation of Vegetable waste compost:

House hold vegetable peelings of Corn, Onion and Cabbage were collected, sun-dried and powdered. The vegetable waste powder was mixed with soil in 1:3 proportion and these mixtures were watered and mixed to get homogeneous compost. The formulated compost was further allowed to settle for a week [10].

2.6 Inoculum Preparation in Prepared compost:

The formulated compost mixtures were steam sterilized consequently for three times. After sterilization, 1ml broth cultures each of *Rhizobium* spp., *Azotobacter* spp., *Lactobacillus* spp. and *Spirulina* (5grams each) inoculated into formulated soil waste mixture. The inoculum preparation was done in variant combinations as mentioned below-

R+A+L+S; R+A+L; R+L; A+L; Test Control (With chemical fertilizer and without inoculation); Control (Without chemical fertilizer and without inoculation)

Where, R- *Rhizobium* spp., A- *Azotobacter* spp., L- *Lactobacillus* spp., S- *Spirulina*

The inoculated mixtures of vegetable compost were further incubated for the interval of 4 weeks.

2.7 Germination of Seeds and plant growth using vegetable compost:

Vigna radiata seeds were soaked overnight in sterile distilled water and were sown in pots containing formulated vegetable compost inoculated with different combinations of organisms as mentioned above. In each set approximately 4-5 seeds were sown. The seedlings were germinated within 48 to 72hrs and growth of plantlets was observed. After 45days the root length, shoot length and the total length of the plants were measured [11].

III. RESULTS AND DISCUSSION

Environmental pollution is the major threat confronting the world and the rampant use of chemical fertilizers and pesticides can contribute to the deterioration of the environment. This ill-practice can lead to loss of soil fertility which may have a huge impact on agricultural productivity. Food waste can be transformed into useful form as organic fertilizers to reduce the impacts of food wastes disposal [12]. Composting and recycling food waste is part of waste management strategy to combat the ill-use of synthetic fertilizers [13].

Hence in the present investigation, comparative study was undertaken to evaluate efficiency of the microorganisms like *Rhizobium*, *Azotobacter* and *Lactobacillus* and *Spirulina* in different combinations with vegetable waste to formulate it into a potential biofertilizer and in enhancing the growth of *Vigna radiata* plants.

In the present research work, *Rhizobium* spp. was successfully isolated from healthy root nodules using surface sterilization method, while *Azotobacter* spp. was isolated from the soil sample. *Lactobacillus* was successfully isolated from the curd sample. *Spirulina* was procured from the market and all these microorganisms were utilized for preparing microbial inoculums in combinations with vegetable wastes like corn and cabbage, cabbage and onion, onion and corn and soil during the study.

Table 1: Shoot and Root Lengths of the Plants treated with Vegetable Waste Combination (Corn + Cabbage)

Sr. No.	Inoculum Groups	Shoot length (cms)	Root length (cms)	Total lengths of Plantlets (cms)
1	R+A+L+S	22.0	6.2	28.2
2	R+A+L	20.3	5.3	25.6
3	R+L	20.0	4.1	24.1
4	A+L	12.2	3.7	15.9
5	Test Control	15.7	4.9	20.6
6	Control	12.2	4.9	17.1

Table 2: Shoot and Root Lengths of the Plants treated with Vegetable Waste Combination (Corn + Onion)

Sr. No.	Inoculum Groups	Shoot length (cms)	Root length (cms)	Total lengths of Plantlets (cms)
1	R+A+L+S	24.4	6.0	30.4
2	R+A+L	20.5	5.7	26.2
3	R+L	14.3	4.4	18.7
4	A+L	14.0	3.8	17.8
5	Test Control	13.6	6.0	19.6
6	Control	15.5	5.0	20.5

Table 3: Shoot and Root Lengths of the Plants treated with Vegetable Waste Combination (Cabbage + Onion)

Sr. No.	Inoculum Groups	Shoot length (cms)	Root length (cms)	Total lengths of Plantlets (cms)
1	R+A+L+S	19.1	3.7	22.8
2	R+A+L	17.7	4.5	22.2
3	R+L	15.4	2.7	18.1
4	A+L	12.8	2.5	15.3
5	Test Control	15.3	1.5	16.8
6	Control	12.7	1.4	14.1

In case of Corn and cabbage compost, the highest values were observed in case of R+A+L+S consortium. The shoot length was found to be 22.0cms while the root length was 6.2cms. Total length of the plantlet was found to be 28.2cms (Table 1). The values of shoot length and root lengths of different setups showed the clear differentiation and the highest values was observed in case of R+A+L+S with supplemented with Corn + Onion. The shoot length was found to be 24.4cms while the root length was 6.0cms. Total length of the plantlet was found to be 30.4cms (Table 2). In case of cabbage and Onion compost, the highest value was observed in R+A+L+S. The shoot length was found to be 19.1cms while the root length was 3.7cms. Total length of the plantlet was found to be 22.8cms (Table 3). Vegetable waste is highly organic, rich in carbohydrates and proteins which is the source of nutrients to the microorganisms. However, microorganisms might utilize these complex organic substances and converted the waste into a reusable fertilizer by improving the quality of compost with adequate amounts of organic carbon and nitrogen [14].

The current research study has clearly indicated that the highest growth was observed by microbial consortium of R+A+L+S while the least growth was observed by microbial inoculum combination of A+L [10, 15]. Many vegetables show presence of ideal conditions for the survival and growth of many types of micro organisms. Hence the present study concludes that a simple microbiological process could provide a solution to the problem of vegetable waste disposal, and for it's recycling into useful compost by the action of decomposing microorganisms and by utilizing this process potential microbial compost can be formulated.

IV. CONCLUSION

Microbial degradation has recently emerged as a simple but efficient biotechnological tool for recycling organic wastes to produce better end product. Composting is a good organic method of enriching the soil. Compost can be easily prepared in a short span of time in the pots with garden and kitchen refuse using microbial consortium prepared from the soil borne bacteria.

The growth efficiency of *Vigna radiata* seeds was higher in the microbial consortium treated compost. Plants shoot length and root length was increased in experimental compost than in the control and in test control (Synthetic Fertilizer) in all the combinations. Hence the present process can be the easiest one to convert the waste into a byproduct which can be utilized as an eco friendly biofertilizer. The comparative assessment undertaken in the current study gave the major outcome that the formulated biofertilizer was better than the synthetic fertilizer and hence can serve as the potential substitute to the hazardous chemical or synthetic fertilizer. Towards the end the positive outcome substantiated that microbial biotechnology can be a powerful tool for the decomposition of vegetable waste into a value added material.

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