Coco Pods As Source Of Organic Potassium And Potassium Mobilization By Actinomycetes

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Abstract

Actinomycetes species were identified which has the ability to mobilize bound potassium from the agro wastes of cocco. Actinomycetes broth was added to the finely grinded specific amount of coccopods. Onions were planted in this mixture to check the difference in growth rate along with control plants in normal soil. The amount of potassium released and utilized by the plants is estimated using dry weight analysis of plant material and also by flame photometer. Actinomycetes enhance plant growth by mobilizing bound potassium from coccopods. The Actinomycetes and cocco pod mixture can be used as a biofertilizer to enhance plant growth and yield.

INTRODUCTION

Plants need potassium to produce sugars. Starch, proteins, enzymes in which turn provide good internal chemistry to plants. It also promotes growth of strong vigorous roots and resistances to various plant diseases (Shelcome 1998). These ions help in membrane permeability, pH control, stomata regulation, and utilization of Light, CO_2 assimilation and translocation of enzyme photosynthase (Department of organic farming, university of Kassel& IBO GSF). Rapidly growing cereal crops takes up to 6 Kgs of potassium per hector per day (Shelcome 1998). In soil, potassium ions tightly held in the colloidal platelets or the solid framework. These ions are released by weathering and become available to plants (Shelcome 1998). Indian soil is deficient in potassium (IBO GSF). So w have to provide potassium from external sources. Chemical sources will reduce the fertility of the soil. Hence potassium from biological origin should recommend. India is cultivating cocco in high levels in different parts of the country. From the cocco fruits only the seeds are used for the production of cocco powder used in chocolate production. The fleshy part of the fruit (coccopods) is dumped as an agro waste, which is estimated to be rich in potassium. But plants cannot absorb directly the potassium present in it due to its strongly bound nature in the coccopods. Some Actinomycetes were identified which has the ability to transform the bound potassium to plant absorbable form. The aim of the study is to develop a potassium mobilizing biofertilizer, which enhances plant growth.

MATERIALS AND METHOD

ISOLATION OF MICROORGANISM

Soil samples rich in potassium were collected. Serially diluted samples were plated on a selection medium of starch casein agar containing sephadox and incubated the culture at 27 °C. Isolated individual colonies were sub cultured onto Luria Brettani agar medium and cultures were stored at 4°C. Organisms were inoculated into LB broth and kept in environmental shaker at 37°C for 3 d at 100 rpm. The optical density of the broth was found to be 0.4 OD units at 600nm. Actinomycetes were identified by morphological, cultural and physiological characteristics as presented in Bergey's manual of systematic bacteriology (Anon.1989)

BIOLOGICAL POTASSIUM SOURCE AND PREPARATION

After the cocco are ripened (yellow or red) the seeds were removed from the fleshy part. The coccopods dumped as heap and allowed to degrade for a period of 3 months in the field. Then the pods become black in color. These pods were collected and crushed thoroughly too small granules. It was sterilized in an autoclave at 121 °C for 15 minutes. After sterilization allow it to cool.

DETERMINATION OF POTASSIUM MOBILIZING ACTIVITY OF ACTINOMYCETES

The 3 d old culture of Actinomycetes was taken. 25 and 30gm of sterilized coccopods were weighed and mixed with 10 and 5gm of sterile sand respectively. Five replicates of

each sample were made. 10 and 15ml of culture broth was mixed to the mixture of sterile cocco and sand. Onions are planted in all cups and they were allowed to grow for a period of 15 days with appropriate watering.

ESTIMATION OF POTASSIUM

Dry weight of the plant material of both plants grown in normal soil and in cocco pods were taken using a normal weighing balance. The difference in weight gives approximate amount of potassium absorbed by the plant.

ESTIMATION OF POTASSIUM BY FLAME PHOTOMETER

Five different soil samples were taken to estimate the level of potassium. One gram of soil is diluted with 50ml of distilled water segmented with air and thoroughly mixed. Standard solution containing 1000 ppm of potassium is used (250mlwater + 447 mg potassium chloride). Then it is diluted ti20 ppm, 40 ppm, 60 ppm, 80 ppm, 100ppm.first we have to feed these standards in flame photometer and then feed these samples. Finally it will show the result. Then graph plotted in standards in “X-axis”, potassium level in soil “Y-axis”.

ISOLATION AND ESTIMATION OF PROTEINS

The decomposed coco pad was taken and surface sterilized with 70% ethanol & detergent (twin 20 & twin100). After sterilized crush the coco pads under the ice condition with sodium phosphate buffer (pH 7.0). Give a rough spin at 1500 rpm for 2-3 minutes& take supernatant and add acetone (1:4 ratio) and keep it ice for 30 minutes. Again centrifuge at10, 000-12,000 rpm. Discard the supernatant & air try the pellet. Store the pellet with phosphate buffer in deep freezer. The concentration was determined by method of bar ford (1979) using bovine serum albumin as the standard

RESULTS

ISOLATION OF ACTINOMYCETES

From the selection medium chalky white molar tooth shaped colonies were selected and pure culture was made in LB agar.

POTASSIUM MOBILIZATION BY ACTINOMYCETES

The plants grown in coccopods inoculated with actinomycetes showed fast and healthy growth compared to control plants grown in normal soil (refer fig.1 and fig 2). Rate of formation of roots are more in plants grown in coccopods and actinomycetes (Refer Table 1).

Figure 1

Figure - 1 A) Plant grown in 25g cocco and 10ml organism broth. B) Plant grown in normal soil

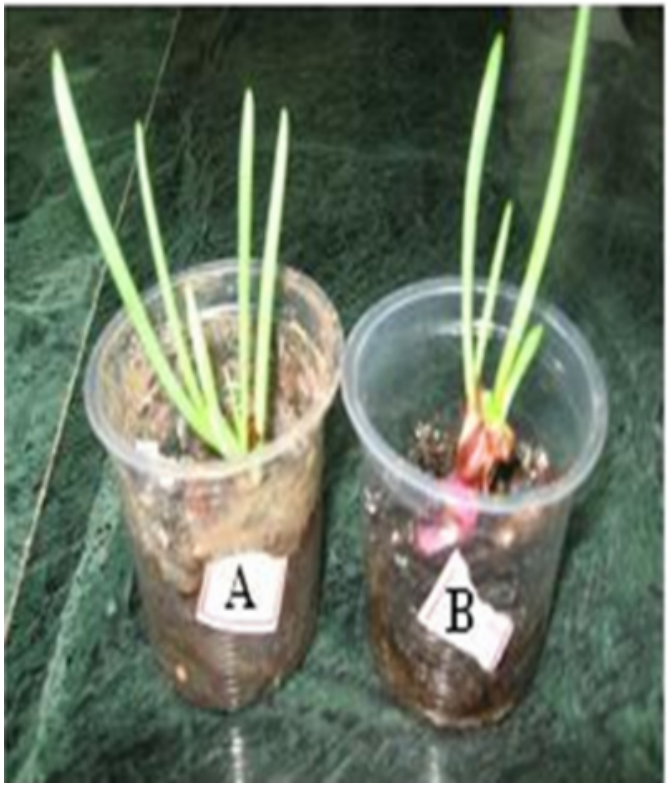

Figure 2

Figure - 2 A) Plant grown in 30g cocco and 10ml organism broth. B) Plant in normal soil.

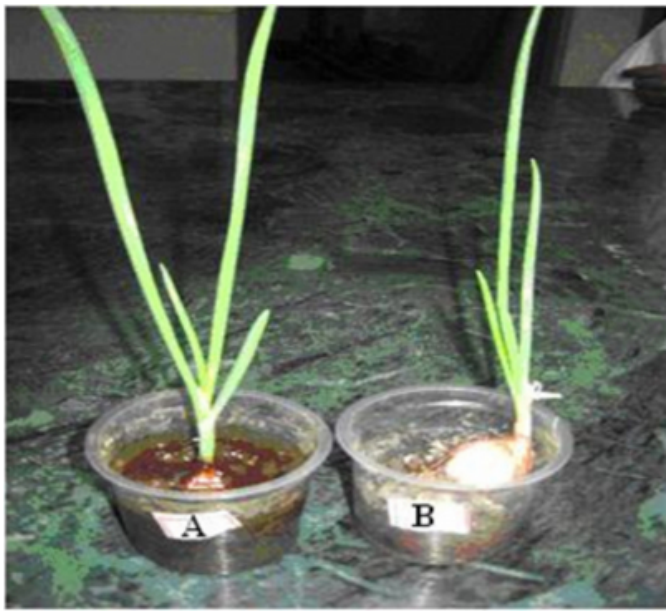

Figure 3

Figuer - 3 Potassium level in soil sample by flame photometer analysis

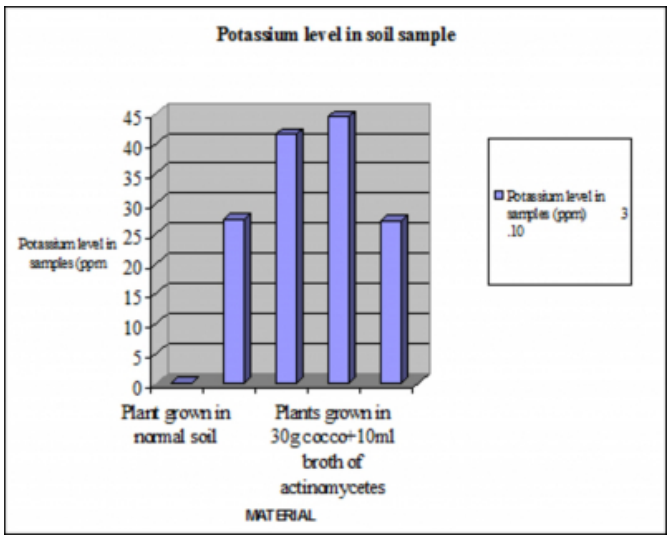

Figure 4

Table 1

S.No	Material	Average weight of plant material (g)*	Difference
1	Plant grown in normal soil	1.03±0.03	
2	Plants grown in 25g cocco+10ml broth of actinomycetes	1.34±0.01	0.31±0.02
3	Plants grown in 25g cocco +15ml broth of actinomycetes	1.50±0.04	0.47±0.03
4	Plants grown in 30g cocco+10ml broth of actinomycetes	1.62±0.02	0.59±0.02
5	Plants grown in 30gcocco+15ml broth of actinomycetes	1.34±0.02	0.31±0.02

*Results are given as the mean of 5 replicates for each treatment ± S.E. of the mean

Difference in plant growth of treated and control plant by taking the difference of the dry weight of plant shoot

ISOLATION AND ESTIMATION OF PROTEIN

The protein present in coco pads is 80 mg/ml. It shows that coco pads are the major one for this potassium mobilization.

DISCUSSION

Balanced nutrition plays a major role, if not the biggest role in the production of quality produce and the regulation of plant growth. Nutrient concentration in plant tissues is the most accurate indicator of nutritional health of plants. The above results show that actinomycetes species has the ability to mobilize potassium from coco pods, making it available for plants. The plants grown in 25g of cocco pods and 10ml of organism broth exhibited fast growth rate compared to plants grown in 30g cocco pods and 10ml broth. This indicates that too much of potassium hinders the growth of plants, hence optimum amount of potassium is recommended for plant nutrition.

The plants grown in 10ml of organism broth showed better growth than plants grown in 15ml of broth in both cases (with 25g and 30g of cocco pods). This too indicates the need of optimizing actinomycetes concentration. Any concentration above or below this optimum hinders the growth by disturbing the biological equilibrium of the soil.

CONCLUSION

The study concludes that optimum amount of cocco pods and actinomycetes are necessary to enhance plant growth.

References

r-0. Anon (1989) Berger's Manual of Systematic Bacteriology, volume 4. Ed. Williams, S.T., Sharpe, M.E. and Holi, J.G.Baltimore, M.D, USA: Willimas and Wilkins.
r-1. Jiang, Y., Li WJ, Xup.Review-Study of diversity of Actinomycetes under salt and alkaline environment. Institute of Microbiology, Yunnan University, Kuswing, China.
r-2. Sharma, S., Mayer, J and Schloter,M. Legume rhizosphere-structure and functional Biography 15-17 Shelcome Beyene., Annual review- Soil properties and function(1998-1999).
r-3. Department of Organic farming and cropping systems, University of Kassel, Norbandhofster, Germany.
r-4. Prescott, harely, klein, Microbiolgy, 5thedition,p.536
r-5. IBO GSF National Research center for environment and health.
r-6. F.Mckenna, K.A.EiTarabily, S.petrie, C.Chen and B.Dell application of actinomycetes to soilamiliorate water repellency, applied microbiology, 2002, volume 35 107-112.
r-7. K.C.Marshall and M.Alexander, growth characteristics of fungi and actinomyctes, laboratory of soil microbiology, department of agronomy, Cornell university, Ithaca, New York

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