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Research Article

Composting of coir waste using bacteria (*Pseudomonas* and *Streptococci*) and fungi (*Aspergillus* and *Rhizopus*) and their effect on sugar cane plant growth

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Abstract

Now a day imbalanced use of chemical fertilizers and pesticides on soil and in plant are not only harmful to soil micro flora and fauna but also reduce the progressive productivity potential of the land. The Sugarcane is a very hardy crop, gives an assured income without loss which needs less care compared to other commercial crops. Coir pith is a by-product from coir industry, utilisation of coir waste forms a sort of recycling to accomplish better resource and environment protection, the composted coir pith is effective and it improves the yield of sugar cane plant and also maintains the soil fertility. The use of basal and foliar spray coir pith based fertilizers at different concentration can influence the growth and productivity of sugar cane plant.The results of the present study obviously suggest that the application of Coir waste to sugar cane fieldgives 80% yield.

Keywords: Coir waste, Cellulolytic bacteria, fungi, sugar cane plant.

Introduction

The Sugarcane is a very hardy crop, gives an assured income without loss which needs less care compared to other commercial crops. In view of these advantages, most of the farmers prefer to plant cane atleast in 50% of the area available to them. To reduce the cost of cultivation, which is the present need of the cane farmer, we have introduced many improved agronomic techniques and followed different farmer friendly and suitable procedures.

In this regard we have experimented on reducing the cost of cultivation and labour requirement for taking of cane plantation. We have been concentrating on the possibility of minimizing the labour along with saving the input.

The seed material usage and the various planting techniques were generalized by the State research stations in Andhra Pradesh i.e., planting three duded setts in the furrows.

We have focused on the seed saving technology and foregone a critical study for about three years to arrive a standardized procedure that can be successful in well drained garden soils, upland areas where irrigation sources are available.

Coir pith is a waste material from coir industry. Large quantity of coir waste, about - 7.5 million tonnes is available annually from coir industries in India (Kamaraj, 1994). Utilisation of this waste

forms a sort of recycling to accomplish better protection. Being an organic waste, its application improves soil physical, chemical and biological properties. In agriculture, it is used as manure and also amendment.

Purpose of this study is to identify the cellulolytic bacteria and fungi in composting coir waste and determine the amount of nitrogen, potassium and phosphorus in compost which is used as organic manure to enhance plant growth and give more yield and it does not have any harmful side effect.

Materials and Methods

1kg of coir waste is spread uniformly.

One bottle (50g) of spawn (culture of *Pleurotussp*) is spread on the coir waste.

This layer is covered another 1kg coir waste, over which 50gm urea is applied.

This process of sandwiching the *pleurotus* and urea alternatively with 1 kg coir waste repeated till the heap reaches a height of one metre.

Water sprinkled on the heap to maintain the moisture content. The heap is kept for 30 days for decomposition.

At the end of 30 days, coir waste turns into a black mass of compost with reduced C: N ratio and increased nutrient content.

The well composed pith compost contains about 1 per cent nitrogen, 1.2 per cent potash, 0.06 per cent phosphorous, 0.5 percent calcium and 0.48 percent magnesium.

Isolation and identification of cellulolytic bacteria and fungi from coir waste

For Bacteria:

Staining techniques

Gram's staining

Motility test

Biochemical characteristics

Indole

Methyl Red

Vogesproskauer

Citrate utilization test

Selective Medium

Cetrimide Agar

Nutrient Agar

Antibiotic sensitivity test

For Fungi

Lactophenol Cotton Blue Technique

Rose Bengal agar

Nutrient status of the compost

Available nitrogen content

Alkaline permanganate method:

20 g of soil was added to 100ml of 0.32% potassium permanganate

↓

100ml of 2.5% NaoH& distillate was taken in beaker with 2% boric acid

↓

It was titrated against N/150 sulphuric acid with double indicators bromocresol Blue and Methyl red

↓

The available nitrogen was calculated.

Available phosphorus content

Prepare a stock solution of 0.1N H_2SO_4 by diluting con. H_2SO_4 360 times (2.78-1000Ml) and standardize with an alkali. A desired volume of this stock solution is diluted 50 times to obtain 0.002N H_2SO_4. Add 3g of ammonium sulphate $(NH_4)_2\ SO_4$ or potassium sulphate K_2SO_4 1 lit to produce a final pH of 3.0

Available potassium content

In use of flame photometer, the sample is aspirated into a flame in the form of a fine spray. In the flame, the solvent gets evaporated leaving the dehydrated salt behind. The salt is dissociated into free gaseous atom in their ground state. Some of the ground level atom take energy from the flame and reach to their exited electronic state. The excited atoms upon returning back to ground level state emit the radiation of a characteristic wavelength. The emitted characteristic radiation is measuring with the help of a Monochromator and detector.

The intensity of the characteristic light produced after spray of sodium into the flame, is proportion to the concentration of potassium and can be read at 768 nm by employing suitable filter

Sodium dodecyl sulfate (SDS) for protein estimation by single bud seedlings nursery method:

The steps involved in development of Single bud seedlings plantation are

1. Harvesting the seed cane with brush cutter
2. Single budded setts preparation.
3. Transportation of single bud setts from harvesting spot to nursery bed.
4. Bagging and stacking the setts for germination.
5. Seedlings nursery preparation.
6. Seedlings plantation.

Determination of growth paramete
Shoot length

Measured from the base of the to the tip of top most leaf.

Root length

Measured from the base of the root of the tip of the primary root

Procedure for biochemical properties

Estimation of soluble sugar (Mahadevan and Sridhar (1996))
Estimation of reducing sugar (Nelson 1994)
Estimation of total lipid (Tomilson and Rich 1969)
Estimation of amino acid (Mahadevan and Sridhar 1996)
Estimation of protein (lowry*et al*., 1951)
Estimation of total phenol
Estimation of orthodihydro phenol (Mahadevan and Sridhar 1996)

Results and Discussion

Cellulolytic bacteria & fungi were isolated from coir waste compost and identified them as *Streptococcus, Pseudomonas &Aspergillusniger, A. flavus*and*Rhizopus* respectively. Nutrient content of the compost was estimated and the available nutrient component such as N,P,K from the compost were found to be 504 kg/ ha, 74.5 kg/ ha, 352.8 kg/ha respectively.

Coir waste compost was applied various concentration to the test plant sugar cane and grown under seedling method, growth of shoot and root length of sugar cane plant was increased than the sugar cane plant growth with out the application of coir waste compost.

Now a day imbalance use of chemical fertilizer and pesticides on soil and in plant are not only harmful to soil flora and fauna but also reduce the progressive productivity potential of the land. Coir waste contain high amount of cellulose and lignin.

Bio compost is the viable process that means converting this organic substance to beneficial product such as biofertilizers and other soil conditioner. Composting has become an increasingly important strategy for the treatment of organic waste.

The coir pith manure shows an excellent medium for soil and it contain high water holding capacity it cannot be easilydegraded by soil.

Conclusion

Coir pith undergoes decomposition very slowly because of its low pentose to lignin ratio of less than 0.5% which is minimum required for the slow

Figure 1. sugacane treated with biofertilizers

Figure 2. Effect of biofertilizers on sugacane plants

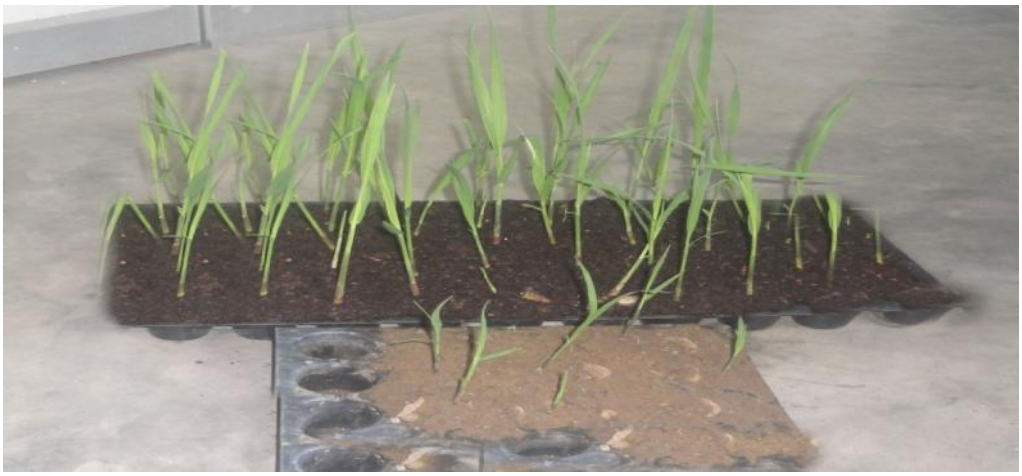

Figure 3. Effect of biofertilizers on sugacane plants

decomposition of organic matter in the soil. An attempt has been made to degrade the coir and has been tested for its efficiency in acting as a bio fertilizer. Usage of inorganic fertilizers in agricultural production has resulted in serious problems in infertility of the soil and it also contaminates the underground water.

Biodegradation of coir pith by the bacterial isolates along with urea can produce value added biotechnological products like bioactive compounds and bio fertilizers. In this present study, bacterial colonies obtained from coir pith have been used for coir composting. The composted coir pith is cost effective and it improves the yield of selected plants and also maintains the soil fertility. The use of basal and foliar spray coir pith based fertilizers at different concentration can influence the growth and productivity of the plants.

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