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Comparative Analysis of Cocopeat and Soil on Plant Constituents

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KEYWORDS

Growing media, plant growth, growth performance, cocopeat, soil, dirt-free media, infertile topsoil.

ABSTRACT:

Overuse of chemical fertilizers shows interference with biological components of the soil, hence resulting in soil acidification, stunning growth of the plant, altered pH of the soil, growth of pests, and, dense release of greenhouses in the environment. This further increases the concentration of harmful ions in soil and inhibits crop growth leading to a decline in soil fertility. The objectives of the study were to examine the effect of different growing media on a selected plant model (finger millet). Growing media were the combination of 100% topsoil, 100% cocopeat, and 50:50% topsoil + cocopeat. After 3 months of assessment, excellent growth performance was shown by the 50:50% topsoil + cocopeat growth media, the minimum recorded in 100% soil growth media.

1. Introduction

The Domestication of crops has embarked on an evolutionary transition right from the Darwinian period (1). Soil fertility is an essential parameter in plant growth. Soil provides nutrients and physical conditions for plant growth & fructification (2). Hence, soil fertility inspection is of much importance. High agricultural production requires detailed knowledge of soil, its quality, and its fertility(3). Over-exploitation of the soil leads to the depletion of topsoil, decrease in groundwater level, groundwater contamination, pollution of gases, and the outbreak of several diseases. Decline in soil fertility, results in an overall loss of land productivity, leading to soil degradation (4).Several factors lead to soil degradation: industrial, commercial & agricultural pollution; overgrazing, unsustainable agricultural practices & urban expansion; and long-term climate changes that have caused a consequential impact on human health (5). Amidst this, several technological developments emerged with a positive impact, but they also have considerable costs. These include the decline of family farms, negligence about the living and working conditions of agricultural workers, new threats to human health and safety, and the breakdown of rural communities. According to a report by the United Nations (UN), nearly 1/3rd of the world's agricultural region has vanished in just the last four decades and if the current rate of losses continues, it is predicted that all of the world's topsoil could become infertile within 60 years. Drastic changes in the environment, mainly the changes that are seen in the climate, even though climate change is a persistent process over the years on the earth the rate of this imbalance has increased in greater manifolds which has brought about severe effects on the quality of the soil due to uneven precipitation distribution over the years, and extreme conditions like drought, etc. Scarcity of water and extreme weather conditions reduce the fertility of soil leading to a loss in the yield of crop production which has now become visible(6) (7). statistical analysis put forth by the Food and Agriculture Organization (FAO) in the year 2016 showed that if there is a continuous change in the climate as per the current conditions there will be a total decline in the production of various major crops by the year 2100 (8). Urbanization also largely results in the loss of productivity due to the paving of soil, the ongoing urbanization will lead to the causes a huge total loss of 65% by 2040 (9)(10). Overuse of chemical fertilizers shows interference with biological components of the soil, hence resulting in soil acidification, stunning growth of the plant, altered pH of the soil, growth of pests, and, dense release of

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greenhouses in the environment. This further increases the concentration of harmful ions in soil and inhibits crop growth leading to a decline in soil fertility (11). Fig 1 shows the current situation of the total fertility of the soil throughout the world.

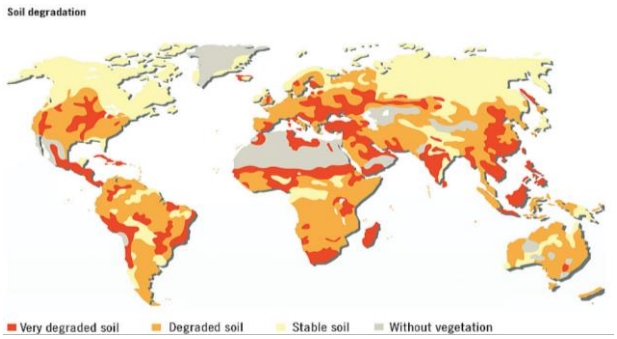

Fig 1: global soil degradation; source: globalagriculture.org

Soil is a non-renewable resource, hence increased exploitation of the soil thereby, encouraging the usage of soilless materials in the production of horticultural crops. Several growing media have been found that include sand, perlite, rock wool, sawdust, cocopeat, compost, etc., which are suitable for the cultivation of high-value crops due to their properties like strong water holding capacity, good aeration, and accumulation of balanced nutrients. One of the widely available dirt-free materials in the tropics is coconut dust commercially known as cocopeat/coir dust (12). A member of the Aracaceae family, *Cocos nucifera* L., is a palm tree that is commercially exploited to provide a variety of products. The brown coir pith comes from mature coconuts. Due to its peak C:N ratio and higher lignin residues, the delayed degradation prevents it from being used as a direct organic matter. The by-product of the coconut husk fiber-cocopeat can therefore be used as an alternative to the soil in organic farming. The natural fibre cocopeat has a distinct pH, aeration, and good water-absorbing capacity with sufficient nutrients. Cocopeat is extensively being used as an alternative to the soil in horticulture (13). Amongst all of the different types of growing media cocopeat shows better results when used solely or in combination with different growth media for high-value crops (14)(15). As in tropical regions, coconuts (Cocos nucifera L.) are present in an abundant amount in the pacific islands. Cocopeat has been produced and selected as a growing media.

Coconut coir along with peat has been used as media for the production of lettuce, Ipomoea aquatica, tomato, and various ornamental plants (16). Cocopeat has been used in combination with vermicompost and showed good results for selecting growing media, growers depend on locally available, less expensive, and reliable substrates (17). Coco pith offers many advantages as growing media and also resembles Sphagnum peat moss and is commercially known as cocopeat. As the demand for commercial horticulture increases there is a reduction in the availability of Sphagnum peat due to the exploitation of peat areas. Cocopeat has been replacing Sphagnum peat in horticulture as it is recognized as an ideal soil improver and a component of soilless container media. Coco Pith-based media gives a proper microenvironment for the root region and has shown enhancement in height, number of leaves, and fresh biomass during plant growth. A clear determining factor for a plant's health condition is an increased level of physiochemical components such as an increase in total phenolic content, higher amounts of nitrate, chlorophyll, carotenoids, and Vitamin C. Due to the loss of the nutrients present in the soil, the optimum growth(15)of the healthy plant is at risk. Plants grown in Cocopeat-based growing media have shown better biochemical compositions and nutrients in leaves. Hence, cocopeat is an ideal alternative in tropical areas since coconuts are abundant in the tropics that otherwise would be wasted and it is best suited for soil conditioning (14)(18). The use of cocopeat for plant production helps in soil remediation, and mulch and leads to a renewable and sustainable system.

In this present study, a comparative analysis between the cocopeat and soil is performed to understand its effect on the complete growth of a selected plant model (finger millet) by examining the different plant constituents (physiochemical parameters). A comparative analysis of the constituents of the cocopeat and soil was also examined.

Elusine coracana, a finger millet inheriting from the family of Poaceae, commonly termed as ragi is rich in Iron, phosphorous, calcium, fiber, and vitamin content is chosen as a plant model due to its ability to grow faster, the seeds germinate within 24 hours and complete growth of the plant can be seen within 2 weeks. To determine the different plant constituents, cocopeat, cocopeat + soil, and soil was used as a growing medium.

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The selected physicochemical parameters to be examined are - **relative water content, total protein content, total sugar content, total chlorophyll content, and ascorbic acid**.

pH – The" potential of hydrogen" is used to determine whether the substance is acidic or basic. The pH of the growing media for different plant species plays a critical role that greatly influences the biogeochemical actions that in turn help in a suitable environment for the growth of the plant. The activity of microorganisms including the solubility of nutrients and their availability produce some of the chief processes which are pH dependent. As an illustration, soils containing acid have a dense number of macronutrients that are accessible to plants rather than soil that is neutral-alkaline, which later favours growth in plants (19).

Chlorophyll is the pigment that imparts the green colour to plants and is involved in photosynthesis by absorption of light at different wavelengths, thus the amount of chlorophyll also reflects the photosynthetic capability and plant's health condition.

The chlorophyll cycle involves a metabolic pathway seen in algae and plants involved in the conversion of intermediates chlorophyll a to chlorophyll b catalyzed by Rieske-type oxygenase. The chlorophyll enzymes for the metabolic process are regulated by a Light-harvesting Complex (LHS) and this is uncoupled to the core of photosynthesis. The degeneration of chlorophyll takes place during the time of ageing of leaves and the development of fruit (20)(21). The diverse effect of precipitates influences the chloroplast's phytochemical activity. The synthesis of chlorophyll might fall into the effect of temperature (22).

The total chlorophyll content was estimated spectrophotometrically.

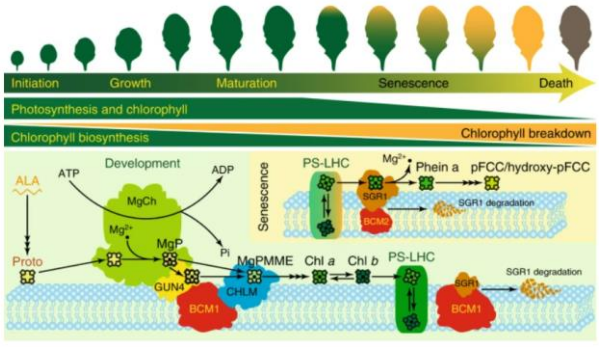

Fig 2: Effect of chlorophyll in the survival of the plant; source: nature.com

Protein is one of the primary metabolites which helps in providing growth and acts as an energy component along with carbohydrates and lipids (23). The protein content was estimated by a UV spectrophotometric method by Lowry's method. BSA (Bovine serum albumin) was used as a standard reagent and hence the unknown protein was determined.

Saccharides play a vital role in the growth and development of the plant by acting in various ways to give structure and also act as a storage component and also form intermediates of many metabolic pathways. It helps in the defence pathways of the plants (24)(25).

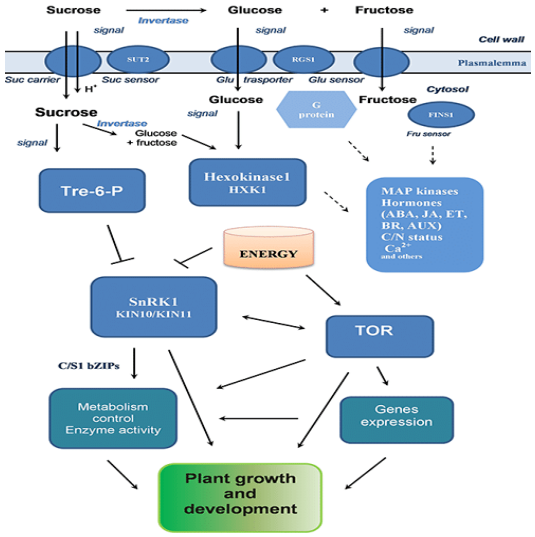

Fig 3: Metabolism of sugar plays a vital role in plant growth and development; source: researchgate.net

Vitamin C also known as ascorbic acid plays an essential role in the growth of the plant. It can function as a redox buffer, a co-factor for different enzymes that are involved in photosynthesis regulations, biosynthesis of hormones, and generation of antioxidants acid (26). This is determined by the process of titration using Indophenol dye.

2. Methods

➢ Preparation of cocopeat:

The cocopeat was prepared by the following process:

The coir like fibres of the coconut husk were first collected in bulk and dried. Later the Outer layer of the husk was peeled. After skinning the husk of the coconut, they were further sieved using an iron mesh. The husk

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sieved was obtained in the form of fine texture, which in addition was soaked with water and sundried subsequently.

The resulting mixture termed cocopeat was thus used as a growing medium for plantation.

Fig 4: Shredded coconut husk

Fig 5: Cocopeat

➢ **Preparation of planting:**

The planting mechanism was done sequentially:

The plant chosen to be planted was Ragi, a finger millet which is rich in high fiber content and amino acids. These seeds of Ragi were first soaked for an hour or so. Further, the seeds sunken inside were used to plant, while the ones floating on top were discarded.

These seeds were thus planted into three growing mediums – 100% soil, 100% cocopeat, and 50:50% soil + cocopeat.

Fig 6: soaked ragi seeds planted in 3 different growth media.

Fig 7: Initial growth of the ragi plant potted in 3 different growth media; 100% soil, 100% cocopeat, and 50:50% soil + cocopeat respectively.

Fig 8: Mature grown ragi plants in 3 different growth media; 100 % soil, 100% cocopeat, 50:50 % soil + cocopeat respectively**.**

Determination Of Biochemical Properties Of The Selected Plant Model Finger Millet Grown In 3 Types Of Growing Media:100% Cocopeat, 50:50% Soil + Cocopeat, And 100% Soil

The selected biochemical parameters are **Relative water content, Total protein content, Total reducing sugar, Total chlorophyll, and Ascorbic acid.**

Using these properties, the suitability of all 3 growing media was tested.

1. Relative water content:

- **Principle:** Leaf Relative water content is a measure of plant water status and directly reflects crop growth and development by affecting photosynthesis.
- **Procedure:** For the estimation of water content, 3g of fresh leaves were taken and weighed to obtain fresh weight (FW) then leaves were immersed in water for 24 hours which was later used to get turgid weight (TW). Leaves were oven-dried for 48 hours and were weighed again to measure dry weight (DW).

Relative water content was calculated by the formula.

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$$RWC = \frac{(FW - DW)}{(TW - DW)} x100$$

2. Estimation of Total Chlorophyll:

- **Principle:** Chlorophylls extractions are performed using different organic solvents such as ethanol, acetone, and methanol. Chlorophyll in its chemical nature is fat-soluble. Organic solvents take up the water that is interacting with the chlorophyll, the lipid bonds between the chlorophyll and the thylakoid are broken by the use of 80% acetone that suspends the pigment in the solution.
- **Reagents:** 80% Acetone
- **Procedure:** 3g of fresh leaves were taken out from the respective media pots and homogenized with 10mL of 80% acetone, the same was incubated for 15 minutes. The sample was later centrifuged at 2500rpm for 3 minutes. Spectrophotometrically the optical density was noted (645nm, 663nm) for both chlorophyll **a** and chlorophyll **b** respectively. Optical Density (CT) of the total chlorophyll is the sum of chlorophyll **a** (D_{645}) and chlorophyll **b** (D_{663})

$$CT = 20.2(D645) + 8.02(D663)$$

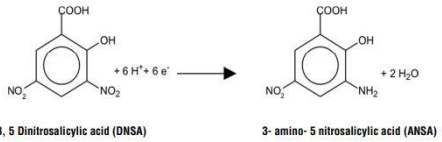
Total leaf chlorophyll was calculated: Total chlorophyll (mg/g DW) = $0.1 x CT x \frac{(LeafDW)}{(LeafFW)}$

3. Estimation of total Phenolic content:

- **Principle:** phenol present in the sample reacts and reduces FC reagent to molybdenum – tungsten blue. The colour blue colour developed is measured at 760nm using a spectrophotometer.
- **Reagent:** Folin – Ciocalteu reagent (FCR), sodium bicarbonate, gallic acid
- **Procedure:** For sample preparation, 1g of plant leaves were taken and homogenized with distilled water and subjected to centrifugation for 5 minutes at 3000rpm supernatant was used for future analysis. 1mL of FC reagent and 5mL of distilled water were mixed with 1mL of supernatant from the extract in a volumetric flask. 1mL of sodium carbonate was added after 5 minutes and shaken vigorously, and the final mixture was kept for incubation in dark conditions for 60 minutes at room temperature. The coloured developed was measured at 760 nm using a UV spectrophotometer against a blank of (1mL Na_2CO_3 + 6mL distilled water) and total phenolic content was calculated from the calibration curve of standard gallic acid (10-250 mg/L) and expressed as mg gallic acid equivalent (TAE) per gram dry extract weight.

4. Estimation of Sugar content by DNSA Method:

- **Principle:** 3, 5-Dinitrosalicylic acid (DNS) reacts with the free carbonyl group (C=O) present on the reducing sugars. oxidation of the aldehyde functional group and the ketone functional, dinitro salicylic acid gets reduced to 3- amino5-nitrosalicylic acid (ANSA) and converted to a reddish-brown coloured solution.



3, 5 Dinitrosalicylic acid (DNSA) 3- amino- 5 nitrosalicylic acid (ANSA)

-
- **Reagents:**

i. DNS reagent

ii. **Stock standard sugar solution**:100 mg of glucose in water and make up the volume to 100 mL.

iii. **Working standard solution**: Take 50 mL from this stock solution and make up the volume to 100 mL.

- **Preparation of plant extract:** 0.5g media sample was taken, grounded, and centrifuged at 3000rpm for 5 minutes. The supernatant was transferred into a fresh tube and the pellet was dissolved with 80% ethanol was centrifugated again, and the supernatant was subjected to evaporation. The evaporated sample was diluted with distilled water and 1mL of the sample was used for further estimation of sugar by DNS method.
- **Procedure:** 0.2 to 1 ml of working standard was taken in different tubes marked as S1 to S5 and volume was made up to 2 ml with distilled water. A suitable blank is also made using distilled water.1 ml of DNS reagent was added to all the tubes followed by heating all the tubes in a boiling water bath for 10 minutes. The same procedure was applied to the 3 test samples and the amount of reducing sugar present in the test samples was estimated colorimetrically (absorbance at 540 nm) by plotting a standard graph for glucose using the DNS method.

5. Estimation of protein by Lowry's method:

- **Principle:** The principle behind this method is, peptide nitrogen reacts with copper ions under alkaline conditions and subsequent reduction of Folin-Ciocalteu phosphomolybdic acid to molybdenum blue by oxidation of aromatic acids.

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- **Reagents:**

i. Solution A: 2% Sodium Carbonate dissolved in 0. 1N Sodium Hydroxide.

ii. Solution B :0.5% Copper Sulphate dissolved in 1% potassium sodium tartrate.

iii. Alkaline Copper solution C: 50 ml of A and 1 ml is mixed

iv. Folin-Ciocalteu Reagent

v. Stock Standard: 100 mg of bovine serum albumin is dissolved in distilled water and makes up the volume to 100 ml.

vi. Working Standard: 20 ml of the stock solution is used (200ug/ml)

- **Procedure:**

1. In clean and dry test tubes pipette out 0.2, 0.4 to 1 ml of the working standard.
2. Volume in all the test tubes was made up to 1 ml by adding of distilled water. A tube with 1 ml of water serves as the blank.
3. To all tubes which include the blank 5 ml of reagent "C" is added and incubated in the dark for 10 minutes.
4. 0.5 ml of FC reagent is pipetted out in all the tubes and kept for the second round of incubation, in the dark for 30 min.
5. Colorimetrically the color thus developed is read at 660 nanometers.

the amount of protein in the sample is estimated by plotting a standard curve graph.

- **For unknown sample: -**
- **Preparation of plant extract: -** 0.5 g of leaves were taken and grounded well with 5-10 ml of phosphate buffered saline sample was centrifuged at 3000 rpm for 5 minutes and supernatant was used for further estimation.1mL of supernatant was taken, 5mL of alkaline copper sulfate added to it, and allowed to stand for 1 hour. Finally, 0.5 ml FC reagent was added to the sample and was incubated for 20 minutes at room temperature. The blue colour developed was measured. The standard curve of Bovine Serum Albumin was plotted and used for calculating the amount of protein in the sample.

6. Estimation of Ascorbic acid content using 2,6 –dichlorophenolindophenol.

- **Principle:** Ascorbic acid is a reducing agent, when 2,6 dichlorophenol indophenol is treated with ascorbic acid, blue colour dye is reduced to pale pink colour. Ascorbic acid itself oxidized to dehydroascorbic acid. The titrations were carried out in the presence of 4% oxalic acid to inhibit aerobic oxidation.
- **Reagents Required:**

- **Standard dye- 2,6 dichlorophenolindophenol**
- Stock ascorbic acid solution –100 mg /100 ml
- Working standard solution: -10 ml of stock is diluted to 100 ml using 4% oxalic acid
- 4% oxalic acid

- **Procedure:**

i. Titration I – standardization of dye using standard Ascorbic acid

Pipette out 5 ml of working standard solution into a clean conical flask, to this add 20 ml of 4% oxalic acid and titrate against dye taken in the burette. The appearance of a pale pink colour is the end point; titrations were repeated for concordant values and calculated the dye equivalents of standard ascorbic acid.

ii. Preparation of sample: - 1g of fresh foliage was taken in the test tube and 4 ml of extracting solution was added (oxalic acid, EDTA), and centrifuged at 3000 rpm for 5 minutes.1 ml of supernatant was taken in another test tube, to this 1 ml of orthophosphoric + 1 ml of 5% tetraoxosulphate + 2 ml of ammonium molybdate and 3 ml of distilled water were added and incubated for 15 minutes.

iii. Titration II- Estimation of ascorbic acid using standardized dye

The given unknown solution is made up to the mark using 4% oxalic acid, pipette out 5 ml of unknown solution into a clean conical flask, which is titrated against standardized dye taken in the burette. The appearance of a pale pink colour is the end point; titrations were repeated for concordant values and calculated the amount of vitamin C present in the given sample.

7. pH: For the 3 media samples pH was measured by homogenizing 5g of fresh leaves from respective media in 50mL deionized water and was filtered with a

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Whatman filter paper. pH was observed by dipping the pH strips.

STATISTICAL ANALYSIS: Test for the plant physiochemical components was carried out in triplicate. All results are expressed as mean ± S.E.M. Statistical analysis was performed using Student's t-test. P-values less than 0.05 were considered statistically significant.

Comparison of physiochemical properties for cocopeat and soil:

1. **Bulk Density**
2. **PH**
3. **Calcium**
4. **phosphorous**
5. **Water retention**

1. Bulk Density: - The bulk density was determined using a measuring cylinder. An empty 250 ml measuring cylinder was filled with oven dried sample and then the sample weight was taken. By using the following formula bulk density of the growth media was calculated

Bulk density (g/cc) = (weight of the sample)/ (volume of the sample)

2. pH: -The pH values for cocopeat media and soil were determined by mixing 2 g of media with 20 ml of distilled water, agitated for 30 minutes and kept standing for a few hours. The mixtures were filtered and pH was measured using a pH meter.

3. Evaluation of calcium content using titrimetric method

- **Principle-** When calcium is treated with ammonium oxalate a white precipitate of calcium oxalate bound to the chloride ions is formed. Washing the precipitate with ammonia helps to get rid of the chloride ions this 1N sulphuric acid is added leading to the liberation of oxalic acid. The liberated oxalic acid is evaluated by titrating it against standardised potassium permanganate. The amount of calcium is directly proportional to the amount of oxalic acid.

- **Reagents Required**

- Ammonium oxalate solution (4 %), Ammonia solution (2%), Potassium permanganate (0.1N), Standard oxalic acid solution (0.1N), Sulphuric acid (1N)

- **Procedure**

- **Standardisation of Potassium permanganate**

To a clean conical flask 10ml of oxalic acid + 10ml of dilute sulphuric acid is pipetted, and heated to 60 ° C. This solution is titrated against potassium permanganate solution that is filled in the burette. The end point is pale permanent pink colour. The step is repeated for consonant values.

- **Precipitation of calcium oxalate**

1. 2ml of growth media sample + 2ml of distilled water + 1ml of 4 % ammonium oxalate is taken in a centrifuge tube, and allowed to stand overnight at 4 ° C for precipitation of calcium to form. After incubation, the tube is centrifuged and the supernatant is discarded. To resuspend the pellet 3ml of 2% ammonia is added and centrifuged. These steps are repeated thrice, the supernatant is tested for chloride ions.
2. 10 ml of 1N sulphuric acid is added and heated up for solubilization which is then titrated against potassium permanganate solution, the following results are noted. The endpoint is the appearance of a pale permanent pink colour. The step is repeated for consonant values the amount of calcium content is then evaluated.

4. Evaluation of Inorganic Phosphorous content by using the Fiske-Subarrow method:

- **Principle:** The solution in which inorganic phosphorous is to be estimated is treated with acid molybdate reagent to form phosphorous molybdic acid. The Molybdenum element of the phosphorous molybdic acid is reduced by ANSA reagent (Amino Naptho Sulphuric acid) and is given a blue-coloured compound which is estimated colorimetrically at 640nm.

- **Reagents Required:**

1. Standard Phosphorous Solution:

Dissolve 35.1mg of potassium (KH2PO4) dihydrogen phosphate in 100ml of distilled water and make up to 250ml (80ug/ml)

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Working standard: 8ug/ml

2. Molybdate reagent:

2.5% of ammonium molybdate in 5N H2SO4 (100mL)

3. ANSA Reagent:

10% TCA (in solvent)

- **Procedure:** Pipette out 0.2 ml to 1 ml of standard phosphorous solution in a series of test tubes and mark it as standard (S1 – S5). Pipette out 1ml of unknown samples and mark them as T1 (cocopeat), and T2 (soil). Make up the test tube to 1 ml using distilled water. Take 1 ml of distilled water as a blank, and now add to each test tube the following solution in a sequential manner.

1. 0.4 ml of 10% TCA.
2. 0.4 ml of molybdate reagent.
3. 0.2 ml of ANSA reagent.
4. 4 ml of distilled water.

Mix well all Test tubes. Keep at room temperature for 5 minutes. Measure the blue colour complex using a Colorimeter of 640nm. Draw the standard graph with a concentration of phosphorous on the X-axis and optical density (OD) on the Y-axis.

5. **Water Retention:** For measuring water retention. 0.5 g of media sample was weighed and then immersed in water for 24 hours. The next day sample was blotted dried and reweighed sample was kept in a hot oven dried for 2 days at 70 degrees Celsius and again weighed to obtain dry weight. The formula used was.

$$RWC = \frac{FW - DW}{TW - DW}$$

3. Results

Results shown in Table 1 indicate the physiochemical comparison of the selected parameters (**Relative water content, Total protein content, Total reducing sugar, Total chlorophyll, and Ascorbic acid)** for the ragi plant grown in different growth media **100% soil**, **100% cocopeat, and 50:50% soil + cocopeat.**

Results shown in Table 2 indicate the comparison done between the components of the soil and the cocopeat, where the cocopeat itself showed better results as compared to the soil.

From the results of the study, it was indicated that the growth of the selected plant model was completely dependent on the nutrients that were present with the different growing media.

All the growth media more or less did show good physical characteristics that are essential for growth. The maximum concentration for the selected parameters was recorded for the plant grown in the 50:50 % Soil + cocopeat growing media, whereas the minimum concentration was recorded for the plant grown in 100% soil growth media.

Cocopeat is produced from coconut husks which have two components: fibers called coir and coir pith which is the spongy parenchymatous part. Cocopeat has an excellent air-to-water ratio which makes it a wonderful growing media because these properties make a healthy root environment. Moisture is stored in micro sponges of the coir pith and fibers provide aeration due to the presence of porosity in the coir as coconut is made of sclerified tissues, and coconut fibers do not keep much water content. Several properties of cocopeat makes it an ideal growing media such as high water holding capacity, and high moisture content it also provides a preferable pH between 5.8 - 6.8 making it slightly alkaline, when used along with soil as a growing media it neutralizes the soil pH also helps in slow release of the nutrients in turn providing a proper balance for the growth of plants, electrical conductivity, bulk density, air-filled porosity, and high cation exchange capacity allowing it to retain a high amount of exchangeable sodium (Na), potassium (K), magnesium (Mg), and calcium (Ca) (table 2). The above characteristics make coco peat an ideal use for increasing the fertility of the soil.

Table-1: Growing media effect on Biochemical properties of the ragi plant

EXPERIMENTS	**SAMPLE**	**MEANCONC ± STANDARD ERROR (S.E.M)**
CHLOROPHYLL	SOIL	0.361 ± 0.083

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	COCO	0.093 ± 0.020
	SOIL + COCO	5.1483 ± 1.925
ASCORBIC ACID	SOIL	0.966 ± 0.033
	COCO	1.433 ± 0.066
	SOIL + COCO	1.8 ± 0.152
SUGAR	SOIL	20.933 ± 7.055
	COCO	40.933 ± 1.333
	SOIL + COCO	138.266 ± 17.486
TOTAL PHENOL	SOIL	122.950 ± 12.315
	COCO	126.130 ± 4.095
	SOIL + COCO	135.210 ± 44.988
TOTAL PROTEIN	SOIL	1160.888 ± 44.44
	COCO	445.33 ± 380
	SOIL + COCO	1220.1 ± 143.053
RWC	SOIL	33.58
	COCO	44.66
	SOIL + COCOPEAT	49.45

Table 2 : Comparison of physiochemical properties for cocopeat and soil:

TESTS	**SAMPLES**	**RESULTS**
PH	SOIL	11
	COCOPEAT	6.2
BULK DENSITY	SOIL	2.65 g/cm3
	COCOPEAT	0.076 g/cm3
WATER RETENTION	SOIL	20%
	COCOPEAT	70.00%
CALCIUM CONTENT	SOIL	8.5 mg/100ml
	COCOPEAT	15 mg/100ml
PHOSPHORUS CONTENT	SOIL	2.4 mg/100ml
	COCOPEAT	8 mg/100 ml

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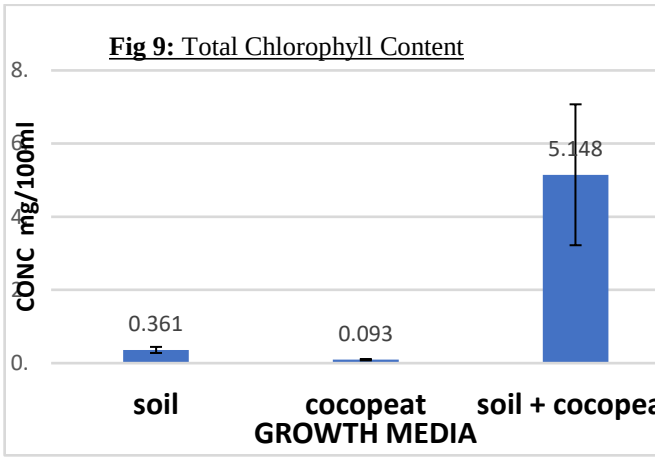

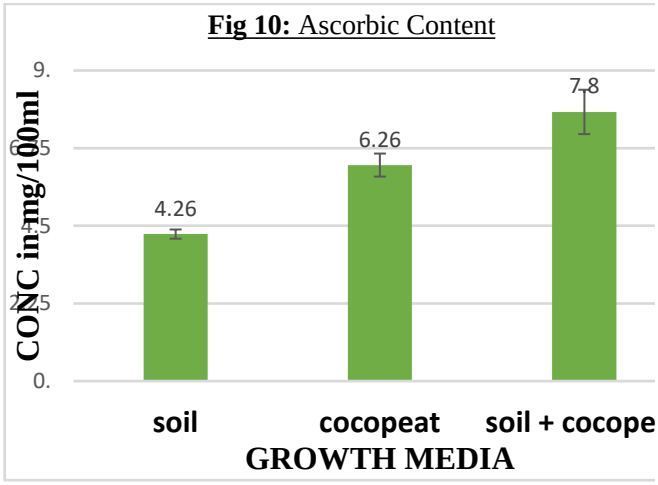

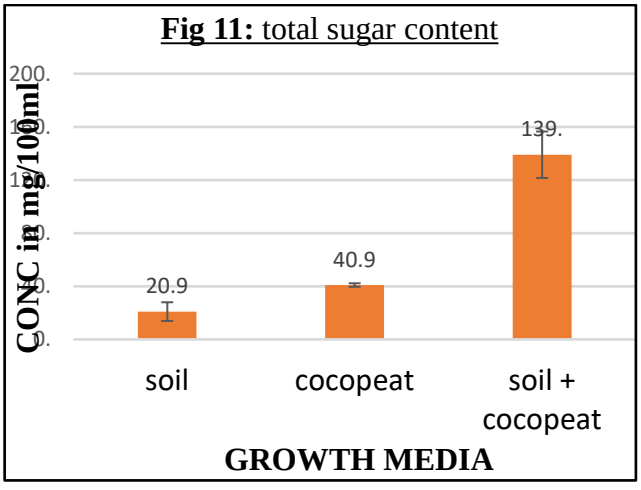

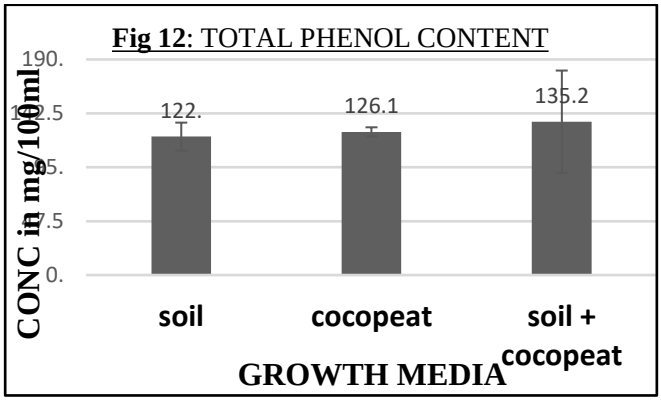

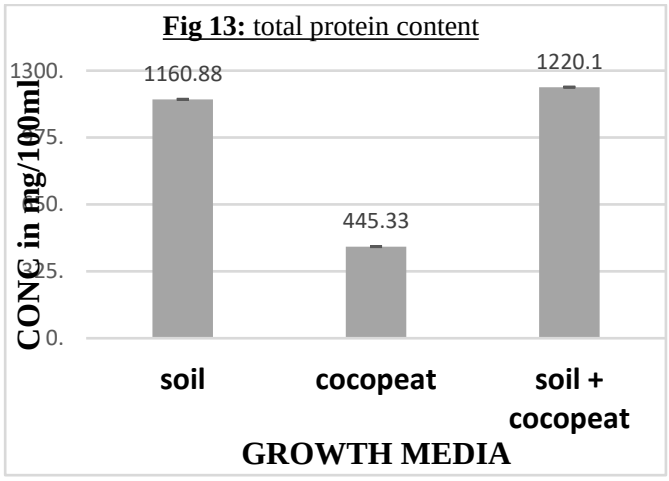

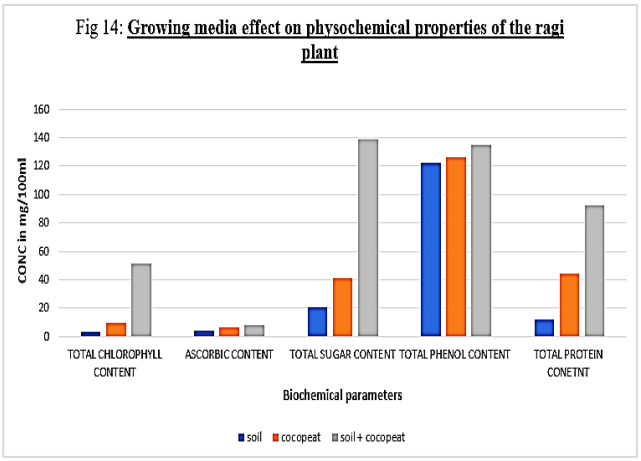

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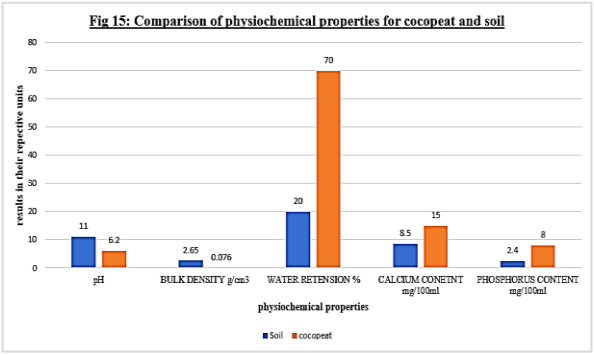

4. Discussion

Cocopeat contains certain excellent physiochemical properties that make it an ideal material that can be used to help increase the fertility of the Soil. Cocopeat solely also works as an effective growth media for the growth of a healthy plant, hence it can be used for various small plotting plants.

Cocopeat along with different growth media for example vermicompost can also be used to enhance the fertility of the soil. Coir also possesses anti-fungal as well as root-stimulating properties that are resistant to some of the soil pathogens such as phytophthora.

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