

## LIQUID BIO-FERTILIZER FORMULATED FROM COCONUT AND ITS EFFECT ON GROWTH AND ROOT CHARACTERISTICS OF ROBUSTA COFFEE SEEDLINGS UNDER DROUGHT CONDITIONS

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Received-05.01.2019, Revised-26.01.2019

**Abstract:** A nursery trial was carried out at Regional Coffee Research Station, Chundale, Wayanad district, Kerala during 2018 to study the effects of concentration levels of liquid organic nutrient mixture (20 ml, 30 ml and 40 ml dissolved in 4.5 lit of water square meter of nursery area of area) prepared from coconut, cow byproducts and naturally available organic materials against standard nursery nutrient management practices like application of inorganic fertilizer (20g of urea dissolved in 4.5 lit of water for square meter of nursery area) and supernatant solution of fermented cow dung slurry on growth and root characteristics of robusta coffee seedling. There were significant differences ( $p>0.05$ ) in growth parameters (plant height and numbers of leaves) and root parameters (root length and average root diameter) due to the different nutrient management options. Significant differences were observed in organic treatment resulted in tallest plant height (48.25 cm) and maximum numbers of leaves (16.50) where seedlings received Coconut mixture nutrient spray @ 40 ml and which is on par with the treatment received Coconut mixture nutrient spray @ 30 ml and shortest plant height (31.85 cm) and lesser numbers of leaves (9.15) were noticed in the control without nutrient spray. Similar trend were observed in root parameters and resulted in lengthiest root (39.50 cm) and maximum root diameter (2.45 mm) in the treatment received Coconut mixture nutrient spray @ 40 ml. This preliminary result indicate that liquid organic nutrient mixture prepared from coconut, cow byproducts and naturally available organic materials is an effective bio-fertilizer and are most effective at high levels compared to conventional methods followed by the planters under the moisture stress condition.

**Keywords:** *Coffea robusta*, Coconut milk extract, Groundnut cake, Organic nutrient mixture

### INTRODUCTION

Climate change has become an important area of concern to ensure food and nutritional security for growing population. In the context of climate change and variability, farmers need to adapt quickly to enhance their resilience to increasing threats of climatic variability such as droughts, floods and other extreme climatic events (Mohan Kumar *et al.*, 2018). Concentrated efforts are required for mitigation and adaptation to reduce the vulnerability of agriculture to the adverse impacts of climate change and making it more resilient (Chemura *et al.*, 2010 & 2013).

The success of new planting in perennial crops like coffee depends primarily on planting of vigorous, disease-free healthy seedlings in the field. Rising of healthy coffee seedlings is an important management practice in coffee plantations due to unreliable rainfalls and frequent droughts that affect growth of seedlings and influence the production of coffee seedlings for new/replanting (Haggar *et al.*, 2011).

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Therefore, utmost attention is required to raise desirable planting material in the nursery (Coffee Guide, 2014).

According to research studies, the coconut milk nutrient mixture made a positive influence on the plant growth and promotes more rapid root formation and ultimately the entire plant especially under stress conditions (Giselle, 2003 and Sandoval *et al.*, 2014). Studies on application of coconut nutrient mixture spray on coffee seedling at nursery level had not been attempted in coffee grown region. Hence, keeping in view the above facts, investigation was carried out to study the influence of liquid bio-nutrient mixture on growth and root characteristics of robusta coffee seedlings under drought conditions and to establish the healthy robusta coffee seedlings, which have direct implications to coffee production.

### MATERIALS AND METHODS

A nursery experiment was conducted at Regional Coffee Research Station, Chundale, Wayanad

district, Kerala during 2018 to study the influence of organic nutrient mixer prepared from coconut, banana, groundnut cake and cow milk curd on Robusta coffee seedlings. Wayanad is a conventional coffee growing district of Kerala state and situated at an elevation ranging from 700 mm to 2100 mm above MSL. During the hot weather, the temperature goes to maximum 35°C and during the cold weather goes down to 7°C. The average rain fall is 2800 mm per year.

The experiment was laid out with 6 treatment combinations and 3 replications in randomized block design at nursery. The treatment includes planters practices (Urea 20 g and Fermented cow dung slurry @ 30 ml spray) and three levels of coconut mixture nutrient spray (20, 30, 40 ml/4.5 lit water for every square meter of area). Three months aged C x R variety of coffee seedlings was used for this trial. The treatment details are given below,

T1: No nutrient mixture spray - Control

T2: Urea spray @ 20 g (standard practice)

T3: Coconut mixture nutrient spray @ 20 ml

T4: Coconut mixture nutrient spray @ 30 ml

T5: Coconut mixture nutrient spray @ 40 ml

T6: Fermented cow dung slurry @ 30 ml (conventional practice)

#### Preparation of liquid bio-nutrient mixture

Mix 5 litres of coconut milk and 5 litres of tender coconut water with 1 litre of cow milk curd and add poovan variety of banana (6 nos.), groundnut cake (1kg) and jaggery (1 kg) in to the above mentioned

solution. Mix thoroughly and ferment this mixture in a earthen pot for a week to 10 days. Stir this mixture daily both morning and evening stir the mixture in clock and anti clock wise direction. Ensure it is closed tightly with cloth, bury 3/4 of the pot in a pit which is already prepared. The pit has to be filled with organic manner like humus, compost and soil to maintain the optimum heat for fermentation. Filter and mix it with water as the treatments and spray on the coffee seedlings in 2 times at 7 days intervals.

## RESULTS AND DISCUSSION

### Effect of organic nutrient spray on growth characteristics of Robusta coffee seedlings

#### Plant height and numbers of leaves

During final observation time, among the treatments, the seedlings received Coconut mixture nutrient spray @ 40 ml showed significant difference with respect to plant height (48.25 cm) and numbers of leaves (16.50) and which is on par with the treatment received Coconut mixture nutrient spray @ 30 ml (47.40 cm and 15.50 respectively). This might be slow and continues supply of nutrients from organics applied to the plants (Da Matta, 2004; Worku and Astatkie, 2010 and Sandoval *et al.*, 2014). This is followed by treatment received Coconut mixture nutrient spray @ 20 ml (T3) and Fermented cow dung slurry @ 30 ml. Shortest plant height (31.85 cm) and lesser numbers of leaves (9.15) were noticed in the control without nutrient spray (Table1).

**Table 1.** Effect of organic nutrient spray on growth characteristics of Robusta coffee seedlings.

| Treatments   | Plant height (cm) | No. of leaves |
|--|-------------------|---------------|
| T1: No nutrient mixture spray - Control                    | 31.85             | 9.15          |
| T2: Urea spray @ 20 g (as recommended by the coffee board) | 38.50             | 11.64         |
| T3: Coconut mixture nutrient spray @ 20 ml                 | 43.25             | 13.61         |
| T4: Coconut mixture nutrient spray @ 30 ml                 | 47.40             | 15.50         |
| T5: Coconut mixture nutrient spray @ 40 ml                 | 48.25             | 16.50         |
| T6: Fermented cow dung slurry @ 30 ml                      | 43.00             | 13.54         |
| SEd  | 1.19              | 0.44          |
| CD (5%)  | 3.41              | 1.25          |

### Effect of organic nutrient spray on root characteristics of Robusta coffee seedlings

#### 1. Root length:

Among the treatments (Table 2), the seedlings received Coconut mixture nutrient spray @ 40 ml (T5) showed significant difference with respect to root length of seedlings (39.50 cm) and which is on

par with the treatment received Coconut mixture nutrient spray @ 30 ml (T4) (39.20 cm). This is followed by treatment received Coconut mixture nutrient spray @ 20 ml (T3) and Fermented cow dung slurry @ 30 ml (T6). The least length was recorded in the control (T1) (30.12 cm). This result coincides with the research findings of Giselle H. Bui, (2003) and Sandoval *et al.* (2014).

## 2. Average root diameter:

Among the treatments (Table 2), the seedlings received Coconut mixture nutrient spray @ 40 ml

(T5) showed significant difference with respect to root length of seedlings (2.45 mm) and which is on par with the treatment received Coconut mixture nutrient spray @ 30 ml (T4) (2.34 mm). This is followed by treatment received Coconut mixture nutrient spray @ 20 ml (T3) and Fermented cow dung slurry @ 30 ml (T6). The least length was recorded in the control (T1) (30.12 cm). This result coincides with the research findings of Tilak *et al.* (2005) and Chemura *et al.* (2013). The least root diameter was recorded in control (1.45 mm).

**Table 2.** Effect of organic spray on root characteristics of Robusta coffee seedlings.

| Treatments   | Root length (cm) | Average root diameter (mm) |
|--|------------------|----------------------------|
| T1: No nutrient mixture spray - Control                    | 30.12            | 1.45                       |
| T2: Urea spray @ 20 g (as recommended by the coffee board) | 34.39            | 1.78                       |
| T3: Coconut mixture nutrient spray @ 20 ml                 | 37.30            | 2.10                       |
| T4: Coconut mixture nutrient spray @ 30 ml                 | 39.20            | 2.34                       |
| T5: Coconut mixture nutrient spray @ 40 ml                 | 39.50            | 2.45                       |
| T6: Fermented cow dung slurry @ 30 ml                      | 36.19            | 1.98                       |
| SEd  | 0.43             | 0.06                       |
| CD (5%)  | 1.23             | 0.18                       |

## CONCLUSION

It is concluded with this Preliminary data that seedlings received Coconut mixture nutrient spray @ 40 ml showed significant difference with respect to growth and root characters and which is on par with the treatment received Coconut mixture nutrient spray @ 30 ml to other treatments compared to the conventional nutrient management practices in nursery. Adoption of such resilient practices and technologies by farmers appears to be more a necessity than an option. This information is important in building a productive, sustainable and robust coffee production system under challenges of environmental accounting and reduced rainfalls in rain-fed systems due to climate change.

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