

SUMMARY AND CONCLUSION

The present investigation entitled “**Effect of Biocomposted Sugarcane Trash and Bagasse on Selected Crop Plants and Soil Nutrient Status**” was undertaken to study the effect of composted sugarcane trash and sugarcane bagasse as a growth promoter for soil fertility and to find out means and solution for the profitable utilization and to reduce its environmental hazards. The ultimate goal of sustainable agriculture is to develop farming system that are productive and profitable, conserve the natural resources base, protect the environment and enhance health and safety measures.

The changes in sugarcane trash and sugarcane bagasse after composting, microbial population, physico-chemical, biometric, yield parameters, biochemical, initial and post-harvest soil analysis, initial and post-harvest soil microbial population, antioxidant and antibacterial activity under the influence of composted sugarcane trash and sugarcane bagasse on Onion (*Allium cepa* L.), Black nightshade (*Solanum nigrum* L.), Tomato (*Solanum lycopersicum* L.), Brinjal (*Solanum melongena* L.) were analysed. The conclusion drawn from all the above phases of the investigation are summarized in this chapter.

PHASE I

5.1 COMPOSTING

5.1.1 Physico-chemical composition of the raw and composted sugarcane trash and sugarcane bagasse

The physico-chemical parameters lignin (%), cellulose (%), pH, electrical conductivity (millimhos cm^{-1}), nitrogen (%), phosphorus (%), calcium (%), magnesium (%) and C:N ratio were analysed in six types of compost and control to assess the compost maturity. Among the six different compost treatments, (C₆) (Predecomposed sugarcane bagasse, *Trichoderma asperelloides* and (*Eudrilus eugeniae*) 5t/h) was found to be an efficient compost, because of the significant reduction in lignin, cellulose, organic carbon and C:N ratio and significant increase in nitrogen, potassium, calcium and

magnesium followed by other treatments and control. The C:N ratio is one of the most important parameters that determine the extent of composting and degree of compost maturity. As the decomposition progressed, due to the losses of carbon mainly as carbon dioxide, in the process of respiration, the carbon content of the compostable material decreased with time and production of mucus and nitrogenous excrement enhanced the level of nitrogen, which lowered the C:N ratio.

5.1.2 Microbial population

The total bacterial, fungal and actinobacteria count increased in all the treatments compared to the control treatment. The maximum increase was noted in C₅ (Predecomposed sugarcane bagasse + *Trichoderma asperelloides* + *Eudrilus eugeniae* 5t/h) which is followed by C₂ (Predecomposed sugarcane trash + *Trichoderma asperelloides* + *Eudrilus eugeniae* 5t/h) when compared to the control on 30 day with a remarkable increase on 60 day and declined slightly on 90 day.

5.1.3 Fourier transform-infrared (FT-IR) spectrum analysis

FT-IR spectra analysis of raw and composted sugarcane trash and sugarcane bagasse waste showed some similar functional groups with different wavelength of peaks. Various organic compounds are present in spectra, significant difference can be observed in C₃ (Predecomposed sugarcane trash, *Trichoderma asperelloides* and microbial consortium) and C₅ (Predecomposed sugarcane bagasse, *Trichoderma asperelloides* and *Eudrilus eugeniae* 5t/h) treatments.

PHASE II

5.2 FIELD CULTURE EXPERIMENTS

5.2.1 Biometric characters

Onion (*Allium cepa* L.)

A significant increase in shoot length, root length and number of leaves was recorded in T₃, T₁ and T₂ followed by the other treatments and control on 30, 60 and 90 DAS. Maximum leaf length was recorded in T₃, T₁ and T₂ on 30, 60 and 90 DAS. A remarkable rise in the fresh weight and dry weight were observed in T₃, T₁ and T₂ followed by the other treatments and control on 30, 60 and 90 DAS.

Black nightshade (*Solanum nigrum* L.)

Maximum shoot length, root length and number of leaves were observed in T₄ treatment followed by T₅ treatment when compared to the control on 30, 60 and 90 DAS. Maximum number of flowers and number of branches were noted in T₄, T₅ and T₆ on 30, 60 and 90 DAS.

Plant fresh weight was significantly increased in T₄ treatment on 30, 60 and 90 DAS as compared to the control. Maximum dry weight was recorded in T₄ treatment followed by other treatments and control on 30, 60 and 90 DAS.

Tomato (*Solanum lycopersicum* L.)

Shoot length was noticed in T₃ treatment followed by T₁ treatment on 30, 60 and 90 DAS. Minimum shoot length was observed in control when compared to the other treatment. A significant increase in root length was observed in T₃ treatment followed by T₁ treatment when compared to the control on 30, 60 and 90 DAS. Number of leaves were noted in T₃ treatment on 30, 60 and 90 DAS. Maximum number of flowers and number of branches was observed in T₃ treatment followed by T₁ treatment and other treatment when compared to the control on 30, 60 and 90 DAS. Plant fresh weight and dry weight were noted in T₃ treatment followed by T₁ treatment on 30, 60 and 90 DAS.

Brinjal (*Solanum melongena* L.)

A significant increase in shoot length, root length and number of leaves were recorded in T₅ treatment followed by T₃ treatment when compared to the other treatment and control on 30, 60 and 90 DAS. Maximum number of flowers and number of branches was noted in T₅ treatment on 60 and 90 DAS when compared to the control. Maximum fresh weight and dry weight was noticed in T₅ treatment followed by T₃ treatment compared to the other treatment and control on 30, 60 and 90 DAS.

5.2.2 Yield Characters

Maximum number of bulbs, diameter of bulb (cm), bulb length (cm), single bulb weight (g) and bulb yield per plot (kg) was more in T₃ treatment followed by T₁ treatment when compared to the control on 90 DAS in onion (*Allium cepa* L.). A significant increase in number of fruits, diameter of fruits (cm), single fruit weight (g), fruit yield per plant (kg)

and fruit yield per plot (kg) in T₄ treatment when compared to control on 90 DAS in black nightshade (*Solanum nigrum* L.). Highest number of fruits, diameter of fruits (cm), single fruit weight (g), fruit yield per plant (kg) and fruit yield per plot (kg) in T₃ treatment followed by T₁ treatment when compared to the other treatments and control on 90 DAS in tomato (*Solanum lycopersicum* L.). The number of fruits, fruit length (cm), single fruit weight (g), fruit yield per plant (kg) and fruit yield per plot (kg) was increased in T₅ treatment on 90 DAS in brinjal (*Solanum melongena* L.).

PHASE III

5.3 BIOCHEMICAL CHARACTERS

Maximum protein, carbohydrates and chlorophyll a, b and total chlorophyll content in leaves was noted in T₃ treatment followed by T₁ treatment when compared to the control and other treatment on 30, 60 and 90 DAS in onion (*Allium cepa* L.) and tomato (*Solanum lycopersicum* L.). The increase in protein, carbohydrates and chlorophyll a, b and total chlorophyll content in leaves was observed in T₄ treatment on 30, 60 and 90 DAS in black nightshade (*Solanum nigrum* L.). A significant increase in protein, carbohydrates and chlorophyll a, b and total chlorophyll content in leaves were recorded in T₅ treatment followed by T₂ treatment when compared to the control and other treatment on 30, 60 and 90 DAS in brinjal (*Solanum melongena* L.).

PHASE IV

5.4 SOIL STATUS

5.4.1 Initial nutrient status in soil

The results revealed that soil pH, electrical conductivity (millimhos cm⁻¹), available nitrogen (kg/ha), phosphorus (kg/ha) and potassium (kg/ha) were found to be more in T₅ treatment as compared to control.

5.4.2 Post harvest nutrient status in soil

Maximum pH, electrical conductivity (millimhos cm⁻¹), available nitrogen (kg/ha), phosphorus (kg/ha) and potassium (kg/ha) were observed in T₃ treatment followed by other treatment and control in onion (*Allium cepa* L.) and tomato (*Solanum lycopersicum* L.). A significant increase in pH, electrical conductivity (millimhos cm⁻¹), available nitrogen

(kg/ha), phosphorus (kg/ha) and potassium (kg/ha) were noted in T₄ treatment in black nightshade (*Solanum nigrum* L.). The maximum pH, electrical conductivity (millimhos cm⁻¹), available nitrogen (kg/ha), phosphorus (kg/ha) and potassium (kg/ha) were recorded in T₅ treatment followed by other treatment and control in brinjal (*Solanum melongena* L.).

5.4.3 Initial Soil microbial population

The soil bacterial, fungal and actinobacteria count increased in all the treatments compared to the control treatment. The maximum increase was noted in C₅ (predecomposed sugarcane bagasse, *Trichoderma asperelloides* and *Eudrilus eugeniae* 5t/h) treatment.

5.4.4 Post harvest soil microbial population

Maximum bacteria, fungi and actinobacteria were observed in T₃ treatment followed by other treatment and control in onion (*Allium cepa* L.) and tomato (*Solanum lycopersicum* L.). A significant increase in bacteria, fungi and actinobacteria were noted in T₄ treatment in *Solanum nigrum* L. and T₅ treatment in *Solanum melongena*.

5.4.5 Antioxidant and antibacterial activity

All the above analyzed data were found to be statistically significant in all the compost as compared to the control treatment. Among the six types of compost, T₃, T₄ and T₅ was found to be an efficient organic manure compared to other treatments. The treatment T₃, T₄ and T₅ significantly enhanced the microbial population, physico-chemical parameters, biometric, yield and biochemical content, initial and post-harvest soil and soil microbial population of the selected plants namely onion (*Allium cepa* L.), black nightshade (*Solanum nigrum* L.), tomato (*Solanum lycopersicum* L.), brinjal (*Solanum melongena* L.).

From above the result, antioxidant and antibacterial activity was conducted with bulb, leaves and fruits extracts of the selected plants grown under best treatment and control.

5.4.6 Antioxidant activity

The selected plant bulb, leaves and fruits samples were analyzed for (DPPH radical scavenging activity, hydrogen peroxide scavenging activity, nitric oxide radical scavenging and reducing power assay) in the different extracts. By comparing the four plants, antioxidants activity was shown in fruits extracts of *Solanum melongena* L. followed by *Solanum lycopersicum* L. in the best treatment T₅ – Compost 5 (Predecomposed Sugarcane bagasse,

Trichoderma asperelloides and earthworm (*Eudrilus eugeniae*) 5t/h) and T₃ – Compost 3 (Predecomposed Sugarcane trash, *Trichoderma asperelloides* and Microbial consortium 5t/h) as compared to control.

5.4.7 Antibacterial activity

Antibacterial activity of *Allium cepa* L., *Solanum nigrum* L., *Solanum lycopersicum* L. and *Solanum melongena* L. bulb, leaves and fruits of best treatment and control were examined against bacterial species. Both the extracts showed better antibacterial activity in all the plants analyzed. Among the extracts of *Solanum nigrum* L. showed highest zone of inhibition against *Staphylococcus aureus* followed by *Solanum lycopersicum* L. The zone of inhibition was moderately differ from each other as compared to the standard antibiotics.

CONCLUSION

The present research is to brighten the possibilities of using the agro-industrial waste like sugarcane trash and sugarcane waste in enhancing the crop productivity. Composted sugarcane trash and sugarcane bagasse produced by degradation of lignocellulolytic fungi (*Pleurotus florida* and *Trichoderma asperelloides*), *Eudrilus eugeniae* and Microbial consortium was found to be an efficient organic manure.

From our results, it can be concluded that combined application of compost increased the microbial population, physico-chemical parameters, biometric, yield parameters, biochemical, soil analysis, soil microbial population, antioxidant and antibacterial activity in the test crops namely onion, black nightshade, tomato and brinjal compared to the control. This might to be due to the synergistic interaction of the constituent present in the composted sugarcane trash and sugarcane bagasse. Compost of sugarcane trash and sugarcane bagasse provides as a good source of nutrient. Organic fertilizer leads to improve soil water holding capacity and cation exchange capacity. It will be saving water cost and chemical fertilizer along with minimizing environmental pollution.

A fairly good concentration of nitrogen, phosphorus, potassium and micronutrients makes sugarcane trash and sugarcane bagasse, a potential role player in enhancing the soil fertility and crop productivity. To conclude the integrated management of sugarcane trash

and sugarcane bagasse in various concentrations improved the vegetative and yield parameters of the test crops onion (*Allium cepa* L.), black nightshade (*Solanum nigrum* L.), tomato (*Solanum lycopersicum* L.), brinjal (*Solanum melongena* L.).

RECOMENDATIONS FOR FUTURE STUDY

- Composted sugarcane trash and sugarcane bagasse may be applied to maximize yield of different crops and soil fertility.
- The hygroscopic nature of sugarcane trash and sugarcane bagasse, its ability to exchange stored moisture with the atmosphere can be exploited for the cooling effect.
- Effect of sugarcane trash and sugarcane bagasse along with farmyard manure application to different soils and cropping system in the long run can be studied.
- Compost can be sold to local farmers and fielders which is an elegant solution to solve the problem of using chemical fertilizers and soil pollution.
- Create awareness to public of the importance of organically grown plant growth-based products
- Press mud, a by-product of sugar manufacture and a cheap alternative to chemicals may offers opportunities to farmers to efficiently use even poor-quality ground water and improve crop productivity and soil fertility.
- Application of farmyard manure along with the composted sugarcane trash and sugarcane bagasse can results in the improvement of soil quality and long-term sustainability of degraded soils.