# *Summary and Conclusion*

# CHAPTER – V

# SUMMARY AND CONCLUSION

For centuries, one of the most eternal problems mankind facing has been the dilemma of how to dispose waste. Urbanization, modernization and industrialization have increased solid waste generation. As global populations expected to climb into billions within the next century, our society must find new ways not only to reduce, reuse and recycle our waste, but also to clean up our environment. For the past 25 years, however, non-disposal methods such as waste prevention and recycling have become more common. Therefore, there is a growing and urgent need to develop and promote technologies that can distinctly address these problems by reducing the impact that pollution has on human health and ensuring a sufficient and sustainable supply and distribution of high quality and safe foods.

Solid waste is generally coming out of our own establishments. Each household on an average generates about 1 kg of waste per day that reaches to road side bins or heaps of garbage. An average of 800 tonnes of waste is generated daily in every city. Out of which, 200 tonnes are dry waste, while 70 per cent is organic in nature. Today, majority of the city's municipal / corporation is able to manage and dispose off all the solid waste generated on their own. The solid waste segregated, thus can be used to remediate the nature and environment. So each individual has a role in keeping the city clean by composting their own household waste and converting it into a nutrient enriched organic manure.

The solid waste (SW) collected from the campus of Avinashilingam University for Women, Coimbatore were segregated as biodegradable

and non-biodegradable fractions. The biodegradable fractions of SW were composted using activated EM and the effect of EM-SW compost was evaluated on the test crops, Lady's finger (*Abelmoschus esculentus* (L.) Moench.) and Cow pea (*Vigna ungiculata* (L.) Walp.).

The results of the present investigation are summarized below :

## 5.1 EM – SW COMPOST – BIOCHEMICAL ANALYSIS

Statistical scrutiny of the biochemical analysis of the EM-SW compost showed that there was a significant reduction in all the parameters.

### 5.1.1 Cellulose Content, Organic Carbon and Total Phenol

A remarkable decrease was recorded in the cellulose content from 43.01 to 29.14 per cent, organic carbon content from 29.43 to 19.35 per cent and total phenol of 0.62 mg $g^{-1}$ from 2.85 mg $g^{-1}$ over 60 days of decomposition with activated Effective Microorganisms.

### 5.1.4 C : N Ratio

C : N ratio of EM-SW compost was narrowed down drastically to 15 : 1 from 52 : 1.

### 5.1.5 Total Nitrogen

The total nitrogen content of EM-SW compost tended to increase from 0.57 per cent to 1.26 per cent.

### 5.1.6 Total Soluble Sugars, Reducing and Non-Reducing Sugars

The total soluble sugars, reducing and non-reducing sugars also showed a significant reduction from 1.60 mg $g^{-1}$ to 0.83 mg $g^{-1}$, from 0.97 mg $g^{-1}$ to 0.55 mg $g^{-1}$ and from 0.63 mg $g^{-1}$ to 0.28 mg $g^{-1}$ respectively in EM-SW compost.

### 5.1.7 Catalase and Peroxidase

There was a gradual increase in catalase enzyme activity from 3.76 to 13.42 $Ul^{-1}$ $min^{-1}$ $mg^{-1}$ enzyme protein and peroxidase enzyme activity from 14.0 μ to 71.8 μ moles of pyrogallol oxidized $min^{-1}$ $mg^{-1}$, enzyme protein in EM-SW biocompost during 60 days of decomposition.

### 5.1.9 Dehydrogenase

There was a gradual decrease in dehydrogenase enzyme activity from 56.8 to 30.5 μ mol. of TTC formed $g^{-1}$ of sample $mg^{-1}$ enzyme protein over 60 days of decomposition of SW with activated EM.

### 5.1.10 pH and Temperature profle of EM-SW compost

A gradual increase in pH was noticed which ranged from 6.3 to 7.5 during 60 days of decomposition of SW by activated EM.

The temperature profile during 60 days of decomposition of SW by activated EM showed an increase in temperature of 20.7 to 61.3°C upto 40 days and it decreased gradually to 30.1°C.

## 5.2 EFFECT OF EM-SW COMPOST ON TEST CROPS, LADY'S FINGER AND COW PEA

Statistical scrutiny of the results of the biometric yield and biochemical parameters from 30 to 90 DAS clearly indicated that the treatment $T_3$ (EM-SW compost 80 t $ha^{-1}$) was significantly superior ($P<0.01$) than other treatments compared to absolute control $T_1$ in the following parameters.

### 5.2.1 Biometric Parameters

#### 5.2.1.1 Plant Height and Root Volume

The treatment $T_3$ showed maximum increase in plant height from 33.40 cm to 102.40 cm and root volume from 0.79 to 5.15 cu. cm in Lady's finger and in cowpea from 27.47 cm to 65.83 cm and root volume from 0.47 to 4.98 cu. cm. over the control, $T_1$.

#### 5.2.1.3 Number of Nodules / Plant – Cow Pea

Number of nodules were high in $T_3$ treatment of Cow pea (leguminous plant) recording an increase from 14.0 to 20.6.

#### 5.2.1.4 Number of Leaves and Flowers / Plant

The treatment $T_3$ registered maximum number of leaves and flowers/plant from 30 to 60 DAS which ranged from 4.4 to 8.1 and 1.3 to 3.61 in Lady's finger and in cow pea from 14.2 to 46.8 and from 5.0 to 8.3 over the control $T_1$.

#### 5.2.1.5 Fresh and Dry Weight of Plants

Fresh and dry weight of plants showed a remarkable increase in $T_3$ treatment which varied from 5.08 to 92.80 g and from 2.70 to 22.40 g in Lady's finger and from 6.40 to 34.80 g and from 2.40 to 16.40 g in Cow pea than the control, $T_1$.

### 5.2.2 YIELD PARAMETERS

#### 5.2.2.1 Number of Pods / Plant and Seeds/Pod

Maximum number of pods/plant and seeds/pod was observed in $T_3$, treatment recording 4.3 and 38.0 in Lady's finger and 14.0 and 12.0 in cow pea compared to $T_1$ (control).

### 5.2.2.2 Single Pod Weight

The treatment $T_3$ recorded a maximum weight of 18.4 g and 8.5 g in Lady's finger and Cow pea than the control $T_1$ (10.5 g and 4.6 g in Lady's finger and Cow pea.)

### 5.2.2.3 Length of Pod

$T_3$ treatment produced maximum length in pod registering 13.3 cm in Lady's finger and 25.6 cm in Cow pea compared to control, $T_1$ (7.6 cm and 9.7 cm in Lady's finger and Cow pea).

### 5.2.2.4 Number of Seeds / Pod

Maximum number of seeds / pod was observed in $T_3$, 38.0 and 12.0 in Lady's finger and Cow pea over the control, $T_1$ (22.0 and 8.30 in Lady's finger and Cow pea).

### 5.2.2.5 Single Pod Weight and Seed Weight (100)

The treatment $T_3$ (EM –SW biocompost – 80 t $ha^{-1}$) recorded maximum single pod weight of 18.4 and 100 seed weight of 4.5 g in Lady's finger and in Cow pea the maximum single pod weight was 8.5 g and 100 seed weight was 10.0 g than the control, $T_1$.

## 5.2.3 BIOCHEMICAL PARAMETERS

### 5.2.3.1 Leghaemoglobin (Cow pea)

The leghaemoglobin content in the root nodules in $T_3$ treatment, Cow pea showed an increase from 0.026 $mg^{-1}$ $g^{-1}$ to 0.031 $mg^{-1}$ $g^{-1}$ up to 60 DAS and declined gradually to 0.025 $mg^{-1}$ $g^{-1}$ at harvest.

### 5.2.3.2 Total Protein Content

A remarkable increase in protein content from 30 to 60 DAS was registered in Lady's finger which ranged from 0.35 to 0.39 mg $g^{-1}$ tissue

and in Cow pea from 1.48 to 3.28 mg $g^{-1}$ tissue and it decreased to 0.35 mg $g^{-1}$ tissue and 2.54 mg $g^{-1}$ tissue at harvest compared to $T_1$, control.

#### 5.2.3.3 Total Carbohydrate

Carbohydrate content recorded a gradual increase upto 60 DAS in $T_3$ treatment of Lady's finger and Cow pea which varied from 10.80 mg $g^{-1}$ to 16.66 mg $g^{-1}$ and from 10.05 mg $g^{-1}$ to 19.83 mg $g^{-1}$ and decreased gradually to 15.16 mg $g^{-1}$ in Lady's finger and to 16.60 mg $g^{-1}$in Cow pea.

#### 5.2.3.4 Chlorophyll Content

Chlorophyll (a, b and total) content in the leaves increased significantly upto 60 DAS in $T_3$ treatment and declined gradually at 90 DAS in both Lady's finger and Cow pea. Out of the four treatments, $T_3$ showed remarkable increase in chlorophyll a, b and total from 30 to 60 DAS in Lady's finger and Cow pea, which ranged from 0.016 to 0.057 mg $g^{-1}$ and 0.055 to 0.058 mg $g^{-1}$ tissue (a), 0.016 to 0.072 mg $g^{-1}$ and 0.053 to 0.060 mg $g^{-1}$ tissue (b) and 0.029 to 0.129 mg $g^{-1}$ and 0.108 to 0.119 mg $g^{-1}$ tissue (total) respectively.

### 5.3 ENZYMIC AND NON-ENZYMIC ANTIOXIDANTS

#### 5.3.1 Catalase and Peroxidase

Catalase enzyme activity was displayed maximally in $T_3$ treatment of Lady's finger and Cow pea which ranged from 0.62 to 4.4 $Ul^{-1}$ $min^{-1}$ $mg^{-1}$enzyme protein and 1.4 to 2.7 $Ul^{-1}$ $min^{-1}$ $mg^{-1}$enzyme protein. A significant increase in peroxidase activity was recorded in $T_3$ treatments of Lady's finger and Cow pea which varied from 25.1 to 72.3 μ moles of pyragallol oxidized $min^{-1}$ $mg^{-1}$ enzyme protein and 39.2 to 67.2 μ moles of pyragallol oxidized $min^{-1}$ $mg^{-1}$ enzyme protein.

### 5.3.2 Ascorbic Acid (Vit. C) and Tocopherol (Vit. E)

Ascorbic acid and tocopherol content showed a significant increase in $T_3$ treatment which ranged from 23.4 to 37.46 mg $g^{-1}$ and 4.2 to 6.2 μg $g^{-1}$ in Lady's finger and in cow pea, it varied 24.2 to 37.6 mg $g^{-1}$ and from 4.1 to 6.4 μg $g^{-1}$.

## 5.4 SOIL ANALYSIS OF TEST PLANTS

### 5.4.1 ENZYME ACTIVITY

#### 5.4.1.1 Dehydrogenase

The dehydrogenase activity was increased maximally in $T_3$ from 19.7 to 57.5 μ moles of TTC formed $g^{-1}$ soil $mg^{-1}$ enzyme protein in Lady's finger and of 94.3 to 140.1 μ moles of TTC formed $g^{-1}$ soil $mg^{-1}$ enzyme protein in Cow pea upto 60 DAS and decreased to 47.1 and 123.7 μ moles of TTC formed $g^{-1}$ soil $mg^{-1}$ enzyme protein.

#### 5.4.1.2 Urease

There was a gradual increase in urease enzyme activity in $T_3$ treatment in Lady's finger and Cow pea upto 60 DAS and it was from 10.2 to 34.5 μ moles of ammonia formed $min^{-1}$ $mg^{-1}$ enzyme protein and 8.3 to 39.1 μ moles of ammonia formed $min^{-1}$ $mg^{-1}$ enzyme protein at 60 DAS and decreased gradually to 24.6 μ moles of ammonia formed $min^{-1}$ $mg^{-1}$ enzyme protein and 13.2 μ moles of ammonia formed $min^{-1}$ $mg^{-1}$ enzyme protein.

### 5.4.2 pH, EC and NPK

Initial and experimental soil analysis of $T_3$ treatment (EM-SW compost 80 t $ha^{-1}$) showed maximum pH, EC and available NPK levels in both Lady's finger and Cow pea which showed a pH of 8.7 in both test plants and EC was 0.43 and 0.176 $dSm^{-1}$, followed by the NPK amount

was 217 ( N ), 31.6 ( P) and 587(K) in Lady's finger and in Cow pea the available nutrients was 109.0 in N, 6.5 in P, 245.0 in K.

## 5.5 CONCLUSION

The research findings in the present study revealed that, the urban solid waste can be converted into a value added enriched organic manure, by an eco-friendly Effective Micro-organism (EM) technology. The compost maturity of the EM-SW compost could be assessed by significant reduction in cellulose, organic carbon, total phenol, total soluble sugar, reducing and non-reducing sugar, C:N ratio and an increase in total nitrogen, catalase, peroxidase, dehydrogenase, pH and temperature profile.

The activated EM not only enhanced the biometric, yield and biochemical parameters of the test plants - Lady's finger and Cow pea, but also increased the decomposition of organic matter content in the soil. The lactic acid bacteria present in EM solution reduced nematode populations and controlled propagation and spread of *Fusarium*, thereby inducing better environment for crop growth.

The Effective Microorganisms technology make substantial contribution to the consumers in providing better and pollution free crops to the daily diet and transforming the land from chemically polluted to microbial populated land.

## 5.6 RECOMMENDATIONS FOR FUTURE STUDY

The inoculation of EM cultures to the soil or plant ecosystem plays an important role in improving the soil quality, yield and quality of crops. The cost effective pilot study of EM-SW compost technology can be carried out on a large scale to compost municipal solid waste (MSW). The

incineration of MSW, which results in environmental pollution, can be avoided.

EM technology provides new source for revenue to SHG and entrepreneurs, who can turn all the waste that they have access to, into cost effective organic manure and build up a very profitable business using this technology.