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# Proximate composition of trash fishes and their utilization as organic amendment for plant growth

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Original Article

## Abstract

The present study aims to characterize and determine the potential use of trash fish manures in agricultural fields. Nutrient and minerals were analyzed in trash fish samples. High amount of nitrogen (6%), phosphorous (5%) and potassium (4%) were present in trash fish and used for plant growth study. Three commercial plants viz. *Lycoperscon esculantum, Hibiscus esculenta* and *Solanum melongena* were selected for analysis. The shoot length, root length, total length, number of leaves, leaf length, biomass of the plant and roots division were measured in every 15 days interval upto 45 days. After 45 days, the percentage of root length growth of *L. esculantum*, *H. esculenta* and *S. melongena* in experimental plants showed 84, 99 & 82% and the shoot length growth were 50, 45 & 66% higher than the control plants. The outcome of the result in the experimental plants showed fast growth than the control plants. Two way Analysis of Variance showed that the root length and shoot length significantly affect the plant growth.

***Keywords:*** *Trash fish, nutrients, minerals, fertilizer, plant growth parameters.*

## Introduction

A current farming practice exists where increased plant yield and productivity are obtained by amending the soil with a variety of organic amendments as plant manures (Anwar *et al.*, 2005). The marine fisheries consist of multispecies composition and the occurrence of by-catch consisting of several species of fish. Due to low quality, small size, low value, inedible and easily perishable, fishes are often discarded that are not utilized for human consumption are called Trash fishes (Rukhshana *et al.*, 2005 and Immaculate *et al.*, 2013). The direct input of fish or incorporated with artificial feed to fishes are considered as better alternative in aquaculture (Xu *et al.*, 2007). The fish wastes can be used as fertilizer for seafood processing industry and feed for fishes. Trash fishes can provide a balanced diet for optimum growth rate for plants (Aung *et al.*, 1981; Swanson *et al.*, 1980; Dedolph, 1962; Aiyelaagbe *et al.*, 1985).

Fish manure contains NPK and micronutrients are necessary for plant growth. Nitrogen is very important in plants for good foliage growth and dark green color. Phosphorous is important for rooting and also for blooming, and potassium is important for cold hardiness and plays a role in fruiting and blooming (Smith, 1985). Fish manure is made possible to use as balanced fertilizer where the NPK are equal or close to one another throughout the growing cycle (Chand *et al.*, 2006). A better plan is to look for a fertilizer brand that has at least two formulas to accommodate different stages in the plants growing cycle and/or different varieties of plants.

For vegetables that flower blossoms first like tomatoes and greens, a fertilizer with a higher proportion of phosphorus works well.

The frequent use of manures is an important part of agricultural production around the world. For several years, major crop producers have preferred the use of fish manures due to its high yield in crop productivity (Spitters and Kramer, 1986). Recently, many agricultural companies have shifted from using inorganic fertilizers to fish fertilizers. Plant growth analysis is now a widely used tool in such different fields for plant breeding (Wilson and Cooper, 1970). In this study, the plants *Lycoperscon esculantum*, *Hibiscus. esculenta* and *Solanum. melongena* were selected and used trash fish organic manure. Different parameters were analyzed in periodic intervals like 15, 30 and 45 days to find out the performance of the trash fish manure.

## Material and methods

### Trash fish manure preparation

Trash fishes were collected from the fish landing centers of Pulicat (13°56′58″ N and 80°17′47″ E) and Royapuram (13°10′40″ N and 80°29′37″ E) in Chennai, southeast coast of India. The collected trash fishes were cleaned and washed with filtered sea water to remove dirt and slick. The soft tissue was removed and dried at 60ºC in oven. The dried tissue was reduced into fine powder using mortar and pestle and it was sieved using a plastic sieve with 0.2 mm opening and was stored in desiccators for further analysis.

### Chemical composition in trash fish

Proximate composition like protein, carbohydrate, vitamins and fat contents in trash fishes were analyzed. Moisture was determined by drying the samples in oven at 105°C to constant weight (Egan *et al.*, 1997; AOAC, 1990) and carbohydrate was estimated by following the method of Dubois *et al.* (1956). Vitamin B1 and B2 contents were determined by following the method of Brubacher *et al.* (1985) and fat content was done following the method of Bligh and Dyer (1959), with modifications described by Kinsella *et al.* (1977). Crude protein content of trash fish manure was determined according to method described by Lowry *et al.* (1951) with slight modifications.

### Trash fish manure analysis

The concentrations of metals such as lead, nickel, copper, zinc and calcium (Deshpande *et al.*, 2009), sodium (Robinson, 1960) and magnesium (Williams *et al.*, 2006) were measured in the trash fish manure using Atomic Absorption Spectrophotometer (1983- 400 HGA 900/AS 800 Perkin Elmer) by using ICP multi-Element standard (MERCK-112837), while the concentration of nitrogen and phosphorous were measured by the method followed by Yasuhara and Nokihara, 2001 and Taylor, 2000 respectively. The quantity of potassium present in the trash fish was measured using flame photometry (Amrutkar *et al.*, 2013).

### Plant and pot experiment

*L. esculantum*, *H. esculenta*, and *S. melongena* were suitable for home climate and thus selected for plant growth analysis. Plastic and mud pots were selected for the experiment. Five pots (three plastic and two muds) for each plant, totally 15 pots were selected for three plants. Two pots (each one of plastic and mud) were used as control and three pot (two plastic and one mud) for experiment. The length and width of the pot (both plastic and mud) were 45 and 30 cms respectively. Holes were made at bottom of the pots for release of the excess water from pot. The seeds of *L. esculantum*, *H. esculenta*, and *S. melongena* were collected from Department of Botany, Madras Christian College, East Tambaram, Chennai. All the experiments were carried out in open condition because of the nature of soil and the local environment that provides suitable growth conditions. The soil used in this study was collected from inside the Madras Christian College campus and the physico-chemical parameters of the soil in neutral pH has adequate mineral and toxic contents (Raman and Sathiyanarayanan, 2009).

### Plant growth analysis

Every 15 days prior to initiation of the experiment, three to five plant seeds were sown in pots filled with soil. Number of leaves were emerged with small bands that interfered with plant growth. Computer-generated spreadsheets were created with appropriate spaces for recording measurements in every 15 days. The plant's shoot length, root length, total length, number of leaves, leaf length, biomass of the plant and root division were measured. All parameters were measured for control and in experimental plants. The triplicate was considered for all the parameters and the control plants were maintained without trash fish manure.

### Statistical analysis

All the experiments were executed in triplicates and the results were presented as the mean. Statistical analysis was performed with multiple variance analysis (Two way ANOVA) using Tukey's test by comparing all the experimental parameters with control.

## Results and discussion

### Trash fish manure characteristics

Trash fishes contains 28% *Upeneus* sp., 23% *Rastrelliger brachisoma*, 14% *Terapon jarbua*, 10% *Liza macrolepis*, 7%

*Siganus javus* and 5% *Leiognathus* sp. 13% of miscellaneous contains *Stolephorus* sp. *Tetraodon* sp., *Rastrelliger* sp., *Sardinella* sp., *Therapon* sp. and *Lates* sp (Table 1). Initially trash fish manure was analyzed for the minerals (Table 2) and vitamins (Table 3). Metals like manganese, nickel, copper, zinc and lead are in traces since the possibility of heavy metal accumulation in trash fishes are very less.

Table 1. Species composition of trash fish collected

| S. No. | Fishes | Percentage (%) |
|---|---|---|
| 1. | *Upeneus* sp. | 28 |
| 2. | *Rastrelliger brachisoma* | 23 |
| 3. | *Terapon jarbua* | 14 |
| 4. | *Liza macrolepis* | 10 |
| 5. | *Siganus javus* | 7 |
| 6. | *Leiognathus* sp. | 5 |
| 7. | Miscellaneous | 13 |

Table 2. Concentration of minerals and metals in trash fish manure

| S. No. | Minerals | Quantity (mg/100mg) |
|---|---|---|
| 1. | Phosphorous | 5.2187 |
| 2. | Calcium | 0.4039 |
| 3. | Sodium | 0.1128 |
| 4. | Potassium | 4.3541 |
| 5. | Magnesium | 0.3321 |
| 6. | Nitrogen | 6.0193 |
| 7. | Nickel | Traces |
| 8. | Copper | Traces |
| 9. | Zinc | Traces |
| 10. | Lead | Traces |

Table 3. Proximate composition of trash fish manure

| S. No. | Vitamins | Quantity (mg/100mg) |
|---|---|---|
| 1. | Vitamin B1 | 0.0012 |
| 2. | Vitamin B2 | 0.0024 |
| 3. | Carbohydrates | 0.5645 |
| 4. | Protein | 24.466 |
| 5. | Fat | 8.3233 |

Some gardeners got encouraging results by using a high growth (high nitrogen) formula at the beginning of the growth cycle and switch on to a high bloom (high phosphorus) fertilizer for plants begin to flower (Anwar *et al*., 2005). All plants have distinct growing and blooming cycles, but each plant needs to be individually recognized and its cycle has to be properly coordinated to achieve the best blooming results. Similarly the trash fish manures afford the high NPK content to plants for their growth. The trash fish manure has the high amount of minerals like nitrogen, phosphorous and potassium that are used as nutrients and growth promoters for plants. The key for a coordinated growing and blooming cycle lies in feeding plants with proper proportion of nitrogen, phosphorous and potassium (N-P-K) at specific time periods as per the individual requirement. The first step to achieve beautiful blossoms is to develop a vigorous root structure. The first feeding trash fish manure, a natural organic fertilizer with a nitrogen formula of 5% is of almost important at this stage (Alarcon *et al*., 2002).

Tolonen (1990) reported that the highest average concentration of phosphorous and magnesium was observed in *Clupeonella cultriventris*. Magnesium is an essential mineral for cell function and it occupies a key role in all reactions with phosphate, the cells also require magnesium for cell division and enzyme production. Calcium and phosphorous contents are elevated in *Oreochromis niloticus* to the tuna of 1580.0 mg and 120.0 mg/100 g contents, respectively which much higher than the shrimp head (Maia Junior, 1998). Total phosphorous content varied from species to species and *Crenidens indicus* has 17.78 mg/g and *Aphanius dispar* 43.89 mg/g of phosphorous content (Immaculate *et al*., 2013). In marine fishes, 4.2 to 6.78% of the phosphorous and 25% of magnesium occurred (Stansby, 1962), while nitrogen in rainbow trout manure is much higher than the other minerals (Smith, 1985).

## *Effect of trash fish manure on growth of plants*

The rate of growth and development for the trash fish manure and control group were determined by averaging the measurements of growth parameters of all the plants on an interval of 15 days basis. All the tested plants were grown faster than the control plants. There is no change in growth while conducting the experiments in plastic and mud pots. The experimental plants of *L. esculantum* were grown faster than the control plants in all the parameters. After 45 days, the shoot length of experimental plants was almost double than that of the control plants. The testing plants of *H. esculanta* were developed more rapidly than the control plants in all the factors. Like that, the experimented plants of *S. melongena* were also raised more than the control plants. All the parameters of tested plants have grown faster than the control plants during the 30 and 45 days period (Table 4).

Two way ANOVA analysis of variance of growth parameters evidenced statistically significant effects owing to experiments as well as control and interactions of both (Table 5). The comparison of control and experimental study also showed that the parameters were significantly affecting the growth of the plants. An individual comparison between the parameters and growth showed that the shoot length and root length are

Table. 4 The growth parameters of *L. esculantum, H. esculenta* and *S. melongena* in different time interval

| Periods (Days) | | Shoot Length (cm) | | | Root length (cm) | | | Total Length (cm) | | | Number of leaves | | | Leaf Length (cm) | | | Biomass (gm) | | | Root Division | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L.e | H.e | S.m | L.e | H.e | S.m | L.e | H.e | S.m | L.e | H.e | S.m | L.e | H.e | S.m | L.e | H.e | S.m | L.e | H.e | S.m |
| 15 | C | 6.5 | 4.8 | 2.9 | 0.8 | 3.8 | 1.2 | 7.3 | 8.6 | 4.2 | 2 | 2 | 2 | 0.4 | 0.4 | 0.4 | 0.5 | 0.7 | 0.3 | D | D | ND |
| | E | 8.5 | 6.5 | 3.8 | 1.2 | 5.9 | 2.0 | 9.5 | 12.4 | 5.8 | 2 | 2 | 2 | 0.5 | 0.5 | 0.5 | 0.7 | 0.9 | 0.4 | D | D | ND |
| 30 | C | 7.5 | 5.8 | 4.5 | 1.5 | 4.8 | 2.5 | 9.0 | 10.6 | 7.0 | 6 | 6 | 4 | 1.0 | 0.9 | 0.8 | 3.0 | 2.5 | 1.0 | D | D | D |
| | E | 10.0 | 8.8 | 6.2 | 2.0 | 7.8 | 4.5 | 12.0 | 16.6 | 10.8 | 8 | 8 | 4 | 2.0 | 1.5 | 1.4 | 4.0 | 3.3 | 1.9 | D | D | D |
| 45 | C | 10.2 | 8.2 | 8.5 | 5.4 | 6.4 | 6.2 | 15.6 | 14.6 | 14.7 | 12 | 10 | 12 | 3.0 | 2.5 | 3.4 | 6.2 | 5.8 | 6.8 | D | D | D |
| | E | 18.8 | 16.3 | 15.5 | 8.1 | 9.3 | 10.3 | 27.0 | 25.5 | 25.8 | 16 | 14 | 16 | 4.1 | 4.3 | 4.6 | 10.3 | 8.5 | 9.3 | D | D | D |

L. e - *Lycoperscon esculantum*; H. e - *Hibiscus esculenta*; S. m - *Solanum melongena*;

C- Control; E- Experiment; D- Divided; ND - Not divided.

the dominant parameters that significantly affect the growth of plants.

In practice, throughout the globe the trash fishes are not exploited appropriately and consider as a waste and hurl away. At present the cost of inorganic fertilizers have boosted up day by day and difficult for the farmers, gardeners etc to buy also, inorganic fertilizers decrease the quality of soil and affect the next planting. Alternatively, trash fishes provide the source for the fertilizer that affords the high NPK content for plant growth. Our results promote the use of trash fish as a plant manure and fertilizer rather than discarding to seashore where it may escort for pollution.

Table 5. Statistical analysis of growth parameters using Two-way Analysis of Variance

| Plants | | | Parameters | Plant growth | Parameters × Plant growth |
|---|---|---|---|---|---|
| *L. esculantum* | 15 days | d. f | 4 | 1 | 4 |
| | | F - value | 3399 | 281.7 | 57.82 |
| | | p - value | <0.01 | <0.01 | <0.01 |
| | 30 days | d. f | 4 | 1 | 4 |
| | | F - value | 3333 | 629.6 | 58 |
| | | p - value | <0.01 | <0.01 | <0.01 |
| | 45 days | d. f | 4 | 1 | 4 |
| | | F - value | 3270 | 2724 | 330.4 |
| | | p - value | <0.01 | <0.01 | <0.01 |
| *H. esculenta* | 15 days | d. f | 4 | 1 | 4 |
| | | F - value | 2400 | 508.1 | 80.01 |
| | | p - value | <0.01 | <0.01 | <0.01 |
| | 30 days | d. f | 4 | 1 | 4 |
| | | F - value | 7261 | 3109 | 351.2 |
| | | p - value | <0.01 | <0.01 | <0.01 |
| | 45 days | d. f | 4 | 1 | 4 |
| | | F - value | 9873 | 8866 | 923.3 |
| | | p - value | <0.01 | <0.01 | <0.01 |
| *S. melongena* | 15 days | d. f | 4 | 1 | 4 |
| | | F - value | 1676 | 314.9 | 48.45 |
| | | p - value | <0.01 | <0.01 | <0.01 |
| | 30 days | d. f | 4 | 1 | 4 |
| | | F - value | 4122 | 1782 | 164.2 |
| | | p - value | <0.01 | <0.01 | <0.01 |
| | 45 days | d. f | 4 | 1 | 4 |
| | | F - value | 12916 | 11716 | 1414 |
| | | p - value | <0.01 | <0.01 | <0.01 |

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