Available online at www.sciencedirect.com

ScienceDirect

Science of the Total Environment 384 (2007) 333–341

Science of the Total Environment
An International Journal for Scientific Research into the Environment and its Relationship with Humankind

www.elsevier.com/locate/scitotenv

# Effect of halophytic compost along with farmyard manure and phosphobacteria on growth characteristics of *Arachis hypogaea* Linn.

K.C. Ravindran [a,*], K. Venkatesan [a], T. Balasubramanian [b], V. Balakrishnan [a]

[a] *Department of Botany, Annamalai University, Annamalainagar 608 002, Tamil Nadu, India*
[b] *CAS in Marine Biology, Annamalai University, Parangipettai 608 502, Tamil Nadu, India*

Received 26 January 2007; received in revised form 1 May 2007; accepted 19 May 2007
Available online 27 June 2007

**Abstract**

Organic compost has been identified as an alternative to chemical fertilizer to increasing soil fertility and crop production in sustainable farming. The objective of the present study was to evaluate the effects of halophytic compost which are normally available in coastal areas on growth parameters in *Arachis hypogaea*. Halophytic compost along with farmyard manure (FYM) and phosphate solubilising bacteria (PSB) resulted in production of highest biomass such as plant height, number of compound leaves, total number of root nodules, fresh and dry weight of root nodules and fresh and dry weight of plant. Various combination of halophytic composts used in the present study, *Suaeda* compost + farmyard manure + phosphate solubilising bacteria treatment showed an enhanced biomass when compared to other halophytic compost and control.


*Keywords: Arachis hypogaea*; Compost; Growth; Halophytes; Soil fertility

## 1. Introduction

Use of organic amendments is generally seen as a key issue for soil health and sustainability in cropping systems, both in terms of maintaining the amount and quality of soil organic matter and supplying important micronutrients (Timsina and Conner, 2001). Composting, the biological oxidation of organic matter, is an important process. However, traditional methods of composting result in losses of about 55% of organic matter and from 30 to 50% of nitrogen (Kumaraswamy, 2001). There has been much discussion on the effect of organic fertilizer and waste compost from pig manure on soil properties and crop quality (Weon et al., 1999). However, little research has been done on the effect of halophytic compost (compost prepared by using leaves, stem and root of halophytes after decomposition) in relation to plant growth.

India ranks first in the world's groundnut production, accounting for 40% of the world area (7.5 m ha) and 31.7% (5.7 mt) of the total production in the world. At present, India accounts for 9.6% of the world's total output of oil seeds, with more than 25 million hectares of land under oil seeds. Despite considerable area and production of groundnut in the country, the average yield of groundnut is too poor, only about 900 kg/ha as against 1416 kg/ha Asian average and 1275 kg/ha the world average (Hegde, 2005).

* Corresponding author. Tel.: +91 4144 238248x354; fax: +91 4144 238145.
*E-mail address:* drkc_ravi@rediffmail.com (K.C. Ravindran).

0048-9697/$ - see front matter © 2007 Elsevier B.V. All rights reserved.
doi:10.1016/j.scitotenv.2007.05.026

Mangroves, which thrive and grow luxuriantly in tidal saline wetlands along tropical and subtropical coasts, are especially adapted to salinity and water logging stress. Mangrove forests literally live in two worlds at once, acting as the interference between land and sea. Mangroves protect coastlines from erosion, storm damage and wave action. The mangroves also prevent shoreline erosion by outing as buffers and catch alluvial substrate. Thus stabilizing land elevation by sediment accretion that balances sediment loss. Halophytes survive salt concentration equal to greater than that of seawater and possess physiological mechanisms that maintain a lower water potential inside the cell than in the soil (Ungar, 1991).

In India, Tamil Nadu has a coastline of 950 km. Extensive mangrove wetlands are located in Pichavaram of Cuddalore district and Muthupet of Thanjavur district. Small patches of mangroves have also been found along the park strait as well as in some of the islands of the Gulf of Mannar Biosphere Reserve. The Pichavaram mangrove wetland is located in the northern extreme of the Cauvery delta, near the mouth of river coleroon. Its total area is about 1350 ha and 13 true mangrove species and 20 species of halophytic herbs and shrubs occur naturally in this salt marsh habitat and these species belong to diverse families.

Cuevas (1997) recorded the nutrient values of halophytes and observed that nutrient content in halophytes were higher when compared to green manures (glycophytes), while obtained from some species such as *Crotalaria juncea*, *Sesbania aculeate*, *Cyamopsis tetragonoloba* and *Vigna catajung*. However, halophytes accumulate NaCl in their tissues. The present work is based on the concept that, when halophytes are subjected to composting, it is possible that NaCl content present in the tissues will degrade during decomposition. $Na^+$ in NaCl may chelate with the organic acids produced during decomposition and release the $Cl^-$, resulting in the reduction of NaCl. Decomposition nullifies the presence of NaCl content in the plant tissues. Watson (2003) also stated that leaching the compost with water reduce the concentration of soluble salts.

The objectives of this study were to determine the influence of the different halophytic compost in combination with farmyard manure and phosphate solubilising bacteria on the growth characteristics of *Arachis hypogaea* cultivated along the coastal areas.

## 2. Methods

### 2.1. Experimental site

The experiment was carried out at the Thandavarayan Sozhagan Pettai village near Pichavaram mangrove forest, 12 km away from Annamalai University. The experimental field is situated at 11°21′ N latitude and 79°50′ E longitude at an altitude of above +5.25 M mean sea level. The experiment outline was entirely randomized block design, with three repetitions.

### 2.2. Compost preparation

Three fast growing and dominant halophytes such as *Suaeda maritima* (L.) Dumort., *Sesuvium portulacastrum* L. and *Ipomoea pes-caprae* (L.) Sweet were identified for making compost after a detailed survey. Well decomposed farmyard manure was selected for the study and mixed with halophytic compost. Phosphobacteria (*Bacillus megatherium* var. *phosphaticum*) were obtained from the Department of Agricultural Microbiology, Faculty of Agriculture, Annamalai University, India. Three months of healthy halophytes were harvested from nursery and used for preparation of compost. The plant materials as appropriate as rice straw were chopped well. The substrates were piled loosely in a compost pit and bulky in nature which provide better aeration within the heap. The material was too compact and no heavy weights were put on top. Aeration was provided by placing perforated bamboo trunks horizontally and vertically at regular intervals, to carry air through the compost heap. The fungus *Pleurotus sajor-caju* (Fr.) Singer, was added to the compost heap for best decomposition. The amount of activator used was usually 1% of the total weight of the substrates (Cuevas, 1997). Heat was maintained at 50 °C or higher and the heap was turned over every 5–7 days for the first 2 weeks and thereafter once every 2 weeks. Turning over the pile provided adequate aeration and evened up the rate of decomposition throughout the pile. By the end of the third month, the compost was ready for use. It was dark

Table 1
Physico-chemical properties of the experimental soil

| Properties | Value |
|---|---|
| *A. Physical properties* | |
| Coarse sand (%) | 48.86 |
| Fine sand (%) | 34.25 |
| Silt (%) | 5.58 |
| Clay (%) | 10.26 |
| Textural class | Sandy |
| *B. Chemical analysis* | |
| Available N (kg $ha^{-1}$) | 144.8 |
| Available $P_2O_5$ (kg $ha^{-1}$) | 4.85 |
| Available K (kg $ha^{-1}$) | 156.7 |
| Organic carbon (%) | 0.32 |
| Organic matter (%) | 0.55 |
| Soil reaction (pH) | 7.89 |
| Electrical conductivity (d $Sm^{-1}$) | 1.36 |