Journal of Phytology 2009, 1(3): 142–146
© Journal of Phytology, 2009
ISSN: 2075-6240
Available Online: www.journal-phytology.com

REGULAR ARTICLE

EFFECT OF SEAWEED LIQUID FERTILIZER ON THE GERMINATION AND GROWTH OF SEEDLING OF MANGROVE - *RHIZOPHORA MUCRONATA* BOIR

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SUMMARY

Seaweeds are among the important marine living resources with tremendous commercial application. The effect of sea weed liquid fertilizer of *Padina boergesenii* was studied on the growth parameters of *Rhizophora mucronata*. The propagules were soaked in different concentrations (0.5, 1, 1.5 and 2%). Within 24 hours soaking, all the soaked propagules were carefully planted in individual polythene bags each containing 2 kg of soil best response was found after 90 days at 1% concentration of seaweed extract in almost all the growth parameters. The maximum growth was recorded at 1% concentration Viz., shoot length 24.3 cm, leaf breadth 3.45 cm, leaf length 7.1 cm when compared to control (13.7 cm shoot length, leaf breadth 3.0 cm and leaf length 5.35 cm). It was concluded that differential response was noticed in the mangrove plant to the seaweed extract treatment. In spite of these differential responses, *Padina boergesenii* was found to be an effective seaweed liquid fertilizer (SLF) in mangrove plant.

Keywords: Biomass, Germination, Mangrove, Seaweed liquid fertilizer.

T. Nedumaran and P. Perumal. Effect of Seaweed Liquid Fertilizer on The Germination and Growth of Seedling of Mangrove - *Rhizophora mucronata* Boir. J Phytol 1 (2009) 142-146
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1. Introduction

Seaweeds are among the important marine living resources have an array of uses and one among the unique and important uses has been its application in agriculture including forestry. The plant growth hormones effect of seaweed is advantageously made use of to stimulate germination and growth of seeds especially in a degraded environment. Mangroves are the tidal swamp forests of marsh communities of coastal wetlands, which exist in the intertidal zones of sheltered shores, estuaries, tidal creeks, back waters, lagoons and mudflats of the tropical and subtropical regions of the world. They form one of the important ecological assets precious economic resources and sensitive and fragile ecosystems of the coastal marine environment. There exist totally 22 genera 65 species under 16 families of mangrove in the world [1]. These plants are endowed with many peculiar and characteristic, which serve as the principal and prime breeding, feeding and nursery grounds for many a finfish and shellfish. According to Macnae "No mangroves, no prawns" [2] and they serve as wonderful and real custodians of their juvenile stock and as natural wealth [3]. They provide detritus for the coastal ecosystem protect the coastal environs from the deleterious effects of cyclones and winds by acting as a buffer zone or barrier and ultimately prevents soil erosion [4]. Today, several medicines are produced from mangroves, which are used for curing abdominal troubles and skin diseases [5]. They are also found to cure sores, leprosy, headaches, rheumatism, snakebites, boils, ulcers, diarrhea and haemorrhages. There is a serious and heavy damage to mangrove seedlings or propagules due to traditional fishing method using dragnets, which is prevalent in almost all the coastal areas. Research reports reflect that degradation to the tune of nearly 40% has happened to this precious ecosystem in the coastal wetlands or swamps [6, 7]. The mangrove covers certainly has a high socio-economic value, biodiversity and an ever-positive role in maintaining environmental stability of late the populace and the scientific community have become aware of threat and standard undertaking lot of measures of conservation and protection through artificial propagation of seedlings.

Some chemicals are found to enhance the root growth of *Rhizophora* and *Avicennia* species Viz., Naphthalene Acetic Acid (NAA), Indole Butyric Acid (IBA), Keradix, Indole-3-Acetic Acid (IAA), Phenolics, Gibberellic Acid (GA3), Methanol, Boric Acids and Triacontanol [8, 9, 10]. These chemicals are hormones activators or inducers act in concert with various conductive environmental features to enhance the germination first and later the growth of propagules. The suitability of each has to be assessed and confirmed by conducting some experimental studies in the laboratory. The present investigation has been under taken to fill the lacuna with regard to the possibilities of making use of seaweed liquid fertilizer to promote germination and growth of mangrove seedlings. *Rhizophora*, a common mangrove tree species of tropical coastal environments propagates through viviparous propagules, which are difficult to rooting in their natural habitats [11, 12]. Hence, large-scale plantation of mangroves on degraded shore line is highly warranted and this will require nurseries for mangroves.

2. Materials and Methods

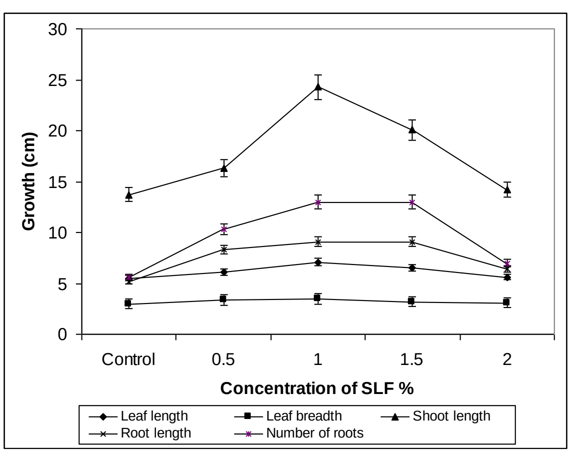
Healthy Propagules of *Rhizophora mucronata* were collected from Pichavaram mangrove forest (Lat. 11°27′N; Long, 79°47E) on the south east coast of India and brought to the laboratory. These propagules were maintained under laboratory conditions and the experiments were performed using soil collected from field. The salinity was maintained at 15-25% by employing the estuarine water. However, the pH of the soil was maintained between 7.6 and 8.0 preparation of seaweed liquid fertilizer [13]. The propagules were later soaked in varied concentrations Viz., 0.5, 1, 1.5 and 2 % for 24 hours. All the soaked propagules were carefully planted in individual polythene bags each containing 2 kg of soil separately and the polybags with untreated propagules, which were maintained as control. Propagules were irrigated well with estuarine water at a regular interval of 2 days. All these setups were kept at 29-± 2°C room temperature and the propagules were maintained 90 days without any disturbance in shady place.

After the completion of the experimental study, all the propagules were measured for determining the growth (morphological) parameters. After completing the growth measurements, the biomass was measured by considering the wet and dry weights of propagules. Dry weight was determined by oven drying at 60°C for 24 hours and statistical analysis was employed with one-way ANOVA.

3. Results and Discussion

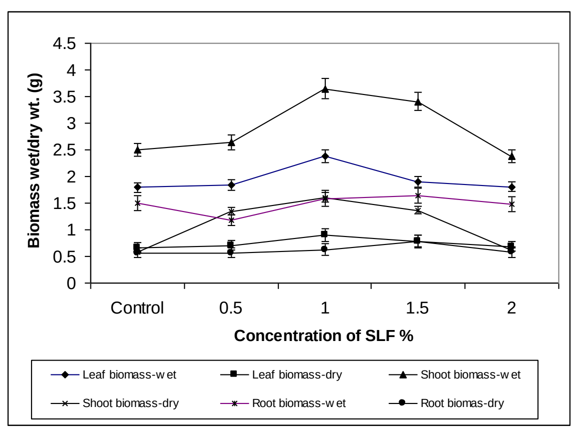
Rhizophora mucronata seedling treated in various concentrations of SLF showed better results with regard to shoot length root length and number of roots produced (Fig.1). *R. mucronata* seedlings showed maximum growth in 1% concentration in following parameters such as, shoot-length (24.3cm), leaf length (7.1cm), leaf breath (2.45cm) and number of roots (13 cm). However, with respect to root length, maximum growth was found in 1.5% concentration (9.4 cm). The growth was recorded in control with respect to shoot length, leaf length leaf breath, root length and number of roots was 13.7cm, 5.5cm, 3.0cm, 5.2cm and 5cm respectively. Minimum growth with respect to the above parameters (14.2cm, 5.6cm, 3.1cm, and 6.4cm) was recorded in 2% concentration.

Fig 1. Effect of different concentrations of seaweed liquid fertilizer on growth parameters of mangrove propagules of *Rhizophora mucronata*



The increase in biomass values of root, shoot and leaf were recorded both in terms of wet weight and dry weight in different concentrations of seaweed liquid fertilizer (Fig.2). Shoot biomass (wet weight) reached a peak value of 3.65 g at 1% and the trough was recorded at 2 % and 2.38 g against the control values of 2.5 g. In terms of dry weight, the respective values were 1.61 g and 0.63 g at 1% and 2% concentrations. The minimum shoot biomass in terms of wet weight (2.5 g) and dry weight (0.58 g) were noticed in control compared to 2 % concentration of SLF. Regarding the leaf biomass, maximum values in terms of wet weight (2.38 g) and dry weight (0.90 g) were recorded in the 1 % concentrations. The minimum increase in wet weight (1.81 g) and dw (0.69 g) were recorded in 2 % concentration. Finally with respect to root biomass the maximum values were recorded at 1.5% concentration 1.64 g wet weight and 0.78 g dry weight and 0.5% concentration presented in minimum values (1.18 g wet weight and 0.57 g dw).

Fig 2. Effect of different concentration of seaweed liquid fertilizer on biomass (wet/dry wt.) of *Rhizophora mucronata*



In agriculture, seaweeds act as useful soil conditioners, fertilizers and green manure. Their manorial value is due to the high content of potassium salts, micronutrients and growth substances, chiefly cytokinins.

Seaweed application is ideally suited for high sandy soils, which are generally deficient in potassium. Physical condition of the soil is improved by seaweed application because of their gelatinous nature. Carbohydrate and other organic matter present in the seaweeds alter the nature of soil and improve its moisture retaining capacity. They are also valuable as a source of trace element and other organic substances like amino acids, auxins, gibberellins and vitamins.

In the past few years, it has been shown that seaweed products enhance the germination of seeds, increase the uptake of plant nutrients. Cytokinins have decisively shown that the major growth inducing factors in liquid seaweed extracts [14] which were isolated and quantified from the brown seaweed *Asocphyllum nodosum* [15]. Though considerable work has been done in seaweed liquid fertilizer on crop they were mainly focused on germination studies only. Hence, present study was aimed to focus the main aspects on the effect of seaweed liquid fertilizers prepared from *Padina boergesenii* on *Rhizophora mucronata*.

From the present investigation, it is clear that seaweed extracts, whether water or aqueous extract soaked enhanced the growth at optimum concentration. This observation is in conformity with the earlier report that algal extracts at low concentration promote the growth in plants [16]. The results of the present study revealed that the growth in terms of leaf, shoot and root, breath of leaf and number of roots produced more in SLF treated seedlings compared to seedlings untreated of *Rhizophora mucronata* (Fig.1). The rooting in the present investigation was more at the concentrations of 1 and 1.5 %. Similar results were recorded with compounds like IBA and NAA improved the number of roots of *R. apiculata* even at 2 ppm concentration [8] and *Avicennia* marina showed maximum root growth in higher concentrations of hormones like IAA and GA_3 were found to increase the number of roots [10]. The increase was not statistically significant in the present study however, values related to number of roots showed 0.5% statistical significance. Lower concentrations of caffeic acid (10 ppm), ferulic acid (10 ppm) and gallic acid (1ppm) enhanced root number [8] and this findings is in discord with the present work in which 1 % methanol was found to be enhance number of roots in mangrove seedlings [12, 3]. The beneficial effects of SLF on terrestrial plants include improving the overall growth and the ability to withstand always-environmental conditions [17].

Higher concentrations of triacont and (200 and 240 ppm) reduced root biomass and it was promoted in the lower concentration of 40 ppm. In the present study also at higher concentration of SLF (2%) a lower root biomass was obtained similar findings line with previous report [18]. IAA 10 ppm and GA_3 (50 ppm) increased root biomass dry weight similarly significantly increased root biomass in 1% SLF [10]. The dry weight of root in *R. mucronata* was greatly increased by leaf litter leachates [11] and *Bruguiera gymnorrhiza* increase in dry matter production by nitrate and ammonium [19]. The present study 1.5% SLF produced maximum values of shoot biomass (in both wet and dry weight). While, dry matter production decreased with increasing concentration of triacontranol and at 240 ppm shoots growth was terminated [20].

The present study is a preliminary one but it has showed with usefulness of SLF improving the shooting and rooting potential of the mangrove seedlings which were treated in various concentrations of SLF. The performance of such seedlings can also be evaluated in the fields and also in the degraded environment. The synergistic influence of SLF and other compounds on the shooting and rooting potential of mangrove propagules also merits of this investigation. In such endeavors, optimum concentration 1% SLF which showed enhancement of growth rate in the present study could be used as this concentration will be cost effective.

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