The Palawan Scientist
Vol. 4, No. 1. pp. 56-62, 2008.

ISSN No. 1656-4707

Sargassum filipendola Extract as Bio-Fertilizer to Lowland Rice (*Oryza sativa* Linn.)

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ABSTRACT

This study aimed to evaluate the effects of varying concentration of *Sargassum filipendula* (seaweed) extract on the growth and yield of lowland rice and to identify the level of seaweeds extract that best promotes growth and yield of lowland rice. Results revealed that *Sargassum filipendula* extract had highly significant effect on the average number of days from transplanting to maturity of rice plants. Plants applied with 100% seaweeds extract (T_5) obtained the earliest maturity of 83.0 days. Likewise, the rice plants applied with seaweeds extract were significantly different from the control plants in terms number of grains per panicle. However, the average weekly height increments, average number of tillers per plant, final height, and plot yield in kilograms were not significantly affected by the application of the extract.

Keywords: seaweeds, Sargassum filipendula, lowland rice, Oryza sativa

INTRODUCTION

Rice (*Oryza sativa* Linn.) is an annual crop and mainly produced in the Philippines as staple food and considered as lifeblood of the Filipino. It is a good source of carbohydrates and its by-products such as rice bran are commonly used as animal feeds.

Farmers today rely mostly in chemical fertilizer to provide the essential elements required by the plant. Commercial fertilizers are very costly which make it difficult for low income farmers to acquire and use. Aside from being expensive, these fertilizers have negative effect to the soil, to the environment and to human health.

Organic sources like extracts from seaweeds are suitable for growing different crops. It contains more than 60 minerals. It has fair amount of nitrogen

and potash but little phosphorous. It is particularly rich in micronutrients such as iron, copper, zinc, boron, and manganese. Seaweed species such as *Sargassum* seaweed improves soil quality by increasing the organic matter and by adding nutrients essential for plant growth. Different nutrients are present in *Sargassum* but the concentration vary with species. But in general, these seaweed species have near neutral to slightly alkaline pH, with a nutrient value of 1.5% Nitrogen, 0.1% Phosphorous, and 1.3% Potassium. In addition, it contains 5% Calcium and 1.3% Magnesium, plus it is a great source of essential micronutrients (Wallace, 1966). Hence, this study was conducted to evaluate *Sargassum* as an alternative fertilizer for use in lowland rice production.

METHODOLOGY

The study used Randomized Complete Block Design with five (5) treatments and three (3) replications. The treatments were: T_1 – tap water; T_2 – 25% seaweeds extracts (SE) + 75% tap water (TW) ;T_3 – 50% SE + 50% TW; T_4 – 75% SE+ 25% TW; and T_5 – 100% SE. Five (5) sample plants per plot were randomly selected as basis of observation.

Land preparation. An area of 72 square meters (8m x 9m) was plowed and harrowed thoroughly using carabao drawn-implements. The area was divided into three blocks and further subdivided into five (5) equal plots of 1 x 2 m per block with one meter leeway between plots and blocks.

Seedbed preparation. An area of 2m x 5 m seedbed was plowed and harrowed. The plot bed was raised to 5-6 cm high to facilitate water management.

Soaking and incubating of seeds. The cleaned seeds were placed in a clean sack and soaked in clean running water for 24 hours. It was incubated for 36 hours before broadcasting in the prepared seedbed.

Uprooting and transplanting of seedlings. Seedlings were uprooted 20 days after sowing and transplanted at a distance of 25 x 25 cm apart at an average of three seedlings per hill.

Care and management. The area was properly irrigated and drained to control golden kuhol (snails). Weeds were hand pulled during the early vegetative growth stage of the rice plants.

Collection of seaweeds and preparation of extract. Kulafu seaweeds gathered from the shore of Port Barton, San Vicente, Palawan were washed with tap water and then grounded using mortar and pestle. The grounded kulafu was squeezed to separate extracts from pulp. The extracts were cleaned using a cheese cloth strainer.

Application of seaweed extracts. The seaweed extracts were applied using a hand sprayer. Application was done a day after transplanting and every two (2) weeks thereafter.

Harvesting. Sample plants were harvested first to get the data on per sample basis. Harvesting was done when rice grains attained approximately 80% physiological maturity. The "gapas" method was used in harvesting.

Threshing. "Giik" method was used in threshing. This involves spreading the stalks of paddy rice on hard surface or mat and applying a combination impact-friction force of the feet to the rice panicles by trampling until the grains are loosed and detached from the panicle.

Drying and cleaning. The harvested grains were sundried to reduce the moisture content of the grains. The grains were cleaned by winnowing.

The data collected were average weekly height increment, average number of tiller per plant, average number of days from transplanting to maturity, number of days from transplanting to 80% physiological maturity, final height, average number of grains per panicle, plot yield in kilogram and computed yield per hectare.

The data gathered were analyzed using Analysis of Variance (ANOVA) and Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Average weekly height increment

The plants sprayed with 25% seaweed extract (T_2) had the highest average height increment of 7.14 cm per week. This was followed by control plants (T_1) and plants sprayed with 75 percent (T_4), 100 percent (T_5) and 50 percent seaweeds extracts with average weekly height increments of 7.09 cm, 7.06 cm, 7.03 cm and 6.83 cm, respectively.

ANOVA showed no significant differences among treatment means. This finding implies that the application of seaweeds extract to lowland rice has no effect on the weekly height increment.

Table 1 Average weekly height increment, average number of tillers per plant, average number of days from transplanting to maturity, final height, average number of grains per panicle and plot yield of sample rice plants.

Treatment	Average weekly height increment (cm)	Average number of tillers per plant	Average number of days from trans-planting to maturity	Final height	Average number of grains per panicle	Plot yield (kg)
T_1 – Control	7.09	6.373	85.00^a	97.11	108.600	1.009
T_2 - 25% KSE	7.14	6.483	84.00^b	99.27	129.133	1.086
T_3 - 50% KSE	7.03	6.420	84.00^b	98.34	133.533	1.120
T_4 - 75% KSE	7.06	7.463	83.33^b	98.84	131.467	1.077
T_5 -100% KSE	6.83	7.247	83.00^c	95.50	143.933	1.138
F-value (Treatments)	0.523^{ns}	2.95^{ns}	26.487^{**}	1.944^{ns}	6.108^{*}	0.250^{ns}

Note: Means having the same letter superscript are not significantly different at 0.01 level based on DMRT
ns = not significant
* - significant
** - highly significant

Average number of tillers per plant

The control plants (T_1) produced an average of 6.373 tillers per plant followed by the plants sprayed with 50 % (T_3), 25 % (T_2),100 % (T_5) and 75 % (T_4) seaweeds extract with average tillers of 6.420, 6.483,7.247 and 7.463 per plant, respectively. ANOVA revealed no significant differences among the treatment means. The plants applied with varying levels of seaweeds extracts and the untreated plants are comparable in terms of average number of tillers per plant. This finding implies that the application of seaweeds extracts as foliar fertilizer has no effect on the tillering formation of lowland rice plant.

Average number of days from transplanting to maturity

On the average, plants treated with 100% seaweed extract (T_5) had the shortest period of 83 days from transplanting to maturity, followed by plants treated with 75% seaweed extract (T_4) with 83.3 days from transplanting to maturity. On the other hand, plants treated with 25% and 50% (T_2 and T_3) seaweed extract had an average of 83.33 days from transplanting to maturity while control plants (T_1) obtained the longest period of 85 days from transplanting to maturity.

ANOVA revealed that treatment means showed highly significant differences. The application of 25% to 100% seaweed extract had significantly shorter period from transplanting to maturity than control plants. Furthermore, the application of 100% kulafu seaweeds extract had significantly lesser days between transplanting and maturity than the application of 25%, 50% and 75% seaweed extract. This implies that the application of seaweeds extracts to the rice plants promotes faster maturity. Seaweed foliar spray promotes faster, stronger stem, and leaf growth, earlier blooming and fruit set when sprayed on leaves and flower buds (Smitte, 1991). Furthermore, seaweed extract stimulate and enhance flowering of some plant species Schmidt (1990).

Final Height

The plants sprayed with 25% seaweeds extract (T_2) had the highest final height of 99.27 cm. On the other hand, the plants sprayed with 75% (T_4) and 50% (T_3) seaweeds extract and control plants (T_1) have final height of 98.84 cm.,98.34 cm and 97.11 cm, respectively. Furthermore, the plants sprayed with 100% seaweeds extract (T_5) had the lowest final height of 95.5 cm. ANOVA showed no significant differences among treatment means in terms of final height of rice plants. This finding implies that the plants applied with kulafu seaweeds extract are comparable to the control plants in terms of final height of lowland rice.

Average number of grains per panicle

Plants treated with 100% seaweed extract (T_5) had the highest average grains per panicle of 143.933 while plants treated with 50% (T_3), 75% (T_4) and 100% (T_5) seaweeds had average grains per panicle of 133.533, 131.467 and 129.33. On the other hand, the control plants (T_1) had the least average grains per panicle of 108.600.

ANOVA showed significant differences among the treatment means on the number of grains per panicle. This implies that application of 25% to 100% seaweeds extract produced significantly greater number of grains per panicle than the control thus, it can be said that application of *Sargassum filipendula* extract promotes grain development to the rice plants.

The significant effect could be attributed to the presence of iron in seaweeds extract which gave special benefits to plants when supplied (Nabati, 1994). Furthermore, *Sargassum filipendula* contain more than 60 minerals. It has fair amount of nitrogen and potash but little phosphorous. It is particularly rich in micronutrients such as iron, copper, zinc, boron and manganese. (Wallace, 1966).

Plot yield

The plants sprayed with 100% seaweeds extract (T_5) had the highest average yield of 1.138 kilograms per plot, followed by the plants with 50% seaweeds extract (T_3) with an average yield of 1.120 kg per plot. On the other hand, the plants sprayed with 25% and 75% seaweeds extract (T_2 and T_4) had an average yield of 1.086 kg and 1.077 kg per plot while control plants (T_1) obtained the lowest average yield of 1.009 kg per plot. ANOVA revealed no significant difference between the treatment means which implies that the plants applied with kulafu seaweeds extract are comparable to the control in terms of plot yield.

Computed yield per hectare

The plants sprayed with 100% seaweeds extract (T_5) obtained the highest average yield of 5,685 kgs per hectare, followed by the plants sprayed with 50% seaweeds extract (T_3) with an average yield of 5,601.5 kgs per hectare. The plants sprayed with 25% and 75% seaweeds extract (T_2 and T_4) had average yield of 5,430 kgs and 5,385 kgs per hectare whereas control plants (T_1) had the lowest average yield of 5,045 kilograms per hectare. ANOVA revealed no significant difference between the treatment means with regards to rice yield per hectare.

Table 2. Computed average yield per hectare in kilograms.

Treatment	Average Yield
T_1 – Control	5045.0
T_2 - 25% seaweeds extract	5430.0
T_3 – 50% seaweeds extract	5601.5
T_4 – 75% seaweeds extract	5385.0
T_5 – 100% seaweeds extract	5685.0

Conclusion

Based on the results of the study, the application of 100% application *Sargassum filipendula* extract best promotes the maturity of rice plants among the treatments. Moreover, the application of varying concentration (25%, 50%, 75% and 100%) of *Sargassum filipendula* extract increase the average number of grains per panicle compared to the control however, it did not significantly affect height increment, number of tillers, final height and plot yield of rice plants.

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