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RESEARCH ARTICLE

PRELIMINARY GROWTH STUDIES IN RICE SEEDLINGS

***Gayathri, V. and Anusuya, S.**

Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore – 641043

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ABSTRACT

An experiment was conducted to study the influence of farm yard (FYM), chemical fertilizer (DAP), organic manure (neem cake) and leaf extract (*Ocimum basilicum*) on the growth and biochemical parameters of paddy (*Oryza sativa* L. var. IR 20). The paddy seeds soaked in water were transferred to petriplates containing cotton and filter paper. The germination was 100% in the plates. After transfer into pots, the growth of the seedlings was observed. The growth was evaluated on 30th and 45th day. The root length and shoot length were significantly higher in T_3 and T_4 on 30th day and 45th day respectively. The fresh and dry weight of the seedlings showed a significant increase in T_4 plants on both 30th and 45th day.

INTRODUCTION

Rice (*Oryza sativa* L.) is the most important staple food of more than three billion people in the world; most of them live in Asia, (Dwivedi *et al.,* 2014). Rice, the most important food crop in terms of direct consumption, is cultivated under a wide range of environment (Mohammed and Tarpley, 2009) and chemical fertilizer is the most important input required for rice cultivation. In the red soil regions, paddy is the main cereal crop, contributing 19% and 29% of the world rice area and rice production, respectively (Sun and Huang, 2011). In recent years, due to the rapid population growth and a continuous decline in the amount of cultivated land area, the rate of fertilizer application keeps on rising in order to obtain high crop production (Wang *et al*., 2010). Paddy soils are a group of anthropogenic soils with a long history of rice cultivation that are currently producing one-quarter of the grain consumed in China, representing an extremely important farming system in terms of global food security (Gong, 1999). A recent study argued that paddy soils should have greater organic carbon sequestration potential than dry cropland soils (Lal, 2002). Indian agriculture is moving rapidly towards commercialization, but many farmers still give primacy to cereals in their cropping system on the consideration of food security, low risk and easy market access.

Corresponding author: Gayathri, V.
Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore – 641043

The rice-wheat cropping system (RWCS) has been, and remains the most preferred cropping in Punjab, due to its comparative economic advantages, assured marketing and stable productivity levels (World Bank, 2003 and Sidhu *et al.,* 2010). Rice cultivation is the principal activity and source of income for millions of households around the globe and several countries in Asia and Africa are highly dependent on rice as a source of foreign exchange earnings and government revenue (FAO, 2009). Globally, rice is the second most important crop in terms of area, but as food, rice is an important crop since it provides more calorie than any other cereal (Islam *et al*., 2014).

MATERIALS AND METHODS

A study was conducted to assess the effect of different fertilizer and leaf extract on growth of *Oryza sativa* L. var. IR 20.

Collection of Various Materials

Red soil and clay soil were collected from Sundatty village, Kotagiri.

Collection of Seeds

The paddy seeds (*Oryza sativa* L. var. IR 20) were procured from Department of Grains, Tamil Nadu Agricultural University, Coimbatore.

Farm Yard Manure

Farm yard manure (FYM) is prepared basically using cow dung. It is highly useful and some of it's properties are

1. Farm yard manure is rich in nutrients.
2. A small portion of nitrogen is directly available to the plants, while, a large portion is made available as and when the FYM decomposes.
3. Availability of potassium and phosphorus from farm yard manure is similar to that from inorganic source.
4. Application of farm yard manure improves soil fertility.

Chemical Fertilizer

Di- Ammonium Phosphate

Di- Ammonium Phosphate (DAP) is used as a chemical fertilizer. When applied to plant, it temporarily increases the soil pH resulting in increased growth of the plant.

Organic Fertilizer

Neem Cake

Neem cake is an organic fertilizer for farms, gardens and lawns. Neem cake is the main product of neem seed kernel and contains natural nutrients.

Neem cake as fertilizer

Neem cakes have adequate quantity of NPK in organic form for plant growth. Being totally a botanical product, it contains 100 % natural NPK content and other essential micronutrients.

Use of neem cake as a fertilizer

1. Very cost effective.
2. Better yield than conventional urea and fertilizers.
3. Rich source of NPK and other micronutrients.
4. In comparison to urea which is a nutrient collector, neem cake itself contains nutrients for the plant and maintain power of soil.
5. Though neem cake is a fertilizer, it also acts as a pesticide.

Collection of *Ocimum basilicum*

Ocimum basilicum leaves were collected from Sundatty village, Kotagiri.

Herbal extract

Ocimum basilicum

The other names are basil, garden basil and sweet basil. The plant belongs to the family Lamiaceae. Basil is a low growing (30-100cm) annual plant. It has slightly hairy stem and ovate, entire to slightly toothed leaves. The plant is generally used in treatment for problems concerning digestion and nervous system. Leaves are taken (fresh or dried) in case of fever, abdominal cramps, gastro-enteritis, nausea and poor digestion. Leaf extracts were taken afresh by grinding the leaves in a mixie and filtering with the help of a muslin cloth.

Methods

The soil was cleaned by removing stones and other unwanted materials. The red soil and clay soil were mixed in the ratio of 1:1 and filled in pots having 5 kg capacity. A study was conducted to assess the effect of farm yard manure, chemical fertilizer (diammonium phosphate), organic fertilizer (neem cake) and leaf extract (*Ocimum basilicum*) on the growth of rice seedlings. The treatments were given at every 2 weeks interval i.e., on 15th day, 30th day and 45th day after sowing the seeds.

Treatments

T_0 - Control
T_1 - FYM
T_2 - DAP
T_3 - Neem Cake
T_4 - Leaf extract (*Ocimum basilicum*)

Germination Percentage

Paddy seeds were surface sterilized with 0.1% $HgCl_2$. Then, they were soaked in distilled water for 2 hours. Later, they were transferred to petriplates (200x20mm). After one week, the seeds were tested for germination. The germination percentage was calculated using the following formula

$$\text{Germination (\%)} = \frac{\text{Number of seeds germinated}}{\text{Number of seeds sown}} \times 100$$

Growth Parameters

Plant samples were uprooted carefully on 30th and 45th day and the following growth parameters were measured and recorded for all the treatments.

1. Root Length (cm)
2. Shoot Length (cm)
3. Fresh Weight (gm)
4. Dry Weight (gm)

Root Length (Shukla and Mishra, 1986)

The plants were taken from control pot and other treatment pots and washed to get rid off adhering soil particles. Then, the length of the roots were measured with the help of a scale from root collar point to root tip and expressed in centimeter.

Shoot Length (Shukla and Mishra, 1986)

The shoot length of the plants were measured with the help of scale from the root collar point to shoot apex and expressed in centimeter.

Fresh Weight (Shukla and Mishra, 1986)

Fresh weight of the plants were measured with the help of an electronic digital balance and expressed in grams.

Dry weight (Shukla and Mishra, 1986)

The collected plant materials were kept in hot air oven at 55°C for 24 hours. Then, the dry weight of the plants was measured using an electronic digital balance and expressed in grams.

RESULTS AND DISCUSSION

The paddy seeds sown in petriplates showed 100% germination (Plate 1). The germinated seeds were allowed to grow in petriplate for one week. Later, the seedlings were transferred to paper cups. After one week, the seedlings from cups were transferred to pots containing soil. Different fertilizers such as farm yard manure (FYM), di-ammonium phosphate (DAP), neem cake (NC), and leaf extract (LE) were added one week after transplantation into pots. The growth of the rice seedlings in terms of root length and shoot length were measured on 30th day and 45th day of the seedlings. The results of the experiment conducted in *Oryza sativa* L. var. IR 20 with farm yard manure, chemical fertilizer (di-ammonium phosphate), organic manure (neem cake) and leaf extract (*Ocimum basilicum*) on growth are given below.

Plate 1. Germination of paddy seeds

Growth parameters

Root length

The growth parameters of rice seedlings were analyzed on 30th and 45th day and tabulated in Table 1. The maximum root length was observed in T_4 on 30th day and 45th day and the readings were 7.47 ± 1.45 and 8.83 ± 1.19 cm respectively. The minimum root length was observed in T_2 on 30th day and T_3 on 45th day and the values were 6.23 ± 0.49 and 7.53 ± 0.76 cm respectively. Wang *et al.* (2008) have reported that the nitrogen supply in urea influenced the growth of maize plants especially in the roots. Ne Meat Alla and El-Geddawy (2001) has reported that the use of foliar spray of macronutrients significantly increases the root length of sugar beet.

Shoot length

The highest shoot length was obtained in T_3 (16.57 ± 2.43 cm) on 30th day and T_4 (18.83 ± 2.08cm) on 45th day (Table 1). The minimum shoot length on 30th day was found in control plants and on 45th day, the minimum shoot length was found in plants that were supplied with DAP. The values were 14.33 ± 1.91 and 17.17 ± 0.15 cm respectively. The results are in accordance with Shiralipour and Faber (1996) on broccoli (*Brassica Oleraceaves italica*) plant that had the tendency to increase the shoot length by the application of organic manure. This view has also been supported by Arisha *et al.* (2003) on the plant growth of broccoli. Irshad *et al.* (2002) also reported that manure and urea fertilizer enhanced maize plant growth as compared to control. Shah *et al*. (2007) has supported the view with their results showing that integrated use of urea could produce maximum growth in maize plant. The results of shoot length are in agreement with the findings of Babalad (1999) in soybaen, who have opined that there is a need of organic manure application along with inorganic fertilizer.

Table 1. Shoot length and Root length of rice seedlings

Treatment	Shoot Length (cm)		Root Length (cm)	
	30th Day	45th Day	30th Day	45th Day
T_0	14.33 ± 1.91	18.03 ± 0.15	7.37 ± 0.74	8.37 ± 0.83
T_1	15.70 ± 2.52	18.77 ± 0.83	7.03 ± 1.04	7.90 ± 1.29
T_2	16.37 ± 2.05	17.17 ± 0.15	6.23 ± 0.49	7.53 ± 0.76
T_3	16.57 ± 2.43	18.63 ± 0.35	6.63 ± 1.06	7.70 ± 1.31
T_4	16.23 ± 1.20	18.83 ± 2.08	7.47 ± 1.45	8.83 ± 1.19
SEd	1.33666		0.86204	
CD ($p<0.05$)	2.78824		1.79819	
CD ($p<0.01$	3.80342		2.45290	

Values are mean ± SD of triplicates

Fresh weight

The fresh weight was found to be higher in T_4 on both 30th and 45th day (Table 2). The values were 0.48 ± 0.02 g and 0.65 ± 0.04 g respectively. The minimum fresh weight was observed in T_2 on 30th and 45th day and the values were 0.26 ± 0.02 g and 0.31 ± 0.01 g respectively. The results are in accordance with the result obtained in broccoli by application of 60 and 80 kg organic manure along with 60 kg inorganic fertilizer (Ouda and Mahadeen, 2008).

Table 2. Fresh weight and Dry weight of rice seedlings

Treatment	Fresh Weight (g)		Dry Weight (g)	
	30th Day	45th Day	30th Day	45th Day
T_0	0.40 ± 0.02	0.50 ± 0.03	0.02 ± 0.01	0.04 ± 0.02
T_1	0.30 ± 0.01	0.42 ± 0.02	0.02 ± 0.01	0.05 ± 0.01
T_2	0.26 ± 0.02	0.31 ± 0.01	0.02 ± 0.02	0.03 ± 0.02
T_3	0.32 ± 0.01	0.36 ± 0.01	0.02 ± 0.01	0.03 ± 0.01
T_4	0.48 ± 0.02	0.65 ± 0.04	0.05 ± 0.01	0.09 ± 0.01
SEd	0.01513		0.00989	
CD ($p<0.05$)	0.03156		0.02063	
CD ($p<0.01$	0.04305		0.02814	

Values are mean ± SD of triplicates

Dry weight

The dry weight was found to be maximum in T_4 on 30th and 45th day (Table 2) and the values were 0.05 ± 0.01 g and 0.09 ± 0.01 g. The minimum dry weight of 0.02 ± 0.01 g was observed in all the treatments except T_4 on 30th day. A minimum dry weight of 0.03 ± 0.02 g and 0.03 ± 0.01 were observed in T_2 and T_3 on 45th day respectively. Wong *et al.* (1999) and Magnusson (2002) obtained an increase in weight by the use of organic manures in Chinesis cabbage (*B. Chinesis*). Manure enriches the soil. The word "Manure" most often refers to any kind of fertilizer. The benefit of using green manure by farmers is that, it adds organic matter to the soil by releasing important plant nutrients, including nitrogen and helps to increase crop growth. Thus, the use of manures that supply nutrients to the soil is needed for plant growth. To reduce carbon dioxide, methane and nitrous oxide, farmers

should be encouraged to discard organic waste instead of burning and also they showed be trained to use organic fertilizers instead of chemical fertilizers. The application of organic fertilizer in agriculture, particularly, in paddy field farming, would prevent pollution and conserve the environment.

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