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RESEARCH ARTICLE

ASSESSMENT OF BIOCHEMICAL PARAMETERS IN PADDY SEEDLINGS

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ABSTRACT

An assessment was done to investigate the effect of farmyard manure, DAP, neem cake and leaf extract on biochemical (viz., chlorophyll, protein and carbohydrate) parameters of paddy seedlings. The biochemical parameters were measured on 30th and 45th day. The values indicated that the chlorophyll '*a*', chlorophyll '*b*' and total chlorophyll contents were higher in T_4 on 30th day and 45th day. Similarly, the protein content was higher on 30th and 45th day in 0.5 ml extract of T_4 plants. In 1 ml of sample, on 30th day, the protein content was higher in T_1 and on 45th day, it was higher in T_4. The carbohydrate content of plants also increased in plants supplied with leaf extracts.

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INTRODUCTION

Non – leguminous plants like rice, maize and wheat belonging to the poaceae family form staple food for approximately 6.5 billion people around the world. An exponential rise in the world population indicates the need for increased crop production. This rise in production has been a result of the indiscriminate use of chemical fertilizers (NPK) in combination with advanced technology. Nitrogen fertilization of non-leguminous crops is one of the most expensive inputs in agriculture (Bhattacharjee *et al*., 2008). The high-yielding rice variety has resulted in an increase in rice production but requires large amounts of chemical fertilizers, leading to health hazards and environmental pollution. Recently, there is a growing interest in plant growth – promoting rhizobacteria (PGPR) due to their efficacy as biological control and growth promoting agents in many crops (Thakuria *et al*., 2004; Joseph *et al*., 2007). The macro and micronutrients in the soil is considered to be most essential for the growth and yield of plant. The plants cannot complete their life cycle without the mineral nutrients that are responsible for the metabolic functions of the plants (Choudhary and Panda, 2005). The major determinant of the success or failure of a crop production depends on the availability of plant nutrients either naturally/artificially in soil.

The main source to replenish the plant nutrients in agricultural soils include organic, inorganic and bio-fertilizers (Masarirambi *et al*., 2012). For a sustainable crop production, no single source of plant nutrients can meet the total nutrient requirement. The use of chemical fertilizer in agriculture is increasing and this reduces the fertility of soil by reducing the soil health. Soil health is needed for sustainable crop productivity (Korsaeth *et al*., 2002).

MATERIALS AND METHODS

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

Collection of various materials

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

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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 it improves the fertility of the soil.

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. It is a rich source of NPK and other micronutrients. It also acts as a pesticide.

Collection of *Ocimum basilicum*

Ocimum basilicum leaves were collected from sundatty village, Kotagiri.

Herbal extract

Ocimum basilicum

The plant belongs to the family Lamiaceae. Basil is a low growing (30-100cm) annual plant. 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 (di-ammonium phosphate), organic fertilizer (neem cake) and leaf extract (*Ocimum basilicum*) on the biochemical parameters of paddy 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*)

Biochemical Parameters

1. Chlorophyll - estimated on 30th and 45th day of seedling
2. Protein - estimated on 30th and 45th day of seedling
3. Total carbohydrate - estimated on 30th and 45th day of seedling

The above parameters were estimated by collecting leaf samples at that particular stage of growth. Chlorophyll '*a*', '*b*' and total chlorophyll were analysed following the method of Arnon (1949). The protein content of the seedlings was estimated using Lowry *et al*. (1951). Carbohydrate content was estimated using Anthrone method of Hedge and Hofreiter (1962)

RESULTS AND DISCUSSION

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 the biochemical parameters are given below. The biochemical parameters such as chlorophyll *a*, chlorophyll *b*, total chlorophyll, protein and carbohydrate content of the paddy seedlings were analyzed on 30th and 45th day and the results are tabulated.

Chlorophyll content

The maximum chlorophyll '*a*' was observed in T_4 on 30th day (Table 1) and the value was found to be 8.74 ± 0.01 mg/g. On 45th day, the chlorophyll content increased in T_4 and the value was 11.33 ± 0.04 mg/g. The chlorophyll '*b*' content was more in T_4 on 30th day (4.81± 0.03 mg/g). On 45th day, the maximum chlorophyll '*b*' was found in T_4 and the value was 9.18 ± 0.02 mg/g (Table 1). The highest total chlorophyll content was obtained in T_4 on 30th day (Table 1) and the value was 4.40 ± 0.05 mg/g. On 45th day again, the maximum total chlorophyll content was found in T_4 and it was 8.22 ± 0.03 mg/g.

Least chlorophyll content was observed in control plants (T_0) on both 30th and 45th day. The amount of chlorophyll '*a*' was found to be 1.87 ± 0.02 and 4.63 ± 0.02 mg/g. The least chlorophyll '*b*' content on 30th and 45th day was found to be 2.50 ± 0.05 and 4.78 ± 0.04 mg/g. The lowest total chlorophyll content of 2.28 ± 0.01 and 4.24 ± 0.01 mg/g were obtained on 30th and 45th day respectively in control plants. The observations of the present work agree with the previous findings obtained in other vegetable crops (Arisha and Beadisi, 1999 and Al-Tarawneh, 2005). Abbasniayzare *et al*. (2012) have shown that the use of biofertilizers (NK and Barvai) increases the chlorophyll content in plants.

Protein content

The protein content of rice seedlings were measured on 30th and 45th day (Table 2). The readings were taken by using 0.5ml and 1ml of sample. The highest protein content in 0.5 ml of sample on 30th day was observed in T_4 plant and the reading was 8.41 ± 0.04 mg/g, and in 1 ml sample, it was higher in T_1 on 30th day and the reading was 9.46 ± 0.06 mg/g.

Table 1. Chlorophyll "*a*", chlorophyll "*b*" and "total" chlorophyll content of rice (*Oryza sativa* L.) seedlings (mg/g)

Treatment	Chlorophyll 'a' (mg/g)		Chlorophyll 'b' (mg/g)		Total Chlorophyll (mg/g)	
	30th day	45th day	30th day	45th day	30th day	45th day
T_0	1.87 ± 0.02	4.63 ± 0.02	2.50 ± 0.05	4.78 ± 0.04	2.28 ± 0.01	4.24 ± 0.01
T_1	8.27 ± 0.04	7.93 ± 0.01	4.27 ± 0.02	8.60 ± 0.050	3.90 ± 0.03	7.64 ± 0.02
T_2	6.05 ± 0.02	8.71 ± 0.05	3.12 ± 0.01	8.90 ± 0.03	2.85 ± 0.03	7.94 ± 0.03
T_3	5.54 ± 0.05	8.36 ± 0.03	3.06 ± 0.03	8.97 ± 0.01	2.82 ± 0.04	7.95 ± 0.05
T_4	8.74 ± 0.01	11.33 ± 0.04	4.81 ± 0.03	9.18 ± 0.02	4.40 ± 0.05	8.22 ± 0.03
SEd	0.02625		0.02620		0.02625	
CD(p<0.05)	0.05475		0.05466		0.05475	
CD (p<0.01	0.07468		0.07456		0.07468	

Values are mean ± SD of triplicates

Table 2. Protein content of rice (*Oryza sativa* L.) seedlings (mg/g)

Treatment	30th day		45th day	
	0.5 ml	1 ml	0.5 ml	1 ml
T_0	1.05 ± 0.07	5.04 ± 0.04	1.36 ± 0.01	1.06 ± 0.02
T_1	3.25 ± 0.05	9.46 ± 0.06	7.59 ± 0.01	6.20 ± 0.04
T_2	1.20 ± 0.05	7.61 ± 0.03	1.06 ± 0.03	7.20 ± 0.02
T_3	6.02 ± 0.08	4.60 ± 0.02	2.31 ± 0.01	4.80 ± 0.01
T_4	8.41 ± 0.04	7.04 ± 0.04	8.80 ± 0.05	7.40 ± 0.05
Sed	0.03350			
CD(p<0.05)	0.06771			
CD (p<0.01)	0.09060			

Values are mean ± SD of triplicates

Table 3. Carbohydrate content of rice (*Oryza sativa* L.) seedlings (mg/g)

Treatment	30th day		45th day	
	0.5 ml	1 ml	0.5 ml	1 ml
T_0	8.00 ± 1.00	11.33 ± 1.53	16.33 ± 1.53	42.67 ± 2.08
T_1	34.33 ± 1.53	60.00 ± 1.00	46.33 ± 1.53	80.67 ± 2.08
T_2	12.33 ± 2.52	26.67 ± 5.86	35.00 ± 3.61	44.00 ± 2.00
T_3	38.00 ± 1.00	68.33 ± 1.53	54.33 ± 2.52	72.67 ± 3.06
T_4	48.33 ± 1.53	94.00 ± 2.00	86.67 ± 3.06	104.33 ± 3.51
SEd	2.03852			
CD(p<0.05)	4.12009			
CD (p<0.01	5.51311			

Values are mean ± SD of triplicates

On 45th day, the protein content increased in T_4 in both (0.5ml and 1ml) sample and the values were found to be 8.80 ± 0.05 and 7.40 ± 0.05 mg/g respectively. The lower protein content was observed in control plant on 30th day in 0.5ml of sample and the reading was 1.05 ± 0.07 mg/g. In 1ml sample, minimum protein content was found in T_3 on 30th day and the reading was 4.60 ± 0.02 mg/g. On 45th day, the protein content decreased in T_2 in 0.5ml and it was 1.06 ± 0.03 mg/g. The minimum protein content of 1.06 ± 0.02 mg/g was obtained in control plants on 45th day in 1ml sample. Experiment in chick pea by Mohammadi *et al*. (2010) reveals that application of green manure increases the protein content of the seed. In *Amaranthus dubius*, Manoharan *et al.* (2011) showed an increase in the amount of carbohydrate and protein content in plant treated with cyanospray compared to other treatments.

Carbohydrate content

The carbohydrate content on 30th as well as 45th day was higher in T_4 plants in both 0.5ml and 1ml sample (Table 3) and the (30th day) values were found to be 48.33 ± 1.53 and 94.00 ± 2.00 on 30th day and 86.67 ± 3.06 and 104.33 ± 3.51mg/g on 45th day respectively. Minimum carbohydrate content was shown by control plants on 30th and 45th day. The readings were observed to be 8.00 ± 1.00 and 11.33± 1.53 mg/g on 30th day and 16.33± 1.53 and 42.67 ± 2.08 mg/g on 45th day. Rajula and Padmadevi (2000) has recorded an increase in biochemical parameters like chlorophyll, protein and carbohydrate in *Helianthus annus* L. by the use of cyanopith and cyanospray. 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. The use of nitrogen, the main nutrient element in crop growth, tends to be inefficient. A great deal of applied nitrogen is lost by leaching, volatilization and other natural processes. This is not only wasteful, but burdens the natural environment with excessive nitrogen. The problem is particularly marked in paddy fields, since nitrogen losses are high under flooded conditions. The nutrient retaining capacity of the soil is less when the soil lacks organic matter.

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