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Analysis of biochemical and yield parameters of *Zea Mays* (Corn) cultivated in the field supplemented with coir pith based cyanobacterial biofertilizers

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Abstract

In recent years, the organic biofertilizer and organic food production place a major role in the world. The cyanopith biofertilizer is an organic biofertilizer produced by biodegradation of coir pith using cyanobacteria (Cyanopith and Cyanospray). The effects of basal, foliar spray and combined application of basal with foliar spray of coir pith based cyanopith biofertilizer on *Zea mays* (corn) were determined by analysis of the yield and biochemical parameters of control and test plants after treatments. The present investigation showed that the combined application of basal with foliar spray of cyanopith biofertilizers significantly increased the yield and biochemical parameters of *Zea mays.*

Key words: Cyanobacteria, Cyanopith, Cyanospray, *Zea mays.* Maize, *Oscillatoria annae*

Introduction

Organic agriculture is one among the broad spectrum of production methods that are supportive of the environment. The demand for organic food is steadily increasing both in the developed and developing countries with an annual average growth rate of 20–25%. Organic agriculture, without doubt, is one of the fastest growing sectors of agricultural production (Ramesh *et al.,* 2005). The cyanobacteria oxygen evolving photosynthetic prokaryotes are found in varied aquatic and terrestrial habitats in nature as well as in association with other organisms. Cyanobacteria are capable of abating various kinds of pollutants and have advantages as potential biodegradating organisms (Malliga and Viswajith, 2005). The wastes of coir yarn industry get accumulated in large quantities making their disposal difficult, though it is used as soil conditioner. Malliga *et al*., (1996) have reported that *Anabena azollae* while being used as a biofertilizer exhibited lignolysis and release of phenolic compounds which induced profuse sporulation of the organism. This report gives the usefulness of coir pith as carrier for cyanobacterial biofertilizer with supporting enzyme studies on lignin degrading ability of cyanobacteria and use of lignocellulosic coir pith as an excellent and inexpensive carrier for cyanobacterial biofertilizer. *Oscillatoria annae* grow luxuriantly along with coir pith in field condition. During degradation the color of the medium changed from colorless to brown, this indicated the release of phenolic compounds in to medium. Combined effect of basal and foliar application of coir pith based cyanobacterial biofertilizer showed positive impact on the growth of *Basella rubra* L. (Christopher *et al.,* 2007). Maize (*Zea mays*) is an important cereal crop of the world. The per capita consumption of maize in some countries exceeds 100 kg per year (Paterniani, 1990; Pandey and Gardner, 1995). Hence the present investigation has been selected to study the effect of cyanopith biofertilizer on the yield and nutritional values of *zea mays***.**

Materials and Methods

Filed experiments were conducted at Bharathidasan University, Tiruchirappalli, Tamil Nadu, India, during karief season of 2009. Coir pith was collected locally from a coir yarn industry. The culture of *O. annae* was inoculated into coir pith in 1:10 ratio (wet: dry weight) for mass cultivation in a pit. After 20-25 days of incubation, the whole content was separated into pellet and supernatant. The dried pellet (Cyanopith) was used as a basal fertilizer and the supernatant (Cyanospray) was used as foliar spray for cultivation of *Zea mays* L. The cyanobacterial Biofertilizer was applied in different concentrations of foliar spray (S-0.1% to S-0.5%), Basal fertilizer (B-25g, B-50g, B-100g), combined application of spray with basal (S-0.4% + B-25g, S-0.4%, +B-50g, S-0.4% +B-100g) and plants without any treatment was used as control. The experiments were conducted in a completely randomized block design with three replicated at each treatments. Observations were made from selected plants for each experiment after 90 days. The effect of the treatments was studied on parameters like yield and nutritional values such as chlorophyll *a*, chlorophyll *b* (Arnon, 1949), protein (Lowry *et al*., 1951), carbohydrate (Yemm and willis, 1954), sugars (Yemm and willis, 1954). Data were analyzed following analysis of various (Anova) technique and mean separations were adjusted by the multiple

comparison test. Means were compared by using Fisher's LSD test at 5% level of significance.

Results and Discussion

Application of spray, basal separately and combined application of spray and basal of cyanopith biofertilizer on *zea mays* showed interesting results. Among this the combined application of spray with basal (S – 0.4% + B – 25g) showed higher yield when compared with control and other treatments (Fig. 1). Moreover, continuous application of blue green algae to the rice fields for at least three to four consecutive seasons sustained the high crop yield at reduced level of commercial nitrogen (Kannaiyan, 1993). Singh and Rajodia, (2001) found a significant increase in number of leaves, fresh weight of leaves and roots and yield of raddish followed by the addition of gibberellic acid (30 ppm). They also reported that the increase in vegetative characters may be due to cell division and quick cell multiplication.

Chlorophyll *a*, Chlorophyll *b* also increased in the combined application of basal and sprays (S-0.4%+B-25g) on cyanopith biofertilizer when compared with control and other treatments (Fig. 2). According to Mahla *et al.*, (1999) application of NAA and mixtalol NAA spray increased chlorophyll contents in leaves, thereby increased photosynthetic efficiency over control. This might have led to provide more assimilates for better modulation. The chlorophyll *a* content was maximum in *Oscillatoria annae* with *Lantana camara* 500ppm, whereas chlorophyll *b* increased-in *Oscillatoria annae* with *Prosopis juliflora* 250ppm and carotenoids in *Oscillatoria annae* with *Prosopis juliflora* 1000ppm treated plants. The reduction in chlorophyll content on treatment with lignocellulosic control indicates that its application had a negative impact on the growth of *Tagetes erecta*. However, the *Oscillatoria annae* treated foliar spray did not have any inhibitory effect on *Tagetes erecta* (Viswajith, 2009).

Fig. 1. Analysis on yield of *Zea mays* by using coir pith based cyanobacterial biofertilizer

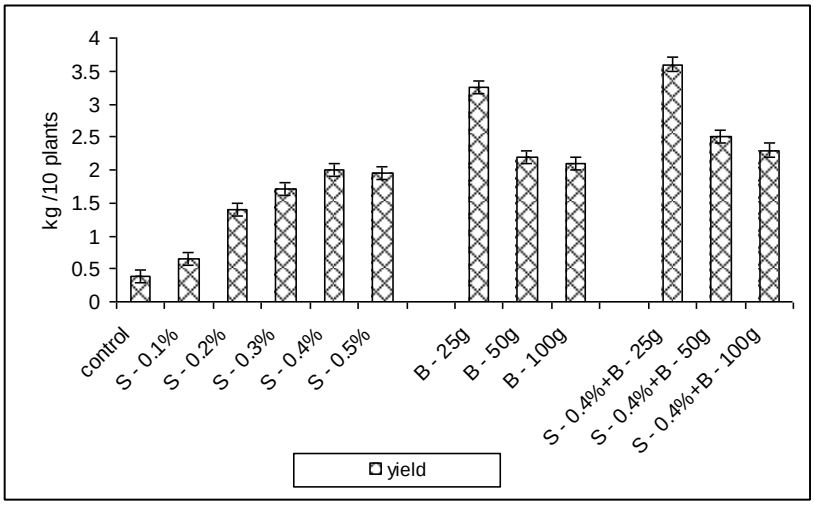
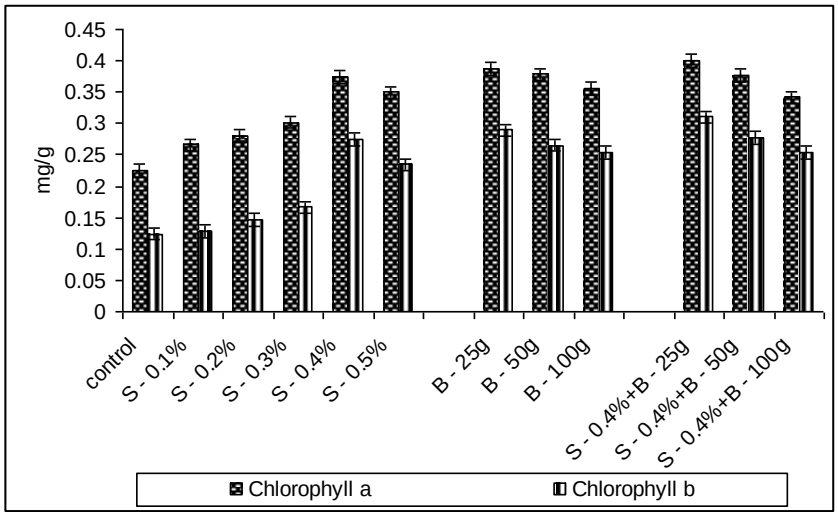


Fig. 2. Analysis on nutritional values of *Zea mays* by using coir pith based cyanobacterial biofertilizer



S- Cyanospray
B- Cyanopith Basal

Combined application of basal with spray on cyanopith biofertilizer showed the maximum protein and sugar content when compared with control and other treatments (Fig. 3). Rajula and Padmadevi, (2000) also showed increase in biochemical contents like protein, carbohydrate, amino acid in the seedling of *Helianthus annuus* L. grown in effluent blended with cyanobacteria. Varalakshmi, (2007) reported the ability of *Oscillatoria annae* to convert tryptophan to IAA. The effect of *O. annae* based IAA foliar spray on morphology and biochemistry of *Oryza sativa*, *Helianthus annuus* and *Hibiscus esculentus* showed significant results.

Carbohydrate content was also increased in the combined application of spray with basal of cyanopith biofertilizer when compared with control and other treatments (Fig. 4). Uma and Kannaiyan, (1995) stated inoculation of immobilized cyanobacteria polyurethane foam improved the total carbohydrate, protein, amino nitrogen and chlorophyll content of the seedlings significantly. Also they reported higher growth, nitrogenase activity, ammonia excretion and heterocyst frequency than free-living cultures.

Fig. 3. Analysis on nutritional values of *Zea mays* by using coir pith based cyanobacterial biofertilizer

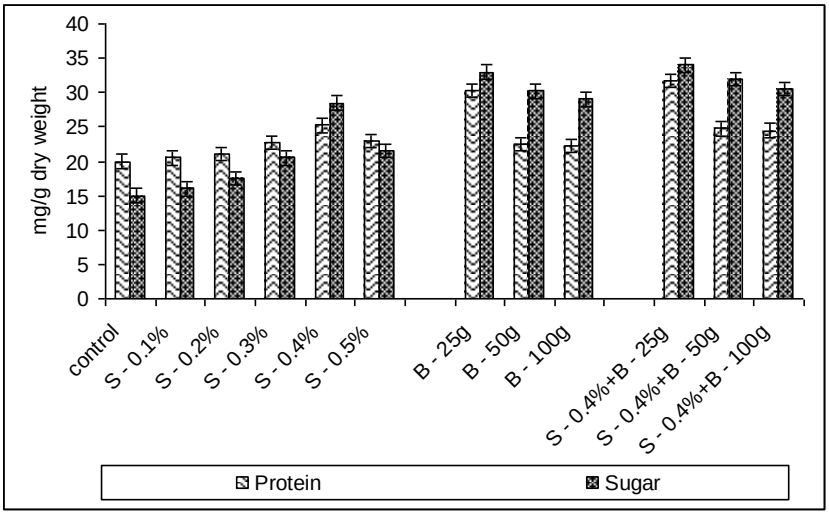
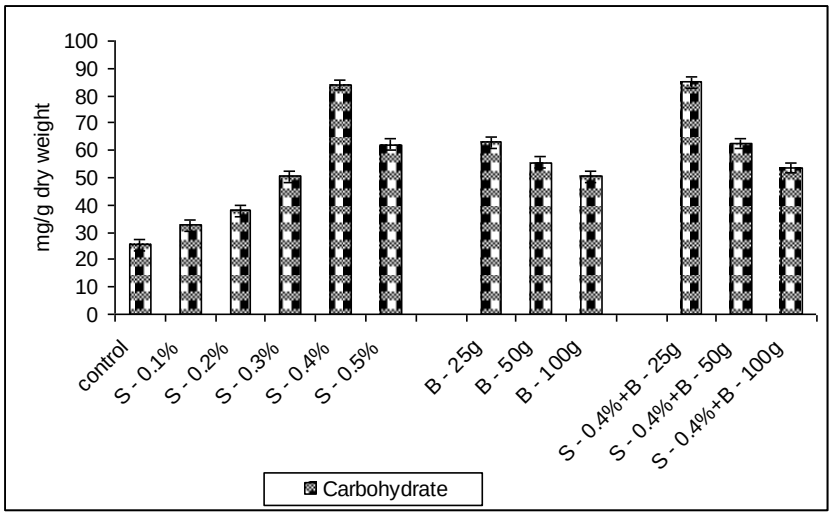


Fig. 4. Analysis on nutritional values of *Zea mays* by using coir pith based cyanobacterial biofertilizer



S- Cyanospray
B- Cyanopith Basal

Conclusions

Thus the present investigation proved that the combined application of spray and basal showed better yield and nutritional values when compared to other treatments of *Zea mays* plant. The cyanopith biofertilizer adds nutrients to soil, releases plant growth promoting substance, increases soil organic condition, improve soil structure, water holding capacity, reduces soil crusting problems, reduces erosion from wind and

water and improves buffering capacity against fluctuation in pH level of soil.

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