EVALUATION OF COST EFFECTIVE ORGANIC FERTILIZERS

*A. Dubey and D. K. Dubey

Research & Development Centre, Kilpest India Ltd., Govindpura, Bhopal, 462023, (M.P), India

*Corresponding author

E-mail: alka.dubey01[a]gmail.com

ABSTRACT

Organic farming/products are becoming very necessary in today's world to control ecosystem health and to impart related human health benefits, world over there is growing demand for organic produce. A field experiment was conducted at the research farm of Kilpest India Ltd., Bhopal, during 2009 on rice using BGA *Chlorella pyrenoidosa* and *Nostoc muscorum* and biological hydrolysate of Soybean .These treatments were compared with recommended dose of Fytozyme. Currently, fytozyme (40% chemically hydrolysed protein solution) is being used as organic fertilizer world over which was taken as positive control. Cost of all the organic amendments were considered and kept at par with the Fytozyme. Results revealed a significant increase in growth parameters and straw yield in plot treated with *Chlorella pyrenoidosa*. Grain yield was also higher in *C. pyrenoidosa* (3.35 t/ha) followed by Fytozyme (3.05 t/ha) and *Nostoc* as well as biological Soy hydrolysate (both 2.81 t/ha). Thus concluding a better viable organic product.

Key Words

Rice, organic farming, organic materials, crop productivity,

INTRODUCTION

Soil fertility is diminishing gradually due to soil erosions, loss of nutrient, accumulation of salts and other toxic elements, water logging and un-balanced nutrient compensation. Organic wastes and bio-fertilizers are the alternate sources to meet the nutrient requirement of crops and to bridge the future gaps. Farming regions that emphasizing heavy chemical application led to adverse environmental, agricultural and health consequences. Many efforts are being exercised to combat the adverse consequences of chemical farming (Faheed *et al.* 2008). Bio-fertilizer, organic manuring and bio-control have emerged as a promising component of integrating nutrient supply system in agriculture.

Organic farming production system aims at promoting and enhancing agro-ecosystem health, biodiversity, biological cycles and soil biological activities. Crop plants remove varying amounts of different nutrients from soil and to compensate the loss from the soil, organic amendments rich in nutrients must be added (Singh & Mandal 2000).In organic farming micro- & macro- organisms deliver a smorgasbord of minerals, vitamins and other nutrients to the crop at a metered place.

Seaweeds are the macroscopic marine algae and its use as manure in farming practices is very ancient and was prevalent among the Romans and also practiced in Britain, France, Japan, Spain and China. The seaweeds are used directly or after composting (Thirumaran G. *et al.,* 2009).

Microbiological fertilizers are important to environment friendly stainable agricultural practices (Bloemberg *et al.*, 2000). They can be conveniently produced on sewage and brackish water and partially substituted the chemical fertilizers to avoid environmental pollution.

Blue-green algal extract excretes a great number of substances that influence plant growth and development (Ordog, 1999). These microorganisms have been reported to benefit plants by producing growth promoting regulators, vitamins, amino acids, polypeptides, antibacterial and antifungal substances that exert phytopathogen biocontrol and polymers, especially exopolysaccharides, that improve plant growth and productivity (Zaccaro *et al.*, 1999). Adam (1999) found that algal filtrate of the cyanobacterium *Nostoc muscorum* significantly increased germination of wheat seeds as well as their growth parameters and nitrogen compounds, compared to controls. Also, Lozano *et al.* (1999) stated that, the application of an extract from algae to soil or foliage increased ash, protein and carbohydrate contents of potatoes.

In the light of above mentioned reviews, it was of particular interest to evaluate the organic fertilizer in order to improve the yield quality and productivity of Rice.

MATERIALS & METHODS

Experimental site:

The field experiments were performed at research field of Kilpest India Ltd., Bhopal, M. P. during the Kharif seasons 2009/10 in Randomized Blocked design with a plot size of $36ft^2$ each. For experiment scented variety Pusa Basmati-1 variety of rice was taken.

Organic fertilizers:

In this experiment different treatments comprising organic amendments such as Blue Green Algae (*Chlorella pyrenoidosa*, and *Nostoc muscorum)*, biological Soy hydrolysate, and Fytozyme each were applied to test in organic crop production. Fytozyme is well established product in market; it is chemical hydrolysate of soya protein loaded at 7%on bentonite granules. Similar to this a biological hydrolysate of soya protein was prepared using bacteria *Lactobacillus sp.* at R&D centre of Kilpest.

Chlorella pyrenoidosa and *Nostoc muscorum* were procured from NCIM, Pune and were cultivated at R&D centre, Kilpest in BG11 media at temperature 25$\pm$ 2°C and surface light of 2500 lux (measured by Goosen luxmetre) for 20 days. After 20 days cell number was determined by taking 0.1 mm deep having Improved Naubauer Hemocytometer ruling (A.O. Spencer "Bright Line"). The thick wet biomass with cell count of $2x10^9$ mm^3 /mL algal suspension was harvested and loaded on blank bentonite granules to use for experiment.

Treatment:

Presently, Fytozyme gr is used by farmer at the dose of 20kg/ha which is available at the cost of 1USD/kg as a biofertilizer. Treatment of all organic amendments was done considering cost as a limiting factor and was at par with the Fytozyme. Fytozyme, biological Soy hydrolysate, as well as Algal culture (both *Chlorella pyrenoidosa* and *Nostoc muscorum*) were loaded on blank granules and were applied at the dose of 20kg/ha.

These treatments were compared with absolute control as well as with Fytozyme which is considered as a positive control.

The observations on plant growth, grain yield, and soil nutrients were taken as per standard procedures.

RESULTS AND DISCUSSION

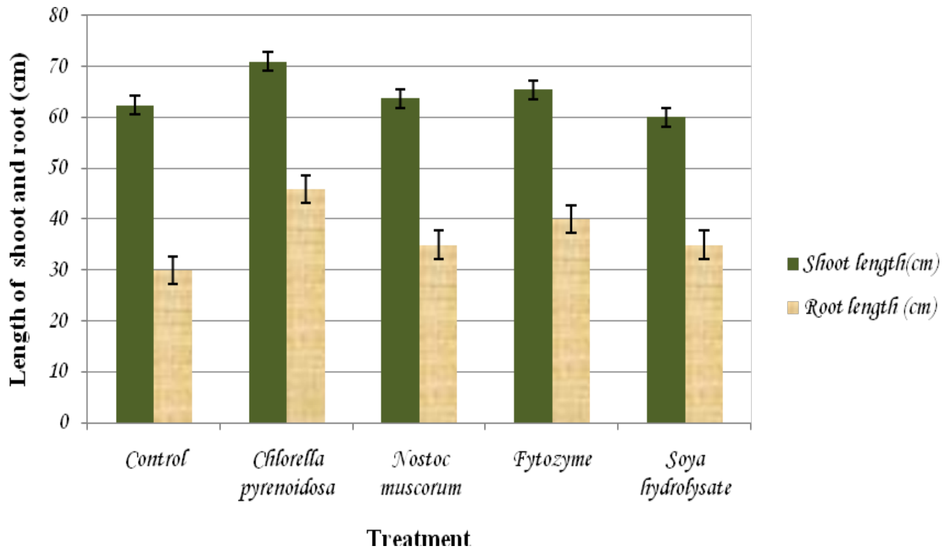
Treatments in the present study, caused significant increase in shoot and root length compared with those of control (Fig. 1a). The best result was found with the *Chlorella pyrenoidosa* treatment followed by biological Soy hydrolysate, Fytozyme and *Nostoc muscorum*. This resulted due to the improved nutrients status of plants because of the presence of organic amendments in the soil.

Similar trends were found by Al-Gosaibi (1994), Shaaban and Mobarak (2000), Mahmoud and Amara (2000), Mekki *et al.* (1999) and Galal *et al.* (2000). Such observations might prompt a reduction in the use of chemical fertilizers, the consequent pollution and health hazard as reported by Verma (1996).

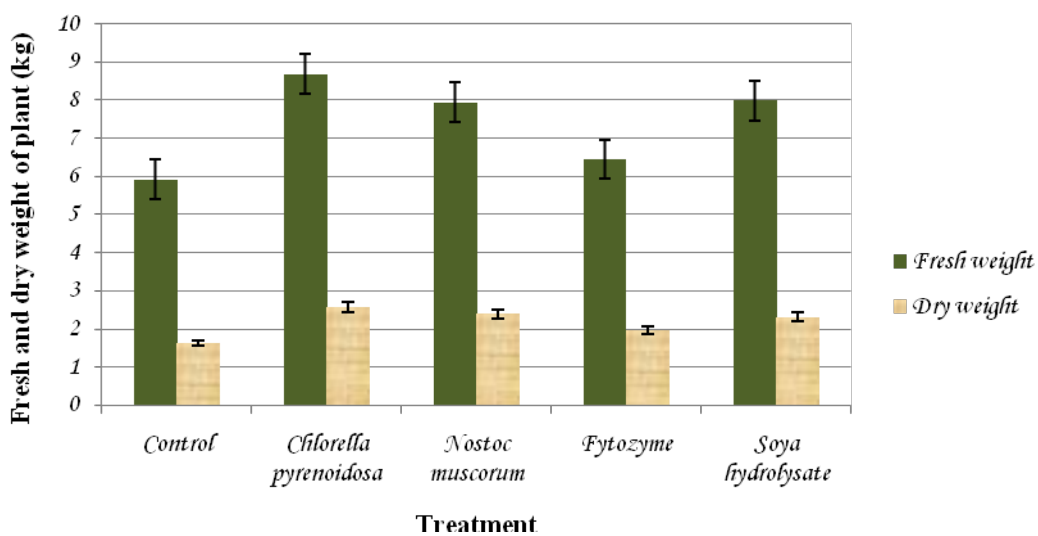
Increase in dry weight accumulation as well as plant height is a result of improving the nutrient status in the plant tissues caused by the presence of *Chlorella*. Fresh and dry weights were found to be increased significantly ($p< 0.01$) with the addition of different fertilizers (Fig.2)

Fig. 1 Effect of biofertilizers on growth parameters [(a). Shoots and root length of plant; b). Fresh and dry weight of plant]

(a)



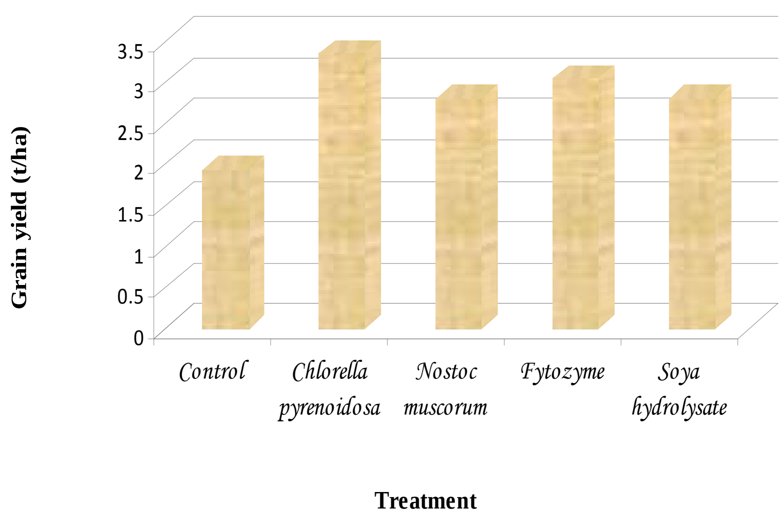
(b)



Both grain and straw yield also increased significantly in plants treated with different fertilizers. Fayza A. Faheed (2008) reported an improved agronomic parameters viz., green fodder and yield in Lettuce inoculated with *Chlorella vulgaris*. The effect of biofertilizers on ear length of the plant also caused significant increases. An increased ear length i.e. 6.05% over the control was found in *C. pyrenoidosa*. Increase in ear length may increase the number of grains in spikes besides increasing the size of the grain. Kumar and Balasubramanian (1986) have shown an increase in grain size of rice as a result of biofertilizer application.

Fytozyme is a good and established product of market and is best in promoting growth and enhancing agronomic quality. However, the results shows that the highest increase in yield was found in the plot treated with *C. pyrenoidosa* (3.35 t/ha). It is evident that the increases in plant height, leaf number and leaf area have contributed to increased yield plots supplied with *Chlorella*. Similar results were reported earlier by Shaaban (2001) in Maize inoculated with *Chlorella vulgaris*. However, plots supplied with biological Soya hydrolysate and *Nostoc* shows fewer yields then that of positive control (Fig.2)

Fig. 2 Effect of organic amendments on crop yield



CONCLUSION

Organic amendments so used enhances soil fertility, plant nutrient status, saves cost of secondary- and micro-nutrients required for obtaining good yields and leads to less environmental pollution. It was proved by highly significant increase in yield and soil fertility in the plot treated by *Chlorella*. Hence, it can be concluded that *Chlorella pyrenoidosa* may prove as better organic fertilizer then the positive control Fytozyme at the same cost and dose for farmer.

ACKNOWLEDGEMENT
The author is grateful to Kilpest India Limited for their fund and cooperation.

REFERENCES

1. Adam MS, 1999. The promotive effect of the cyanobacterium *Nostoc muscorum* on growth of some crop plants. Acta Microbiol. Polo., 48: 163–71

2. Al-Gosaibi AM, 1994. Use of algae as a soil conditioner for improvement of sandy soils in Al-Ahasa. J. Agri. Sci., 19: 1877–83.

3. Bloemberg GV, Wijfijes AHM, Lamers GEM, Stuurman N, Lugtenberg BJJ, 2000. Simulataneous imaging of *Pesudomonas flourescens* WCS 3655 populations expressing three different autofluorescent proteins in rizosphere: new perspective for studying microbial communities. Mol. Plant Mic. Int., 13: 1170–6

4. Fayza A Faheed and Zeinab Abd-El Fattah, 2008. Effect of *Chlorella vulgaris as* Bio-fertilizer on Growth Parameters and Metabolic Aspects of Lettuce Plant.. J. Agri. Soc. Sci.,4: 165-169.

5. Galal YGM, EL-Ghandour, Aly IA, Soliman SS, Gadalla A, 2000. Non-isotopic method for the quantification of biological nitrogen fixation and wheat production under field conditions. Biology and Fertility of Solis. 32: 47–51.

6. Kumar K, Balasubramanian A, 1986. Field evaluation of different method of Azospirillum inoculation in rice. National Seminar on Microbial Ecology, Jan 23-24.Department of Agri. Microbiology, Tamil Nadu Agri. University, Coimbatore, India:15.

7. Lozano MS, Star Verde J, Maiti RK, Oranday CA, Gaona RH, Aranda HE and Rojas GM, 1999. Effect of an algal extract and several plant growth regulators on the nutritive value of potatoes (*Solanum tuberosum* L. var. gigant). Archives Latinoamericanos de Nutricion,, 49: 166- 170.

8. Mahmoud HAF, Amara MAT, 2000. Response of tomato to biological and mineral fertilizers under calcareous soil conditions. Bulletin of the Faculty of Agriculture Cairo University. 51: 151–74.

9. Mekki BB, Selim MM, Saber MSM, 1999. Utilization of biofertilizers in field crop production, effect of organic manuring, chemical and bio-fertilizers on yield and nutrient content of millet grown in a newly reclaimed soil. Egypt J. Agron., 21: 113–24.

10. Ordog V, 1999. Beneficial effects of microalgae and cyanobacteria in plant/soil systems, with special regards to their auxin- and cytokinin- like activity. International workshop and training course on microalgal biology and biotechnology. Mosonmagyarovar, Hungary, June. 13-26.

11. Shaaban MM, Mobarak ZA, 2000. Effect of some green plant material as soil additives on soil nutrient availabilitry, growth, yield and yield components of faba bean plants. J. Agri. Sci., 25: 2005–2016.

12. Shaaban MM, 2001. Nutritional status and growth of maize plants as affected by green microalgae as soil additives. J. Biol. Sci., 1(6): 475-479.

13. Singh YV, Mandal BK, 2000. Rate of mineralization of Azolla, other organic materials and urea in water logged soils. Trop. Agr. (Trinidad)., 77 (1): 119-122.

14. Thirumaran G, Arumugam M, Arumugam R, Anantharaman P, 2009. Effect of seaweed liquid fertilizer on growth and pigment concentration of *Cyamopsis tetrogonolaba* (L) Taub. American-Eurasian J. Agron., 2 (2): 50-56.

15. Verma OPS, 1996. Integrated nutrient management in pearl millet (*Pennisetum glacucum*) under rainfed conditions. Indian J. Agron., 41: 58.

16. Zaccaro de Mule MC, Caire G, Cano M, Palma M, Colombo K, 1999. Effect of cyanobacterial inoculation and fertilizers on rice seedlings and post harvest soil structure. Comm. Soil Sci. Plant Anal., 30: 97- 107.