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Short Communication

Effect of Liquid Biofertilizer on the Growth Parameters of *Zea mays, Vigna mungo* and *Vigna radiata*

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Abstract

Effect of prepared liquid biofertilizers- *Azospirillum*, plant growth promoting rhizobacteria (PGPR) and vescicular-arbuscular mycorrhizae (VAM) was tested in three different crop plants *viz.*, maize, black gram and green gram. Plant growth parameters such as plant height, root length and plant weight was recorded. Plant height and weight of maize treated with PGPR significantly increased i.e., 20 cm and 1.72 g respectively compared with the control. Root length was increased maximum in the plant treated with VAM compared with the control i.e., 18.5 cm. The study shows that the liquid biofertilizers are capable of promoting plant growth.

Keywords

Azospirillum

Biofertilizer

PGPR

Plant growth

VAM

Introduction

Green revolution technologies such as greater use of synthetic agrochemicals like fertilizers and pesticides, adoption of nutrient-responsive, high-yielding varieties of crops, greater exploitation of irrigation potentials has boosted the production output in most cases. However, continuous use of these high energy inputs indiscriminately now leads to decline in production and productivity of various crops as well as deterioration of soil health and environment. Using chemical fertilizers to increase the crop production is becoming highly essential for most of the developing countries. Biologically fixed nitrogen is such a source which can supply an adequate amount of nitrogen to the plants and other nutrients to some extent. It is a non-hazardous way of increasing soil fertility. Biofertilizer are more beneficial than inorganic fertilizers, cost effective, eco-friendly and renewable source of plant nutrients to supplement chemical fertilizers. Biofertilizers also play a vital role in maintaining long term soil fertility and sustainability (NIIR, 2012).

India has made spectacular breakthrough in production and consumption of fertilizers during the last four decades. But consumption of chemical fertilizers for agricultural crops will be quite a limiting factor for increasing agriculture production in future. Because of escalating energy cost, chemical fertilizers are not available at affordable prices to farmers. Moreover, the unbalanced and continuous use of chemical fertilizers is leading to reduction in crop yields and in imbalance of nutrients in the soil which has adverse effect on soil health (Bronick and Lal, 2005).

Although, chemical fertilizers are playing a crucial role to meet the nutrient requirement of the crop, persistent nutrient depletion is posing a greater threat to the sustainable agriculture. Therefore, there is an urgent need to reduce the use of chemical fertilizers and in turn increase in the use of organics which are needed to check the yield and quality levels. Biofertilizers are one of the major sources of PGPRs help to sustain soil fertility and crop yield. The studies conducted by Rajasekar and Karmegam (2009 and 2010) showed that the biofertilizer microorganisms kept in vermicast carrier material increased the viability and endurance, so that the biofertilizer organisms can be kept for long time without losing their effectiveness. Now-a-days, keeping biofertilizer in liquid media for field application is gaining momentum. Hence the present work has been aimed to produce a liquid biofertilizer and to test its efficiency in maize (*Zea mays*), black gram (*Vigna mungo*) and green gram (*Vigna radiata*).

Materials and methods

The present investigation on the response of biofertilizers to plants was carried out in the Biofertilizer unit at Shivashakti Bio-Technologies Ltd., Rudrapur. Specific broth was used for initial cultivation of microbes from biofertilizer. After isolation, microbial strains were routinely cultured using nutrient agar. Microbes were assayed in own selective medium agar (Rao, 1995). Quality checks on biofertilizer were done by mother culture tests like growth, purity, Gram staining and pH and broth tests including turbidity, total count and viable count (Rao, 1995). The following microorganisms were used for the study: *Azospirillum lipoferum, Azotobacter chroococcum, PGPR-Pseudomonas sp. & Bacillus sp.*, and VAM.

Efficiency of the prepared liquid biofertilizer was checked in maize, black gram and green gram. Plant growth parameters such as shoot length, root length and weight of the plant were measured. Before the incubation of the seeds onto the medium, the seeds were sterilized to become free from the microorganism. The seeds were initially placed in mercuric chloride for 4 min. and then transferred to sodium hypo chloride for 3 min and to NaCl for 3 min. followed by alcohol for 2 min. From alcohol the seeds were finally transferred to the broth of respective organism (cell count 2×10^8 cells/ ml). The forceps were sterilized under the flame and used to transfer the seeds on to the medium. The seeds of maize, black gram and green gram were transferred in to separate set of tubes and kept for the incubation of 12 days in triplicates. The plant height, weight and root length for each plant tested were recorded.

Results and discussion

Plant height and weight of maize treated with PGPR significantly increased at the incubation of 12 days (i.e., 20 cm and 1.72 g respectively) compared with the control (Table 1). Root length was increased maximum in the seed treated with VAM compared with the control i.e., 18.5 cm. Growth performance of black gram in various treatments of biofertilizers is given in Table 1. Plant height and weight of black gram at the incubation of 12 days, treated with PGPR showed increase than in control respectively. Root length was observed maximum in VAM treatment (9.2 cm) followed by PGPR (6.5 cm) and control (5 cm). Based on the observations of growth parameters of biofertilizer treated green gram, highest length of shoot, root and gain of weight was obtained in VAM treated seed i.e., 14.6 cm, 6.5 cm and 0.41 g respectively. The growth performance was in the order of VAM, PGPR, *Azospirillum* and control (Table 1). Plant height and weight of maize treated with *Azospirillum* significantly increased at the incubation of 12 days (i.e., 19.2 cm and 1.74 g respectively) compared with the urea and control (Fig. 1). Root length was increased maximum in the seed treated with *Azotobacter* compared with the urea and control i.e., 16.5 cm. Effect of biofertilizer treated with black gram is given in Fig. 2.

Plant height of black gram treated with *Azospirillum* significantly increased at the incubation of 12 days (i.e., 10.5 cm) compared with the urea and control. Root length and plant weight increased maximum in the seed treated with *Azotobacter* compared with the urea and control i.e., 7.5 cm and 0.35 g respectively. Plant height, weight and root length of green gram treated with *Azospirillum* significantly increased at the incubation of 12 days (i.e., 11.5 cm, 6.5 and 0.45 g respectively) compared with the urea and control (Fig. 3).

Table.1 Effect of liquid biofertilizers on maize, black gram and green gram. (Values are mean of three replicates)

Treatments	Shoot Length (cm)	Root Length (cm)	Plant Weight (gm)
Maize			
Control	9.5	12.5	0.75
Azospirillum	18.5	17.5	1.50
PGPR	20.0	16.5	1.72
VAM	16.5	18.5	1.65
Black gram			
Control	9.0	5.0	0.22
Azospirillum	11.5	6.3	0.30
PGPR	12.9	6.5	0.36
VAM	12.0	9.2	0.35
Green gram			
Control	9.5	4.1	0.19
Azospirillum	11.0	5.4	0.28
PGPR	11.5	6.0	0.32
VAM	14.6	6.5	0.41

Azospirillum apart from its role in nitrogen fixation from the atmosphere, also involved in the production of phytohormones like IAA, GA3 and cytokinin like substances, N is the chief constituent of protein, essential for the formation of protoplasm, which lead to cell enlargement, cell division and ultimately resulting in increased plant growth. Phosphobacteria augment the plant growth mainly due to the biosynthesis of growth promoting substances like vitamin B_2 and auxin. The results of the present investigation are in confirmation with the findings of Nanthakumar and Veeraraghavathatham (2000) in brinjal and Govindarajan and Thangaraju (2001) in chilli.

Fig.1 Effect of biofertilizer and inorganic fertilizer (urea) on maize (*Zea mays*)

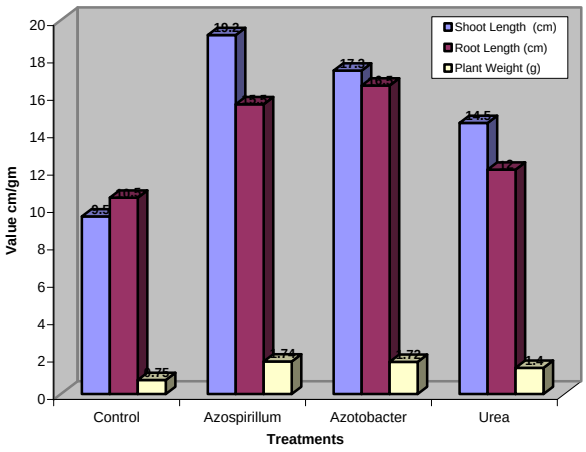


Fig.2 Effect of biofertilizer and inorganic fertilizer (urea) on black gram (*Vigna mungo*).

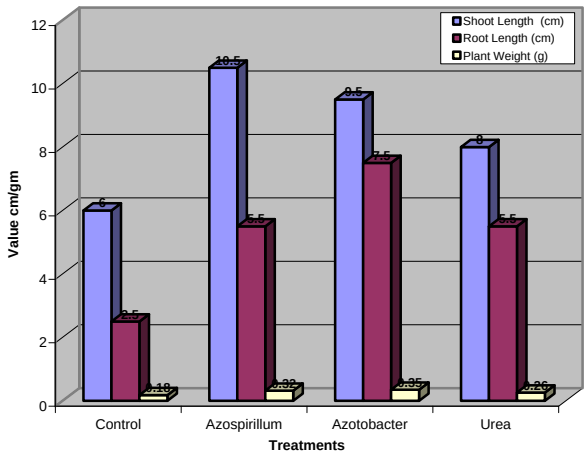
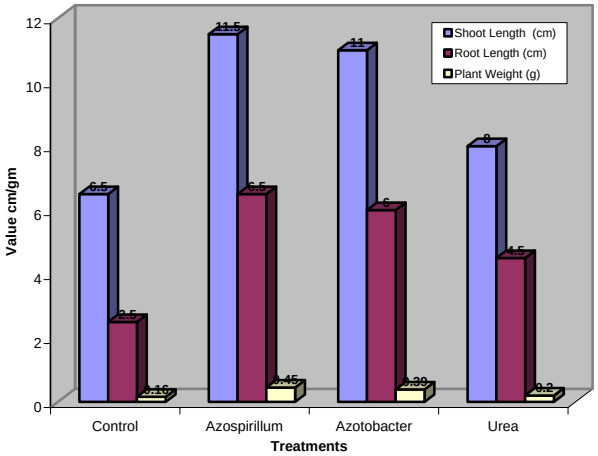


Fig.3 Effect of biofertilizer and inorganic fertilizer (urea) on green gram (*Vigna radiata*)



Significant increase in plant height due to combined application of *Azospirillum*, phosphate solubilizing bacteria (PSB) and inorganic fertilizers has been reported earlier in crossandra (Narashima Raju and Haripriya, 2001) and gundumalli (Manonmani, 1992). Similar results were obtained by the application of *Azotobacter*+ PSB + VAM in *Valeriana jatamansi* (Salathia, 2005) and gladiolus (Srivastava and Govil, 2005).

The nutrient uptake is favorably influenced by *Azospirillum* inoculation. *Azospirillum* has the ability for better root induction in the inoculated plants mainly due to the production of growth hormones. As a result, such plants are capable of absorbing more and more available nutrients from the soil which, in turn, result in better establishment of seedlings and their subsequent growth (Govindan and Purushothaman, 1984). The strains of *Azospirillum* and PSB gave good results in China aster (Chaitra, 2006). The present study indicates that there is a huge potential for utilizing liquid-biofertilizers for enhancing the crop growth and yield.

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