Study on the combined effect of Bio-Fertilizers on morphological parameters of Groundnut (*Arachis hypogaea* L.)

T. Azhaguthasan[1], T.Ravi Mycin[1] and Shanthi K[2].
[1]Department of Botany, Annamalai University, Annamalai Nagar - 608 002, India
[2]Department of Botany, Government Arts college, Thiruvannamalai, 606 603, India

Abstract

The present study was to investigate the effect of biofertilizer on vegetative growth and productivity of ground nut plant grown in the field condition. The Field experiments were conducted in Botanical Garden, Department of Botany, Annamalai University, Annamalainagar, Tamil Nadu, India. The growth parameters such as shoot length, root length, biomass (fresh weight and dry weight were analyzed at 15, 30 and 45 days after the treatments. The combined application of biofertilizer (*Azospirillum* + *Rhizobium* + PSB+ AM Fungi) has get better result than the other treatment. However, the study was carried out by using biofertilizer alone, further study needed compare with fertilizer to compare the both biofertilizer and chemical fertilizer.

Key words: Ground nut, biofertilizer, *Azospirillum*, *Rhizobium* and biomass

Introduction

The low soil fertility is caused by continues cropping and heavy application of organic fertilizer or chemical fertilizer. Chemical fertilizers have been used intensively around the world to increase crop yield. (Altuhaish *et al.,* 2014). However, they start depositing their harmful effects to the soil and environment causing reduction in soil quality and environmental degradation (Rodriguez *et al.,* 2004). To achieve high production value targets while maintaining preservation of sustainable agriculture resources needs effort and appropriate strategies including the utilization of biofertilizers and organic fertilizers (Altuhaish *et al.,* 2014). Utilization of organic materials and microorganism is useful to develop sustainable agriculture and to minimize the use of inorganic chemicals (Ghorbani *et al.,* 2008). Biological agriculture is an element of the system for sustainable agriculture and an alternative to traditional approaches in agriculture. It only seemingly turns back to the old agricultural systems (Berova *et al.,* 2010). Thus the objective of this study was to investigate the effect of biofertilizer on vegetative growth and productivity of ground nut plant grown in the field.

Materials and methods

Seed Materials

The seeds of groundnut (*Arachis hypogaea* L.) var. VRI 2 were obtained from Regional Research Station of Tamil Nadu Agricultural University, Virudhachalam, Cuddalore District, Tamil Nadu, and India.

Biofertilizers

Biofertilizers such as Phosphate solubilizing bacteria (PSB), AM Fungi, *Rhizobium*, *Azospirillum* were obtained from the Department of Microbiology, Faculty of Agriculture, Annamalai University, Annamalai nagar, Tamil Nadu.

Field experiment

The Field experiments were conducted in Botanical Garden, Department of Botany, Annamalai University, Annamalainagar, Tamil Nadu, India. The experiments were conducted during March 2015 to June 2016. (The experimental site was situated at 11.24 N latitude and 79.41E longitude with an attitude of 5.79 M above Mean Sea Level (MSL).

Seed Treatment

The seeds of groundnut were surface sterilized with 80 percent ethanol and 0.1 percent mercuric chloride and washed the seeds with sterile distilled water for 3 to 4 times.

Experimental Details

Treatments	Name of Biofertilizers
T1	Control
T2	PSB+ AM Fungi
T3	*Rhizobium*+ AM Fungi
T4	*Azospirillum* + PSB
T5	*Azospirillum* + *Rhizobium* + PSB
T6	*Azospirillum* + *Rhizobium* + PSB+ AM Fungi

Growth parameters

The growth parameters such as shoot length, root length, biomass (fresh weight and dry weight were analyzed at 15, 30 and 45 days after the treatments.

Shoot length and root length (cm/plant)

Five plants were randomly selected for recording the root length and shoot length of crop plants. They were measured by using centimeter scale and recorded.

Fresh weight and dry weight (mg/plant)

Five plant samples were randomly selected at regular intervals. They were separated into root and shoot. Their Fresh weight was taken by using an electrical single pan balance. The fresh plant materials were kept in a hot air oven at 80 C for 24 hrs and then their dry weight were also determined.

Result

Morphological parameters

The field experiment was conducted to find out the effect of Plant growth promoting biofertlizer on growth and biomass of groundnut (*Arachis hypogaea* L.).

Shoot length (cm/plant)

The results on the effect of Plant growth promoting rhizobacteria on the shoot length (cm/plant) of groundnut crop at various stages of its growth (15, 30,and 45 DAS) are shown in Fig-1. The highest shoot lengths (8.33, 16.16 and 25.9 cm/plant) were recorded in groundnut crop grown in T6 treatment. The lowest

shoot length (5.9, 13.5 and 21.4 cm/plant) was recorded at various stages of its growth (15, 30, and 45 DAS) in the crop grown in control.

Root length (cm/plant)

The results on the effect of Plant growth promoting rhizobacteria on root length of groundnut at various stages of its growth (15, 30 and 45 DAS) are shown in Fig-2. The highest root lengths (5.9 9.9 and 15.5 cm/plant) were recorded in groundnut grown in T6 treatment. The lowest root lengths (4.1,8.0 and 13.1 cm/plant) were recorded at various stages of its growth (15, 30 and 45 DAS) in the crops grown control.

Fresh weight of plant (g/plant)

The effect of Plant growth promoting rhizobacteria on fresh weight (g/plant) of groundnut crop at various stages of its growth (15, 30 and 45 DAS) is shown in Fig-3. The highest fresh weights (9.73, 16.53 and 21.3 g/plant) were recorded in groundnut crop grown in T6 treatment. The lowest fresh weight of plant (7.80, 14.13 and 18.25 g/plant) at various 15, 30 and 45 DAS, were recorded in the crops grown in control.

Dry weight of plant (g/plant)

The results on the effect of various treatment of plant growth promoting rhizobacteria on dry weight (g/plant) of groundnut crop at various stages of its growth (15, 30 and 45 DAS) are shown in Fig-4. The highest dry weights of plant (2.32, 4.81 and 5.99 g/plant) were recorded in groundnut crop grown T6 treatment. The lowest dry weights (1.92,3.21 and 4.31 g/plant) of plant at 15, 30 and 45 DAS were recorded in the crops grown in control.

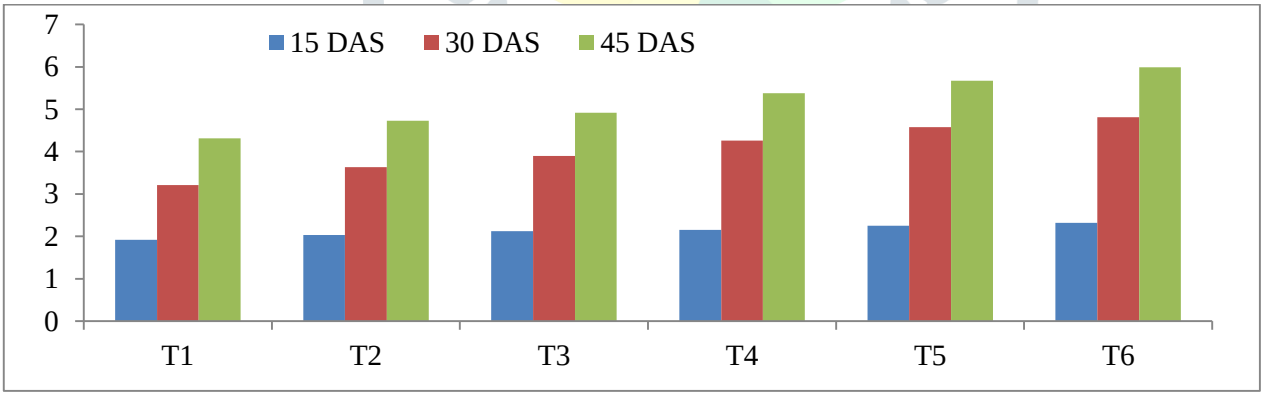

Fig-1. Influence of different treatments of biofertilizers on shoot length of Groundnut (*Arachis hypogaea* L.).

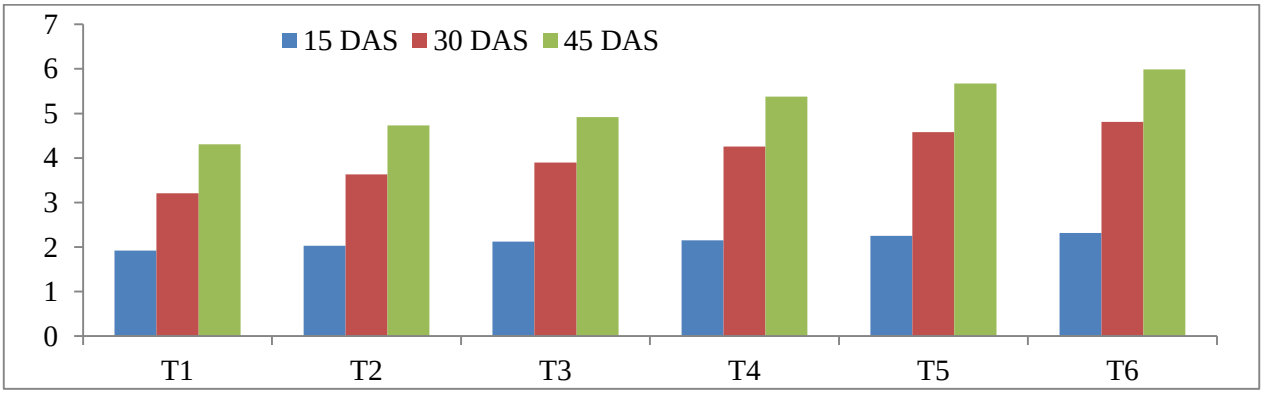

Fig-2. Influence of different treatments of biofertilizers on root length of Groundnut (*Arachis hypogaea* L.).

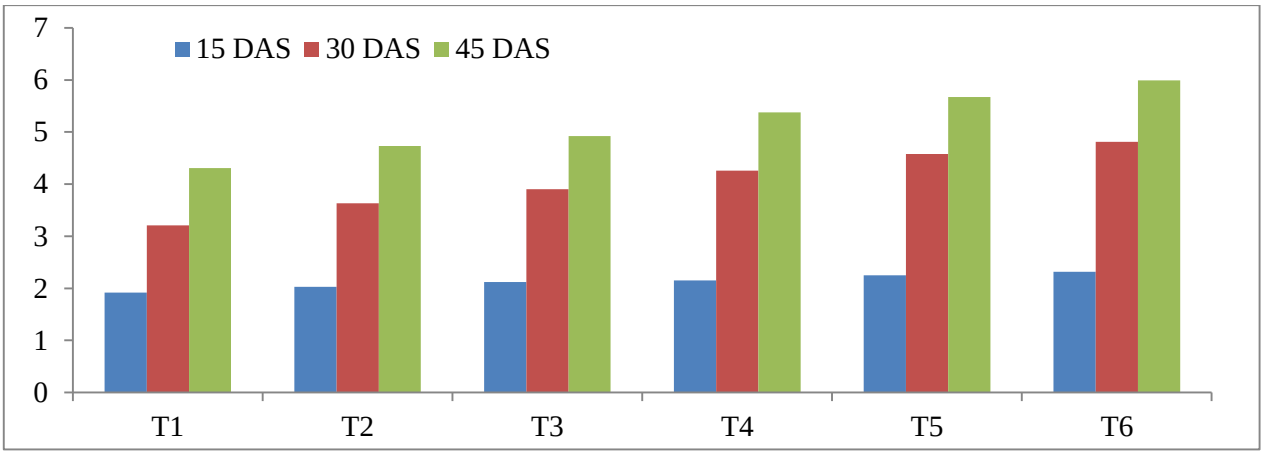

Fig-3. Influence of different treatments of biofertilizers on fresh weight of Groundnut (*Arachis hypogaea* L.).

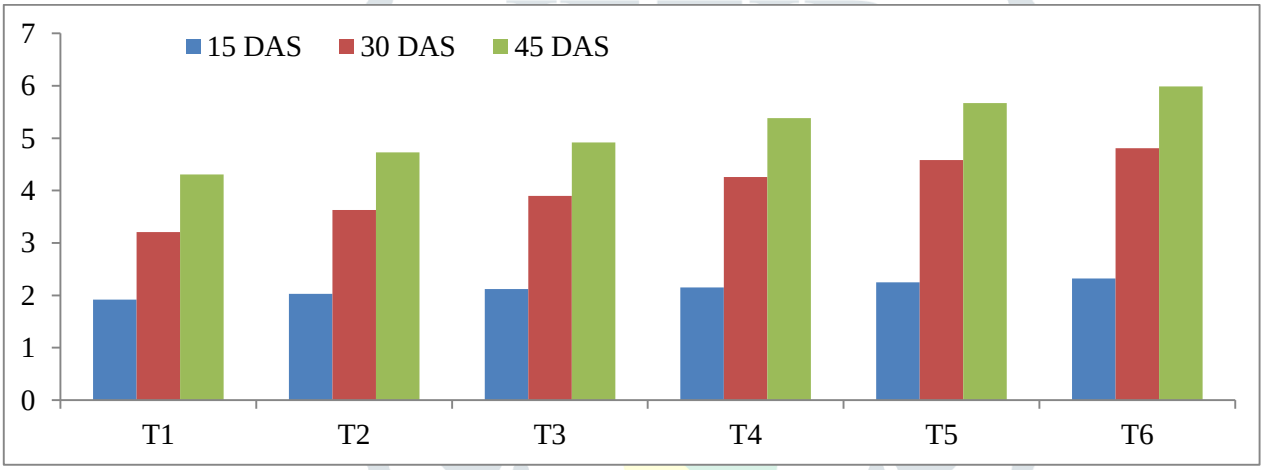

Fig-4. Influence of different treatments of biofertilizers on dry weight of Groundnut (*Arachis hypogaea* L.).

Discussion

PGPR have been demonstrated to increase growth and productivity of many commercial crops, cucumber (Maleki *et al.*, 2010). Verma *et al.*, 2013 reported that the root and shoot dry weight significantly increased by combined inoculation of seed with *Mesorhizobium sp*, *Pseudomonas aeruginosa*, *Bacillus megaterium* and *A.chroccoccum* respectively. Many authors (Maqshoof Ahmad *et al.*, 2012; Anandaraj *et al.*, 2010; Mishra *et al.*, 2010) suggested that the effect of the mixed inoculation of the *Rhizobium sp*, *Pseudomonas fluorescence* and *Bacillus megaterium* significantly increases the root and shoot growth when compared to uninoculated on green gram. Moreover Manoharan *et al.*, 1988 concluded that the increase in number of branch and number of leaves might be due to the continuous supply of nutrients due to the action of bio-fertilizers and release of nutrients from the organics. The increase of plant growth with the application of Bio-fertilizers and nitrogen fertilizers on plant might be some enzymatic systems and also play a key role in cell division and cell elongation (Ojaghloo *et al.*, 2007). Peoples *et al.*, (1995), who suggested that biofertilizer increased the solubility and availability of N in the rhizosphore and elongation of

internode, which increased cell division and cell elongation there by increased plant height, branches and leaves leading more photosynthetic area and finally yield of crop plant. However, many researcher reported that the (Javaid and Mahmood, 2010), wheat (Javaid and Shah, 2010), and lettuce (Hasaneen *et al.*, 2009). Increment of growth parameters by biofertilizer treatments has been recorded in many plants; for example, soybean. Biswas *et al.*, (2015) also found that seed treatment with bio-fertilizers viz., Azotobacter chroococum, PGPR, *Trichoderma harzianum*, *Trichoderma viride*, PSB, *Rhizobium*, significantly increased germination of wheat seed and increased tillering.

Conclusion

The experiment was conducted to know the effect of different biofertilizer on growth parameters such as seed germination, shoot length, root length and biomass (fresh weight and dry weight) in ground nut. Six treatment was carried out with application of PSB+ AM Fungi, *Rhizobium*+ AM Fungi, *Azospirillum* + PSB, *Azospirillum* + *Rhizobium* + PSB and *Azospirillum* + *Rhizobium* + PSB+ AM Fungi were laid in Randomized Block Design with three replications. The combined application of biofertilizer has get better result than the other treatment. However, the study was carried out by using biofertilizer alone, further study needed compare with fertilizer to compare the both biofertilizer and chemical fertilizer.

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