Journal of Applied and Advanced Research 2016. 1(1); 46-48
http://www.phoenixpub.org/journals/index.php/jaar

Research Article – Plant Science

Effect of biofertilizer and some plant growth hormones on germination and seedling character of Sesame (*Sesamum indicum* (L.).

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Abstract

In this study, the effect of plant growth regulators (IAA and GA_3) and living bacteria containing (Azospirillam) biofertilizer were investigated on the germination, root length and shoot length. The seeds of sesame variety TMV – 7 were treated with different concentration of gibberlic acid (1.0mgL^{-1}, 1.5 mgL^{-1}, 2.0 mgL^{-1} and 2.5 mgL^{-1}) and indole acetic acid(1.0mgL^{-1}, 1.5 mgL^{-1}, 2.0 mgL^{-1} and 2.5 mgL^{-1}). The biofertilizer, Azospirillam was mixed with rice Starch in a container to form slurry. Germination, root length and shoot length were evaluated. From the results, it was observed that the biofertilizer had regulatory effect on seed germination, root length and shoot length over control. In plant growth hormones treated plants, 2.0mg/l of GA_3 shows maximum effect compared to IAA. It can be concluded that, the biofertilizer treatment stimulated the germination and growth by excreting phytohormones and enhancing the nutrient mobilization from the seed.

Key words: Plant growth hormones, Biofertilizer, Germination and seedling characters.

Introduction

The growing population demands an equal growth in the rate of production of food crops to meet the ever increasing demand for food. In developing countries, the only way to meet this growing demand is by increasing the productivity of food crops, as there is no or less opportunity for opening up new arable lands for agriculture due to population density and urbanization. Chemical methods have been used to increase the productivity of food crops by promoting plant growth and controlling plant pathogens. High inputs of agro -chemicals cause negative environmental effects such as pollution, death of non-target micro-organisms residue accumulation in soil and finally affect soil fertility. All these negative effects of synthetic fertilizers lead to the search of more sustainable and eco friendly agricultural practices. Soil organic matter and beneficial soil microbes are of growing importance as key factors in maintaining soil quality and crop production.

Indole acetic acid (IAA) and gibberlic acid (GA_3) can manipulate a variety of growth and developmental phenomena in various crops. IAA has been found to increase the plant height, number of leaves per plant with consequent enhancement in seed yield in Cotton (Kapgate *et al.*, 1989). It also increases the flowering, fruit set, the total dry matter of crops (Gurudev and Saxena, 1991). Likewise, GA_3 stimulated stem elongation (Harrington *et al.*, 1996), and enhance total yield (Deotale *et al.*, 1998).

"Biofertilizer" in term refers to preparations containing living cells of efficient strains of N_2 fixing, phosphorous solubilizing or cellulolytic microorganism which have the capacity to enrich soil fertility either as for living or in the association with the host plant. Simply the term biofertilizer denotes all the nutrients input of biological origin for plant growth (Subba Rao, 1982). The experiment was conducted to study the effect of IAA and GA_3 in modifying the germination and morphological characters of Sesame.

Materials and Methods

Genetically pure seeds of Sesamum (*Sesamum indicum*) var. TMV– 7 obtained from Oil seed Research Center, Tindivanam formed the base material for the study. The field experiment was conducted at Botanical garden, Department of Botany, Annamalai University, Annamalai nagar. The seeds were treated with different concentrations of Gibberlic Acid (1.0mgL^{-1}, 1.5 mgL^{-1}, 2.0 mgL^{-1} and 2.5 mgL^{-1}) and Indole Acetic Acid (1.0mgL^{-1}, 1.5 mgL^{-1}, 2.0 mgL^{-1} and 2.5 mgL^{-1}). For biofertilizer treatments, the azospirillam was mixed with rice starch in a container to form slurry.

Received: 22-06-2016; Revised: 07-07-2016; Accepted 08-07-2016; Published Online: 14-07-2016

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Table 1. Effect of IAA and GA_3 and biofertilizer on seed germination and seedling growth characters of Sesame.

Treatments	Concentration	Germination (%)	Root length (cm)	Shoot length (cm)
Control	-	80	4.28±0.08	5.21±0.15
IAA	1.0 mg/l	79	4.41±0.10	5.41±0.15
	1.5 mg/l	82	4.65±0.17	6.76±0.20
	2.0 mg/l	93	5.20±0.13	7.83±0.11
	2.5 mg/l	72	3.86±0.11	4.89±0.14
GA_3	1.0 mg/l	83	3.82±0.09	6.23±0.08
	1.5 mg/l	90	4.76±0.14	7.21±0.05
	2.0 mg/l	94	6.81±0.06	8.76±0.20
	2.5 mg/l	74	3.24±0.11	4.93±0.07
Biofertilizer	-	98	7.23±0.31	10.11±0.27

Seeds were soaked in the slurry and kept overnight for germination. Three replicates of fifty seeds were sown in sand medium. The two factorial experiments comprised of the growth regulators was laid out in randomized complete block design (RCBD). After the periods of seven days the normal seedlings were conducted and the mean values were expressed as percentage.

Germination percentage

Germination percentage was calculated on the basis of number of seeds germinated and expressed as in percentage.

Root length (cm)

At the time of germination count, ten normal seedlings were taken at random. The length between the collar and tip of the primary root was measured as root length and the mean length expressed in centimeter.

Shoot length (cm)

From ten seedlings, the length between collar and tip of the primary shoot was measured as shoot length and the mean value expressed in centimeter.

Results and Discussions

The seed germination was observed on 7^{th} day after the emergence of radical and thereafter plumule. The Azospirillam treated plants have shown better performance than the growth hormones treated plants and controls (Table.1). Seed germination status depends on embryo growth potential or inhibitors (Koorneef *et al.,* 2002). This potential depends on the seed structure, especially embryo structure and affective factors on embryo (Mares, 2005). The maximum germination was observed in biofertilizer treated plants (98%). In growth promoting hormones, GA_3 2.mg/l (94%) was found to be more efficient in inducing germination.

According to the result of Siqueira *et al.,* (1993) and Gholomi *et al.,* (2009), a positive effect on germination was observed in biofertilizer treatment. As was published by Kloepper *et al.,* (2011) the biofertilizer increased the yield up to 43% in Wheat. The biofertilizer made the germination more effective in comparison to the control.

All the treated plants showed a stimulatory effect on root length of Sesame over control (Table. 1). The biofertilizer treatment also influenced on root growth positively, which plays an important role in nutrient uptake. The maximum root length was observed in biofertilizer treated plants (7.23 cm) followed by 2.mg/l (6.81cm) in GA_3 treated plants over controls. A significant variation was observed in the shoot length due to the application of biofertilizer and growth hormones. Shoot length increased gradually with the advancement of growth of the plant in all treatments. The growth regulators had stimulatory affected on plant height. Maximum shoot length was observed in biofertilizer treated plants (10.11cm) and 2.0mg/l (8.76 cm) in GA_3.Among plant growth hormones, GA_3 is found to be more efficient when compared to IAA. Growth and development of higher plants are complex phenomena that are regulated by the concerted action of phytohormones, which plays a crucial role, being able to induce both quantitative changes in growth and differentiation of cells and organs (Jones, 1992).

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