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Azolla Bacteria Promoting Rice Growth Under SalineCondition

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Abstract

Azolla as a use for nitrogen in rice crops its can be used for reclaiming the saline soil and reducing the Electro conductivity and pH and also provide nitrogen to plant and soil and improve soil texture and structure. It is measured with a conductivity cell or EC meter and expressed in milliohms or milli-Siemens (mS) per cm.1Mho = 1Siemens. The original EC of Soil is 1.3 and after induces salinity level create the EC became reach to 7 dSm^{-1}. The pH after the development of salinity reaches to 8.2. After the analysis of soil sample by hydrometer the soil class become occurred in clay soil texture. In initial growth of rice studied, the data show that initial growth in control was to week as compare to treatment three. In treatment two where the salinity 3dSm^{-1} + Azolla were show no resistance to growth but in treatment three where the salinity 7dSm^{-1} + Azolla were show to much resistance. In each plot five Plants were selected and measure the length of each plant from top to bottom and taken average of five plants. The length of control pot rice is 40cm mean without azolla and treatment two the average height of the plants was 70cm where the salinity level is 3 dSm^{-1}+ Azolla. In treatment three where the salinity 7dSm^{-1} + Azolla show 43 cm plant height.

Keywords: Azollabacteria; Saline soil; Rice; Plant growth

Introduction

In addition to the use of Azolla as an N source for rice crops, it can be used for reclaiming saline soils, reducing evapotranspiration, and to control weed infestations in rice crops [1]. Azolla can also be used directly as a feed for fish, and a technology called "Azobiofer" has been developed for the production and use of Azolla for irrigated rice and fish cultivation [2].It can also be used to purify wastewater as it can accumulate P and some heavy metals from water [3,4]. However, there are some constraints on the production and use of Azolla, like the availability and control of water supplies, P limitations in soils, predators of Azolla, and its temperature sensitivity. A high-temperature- tolerant Azolla species, Azollamicrophylla, can be used in tropical countries to overcome the problem of its sensitivity to high temperatures. This species can survive at temperatures of up to 38°C and can fix N[5]. Other problems of Azolla production can be alleviated by proper management practices.

Azolla is a free-floating freshwater fern, which fixes atmospheric N through the symbiotic association with Anabaena azollae that lives inside the dorsal lobes of Azolla leaves, potentially supplying a substantial amount of N to the rice crop [6]. Azolla can fix 22–40kg N ha^{-1} within 30 days [7]. It can be grown simultaneously with irrigated rice without additional requirements for land and water [8,9]. Rice yields can be increased by 1.4–1.5t ha^{-1} by Azollaapplication [10]. There are now seven recognized species of the family Azollaceae: Azollacaroliniana, *A. Azolla* can contribute 40–60kg N ha^{-1} per rice crop [11]. The N accumulated by Azolla is derived mostly from the air. It has been established, by using the 15Ntracer technique, that rice plants can assimilate around 33% of the N fixed by Azollawithin 60 days.

More than half of the world inhabitants is reliant onrice. The rice crop was sown on 145 million hectares of land in 1988, producing 468 million tons. About 75% of rice land are wetlands where rice grows in waterlogged fields during part or all of the cropping period. From the point of view of yield sustainability, traditional wetland rice cultivation has been extremely successful. Moderate but stable yield has been maintained for thousands of years without adverse effects on soil [12]. This isbecause flooding allows the establishment of environmental conditions that maintain soil N fertility. In particular, flooding leads to the differentiation of a wide range of macro- and micro-environments that differ in their redox potential, physical properties, light status, and nutrient sources for the micro flora. As a result, all groups of N-fixing microorganisms find environments suitable for their growth in wetland rice fields (Figure 1)[13-16].

Figure 1: All groups of N-fixing microorganisms find environments suitable for their growth in wetland rice fields.

Material and Method

The experimental study conducted at National Agriculture Research Center Islamabad during june-2018.The experimental study was design pots with three times repetition and two level of salinity. Each pot contains 4kg soil. Azolla used as bio-fertilizer and promoter of the rice crop growth under different salinity level.Azolla apply before the rice transplanting. The following experimental parameter was study.

Soil sample

The soil sample taken from National Agriculture Research center Islamabad anddeveloped two salinity levels. The soil samples were dry and grind. After grinding the soil samplesewed and fill the pots.

Electric conductive (EC)

The 5g soil sample taken in conical flask and add water up to saturation level. The soil pest place for 24 hour or overnight. The vacuum pump used to get the soil extract. The electric conductivity find from EC meter. Its unit dSm^{-1}.

pH

The 5g soil sample taken in conical flask and add water up to saturation level. The soil pest place for 24 hour or overnight. The vacuum pump used to get the soil extract. The pH meter electrode place in soil extracts and waits for reading.

Soil texture

The soil sample Texture Determination refers to the size of the particles that make up the soil.The terms clay, sand and silt refer to relative sizes of the soil particles.Sand, being the larger size of particles, feels gritty.Silt, being moderate in size, has a smooth or floury texture. Clay, being the smaller size of particles, feels sticky. Hydrometer were used for texture determination.

Different treatments levels

a. Control

b. Salts level 3 dSm^{-1}+ Azolla

c. Salts level 7 dSm^{-1} + Azolla

Initial growth of rice

In initial growth of rice study that how much azolla promoting rice plant initially in saline condition and how much can die.

Plant height

In each plot five Plants were selected and measure the length of each plant from top to bottom and taken average of five plants.

Results and Discussion

The experimental study conducted at National Agriculture Research Center Islamabad during june-2018.The following experimental parameter were study Electric Conductivity, pH, texture, initial growth, and Plant height.

Electrical conductivity (EC)

Specific electrical conductivity of a solution is directly related to its ion content. It is measured with a conductivity cell or EC meter and expressed in milliohms or milli-Siemens (mS) per cm.1Mho = 1Siemens. The original EC of Soil is 1.3 and after induces salinity level create the EC became reach to 7 dSm^{-1}.

pH

When the pH meter calibration is done, rinse the electrode and place into the sample and wait for reading, the initial reading of soil sample is 7.6. The pH after the development of salinity reaches to 8.2.

Soil texture

Texture refers to the size of the particles that make up the soil.The terms sand, silt, and clay refer to relative sizes of the soil particles.Sand, being the larger size of particles, feels gritty.Silt, being moderate in size, has a smooth or floury texture. Clay, being the smaller size of particles, feels sticky. After the analysis of soil

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sample by hydrometer the soil class become occurred in clay soil texture.

Initial growth of rice

In initial growth of rice studied, the data show that initial growth in control was to week as compare to treatment three. In treatment two where the salinity $3dSm^{-1}$ + Azolla were show no resistance to growth but in treatment three where the salinity $7dSm^{-1}$ + Azolla were show to much resistance.

Plant height

In each plot five Plants were selected and measure the length of each plant from top to bottom and taken average of five plants. The length of control pot rice is 40cm mean without azolla and treatment two the average height of the plants was 70cm where the salinity level is 3 dSm-1+ Azolla. In treatment three where the salinity 7dSm-1 + Azolla show 43cm plant height.

Conclusion

In this experiment we conclude that azolla can promote the rice growth up certain salinity level because azolla can reduce the soil EC and soil pH and also provide nitrogen.

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