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Review Paper

Assess Effect of Different *Azospirillum* Trends on Seed Yield and its Components of Barley (*Hordeom vulgare* L.)

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RESEARCH ARTICLE

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ABSTRACT

Fertilizer management is one of the most important factors in successful cultivation of crops affecting yield quality and quantity. Chemical fertilizers have several negative impacts on environment and sustainable agriculture. Therefore, bio fertilizers are recommended in these conditions and growth prompting bacteria uses as a replacement of chemical fertilizers. Organic farming has emerged as an important priority area globally in view of the growing demand for safe and healthy food and long term sustainability and concerns on environmental pollution associated with indiscriminate use of agrochemicals. Biofertilizers aid plants in accessing the nutrient present in its surroundings. The microbes frequently employed as the biofertilizers include *Rhizobium*, *Azotobacter*, *Anbaena* (nitrogen fixers), *Pseudomonas putida*, *Mycorrhizal fungi*, etc. Likewise, phytohormone/auxin-producing bacteria could also be utilized as biofertilizers. Three *Azospirillum* trends (*A. lipoferum*, *A. brasilense* and *A. irakiens*) were applied in Ahvaz climate condition and nitrogen treatments were applied at rates of 100 and 75%, respectively. This work is aimed at standardizing and validating of *Azospirillum* trends as an alternative to seed inoculation technique. The effect of soil Azospirillum trends population were ascertained which *A. brasilense* also adversely affected the soil's physical, chemical, and biological traits and barley yield, probably because high amounts of nitrogen were introduced into the soil by the vinasse, which destabilized its structure. Barley yield increased 24.5% with *A.brasilense*, 12.7% with *A. lipoferum* and 8.4% with *A. irakiens* at 75% and 100% nitrogen than control treatments. These results suggest that the chemical composition of the three Azospirillum species notably influenced the soil properties and therefore the barley yield parameters of the three Azospirillum studied, alone the application of nitrogen originated a positive effect in soil and barley yield parameters.

KEYWORDS: *Biofertlizer, Cereal, Microorganism, Nitrogen, Nutrition*.

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1. BACKGROUND

Azospirillum is a species of bacteria which is utilized as one of the leading fundamental biofertilizer in nature. Which is involved in the fixation process of atmospheric nitrogen in to the world's most portion staple food crops like rice, maize, sorghum, wheat and millets? The genus of *Azospirillum* are narrowly found in soils and its inoculation of cereal and feed crops resulted in yield extended in different field experiments (Boddey and Dobereiner, 1988), during the formation of essential plant development promoting substances. *Azospirillum* could be a smaller scale aerophilic, gram negative, rod shaped, plant growth promoting bacteria, which is well develop in Nitrogen free semi-solid malate medium. *Azospirillum* could be a symbiotic bacterium. These are the foremost critical biofertilizer in the cultivating of rice. *Azospirillum* bacteria present in the root zones of rice and are able to fix more atmospheric nitrogen which is locked in by the plants. The organism multiply under both anaerobic and oxygen consuming condition, in spite of the fact that it favor micro aerophilic condition for development, a part from nitrogen fixation, and the main important work of *Azospirillum* is growth promoting substance production (IAA), illness resistance and drought tolerance are some of the extra benefits suitable to *Azospirillum* inoculation. In this survey, we discussed about the biofertilizer arrangement by using *Azospirillum* as an inoculants (Suhameena *et al*., 2020). Different type of biofertilizers mentioned in table 1.

Table 1. Types of Biofertilizer (Suhameena *et al*., 2020)

Biofertilizer	Microorganisms
Nitrogen fixing	*Rhizobium, Azotobacter, Azospirillum, Radyrhizobium*
Phosphorus Solubilizing (PSB)	*Bacillus, Pseudomonas, Aspergillus.*
Plant Growth Promoting	*Pseudomonas*
Phosphorus solubilizing (Fungi)	*Mycorrhiza*
Algae	*Cyanobacteria and Azolla sp*

1.1. *Nitrogen Fixation of Azospirillum*

Azospirillum can subsist generously or in beneficial interaction and in additionally case entraps atmospheric nitrogen and changes over the un responsive nitrogen to NH3, A assortment that's readily expend by plants, this movement is term as organic nitrogen fixation (BNF) and is catalyze by the oxygen helpless enzyme nitrogenase show interior the bacteria by the taking after reaction;

$N_2 + 8H + 8e^- + 16$ ATP Nitrogenase $2NH_3 + H_2 + 16$ ADP $+ 16$ P_i -------- (1)

The capability of endophytic to settle atmospheric N contained by a have has been demonstrated utilizing not at all like approaches: acetylene reduction measure, 15N isotope weakening (Van Berkum and Bohlool, 1980). *Azospirillum sp* is the foremost well-organized N fixers within the field whereas all compulsory circumstance for organic N fixation are show (Lima *et al*., 1987).

They up to 18% of plant N were ensuing from N fixation (Hartmann *et al*., 1988). All natural sort *Azospirillum* organisms were available for the N fixation by non-living and associated forms with plants (Kucey *et al*., 1993). It coupled with rice, *A. lipoferum* N-4 contributed as respects 66% of the total N availability in plants were confirmed with N isotopes (Heulin *et al*., 1989). Mutated *A. lipoferum* with mesophilic lac-z marking did not show significant variations in nitrogen filtration at the range of 45°C temperature out of 40 thermo tolerant mutants. Among the mutants, only 14 mutants were grow efficiently and fix the nitrogen when the temperate over 40°C (Anand *et al*., 1999). The impact of inoculation of *Azospirillum* are the early development, high yield and N fixation of rice. Microscopic organisms of the class *Azospirillum* energize plant development specifically more over by amalgamate phyto-hormones or by promoting nourishment by the process of natural N fixation (Gadagi *et al*., 2003). Different mode of action of *Azospirillum* on plant growth was mentioned in Fig.1. (Raffi and Charyulu, 2021)

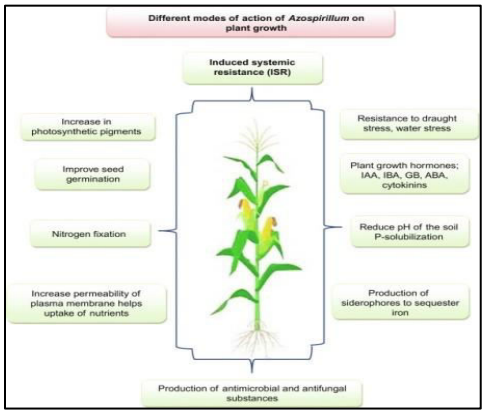

Fig.1. Role of *Azospirillum* on crop function.

2. OBJECTIVES

Current study was conducted to evaluate the different Azospirillum trends to increase effective factor on Barley yield.

3. EVIDENCE ACQUISITION

Current research was conducted according evaluate results of valid researcher.

4. RESULT AND DISCUSSION

The genus *Azospirillum* is a member of a phylogenetic subgroup in the α-subclass of Proteobacteria. It comprises free-living bacteria capable of colonizing the internal and external tissues of plant roots (Chitra *et al*., 2017). Azospirillum is one of the most studied genera within plant growth-promoting rhizobacteria- or PGPR- due to its ability to improve the growth and grain yield of many agronomical important crops. Azospirillum spp. is distributed worldwide and has been isolated from the root surface and rhizosphere of various plants, including cereal crops and forage grasses (Vanlalveni *et al*., 2021). The higher utilization of Azospirillum requires exploring environmentally safe procedures along with the measurement of their benefits to surroundings (Iannone *et al*., 2021). Azospirillum trends are widely used to treat various crop seeds and are considered an effective antimicrobials where can penetrate and altered the structures of cell walls and causing to promote high yield (Yin *et al*., 2020). Azospirillum with nitrogen has a promising strategy for improving conventional means that generally use reducing

harmful agents for hormones synthesis (Salouti and Faghri, 2017). Furthermore, natural agents contain many functional groups such as nitrogen groups which can improve the soil condition (Hamouda *et al*., 2020). One of the main mechanisms that explain plant growth promotion by *Azosprillum* is its ability to produce or metabolize compounds such as phytoregulators (Ozdal *et al*., 2017). These compounds include auxin, especially indole 3-acetic acid, gibberellins, cytokinins, nitric oxide, ethylene, and other molecules regulating plant growth under abiotic stress conditions such as abscisic acid (Ionnone *et al*., 2021). There is an increasing demand for bio inputs to maximize crop production and thus, the quality of these products must be guaranteed. In this sense, method for the increasing of viable cells using fewer Petri plates, with the possibility of including a high number of replicates, has been previously described. This technique, known as the drop plate method (Cassán *et al*., 2020), was proposed for assessing Azospirillum trends based inoculants (Coniglio *et al*., 2019). The aims of this work were to standardize and validate the plate method for *Azospirillum* containing inoculants. Standard samples of Azospirillum based inoculants were analyzed. The protocol used in all trials included a complete description of the methodology for sample conservation, homogenates and dilution preparation, culture media formulation, incubation conditions, and detection of contaminating microorganisms (Manivasagan *et al*., 2016). Each laboratory received the inoculant sample corresponding to the trial and divided it into three subsamples, which were considered technical replicates. For increasing Azospirillum viable cells through the spread plate technique, 100 µl of the dilutions 10^{-5} For *A. lipoferum* (a), 10^{-6} For *A. brasilence* and 10^{-7} For *A. irakiens* (b) were sown in duplicate (spreading replicates) in Petri plates containing RC culture medium (Korpayev *et al*., 2021).

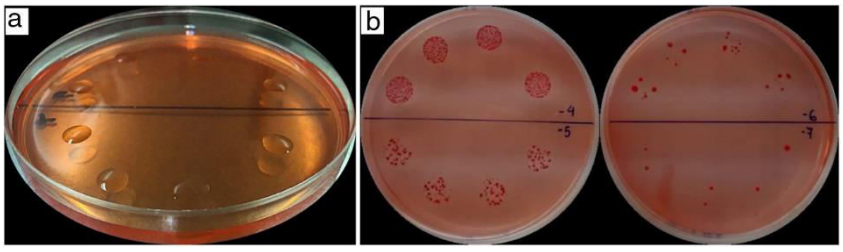

Fig. 2. Congo red (RC) Petri plates with 20 µl drop volume of 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7} dilutions, in quadruplicate. a. Typical colonies of *A. lipoferum. b. A. brasilence* and *A.irakiens* on the RC culture media with medium surface in numbers in accordance with the ten-fold dilutions.

Petri plates corresponding were incubated at 28–30 C for 4 days. Colony counting was performed after the incubation period and repeated 2 days later (6 days after sowing). This method allows including more replicates using fewer Petri plates and culture medium amounts, making it a more cost-

effective method than the spread plate technique (Herigstad *et al*., 2001). Furthermore, fewer Petri plates and culture media consumption implies a reduction in waste amounts, which would result in reduced environmental impact. This work shows that the only requirement to carry out the plate method is to have minimal training in microbiological techniques. Based on this work, we can say that the inexperience in the plate method is not expected to constitute a limitation if a clear and comprehensive protocol is available to facilitate the work and to guarantee reliable results.

5. CONCLUSION

The chemical composition of the three Azospirillum species notably influenced the soil properties and therefore the barley yield parameters of the three Azospirillum studied, alone application of nitrogen originated a positive effect in soil and barley yield parameters.

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FOOTNOTES

CONFLICT OF INTEREST: Author declared no conflict of interest.

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