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Evaluation of *Azospirillum* strains as biofertilizers for rice

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ABSTRACT

Azospirillum bacteria (*Azo*-BHU) was isolated from rice roots interior at the heading stage from agricultural farm of Banaras Hindu University, Varanasi, UP. *Azospirillum* colonies were purified and screened along with *Azo*-IARI (as check) for their plant growth promoting ability on rice. Seeds were coated with the culture of these isolates keeping uncoated seeds as control. Inoculation showed early germination (one day early than control seed of cultivar). The effect of *Azospirillum* isolates was significantly higher on rice varieties viz BPT-5204, NDR-97, HUR-36, Pankaj, Jaya and Padma with respect to growth characters such as number of tillers/m^2 area, plant height, grain yield, panicle length, biomass and test weight. It was concluded that with the use of *Azospirillum* (*Azo*-BHU) as biofertilizer a sustainable way of rice cultivation can be done without application of high cost and hazardous fertilizers.

Keywords: *Azospirillum*; rice; biofertilizers; sustainable agriculture

INTRODUCTION

Rice is the most important and extensively grown food crop occupying about 40 million hectares of land and it is being consumed by the people of India in various forms as staple food. Intensive crop cultivation requires the use of chemical fertilizers however the chemical fertilizers are not only short in supply but quite expensive too. Therefore current trend is to explore the possibility for supplementation of chemical fertilizers and natural biofertilizers. Biofertilizers are of microbial origin, consume relatively less energy and provide not only available nitrogen and phosphorus to growing crop but also provide plant growth promoting substances and protect the germinating seedlings from harmful soil organisms. It is apparent from literature that *Azospirillum* is an important bacteria which enhances plant growth through associative nitrogen fixing activity and by producing plant growth promoting substances. Thus this organism is being used as biofertilizer for almost all cereal crop. *Azospirillum* fixes nitrogen and makes the fixed nitrogen available to growing plants directly and provides nutrients at very low cost (Singh 2004).

The present investigation was carried out to evaluate the newly isolated and pot experiment tested *Azospirillum* strain as biofertilizer for rice cultivation in India.

MATERIAL and METHODS

Experimental site and rice varieties: In order to test plant growth promotion of *Azospirillum* six rice cultivars viz BPT-5204, NDR-97, HUR-36, Sarjoo-52, Ratana and Govind were used and experiments were conducted at agricultural farm of Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, UP. Nitrogen free Bromothymol Blue (NFB) was used to grow *Azospirillum* cells. One week old growing culture of *Azospirillum* strains was used for seed coating and nursery root treatment before sowing and transplanting. Just before sowing 5.0 ml of bacterial culture suspension and 10 ml of sticker solution (100 g jaggery + 100 ml water + 25 ml *Gum arebica*) were taken into deep tray and mixed thoroughly. Five hundred gram seeds were placed in same tray and mixed properly with hand for good adherence of bacteria on the surface of each seed and further sown in nursery (Singh et al 2006).

Details of the experiment: Statistical design- randomized block design, treatments- 3, varieties- 6, replications-3, fertilizers level- 2(N 0 kg/ha and N 50 kg/ha), plot size- 5m x 3m= 15 sqm, spacing- 20 x 15 (row to row 20 cm and plant to plant 15 cm), net area- 810 sqm, Bund and channel- about 350 sqm, total area-1200 sqm.

Recording of the experimental data: Data on days to 50 per cent flowering, plant height, panicle length, number of tillers/sqm area, total biomass, grain yield/plot and test weight were recorded from each plot from all replications.

RESULTS and DISCUSSION

Azospirillum inoculation helped in early germination in all rice cultivars in comparison to their respective controls (Table 1). Treated seed germinated approximately a day earlier to control seeds of some cultivars. Similar observation was recorded in wheat and barley (Singh et al 1999). Cultivar NDR-97, Sarjoo-52 and BPT-5204 seedlings established in four days followed by HUR-36 that established in five days and remaining cultivars took six days for establishment after transplanting (Singh and Singh 2012). Maximum number of tillers/sqm area (472.1) were recorded in Sarjoo-52 and minimum in NDR-97 (358.5). Highest plant height was recorded in HUR-36 (110 cm) while lowest was in Govind (82.2 cm). Maximum grain yield kg/plot was recorded in Sarjoo-52 (3.80 kg) and minimum in NDR-97 (2.40 kg). Highest panicle length was recorded in Ratna (22.2) and lowest in BPT-5204 (18.0). Maximum biomass kg/plot was recorded in Sarjoo-52 (9.0 kg) while

Table 1. Rice growth on *Azospirillum* inoculation

Rice variety	Plant height (cm)	Panicle length (cm)	# Tillers/ sqm area	Total biomass (kg)	Grain yield/ plot (kg)	Test weight (g)
Control	81.9	17.9	351.8	4.0	2.38	16.2
BPT-5204	105.3 (5.7)	18.0 (1.9)	365.4 (4.5)	8.0 (15.0)	3.70 (21.7)	19.6 (1.8)
NDR-97	85.9 (1.8)	18.9 (3.2)	358.5 (3.9)	6.0 (12.0)	2.40 (14.5)	20.8 (2.7)
HUR-36	110.0 (6.1)	21.8 (3.7)	360.1 (4.1)	8.0 (15.0)	2.50 (18.3)	16.8 (0.9)
Sarjoo-52	98.4 (2.9)	20.7 (4.6)	472.1 (6.2)	9.0 (17.0)	3.80 (23.1)	21.5 (3.9)
Ratana	95.4 (2.4)	22.2 (5.8)	409.7 (5.9)	7.0 (13.0)	2.60 (19.6)	17.2 (1.2)
Govind	82.2 (0.8)	19.5 (3.6)	362.9 (4.2)	5.0 (6.0)	3.10 (20.4)	18.7 (1.4)
Mean	96.2	20.1	388.1	7.1	3.01	19.1

SEM= 0.63, $CD_{0.05}$= 1.07, $CD_{0.01}$= 1.59
Values in parentheses denote per cent increase over control

minimum was recorded in Govind (5.0 kg). Highest test weight was recorded in Sarjoo-52 (21.5 g) and lowest in HUR-36 (16.8 g) (Singh et al 2011). *Azo*-BHU responded well on all traits ie plant height, panicle length, number of tillers/sqm area, total biomass, grain yield/plot and test weight was recorded from each plot from all replications as compared to standard check isolate (*Azo*-IARI) which was used as biofertilizer. Therefore it may be concluded that the new isolate (*Azo*-BHU) should be used as diazotroph bacterial biofertilizer for rice cultivation in zone-8 (eastern plane zone) of India.

REFERENCES

Singh MK 2004. Evaluation of *Azospirillum* strains as biofertilizer for rice. MSc thesis, BHU, Varanasi, UP, India, pp 2-4

Singh MK and Singh SK 2012. Novel bacterium *Rhizobium undicola* isolated from the upland cultivated rice (*Oryza sativa* L) promoting plant growth. In: Abstracts, National Seminar on Emerging Challenges and Paradigm for Sustainable Agri-Rural Development, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India, pp 123.

Singh MK, Singh DP, Mesapogu S, Babu BK and Bontemps C 2011. Concomitant colonization of *nifH* positive endophytic *Burkholderia* sp in rice (*Oryza sativa*) promotes plant growth. World Journal of Microbiology and Biotechnology **27:** 2023–2031.

Singh MK, Singh RK, Singh RP 2006. Isolation and Identification of *Azospirillum* and its evaluation as plant growth promoting rhizobacteria in rice (*O sativa* L). In: 8th Indian Agricultural Scientists and Farmers Congress, Banaras Hindu University, Varanasi, UP, India, pp 101-102.

Singh RP, Lawanaya GR and Vaishampayan A 1999. Isolation and screening of *Azospirillum* strains for developing biofertilizer for wheat (*T aestiveum*). In: Biotechnology of Microbes and sustainable utilization (RC Rajak ed). Scientific Publishers, Jodhpur, Rajsthna, India pp 57-62.

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