



Determining Plant Growth Promoting Effect of Potential PGPR (plant growth promoting rhizobacteria) Strains

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Abstract

This experiment was conducted to test the hypothesis that the bacterial strains N-6, N-12 and X are Plant Growth Promoting Rhizobacteria (PGPR). The bacterial strains, X, N-12 and N-6, were isolated previously from the rhizosphere of plants and selected for their potential PGPR characteristics. The strain X has not been tested previously but exhibited bio-control characteristics in a petri dish. To test for plant growth promoting ability of the strains, thirty-six maize seeds were inoculated per strain. They were planted in sterile soil placed in pots and allowed to grow outdoors for twenty-five days before cropping for measurement. Results revealed that inoculation with the three bacteria did not promote growth in a statistically significant manner. Further experimentation will still be required to test the growth promoting activities of N12, N6 and X.

Introduction/Background

PGPR colonize the rhizosphere resulting in stimulated plant growth due to a symbiotic relationship with the plant roots (Vessey, 2003), (McCully, 2001). According to Kloepper (1980) PGPR are hypothesized to stimulate plant growth through nitrogen fixation, phytohormone secretion, solubilizing compounds, and mineralization of phosphates as well as biocontrol mechanisms.

Three bacterial strains, N6, N12, and X, isolated by Dr. Ben Fan from Nanjing Forestry University, are being tested for their plant growth promoting mechanisms. N6 and N12 are thought to be non-legume, free-living bacteria (Dr. Ben Fan) and hypothesized to be soil bacterium *Bacillus mucilaginosus*; characterized by their exopolysaccharide producing activity (Nyanikova, 2002). The third bacterial strain, X, was accidentally discovered in Dr. Fans soil bacterial isolation procedure. It was left aside in a petri dish and was later observed displaying obvious biological control characteristics. This experiment will reveal whether this strain is a phytopathogen or a PGPR. Plant growth is enhanced due to biocontrol of plant pathogens (Weller, 1993).

Biocontrol rhizobacteria can influence plant growth by a variety of biological control mechanisms such as detoxification of virulence factors, antibiosis, and production of iron limiting siderophores (E. Baraka, 2005). The main objective of this research is to determine if strains N6, N12 and X are PGPR using maize plants as a test model.

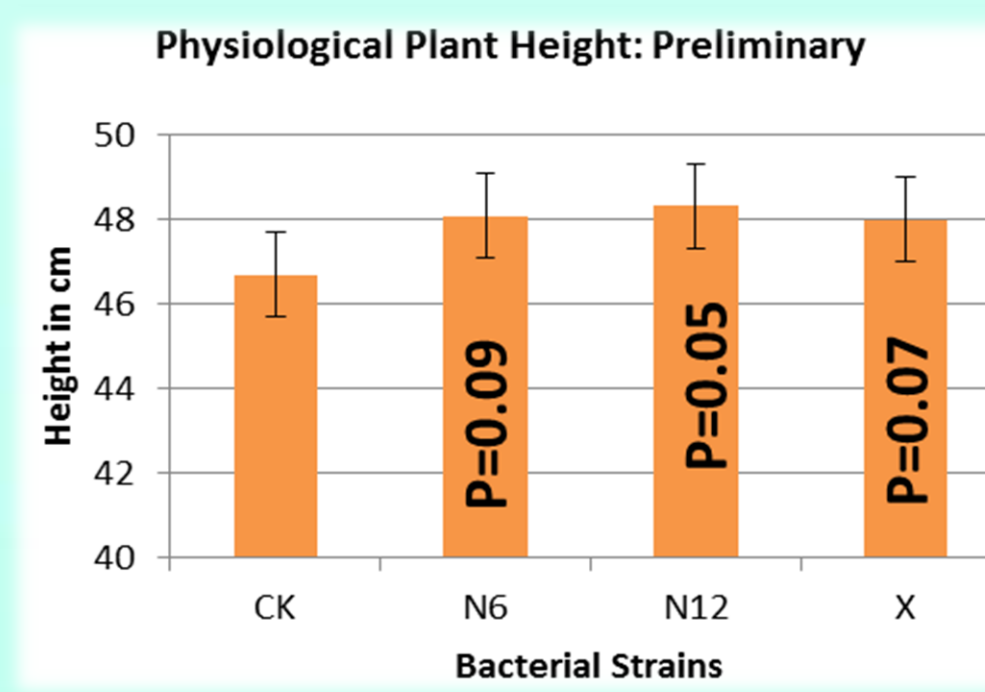


Figure 1: Preliminary physiological height data obtained June 27th 2012

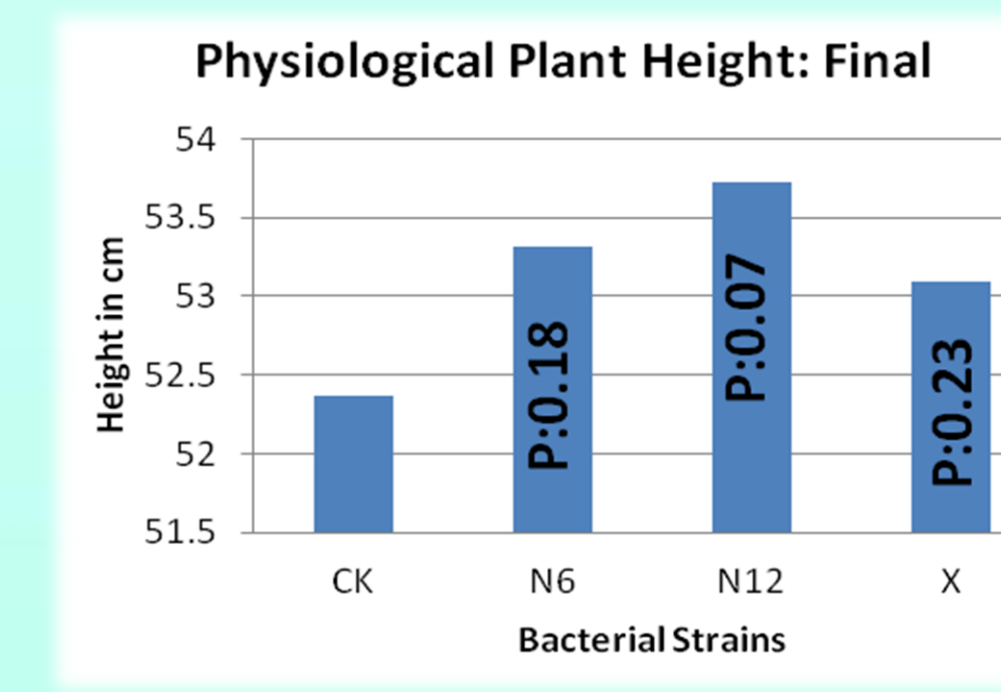


Figure 2: Final physiological height data obtained July 5th 2012

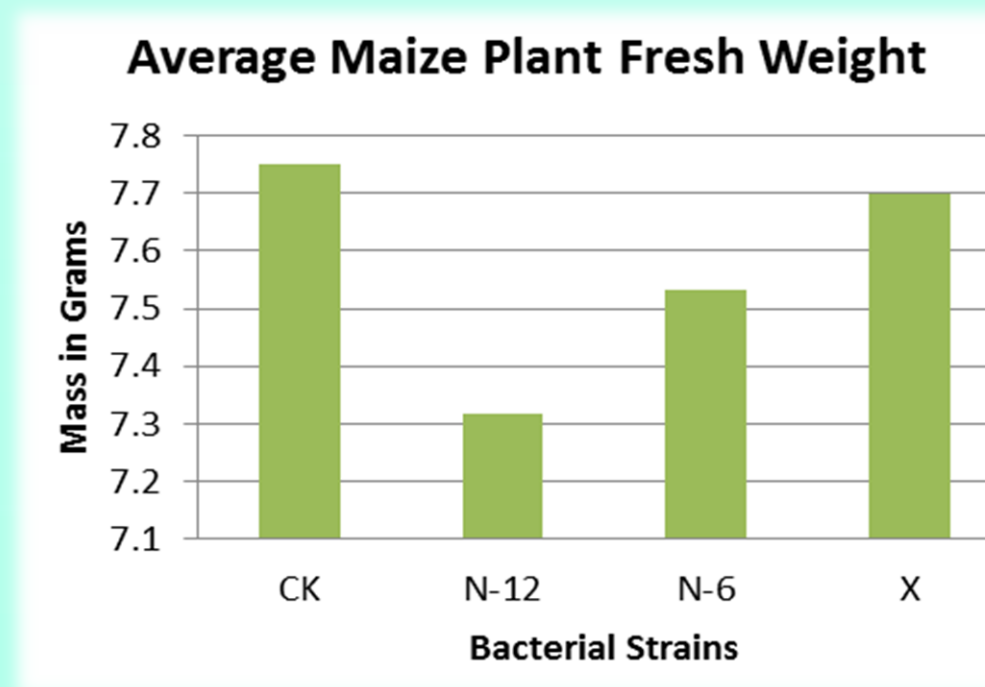


Figure 3: Average weight of fresh maize plants obtained July 5th 2012

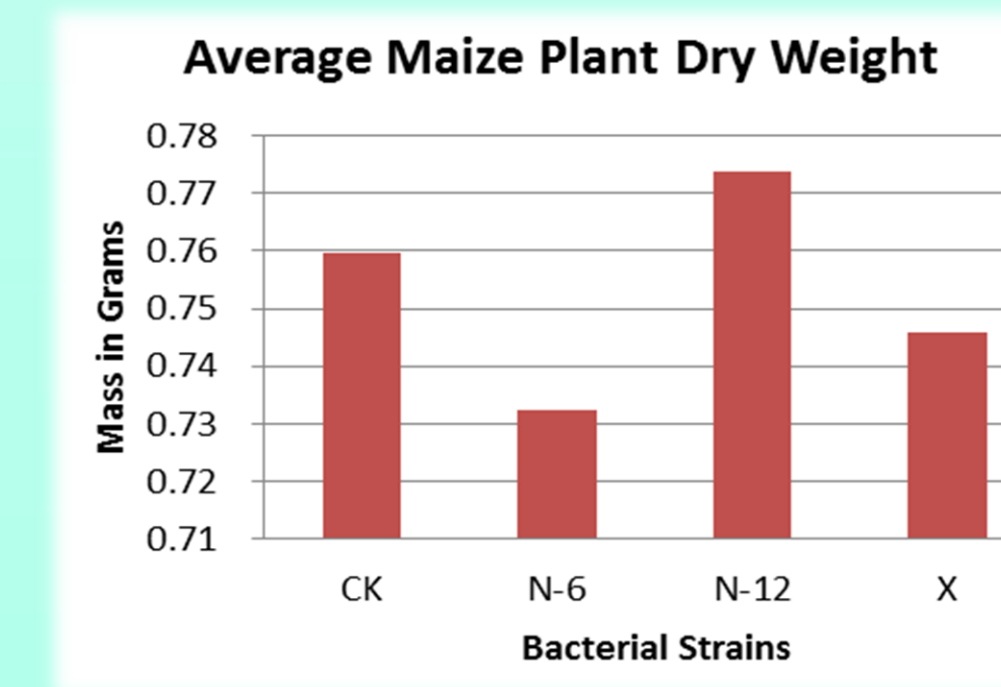


Figure 4: Average weight of dried maize plants data obtained July 5th 2012

Materials and Methods

In order to test if the three different strains were PGPR the strains were cultured and inoculated to cleansed maize seeds. Roots of germinating corn seeds were then dipped into culture masses to inoculate. Best 144 of 400 seeds germinated were chosen to inoculate. Thirty-six seeds were inoculated for each strain as well as thirty six control maize seedlings. Seeds were then planted three per pot. The soil was autoclaved twice to ensure that soil was sterile. The pots were organized using the Latin Square method made famous by Leonhard Euler to reduce bias due to sun exposure, rain fall and shadow (Kumar, 2012). The pots were placed to grow on the roof of a tall building on campus of Nanjing Forestry University in Nanjing, China due to convenience. This experiment was conducted from June 10th to July 5th with temperatures ranging from 95-75 degrees Fahrenheit. The seeds were watered daily. After cropping the fresh weight and physiological height data was obtained, the plants were then dried for four days at 60°C to obtain dry weight data.

Results

Inoculation of maize seeds with the three strains of bacteria did not significantly enhance plant growth.

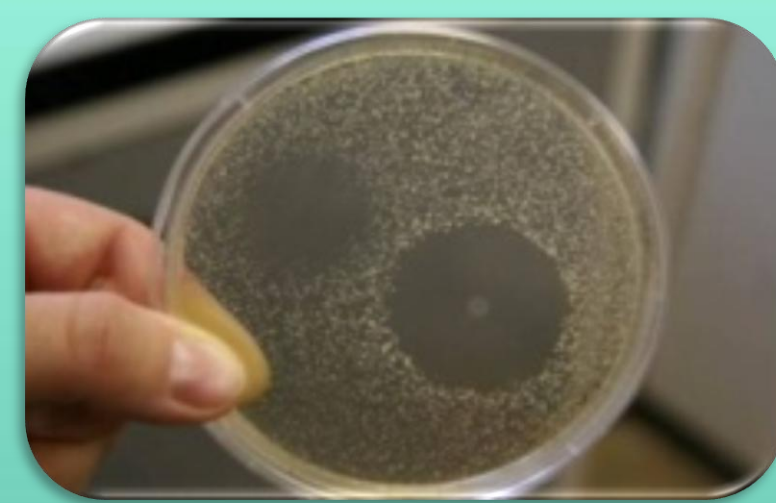
Figure 1 is a graph documenting the physiological height averages of the maize plants on June 27th. This was preliminary data obtained to gauge the effect of the bacteria at the time. N12 is the only rhizobacteria that resulted in plant growth that was significantly greater than the control.

Figure 2 shows the averages of the final physiological height of the maize plants. None are statistically significant in increasing plant height. Height variation can be attributed to random plant variability.

Figures 3 and 4 show maize plant average fresh weight and dry weight respectively. The results of the study showed that inoculation of maize seeds with these particular bacterial strains did not affect fresh or dry weight. Across all three unidentified strains the null hypothesis was not rejected.

Conclusion

The contention that plant growth promoting bacteria increase fresh and dry weight as well as overall plant growth was not supported by this experiment. Various experiments prove that other strains of rhizobacteria do indeed promote plant growth evident from similar experimentation procedures. Reasons for error may be the strains are not actually PGPR, the maize was not a suitable model or because the experiment was not well performed. This experiment did not give enough evidence to prove or disprove x, N-12 or N-6 to be PGPR. But due to previous experiments revealing PGPR potential, further experimentation will be conducted to provide conclusive evidence regarding their growth promoting abilities.



Sources

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