The Effect of Pseudomonas, Piriformospora indica and Laccaria bicolor on the Growth of Gossypium hirsutum

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The purpose of this study is to evaluate a novel combination of Pseudomonas fluorescens, Piriformispora indica, and Laccaria bicolor on the yield and growth of Gossypium hirsutum. It was hypothesized that the aforementioned microbial community would alter the root architecture, growth habit, and yield of cotton. The roots of cotton plants were inoculated with the microbial community and compared against a control population. Measurements were taken for height, the number of fruiting branches and buds, flowers, and bolls. The root architecture was analyzed using tomography. X-ray images were digitized to create three-dimensional images from which root diameter, cross-sectional area, and root spread were obtained. The results indicated that the inoculated plants went through three stages of growth. In the first stage, the microbes were dormant, and the two populations grew at the same rate. In the second stage, the microbes multiplied at the expense of the plants as they competed for nutrients. In the final stage, hormones produced by the microbes accelerated the growth of the inoculated plants. The inoculated population formed 350% more lateral roots, had a larger mass of roots deeper in the growing medium and showed a 14% increase in yield over the control population. Also, the inoculated plants did not have a tap root structure, like the control plants. The significant number of lateral roots and gravitropism are both key indicators of high levels of auxin in the roots, which could only come from P. fluorescens and L. bicolor. The increased flowering observed is an indication of the presence of gibberellin produced by the P. indica. The increased yield is the highest ever reported for cotton.

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