

## BIOAG PROJECT FINAL REPORT

TITLE: ARBUSCULAR MYCORRHIZAL SYMBIOSIS AND PLANT GROWTH AND PRODUCTIVITY

PRINCIPAL INVESTIGATOR(S): B.W. POOVAIAH AND LIQUN DU

COOPERATOR(S): LYNNE CARPENTER-BOGGS, N. RICHARD KNOWLES

KEY WORDS: ORGANIC AGRICULTURE, SUSTAINABILITY, PLANT GROWTH, PRODUCTIVITY, SYMBIOSES, BACTERIA, FUNGI, NITROGEN, PHOSPHORUS

ABSTRACT: THE PLANT RHIZOSPHERE RELIES ON A COMPLEX SYSTEM OF BACTERIA, FUNGI AND MINERALS IN THE SOIL. THE COMBINATION, IN THE RIGHT BALANCE, HELPS PLANTS ACQUIRE VALUABLE NUTRIENTS SUCH AS NITROGEN AND PHOSPHORUS, PROTECTS PLANTS FROM DISEASES, INCREASES WATER ABSORPTION AND PROMOTES GROWTH AND DEVELOPMENT. THE OVERALL GOAL OF THIS PROJECT IS TO INVESTIGATE THE RHIZOSPHERE ECOLOGY AND ITS IMPACT ON CROP PRODUCTIVITY.

PROJECT DESCRIPTION: THE NUTRIENT STATUS OF THE SOIL (ESPECIALLY NITROGEN AND PHOSPHORUS) HAS A DIRECT EFFECT ON MICROBIAL COLONIZATION. THE HYPOTHESIS BEHIND THIS PROJECT IS THAT THERE IS AN INVERSE RELATIONSHIP BETWEEN NUTRIENT STATUS OF THE SOIL AND BACTERIAL AND FUNGAL COLONIZATION. SINCE THE FOCUS OF THIS INVESTIGATION IS ON MYCORRHIZAL SYMBIOSIS, THIS HYPOTHESIS SUGGESTS THAT IF THE SOIL HAS HIGH PHOSPHORUS CONTENT, THE FUNGAL COLONIZATION DECREASES. HENCE, IT IS BELIEVED THAT IF THE SOIL IS HIGH IN PHOSPHORUS, THERE MAY NOT BE A DETECTABLE BENEFIT FROM INOCULATING THE ROOT ZONE WITH MYCORRHIZAL FUNGI.

### OUTPUTS

- **Work Completed:** We have reported in a publication that recently appeared in *The Plant Journal* a unique mechanism which “turns on” and “turns off” both bacterial and fungal symbioses. With this background information, we are proceeding to optimize the rhizosphere conditions for increased crop productivity.
- **Publications, Handouts, Other Text & Web Products:** Apart from *The Plant Journal* publication mentioned above, we have also published a paper in *Plant Physiology* describing the mechanistic aspects of this finding.
- **Outreach & Education Activities:** In addition to the PI and cooperators, one graduate student from the PI’s lab is currently working toward his Ph.D. degree on this project.

### IMPACTS

- **Short-Term:** The support received from the BIOAg program has helped us to lay the necessary foundation for future work on this topic.
- **Intermediate-Term:** This information should help increase crop productivity.
- **Long-Term:** This project should provide information that could increase plant growth and development as well as productivity, thereby providing economic and ecological benefits to the state.

ADDITIONAL FUNDING APPLIED FOR / SECURED: WE ARE PLEASED TO REPORT THAT WSU’S EMERGING RESEARCH ISSUES FOR WASHING AGRICULTURE COMPETITIVE GRANT PROGRAM HAS PROVIDED TWO YEARS OF SUPPORT (\$78,160) TO CONTINUE THIS WORK.

GRADUATE STUDENTS FUNDED: ONE GRADUATE STUDENT

RECOMMENDATIONS FOR FUTURE RESEARCH: BOTH BASIC AND APPLIED RESEARCH ON BACTERIAL AND FUNGAL SYMBIOSES WILL CONTINUE IN THE PI’S LAB. MORE RESEARCH ON RHIZOSPHERE ECOLOGY AND ITS IMPACT ON CROP PRODUCTIVITY WOULD BE VERY BENEFICIAL FOR THE STATE.