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Project Title: Management of Fusarium Head Blight With Biological Control Agents.

PROJECT 1 ABSTRACT

(1 Page Limit)

A field-screening trial for the effectiveness of bacteria acting as biological control agents in managing Fusarium head blight (FHB) will be conducted. Treatments will compare several bacterial strains used as biological control agents (BCAs) applied at various stages of crop development to an untreated control and a fungicide (Folicur) standard. A variety of BCAs will be cultured and applied from investigators in South Dakota and Nebraska, as part of a uniform BCA trial. Because it is difficult to guarantee FHB occurrence, the trial will be planted on sites with spring wheat residue and the site will be challenge inoculated with *Fusarium graminearum* conidia. Plots will be mist-irrigated to increase the likelihood of disease development. Foliar application of cells of the bacterial BCAs will be used in the field at flowering. Extent of FHB development and DON levels in grain will be measured. In some field plot trials, Folicur and one or more selected *Bacillus* strains will be combined and sprayed together to assay whether the combination will have a better ability to control FHB and/or reduce DON levels than each applied alone. Plate count enumeration of *Bacillus* BCAs applied to plant material will be conducted using recently developed culture conditions using high salt and high temperature, and antibiotic resistant spontaneous mutant strains to follow BCA population changes on wheat and barley heads and how these correlate to presence or absence of reduction in FHB and/or DON. Spray application both before and at anthesis will be compared for efficacy of controlling FHB and DON levels, and effect on populations of applied BCAs. Extracts from grain heads inoculated with BCAs will be analyzed for evidence of antibiotics produced by the BCAs, to see if there is evidence for *in situ* antibiotic production by BCAs. Also, PCR analysis of material washed from grain heads inoculated with *Bacillus* BCAs will look for evidence of lipopeptide antibiotic genes in larger amounts than in grain heads that have not been treated with BCAs. Further laboratory studies with pure cultures of the BCAs isolated from South Dakota wheat residue and foliage will examine the production of antibiotics (such as iturin and surfactin) by these *Bacillus spp.* in a limited number of growth media, with the identity of these lipopeptides to be verified by use of mass spectrometry.

Bacterial BCAs may offer a more environmentally friendly control option for plant diseases than some chemical fungicides. By using bacterial BCAs isolated from wheat in a local environment, compatibility of the agent with the crop or success in establishing the agent on the crop should be more reliable. Results of this study will provide guidance in how best to use the agents in a commercial wheat and/or barley production system and how effective the BCAs may be in field situations.