FY23 Executive Summary: A tool for Cheap and Rapid Tracking of Soybean Inoculant Populations in Field Soil

Unnecessary inoculation wastes farmers' money and cuts into their bottom line. However choosing not to inoculate carries significant risk; if optimal nodulation does not occur, soybean crops may not get enough nitrogen resulting in yield losses. Unfortunately, no practical approach currently exists for farmers to predict the requirement for inoculation prior to planting. This work continues efforts to develop a cheap and reliable tool to track rhizobia in farmer's field soils, informing inoculant decisions for farmers either indirectly through accelerating agronomy or directly through use a service. In research this funding year, we showed we could improve the sensitivity of the assay we previously developed by incorporating fluorescent probe technology. Next, we investigated biases in the assay when utilizing vastly different soils from Central Grasslands REC and Williston REC. We found that sandier soils from Williston did result in an underestimation of the number of rhizobia present, and identified improving the robustness of the assay to different soiltypes as an area for improvement in future years. Excitingly, we did find the assay proved robust to diverse sampling procedures. While careful preservation at cool temperatures and freezing of samples is typically thought of as required for molecular analysis, we found our quantification was nearly identical when soil samples were dried and stored at room temperature for weeks; conditions that might be expected for samples sent by farmers for soil chemical analysis. These data indicate the viability of this tool as a possible "add-on" to soil chemical analysis for farmers as they test their soils in the Fall or Spring before planting. Finally, by analyzing 23 different field samples and combining the data with a similar number of field samples from 2022, we began to get a picture of how rhizobial populations shift in North Dakota farm fields. Although reduced populations were expected in Western North Dakota based on 2022 data, with the expanded dataset from 2023, less differences were observed. Across the state, populations generally remained high up to 3 years after soybean planting and declined after that which is roughly in line with state recommendations to inoculate every 5 years. Some fields as little as two years post planting however were found to have undetectable levels of rhizobia. This indicates the potential value of the tool as a failsafe to indicate if farmers should inoculate sooner should their fields not follow typical expected patterns of rhizobia/nodulation over time.