Enhanced root growth reduces Nitrous Oxide emissions

Jeffrey Aguilar[2], Eric Rogers[2], Mickala Stallman[1], Jesse Windle[2], Michael J. Castellano[1], Emily E. Wright[1], Makayla Garland[2], Rachel F. Greenhut[2], Jim Gumpert[2], William S. Niebur[2], Philip N. Benfey[2,3], Sotirios V. Archontoulis[1]

[1]Iowa State University, Department of Agronomy; [2]: Hi Fidelity Genetics; [3]Duke University

Nitrous oxide (N_20) is a greenhouse gas that is three hundred times more potent than carbon dioxide. The majority of N_20 emissions worldwide are the result of excess soil nitrogen being metabolized by microbes. It has been hypothesized that crops with better nitrogen uptake efficiency and more roots will reduce excess soil nitrogen therefore reducing N_20 emissions. To test this hypothesis, a pilot study was performed in 2021 in collaboration with Iowa State University in which root growth dynamics were captured using RootTracker ™ technology in four commercial maize hybrids. This preliminary study showed a correlation between increased root growth and reduced N_20 emissions. Further, we find genetic differences in root growth that is consistent across reps, suggesting that i) cultivar choice impacts N_2O emissions and ii) that it is possible to breed for root system architecture to limit N_2O emissions. It was also observed that the hybrid with the fastest rate of root growth (lowest N_20 emissions) did not reach the greatest soil depth, suggesting early root establishment could be pivotal to more efficient nitrogen uptake. These preliminary results suggest there are differences in root growth by variety that could be exploited to reduce agricultural N_20 emissions at scale.