

The Physiological Utility of Root Hair Length for Ammonium Acquisition

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ABSTRACT

Rapid increase in crop production worldwide has been associated with intensive nitrogen (N) fertilizer application. However, more than half of the applied N fertilizer is lost to the environment, which has detrimental impacts. This emphasizes the need to improve crop N efficiency. Ammonium and nitrate are the most abundant soil N forms acquired by plants. Ammonium differs from nitrate in being relatively immobile and readily bound to soil particles. Therefore, root traits that enhance soil exploration are important for acquisition of ammonium. In this regard root hairs could be particularly important. Root hairs are sub-cellular extensions of root epidermal cells. The presence of long root hairs has been shown to improve acquisition of immobile nutrients such as phosphorus by increasing soil exploration. In this proposed project, the physiological utility of root hair length for ammonium acquisition will be studied under low and high ammonium conditions. Maize recombinant inbred lines contrasting in root hair length and a nitrification inhibitor, Nitrapyrin, will be employed. The application of root hair length to conventional/molecular plant breeding programs may benefit both low and high input agricultural systems by increasing N efficiency, lowering N fertilizer requirements, as well as decreasing N loss, which would have positive impacts on the environment and the economy.