

Nutrient Uptake Interactions in Wheat as a Function of Long-term Rotation and Fertilization

Miles Dyck, PhD, PAg. Professor of Soil Science, Department of Renewable Resources, 442 Earth Sciences BLDG University of Alberta. Edmonton, AB T6G 2E3. mdyck@ualberta.ca

Over the last 20-30 years, increased intensification, and diversification of crop rotations on the Northern Great Plains has increased nutrient removal from cropping systems, affecting soil nutrient cycling, soil C and nutrient balances. Effective management of soil nutrient stocks to meet crop demand is one key to realizing yield potentials given growing season conditions. Because short-term changes in soil nutrient stocks are incremental, the effects of crop rotation and fertilization on crop yields and nutrient uptake are best quantified through long-term observations. Several long-term agroecological experiments (LTAEs) in western Canada have databases with these long-term observations. One example, the University of Alberta Breton Classical Plots, established in 1929, consist of two crop rotations of varying diversity and intensity: 1) wheat-fallow (WF); and 2) five-year, cereal-forage. Superimposed on these rotations are 8 fertility treatments, including a check (control), manure, balanced (NPKS) and nutrient exclusion treatments. Soil total C, N, P, K and S levels were measured on soil samples (0-15 cm) collected from both rotations in 2018. Wheat yields and above-ground N, P, K and S uptake for the 2010-2021 growing seasons from both rotations were compared. The 12-year average yield and crop recovery of N, P, K and S differed between the two crop rotations and fertilization treatments. For example, in the 5-yr rotation, yields and crop N recovery response to P, K and S fertilization was significantly greater than in the WF rotation. Other interactions between crop N, P, K and S recovery and fertilization history were apparent. These results suggest monitoring soil nutrient stocks and harvest removals to inform longer term nutrient management plans could prove effective. Current technologies make this feasible at the field scale.