

AGR1403: Nutrient content and release from soybean residues in comparison to other pulse crops in Saskatchewan

As soybean acreage is expanding in Western Canada, there is a need to assess important agronomic soybean production aspects including yield, nutrient uptake, N₂ fixation, and the effects on following crops under local soil-climatic conditions. Through a three-year rotation study conducted at four sites in the Black and Dark Brown soil zones in Saskatchewan, Canada, this research aimed to estimate the grain and straw yield, nutrient uptake, and N₂ fixation of three short-season soybean varieties in comparison to three pea and three lentil varieties, and the effects on the yield, nutrient uptake, and residue N recovery by following wheat and canola crops grown on the stubble of soybeans, peas, or lentils. Soil nutrient supply rates and greenhouse gas emissions as influenced by soybean, pea, and lentil residues were also estimated in this research. Soybeans produced similar or higher grain yield and nutrient uptake, and had similar effects on soil macro- and micronutrient availability to the following crops in comparison to peas and lentils. Lentils generally had lower grain yield yet similar rotational effects across the sites. Straw yield and composition of the legume appeared to be a more reliable indicator of nutrient contribution to following wheat and canola crops than the grain yield. Compared to peas and lentils, soybeans had significantly higher P, K, Ca, Mg, and S concentrations in the grain across the sites, and similar or larger removal of these nutrient elements, suggesting potential for additional depletion of these elements from the soil over the long-term when soybeans are grown. At maturity, soybeans, peas, and lentils fixed similar amounts of N in the above-ground plant components (grain + straw), with the majority (67-85%) of fixed N retained in the grain of soybeans (119 kg N ha⁻¹), peas (160 kg N ha⁻¹), and lentils (89 kg N ha⁻¹). Nitrogen derived from fixation comprised over 60% of the total above-ground N of the pulse crops. Soybeans were found to be a good N fixer with about 70% of its N derived from fixation. Soybean, pea, and lentil stubbles demonstrated similar effects on greenhouse gas emissions and soil N and P supplies measured under both field and controlled conditions. Overall, this research suggests promising prospects for soybean production under the soil-climatic conditions in the northern Great Plains, with considerations for soil P and K depletion in the long term when soybeans are grown over several rotational cycles, although similar short-term effects on yield and nutrition of following crops were observed from soybeans, peas, and lentils grown under similar conditions. This suggests in the short-term, the requirements for added fertilizer for wheat and canola grown following soybeans would be relatively similar to peas and lentils.