

The role of red clover genotype in improving nitrogen fixation and transfer efficiency in legume-grass forage based production systems

Ranaweera Thilakarathna, Dalhousie University, Vernon Rodd, Agriculture & AgriFood Canada, Mark Grimmet, Agriculture & AgriFood Canada, Sherry Fillmore, Agriculture & AgriFood Canada, Balakrishnan Prithiviraj, Dalhousie University

Nitrogen is a growth-limiting nutrient in grassland systems and its availability is a crucial factor in forage production. High yields and feed quality in forages are traditionally achieved through the addition of chemical fertilizers, but the increasing price of inorganic nitrogen and the fact that nitrogen fertilizers have been linked to a number of environmental issues has spurred interest in developing alternatives nitrogen fertilizer. The incorporation of legumes into pastures and hayfields can increase soil nitrogen through the natural, bacteria-mediated conversion of atmospheric nitrogen (N_2) to ammonium (NH_4^+), in a process known as biological nitrogen fixation (BNF). To better understand the varying effects of diverse red clover cultivars on the efficiency of nitrogen fixation and transfer to companion bluegrass a field study, utilizing ^{15}N dilution technique, was conducted involving six diverse red clover cultivars (three diploid and three tetraploid) over two growing seasons (2010 and 2011). The effects of red clover cultivars on the potential for N leaching and soil N cycling were also assessed during the growing periods by analyzing soil-water samples for nitrate (NO_3^-) and NH_4^+ , and soil samples for NO_3^- , NH_4^+ , and total N, under a bluegrass mixed stand. Significant differences were observed among cultivars in the amount of N fixed during the growing periods but all cultivars derived more than 92% of their shoot N from biological N fixation. When considering all red clover cultivars collectively, the proportion of bluegrass N derived from interplant N transfer from red clover to bluegrass increased over the growing season and it was higher in the second post establishment year than the first post establishment year (46.4 vs 22.9 mg N plant⁻¹, respectively). Significant differences among red clover cultivars were observed for N transfer to bluegrass and for N cycling patterns. These results indicate the potential for developing red clover cultivars specifically for mixed stands, improving N transfer to companion non-legume plants while minimizing N losses through leaching.