Field testing of alfalfa populations carrying both freezing tolerance and root-rot resistance.

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Two important traits for alfalfa productivity under cold climate conditions are freezing tolerance and root-rot disease resistance. Castonguay's group in Quebec has recently improved several alfalfa backgrounds for their tolerance to freezing (TF populations) using numerous cycles of recurrent selections under controlled conditions (Castonguay et al., 2009). Using Apica and Caribou TF3-derived populations (three cycles of selection for freezing tolerance), we proceeded with three additional cycles of selection for resistance to Phytophthora root rot (PRR). PRR, caused by *Phytophthora medicaginis* is a major cause of decline of established alfalfa in North America.

For each cycle of selection, we screened about 1500 genotypes of these two PRR-sensitive backgrounds using a blend of four different PRR isolates. PRR-resistant Amerigraze and PRR-sensitive Saranac seedlings were used as controls. The best one hundred (100) genotypes of each background were selected and intercrossed to generate seeds for the next cycle of selection. We assessed all these alfalfa populations (for Apica; ATF3, APRR1, APRR2, APPR3 and for Caribou; CTF3, CPRR1, CPRR2, CPRR3, and Amerigraze, Saranac) for their yield performance under clay-rich field conditions for two years (third year now) in Quebec. *Phytophthora medicaginis* is a naturally occurring pathogen in the chosen field and therefore, the test plot was not further inoculated. *Aphanomyces euteiches* was also present but to a less extent. A 3-summer cut schedule was used as compromise for yield optimisation as well as for stand vigor and longevity. Alfalfa populations with improved PRR-resistance were significantly more productive than the original TF-Apica and TF-Caribou populations (improved tolerance to freezing). The remarkable yield increased was mostly due to the fact a lot more alfalfa plants survived in the PRR-selection treatments. No significance difference in the yield per individual plant was found between the treatments.