

Wheat breeding against the most common fungal diseases in Switzerland landscape
Kevin Gauthier, Alain Handley-Cornillet, Amandine Fasel, Elodie Isoz, Rachid Majdi, Pierre Stevenel, Boulos Chalhoub

Agroscope, Crops improvement and genetic resources, Strategical research domain plants improvement, Nyon, Switzerland

Wheat followed a long breeding path which led to tremendous improvements of the grain yield and quality. Both traits are affected in Switzerland by several fungal diseases that affect wheat, notably Fusarium head blight, Septoria blotch, rusts, powdery mildew and bunts. These pathogens were controlled by fungicides but their negative impacts on the environment urged the development of more sustainable solutions. Therefore, the aims of wheat breeding are focused to develop more resistant wheat cultivars.

Pre-breeding for resistance, defined here as the identification of resistance genes and QTL in wheat germplasm collections and their introgression into elite cultivars, is a main prerequisite to any breeding program for disease resistance in wheat. Genericity and stability of the genes and QTL of resistance, accuracy and speed of their identification and size of the introgression into wheat elite lines are key success parameters of disease resistance pre-breeding processes. In our work, the monitoring of the diversity and dynamics of fungi pathogens within Switzerland and the use of the most representative pathotypes is very important to insure an efficient screening of wheat resistances in the field. This characterization is complemented with greenhouse trials involving inoculum with other virulence to find new resistance donors. Thereafter, we use mapping populations (generated by double haploid or recombinant inbred lines approaches) and genome wide association studies to identify genes and QTLs of resistance within the genome of the donor. Once mapped, resistance genes and QTLs are introgressed into elite lines using the most recent technologies (e.g., speed breeding, backcross assisted by markers and genomic selection) to insure a fast availability of the resistance in breeding programs. Our wheat disease resistance pre-breeding and breeding strategy deployed here is ensuring development of resilient and robust wheat cultivars, with the best durable resistance, contributing to sustainable agriculture.