Breeding for disease resistance in plants, moving from efficiency to durability

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Breeding for disease resistance proved successful in the past years and delivered many cultivars with multiple disease resistances in a wide range of crops. Genetic control of pathogen is generally considered to be the most efficient, environment friendly and simplest way to control plant pathogens. However, 'simplicity' may not be the right attribute, considering that genetic resistance is expected to provide a high level of crop protection during a long time in intensive cultivation conditions. Genome mapping provides molecular markers for many resistance loci (*i.e.*, major genes or Quantitative Trait Loci) that facilitate the introgression of major resistance alleles into cultivars, through backcross breeding schemes. However, marker assisted selection for polygenic quantitative resistances does not meet such a success Success stories but also difficulties will be illustrated in different situations:

- Breeding for a high level of resistance when only partial and polygenic resistance is available is a frequent challenge with extremely polyphagous pathogens. In such cases, the combination of quantitative resistance factors from multiple accessions and sophisticated phenotyping procedures are required.
- When specific interactions occur between resistance factors and pathogen strains (races or pathotypes), the spectrum of resistance of the cultivar has to be completed in regard to the variability of the pathogen population in the area of seed marketing.
- The durability of the resistance is a major challenge when the high adaptative potential of the pathogen favours the resistance breakdown. But new approaches considering the selection pressure of resistance genes on the pathogen populations recently delivered keys for durable resistance breeding.