PRECISION PLANT BREEDING BY GENOME EDITING IN INNOVATIVE AGRICULTURE

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Crop productivity is an outcome from the interaction between genetic and environmental factors. Farmers can control soil conditions, pests and pathogenic damages and the improvement of genetic program is in hands of plant breeders. Traditional plant breeding techniques such as selection, crossing. polyploidy, mutagenesis are based on phenotypic traits without knowing the genes controlling plant parameters. Gene technology opened ways to identify and isolate agronomic genes responsible for yield stability and quality. Classical mutagenesis is based on chemical mutagens or irradiation. Despite of random alteration of plant genomes more than three thousand crop varieties were produced by these technologies. Recent scientific discoveries opened ways for targeted mutagenesis when out of 2.2 billion nucleotides of maize we can select a target gene and alter single base pair. Both the CRISPR/Cas9 editing and synthetic oligonucleotides-directed mutagenesis (ODM) allow genome editing preferentially knock-out genes. Here several examples will be presented to show the power of these new technologies. We also outline the major components of different approaches including our research efforts to generate gluten-free wheat variants. The ODM technology requires improvement of efficiency and use of different selection protocols. The first products of precision breeding are close to the practice. We have to discuss the different regulatory issues. According to the present EU definition of GMOs, mutants are excludes from the GMO chaterogy.

References

Balázs Ervin, Dudits Dénes (eds.) (2017): Precíziós nemesítés. Kulcs az agrárinnovációhoz. Agroinform Kiadó, Budapest.

Tiricz H, Nagy B, Ferenc G, Török K, Nagy I, Dudits D, Ayaydin F. (2018): Relaxed chromatin induced by histone deacetylase inhibitors improves the oligonucleotide-directed gene editing in plant cells. J Plant Res. 131(1): 179-189.