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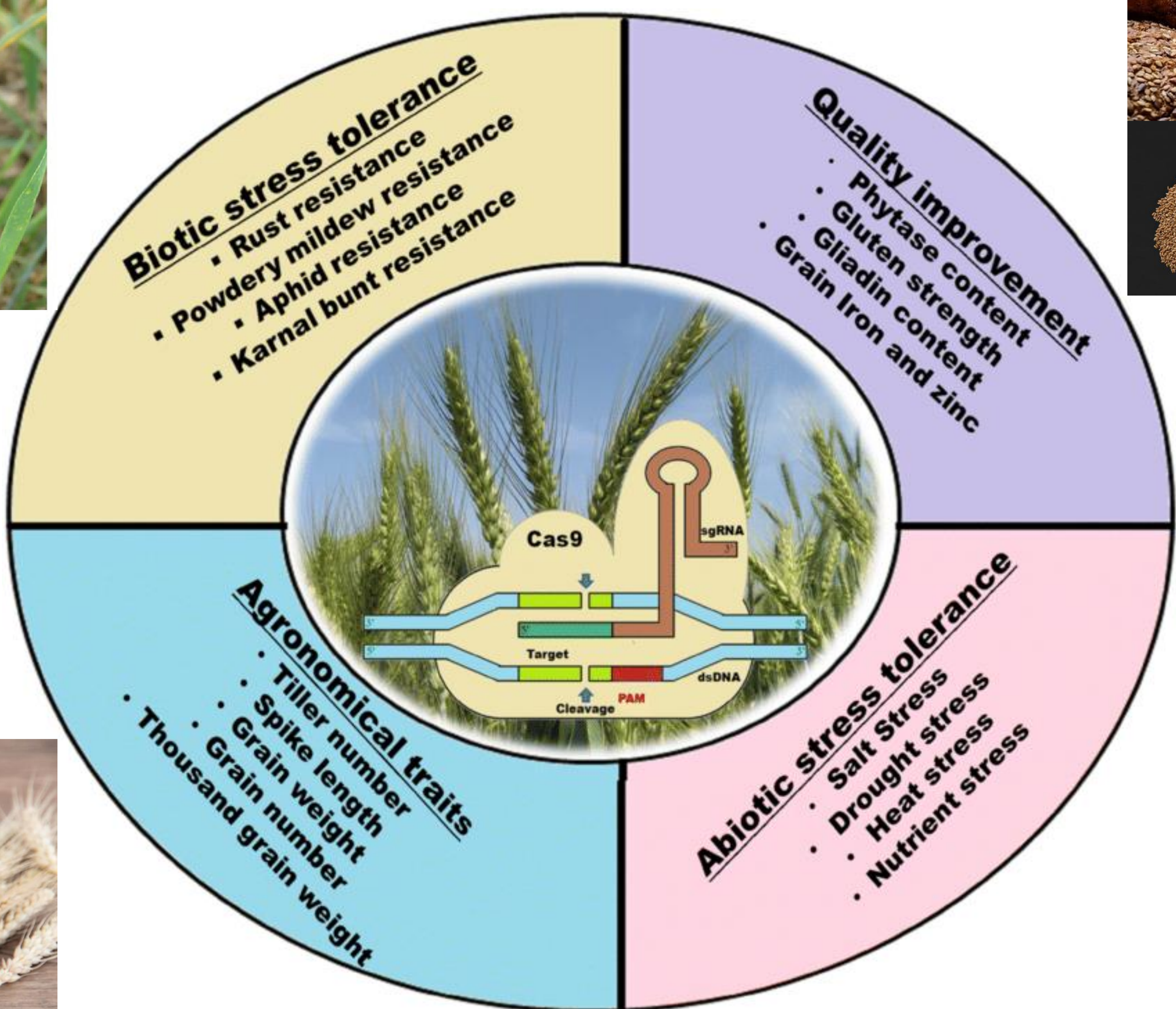
GENOME EDITING OF WHEAT - CHALLENGES AND PROSPECTS FOR TACKLING CHANGING ENVIRONMENT

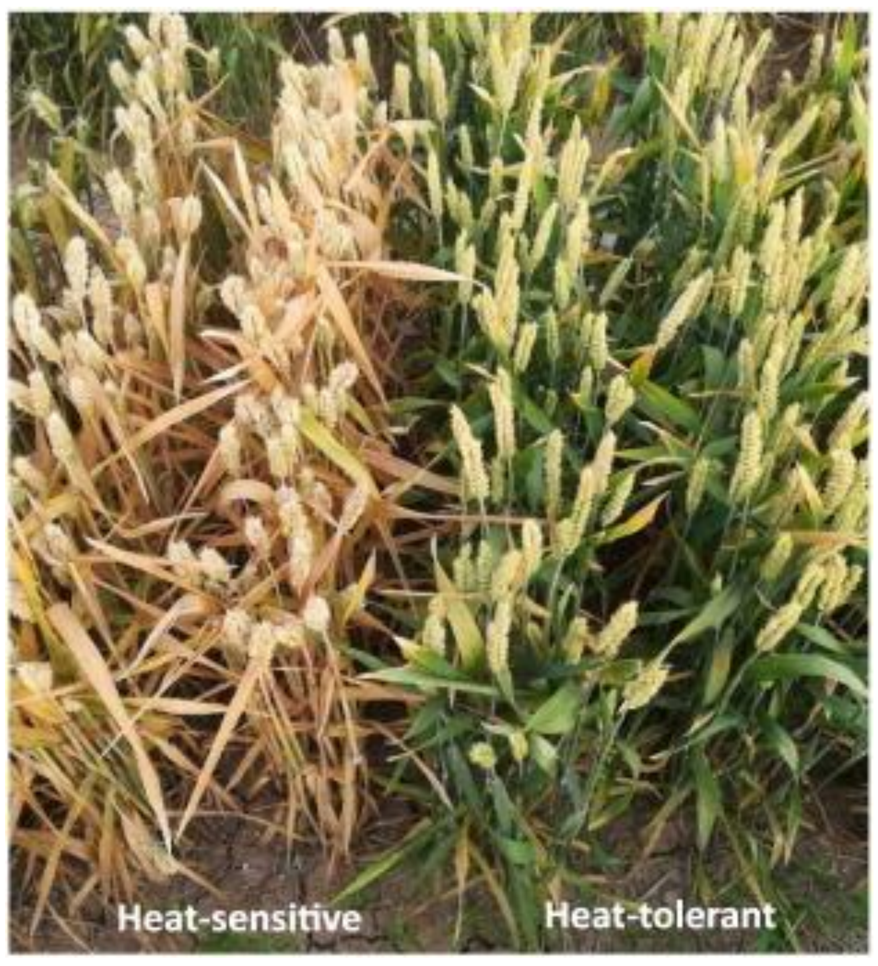
PlantEd **COST Action CA18111** Genome Editing in Plants

Developing wheat able to sustainably produce high yields when grown under biotic/abiotic stresses is an important goal, in order to obtain food security in the face of ever-increasing human population and unpredictable global climatic conditions. However, random mutagenesis or genetic recombination as conventional ways for wheat improvement, are time-consuming and cannot keep pace with increasing food demands. Targeted genome editing (GE) technologies, like zinc-finger nucleases, transcription activator-like effector nuclease, and clustered regularly interspaced short palindromic repeats (CRISPR)/(CRISPR)-associated protein 9 (Cas9)) have been successfully used in editing wheat genome to get heritable variations for creating diversity and precision breeding. The tetraploid durum wheat (*Triticum turgidum* ssp. durum L.) and the hexaploid bread wheat (*Triticum aestivum* L.) are the most widely cultivated types, both with large genomes, developed as a consequence of ancient hybridization events between ancestral progenitors. The highly conserved gene sequence and structure of homoeologs among subgenomes in wheat often permits their simultaneous targeting using CRISPR-Cas9 with single or paired single guide RNA (sgRNA). Since its first successful deployment in wheat, CRISPR-Cas9 technology has been applied to a wide array of gene targets of agronomical and scientific importance, such as α-gliadin genes to lower gluten grain content, *TaGW2* to increase grain weight, *TaZIP4-B2* to understand meiotic homologous crossover, *TaQsd1* to reduce preharvest sprouting, *TaMTL* and *CENH3* for haploid plant induction etc. In the future, genes important for abiotic stress tolerance of wheat should be also targeted by GE technologies. During the last decade, identification of sources for abiotic stress tolerance in the IFVCNS wheat collection was performed under different projects, complemented with molecular analyses for identification of candidate genes of importance for wide adaptation of wheat to changeable environments. The final aim is the exploitation of IFVCNS wheat collections and the newest breeding technologies, such as genome editing, epigenetic tools, genome selection etc. for creation of highly productive resilient wheat varieties, as well as ideotypes specific for certain agro-ecological conditions.

Probable traits for CRISPR-based genome editing in wheat



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