

Applications of Molecular Breeding Technologies in Commercial Crop Breeding

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Abstract

Molecular breeding is a new field that emerged in the early 1990s evolving from plant genomics, molecular biology, molecular genetics, quantitative genetics, and breeding. In a broad sense, it is the application of molecular marker, transgene, and gene editing technologies in traditional plant breeding. Molecular breeding technologies, innovating breeding methodologies and discovering/creating novel genetic variation, have been widely applied to commercial breeding programs of large multi-national seed companies since the discovery of SNPs and the advent of high throughput SNP genotyping technologies, and are the competitive advantages of the world's largest seed companies. In this talk, molecular breeding technologies will be seamlessly integrated into all aspects of traditional breeding process, including genetic diversity assessment of breeding materials, parental line selection and cross design of segregating breeding populations, marker-assisted selection (MAS) of major genes/QTL, marker-assisted recurrent selection (MARS), linkage drag elimination or minimization, marker-assisted backcross conversion (MABC), genome-wide selection (GWS) of polygenic traits, GWS-guided creation of heterotic hybrids, SNP marker-based assessment of genetic purity of advanced breeding lines and hybrid seeds, and DNA fingerprint-based protection of proprietary varieties or hybrids will be presented. Trends in molecular breeding will also be discussed.

Key words: crop breeding, molecular breeding, marker-assisted selection,

分子育种技术在商业育种上的应用

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摘要

分子育种作为全新的领域最早出现在 20 世纪 90 年代, 涉及植物基因组学、分子生物学、分子遗传学、数量遗传学和育种学。广义上讲, 分子育种是分子标记、转基因和基因编辑技术在常规植物育种中的应用。因为 SNPs 的以及高通量 SNP 基因分型技术的出现, 分子育种技术、新的育种方法以及发现和创造新的遗传变异已经广泛运用于许多跨国种业巨头公司的商业育种中并成为世界种业巨头竞争的优势。本演讲中, 分子育种技术完全融入传统育种的各个方面, 包括育种材料遗传多样性的评估、亲本自交系的选择和分离育种群体的杂交设计、主效基因或 QTL 分子标记辅助选择 (MAS)、标记辅助轮回选择 (MARS)、去连锁累赘或连锁累赘最小化、分子标记回交转育 (MABC)、对多基因性状的全基因组选择 (GWS)、基于全基因组选择的优势杂种的选育、基于 SNP 标记的高代自交系及杂种的遗传纯度评估, 基于 DNA 指纹图谱的自主研发的品种或杂种的知识产权的保护。并进一步讨论分子育种的未来趋势。

关键词: 作物育种、分子育种、分子标记选择