Sunflower Breeding Achievement and Challenges

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Abstract

A highly segmented market, such as that of sunflower, can rapidly change the demands placed on breeders and their programs. Environmental variations also change the attitude of breeders themselves, by shifting the process from distinct programs based on the efforts of an individual to team-based programs. Effective delivery will require: increases in breeding efficiency, discovery and development of new native traits through interspecific hybridization and induced mutations, introduction of new methods and techniques, expedition of the selection process using methods such as Marker Assistant Selection (MAS) and MARS, efficient intra-/extra organizational material transfer (including the drafting and validation of material transfer agreements where necessary), strict breeder rights enforcement wherever possible, and the creation of joint programs in collaboration with public and non-profit institutions. One of the greatest challenges breeders face is improving the analysis and understanding of gene expression/regulation and the subsequent impact on individual phenotypes, the phenome, and the metabolome given the context of environment. Genome-based selection as a methodology is of a more recent date and has great prospects for the future. Information relating to the phenotype and genotype of a reference population enables the prediction of model parameters. One of the greatest challenges found in breeding today is the selection of genotypes which bear higher yields in ever more volatile and complex climate conditions. The adaptability of a genotype depends largely on introducing new traits into hybrids which provide better productivity and stability. Crop physiology should support the discovery of complex traits by taking advantage of data and knowledge integration under a Genotype by Environment approach. Characterization and elucidation of mechanisms for gene regulation in sunflower will have high impacts for our scientific, agricultural, and commercial aspirations in near future.

Key words: sunflower breeding, challenge, genome-based selection

向日葵育种取得的成就与挑战

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摘要

像向日葵这样高度细分的市场，可以迅速改变育种家及其研究项目的需求。环境的变化育种家们的态度也会发生变化，从独立研究转向团度合作项目。有效的沟通和传达要求：提高育种效率、通过种间杂交和诱变创造全新的性状、引进新方法新技术、使用 MAS 和 MARS 的方法加速选育进程、有效的机构之间材料交换（必要时包括签署材料转移协议）、可能条件下严格的育种家权利约束、以及创造与公共组织与非营利机构携手合作。育种家面临的最大挑战之一是提高对基因表达/调控的理解以及后续对个体表型、表型组和特定环境中代谢调控的影响。基于基因组的选择是最新的很有前景的方法。与参照群体的表型和基因型有关的信息能够进行模型参数的预测。当前，育种上巨大的挑战之一是选择在不稳定和复杂气候条件下高产的基因型。一种基因型的适应性很大程度上取决于将新性状转移到杂交种中以提供高产和稳产的特性。作物生理学应当整合基因型与环境互作的数据和知识来开展复杂性状的发现和研究。阐明和揭示向日葵的基因调控机制将会对我们未来的科技、农业、商业产生巨大影响。

关键字：向日葵育种、挑战、基因选择