2024年第6期总306期

小麦遗传育种专题

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2024年02月05日

前沿资讯

1．Balancing quality with quantity: A case study of UK bread wheat（质与量的平衡:以英国面包小麦为例）

简介：Bread wheat (Triticum aestivumL.) has historically been an important crop for many human civilisations. Today, variability in wheat supply and trade has a large influence on global economies and food security. The United Kingdom is an example of an industrialised country that achieves high wheat yields through intensive cropping systems and a favourable climate. However, only a minority of the wheat grain produced is of suitable end-use quality for modern bread baking methods and most wheat produced is fed to livestock. A large agricultural land area and input use dedicated to producing grain for animal rather than human food has wide-ranging negative impacts for environmental sustainability and domestic food production. Here we pre-sent an historical perspective of agricultural and economic changes that have resulted in UK production primarily focusing on wheat quantity over quality. Agricultural intensification, liberalisation of free trade in agricultural commodities, innovations in the milling and baking sector, developments in scientific understanding of genetics and plant breeding, and geopolitical changes have all played a role. We propose that wheat breeding plays a crucial role in influencing these issues and although wheat breeders in the United Kingdom have historically applied the most-up-to-date scientific advances, recent advances in genomics tools and quantitative genetics present a unique opportunity for breeders to redress the balance between quantity and quality.

来源：New Phytologist

发布日期:2023-12-18

全文链接:

http://agri.nais.net.cn/file1/M00/10/3A/CsgkOEFjdtuAfIq3ACdappXbXlA415.pdf

学术文献

1．Reviving grain quality in wheat through non-destructive phenotyping techniques like hyperspectral imaging（利用高光谱成像等非破坏性表型技术恢复小麦籽粒品质）

简介：A long-term goal of breeders and researchers is to develop crop varieties that can resist environmental stressors and produce high yields. However, prioritising yield often compromises improvement of other key traits, including grain quality, which is tedious and time-consuming to measure because of the frequent involvement of destructive phenotyping methods. Recently, non-destructive methods such as hyperspectral imaging (HSI) have gained attention in the food industry for studying wheat grain quality. HSI can quantify variations in individual grains, helping to differentiate high-quality grains from those of low quality. In this review, we discuss the reduction of wheat genetic diversity underlying grain quality traits due to modern breeding, key traits for grain quality,

traditional methods for studying grain quality and the application of HSI to study grain quality traits in wheat and its scope in breeding. Our critical review of literature on wheat domestication, grain quality traits and innovative technology introduces approaches that could help improve grain quality in wheat.

来源： WILEY online Library

发布日期: 2023-09-03

全文链接:

http://agri.nais.net.cn/file1/M00/03/67/CsgkOWW6KtGAQ_GPAEbb9KewS3Q901.pdf

2．Molecular Characterization and Marker Development of the HMW-GS Gene from Thinopyrum elongatum for Improving Wheat Quality(用于改良小麦品质的长穗偃麦草HMW-GS基因的分子特征和标记开发)

简介： The quality of wheat primarily depends on its storage protein quality, especially in regards to gluten content and high-molecular-weight glutenin subunits (HMW-GS). The number of HMW-GS alleles is limited in bread wheat (Triticum aestivum L.), whereas it is abundant in wheat relatives. Therefore, HMW-GS alleles from wheat relatives could provide a potential for improving quality in wheat breeding. Thinopyrum elongatum (EE) is one of the relatives of wheat. The E genome is closely related to the ABD genome in wheat; therefore, Th. elongatum is often used as an excellent exogenous gene donor for wheat genetic improvement. In this study, the high-molecular glutenin subunit gene was cloned and sequenced from Th. elongatum. A specific molecular marker for identifying the Glu-1Ey subunit gene was developed and applied to detected wheat-Th. elongatum alien introgression lines. Quality analysis indicated that the substitution and addition lines containing Th. elongatum alleles significantly ($p < 0.05$) increased grain protein content by 3.76% to 5.11%, wet-gluten content by 6.55% to 8.73%, flour 8-MW by 0.25% to 6.35%, and bread volume value by 33.77 mL to 246.50 mL, in comparing it with Chinese Spring. The GMP content and lactic acid SRC showed significant positive correlations with flour processing quality and might be used as indicators for wheat quality. The results were expected to provide a novel route for improving processing quality in wheat quality breeding.

来源： PubMed Central

发布日期: 2023-07-04

全文链接:

http://agri.nais.net.cn/file1/M00/03/67/CsgkOWW6JaGAfFlaACgL6sdQH2c782.pdf

3．Genomics-assisted breeding: The next-generation wheat breeding era(基因组辅助育种:下一代小麦育种时代)

简介： Common wheat provides approximately 20% of the total dietary calorie intake of human beings. Recent technological advances in whole-genome sequencing and their application in wheat and its progenitor species provide new opportunities to uncover the genetic variation of wheat traits and to accelerate the traditional breeding (TB) strategies in

the context of genomics-assisted breeding (GAB). Integration of TB, marker-assisted selection (MAS) and genomic selection (GS) with high-density SNP markers is expected to accelerate the breeding process and to further enhance genetic gain. With the assistance of the next- or third-generation sequencing technologies and high-throughput phenotyping platforms, GAB can now realistically be considered in the following area: (i) genome sequencing and high-quality assembly to uncover new variations, (ii) whole-genome sequence-based association studies, (iii) gene function (or functional gene) identification and (iv) integration of whole genomic breeding information, utilizing multi-omics data and different breeding strategies. We argue that GAB is becoming the preferred strategy in pursuit of new wheat cultivars with superior traits on high yielding, high nutritional quality, climate-resilience and so on.

来源： WILEY online Library

发布日期:2023-05-01

全文链接:

http://agri.nais.net.cn/file1/M00/10/3A/CsgkOEFjb6uAB39nABDC5WTiEkA715.pdf

4 . APPRAISAL OF BREAD WHEAT GERMPLASM FOR QUALITY ATTRIBUTES AND THEIR RELATIONSHIP WITH GRAIN YIELD(面包小麦种质品质属性评价及其与产量的关系)

简介： The increasing global population demands potential high-yielding wheat genotypes, even under changing climatic conditions. Wheat Research Institute (WRI), Faisalabad, designed a two-year study during 20182020, following augmented block design, to assess the association between yield and quality parameters in 245 bread wheat genotypes, including 10 checks. Separating all genotypes into four sets was according to their origin, i.e., local landraces, exotic material from CIMMYT (International Maize and Wheat Improvement Center), Pakistani accessions, and miscellaneous. A sufficient amount of genetic variation among all the genotypes for the measured traits was evident from the analysis of variance (ANOVA). Correlation studies demonstrated a similar trend of association among traits in Pakistani and CIMMYT lines, but distinct patterns of association among landraces and mixed genotypes occurred. The whole population of diversified germplasm showed a positive association of yield with all the traits except chapatti quality, pH of flour, and gluten during 2018 2019. Similarly, in 20192020, grain yield was positively associated with all the traits except test weight, chapatti quality, and pH of flour. The attributes responsible for the grain size, i.e., grain length, width, thickness, and a thousand kernel weight, expressed a strong association among each other and with the grain yield. A positive correlation between grain yield and grain quality characters (bread and chapatti quality, test weight, gluten, and protein) emerged in the pre-green revolution germplasm during both years, which can benefit wheat quality improvement. The study concluded that for future wheat breeding programs for high-yield potential, more attention should focus on the traits responsible for grain size.

来源： EBSCOhost

发布日期:2023-04-01

全文链接:
http://agri.nais.net.cn/file1/M00/10/3A/CsgkOEFjerSAIOR5AAZSjqYrjgs880.pdf