2023年第30期总278期

小麦遗传育种专题

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2．一种用于小麦育种的多层式育种箱

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前沿资讯

1．Genetic mapping and analysis of candidate leaf color genes in common winter wheat (Triticum aestivum L.)(普通冬小麦叶片颜色候选基因遗传定位与分析)

简介：Leaf color-related genes play key roles in chloroplast development and photosynthetic pigment biosynthesis and affect photosynthetic efficiency and grain yield in crops. In this study, a recessive homozygous individual displaying yellow leaf color (yl1) was identified in the progeny population derived from a cross between wheat cultivars Xingmai1 (XM1) and Yunong3114 (YN3114). Phenotypic identification showed that yl1 exhibited the yellow character state over the entire growth period. Compared with XM1, yl1 plants had significantly lower chlorophyll content and net photosynthetic rate, and similar results were found between the green-type lines and yellow-type lines in the BC_2F_3 XM1×yl1 population. Gene mapping via the bulked segregant exome capture sequencing (BSE-seq) method showed that the target gene TaYL1 was located within the region of 582,556,971600,837,326 bp on chromosome 7D. Further analysis by RNA-seq suggested TraesCS7D02G469200 as a candidate gene for yellow leaf color in common wheat, which encodes a protein containing the AP2 domain. Moreover, comparative transcriptome profiling revealed that most differentially expressed genes (DEGs) were enriched in chlorophyll metabolism and photosynthesis pathways. Together, these results indicate that TaYL1 potentially affects chlorophyll synthesis and photosynthesis. This study further elucidates the biological mechanism of chlorophyll synthesis, metabolism, and photosynthesis in wheat and provides a theoretical basis for high photosynthetic efficiency in wheat breeding.

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http://agri.ckcest.cn/file1/M00/03/5C/CsgkOYj8Fq-AfNjcAEAW_XrEGg0499.pdf

2．Improved multi-trait prediction of wheat end-product quality traits by integrating NIR-predicted phenotypes(通过整合近红外预测表型改进小麦最终产品品质性状的多性状预测)

简介：Historically, end-product quality testing has been costly and required large flour samples; therefore, it was generally implemented in the late phases of variety development, imposing a huge cost on the breeding effort and effectiveness. High genetic correlations of end-product quality traits with higher throughput and nondestructive testing technologies, such as near-infrared (NIR), could enable early-stage testing and effective selection of these highly valuable traits in a multi-trait genomic prediction model. We studied the impact on prediction accuracy in genomic best linear unbiased prediction (GBLUP) of adding NIR-predicted secondary traits for six end-product quality traits (crumb yellowness, water absorption, texture hardness, flour yield, grain protein, flour swelling volume). Bread wheat

lines (1,4001,900) were measured across 8 years (20122019) for six end-product quality traits with standard laboratory assays and with NIR, which were combined to generate predicted data for approximately 27,000 lines. All lines were genotyped with the Infinium™; Wheat Barley 40K BeadChip and imputed using exome sequence data. End-product and NIR phenotypes were genetically correlated (0.50.83, except for flour swelling volume 0.19). Prediction accuracies of end-product traits ranged between 0.28 and 0.64 and increased by 30% through the inclusion of NIR-predicted data compared to single-trait analysis. There was a high correlation between the multi-trait prediction accuracy and genetic correlations between end-product and NIR-predicted data (0.690.77). Our forward prediction validation revealed a gradual increase in prediction accuracy when adding more years to the multi-trait model. Overall, we achieved genomic prediction accuracy at a level that enables selection for end-product quality traits early in the breeding cycle.

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学术文献

1．Variability in iron, zinc, phytic acid and protein content in pre-breeding wheat germplasm under different water regimes（不同水分条件下小麦种质铁、锌、植酸和蛋白质含量的变异）

简介： More than one-third of the global population suffers from iron and zinc deficiency, developing anaemia like diseases mostly in the developing countries. Therefore, the current study focuses on the investigation of variability and bioavailability of micronutrients such as iron and zinc in bread wheat mediated by lower levels of phytic acid which is often categorised as an antinutritional compound. Phytic acid in cereals acts as an chelator of major micronutrients such as iron and zinc, thus lowering their bioavailability both in humans and animals. In addition, drought is a major component affecting the micronutrient accumulation in wheat kernels. Therefore, a pre-breeding wheat germplasm set comprising 137 genotypes was grown under irrigated and restricted irrigated conditions for 2 years. This germplasm set was used to assess the variability for iron, zinc and phytic acid content in the wheat kernels. Mean iron and zinc content was 45.83 and 49.43 ppm under irrigated conditions, whereas it was 40.53 and 49.62 ppm under restricted irrigated conditions. Afterward, the molar ratios of phytate with iron and zinc were calculated to predict their bioavailability. Based on the daily recommended values, promising genotypes were shortlisted with low phytic acid combined with high iron and zinc content. These promising genotypes will be further used in wheat breeding programme to breed biofortified wheat cultivars with higher micronutrient and reduced phytic acid concentration combined with enchanted abiotic stress tolerance which can potentially help in alleviating the hidden hunger under changing climatic conditions.

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相关专利

1. 一种小麦育种的选种装置

简介:本实用新型公开了一种小麦育种的选种装置，涉及小麦育种技术领域，包括水箱、过滤筒和盖板，水箱的表面固定连通有连接管；水箱的表面固定连接有固定块，固定块的上方设置有转动电机，转动电机的输出轴固定连接有连接柱，连接柱的上端固定连接有转板一，转板一的表面设置有供过滤筒竖直移动以及转动的驱动部件；该小麦育种的选种装置，可使得过滤筒内的小麦育种完全翻滚起来，从而可将过滤筒内的次品小麦育种以及小麦育种中的灰尘和杂质通过圆形通孔排出至水箱中，避免了过滤筒内有杂质残留也提升了小麦育种选种的质量，并且不用排出水箱内的盐水，即可将成品小麦育种取出，避免了盐水浪费的同时也提升了小麦育种选种的效率。
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2. 一种用于小麦育种的多层式育种箱

简介:本实用新型公开了一种用于小麦育种的多层式育种箱，包括育种箱体和隔层板，育种箱体的前端设置有密封门，育种箱体的前端且位于密封门的上端设置有显示屏，育种箱体的前端且位于显示屏的右侧设置有电源开关，育种箱体的内部设置有隔层板，育种箱体的内部且位于后壁位置处设置有恒温加热管，育种箱体的内部偏底端位置处设置有风机，育种箱体的内部且位于风机的四周设置有进风口，风机、恒温加热管和电源开关电性连接，在小麦育种用多层式育种箱的育种箱体内部偏底端位置处设置有风机和进风口，通过风机和进风口的设置，能够增加小麦育种用多层式育种箱内部的空气流通，进而使得小麦育种用多层式育种箱内部的加热更加的均匀。
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