



2019年第7期总7期

杂交水稻专题

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2019年7月29日

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▶ 前沿资讯

1. 植物（水稻）减数分裂纺锤体组装研究获新进展

简介: 研究人员详细观察了单、双子叶植物减数分裂纺锤体组装的细胞学过程，证实最终的两极纺锤体是由多极纺锤体转变而来的。系统研究减数分裂突变体纺锤体的组装，研究人员发现在DSB形成因子OsmTOPVIB功能丧失情况下，多极纺锤体不能转变为两极纺锤体。而在其他一系列不产生DSB的突变体中，两极纺锤体均可正常形成。这说明在减数分裂过程中，纺锤体的正确组装并不依赖于DSB形成。而在同源重组不能发生导致仅有单价体存在的性母细胞中，部分单价体的着丝粒会改变其原来的单极取向，成为类似有丝分裂的双极取向，这是两极纺锤体形成的重要保证。研究表明，OsmTOPVIB通过改变姊妹染色单体着丝粒的黏连参与减数分裂纺锤体的组装。相关结果为由染色体介导植物减数分裂纺锤体的组装理论提供了直接证据。该成果于7月24日在《美国国家科学院院刊》(PNAS)上在线发表。程祝宽研究组和中科院植物研究所种康研究组合作博士后薛治慧为该文章的第一作者，程祝宽为通讯作者。相关研究得到国家重点研发计划、国家自然科学基金等的资助。

来源: 中国科学院

发布日期: 2019-07-25

全文链接:

http://www.cas.cn/syky/201907/t20190725_4702187.shtml

2. 成功克隆出控制稻米品质的重要基因

简介: 近日，从扬州大学获悉，该校农学院刘巧泉教授研究团队在国家杰出青年科学基金和国家重点研发计划等项目资助下，成功克隆了控制稻米蒸煮与食味品质最重要基因——蜡质基因(Waxy, Wx)的祖先等位基因Wx1v，并阐明了栽培稻中不同Wx等位基因间的进化关系，为稻米蒸煮与食味品质改良提供了重要的基因资源和技术支撑。相关研究成果近日已在《分子植物》在线发表。“水稻是我国最重要的粮食作物，也是一种古老的多型性作物。人类栽培水稻已有近一万年历史，在不同地域、不同生态环境条件下经过长期的演变和分化，形成的品种类型极为丰富，它们在品质性状上所表现出的变异也极为复杂。”刘巧泉说，直链淀粉含量是衡量稻米品质，尤其是稻米蒸煮与食味品质的最重要指标，而直链淀粉是由Wx基因编码的淀粉颗粒结合淀粉合成酶催化合成的。在栽培稻中已克隆了多个Wx复等位基因，并已被广泛应用，但这些等位基因间的演变和分化关系并不明确。据了解，刘巧泉研究团队通过近二十年的努力，从一个地方籼稻品种中图位克隆了Wx的一个特异等位基因Wx1v。携带Wx1v的稻米中含有更多中短分子量的直链淀粉，表现为高直链淀粉含量和低淀粉粘滞特性，米饭口感和食味较差。该团队还研究发现，在具中低直链淀粉含量的Wx等位基因中引入该功能位点，可用于优良食味稻米的培育。刘巧泉介绍，团队通过群体遗传学和分子进化分析，证明Wx1v与野生稻中Wx基因序列及功能基本一致，在进化中属于祖先基因。栽培稻中的秋稻和少数籼稻品种中含有Wx1v等位基因，而栽培稻中其他Wx等位变异类型都是从其进化或人工选择而来。有趣的是，这些等位基因具有明显的优势地理分布区域，说明人工选择在该基因的演化过程中发挥了重要作用。

来源: 北京农业信息网

发布日期: 2019-07-08

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全文链接:

<http://www.agri.ac.cn/news/201978/n3008150568.html>

学术文献

1. Twenty-four alleles at twelve quantitative trait loci act additively to control tiller angle in cultivated rice (12个数量性状位点的24个等位基因对水稻分蘖角的调控作用)

简介: Tiller angle, controlled by quantitative trait loci (QTL), is crucial for achieving ideal plant architecture in rice, which affects its final yield values. It is important to understand the genetic mechanisms underlying tiller angle when breeding new plant-type varieties. To uncover the genetic regulation mechanisms in cultivated rice, we performed QTL analysis using a recombinant inbred line (RIL) mapping population consisting of 219 lines developed by crossing two rice cultivars, Lemont and Yangdao4. The angle between the side tiller (ST) and the horizontal ground was measured as a tiller angle-related trait in QTL analysis. Twenty-three QTLs responsible for ST-ground angle were detected using multiple interval mapping in four mapping environments. A major QTL, qTA9, was detected on chromosome 9, which explained 12.9, 39.8, 37.9, and 28.3% of the phenotypic variation in the four mapping environments, respectively. Another QTL, qTA8, with a relatively large effect, was detected on chromosome 8. The other 21 QTLs explained <10% of the phenotypic variation individually. These 23 detected QTLs were localized in 12 loci that act additively to influence tiller angle as demonstrated by regression analysis: plants carrying more ST-ground angle-increasing alleles at the 12 loci had larger ST-ground angles than those carrying more angle-decreasing alleles. Multiple comparison tests indicated that if marker-assisted selection was used in breeding, selecting five loci randomly from the 12 loci was enough to guarantee a phenotype with a ST-ground angle of over 78 degrees. These results reveal the sophisticated genetic mechanisms controlling tiller angle in cultivated rice.

来源: Plant Growth Regulation: An International Journal on Natural and Synthetic Regulators

发布日期:2019-05-07

全文链接:

<http://agri.ckcest.cn/file1/M00/06/8B/Csgk0F05c4KAF0mQABIr9g-XeWY786.pdf>

2. Removal of cadmium from rice by *Lactobacillus plantarum* fermentation (植物乳杆菌发酵去除水稻中镉的研究)

简介: Cadmium (Cd) contamination in rice has become a serious food safety concern in developing countries. Microbial fermentation has been demonstrated as a promising method for removing Cd from rice. The present study evaluated the effects of *Lactobacillus plantarum* fermentation on Cd levels in rice and analyzed the modes of Cd removal. Fermentation by 10 strains of *L. plantarum* exhibited varied Cd removal capacities, which could be related to variations in the Cd-binding and acid-producing abilities of the strains. In

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light of the relatively superior Cd removal (over 80%) using fermentation by *L. plantarum* CCFM8610, the procedure was optimized, and the predicted Cd removal percentage reached 93.37%. *L. plantarum* CCFM8610 fermentation induced alterations in the physicochemical properties of rice such as reductions in the protein, lipid, and ash contents; appearance of a porous micro-morphology; alteration of the crystal structure of rice starch granules; and improved gelatinization properties. These results suggest that fermentation by *L. plantarum* strains is an effective means of removing Cd from rice and could be considered as a strategy for the development of Cd-free rice-based foods.

来源: Food Control

发布日期: 2018-09-28

全文链接:

http://agri.ckcest.cn/file1/M00/06/8A/Csgk0F04_9KAV4w2AC90Rph2LEk650.pdf

3. GRAIN YIELD AND NITROGEN UTILIZATION IN RESPONSE TO REDUCING NITROGEN RATE IN HYBRID RICE TRANSPLANTED AS SINGLE SEEDLINGS (单株杂交水稻籽粒产量与氮素利用对氮素减量的响应)

简介: Transplanting single seedlings rather than seedlings in clumps has been increasingly attractive in hybrid rice production in China due to reduced seed requirements and higher grain yield. This study was conducted to determine grain yield and nitrogen (N) utilization in response to reductions in the N rate in hybrid rice under single-seedling transplanting. Field experiments were done in 2015 and 2016 on a moderate to high fertility soil at the Experimental Farm of Hunan Agricultural University, China. The hybrid rice cultivar Liangyoupeijiu (LYPJ) was used in 2015, and two hybrid cultivars LYPJ and Xiangliangyou 900 were used the next year. In each year, the rice plants transplanted with a single seedling per hill were grown with three N rates, including the usual N rate (150 kg ha⁻¹) and two reduced N rates (120 and 90 kg ha⁻¹). Grain yield, yield attributes, and N uptake and use efficiency were determined for each N rate. Significant reduction in grain yield was observed in only one of three cultivar-year combinations when N rate was reduced by 20% (from 150 to 120 kg ha⁻¹), and the magnitude of yield reduction was only 4%. Although significant reduction in grain yield was observed in two of the three cultivar-year combinations when N rate reduced by 40% (to 90 kg ha⁻¹), the highest yield reduction was only 7%. Yield attributes were generally changed slightly when N rate was reduced by 20%, while compensation among yield attributes and N utilization characteristics could explain why a 40% reduction in N rate did not result in substantial yield loss. Partial factor productivity of applied N (PFPN) was increased by 21-24% and 56-63% with 20% and 40% reductions in the N rate, respectively. The higher PFPN with a reduced N rate was attributed to higher recovery efficiency of applied N (REN) or to both higher REN and internal N use efficiency. Our study suggests that reducing N rate does not necessarily result in yield loss due to compensation among yield components and increased N use efficiency in hybrid rice transplanted as single seedlings under moderate to high soil fertility conditions.

来源: EXPERIMENTAL AGRICULTURE

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发布日期:2018-06-12

全文链接:

<http://agri.ckcest.cn/file1/M00/00/01/Csgk0V05auCAEM5kAARTyMV3100147.pdf>

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