2023年第37期总285期

# 小麦遗传育种专题

## 本期导读

### 前沿资讯

1．Ag/ZnO核壳NPs对模拟全太阳光谱下小麦幼苗光合作用和生长速率有促进作用

2．紫硬粒小麦基因型对Sitophilus granarius（L.）的吸收和利用效率

### 学术文献

1．小麦根际生化对磷获取的影响与育种的里程碑

2．硬粒小麦地方品种产量和品质性状的选育潜力

3．以环境为导向的选择标准克服小麦抗旱性育种

中国农业科学院农业信息研究所
联系人：唐研;孟静;顾亮亮
联系电话：0531-66657915
邮箱：agri@ckcest.cn
2023年09月11日

## 前沿资讯

### 1．Ag/ZnO core–shell NPs boost photosynthesis and growth rate in wheat seedlings under simulated full sun spectrum（Ag/ZnO核壳NPs对模拟全太阳光谱下小麦幼苗光合作用和生长速率有促进作用）

**简介：**Breeding programs rely on light wavelength, intensity, and photoperiod for rapid success. In this study, we investigated the ability of Ag/ZnO nanoparticles (NPs) to improve the photosynthesis and growth of wheat under simulated full solar spectrum conditions. The world population is increasing rapidly, it is necessary to increase the number of crops in order to ensure the world's food security. Conventional breeding is time-consuming and expensive, so new techniques such as rapid breeding are needed. Rapid breeding shows promise in increasing crop yields by controlling photoperiod and environmental factors in growth regulators. However, achieving optimum growth and photosynthesis rates is still a challenge. Here, we used various methods to evaluate the effects of Ag/ZnO NPs on rice seeds. Using bioinformatics simulations, we evaluated the light-harvesting efficiency of chlorophyll a in the presence of Ag/ZnO NPs. Chemically synthesized Ag/ZnO nanoparticles were applied to rice grains at different concentrations (050 mg/L) and subjected to a 12-h preparation time. Evaluation of seed germination rate and growth response in different light conditions using a Light Emitting Diode (LED) growth chamber that simulates a rapid growth system. The analysis showed that the surface plasmon resonance of Ag/ZnO NPs increased 38-fold, resulting in a 160-fold increase in the light absorption capacity of chlorophyll. These estimates are supported by experimental results showing an 18% increase in the yield of rice seeds treated with 15 mg/L Ag/ZnO NPs. More importantly, the treated crops showed a 2.5-fold increase in growth and a 1.4-fold increase in chlorophyll content under the simulated full sun spectrum (4500 lx) and a 16-h light/8-h dark photoperiod. More importantly, these effects are achieved without oxidative or lipid peroxidative damage. Our findings offer a good idea to increase crop growth by improving photosynthesis using Ag/ZnO nanoparticle mixture. To develop this approach, future research should go towards optimizing nanoparticles, investigating the long-term effects, and exploring the applicability of this process in many products. The inclusion of Ag/ZnO NPs in rapid breeding programs has the potential to transform crops by reducing production and increasing agricultural productivity.

**来源：**Nature

**发布日期:**2023-09-01

**全文链接:**

http://agri.nais.net.cn/file1/M00/10/30/CsgkOGT3xkCAU9jvAE7ZBkkykTU703.pdf

### 2．Acceptance and utilization efficiency of a purple durum wheat genotype by Sitophilus granarius (L.)（紫硬粒小麦基因型对Sitophilus granarius (L.)的吸收和利用效率）

**简介：**The granary weevil (Sitophilus granarius L.) is a major primary pest of stored cereals

throughout the world. Among the major classes of plant secondary metabolites, flavonoids can affect insect feeding behaviour and their growth rate. In this study, the susceptibility of an anthocyanin-rich purple durum wheat genotype (T1303) to the granary weevil was evaluated in comparison with two yellow durum (Ofanto) and bread (Mec) wheat varieties. The feeding response and food utilisation efficiency by adult insects was also investigated by calculating nutritional indices in whole flour disk bioassays. Different levels of susceptibility to granary weevil emerged among genotypes tested. The mean food consumption by an insect, F1 progeny, and female parental offspring calculated for the T1303 genotype were significantly lower than those of yellow kernel wheat varieties. Moreover, T1303 genotype induced deterrence in the adult insects as demonstrated by the positive values of the food deterrence index. Besides, relative grow rate and efficiency conversion of ingested food indices were negative for T1303 and positive for both yellow wheat varieties indicating respectively a decrease and an increase of insect body weight during the bioassays. Finally, a higher mortality rate was recorded for insects fed on T1303 flour disks compared to disks obtained from yellow wheat varieties. These results provide evidence for the antifeedant and toxic effects of anthocyanins present in the T1303 pericarp against the granary weevil. Overall, this study contributes new insights into the mechanisms of host acceptance and food utilization by S. granarius and would be useful to identify antifeedant flavonoids as well as to develop varietal resistance-based strategies against this pest.

**来源：** Nature
**发布日期:** 2023-08-30
**全文链接:**
http://agri.nais.net.cn/file1/M00/03/5E/CsgkOYlOevqAM_hmABH-wgGso7U188.pdf

## 学术文献

### 1 . Breeding Milestones Correspond with Changes to Wheat Rhizosphere Biogeochemistry That Affect P Acquisition（小麦根际生化对磷获取的影响与育种的里程碑）

**简介：** Breeding wheat (Triticum aestivum L.) has resulted in small gains in improved nutrient acquisition and use as numerous traits are involved. In this study, we evaluated the impact of breeding on P-acquisition and identified both plant and soil variables that could be used to inform the selection of germplasm with increased P acquisition efficiency. We previously screened a historic panel of winter wheat cultivars for root system architecture and root tip organic acid content when grown in P-deficient solution/agar and used these characteristics together with breeding history to develop a predicted P extraction potential (PEP). We tested the validity of the PEP classification by growing cultivars under sufficient and insufficient soil P conditions. Old, wild-type cultivars had the greatest P utilization efficiency (PUtE) when grown under insufficient P, likely a result of the chemical potential of wild-type (with respect to Rht-B1) cultivars (greater organic acid production) rather than root system size. Wild-type plants had differences in rhizosphere microbial community structure, rhizosphere bicarbonate-extractable P, and bulk soil Fe and Al, indicating the utilization of

typically less available P pools. The PEP classification based on the presence of dwarfing allele and era of release offers a path forward for breeding for improved P acquisition.
**来源：** MDPI
**发布日期:**2023-03-10
**全文链接:**
http://agri.nais.net.cn/file1/M00/03/5E/CsgkOYlOhFSAFSy_ABNnyiI_U18231.pdf

## 2 .Breeding Potentials of Durum Wheat Landraces for Yield and Quality Traits(硬粒小麦地方品种产量和品质性状的选育潜力)

**简介：** The study was carried out to evaluate yield components and some physiological quality traits for 30 durum wheat landraces (native and foreign originated) and 5 obsolete cultivars in Thrace ecological conditions. Experiments were set up in randomized block design in 3 replicated during the 3 consecutive growing seasons. As a result of the analysis of variance, the differences between the averages of the genotypes for the traits were found to be statistically significant. This indicated that there may be enough variation for traits within landraces. The mean values of genotypes ranged between 2238 kg/ha$^{-1}$ and 3749 kg/ha$^{-1}$ for grain yield, 98.8 cm and 135.3 cm for plant height, 6.04 cm and 8.88 cm for spike length, 26.6 and 35.3 for the number of grains per spike, 0.988 g and 1.494 g for grain weight per spike, 36.1 g and 42.7 g for thousand grain weight, 74.4 kg/hl$^{-1}$ and 79.4 kg/hl$^{-1}$ for test weight and 82.1% and 94.6% for vitreous grain percentage. Although Kahramanmaraş, Dicle, Boğacak, Sorgül, Ionia, Cyprus and Haurani were determined as promising populations for yield and yield components, Siverek, Çanakkale, Tokat, Gaziantep, Yozgat and Urfa landraces had better physical quality. The estimated coefficient of variation and broad sense heritability shifted from 3.9% to 24.52% and from 7.91% to 72.44% for the traits, respectively. Moderately high coefficient of variation, broad sense heritability a genetic advance for plant height, spike length and vitreous grain percentage indicated that selection based on these traits will be more effective and accomplished in the genetic material.
**来源：** Ekin
**发布日期:**2023-02-01
**全文链接:**
http://agri.nais.net.cn/file1/M00/10/30/CsgkOGT3z1GAE1c-AAWcF8bXjjs760.pdf

## 3 . Environment-oriented selection criteria to overcome controversies in breeding for drought resistance in wheat(以环境为导向的选择标准克服小麦抗旱性育种)

**简介：** Wheat is one of the most important cereal crops, representing a fundamental source of calories and protein for the global human population. Drought stress (DS) is a widespread phenomenon, already affecting large wheat-growing areas worldwide, and a major threat for cereal productivity, resulting in consistent losses in average grain yield (GY). Climate change is projected to exacerbate DS incidence and severity by increasing temperatures and changing rainfall patterns. Estimating that wheat production has to substantially increase to

guarantee food security to a demographically expanding human population, the need for breeding programs focused on improving wheat drought resistance is manifest. Drought occurrence, in terms of time of appearance, duration, frequency, and severity, along the plant's life cycle varies significantly among different environments and different agricultural years, making it difficult to identify reliable phenological, morphological, and functional traits to be used as effective breeding tools. The situation is further complicated by the presence of confounding factors, e.g., other concomitant abiotic stresses, in an open-field context. Consequently, the relationship between morpho-functional traits and GY under water deficit is often contradictory; moreover, controversies have emerged not only on which traits are to be preferred, but also on how one specific trait should be desired. In this review, we attempt to identify the possible causes of these disputes and propose the most suitable selection criteria in different target environments and, thus, the best trait combinations for breeders in different drought contexts. In fact, an environment-oriented approach could be a valuable solution to overcome controversies in identifying the proper selection criteria for improving wheat drought resistance.

**来源：**ScienceDirect
**发布日期:**2023-01-01
**全文链接:**
http://agri.nais.net.cn/file1/M00/10/30/CsgkOGT3ORGAXpPOABgFggInZNU714.pdf