2022年第28期总351期

蔬菜育种专题

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学术文献

1. What regulates the rhizodeposition of winter oilseed rape during growth?(调控冬油菜生长期间根际沉积的因素)

简介：The goal of this work was to contribute to a better understanding of the process of rhizodeposition in crops and to find helpful approaches for creating a simple model of rhizodeposition. For this purpose, we tested three hypotheses about the relationships and changes in the relative C partitioning coefficients and their ratios. In particular, we analyzed the relation-ships between root growth, belowground respiration, rhizodeposition and other traits during plant growth.

The ranges of variation in ^{14}C partitioning coefficients and various plant traits were determined after ^{14}C labeling of four winter oilseed rape geno-types in three developmental stages.

For all genotypes, we found very strong and significant correlations between the percentages of freshly assimilated C used for rhizodeposition and root growth. In addition, we showed that the ratios of the rel-ative ^{14}C fluxes in the root-soil-soil gas system changed significantly during plant development and that the rela-tive and absolute C fluxes of rhizodeposition followed different trends. The root growth rate and the change in the ratio of the percentages of ^{14}C in rhizodeposition and root tissue over time were the key factors that deter-mined the absolute amount of rhizodeposited C. We also found that the C partitioning in a taproot system leading to root growth and rhizodeposition was similar to that of an adventitious root system.

来源：Plant and Soil

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http://agri.ckcest.cn/file1/M00/10/09/CsgkOGLGSbaABNkcAC_5t-yPSRA785.pdf

2. BrKAO2 mutations disrupt leafy head formation in Chinese cabbage (Brassica rapa L. ssp. pekinensis)(BrKAO2突变破坏大白菜叶状头形成)

简介：Chinese cabbage yield and quality are determined by leafy head formation. Cloning and characterising the key genes regulating leafy head formation are essential for its varietal improvement. We used an EMS-mutagenised population of the heading type ‘FT’ Chinese cabbage line and identified two allelic non-heading mutants, i.e. nhm3-1 and nhm3-2. Genetic analysis showed that the mutant trait was controlled by a single recessive gene. MutMap and Kompetitive Allele Specific PCR genotyping revealed that BraA05g012440.3C was the candidate gene, which encodes ent-kaurenoic acid oxidase 2 in gibberellin (GA) biosynthetic pathway. It was named BrKAO2. Two non-synonymous mutations in the second BrKAO2 exon, respectively, accounted for the mutant phenotypes of nhm3-1 and nhm3-2. BrKAO2 was expressed during all leaf development stages, and there were no significant differences between the wild type and mutants in terms of BrKAO2 expression. The mutant phenotypes were restored to the wild type via exogenous GA3 application. RNA-Seq was

performed on wild-type 'FT', nhm3-1, and nhm3-1 + GA3 rosette leaves, and several key genes involved in GA biosynthesis, signal transduction, and leafy head development were identified. These findings indicate that BrKAO2 is responsible for the leafy head formation in nhm3 mutants.

来源：Theoretical and Applied Genetics

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3. Prediction of Phenolic Contents Based on Ultraviolet-B Radiation in Three-Dimensional Structure of Kale Leaves(基于 UV-B 辐射的羽衣甘蓝叶片三维结构酚含量预测)

简介：Ultraviolet-B (UV-B, 280-315 nm) radiation has been known as an elicitor to enhance bioactive compound contents in plants. However, unpredictable yield is an obstacle to the application of UV-B radiation to controlled environments such as plant factories. A typical three-dimensional (3D) plant structure causes uneven UV-B exposure with leaf position and age-dependent sensitivity to UV-B radiation. The purpose of this study was to develop a model for predicting phenolic accumulation in kale (Brassica oleracea L. var. acephala) according to UV-B radiation interception and growth stage. The plants grown under a plant factory module were exposed to UV-B radiation from UV-B light-emitting diodes with a peak at 310 nm for 6 or 12 h at 23, 30, and 38 days after transplanting. The spatial distribution of UV-B radiation interception in the plants was quantified using ray-tracing simulation with a 3D-scanned plant model. Total phenolic content (TPC), total flavonoid content (TFC), total anthocyanin content (TAC), UV-B absorbing pigment content (UAPC), and the antioxidant capacity were significantly higher in UV-B-exposed leaves. Daily UV-B energy absorbed by leaves and developmental age was used to develop stepwise multiple linear regression models for the TPC, TFC, TAC, and UAPC at each growth stage. The newly developed models accurately predicted the TPC, TFC, TAC, and UAPC in individual leaves with $R^2 > 0.78$ and normalized root mean squared errors of approximately 30% in test data, across the three growth stages. The UV-B energy yields for TPC, TFC, and TAC were the highest in the intermediate leaves, while those for UAPC were the highest in young leaves at the last stage. To the best of our knowledge, this study proposed the first statistical models for estimating UV-B-induced phenolic contents in plant structure. These results provided the fundamental data and models required for the optimization process. This approach can save the experimental time and cost required to optimize the control of UV-B radiation.

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4. Physiological Mechanism of Exogenous 5-Aminolevulinic Acid

Improved the Tolerance of Chinese Cabbage (Brassica pekinensis L.) to Cadmium Stress(外源5-氨基乙酰丙酸提高白菜(Brassica beijing ensis L.)镉胁迫抗性的生理机制)

简介：The 5-aminolevulinic acid (ALA), a new type of plant growth regulator, can relieve the toxicity of cadmium (Cd) to plants. However, its mechanism has not been thoroughly studied. In the study, the roles of ALA have been investigated in the tolerance of Chinese cabbage (Brassica pekinensis L.) seedlings to Cd stress. The results showed that Cd significantly reduced the biomass and the length of the primary root of seedlings but increased the malondialdehyde (MDA) and the hydrogen peroxide (H_2O_2) contents. These can be effectively mitigated through the application of ALA. The ALA can further induce the activities of antioxidant enzymes in the ascorbate-glutathione (AsA-GSH) cycle under Cd stress, which resulted in high levels of both GSH and AsA. Under ALA + Cd treatment, the seedlings showed a higher chlorophyll content and photosynthetic performance in comparison with Cd treatment alone. Microscopic analysis results confirmed that ALA can protect the cell structure of shoots and roots, i.e., stabilizing the morphological structure of chloroplasts in leaf mesophyll cells. The qRT-PCR results further reported that ALA downregulated the expressions of Cd absorption and transport-related genes in shoots (HMA2 and HMA4) and roots (IRT1, IRT2, Nramp1, and Nramp3), which resulted in the low Cd content in the shoots and roots of cabbage seedlings. Taken together, the exogenous application of ALA alleviates Cd stress through maintaining redox homeostasis, protecting the photosynthetic system, and regulating the expression of Cd transport-related genes in Chinese cabbage seedlings.

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5. Transport, Stability, and In Vivo Hypoglycemic Effect of a Broccoli-Derived DPP-IV Inhibitory Peptide VPLVM(西兰花衍生的DPP-IV抑制肽VPLVM的转运、稳定性和体内降血糖作用)

简介：Diabetes is a major metabolic disease that requires long-term pharmacotherapy. Bioactive peptides have unique advantages such as higher potency, selectivity, and safety over small molecules and have achieved great success in the treatment of diabetes. We previously isolated a dipeptidyl peptidase-IV (DPP-IV) inhibitory peptide VPLVM with IC_{50} = 99.68 μM from the protein hydrolysates of broccoli stems and leaves. Here, we evaluated the interaction with DPP-IV, transport, stability, and in vivo hypoglycemic effects of VPLVM. VPLVM interacted closely and steadily with DPP-IV at S1 and S2 pockets. VPLVM had a good gastrointestinal enzyme resistance and was transported through the Caco-2 cell monolayer via paracellular diffusion and by the PepT1 with a P_{app} of 6.96 × 10^{-7} cm/s. VPLVM has a $t_{1/2}$ of 12.56 ± 0.41 min in vitro plasma stability. In the oral glucose tolerance test, VPLVM showed an excellent hypoglycemic effect at 30 min after administration. VPLVM has potential as a candidate for the treatment of hyperglycemia.

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