2022年第16期总339期

蔬菜育种专题

本期导读

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1. 纳米颗粒在植物中的毒性 - 细胞/形态生理学、生化和分子反应的评估

2. 根际工程

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学术文献

1．Analysis of Growth Characteristics of Kimchi Cabbage Using Drone-Based Cabbage Surface Model Image（利用源自无人机的卷心菜表面模型图像进行卷心菜生长特性分析）

简介：Cultivation soil is the basis for cabbage growth, and it is important to assess not only to provide information on how it affects the growth of vegetable crops but also for cultivation management. Until now, field cabbage surveys have measured size and growth variations in the field, and this method requires a lot of time and effort. Drones and sensors provide opportunities to accurately capture and utilize cabbage growth and variation data. This study aims to determine the growth stages based on drone remote estimation of the cabbage height and evaluate the impact of the soil texture on cabbage height. Time series variation according to the growth of Kimchi cabbage exhibits an S-shaped sigmoid curve. The logistic model of the growth curve indicates the height and growth variation of Kimchi cabbage, and the growth rate and growth acceleration formula of Kimchi cabbage can thus be derived. The curvature of the growth parameter can be used to identify variations in Kimchi cabbage height and its stages of growth. The main research results are as follows. (1) According to the growth curve, Kimchi cabbage growth can be divided into four stages: initial slow growth stage (seedling), growth acceleration stage (transplant and cupping), heading through slow growth, and final maturity. The three boundary points of the Kimchi cabbage growth curve are 0.2113 G_{max}, 0.5 G_{max}, and 0.7887 G_{max}, where G_{max} is the maximum height of Kimchi cabbage. The growth rate of cabbage reaches its peak at 0.5 G_{max}. The growth acceleration of cabbage forms inflection points at 0.2113 G_{max} and 0.7887 G_{max}, and shows a variation characteristic. (2) The produced logistic growth model expresses the variation in the cabbage surface model value for each date of cabbage observation under each soil texture condition, with a high degree of accuracy. The accuracy evaluation showed that R^2 was at least 0.89, and the normalized root-mean-square error (nRMSE) was 0.09 for clay loam, 0.06 for loam, and 0.07 for sandy loam, indicating a very strong regression relationship. It can be concluded that the logistic model is an important model for the phase division of cabbage growth and height variation based on cabbage growth parameters. The results obtained in this study provide a new method for understanding the characteristics and mechanisms of the growth phase transition of cabbage, and this study will be useful in the future to extract various types of information using drones and sensors from field vegetable crops.

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2．Morpho-anatomical, biochemical and molecular genetic responses of canola (Brassica napus L.) to sulphur application（油菜（Brassica napus L.）对硫磺施用的形态解剖学、生化和分子遗传反应）

简介：Brassica napus (canola), a major economic crop in Egypt, contains much oils and proteins. In the present study, the foliar applications of ammonium sulphate (A.S.) [$(NH_4)_2SO_4$] (0, 1% 0.2% and 0.3%) to canola plants had distinctive impacts on the morpho-anatomical, biochemical, and molecular genetic responses. Interestingly, there is a positive impact when sulphur (S) is foliarly applied at 0.2% of A.S. as revealed in antioxidants, flavonoids, total carbohydrates, and protein contents which were significantly affected. On the other hand, higher levels of glucosinolates were recorded for 0.3% and 1% A.S. (4.838 and 1.905, respectively). The electrophoretic analysis of proteins displayed 51 bands of molecular weights ranging from 8.555 to 240.6 kDa with 88.24% polymorphism with a mean band frequency of 0.373. Cytotoxicity assay revealed that the lower cell death was detected in treated root tips of canola plants following 0.2% A.S. treatment, as compared to control. With increasing of sulphur treatment, the root cortex thickness, number of conducting elements, and pericycle thickness decreased while root pith area increased. In canola leaves of high S level, the leaf blade thickness, the thickness of abaxial and adaxial epidermis surface, mesophyll thickness, and metaxylem area increased, while the xylem conducting elements number decreased. Moreover, SCoT molecular markers have been used to evaluate the genetic variation among Brassica napus genotypes subjected to different A.S. treatments. Four of the seven SCoT primers were revealed to be polymorphic in both treated and untreated samples. A total of 39 amplicons, ranging in size from 200 to 1080 bp, were amplified, with 9 (23.07%) of them being polymorphic. Clustering dendogram based on SCot markers data divided Brassica genotypes into two main clusters based on similarity coefficients indices. B. napus treated with 0.2% A.S. was separated in a distinct cluster. Furthermore, treatments with sulphur enhanced the activity of antioxidant enzymes as well as the expression level of their encoding genes (CAT, catalase; POD, peroxidase; APX, ascorbate peroxidase; SOD, superoxide dismutase; GR, glutathione reductase), particularly at 1% and 0.2% A.S. treatments. Taken together, this study revealed that foliar application of sulphur treatments, particularly at 0.2%, have a great potential to improve canola crop.
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3. Mechanism of Pb accumulation in Chinese cabbage leaves: Stomata and trichomes regulate foliar uptake of Pb in atmospheric $PM_{2.5}$(大白菜叶片Pb积累机制：气孔和毛状体调节大气中 $PM_{2.5}$-Pb的叶面吸收)

简介：Chinese cabbage (Brassica rapa ssp. pekinensis) is one of the most popular and frequently consumed leafy veg-etables. It was found that atmospheric $PM_{2.5}$-Pb contributes to Pb accumulation in the edible leaves of Chinese cabbage via stomata in North China during haze seasons with high concentrations of fine particulate matter in autumn and winter. However, it is unclear whether both stomata and trichomes co-regulate foliar transfer of $PM_{2.5}$-Pb from atmospheric deposition to the leaf of Chinese cabbage genotypes with

trichomes. Field and hydroponic experiments were conducted to investigate the effects of foliar uptake of $PM_{2.5}$-Pb on Pb accumulation in leaves using two genotypes of Chinese cabbage, one without trichomes and one with trichomes. It was verified that open stoma is a prominent pathway of foliar $PM_{2.5}$-Pb transfer in the short-term exposure for 6 h, contributing 74.5% of Pb accumulation in leaves, whereas Pb concentrations in the leaves of with-trichome genotype in the rosette stage were 6.52- and 1.04-fold higher than that of without-trichome genotype in greenhouse and open field, respectively, which suggests that stomata and trichomes co-regulate foliar Pb uptake of from atmospheric $PM_{2.5}$. Moreover, subcellular Pb in the leaves was distributed in the following order of cytoplasm (53.8%) > cell wall (38.5%)> organelle (7.8%), as confirmed through high-resolution secondary ion mass spectrometry (NanoSIMS). The Leadmium™ Green AM dye manifested that Pb in $PM_{2.5}$ entered cellular space of trichomes and accumulated in the basal compartment, enhancing foliar Pb uptake in the edible leaves of cabbage. The results of these experiments are evidence that both stomata and trichomes are important pathways in the regulation of foliar Pb uptake and translocation in Chinese cabbage.

来源：Environmental Pollution

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科技图书

1．Toxicity of Nanoparticles in Plants - An Evaluation of Cyto/Morpho-physiological, Biochemical and Molecular Responses(纳米颗粒在植物中的毒性 －细胞/形态生理学、生化和分子反应的评估)

简介：Toxicity of Nanoparticles in Plants: An Evaluation of Cyto/Morpho-physiological, Biochemical and Molecular Responses, Volume Five in the Nanomaterial-Plant Interactions series, reviews the latest research on toxicological effects of using nanotechnology in plants. Key themes include analyzing plant exposure to nanomaterials, mechanisms of toxicity of nanoparticles to plants, and effects, uptake and translocation of various different nanoparticles. This will be an essential read for any scientist or researcher looking to assess and understand the potential toxicological risks associated with plant nanotechnology. To date, nanotechnology is considered one of the most promising areas of research due to the widespread applications of nanomaterials in plant science and agriculture. However, extensive use of nano-based products raises concerns regarding their toxicity in crop plants, their environmental impact and potential consequences to humans via the food chain.

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2. Rhizosphere Engineering（根际工程）

简介：Rhizosphere Engineering is a guide to applying environmentally sound agronomic practices to improve crop yield while also protecting soil resources. Focusing on the potential and positive impacts of appropriate practices, the book includes the use of beneficial microbes, nanotechnology and metagenomics. Developing and applying techniques that not only enhance yield, but also restore the quality of soil and water using beneficial microbes such as Bacillus, Pseudomonas, vesicular-arbuscular mycorrhiza (VAM) fungi and others are covered, along with new information on utilizing nanotechnology, quorum sensing and other technologies to further advance the science. Designed to fill the gap between research and application, this book is written for advanced students, researchers and those seeking real-world insights for improving agricultural production.

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