

Research Team of Precision Production and Management Technology of Citrus, CRI, CAAS-SWU



Professor Deng Lie

The research team of precision production and management technology of citrus, based on the support of National Citrus Engineering Research Center of China, Functional Laboratory of Citrus Cultivation & Farming of Ministry of Agriculture (MOA) of China, and Chongqing Key Laboratory of Citrus Science of Chongqing Sciences & Technology Commission, was founded in 2010. The team is led by Prof. Deng Lie, and team members include five associate professors, one assistant professor, two agronomists, and 13 postgraduate students.

In order to promote R&D of key technology and equipment of precision production and intelligent management for citrus, the team focuses on the research of planning of mechanized citrus orchard, variable rate fertilization technique, orchard management intelligent decision support technology, unmanned aerial vehicle (UAV) low-altitude remote sensing and spraying, non-destructive detection techniques of citrus fruit quality and leaves nutrition. The main research contents and achievements of the team are as follows:

(1) The intelligent decision support technology of citrus production

Citrus plant growth information, climate information, and soil information of orchard were collected, shared and analyzed. Intelligent decision support technologies and systems of citrus production were developed. Production guidance information messages, such as pruning, spraying, fertilization, irrigation, and harvesting were automatically recorded and fast pushed to fruit grower, and low temperature, disease and pest, drought and other disasters were pre-warned. The systems have been established and run in several citrus producing areas in China .

(2) Nutrition diagnosis and variable fertilization techniques

Real-time nutrition detection and diagnosis techniques and equipments of citrus trees and soil based on the near-infrared spectroscopy have been systematically studied and developed. The high-precision variable fertilization decision system and precision fertilization prescription map in mountain citrus orchard was developed and applied in multiple citrus orchards in Chongqing, Zhejiang and Jiangxi Provinces.

(3) Identification, traceability techniques of citrus germplasm resources

Based on the VIS/NIR spectroscopy and imaging spectroscopy, identification and traceability of citrus germplasm resources were achieved. The citrus germplasm spectral library was established.

(4) Agricultural aviation technology in citrus

Low-altitude multi/hyper-spectral remote sensing systems were developed using a multispectral camera array or hyperspectral camera mounted at an eight-rotor unmanned aerial vehicle (UAV). Remote sensing data of citrus plants or orchard were obtained using the systems, and nutrition contents were calibrated and predicted using the data and chemometrics methods.

Droplet deposition and distribution in citrus plants crown using UAV spraying system was tested and analyzed, and the control effect of UAV spraying system on the citrus leaf-miner was further experienced. The results showed that the hedgerow type citrus canopy and the canopy with opening structure could obtain better droplets deposition distribution and the leaf-miner control effect by the UAV spraying application, but it is still needed to improve the effectiveness of the insect control.

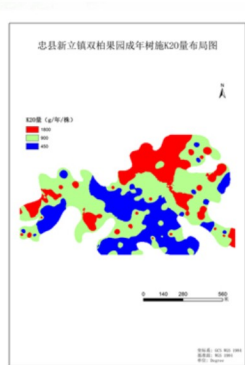
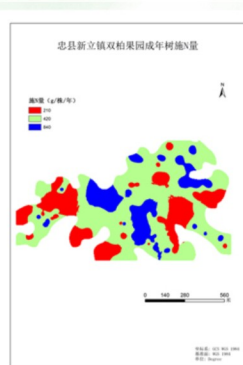
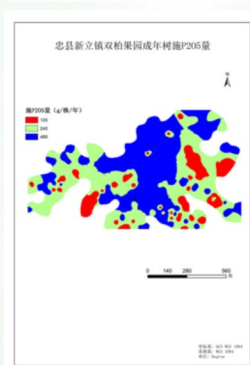
(5) Mechanization in citrus orchard

In order to meet the urgent demand for China's fruit industry to the orchard management machinery, Prof. Deng's team timely started planning of modern mechanized orchard and mechanization research. Technical regulations for building the mechanized orchard was drafted. The multifunctional operation machinery, intelligent machinery, UAV spraying and remote sensing system and the matching agronomic techniques for the orchard were developed in cooperation with agricultural research institutions and enterprises. The citrus orchard operation machinery, target spraying and surface fertilizing machinery, orchard mowing and covering machinery, ditching & fertilizing machinery and multi-functional rail operation system for the mountain orchard have been created and demonstrated in the tens of thousands citrus orchard in China.

(6) Non-destructive quality detection techniques

Non-destructive detection technique for citrus fruit was researched and developed based on VIS/NIR spectroscopy. Mature period and quality harvest decision support system for citrus varieties have been carried out. The team is focusing on the research and development of a vehicle mounted citrus fruit quality detection and grading equipment using machine vision.

The team has finished or is carrying out four projects of National Natural Science Foundation, one National High Technology Research and Development Program, one National International Science and Technology Cooperation Program, one Chongqing International Science and Technology Cooperation Program, one Chongqing Science and Technology Support and Demonstration Project, and other scientific research projects. More than 10 items of patents and software copyright have been licensed. More than 60 academic papers have been published, among which 35 have been indexed by SCI/EI. The team hopes to strengthen expecting fundamental and applied researches in Precision Production and Management Technology for citrus industry in the future.



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