# Scientific Monitoring and Assessment Report on the Rice Production Situation in Dongguan City

## Executive Summary

This report is based on the Dongguan Smart Agriculture Integrated Management Platform. It conducts a multi-dimensional and quantitative monitoring and assessment of the city's rice production system for the period from July 1 to August 31, 2025, covering the critical peak tillering stage of vegetative growth to the initial heading stage of reproductive growth. The assessment integrates multi-source satellite remote sensing, low-altitude UAV hyperspectral and visible-light remote sensing, IoT sensor networks, and operational statistical data. Through data assimilation and model inversion, it aims to provide objective and precise decision-making support.

## Key Findings

During the monitoring period, the overall physiological and biochemical indicators of rice across the city were normal, showing a stable and positive growth trend. However, significant spatial heterogeneity was observed. Localized areas in the eastern region experienced a slight delay in biomass accumulation due to periodic insufficient soil available water during the tillering stage. The phenological process in the southern region was advanced, overlapping with the high-risk period for typhoons and severe convective weather predicted by climate models, highlighting significant vulnerability to meteorological disasters. Meanwhile, there is room for improvement in irrigation water use efficiency, and the spatiotemporal coordination of agricultural input supply chains needs enhancement. The report issues a medium-level warning regarding potential risks of lodging and pre-harvest sprouting during the heading and flowering stages in the southern production areas.

## I. Multi-Source Remote Sensing Inversion Analysis of Core Agricultural Indicators

### 1.1 Dynamic Monitoring and Mapping of Phenological Stages

Based on time-series vegetation index (NDVI, EVI2) curves and using dynamic threshold methods and curvature change recognition models, the platform accurately interprets the phenological progression of rice across the city. As of August 31, the spectral characteristics of the rice canopy indicate that the entire city has generally entered the heading stage. Zonal statistics show: the northern region reached the peak tillering stage (peak NDVI growth rate) around July 20 and entered the heading stage (with EVI2 beginning to fluctuate upward) on August 25; the eastern region experienced slight developmental delays due to earlier water conditions, with corresponding dates of July 25 and August 28; benefiting from sufficient accumulated temperature, the southern region progressed the fastest, with dates of July 18 and August 22, respectively. The spatiotemporal fused phenological map generated by the platform has a spatial resolution of 10 meters, accurately reflecting developmental differences at the field scale.

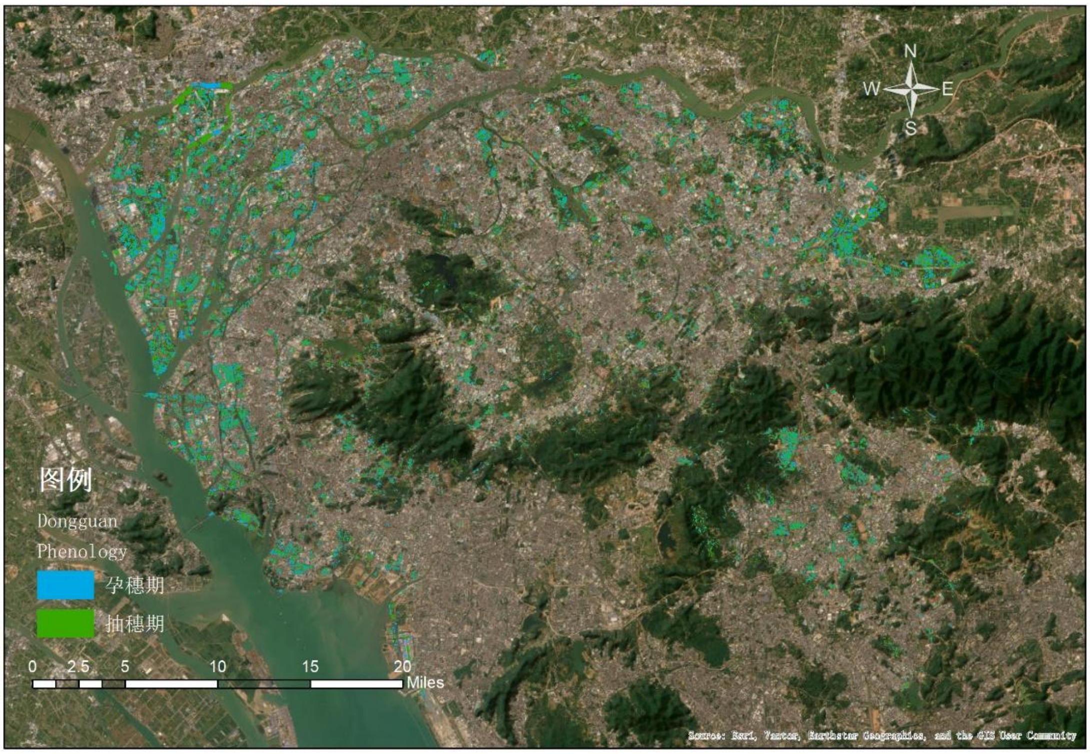


Figure 1. Intelligent Monitoring Results of Rice Phenological Stages in Dongguan on August 25, 2025

## 1.2 Retrieval of Biophysical Parameters and Yield Potential Estimation

Utilizing spectral information from the red, red-edge, and near-infrared bands, combined with radiative transfer models (such as PROSAIL), key biophysical parameters were retrieved. The Leaf Area Index (LAI) distribution map indicates that approximately 85% of the city's rice fields have LAI values within the optimal high-yield range of 3.5–5.5, demonstrating favorable canopy structure. In the eastern region, about 5% of the cropland exhibits LAI values between 2.5 and 3.0, indicating insufficient leaf area, which is associated with reduced effective tillering due to prior water stress.

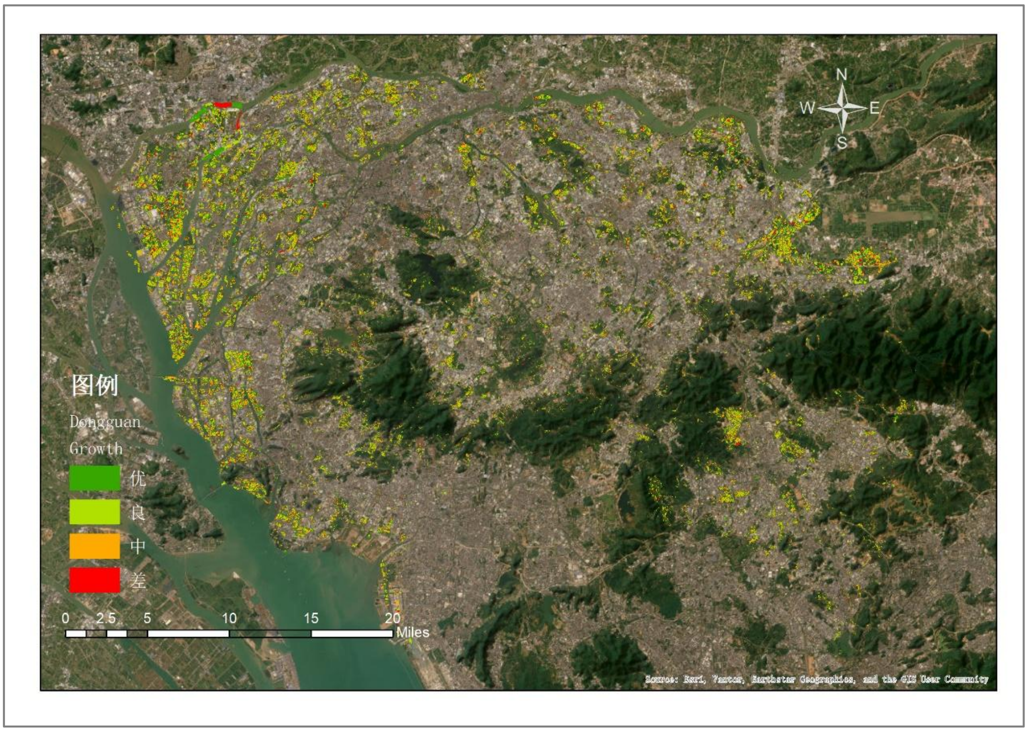


Figure 2. Intelligent Monitoring Results of Rice Growth Classification in Dongguan on August 25, 2025

By integrating the WOFOST crop growth model and inputting real-time meteorological data along with the retrieved time series of LAI and leaf chlorophyll content (Cab), a process-based simulation of yield was conducted. Preliminary simulation results indicate that, under scenarios without major disasters, the theoretical average yield potential for the city is approximately 630 kilograms per mu. However, the final formation of yield components (panicle number, grain number per panicle, and grain weight) depends approximately 60% on the grain-filling environment within 35 days after heading, particularly photosynthetic active radiation and diurnal temperature range.

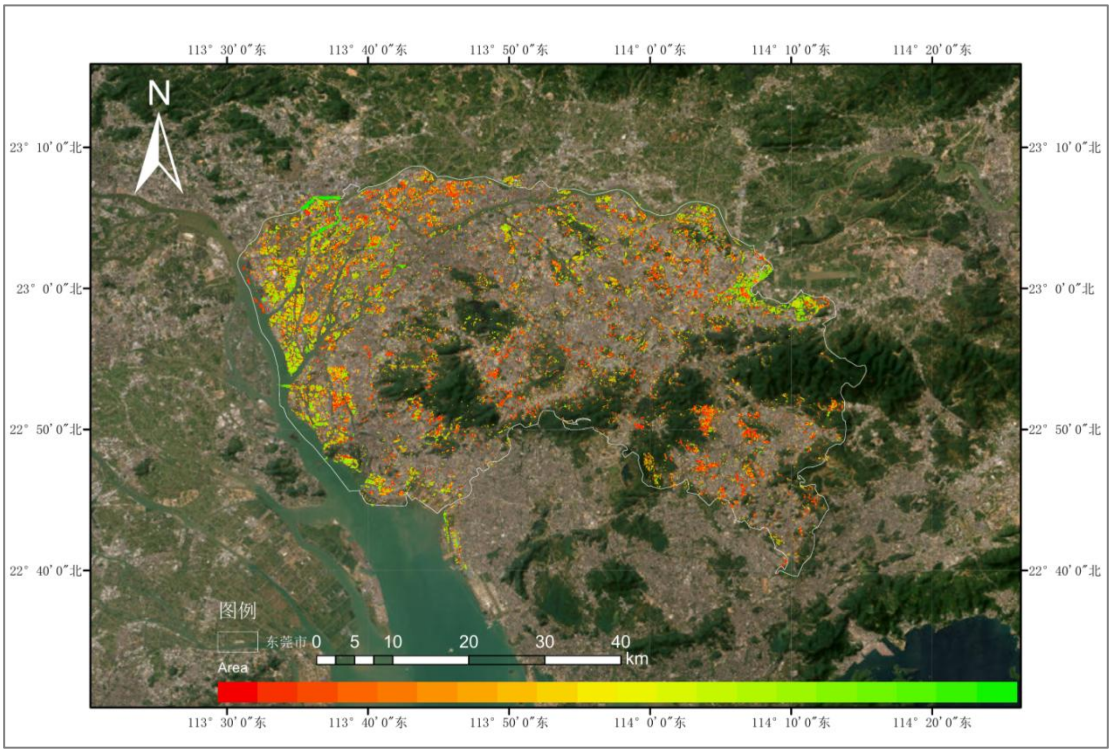


Figure 3. Estimated Final Rice Yield in Dongguan on August 25, 2025

## II.Water Resource System Efficiency Assessment and Facility Condition Diagnosis

### 2.1 Water Regime Dynamics and Supply-Demand Balance Simulation

The platform integrates hydrological monitoring data, indicating that the current total water storage in major reservoirs is 85% of their designed beneficial capacity, which falls within the safe storage range. A one-dimensional hydrodynamic model simulation reveals that the total diversion flow in the main canal system in late August was 184.4 $m^3/s$, with the Qixing Canal and Tangyi Canal accounting for 28% and 22% of the total diversion, respectively, serving as the primary water conveyance arteries. By comparing irrigation water demand with canal inflow, the current supply and demand are essentially balanced. However, the model also indicates that if the water conveyance efficiency of the canal system in the eastern irrigation district is not improved, end-user water scarcity pressure may arise during the peak water demand period at the heading stage.

### 2.2 Intelligent Inspection of Irrigation Infrastructure Health

Unmanned aerial vehicles (UAVs) equipped with visible-light and multispectral cameras were employed to collect centimeter-level resolution data for key irrigation district channels. Deep learning image segmentation models (e.g., U-Net) automatically identified areas of sediment accumulation and aquatic vegetation coverage within the channels. Quantitative assessment shows that approximately 3 kilometers of channels in the eastern irrigation district have moderate to severe sedimentation, leading to a reduction in their cross-sectional flow area. According to Manning's formula estimation, water conveyance efficiency has decreased by approximately 10.2% compared to the design value. This engineering bottleneck is the direct cause of the phenomenon where water is available upstream but scarce downstream. Relevant coordinates, estimated sedimentation volumes, and high-resolution imagery have been structured and stored in the database, automatically triggering facility maintenance work order processes.

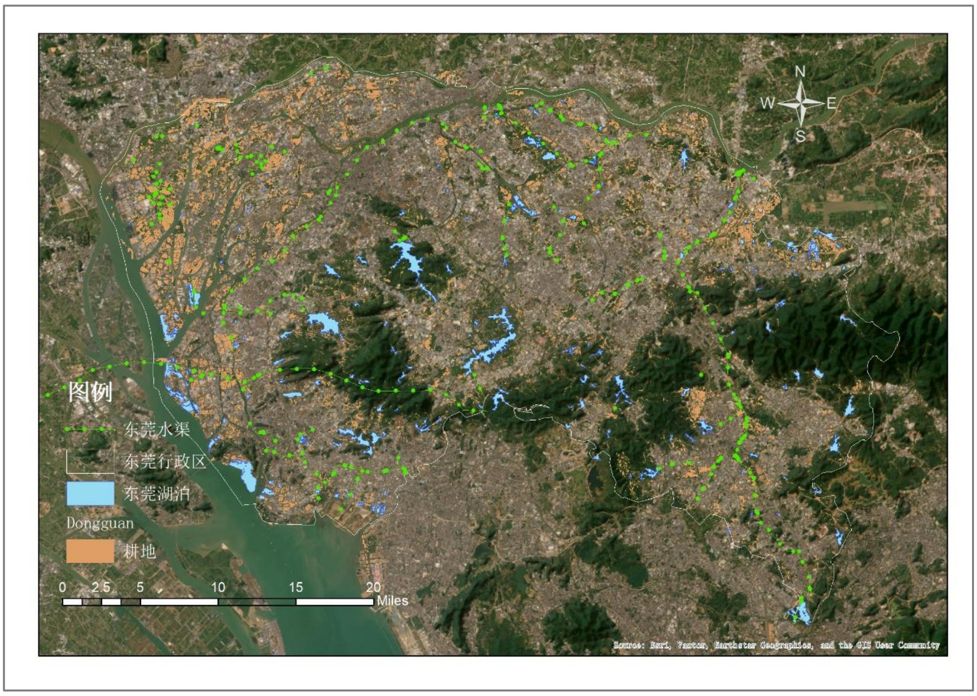


Figure 4. Assessment Results of Water Conservancy Facilities Status in Dongguan for August 2025

## III. Analysis of Stability in the Production Factor Supply Chain

### 3.1 Analysis of the Match Between Agricultural Input Inventory and Demand

The platform integrates the supply and marketing system database. Currently, the city's main agricultural input inventories are: NPK compound fertilizers, 3,018 tons; broad-spectrum insecticides/fungicides, 14.85 tons; and agricultural plastic film, 44.58 tons. Based on the nutrient requirements for the next stage (grain-filling period) predicted by the rice growth model and historical pest and disease occurrence models, the total inventory is sufficient. However, spatial network analysis reveals that the inventory turnover rate for high-potassium compound fertilizers at logistics nodes in the northern region has exceeded the warning threshold. The current inventory can only meet the expected demand for approximately 10 days, indicating a risk of regional and structural shortage. The platform has activated a supply chain alert, recommending the initiation of regional transfer or emergency replenishment procedures.

### 3.2 Assessment of Spatiotemporal Accessibility of Socialized Service Resources

The city's service resource network consists of 120 geographically registered agricultural service organizations and 310 plant protection drones. Using the platform's scheduling algorithm, optimal dispatch plans can be generated within 15 minutes based on the location, area, and urgency level of pest and disease outbreak points, combined with the real-time location, equipment model, and service capacity of the service organizations. This ensures efficient spatiotemporal matching between service demand and supply, reducing emergency response time from the traditional 24–48 hours to 2–4 hours.

## IV. Agricultural Management Prescriptions Based on Risk-Decision Models

### 4.1 Zonal Precision Management Prescriptions

- **Eastern Region (Supplementary Fertilization for Weak Areas):** For fields with low Leaf Area Index (LAI), the prescription recommends foliar application of a panicle fertilizer containing potassium dihydrogen phosphate (concentration 0.3–0.5%) and trace elements within 5–7 days after heading, aiming to enhance photosynthetic efficiency and grain filling. Simultaneously, the irrigation priority is to complete mechanical desilting of identified silted channels within three days to ensure the irrigation prerequisites for implementing this prescription.

- **Southern Region (Stress Resistance and Yield Protection)：** Based on ensemble typhoon track forecasting products, the platform calculates lodging risk indices under various landing scenarios. Defensive prescriptions include: immediate clearance and inspection of field ditches upon warning issuance; and reducing the field water layer to below 3 cm within 24–36 hours before the typhoon's arrival to lower the plant's center of gravity and wind resistance.

### 4.2 Global Optimization Management Recommendations

- **Water-Fertilizer Synergy：** After all production areas enter the grain-filling stage, a moist irrigation system characterized by "regulating fertilizer through water and nourishing roots through aeration" should be implemented. This involves maintaining soil moisture at 80–100% of field capacity without establishing a standing water layer. This practice enhances root vitality, promotes nutrient uptake, and is projected to reduce inefficient nitrogen emissions by approximately 15%.
- **Green Pest Control：** Based on real-time data from the platform's insect monitoring lamps and pheromone traps, when the brown planthopper population reaches 800 insects per hundred clumps or the moth density of the rice leaf roller reaches 50 per mu

(control threshold), the platform will automatically issue aerial application tasks and recommend highly effective, low-toxicity, and environmentally friendly pesticide combinations.