



SPEECH INFORMATION (For Conference Program Book)

Topic

【英文】

Homeostatic Systemins™: A Biostimulant for Enhancing Plant Homeostasis

【中文】

內穩系統素™ (Homeostatic Systemins™)：打造植物內穩調控的生物刺激素





Global climate change has intensified complex abiotic and biotic stresses, widening the yield gap and challenging sustainable crop production. To address this issue, CH Biotech developed Homeostatic Systemins™, an innovative biostimulant technology designed to stabilize the plant homeostatic system and overcome the long-standing trade-off between growth and defense. Built upon Precision-Oriented Peptides, these systemins precisely modulate metabolic and physiological pathways to enhance resilience without compromising yield potential. Homeostatic Systemins™ are developed through a rigorous three-step pipeline. First, subcritical hydrolysis is applied to feather-derived proteins to produce structurally intact, high-bioactivity peptide combinations with traceable sequences. Second, UPLC-ESI-HR-MS/MS enables accurate peptide identification. Third, the BIOPEP-UWM™ database and AI-driven screening predict and validate bioactive functions. This approach yields five functional peptide groups with defined roles in abiotic stress regulation, antioxidant activity, anti-senescence, and defense induction. Mechanistically, Homeostatic Systemins™ operate through multiple regulatory layers. In the rhizosphere, they promote beneficial microbes such as *Bacillus* and *Trichoderma* while reducing pathogenic fungi including *Fusarium* and *Cladosporium*. They also modulate quorum sensing, inhibiting virulence-associated pathways in pathogens and enhancing biofilm formation in beneficial bacteria, thereby improving nutrient assimilation and rhizosphere stability. Within plants, Homeostatic Systemins™ activate genes associated with nitrogen metabolism, photosynthesis, and ROS scavenging. They also trigger immune pathways, PTI and ETI, and promote the production of secondary metabolites with antimicrobial, and antioxidant, functions. Physiological and transcriptomic analyses reveal enhanced resilience to heat, cold, and oxidative stress. In tomato and maize, Homeostatic Systemins™ preserve photosynthesis, reduce ROS accumulation, and accelerate recovery after chilling. Transcriptome data show reduced excessive gene activation, indicating energy-efficient stress adaptation. Overall, Homeostatic Systemins™ provide an environmentally friendly, precision-regulated approach to improving plant resilience, stabilizing homeostasis, and advancing climate-smart agriculture.

## Abstract

### 【中文】

全球氣候變遷帶來的高溫、低溫、乾旱、病原等複合逆境，讓作物越來越難穩定生長，也造成產量長期無法提升。為了解決這個問題，正瀚生技開發了「內穩系統素™」(Homeostatic Systemins™)，核心目標就是「幫助植物維持身體的平衡」，讓作物在壓力下依然能長得好，也不必在「生長」與「防禦」之間做痛苦的取捨。「內穩系統素™」是由公司研發的精準導向胜肽 (Precision-Oriented Peptides) 所打造。這些胜肽不是隨便挑選，而是經過三大步驟的嚴格篩選：首先用次臨界水解技術，把羽毛蛋白分解成具活性的胜肽；再用高解析質譜精準鑑定每種胜肽的序列；並搭配 BIOPEP-UWM™ 資料庫與 AI 評估功能，挑出真正能幫助植物的關鍵胜肽。最後，找出了五大功能胜肽，可提升抗逆、抗氧化、延緩衰老、增強防禦等作用。「內穩系統素™」的作用是多方位的。在作物根圈，它能讓枯草桿菌、木黴菌等好菌變多、壞菌變少，並調整微生物之間的「訊息溝通系統」(quorum sensing)，降低病原菌的致病能力，同時提高益生菌的定殖能力與生物膜形成，讓根更能吸收養分。在植物體內，「內穩系統素™」會啟動與氮代謝、光合作用、抗氧化相關的基因，也會引發植物的 PTI、ETI 免疫反應，並促進抗菌、抗氧化的次級代謝物生成，全面提升植物健康。實驗顯示，不論是高溫、低溫或氧化壓力，作物的表現都更穩定。番茄能維持光合作用、玉米在冷害後恢復更快、ROS 累積也大幅降低。轉錄體分析也發現，植物不會過度反應，表示它能更有效率地面對壓力。總結來說，「內穩系統素™」是一個安全、環境友善、又兼具精準調控能力的新世代生物刺激素，能全面提升植物韌性，穩定作物生長，是邁向氣候智慧農業的重要工具。

