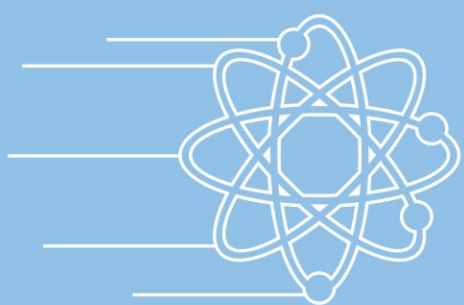




涝渍灾害与湿地农业 湖北省重点实验室

1 Introduction 平台简介

依托单位：长江大学

2002年12月，立项建设

2005年11月，通过评估验收

固定研究人员：**89人**

流动研究人员：**6人**

实验室2800m²，试验基地1900亩。



目标定位

面向**国家粮食安全、长江大保护**等重大战略需求，践行“绿水青山就是金山银山”理念，以江汉平原为主的**长江中游农业湿地**为主战场，以产业问题为导向，以科技创新为核心，以成果转化为纽带，聚焦“**湿地作物高效生产、湿地生物资源利用、湿地生态与保护**”的协同研究，以高水平保护促进高质量发展，形成一批自主创新、具有独立知识产权的成果，助推乡村振兴和经济社会发展。

主要研究方向

湿地作物高效生产

- 选育抗逆高产优质作物新品种
- 集成湿地作物抗逆高产栽培技术
- 建立稻田立体综合种养技术

湿地生态保护与利用

- 湿地区域土地利用及其环境效应
- 农业活动对湿地水土环境的影响
- 平原湖区农业氮磷负荷调控技术

湿地生物资源利用

- 特色淡水鱼类苗种繁育技术
- 特色淡水鱼类高效生态养殖技术
- 湿地水生植物资源利用

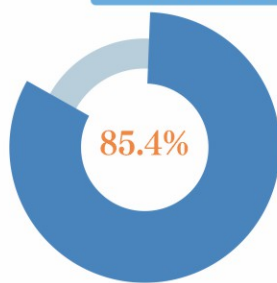
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技术团队

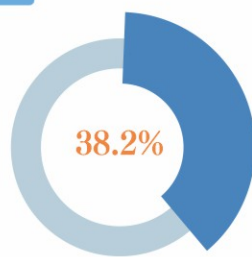
Technical Team

引进优秀博士11人
专职研究人员89人
高级职称76人
40岁以下34人
博士学位85人
省部级以上人才23人。

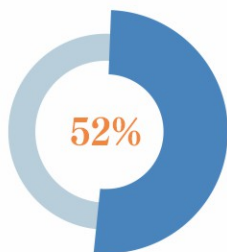
科研队伍



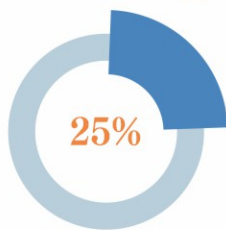
高级职称



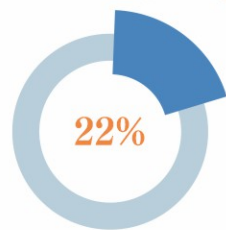
40岁以下



湿地作物高效生产方向



湿地生物资源利用



湿地生态保护与利用

学术委员会

姓名	聘任职务	职称/职务	工作单位	研究领域
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许本波	委员	教授	长江大学农学院	作物栽培

学术带头人

涝渍灾害与湿地农业湖北省重点实验室



张运波 教授 博导

实验室主任

主要研究方向作物资源利用与高效生产。主持国家自然科学基金、国家重点研发课题、国家重点研发子课题等科研项目10余项，主编参编专著4部。作为主要完成人获湖北省科技进步二等奖和三等奖各1项，湖北省发展研究二等奖1项，完成地方标准4项，授权发明专利5项，发表论文50余篇。



张学昆 三级教授 博导 湿地作物高效生产

“十三五”期间，为农业部油料专家指导组副组长，国家重点研发计划“七大农作物育种攻关”“长江中游适宜机械化高产油菜新品种培育”项目首席。发表论文100多篇，专利5项，获国家科技进步二等奖1项、湖北省科技进步一等奖2项和湖北省科技创新源泉工程创新创业人才奖，其他省部级奖励多项。



杨代勤 二级教授 博导 湿地生物资源利用

国家现代农业产业技术体系岗位科学家，湖北省有突出贡献中青年专家，湖北省“五一劳动奖章”获得者；主要从事名优水产养殖及鱼类营养与饲料方面的研究工作。先后主持国家、省部级科研项目13项，获省部级科研奖项6项，授权国家发明专利6项，出版著作5部，发表研究论文100余篇。



朱建强 二级教授 博导 湿地生态保护与利用

湖北省有突出贡献中青年专家，主要从事稻田培肥增效和稻田控水消减面源污染、稻虾模式水量水质调控及专用肥研发等方向的研究。承担国家、省部、国际NGO等科研项目20余项，获得湖北省科技进步奖6项，主持完成3部省级地方规程，出版学术著作5部，共发表学术论文280余篇。

3

科研设备 Research Facilities



仪器设备使用与共享

实验室每年固定运行经费80万元；

实验室和基地拥有先进的仪器设备321台件，总价值4623万元；

所有实验室和实验专人维护，设备开放共享，运行良好。

大型仪器设备共享平台

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【第74期】高分辨率激光共聚焦显... 2024-07-03

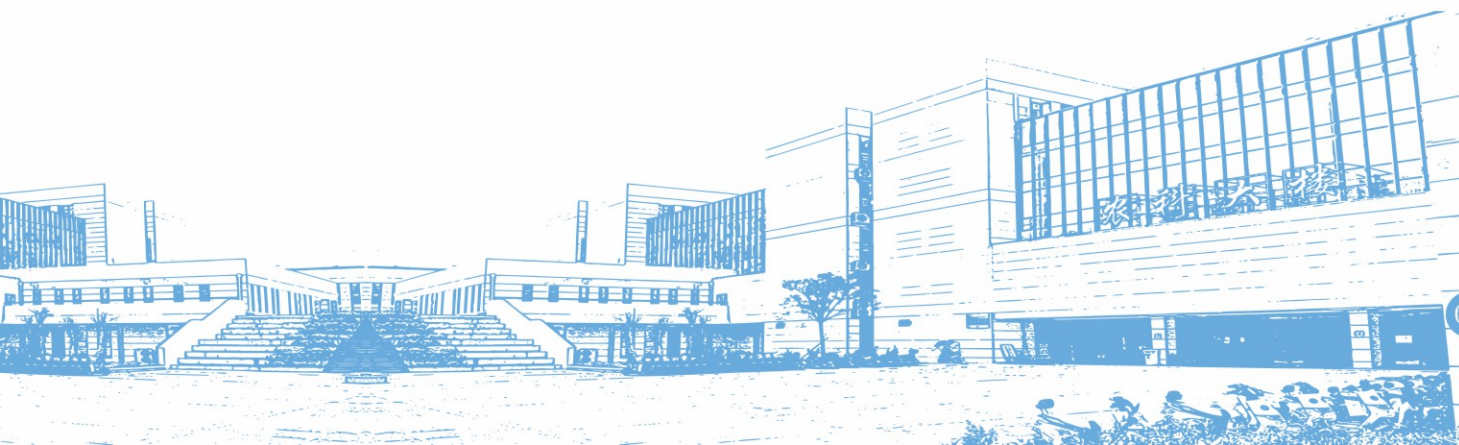
【第52期】生物透射电子显微镜 2024-06-28

【第51期】生物透射电子显微镜 2024-06-12

【第73期】高分辨率激光共聚焦显... 2024-06-07

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4

研究成果 Research Achievements



标志性成果

湿地作物抗逆机理解析

中心拥有水稻、小麦、油菜、玉米等种质资源3万余份，创制了作物产量、非生物胁迫等特殊性状新种质160余份，解析了湿地作物增产的分子机制，针对气候变化背景下的产量潜力，提出了风险适应性栽培的策略，在Nat. Commun., J Clean Prod等期刊上发表论文50余篇。

Silver lining to a climate crisis in multiple prospects for alleviating crop waterlogging under future climates

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Published online: 10 February 2023
Check for updates

Ka Liu^{1,2,3*}, Matthew Tom Harrison^{1,2,3}, Huihui Yan^{1,2,3}, De Li Liu^{1,2,3}, Huihui Ma^{1,2,3}, Gerni Hogenboom^{1,2,3}, Bin Wang^{1,2,3}, Bin Peng^{1,2,3}, Kaituo Guan^{1,2,3}, Jiaojia Jia^{1,2,3}, Zhen Wang^{1,2,3}, Feng Zhang^{1,2,3}, Xiangyang Yin^{1,2,3}, Sotirios Archontoulidis^{1,2,3}, Lixiao Nie^{1,2,3}, Ana Badicu^{1,2,3}, Jianqiang Wu^{1,2,3}, Daniel Walther^{1,2,3}, Jia Zhu^{1,2,3}, Ana Borrero Benjumea^{1,2,3}, Shah Fahad^{1,2,3}, Xiaohu Tian^{1,2,3}, Wenliu Wang^{1,2,3}, Fulu Tao^{1,2,3}, Zhao Zhang^{1,2,3}, Reinhold Hitzler^{1,2,3}, Yuxia Yuan^{1,2,3}, Min Zhu^{1,2,3}, Parthiv Das^{1,2,3}, Jiaojiao Nie^{1,2,3}, Yandong Yang^{1,2,3}, Yunbo Zhang^{1,2,3} & Meixue Zhou^{1,2,3}

Extreme weather events threaten food security, yet global assessments of impacts caused by crop waterlogging are rare. Here we first develop a paradigm that distills common stress patterns across environments, genotypes and climate histories. Second, we embed improved process-based understanding into a farming systems model to discern changes in global crop waterlogging under future climates. Third, we develop avenues for adapting cropping systems to waterlogging contextualized by environment. We find that yield penalties caused by waterlogging increase from 3–11% historically to 10–20% by 2080, with penalties reflecting a trade-off between the duration of waterlogging and the timing of waterlogging relative to crop stage. We document greater potential for waterlogging-tolerant genotypes in environmental with longer temperate growing seasons (e.g., UK, France, Russia, China), compared with environments with higher annualized rates of evapotranspiration to precipitation (e.g., Australia). Under future climates, altering sowing time and adoption of waterlogging-tolerant genotypes reduces yield penalties by 18%, while earlier sowing of winter genotypes alleviates waterlogging by 8%. We highlight the serendipitous outcome wherein waterlogging stress patterns under present conditions are likely to be similar to those in the future, suggesting that adaptations for future climates could be designed using stress patterns realized today.

Increasingly frequent and compound extreme weather events driven by the intensification of the global water cycle threaten the sustainability and consistency of crop food production¹. Coupled with global population growth and a burgeoning demand for food, exposure to weather extremes demand the development of new knowledge, technologies and practices that enable scalable, sustainable intensification².

Robust predictions of climate impacts on crop growth underpinned by process-based models³ are fundamental in the quest to anticipate and credible systems-based adaptations that minimize adverse impacts and enable systems to sustainably meet future demands.

Aquaculture

Contents lists available at ScienceDirect
Journal homepage: www.elsevier.com/locate/aquaculture

Field distribution characteristics and influencing factors of crayfish in rice-crayfish integrative system

Yong Zhou^{1,2,3}, Matthew Tom Harrison^{1,2,3}, Ka Liu^{1,2,3}, Li Xiao^{1,2,3}, Jie Zhu^{1,2,3}, Min Wang^{1,2,3}, Haoxuan Li^{1,2,3}, Guoxin Yao^{1,2,3}, Bo Zhu^{1,2,3}, Zhangyong Liu^{1,2,3}

¹ Jiangsu Collaborative Innovation Center for Grain Industry, College of Agriculture, Yangzhou University, Yangzhou, Jiangsu 225009, PR China
² College of Life Science and Technology, Hainan Key Laboratory of Quality Control of Characteristic Products and Vegetables, Hainan Engineering University, Xiangning, Hainan 571339, PR China
³ Hainan Institute of Agriculture, University of Tainan, Hainan, Xuefeng 571600, China

Abstract
Transformation of food systems will be required to feed the burgeoning global population in the coming decades. Crayfish (Decapoda: Decapoda) are an important part of the aquatic food system. One such transformation is rice-crayfish integrative system (RCIS), but some recent emergence of rapid growth in RCIS has led to a rapid increase in the number of RCIS systems. However, the field distribution characteristics of RCIS are still unclear, even though such information is key to management of RCIS, including rice planting and environmental protection. Here, we conducted a large field survey of RCIS in the Yangtze River Delta region of China, using field survey (including GPS tracking and LIDAR tracking). We had four key observations: (1) spatial distribution of RCIS was highly heterogeneous; (2) the individual weight of crayfish per pond area was normally distributed and there was a linear relationship between the number and weight of crayfish captured in different ground cages; (3) distribution characteristics of RCIS showed diversity, with eight types of RCIS being higher than those of the rice culture, and with day cages being less than that measured at night (even 1, 3, 14 and 15 m from the shore line edge was always higher than that of other RCIS) and (4) RCIS was more common in RCIS with less water depth (2–3 m) but there was no significant correlation with other environmental indicators, including temperature, pH, dissolved oxygen (DO), soil, total dissolved solids (TDS), conductivity (EC), turbidity and field weight of aquatic plants. We conclude that spatial distribution of RCIS in RCIS was closely related to water depth and field topography, with the highest density found in ponds within 5–7 m of the shore edge of rectangular field. Co-culture farmers can adjust their breeding and capturing strategies based on the distribution characteristics reported here, thereby reducing breeding costs and improving labor efficiency and mitigating detrimental environmental impacts.

1. Introduction
Rice is a staple food for nearly 50% of the global population (Zhou et al., 2018; Jiang et al., 2017), with rice crops increasing ~30% of the total cereal cropping area (Zhou et al., 2018). In recent years – in part thanks to waterlogged conditions suitable for aquatic animals – traditional rice farming systems have given rise to rice-aquatic animal culture in parts of Asia, including China (Liu et al., 2011; Zhou et al., 2012), India (Sharma et al., 2017) and Vietnam (Phuoc et al., 2013).

Journal of Cleaner Production

Contents lists available at ScienceDirect
Journal of Cleaner Production
Journal homepage: www.elsevier.com/locate/jclepro

An environmental and economic assessment of sustained cleaner production for double rice from the combination of controlled-release urea and water-saving irrigation

Jun Hou^{1,2}, Yingbing Tian^{1,2}, Jianli Zhou^{1,2}, Kaiwen Liu^{1,2}, Bing Cao^{1,2,3}

¹ College of Agriculture, Engineering Research Center of Ecology and Agricultural Use of Wet Land, Ministry of Education, Yangtze University, Jingzhou, 434005, China
² Institute of Rice Nutrition, Nutrition and Environment, Beijing Academy of Agriculture and Forestry Sciences, Beijing, 100087, China
³ Beijing Engineering Technology Research Center for Slow-Controlled Release Fertilizer, Beijing, 100087, China

Abstract
Controlled-release urea (CRU) and water-saving irrigation are being intensively used to obtain higher rice (Oryza sativa) yields with lower greenhouse gas emissions. However, the environmental impact potential of the combined CRU + CRU is still unclear. Two-factor experiments, nitrogen practices with urea and CRU while irrigation practices with conventional irrigation (CI) and alternate wetting-drying water-saving irrigation (AWI), were used to clarify the potential impacts in the Jingzhou Plain in China. Life cycle assessment (LCA) methodology was used to examine seven environmental impact categories, including soil non-renewable energy depletion, global warming potential (GWP), acidification potential (AP), eutrophication potential (EP), human toxicity potential, freshwater toxicity potential (FTP) and soil toxicity potential in addition to an economic assessment. The largest contribution observed to the nonrenewable environmental impact included the CRU (1.26, 1.26, 1.26, 1.26, 1.26, 1.26, 1.26) and FTP (1.02, 1.02, 1.02, 1.02, 1.02, 1.02, 1.02), while the other four factors contributed little, and CRU + AWI had the lowest weighting value (0.001). The EP was affected by a fertilizer off-set and by the farm (7% and 68%–71%), whereas other indicators from the planting season and winter fallow (7%–12% and 9%–12%) and the FTP differed slightly among the four treatments. Net economic benefits (NEB) represented 15,241 CNY ha⁻¹ and benefit-cost ratio (BCR) of 1.26. CRU + AWI was similar to those of CRU + CI, and water increased by 38%–47% and 13%–41% compared with CI and AWI, respectively. Results of results based on the combination of CRU and AWI had the lowest environmental load with a high grain yield, economic benefits and soil organic carbon storage to enable the sustainable production of rice.

1. Introduction
The double rice (Oryza sativa) production system in China provides higher rice yields than single and rice-rice-rice (Zhou et al., 2017). However, they also create an anaerobic environment that generates the production of methane (CH₄) and nitrous oxide (N₂O) under the continuous submerged conditions for approximately six months (Liu et al., 2010; Jiang et al., 2013). Nitritification and irrigation have been recognized to serve as the key inputs to optimize grain yields and largely affect GHG emissions (Liu et al., 2013).

Theoretical and Applied Genetics

Contents lists available at ScienceDirect
Journal homepage: www.elsevier.com/locate/tappgen

Fine mapping and genetic analysis identified a C₂H₂-type zinc finger as a candidate gene for heading date regulation in wheat

Yuting Li^{1,2}, Hongchao Xiang¹, Huijun Guo¹, Chanyun Xue¹, Meiye Fu¹, Hongxin Xie¹, Linshu Zhao¹, Jiaju Gu¹, Shihong Zhao¹, Yaping Dong¹, Changjie Wang¹, Ahsan ul-Haq¹, Lixiang Liu¹, Zhongfang Xie¹

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Abstract
Key message A minor-effect QTL, Qhd2.5A, that affects heading date in wheat was mapped to a genomic interval of 1.78-Mb on 2AS, and gene analysis indicated that the C₂H₂-type zinc finger protein gene *Tnrc22A02G182200* is the best candidate for Qhd2.5A.

Abstract Heading date (HD) is a complex quantitative trait that determines the regional adaptability of cereal crops, and identifying the underlying genetic elements with minor effects on HD is important for improving wheat production in diverse environments. In this study, a minor QTL for HD that we named Qhd2.5A was detected on the short arm of chromosome 2A by Bulk Segregant Analysis and validated in a recombinant inbred population. Using a segregating population of 4894 individuals, Qhd2.5A was further delimited to an interval of 0.41 Mb, corresponding to a genomic region spanning 1.78 Mb (from 138.87 to 140.57 Mb) that contains 16 high-confidence genes based on IWGSC RefSeq v1.0. Analyses of sequence variations and gene transcription indicated that *Tnrc22A02G182200*, which encodes a C₂H₂-type zinc finger protein, is the best candidate gene for Qhd2.5A that influences HD. Screening a TILLING mutant library identified two mutants with premature stop codons in *Tnrc22A02G182200*, both of which exhibited a delay in HD of 2–3 days. Additionally, variations in its putative regulatory sites were widely present in natural accessions, and we also identified the allele which was positively selected during wheat breeding. Epistatic analyses indicated that Qhd2.5A-mediated HD variation is independent of Vrn1 and environmental factors. Phenotypic investigation of homozygous recombinant inbred lines (RILs) and F₂ families showed that Qhd2.5A has no negative effect on yield-related traits. These results provide important cues for refining HD and environmental factors. Phenotypic investigation of homozygous recombinant inbred lines (RILs) and F₂ families showed that Qhd2.5A has no negative effect on yield-related traits. These results provide important cues for refining HD and environmental factors.

Introduction
The timing of flowering marks the transition from vegetative growth to reproductive development, and thus it is essential for plants to optimize seed production and complete a successful life cycle (Andersson and Comblanc 2012). In cereal crops, heading date (HD; flowering time) is an important and complex agronomic trait that determines reproductive ability under various climatic conditions, thereby affecting crop production. Plants have evolved multiple pathways that integrate intrinsic genetic signals and external environmental stimuli to initiate flowering at the appropriate time (Jiang and Muller 2009). Hence, identification and cloning of QTLs of genes that control HD will deepen our understanding of natural genetic control of seed traits and provide useful genetic resources for the engineering and breeding of novel wheat varieties with high yield and broad adaptability.

湿地作物抗逆品种选育

技术突破：针对本区域水稻灌浆期气温高、品质差等特点，在解析水稻耐高温机理基础上，利用分子标记辅助选择技术，成功选育了耐高温水稻国审新品种6个。

成果效益：品种实现了转化，经济效益显著，推动行业发展。



代表性技术成果

抗病优质生姜新品种选育及产业化应用

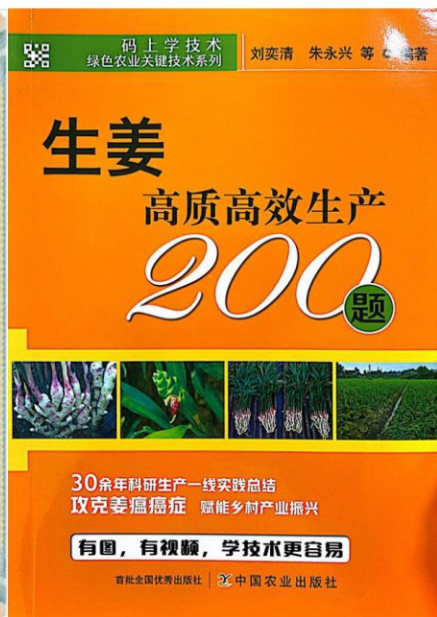
技术突破：破译生姜基因组遗传密码；攻克优质高产与耐湿抗热协同改良的难题，育成突破性新品种5个，使我国生姜抗病育种跃居国际领先行列；集成创新生姜产业化关键技术；突破了平原湖区生姜种植的范畴，为乡村振兴提供了方案。



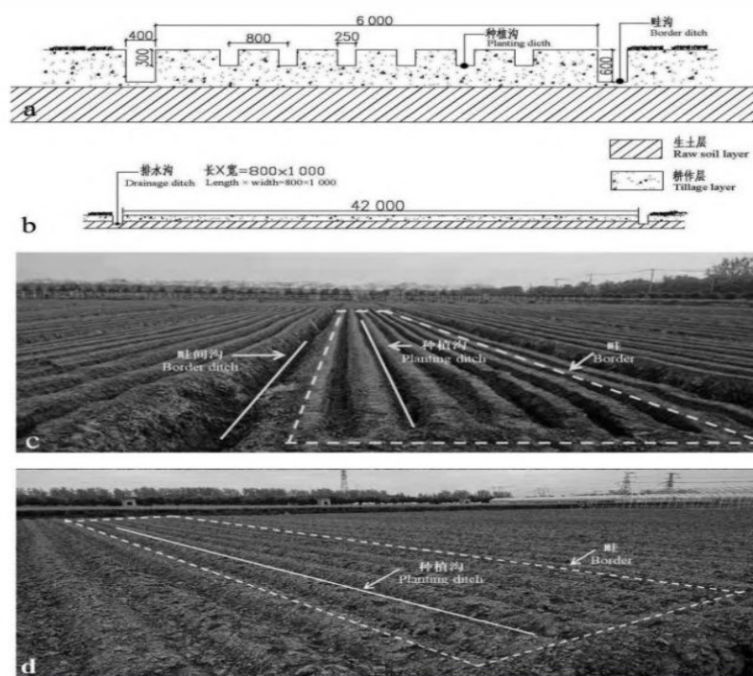
封面论文



“长姜1号”登记证



网格防病



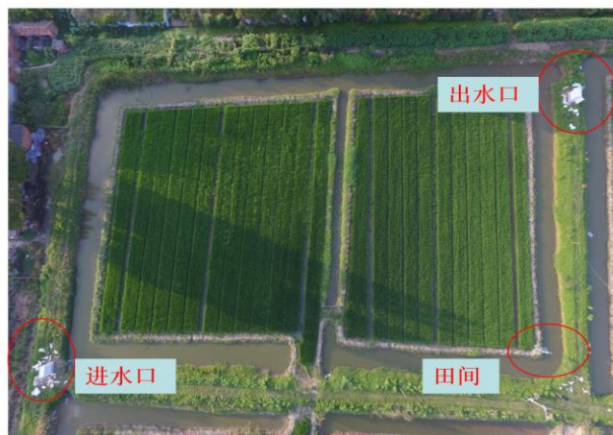
网格防病



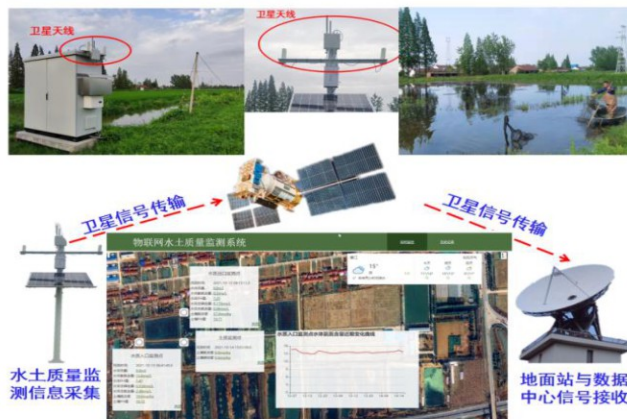
奖励证书

稻田氮磷物联网智能监测、风险识别和产地调控技术

技术突破：集成了江汉平原从稻田到河流到湖泊的氮磷面源污染物“智能监测”+“风险识别”+“产地调控”技术体系。采用天基物联网技术，有效解决了氮磷实时自动监测、数据高效转换传输、风险识别预警等难题，运用绿肥+缓控释肥有机无机相结合形成了稻田氮磷污染产地调控技术。

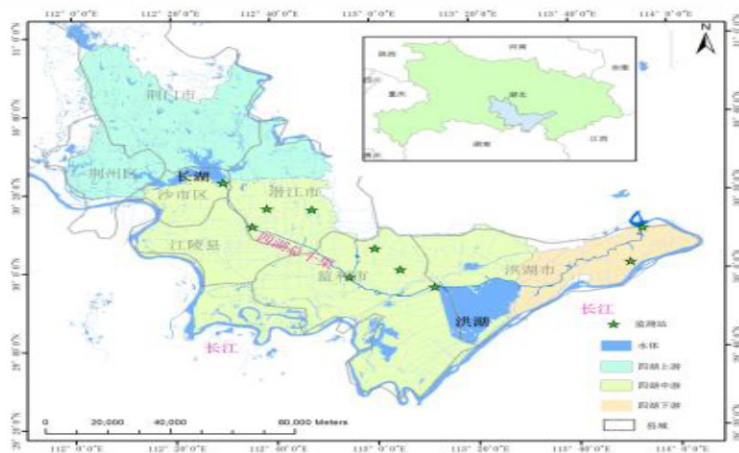


➤ 在潜江首次建立物联网稻-虾氮磷污染监测站，2021

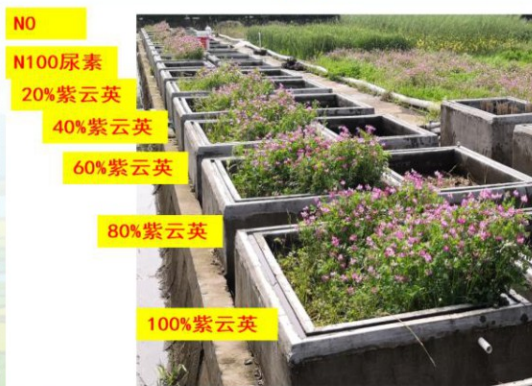


➤ 稻-虾物联网氮磷智能在线监测系统平台

智能监测



风险识别



产地调控

稻虾鳊生态种养模式研究与应用

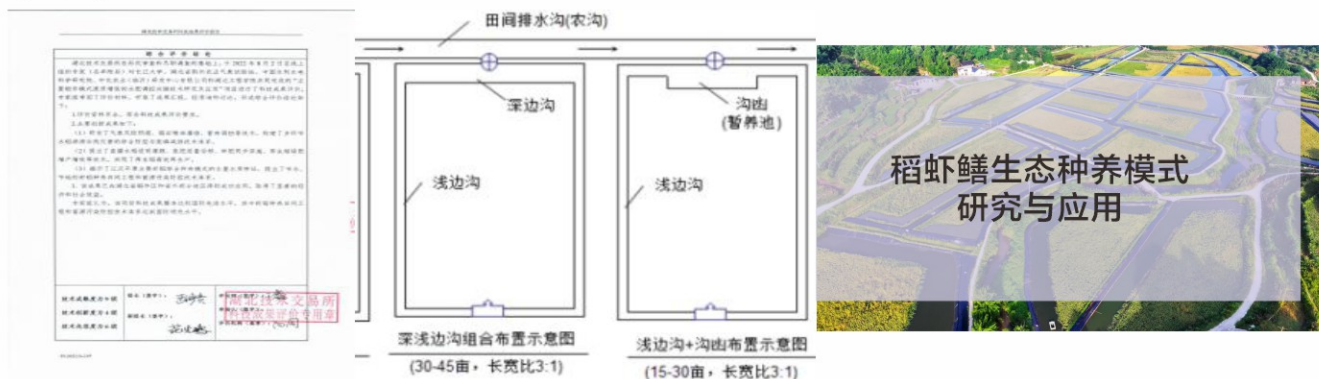
技术突破：利用水稻、虾与黄鳊之间的互利共生关系，攻克了稻虾模式下小龙虾密度高，起捕规格小的技术难题，利用黄鳊控制小龙虾的规格和带动的黄鳊产量，通过攻克黄鳊亲本定向培育技术，研发出黄鳊人工仿生态繁殖技术和大规格苗种培育技术，实现了优质稻、精品虾、生态鳊的良好效益。

成果效益：较稻虾模式每亩效益增加1500元以上，推广面积8.5万亩。



稻虾生态种养田间工程建设与节水减排技术

技术突破：针对稻虾综合种养发展过程存在的占地扩大化趋势、氮磷流失风险等突出问题，构建了稻虾种养生产单元节地型田间工程建设技术，建立了在小龙虾养殖期、水稻种植期、稻虾共生期和种养转换期等不同单元时期面源污染的综合防控技术体系，整体达到国际领先水平。



5

合作交流 人才培养和 Academic Exchanges Personnel Training and



社会服务

实验室有湖北省科技特派员31人，荆州市科技特派员15人，院士专家工作站7个。
特派员工作站11个、建立示范基地52个，参与建设乡村振兴基地19个。
全方位参与共建石首全国农业科技现代化先行县。



刘奕清教授、张学昆教授、获湖北省科技厅通报表扬。农业农村部对张学昆教授油菜团队发来感谢信。

湖北省科学技术厅文件

鄂科技发农〔2023〕33号

湖北省科技特派员（含“三区”科技人才） 及组织实施单位通报表扬名单

一、科技特派员（54人）

刘卫 华中科技大学
郭爱珍 华中农业大学
向梅先 中南民族大学
董邦全 湖北大学
刘奕清 长江大学
张学昆 长江大学
刘国平 长江大学

刘青 武汉轻工大学

二、“三区”科技人才（39人）

倪德江 华中农业大学
李小军 中南民族大学
王乾 长江大学
蔡俊 湖北工业大学

农业农村部种植业管理司

感谢信

长江大学：

2023年，农业农村部落实党中央、国务院决策部署，全力以赴攻难关、破难题，毫不松懈抓好粮油生产，强化新品种新技术推广应用，持续扩大油菜面积，切实抓好油菜大面积单产提升，我国油菜种植面积、单产和总产跃上一个新台阶，为保障我国油料供给安全做出了积极的贡献。

贵单位作为农业农村部部共建高校，积极支持油菜生产技术指导，充分体现出维护国家粮油安全和实施乡村振兴的高度政治责任感和使命感。贵单位农学院张学昆教授积极承担农业农村部油菜专家指导组组长，编制了全国油菜生产技术指导意见，开展油菜绿色高效生产关键技术集成示范与农民培训，深入一线指导生产和抗灾救灾，为提高我国油菜生产技术水平做出了重要贡献。

在此，向贵单位的高度重视、大力支持致以诚挚的感谢！

农业农村部种植业管理司

2024年4月

科学技术普及

重点实验室与我校农业农村部现代职业农民培训基地紧密配合，开设湖北省基层农技人员知识更新、青年农民创业创新班等**各类农民培训班10场次**，培训农业技术人员**600多人次**，农村创业人才**8000多人次**，发放资料**6.4万余份**。





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