

## 《智慧农业发展战略研究》专题快报

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中国工程科技知识中心农业分中心

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### 【动态资讯】

#### 1. 关于破解科研生产“两张皮”的实践与探索

【农业日报】2013年11月27日，习近平总书记视察我院，首次作出“给农业插上科技的翅膀”重要指示。2018年6月总书记视察山东时再次强调：“要加强农业科技创新和推广，让农业借助科技的翅膀腾飞起来。”科研与生产“两张皮”，曾是阻碍农业科技展翅高飞的痼疾。近年来，我院坚持以“给农业插上科技的翅膀”为总战略，以破解科研生产“两张皮”为着力点，以“推倒四面墙、迎来八面风”为总基调，大力推进科技体制机制改革，有力打通科研和生产转移转化通道，把论文写在希望田野，把成果送到千家万户。

链接:

<http://agri.ckcest.cn/file1/M00/0F/EE/Csgk0GHTsNCAPZLMAAjlA1tqZKw397.pdf>

#### 2. 建立农业科技优先发展的政策体系

【农业日报】在全党全国深入学习贯彻十九届六中全会精神之际，中国农科院与农业农村部科技发展中心、山东省农科院联合召开第二届“给农业插上科技的翅膀”理论研讨会，聚焦推进高水平农业科技自立自强这个时代主题，意义格外重大。结合深入贯彻习近平总书记给中国农科院抢占制高点、把握主动权、引领现代化的重要指示精神，重点谈三点意见。

链接:

<http://agri.ckcest.cn/file1/M00/03/1C/Csgk0WHTsLSAbwXIAAjlA1tqZKw516.pdf>

#### 3. 江苏丰县 用科技点亮“智慧乡村”

【农业日报】作为省内首批国家数字乡村试点县，近年来，江苏省徐州市丰县“智慧乡村”建设成为实现乡村振兴、农业绿色发展的重要路径。在素有“牛蒡之乡”美誉的范楼

镇齐阁村，“智慧乡村”建设试点工作初见成效。农行丰县支行基于数字乡村建设需要，结合前期调研情况和村民实际需求，从村情出发，充分考虑齐阁村的特点和需求，在农村产业经营、乡村治理、居民生活等领域积极探索智慧化应用，促进智慧乡村治理、智慧乡村旅游、智慧教育、智慧医疗等全方位深度融合，因地制宜制定具体的“智慧乡村”服务方案，为齐阁村“智慧乡村”建设提供一揽子综合金融服务，通过布局体检机器人、游客中心互动终端、充电桩、“惠农通”等智能化设备，打造了掌银扫码健康体检、掌银扫码领红包、掌银扫码充电、掌银扫码支付优惠等支付场景，设计了微信、钉钉扫码申请贷款程序并推广，打造了当地金融服务“智慧乡村”的样板。该行两次组织工作人员到齐阁村现场办理借记卡、信用卡业务，指导当地村民熟悉使用掌银功能，受到了村民热烈欢迎。

**链接:**

<http://agri.ckcest.cn/file1/M00/0F/EE/Csgk0GHTs3eAdgB9ABYWBSFm008469.pdf>

#### 4. 生物饲料技术创新论坛召开

【农业日报】12月23日，由北京市兽药饲料监测中心主办的“高效循环、减量替代、绿色发展”为主题的生物饲料应用技术创新论坛暨果渣废弃物可饲化高效循环应用技术大会在北京召开。会议围绕如何利用生物发酵技术开发地缘性饲料原料资源，为我国玉米豆粕减量替代提供新的思路和方案。来自京津冀地区的行业管理者、饲料生产企业、养殖企业及相关人员通过“新饲料”直播线上参会。北京市兽药饲料监测中心以联合大北农集团饲用微生物工程国家重点实验室共同实施的《果渣废弃物可饲化高效利用技术研究示范应用》农业科技项目为依托，创建了发酵果渣替代基础日粮中3%-5%玉米的配套应用技术，形成了具有平谷特色可复制可推广的地缘性饲料原料资源开发新方案。2021年累计处理平谷地区果渣2700吨，制成发酵饲料5400吨，以北京市农业中关村平谷区为重点辐射带动京津冀，累计示范生猪7100头，蛋鸡8.5万羽，节约玉米5400吨，有效缓解人畜共粮问题，实现果渣资源的高效循环利用。此次论坛由北京市兽药饲料监测中心副主任王继彤和大北农集团副总裁沈红霞主持，北京市兽药饲料监测中心主任刘钧在开幕式上致辞。专家们围绕推动畜牧业绿色高效发展、玉米豆粕减量替代技术、生物饲料标准制定与创制研发、果渣可饲化高效循环利用技术等多个内容做了专业报告。

**链接:**

<http://agri.ckcest.cn/file1/M00/03/1C/Csgk0WHTsc2AEmfcABYWBC95b04500.pdf>

#### 5. 北大荒集团发布无人驾驶农机作业质量企业标准

【中国农网】12月28日，北大荒集团在首届北大荒建三江粳稻论坛上，正式发布无人驾

驶农业机械作业质量企业标准，包含无人驾驶插秧机、玉米籽粒收获机、大豆收获机、拖拉机、稻麦收获机、拖拉机组犁、拖拉机组卫星平地机、拖拉机组电控播种机、喷杆喷雾机、无人驾驶航空器的十个企业标准。

链接:

<http://agri.ckcest.cn/file1/M00/0F/EE/Csgk0GHTse-AJxg3AAmTXPPFE6o815.pdf>

## 6. 从“会”种粮到“慧”种粮——湖南打造智慧智能农机产业链发展高地见闻

【中国农网】农场不见人，农活却干得又快又好；利用大数据，种出的大米好吃又好卖……这是2021年发生在农业大省湖南的种粮新鲜事。2021年来，湖南省农业农村厅全力推动智慧智能农机产业链发展高地建设，切实加大智慧农业示范创建力度。三湘大地，一场农业智慧化、数字化、无人化的变革正在探索中前行，为湖南的农业现代化注入了新的力量。“会种粮，不如‘慧’种粮。”切身感受到智慧农业在降本增效、节肥减药、扩面提质的好处后，种了一辈子地的湖南省常德市西洞庭管理区紫湾农机水稻专业合作社负责人张先红感慨道。

链接:

<http://agri.ckcest.cn/file1/M00/03/1C/Csgk0WHTswOAaQ9DAAnEh-109ZE227.pdf>

### 【文献速递】

#### 1. Nutritional valuation and food safety of endemic mediterranean halophytes species cultivated in abandoned salt pans under a natural irrigation scheme

文献源: ScienceDirect,2022-02-05

摘要: Recent global changes have contributed to water scarcity and land degradation, urging for the development of alternative solutions in agriculture. Halophytes biosaline agriculture has been viewed in the past decades as a potential alternative to traditional agriculture practices in degraded lands and salinized soils. Abandoned salt pans provide ideal areas for halophyte cultivation, such as *Halimione portulacoides* (sea purslane), *Sarcocornia fruticosa* (shrubby swampfire), *Atriplex halimus* (sea orache), *Beta maritima* (sea beet), *Inula crithmoides* (golden samphire) and *Suaeda vera* (shrubby seablite). The use of a natural irrigation scheme with estuarine water for food production is a rather novel practice in the Mediterranean area. In the present work, we evaluate the nutritional value of these six halophytes cultivated in abandoned salt pans, irrigated with natural estuarine water. The halophytes produced under this cultivation scheme resulted in vegetable products with a high nutritional value. These edible halophyte presented low sugar content

and high protein, omega-3 fatty acids and  $\beta$ -cryptoxanthin contents, together with a valuable source of highly concentrated phenolic and flavonoid antioxidant molecules. Moreover, these halophytes provide several mineral elements which are normally scarce in modern human diets (e.g. iodine and selenium), and very low concentrations, below the maximum thresholds, of carcinogenic elements. When compared to traditional vegetables, such as spinach, halophytes presented a high nutritional value, reinforcing the application of these cultivation schemes as means to attain highly nutritive alternative vegetable sources for a healthier human diet.

链接:

<http://agri.ckcest.cn/file1/M00/03/1C/Csgk0WHT-h2ATisIAF3QEbcQ774034.pdf>

## **2. Silencing of cytochrome P450 gene CYP321A1 effects tannin detoxification and metabolism in *Spodoptera litura***

文献源: ScienceDirect,2022-01-01

摘要: Cytochrome P450 monooxygenase (P450 or CYP) plays an important role in the metabolism of insecticides and plant allelochemicals by insects. CYP321B1, a novel *Spodoptera litura* P450 gene, was identified and characterized. CYP321B1 contains a 1488 bp open reading frame (ORF) that encodes a 495 amino acid protein. In fourth instar larvae, the highest CYP321B1 expression levels were found in the midgut and fat body. In the tannin feeding test, tannin can significantly induce the expression of CYP321B1 in the midgut and fat body of 4th instar larvae. To verify the function of CYP321B1, RNA interference and metabolome analysis were performed. The results showed that silencing CYP321B1 significantly reduced the rate of weight gain under tannin induction. Metabolome analysis showed silencing affected 47 different metabolites, mainly involved in secondary metabolite biosynthesis and amino acid metabolism, including amino acids, lipid fatty acids, organic acids and their derivatives. Hexoacetic acid and cysteamine are the most highly regulated metabolites, respectively. These findings demonstrate that CYP321B1 plays an important role in tannin detoxification and metabolism. Functional knowledge about metabolite detoxification genes in this major herbivorous insect pest can provide new insights into this biological process and provide new targets for agricultural pest control.

链接:

[http://agri.ckcest.cn/file1/M00/0F/EE/Csgk0GHT9CGAEgTAD-k8i\\_R2us742.pdf](http://agri.ckcest.cn/file1/M00/0F/EE/Csgk0GHT9CGAEgTAD-k8i_R2us742.pdf)

### 3. Cautionary notes on the use of co-occurrence networks in soil ecology

文献源: Soil Biology and Biochemistry,2021-12-31

摘要: Soil ecology is witnessing exponential growth in the number of studies using co-occurrence network analysis. Researchers reconstruct networks based on the co-occurrence of taxa or genes across soil samples at a wide range of geographic scales - from single aggregates to the whole planet - and taxonomic scopes, some studies targeting specific taxa or guilds to others surveying the whole microbiome as well as micro- and mesofauna. Co-occurrence networks can be very useful to extract simple patterns from complex datasets. Applications include the detection of abiotic and biotic factors that determine community structure, the identification of keystone taxa and their relationship to specific soil functions, and the inference of mechanisms of community assembly. However, networks are more and more often misused and serve as mere graphic tools with no attempt at hypothesis testing. In this perspectives article, we first review the main usage of co-occurrence network analysis in soil ecology during the last decade. We then discuss the applications and caveats of network analysis in soil ecology, leaving apart strictly methodological aspects of network reconstruction, which is beyond the focus of this article. Finally, we include recommendation guidelines such as the possibility of informing networks with geographic, environmental and/or phylogenetic information with the hope that this will facilitate network analysis to become a useful tool that helps elucidate meaningful patterns in soil ecology.

链接:

<http://agri.ckcest.cn/file1/M00/0F/EE/Csgk0GHT-DWACVKEAB-MvCAjXjM160.pdf>

### 4. 智慧农业灌溉系统的设计与实现

文献源: 节水灌溉,2021-12-31

摘要: 为了改进农业灌溉系统的硬件配置、网络速度及实现客户端功能的多样化,达到实时远程监测与管理的目的,设计了一套基于物联网的智慧农业灌溉系统。该系统根据收集到的土壤温湿度、pH值等农场环境参数,然后与预定值进行比较,从而做出相应的动作,通过4G通信模块将数据传输到云端,远程监测控制端设计了App,制作农场生产环境和灌溉的可视化数据界面,为系统提供了更友好的管理方式;测试表明本灌溉系统网络稳定、响应快,经济效益提高了3.5%,总体达到了智慧喷灌的目的,提高了农业灌溉的智能化水平,可广泛应用于大规模农业灌溉场景。

链接:

<http://agri.ckcest.cn/file1/M00/0F/EE/Csgk0GHT74CAfPGsAA2NqVQcU5w561.pdf>

## 5. 基于物联网技术的奶牛瘤胃pH值和温度监测系统的设计

文献源: 农业机械学报,2021-12-31

摘要: 针对目前传统检测方法实施难度大、易交叉感染的问题,设计了奶牛瘤胃pH值和温度无线检测单元、Sub-1G无线传输网络和阿里云实时显示界面,实现了奶牛瘤胃pH值和温度的连续监测。瘤胃检测单元采用Labsen331 pH复合电极进行pH值检测,采用Pt1000铂电阻进行测温。信号调理电路使用AD8603运算放大器,模数转换电路使用AD7792。核心控制电路使用STM8L151微控制器,通过315 MHz无线信号传输数据到项圈中继节点。无线传输网络基于TI-15.4协议实现。数据经项圈节点中继后,由数据集中器通过串口通信发送给物联网网关。通过4G网络,网关按照MQTT协议将数据传输至阿里云。本文进行了pH值和温度测量准确性、检测单元功耗、无线传输网络可靠性等验证试验和现场监测试验。验证试验结果表明,pH值测量误差小于 $\pm 0.02$ ,温度测量误差小于 $\pm 0.3$  °C,检测单元使用2200 mAh/3.6 V锂电池供电,检测间隔设定为10 min时,电池寿命可达1800 d,无线传输网络可在180 m内可靠传输。现场试验结果表明监测系统记录值和人工测定瘤胃液pH值之间具有良好的相关性( $r = 0.961$ ,  $P < 0.05$ ),本文设计的监测系统可以连续监测奶牛瘤胃pH值和温度的变化,为奶牛健康监测和精准饲喂提供参考。

链接:

[http://agri.ckcest.cn/file1/M00/03/1C/Csgk0WHT7\\_CAS4blAA7m7vNL7Sg482.pdf](http://agri.ckcest.cn/file1/M00/03/1C/Csgk0WHT7_CAS4blAA7m7vNL7Sg482.pdf)

## 6. 生物炭减缓农业生态系统土壤N<sub>2</sub>O排放的研究进展

文献源: 中国农业大学学报,2021-12-24

摘要: 为进一步厘清生物炭在减缓农业生态系统土壤N<sub>2</sub>O排放的作用和机制,本研究基于CNKI、Springer、Wiley和Science Direct数据库,以"生物炭"、"农业生态系统"、"N<sub>2</sub>O"为关键词,搜索2008—2021年相关文献,并进行了总结和归纳。结果表明:土壤N<sub>2</sub>O可通过多种微生物过程产生,其中硝化作用和反硝化作用是主要过程,硝化细菌反硝化、硝态氮异化还原成铵、化学反硝化等非生物过程也可产生N<sub>2</sub>O;生物炭添加对土壤N<sub>2</sub>O排放影响的结论不一,多数研究认为生物炭有利于减少土壤N<sub>2</sub>O的排放,少数认为生物炭刺激了土壤N<sub>2</sub>O的排放或对其无影响;提出了生物炭减缓土壤N<sub>2</sub>O排放机制(生物炭本身理化性质的差异、生物炭影响土壤理化性质和氮转化过程);并分析了生物炭降低堆肥土壤N<sub>2</sub>O排放的潜力和生物炭促进酸性土壤的植物生产力。最后,基于上述研究提出三点展望:有必要建立生物炭特性数据库;系统性的加强生物炭在N<sub>2</sub>O减排潜力的估算;进行长期野外田

间试验的必要性。

**链接:**

<http://agri.ckcest.cn/file1/M00/0F/EE/Csgk0GHT75iAcJq7ACt6goJEz80623.pdf>

## **7. 生态网络分析研究进展及其在农业生态系统氮循环中的应用前景**

文献源: 中国生态农业学报(中英文),2021-12-24

摘要: 农业生态系统氮循环直接关系到粮食安全和生态环境保护, 受到国内外的广泛关注。生态系统氮循环包括氮在生态系统各个组分间迁移和转化的全部过程, 具有整体性和复杂性。然而, 现有研究大多集中在氮循环的单一或局部过程, 难以从全局水平上反映农业生态系统氮循环的变化规律。作为一种系统分析工具, 生态网络分析通过构建可以模拟复杂系统中物质或者能量流动结构的生态网络分室模型, 进而可以从全局的视角来分析生态系统的内在、整体属性及其变化规律。因此, 利用生态网络分析从整体上审视农业生态系统氮素循环规律具有良好的应用及发展前景。鉴于此, 该文介绍了生态网络分析方法的基本原理、作者在生态网络分析方法研究中取得的新进展, 包括基于自主提出的网络粒子追踪法 (Network Particle Tracking, 简称NPT) 将生态网络分析的应用范围由稳态系统扩展至动态系统和新提出两个性能更优的系统评价指标。此外, 分析了生态网络分析方法主要优势、实现步骤及应用案例、指出了阻碍生态网络分析在农业生态系统氮循环研究中的应用的主要问题以及应对策略, 展望了生态网络分析在农业生态系统氮循环中的可能应用。

**链接:**

<http://agri.ckcest.cn/file1/M00/03/1C/Csgk0WHT7XSALcBkABlgRmTWwJ8581.pdf>

## **8. 基于物联网的“智慧农业”构建探究**

文献源: 现代农机,2021-12-15

摘要: 物联网技术的出现,为农业智能化发展提供了较大的便捷。茶园在物联网、相关技术的支持下,能够建设智能化与现代化的农业节水灌溉系统。文章以茶园灌溉系统为例,探究物联网“智慧农业”构建。

**链接:**

<http://agri.ckcest.cn/file1/M00/03/1C/Csgk0WHT7MiATF1EABG99Mh8Bmk974.pdf>

## **9. Fatty acid profiles of milk from Holstein cows, Jersey cows, buffalos, yaks, humans, goats, camels, and donkeys based on gas chromatography–mass spectrometry**

文献源: ScienceDirect,2021-11-19

摘要: Due to the diversity and limitation of determination methods, published data on the fatty acid (FA) compositions of different milk samples have contributed to inaccurate comparisons. In this study, we developed a high-throughput gas chromatography-mass spectrometry method to determine milk FA, and the proposed method had satisfactory linearity, sensitivity, accuracy, and precision. We also analyzed the FA compositions of 237 milk samples from Holstein cows, Jersey cows, buffalos, yaks, humans, goats, donkeys, and camels. Holstein, Jersey, goat, and buffalo milks contained high content of even-chain saturated FA, whereas goat milk had higher content of medium- and short-chain FA (MSCFA). Yak and camel milk are potential functional foods due to their high levels of odd- and branched-chain FA and low ratios of n-6 to n-3 polyunsaturated FA (PUFA). Human milk contained lower levels of saturated FA, MSCFA, and conjugated linoleic acid, and higher levels of monounsaturated FA and PUFA. As a special nonruminant milk, donkey milk contained low levels of monounsaturated FA and high levels of PUFA and MSCFA. Based on the FA profiles of 8 types of milk, nonruminant milk was distinct from ruminant milk, whereas camel and yak milk were different from other ruminant milks and considered as potential functional foods for balanced human diet.

链接:

<http://agri.ckcest.cn/file1/M00/03/1C/Csgk0WHT85eAYIJXADaeRySY954853.pdf>

### 【会议论文】

#### **1. Study on Performance Evaluation of Fresh Agricultural Supply Chain Based on BP Neural Network**

发布源: IEEE

发布时间: 2021-12-23

摘要: A BP neural network is an algorithm for forward multi-layer backpropagation learning. Its basic idea is forward propagation and error backpropagation in the learning process. At present, the most common result of a BP neural network is a three-layer structure. In view of the performance evaluation of fresh agricultural supply chain, this paper proposes a performance evaluation method based on BP neural network. First, three first-level indicators and six more detailed second-level indicators are set up according to the characteristics of the data, and the BP neural network is trained and tested by cross-checking method. The BP neural network after training was evaluated by using the confusion matrix, accuracy and recall rate, MMC, ROC curve, and AUC value. It was found that in the confusion matrix output by BP neural network, TP values of the three first-level



indicators were all large, while the accuracy and recall rate, MMC, ROC curve, and AUC values were all high. The values of 0.958, 0.678, and 0.588 respectively indicate that BPNN has good reliability and prediction accuracy. This paper further compares the BP neural network, decision tree model, SVM, and various evaluation results of ARIMA. The BP neural network is second only to ARIMA in accuracy and recall rate, and improves MCC and AUC values by 10.54% and 14.05% compared with ARIMA, with the best comprehensive performance. Meanwhile, with the increase of data volume, compared with the other three models, BP neural network has more advantages on AUC and has stronger evaluation authenticity and reliability in the big data environment.

链接:

[http://agri.ckcest.cn/file1/M00/0F/EE/Csgk0GHT60-AP1aoABW1ZH\\_pNnU328.pdf](http://agri.ckcest.cn/file1/M00/0F/EE/Csgk0GHT60-AP1aoABW1ZH_pNnU328.pdf)

## **2. Sustainability and Impactness of Smart-Agri Architecture on Environment**

发布源: IEEE

发布时间: 2021-12-13

摘要: Agriculture is an innovative way of cultivating crops where the resources are optimized to reduce the harmful impacts on environment and to get better crop yields. India has immense opportunities to make use of the potential of Agri-Tech solutions as majority of farmers possess small land holdings. Ecological sustainability is another significant challenge currently needed to be addressed. The paper propose a Smart-Agri architecture based on digital systems with available technologies for incorporating the factors required for better crop yield and to maintain a sustainable ecosystem. The architecture specifically caters to the need of Small Cardamom which is grown in hilly regions and is particularly much delicate to the climate changes. Due to the rampant use of fertilizers and pesticides, lot of degradation has happened to the Cardamom hill reserve zones over past few decades. In the system, data is to be collected from different parts of a farm using mesh connected ZigBee network making a low-power framework, to monitor soil and plant health and analyze data for finding implications to sort out recommendations meeting sustainability and crop goals. The proposed architecture aims to optimize the resources for small farms by assessing the needs of farmlands. This helps to mitigate the adverse effects on nature.

链接:

[http://agri.ckcest.cn/file1/M00/03/1C/Csgk0WHTt\\_SAcxXNAAosiMXTKOs700.pdf](http://agri.ckcest.cn/file1/M00/03/1C/Csgk0WHTt_SAcxXNAAosiMXTKOs700.pdf)

### **3. Cyber Security Intrusion Detection for Agriculture 4.0: Machine Learning-Based Solutions, Datasets, and Future Directions**

发布源: IEEE

发布时间: 2021-12-10

摘要: In this paper, we review and analyze intrusion detection systems for Agriculture 4.0 cyber security. Specifically, we present cyber security threats and evaluation metrics used in the performance evaluation of an intrusion detection system for Agriculture 4.0. Then, we evaluate intrusion detection systems according to emerging technologies, including, Cloud computing, Fog/Edge computing, Network virtualization, Autonomous tractors, Drones, Internet of Things, Industrial agriculture, and Smart Grids. Based on the machine learning technique used, we provide a comprehensive classification of intrusion detection systems in each emerging technology. Furthermore, we present public datasets, and the implementation frameworks applied in the performance evaluation of intrusion detection systems for Agriculture 4.0. Finally, we outline challenges and future research directions in cyber security intrusion detection for Agriculture 4.0.

链接:

[http://agri.ckcest.cn/file1/M00/03/1C/Csgk0WHTti6AWFHCAVi\\_ZMFDE0612.pdf](http://agri.ckcest.cn/file1/M00/03/1C/Csgk0WHTti6AWFHCAVi_ZMFDE0612.pdf)

### **4. Soil pH Prediction using Artificial Intelligence**

发布源: IEEE

发布时间: 2021-11-13

摘要: The pH value of soil is a critical parameter which governs the fertility of soil. In Uttarakhand, due to very encouraging climatic conditions like temperature, moisture and humidity, the soil has an appropriate pH value, and hence it is very fertile, due to which, the agriculture has become a significant source of income for Uttarakhand people. This research article is based upon the secondary data pertaining to soil of Kumaun region of Uttarakhand. This available data has been used to develop and train RBF NN (radial basis function neural network) and FIS (subtractive clustering based fuzzy inference system), on MATLAB, for predicting the pH of soil out of the given minerals concentration e.g. P, K, Fe, Mn, Cu. Eventually, the prediction performance of both the designed models are compared in terms of mean square prediction error.

链接:

<http://agri.ckcest.cn/file1/M00/0F/EE/Csgk0GHTuC6AWSQ9AAxvrDnrApw155.pdf>

## **5. DROUGHT MONITORING METHOD BASED ON MULTISCALE REMOTE SENSING DATA**

### **FUSION**

发布源: IEEE

发布时间: 2021-10-12

摘要: Drought is one of the agricultural natural disasters, which seriously threatens the natural ecological environment and world's food security. The FY-3B satellite has the ability of drought monitoring, but its spatial resolution is low, which isn't suitable for small and medium scale drought monitoring. In view of this, this paper calculates the High resolution Soil Moisture Drought Index (HSMDI) in the study area through the effective fusion of MODIS optical data which is small and medium scale and FY-3B soil moisture data of large scale. The results were verified by the measured meteorological data and simulated soil moisture data, which showed that HSMDI had a good consistency with precipitation and soil moisture ( $P < 0.05$ ). The spatial and temporal characteristics of drought described by HSMDI were consistent with the actual drought situation in the study area, indicating that the method can effectively achieve small and medium scale drought monitoring.

链接:

[http://agri.ckcest.cn/file1/M00/03/1C/Csgk0WHTuRqAQ\\_iIABVpJH\\_ZW-Y758.pdf](http://agri.ckcest.cn/file1/M00/03/1C/Csgk0WHTuRqAQ_iIABVpJH_ZW-Y758.pdf)

## **6. Metal-Based Green Synthesized Nanoparticles: Boon for Sustainable Agriculture and Food Security**

发布源: IEEE

发布时间: 2021-06-16

摘要: The applications of metal-based nanoparticles (MNPs) in the sustainable development of agriculture and food security have received greater attention in recent years in the science community. Different biological resources have been employed to replace harmful chemicals to reduce metal salts and stabilize MNPs, i.e., green methods for the synthesis have paid attention to the nanobiotechnological advances. This review mainly focused on the applications of green synthesized MNPs for the agriculture sector and food security. Because of the novel domains, the green synthesized MNPs could be helpful in the different areas of agriculture like plant growth promotion, plant disease, and insect/pest management, fungicidal agent, in food security for food packaging, for increasing the shelf

life and protection from spoilage, and other purposes. The global scenario of the recent studies on the applications of green synthesized MNPs, particularly in sustainable agriculture and food security, is comprehensively discussed.

链接:

<http://agri.ckcest.cn/file1/M00/0F/EE/Csgk0GHTtpmAVVjEACyFd6jv6zs163.pdf>

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