中国工程科技知识中心
China Knowledge Centre for Engineering Sciences and Technology

《现代智慧生态农业发展战略研究》专题快报

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中国工程科技知识中心农业分中心

中国农业科学院农业信息研究所　　2021年6月20日

【动态资讯】

1．京郊新一代农业生产实现智能化

【农业农村部】智能工厂不仅能生产汽车、电视、手机，还能种植蔬果。在京郊，已有4个规模化智能温室蔬菜生产“车间”投用，总面积达到30公顷。“蔬菜工厂”里不仅有先进的栽培技术应用，大大提升蔬菜水果产量，还有5G、机器人等科技手段，蔬菜水果听着音乐茁壮成长。蔬菜工厂是指生产蔬菜的“工厂”，在具有现代化、标准化等特征的智能温室中，环境相对可控，采用标准化生产技术流程，使农产品生产实现如同工业生产般高效、稳定的效果。与其他生产方式相比，蔬菜工厂的核心优势是土地产出效率高、标准化程度高及可控性强，高投入高产出。

链接:

http://agri.ckcest.cn/file1/M00/0F/B2/Csgk0GDNwi6AA0XjAAX1X3w_kBM969.pdf

2．智慧农业 从实验室走向产业应用

【农业农村部】大数据、云计算、5G、无人驾驶、北斗导航、区块链……越来越多的新科技逐渐应用于农业，让农业插上智慧的翅膀，让农村安上智慧的“芯”脏，让农民过上智慧的生活。大数据赋能，农业迈向标准化；降本增效，促农民增收；解决痛点，走向产业应用。

链接:

http://agri.ckcest.cn/file1/M00/0F/B3/Csgk0GDNwwGAJ43NAAYs27Wf0Dw588.pdf

3．智慧农业建设现场经验交流会在安徽举办

【农业农村部】6月10日，全国农业农村信息中心系统智慧农业建设经验现场交流会在安徽省芜湖市举办，贯彻落实党的十九届五中全会有关建设智慧农业的重大决策部署，

交流经验，推广典型，推动全国智慧农业建设、数字乡村发展在“十四五”期间开好局、起好步。会议强调，建设智慧农业是现代信息技术加快发展的必然产物，要紧扣立足新发展阶段、贯彻新发展理念、构建新发展格局，把智慧农业、数字乡村放到建设网络强国、数字中国、智慧社会中谋划推进。要瞄准农业现代化的总目标，加快农业产业数字化，提高农业生产智能化水平。要着力加强数据资源建设，夯实智慧农业基础。要坚持问题导向，搭建应用场景，确保取得实效。要增强系统观念，加大联合攻关力度，推动形成政产学研用合力推进的智慧农业建设生态。中国工程院院士赵春江在会上作主旨演讲。安徽省农业信息中心、北大荒集团建三江分公司等9家单位、企业作经验介绍和案例分享。来自全国各省（区、市）农业农村信息中心系统负责人及相关企业参会。同期还举办了2021数字农业农村新技术新产品新模式交流会，推介了205项有明确应用场景和推广价值的新技术、新产品和新模式。

链接:

http://agri.ckcest.cn/file1/M00/0F/B3/Csgk0GDNw5SADEEGAAOsKJgUlR0295.pdf

4．设施农业智慧化　寿光有了新模本

【农民日报】中国设施蔬菜的大规模种植发端于山东寿光，经过30年的发展，寿光依然站在设施蔬菜种植技术的最前沿。设施农业智慧化，寿光做出了最新模本。在寿光现代农业高新技术试验示范基地智慧农业科技园内，记者见到了“中国寿光型”智能玻璃温室，它东西长312米，南北宽256米，由中国工程院院士赵春江领衔规划设计，应用了120多项专利技术，解决了智能温室冬季生产能耗大的问题，并且实现整个基地生产管理的全流程云端托管、智慧程控和远程操控。在冬暖式大棚盛行的寿光，一经投用便引来社会各方关注。

链接:

http://agri.ckcest.cn/file1/M00/0F/B3/Csgk0GDNxYKAVncrAAbE2vyeuWs865.pdf

【文献速递】

1．Long-term conversion from rice-wheat to rice-vegetable rotations drives variation in soil microbial communities and shifts in nitrogen-cycling through soil profiles

文献源：ScienceDirect,2021-12-15

摘 要： Land-use change (LUC) caused by agricultural intensification has aggravated soil reactive nitrogen (Nr) pollution in global rice agroecosystems. Microorganisms mediate Nr transformation; however, the structural and functional responses of the microbial community to LUC and soil Nr loading have yet to be synthesized. Simultaneously, ricewheat

(RW) rotations in China have been subjected to high rates of LUC, primarily to intensive ricevegetable (RV) rotations. Here, 16S rRNA gene sequencing coupled with Phylogenetic Investigation of Communities by Reconstruction of Unobserved States (PICRUSt2) was performed to assess the influence of conversion from RW to RV on soil Nr fractions, microbial communities, and N-cycling genes, especially over longer time scales and at deeper soil depths. Compared to RW, bacterial alpha-diversity increased in the 10-year RV, whereas archaeal alpha-diversity decreased with increasing years under RV rotations. Microbial beta-diversity significantly decreased after the conversion from RW to RV rotations, resulting in reduced heterogeneity in community structure (composition and abundance) across 040 cm soil profiles in RV rotations. Redundancy analysis suggested that this homogenization was driven by increased concentrations of nitrate N and decreased soil pH and soluble organic N concentrations in the RV. At 020 cm, RV decreased the abundance of Geobacter spp., Candidatus_Nitrosotalea spp., and their related N-fixation genes, whereas it increased the abundance of Streptomyces spp. and their related nitrification genes. Moreover, the 20-year RV significantly increased the potential denitrification and N2O emissions from soil at 040 cm by decreasing the abundance of bacterial nosZ genes (encoding nitrous-oxide reductase) and increasing archaeal nirK, nirS (nitrite reductase) genes, and bacterial norB and norC genes (nitric-oxide reductase). Collectively, RW-to-RV conversion decreased soil microbial diversity and increased the size of denitrification/N2O-producing communities, this homogenization of microbiomes in long-term RV system may be a potential source of N2O.

链接:

http://agri.ckcest.cn/file1/M00/0F/B2/Csgk0GDNruOAWD6-ACcq-lTE5Ho618.pdf

2．Property rights and wrongs: Land reforms for sustainable food production in rural Mali

文献源：ScienceDirect,2021-10-01

摘 要： Agricultural land reforms are crucial to promote investments in sustainable land management and food production amidst accelerating urbanization and increasing population growth. However, notable gaps remain in the literature regarding how land reforms designed at the national level are implemented in localized contexts, especially as they interplay with customary tenure regimes. Adopting an institutional bricolage perspective, we explore interactions between local tenure arrangements and government land reforms and the resulting implications for food production in rural Mali. We show that

specific market-based land tenure arrangements in the study area emerged from a combination of urbanization pressures and government-designed land reform. We find that tenure security is linked to agricultural investment decisions, as also documented by previous studies. We likewise show that anxieties and ambiguities stemming from state-mandated land registration foster the emergence of monetized forms of access to collective land. These new market-based systems drive greater outmigration of productive community members, leading to labour shortages and weakening the social cohesion and mutual support systems upon which the most vulnerable depend. The findings show that top-down land reforms in rural Mali lead to disruptions of the social fabric, along with re-organizations of tenure systems to accommodate social norms and priorities. We illustrate how, in the context of centralized policy making with limited local consultation, community members resist cooperating and creatively search for alternatives to achieve their social goals. Empirical investigations of socio-institutional challenges such as land tenure

链接:

http://agri.ckcest.cn/file1/M00/0F/B2/Csgk0GDNsBOAMCQ6ACF3Y9kgRrA709.pdf

3．Soil acidification enhances the mobilization of phosphorus under anoxic conditions in an agricultural soil: Investigating the potential for loss of phosphorus to water and the associated environmental risk

文献源：ScienceDirect,2021-06-19

摘要：Soil redox potential (EH) and pH are key parameters regulating the solubility and fate of phosphorus (P). However, the impact of soil acidification on the redox-induced mobilization and speciation of P in soils under a wide range of EH values has not been extensively studied. Here, we investigated the mobilization and speciation of P in an acidified agricultural soil at two different pH values (e.g., highly acidic soil; pH= 5.6 and slightly acidic soil; pH= 6.1) compared to the un-acidified soil (control soil; pH= 7.3) under a wide range of EH condition (+459 to 281 mV). The impacts of EH/pH-dependent changes of Fe-Mn oxides, and dissolved organic (DOC) and inorganic (DIC) carbon on P mobilization and speciation were also investigated using geochemical and spectroscopic (X-ray absorption near edge structure) techniques. The concentrations of dissolved P under anoxic conditions increased up to 69.3% in the highly acidic soil compared with the control soil. The decrease of the Fe-P fraction, the decrease of Ferrihydrite-Pads speciation, and the strong linear

correlation between the dissolved P and Fe2+ (R 2 >0.85) supports the finding that enhanced P mobilization under anoxic conditions may be attributed to Fe reduction in the highly acidic soil. The concentration of dissolved Fe and P remained low until pH dropped below 6.35 for P and 6.28 for Fe, while a liner increase was found in dissolved Mn accompanying a general trend of pH decrease. This result suggests that the dissolution of reducible Mn under acidic soil conditions was an important factor for enhancing mobilization of dissolved P under anoxic conditions . This trend was due to the low amount of Mn, indirectly speeding up Fe reduction. These results can help to develop management practices to effectively mitigate P export and protect water resources from diffuse P pollution.

链接:

http://agri.ckcest.cn/file1/M00/0F/B2/Csgk0GDNr2-AUK2sABBk4BPDPVY774.pdf

4．Digitalization to achieve sustainable development goals: Steps towards a Smart Green Planet

文献源：ScienceDirect,2021-06-19

摘要：Digitalization provides access to an integrated network of unexploited big data with potential benefits for society and the environment. The development of smart systems connected to the internet of things can generate unique opportunities to strategicallly address challenges associated with the United Nations Sustainable Development Goals (SDGs) to ensure an equitable, environmentally sustainable, and healthy society. This perspective describes the opportunities that digitalization can build towards building the sustainable society of the future. Smart technologies are envisioned as game-changing tools, whereby their integration will benefit the three essential elements of the foodwater-energy nexus: (i) sustainable food production; (ii) access to clean and safe potable water; and (iii) green energy generation and usage. It then discusses the benefits of digitalization to catalyze the transition towards sustainable manufacturing practices and enhance citizens' health wellbeing by providing digital access to care, particularly for the underserved communities. Finally, the perspective englobes digitalization benefits by providing a holistic view on how it can contribute to address the serious challenges of endangered planet biodiversity and climate change.

链接:

http://agri.ckcest.cn/file1/M00/0F/B2/Csgk0GDNrg-AE4EdACSrMJNlFRA277.pdf

5．冬小麦SPAD的无人机可见光和多光谱植被指数结合估算

文献源：农业机械学报,2021-06-16

摘要：叶片叶绿素相对含量值（Soil and plant analyzer development，SPAD）能够反映作物叶片叶绿素含量的高低，是表征作物健康状态的重要指标。采用无人机搭载可见光和多光谱相机同步获取冬小麦可见光和多光谱影像，同时获取冬小麦叶片SPAD值。探究了可见光和多光谱植被指数与SPAD值的关系；将可见光植被指数与多光谱植被指数相结合进行了SPAD值的估算；利用逐步回归和随机森林回归方法估算了SPAD值，并将估算结果进行对比，筛选冬小麦叶片SPAD值的最优估算模型。结果表明，SPAD值与可见光植被指数（IKAW和RBRI）、多光谱植被指数（GNDVI、CI、GMSR和GOSAVI）具有较好的相关性，与可见光植被指数（CIVE）和多光谱植被指数（GNDVI）的相结合指数具有较好的相关性，其估算模型的R2为0.89，模型验证的RMSE为2.55，nRMSE为6.21%。研究表明，可见光植被指数与多光谱植被指数相结合的指数与可见光植被指数或多光谱植被指数相比，可见光植被指数与多光谱植被指数相结合的指数的逐步回归和随机森林回归模型估算SPAD值的精度高于仅用可见光植被指数或多光谱植被指数，其逐步回归估算模型的R2为0.91，模型验证的R2、RMSE和nRMSE分别为0.89、2.32和5.64%；其随机森林回归估算模型的R2为0.90，模型验证的R2、RMSE和nRMSE分别为0.88、2.51和6.12%，具有较好的估算结果。

链接:

http://agri.ckcest.cn/file1/M00/0F/B2/Csgk0GDNq3eAJwTfAA9pcf3thyE819.pdf

6．智能制造和大数据挖掘在农业机械设计中的应用

文献源：农机化研究,2021-06-15

摘要：随着制造信息的爆炸性增长及处理信息工作量的猛增,要求制造系统表现出更大的智能化,除了需要专业人才和专门知识外,还需要智能制造系统具有大数据挖掘和分析处理能力,从而使系统具有感知分析、推理、决策、控制等功能。为此,在农机数字化设计平台上引入了智能制造系统,并利用大数据挖掘技术对系统进行了优化,建立了经验数据库,在加工类似零部件时可以直接生成加工指令和工艺方案。实际应用表明:智能制造系统地引入有效缩短了加工工艺的设计周期,提高了设计效率,降低了设计制造成本。

链接:

http://agri.ckcest.cn/file1/M00/0F/B2/Csgk0GDNrUKAO848ABLYixn_Ni4193.pdf

7．基于LSTM算法的智能节水灌溉预测模型研究

文献源：农机化研究,2021-06-15

摘要：针对当前农田灌溉缺乏科学技术指导、水资源浪费严重的现状,为提高灌溉用水的利用效率,在智慧农业灌溉系统体系结构的基础上,提出了一种基于LSTM算法的智慧农业灌溉预测模型,可根据作物生长需求、生长环境和种植土壤等数据实现精准灌溉,能够最大程度地节约水资源。通过实验对LSTM灌溉预测模型与传统灌溉预测模型的预测值进行对比分析,结果表明:LSTM模型预测结果更为接近实际值,性能优良,可为实现智能节水灌溉提供可靠的依据。

链接:

http://agri.ckcest.cn/file1/M00/0F/B2/Csgk0GDNrOeASo21AB-j98zkpj0556.pdf

8．基于生态农业的蔬菜大棚可持续化种植研究

文献源：农机化研究,2021-06-15

摘要：以生态农业蔬菜大棚持续化种植过程为研究对象,通过对种植过程中的资源循环利用过程进行分析,建立一种基于蔬菜种植、生猪饲养及沼气生成为一体的生态农业蔬菜种植大棚,可对蔬菜种植时产生的废弃物进行堆肥发酵处理,生成沼气用于取暖照明,发酵液及残渣用于喂猪或有机肥添加,降低种植过程中废弃物排放,形成一种生态化持续种植模式。分别对生态蔬菜大棚和传统蔬菜大棚的投入产出和投入收益进行对比,结果表明:生态蔬菜大棚所产生的经济效益明显高于传统蔬菜大棚,且废弃物排放少。

链接:

http://agri.ckcest.cn/file1/M00/0F/B2/Csgk0GDNrASAD1QzAAvA55w3_kg941.pdf

9．不同植保机械施药对棉蚜防效的影响

文献源：农机化研究,2021-06-15

摘要：为研究不同植保机械施药对棉蚜防治效果的影响,探索防治棉蚜的最佳植保机械。使用3种植保机械,即喷杆喷雾机、喷枪、植保无人飞机进行了棉田施药试验,以虫口减退率与校正防效为指标,考察了3种植保机械对棉蚜的防治效果。考虑到雾滴在棉花叶片上的沉积效果对棉蚜防治效果的影响,综合对比了3种植保机械在棉花叶片上的雾滴沉积效果。试验结果表明:3种植保机械在水敏纸上的雾滴沉积密度和覆盖率整体趋势为上层>下层,正面>反面;雾滴沉积均匀性趋势为植保无人飞机>喷杆喷雾机>喷枪,正面>反面,上层>下层;植保无人飞机在水敏纸上的雾滴沉积分布整体好于其它两种植保机械。3种植保机械在相同部位水敏纸上的雾滴沉积密度和覆盖率均存在显著性差异,喷杆喷雾机可用于爆发性病虫害的防治。3种植保机械施药后第10天均能达到对棉蚜的防效指标,且喷杆喷雾机最佳;各植保机械药后第10天对棉蚜的防效没有显著性差异,而植保无人飞

机比其它两种植保机械节省60倍的水量和药液。研究结果可为棉花田间施药机械的使用和作业条件的选择提供参考。

链接:

http://agri.ckcest.cn/file1/M00/0F/B2/Csgk0GDNqxGAGCdhAAp9nEw212I605.pdf

10．基于文献计量的农地生态化利用研究现状及热点分析

文献源：土壤通报,2021-06-09

摘要：基于文献计量法,利用1992～2020年CNKI和2002～2020年WOS共4931条文献,使用CiteSpace软件,先从时间空间分布和发文期刊分布等角度回顾农地生态化利用研究概况,再基于高频关键词和新近突现词总结归纳研究热点和前沿,最后对农地生态化利用进行研究展望。研究发现:（1）时间分布上,国内外发文量整体上均呈波动上升趋势;（2）空间分布上欧洲和美国是该研究领域主要阵地,而中国在国际上亦具有重要地位,中国农业大学等机构走向了国际化;（3）发文期刊上,国内外发文期刊均较为集中,国外偏向环境科学与生态,国内更偏向经济学科;（4）研究热点上,主要有生态化农业经营管理模式、农业从业者农地生态化利用意愿和行为、农地生态化利用制度保障和农地生态化利用评价四大热点;（5）研究前沿上,在农业从业者方面国外关注动机和知识的影响,国内关注社会资本、土地流转和经营规模的影响,在评价性研究上国外关注粮食安全、贫困和生态系统服务,国内关注耕地生态安全和耕地保护分区,制度保障上国内关注生态补偿、轮作休耕和政策工具。

链接:

http://agri.ckcest.cn/file1/M00/0F/B2/Csgk0GDNrGmAausqABuw_ugMakY814.pdf

【相关专利】

1．一种智能农业机械玉米收割玉米须分离收获机

发布源：中国专利

发布时间：2021-06-08

摘要：本发明公开了一种智能农业机械玉米收割玉米须分离收获机,包括有一机体,所述机体内还设有一与所述第一玉米输送筒相对应连通的第二玉米输送筒,所述第二玉米输送筒内设有一转动的输送皮带,所述输送皮带上设有一圈相对应的输送支架,所述机体内还设有一玉米棒夹紧输送腔,所述玉米棒夹紧输送腔两侧分别设有一相对应转动的输送夹紧带,所述机体内还设有一与所述输送支架相对应的切割盘,所述机体内还设有一玉米须分离腔,两端所述玉米须分离腔内分别设有两个相对应夹紧转动的啮合胶轮,能够利用所述输送夹紧带将玉米棒夹紧,并且能够通过所述啮合胶轮的转动进一步的将玉米棒上

的玉米须啮合摘取,从而进一步提高收获玉米须的效率。

链接:

http://agri.ckcest.cn/file1/M00/0F/B2/Csgk0GDNvz6AJDaLABm4jx4rbr0967.pdf

2．一种智能农业灌溉系统

发布源：中国专利

发布时间：2021-06-08

摘要：本发明提供了一种智能农业灌溉系统,包括灌溉区、灌溉器、控制台、水箱、注水机、水位测试传感器,水箱的内部设置有水位测试传感器,水箱一侧嵌入设置有主输送管,且水箱另一侧嵌入设置有副输送管,主输送管的一端设置有注水机,副输送管的一侧设置有抽水泵,且抽水泵、注水机和水位测试传感器均通过暗线与控制台信号连接,副输送管的另一端连接有灌溉器,灌溉器设置在灌溉区的中部。本发明通过控制台内部的设计,可以让使用者通过手机等电子设备利用蓝牙的无线连接,远程控制该灌溉系统,达到便于操作的效果。

链接:

http://agri.ckcest.cn/file1/M00/0F/B2/Csgk0GDNvnKAVpkCAAbsMJLRuOg492.pdf

3．一种农业物联网数据通讯方法

发布源：中国专利

发布时间：2021-06-08

摘要：本发明提供了一种农业物联网数据通讯方法,包括：一上位机和数个无线检测模块,上位机用于发送初始化命令、初始化参数、无线传输数据并进行显示；无线检测模块,包括数据采集单元和无线传输单元,分别检测大气温湿度、土壤温湿度、光照度、CO-2浓度参数。设计了地址块、数据块、电量信息块、请求块、命令块,上位机根据无线检测模块发送的请求次数和电量信息,实时调整优先级态,进而动态调整通讯次序,保证了通讯的可靠性。为了区分各通讯块,设置了类型段,有效提升多机通讯的效率。本发明实现简单,满足实际应用的需要。

链接:

http://agri.ckcest.cn/file1/M00/0F/B2/Csgk0GDNvQmAObTHAAUgaxaymTM786.pdf

4．一种基于物联网技术的智慧农业装置

发布源：中国专利

发布时间：2021-06-08

摘要：本发明属于农业设备技术领域,提供了一种基于物联网技术的智慧农业装置,包括晾晒平台、储物箱和软绞龙,还包括：监测模块、通信模块、定时模块、控制模块和执行模块,监测模块用于监测环境信息并传递给通信模块和控制模块,通信模块用于向用户终端发送监测模块传递过来的信息和接收来自用户终端的无线控制指令并将该信息发送给控制模块,定时模块用于根据用户的定时操作向控制模块发送用于指示执行模块执行相关动作的执行信号,控制模块用于根据监测模块、通信模块和定时模块传送过来的信息控制执行模块执行相关动作,执行模块用于根据控制模块传送过来的执行信号执行相应的动作。本发明所提供的基于物联网技术的智慧农业装置,晾晒效率较高。

链接:

http://agri.ckcest.cn/file1/M00/0F/B2/Csgk0GDNu7OARFggABIwLFj9YEo095.pdf

【会议论文】

1．Optimization for antenna based IoT in Smart agricultural applications

发布源：IEEE

发布时间：2021-06-18

摘 要： This article proposes the development of antenna based IoT and optimization for smart agricultural applications. IoT applied for smart farming system development usually contains the problems of signal spread. Therefore, in this research, MIMO antenna connected through a power divider circuit and esp32 board is developed to larger wideband of frequency response. Moreover, to find the proper route of sending the data, the path optimization is used.

链接:

http://agri.ckcest.cn/file1/M00/0F/B2/Csgk0GDNsTGAVlRTADeU-XR88ws582.pdf

2．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. In the present review, 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/B2/Csgk0GDNt5uASB0uAAcfLWFkCp8977.pdf

3．Miniature K-Band Radar for Agricultural Remote Sensing

发布源：IEEE

发布时间：2021-06-03

摘要： Remote sensing for agricultural applications employs multi-spectral data collection. While optical-wavelength normalized difference vegetation index (NDVI) is the most common, smart agriculture can benefit from the addition of longer wavelengths to the sensing techniques. A radar operating in the 12.5 cm band (23 to 25 GHz spectrum) is described. The design leverages low-cost commercial ICs and coherent calibration cancellation techniques to sense at standoff distances as short as 10 cm, while providing a small size, weight, and power (SWaP) solution suitable for a variety of platforms. Field trials are overviewed on crops ranging from soybean to grain sorghum validating the ability to measure crop height and structure with high spatial resolution.

链接:

http://agri.ckcest.cn/file1/M00/0F/B2/Csgk0GDNuL6ALKH3AA0Q9MrX0xs710.pdf