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

《智慧农业发展战略研究》专题快报

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【动态资讯】

1．南京：汇聚院士智慧打造创新基地

【科技日报】8月24日—26日，全国农业科技创新工作会议暨2022全国农业高新技术成果交易活动在南京国家现代农业产业科技创新中心（以下简称南京国家农创中心）召开。记者发现，南京国家农创中心先后引进了各类高端人才团队超50个，包括赵春江、邹学校、沈其荣、赵其国、李德发等近10个院士团队，打造了全国唯一的集群式农业院士创新基地。无人农场，让种地智能又轻松在汤泉农场数字大田，赵春江院士团队将智能测控技术应用于农业机械，创新研发了无人农场技术系统，可实现水稻和小麦耕种管收等关键作业环节“无人化”作业。

链接:

http://agri.ckcest.cn/file1/M00/03/3C/Csgk0YdojWyAExA4AAFXuUVKRqE110.pdf

2．智慧农业谱写乡村振兴质量新篇

【中国质量报】巍然屹立的马鞍山，蜿蜒流淌的锡伯河，共同织就了绿茵为窗的喀喇沁。内蒙古自治区赤峰市喀喇沁旗位于内蒙古东南部，蒙、冀、辽三地交界处，独特的地理位置孕育了丰富的生态资源，全旗坚持走以生态优先、绿色发展为导向的农牧业高质量发展之路，聚力发展肉牛、肉鸭、中药材、设施蔬菜四大主产业，在此基础上“抓产业、建平台、促投资、创品牌”。2021年，全旗实现地区生产总值99.4亿元，同比增长 8.6%，位居赤峰市第1位、自治区第10位。喀喇沁旗王爷府镇被誉为“中国番茄之乡”，硬果番茄种植面积6667公顷。一个产业能够做大做强离不开质量提升、品牌塑造和标准规范，在“赤诚峰味”品牌战略引导下，喀喇沁旗精心培育喀喇沁旗农产品区域公用品牌，涌现出以王府番茄为代表的一批农产品品牌，获得“赤诚峰 味”品牌授权，喀喇沁农产品影响力和美誉度不断提升。

链接:

http://agri.ckcest.cn/file1/M00/03/3C/Csgk0YdoixaAcXbPAAEms1ArFS4843.pdf

3．让“数字乡村”再塑农村生活之美

【河南日报】一根“线”弥合城乡“数字鸿沟”，一张“网”织出“数字乡村”之美。乡村振兴，离不开信息基础设施的现代化，离不开数字技术在农村的普惠发展。我省在推进乡村振兴战略上，持续加大农村地区网络建设力度，统筹实施农村5G和4G网络覆盖、光纤宽带网络覆盖、电信普遍服务、网络提速提质、网络信息惠民等工程，推动农村信息基础设施提档升级，促进信息化与农业现代化深度融合，让农民共享数字经济红利。

链接:

http://agri.ckcest.cn/file1/M00/03/3C/Csgk0YdojEyAWMm2AAEhlBAne-I577.pdf

4．代仁强从农艺师到农业数字化技术员农业数字职业化让种植变得轻松智慧

【求贤】伴随着互联网技术的快速发展，物联网、云计算、大数据等技术被运用到农业生产各环节，数字农业、智慧农业应运而生。在转变农业农村发展方式的过程中，对大量农业数字科技人才的需求也激增。近日，人力资源社会保障部等部门联合发布了18个新职业，农业数字化技术员便是其中之一。农业数字化技术员指从事农业生产、农村生活数字化技术应用、推广和服务活动的人员。主要工作任务包括收集农业生产案例、分析数字化需求、组织实施农业数字化解决方案，为用户提供现场指导和技术培训等。

链接:

http://agri.ckcest.cn/file1/M00/10/0E/Csgk0GMR3amANH-rABG_fuxBh7E714.pdf

5．电子信息技术在智慧农业中的应用

【中国果树】智慧农业以信息、知识及装备为核心要素，通过信息技术、智能装备等与农业的深度跨界融合，推动人类对农业系统综合管控能力的提升。与数字农业、精准农业不同的是，智慧农业是数据、知识、模型、软件、硬件等要素相互作用的结果，更强调机器装备对农业各环节的智能化操作水平，因此各类电子技术、信息技术、控制技术在机器装备中的应用对于智慧农业目标的实现至关重要。

链接:

http://agri.ckcest.cn/file1/M00/03/3D/Csgk0Ydojy-AW8epAAxBfb38Wy0356.pdf

6．创新发展智慧农业 数字乡村建设提速

【经济参考报】我国现有行政村已全面实现“村村通宽带”；截至今年7月底，所有地级

市城区、县城城区和96%的乡镇镇区实现5G网络覆盖。与此同时，农业生产信息化水平稳步提升，智慧农业应用不断涌现。业内人士指出，“十四五”是实施数字乡村发展战略的关键时期，应进一步推进乡村数字基础设施建设，加快智慧农业发展，培育乡村数字经济新业态。

链接:

http://agri.ckcest.cn/file1/M00/10/0F/Csgk0GMR4AGAfC7eAAFeYUQTONg968.pdf

7．数字赋能打造智慧农业新高地

【淄博日报】据介绍，自2020年以来，市委、市政府坚持数字赋能、换道超车，积极抢占数字农业农村发展“新赛道”，在全国率先提出打造数字农业农村中心城市。在全面推动数字赋能农业发展方面，我市引进了中科院、中国农科院、浙江大学等18家科研院校开展产、学、研、推深度合作，引进中化集团、阿里、京东等23家头部企业共建数字农业农村重大项目59个。推动数字技术在种植、养殖、加工等环节广泛应用，重点打造粮食、蔬菜、黑牛（奶牛）、香菇、猕猴桃、苹果等6条数字农业产业链，塑造了一批数字农业典型应用场景，中以数字果园、七河数字车间、得益数字牧场等在多个省市实现复制推广。

链接:

http://agri.ckcest.cn/file1/M00/03/3D/Csgk0YdokXCAX1_XAAC8AIWpXmE217.pdf

【文献速递】

1．气候智慧型农业研究：热点、趋势和展望

文献源：中国生态农业学报(中英文),2022-08-31

摘要：气候智慧型农业（climate-smart agriculture，CSA）作为应对气候变化和粮食安全双挑战的高潜力农业系统解决方案，一经提出就受到了国际各界的高度重视，而中国的CSA研究项目进展缓慢，且尚未引起学术界的广泛关注。本研究借助CiteSpace（5.8.R3）软件，选取Web of Science核心数据集，对2010—2021年的国际CSA研究文献进行分析，梳理了国外研究热点与趋势变化，并提出新的展望思考，为我国CSA发展提供理论和实践支撑。研究结果表明：1) CSA已形成多维度平衡农业与气候变化的完整概念框架；2) CSA与可持续集约化、智慧农业、保护性农业等研究交织融合发展，研究热点围绕着生产力、适应、缓解这“3个支柱”展开；3) CSA研究趋势有泛化倾向，表现在研究区域转向发展中国家，研究对象注重多目标，研究内容涉及多领域；最后，对CSA的未来研究趋势进行展望，将更关注其内涵探索、实施框架制定、脆弱群体需求、跨学科合作和农业转型等方面。此外，本文强调，CSA作为应对气候变化的农业发展新模式，其理论框架

和实践技术对中国农业转型具有理论和实践的双重意义，其在中国的应用与适应发展是一个亟待开拓探究和富有挑战的领域。

链接:

http://agri.ckcest.cn/file1/M00/10/0E/Csgk0GMR2sKACyrNABIgbOd3Erw766.pdf

2．基于Qt的农业大棚自动监控系统设计

文献源：安徽大学学报(自然科学版),2022-08-30

摘要：传统农业依托自然环境进行生产，而现代智慧农业可以控制大棚的小环境，使农作物在最适宜的环境中生长。以Qt（Qt是Qt Company开发的跨平台C++图形用户界面应用程序开发框架）为开发环境，设计能自动监测农业辣椒大棚环境数据的系统。基于GPRS（general packet radio service）及UDP（user datagram protocol）将采集到的环境数据传送至MySQL（my structured query language）数据库。该自动监测系统能显示图像、查询及导出数据。测试结果表明：该系统测量数据的准确度高；能根据设定的数据范围进行自动调节，在湿热夏季也能营造出适宜辣椒发育的类春季气候环境，满足了智慧农业的需求。

链接:

http://agri.ckcest.cn/file1/M00/10/0E/Csgk0GMR29-ALPNRAAswhy75ClU253.pdf

3．发展智慧农业 促进农业现代化

文献源：智慧农业导刊,2022-08-25

摘要：农业进入新时代发展阶段，农业需要与时俱进，故而农业发展要想实现现代化，就必须要有智慧农业大力支持，这样做的根本原因在于智慧农业发展对农业现代化有良好推动作用。据此，文章首先从相关概念着手，分析智慧农业发展的优点，然后阐述当前智慧农业发展的现况和智慧农业发展的重点，最后提出发展智慧农业的策略，以供相关人员参考。

链接:

http://agri.ckcest.cn/file1/M00/03/3D/Csgk0YdokHyAbkzxABMWw8nDSIQ129.pdf

4．河南省智慧农业发展策略研究

文献源：智慧农业导刊,2022-08-25

摘要：通过对河南省智慧农业的发展现状分析，发现河南省智慧农业目前存在着资金投入力度不够、农民综合素质难以达到智慧农业的发展要求及农业信息化水平较低的问题，该文结合相关数据，对河南省的智慧农业发展提出注重培养智慧农业高质量人才、

加快推进智慧农业信息化建设及完善融资体系和加大资金投入力度的对策和建议，以期对区域智慧农业的发展产生参考意义和思考价值。

链接:

http://agri.ckcest.cn/file1/M00/10/0F/Csgk0GMR3xaAa2dXABJ0_aXa6bg967.pdf

5．Wireless communication protocols in smart agriculture: A review on applications, challenges and future trends

文献源：Ad Hoc Networks,2022-08-23

摘要：IoT based smart agriculture systems are important for efficient usage of lands, water, and energy resources. Wireless communication protocols constitute a critical part of smart agriculture systems because the fields, in general, cover a large area requiring system components to be placed at distant locations. There are various communication protocols with different features that can be utilized in smart agriculture applications. When designing a smart agriculture system, it is required to carefully consider the features of possible protocols to make a suitable and optimal selection. Therefore, this review paper aims to underline the specifications of the wireless communication protocols that are widely used in smart agriculture applications. Furthermore, application-specific requirements, which may be useful during the design stage of the smart agriculture systems, are highlighted. To accomplish these aims, this paper compares the technical properties and investigates the practical applications of five different wireless communication protocols that are commonly used in IoT applications: ZigBee, Wi-Fi, Sigfox, NB-IoT, and LoRaWAN. In particular, the inconsistencies in the technical properties of these protocols reported in different resources have been highlighted and the reason for this situation has been discussed. Considering the features offered by the protocols and the requirements of smart agriculture applications, the appropriateness of a particular protocol to a particular smart agriculture application is examined. In addition, issues about cost, communication quality, and hardware of the five protocols have been mentioned. The trending technologies with high potential for the future applications of smart agriculture have been introduced. In this context, the relation of the technologies like aerial systems, cellular communication, and big data analytics with wireless have been specified. Finally, the leading protocol and the smart agriculture application area have been highlighted through observing the year-based distribution of the recent publications. It has been shown that usage of LoRaWAN protocol has become more widespread in recent years.

链接:

http://agri.ckcest.cn/file1/M00/03/3D/Csgk0YdomIOAUqVrAEPqA9Na24c966.pdf

6．无人机多光谱遥感技术在农业统计中的运用

文献源：南方农机,2022-08-19

摘要：将以信息化技术为核心的无人机遥感技术应用到农业统计工作中，可以实现快速精确收集农业生产相关信息数据。无人机遥感技术与传统人工统计模式相比具有较为显著的高效性、客观性以及真实性，能够为我国农业发展提供真实可靠的数据支持。基于此，研究小组首先对无人机多光谱遥感技术与可见光遥感技术的区别进行简单阐述，随后对无人机多光谱遥感数据信息的获取和处理进行分析。结果显示，无人机遥感技术能够对农作物生长情况、病虫害、营养水分等进行详尽调查，得到真实可靠的农作物信息。

链接:

http://agri.ckcest.cn/file1/M00/10/0F/Csgk0GMR4ZSAVoX7ABMpB_VIcw8544.pdf

7．基于农村电子商务的智慧农业发展路径

文献源：南方农机,2022-08-19

摘要：在我国互联网技术高速发展的社会背景下，通过互联网及科学技术可实现农业的机械化生产，制定出有针对性的惠农政策，促使我国农业走向现代化和规模化的发展之路。基于此，笔者从农村电子商务对智慧农业发展的影响入手，分析智慧农业现存问题，从优化发展环境、推动农业设备升级、完善农业科研体系等方面展开了阐述，探讨了电子商务背景下智慧农业的有效发展路径。

链接:

http://agri.ckcest.cn/file1/M00/10/0F/Csgk0GMR4PeAeL22AAC8AIWpXmE233.pdf

8．基于大数据的智能农业云服务平台设计与实现

文献源：安徽农业科学,2022-08-18

摘要：以Lambda Architecture大数据技术框架为基础，应用HDFS、Hadoop MapReduce、Storm等一系列大数据处理和分析技术，并基于云计算服务，构建了一种基于大数据的智能农业云服务平台。该平台设计为3层大数据云服务架构，从底层至系统上层依次为云服务层、大数据系统层和应用层。平台支持农业资源基础数据、农业生产数据、生产经营主体数据、市场信息数据、科技服务数据的查询浏览、统计分析、信息共享、信息发布等功能，解决了现代农业产业园背景下，农业经营的全产业链大数据管理和分析的应用问题，系统在广东省部分现代农业产业园初步部署。

链接:

http://agri.ckcest.cn/file1/M00/10/0F/Csgk0GMR40SAPYAkACTvFLpjhgs423.pdf

9．Drought monitoring and its effects on vegetation and water extent changes using remote sensing data in Urmia Lake watershed, Iran

文献源：IWA publishing,2022-05-01

摘要：The assessment of drought hazards is important due to their socio-economic impacts on water resources, agriculture, and ecosystems. In this study, the effects of drought on changing water area and canopy of the Lake Urmia watershed in the northwest of Iran have been monitored and evaluated. For this purpose, the Standardized Precipitation Index (SPI) was calculated in short and medium periods (1-month and 3-month) to determine the dry-spell periods in the Lake Urmia basin. In reviewing this analysis, the annual average has been examined and evaluated. Furthermore, Moderate Resolution Imaging Spectroradiometer (MODIS) and remote sensing data were used to calculate the Normalized Difference Vegetation Index (NDVI), the Enhanced Vegetation Index (EVI), the Normalized Difference Water Index (NDWI), and the Temperature-Vegetation-Dryness Index (TVDI) to identify the area of water body, water level, and vegetation changes during 20 years (2000-2020). The Pearson correlation coefficient was also employed to explore the relationship between the drought and the remote sensing-derived indices. According to the results of drought analysis, 2000, 2002, 2004, 2006, 2008, 2010, 2012, 2014, 2016, 2018, and 2020 had experienced dry spells in the Lake Urmia basin. The NDWI changes also showed that the maximum area of the Lake Urmia happened in 2000, and its minimum was recorded in 2014. The variation of NDVI values showed that the highest values of vegetation cover were estimated to be 2,850 km^2 in.2000, and its lowest value was 1,300 km^2 in.2014. The maximum EVI and TDVI were calculated in 2000, while their minimum was observed in 2012 and 2014. Also, the correlation analysis showed that the SPI had the highest correlation with NDVI. Meanwhile, 1-month SPI had a higher correlation than the 3-month SPI with NDVI and EVI. As a concluding remark, NDVI and NDWI were more suitable indices to monitor the changes in vegetation and drought-related water area. The results can be used to make sound decisions regarding the rapid assessment of remote sensing-derived data and water-related indices.

链接:

http://agri.ckcest.cn/file1/M00/03/3D/Csgk0YdooRWAOMz7ACMNQ1zHZ3M939.pdf

10．Interactive impacts of climate change and agricultural management on soil organic carbon sequestration potential of cropland in China over the coming decades

文献源：ScienceDirect,2022-04-15

摘要：Cropland plays an important role in Soil Organic Carbon (SOC) sequestration. Although the SOC stock and its dynamic in the past decades have been extensively investigated, the information as to where, how much, and how SOC could be potentially sequestered in the coming decades has rarely been available. Here, the Rothamsted Carbon model was applied to investigate the spatiotemporal pattern of SOC sequestration potential for China's cropland in 2021-2040 at 1 km resolution, as well as the interactive impacts of climate change and agricultural management on SOC sequestration. Under the combined impacts of climate change and C input, the SOC sequestration of China's cropland in 2021-2040 would be about 0.56 Mg C ha^{-1} (0.06% yr^{-1}), 1.33 Mg C ha-1 (0.15% yr^{-1}), 2.10 Mg C ha^{-1} (0.24% yr^{-1}), and 3.65 Mg C ha^{-1} (0.41% yr^{-1}), with no increase, 5%, 10%,and 20% increase of C input, respectively. Therefore, a >20% increase in C input would be necessary to realize the promise of the '4 per 1000' initiative. Climate change would decrease SOC sequestration by 26.6-27.6 Tg yr^{-1} (or 60.4-62.7%). An increase of C input by 0%, 5%, 10%,and 20% relative to business as usual (BAU) would increase SOC sequestration by 4.8 (or 10.8%), 6.6 (or 14.9%), 13.1 (or 29.8%), and 26.2 (or 59.6%) Tg yr^{-1}, respectively. The contributions of temperature, precipitation, and C input to SOC sequestration will be averagely 18.6%, 22.4%, and 59.0%, respectively. Our findings quantify the SOC sequestration in 2021-2040 at a high spatial resolution under the interactive impacts of climate change and agricultural management, which help to identify potential foci and develop region-specific measures to increase SOC sequestration efficiently.

链接:

http://agri.ckcest.cn/file1/M00/10/0F/Csgk0GMR7uSAAhc5AFLkFfpPGDw471.pdf

11．On-line monitoring of plant water status: Validation of a novel sensor based on photon attenuation of radiation through the leaf

文献源：ScienceDirect,2022-04-15

摘要：Non-destructive real-time monitoring of leaf water status is important for precision irrigation practice to increase water productivity and reduce its use. To this end, we tested and validated a novel leaf sensor (Leaf Water Meter, LWM), based on the photon

attenuation during the passage of the light through the leaf, to monitor plant water status. Four woody species were subjected to multiple cycles of dehydration and re-hydration, and the signals recorded by the LWM were compared with classical measurements of plant water relations (relative water content and water potential). A good agreement between the signals recorded by LWM sensor and the destructive measurements, throughout the repeated water stress and rewatering cycles, was found across all species. These results demonstrate that LWM sensor is a sensitive, non-destructive and easy-to-handle device to reliably monitor in continuous fashion leaf water status. In conclusion, this sensor may be considered a promising tool for smart irrigation scheduling in precision agriculture context to decrease water wastage in light of global change and increasing conflicts over water demand.

链接:

https://dr2am.catas.cn:88/--/com/sciencedirect/www/hs/_/science/article/pii/S0048969721079602?via%3Dihub&__dp=https

12．On-line monitoring of plant water status: Validation of a novel sensor based on photon attenuation of radiation through the leaf

文献源：ScienceDirect,2022-04-15

摘要：Non-destructive real-time monitoring of leaf water status is important for precision irrigation practice to increase water productivity and reduce its use. To this end, we tested and validated a novel leaf sensor (Leaf Water Meter, LWM), based on the photon attenuation during the passage of the light through the leaf, to monitor plant water status. Four woody species were subjected to multiple cycles of dehydration and re-hydration, and the signals recorded by the LWM were compared with classical measurements of plant water relations (relative water content and water potential). A good agreement between the signals recorded by LWM sensor and the destructive measurements, throughout the repeated water stress and rewatering cycles, was found across all species. These results demonstrate that LWM sensor is a sensitive, non-destructive and easy-to-handle device to reliably monitor in continuous fashion leaf water status. In conclusion, this sensor may be considered a promising tool for smart irrigation scheduling in precision agriculture context to decrease water wastage in light of global change and increasing conflicts over water demand.

链接:

http://agri.ckcest.cn/file1/M00/03/3D/Csgk0YdonymASieeAB4Vx_QAF4o313.pdf

13．Hedge and Alder-Based Agroforestry Systems: Potential Interventions to Carbon Sequestration and Better Crop Productivity in Indian Sub-Himalayas

文献源：Frontiers,2022-04-14

摘要：Agroforestry systems (AFSs) have potential to combat climate change and to ensure food security. AFSs can sequester carbon and amend the organic matter, thereby enhancing the crop productivity. Carbon sequestration depends on the type of AFSs, climate, cropping pattern, and management practices. The aim of this study was to evaluate different AFSs for their potential to sequester carbon and impact on soil organic matter (SOM) in the eastern sub-Himalayas, India. Hedge-, alder-, and guava-based AFSs were established along with control (without any tree), and the maize-mustard-potato cropping pattern was followed in each AFS. Soil samples were collected after the fifth crop cycle and further analyzed. The results showed that crop productivity was significantly higher in all the AFSs than control. On average, soil organic carbon (SOC) was found to be significantly higher by 62 and 64% in hedge-based AFSs as compared to guava-based AFSs and control, respectively, and at par with alder-based AFSs. Particulate organic carbon (POC) was higher in all the three AFSs than in the control. For microbial biomass carbon (MBC) and microbial biomass nitrogen (MBN) contents, the trend of AFSs was expressed as alder-based AFS > hedge-based AFS > guava-based AFS > control. Hedge- and alder-based AFSs had higher SOC stocks than guava-based AFSs and control. Carbon dioxide equivalent (CO2 eq.) emissions were greater in control than hedge-based AFSs (35.2 Mg ha^{-1}), followed by alder-based AFSs (28.6 Mg ha^{-1}), and the lowest was observed in guava-based AFSs. On an average, hedge species accumulated more nitrogen (N), phosphorus (P), and potassium (K), which were 60, 12, and 28 kg ha^{-1} yr^{-1}, respectively. This conclusively proved that AFSs were significantly affecting SOM pools and crop productivity and had a significant role in carbon retention in the soil. Overall, hedge- and alder-based AFSs retained higher soil carbon, and hence, hedge- and alder-based AFSs may be promoted to achieve climate-smart agriculture practices in the acid soils of the Indian sub-Himalayan region.

链接:

http://agri.ckcest.cn/file1/M00/10/0F/Csgk0GMR7WCAY2uwACLZ244USRo572.pdf

14．Evaluation of drought tolerance of wheat genotypes in rain-fed sodic soil

environments using high-resolution UAV remote sensing techniques

文献源：ScienceDirect,2022-03-24

摘要：Identifying drought-tolerant crops/genotypes may provide a sustainable solution to improve productivity on rain-fed sodic soils. However, the identification of genotypes tolerant to sodicity has been impeded by a lack of suitable, high-throughput techniques. Here, we propose an unmanned aerial vehicle remote sensing coupled with field experimental approach to evaluate drought tolerance and/or water use of contrasting wheat genotypes by quantifying Genotype x Environment interactions on rain-fed moderately sodic and highly sodic soil sites in Australia. Significant differences ($p < 0.05$) between the sites and some between genotypes were observed based on remote sensing-based vegetative drought indices, while in-season agro-climatic and soil moisture conditions were similar ($p > 0.10$) between the sites. This suggests that genotypes at both sites would have grown with similar access to moisture if differences in soil constraints had not been present. Further, as a useful indicator of drought, a crop health index was computed by integrating drought vegetative and temperature response variables that significantly correlated with wheat yield (coefficient of determination R2= 0.67; root mean square error RMSE = 28.4 gm^{-2} and R^{-2} = 0.41; RMSE = 33.6 gm^{-2} for the moderately sodic and highly sodic site, respectively). Further, a drought stress tolerance index was developed using estimates of yield anomaly between the sites to differentiate genotypes tolerant to drought on sodic soils. Genotypic ranking to drought tolerance was further compared and validated with actual field measured crop water use efficiency data. Wheat genotypes Bremer and Gladius were identified as the most and least tolerant to drought on sodic soils. The research improves our understanding of genotypic response in drought stress and can assist farmers in the selection of drought-tolerant wheat genotypes in sodic soil environments.

链接:

http://agri.ckcest.cn/file1/M00/10/0E/Csgk0GMJ4TeAdxoFACJriA7qBIk633.pdf

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