中国工程科技知识中心
CKCEST 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

2021年第14期（总第29期）

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7月19日

【动态资讯】

1．农业农村部推进地标农产品数字化 腾讯“安心农品计划”助力地标品牌升级

【中国农网】7月15日，农业农村部“2021年地理标志农产品保护工程”培训在京举行，腾讯“安心农品计划”地理标志农产品品牌助力行动同期启动。基于腾讯“安心平台”在码链溯源、品牌保护、营销助力等方面的能力，腾讯将在农产品溯源、行业标准制定、品牌营销及保护、品牌形象设计等方面为地标农产品品牌升级提供扶持。腾讯还将与农民日报携手，结合微信小程序、视频号等平台资源，为优秀地理标志农产品品牌的影响力建设提供助力。培训班上，在农业农村部农产品质量安全监管司指导下，中国绿色食品发展中心、农民日报社、腾讯启动“2021年地理标志农产品保护与发展宣贯活动”，“安心农品计划”地理标志农产品品牌助力行动，正是融合产业互联网数字化能力，对地理标志农产品保护发展工作的践行与探索。

链接:

http://agri.ckcest.cn/file1/M00/0F/BB/Csgk0GD2tpCAa9pvAAyK7tT2ROY150.pdf

2．以专业化社会化服务引领农业现代化发展——农业农村部总畜牧师、农村合作经济指导司司长张天佐就《关于加快发展农业社会化服务的指导意见》答记者问

【农业农村部】近日，农业农村部印发《关于加快发展农业社会化服务的指导意见》（以下简称《意见》）。农业农村部总畜牧师、农村合作经济指导司司长张天佐就《意见》相关情况回答记者提问。张天佐表示各地鼓励农资企业、农业科技公司、互联网平台等各类涉农组织依托原有的技术、装备、渠道、市场、信息化等优势，采取“农资+服务”“科技+服务”“互联网+服务”等方式，积极向农业服务业拓展，开展农资供应、技术集成、农机作业、线上线下对接等综合农事服务，促进技物结合、技服结合。如供销社系统、中化农业等农资农化企业围绕农业全产业链，着力打造区域性农业综合服务中心，提供

农业生产经营综合解决方案，有效破解农业生产主体的共性难题。

链接:

http://agri.ckcest.cn/file1/M00/0F/BB/Csgk0GD2s7KAHYKWAAa-uXiiyt0374.pdf

【文献速递】

1．Calibration method to address influences of temperature and electrical conductivity for a low-cost soil water content sensor in the agricultural field

文献源：sciencedirect,2021-09-01

摘要：The performance of a low-cost soil water content sensor (5TE, Decagon Devices, Inc.) for monitoring volumetric soil water content in an agricultural field was investigated. Prior to the in-field measurements, calibration methods for the sensor to correct the influences on soil temperature and electrical conductivity (EC) of the soil water were established. Dried soil collected from the agricultural field, pure water, and an in-laboratory thermostatic reservoir were used. First, calibration formulas for the soil temperature and EC were obtained using a dataset of laboratory measurements. Second, the soil water content in the field was measured using the 5TE sensor with three different calibration curves, applying: (A) no correction of EC for curves at 20 ◦C, (B) temperature correction only, and (C) temperature and EC corrections. The differences between the sensor and actual measurements were (1) 2.5%, (2) 2.5%, and (3) 2.2% expressed as volumetric soil water content (m3 m3). Higher accuracy was confirmed in the 5TE-sensor measurements under condition (3) at higher EC values. Finally, we demonstrated that the 5TE sensor with the proposed calibration method is useful for monitoring soil water content in agricultural fields.

链接:

http://agri.ckcest.cn/file1/M00/0F/BB/Csgk0GD2wWCAMGaNAAfI4BO8W2k392.pdf

2．基于卷积注意力的无人机多光谱遥感影像地膜农田识别

文献源：农业机械学报,2021-07-19

摘要：为监测地膜农田的种植分布，准确评估由其导致的区域气候和生态环境变化。基于DeepLabv3+网络，通过学习面向地膜语义分割的通道注意力和空间注意力特征，提出一种适用于地膜农田的改进深度语义分割模型，实现对无人机多光谱遥感影像中地膜农田的有效分割。以内蒙古自治区河套灌区西部解放闸灌区中沙壕渠灌域2018-2019年4块实验田的无人机多光谱遥感影像为研究数据，与可见光遥感影像的识别结果进行对

比，同时考虑不同年份地膜农田表观存在的变化，设计了2组实验方案，分别用于验证模型的泛化性能和增强模型的分类精度。结果表明，改进的DeepLabv3+语义分割模型对多光谱遥感影像的识别效果比可见光高出7.1个百分点。同时考虑地膜农田表观变化的深度语义分割模型具有更高的分类精度，其平均像素精度超出未考虑地膜农田表观变化7.7个百分点，表明训练数据的多样性有助于提高地膜农田的识别精度。其次，改进的DeepLabv3+语义分割模型能够自适应学习地膜注意力，在2组实验中，分类精度均优于原始的DeepLabv3+模型，表明注意力机制能够增加深度语义分割模型的自适应性，从而提升分类精度。本文提出的方法能够从复杂的场景中精准识别地膜农田，为分析地膜农田的种植分布和监测提供参考。

链接:

http://agri.ckcest.cn/file1/M00/02/E9/Csgk0WD3rVqAAQmCAA7UpZRXLds221.pdf

3．Soil moisture sensor for agricultural applications inspired from state of art study of surfaces scattering models & semi-empirical soil moisture models

文献源：sciencedirect,2021-06-29

摘 要 ： In this research work, models for the scattering from rough surfaces and semi-empirical soil moisture models are presented. Models using the ‘‘Bidirectional reflectance distribution function (BRDF)” are focussed in this study. Therefore the effect of the ‘‘surface roughness” on the moisture content estimation can be analyzed. ‘‘Kirchhoff Approximation Model,” ‘‘Small Perturbation Model,” ‘‘Integral Equation Model,” and ‘‘Small Slope Approximation Method” are mathematically investigated in this research work. Integral Equation Model and Small Slope Approximation Method are having the most extensive range of validity. The main disadvantage of these methods is that they follow a complex methodology and are pretty tricky to implement. Two semi-empirical soil moisture models, popularly known as the ‘‘Dubois model” and ‘‘Oh model,” are also presented and analyzed in this research work. These models assess the moisture content present in the soil depending upon several factors, i.e., incidence angle (hÞ, wavelength (k), frequency (mÞ, scattering coefficients, etc. Scattering coefficients provide information in terms of polarization in ‘‘horizontal-horizontal (HH),” ‘‘verticalvertical (VV),” ‘‘horizontal-vertical (HV),” or ‘‘vertical-horizontal (VH)” directions. Finally, a novel IoT-based resistive soil moisture sensor is developed and presented in this research work which provides voltage values corresponding to different moistured soil surfaces. Thus in this work, complex mathematics behind the scattering from rough surfaces is presented. Popular

semi-empirical soil moisture models for moisture content estimation are presented. Finally, a prototype of the soil moisture sensor is developed to predict the moisture conditions for the different soil surfaces.

链接:

http://agri.ckcest.cn/file1/M00/02/E9/Csgk0WD2wuaAYQEkACAoISyPE9Y409.pdf

4．智慧苹果园“空-天-地”一体化监控系统设计与研究

文献源：中国农业科技导报,2021-06-15

摘要：针对传统苹果园存在的数据监测体系不完善、管理缺乏科学数据等问题,开发了一种苹果园"空-天-地"一体化监控系统。综合应用卫星遥感、无人机、农业物联网、人工智能等现代信息与智能装备技术,集成果园信息采集装置套件,并基于SSM框架（SpringMVC、Spring、Mybatis）构建果园监测集成数据中台。通过果园"空-天-地"一体化的信息技术采集体系集成创新和基于AI的苹果病虫害图像识别应用,实现覆盖果园土壤、生态环境、果树个体及群体的立体化监测服务功能,提高果园监测效率与数据可信度,对促进苹果园生产管理向着科学化、数字化、智能化转变的新业态升级具有重要研究意义。

链接:

http://agri.ckcest.cn/file1/M00/0F/BB/Csgk0GD2v9mAL0L0AGlKAY7y9ak527.pdf

5．Greenhouse data acquisition system based on ZigBee wireless sensor network to promote the development of agricultural economy

文献源：sciencedirect,2021-06-12

摘要：Information technology continues to promote the in-depth progress and development of smart agriculture, while the corresponding agricultural economic development is increasingly dependent on the degree and level of agricultural informatization. At present, the development of digital and information greenhouse technology has become the focus and difficulty of agricultural development. Based on this, this paper will design a set of agricultural digital greenhouse system based on ZigBee wireless sensor network technology. At the same time, in the corresponding data acquisition and processing problems, this paper uses the PID controller under the particle filter optimization technology to optimize the error of the corresponding data acquisition system, and eliminate the corresponding noise and interference, so as to ensure the stability and effectiveness of the corresponding data acquisition system in the digital greenhouse, reduce the power consumption of the whole

system, and ensure the stable transmission of data. Experimental results show that the proposed digital greenhouse technology can not only improve crop yield rapidly, but also optimize the noise control level of key algorithm by 10 points compared with the traditional filtering technology, so it has a long-term promotion significance.

链接:

http://agri.ckcest.cn/file1/M00/0F/BB/Csgk0GD2wiWAVG21AEBLxY5xmXM545.pdf

6．西南地区发展气候智慧型农业的对策建议

文献源：中国农业科技导报,2021-05-14

摘要：目前,全球气候变化形势严峻,而农业生产与气候变化存在相互影响的关系。探索气候变化条件下的新型农业生产模式,既可以提高农民收入、保障区域粮食安全,又可以减少温室气体排放、缓解气候变化。本文在系统梳理气候变化对农业生产的影响、农业生产对气候变化的推动作用和适应气候变化下的农业生产方式相关文献的基础上,全面分析了气候变化下农业生产面临的严峻考验和转变农业生产方式的重要意义。传统农业生产方式在人口持续增长和气候变化的双重影响下已不能满足需求,为应对气候变化提出的气候智慧型农业可以促使农业可持续发展,增强农业生产适应性,减少温室气体排放,缓解全球气候变化。依据西南地区的自然条件和国内外应对气候变化的先进农业生产经验,提出了我国西南地区发展气候智慧型农业的建议对策,制定区域气候智慧型农业的政策制度,完善区域气候智慧型农业的技术措施,综合开发和因地制宜选择气候智慧型农业的发展模式。

链接:

http://agri.ckcest.cn/file1/M00/0F/BB/Csgk0GD2wDOAInTuAAfI4BO8W2k594.pdf

7．Design and fabrication of an agricultural robot for crop seeding

文献源：sciencedirect,2021-04-02

摘 要： Crop seeding is a time-consuming and tedious activity for farmers and is only exacerbated in large agriculture fields. Manually sowing seeds by hand is a highly inefficient process that requires a lot of human effort and can lead to health concerns for farmers, while spreading seedlings using tractors results in a high wastage of seedlings. This research paper describes the development of a low-cost agricultural robot for crop seeding. The prototype system consists of two parts, namely a mobile base for robot movement and a seeding mechanism attached to the mobile base for crop seeding application. The mobile base has a four-wheel design to ease movement on uneven terrains, while the seeding

mechanism uses the concept of a crank-slider to continuously inject seedlings into the ground. Crop seeding tests show that the robot is able to sow 138 seedlings in 5 min, with an accuracy of 92%, compared to 102 seedlings by human workers. This demonstrates an increase in the crop seeding efficiency of over 35%. As for the battery life test, it was determined that the robot can function for up to 4 h on a single charge. Thus, there will not be an increase in the operation time and reduction in the efficiency of the crop seeding process due to the recharging times when human workers are replaced with the prototype system. The recharging duration for the robot power supply is 1.5 h. While the prototype system has successfully achieved its objective of reducing human interference, labour requirement, and the overall operating costs in the field of agriculture for crop seeding process, by making the robot fully autonomous, using either a rail- or line-following system, labour costs can be further reduced as an operator is not required to manually steer the robot to each seeding path.

链接:

http://agri.ckcest.cn/file1/M00/02/E9/Csgk0WD2w-2ALFKvABm79Xbf9bQ533.pdf

8．Design and development of a robot for spraying fertilizers and pesticides for agriculture

文献源：sciencedirect,2021-04-02

摘要：The agriculture industry is one that is highly resource- and labour-intensive. As such, farmers are increasingly turning to technology and automation to address this issue. However, agricultural robots are far too complicated, slow, and costly to be made publicly available. As a result, the agriculture sector still lags behind in integrating modern technologies. This research paper details the development of a low-cost agricultural robot for spraying fertilizers and pesticides in agriculture fields as well as for general crop monitoring. The prototype system is a two-wheeled robot that consists of a mobile base, a spraying mechanism, a wireless controller for controlling the robot movement, and a camera for crop health and growth monitoring as well as detecting the presence of pests in the agriculture field. Tests conducted on the prototype system show that while the productivity of the robot in terms of crop coverage is slightly lower than a human worker, the labour cost savings afforded by the agricultural robot prototype is much greater as it functions completely in an autonomous mode and only requires the operator to control the robot when placing it at the start of the crop path. Furthermore, the prototype system also provides greater resource savings and reduction in the contamination of underground water

sources due to leeching process, thus achieving precision agriculture goals. Lastly, the excellent battery life of the prototype system ensures that there will be no increase in the operation times and reduction in the efficiency of the fertilizer and pesticide spraying process due to the recharging times when replacing human workers. Future recommendations include making the agricultural robot fully autonomous, using either a railor line-following system, to further reduce the labour requirements and costs. ? 2021 Elsevier Ltd. All rights reserved.

链接:

http://agri.ckcest.cn/file1/M00/02/E9/Csgk0WD2w3CAHcJNABroXzGlGuM530.pdf

9．Safety and ergonomics in human-robot interactive agricultural operations

文献源：sciencedirect,2020-12-24

摘要：An emerging scientific field is the study of safety and ergonomics in the agricultural sector during human-robot interaction. Human-robotic synergetic systems are considered to be the most mature way to circumvent problems appearing due to the complex and unpredictable nature of the agricultural environment, which contrasts with the stable domain found in industrial settings. In promising working ecosystems, the distinctive cognitive human characteristics of perception, decision making and acting can be combined with the strength and repeatable accuracy of robots. However, safety must be guaranteed both in terms of avoiding accidents during unwanted physical contacts and provoking musculoskeletal disorders. The latter is a concise term for describing numerous soft tissues disorders, which have reached epidemic proportions among farmers undermining their quality of life. This investigation, by describing the fundamentals of human-robot interaction from an agriculture-oriented perspective, methodically tries to identify potential hazards that can put human safety at risk. In order to overcome these hazards, approaches for minimising the occurrence of injuries analysed along with methods for safe collaboration. The innovation of this study lies on focusing on ergonomics during agricultural human-robot interactive operations. Thus, through reviewing the basic ergonomic principles and the main risk factors, potential challenges are captured concerning human factors, technologies and policy directions. Ensuring of safety in this kind of systems should have a positive impact in technological, societal and economic aspects. For this purpose, an intensive effort and interdisciplinary collaboration are required to establish a sustainable anthropocentric human-robot interactive ecosystem.

链接:

http://agri.ckcest.cn/file1/M00/0F/BB/Csgk0GD3m16AZKUgABiqaICfcd4335.pdf

【会议论文】

1．A Cluster based Sensor-Selection Scheme for Energy-Efficient Agriculture Sensor Networks

发布源：IEEE

发布时间：2021-07-19

摘要：Agricultural chemicals, which are frequently used in agricultural fields, have many different side effects on the environment, biological diversity and people. It is aimed to reduce the use of agricultural chemicals within the scope of sustainable agriculture. For this purpose, it is an important requirement for robots used in agricultural fields to precisely distinguish between crops and weeds. One of the biggest challenges in this regard is the wide variety of plant species. For this reason, the systems to be used in agricultural areas need to cope well with the changes caused by weed and crop varieties. In this study, a examination is made using various unsupervised domain adaptation approaches to tackle the challenge of species diversity in the weed and crop classification task. Thus, it is aimed to measure the generalize the classification process of crop and weed species that have not been seen before.

链接:

http://agri.ckcest.cn/file1/M00/0F/BB/Csgk0GD4L2qAD9GDAAe6ctEnlAk263.pdf

2．Weed and Crop Classification with Domain Adaptation for Precision Agriculture

发布源：IEEE

发布时间：2021-07-19

摘要：Agricultural chemicals, which are frequently used in agricultural fields, have many different side effects on the environment, biological diversity and people. It is aimed to reduce the use of agricultural chemicals within the scope of sustainable agriculture. For this purpose, it is an important requirement for robots used in agricultural fields to precisely distinguish between crops and weeds. One of the biggest challenges in this regard is the wide variety of plant species. For this reason, the systems to be used in agricultural areas need to cope well with the changes caused by weed and crop varieties. In this study, a examination is made using various unsupervised domain adaptation approaches to tackle

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链接:

http://agri.ckcest.cn/file1/M00/0F/BB/Csgk0GD4LwKASjStAAcn95hVZNI030.pdf

3．A Simulation of Mobile Transportation Robot for Agricultural Products Handling to Warehouse

发布源：IEEE

发布时间：2021-05-19

摘要：Agriculture is undoubtedly the largest livelihood source in Bangladesh, the backbone of the country? s economy and provides to the total economic growth of Bangladesh. Agriculture in Bangladesh is constrained every year by challenges, such as Climate Changes and Population Growth. Matters concerning agriculture have been always hampering the advancement of the country. A revolution in agriculture is expected and IoT Based Smart Agriculture Robotic System is a part of it. Internet of Things (IoT) s e n s o rs have capability of providing meaningful information for agriculture making this concept more emerging and attractive day by day. In this work, we designed a system using smart technology which can do complex work easily. This work m eets major factors of agriculture, field monitoring, automated system. The system designed in this work can monitor the humidity, moisture level, temperature, air quality and can even detect raining. According to the data received from all the sensors, the water pump and cutter get automatically activated or deactivated. This work not only focuses on the crop field but also stores the data in cloud using Io T for further analysis for doing precise agriculture. Using those data, forecast can be made about flood or drought. In this work, Io T is controlled by the mobile application, which can be operated from anywhere. Automation system works based on sensors and actuators. Using this system, farmers will be able to do efficient work and crop productivity will be at highest level. Smart Agriculture Robot using IoT can have a positive effect on today’s agricultural growth.

链接:

http://agri.ckcest.cn/file1/M00/02/E9/Csgk0WD2yAyAHlvxAKenKmXHu_k544.pdf

4．Smart Agriculture Using Wireless Sensor Monitoring Network Powered By Solar Energy

发布源：IEEE

发布时间：2021-04-12

摘要：Every single life in this world depends on agriculture to reside. People are cultivating plants in a traditional way of agriculture since from thousands of years. In this era of development there is a huge demand to fulfil. So a revolution is clearly needed in the field of agriculture. This paper explores how a smart agriculture can be installed in place of traditional agriculture. Here an agri-tech system is designed to monitor several parameters of the crop field through wireless sensors and also automation is applied to balance those monitored parameters. Wireless sensors are used to monitored the soil moisture level, pH level of the soil, soil temperature etc. After monitoring, these real time data are transferred by zigbeenetwork to a control system (raspberry pi)to balance the parameters of the soil of the crop field according to the requirements. Zigbeeprotocol gives the input of the raspberry pi which analyzes the data properly and according to the requirements it gives the output. This output is able to pump the required amount of the water to the crop field, balanced the pH level by spreading the précised type of fertilizer and also checks the temperature of the soil. Thus the percentage of crop production is effectively increased by this automatic monitoring system. The energy needed to drive the system, will be provided by solar panels in off-grid manner.

链接:

http://agri.ckcest.cn/file1/M00/02/E9/Csgk0WD3hjuAJ0cCABg5mg-Soac432.pdf

5．Smart Agriculture Robotic System Based on Internet of Things to Boost Crop Production

发布源：IEEE

发布时间：2021-02-01

摘要：Agriculture is undoubtedly the largest livelihood source in Bangladesh, the backbone of the country?s economy and provides to the total economic growth of Bangladesh. Agriculture in Bangladesh is constrained every year by challenges, such as Climate Changes and Population Growth. Matters concerning agriculture have been always hampering the advancement of the country. A revolution in agriculture is expected and IoT Based Smart Agriculture Robotic System is a part of it. Internet of Things (IoT) sensors have capability of providing meaningful information for agriculture making this concept more emerging and attractive day by day. In this work, we designed a system using smart technology which can do complex work easily. This work meets major factors of agriculture, field monitoring,

automated system. The system designed in this work can monitor the humidity, moisture level, temperature, air quality and can even detect raining. According to the data received from all the sensors, the water pump and cutter get automatically activated or deactivated. This work not only focuses on the crop field but also stores the data in cloud using IoT for further analysis for doing precise agriculture. Using those data, forecast can be made about flood or drought. In this work, IoT is controlled by the mobile application, which can be operated from anywhere. Automation system works based on sensors and actuators. Using this system, farmers will be able to do efficient work and crop productivity will be at highest level. Smart Agriculture Robot using IoT can have a positive effect on today?s agricultural growth.

链接:

http://agri.ckcest.cn/file1/M00/02/E9/Csgk0WD2xieARDvqAAvkk20OCFA544.pdf

6．Unmanned Aerial Vehicles in Smart Agriculture: Applications, Requirements, and Challenges

发布源：IEEE

发布时间：2021-01-06

摘要：In the next few years, smart farming will reach each and every nook of the world. The prospects of using unmanned aerial vehicles (UAV) for smart farming are immense. However, the cost and the ease in controlling UAVs for smart farming might play an important role for motivating farmers to use UAVs in farming. Mostly, UAVs are controlled by remote controllers using radio waves. There are several technologies such as Wi-Fi or ZigBee that are also used for controlling UAVs. However, Smart Bluetooth (also referred to as Bluetooth Low Energy) is a wireless technology used to transfer data over short distances. Smart Bluetooth is cheaper than other technologies and has the advantage of being available on every smart phone. Farmers can use any smart phone to operate their respective UAVs along with Bluetooth Smart enabled agricultural sensors in the future. However, certain requirements and challenges need to be addressed before UAVs can be operated for smart agriculture-related applications. Hence, in this article, an attempt has been made to explore the types of sensors suitable for smart farming, potential requirements and challenges for operating UAVs in smart agriculture. We have also identified the future applications of using UAVs in smart farming.

链接:

http://agri.ckcest.cn/file1/M00/02/E9/Csgk0WD3hciAXJjaAAxmrdegu8E964.pdf

7．农业数字化应用中存在的问题及建议

发布源：中国会议

发布时间：2020-12-18

摘要：<正>一、农业数字化应用发展现状随着乡村振兴战略的深入实施和"数字中国"建设步伐的不断加快,我国农业进入了高质量发展的新阶段,迎来了数字技术深度融合的新时代。国内农业数字化应用发展方兴未艾,呈现出良好的发展态势。

链接:

http://agri.ckcest.cn/file1/M00/0F/BB/Csgk0GD3nRCAcHBDAApIvRrERFA431.pdf

【专业会议】

1．2021 3rd International Conference on Agricultural Science and Technology and Ecological Engineering（ASTEE 2021）

发布源：acic

发布时间：2021-08-20

摘要：ASTEE 2021旨在将农业科技和生态工程领域的创新学者和行业专家聚集到一个共同的论坛。会议的主要目标是促进农业科技和生态工程领域的研究和开发活动，另一个目标是促进世界各地的研究人员、开发人员、工程师、学生和从业人员之间的科学信息交流。

链接:

http://agri.ckcest.cn/file1/M00/0F/BB/Csgk0GD3pzOAfaleABlh375EUfk784.pdf

2．2021年图像处理与智能控制国际学术会议（IPIC 2021）

发布源：icipic

发布时间：2021-07-30

摘要：2021年图像处理与智能控制国际学术会议（IPIC 2021）将于2021年7月30日-8月1日在中国，兰州召开, IPIC 2021将围绕“图像处理”、“智能控制”及“计算机视觉”等研究领域展开讨论。此会议旨在为世界各地该领域的专家、学者、研究人员及相关从业人员建立一个广泛、有效的交流合作平台，及时了解行业发展动态、掌握最新技术，拓宽研究视野，推动学术进步以及技术成果的高效应用。与会代表不仅可以聆听国内外知名专家精彩报告，并且可以亲自参与其中与来自世界各地的专家学者进行面对面的交流与探讨。

链接:

http://agri.ckcest.cn/file1/M00/0F/BB/Csgk0GD3obKAMNw6AFAUqYl2gPI834.pdf

3．“智慧助力农业 创新绿色引领产业未来”主题论坛在贵阳召开

发布源：中国农网

发布时间：2021-07-14

摘要：7月13日，2021生态文明贵阳国际论坛“智慧农业助力农业创新绿色引领产业未来”主题论坛在贵阳举行。来自国内外的知名专家学者及行业相关负责人围绕全球粮食安全现状、乡村振兴背景下绿色生态产业发展、智慧农业引领绿色农业可持续发展、现代山地特色高效农业绿色发展之路等议题展开讨论。

链接:

http://agri.ckcest.cn/file1/M00/0F/BB/Csgk0GD2t5KAWl7WAAiqq8_JMlk520.pdf

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