

## 《农业水土资源监控研究》专题快报

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### 【动态资讯】

#### 1. 水利部：137亿元支持大中型灌区现代化改造

【农民日报】日前，记者从水利部召开的加快水利基础设施建设有关情况新闻发布会上获悉，今年水利部安排中央投资137亿元，支持493处大中型灌区现代化改造，已有349处完成招标，320处开工。此外，计划今年新开工的6处新建大型灌区已开工两处。党中央、国务院历来高度重视农田灌排设施建设，现已建成大中型灌区7330处。目前，全国耕地灌溉面积达到10.37亿亩，在占全国耕地面积54%的灌溉面积上生产了75%以上的粮食和90%以上的经济作物。“十四五”以来，国家持续推进大中型灌区现代化建设与改造，水利部会同国家发改委专门印发了《“十四五”重大农业节水供水工程实施方案》，明确提出“十四五”对124处大型灌区开展现代化改造。在水土资源匹配地区新建30处大型灌区，会同财政部印发了《全国中型灌区续建配套与节水改造实施方案（2021-2022年）》，支持461处中型灌区实施节水改造。水利部农村水利水电司司长陈明忠介绍，今年水利系统围绕粮食的播种生产，以大中型灌区为单元，建立了春灌台账，深挖水利工程供水潜力，优化灌区供水调度，合理配置水资源，做到了科学用水、计划用水、节约用水，有效保障今年春灌农业用水。截至今年5月底，全国大中型灌区春灌累积灌溉面积达到3亿亩，供水449亿立方米，全面完成今年春灌任务，为粮食生产尤其是夏粮的丰收提供了有效保障。

链接:

<http://agri.ckcest.cn/file1/M00/10/07/Csgk0GKvCviAaW9-AEkH4v9u7po166.pdf>

#### 2. 新疆麦盖提县：打造“节水丰产”新样板

【农民日报】今年以来，新疆麦盖提县积极落实“藏粮于技，藏粮于地”战略，立足高标准农田，小面积试验种植小麦浅埋滴灌宽幅匀播技术，充分发掘农田节水潜力，增强农

民节水意识，助力农业节水转型升级。当前，小麦生长已进入后期管理阶段，田间去杂工作是保障种源纯度的一项关键措施。在麦盖提县希依提墩乡东风村滴灌小麦试验田里，村民巩建林正在和技术人员一起给小麦除杂。放眼望去，田地里的小麦茎秆粗壮、麦穗硕大、籽粒渐丰，微风过处麦浪滚滚，滴灌小麦的种植方式让巩建林赞不绝口。“今年我家的192亩小麦都运用的是小麦浅埋滴灌宽幅匀播技术，预计今年每亩小麦产量能达到520公斤，对比往年每亩产量要高100公斤。”巩建林介绍。据介绍，麦盖提县滴灌小麦种植新模式一改过去大水漫灌的传统灌溉方式，采用浅埋滴灌水肥一体化新技术进行精量滴灌。巩建林家的小麦种植运用上滴灌设施后，实现了冬小麦浇灌从大水漫灌到精量滴灌的转变，获得了比常规灌溉方式节水65%左右的良好效果。不仅如此，省工、省时、省力，成本还低，这些优点让巩建林一开始试验种植的担心全无，直呼划算。这种新技术还可达到节肥24%、节本增效17%的成效，从而助推种植户实现节本增效、增收节支，让群众日子过得更殷实、更红火。

**链接:**

<http://agri.ckcest.cn/file1/M00/03/35/Csgk0YcFvGSAIk1BACoTGhwytoU845.pdf>

### **3. 当好维护国家粮食安全“压舱石” 争当农业现代化建设排头兵**

【中国农网】的十八大以来，习近平总书记先后两次到黑龙江考察调研，为新形势下黑龙江振兴发展指明了方向。在党的二十大即将召开、实施“十四五”规划承上启下、乡村振兴全面展开之年，面对世纪疫情和百年变局，黑龙江牢牢把握当好维护国家粮食安全“压舱石”、争当农业现代化建设排头兵战略定位，在粮食生产、黑土地保护、种业科技等方面取得重大成就。近日，黑龙江省人民政府与大北农集团签订全面战略合作协议，未来十年，大北农集团开展“龙江十年千亿投资计划”，助推黑龙江打造生物硅谷，由此本报记者采访了国际农业教育科学院院士、联合国粮农组织全球土壤伙伴关系国际黑土研究院主席、黑龙江省农业科学院原院长韩贵清研究员，围绕黑龙江农业重要地位、现代农业发展成就和当前面临的机遇挑战以及未来在发展科技农业、绿色农业、质量农业、品牌农业等方面内容，全面解读黑龙江在维护好国家粮食安全“压舱石”、保障农产品供给安全“主力军”、国家粮食统筹调剂可靠“供应地”等方面发挥的重要作用，全景展示黑龙江加速推进农业高质量发展的振兴之路。

**链接:**

<http://agri.ckcest.cn/file1/M00/10/07/Csgk0GKvDROAHXJiACZSV1irsIE958.pdf>

## **【文献速递】**

### **1. Research on the competitive and synergistic evolution of the water-energy-food system**

## **in China**

文献源: ScienceDirect,2022-06-19

摘要: Water, energy, and food are essential and strategic resources for human well-being and socio-economic development and form the water-energy-food (WEF) system with competition and synergy. The competitive and synergistic evolution model was developed to remedy the limitations in quantitatively analyzing the tradeoffs and synergies of the WEF system. Firstly, an assessment model was developed for measuring the synergy and competition of the WEF system based on the order degree of each subsystem (That is, the development degree of each subsystem) and synergy theory. Then the synergy evolution model (SEM), with the help of a logistic model and accelerated genetic algorithm (AGA) model, was developed to measure and identify the steady-state. Furthermore, an empirical study was conducted with 30 provinces in China as examples. The results indicated that the food subsystem had the highest average order degree (0.347), followed by the energy subsystem (0.305), and the water subsystem had the lowest (0.281). The degree of order of the three subsystems exhibited an upward trend in time and has differences in the spatial distribution. Also, the results showed that synergistic, restrictive, and competitive relationships exist within the WEF system. Areas with competitive and restrictive relationships are mainly located in South China and North China, respectively, within the relationship between the water and energy subsystems. The entire country showed a restrictive relationship between the water and food subsystems. The energy and food subsystems showed that the eastern regions with relationship, while the western regions with competitive and restrictive relationship. Finally, effective measures (e.g., optimize the industrial structure, continuing to implement the strategy of “storing grain in the land and technology”, and to hold the arable land minimum) are suggested to achieve the WEF system coordinated and sustainable development. We believe that the assessment model is also applicable to assess the other complex and dynamic system worldwide that involve multiple factors.

链接:

[http://agri.ckcest.cn/file1/M00/03/34/Csgk0YcFqXGAa\\_ZMACSZu0mxEsc293.pdf](http://agri.ckcest.cn/file1/M00/03/34/Csgk0YcFqXGAa_ZMACSZu0mxEsc293.pdf)

## **2. A dynamic bidirectional coupling model for watershed water environment simulation based on the multi-grid technique**

文献源: ScienceDirect,2022-06-18

**摘要:** Water pollution is a critical issue of global importance. Water environment modeling is an important tool for studying water pollution in basins. Based on a review of existing water environment models, a dynamic bidirectional coupling model for the water environment (E-DBCM), consisting of an upland watershed module (UWSM) and a 2D downstream waterbody module (DWBM), was developed using the multi-grid technique. The computational domain was discretized with grids of different sizes, and different time steps were adopted in regions with different grid sizes. The UWSM was applied to describe the generation and transport of pollutants on coarse grids to improve the computational efficiency, while the DWBM was capable of simulating the hydrodynamic and pollutant transport processes on fine grids to obtain a high accuracy. These two modules were spatially connected by a moving coupling boundary. Two test cases were used to validate the performance of the proposed model, and the results indicated that the E-DBCM had satisfactory computing efficiency while maintaining acceptable numerical accuracy. The water environment of the Yanqi River Basin was evaluated using the proposed E-DBCM. The maximum percent bias was 10.31 %, which indicates that the E-DBCM is reliable and that the numerical accuracy satisfies the engineering demand. The computational efficiency dramatically increased by 90 % when the watershed was discretized using the multi-grid technique. It was found that water pollution problems in this basin were serious, especially during the flood season. Various measures should be taken to improve the water environment treatment and strengthen protection measures in the Yanqi River Basin.

**链接:**

[http://agri.ckcest.cn/file1/M00/10/07/Csgk0GKvFmmAam8xABsdxE\\_mhZQ092.pdf](http://agri.ckcest.cn/file1/M00/10/07/Csgk0GKvFmmAam8xABsdxE_mhZQ092.pdf)

### **3. Effect of barometric pumping on relative humidity in the loessal soil of the loess Plateau**

**文献源:** ScienceDirect,2022-06-18

**摘要:** Monitoring experiments of soil air in column show that relative humidity (RH) of air in the soil of the Loess Plateau fluctuates with atmospheric pressure (AP), which is barometric pumping resulting in the vertical movement of soil air and the change of its RH. When AP increases, soil air is compressed and atmospheric air enters the soil, causing RH to decrease. When AP decreases, soil air expands and rises, causing the flow of moist air outwards from the soil and increasing RH. Therefore, RH fluctuates reversely with AP (the correlation coefficient between RH and AP can reach 0.74). This paper studies the effect of barometric pumping on RH in the loessal soil of the Loess Plateau, and reveals the mechanism

responsible for the vertical movement of soil air. On a yearly timescale, the volume of soil air expands with a general decrease in AP from January to July, then compresses with an increase in AP from July to December. On a daily timescale, the air in soil shows bimodal fluctuations. Barometric pumping is the driving force underpinning the soil air movement, and therefore dominating its fundamental characteristics. From a preliminary establishment of model calculation, the volume of soil air movement occurring in the Loess Plateau is proportional to the amplitude of AP fluctuations, aerated porosity, and thickness of the local loess layer. The amplitude of air fluctuations in the soil is independent from the aerated porosity.

链接:

<http://agri.ckcest.cn/file1/M00/10/07/Csgk0GKu-riAaQWhADk5GIyAWOU297.pdf>

#### **4. A novel model for water quality prediction caused by non-point sources pollution based on deep learning and feature extraction methods**

文献源: ScienceDirect,2022-06-18

摘要: Non-point source (NPS) pollution is an important factor affecting the quality of water environment. In recent years, a large number of online water quality monitoring stations have been used to obtain continuous time series water quality monitoring data. These data provide the necessary basis for the application of deep learning methods in water quality prediction. However, the prediction accuracy of traditional deep learning methods is low, especially in predicting the water quality with NPS pollution. Aiming to address this limitation, a novel deep learning model named SOD-VGG-LSTM with the simulation-observation difference (SOD) modular based on physical process, the visual geometry (VGG) modular reflecting spatial characteristics, and the long short-term memory (LSTM) modular based on deep learning method was developed to improve the accuracy of the water quality prediction with NPS pollution. The established model can overcome the problem that mechanism models can not predict the changes of water quality on the hourly or minute time scale. The model was applied in Lijiang River watershed. Experimental results indicated that the proposed model had the highest accuracy in the extreme value prediction compared with the mechanism model and LSTM model. The maximum relative errors between the predicted and observed results for DO, CODMn, NH<sub>3</sub>-N, and TP were 8.47%, 19.76%, 24.1%, and 35.4%, respectively. The model evaluation demonstrated that the established SOD-VGG-LSTM model achieved superior computational performance

compared to Auto Regression Integrate Moving Average model (ARIMA), Support Vector Regression model (SVR), and Recurrent Neural Network model (RNN). The evaluation results showed that SOD-VGG-LSTM achieved 3.2 - 39.3% higher  $R^2$  than ARIMA, SVR and RNN. The proposed model can provide a new method for water quality prediction with NPS pollution.

链接:

<http://agri.ckcest.cn/file1/M00/03/35/Csgk0YcFqq6AcoQPAC0sQxGFCxg542.pdf>

## 5. Valorization of fruit waste-based biochar for arsenic removal in soils

文献源: ScienceDirect,2022-06-18

摘要: Fruit waste disposal is a serious global problem with only 20% of such waste being routinely treated prior to discharge. Two of the most polluting fruit wastes are orange peel and walnut shell and new methods are urgently required to valorize such waste. In the present study, they were valorized via conversion into biochars at 500 °C (OPB500 for orange peel-based biochar produced at 500 °C and WaSB500 for walnut shell-based biochar produced at 500 °C), and evaluated for arsenic adsorption. A pore-rich surface morphology was observed with a low H/C ratio indicating high stability. Spectroscopic studies revealed the presence of minerals and surface functional groups (amide, carbonyl, carboxyl, and hydroxyl) suggesting high potential for arsenic immobilization. Adsorption studies revealed an arsenic removal efficiency of 88.8 ± 0.04% for WaSB500 exposed to initial arsenic concentration of 8 ppm for 5% biochar dose at 25 °C and 30 min contact time. In comparison, OPB500 showed slightly lower removal efficiency of 80.7 ± 0.1% (10 ppm initial concentration, 5% dose, 25 °C, 90 min contact time). Peak shifts in XRD and FTIR spectra together with isotherm, kinetic, and thermodynamic studies suggested arsenic sequestration was achieved via a combination of chemisorption, physisorption, ion exchange, and diffusion. The present investigation suggests valorization of fruit waste into thermo-stable biochars for sustainable arsenic remediation in dynamic soil/water systems and establishes biochar's importance for waste biomass minimization and metal (loid) removal from fertile soils.

链接:

<http://agri.ckcest.cn/file1/M00/10/06/Csgk0GKu-XCAIJzwABqgixSPbwU238.pdf>

## 6. 基于天地协同与深度学习的灌区地下水位模拟研究

文献源: 长江科学院院报,2022-06-18



**摘要:** 本文利用灌区地面和遥感的天地协同序列观测数据,以降水、土壤湿度、地下水位历史观测量、哨兵-2遥感观测值作为地下水位的模拟因子,采用基于多层GRU网络的深度学习模型建立地面和遥感观测因子与地下水位的内在联系,进行灌区地下水位模拟的研究,并在南北方两处灌区研究区进行地下水位模拟实验和结果分析。实验结果表明,基于天地协同与深度学习的灌区地下水位模拟模型具有自行建立外界环境因素和灌区地下水位内在关系的能力,具有较好的地下水位模拟效果,以及在不同地理环境下的模型适用性,具有一定的应用潜力,能够为灌区的农作物种植和水资源管理提供决策信息支持。

**链接:**

<http://agri.ckcest.cn/file1/M00/03/34/Csgk0YcESAaAU4-rABXP078xXPQ810.pdf>

## 7. 紫色土埂坎典型草本根系摩阻特性对土壤含水率的响应

文献源: 草业学报,2022-06-16

**摘要:** 为进一步探索紫色土埂坎草本根-土界面摩阻特性与土壤含水率的关系,以紫色土埂坎常见稗草、马唐和牛筋草3种草本根系为研究对象,设置不同土壤含水率(5%、10%、15%、20%和25%),通过直剪和拉拔摩阻试验测定草本根-土复合体的摩阻特性指标(黏聚力、摩擦系数、最大抗拔力和抗拔强度),分析了土壤含水率对不同草本根-土界面摩阻特性的影响。结果表明: 1)当含水率为15%和20%时,根-土界面黏聚力达到较小值,而摩擦系数、最大抗拔力和抗拔强度达到较大值。2)3种草本根-土界面拉拔摩阻特性差异显著( $P < 0.01$ ),牛筋草根-土界面平均最大抗拔力和抗拔强度分别是马唐的1.18和1.30倍,是稗草的1.14和1.10倍。3)草本根-土界面间抗剪强度和垂直荷载的关系服从莫尔-库伦准则。当含水率为20%和25%时,根-土界面间抗拔力达到较大值。4)在相同垂直荷载和土壤含水率条件下,牛筋草根-土界面抗剪强度显著高于马唐和稗草( $P < 0.05$ )。由此可知,牛筋草根系能增强紫色土埂坎稳定性,其根系对埂坎的加固作用约在土壤含水率为15%时效果最佳。研究结果可为三峡库区紫色土埂坎固埂护坡草本植物的筛选提供参考。

**链接:**

[http://agri.ckcest.cn/file1/M00/10/06/Csgk0GKtmiaAcbmKABRMwXAFZ\\_g178.pdf](http://agri.ckcest.cn/file1/M00/10/06/Csgk0GKtmiaAcbmKABRMwXAFZ_g178.pdf)

## 8. 中国稻田土壤铁流失及其环境意义

文献源: 中国科学:地球科学,2022-06-16

**摘要:** 铁是重要的生命元素,其在地球表层系统中的迁移和循环过程对陆地和海洋生态系统有重要影响.中国稻作历史悠久、稻田分布广泛、类型众多、人为活动影响强烈,频

繁的干湿交替导致水稻土中铁的迁移过程十分活跃,且与自然土壤相比有很大差异,但关于这类独特的人工湿地生态系统铁的界面迁移流失量及其对河流乃至近海环境的贡献还缺少系统的评估.本研究以中国典型稻作区不同景观(沼泽、平原、阶地)和母质类型(酸性、中性、石灰性)起源的7个时间序列水稻土为对象,系统分析了水稻种植前后土壤中Fe的动态演化特征,并在收集和整理相关大量文献数据的基础上,估算了全国尺度由于人为植稻引起的铁流失量.结果表明,不论起源于何种景观与母质类型,水稻土在1m土体内最终都会呈现铁的流失趋势.起源于低洼沼泽区石灰性湖相沉积物的水稻土,在前期(50a) Fe呈现一定的累积,之后呈现流失趋势(铁流失的平均速率为 $0.026\text{kg m}^{-2}\text{a}^{-1}$ );起源于平原地区石灰性母质的水稻土在1000a内Fe以土体内表层还原淋溶与亚表层氧化淀积的内循环过程为主,之后呈现流失趋势(铁流失的平均速率为 $0.029\text{kg m}^{-2}\text{a}^{-1}$ );而起源于平原与丘陵地区酸性和中性母质的水稻土在植稻初期就出现Fe的快速流失(Fe的最大流失速率达 $1.106\text{kg m}^{-2}\text{a}^{-1}$ ),之后Fe流失速率趋缓.起源母质pH、 $\text{CaCO}_3$ 与有机质含量、地形控制的物质运移以及人为灌溉引起的土壤水分状况变化与植稻年龄共同决定了稻田Fe流失的模式和速率.根据时间序列水稻土数据与文献数据,初步估算出全国稻田土壤Fe流失通量约为 $46.4\sim 195.7\text{Tg a}^{-1}$ ,全国稻田Fe流失总量约为 $5121.5\sim 9412.2\text{Tg}$ .稻田Fe流失的准确估算对科学评估土地利用变化对Fe的生物地球化学循环的影响具有重要意义。

链接:

<http://agri.ckcest.cn/file1/M00/03/34/Csgk0YcEScqAQPW4ABQFtcxrGmg708.pdf>

## 9. 区域尺度土壤-农作物体系营养元素铁的地球化学评价及膳食补铁区划

文献源: 地球与环境,2022-06-16

摘要: 铁(Fe)是人体健康必需的微量元素,人体Fe摄入不足或过量都会引起严重健康问题。目前区域尺度的土壤-农作物体系中Fe元素的预测及膳食摄入评估方面的研究较少.本文以四川省邻水县为研究区,采集了109套玉米与根系土样品以及6 980件表层土壤样品,开展了土壤-农作物体系营养元素铁的地球化学评价及膳食补铁区划研究。结果表明,研究区表层土壤Fe含量范围为 $3\ 070\sim 198\ 100\text{ mg/kg}$ ,算术平均值为 $52\ 370\pm 1\ 270\text{ mg/kg}$ ,明显高于我国的土壤Fe背景值。研究区玉米籽实Fe含量范围为 $10.09\sim 24.4\text{ mg/kg}$ ,算术平均值为 $15.57\pm 2.89\text{ mg/kg}$ ,显著低于我国玉米中Fe含量均值。建立了玉米Fe生物富集系数预测模型,预测了玉米籽实Fe含量,并依据日均摄入Fe含量推荐值和居民膳食结构调查结果,给出了研究区玉米最佳Fe含量范围值为 $13.88\sim 30.85\text{ mg/kg}$ 。研究区膳食摄入评估结果表明,研究区大部分区域18~60岁人群Fe摄入较为充足;摄入缺乏区域零星分布,占研究区总耕地面积的3.87%。最后,给出了食用玉米不同地区需要补充Fe微量元素区划图,为研究区居民预防缺Fe引发的健康疾病提供了科学依据。



链接:

<http://agri.ckcest.cn/file1/M00/10/06/Csgk0GKtlvyAW6m-AD8-OGQe9co893.pdf>

## 10. 黄土高原不同降水量区苹果园土壤干燥化效应及生产水足迹模拟

文献源: 应用生态学报,2022-06-15

摘要: 为探明黄土高原地区旱作苹果园深层土壤干燥化效应和生产水足迹动态变化, 选择半湿润区洛川和半干旱区米脂两个典型苹果种植区, 采用WinEPIC模型定量模拟分析两个区域1980—2020年旱作苹果园0~15 m土壤水分动态变化和苹果生产水足迹演变规律。结果表明: 洛川和米脂成龄果园年产量大致呈“S”型趋势变化, 年均值分别为24.64和18.42 t·hm<sup>-2</sup>; 年均蒸散量分别为623.82和458.97 mm, 年均干旱胁迫日数分别为20.40和52.73 d, 年均水分过耗量分别为167.94和121.15 mm。洛川1~25龄、米脂1~23龄果树土壤有效含水量下降趋势明显, 土壤干燥化速率分别为64.60和68.03 mm·a<sup>-1</sup>; 洛川和米脂深层土壤干层形成的时间为第13年和第7年, 并分别于第23年和第22年后达到稳定, 降水量高的地区形成和达到稳定土壤干层的时间较晚, 如果土壤水分长期处于亏缺状态, 最终会形成不可逆转的土壤干层。洛川和米脂苹果生产水足迹均呈前期低后期高的特征, 年均生产水足迹值分别为0.187和0.194 m<sup>3</sup>·kg<sup>-1</sup>。苹果产量和生产水足迹受降水影响, 在水资源短缺的黄土高原地区, 为了苹果产业能够持续健康发展, 建议苹果树最佳种植年限为23年左右, 最多不应超过25年。

链接:

<http://agri.ckcest.cn/file1/M00/03/34/Csgk0YcES1aAJ77rAAo0vAvMdlM285.pdf>

## 11. 基于BP神经网络方法的黄土水分特征曲线预测模型比选

文献源: 中国农村水利水电,2022-06-14

摘要: 黄土高原区水资源严重匮乏, 研究土壤水分特征曲线对于提高水分利用率、节约水资源有着重要的现实意义, 但直接试验测量土壤水分特征曲线面临操作技术难度大、耗时费力等诸多问题, 因此对土壤水分特征曲线进行科学合理预测十分必要。为提高黄土高原区土壤水分特征曲线预测模型精度, 以山西省五个县市的试验点黄土为研究对象进行模型比选。基于BP神经网络算法, 以土壤基本指标粘粒含量、粉粒含量、干容重、有机质和全盐量共5个影响因素作为预测模型的输入变量, 以经验模型的参数作为预测模型的输出变量, 分别建立了Gardner经验模型参数和Van Genuchten经验模型参数的预测模型, 并根据实测数据库的预测结果进行对比和分析。结果表明: 建立的经验模型参数的BP神经网络预测模型, Gardner经验模型建模和验证后的两个参数相对误差的平均值都小于4%, Van Genuchten经验模型建模和验证后的两个参数相对误差的平均值都小

于5%；不论是建模的训练数据库还是验证数据库，Gardner经验模型参数的预测模型精度均高于Van Genuchten经验模型参数的预测模型精度。因此，建议针对黄土高原区的黄土水分特征曲线预测模型的建立，选用Gardner经验模型更加合适，且此经验模型的表达式简单易懂，更利于农田水利相关的基层工作人员的学习与利用。

**链接:**

[http://agri.ckcest.cn/file1/M00/10/06/Csgk0GKtI5mAMQ5\\_AA5Wt6Qvv1g658.pdf](http://agri.ckcest.cn/file1/M00/10/06/Csgk0GKtI5mAMQ5_AA5Wt6Qvv1g658.pdf)

## 12. 近红外光谱的北方寒地土壤含水率预测模型研究

文献源：光谱学与光谱分析,2022-06-07

摘要：我国北方寒地温差大，土壤温差对近红外光谱测量土壤墒情有较大影响。针对这一问题，以北方寒地土壤为研究对象，探究大范围温度胁迫下（-20~40℃）土壤的近红外光谱与土壤不同含水率之间的关系预测模型方法。选取黑龙江八一农垦大学农学院试验基地中的黑土，经烘干、过筛等操作处理后配置含水率范围在15%~50%内八种不同湿度的土壤样品，建立北方寒地土壤大范围温度胁迫下土壤的近红外光谱信息与含水率之间的定量预测模型。在全波段光谱数据的基础上，结合五种不同光谱信号预处理方法，采用BP神经网络算法、优化支持向量机算法（SVM）、高斯过程算法（GP）三种智能算法建立北方寒地土壤近红外光谱与含水率的预测模型并验证模型的效果。利用69组数据进行训练建模，BP神经网络相关参数设置为学习速率0.05,最大训练次数设置为5000,隐层单元数确定为20; SVM采用径向基函数，并利用leave-one-out cross validation确定了最佳惩罚参数为0.87,使模型预测的准确性提高；高斯过程算法内部采用马顿核。模型的定量评估采用决定系数（R<sup>2</sup>）和均方根误差（RMSE）。结果表明，在建立的全部BP神经网络模型中，效果最佳的为S\_\_G-BP神经网络模型，模型的R<sup>2</sup>为0.960 9, RMSE为2.379 7;在SVM模型中SNV-SVM模型的效果最好，模型的R<sup>2</sup>为0.991 1, RMSE为1.081 5;在GP模型中S\_\_G-GP模型的效果最好，模型的R<sup>2</sup>为0.928, RMSE为3.258 1,综上基于SNV预处理的SVM模型训练效果最优。利用剩余的35组光谱数据作为预测集验证模型性能，经模型对比分析发现基于SVM算法的预测模型效果优于其他两种算法，其中基于S\_\_G的SVM模型效果最优，其预测模型的R<sup>2</sup>和差RMSE分别为0.992 1和0.736 9。综合建模集与预测集的参数最终确定基于S\_\_G的SVM模型为最佳模型。此模型可以作为大范围温度胁迫条件下（寒地）的土壤含水率有效预测方法，为设计优化适宜寒地便携式近红外土壤含水率快速测量仪提供科学依据。

**链接:**

<http://agri.ckcest.cn/file1/M00/03/34/Csgk0YcESOWASHbFAAxVrQ-Wnew204.pdf>

### 13. 汇聚海量数据 深化应用场景 开创智慧水土保持

文献源：中国水土保持科学(中英文),2022-04-15

摘要：数字经济、智慧社会成为当今世界创新发展的新动能，智慧水土保持要为生态保护与高质量发展提供更强大动力与支撑。智慧水土保持的基础是海量数据，需广泛、深度挖掘数据资源。大数据、云计算、人工智能、互联网、区块链等高新科技与水土保持管理及社会化服务的深度融合，区域土壤侵蚀长系列、多频次调查数据，为水土流失防治的科学布局、智慧决策提供支撑；长期、定位观测数据的深度开发，将为构建预测预报模型、预警预案提供支持。水土保持重点工程图斑精细化管理，流域山水林田湖草沙综合治理理论、标准、成果的深度开发，支持水土保持生态功能监测评价、生态系统质量与稳定性、可推广成功案例及其科学配置的技术措施智能化服务。生产建设项目水土保持方案、监测、监理、验收、信息化监管等海量数据开发，服务于科学精准高效跟踪检查，水土保持合规性自主预判、问题警示、整改核实等；对违反水土保持信用情形实施智能监测、警示、快速跟踪。年度水土流失动态监测数据深度开发，服务于水土保持任务完成监测、目标考评，重要生态功能区、生态敏感区、水土流失重点防治区的智能化跟踪监测、预警、评价。

链接:

<http://agri.ckcest.cn/file1/M00/10/06/Csgk0GKtmLqADVb4AAPkO4MvHXc993.pdf>

## 【会议论文】

### 1. Rainfall Prediction for Enhancing Crop-Yield based on Machine Learning Techniques

发布源：IEEE

发布时间：2022-06-16

摘要：The agriculture industry is the backbone of the economy in nations like India. Many agricultural crops in India have been impacted by climate change. As a country's population grows, its reliance on agriculture grows, and the country's economic process suffers as a result. In this situation, crop yields have a significant impact on the country's economic progress. There were insufficient food grains to feed the populace. Despite the existence of numerous methodologies or procedures for estimating agricultural production, their accuracy is not up to par. According to the literature review, there are no acceptable remedies or technologies to address the aforementioned condition. This method represented a push toward over-mechanization of agriculture. Agriculturists were encouraged and supported to engage in technology-based farming. This initiative attempts to assist farmers in forecasting future harvests and properly managing their costs by taking into account variables such as temperature, rainfall, and land acreage. To forecast the crop

output of a certain agriculture region depending on the quantity of rainfall, the proposed method employs machine learning techniques and multilayer Perceptron. Farmers will be able to anticipate crop yields prior to planting and make the appropriate investment decisions as a result of this research. To estimate agricultural yields early in the harvest, this approach also focuses on appropriate marketing and storage stages. The findings of the suggested system are made available to the farmer group. The suggested technique is beneficial for precisely anticipating agricultural yield output.

链接:

[http://agri.ckcest.cn/file1/M00/10/07/Csgk0GKu\\_TGAOActABVYr9aKgEQ975.pdf](http://agri.ckcest.cn/file1/M00/10/07/Csgk0GKu_TGAOActABVYr9aKgEQ975.pdf)

## **2. Development of Racking and Irrigation System for Industrial Revolution 4.0 Vertical**

### **Farming**

发布源: IEEE

发布时间: 2022-06-14

摘要: This paper presents a design for multi-layer vertical farming rack to be used as an integrated component in fully automated farming of ginger plants with minimum interactions of humans, in line with Industrial revolution 4.0. The vertical rack is designed in parallel so an Automated Guided Vehicle (AGV) can travel along in the middle for data collecting, observation and retrieving purposes. The whole rack system can hold 96 plants, consists of two 19 m rows. Each row has two stacks of plants. 64 units of plants will receive LED treatment, where else the balance 32 unit of plants will not have LED installed for experiment purposes. Rack will be equipped with protrusions to assist robot with its position sensor. Also, each plant containment will be equipped with required LED lights and watering system, complete with waste water drainage path. AGV was tested along the racks to test its stability and reachability of the arm in retrieving plants tray. This test was carried out using dummy load to test the overall strength, vibration and accuracy of the AGV arm. All tests passed satisfactory.

链接:

<http://agri.ckcest.cn/file1/M00/10/07/Csgk0GKvAG6ALiN4ABFXbvdHymI007.pdf>

## **3. Novel Robotic Approach to Irrigation and Agricultural Land Use Efficiency**

发布源: IEEE

发布时间: 2022-06-14

摘要： Current industrial agricultural methods often use inefficient watering, fertilizing, and pest control practices, in part because they lack feedback systems. The prototype proposed combines current agricultural sensing and analysis research with a robotic platform to precisely monitor and care for crops. In this paper, we provide a proof of concept with a path to scalability such that the system may be implemented at an industrial scale.

链接:

<http://agri.ckcest.cn/file1/M00/03/35/Csgk0YcFsHOAAiyIABcAT2FIH7Y670.pdf>

#### **4. Automated Irrigation Management System using IoT**

发布源: IEEE

发布时间: 2022-06-08

摘要： Agriculture spread to a great extent in the Indian economy above 60%, as the population is increasing, which also increases the need for modern technology for the increased production of crops. The Stereotyped methods of irrigation like sprinkler and inflow types are not much effective. As they out-turn in water loss and fungus-related issues because of overwatering. In the future, there may be a situation of demanding more water resources for agriculture. These circumstances can be avoided by using an Automated Irrigation System using IoT. IoT is a highly emerging technology that lets objects communicate through Internet, IoT has been used in a large set of applications like traffic management, smart cities, etc. The major application of IoT is a smart irrigation system, through this smart irrigation there is an advantage of the increase in crop production and decreased use of fertilizers. Using this smart irrigation, the condition of soil like humidity and moisture can be determined by fixing different sensors and these aspects increase the crop and this precise agriculture benefits the farmer. The data from the sensors is wirelessly transmitted to the server database. When the field's moisture and temperature are reduced, the irrigation will be automated. Periodically, the farmer receives information about the field's status by mobile.

链接:

[http://agri.ckcest.cn/file1/M00/03/35/Csgk0YcFsluAYuIAABVn\\_uhgAgw652.pdf](http://agri.ckcest.cn/file1/M00/03/35/Csgk0YcFsluAYuIAABVn_uhgAgw652.pdf)

#### **5. Soil NPK Prediction Using Multiple Linear Regression**

发布源: IEEE

发布时间: 2022-06-07

摘要：—Soil nutrients are the important parameter which contributes a major role in healthy plant growth. In soil, the presence of three macro nutrients namely Nitrogen (N), Phosphorus (P), and Potassium (K) are essential for proper crop growth. Without having adequate knowledge about nutrient levels present in soil, farmers apply large quantity of fertilizers in their field. This leads to depletion or enhancement of nutrient content in the soil and it degrades the soil fertility. Laboratory soil test is time consuming and it involves addition of many chemical reagents. Hence in this paper, the soil macronutrients are predicted using Multiple Linear Regression (MLR) technique. It is a statistical method where several independent or explanatory variables are used to predict the dependent or response variable. MLR technique is formulated to determine a mathematical relationship among several parameters. It shows the relationship between dependent and independent variables. In this technique, soil parameters like nitrogen, phosphorus, potassium, pH and electrical conductivity are used to sketch the relationship among these parameters and predict the values of NPK. The predicted NPK data shows an accuracy of approximately 80% when compared with the actual dataset. These results improve the decision-making capabilities of farmers in applying right quantity of fertilizers and increase crop production.

链接:

<http://agri.ckcest.cn/file1/M00/10/07/Csgk0GKvAnqAf9oZAAGUpZU4uZo965.pdf>

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