

《中文核心期刊要目总览》收录  
Ei Compendex(核心版)收录  
百种中国杰出学术期刊  
RCCSE中国权威学术期刊



ISSN 1002-6819  
CN 11-2047/S  
CODEN NGOXEO  
www.tcsae.org

# 农业工程学报

NONGYE  
GONGCHENG  
XUEBAO

TRANSACTIONS OF THE CHINESE SOCIETY  
OF AGRICULTURAL ENGINEERING

2020年 06  
第36卷 VOL. 36



中国科学技术协会 主管

中国农业工程学会 主办



# 农业工程学报

2020 年 3 月第 6 期 总第 382 期 (第 36 卷)

## 目次

### • 农业装备工程与机械化 •

- 蔬菜移栽机斜插夹钵式取投苗装置研制 .....谢守勇, 阳尚宏, 刘 军, 宋 磊, 谢秋菊, 段廷亿 (1)
- 基于香蕉根系分布形态的变量排肥器参数优化与试验  
.....宋帅帅, 段洁利, 邹湘军, 杨 洲, 欧治武, 王 彪 (11)
- 基于线性自抗扰的稻田除草对行控制系统设计与试验  
.....陈学深, 方贵进, 马 旭, 蒋 郁, 齐 龙, 黄柱健 (19)
- 淡水鱼腹背定向装置设计及试验 .....万 鹏, 黄 俊, 谭鹤群, 朱 明, 赵竣威 (28)
- 柴油机燃烧室的系统设计方法研究与应用 .....雷基林, 于 跃, 辛千凡, 申立中, 宋国富, 陈丽琼 (36)

### • 农业航空工程 •

- 植保无人机喷施雾滴沉积特性的荧光示踪分析  
.....张瑞瑞, 李龙龙, 文 瑶, 陈立平, 唐 青, 伊铜川, 宋佳星 (47)

### • 农业水土工程 •

- 考虑植株氮垂直分布的夏玉米营养诊断敏感位点筛选  
.....李岚涛, 盛 开, 尹焕丽, 郭 娅, 王丹丹, 王宜伦 (56)
- 基于叶面积指数构建滴灌玉米营养生长期临界氮稀释曲线 .....贾 彪, 付江鹏 (66)
- 基于核磁共振技术的孔隙水形态及土壤渗透性分析 .....董均贵, 吕海波, 陈国强 (74)
- 黄河三角洲不同土地利用类型土壤微观结构特征 .....刘传孝, 李克升, 耿雨晗, 李全新 (81)
- 根系密度对黄土塬沟头溯源侵蚀产沙和形态演化过程的影响  
.....冯兰茜, 王文龙, 郭明明, 史倩华, 陈同德, 康宏亮 (88)
- 气候与人类活动对丹江口水源区植被覆盖变化的影响 .....刘 海, 黄跃飞, 郑 粮 (97)
- 地表粗糙度及植被盖度对坡面流曼宁阻力系数的影响  
.....杨坪坪, 李 瑞, 盘礼东, 王云琦, 黄 凯, 张琳卿 (106)
- 糠醛渣改良土壤增强苕子对盐碱土的适应性  
.....张美娟, 王 冰, 黄升财, 陈红娜, 时俊美, 夏关雪莹, 屈琳俐, 程宪国 (115)
- 斑块状植被覆盖下坡面流水动力学特性 .....刘西乐, 张宽地, 杨 婕, 孟 鹤, 王静雯 (122)

### • 农业信息与电气技术 •

- TRMM 在海河流域南系的降水估算精度评价及其对 SWAT 模型的适用性  
.....谭丽丽, 黄 峰, 乔学瑾, 刘海鹏, 李春强, 李保国 (132)
- 花铃期受涝棉花的高光谱-光合特征及关系模型 .....吴启侠, 谭京红, 朱建强, 刘凯文, 李晋波 (142)
- 基于流形光谱降维和深度学习的高光谱影像分类 .....师 芸, 马东晖, 吕 杰, 李 杰, 史经俭 (151)

自然环境下贴叠葡萄串的识别与图像分割算法 .....	刘 平, 朱衍俊, 张同勋, 侯加林 (161)
• 农业生物环境与能源工程 •	
高纬度地区多功能日光温室设计 .....	王洪义, 祖 歌, 杨凤军, 李德泽, 田丽美 (170)
农业基站室外自然冷能微热管阵列式空冷器性能 .....	靖赫然, 赵耀华, 全贞花, 王林成 (179)
利用旋流效应强化平板型太阳能空气集热器性能 .....	胡建军, 郭 萌, 张广秋, 张士英, 郭金勇, 陈立娟 (188)
面向农村微能网的评价指标构建及应用 .....	张 新, 杨建华, 王维洲, 井天军, 张 漫 (196)
基于 Kjeldahl 与 Dumas 方法的农作物秸秆总氮含量分析 .....	王鑫磊, 袁湘汝, 张潇潇, 解茹越, 肖卫华, 韩鲁佳 (206)
铁改性生物炭抑制土壤中 As 的迁移 .....	吴福飞, 贾宏涛, 董双快, 王 红, 朱 丹 (215)
1978—2017 年中国农业污染物影子价格及污染成本测算 .....	邹利林, 刘彦随, 王永生 (223)
• 农业资源循环利用工程 •	
石灰性土壤添加污泥后土壤的肥力特征及磷素淋失临界值 .....	常会庆, 吴 杰, 王启震, 焦常锋, 朱晓辉, 王 浩 (231)
玉米秸秆与污泥混合热解对生物碳特性及重金属的影响 (英文) .....	蔡尽忠, 李火金, 邓 盈 (239)
香蕉纤维素-壳聚糖/聚丙烯酰胺双网络水凝胶的制备及吸附性能 .....	宋传捷, 郑丽丽, 郑晓燕, 艾斌凌, 杨 旸, 钟 爽, 校 导, 郝凤岭, 盛占武 (246)
• 土地保障与生态安全 •	
基于空间分异的高标准农田建设空间特征判别系统设计与实现 .....	李少帅, 郎文聚, 张 燕, 杨 剑, 曹文静, 李红举, 陈元鹏 (253)
• 农产品加工工程 •	
常温真空包装对保持小米储藏品质的影响 .....	石建春, 李志刚, 王 愈, 陈振家, 高俊宇, 刘雅琪, 白旭婷 (262)
东北地区稻谷储藏期间脂肪酸含量的预测模型 .....	王启阳, 吴文福, 兰天忆 (269)
冲击式速冻设备上下送风速度对虾仁冻结过程的影响 .....	谢 晶, 舒志涛, 杨大章, 陈 聪 (276)
酸性浸润干燥辅助低水耗水代法提取亚麻籽油工艺 .....	张文斌, 彭怀云, 杨瑞金, 华 霄, 赵 伟 (284)
复配亚麻籽油和辅酶 Q10 乳液的制备及表征 .....	黄 娟, 王云娟, 白 华, 宋育聪, 吕奕文, 潘 挺, 潘 芳 (292)
三聚氰胺-脲醛树脂改性木基石膏复合材料的效果及机理 .....	岳 孔, 梁 冰, 赵明元, 唐中秋, 王 烽, 刘 健, 刘伟庆 (300)
• 专题论坛 •	
秦巴山区消费扶贫的益贫性空间分异 .....	王 刚, 廖和平, 洪惠坤, 朱 琳, 李 涛 (308)
基于辩证营养学的营养与健康系统构建 .....	孙君社, 王民敬, 郭力城, 苏凤哲, 裴海生, 郭晓晖 (317)

**Transactions**  
**of the Chinese Society of Agricultural Engineering**  
**Vol.36 No.6 Mar. 2020**  
**CONTENTS**

**• Agricultural Equipment Engineering and Mechanization •**

- Development of the seedling taking and throwing device with oblique insertion and plug clipping for vegetable transplanters  
.....*Xie Shouyong, Yang Shanghong, Liu Jun, Song Lei, Xie Qiuju, Duan Tingyi* (1)
- Parameter optimization and test of variable fertilizer apparatus based on root distribution pattern of bananas  
.....*Song Shuaishuai, Duan Jieli, Zou Xiangjun, Yang Zhou, Ou Zhiwu, Wang Biao* (11)
- Design and experiment of control system for weeding alignment in rice field based on linear active disturbance rejection control  
.....*Chen Xueshen, Fang Guijin, Ma Xu, Jiang Yu, Qi Long, Huang Zhujian* (19)
- Design and test of orientation device for freshwater fishes' abdomen and back  
.....*Wan Peng, Huang Jun, Tan Hequn, Zhu Ming, Zhao Junwei* (28)
- Investigation and application of systematic design method for combustion chamber of diesel engine  
.....*Lei Jilin, Yu Yue, Xin Qianfan, Shen Lizhong, Song Guofu, Chen Liqiong* (36)

**• Agricultural Aviation Engineering •**

- Fluorescence tracer method for analysis of droplet deposition pattern characteristics of the sprays applied via unmanned aerial vehicle  
.....*Zhang Ruirui, Li Longlong, Wen Yao, Chen Liping, Tang Qing, Yi Tongchuan, Song Jiaxing* (47)

**• Soil and Water Engineering •**

- Selecting the sensitive position of maize leaves for nitrogen status diagnosis of summer maize by considering vertical nitrogen distribution in plant  
.....*Li Lantao, Sheng Kai, Yin Huanli, Guo Ya, Wang Dandan, Wang Yilun* (56)
- Critical nitrogen dilution curve of drip-irrigated maize at vegetative growth stage based on leaf area index  
.....*Jia Biao, Fu Jiangpeng* (66)
- Pore-water form determined by using NMR method and its influence on soil permeability  
.....*Dong Jungui, Lyu Haibo, Chen Guoqiang* (74)
- Microstructure characteristics of soils with different land use types in the Yellow River Delta  
.....*Liu Chuanxiao, Li Kesheng, Geng Yuhan, Li Quanxin* (81)



Effects of root density on gully headcut erosion and morphological evolution process in gully regions of Loess Plateau	.....	<i>Feng Lanqian, Wang Wenlong, Guo Mingming, Shi Qianhua, Chen Tongde, Kang Hongliang</i>	( 88 )
Effects of climate and human activities on vegetation cover changes in Danjiangkou Water Source Areas	.....	<i>Liu Hai, Huang Yuefei, Zheng Liang</i>	( 97 )
Effects of surface roughness and vegetation coverage on Manning's resistance coefficient to overland flow	.....	<i>Yang Pingping, Li Rui, Pan Lidong, Wang Yunqi, Huang Kai, Zhang Linqing</i>	( 106 )
Enhancing the adaptation of <i>Vicia villosa Roth</i> to salinity-alkalinity soils improved using furfural residues	.....	<i>Zhang Meijuan , Wang Bing, Huang Shengcai, Chen Hongna, Shi Junmei,</i> <i>Xia Guanxueying, Qu Linli, Cheng Xianguo</i>	( 115 )
Hydrodynamic characteristics of overland flow under patchy vegetation cover	.....	<i>Liu Xile, Zhang Kuandi, Yang Jie, Meng He, Wang Jingwen</i>	( 122 )

### • Agricultural Information and Electrical Technologies •

Evaluation of TRMM satellite-based rainfall data in southern Haihe River Basin and suitability for SWAT model	.....	<i>Tan Lili, Huang Feng, Qiao Xuejin, Liu Haipeng, Li Chunqiang, Li Baoguo</i>	( 132 )
Hyperspectral and photosynthetic characteristics of waterlogged cotton during flowering and boll-forming stages and their relationship model	.....	<i>Wu Qixia, Tan Jinghong, Zhu Jianqiang, Liu Kaiwen, Li Jinbo</i>	( 142 )
Hyperspectral image classification based on manifold spectral dimensionality reduction and deep learning method	.....	<i>Shi Yun, Ma Donghui, Lyu Jie, Li Jie, Shi Jingjian</i>	( 151 )
Algorithm for recognition and image segmentation of overlapping grape cluster in natural environment	.....	<i>Liu Ping, Zhu Yanjun, Zhang Tongxun, Hou Jialin</i>	( 161 )

### • Agricultural Bioenvironmental and Energy Engineering •

Design of multi-functional solar greenhouses in high latitude areas	.....	<i>Wang Hongyi, Zu Ge, Yang Fengjun, Li Deze, Tian Limei</i>	( 170 )
Performance of outdoor natural cooling microheat pipe array air cooler for agricultural base station	.....	<i>Jing Heran, Zhao Yaohua, Quan Zhenhua, Wang Lincheng</i>	( 179 )
Improving the heat collection performance of baffle type solar air collectors using swirl flow effect	.....	<i>Hu Jianjun, Guo Meng, Zhang Guangqiu, Zhang Shiying, Guo Jinyong, Chen Lijuan</i>	( 188 )

Construction and application of evaluation indexes for rural micro-energy-grid	
.....	<i>Zhang Xin, Yang Jianhua, Wang Weizhou, Jing Tianjun, Zhang Man</i> (196)
Analysis of the total nitrogen content of crop residues determined by using Kjeldahl and Dumas methods	
.....	<i>Wang Xinlei, Yuan Xiangru, Zhang Xiaoxiao, Xie Ruyue, Xiao Weihua, Han Lujia</i> (206)
Inhibition effect of iron modified biochar on migration of As in soil	
.....	<i>Wu Fufei, Jia Hongtao, Dong Shuangkuai, Wang Hong, Zhu Dan</i> (215)
Shadow prices and pollution costs of agricultural pollutants in China from 1978 to 2017	
.....	<i>Zou Lilin, Liu Yansui, Wang Yongsheng</i> (223)

### • Agricultural Resource Recycling Engineering •

Fertility property and phosphorus leaching risk threshold of calcareous soil with sludge	
.....	<i>Chang Huiqing, Wu Jie, Wang Qizhen, Jiao Changfeng, Zhu Xiaohui, Wang Hao</i> (231)
Effects of maize stovers and sewage sludge co-pyrolysis on characteristics and heavy metals in biochar	
.....	<i>Cai Jinzhong, Li Huojin, Deng Ying</i> (239)
Preparation of banana cellulose-chitosan/polyacrylamide double network hydrogel and its adsorption	
.....	<i>Song Chuanjie, Zheng Lili, Zheng Xiaoyan, Ai Binling, Yang Yang, Zhong Shuang, Xiao Dao, Hao Fengling, Sheng Zhanwu</i> (246)

### • Land Security and Ecological Safety •

Design and implementation of spatial differentiation-based system for identifying spatial features of well-facilitated farmland construction	
.....	<i>Li Shaoshuai, Yun Wenju, Zhang Yan, Yang Jian, Cao Wenjing, Li Hongju, Chen Yuanpeng</i> (253)

### • Agricultural Produce Processing Engineering •

Effect of vacuum packaging at room temperature on maintaining storage quality of millet	
.....	<i>Shi Jianchun, Li Zhigang, Wang Yu, Chen Zhenjia, Gao Junyu, Liu Yaqi, Bai Xuting</i> (262)
Models for predicting the fatty acid contents of rice during storage in the northeast China	
.....	<i>Wang Qiyang, Wu Wenfu, Lan Tianyi</i> (269)
Effects of upper and down air supply velocities in impingement quick freezing equipment on freezing process of shrimp	
.....	<i>Xie Jing, Shu Zhitao, Yang Dazhang, Chen Cong</i> (276)
Technology for aqueous extraction of flaxseed oil with method of lower water consumption by pretreatment of acidic moisture-conditioning plus drying	
.....	<i>Zhang Wenbin, Peng Huaiyun, Yang Ruijin, Hua Xiao, Zhao Wei</i> (284)

Preparation and characterization of linseed oil and coenzyme Q10 co-loaded emulsions

.....*Huang Juan, Wang Yunjuan, Bai Hua, Song Yucong, Lyu Yiwen, Pan Ting, Pan Fang* (292)

Effect and mechanism of modification of particle-gypsum composites with melamine-urea-formaldehyde resin

.....*Yue Kong, Liang Bing, Zhao Mingyuan, Tang Zhongqiu, Wang Feng, Liu Jian, Liu Weiqing* (300)

### • Special Forum •

Spatial differentiation of methods for poverty alleviation by consumption in Qinling-Daba mountain areas of China

.....*Wang Gang, Liao Heping, Hong Huikun, Zhu Lin, Li Tao* (308)

Construction of nutrition and health system based on dialectical nutrition

.....*Sun Junshe, Wang Minjing, Guo Licheng, Su Fengzhe, Pei Haisheng, Guo Xiaohui* (317)