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## 农牧业信息化专题

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1. 集成电分析生物传感器阵列

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## ▶ 前沿资讯

### 1 . Use waste streams as fertilisers (使用废物流作为肥料)

简介: Herre Bartlema has spent his whole life working with fertilisers and fertilisation. He has been working for years as an advocate of band application and using residual waste streams. Band application has since become widely accepted, and it seems that the tide is now turning in favour of those waste streams.

Use minerals from residual waste streams. From Bartlema's viewpoint, the way to improve sustainability and precision fertilisation is to use minerals from residual waste streams originating in the agricultural sector and in the industry. "From a technological and logistical perspective, there are no insurmountable problems. It benefits the soil, the environment, and the overall yield." Educated at Wageningen University, Bartlema has spent a hardworking life being responsible for research into fertilisers at DSM (now OCI Nitrogen), making him an expert in the field. Over the past few years, he has been promoting the use of residual waste streams through the Netherlands' Centre for Development of Band Application, which he set up, and through events such as the annual 'Precision Fertilisation Day'.

'Messing about' with broadcast spreaders. Bartlema compares precision fertilisation using band application to picking low hanging fruit. "It's efficient, with positive results for the crop and for the grower's wallet. But look at what I regard as messing about with large-scale broadcasting spreaders. What haven't they invented for even grain distribution? Fertiliser spreaders have become expensive and complicated. And yet corners of plots are still under-fertilised, and it's still not possible to finish off your headlands neatly and to avoid creating ruts. Band application of liquid fertilisers is possible during planting or while working the soil. Without the carry-on you get with grains that behave unpredictably. What you do have is certainty of even dosing, even in the side rows, and certainty that the minerals will be delivered directly to the roots."

4 truths of skilled fertilization. Bartlema substantiates his claim with the vision of Meststoffen Netherlands, the association of producers and distributors of mineral fertilisers, with regard to sustainable fertilisation. It includes what he calls the 4 truths of skilled fertilisation in the 21<sup>st</sup> century. 'Fertilisers need to be applied in the right place', is the first truth. The other 3 concern the time of dosing, the choice of fertiliser, and attuning dosing to the needs of the crop and soil supply. As far as the right dosing is concerned: "With band application, you can almost always reduce the amounts compared with broadcast fertilising." For beans, potatoes, sugar beet, and onions, he suggests reducing phosphate by up to 50% and nitrogen by up to 15% compared with recommendations from soil sample analyses.

Residual waste streams. The key to closing the loop is replacing fertilisers with minerals from residual waste streams (or renewable sources). "The production and application of nitrogen in the form of fertiliser generates 8 kilos of CO<sub>2</sub> emissions per kilo of N. Fertilising potatoes with 200 kilos of N per hectare accounts for almost half of the total carbon footprint for that crop. We can reduce that." There is no shortage of residual waste streams. The agricultural sector itself provides, among other things, ammonium sulphate derived from scrubbers on pig- or poultry farms. "This generates 40,000t of nitrogen per year, equal to the

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nitrogen content in 150,000 tonnes of calcium ammonium nitrate (CAN). Compost producers also generate 20,000t of nitrogen per year, while 50,000t comes from the production of caprolactam, a product used in plastics. Agricultural nitrogen consumption amounts to 200,000t every year. Over half of that can be met by these residual waste streams. The remaining nitrogen demand can be met through nitrogen fixation by clovers and by using the thin fraction of slurry.” Quality does not have to be a problem either, as the nitrogen is present in these residual waste streams as ammonium, making it “ideal for spring application, while being insusceptible to run-off.”

‘Reducing nitrogen dosing’. Ammonium sulphate is available in 1000-litre vessels, with 4%, 5% or 6% nitrogen. In order to overcome any logistical difficulties, it is possible, for example, to add urea (46% N in granular form), thereby increasing the N-content to 15%. “Then you have a hybrid circular fertiliser. Urea is mass-produced as CAN, but requires far less energy and emits hardly any greenhouse gases. What’s more, urea can be manufactured using solar power.” With 60 kg of nitrogen per cubic metre of ammonium sulphate waste, dosing need not be a problem. “Compared with broadcasting, the dose in band application can often be 15 to 20% lower. And that’s before we consider autonomous, driverless fertiliser spreaders. Not a reality yet, but not too long ago the use of liquid fertilisers wasn’t either.”

The benefits. The question is what financial and other benefits result from band application of residual waste streams. Bartlema produces a calculation for potatoes grown with band application of ammonium sulphate + urea. Taking account of a 3% increase in yield due to higher use of nitrogen, 2% additional production due to the full utilisation of the plot from one edge to the other, and a 15% saving in nitrogen due to precision fertilisation, he arrives at a cost saving of € 140 per hectare. “It’s not much, but the real saving is made in the additional application capacity for organic fertiliser as a result of the mineral savings. The use of minerals from residual waste requires thinking outside the box and takes some getting used to, but it is easily achievable. We have sufficient residual waste sources, and we have the application technologies available.

来源: Future Farming

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全文链接:

<http://agri.ckcest.cn/file1/M00/06/6A/Csgk0FzAMAaASZXTAAKrT17i23M541.pdf>

## 2 . Toyota develops real-time soil sensor (丰田开发实时土壤传感器)

简介: 丰田开发了一种实时土壤传感器来诊断土壤特性并提出改进建议。丰田汽车公司 (TMC) 开始对这种新的支持服务进行现场试验, 该服务利用农业用地分析过程中土壤成分的实时可视化数据来诊断土壤特征并提出改进建议。丰田表示, 这项服务的目的是 “通过无废物添加肥料和其他土壤改良剂, 快速识别农田土壤成分的变化, 帮助提高农业生产力, 并降低对环境的影响。” 丰田正在与东海贸易有限公司合作在日本三重县的农田进行项目试验, 该公司拥有与农业机械和化肥有关的广泛专业知识, 以及与农业产业的广泛接触。汽车制造商丰田正在寻求各种方式将其汽车生产管理和过程改进技术应用用于解决农业所面临的问题, 例如农业人口老龄化和粮食自给自足率下降, 旨在帮助解决一系列环境和社会问题, 实现更可持续的社会发展。一个具体的例子是 Housaku-Keikaku 农业 IT 管理工具, 丰田在 2014 年推出一种基于云的解决方案服务, 采

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用丰田生产系统的规则来提高农业效率。此外，丰田一直专注于进行以数据为中心的耕作管理的智能农业技术，与东京农业大学和Sakae Shibusawa教授合作开展与实时土壤传感器相关的研究与开发。

来源: Future Farming

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<http://agri.ckcest.cn/file1/M00/06/6A/Csgk0FzAL4SAE9anAAKUDHS3NUc820.pdf>

## ➤ 学术文献

### **1 . A Comparison of the Accuracy and Efficiency of Two Ionic Strength Adjustment Buffers in Measuring Potassium Using an Ion-Selective Electrode (两种离子强度调节缓冲剂在离子选择电极上测定钾离子的准确度和效率的比较)**

简介: It is recommended to use ionic strength adjustment buffers to increase reading accuracy while measuring potassium ( $K^+$ ) concentrations in aqueous solutions by using ion-selective electrodes (ISEs). Three laboratory leachate column studies were conducted to evaluate the efficiency of two buffers, 2.5 M sodium perchlorate ( $NaClO_4$ ) and 2.5 M sodium chloride ( $NaCl$ ), in measuring  $K^+$  concentrations in three media types (peat moss, Oxisols, and Mollisols soils). Three algae species,  $KCl$ , and  $KNO_3$  were applied to provide 112 and 336 kg  $K/ha$ . Leachate samples were collected to a total of 16 weeks and measured using a  $K$ -ISE. The  $K^+$  data from the three trials showed a highly significant ( $r \sim 0.99$ ) correlation between the two buffers. T-Test results showed highly significant ( $P < 0.01$ ) differences between unbuffered and the two buffered solutions. However, there were no significant differences between the two buffered solutions, under the peat moss, Oxisols, and Mollisols soils. The results suggest that the least expensive buffer of 2.5 M  $NaCl$  is as accurate as  $NaClO_4$  in such aqueous solutions.

来源: COMMUNICATIONS IN SOIL SCIENCE AND PLANT ANALYSIS

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### **2 . Effects of daytime intra-canopy LED illumination on photosynthesis and productivity of bell pepper grown in protected cultivation (日间冠内LED照明对保护栽培甜椒光合作用和产量的影响)**

简介: In the past decade, light-emitting diodes (LEDs) have been replacing most other types of light sources. One emerging use for LEDs in horticulture is 'intra-canopy illumination' or 'LED-interlighting', feasible owing to their low heat output and small physical size. The interlighting technique, typically implemented in environmentally-controlled greenhouses also supplemented with overhead lighting, is mostly relevant for high-wire vegetable

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cultivation, in which self-shading results in light limitations for a large fraction of the canopy. Interlighting has been shown to increase the yield and/or improve fruit quality in all-year round greenhouse crops such as tomato, cucumber and sweet pepper. In this work, we utilized daytime supplemental intra-canopy LED illumination for sweet pepper grown in high-density 'Spanish' trellis systems within passive high tunnels in the Jordan Valley, Israel (latitude ~ 32 °N). While canopy top at these conditions is not light-limited, extensive deep shading of the inner canopy is a disadvantage. In two experiments carried out in two separate seasons, the supplemental lighting, which enhanced the photosynthetic rates of the inner canopy foliage by 3.5- to 5.7-fold, resulted in significant increase (30%) of the fruit yield during the spring season. The added yield was attained by higher fruit numbers, with no notable effects on fruit size or weight. Our results raise the prospect that LED-interlighting may be a useful practical tool for maximizing fruit production, even in geographical regions of ample sunlight.

来源: SCIENTIA HORTICULTURAE

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<http://agri.ckcest.cn/file1/M00/06/6A/Csgk0FzALnCAZusfABWFydMsOC4568.pdf>

### **3 . Optimized angles of the swing hyperspectral imaging system for single corn plant (玉米单株摆动高光谱成像系统角度优化)**

简介: During recent years, hyperspectral imaging systems have been widely applied in the greenhouses for plant phenotyping purposes. Current systems are typically designed as either top view or side view imaging mode. Top view is an ideal imaging angle for top leaves with flat leaf surfaces. However, most bottom leaves are either blocked or shaded. From side view, the entire plant structure is viewable. However, most leaf surfaces are not facing the camera, which impacts measurement quality. Besides, there could be advantages with certain tilted angle(s) between top view and side view. It's interesting to explore the impact of different imaging angles to the phenotyping quality. For this purpose, a swing hyperspectral imaging system capable of capturing images at any angle from side view (0° ) to top view (90°) by rotating the camera and the lighting source was designed. Corn plants were grown and allocated into 3 different treatments: high nitrogen (N) and well-watered (control), high N and drought-stressed, and low N and well-watered. Each plant was imaged at 7 different angles from 0° to 90° with an interval of 15°. The soil plant analysis development (SPAD) values and relative water content (RWC) ground truth measurements were used to establish treatment effects. The results showed that averaged plant-level Normalized Difference Vegetation Index (NDVI) values of plants in different treatments changed at different imaging angles. The results also indicated that for pixel-level NDVI distributions, the titled imaging angle of 75° was optimal to distinguish different water treatments, whereas, the tilted imaging angle of 15° was optimal to distinguish different N treatments. For pixel-level RWC distributions, the distribution difference between different water treatments was larger at higher imaging angles.

来源: COMPUTERS AND ELECTRONICS IN AGRICULTURE

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## ➤ 相关专利

### 1 . Integrated electro-analytical biosensor array (集成电分析生物传感器阵列)

简介: A biosensor pixel for measuring current that flows through the electrode surface in response to electrochemical interactions and a biosensor array architecture that includes such biosensor pixels. The biosensor pixel includes an electrode transducer configured to measure a current generated by electrochemical interactions occurring at a recognition layer placed directly on top of it in response to an electrical voltage placed across an electrode transducer-electrolyte interface. The biosensor pixel further includes a trans-impedance amplifier connected to the electrode transducer, where the trans-impedance amplifier is configured to convert the current into a voltage signal as the electrochemical interactions occur. Additionally, the biosensor pixel includes a 1-bit comparator coupled to the trans-impedance amplifier and a 1-bit digital-to-analog converter coupled to the 1-bit comparator, where the 1-bit digital-to-analog converter injects different levels of charge into an input of the trans-impedance amplifier at each cycle based on an output of the 1-bit comparator. 专利类型: 发明专利; 专利状态: 转让; 申请日期: 2013-04-30; 公开日期: 2018-05-29; 申请号: US16111585; 公开号: US20190064100A1; 申请来源: 申请人直接申请 (来自Incopat数据库)。

来源: 美国专利商标局

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