

Application of Precision Irrigation Technology for Sunflower Water Saving in the Hetao Irrigation District

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Abstract

The Hetao Irrigation District diverts 50 billion cubic meters of water annually from the Yellow River for irrigation, which exceeds its water rights by 10 billion cubic meters. Thus, the annual supply of irrigation water was 25% insufficient in this area. Due to an annual average rainfall of only 130~150 mm and evaporation of up to 2000~2400 mm, irrigation is important for crop production in this area. The irrigated area is 48 million hectares and the sunflower planted area accounts for up to one quarter of the total water use in the Hetao Irrigation District. Sunflower is an important economic crop for farmers and this region.

Precision irrigation, integrated with Internet of Things (IoT) technology, can achieve the goal of irrigation water saving. The elements and procedures include: (1) installation of on-farm sensors and transmitters (e.g. soil moisture, water meter, agricultural weather station), (2) creation of Internet of Things (IoT) systems (e.g. LoRa, NB-IoT), (3) development of a precision irrigation platform to analyze large data and perform optimal irrigation decisions, and (4) development of a mobile phone APP for farmers and managers to receive on-farm real-time information. Recently, many countries have developed precision irrigation systems for efficient utilization of water resources, including as follows: (1) the American Climate Company developed the California Irrigation Management Information System (CIMIS) to perform smart irrigation management, (2) the Euro Union developed the Flexible and Precise Irrigation Platform to Improve Farm Scale Water Production (FIGARO) to promote irrigation water management for high water consumption crops.

Sunflower belongs to high water consumption crops with seasonal irrigation water requirements up to 558 mm in the Hetao Irrigation District. It is an important theme of applying precision irrigation technology to promote irrigation water efficiency, increase sunflower production and quality, enhance farmers' income, and maintain sustainable environment development.

Keywords: precision irrigation, water saving, Hetao irrigation district

精准灌溉技术应用于河套灌区向日葵节水灌溉概念

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摘要

河套灌区年引黄河 50 亿立方公尺水量进行灌溉，超过核定水量约 10 亿立方公尺，灌溉水量不足达 25%。该区年平均降雨量仅 130~150 公厘，年蒸发量达 2000~2400 公厘，作物生产高度仰赖灌溉系统进行灌溉。河套灌区灌溉面积约 48 万公顷，向日葵种植面积占该区总面积约四分之一，向日葵为该区重要经济作物及农民主要经济来源之一。

精准灌溉为结合物联网进行节水灌溉技术，组成项目包括：(1) 田间设置传感器及发送器(气象站，土壤水分，水量)，(2)物联网系统 (LoRa 及 NB-IoT)接收田间数据，(3)精准灌溉平台，接收物联网田间实时数据，进行大数据分析 & 节水灌溉决策，(4)手机 App，农民及灌溉管理者实时掌握田间信息。精准灌溉为近年世界各国发展趋势以有效率使用有限水资源，包括：(1)美国加州灌溉管理信息系统 (California Irrigation Management Information System, CIMIS)，由美国天气大数据公司建置，进行农业灌溉用水的智慧管理，(2)欧盟发展精准灌溉平台 (Flexible and Precise Irrigation Platform to Improve Farm Scale Water Production, FIGARO)，提升向日葵等高耗水作物灌溉管理。

河套灌区向日葵每季灌溉需水量达 558 公厘，属于高耗水作物，河套灌区应用精准节水灌溉技术于提升灌溉用水效率，提高向日葵产量与质量，增进农民收入，维持促进永续环境发展为重要课题。

关键词: 向日葵、精准灌溉、节水灌溉、物联网、河套灌区