Chapter 6
Harnessing Environmental Intelligence to Enhance Crop Management by Leveraging Deep Learning Technique

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ABSTRACT

This chapter aims to enhance crop management practices by harnessing environmental intelligence through the power of deep learning techniques. Efficient and sustainable crop management is crucial for meeting the increasing demand for agricultural products while minimizing environmental impact. In recent years, the integration of deep learning techniques with environmental data has shown great potential in improving crop management practices. The proposed approach involves training deep learning model Dense Net 121 to predict important crop management factors, including yield estimation, disease, and pest outbreaks. The models are trained using historical and real-time data, enabling them to adapt and respond to dynamic environmental conditions. By capturing complex patterns and interactions, deep learning models can provide valuable insights and recommendations to farmers, enabling them to optimize resource allocation, reduce input wastage, and improve overall crop productivity.

1. INTRODUCTION

Crop management plays a pivotal role in modern agriculture, encompassing a range of practices and strategies aimed at optimizing crop productivity, minimizing

DOI: 10.4018/978-1-6684-9975-7.ch006

environmental impact, and ensuring long-term sustainability. With the world's population steadily increasing, crop management practices have become even more critical to meet global food demands while safeguarding natural resources. This chapter explores the importance of crop management in agriculture and highlights key aspects and strategies involved in its implementation (Alston & Pardey, 2014).

Maintaining soil health and fertility is a fundamental component of effective crop management. Soil assessments, including analysis of nutrient content, pH levels, and organic matter, provide valuable insights into the specific needs of crops. By adopting practices like crop rotation, cover cropping, and organic matter addition, farmers can enhance soil structure, nutrient availability, and microbial activity. Improved soil health not only boosts crop yields, but also reduces erosion, enhances water retention, and promotes overall ecosystem resilience. Efficient water management is imperative for sustainable crop production. Crop management practices such as precision irrigation techniques, soil moisture monitoring, and water-use efficiency strategies help minimize water wastage, conserve water resources, and mitigate the risk of water scarcity. By matching irrigation schedules to crop water requirements and employing technologies like drip irrigation or sensor-based systems, farmers can optimize water usage while ensuring adequate hydration for crops.

Pests and diseases pose significant threats to crop health and productivity. Integrated Pest Management (IPM) practices are essential for effective crop management. IPM combines various techniques, including biological control (such as beneficial insects), cultural practices (like crop rotation and trap crops), and targeted pesticide applications, to manage pest populations while minimizing the use of chemical pesticides. By integrating pest's and disease monitoring, prevention, and control measures, farmers can reduce crop losses, preserve beneficial organisms, and safeguard the environment (Li et al.,). Proper nutrient management is crucial for optimal crop growth and productivity. Soil testing and analysis help determine the precise nutrient requirements of crops. By implementing balanced fertilization practices, including the judicious use of organic fertilizers, farmers can supply essential nutrients in the right amounts and at the right time. Precision application techniques, such as variable rate fertilization, ensure optimal nutrient distribution across fields, minimizing nutrient runoff and pollution while maximizing crop uptake. Weeds compete with crops for resources and can significantly reduce yields. Effective weed control is vital for crop management. Integrated weed management practices, combining mechanical methods (such as tillage or mulching), cultural practices (like crop rotation), and targeted herbicide use, help suppress weed growth and minimize their impact on crop productivity. Selective herbicides are preferred to minimize damage to desirable plants and reduce chemical input.

Crop management today increasingly relies on data-driven decision making. Modern technologies, such as remote sensing, drones, and automated sensor systems,

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Ravinder Kumar (2020). *Handbook of Research on Engineering Innovations and Technology Management in Organizations (pp. 245-252).*
www.irma-international.org/chapter/espousal-of-industry-40-in-indian-manufacturing-organizations/256679