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Popular Article

Precision Agriculture: Future Technology for Today's Farmers

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Abstract

New trends are starting to develop in the agriculture industry as a result of recent improvements in communication technology and wireless sensor networks. It is now time to utilize all current methods and technologies for increased economic and ecologically sustainable crop production by fusing information technology and agricultural science. By customizing management for specific tiny sections inside fields as opposed to managing whole fields as a single unit, this exciting new trend of precision agriculture and farming sets itself apart from traditional agriculture. Although this objective is not new, the technology that are currently accessible enable the realization of precision agriculture in a real-world agricultural environment. This essay provides an overview of the transfer of precise technology to the agricultural industry, the state of precision farming today, and implementation tactics.

Introduction

Precision agriculture is usually understood to be a farm management system that uses information and technology to discover, evaluate, and control variability within fields for the best possible profitability, sustainability, and conservation of the land resource. New informational technologies can be applied to this type of farming to help decision-makers in many areas of crop production. The efficiency gains that may be made by recognizing and managing the inherent variability present in a field are highlighted by precision agriculture. The objective is to manage and distribute inputs on a site-specific basis to maximize long-term cost/benefit, not to produce the same yield everywhere. The farmers are searching for innovative strategies to boost productivity and reduce expenses due to rising input costs and falling crop prices. The use of precision agricultural technologies might increase production and profitability (Singh, 2010). Today's farmers are searching for innovative strategies to boost productivity and reduce expenses due to rising input costs and falling crop prices. The use of precision agricultural technologies might increase production and profitability.

Need for Precision Agriculture

By using less water, fertilizer, pesticides, herbicides, and herbicides along with other agricultural equipment, precision farming has the potential to be beneficial for both the economy and the environment. A precision farming technique acknowledges site-specific variances within fields and modifies management activities appropriately. This is preferable to managing a whole field based on some hypothetical average state, which may not exist anywhere in the field. Typically, farmers are aware of the uneven yields of their farms throughout the terrain. These differences can be linked to management techniques, soil conditions, and/or environmental traits. Years of observation and execution via trial and error were needed to build a farmer's mental database about how to handle various sections in a field.

Today, it is challenging to retain that degree of field condition information due to increased farm sizes and changes in the regions cultivated as a result of yearly changes in lease agreements. The gathering and analysis of data might be automated and made simpler with precision agriculture. It enables the rapid and effective implementation of management choices on smaller fields inside bigger fields.

Precision farming is a combination of the use of several technologies. These combinations are all interconnected and are in charge of how crops grow. The same are covered below:

GPS (Global Positioning System)

Farmers can use GPS to pinpoint the exact location of field data such as soil type, pest activity, weed invasion, water holes, boundaries, and impediments. A light or sound guiding panel (DGPS), antenna, and receiver are part of an autonomous controlling system. Signals from GPS satellites are broadcast, enabling GPS receivers to determine their location. The technology enables farmers to accurately pinpoint the locations of fields so that inputs (seeds, fertilizers, pesticides, herbicides, and irrigation water) can be applied to a specific field in accordance with performance standards and prior input applications (Pedersen and Lind, 2017).

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GIS (Geographical Information system)

This system is made up of components such as hardware, software, and protocols that facilitate the production of maps by collecting, storing, retrieving, and analyzing feature attributes and location data. GIS connects data in one location so that it can be extrapolated as needed. Computerized GIS maps differ from traditional maps and have multiple informational layers (e.g. yield, soil survey maps, rainfall, crops, soil nutrient levels and pests). Information on field topography, soil types, surface drainage, subsurface drainage, soil tests, irrigation, chemical application rates, and crop production can all be found in a farming GIS database (Hakkim *et al*., 2016). By integrating and altering data layers to create an analysis of management scenarios, the GIS can be used to analyze present and alternative management in addition to data storage and display.

Variable-Rate Technologies (VRT)

Systems using variable-rate technologies (VRT) control the rate at which agricultural inputs are delivered based on the soil type identified on a soil map. Extrapolating data from the GIS may be used to regulate activities like planting, fertilizer and pesticide application, herbicide selection, and application at the proper time and location at a variable rate. The same concepts of soil sampling are applied in grid soil sampling; however sampling intensity is increased (Raj *et al*., 2021). The geographic location of soil samples gathered in a systematic grid also provides the ability to plot the data. Creating an application map, often known as a map of nutrient requirements, is the aim of grid soil sampling.

Crop Management

Farmers are given a better knowledge through satellite data of the variety in topography and soil characteristics that affect crop production within a field. In order to maximize output and efficiency, farmers may therefore carefully regulate production parameters including seeds, fertilizers, pesticides, herbicides, and water control.

Precision irrigation in pressurized systems

Recent innovations in sprinkler irrigation are now being made available for commercial usage by regulating the motion of the irrigation equipment with GPS-based controls. In addition to motion control, wireless communication and sensor technologies are being developed to keep track of soil and environmental conditions as well as the operation parameters of irrigation machines (such as flow and pressure) in order to increase the effectiveness of water application and crop utilization.

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These technologies have amazing promise, but more work must be done before they can be bought on the open market.

Yield Monitor

Yield monitors are made up of a number of parts. They often contain a variety of sensors and other parts, such as a data storage device, user interface (display and keypad), and task computer, which is housed in the combine cab and manages the integration and communication of these parts. The sensors measure the speed of the separator, the ground speed, the mass or volume of the grain flow, and the grain itself. Grain yield is continually monitored by measuring the force of the grain flow as it collides with a sensible plate in the combine's clean grain elevator.

Precision farming within the fruits and vegetables

With automation systems capturing characteristics relevant to product quality, producers can now grade goods and monitor food quality and safety in the fruit and vegetable industry due to the recent rapid adoption of machine learning technologies. These characteristics include colour, size, form, flaws on the outside, sugar content, acidity, and other interior characteristics (Njoroge *et al*., 2002). To give entire fruit and vegetable processing procedures, it may also be feasible to follow field operations like pesticide spraying and fertilizer use. Consumers may get this information for risk management and food traceability, while farmers can use it for precision agriculture to achieve higher-quality, higher-yielding crops with less wasteful inputs. In recent years, a number of novel strategies that consider the real size of the tree, the crop's health, as well as the environmental circumstances have been established.

Precision livestock farming (PLF)

The management of livestock production utilizing the tenets and tools of precision agriculture is known as precision livestock farming (PLF). Animal nutrition, milk production, egg production, diseases diagnosis and monitoring, features of animal behavior and the physical environment, such as the thermal micro-environment and gaseous pollutant emissions, are processes that are appropriate for the precision livestock farming method. Systems include milk monitoring to assess fat and microbial levels, assisting in the identification of possible diseases, as well as new automated feeding systems, weighing systems, robotic cleaners, feed pushers, etc.

Conclusions

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The present economic and environmental issues that the farmers in the North Eastern region of India are having with their output agriculture can be solved through precision agriculture. Although there are still concerns regarding cost-effectiveness and the best uses for the technical instruments we now possess, the idea of "doing the right thing at the right moment" has a strong intuitive appeal. A concerted effort should be made to harness new technical advancements to transform the "Green Revolution" into a "Evergreen Revolution" in light of the pressing need of the day. In the end, precision agriculture's success will primarily depend on how effectively and how fast the information required to steer the new technology can be discovered.

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