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Precision Farming

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INTRODUCTION

The idea of precision farming is attractive, and its guiding principles naturally raise expectations about the possibility of more efficient use of agricultural inputs, which should increase revenues and result in less environmentally damaging production. The technological advancements in precision farming today can supply the means for tomorrow's environmentally sustainable agriculture. Precision farming has the potential to significantly increase yields while requiring fewer external inputs, particularly for small farmers in developing nations.

NEED OF PRECISION FARMING

The difficulties facing the world food system now are formidable and will become more so during the next forty years. If enough effort and money are put in, a lot can be done right now with the knowledge and tools available. But in order to meet the difficulties of the future, the food system will need to undergo more significant changes, and funding for research will be required to create novel solutions to enduring problems. Major barriers to agricultural growth and development now include worries about trade liberalization's impact on the agricultural industry, the lack of jobs available outside of agriculture, variations in the world's climate, shrinking and fragmented land holdings, stagnating farm incomes, depleting and deteriorating natural resources, and declining overall productivity. As a result, it is anticipated that future agricultural productivity will depend on the effective utilization of recently created technologies.

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Precision farming is a technique that considers the unique characteristics of each fields and adjusts management practices appropriately, rather than managing the entire field based on an average condition that may not be present throughout the field. Most farmers are aware that the yields in their farms vary depending on the terrain.

Classification of Precision Farming (PF) Technologies
Data Collection Technologies
Data Process & Decision making Technologies
Application Technologies

TOOLS AND EQUIPMENT

On-line resources for precision agriculture Online resources abound with knowledge about state-of-the-art techniques for agricultural output. Growers can learn about new goods and services, technical details, software upgrades, troubleshooting manuals, and other updates through this channel, which is used by the majority of producers of agricultural equipment, GPS devices, sensors, and other PA technologies.

Precision livestock farming (PLF) The management of cattle production through the application of precision agricultural technology and concepts is known as precision livestock farming, or PLF for short. Many activities, such as animal development, the production of milk and eggs, disease diagnosis and monitoring, the study of animal behavior features, and physical aspects of the environment such as the temperature microenvironment and the emissions of gaseous pollutants, can benefit from precision livestock farming.

Precision farming within the fruits & vegetables and viticulture sectors With automation systems collecting metrics linked to product quality, growers are now able to grade products and monitor food safety and quality in fruit and vegetable farming thanks to the recent and rapid application of machine vision techniques. Color, size, form, flaws on the outside, acidity, sugar content, and many internal attributes are among them. Furthermore, monitoring field operations—such as the application of pesticides and fertilizers—may provide comprehensive instructions for processing fruits and vegetables.

Global positioning system (GPS)- GPS is a navigation system that records positional data, such as latitude, longitude, and elevation, using a network of satellites. Its precision ranges from 100 to 0.01 meters. GPS allows farmers to locate field data precisely, like the type of soil, the presence of weeds and insects, water holes, boundaries, and impediments. The components of an automatic controlling system include a light or sound guiding panel (DGPS), a receiver, and antenna. GPS receivers can locate themselves thanks to the signals that GPS satellites transmit. The method allows farmers to precisely determine field regions based on performance requirements and past input applications so that inputs (seeds, fertilizers, insecticides, herbicides, and irrigation water) can be applied to a specific area.

Precision farming on arable land- On arable land, farmers that apply PA techniques are the most sophisticated and frequently employed.By avoiding heavy machinery from unintentionally harming crops and compacting soil, CTF is a whole farm solution that reduces costs associated with conventional methods. GNSS technology and decision support systems are used in controlled traffic solutions to limit all field vehicles to the minimum area of permanent traffic lanes.

Sensor technologies A wide range of technologies are used to measure various aspects of life, such as humidity, vegetation, temperature, texture, structure, physical character, vapor, air, and nutrition level. Ultrasonic sound, photoelectricity, conductivity, and electromagnetic are some of these technologies. Remote sensing data are

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used to detect droughts, identify pests and weeds, evaluate plant and soil conditions, and distinguish between various crop varieties. Large volumes of data can be collected with sensors without the requirement for processing in a lab.

Grid soil sampling and variable-rate fertilizer (VRT) utilization There are many applications for autonomous variable-rate technology (VRT) in agriculture. Using a soil map to determine the kind of soil, VRT systems determine the rate at which farm inputs are applied. Operations like planting, dousing in fertilizer and insecticides, selecting and sprinkling herbicides at a variable rate at the appropriate site at the appropriate time, may all be managed by using information obtained from the GIS. In the US, VRT is possibly the most widely used PFS technology.

Crop management Farmers can gain a better knowledge of the variations in soil characteristics and topography that affect crop productivity in the field by using satellite data. To optimize yield and efficiency, growers can thus carefully control production parameters like seeds, fertilizers, pesticides, herbicides, and water control.

Geographic information system (GIS) This system is made up of methods, software, and hardware that make it easier to gather, store, retrieve, and analyze feature qualities and location data for the goal of creating maps. Geospatial information systems (GIS) connect data in one place, facilitating future growth as required. More layers of data (such as yield, crops, soil nutrient levels, rainfall, and pests) are included in computerized GIS maps than in traditional maps, making them more detailed. Geographic Information System (GIS) is a type of computerized map, but its true function is the application of statistical and spatial methods to terrain and feature analysis.

Soil and plant sensors Precision agricultural technology heavily relies on sensor technology, which has been reported to be able to offer information on plant fertility and water status as well as soil qualities. a detailed inventory of all the sensors that are available today, along with attributes that would make future sensors attractive.

Precision irrigation in pressurized systems Recent Commercial applications can now benefit from sprinkler irrigation developments made possible by the use of GPS-based controllers to control the mobility of the irrigation equipment. Beyond motion control, research and development is underway to develop wireless communication and sensor technologies that can track soil and environmental data, as well as irrigation machine operating parameters including pressure and flow, to improve the efficiency of agricultural water application and consumption. Even though these technologies have a lot of promise, more work needs to be done before they can be offered for sale.

Rate controllers Pace controllers are devices that regulate the rate at which chemical inputs, such insecticides and liquid or granular fertilizers, are delivered. When a tractor or spreader crosses a field, these rate controllers keep an eye on its speed as well as the flow rate and pressure of any liquid substance. If necessary, they alter the distribution in real time to achieve a target rate. Due to its extensive history, rate controllers are often utilized as stand-alone devices.

Software Software will frequently be needed to carry out a variety of duties when deploying precision agriculture technology, including information layer mapping, display-controller interface, pre- and post-processing data analysis and interpretation, farm accounting of inputs per field, and many more. The most popular ones are those that create maps (such as yield, soil, or chemical maps); filter data acquired; create maps with variable rate applications (such as chemical, fertilizer, or lime maps); merge many maps into one; and offer advanced geostatistical features.

Yield monitor Yield monitors are a combination of several components. Usually, they consist of multiple sensors and additional

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parts, such as a data storage device, a user interface (keypad and monitor), and a task computer housed in the combine cab that regulates how these parts interact and work. Grain, ground speed, separator speed, and quantity or volume of grain flow are all measured by the sensors. Grain yield is continuously monitored by observing the power of grain flow when it strikes a sensible plate using the clean grain elevator on the combine.

CONCLUSION

Precision farming requires effective monitoring and management of soil, crop, and environmental parameters to yield optimal results in terms of productivity, profitability, resource efficiency, environmental sustainability, and other related factors. This is necessary to acquire outstanding products in agricultural and horticultural crops. Thus A status report on precision agricultural technologies in India was given, with a focus on tactics for remote monitoring and manipulation.

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