Precision Farming : The Evergreen Revolutionary Approach

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INTRODUCTION

Precision farming is a method where the inputs are utilized in particular quantities to get expanded common yields in contrast to usual cultivation techniques. Hence, it is a complete device designed to optimize manufacturing by using the usage of key factors of information, technology, and management, so as to enlarge manufacturing efficiency, improves product quality, improves the efficiency of crop chemical use, preserve energy and defend environment. Farming is turning into extra scientific, with remote sensing, GPS and data analytics all being introduced as farming equipment. Tractors can map fields, drive themselves and check its own movement within inches so that it doesn't waste fertilizer, seed or fuel. In India, to set up precision farming, one most important trouble is the small field size. Commercial as well as horticultural crops additionally exhibit a wider scope for precision agriculture in the cooperative farms.

The first agricultural revolution was once the expand of mechanized agriculture, from 1900 to 1930. Each farmer produced adequate foods to feed about 26 human beings throughout this time. The 1990s prompted the Green Revolution with new strategies of genetic modification, which led to every farmer feeding about one hundred fifty five people. It is predicted that by way of 2050 the world populace will attain about 9.6 billion, with new technological developments in the agricultural revolution of precision farming; every farmer will be capable to feed 265 humans on the same acreage.

Definition of Precision Farming: Precision Agriculture is "an integrated information- and production-based farming system that is designed to increase long term, site-specific and whole farm production efficiency, productivity and profitability while minimizing unintended impacts on wildlife and the environment". Site-Specific Crop Management (SSCM) is "a form of Precision Farming whereby decisions on resource application and agronomic practices are improved to better match soil and crop requirements as they vary in the field".

The Need for Precision Farming: The 'green revolution' during 1960's has made our country self sufficient in food production. This has been possible due to high input application with increase amount of fertilization, irrigation, pesticides, higher utilization of HYV's and increase of mechanization in agriculture-

1. The world's highest productive countries have much more potentiality for producing crop than India. Even India can't touch them through their high yielding varieties as there have lacking of advanced technologies like precision farming.

2. The green revolution is also associated with negative ecological/environmental consequences. In this context, there is a need to convert the green revolution into an

evergreen revolution, which will be triggered by following systematic approach of farming that can help to produce more from the available land, water, labour and natural resources, without either ecological or social harm.

Advantages of precision farming: The goal of precision farming is to improve agricultural yield and reduction of environmental risks, while benefits are:

- Monitor the soil and plant physic-chemical parameters.
- Obtain data in real time.
- Enhance agricultural productivity and prevent soil degradation.
- Reduce excessive chemical usage in crop production.
- Water resources will be utilized efficiently.
- Improve quality, quantity and reduced cost of production in agricultural crops.
- Non-uniform fields can be sub-divided into smaller plots based on their unique requirements.
- Provide better farm records essential for sale and succession

Limitation of Precision Farming in India: There are many limitations for adoption of Precision Farming in developing countries especially in India-

- High capital costs may discourage farmers not to adopt this type of farming.
- Precision agriculture techniques are still under development and require expert advice before the implementation.
- It may take several years to collect the sufficient data for fully implementation of this system.
- It is an extremely difficult task particularly the collection and analysis of the data.
- Small farm size in India is another problem.
- Lack of success stories.
- Heterogeneity of cropping systems and market imperfections.
- Land ownership, infrastructure and institutional constrains.

How could India benefit from precision farming? : Site-specific application of irrigation in wheat of Punjab and Haryana, use of pesticides in cotton and fertilizers applications in oil palm plantation in South India, and coffee and tea garden of eastern India can highly reduce the production costs and also reduce environmental loading of chemicals. Farmers can mitigate problems like water stress, nutrient deficiency, and pests/diseases. It also increases opportunities for skilled employment in the agriculture sector and also provides new tools for evaluating multifunctional aspects including non-market functions. It has the essential role in the monitoring of greenhouse conditions.

Application of precision farming in Horticulture: Horticulture produce goes through spoilage at the time of harvesting, handling, storage, marketing and processing, resulting in huge wastage. Efficient management of wastage can help preserving essential nutrient of the food and feeds bringing down the production cost of processed product; besides minimize the pollution hazard and purify the environmental condition. Recycling and reduction of horticultural waste is one of the most important aspects.

The policy approach to deal with precision farming at farm level:

- Identify the specialty zones for the advancement of crop specific precision farming.

- Creation of multidisciplinary teams involving agricultural scientists in various fields of engineers, manufacturers and economists to study the overall scope of precision agriculture.
- Provide complete technical backup support to the farmers to develop pilots or models, which can be recreated on a large scale.
- Pilot study ought to be led on farmers' fields to show the after effects of precision agriculture implementation.
- Creating awareness among farmers about consequences of applying imbalanced doses of different inputs like irrigation, fertilizers, insecticides and pesticides.

Tools and Equipments of Precision Farming:

- **Global positioning system (GPS)**:
  1. GPS is a navigation system based on a network of satellites that helps users to record positional information of latitude, longitude and elevation.
  2. It permits farmers to find the specific situation of field information, such as soil type, pest occurrence, weed invasion, water holes, boundaries and obstructions.
  3. This system allows farmers to identify field locations so that different inputs (seeds, fertilizers, pesticides, herbicides and irrigation water) can be applied to an individual field, in light on performance criteria and previous input applications.
- **Sensor technologies**:
  1. Various technologies such as electromagnetic, conductivity, photo electricity and ultra sounds are used to measure humidity, density of vegetation, temperature, texture-structure, nutrient level and physical character of soil, vapour and air etc.
  2. Remote sensing data are used to distinguish crop species, diagnosis of stress conditions, identify pests and weeds, and monitor drought, soil and plant conditions.
- **Geographic information system (GIS)**: This system comprises hardware, software and procedures, designed to support the compilation, storage, retrieval and analysis of feature attributes and location data to produce maps. A farming GIS dataset can provide information on filed topography, soil types, surface drainage, subsurface drainage, soil testing, irrigation, chemical application rates and crop yield.
- **Variable-rate fertilizer (VRT) application:** VRT systems set the rate of delivery of farm inputs depending on the soil type noted in a soil map. Information available from the GIS can control different processes, such as seeding, fertilizer and pesticide application, herbicide selection and application at a variable rate in the right place at the right time
- **Crop management:** Satellite data provide a better understanding of the variation in soil conditions and topography that influence crop performance within the field. Farmers can, therefore, precisely manage production factors, such as seeds, fertilizers, pesticides, herbicides and water control, to expand yield and efficiency.
- **Soil and plant sensors:** Sensor technology is an important component of precision agriculture technology and their use has been widely reported to provide information on soil properties and plant fertility/ water status.
- **Rate controllers:** Rate controllers are the devices, designed to control the delivery

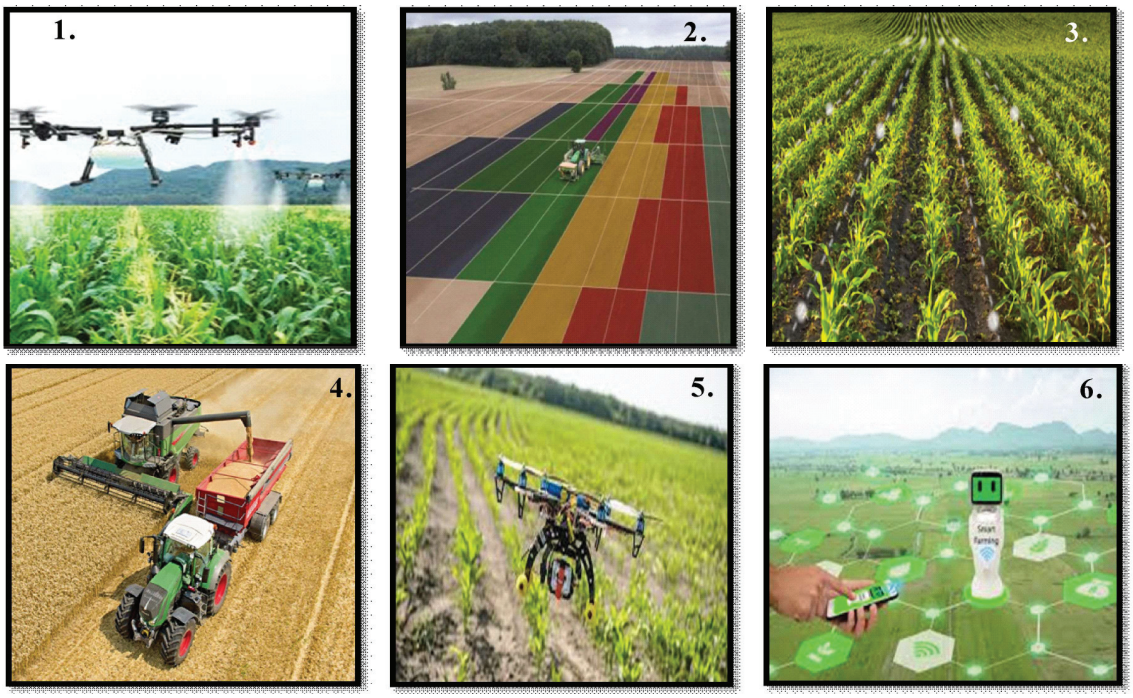
rate of chemical inputs such as fertilizers and pesticides, either in liquid or granular form. These rate regulators monitor the speed of the farm vehicle/sprayer traveling across the field, as well as the flow rate and pressure (if liquid) of the material, making delivery adjustments in real-time to apply with in a target rate.

➢ **Precision irrigation through pressurized systems:** Recent developments are being released for commercial use in sprinkler irrigation by controlling the irrigation machines motion with GPS based controllers. In addition to control the motion, wireless communication and sensor technologies are being developed to monitor soil and ambient conditions, along with operation parameters of the irrigation machines (*i.e.* flow and pressure) to accomplish higher water application efficiency and utilization by the crop.

➢ **Software**: Use of software to carry out diverse tasks such as display-controller interfacing, information layers mapping, pre and post processing data analysis and interpretation.

➢ **Yield monitor:** The sensors measure the mass or the volume of grain flow (grain flow sensors), separator speed and ground speed. In case of grains, yield is continuously recorded by measuring the force of the grain flow as it impacts a sensible plate in the clean grain elevator of the combine.

➢ **Precision farming on arable land**: The use of precision farming techniques on arable land is the most widely used and most advanced amongst farmers. Controlled traffic methods involve restricting all field vehicles to the minimal area of permanent traffic lanes with the aid of GNSS technology and decision



1. Use of drones to spray chemicals, 2. Integration of sensor data in crop model 3. Soil moisture sensor, 4. Harvesting 5. Checking crop growth 6. Creating marketing channel

support systems. Another important application of precision agriculture in arable land is to optimize the use of fertilizers, starting with the three main nutrients Nitrogen, Phosphorus and Potassium.

➢ **Precision farming within Horticulture sectors:** In fruit and vegetable farming the recent rapid adoption of machine vision methods allows growers to grade the products and to monitor the food quality and safety, with automation systems. These include colour, size, shape, external defects, sugar content, acidity, and other internal qualities. Moreover, tracking of field operations such as chemicals sprayed and use of fertilizers can be conceivable to provide complete fruit and vegetable processing methods.

➢ **Precision livestock farming (PLF):** Precision livestock farming (PLF) is defined as the management of livestock production using the principles and technology of precision agriculture. It include animal growth, milk and egg production, detection and monitoring of diseases and aspects related to animal behaviour and the physical environment such as the thermal micro-environment and emissions of gaseous pollutants.

Conclusion: Precision farming is sometimes misinterpreted as sustainable agriculture. Precision farming is a tool to help make agriculture more sustainable however it is not the total answer. Precision farming aims at maximum production efficiency with little environmental impact.

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