

Precision Farming - Way Toward Smart Farming

Ganesh Pawar^{*1} and Yugandhara Patil²

^{*1}SMS (Plant Protection) KVK, Tadsar (M.S.) India

²SMS (Agricultural Extension) KVK, Tadsar (M.S.) India

ARTICLE ID: 58

What is Precision Farming ?

Precision farming is an approach for farm management by using information technology (IT) to ensure that crops and soil receive exactly what they need for optimum health and productivity. It is also known as satellite agriculture, as it relies upon specialized equipment, software and IT services. Sensors in fields measure the moisture content and temperature of the soil and surrounding air. Satellites and robotic drones provide farmers with real-time images of individual plants. Predictive analytics software uses the data to provide farmers with guidance about soil management, crop rotation, optimal planting time and harvesting times. Information from those images can be processed and integrated with sensor and other data to yield guidance for immediate and future decisions, such as precisely what fields to water and when or where to plant a particular crop.

This helps the farmer avoid wasting resources and prevent run-off, ensuring that the soil has just the right amount of additives for optimum health, while also reducing costs and controlling the farm's environmental impact. Today use of Mobile apps, smart sensors, drones and cloud computing makes precision agriculture possible.

Importance of Precision Farming in agricultural revolution?

1. Farmers can control all the processes remotely with a precision agriculture system. Even small farms can manage large fields or a group of small areas.
2. It dramatically improves the efficiency of crops and saves financial costs while increasing production. The last aspect is essential since it seems that precision agriculture technologies are costly at first glance.
3. So, growers can accurately sum the required fertilizer amount, determine effective fertilizer types for a particular area.

4. Moreover, the importance of precision farming technologies is that they improve the planning of agricultural operations for an extended period, adjusting the real-time strategy during force majeure.
5. Optimizing the soil use preserves its quality, enabling a stable food supply. Therefore, precision farming in agriculture plays an essential part in solving the global problem of hunger.
6. The Precision farming invention is shaped by two trends: Big Data and Advanced Analytics Capabilities, and Robotics - aerial imagery, sensors, and sophisticated local weather forecasts.
7. In simple words farming that collects and uses data from plots for managing and optimizing the production of crops is known as predictive farming.
8. Predictive farming is analogous to taking a pill to target an ailment. The solutions are highly tailored from the type of crop suitable for a plot to the use of pesticides in targeted regions only.
9. Adopting precision agriculture and modern farming reduces the production cost and wastage, as the tailored needs of each plot are catered to.
10. Precision farming is practiced by adopting analytical software and the use of technical equipment. Rigorous data collection is done on soil testing, plot measurement, weather pattern analysis, and crop analysis through sensor-equipped devices placed on the fields.
11. The data is calibrated to devise conclusions and based upon those results a very detailed and precise set of practices can be adopted.

Need for precision farming

1. A refined set of cultivation practices and choice of crops based on suitability of land
2. Elimination of volatility and risk
3. Waste management
4. Reduced production costs
5. Minimum environmental impact
6. Optimized use of fertilizers
7. Water management

Benefits of Precision Farming

Since details of areas in a single farm can be traced, precision farming benefits farmers in several ways.

1. Precision agriculture is helpful for growers and the environment as well. Moreover, these areas are interconnected since environmental degradation worsens conditions for agriculture.
2. minimizing the cost of materials and resources, like water, seeds, fuel, etc.;
3. maintaining soil health by reducing the number of pesticides;
4. lowering agriculture's dependence on weather conditions;
5. maximum realization of the genetic potential of the produced crops.

All these advantages of precision farming allow farmers to improve the quality of products significantly and, at the same time, reduce their costs.

Precision Farming Technologies and Methods

Precision farming requires special equipment and software to collect and analyze all the information. As precision agriculture technology requires hardware and software, specialists are needed to implement them. The precision farming technology can be conditionally divided into ground, aerial, and satellite.

Agriculture Technologies used in Precision Farming

Global Positioning System (GPS)

GPS refers to ground-based technology permitting growers to gather data in real-time. It is suitable for the following tasks:

- mapping of irrigation systems, fields, and roads;
- detection of areas with problem plants;
- soil testing in specific field areas;
- the tractor driving with a parallel steering system;
- VRA for precise seed and fertilizer application.

GIS Technology in Precision farming

For dividing the farm into separate zones, remote sensing is needed. Geographic information systems operates with object details and location data to create maps, including digital ones with all zones having their characteristics, the analysis of which requires GIS and GPS use. Traditionally, these zones are divided according to a soil type, nutrient availability, soil moisture content, pH rate, and pest infestation. GIS in precision agriculture permits farmers to view records, such as soil survey maps and plant characteristics

traditionally grown in the region. Satellite images and aerial photographs provide additional information.

UAVs in Precision farming

Aerial technologies for crop management are based on using unmanned aerial vehicles (UAVs). Thus, farmers can monitor the crop condition without scouting all fields. They can attach a hyperspectral camera to UAV and record the required information. Using UAVs or drones in precision agriculture is a more progressive solution. They can be controlled remotely and consume less time

Satellite Remote Sensing in Precision Agriculture

This technology allows growers to observe and monitor crop health using satellite images. They provide up-to-date information on moisture stress, disease, structural anomalies, and nutrient levels. Modern precision agriculture satellite imagery has a high spectral resolution, allowing growers to get the most accurate data. It is always beneficial to combine scouting with satellite remote sensing as it will help us to obtain precise data and decision making will be simplified. Also, they can use satellite imagery for planning plant treatments and selecting agricultural chemicals.

Precision farming and its application fields

Field mapping and yield monitoring in precision farming

When creating a field map, it is necessary to consider the environment's condition to obtain objective data, such as landscape, earth, and weather. Therefore, GPS and satellite remote sensing are being used for this. Thus, the maps display all the field nuances and harvest state. Based on such a precision agriculture yield map.

Micro irrigation (Drip irrigation)

A micro-irrigation system allows growers to effectively plan the field's irrigation by identifying areas with high or low soil moisture. Precision farming makes it possible to carry out variable rate irrigation (VRI) to vary the water supply volume for different field parts. This level of control can significantly improve irrigation efficiency and result in significant water savings. With help of it, farmers can quickly identify areas of the field that need additional watering, regions of flooding, or areas with excessive moisture. Area-Specific Crop Management



It is an agricultural management concept based on monitoring, counting, and reacting to crop variability between fields or within one area. Most current sitespecific crop management methods use accurate global positioning combined with site-specific measurements to quantify spatial changing field conditions. They collect field data (such as pest presence) and remote sensing data (such as from satellites). It can identify problematic sites in a field with various possible pathogens: pests, fungus, fertilizer misuse, weeds, lack of moisture, etc.

Soil Mapping in Precision farming

Precision farming is impossible without quality ground mapping. With its help, farmers evaluate the soil properties, its chemical composition, the nutrients' presence, etc. Soil mapping practice has existed for a long time, but modern technologies provide even more detailed information, making the new generation of digital maps more efficient. For obtaining data, farmers use several types of precision agriculture sensors. For eg. Optical sensors, electrochemical sensors, mechanical sensors.