

Precision Farming: Information, Technology and Management using in Farm Production

***M. Karal Marks**

PG Student, Department of Vegetable Science, Horticultural College and Research Institute, Periyakulam, India

***Corresponding Author's email: karalmarksagri@gmail.com**

Precision farming is one of the most scientific and modern approach to sustainable agriculture. It involves management of within field variations and helps farmers to grow crops more efficiently. Precision farming, also known as site-specific management. Refers to the practice of applying agronomic inputs across a farm. Mainly fertilizers and other chemicals, at variable rates based on soil nutrients or chemical tests, soil textural changes, weed pressures and yield maps foreach field in the farm.



Objectives

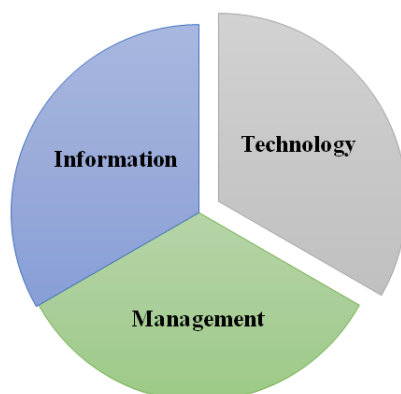
- To increase production efficiency
- To improve product quality
- More efficient input use
- To reduce ecological degradation
- Energy conservation
- Soil and groundwater protection



Basic components of precision farming

- Understanding and measurement of variability
 - Management of this variability by matching inputs to conditions within field using site-specific management mechanisms
 - Measurement and recording of the efficiency and efficacy of these site-specific practices
- Fundamental techniques.

Key elements



Information

- Timely and accurate information is essential for all phases of production from planting to post-harvest.
- Available information includes
 - crop characteristics
 - soil properties,
 - fertility requirements
 - weed populations
 - insect populations
 - plant growth response
 - harvest data and post-harvest processing data.

Modern technology

- The modern technology in agriculture is the second key to success. Technology is rapidly evolving.
- The personal computer is one example of such technology. The computer can help in organizing and managing data more effectively.
- Computer software, including spreadsheets, databases, geographic information systems (GIS) and other types of application software are readily available.
- Management
 - The management, which combines the information obtained and the available technology into a comprehensive system, is the third key to success

Enabling technologies

- Computers
- Global Positioning System (GPS)
- Geographic Information System (GIS)
- Sensors
- Application control

Computers

- Precision farming requires the acquisition, management, analysis and output of large amounts of spatial and temporal data.
- So, the system needs microprocessors that could operate at speeds of millions of instructions per second.
- The extent to which agriculture can utilize computer technology is important for the success of agriculture.

**Role of Computers in Precision Farming**

- Yield mapping PC.
- Computers for field scouting
- Yield monitor integrated with GIS Software
- Farm site mate
- Guide mate
- Farm trace mate
- Field star
- PC Software
- Mapping software

Global positioning systems (GPS)

- A global positioning systems receiver is a location specific device that calculates its position on earth from radio signals broadcast by satellites orbiting the earth.

- To locate an accurate position of an object using GPS, the distance of GPS receiver from a minimum of four satellites is measured.
- The distance from the orbiting satellites is calculated using the equation:
- $\text{Velocity} \times \text{Time} = \text{Distance}$



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Geographic information system (GIS)

- GIS is an organized collection of computer hardware, software and geographic data and personnel designed to efficiently capture, store, update, manipulate and display all forms of geographically referred information.

Role of GIS in precision farming

- an organized collection of computer hardware, software, geographical data and personnel designed to efficiently capture, store, update, manipulate, analyze and display all forms of geographically referenced information.
- rightly called as the 'brain of precision farming'

Remote sensing

- Remote sensing is a potential tool in providing spatial and temporal information on soil and crop variables which could be related with crop growth and yield models.
- Assessment of spatial variability
- Soil characterization
- Management of soil alkalinity
- Mapping leaf area- for canopy and irrigation management

The application of remote sensing in precision horticulture

- Weather forecasting
- Soil properties
- Pest detection
- GPS guided agricultural machinery
- Crop water Stress and irrigation water management
- Yield forecasting

Key aspects of precision farming in vegetable crops

- Optimized Resource Use
- Improved Crop Monitoring
- Data-Driven Decision Making
- Enhanced Yield and Quality
- GPS and GIS
- Remote Sensing
- Soil Moisture Sensors
- Automated Irrigation Systems
- Variable Rate Application (VRA)

Conclusion

Precision farming represents a transformative shift in modern agriculture, moving from generalized, one-size-fits-all practices to data-driven, site-specific crop management. By integrating advanced technologies such as GPS, GIS, remote sensing, drones, IoT-based sensors, and data analytics, it enables farmers to apply inputs like water, fertilizers, and pesticides precisely where and when they are needed. This approach not only maximizes crop productivity and quality but also reduces input costs, conserves natural resources, and minimizes environmental impacts.