PRECISIOIN AGRICULTURE: AN APPROACH TO FARM MANAGEMENT

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Introduction

Digitalization is the recent rapid change in the developing country including India. Digitalization has entered in almost all the sectors like banks, hospitals, private and public sectors. And with the slow pace it is also revolutionizing in the vast and complex sector that is Agriculture sectors. And which is creating new scopes for the application of Precision Agriculture. Precision Agriculture is the century's most valuable innovation in farm management which utilizes information technologies.

Definition: Precision Agriculture, Satellite Farming or Site-specific Crop management is an approach to farm management to ensure that the crops and soil receive exactly what they need for optimum health and productivity.

It is the application of technologies, skills and principles to accomplish spatial and temporal variability associated with all aspects of agriculture production for the purpose of improving crop performance and environmental quality. According to Mckinsey, the development of precision agriculture is shaped by two trends: "Big data and Advanced analytics capabilities, and Robotics- aerial imagery, sensors, sophisticated local weather forecasts".

Why do we need precision agriculture?

- In order to increase the productivity of the agricultural produce.
- To minimize the application of chemicals (fertilizers, pesticides, insecticides and herbicides *etc.*) in crop production.
- For the efficient use of water resources.
- To prevent soil degradation.
- To protect crops from uncertain weather conditions.
- To analyse the actual need of crop as well as soil for optimum growth and productivity.
- For the dissemination of modern farm practices to the farmers regarding improve quality and quantity produce.
- To reduce the cost of production and wastage.

Tools of precision agriculture

1. **Global Positioning System (GPS) receivers:** GPS is global navigation satellite system. It can provide 24-hour, global, all weather location services with high precision and low cost. A

global positioning system (GPS) receiver having a common radio frequency section and a separate digital signal processing channel for each of a plurality of satellite signals which are simultaneously being received and processed by the receiver in order to calculate the position, velocity or other desired parameters of the receiver.

Fig. 1: Locating Global positioning system

2. **Differential Global Positioning System (DGPS):** It is an enhancement in the GPS. DGPS uses two receivers resulting in higher accuracy than single-point measures. The DGPS method can use the correct information for GPS positioning.
3. **Geographic Information Systems (GIS):** GIS digitally record geographical and topographical features. GIS using geomatics Technology enable the farmers to and project current and future fluctuations in precipitation, temperature, crop output etc.

Fig. 2: Assessment of environmental quality using RS and GIS

4. **Remote sensing:** The art and science of collecting information about objects or areas from a distance without having physical contact with objects area being inspected is termed as Remote Sensing.

Uses-

- Gathering of basic data for observing of crop growth.
- Soil mapping, flood mapping, wasteland mapping, cover/ land use mapping.
- Forecasting crop production

RS techniques generally use three platforms. They are:

- Ground based- Spectral Radiometer, Pilot-Balloons, and Radars.
- Air based- Aircrafts
- Satellite based- Polar orbiting satellites, Geostationary satellite.

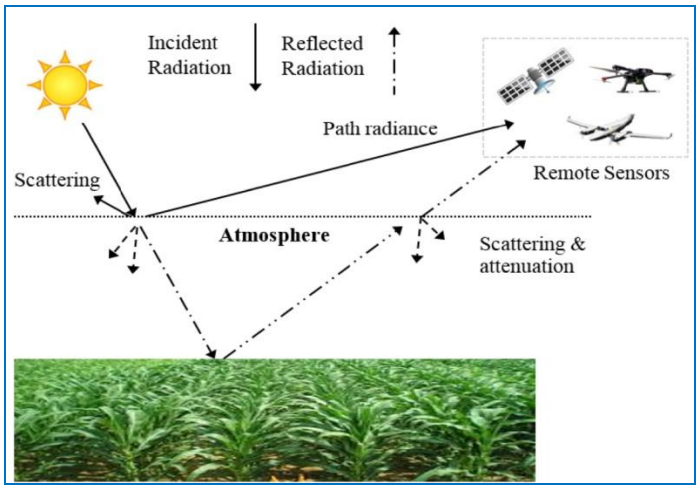

Fig. 3: Remote sensing in precision agriculture

5. **Variable Rate Applicator**: The application of a material, such that the frequency of application is based on the precise location, or qualities of the area that the material is being applied to is referred to as VR. VR application can be either Map based or sensor based.

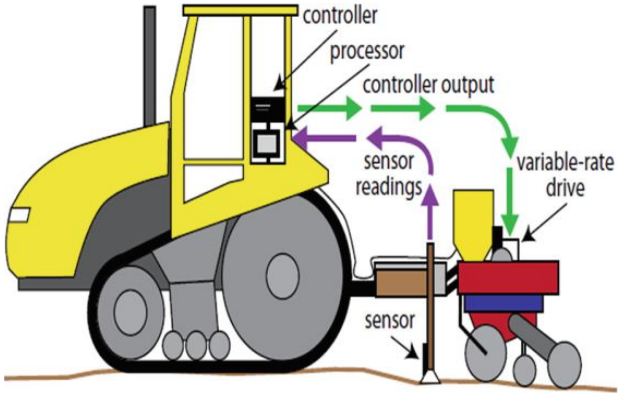

Fig. 4: Variable rate applicator

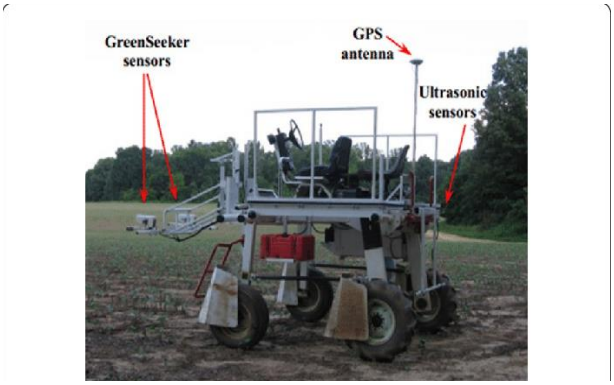

Fig. 5: Variable rate fertilizer applicator for cotton

Application of VRA in Precision agriculture-

- Variable Rate Seeding
- Variable Rate Weed control
- Variable Rate Fertilizer

6. **Combine harvesters with yield monitors**

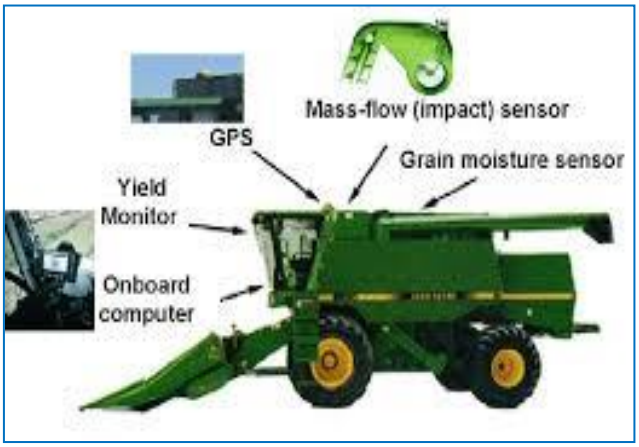

Fig. 6: Combine Harvester with yield monitor on board computer, GPS and sensors

Advantages of precision agriculture:

a. Saving time.
b. Reduce fertilizer and chemical application costs.
c. Reduce pollution through poor use of chemicals.
d. Provide better farm records.
e. Farmers can observe the performance of the new varieties by site specific area.
f. Provide high yield and more profitability.
g. Provide good quality of life to the farmers.

Limitations of precision agriculture:

a. Expensive to adopt.
b. Lack of technical expertise.
c. Insufficient knowledge about the technology.
d. Not applicable for small land holding due to its high cost.
e. Heterogeneity of cropping system and market imperfections.

Conclusion

From agronomical, technical and environmental perspective, Precision agriculture is proved to be a powerful tool once it is applied appropriately. But the main challenges for poor adoption of this valuable innovation are economic challenges i.e. high initial cost and educational challenges i.e. lack of local experts, funds, knowledgeable research and extension personnel.

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