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Precision Agriculture: Concept, Scope and Adoption in India

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INTRODUCTION

- Agriculture is backbone of the Indian economy and the villages are the lifeline of growth of India.
- Precision farming provides a new solution using a systems approach for today's agricultural issues such as the need to balance productivity with environmental concerns.
- Precision agriculture based on advanced information technology.
- It aims to increase economic returns, reduce the energy input and the environmental impacts of agriculture's.
- Precision Agriculture is generally defined as information and technology based farm management system to identify, analyze and manage spatial and temporal variability within fields for optimum productivity and profitability, sustainability and protection of the land resources by minimizing the production costs.
- Precision agriculture is also referred as site specific farming, smart farming and GPS (Global positioning system) based farming.

This technology relies on three key elements,

- 1. Information
- 2. Technology
- 3. Management.

Why precision farming?

PF may be used to improve a field or farm management from several viewpoint.

- Agronomical viewpoint:- Adjustment of cultural practices to take into account the real need of the crop e.g. Better fertilization management.
- **Technical viewpoint:-** Better time management at farm level e.g. planification of agricultural activity.



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- Environmental viewpoint:- Reduction of agricultural impacts (better estimation of crop N needs implying limitation of run off).
- Economical viewpoint:- Increase of the output and reduction of the input, increase of efficiency e.g. lower cost of N fertilization practice. Reduction in soil productivity due to
- Decline of soil fertility
- Soil degradation
- Soil salinization
- Soil erosion
- Indiscriminate use of pesticide and irrigation
- Imbalanced fertilization
- Poor sustainability of agricultural land Concept of precision agriculture

Concept of precision agriculture

- 1. Concept is simple
 - Right input
 - 4 Right amount
 - Right rate
 - 4 At right place

2. Basic concepts

i. Assessing variability (AV):-

In precision farming, inputs are to be applied in accordance with the existing variability. Assessing the in-field variability is very crucial and first step of precision farming. (RS,GPS,GIS,YM)

ii. Managing variability:-

After assessing spatial variability, these precision farming practices aims at managing the variability by applying and making farm inputs available in require quantities at particular time and specific location.

Components in precision agriculture

- 1. Global positioning system(GPS):
- All phases of precision agriculture require positioning information and it can be provided by the GPS
- GPS provides the accurate positional information, which is useful in locating the spatial variability with accuracy.

- This is satellite based information received by a mobile field instrument sensitive to the transmitting frequency.
- GPS help in identifying any location in the field to asses the spatial variability and site specific application of inputs.

2. Geographic information system(GIS)

- The GIS is a tool used to capture, store, update, manipulate, analyze and display all form of geographically referenced information.
- A range of GIS softwares are available to analyze and integrate complex spatial data base.
- GIS has the capability of storing farm record of inputs and outputs in spatial array.
- GIS can be used for linking and integrating data of soil, crop etc with spatially distributed process models as the basis for subsequent decision e.g. VRA
- 3. Remote sensing
- It is a tool for collection, processing and analyzing data to extract information from earth surface without coming into physical contact with it.
- It is a potentially important source of data for PF.
- It is advantageous in obtaining spatially and temporarily variable information for PF.
- 4. Variable rate technology (VRT)
- VRT is used to adjust the agricultural inputs according to the site-specific requirement in each part of the field.
- Uses of VRT
 - ✓ Nutrients / Fertilizer
 - ✓ Micronutrients
 - ✓ Pesticides
 - ✓ Seedings
 - ✓ Irrigation
- Computer controlled nozzels vary the according to the variable rate applicator plan.



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- 5. Yield monitor
- Yield monitor are crop yield measuring devices installed in harvesting equipment.
- The yield data from the monitor is recorded and stored at regular interval along with position data revises from the GIS unit.

Scope of adoption of precision agriculture in India

- Presently, India is producing more than 200 Mt of food grain which makes India selfsufficient in food production.
- But only quantity cannot meet the need of globalized agricultural market. Excellent quality as well as high productivity will be the key factor to compete with others, and the huge scope of PA in India.
- Only in the states of Punjab, Rajasthan, Haryana and Gujarat more than 20 % of agricultural lands have operational holding size of more than four hectare.
- There is a scope of implementing precision agriculture for crops like, rice and wheat especially in the states of Punjab and Haryana.
- Commercial as well as horticulture crops also show a wider scope for precision agriculture in the cooperative farms.
- On other side, studies have already shown that systematic soil testing followed by proper application of NPK fertilizers can increase the productivity level by 2-3 times in most of the states of India.

Strategy for adoption of precision farming in india

Precision agricultural technologies can significantly reduce inputs the and environmental pollution. Precision technologies should be started for high value commercial crops that may bring more benefits to farmers. No technology proves economic benefits with their first use, but the long term adoption of a technology definitely brings these benefits. The primary objective should be to optimize crop inputs and prevent and beneath application of excess of agricultural inputs for reducing environmental risks rather than to get maximum yield. Furthermore, to get the farmers attention towards this type of agriculture should be the main focus of this strategy. Small farmers should start with a single precision application, whereas the progressive farmers should select more than one precision application on their farms because it will bring them more benefits. Small farmers can use low cost and small machinebased variable rate technology. Agencies in the private sector can motivate the progressive farmers to use precision agriculture on their farms by providing them infrastructure support, operational support, coordination and control of farming activities and strategic support. There are several examples of precision nutrient management practices from several countries where farmers practitioners have overcome and the challenges converted them and into opportunities by adopting precision techniques appropriate for their region, operations and resources.