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Precision Agriculture: A New Dimension of Indian Agriculture

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SUMMARY

Precision agriculture (PA), as the name implies, refers to the application of precise and correct amounts of inputs like water, fertilizers, pesticides and others to manage spatial and temporal variability associated with all aspects of agricultural production for the purpose of improving crop performance and environmental quality. Lack of information, connectivity problems faced in remote areas and lack of financial support are hurdles in the path of Precision Agriculture. Future prospects for PA include improvement in the availability and performance of existing technologies. These include improvements in internet connectivity, sensor technology, better and more accurate mobile applications, machinery equipment and others. In the light of tomorrow's expected need and today's urgent requirement, PA needs to become the only choice and not a choice in the field of agriculture.

INTRODUCTION

Precision agriculture (PA) also known as "precision farming", "site-specific crop management", "prescription farming", and "variable rate technology", has been developing since 1990s, and refers to agricultural management systems carefully tailoring soil and crop management to fit the different conditions found in each field. It is a key component of the third wave of modern agricultural revolutions (Ghosh *et. al.,* 2022). In the wake of climate change, depletion of natural resources and an imminent food crisis, India must move beyond aggressive farming and towards precision farming. Precision farming, at a nascent stage in India, can help the country become the top agricultural producer across the globe by maximising farm productivity and profitability. According to Pierce and Nowak (1999), precision agriculture can be defined as the application of principles and technologies to manage spatial and temporal variability associated with all aspects of agricultural production for the purpose of improving crop performance and environmental quality.

Basic Steps in Precision Agriculture

The basic steps in precision agriculture are:

- Assessing variation
- Managing variation and
- Evaluation

Precision Technologies for Assessing Variability

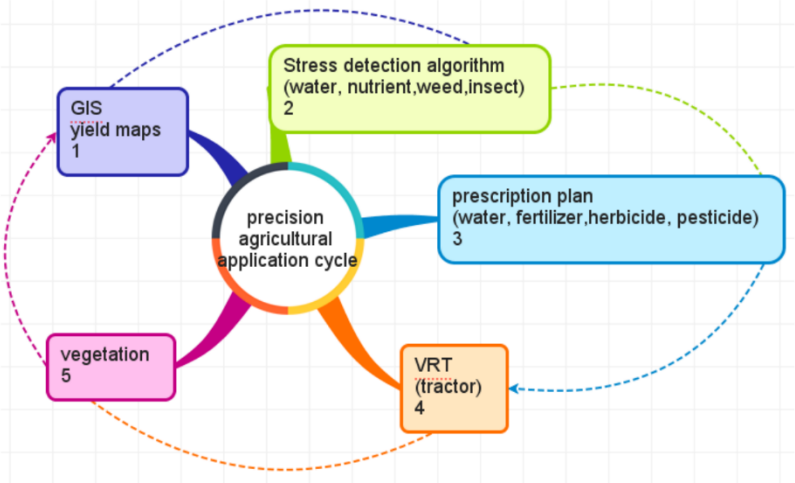
To perform site-specific management, it is crucial to understand and assess the spatial and temporal variability of the topographic factors and their interactions that affect crop production. Various technologies, including Global Positioning System (GPS), geographic information systems (GIS), yield monitors and remote and proximal sensing, assist in data collection to characterize within-field variability in soil and crop properties. Based on these data and other information, farmers can apply the right amount of the right resources (such as fertilizers, pesticides, and water) at the right place and at the right time in the field. As a result of the developments in PA technologies during the last several decades, the ability to produce more detailed spatial information has increased rapidly and offered a better characterization of the within-field crop and soil variability (Rabia *et. al.,* 2022).

Management of Variability

Variable rate technologies integrate engineering and information to enable such site-specific applications. Examples of precision management include variable rate irrigation (VRI), variable rate nitrogen application, variable rate lime application, among many others (Rabia *et. al.*, 2022).

Cycle of precision agriculture. GIS, Geographic information system; VRT, variable rate technology (Abdullahi and Sheriff, 2017)

Advantages



Precision agriculture aims to increase field level management in terms of:

- Botany: by comparing farming practices closely with the needs of plants (e.g., fertilizer inputs)
- Environmental protection: by reducing environmental hazards and farming measures (e.g., limiting nitrogen leakage)
- Economic: by increasing competition through efficient practices (e.g., improved management of fertilizer use and other inputs). (Hemathilake and Gunathilake, 2022)

Drawbacks of Precision Agriculture

- Lack of technical expertise knowledge and technology.
- Not applicable or difficult/costly for small land holdings.
- Heterogeneity of cropping systems and market imperfections.

CONCLUSION

The purpose of precision agriculture (PA) is to ensure profitability, sustainability, and environmental protection. Performances of PA are still debated, as comprehensive research is lacking. From the existing studies it can be concluded that the greatest production advantage of a decade of PA lay in reducing temporal yield variation but did not concern yields. Nevertheless, researchers claimed that reducing yield variation is a positive outcome, as it leads to greater yield stability and resilience to a changing climate.

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