Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 02, Issue: 03 (MAY-JUNE, 2022)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Farmers Today Need to Take up Precision Farming

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Precision farming is an approach where inputs are utilised in precise amounts to get increased average yields, compared to traditional cultivation techniques. Precision farming offers a remedy to many of the concerns arisen because of conventional agriculture. As the conditions of farmlands are quite different in different places, this can effectively save input, reduce cost, provide better protection to crops and soil, and abate the after-effects to the environment. Precision farming can offer a sustainable solution to address food security and conserve natural resources at the same time in India. The recent information technologies and space technologies such as personal computers, GPS, GIS, remote sensing etc., for monitoring crop yields and sensing soil-related variables, are the tools available to make precision agriculture a success.

Introduction

Historically, agronomic practices and management recommendations have been developed for implementation on a field basis. This generally results in the uniform application of tillage, fertilizer, sowing and pest control treatments at a field scale. Farm fields, however, display considerable spatial variation in crop yield, at the 'within-field' scale. Such uniform treatment of a field ignores the natural and induced continuous variation in soil properties. It may result in zones being under- or over-treated, giving rise to economic and environmental problems associated with this inefficient use of resource inputs. The more substantial of these problems being; excessive chemical costs, the release of harmful chemical components, and their unacceptable long-term retention, a less than optimal crop growing environment to name a few. Precision Agriculture (PA) or Precision Farming (PF), in the form of site-specific management, offers a remedy to many of these concerns. The philosophy involves matching resource application and agronomic practices with soil properties and crop requirements, as they vary across a site. This is An information and technology-based farm management system identifies, analyses and manages variability in fields by conducting crop production practices at the right place and time and in the right way, for optimum profitability, sustainability and protection of the land resource.Precision agriculture first appeared in the 1970s in the United States.

Precision farming

The word 'Precision' means exactness or accuracy. Precision agriculture or farming means 'the process by which exact or accurate results of farming can be obtained. Precision agriculture is a management strategy that gathers, processes and analyses temporal, spatial and individual data and combines it with other information to support management decisions according to estimated variability for improved resource use efficiency, productivity, quality,

profitability and sustainability of agricultural production (ISPA, 2019). As the conditions of farmlands are quite different in different places, this can effectively save input, reduce cost, provide better protection to crops and soil, and abate the after-effects to the environment (Gomiero, 2019).

Need for precision farming

The green revolution has left Indian farmers struggling with numerous problems. Inherent soil fertility is declining, leading to land degradation. In India, out of 169.7 million ha, about 144 million ha of land are affected by water or wind erosion alone. Water tables are collapsing, depleting water resources. To feed the evergrowing population, there is a dire need for enhanced productivity/unit of land, water and time. Environment pollution because of increased use of fertilizers and chemicals. Precision agriculture can offer a sustainable solution to address food security and conserve natural resources at the same time in India (Kahn, 2020).

Components of precision farming

1. Data base: Under field conditions, both soils and crops vary spatially and temporally. The information related to soil properties, crop characteristics, weed and insect population and harvest data is important to develop database necessary for realizing the potential of precision agriculture.

2. Technology: The recent Information technologies and space technologies for monitoring yields and sensing soil-related variables are new tools available to make precision agriculture a success. It includes: a. Personal computers (PC). b. Geographic Information Systems (GIS). c. Global Positioning Systems (GPS). d. Sensors. e. Remote Sensing (RS).

Steps in precision farming

1. Assessing variability: The major part of precision agriculture lies in assessing the spatial variability and it must be of sufficient magnitude, spatially structured (non-random), and manageable. Knowing variation implies accuracy, which is very essential. Steps in accessing variability: a. Surveys. b. Interpolation of point Samples. c. High-Resolution Sensing. d. Modelling.

2. Managing variability: Once variation is adequately assessed; farmers must match agronomic inputs to known conditions employing management recommendations. These are site-specific and use accurate applications control equipment. While taking the soil/plant samples, the sample site coordinates should be noted and further can be used for management. This results in the effective use of inputs and avoids any wastage. Steps in Managing the variability: a. Precision Soil Fertility Management. b. Precision Pest Management. c. Crop Management. d. Water Management. e. Soil Management.

3. Evaluation: An evaluation of precision agriculture is required after the assessment and management of spatial and temporal variability. There are three important issues regarding precision agriculture evaluation: a. Economics evaluation: focuses on whether the documented agronomic benefits-translated into value through market mechanisms-exceed the technological and service costs. b. Environment evaluation: focuses on whether precision agriculture can improve soil, water and the general ecological sustainability of our agricultural systems. c. Technology transfer: could imply that precision agriculture occurs when individuals or firms simply acquire and use the enabling technologies.

Methods of precision farming

1. Map-based: It includes grid sampling a field, performing laboratory analyses of the soil samples, generating a site-specific map of the properties and finally using this map to control a variable rate applicator. During both the sampling and application steps, a positioning system GPS is used to identify the current location with higher accuracy in the field. Site-

specific maps may also be used for grid wise site-specific input management. This methodology is most relevant for Indian agriculture at present.

2. Sensor-based: It utilizes real-time sensors and feedback control to measure the desired properties, usually soil properties or crop characteristics and immediately use this signal to control the variable rate applicator. Sensors developed for the measurement of soil properties have the potential to provide benefits from the increased density of measurements at a relatively low cost. A GPS receiver and a data logger are used to record the position of each soil sample or measurement, to generate a map which can be processed along with other layers of spatially variable information to control the variable rate applicator.

Advantages

1. The crop yields are higher and predictable.
2. Increase in the output and/or reduction in the input.
3. Helps the farmer to set a history of his farm practices and results.
4. Better planning and time management of agricultural activities.
5. Application of pesticides only where there is pest-infestation, hence pocket and environment friendly.
6. Reduce chemical and fertilizer costs through more efficient application and reduce pollution.
7. Better estimation of the real needs of the crop.
8. Prevents soil degradation.
9. Efficient use of water resources.
10. Dissemination of modern farm practices to improve quality, quantity and reduced cost of production.
11. Developing favourable attitudes.
12. Precision farming changing the socio-economic status of farmers.

Challenges

Research suggest educational and economic challenges as the two most important in the application of precision agriculture. Among the variables that contribute to educational challenges, lack of local experts, funds, knowledgeable research and extension personnel have more of an impact compared to others. PA and initial costs have more of an impact among the economic challenges compared to the other issues.

Conclusion

Although precision farming seems to offer numerous advantages in the Indian context, many issues are waiting to be addressed before realizing the real benefits from precision nutrient management. Some of them being, developing simple and robust technologies and methodologies, making the interpretation process more automatic, generic and mechanistic as against empirical, evaluation at multiple sites with standardized methodologies providing proof of economic and environmental benefits, and customization of this technology to the actual Indian field conditions.

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