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Precision Farming India & Abroad

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Abstract— Agriculture is still the backbone of livelihood in India and it is primary source of income for 58 percent of population while agriculture is invented 10000 years ago. India is the 2nd, 7th and 3rd largest country in the world based on population, nominal GDP and purchasing power parity respectively. The economy of India is directly depending on agriculture because Gross Value Added by agriculture, forestry and fishing is approximately Rs 17.67 trillion in financial year 2K18. The traditional Indian farming has affected productivity because Indian farmers do not believe in modern methods of agriculture or lack of knowledge of modern agriculture technology like precision farming. That is why productivity of United States farmers is seven times more wheat per acre than Indian farmers because of adoption of precision farming. The scope of precision farming is limited due to smaller farm size per hectare i.e. less than one per hectare and crop diversity in India. But it has very bright scope in North West states like Punjab, Rajasthan, Haryana and Gujarat states with respect to rest of India because of large farm size and rest of India also for commercial crops, high value crops and fruit and vegetable crops. To fulfill the promise of present government of India to double the income of farmers, adoption of precision farming is the necessary condition. The US and Europe are the first and second position holder in terms of precision farming according to recent market study while Asian pacific region countries are in early stages. The growth rate of India and China are highest among the Asian continent. Adoption of precision farming is present time demand to solve the crisis of yield in India also because of reduction of input cost and enhancement of yield 18-20% and 30% respectively.

Keywords— Precision agriculture, Precision Farming, remote sensing, Modern Technology, spatial Variability, Adoption of Technology.

I. INTRODUCTION

Agriculture is the principle & Farming is the practice. Sustainable Agricultural Production System is a judicious Management of An Understanding of Seed, Soil, Nutrition, Water & Other Agro-Chemical inputs Like Fertilizers & Pesticides.

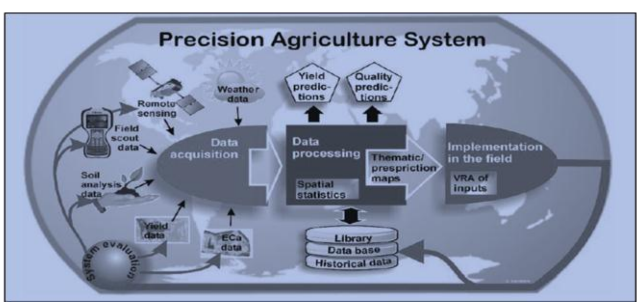

Fig 1: Precision agriculture system

Precision Farming is generally defined as information and technology-based farm management system to identify, analyze and manage variability within fields for optimum profitability, sustainability and protection of land resources. Precision Farming is helping many farmers worldwide to maximize the effectiveness of the crop inputs including seed quality, fertilizers, pesticides and irrigation water. However, the conventional definition of Precision Farming is most suitable when the land holdings are large and enough variability exists between the fields. In India, 1 the average land holdings are very small, even with large and progressive farmers. The more suitable definition for Precision Farming in the context of Indian farming scenario could be- precise application of agricultural inputs based on soil, weather and crop requirement to maximize sustainable productivity, quality and profitability. Today, because of increasing input costs and decreasing commodity prices, the farmers are looking for new ways to increase efficiency and reduce costs. In this regard, Precision Farming is an alternative to improve profitability and productivity. Need of Precision Farming:

1. To enhance productivity in agriculture.
2. Prevents soil degradation in cultivable land.
3. Reduction of chemical use in crop production

4. Efficient use of water resources
5. Dissemination of modern farm practices to improve quality, quantity & reduced cost of production in agricultural crops

1.1 Advantages of Precision Farming

- Use agronomical practices by looking at specific requirements of crop
- allows efficient time management
- eco-friendly practices in crop
- Increases crop yield, quality and reduces cost of production by efficient use of farm inputs, labor, water etc.

1.2 Obstacles to Adoption of Precision Farming in India

- Culture & Perceptions of the Users
- Small Farm Size
- Lack of Success Stories
- Heterogeneity of Cropping Systems & Market Imperfections
- Land Ownership, Infrastructure & Institutional Constraints
- Lack of Local Technical Expertise
- Knowledge & Technical Gaps
- Data Availability, Quality & Costs

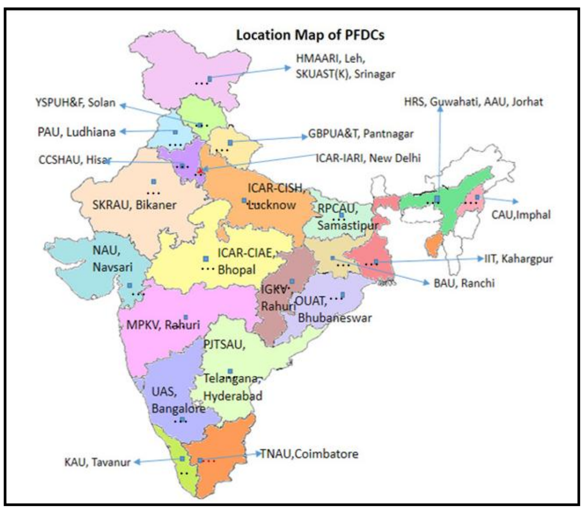

Fig 2: Precision farming development center in India

1.3 Technologies for Precision Farming

In order to collect and utilize information effectively, it is important for anyone considering precision farming to be familiar with the modern technological tools available. The vast array of tools include hardware, software and the best management practices. These are described briefly in the following paragraphs.

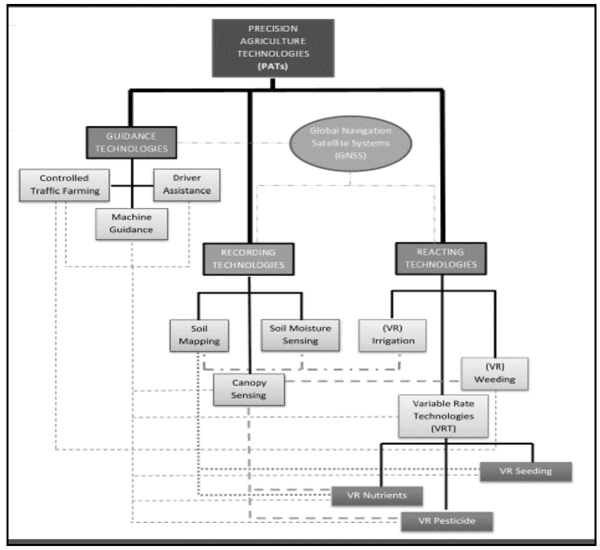

Fig 3: Precision Farming Technology

1.4 Global Positioning System (GPS) receivers

Global Positioning System satellites broadcast signals that allow GPS receivers to compute their location. This information is provided in real time, meaning that continuous position information is provided while in motion. Having precise location information at any time allows soil and crop measurements to be mapped. GPS receivers, either carried to the field or mounted on implements allow users to return to specific locations to sample or treat those areas. Uncorrected GPS signals have an accuracy of about 300 feet. To be useful in agriculture, the uncorrected GPS signals must be compared to a land-based or satellite-based signal that provides a position correction called a differential correction. The corrected position accuracy is typically 63-10 feet. When purchasing a GPS receiver, the type of differential correction and its coverage relative to use area should be considered.

Fig 4: GPS list

1.5 Remote sensing

Remote sensing is collection of data from a distance. Data sensors can simply be hand-held devices, mounted on aircraft or satellite-based. Remotely-sensed data provide a tool for evaluating crop health. Plant stress related to moisture, nutrients, compaction, crop diseases and other plant health concerns are often easily detected in overhead images. Electronic cameras can also record near infrared images that are highly correlated with healthy plant tissue. New image sensors with high spectral resolution are increasing the information collected from satellites. Remote sensing can reveal in-season variability that affects crop yield, and can be timely enough to make management decisions that improve profitability for the current crop. Remotely-sensed images can help determine the location and extent of crop stress. Analysis of such images used in tandem with scouting can help determine the cause of certain components of crop stress. The images can then be used to develop and implement a spot treatment plan that optimizes the use of agricultural chemicals. It is used for:

i) Detection
ii) Identification
iii) Measurement
iv) Monitoring of agricultural phenomena.

Applicable to crop survey

1. Crop identification 2. Crop acreage 3. Crop vigor 4. Crop density 5. Crop maturity 6. Growth rates 7. Yield forecasting 8. Actual yield 9. Soil fertility10. Effects of fertilizes 11. Soil toxicity 12. Soil moisture 13. Water quality 14. Irrigation requirement 15. Insect infestations 16. Disease infestations 17. Water availability 18. Location of canals

1.6 Crop scouting:

In-season observations of crop conditions may include: Weed patches (weed type and intensity); Insect or fungal infestation (species and intensity); Crop tissue nutrient status; Flooded and eroded areas using a GPS receiver on an all-terrain vehicle or in a backpack, a location can be associated with observations, making it easier to return to the same location for treatment. These observations also can be helpful later when explaining variations in yield maps.

1.7 Geographic information systems (GIS):

Geographic information systems (GIS) are computer hardware and software that use feature attributes and location data to produce maps. An important function of an agricultural GIS is to store layers of information, such as yields, soil survey maps, remotely sensed data, crop scouting reports and soil nutrient levels. Geographically referenced data can be displayed in the GIS, adding a visual perspective for interpretation. In addition to data storage and display, the GIS can be used to evaluate present and alternative management by combining and manipulating data layers to produce an analysis of management scenarios.

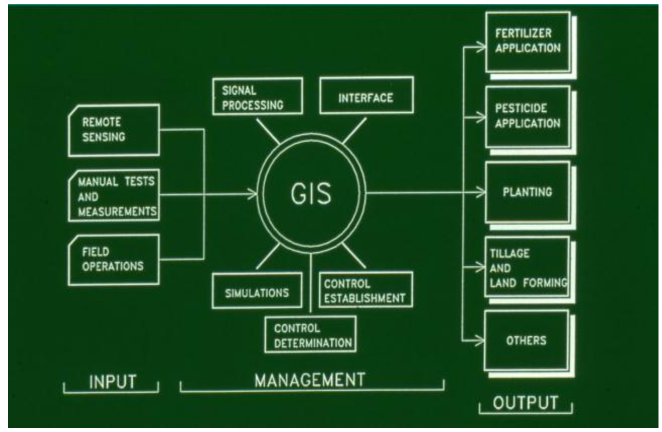

Fig 5: GIS

1.7.1 **List of open source GIS software**:

MapServer, Map Window, PostGIS, QGIS, MySQL Spatial, Thuban, Geoserver, Geotools, fGIS,iGeoPortal, GRASS, GIMP, GeoNetwork, FWTools/GDL/OGR, GVSig, ImageMagic, UDig etc.

1.8 Information management:

The adoption of precision agriculture requires the joint development of management skills and pertinent information databases. Effectively using information requires a farmer to have a clear idea of the business' objectives and crucial information necessary to make decisions. Effective information management requires more than record-keeping analysis tools or a GIS. It requires an entrepreneurial attitude toward education and experimentation.

1.9 Yield monitoring and mapping:

In highly mechanized systems, grain yield monitors continuously measure and record the flow of grain in the clean-grain elevator of a combine. When linked with a GPS receiver, yield monitors can provide data necessary for yield maps. Yield measurements are essential for making sound management decisions. However, soil, landscape and other environmental factors should also be weighed when interpreting a yield map. Used properly, yield information provides important feedback in determining the effects of managed inputs such as fertilizer amendments, seed, pesticides and cultural practices including tillage and irrigation. Since yield measurements from a single year may be heavily influenced by weather, it is always advisable to examine yield data of several years including data from extreme weather years that helps in pinpointing whether the observed yields are due to management or climate-induced.

1.10 Grid soil sampling and variable-rate fertilizer (VRT) application: Under normal conditions, the recommended soil sampling procedure is to take samples from portions of fields that are no more than 20 acres in area. Soil cores taken from random locations in the sampling area are combined and sent to a laboratory to be tested. Crop advisors make fertilizer application recommendations from the soil test information for the 20-acre area. Grid soil sampling uses the same principles of soil sampling but increases the intensity of sampling. For example, a 20-acre sampling area would have 10 samples using a 2-acre grid sampling system (samples are spaced 300 feet from each other) compared to one sample in the traditional recommendations. Soil samples collected in a systematic grid also have location information that allows the data to be mapped. The goal of grid soil sampling is to generate a map of nutrient requirement, called an application map. Grid soil samples are analyzed in the laboratory, and an interpretation of crop nutrient needs is made for each soil sample. Then the fertilizer application map is plotted using the entire set of soil samples. The application map is loaded into a computer mounted on a variable-rate fertilizer spreader. The computer uses the application map and a GPS receiver to direct a product-delivery controller that changes the amount and/or kind of fertilizer product, according to the application map.

II. LITERATURE REVIEW

A brief literature review of major research work carried out in the field of Precision Farming is given below:

RGV Bramley and RP Quabba [2] Explain the opportunities for improving the management of sugarcane production through the adoption of Precision Agriculture.

U. K. Shanwad et.al [3] described the dreams and realities related to Precision Farming for Indian agriculture.
Pinaki Mondal et.al [4] carried out the critical review on Precision Agriculture technologies and its scope of adoption in India.

Barnes et.al [5] detected concurrently the crop water stress, nitrogen status and canopy density using ground-based multispectral data.

Laury Chaerle et.al [6] visualized early stress response in plant leaves by combining hyperspectral reflectance imaging with thermography and chlorophyll fluorescence imaging.
S. Erasmi and M. Kappas [7] determined the crop stress using spectral transformation of hyperspectral data.
Sandor Lenk et.al [8] used multispectral fluorescence and reflectance imaging at leaf level to characterize plants and their health status.

E. Raymond Hunt et.al [9] proved that remote sensing with unmanned airborne vehicles has more potential for within-season crop management than conventional satellite imagery.
Eguchi H. et.al [10] used digital image processing for the images of plant in two wave bands of Red and Infrared for evaluation of growth.

III. PROBLEM STATEMENT

Increase of population and decrease of agriculture land due to industrialization has not affected the productivity of crops and fruits and vegetables due to adoption of new technology. But degradation of land in a huge amount that is 144 million hectares out of 170 million hectares is the biggest problem of present era in India due to water erosion or wind erosion or use of fertilizers or chemical. The use of fertilizers and chemical to increase the productivity to solve the food crisis is also polluted the environment. To eradicate poverty and enhance standard of life precision farming is necessary. The benefits of precision farming could be visualized through reduced use of fertilizers, water, fertilizers, pesticides and herbicides the farm equipment's economically and environmentally friendly. So, the precision farming is necessary for increase productivity, for doing the right thing at the right time in the right place and for managing and accessing field variability.

IV. OBJECTIVE

Now a day's precision framing is acceptable everywhere for crop production and to achieve sustainable agriculture. The objectives are
- To study the scope of precision farming
- To study the market share of precision farming
- To study the cost, benefit and yield under precision farming
- To understand status of project under precision farming
- To manage and maximize long term benefits by distributing inputs

1.11 Working of precision farming

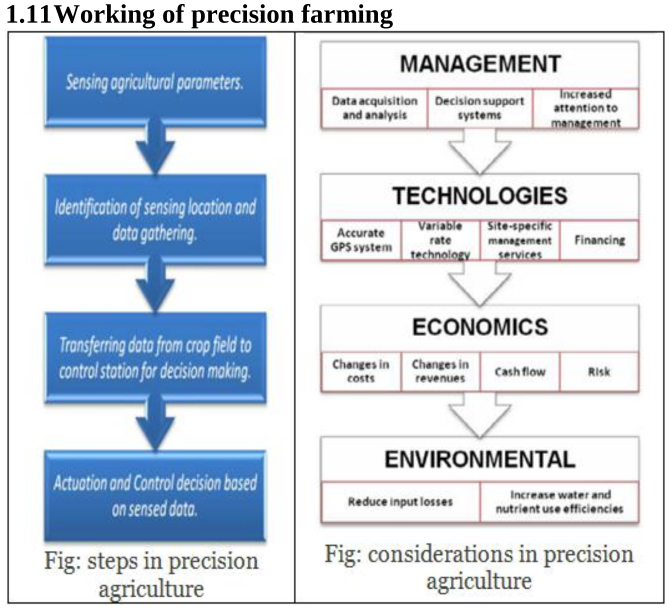

Fig: steps in precision agriculture
Fig: considerations in precision agriculture

Fig.6

Steps to be taken for implementing Precision Farming in India

- Creation of multidisciplinary units involving scientists from various fields, Engineers, Economists to layout design for Precision farming.
- Formation of farmer’s co-operatives
- Governmental legislation to use agricultural inputs judiciously
- Pilot study to be conducted on farmer’s field to show the results of Precision Farming.

A. **Precision Agriculture Startups in rest of the world**

- Cambridge startup CiBo
- Broomfield startup
- Michigan startup
- San Francisco Bay Area startup
- Illinois startup MyAgData
- Sydney startup AgriWebb

B. **Precision Agriculture Startups in India**

- Tata Kisan Kendra (TKK)
- Tamil Nadu Precision Farming Project
- SatSure
- Tech Mahindra Farm Sensor® :

V. RESULTS ANALYSIS

The study, conducted in the Dharmapuri district in Tamil Nadu, India, revealed that adoption of precision farming has led to 80 per cent increase in yield in tomato and 34 per cent in eggplant production. The input cost per hectare was around 2 lakhs.

Comparative Analysis of Cost and Benefits per ha

Particulars	Conventional system	Precision Farming System
sDrip & Fertigation System		Rs. 15000 per Annum
Cultivation Expanses	Rs. 49600	Rs. 76000
Yield	30 MT /ha	135 MT /ha
Water economy		40%
Weight Gain		25% more
Harvest	10 harvest	30 arvest

VI. CONCLUSION AND FUTURE SCOPE

Precision farming is still in initial stage in Asian – Pacific region including India due to lack of knowledge of modern technology like GIS, GPS, Remote Sensing etc. While there are numerous opportunities of adoption of precision farming because it helps farmers to use crop inputs effectively like pesticides, fertilizer, irrigation water and tillage. Precision Farming is an approach to improve profitability and productivity for the farmers to increase efficiency and reduce costs. It can not only address the economical issues of farmers, but also the environmental issue because old agriculture system is also the one of the pollutant agents of the environment Its success depends on the education industry and also the spreading the knowledge of modern technology like precision farming to the farmers with skill improvements. The main conclusions of the study may be presented in a short Conclusion Section. In this section, the author(s) should also briefly discuss the limitations of the research and Future Scope for improvement.

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REFERENCES

[1]. Singh AK (2004) Precision Farming. Water Technology Centre, I.A.R.I., New Delhi.
[2]. Shanwad UK, Patil VC, Honne Gowda H (2004) Precision Farming: Dreams and Realities for Indian Agriculture. KSRSAC, Bangalore.
[3]. USC Precision Agriculture.
[4]. Gomide RL, Inamasu RY, Queiroz DM, Mantovani C, Santos WF (2001) An automatic data acquisition and control mobile laboratory network for crop production systems data management and spatial variability studies in the Brazilian center-west region. ASAE Paper No.: 01-1046.
[5]. Cugati S, Miller W, Schueller J (2003) Automation concepts for the variable rate fertilizer applicator for tree farming. Proceedings of the 4th European Conference in Precision Agriculture, Berlin, Germany.
[6]. Jensen AL, Boll PS, Thysen I, Pathak BK (2000) Pl@nteInfo: a web-based system for personalized decision support in crop management. Comput. Elect. Agric. 25: 271–293.
[7]. Ahmed El-Rabbany GPS for Precision Farming, The Global Positioning System, Second Edition

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