Precision Agriculture: A Sustainable Approach

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Abstract

Precision agriculture is becoming an acknowledged method of crop farming and has become an important method to acquire agricultural outcome in a sustainable and environmental friendly way. Additionally, increasing attention towards automated data, acquisition & knowledge processing is leading towards augmented agriculture management and increased capability in crop production. The advantage and effect of using precision agriculture technology is eminently abased on the abilities of integrated technology along with human efforts. The study related on the subject is centralized on the basis of survey and research on history, development, applications, and benefits of precision agriculture, especially for small scale farms. Consequently, work was analyzed and research data was reviewed in the paper. Precision agriculture imparts with an innovative approach using modern techniques to provide bran d new solutions for present day farming problems, which basically includes balanced productivity with environmental protection.

Keywords: *Precision Agriculture, Crop management, Technologies involved, Approach*

Precision agriculture

Precision Agriculture refers to the precise application of agricultural inputs with respects to soil, weather and crop need in order to improve productivity, quality and profitability in agriculture.

It is a modern agriculture practice involving the use of technology in agriculture like remote sensing, GPS and Geographical Information System (GIS) for improving productivity and profitability. It enables farmers to use crop inputs more efficiently including pesticides,

fertilizers, tillage and irrigation water. More effective utilization of inputs will bring in more crop yield and quality without polluting the environment and will result in sustainable agriculture and sustainable development.

Precision farming, also known as precision agriculture or smart farming, represents a groundbreaking approach that integrates technology, data analytics, and innovative methods to optimize agricultural practices. Hence, Precision Agriculture is about doing the right thing, in the right place, in the right way, at the right time.

Why precision farming

- To increase agriculture productivity
- Prevents soil degradation
- Reduction of chemical application in crop production
- Efficient use of water resources
- Dissemination of modern farm practices to improve quality, quantity and reduced cost of production
- Developing favourable attitudes
- Precision farming changing the socio-economic status of farmers

Key components of precision farming include:

1. **Data Management and Analytics:** At the core of precision farming is a data-driven approach. It involves gathering data from diverse sources like soil sensors, weather stations, and satellite imagery. These insights guide decisions on planting, irrigation, fertilization, and pest control, optimizing resource usage and crop health.

2. **Global Positioning System (GPS):** GPS technology revolutionizes farming by allowing precise tracking and mapping of equipment in the field. This level of accuracy minimizes overlaps in farming activities, streamlines operations, and ensures efficient resource utilization, ultimately boosting productivity.

3. **Remote Sensing:** The deployment of remote sensing tools, such as drones and satellites, empowers farmers with real-time information about crop health, soil conditions, and

potential pest infestations. These technologies enable early issue detection, targeted interventions, and improved crop yields, all while managing resources more effectively.

4. **Variable Rate Technology (VRT):** VRT is a game-changer, permitting the precise application of inputs like fertilizers, pesticides, and irrigation. These applications are tailored to the specific requirements of different areas within a field, preventing resource overuse and reducing the environmental footprint of farming.

5. **Automated Machinery:** Precision farming often embraces autonomous or semi-autonomous machinery. These high-tech marvels excel at tasks like planting, harvesting, and weeding with pinpoint accuracy.

The policy approach to promote precision farming at farm level

➢ Identify the niche areas for the promotion of crop specific precision farming

➢ Creation of multidisciplinary teams involving agricultural scientists in various fields,

➢ engineers, manufacturers and economists to study the overall scope of precision

➢ agriculture

➢ Provide complete technical backup support to the farmers to develop pilots or models, which can be replicated on a large scale

➢ Pilot study should be conducted on farmers' fields to show the results of precision agriculture implementation

➢ Creating awareness among farmers about consequences of applying imbalanced doses of farm inputs like irrigation, fertilisers, insecticides and pesticides.

Drawbacks of precision farming

➢ High cost

➢ Lack of technical expertise knowledge and technology

➢ Not applicable or difficult/costly for small land holdings

➢ Heterogeneity of cropping systems and market imperfections

FUTURE PROSPECTS

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 equipments, etc. However, the most promising prospect in the future of PA is the application of drones towards the implementation of PA. Drones eliminate the need for GPS and strong internet connectivity it requires. With the drone technology we can speedup crop scouting, identifying pest or nutrient issues in crops and addressing them right away, checking for weather damage, finding pivot breakdowns on irrigation systems, checking drainage system performance, the list goes on.

CONCLUSION

In conclusion, precision farming stands as a beacon of hope for sustainable agriculture. The real potential of precision agriculture mainly depends on the gap between the technological capabilities and scientific understanding between information technology and human reasoning. Moreover, site specific farming is paving way to the further scope of adopting modern methods of farming leaving the conventional one using right resources at the right time with proper management, eventually resulting in a sustainable method of farming along with environmental protection. 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. It aims at increased economic returns, as well as at reducing the energy input and the environmental impact of agriculture.

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