



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

A study of “Smart Farming Agro-techniques” and their applications in Organic Agriculture

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Abstract:

Agriculture is the world's largest industry. Conventional agriculture and modern agriculture are two aspects of agriculture. Conventional practices of farming is intensive agriculture method which has been practiced since 1960 and have higher yield but it depletes the soil, pollutes the environment, green houses gas emission, loss of bio-diversity. After decades the sustainable agriculture introduced to control these problems. One of most important application of sustainable agriculture is Green agriculture. It ensures the Minimization of pesticides and protects the soil, Health of farmers and consumers. There are many ways to refer modern agriculture for example Agro-technology to general application in organic agriculture.

The Modern practice of advance technology and equipping the farm is conclusively termed as Smart Farming or Smart Agriculture. **Smart Farming** is a concept of modern Information and Communication Technology to increase the quantity and quality of organic products to control the farm management. the adoption of smart farming techniques is constantly growing and market is still dynamic for these connected devices. By using various smart agriculture gadgets, farmers have gained better control over the process of raising livestock and growing crops, making it more predictable and efficient. The global smart agriculture market size is expected to reach US\$ 15.3 Billion from US\$ 5 billion in 2016

The application of Agro-Technology has tremendous benefits in saving resources, reducing time, money and labour and delivering higher-quality food in greater amounts. These technologies can help country directly or indirectly to meet with future organic food demand positively. The areas of application of smart farming techniques includes Precision farming, Precision Livestock Farming, Automation in smart green houses, Agriculture drones, Crop Management, Cattle Monitoring & Management, End-to-End Farm Management system.

The aim of this paper is to obtain a deeper understanding of the early adoption of smart farming techniques and consumer purchase motives regarding an environmental friendly and green type of consumer products focusing on organic food. The main objective of this paper is to understand the effect & applications of smart farming techniques and adoption of these techniques in modern organic agriculture practices. The following subjects are evaluated for methodology purpose – smart farming techniques, agro technology, sustainable agriculture practices, organic farming mechanization and application of smart agricultural practices. Research design has been taken descriptive and analytical to describe the inclination of farmers towards the smart farming techniques and applicability in present scenario.

Keywords:

Smart farming, Agriculture technology, Organic Farming, Drones, Precision farming, Green houses.

Introduction:

Smart farming and precision agriculture play a crucial role in sustainable agriculture. Production goes much better while using the advance technology like robots, drones, smartphone applications for harvesting, spraying, weeding control and maintenance purpose. These smart technologies consume less input like fertilizers, water as well as less consumption of energy. This intensive form of agriculture controls the water pollution, soil depletion, gas emission, losses of biodiversity and ocean acid.

Green agriculture is the application of the sustainable development principles to agriculture. It ensures the ecological, economic and social limits that ensure the durability of production and it also minimizes the use of pesticides and harmful chemicals which are not good for the health of consumers. Some of the principles are linked with this modern agriculture are firstly, well defined, efficient & self-sufficient production system which is the basic source of income, secondly, protection of bio-diversity & natural resources, thirdly water and soil management, fourthly energy saving and efficiency.

Organic products are generally known as green products with are grown without any harmful pesticides and synthesizers. They are grown natural aspects of harvesting like without pesticides and using of cow dungs & healthy soil. Organic food products do not have any type of harmful growth hormone and any chemical or antibiotics. The main reason of inclination of consumers for organic produce includes greater awareness of products. It reduces the adverse effect of unsafe chemicals and it makes the human health good. Organic agriculture has given prospects to smart agriculture practices in India. Farmers are getting more opportunities in export markets for their organic produces. What we can say “We are what we consume”

Smart Farming is a concept of farming management using modern Information and Communication Technologies to increase the quantity and quality of products. There are many ways to refer smart or modern farming like the advanced

agriculture technology to general application of technology. Smart farming is mostly used to denote the application of advanced technology in farming. Smart agriculture industry is growing very fastly and constantly. By using the advanced technology they are gaining better control over the complete production efficiently.

It is predicted that agriculture technological device installation will hit 75 million by 2020 and it is growing at the rate of 20% annually (Business intelligence bureau 2019). The global smart agriculture market size is expected to reach US\$ 15.3 Billion from US\$ 5 billion in 2016. Smart farming device installation market has been reached at US\$ 75 million by 2020.

Among the advanced smart farming technologies some available technologies in present scenario are:

- Sensor based technology: soil scanner, water & light management, temperature control etc.
- Software based technology: specialized software solution system
- Communication based technology- cellular communication
- Positioning related technology: including Global Positioning System
- Hardware and software related systems: it is related to robotics and automation
- Data analysis related technology: decision making and prediction processes.

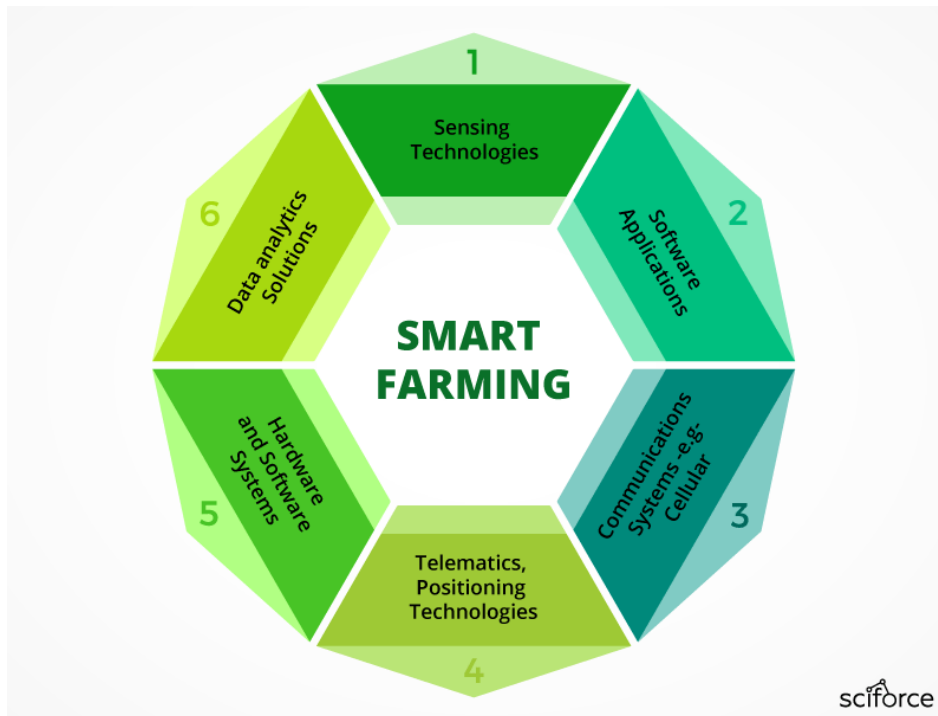


Figure:1

THE BENEFITS OF SMART FARMING: HOW IT IS SHAPING AGRICULTURE

Smart technology has the positive potential to setup the strong transformation in agriculture in every aspect. Some of the aspects are as follows:

1. **Smart agriculture sensors:** These sensors are useful in collection of data, database of data accounts and super sensing indication data like the data of weather conditions, soil health and soil quality & growth indication. these sensors are useful in efficiency.
2. **Better internal control:** In this system we would be able to know how much crops are going to harvest and how better production can be done through smart farming.



3. **Cost management and waste reduction:** smart farming is the best suitable way to control the cost as well as waste management. We will be able to mitigate the loss of lower yields.
4. **Process automation:** Smart devices generally improve the business efficiency by using proper production cycle. We can control the production process to enhance the volume of products and product quality.

REVIEW OF LITERATURE:

ARTICLE NAME	JOURNAL NAME	VOL, ISSUE YEAR,	AUTHOR NAME	CONCLUSION
Artificial Intelligence in Agriculture: A Literature Survey	International Journal of Scientific Research in Computer Science Applications and Management Studies (Scopus indexed and Google scholar)	7 (3) (2018), pp. 1-6	G. Bannerjee, U. Sarkar, S. Das, I. Ghosh	Artificial Intelligence
Smart irrigation system using IOT and raspberry	International Research Journal of Engineering and Technology. (Google scholar)	5 (8) (2018), pp. 1163-1166	S.B. Pawar, P. Rajput, A. Shaikh	Smart agriculture and irrigation system.
Smart crop field irrigation in IOT architecture using sensors	International Journal of Advance Research in Computer Science (Google scholar)	9 (1) (2018), pp. 302-306	M. Savitha, O.P. UmaMaheshwari	Architecture study to help the smart crop harvesting and irrigation
Smart sensors from ground to cloud and web intelligence	IFAC-Papers OnLine (Scopus indexed and Google scholar)	51 (17) (2018), pp. 31-38	W. Yong, L. Shuaishuai, L. Li, L. Minzan, K.G. Arvanitis, C. Georgieva, N. Sigrimis	Smart sensors and web intelligence
Deep learning models for plant disease detection and diagnosis	Computer. Electronic Agriculture (Scopus indexed and Google scholar)	145 (2018), pp. 311-318	K.P. Ferentinos	Information and data received from software's and senores to control the diseases Using sensors
Deep learning in agriculture: a survey	Computer Electronic Agriculture (Scopus indexed and Google scholar)	147 (2018), pp. 70-90	A. Kamilaris, F.X. Prenafeta-Boldú	Survey related to agriculture in which the questions are raised for deep learning of agriculture.
Machine Learning in Agriculture: A Review	Agriculture sensors (Scopus indexed and Google scholar)	18 (2674) (2018), pp. 1-29	K.G. Liakos, P. Busato, D. Moshou, S. Pearson, D. Bochtis	Machine learning to understand the relation of agriculture and smart software's
Artificial Intelligence (AI) in Agriculture	International Journal of Current Microbiology and Applied Sciences (https://doi.org/10.20546/ijcmas.2018.712.241)	ISSN: 2319-7706 Volume 7 Number 12 (2018)	V. Dharmaraj* and C. Vijayanand Department of Agriculture Engineering, Sethu Institute	A direct application of AI (Artificial Intelligence) or machine intelligence across the farming sector. The current paper throws a

	(Scopus indexed and Google scholar)		of Technology, Viruthunagar 626115, Tamil Nadu, India	vision of how the diverse sectors of agriculture can be fuelled using AI
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Artificial Intelligence (AI) in Agriculture	International Journal of Current Microbiology and Applied Science (2018) Journal homepage: http://www.ijcmas.com (Scopus indexed and Google scholar)	7(12): 2122-2128 2122 ISSN: 2319-7706 Volume 7 Number 12 (2018)	V. Dharmaraj and C. Vijayanand Department of Agriculture Engineering, Sethu Institute of Technology, Viruthunagar 626115, Tamil Nadu, India	Artificial Intelligence (AI) and smart machineries in farming.

- ❖ MINISTRY OF HEALTH AND FAMILY WELFARE (Food Safety and Standards Authority of India) Notification New Delhi, 2018.

RESEARCH METHODOLOGY:

- **DATA COLLECTION METHODS**

The data collection technique will be quantitative & qualitative data or mixed methods data. Determining what type of data will need to answer questions is an important step in figuring out the technique which will use. The study is mainly based on the information and data obtained from the secondary sources. Secondary sources included published materials, Thoughts of internet, advanced technology sites, data clouding system, Government documents, reports & discussion with the various senior officials and experts in the field.

- **RESEARCH METHODS:** Research design has been taken descriptive and analytical for describing the use of advanced technology in agriculture and organic farming to increase the organic produce. It concerned with specific technological advancement for the growth of agriculture industry with the help of technological initiatives in smart farming.

SMART FARMING APPLICATIONS

APPLICATIONS OF SMART FARMING IN ORGANIC AGRICULTURE

APPLICATIONS OF INFORMATION TECHNOLOGY IN SMART AGRICULTURE

A. APPLICATIONS OF SMART FARMING IN ORGANIC AGRICULTURE:

Smart farming techniques are improving quality perceptions of farmer for better productivity and these thoughts creating the direct relationship between farmers and farming techniques by using sensors in practice. These sensors are used in farming to collect various data related to weather condition and crop maintenance. a group of smart sensors located at different locations gives the connected weather conditions and sent these informative data to cloud. These applications are as follows:

1. Monitoring weather conditions: it includes following

- mapping the climatic condition
- rainfall events
- wind speed & direction, air pressure & humidity
- monitoring crop growth
- disease prevention
- reduction in time , labour & money

2. Autonomous Irrigation: it includes following

- Surface drip irrigation
- Water optimistic system
- Moisture level and plant health management

3. Monitoring and managing cattle: it includes

- Crop and weather conditions
- Temperature & nutrition level
- Health management

4. Autonomous Agricultural Robots: (Agro-bots)

Agriculture Robots are the major player in smart farming system to deploy to eliminate the errors due to human beings and to reduce the labour at workplace. As we all know agriculture is labor intensive industry where work is generally compromised with repetitive and standardized task so I think agriculture is an ideal area for automation and robotics. These agriculture robots are preliminary used in farming to perform task like planting, weeding, watering, sorting,

harvesting. These robots are necessary to produce higher quality food with fewer efforts. **Some Agriculture Robots performances can be seen as follows:**

1. Crop Maintenance:

The most important things in crop maintenance are weeding and pest control. these robots can navigate field through video, satellite and GPS. For example: Bonirob and Deep-field robots. These robots identify pests & weeds and pull them to destroy. These robots are equipped with sensors, cameras and sprayers. They are connected automatically like driverless tractors and whole system is operated independently.

2. Harvesting

Harvesting is important aspect when we are thinking about the planned crops at specific times so we need to know weather conditions, when and how we shall harvest to complete the harvesting operations. Now a days wide range of machineries are used to harvest the crop which can be seen productive. for example Pansonic tomato picking robot first identify the color, shape and location & Ripeness. These robots avoid the bruising of tomato.

The most important application of drones can be seen in real time monitoring and field analysis as well as in crop maintenance. It is much better than spending lot of time in field or at farm to keep tracking on feet. Now a days helicopter and small sized drones are used to take aerial images and record the farm at minimum costing which can help farmers to collect accurate data of the field. Data are generally related to crop & soil health, plant seeding and harvesting locations. This smart technology is the good example of overall optimization of available resources and use of allocated land.

1. Driverless Tractors:

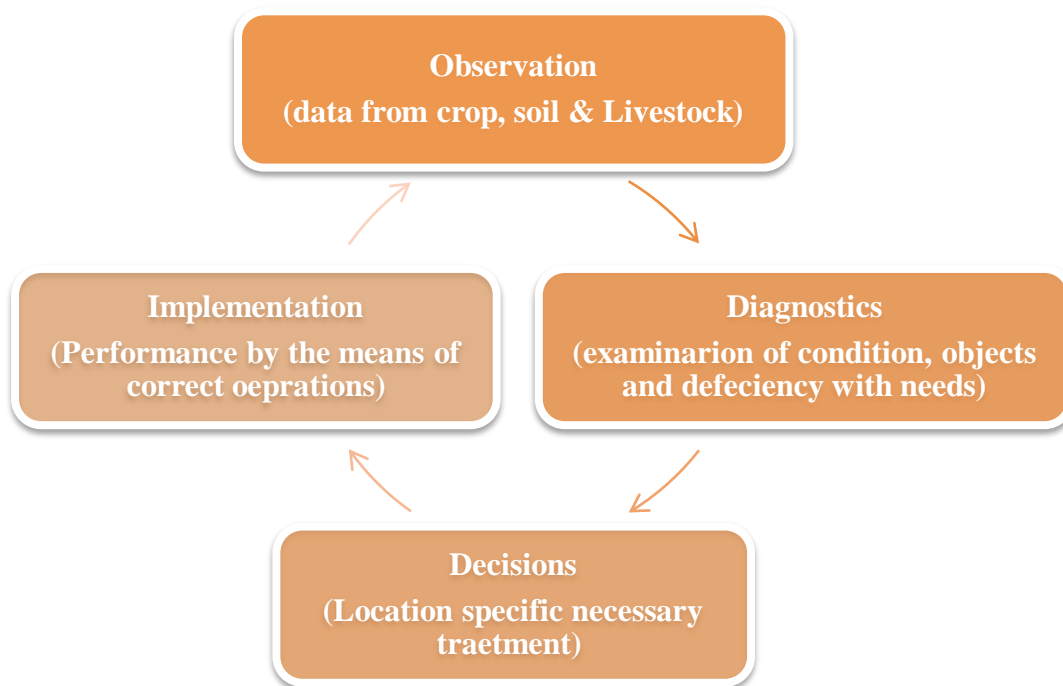
Agriculture is curiously needs a automation system which can convert the labour into smart work so the tractors now became driverless tractors as a result of agricultural advanced mechanization or smart technology. Now farmers will not be having the responsibility for regular maintenance and repair. these tractors can use the big data like weather satellite information for the best use of ideal condition without any human help. This technology supports intangibly like reducing time, money & labour and also transferring good quality of food to the consumer at large scale. Technological advancement now can play crucial role in fulfillment of demand in near future .



*Images for point 1&2

SMART FARMING CYCLE:

Smart technology has been adopted by farmers now days. It results maximum utilization of optimum resources for the farming process. These technologies give valuable and quick data, what we need actually. The devices installed on farming system collect data and process data in repeated cycle that enable farmers to react on emergency issues and change needed in ambient conditions.



B. Applications of Information Technology in smart agriculture

It is believed that the information technology adds values to the agriculture for proper products in crop management system. the smart agriculture has two important basis which are adding revolution in agriculture. These are precision farming and farming automation/robotization.

1. Precision Farming

Precision farming or precision agriculture is the approach which is unique and differentiated. This farming system is like security umbrella on conventional system. It allows decision to be made per square meter or even per plant rather than a field completely. In simple words, plants get unique & precious treatment as they need. With the help of this accuracy within field, farmers can boost the efficiency and effectiveness of pesticides & fertilizers. Precision farming is used to improve economic volatility and environmental conditions according to monitoring system. It includes the decision support system for farm management so that the goal of maximum return can be achieved with optimum utilization of resources. The widespread use of drones or GPS, Ariel images provided by satellite, Map creation etc. provide sufficient and reliable data for crop yield, moisture level, nitrogen level etc.

2. Automation in Smart Greenhouses

Modern concept of greenhouses has replaced the traditional system in which manual intervention was main factor causing production loss, energy loss and increased labour cost. Smart greenhouses are intelligent monitors who control the adverse climatic conditions. Different sensors measure the various parameters for plant harvesting and growth. Smart greenhouses also having latest technology in farming system at small area or at covered field.

➤ PRACTICABILITY OF SMART AGRICULTURE

There are various types of technological sensors and applications that can be used in agriculture:

- **Monitoring of Climate Conditions:**

It includes the managing of climatic conditions, selection of proper crop and finds the required measures to correct for capacity enhancement. Various gadgets are available for climate monitoring with very combinations of strong sensors. Like allmeteo, Pycno etc.



- **Greenhouse Automation**

Green house automation system for smart sensing allows managing the irrigation and lighting system remotely. It is based on parameter for sourcing data from various Weather Stations. GreenIQ is an example of intelligent greenhouse sensor.



- **Crop Management device**

Crop management device should be placed in farm to collect data from crop temperature, crop precipitation, crop moisture, water potential, crop health for the improvement of farming practices. This crop management device is very important in precision farming. Example Arable & Semios.



CONCLUSION:

Smart farming is the future of Agricultural advancement of technology. It bridges the gap between the small & large scale business. This trend of smart technique is expanding the trend of smart agriculture in developing countries. The rapid adoption of precision farming is enhancing the use of advanced sensors and monitoring device. This advanced

technology promotes the growth drivers to fulfill the future demand of organic products. Such revolutionary changes in farming practices not only reflect the opportunities to farmers but also challenge the needed resources.

REFERENCES:

- Bergerman M, Billingsley J, Reid J, van Henten E. Robotics in agriculture and forestry. in Springer Handbook of Robotics, Springer, **2016**; pp.1463–1492.
- Chlingaryan A, Sukkariah S, Whelan B. Machine learning approaches for crop yield prediction and nitrogen status estimation in precision agriculture: A review. *Comput. Electron. Agric*, **2018**; 151: 61–69.
- Feng Q C, Zou W, Fan P F, Zhang C F, Wang X. Design and test of robotic harvesting system for cherry tomato. *Int J Agric & Biol Eng*, **2018**; 11(1): 96–100.
- Mohit kumar Navinay, C.E.C Bilaspur, Rahul Gedam et al. “A Review Paper on Internet of things based Application Smart Agricultural System”. *International Journal of Latest Engineering and Management Research (IJLEMR)* ISSN: 2455-4847, Volume 02 - Issue 04, April **2017**, PP. 69-71.
- MeenaKumari G, Dr. V .Vidya Devi, “Real- Time Automation and Monitoring System for Modernized Agriculture”, *International Journal of Review and Research in Applied Sciences and Engineering (IJRRASE)* Vol3 No.1. PP 7-12 March **2013**.
- MacKean R, Jones J L, Francis Jr J T. Weeding robot and method. Google Patents, 24-Aug-**2017**.
- Nam W H, Kim T, Hong E M, Choi J Y, Kim J T. A Wireless Sensor Network (WSN) application for irrigation facilities management based on Information and Communication Technologies (ICTs). *Comput. Electron. Agric.*, **2017**; 143: 185–192.
- Nikesh Gondchawar, Prof. Dr. R. S. Kawitkar. (2016)*International Journal of Advanced Research in Computer and Communication Engineering*, **2016**.)“IOT Based Smart Agriculture”.
- Nikesh Gondchawar¹, Prof. Dr. R. S. Kawitkar² (june **2016**) “IOT Based Smart Agriculture” (*IJARCCCE*)
- Patil K. A, N. R. Kale, “ A Model for Smart Agriculture Using IoT”, *International Conference on Global Trends in Signal Processing, Information Computing and Communication,IEEE* **2016**.
- Prashant G. Salunkhe, Sahil Y. Shaikh, Mayur S. Dhable, Danis I. Sayyad. (*IJESC*), **2016** “Automatic Seed Plantation Robot”.
- Putjaika, Narayut, et al. "A control system in an intelligent farming by using arduino technology." *Student Project Conference (ICT-ISPC), 2016 Fifth ICT International. IEEE*, **2016**.
- Rajalakshmi, P., and S. Devi Mahalakshmi. "IOT based crop-field monitoring and irrigation automation." *Intelligent Systems and Control (ISCO), 2016 10th International Conference on. IEEE*, **2016**.
- Shamshiri R R, Kalantari F, Ting K C, Thorp K R, Hameed I A, Weltzien C, et al. Advances in greenhouse automation and controlled environment agriculture: A transition to plant factories and urban agriculture. *Int J Agric & Biol Eng*, **2018**; 11(1): 1–22.
- Sales, Nelson, Orlando Remédios, and Artur Arsenio. "Wireless sensor and actuator system for smart irrigation

on the cloud." Internet of Things (WF-IoT), 2015 IEEE 2nd World Forum on. IEEE, **2015**.

- Wolfert S, Ge L, Verdouw C, Bogaardt M J. Big data in smart farming – A review. Agric. Syst., **2017**; 153: 69–80.
- Yue Q, Xu X, Hillier J, et al. Mitigating greenhouse gas emissions in agriculture: from farm production to food consumption. J Clean Prod. **2017**;149:1011–1019.[Crossref], [Web of Science ®], , [Google Scholar]

