# **DAYANANDA SAGAR UNIVERSITY**

Devarakaggalahalli, Harohalli, Kanakapura Road, Ramanagara Dt., Bengaluru – 562 112

**Bachelor of Technology in**

**COMPUTER SCIENCE AND ENGINEERING**

**(Artificial Intelligence & Machine Learning)**

**AI Mini Project-1**

**(22AM2305)**

**Precision farming with the help of Artificial intelligence**

By

**Mohammmedyaseen Sutar ENG22AM0182**

**P Kushal Suhruth ENG22AM0185**

**Monish V M ENG22AM0035**

**Under the supervision of**

|  |  |  |
| --- | --- | --- |
| Prof. Pradeep Kumar K  Assistant Professor  Dept. of CS&E (AI&ML),  School of Engineering  Dayananda Sagar | Prof. Mary Jasmine  Assistant Professor  Dept. of CS&E (AI&ML),  School of Engineering  Dayananda Sagar | Prof. Mitha Guru  Assistant Professor  Dept. of CS&E (AI&ML),  School of Engineering  Dayananda Sagar |

**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (AI&ML),**

#### SCHOOL OF ENGINEERING

#### DAYANANDA SAGAR UNIVERSITY, BANGALORE

**(2023-2024)**



**Day****ananda Sagar University**

**School of Engineering**

**Department of Computer Science & Engineering**

**(Artificial Intelligence & Machine Learning)**

Devarakaggalahalli, Harohalli, Kanakapura Road, Ramanagara Dt., Bengaluru – 562 112

# 

# CERTIFICATE

This is to certify that the AI Mini Project – I (22AM2305) work titled **“Precision farming with the help of Artificial intelligence”** is carried out by **Mohammmedyaseen Sutar, P Kushal Suhruth and Monish V M** bearing **USN :ENG22AM0182, ENG22AM0185, ENG22AM0035** respectivelyBonafede student of Bachelor of Technology in Computer Science and Engineering (AI&ML) at the School of Engineering, Dayananda Sagar University, Bangalore , during the year **2023-2024**.

|  |  |  |  |
| --- | --- | --- | --- |
| Prof. Pradeep Kumar K  Assistant Professor  Dept. of CS&E (AI&ML),  School of Engineering  Dayananda Sagar | Dr. Jayavrinda Vrindavanam V Chairman CSE (AI&ML)  School of Engineering  Dayananda Sagar University | Prof. Mary Jasmine  Assistant Professor  Dept. of CS&E (AI&ML),  School of Engineering  Dayananda Sagar | Prof. Mitha Guru  Assistant Professor  Dept. of CS&E (AI&ML),  School of Engineering  Dayananda Sagar |

##### 

##### 

# TABLE OF CONTENTS

Page

Contents

[DAYANANDA SAGAR UNIVERSITY 1](#_Toc154919464)

[CERTIFICATE 2](#_Toc154919465)

[TABLE OF CONTENTS 4](#_Toc154919467)

[ABSTRACT 8](#_Toc154919468)

[Precision Farming with AI: Cultivating a Smarter Future 8](#_Toc154919469)

[CHAPTER 1 9](#_Toc154919470)

[INTRODUCTION 9](#_Toc154919471)

[1.1 The Need of Precision Farming 9](#_Toc154919472)

[1.2 Concept of Precision Farming 10](#_Toc154919473)

[1.3 Objectives of Precision Farming 10](#_Toc154919474)

[CHAPTER 2 TOOLS AND EQUIPMENT 11](#_Toc154919475)

[2.1 Geographical information system (GIS) 11](#_Toc154919476)

[2.2 Geographical positioning system (GPS) 11](#_Toc154919477)

[2.3 Remote sensing (RS) 12](#_Toc154919479)

[2.4 Variable Rate Technology (VRT) 12](#_Toc154919483)

[2.5 Nutrient expert system 13](#_Toc154919492)

[2.6 Site-specific nutrient management (SSNM) 14](#_Toc154919494)

[2.8 Real-time nitrogen management 14](#_Toc154919498)

[2.9 DRIS approach 15](#_Toc154919500)

[2.10 Bio-intensive farming 15](#_Toc154919502)

[CHAPTER 3 PROBLEM DEFINITION 16](#_Toc154919504)

[CHAPTER 4 METHODOLOGY 18](#_Toc154919506)

[4.1 Assessing the variability 18](#_Toc154919508)

[4.2 Managing the variability 19](#_Toc154919510)

[4.3 Evaluating the variability 19](#_Toc154919512)

[CHAPTER 5 RESULT ANALYSIS 20](#_Toc154919517)

[Advantages of Precision Farming with AI: 20](#_Toc154919518)

[Disadvantages of Precision Farming with AI: 20](#_Toc154919519)

[CHAPTER 6 REFERENCES 21](#_Toc154919520)

# ABSTRACT

## Precision Farming with AI: Cultivating a Smarter Future

Traditional agriculture faces a multitude of challenges, from inefficient resource management to unpredictable yields and environmental concerns. Enter precision farming, a revolutionary approach that leverages artificial intelligence (AI) to transform the way we cultivate the land.

**Data-Driven Decisions:** Imagine fields adorned with sensors, collecting real-time information on soil moisture, nutrient levels, and crop health. AI algorithms analyze this data, painting a detailed picture of the field's needs. Farmers can then make precise decisions about irrigation, fertilization, and pest control, optimizing resource utilization and maximizing yields.

**Targeted Interventions:** Drones equipped with AI-powered cameras soar overhead, identifying weeds, diseases, and insect infestations with pinpoint accuracy. This allows for targeted interventions, minimizing pesticide use and protecting beneficial insects.

**Predictive Power:** AI doesn't just react to problems; it predicts them. By analyzing historical data, weather patterns, and market trends, AI models can forecast crop yields, optimize harvest times, and predict potential outbreaks of pests and diseases, enabling proactive prevention strategies.

**Sustainable Stewardship:** Precision farming fosters a symbiotic relationship between farmers and the environment. By minimizing resource waste and chemical use, it promotes soil health, conserves water, and reduces pollution. This data-driven approach paves the way for a future of sustainable agriculture, ensuring food security for generations to come.

The potential of precision farming is vast, and its impact is already being felt around the globe. As AI technology evolves and becomes more accessible, we can expect to see even greater strides towards a smarter, more sustainable, and more profitable agricultural future.

# CHAPTER 1 :INTRODUCTION :

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 (International Society of Precision Agriculture).

Precision farming or precision agriculture is a modern management strategy that employs the details of site-specific nutrient management, remote sensing, global information system, global positioning system, variable rate application to precise manage the production input. Precision farming or precision agriculture is about doing the right thing, in the right place, in the right way, at the right time through the right procedures. Managing crop production inputs such as water, seed, fertilizer etc to increase yield, quality, profit, reduce waste and becomes eco-friendly. Precision farming intends to match agricultural inputs and practices as per crop and agro-climatic conditions to improve the accuracy of their applications.

## The Need of Precision Farming :

The conventional farming systems has led to extensive usage of agricultural inputs like machinery, pesticides, water, and other inputs resulting in negative environmental impacts such as pollution of the environment by emission of greenhouse gases. Research suggests 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 on the economic challenges compared to the other issues. Rather than this PF increase agriculture productivity with prevents soil degradation. PF reduce the use of the chemical application in crop production and efficient use of water resources. It is also helpful in the dissemination of modern farm practices to improve quality, quantity and reduced cost of production, developing favourable attitudes and changing the socio-economic status of farmers more cost-efficient farming A farmer’s expense sheet is often the thing of doom and dread. Precision farming aims to reduce a farmer’s expenditure by minimising the need for things like fertiliser, pesticide and herbicide. Over a growing season, growers are seeing significant reductions in the amount of money they are spending on all of the above where technology is using the components sparingly and only where needed. As an alternative to blanket spraying, this has seen massive savings and allows farmers to better budget and keeps costs to a minimum.

## Concept of Precision Farming :

The main concept of precision farming is that reducing health hazards and safety for soil, environment and human health by implication of several technologies and machinery. Precision farming depends on the identification, evaluation and management of variability.

In the past, it was difficult for researchers to correlate production techniques and crop yields with resources variability. Precision farming in the form of farming location-specific practices is adopted playing due to consideration of spatial variability of land to maximize crop production and minimize the cost of inputs with the least damage to the environment, soil, water and human health.

## Objectives of Precision Farming :

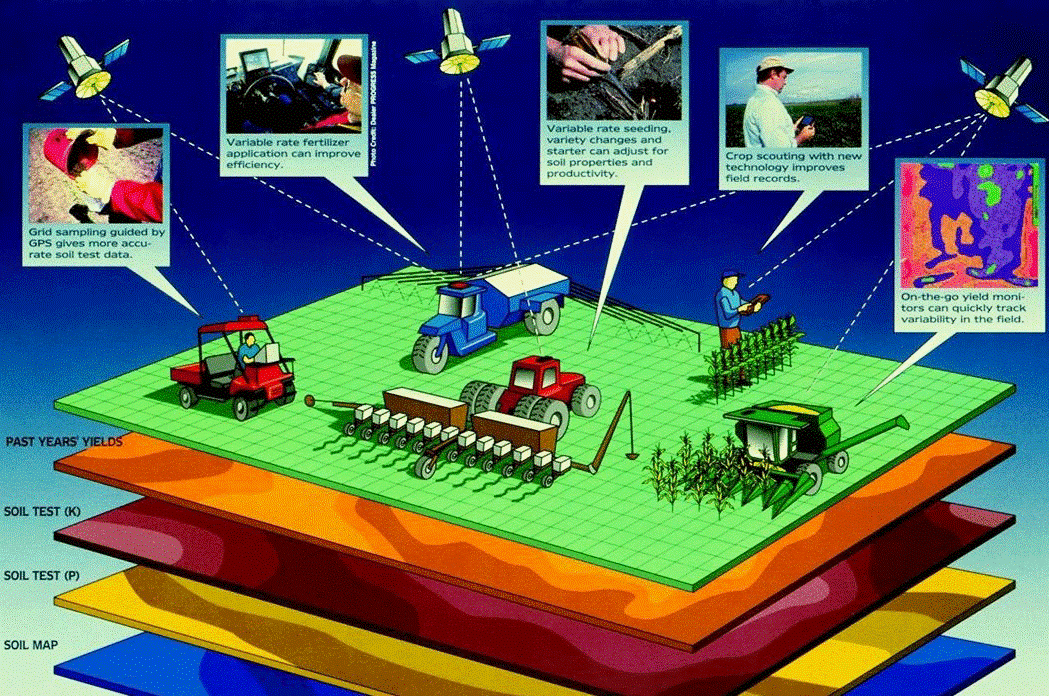
* Increase agriculture productivity
* Prevents soil degradation
* Reduction of chemical application in crop production
* Efficient use of water resources
* Dissemination of modern farm practices to improve quality, quantity and reduced cost of production
* Developing favourable attitudes
* Precision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

# CHAPTER 2: TOOLS AND EQUIPMENT :

# 

# 2.1 Geographical information system (GIS) :

GIS is a computerized mapping system to acquire, store, analyze and display information that is specially referenced to the earth. It is software that imports, exports and processes spatially and temporally geographically distributed data. GIS system provides a way to overlay different layers of data, these data used for land use, irrigation management, the study of the crop, soil and environment etc. this system comprises hardware, software and procedures designed to support the compilation, storage, retrieval and analysis of feature attributes and location data to produce the map.



**Map layers such as soil chemistry, soil type and topography (and derived maps such as soil drainage), previous yields, etc can provide important information for field management**

# 2.2 Geographical positioning system (GPS) :

# The Global Positioning System (GPS) is a navigation system it utilizes a network of 24 satellites in outer space that helps to user to record positional information’s (latitude, longitude and altitude) by using satellites. GPS It has a 95% probability that the given position on the earth will be within 10-15 meters of the actual position. GPS allows precise mapping of the farms and together with appropriate software informs the farmer about the status of his crop and which part of the farm requires what input such as water or fertilizer and/or pesticides etc.

# 2.3 Remote sensing (RS) :

# Remote sensing is the science of obtaining information about objects or areas from a distance, typically from aircraft or satellites. In another word, RS means to collect the information of an object without its physical contact. A remote sensor is used to collect the information. Remote Sensors are general categories of aerial or satellite sensors. They can indicate variations in the colours of the field that corresponds to changes in soil type, crop development, field boundaries, roads, water, etc. Arial and satellite imagery can be processed to provide vegetative indices, which reflect the health of the plant.

# 

# With remote sensing, farmers have access to complete information about ideal environmental and weather conditions well into the future, helping them to plan their cultivation cycle better.

# 2.4 Variable Rate Technology (VRT) :

# Variable-rate technology (VRT) allows fertilizer, chemicals, lime, gypsum, irrigation water and other farm inputs to be applied at different rates across a field. Variable-rate application (VRA) can range from the simple control of flow rate to the more comple x management of rate, chemical mix and application pattern. VRA can match changes in crop yield potential with specific input rates resulting in a more efficient system and minimizing potential environmental impacts. VRT can be used to deal with spatial variability between management zones. There are two types of VRT:

# 1. Map-based control: a map of application rates is produced for the field before the operation.

# 2. Real-time control: decisions about what rates to apply in different locations are made using information gathered during the operation.

# 

# 

# Most of the VRT equipment can be transferred between different applicators. For example, a global positioning system used during a pesticide application may also be used during the fertilizer application.

# 

# VRT applications are controlled by hydraulic motors on this spinner spreader which vary the rate based on the field location. Traditionally the rate would have been controlled by the flow gate and a ground-drive to the conveyor chain.

# 

# 2.5 Nutrient expert system :

# It is computer-based decision tool provide balance nutrition recommendation for rice, wheat and maize for an individual farmer in presence and absence of soil testing data. This tool also estimates attainable yield for farmers based on growing conditions. This tool was developed by ‘International Plant Nutrition Institute’. It is used for all macronutrients. It helps in reducing the wastage of nutrients. It also generates location-specific nutrient management.

# 2.6 Site-specific nutrient management (SSNM) :

# SSNM approach is based on feeding crops with nutrients when needed. SSNM replies on 5R’s i.e. Right dose, time, place, method and source. The processes of SSNM are; Establishment of an attainable yield target. Effective utilization of indigenous nutrient resources Apply fertilizer to fill the deficit between crop need and indigenous supply.

# 

# Site-specific herbicide applicators often carry only water in their bulk tank, such as the 1000 gallon tank on this sprayer. The concentrated herbicide is then pumped into a mixing manifold where it is diluted with the water to achieve the proper rate before entering the spray boom.

# 2.8 Real-time nitrogen management :

# It means synchronization between crop N2 demand and supply for improving nitrogen use efficiency and crop yield. Techniques (Instrumentation) used for real-time N2 management; 1. Chlorophyll (SPAD) meter, 2 Leaf colour chart (For rice crop), 3Through green seeker (It is given NDVI value).

# 2.9 DRIS approach :

# This technique is useful for nutrient analysis in the plant. The full form of DRIS is Diagnosis and recommendation integrated system. It was given by Beaufils, 1973. This technique considered nutrient concentration ratio in the plant rather than individual element concentration.

# 2.10 Bio-intensive farming :

# It is an organic agricultural system. It focused on maximum yield from a minimum area of land while simultaneously maintaining and improving the fertility of the soil. It aims is producing maximum biomass per unit area. The concept and practices of bio-intensive farming introduce by Alan Chadwick in the USA. Components of bio-intensive farming are: Raised bed, BBF, FIRB, intensive planting, intercropping, companion planting and whole system energy.

# CHAPTER 3 PROBLEM DEFINITION :

## The Traditional Struggle: Problems Faced by Farmers Without Precision Farming

Traditional farming, while time-tested, faces a multitude of challenges in the modern age. Without the aid of precision agriculture, farmers grapple with issues that not only impact their yields and profits but also the environment and sustainability of their practices. Let's delve into some of the key problems faced by those who haven't embraced the technological advancements of precision farming:

**1. Inefficient Resource Management:**

* **Blind application of inputs:** Traditional methods often rely on blanket application of fertilizers, pesticides, and water, failing to account for variations within the field. This leads to overuse in some areas and underuse in others, wasting resources and potentially harming the environment.
* **Water mismanagement:** Irrigation without real-time data on soil moisture and crop needs can lead to overwatering, causing waterlogging, soil erosion, and salinization. Underwatering, on the other hand, stresses crops and reduces yields.

**2. Lower Yields and Quality:**

* **Pest and disease outbreaks:** Without targeted pest and disease control, farmers risk widespread crop losses. Traditional methods often involve reactive, rather than proactive, measures, leading to missed windows for prevention.
* **Uneven crop growth:** Variations in soil fertility, drainage, and sunlight exposure can lead to uneven crop growth and quality. Traditional methods struggle to address these micro-variations within a field.

**3. Environmental Impact:**

* **Soil degradation:** Overuse of fertilizers and pesticides can harm soil health, reducing fertility and biodiversity. Inefficient water management can also lead to soil erosion and contamination.
* **Pollution:** Runoff from excess fertilizers and pesticides can pollute water bodies and harm aquatic ecosystems.

**4. Economic Vulnerability:**

* **Market fluctuations:** Without data-driven insights into market demands and crop prices, farmers are more susceptible to price volatility and struggle to optimize their production for profitability.
* **Dependence on middlemen:** Traditional farmers often rely on middlemen for inputs and distribution, reducing their profit margins and control over their operations.

**5. Increased Labor Costs and Risks:**

* **Manual labor dependence:** Traditional farming relies heavily on manual labor, leading to higher costs and exposing workers to safety hazards.
* **Long working hours:** Unpredictable weather and pest outbreaks can demand long hours and physically demanding work from farmers.

While these challenges paint a grim picture, it's important to remember that precision agriculture offers a beacon of hope. By embracing technology and data-driven insights, farmers can overcome these obstacles and build a more sustainable and profitable future for themselves and the environment.

# 

# CHAPTER 4 METHODOLOGY :

# The basic steps in precision farming are, assessing the variability, managing the variability and evaluating the variability. The available technologies enable us in understanding the variability and by giving site-specific agronomic recommendations we can manage the variability that makes precision agriculture viable. And finally,an evaluation must be an integral part of any precision farming system. The detailed steps involved in each process are depicted

# 4.1 Assessing the variability :

# Assessing variability is the critical first step in precision farming. Since one cannot manage what one does not know. Factors and the processes that regulate or control crop performance in terms of yield vary in space and time. Quantifying the variability of these factors and processes and determining when and where different combinations are responsible for the spatial and temporal variation in crop yield is the challenge for precision agriculture. The major part of precision agriculture lies in assessing spatial variability. Techniques for assessing temporal variability also exist but the simultaneous reporting of a spatial and temporal variation is rare. We need both spatial and temporal statistics. We can observe the variability in the yield of a crop in space but we cannot predict the reasons for the variability. It needs the observations at crop growth and development over the growing season, which is nothing but the temporal variation. Hence, we need both space and time statistics to apply precision farming techniques. But this is not common to all the variability/factors that dictate crop yield. Some variables are more produced in space rather with time, making them more conducive to current forms of precision management.

# 4.2 Managing the variability :

# Once the variation is adequately assessed, farmers must match agronomic inputs to known conditions employing management recommendations. Those are site-specific and use accurate applications control equipment. We can use the technology most effectively, In site specific variability management. We can use a GPS instrument so that the site-specificity is pronounced and management will be easy and economical. While taking the soil/plant samples, we have to note the sample site coordinates and further, we can use the same for management. This results in the effective use of inputs and avoids any wastage and this is what we are looking for. The potential for improved precision in soil fertility management combined with increased precision in application control makes precise soil fertility management an attractive, but largely unproven alternative to uniform field management.

# 4.3 Evaluating the variability :

# There are three important issues regarding precision agriculture evaluation.

# a) Economics: The most important fact regarding the analysis of the profitability of precision agriculture is that the value comes from the application of the data and not from the use of the technology.

# b) Environment: Potential improvements in environmental quality are often cited as a reason for using precision agriculture. Reduced agrochemical use, higher nutrient use efficiencies, increased efficiency of managed inputs and increased production of soils from degradation are frequently cited as potential benefits to the environment. Enabling technologies can make precision agriculture feasible, agronomic principles and decision rules can make it applicable and enhanced production efficiency or other forms of value can make it profitable.

# c) Technology transfer: The term technology transfer could imply that precision agriculture occurs when individuals or firms simply acquire and use the enabling technologies. While precision agriculture does involve the application of enabling technologies and agronomic principles to manage spatial and temporal variability, the key term is managing. Much of the attention in what is called technology transfer has focused on how to communicate with the farmer.

# 

# 

# CHAPTER 5 RESULT ANALYSIS :

## Advantages of Precision Farming with AI:

1. **Boosted Yields and Quality:** By tailoring resource allocation based on real-time data, AI helps optimize fertilizer, water, and pest control, leading to increased yields and improved crop quality.
2. **Enhanced Efficiency and Cost Savings:** Automation through AI-powered machinery and data-driven decision-making minimizes manual labor and resource waste, saving time and money for farmers.
3. **Environmental Benefits:** Precise resource management reduces water consumption, minimizes pesticide use, and protects soil health, contributing to a more sustainable agricultural ecosystem.
4. **Resilience to Challenges:** AI models can predict weather patterns, pest outbreaks, and market fluctuations, enabling farmers to proactively adapt and mitigate risks.
5. **Improved Traceability and Transparency:** Data collected through AI sensors offers greater transparency in food production, allowing consumers to track the origin and quality of their food.

## Disadvantages of Precision Farming with AI:

1. **High Initial Investment:** The technology and infrastructure required for precision farming can be expensive, creating a barrier for entry for smaller or resource-constrained farms.
2. **Data Reliance and Connectivity:** Effective AI depends on high-quality data and reliable internet connectivity, which can be limited in rural areas, excluding some farms from the benefits.
3. **Potential Job Displacement:** Increased automation might lead to job losses in traditional farm roles, requiring workforce retraining and adaptation.
4. **Ethical Concerns:** Data privacy and ownership issues arise with the collection and analysis of farm data, requiring robust regulations and data security measures.
5. **Technical Dependence and Vulnerability:** Overreliance on AI systems can leave farmers vulnerable to technical glitches or cyberattacks, potentially impacting operations and yields.

While precision farming with AI offers immense potential for revolutionizing agriculture, it's crucial to acknowledge both its advantages and disadvantages. By addressing the challenges and ensuring equitable access to technology, we can harness the power of AI to cultivate a more sustainable and prosperous future for farmers and consumers alike.

# CHAPTER 6 REFERENCES :

Caffey RH, Kazmierczak RF. and Avault JW. Incorporating Multiple Stakeholder Goals into the Development and Use of a Sustainable Index: Consensus Indicators of Aquaculture Sustainability. Department of Ag Econ and Agribusiness of Louisiana State University, USA. Staff Paper 2001–8. 40.

<https://papers.ssrn.com/sol3/papers.cfm?abstract_id=242312>

Hartwick J. Substitution among exhaustible resources and intergenerational equity. The Review of Economic Studies, 1978; 15(2): 347–354.

<https://ideas.repec.org/a/oup/restud/v45y1978i2p347-354..html>

Khosla R. Zoning in on Precision Ag. Colorado State University Agronomy Newsletter, 2001; 21(1): 2-4 Lowenberg-DeBoer J. Swinton S. Economics of site-specific management in agronomic crops. In The State of Site-Specific Management for Agriculture USA. edited by F. Pierce and E. Sadler, (ASA-CSSA-SSSA, Madison, Wisconsin, USA), 1997; 369–396.

<https://acsess.onlinelibrary.wiley.com/doi/abs/10.2134/1997.stateofsitespecific.c16>

Mandal D. Ghosh SK. Precision farming – The emerging concept of agriculture for today and tomorrow. Current Science, 2000; 79 (12): 1644-1647

<https://www.researchgate.net/publication/237643095_Precision_farming_-_The_emerging_concept_of_agriculture_for_today_and_tomorrow>

Mandal SK. Maity A. Precision Farming for Small Agricultural Farm: Indian Scenario. American Journal of Experimental Agriculture, 2013: 3(1): 200-217.

<https://journaljeai.com/index.php/JEAI/article/view/1018>

Shanwad UK. Patil VC. Gowda H. Precision Farming: Dreams and Realities for Indian Agriculture. Map India Conference Proceedings, 2004. Dharwad.

<https://www.researchgate.net/publication/259713852_Precision_Farming_Dreams_and_Realities_for_Indian_Agriculture>