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Artificial intelligence used in agriculture

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Abstract
Agricultural Robotics is becoming more important. It helps boost productivity, cuts down on boring tasks, and keeps people and the environment safe. In farming, robots make things easier and safer for farmers, leading to better profits and top-notch products with less harm to nature.
This paper looks at how agricultural robots use vision to see and understand things like finding weeds, checking crops, and spotting diseases. It found that many people are interested in using cameras for this, especially RGB cameras. The study also showed that AI can do a good job, but there isn't one perfect method. Different AI techniques each have their strengths for solving different farming challenges. Farmers now have a handy tool called a health monitoring system, powered by AI, which gives them insights into their crops' well-being and suggests nutrients for better growth. This work investigates the comparative analysis of three essential phases of agriculture: Cultivation, Monitoring, and Harvesting, by knowing the depth of AI involved and the robots utilized.

Keywords: Artificial intelligence techniques, agriculture robots, agriculture engineering, smart farming, cultivation, monitoring, harvesting

Introduction
Agriculture, among the oldest and most vital industries globally, faces rising demand due to population growth. To meet food needs and provide jobs for billions, new automated methods are replacing traditional farming, which alone can't suffice anymore. (P. Zhang *et al*., 2021) [1]
Farming is super important for making money in lots of countries, especially poorer ones. But with COVID-19 going around, it's messed up how food gets from farms to Because of COVID, some places stopped sending out food, causing a big food problem everywhere.
The Food and Agriculture Organization (FAO), World Health Organization (WHO), and World Trade Organization (WTO)teamed up to make sure everyone has enough good food to eat and that prices stay steady. Also, UNESCO wants to end hunger everywhere by 2030 as one of its big goals (SDG, 2016). More people mean we need more food. But bugs, weeds, animals, and plant sickness mess up a lot of the crops, causing a big loss of $220 billion each year.
Farmers use lots of chemicals like pesticides and herbicides to keep plants healthy and grow more crops. But these chemicals can make the crops not as good and can pollute the land and water. They're dangerous and can make people sick, causing almost 300,000 deaths every year (Margni *et al*., 2002) [2].
Agriculture 5.0 is like a whole world for farming. It brings together new technologies such as AI, IoT, and ML to make farming better. The goal is to boost productivity while also caring for the environment and making smarter decisions. Using automation and flexible technology, it helps farmers reduce risks, be more sustainable, and make predictions about their crops.
Smart agriculture uses sensors to get accurate information and make the best decisions for maximum productivity. It focuses on using resources wisely and being environmentally friendly. Additionally, by bringing in robotics, it aims to further enhance these practices.
Using solutions and AI techniques, data-driven agriculture sets the stage for sustainable farming ahead. It aligns with Industry 5.0, which stresses teamwork between people and smart machines, prioritizing resilience and eco-friendliness.

Fig 1: A Schematic diagram represented using AI to create illustrations that represent scientific and biotechnological ideas, like growing plants in a lab

Currently, most farming is done traditionally, and it's not very profitable. Without AI and robotics, traditional farming faces various challenges such as:

- Time-consuming tasks like planning land, irrigation, and seed sowing.
- Needing more human labour to handle different agricultural processes.
- Lack of accurate information on weather, soil conditions, and fertilizer use.
- Manual monitoring of crop health and disease identification takes more time and effort.
- More labour is required for weed identification and control.
- Health issues for farmers due to traditional pesticide spraying, reducing crop productivity.
- Tedious tasks like old-fashioned crop cutting and separating healthy crops and fruits.

Poor practices in storing harvested food, leading to degradation.

Using AI techniques can help solve the problems in agriculture.

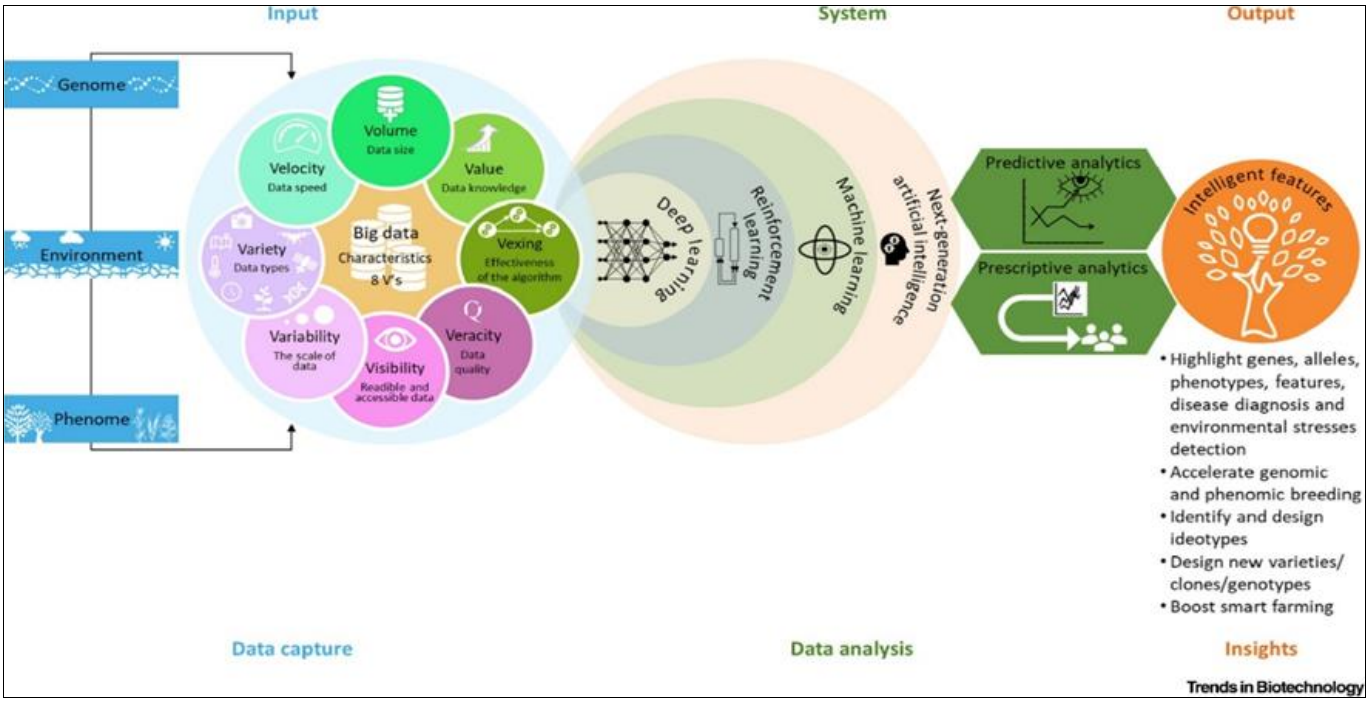

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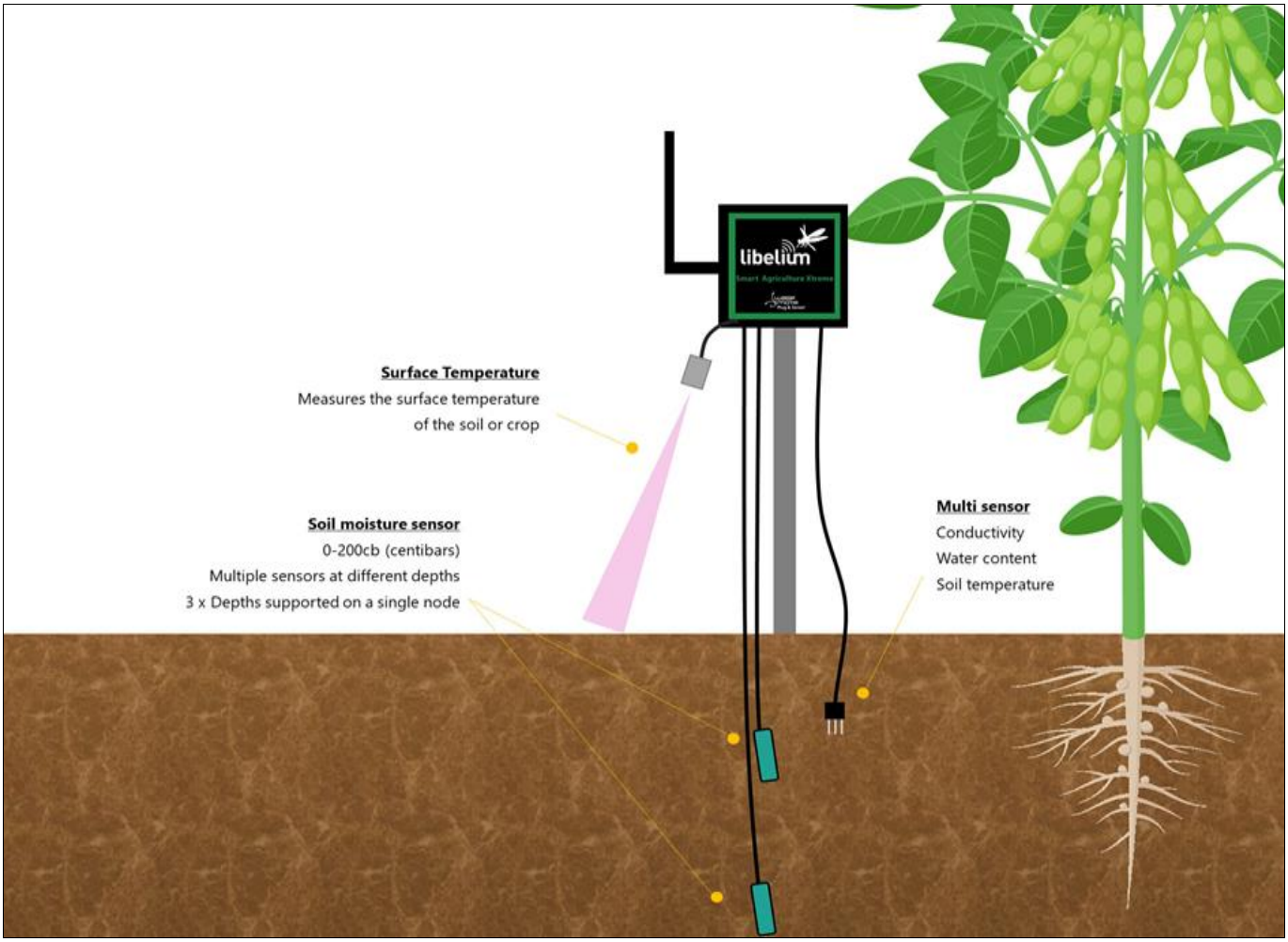
Fig 2: A Schematic diagram represent Enhancing the development of climate-resilient plants through the utilization of artificial intelligence to expedite breeding processes.

Fuzzy logic (FL) has several advantages compared to traditional decision sets. It's a set of rules that tackles problems with nonlinearity, complexity, and uncertainty. L. Zadeh introduced it back in 1965.

In recent years, fuzzy logic (FL) has greatly enhanced the decision-making abilities of controllers. Today, FL is extensively applied in agriculture for tasks like UAV navigation, aerial imaging, crop-cutting robots, farm monitoring, harvesting, and more.



www.manxtechgroup.com

Fig 3: A schematic diagram illustrating Smart Agriculture Node – monitoring moisture, conductivity, surface temperature and soil temperature

Using advanced technology like plant phenotyping and precision agriculture helps assess numerous plants efficiently and provides valuable information for better crop management. Smart Agriculture monitors soil, weather, and crops. It often includes Smart Environment (Air Quality) and Smart Water (Pollution, Turbidity, Nutrients) to cover all aspects like weather and irrigation for a complete solution

Plant phenotyping checks various plant characteristics like shape, stress, yield, and genetics in different environments. Precision agriculture studies differences in crop and soil factors across a field to improve farming efficiency. New technologies in plant phenotyping and precision agriculture play a crucial role in boosting productivity and sustainability in plant production. By understanding various plant traits such as growth, resistance, and physiology, we can develop crop varieties that yield more, withstand stress better, and resist pests and diseases. This is vital for ensuring enough food, feed, fiber, and other resources for the growing global population in the coming century. AI is rapidly evolving. With advances in computational capabilities and increased cloud penetration, more parts of the world economy have begun to reap the benefits of AI.

Farmers can make smarter decisions using AI, enhancing efficiency in agriculture and livestock production. The agricultural sector is keen on adopting AI due to various factors that contribute to better decision-making.

AI sensors can detect weed-infested areas and determine the best herbicide to use in that location. They can also predict weather patterns, evaluate crop health, and detect diseases, pests, or nutrient deficiencies in plants.

https://ai.business/2017

Fig 5: A schematic diagram showing AI and machine learning can identify crop diseases, bolstering food security and ensuring continued sustenance for communities worldwide

Artificial Intelligence

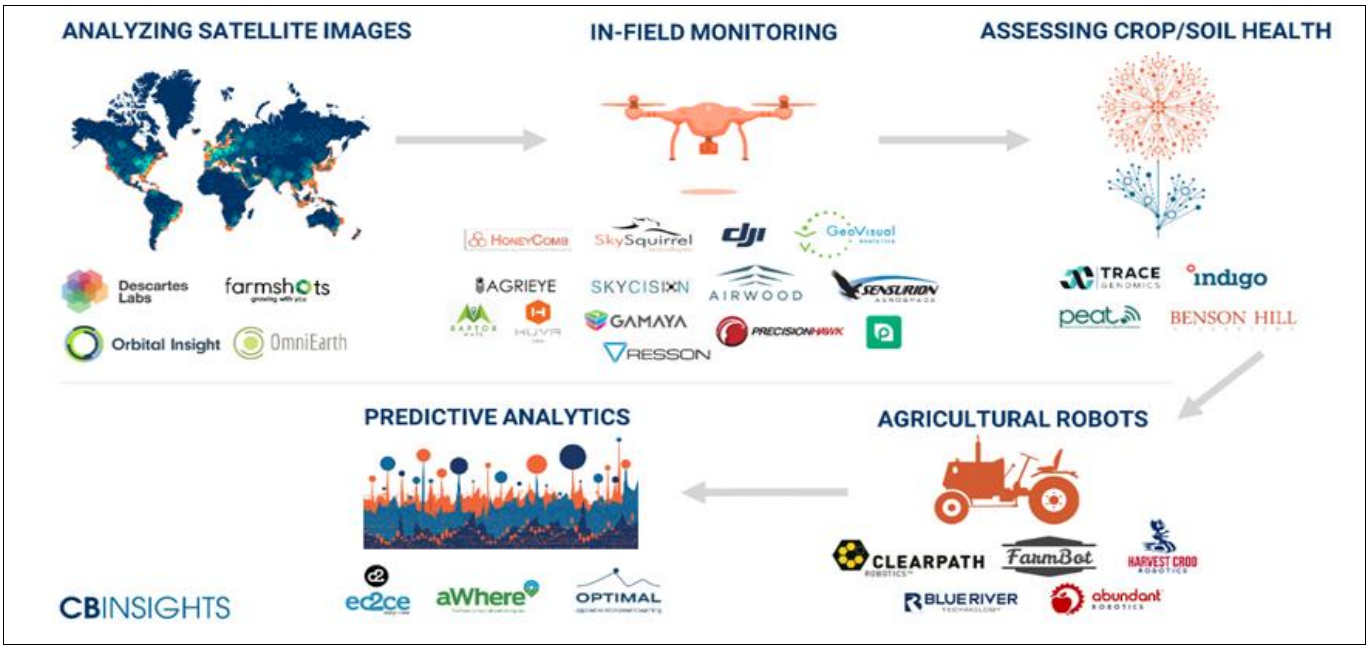


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Fig 6: A schematic diagram representing. The crop patterns and weather impacts. Companies use AI to study millions of these images for helpful information

Artificial intelligence is a field that focuses on creating robots with human-like intelligence, including abilities such as learning and problem-solving, to mimic human cognition and behavior. Research scientists and extension specialists are now using AI technology to address problems in agriculture productivity.

AI uses advanced techniques like deep learning, robots, the Internet of Things (IoT), image processing, artificial neural networks, wireless sensor networks (WSN), and machine learning to address agricultural challenges.

Now, AI technologies help farmers monitor various farm data in real-time, like weather, temperature, water usage, and soil conditions, enabling better decision-making. Smart farming practices developed using AI aim to minimize losses and maximize yields for farmers. (R. Ben Ayed *et al*)

AI, through data from machine learning, assists farmers in tasks like watering, crop rotation, harvesting, crop selection, planting, and pest control. (D. Shadrin *et al*.)

AI technology in agriculture has the potential to improve the world. This technology can perform tasks ranging from simple to complex. The goal of a machine is to learn, reason, and perceive

Need for AI in agriculture

As the population grows and the demand for agricultural products increases, automation is becoming crucial in farming, which traditionally requires a lot of manual labor. AI plays a significant role in various aspects of agriculture, offering predictive analytics and better management systems for farms and crops. This ensures higher crop quality and consistent supply.

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crop quality and consistent supply.

AI'S impact in agriculture

AI is a big help in farming! It makes tough and everyday jobs easier, revolutionizing agriculture. Let's check out some stats to see how AI is changing the game in farming.

1. **Triple Revenue by 2025**
   - The money spent worldwide on smart farming, including AI, is expected to triple by 2025.
   - It will increase to $15.3 billion.

2. **IoTAg Monitoring**
   - AI and the Internet of Things (IoT) help with something called IoTAg monitoring in agriculture.
   - By 2025, it's estimated to be worth $4.5 billion.

3. **AI Solutions Growth**
   - Spending on AI solutions in farming is set to grow a lot.
   - From 2020 to 2026, it will go up from $1 billion to $4 billion.
   - This growth has a rate of 25.5%.

4. **Market Size Increase**
   - In 2019, the market size for AI in agriculture was $852.2 million.
   - By 2030, it's expected to become a massive $8,379.5 million.
   - This growth has a rate of 24.8% during 2020-2030.

5. **Regional Insights**

North America is making the most money from AI in agriculture right now.

But it's predicted that the Asia Pacific region will grow the fastest

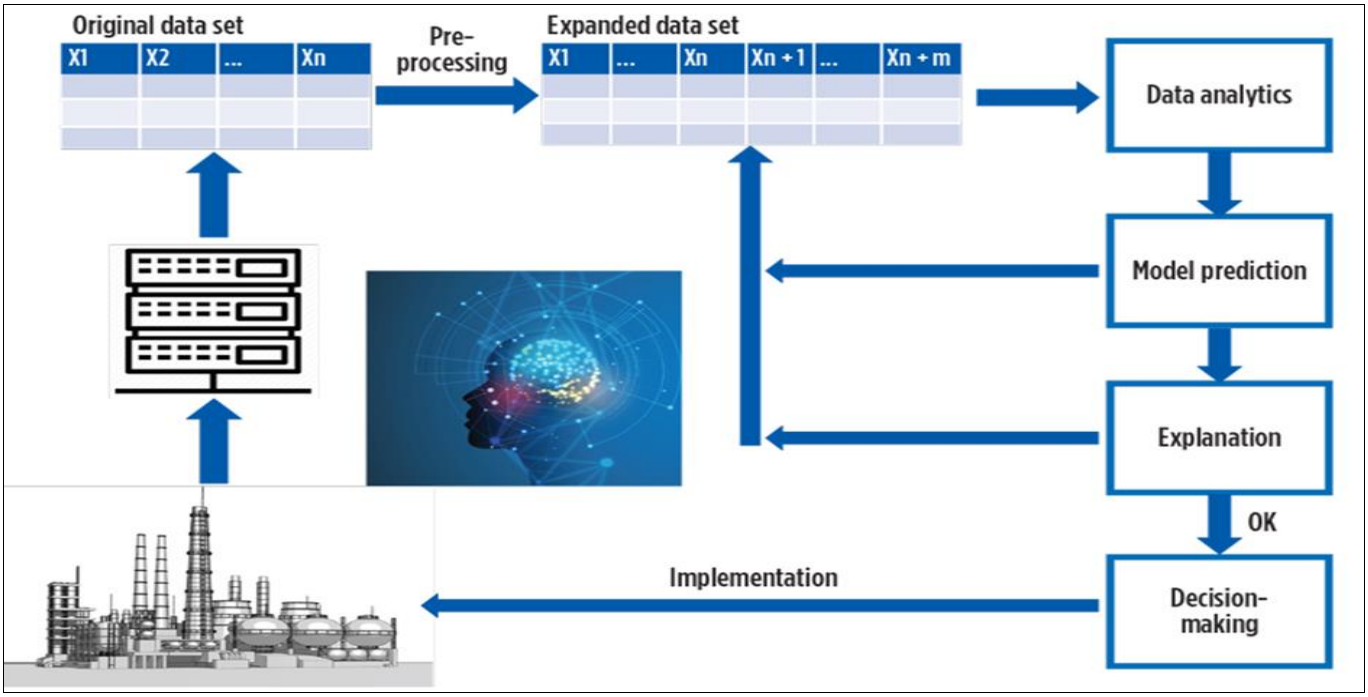

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Fig 7: Artificial intelligence (AI) is revolutionizing agriculture, empowering farmers with data-driven insights for optimized decision-making. This translates to increased efficiency, sustainability, and profitability in the agricultural sector.

Limitations

The lack of simple solutions that seamlessly incorporate and embed AI in agriculture is a significant barrier to the widespread adoption of AI in agriculture. The majority of farmers lack the time and digital skills to investigate AI solutions on their own.

Advantages

- AI makes farming easier: It helps produce, harvest, and sell crops more efficiently.
- AI adapts to climate change: Farmers use AI to respond wisely to changing weather and environmental conditions.
- AI protects crops: It keeps intruders like animals and thieves away from the harvest.
- AI improves crop management: Farmers use technology to manage crops better, leading to better farming practices. AI technology reduces the labour challenge and automates manual work, accelerating the food transformation.

Application

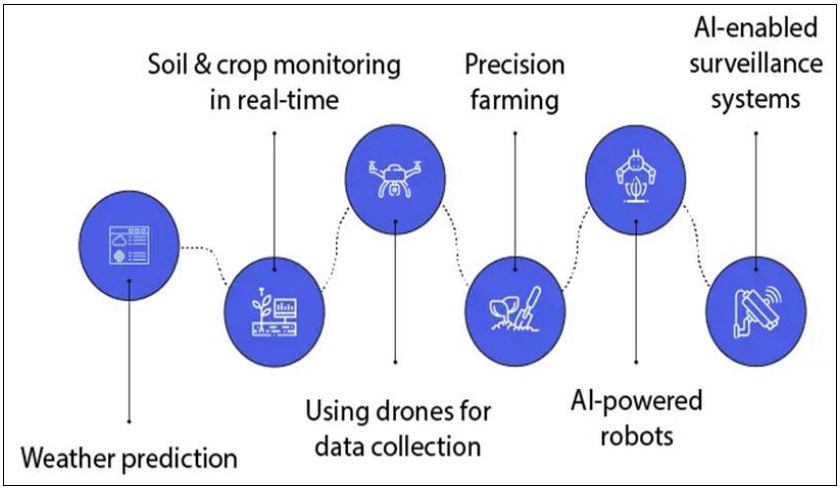

Fig 5: This schematic Diagram shows that the application of artificial intelligence (AI) within agriculture is rapidly evolving, presenting exciting opportunities to enhance both sustainability and efficiency in this critical sector

I. Weather prediction

With more pollution and unpredictable weather, farming has gotten tougher. But AI helps by predicting the best times to plant seeds based on weather patterns like sunlight, wind, and rain. This helps farmers plan better.

II. Soil & crop monitoring in real-time

Soil matters a lot for plants. Deforestation makes soil worse, and farmers find it hard to know which soil is good for which crop.

III. Using drones for data collection
AI and machine learning help farms boost crop yields. Drones give real-time views of crops, while smart sensors track moisture and nutrients. They help farmers see how different treatments affect yields.

IV. Precision farming: Precision farming uses data to grow more crops. Farmers use smartphones and AI apps for personalized plans. This helps meet food needs and boost profits without harming nature

V. AI power robots
Companies are using AI to make robots for farming. These robots will handle weeding, harvesting, and packing crops faster than people.

VI. AI-enabled surveillance system
AI in farming uses satellites to spot any trouble from animals or bugs. It checks past data and alerts farmers on their phones if something's wrong, helping them protect their crops.

Conclusion
Climate change, environmental shifts, and growing food demands call for a powerful solution. AI steps up as a game-changer for 21st-century farming by:

- Boosting efficiency: Saving time, labour, and resources.
- Going green: Protecting the environment with sustainable practices.
- Smart resource allocation: Making the most of water, fertilizer, and energy.

References

1. Zhang P, Guo Z, Ullah S, Melagraki G, Afantitis A, Lynch I. Influence of nitrogen levels and varieties on yield and quality of okra. Crop Res (Hisar). 2005;30(1):80-82.
2. Amjad M, Sultan M, Anjum MA, Ayyub CM. Response of okra (*Abelmoschus esculentus*) to various doses of N & P and different plant spacings. Pak J Res (Sci). 2002;13(1):19-29.
3. Ashish, Ranjan, Chaudhary V. Effect of integrated nutrient management on growth and yield of okra. J Appl Biol. 2006;16(1/2):11-13.
4. Birbal, Nehra BK, Malik YS. Effect of spacing and nitrogen on fruit yield of okra (*Abelmoschus esculentus* (L) Moench) cv. Varasha Uphar. Haryana Agric Univ J Res.
5. Fisher RA. Statistical Methods for Research Workers. Oliver and Boyd Edinburgh, London. 1950;25:47-51.
6. Kaur K, Singh H. Effect of levels and time of nitrogen application on grain and malt quality characteristics of barley varieties. Environ Ecol. 2011;29(2):542-545.
7. Mamta Kumari, Singh RK. Economics of hybrid okra. Int J Plant Sci (Muzaffarnagar). 2006;1(2):363-364.
8. Pal J, Adhikari RS, Negi J. Effect of nitrogen phosphorus and potassium on growth and green herb yield of Thymus serphyllus. ISSN: 2319-7706. 2016;5(1):406-410.
9. Paththinige SS, Upashantha PSG, Ranaweera Banda RM, Fonseka RM. Effect of plant spacing on yield and fruit characteristics of okra (*Abelmoschus esculentus*). Trop Agric Res. 2008;20:336–342.
10. Salvi VG, Shinde M, Dhane SS, Sawant P. Effect of integrated nutrient management on yield and quality of okra grown on lateritic soils of Konkon. J Maharashtra Agric Univ. 2010;35(3):466-469.
11. Singh S, Singh TK, Namdeo KN. Effect of nitrogen and spacing on growth, yield and quality of tomato. Ann Plant Soil Res. 2018;20(3):313-315.
12. Sondhiya R, Pandey R, Namdeo KN. Effect of plant spacings on growth, yield and quality of mustard (*Brassica juncea* L.). Ann Plant Soil Res. 2019;21(2):172-176.
13. Tiwari V, Shrivastava A, Namdeo KN, Kumar MM. Effect of sources and levels of nitrogen on growth, yield and quality of Kalmagh. Ann Plant Soil Res. 2012;14(1):14-1.