

AGRICULTURE FORUM FOR TECHNICAL EDUCATION OF FARMING SOCIETY

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Next Generation Farming: Smart Agronomy Meets Advanced Horticulture

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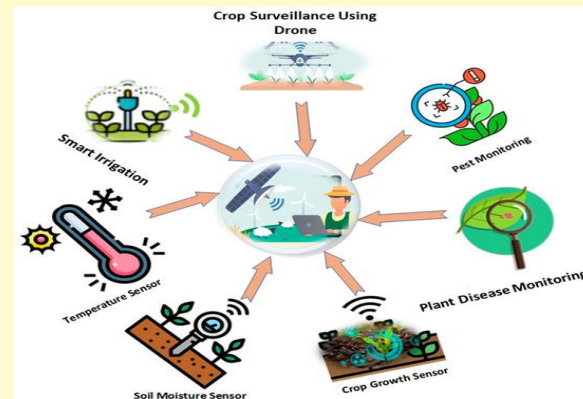
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INTRODUCTION

Agriculture is undergoing a major transformation driven by modern technologies, innovation, and data science. Next-generation farming integrates smart agronomy with advanced horticulture to enhance productivity, sustainability, and profitability. With the use of technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), sensors, drones, and data analytics, farming is becoming more efficient, precise, and resource-saving. The main goal of this approach is to produce more with fewer inputs while conserving natural resources and ensuring environmental sustainability.

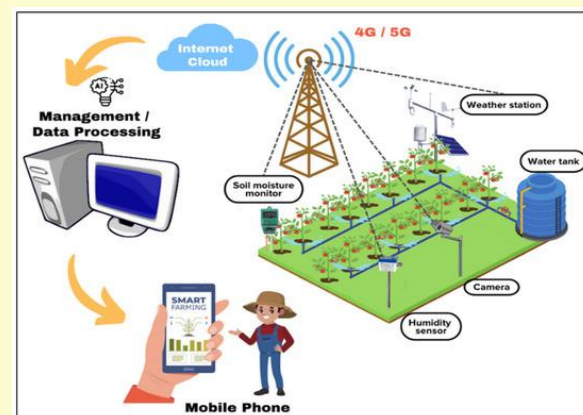
Agriculture is undergoing a major transformation driven by modern technologies, innovation, and data science.

- Next-generation farming integrates smart agronomy with advanced horticulture.
- It aims to enhance productivity, sustainability, and profitability.
- Technologies used include IoT, Artificial Intelligence (AI), sensors, drones, and data analytics.
- Farming is becoming more efficient, precise, and resource-saving.
- These technologies enable real-time monitoring and better decision-making.
- They help optimize the use of inputs like water, fertilizers, and pesticides.
- This approach reduces waste and environmental impact.



Smart Agronomy

Smart agronomy focuses on precision-based crop management using scientific knowledge and digital tools. It involves site-specific nutrient management, real-time monitoring of soil and crop conditions, and data-driven decision-making. By adopting these practices, farmers can provide crops with the exact amount of water, fertilizers, and other inputs required for optimal growth. This not only improves crop yield but also reduces wastage of resources and enhances climate resilience in agricultural systems.



Advanced Horticulture

Advanced horticulture integrates modern technologies into the cultivation of fruits, vegetables, and ornamental crops. It includes innovative practices such as protected cultivation in greenhouses and polyhouses, hydroponics, aeroponics, and vertical farming. These techniques create controlled environments that allow better management of temperature, humidity, and nutrients. As a result, crop production becomes more efficient, consistent, and capable of meeting market demands throughout the year.

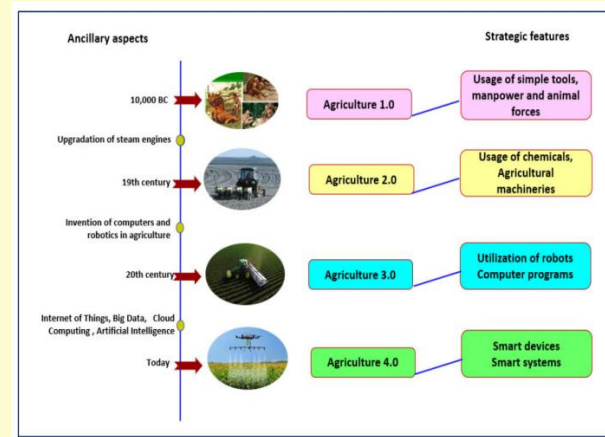


Core Technologies in Next-Generation Farming

Next-generation farming relies on several advanced technologies that form the backbone of modern agriculture. The Internet of Things (IoT) enables real-time monitoring of farm conditions through connected devices, while Artificial Intelligence (AI) and machine learning help analyze data and provide accurate

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recommendations. Drones and remote sensing technologies assist in crop surveillance and field mapping, and GPS and GIS tools support precise land management. Big data analytics further enhances decision-making by processing large volumes of agricultural data to improve productivity and efficiency.



Smart Farming Tools

Various smart tools are used in next-generation farming to improve efficiency and reduce labor. Soil sensors play a crucial role in monitoring soil moisture, temperature, and nutrient levels, allowing farmers to make informed decisions. Smart irrigation systems automate water application based on real-time crop requirements, ensuring optimal water use. Robotics is increasingly being used for tasks such as planting, spraying, and harvesting, reducing dependency on

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manual labor. Additionally, mobile applications provide farmers with real-time updates, weather forecasts, and expert advisory services, making farming more accessible and informed.



Benefits of Next-Generation Farming

Next-generation farming offers numerous benefits, including higher crop yields and improved quality of produce. It ensures efficient use of resources such as water and fertilizers, leading to reduced production costs. The adoption of smart technologies also enhances climate resilience, enabling crops to withstand environmental stresses. Furthermore, these practices promote environmentally sustainable farming systems by minimizing waste and reducing the negative impact on natural ecosystems.

Role in Horticulture Crops

In horticulture, next-generation farming plays a significant role in improving the production of fruits, vegetables, and ornamental plants. Precision

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fertigation techniques ensure efficient nutrient delivery, while controlled environment cultivation enhances crop yield and quality. Artificial Intelligence-based pest detection systems help reduce the use of chemical pesticides, making production safer and more sustainable. Additionally, these technologies enable year-round production, ensuring a consistent supply of high-value crops in the market.

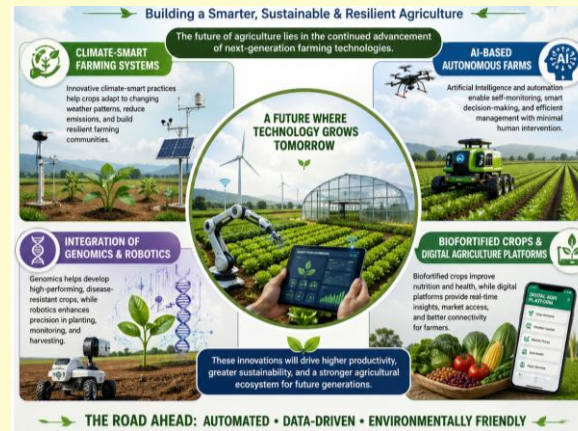
Challenges and Limitations

Despite its many advantages, next-generation farming faces several challenges. The high initial investment required for advanced technologies can be a barrier for small and marginal farmers. There is also a lack of technical knowledge and training, which limits adoption. Inadequate infrastructure and the digital divide between rural and urban areas further restrict the widespread implementation of smart farming practices. Moreover, managing and interpreting large amounts of data remains a challenge for many farmers.

Future Prospects

The future of agriculture lies in the continued advancement of next-generation farming technologies. Climate-smart farming systems, AI-based autonomous farms, and the integration of genomics and robotics are expected to shape the future of agriculture. The development of biofortified crops and digital agriculture platforms will further enhance productivity and sustainability. As these technologies evolve,

farming will become increasingly automated, data-driven, and environmentally friendly.



CONCLUSION

Next-generation farming has emerged as a vital approach for ensuring global food security and promoting sustainable agricultural development in an era of increasing population pressure and limited natural resources. By seamlessly integrating smart agronomy with advanced horticulture, this modern system enhances productivity while maintaining ecological balance. Precision-based practices enable efficient use of water, fertilizers, and other inputs, thereby reducing wastage and conserving valuable natural resources. At the same time, the adoption of advanced technologies such as sensors, automation, and data analytics improves farm management and decision-making, ultimately increasing farmers' income and profitability.

Furthermore, next-generation farming strengthens climate resilience by helping crops adapt to environmental stresses such as drought, temperature fluctuations, and irregular rainfall. It also supports soil health, biodiversity, and environmental sustainability by minimizing harmful agricultural practices. In addition, this approach ensures the production of high-quality, safe, and nutritious food to meet the demands of modern consumers. Overall, next-generation farming represents a progressive shift toward a more efficient, resilient, and sustainable agricultural system, successfully balancing the need for increased agricultural production with the responsibility of environmental conservation.