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Government Schemes to Utilize Before Financial Year End: A Review

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Abstract :

The period preceding the financial year-end is a crucial window for farmers and agri-entrepreneurs to effectively utilize various government schemes aimed at enhancing agricultural productivity, income security, and rural development. This review paper examines major central and state-sponsored schemes in India, including income support programs, credit facilities, crop insurance, infrastructure development initiatives, and sustainable agriculture missions. It highlights the importance of timely application, proper documentation, and awareness to ensure maximum benefit before budget closures and administrative deadlines. The review also discusses key schemes such as PM-Kisan, Kisan Credit Card, PM Fasal Bima Yojana, Agriculture Infrastructure Fund, and livestock development programs, emphasizing their role in strengthening the agricultural sector. Additionally, it identifies major challenges such as lack of awareness, procedural complexities, and limited accessibility, which hinder effective implementation. The paper concludes that improving extension services, digital access, and farmer education is essential for better utilization of these schemes, thereby contributing to sustainable agricultural growth and enhanced farmer welfare.

The closing phase of the financial year (January–March) is a critical period for farmers, agri-entrepreneurs, and rural stakeholders to fully leverage government schemes before deadlines, budget lapses, or revised allocations take effect. In India, a wide range of central and state-sponsored agricultural schemes aim to enhance productivity, ensure income stability, promote sustainability, and support infrastructure development. However, limited awareness, procedural delays, and documentation gaps often prevent beneficiaries from maximizing these opportunities. This review examines key agricultural schemes relevant before the financial year-end and highlights strategies for effective utilization.

Income support and financial assistance schemes form the backbone of farmer welfare. The **PM-Kisan Samman Nidhi Yojana** provides direct income support to eligible farmers in installments, and ensuring updated land records and Aadhaar linkage before the financial year-end is crucial for uninterrupted benefits. Similarly, the **Kisan Credit Card (KCC)** scheme offers short-term credit at subsidized interest rates, and farmers can benefit from interest subvention if loans are repaid within stipulated timelines, typically aligned with the financial year cycle. The **Pradhan Mantri Fasal Bima Yojana (PMFBY)**, a crop insurance scheme, also requires timely enrollment and premium payment to secure coverage, especially for upcoming cropping seasons.

Infrastructure and capital investment schemes are particularly significant during this period, as many operate on annual budget allocations. The **Agriculture Infrastructure Fund (AIF)** provides medium to long-term financing for post-harvest infrastructure such as warehouses, cold storage units, and processing facilities. Beneficiaries must complete application processes and secure approvals before the financial year closes to avoid delays or fund reallocation. Similarly, the **Pradhan Mantri Krishi Sinchai Yojana (PMKSY)** supports irrigation development and micro-irrigation systems like drip and sprinkler irrigation, and farmers should ensure submission of subsidy claims and installation verification within deadlines.

Schemes promoting sustainable and climate-resilient agriculture are also important to utilize before the financial year ends. The **National Mission for Sustainable Agriculture (NMSA)** and **Paramparagat Krishi Vikas Yojana (PKVY)** encourage organic farming, soil health improvement, and resource conservation. Farmers can access financial assistance for organic inputs, certification, and training programs, but timely registration and compliance with scheme guidelines are essential. Additionally, the **Soil Health Card Scheme** provides recommendations for balanced fertilization, and farmers should ensure their soil testing is completed and records updated to plan for the next cropping cycle.

Livestock and allied sector schemes also offer substantial benefits. The **National Livestock Mission (NLM)** and **Rashtriya Gokul Mission** support breed improvement, fodder development, and dairy infrastructure. Farmers and entrepreneurs involved in dairy, poultry, or goat farming can avail subsidies and financial assistance for setting up or expanding units. The **Animal Husbandry Infrastructure Development Fund (AHIDF)** is another key initiative providing credit support for processing and value addition in livestock sectors, which requires timely application before financial closures.

Digital platforms and agri-entrepreneurship schemes are increasingly becoming important. Initiatives such as **Agri-Clinics and Agri-Business Centres (ACABC)** and startup-focused programs under **Atmanirbhar Bharat** encourage youth participation in agriculture. These schemes often have targets linked to annual budgets, making the final quarter a crucial window for approvals and fund disbursement. Ensuring proper documentation, project reports, and bank linkages can significantly improve the chances of successful application. Despite the availability of numerous schemes, several challenges hinder their effective utilization. These include lack of awareness among farmers, complex application procedures, delays in verification, and limited access to digital platforms in rural areas. Strengthening extension services, simplifying procedures, and promoting digital literacy are essential to overcome these barriers. Farmer Producer Organizations (FPOs), cooperatives, and local institutions can play a vital role in aggregating demand, facilitating applications, and ensuring timely access to benefits.

The period before the financial year-end offers a strategic opportunity for farmers and agri-stakeholders to access and maximize the benefits of various government schemes. A proactive approach involving timely application, accurate documentation, and awareness of scheme guidelines is essential to avoid missing out on financial assistance and subsidies.

Water Management Before Summer: बचत ही कमाई है

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Abstract :

Water scarcity is a recurring challenge in Indian agriculture, particularly during the summer season when evapotranspiration rates increase and water availability declines sharply. Efficient water management before the onset of summer plays a crucial role in sustaining crop productivity, conserving natural resources, and enhancing farm profitability. This review paper examines the importance of pre-summer water management strategies, including irrigation planning, soil moisture conservation, rainwater harvesting, and adoption of micro-irrigation systems. It also highlights the role of government initiatives and modern technologies in promoting efficient water use. The paper identifies key challenges such as inefficient irrigation practices, lack of awareness, and infrastructural limitations. It concludes that proactive water conservation measures, combined with farmer education and policy support, can significantly reduce water stress and improve agricultural sustainability. The concept “बचत ही कमाई है” (saving is earning) is reinforced as a guiding principle for efficient water utilization in farming systems.

Introduction

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Water is a fundamental resource in agriculture, influencing crop growth, yield, and overall farm productivity. In India, agriculture consumes approximately 80% of the available freshwater resources, making it highly vulnerable to water scarcity. With increasing climate variability, erratic rainfall patterns, and rapid depletion of groundwater, efficient water management has become critical. The period before summer, particularly from February to April, is crucial for implementing water conservation measures that help mitigate the impact of heat stress and water shortages during peak summer months.

Traditional irrigation practices, such as flood irrigation, often result in excessive water loss through evaporation, runoff, and deep percolation. In contrast, scientific and modern irrigation techniques offer opportunities to optimize water use. Pre-summer water management focuses on conserving soil moisture, improving irrigation efficiency, and ensuring adequate water availability for crops during critical growth stages. This review paper aims to provide a comprehensive overview of strategies, technologies, and policies related to water management before summer.

Impact of Water Scarcity on Agriculture

Water scarcity directly affects crop physiology, reducing photosynthesis, nutrient uptake, and overall plant growth. Insufficient water during critical stages such as flowering and grain filling leads to significant yield losses. In addition, water stress increases the vulnerability of crops to pests and diseases. Soil degradation, salinity, and reduced microbial activity are also common consequences of poor water management.

The economic impact of water scarcity is equally severe, as it leads to lower farm income and increased input costs. Small and marginal farmers are particularly affected due to limited access to irrigation infrastructure and financial resources. Therefore, efficient water management is not only an agronomic necessity but also an economic imperative.

Pre-Summer Water Management Strategies

3.1 Efficient Irrigation Practices

Efficient irrigation is the cornerstone of water management. Micro-irrigation systems such as drip and sprinkler irrigation ensure precise water application, reducing wastage and improving crop yield. Drip irrigation delivers water directly to the root zone, minimizing evaporation losses, while sprinkler systems simulate rainfall, ensuring uniform distribution.

Irrigation scheduling based on crop requirements, soil type, and weather conditions further enhances water-use efficiency. Techniques such as alternate furrow irrigation and deficit irrigation can also help conserve water without significantly affecting yield.

3.2 Soil Moisture Conservation

Soil moisture conservation plays a vital role in reducing irrigation requirements. Practices such as mulching, conservation tillage, and crop residue management help retain soil moisture and regulate temperature. Organic mulches like straw and leaves not only conserve water but also improve soil fertility. Contour farming and bunding are effective in preventing runoff and increasing water infiltration, particularly in rainfed areas. These practices contribute to sustainable soil and water management.

3.3 Rainwater Harvesting and Storage

Rainwater harvesting is an essential strategy for ensuring water availability during dry periods. Farm ponds, check dams, and percolation tanks help store excess rainwater, which can be used for irrigation during summer. Groundwater recharge through these structures also helps maintain water tables.

Community-based water management systems can further enhance the effectiveness of rainwater harvesting, especially in regions facing acute water scarcity.

3.4 Crop Planning and Selection

Selecting drought-tolerant and short-duration crop varieties is an effective way to cope with water scarcity. Crop diversification and rotation also help optimize water use and reduce risk. Adjusting sowing dates to align with water availability ensures better crop establishment and growth. Intercropping systems can improve water-use efficiency by maximizing resource utilization and reducing evaporation losses.

Role of Technology in Water Management

Technological advancements have significantly improved water management practices in agriculture. Soil moisture sensors, remote sensing, and satellite-based monitoring systems provide real-time data for efficient irrigation scheduling. Mobile applications and digital advisory platforms offer farmers timely information on weather conditions and water requirements.

Precision agriculture techniques enable site-specific water management, reducing wastage and improving productivity. Automation of irrigation systems further enhances efficiency and reduces labor requirements.

Government Initiatives and Policies

The Government of India has launched several schemes to promote efficient water use in agriculture. The **Pradhan Mantri Krishi Sinchai Yojana (PMKSY)** focuses on improving irrigation coverage and promoting micro-irrigation under the slogan “Per Drop More Crop.” Subsidies for drip and sprinkler systems encourage farmers to adopt water-saving technologies. Other initiatives include watershed development programs, groundwater management policies, and support for rainwater harvesting structures. These policies play a crucial role in enhancing water-use efficiency and ensuring sustainable agricultural practices.

Challenges in Water Management

Despite the availability of various strategies and technologies, several challenges hinder effective water management. These include lack of awareness among farmers, high initial costs of micro-irrigation systems, inadequate infrastructure, and limited access to credit. Over-extraction of groundwater and poor maintenance of irrigation systems further exacerbate the problem.

Climate change and increasing variability in rainfall patterns add another layer of complexity, making water management more challenging.

Future Prospects and Recommendations

To address water scarcity effectively, an integrated approach combining traditional knowledge and modern technology is required. Strengthening extension services and farmer training programs can improve awareness and adoption of water-saving practices. Promoting community participation and water user associations can enhance resource management.

Investment in research and development for drought-resistant crop varieties and affordable irrigation technologies is essential. Policy interventions should focus on improving access to financial support and ensuring equitable distribution of water resources.

Conclusion

Water management before summer is a critical component of sustainable agriculture. By adopting efficient irrigation practices, conserving soil moisture, and utilizing modern technologies, farmers can significantly reduce water wastage and improve productivity. Government initiatives and policy support further enhance the adoption of these practices.

The principle “बचत ही कमाई है” highlights the importance of conserving water as a means of increasing farm income and ensuring long-term sustainability. As water resources become increasingly scarce, proactive and integrated water management strategies will be essential for securing the future of agriculture.

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Soil Health Improvement After Rabi Season — A Review

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Abstract

Soil health is a cornerstone of sustainable agriculture, directly influencing crop productivity, nutrient efficiency, and environmental resilience. After the Rabi season, soils often experience nutrient depletion, compaction, reduced organic matter, and microbial imbalance due to intensive cultivation practices. This review paper synthesizes current knowledge on soil health status following Rabi cropping and evaluates practical, science-based strategies for restoration. Key approaches discussed include integrated nutrient management, organic amendments, green manuring, crop residue management, conservation tillage, and the use of biofertilizers. The role of soil testing, precision agriculture, and government initiatives such as the Soil Health Card Scheme is also examined. The paper highlights challenges including low organic carbon levels, over-reliance on chemical fertilizers, and limited farmer awareness. It concludes that adopting integrated and location-specific soil management practices can significantly enhance soil fertility, productivity, and long-term sustainability.

Introduction

Soil is a living system that supports plant growth by providing essential nutrients, water, and a medium for root development. In India, the Rabi season—dominated by crops such as wheat, mustard, chickpea, and barley—plays a vital role in food security. However, intensive Rabi cultivation, often involving high fertilizer inputs and repeated tillage, can degrade soil health. Post-harvest soils frequently exhibit reduced nutrient availability, declining organic matter, compaction, and disturbed microbial activity. These changes negatively affect subsequent crop performance and overall farm productivity.

Improving soil health after the Rabi season is therefore critical for sustaining agricultural systems, particularly before the onset of the Kharif season. This period provides an opportunity to restore soil fertility, improve structure, and enhance biological activity. Scientific soil management practices not only increase crop yields but also improve resource-use efficiency and resilience against climate stress. This review aims to analyze the impact of Rabi cropping on soil properties and outline effective strategies for soil health improvement.

Impact of Rabi Cropping on Soil Health

Rabi crops are generally nutrient-intensive, especially cereals like wheat, which extract significant amounts of nitrogen (N), phosphorus (P), and potassium (K) from the soil. Continuous cultivation without adequate replenishment leads to nutrient imbalances and deficiencies, particularly of micronutrients such as zinc, sulfur, and boron. Excessive use of chemical fertilizers, especially nitrogen, can also alter soil pH and reduce microbial diversity.

Soil physical properties are also affected. Repeated tillage operations often lead to soil compaction, reduced porosity, and poor water infiltration. This restricts root growth and limits the availability of oxygen to soil organisms. In addition, the removal or burning of crop residues reduces soil organic carbon, which is essential for maintaining soil structure and fertility.

Biologically, soil microbial activity tends to decline after intensive cropping cycles. Beneficial microorganisms responsible for nutrient cycling, organic matter decomposition, and disease suppression may decrease, resulting in reduced soil vitality.

Strategies for Soil Health Improvement

3.1 Soil Testing and Balanced Fertilization

Soil testing is the first step toward effective soil health management. It helps determine nutrient status and guides the application of fertilizers in balanced proportions. The use of Soil Health Cards enables farmers to make informed decisions, avoiding both deficiency and excess application of nutrients.

3.2 Organic Matter Addition

Incorporation of organic materials such as farmyard manure (FYM), compost, vermicompost, and crop residues significantly improves soil structure, water-holding capacity, and nutrient availability. Organic amendments also enhance microbial activity and increase soil organic carbon levels, which are critical for long-term fertility.

3.3 Green Manuring

Green manuring involves growing specific crops (e.g., dhaincha, sunhemp) and incorporating them into the soil at a tender stage. These crops enrich the soil with organic matter and fix atmospheric nitrogen, improving fertility naturally. This practice is particularly beneficial in retoring soil health between Rabi and Kharif seasons.

3.4 Crop Residue Management

Instead of burning crop residues, incorporating them into the soil helps recycle nutrients and improve organic matter content. Residue retention also reduces soil erosion, enhances moisture conservation, and supports microbial activity.

3.5 Conservation Tillage

Reducing the intensity of tillage operations helps maintain soil structure, reduce compaction, and preserve soil moisture. Practices such as zero tillage and minimum tillage are gaining popularity due to their benefits in improving soil health and reducing input costs.

3.6 Biofertilizers and Microbial Inoculants

Biofertilizers such as Rhizobium, Azotobacter, Azospirillum, and phosphate-solubilizing bacteria play a crucial role in enhancing nutrient availability and improving soil biological activity. These eco-friendly inputs reduce dependence on chemical fertilizers and support sustainable farming.

Role of Technology and Government Initiatives

Technological advancements such as precision agriculture, remote sensing, and digital soil mapping have improved soil management practices. Farmers can now monitor soil conditions in real time and apply inputs more efficiently.

Government programs like the Soil Health Card Scheme, Paramparagat Krishi Vikas Yojana (PKVY), and National Mission for Sustainable Agriculture (NMSA) promote soil health improvement through awareness, financial support, and training. These initiatives encourage the adoption of organic farming and balanced nutrient management practices.

Challenges in Soil Health Management

Despite the availability of various strategies, several challenges persist. These include lack of awareness among farmers, limited access to organic inputs, high labor costs, and the continued practice of residue burning. Small and marginal farmers often face financial constraints that limit their ability to adopt improved practices. Additionally, climate change and erratic weather patterns further complicate soil management, affecting nutrient dynamics and microbial activity.

Future Prospects and Recommendations

To ensure sustainable soil health, an integrated approach combining organic and inorganic inputs is essential. Promoting farmer education and strengthening extension services can improve the adoption of best practices. Incentives for residue management and organic farming can encourage sustainable behavior. Research should focus on developing location-specific soil management strategies and improving the efficiency of biofertilizers. Public-private partnerships can play a key role in making technologies and inputs more accessible.

Conclusion

Soil health improvement after the Rabi season is vital for maintaining agricultural productivity and sustainability. By adopting practices such as balanced fertilization, organic amendments, green manuring, and conservation tillage, farmers can restore soil fertility and enhance resilience. Government support, technological advancements, and increased awareness will be crucial in promoting sustainable soil management. Healthy soil not only ensures better crop yields but also secures the future of agriculture and environmental sustainability.



Krishi Ujala

A Review on Fodder Planning for Summer Season

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Abstract:

Fodder scarcity during the summer season is a major constraint in livestock production systems, particularly in tropical countries like India where high temperatures and limited water availability reduce green fodder supply. Efficient fodder planning before the onset of summer is essential to ensure continuous feed availability, maintain animal health, and sustain productivity. This review paper examines various strategies for summer fodder planning, including selection of drought-tolerant fodder crops, fodder conservation techniques such as silage and hay making, integrated crop–livestock systems, and the role of irrigation and nutrient management. The importance of government initiatives and technological interventions in improving fodder security is also discussed. The paper highlights key challenges such as land limitations, lack of awareness, and poor storage infrastructure, and concludes that a proactive and integrated approach to fodder planning can significantly enhance livestock productivity and farmer income.

. Introduction

Livestock plays a crucial role in the agricultural economy, contributing significantly to rural livelihoods, nutritional security, and income generation. However, one of the major challenges faced by livestock farmers is the seasonal shortage of quality fodder, particularly during the summer months. High temperatures, reduced soil moisture, and limited availability of irrigation water lead to a decline in green fodder production, affecting animal health and productivity.

Fodder planning for the summer season involves the systematic management of resources to ensure a continuous supply of nutritious feed for livestock. This includes selecting suitable fodder crops, conserving surplus fodder from previous seasons, and adopting efficient feeding practices. Proper planning not only helps in maintaining milk production and growth rates but also reduces the cost of feeding, which constitutes a major portion of livestock management expenses.

This review paper aims to analyze the challenges associated with summer fodder scarcity and explore effective strategies for ensuring fodder availability. It also highlights the role of policy support and technological advancements in improving fodder management practices.

Impact of Fodder Scarcity on Livestock

Fodder scarcity during summer leads to significant reductions in livestock productivity. Animals subjected to inadequate nutrition experience weight loss, decreased milk yield, poor reproductive performance, and increased susceptibility to diseases. Heat stress further aggravates the situation by reducing feed intake and increasing maintenance energy requirements.

In dairy animals, insufficient fodder supply directly affects milk production and quality. Similarly, in meat-producing animals, growth rates decline, leading to economic losses for farmers. Fodder shortages also force farmers to rely on expensive commercial feeds, increasing production costs.

Strategies for Summer Fodder Planning

3.1 Selection of Suitable Fodder Crops

Choosing drought-tolerant and fast-growing fodder crops is a key strategy for summer planning. Crops such as sorghum, maize, cowpea, bajra (pearl millet), and hybrid napier grass are well-suited for summer conditions due to their ability to withstand high temperatures and limited water availability. Leguminous fodder crops like cowpea and cluster bean improve soil fertility by fixing atmospheric nitrogen while providing protein-rich feed.

3.2 Fodder Conservation Techniques

Conserving surplus fodder during periods of abundance is essential for bridging the gap during summer. Silage making involves fermenting green fodder under anaerobic conditions, preserving its nutritional value for several months. Hay making, which involves drying fodder to reduce moisture content, is another effective method for long-term storage.

These techniques ensure a consistent supply of quality fodder during lean periods and reduce dependence on fresh green fodder.

3.3 Irrigation and Water Management

Efficient water management is critical for sustaining fodder production during summer. Micro-irrigation systems such as drip and sprinkler irrigation help optimize water use and improve crop yield. Scheduling irrigation based on crop requirements and soil moisture levels further enhances water-use efficiency.

Rainwater harvesting and the use of farm ponds can provide additional water resources for fodder cultivation during dry periods

3.4 Integrated Crop–Livestock Systems

Integrating crop and livestock farming enhances resource utilization and ensures a steady supply of fodder. Crop residues such as wheat straw, rice straw, and maize stover can be used as feed, reducing wastage and improving farm sustainability. Intercropping fodder crops with main crops also maximizes land use efficiency.

3.5 Nutrient Management

Balanced fertilization improves fodder yield and quality. Application of organic manures and biofertilizers enhances soil fertility and supports sustainable production. Adequate nitrogen supply is particularly important for increasing biomass production in fodder crops.

Role of Technology and Government Initiatives

Technological advancements such as improved fodder crop varieties, hydroponic fodder production, and mechanized harvesting have enhanced fodder management practices. Hydroponic systems allow the production of green fodder in limited space and with minimal water, making them suitable for small-scale farmers.

Government schemes such as the National Livestock Mission (NLM) and Rashtriya Gokul Mission promote fodder development, pasture improvement, and livestock productivity. Training programs and subsidies for fodder cultivation and conservation techniques encourage farmers to adopt improved practices.

Challenges in Fodder Planning

Despite the availability of various strategies, several challenges hinder effective fodder planning. These include limited land availability for fodder cultivation, lack of awareness about conservation techniques, inadequate storage facilities, and financial constraints. Climate change and unpredictable weather patterns further exacerbate fodder shortages.

Future Prospects and Recommendations

To ensure fodder security, there is a need for integrated approaches combining improved crop varieties, efficient resource management, and technological innovations. Promoting community fodder banks and cooperative farming can help address land and resource limitations.

Strengthening extension services and farmer training programs is essential to improve awareness and adoption of best practices. Investment in research and development for high-yielding and drought-resistant fodder varieties will further enhance productivity.

Conclusion

Fodder planning for the summer season is critical for maintaining livestock productivity and ensuring economic sustainability for farmers. By adopting strategies such as selecting suitable fodder crops, conserving surplus fodder, and utilizing efficient irrigation methods, farmers can overcome seasonal shortages. Government support and technological advancements play a vital role in promoting these practices. A proactive and integrated approach to fodder management will not only improve livestock health and productivity but also contribute to the overall sustainability of the agricultural system.



Krishi Ujala

Role of Drones in Crop Monitoring and Spraying

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Abstract

Unmanned Aerial Vehicles (UAVs), commonly known as drones, are rapidly transforming modern agriculture by enabling precise, efficient, and data-driven farm management. Their application in crop monitoring and spraying has gained significant attention due to their ability to improve productivity while reducing input costs and environmental impact. This review paper explores the role of drones in agricultural monitoring and spraying, highlighting their advantages in real-time data collection, precision input application, and labor efficiency. It also discusses technological advancements, operational benefits, government initiatives, and existing challenges in drone adoption. The paper concludes that drones have the potential to revolutionize precision agriculture, though widespread adoption requires improved accessibility, training, and policy support.

Introduction

Agriculture is undergoing a technological transformation with the integration of advanced tools aimed at improving efficiency and sustainability. Among these innovations, drones have emerged as a powerful technology for precision farming. Equipped with high-resolution cameras, sensors, and GPS systems, drones provide farmers with real-time insights into crop health, soil conditions, and field variability.

Traditional farming practices often rely on manual observation and uniform application of inputs, which can lead to inefficiencies and resource wastage. In contrast, drone technology enables site-specific management, allowing farmers to monitor large areas quickly and apply inputs precisely where needed. In India, the use of drones in agriculture has gained momentum in recent years, supported by government initiatives and increasing awareness among farmers.

This review paper examines the role of drones in crop monitoring and spraying, their benefits, limitations, and future prospects in modern agriculture.

2. Drone Technology in Agriculture

Drones used in agriculture are typically equipped with advanced imaging systems such as RGB cameras, multispectral sensors, and thermal sensors. These technologies enable the

collection of detailed data on crop health, moisture levels, and pest infestations. Multispectral imaging allows the calculation of vegetation indices such as NDVI (Normalized Difference Vegetation Index), which helps in assessing plant health and detecting stress at early stages. Thermal sensors can identify water stress and irrigation needs, while GPS and mapping technologies enable accurate field surveys and data analysis.

Role of Drones in Crop Monitoring

3.1 Real-Time Crop Health Assessment

Drones provide high-resolution aerial images that help farmers monitor crop conditions in real time. They can detect variations in plant health, identify nutrient deficiencies, and locate areas affected by pests or diseases. Early detection allows timely intervention, reducing crop losses.

3.2 Precision Mapping and Field Analysis

Drone-based mapping enables the creation of detailed field maps, including topography, soil variability, and crop growth patterns. These maps assist in making informed decisions regarding irrigation, fertilization, and crop management.

3.3 Monitoring Irrigation and Water Stress

Thermal imaging and sensor data help identify areas with inadequate water supply. Farmers can optimize irrigation practices by targeting specific zones, thereby conserving water and improving crop performance.

Role of Drones in Crop Spraying

4.1 Precision Application of Inputs

Drones enable targeted spraying of fertilizers, pesticides, and herbicides, reducing chemical usage and minimizing environmental impact. Variable rate application ensures that inputs are applied only where needed, improving efficiency.

4.2 Time and Labor Efficiency

Compared to manual spraying, drones can cover large areas in a short time, significantly reducing labor requirements. This is particularly beneficial in regions facing labor shortage

4.3 Safety and Accessibility

Drone spraying reduces human exposure to harmful chemicals, improving safety for farm workers. It is also useful in difficult terrains, such as hilly areas or waterlogged fields, where traditional machinery cannot operate effectively.

Advantages of Drone Technology

- **Improved Efficiency:** Faster data collection and input application
- **Cost Reduction:** Lower labor and input costs
- **Environmental Sustainability:** Reduced chemical usage and runoff
- **Enhanced Decision-Making:** Data-driven farm management
- **Increased Productivity:** Better crop health and yield

Challenges in Drone Adoption

Despite their benefits, several challenges limit the widespread adoption of drones in agriculture. High initial investment costs, lack of technical knowledge, and regulatory restrictions are major barriers. Small and marginal farmers may find it difficult to afford drone technology without financial support.

Additionally, issues related to battery life, payload capacity, and weather conditions can affect drone performance. Data management and interpretation also require specialized skills, which may not be readily available in rural areas.

Government Initiatives and Policy Support

The Government of India has introduced several initiatives to promote drone usage in agriculture. Subsidies, training programs, and regulatory frameworks under the Drone Rules 2021 aim to encourage adoption. Programs supporting custom hiring centers allow farmers to access drone services without owning the equipment.

These initiatives play a crucial role in making drone technology more accessible and affordable for farmers.

Future Prospects

The future of drones in agriculture is promising, with ongoing advancements in artificial intelligence, machine learning, and automation. Integration with IoT devices and farm management systems will further enhance precision farming practices.

Development of low-cost drones and improved battery technologies will make them more accessible to small farmers. Increased awareness and training will also contribute to wider adoption.

Conclusion

Drones are revolutionizing crop monitoring and spraying by enabling precision agriculture and data-driven decision-making. Their ability to improve efficiency, reduce costs, and enhance sustainability makes them a valuable tool for modern farming. However, addressing challenges related to cost, awareness, and infrastructure is essential for widespread adoption. With continued technological advancements and policy support, drones are set to play a significant role in the future of agriculture, contributing to increased productivity and sustainable development.



Krishi Ujala

Smart Farming Tools for Small Farmers in 2026

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Abstract :

Smart farming technologies are transforming agriculture by enabling small farmers to make data-driven decisions, optimize resources, and improve productivity. In 2026, affordable tools such as IoT-based sensors, smart irrigation systems, mobile applications, drones, and automation kits are becoming increasingly accessible to smallholders. This review paper analyzes the role of these tools in enhancing efficiency, reducing costs, and improving sustainability in small-scale farming systems. It highlights key technologies, their applications, benefits, and adoption challenges. The paper concludes that smart farming tools, when combined with training and policy support, can significantly empower small farmers and strengthen climate-resilient agriculture.

Introduction

Agriculture in the 21st century is shifting from traditional practices to technology-driven systems known as smart farming or precision agriculture. For small farmers, who often operate with limited resources, adopting smart tools can significantly improve productivity and reduce input costs. Smart farming integrates technologies such as the Internet of Things (IoT), artificial intelligence (AI), sensors, and mobile-based advisory systems to enable real-time monitoring and decision-making.

Unlike conventional farming, which relies on generalized practices, smart farming focuses on precision—applying water, fertilizers, and pesticides only where needed. This is particularly important for small farmers, as efficient resource utilization directly impacts profitability. Recent advancements have made these tools more affordable and scalable, making them suitable even for marginal landholdings.

Key Smart Farming Tools for Small Farmers

2.1 Soil Sensors and Monitoring Devices

Affordable soil sensors are among the most impactful tools for small farmers. These devices measure soil moisture, temperature, and nutrient levels, enabling farmers to make informed decisions about irrigation and fertilization.

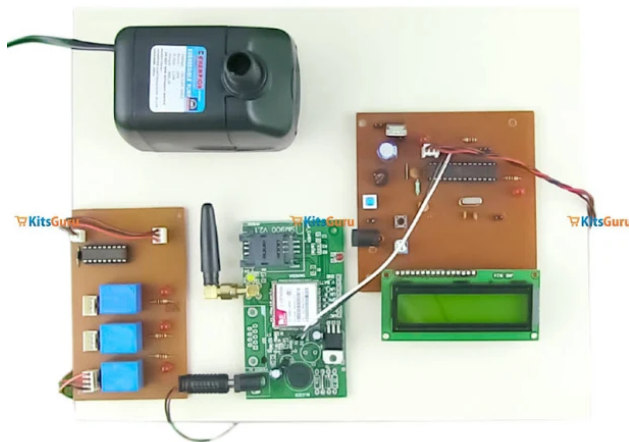


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IoT-enabled sensors continuously collect field data and help farmers avoid overwatering and excessive fertilizer use. This improves crop health while reducing costs and environmental impact.

2.2 Smart Irrigation Systems

Water management is critical, especially in regions facing scarcity. Smart irrigation systems automate watering based on real-time soil and weather conditions.



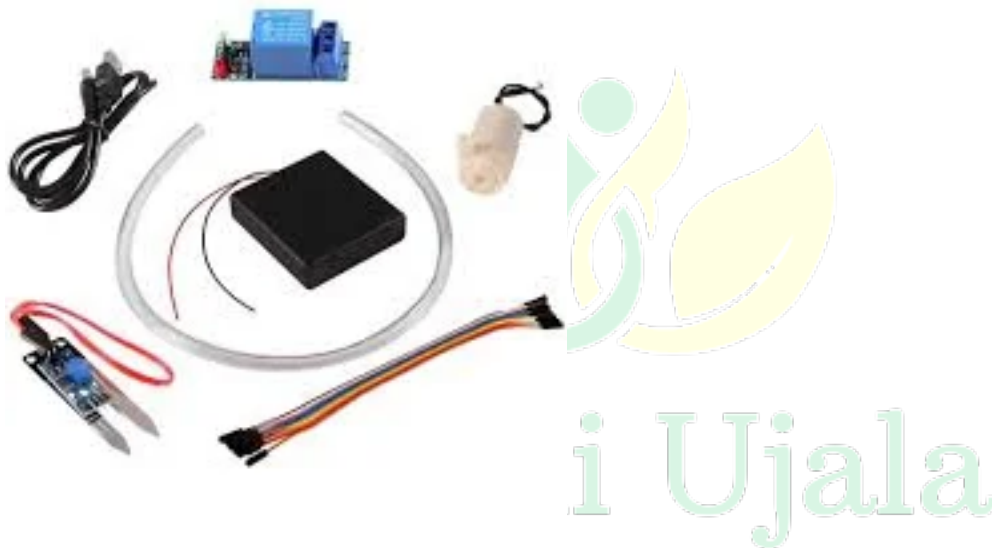
KitsGuru SMS Based Irrigation System · ₹2,999

GSM-based irrigation system allowing remote control of water supply via mobile phone.

These systems use sensors and automation to deliver precise amounts of water, reducing wastage and improving efficiency. Studies show such systems can significantly reduce water use while maintaining crop yield.

2.3 Low-Cost Automation Kits

Small farmers can start with simple automation kits that integrate sensors and pumps for automatic watering.



SP Electron Automatic Watering System Kit · ₹393

Budget-friendly DIY kit with moisture sensor and pump for automatic irrigation.

These entry-level tools are highly affordable and allow farmers to gradually transition into smart farming without heavy investment.

2.4 IoT-Based Smart Farming Systems

Advanced IoT systems combine multiple sensors with cloud-based monitoring and automation.



IoT Based Smart Crop Field Monitoring System · ₹22,727

Integrated system for monitoring soil, climate, and automating irrigation decisions.

Such systems enable real-time monitoring and predictive decision-making, improving efficiency and reducing risks.

Mobile Applications & Digital Advisory Tools

Smartphone-based applications provide weather forecasts, pest alerts, market prices, and crop advisory services. Apps like Kisan Suvidha and IFFCO Kisan act as digital assistants for farmers, enabling better planning and decision-making.

Drone and Remote Sensing Technologies

Although relatively advanced, drones are becoming accessible through custom hiring centers and cooperatives. They help monitor crop health, detect diseases, and apply inputs precisely.

Drone-based imaging and AI tools allow farmers to identify crop stress early and take corrective action, improving productivity and reducing losses.

Benefits of Smart Farming for Small Farmers

Smart farming tools offer multiple advantages:

- **Improved Productivity:** Real-time data helps optimize crop growth
- **Cost Reduction:** Precise input use reduces wastage
- **Water Conservation:** Smart irrigation minimizes water use

- **Climate Resilience:** Better adaptation to weather variability
- **Labor Efficiency:** Automation reduces manual work

These technologies allow small farmers to achieve higher yields with fewer resources, making agriculture more profitable and sustainable.

Challenges in Adoption

Despite the benefits, several barriers exist:

- High initial investment for advanced tools
- Lack of technical knowledge and training
- Limited internet connectivity in rural areas
- Resistance to adopting new technologies

Small farmers often require financial support, training programs, and demonstration models to build confidence in these tools.

Government Support and Initiatives

Governments are promoting smart farming through subsidies, training, and digital agriculture missions. Programs supporting micro-irrigation, digital advisory services, and agri-tech startups are helping farmers adopt modern tools. Collaborative models such as Farmer Producer Organizations (FPOs) and custom hiring centers make advanced technologies like drones more accessible.

Future Prospects

The future of smart farming for small farmers lies in:

- AI-driven decision support systems
- Low-cost sensor technologies
- Integration of IoT with mobile platforms
- Expansion of drone-as-a-service models
- Climate-smart agriculture practices

Emerging innovations are expected to make smart farming even more affordable and user-friendly.

Conclusion

Smart farming tools in 2026 are no longer limited to large-scale farms; they are increasingly accessible to small farmers. Technologies such as soil sensors, smart irrigation systems, mobile apps, and IoT-based monitoring are transforming agriculture into a data-driven, efficient, and sustainable system. While challenges remain, the combination of technological advancements, government support, and farmer awareness can accelerate adoption. Ultimately, smart farming represents a powerful pathway to enhance productivity, reduce costs, and ensure long-term sustainability for smallholder agriculture.



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