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Role of ICT in Enhancing Farmers' Decision-Making through Weather Forecasting

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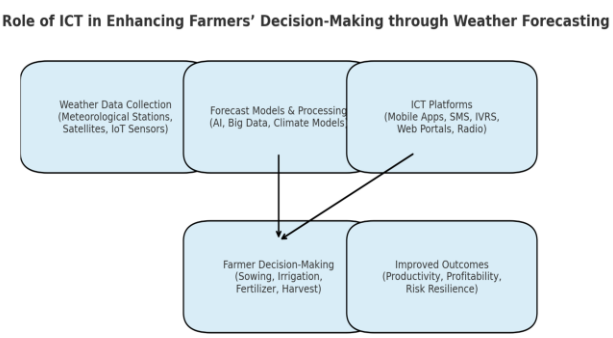
INTRODUCTION

Agriculture has traditionally been extremely weather-sensitive, including factors of rainfall, temperature, humidity, and wind. In light of growing impact of climate change, the number and intensity of extreme weather events like drought, floods, heatwaves, and storms have increased, rendering agriculture more uncertain and risky. Dependent traditional local experience and indigenous knowledge, though priceless, are no longer adequate to deal with the complex and ever-evolving climatic realities. Farmers nowadays need timely and accurate weather forecasts, along with actionable agro-advisories, to make informed judgments on dates of sowing, irrigation scheduling, application of fertilizers, management of pests and diseases, and harvest operations.

Emergence of ICT platforms has transformed the provision of weather-based information to farmer communities. Utilization of tools like mobile apps, SMS messaging, IVRS, community radio, and digital dashboards is making it easier to channel user-friendly information to farmers directly. By combining meteorological agency data, satellite data, and artificial intelligence (AI) predictive models, such ICT systems provide localized, context-specific, and actionable advice. Such ICT advisories have the potential to enhance farm-level decision-making and reduce losses and improve productivity as shown through initiatives in nations such as India through the Gramin Krishi Mausam Sewa (GKMS), mKisan portal, and ICT-based extension programs.



ICT Tools for Weather-Based Agro-Advisories

1. Mobile-Based Applications

Mobile apps are the most used ICT tool for disseminating weather-based advisories. These apps offer daily, weekly, and seasonal forecasts and crop-specific advice based on local agro-climatic conditions. GPS integration and location-based services guarantee highly localized forecasts to farmers, increasing the context of information. Some sophisticated applications include AI-based models, which support predictive analytics for pest and disease incidence.

2. SMS and Voice Services

Where smartphone penetration is low, SMS notifications and Interactive Voice Response Systems (IVRS) remain important means of providing weather information. Such tools enable farmers semi-literate and illiterate farmers to receive timely advisories in local languages. Voice advisories are especially effective among women farmers and older farmers who might have limited literacy or digital capabilities.

3. Web Portals and Digital Dashboards

For extension agents, scientists, and innovative farmers, web portals and dashboards provide connectivity to real-time weather maps, agro-climatic databases, and decision-support systems. These websites have in-depth analytics like rainfall anomaly maps, soil moisture indices, and seasonal outlook. Such tools not only assist individual farm-level decisions but also planning at district or state levels.

4. Radio and Community Networks

Community radios, farmers' field schools, and village knowledge centers are significant in filling the digital divide, particularly in geographically isolated areas. These mediums distribute localized weather forecasts and advisories in the local languages, so even those farmers who do not have smartphones or access to the internet can access them. Community-based dissemination also encourages trust-building and participatory learning among farmers.

5. Remote Sensing and IoT Integration

The convergence of remote sensing technologies, ground sensors, and IoT devices with ICT platforms has improved the accuracy and dynamism of weather advisories. To illustrate, soil moisture sensors, automated weather stations, and evapotranspiration sensors offer near real-time inputs, which are subsequently processed through ICT systems into actionable advisories. The convergence enables dynamic crop monitoring, precision irrigation scheduling, and early identification of stress zones, rendering weather advisories more accurate and farmer-oriented.

Impact on Farmers' Decision-Making

Incorporating ICT-enabled weather advisories in farming has greatly enhanced farmers' capacity to make optimal decisions at pivotal points in crop cultivation. The below points summarize the major impacts:

1. Sowing Decisions

Precise temperature and rainfall predictions allow farmers to coordinate sowing operations with improved weather conditions, thus providing better germination and establishment of seeds. This minimizes re-sowing risks caused by unpredictable rainfall and improves overall yield potential.

2. Irrigation Scheduling

Weather-based advisories help farmers maximize irrigation schedules and prevent unnecessary watering during predicted rainfalls. This results in a saving of significant amounts of water resources, electricity, and fuel, together with the avoidance of groundwater over-extraction.

3. Input Optimization

Application timing for fertilizers and pesticides can be coordinated with weather forecasts to reduce losses due to leaching, volatilization, or wash-off by rain. Precision in the use of inputs reduces the costs of production, enhances input use efficiency, and minimizes adverse environmental effects.

4. Risk Management

Extreme weather event forecasts, through alerts, enable farmers to take precautionary actions. These can be irrigation adjustments, the use of protective shelters, or crop covers. The farmers are then able to better protect crops, limit probable losses, and improve resilience to climatic volatility.

5. Harvest Planning

Timely weather advisories assist farmers in strategizing harvest operations, minimizing crop loss due to unseasonal rains, hailstorms, or storms. This also facilitates post-harvest management through ensuring that the produce is stored, dried, or transported under optimum conditions, hence quality and market value is preserved.

CONCLUSION

ICT has become a strong facilitator in converting weather forecasts into usable agro-advisories for farmers. Through enhancing decision-making in crop planning, input management, and risk reduction, ICT improves farm productivity and resilience. Its full potential, however, needs to be maximized by bolstering the strength of forecasts, making them localized and timely, and overcoming issues with digital access and awareness among farmers. As farming becomes increasingly climate-smart, ICT-enabled weather forecasting will be at the forefront of creating a sustainable and resilient agricultural future.

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