



CLIMATE SMART SOWING: TIMING YOUR CROP FOR MAXIMUM YIELD

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INTRODUCTION

Agriculture has always been closely linked with weather and climate. However, increasing climate variability, delayed monsoons, erratic rainfall, heat waves, and extreme weather events are challenging traditional crop management practices. Among the various agronomic decisions, sowing time remains the most critical and cost-effective adaptation strategy available to farmers. Sowing Time: A Weather-Sensitive Management Decision. Agrometeorology provides the scientific foundation to transition from traditional practices to "Climate Smart Sowing." This approach ensures that the most vulnerable and critical phases of a crop's development such as flowering and grain filling occur when environmental conditions (temperature, humidity, and solar radiation) are optimal, thereby maximizing productivity and minimizing climatic risks. Climate-smart sowing involves aligning crop planting dates with dynamic weather forecasts, thermal time requirements, and soil moisture availability. By adjusting crop calendars to shifting climatic patterns, farmers can dodge extreme heat, minimize pest pressures, and achieve significant yield gains.

Agrometeorological Parameters Governing Sowing Decisions

Soil Moisture Status: Adequate soil moisture is the primary prerequisite for successful crop establishment. In rainfed agriculture, sowing should ideally be undertaken after receiving sufficient rainfall to recharge the root zone rather than after isolated pre-monsoon showers and farmers guarantee optimal seed-to-soil contact and robust early root development.

Thermal Environment: Temperature governs seed germination, phenological development, and physiological processes measured in agrometeorology as Growing Degree Days (GDDs) or Thermal Time. Each crop has specific

thermal requirements that must be considered while selecting sowing dates. Proper timing ensures that sensitive stages such as flowering and grain filling occur within optimum temperature ranges. High temperatures during the reproductive or grain-filling stages severely impair pollen viability and accelerate leaf senescence, leading to shriveled grains and reduced yield.

Pest and Disease Disruption: The life cycles of agricultural pests and fungal pathogens are also dictated by temperature and humidity. Off-season or delayed sowing often overlaps with peak pest emergence. Shifting sowing dates disrupts this biological synchrony, reducing the need for synthetic pesticide applications.

Adapting to Shifting Monsoons and Weather Extremes: Climate change alters both the onset and intensity of monsoon patterns. Agrometeorologists utilize crop simulation models (e.g., DSSAT, APSIM) to analyze decades of weather data, predicting the "Length of Growing Period" (LGP). The concept of Length of Growing Period (LGP) is widely used in agrometeorology to determine suitable sowing windows. Matching crop duration with the available moisture period helps avoid terminal drought and ensures successful crop maturity. If a region is prone to delayed monsoons, climate-smart sowing dictates waiting for adequate moisture rather than sowing early into dry soil, which risks seed mortality. Conversely, in areas prone to early-season flooding, timely earlier sowing of a shorter duration variety allows the crop to establish a deep root system before waterlogging occurs.

Synchronizing Crop Phenology with Weather: One of the principal objectives of climate-smart sowing is to align critical crop growth stages with favourable weather conditions. Timely-sown wheat, for instance,

completes grain filling before the onset of high temperatures in spring. Similarly, kharif crops sown immediately after the establishment of monsoon rains are better positioned to utilize seasonal moisture and avoid early-season drought stress. This synchronization between crop phenology and weather conditions enhances radiation-use efficiency, water productivity, and ultimately crop yield.

Role of Weather Forecasts in Climate-Smart Sowing:

Advances in weather forecasting have transformed agrometeorological advisory services. Farmers now have access to short-range, medium-range, and seasonal forecasts that can guide sowing decisions. Weather-based sowing advisories provide information regarding: Expected rainfall events, Soil moisture conditions, Temperature trends, Dry spell probabilities, Monsoon onset forecasts. Such advisories enable farmers to reduce uncertainty and make scientifically informed planting decisions. Integrating Agromet Advisory Services (AAS). The success of climate-smart sowing hinges on actionable, localized data. Agrometeorological stations and modern Decision Support Systems (DSS) provide farmers with:

- **Medium and Long-Range Weather Forecasts:** Helping farmers identify the perfect 5-to-10-day window for sowing.
- **Soil Moisture Indices:** Using satellite data (like the NDMI) to calculate when fields hold enough moisture to support successful germination without over irrigation.
- **Contingency Planning:** Tailoring seed varieties (e.g., short-duration vs. long-duration) based on current seasonal climate forecasts.

Climate-Smart Sowing in Different Farming Systems

Rainfed Agriculture: In rainfed ecosystems, sowing should be linked with effective rainfall events that ensure adequate soil moisture for crop establishment. Contingency crop plans and short-duration varieties may be required when monsoon onset is delayed.

Irrigated Agriculture: In irrigated regions, temperature and seasonal weather outlooks become more important determinants of sowing schedules. Timely sowing helps crops

avoid heat stress and utilize available growing degree days efficiently.

Conservation Agriculture: Zero tillage and residue retention facilitate earlier planting by conserving soil moisture and reducing field preparation time. These practices have proven particularly beneficial in rice wheat systems where delayed wheat sowing is a recurring concern.

Agrometeorological Benefits of Climate-Smart Sowing

Improved germination and crop establishment, Efficient utilization of rainfall and irrigation water, Reduced exposure to climatic stresses, Better synchronization of phenological stages with favourable weather, Lower pest and disease incidence, Enhanced yield stability under variable climatic conditions, Improved resource-use efficiency and farm profitability.

Future Outlook

As climate change continues to reshape agricultural production environments, climate-smart sowing will become increasingly important. Integration of seasonal climate forecasts, remote sensing technologies, crop simulation models, and agrometeorological advisory services can support location-specific sowing recommendations and strengthen climate resilience in farming systems.

CONCLUSION

Climate-smart sowing represents a practical application of agrometeorological principles in modern agriculture. By aligning planting dates with prevailing and anticipated weather conditions, farmers can optimize resource utilization, minimize climatic risks buffer their crops against escalating climate volatility and improve crop productivity. In an era characterized by increasing climate uncertainty, weather-informed sowing decisions offer a powerful pathway towards resilient and sustainable agricultural production. "The first step towards a successful harvest is not the seed itself, but sowing it at the right time under the right weather conditions." Ultimately, timing crops strategically leads to the triple-win of increased productivity, enhanced agricultural resilience, and sustainable food security.

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