Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 04, Issue: 06 (NOV-DEC, 2024)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Meteorological Parameters and Groundwater Quality Influence Paddy Yield: Insights from MIT College of Agriculture and Technology

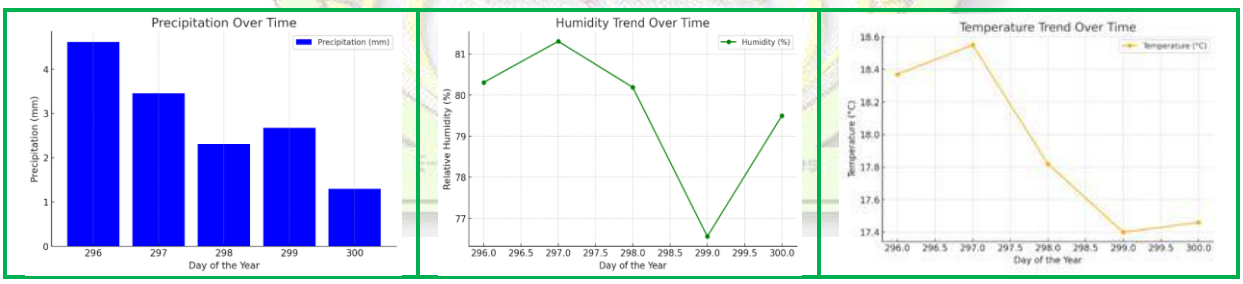
(*Er. M. Ravanashree, Mr. B Balamurali, Dr. S. Ashokh Aravind and Ms. P. Abirami)
Asst. Professor, MIT College of Agriculture and Technology, Musiri, Trichy, Tamilnadu
*Corresponding Author's email: ravanashree.m@mitcat.ac.in

Paddy cultivation is highly sensitive to both meteorological conditions and the quality of water used for irrigation. Understanding how these factors interact is essential for ensuring optimal crop productivity. On **October 28, 2024**, the MIT College of Agriculture and Technology initiated a paddy transplantation project. Using meteorological data collected from NASA POWER and groundwater quality measurements**,** From PWD Government of Tamilnadu we can analyse their combined impact on yield potential and identify strategies to mitigate risks.

Meteorological Parameters Impacting Paddy Growth

The initial weather conditions during and after transplanting provide insights into how the crop will develop.

Day of the Year	Temperature (°C)	Humidity (%)	Rainfall (mm)
296	18.37	80.31	4.62
297	18.55	81.31	3.46
298	17.82	80.19	2.31
299 (Transplant Day)	17.40	76.56	2.67
300	17.46	79.50	1.30



1. Temperature and Its Influence

- **Observed Range:** 17.4°C to 18.55°C
- **Impact:** Slightly cooler temperatures can slow early growth but reduce water loss, minimizing the risk of transplanting shock. Ideal temperatures for paddy are between 20°C-30°C, suggesting some delay in initial development.

2. Humidity and Its Benefits

- **Observed Range:** 76.56% to 81.31%
- **Impact:** High humidity reduces water stress and prevents excessive transpiration. However, it may also increase the risk of fungal infections if not managed properly.

3. Rainfall and Irrigation Needs

- **Observed Range:** 1.3 mm to 4.62 mm
- **Impact:** Moderate rainfall on the transplant day ensures moisture retention in the soil, critical for seedling establishment. However, continued irrigation will be essential if rainfall remains low.

Groundwater Quality and Its Role in Paddy Cultivation

Groundwater used for irrigation plays a crucial role in crop productivity. Below are the groundwater parameters observed at MIT College, along with their potential impact on paddy yield.

Parameter	Value	Impact on Paddy Yield
TDS (Total Dissolved Solids)	604 mg/L	High TDS can induce salinity stress; values below 1000 mg/L are manageable.
NO_2 + NO_3 (Nitrate)	3 mg/L	Essential for growth but excessive levels can disrupt nutrient balance. Safe within this range.
Calcium (Ca)	32 mg/L	Supports root health and structural strength of plants.
Magnesium (Mg)	37.67 mg/L	Aids photosynthesis; excess can interfere with calcium uptake.
Sodium (Na)	135 mg/L	High sodium can reduce soil permeability and cause toxicity.
Chloride (Cl)	191 mg/L	Elevated chloride can lead to toxicity, especially in saline environments.
pH	8.3	Slightly alkaline; may restrict nutrient availability.
EC (Electrical Conductivity)	1080 µS/cm	High EC indicates saline water, which may stress paddy growth if not managed.
SAR (Sodium Absorption Ratio)	3.83	Indicates moderate sodium hazard.
Na% (Sodium Percentage)	54.25%	High sodium content could impair soil structure, reducing crop yield.

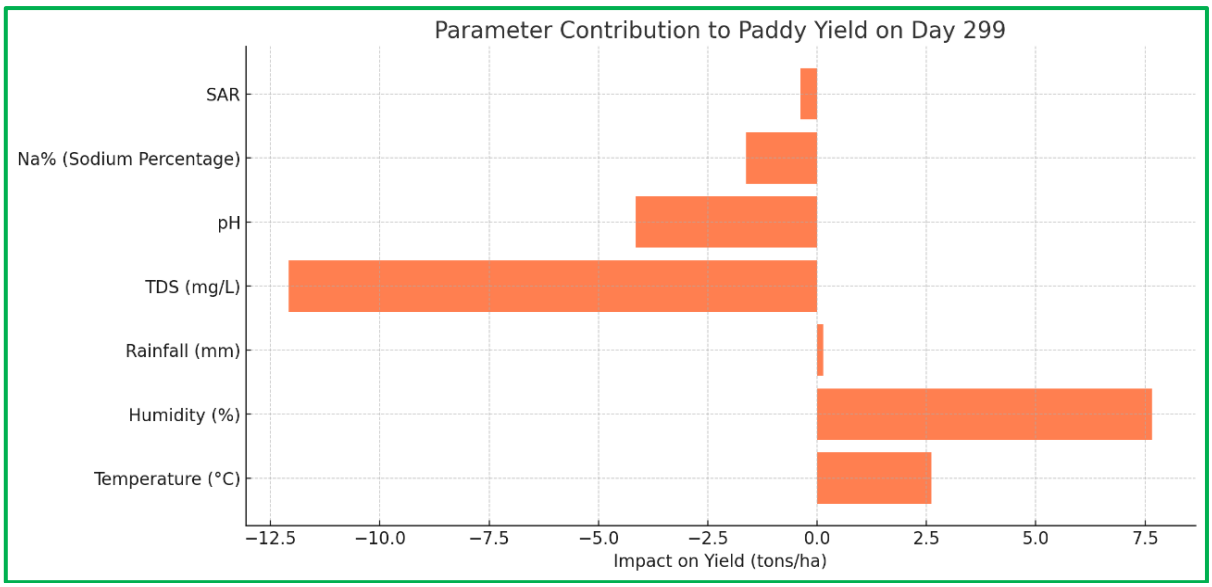
Location of Study Field

Integrating Meteorological and Groundwater Factors for Yield Prediction

The combination of **cool temperatures, high humidity, and moderate rainfall** supports early crop growth. However, challenges arise from **groundwater salinity and alkalinity**, as indicated by high **TDS, Na%, and pH** levels. Below is the impact of individual parameters on yield.

Impact Plot: Parameter Contribution to Paddy Yield

The plot reveals the positive influence of temperature, humidity, and rainfall but highlights the negative impact of **TDS, sodium percentage, and SAR** on crop yield. Without active management, these factors could reduce soil permeability and hinder water absorption by the plants.



Irrigation Techniques to Manage Salinity and Improve Yield

To mitigate the risks associated with salinity and high sodium content, the following irrigation techniques are recommended:

1. Leaching with Freshwater

- Flush salts out of the root zone by applying excess water.
- Use rainwater or low-EC water to avoid further salinization.

2. Alternate Wetting and Drying (AWD)

- Periodically flood and drain the field to reduce water usage and prevent salt buildup.

3. Drip Irrigation with Fertigation

- Deliver water and nutrients directly to the root zone, minimizing salt movement and improving nutrient uptake.

4. Flood Irrigation with Controlled Drainage

- Maintain standing water to dissolve salts but periodically drain the field to prevent long-term waterlogging.

Conclusion: Key Takeaways for Sustainable Paddy Cultivation

The analysis shows that **early weather conditions are favorable**, but challenges from **salinity, sodium content, and high pH** in the groundwater could limit crop potential. To ensure a healthy yield, **proactive irrigation management** and **soil amendments** will be essential throughout the crop cycle.

In summary

1. **Cool temperatures and high humidity** support seedling establishment.
2. **Moderate rainfall** meets initial water needs but requires follow-up irrigation.
3. **High sodium content and salinity hazards** demand regular leaching and soil monitoring.
4. **Slightly alkaline pH** may limit nutrient availability, requiring soil pH management.

By balancing these factors through **weather monitoring and irrigation management**, the MIT College of Agriculture and Technology can ensure a successful paddy harvest.This study underscores the importance of **integrated weather and water management** for sustainable agriculture. Continuous data collection and analysis will further optimize the yield in future crop cycles. If needed, predictive models can be built with real-world data to refine these estimates and strategies.