# KABANDA ARTHUR 23/U/08510/PS

# Precision Agriculture Data Analysis Report

## 1. Correlation Analysis Results

### 1.1 Fertilizer Recommendations Analysis

**Primary Finding:** Soil pH demonstrates the strongest positive correlation (0.086) with fertilizer recommendations.

**Key Insights:**

* Higher soil pH values tend to require more fertilizer application
* Alkaline soils may need additional nutrient supplementation
* Soil moisture shows minimal influence with very weak negative correlation (-0.0017)

### 1.2 Irrigation Recommendations Analysis

**Correlation Rankings:**

1. **Soil pH:** 0.037 (highest correlation)
2. **Temperature:** 0.024 (slight positive correlation)
3. **Soil moisture:** 0.018 (surprisingly weak positive correlation)

**Critical Finding:** Current irrigation systems may not be optimally responsive to actual soil moisture levels.

### 1.3 Environmental Variable Interactions

* **Temperature and Humidity:** Moderate positive correlation (0.032)
* **Soil Moisture and Soil pH:** Very weak negative correlation (-0.0064)
* Most environmental variables show weak intercorrelations, indicating relative independence

## 2. Critical Insights

### 2.1 Fertilizer Management Priorities

* Soil pH is the primary driver for fertilizer recommendations
* Current algorithms prioritize pH correction over moisture-based nutrition
* Weak soil moisture correlation suggests missed opportunities for moisture-responsive fertilization

### 2.2 Irrigation System Inefficiencies

* **Counterintuitive finding:** Soil moisture has only weak correlation with irrigation recommendations
* Irrigation systems may not adequately respond to actual soil moisture conditions
* pH influence on irrigation indicates potential over-reliance on indirect soil health indicators

### 2.3 Environmental Independence

* Low correlations between variables suggest good environmental diversity
* This independence enables more precise, variable-specific management strategies

## 3. Data Analysis Results

### 3.1 Crop Performance Analysis

**Question:** Determine the crop type with the highest average soil moisture.

**Result:**

* **Crop Type:** Wheat
* **Highest Average Soil Moisture:** 47.36%

## 4. Recommendations

### 4.1 Immediate Actions

#### Optimize Irrigation Algorithm

* **Strengthen moisture-responsive irrigation:** Increase soil moisture weight in decision-making
* **Investigate pH-irrigation relationship:** Determine why pH has stronger influence than moisture
* **Implement dynamic thresholds:** Adjust irrigation triggers based on real-time soil moisture readings

#### Enhance Fertilizer Management

* **Maintain pH-focused approach:** Continue prioritizing soil pH in fertilizer recommendations
* **Integrate moisture considerations:** Develop moisture-adjusted fertilizer protocols for water-soluble nutrients
* **Create pH-specific fertilizer blends:** Develop targeted compositions for different pH ranges

#### Temperature-Based Adjustments

For crops experiencing temperatures above 30°C:

* Increase irrigation frequency due to higher evapotranspiration rates
* Adjust fertilizer timing to cooler periods to reduce nutrient volatilization
* Monitor humidity levels to optimize water application using temperature-humidity relationships

### 4.2 Long-term Strategic Improvements

#### Integrated Decision-Making System

* Develop algorithms considering multiple variables simultaneously
* Implement machine learning models to capture non-linear relationships

#### Data Collection Enhancement

* Increase sampling frequency for variables with weak correlations
* Add soil health indicators (organic matter, nutrient levels)
* Implement real-time monitoring systems

#### Zone-Based Management

* Create management zones based on pH ranges
* Develop crop-specific recommendation algorithms
* Implement precision application technologies

## 5. Irrigation Management for Temperature Conditions(300C)

### 5.1 Timing Optimization

**Best Practices:**

* Water early morning (before sunrise) or late evening
* Reduces water loss through evaporation
* Allows better water absorption
* **Avoid:** Midday irrigation when evaporation rates peak

### 5.2 Irrigation Methods and Adjustments

* **Frequency:** Increase irrigation frequency with moderate volumes per session
* **Method:** Implement drip irrigation for direct root zone hydration
* **Monitoring:** Maintain recommended daily water requirements

### 5.3 Crop-Specific Recommendations

#### Leafy Vegetables (Lettuce, Spinach)

* **Frequency:** 2-3 times per day
* **Soil Moisture Target:** 80-90% of field capacity

#### Fruiting Crops (Tomatoes)

* **Water Application:** 30-35 mm every 2-3 days
* **Additional Measure:** Use mulching to retain soil moisture

#### Cereal Crops (Wheat, Maize)

* [Specific recommendations to be developed based on crop requirements]

### 5.4 Additional Protective Measures

* Install shade nets to reduce direct sun exposure
* Use wind breaks to reduce evapotranspiration
* Consider temporary protective structures during peak heat periods

### 5.5 Water Conservation Techniques

* Implement deficit irrigation during less critical growth stages
* Use precision irrigation systems
* Maintain irrigation systems to prevent leaks and ensure uniform distribution