Literature Survey

Weekly Date

2/9/24 to 7/9/24

Several studies focus on optimizing fertilizer use for better yield. Zhang et al. (2015) emphasized the need for nitrogen use efficiency but offered no technical solution. Tilman et al. (2011) discussed sustainable agriculture but lacked AI-based approaches. Sudharsan et al. (2021) used ML models like Random Forest for fertilizer prediction based on soil data, but accuracy depended on dataset quality. Rajalakshmi and Palanisamy (2019) built a decision tree-based system with limited scalability. Gahlot et al. (2020) integrated IoT and ML for real-time data, though costly to implement. Kumar et al. (2018) applied fuzzy logic but needed manual rule updates. FAO (2022) stressed balanced fertilizer use but lacked implementation. Narayana et al. (2022) reviewed AI in agriculture without specific models.

These systems often lack real-time adaptability, multi-crop support, and environmental integration. Our project addresses these gaps using AI/ML to predict fertilizer needs effectively and sustainably.

Review of Existing Systems

Sr. No.	Existing System	Key Features	Techniques Used	Limitations
1	e-Krishi Platform (India)	Provides agricultural advice including fertilizer recommendations	Rule-based expert system	Not customized; generalized recommendations without real-time soil data
2	Nutrient Expert® (CIMMYT and IPNI)	Decision support tool for nutrient management, especially in maize and rice crops	Rule-based algorithms, basic input data	Limited to specific crops; static models; needs frequent manual updates
3	Smart Fertilizer Management System (SFMS)	Helps in fertilizer scheduling and management based on soil tests	Database querying + simple optimization	No AI/ML-based learning; lacks dynamic adaptability to varying field conditions
4	Krishi Network App	Mobile app offering expert advice to farmers, including fertilizer tips	Community-based suggestions, Chat support	Fertilizer advice is generic; lacks AI-based prediction personalization
5	Farmrise App (by Bayer)	Personalized crop advisories including fertilizer scheduling	Data aggregation and basic recommendation systems	Limited AI capabilities; recommendations not deeply predictive or soil-specific

Limitations of Existing Systems

- Generalized Recommendations:
  Most existing systems provide fixed fertilizer advice based on standard crop types and seasons. They do not adapt to real-time soil conditions, weather variability, or specific farm conditions.
- Lack of AI/ML Predictive Modelling:
  Few systems use modern Machine Learning models that learn from historical patterns and predict dynamic fertilizer needs accurately.
- Crop Specific Restrictions:
  Tools like Nutrient Expert are limited to only certain crops (mainly maize and rice), which restricts scalability for other crops.
- Poor Soil Data Integration:
  Many platforms do not integrate soil health data (NPK levels, pH, organic carbon content) effectively for fertilizer recommendation.
- Static Systems:
  Systems are mostly static — any change in climate, pest infestation, or sudden soil degradation is not reflected dynamically in their advice.
- User-Friendliness Issues:
  Some apps and portals are complex for rural farmers to operate easily; many farmers prefer simple, clear, and personalized suggestions.
- No Real-Time Recommendations:
  Real-time environmental factors like rainfall prediction, soil moisture, and temperature are not considered dynamically for fertilizer planning.