

SeedSense: Machine Learning-Based Seed Recommendation System Using District, Soil and Climate Intelligence

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Abstract: Agriculture has always been the backbone of India's economy, and within the country, Maharashtra stands out as one of the most agriculturally significant yet geographically complex states. The diversity in its soil composition, rainfall distribution, and seasonal climate across districts makes seed selection an inherently local problem — what grows well in Amravati may fail entirely in Ratnagiri. Despite this reality, most farmers today still rely on generalized seed recommendations that do not account for where they actually farm or what their soil actually looks like. This paper presents SeedSense, a machine learning-based web application designed to bridge exactly this gap. The system accepts six inputs from the farmer — district, soil type, season, temperature range, rainfall, and soil pH — and returns the top three seed recommendations, each accompanied by a confidence level, an estimated Return on Investment (ROI), and a detailed fertilizer advisory. Two machine learning models were trained and rigorously compared: Random Forest and XGBoost. XGBoost emerged as the stronger performer, achieving 89.3% test accuracy compared to Random Forest's 85.4%, and also demonstrated better generalization with a smaller gap between training and testing accuracy. The system is built on a four-layer modular architecture using Python, Flask, HTML, and CSS. A three-tier rule-based fallback mechanism ensures that the system always returns a recommendation, even for input combinations not well represented in the training data. To make the tool genuinely accessible to rural farmers, the system supports bilingual output in both English and Marathi.

Keywords: SeedSense, Machine Learning, Seed Recommendation, Random Forest, XGBoost, Precision Agriculture, Maharashtra, Soil Type, Rainfall, Fertilizer Advisory, ROI, Flask, Bilingual, Marathi, District-wise Farming, Rule-based Fallback

