

Abstract

Cotton cultivation in Southern Tamil Nadu faces persistent productivity challenges due to delayed detection of leaf diseases, pest infestations, and climate-induced crop stress, resulting in severe yield instability and financial losses for farmers. Across major cotton-growing districts such as Madurai, Virudhunagar, Ramanathapuram, Sivaganga, Theni, and Dindigul, more than 60–70% of small and medium farmers depend on manual field inspection conducted once in 7–10 days, which is insufficient to identify early-stage infections. Innovera Innovation Private Limited, actively engaged in both agricultural technology development and direct cotton cultivation, has experienced these challenges through continuous field operations and farmer interactions. Field assessments indicate that initial disease symptoms typically remain undetected for 5–7 days, during which infections spread to nearly 40–50% of plants under high temperature (34–38°C) and humidity (70–85%) conditions prevalent in the region. As a result, average yields decline from 18–22 quintals per acre under normal conditions to 11–14 quintals per acre during affected seasons, leading to revenue losses of ₹18,000–₹30,000 per acre. In response to disease outbreaks, pesticide usage increases by approximately 20–25%, raising input costs and accelerating soil nutrient degradation. Nearly 75% of associated farmers rely on experience-based judgment rather than scientific diagnosis, resulting in delayed intervention and inconsistent crop management. Existing digital agriculture solutions remain inaccessible to most cultivators due to high costs, technical complexity, and lack of customization for regional cotton varieties and rural user conditions. Consequently, crop management remains largely reactive, with corrective measures implemented only after visible damage has occurred. There is therefore a critical need for an affordable, user-friendly, and mobile-based intelligent application that enables farmers to upload crop images, receive instant disease identification, access localized advisory services, and support data-driven decision-making. Implementation of such an application is expected to reduce disease-related yield losses by 30–40%, decrease pesticide dependency by 15–20%, improve fiber quality, and enhance income stability and environmental sustainability for cotton farmers in Southern India.