Weather-guided late blight management:

Reconciling potato production with environmental health in Rwanda

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OBJECTIVE

Climate change increases weather variability in Rwanda, forcing farmers to rely on routine fungicide applications for late blight *(Phytophthora infestans)* control, leading to chemical overuse and environmental concerns.

Research Question

Can a real-time weather-guided Decision Support System (DSS) maintain potato yields while significantly reducing fungicide applications and environmental impact in Rwanda's diverse landscapes?

METHODS

System Design:

- Automated weather stations and LoRaWAN IoT weather sensors
- SIMCAST Late Blight disease model integration
- Real-time disease management recommendations based on risk index

Field Trials:

- On-farm trial across altitude transect: Nyange (1450m) to Kinigi (2400m)
- 4 potato varieties with varying resistance levels – Twihaze (Resistant), Ndamira (Susceptible), Kirundo (Mid Resistant) and Cyerekezo (Mid Resistant)
- Comparison: Weekly Routine vs Weather-guided applications

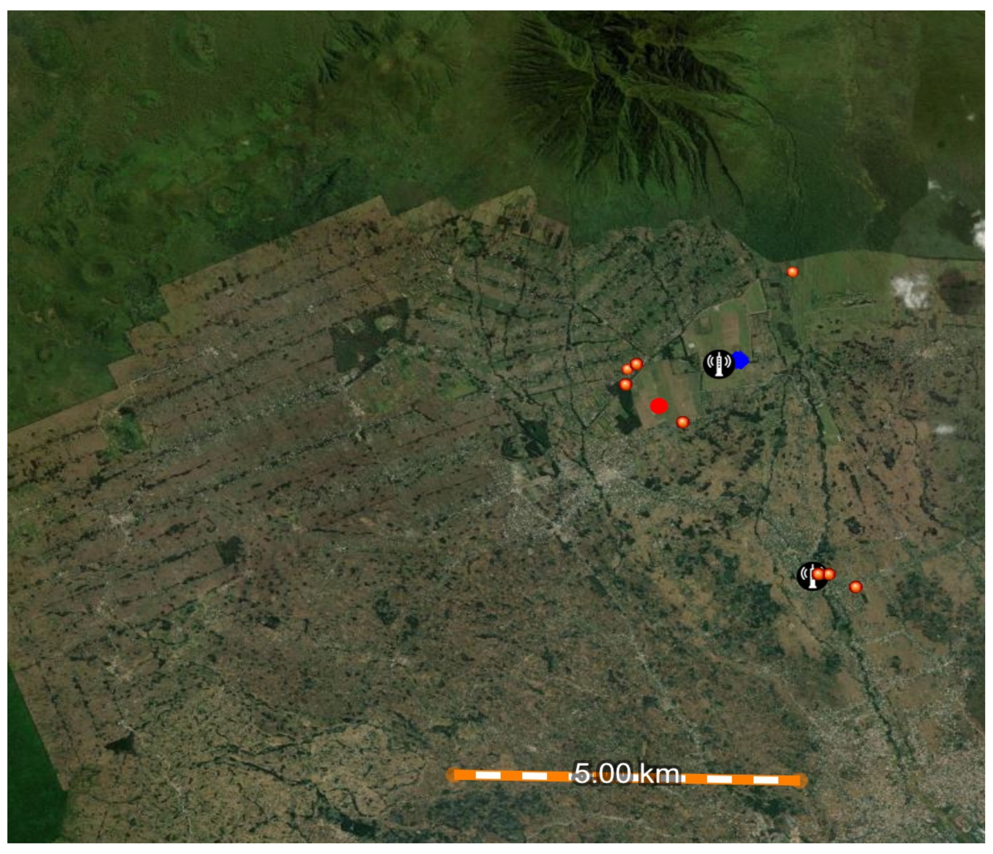
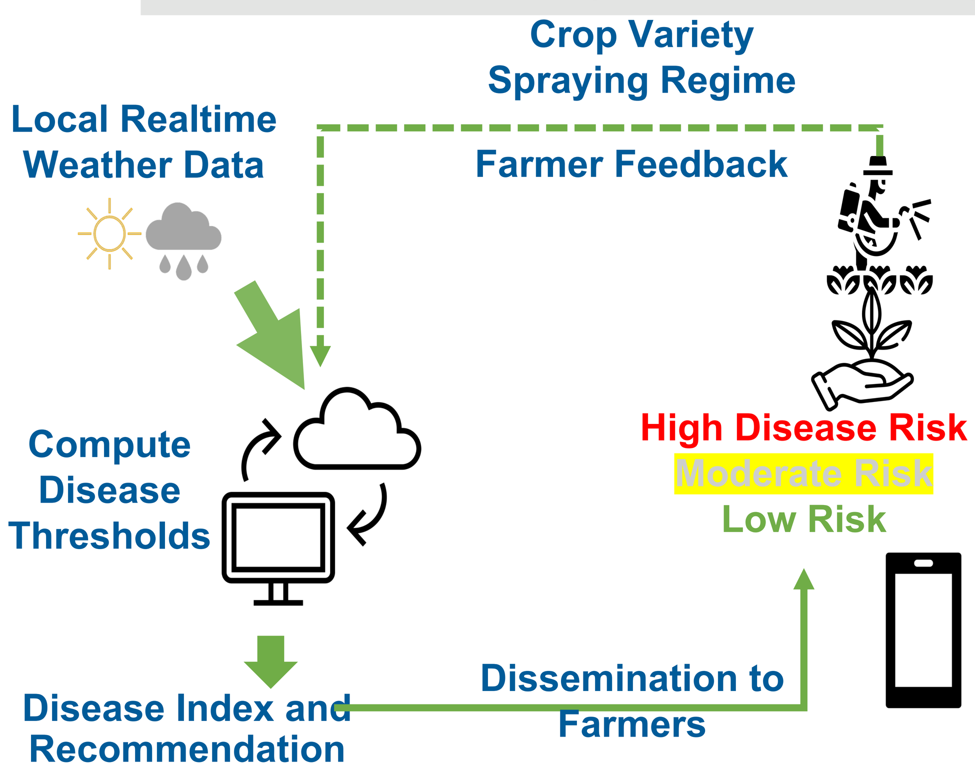


Fig. On-farm trial altitude transect in Nyange Sector (1450m) to Kinigi Sector (2400m), Musanze District, Rwanda



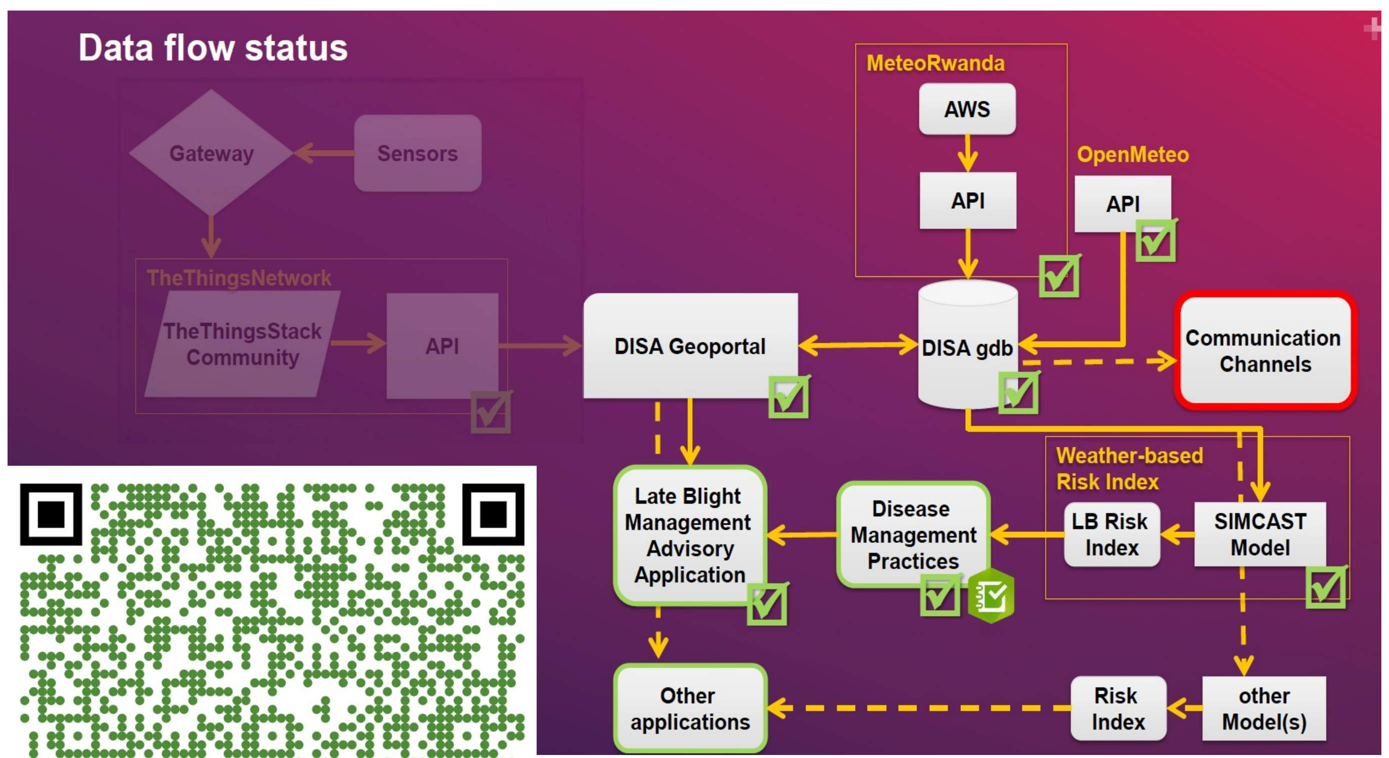


Fig. Information flow scheme for the Late Blight DSS and a live map of blight units (QR)

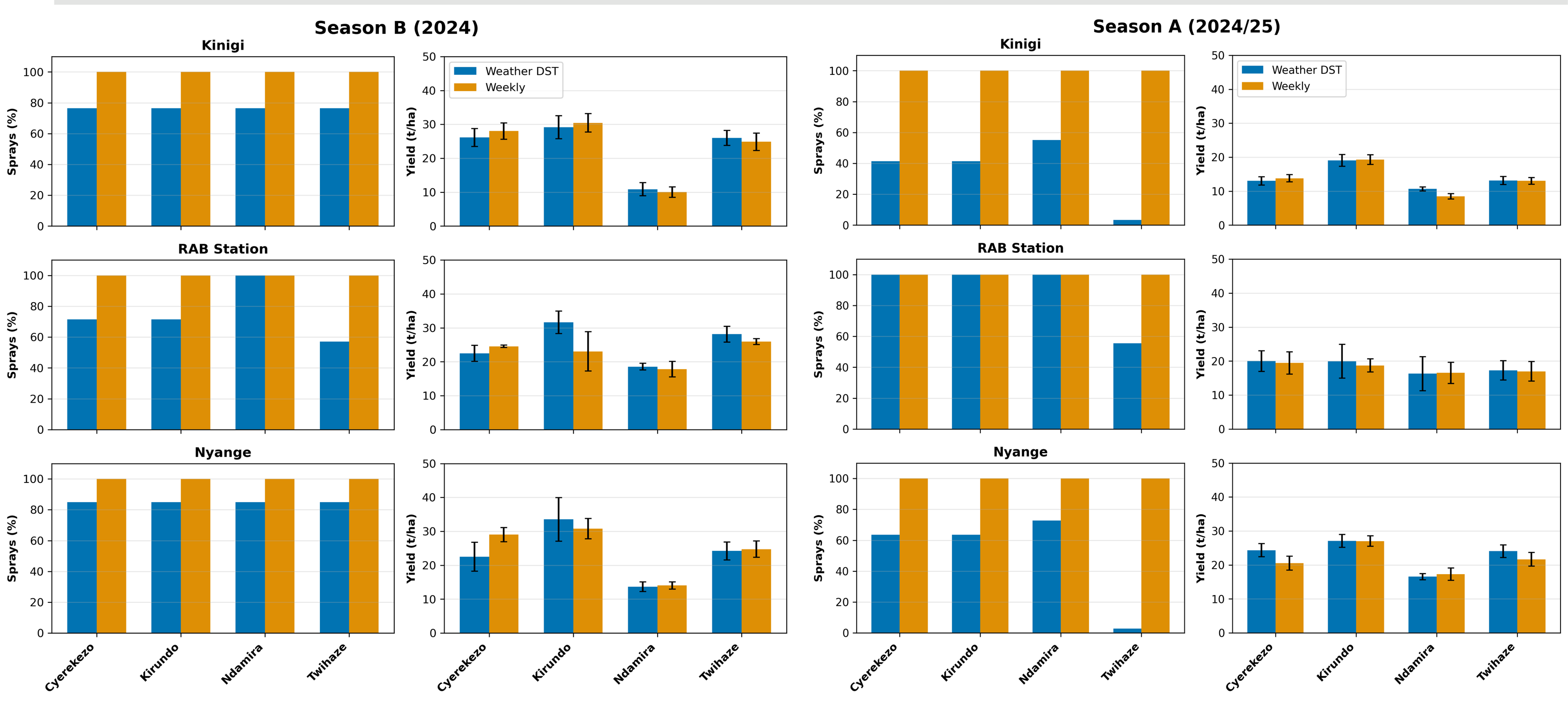
KEY RESULTS

Fungicide Reduction:

- 10-90% reduction in applications depending on variety resistance level
- Susceptible varieties: up to 50% reduction at some locations
- Resistant varieties achieved maximum savings (up to 6 fewer sprays)

Yield Performance:

- ✓ No significant yield losses under DSS management
- ✓ Variety-specific optimization across altitude gradients



Estimation of Economic Benefits and EIQ

INPUT COSTS

Input	Rate	Unit Cost	Cost per Ha
Ridomil	2.5 units/ha	30,000 RWF/unit	75,000 RWF/ha
Mancozeb	2.5 units/ha	7,000 RWF/unit	17,500 RWF/ha
Labour	8 units/ha	3,000 RWF/unit	24,000 RWF/ha

COST SAVINGS BY VARIETY & DISEASE PRESSURE

Variety Resistance	Moderate LB Index	Severe LB Index	Sprays Reduced
Susceptible	140,500 RWF/ha	70,250 RWF/ha	1-2 sprays
Moderately Resistant	210,750 RWF/ha	140,500 RWF/ha	2-3 sprays
Resistant	421,500 RWF/ha	210,750 RWF/ha	3-6 sprays

ENVIRONMENTAL IMPACT QUOTIENT (EIQ)

Variety Resistance	Moderate Disease	Severe Disease	EIQ Reduction (%)
	Weekly → Weather	Weekly → Weather	
Susceptible	530 → 398	663 → 582	12-25%
Moderately Resistant	530 → 317	663 → 530	20-40%
Resistant	530 → 133	663 → 368	44-75%

CONCLUSIONS

This research highlights a practical, climate-smart solution that combines real-time data and ecological principles to reduce chemical footprints, support smallholder resilience, and reconcile agricultural productivity with environmental sustainability in vulnerable ecosystems.

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