



Smart Agriculture and Precision Farming: Crop Sensing, Smart Irrigation and Farm AI



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Introduction:

Smart agriculture and precision farming investments often stall at the pilot stage: sensors are installed without a sampling plan, drone images are collected but never turned into prescriptions, irrigation still runs on fixed schedules and AI tools are bought before the farm's data is usable. Crop yields, water productivity and input costs then barely move. This Core Concept course trains farm and agtech practitioners to read soil and crop data, apply remote sensing and variable-rate inputs, schedule irrigation, run hydroponic systems and judge AI use cases. Participants produce a Farm Digitalisation Roadmap and Business Case.

Course Objectives:

- Interpret crop growth stages and soil test results to set a data baseline for each field, block or greenhouse
- Convert GNSS, yield monitor, satellite and drone imagery layers into management zones and variable-rate prescriptions
- Schedule irrigation and fertigation from crop evapotranspiration and soil moisture readings to raise water productivity in hot, dry conditions
- Select and operate hydroponic and controlled-environment systems by monitoring nutrient solution and greenhouse climate parameters
- Evaluate AI yield prediction and image-based pest and disease detection tools against field data before relying on them
- Build a Farm Digitalisation Roadmap and Business Case that sequences technologies, soil health practices and climate-smart targets

Target Audience:

- Managers responsible for day-to-day crop production on open-field farms, orchards and date plantations
 - Agricultural and irrigation engineers responsible for water systems, machinery and field equipment
 - Greenhouse and hydroponic operations leads responsible for protected-cropping output and quality
 - Agtech deployment and farm data staff responsible for sensors, platforms and digital tools on farms
 - Agricultural development programme officers responsible for technology adoption and extension projects
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Course Outline:

Day 1: Smart Farming Foundations: Crop, Soil and Farm Data Baseline

- Crop Growth Stages and Yield-Limiting Factors for Data-Driven Decisions
- Soil Texture, Organic Matter, Salinity and Nutrient Test Interpretation
- Smart Agriculture Technology Stack: Sensing, Connectivity, Platforms and Machinery
- FAO Climate-Smart Agriculture Objectives: Productivity, Resilience and Emissions
- Farm Digital Readiness Baseline: Fields, Equipment, Records and Skills

Day 2: Precision Agriculture Architecture: Positioning, Remote Sensing and Variable Rate

- GNSS Guidance, Auto-Steer and Field Boundary Mapping
- Satellite and Drone Multispectral Imagery and NDVI Map Interpretation
- Yield Monitor Calibration and Yield Map Cleaning
- Management Zone Delineation from Soil, Yield and Imagery Layers
- ISO 11783 ISOBUS Task Controller and Variable-Rate Prescription Files

Day 3: Smart Irrigation, Fertigation and Controlled-Environment Production

- Crop Evapotranspiration and Crop Coefficient Irrigation Scheduling
- Soil Moisture Probe Placement and Irrigation Trigger Thresholds
- Fertigation Programme Design and Water Productivity per Cubic Metre
- Hydroponic System Selection: NFT, Deep Water Culture, Ebb and Flow and Aeroponics
- Nutrient Solution EC, pH and Dissolved Oxygen Monitoring with Greenhouse Climate Control

Day 4: Farm Data Platforms, AI Use Cases, Soil Health and Technology Risk

- Farm Management Information System Selection and Data Interoperability Checks
- Machine Learning Yield Prediction: Input Layers, Validation and Error Review
- Image-Based Pest and Disease Detection and Crop Scouting Alert Rules
- Regenerative Soil Health Practices: Cover Crops, Reduced Tillage and Soil Carbon Monitoring
- Agtech Failure Modes: Sensor Drift, Coverage Gaps, Data Ownership and Vendor Lock-In

Day 5: Farm Case Work and the Digitalisation Roadmap

- Case Study: Open-Field Cereal Farm Moving to Variable-Rate Fertiliser
 - Case Study: Date Palm and Vegetable Farm Converting to Sensor-Led Drip Irrigation
 - Case Study: Hydroponic Greenhouse Using AI Disease Alerts
 - Farm Digitalisation Business Case: Technology Cost, Water and Input Savings and Yield Gain
 - Farm Digitalisation Roadmap Drafting and Peer Challenge Panel
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Skills You Will Gain:

- Soil and Crop Data Interpretation
- Remote Sensing Analysis
- Variable-Rate Prescription Design
- Irrigation Scheduling
- Hydroponic System Management
- Farm Data Platform Evaluation
- Agricultural AI Validation
- Farm Digitalisation Planning

Why Attend This Course:

- Return with a Farm Digitalisation Roadmap and Business Case built around fields, greenhouses or programmes you manage
- Question agtech supplier claims on sensors, drones and AI accuracy using your own field and yield data
- Use less irrigation water and fertiliser per tonne harvested by acting on moisture, imagery and zone data
- Compare farm technology practice with peers from commercial farms, greenhouse operators, agtech firms and development programmes

Conclusion:

Farm technology pays back only when soil, crop, water and machine data lead to a field decision. The five days move from crop and soil fundamentals, through GNSS, remote sensing, management zones and ISOBUS prescriptions, to evapotranspiration-based irrigation, fertigation and hydroponic production. They then examine farm data platforms, AI yield and disease tools, soil health practices and the ways agtech fails, and close with case work that produces a Farm Digitalisation Roadmap and Business Case.
