OYO AI

USE CASE

USE CASE · GREENHOUSE MANAGEMENT

From crop plan to invoice

Twenty use cases for a commercial greenhouse running on OYO AI, organised by phase: crop planning, task execution, environmental monitoring, harvest and lots, sales, finance, compliance, analytics, water and energy, workforce. Each one carries its actors, preconditions, main flow, alternative flows, postconditions and the rules it enforces.

INDUSTRY

Greenhouse and controlled-environment agriculture

SCOPE

20 use cases · 10 modules · 7 personas

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1 How to read this document

Each use case maps to one feature of the system. The main flow gives the happy path; the alternative flows give the edge cases the system must handle; the postconditions say what is true afterwards.

The template

Line	What it answers
ID and name	The use case, numbered in the order of the release plan.
Primary actor	The persona who starts it.
Secondary actors	Who else is involved, including the system when it acts on its own.
Preconditions	What must already exist, or the screen will refuse.
Trigger	The event that starts it.

Then: **Main flow** (numbered), a **flow diagram**, **Alternative flows**, **Postconditions**, **Rules enforced** and **What proves it**: the acceptance test in one sentence.

The personas

Code	Persona	What they own
P-1	Owner	Cash runway, plan economics, the final override.
P-2	Manager	Tasks, assignments, alerts, dispositions.
P-3	Agronomist	Crop plans, rotation, treatments, disposal, nutrient recipes.
P-4	Worker	Field, warehouse and driving tasks on mobile, online or offline.
P-5	Sales Manager	Orders, availability, contracts.
P-6	Finance Officer	Invoices, payments, payroll, cash flow.
P-7	QA / QC Officer	Grading, water tests, traceability, recalls.
	System	What the rules engine does without being asked.

In the flow diagrams: ● A person acts ● The system acts by itself ● A rule that can refuse

2 The operation in one page

A greenhouse plans crops per zone, turns each plan into tasks, watches the climate through sensors, treats and harvests under food-safety holds, sells against what it can honestly promise, and closes every plan with its economics. Everything in the system hangs off two objects: the crop plan and the lot.

The crop plan is the unit of planning, cost and learning

A plan is one variety, in one zone, over one date range. Activation is **atomic**: the rationale and the zone capacity are validated, tasks are generated from templates, seeds are reserved, the manager is notified and the audit log is written, all or nothing. When the plan completes, its economics are computed and fed into the next plan's rationale.

The lot is the unit of traceability, stock and sale

{SITE}-{YY}{DDD}-{ZONE}-{VARIETY}-{SEQ}

The lot code, written once at harvest and never changed

A lot is created at harvest with an immutable code and carries its whole history: plan, zone, seed batch, treatments and their PHI status, water tests, workers, equipment. Stock, picking (FEFO), reservations, deliveries and invoices all reference the lot, which is what makes a one-up, one-back trace answerable in seconds.

What the system can promise

ATP = unreserved lot stock within shelf life + forecast harvest from active plans − existing reservations − contract commitments

Available to promise, recomputed within one aggregation cycle of any disposal

The gates

Gate	What it blocks	Released by
PHI hold (pre-harvest interval)	Harvest on the plan	The PHI expiry date computed from the treatment product
REI hold (re-entry interval)	Task assignment in the zone	The REI expiry time computed from the treatment product
Certification gate	Assigning a task to an uncertified or expired worker	A valid, unexpired certification on the worker
Credit limit	Confirming an order that would exceed the customer's limit	Finance or Manager override, or payment
Zone capacity	Activating overlapping plans beyond the zone's productive area	Adjusting area, dates or zone
Failed water test	Every lot harvested since the last passing test on that source	QA disposition: hold or recall

The chain, end to end

Crop plan ▶ Tasks ▶ Sensor readings and alerts ▶ Treatments with PHI / REI ▶
Harvest, creates the lot ▶ FEFO picking ▶ Sales order with ATP and credit ▶ Delivery ▶
Invoice and payment ▶ Plan economics

THE RULE THAT MAKES IT AUDITABLE

Every posting is atomic and every gate writes an audit record when it is overridden. A PHI override is flagged as a food-safety override and appears on the compliance dashboard; a FEFO override needs a reason; a blocked task needs a photograph. Nothing is silently skipped.

3 The use-case map

Twenty use cases across ten modules, in the order of the release plan: the core loop and harvest first, then sales and finance, then compliance and analytics, with water, energy and workforce alongside.

Module	ID	Use case	Primary actor
1 · Crop planning and activation	UC-01	Create and activate a crop plan	Agronomist
	UC-02	Apply a rotation template to a zone	Agronomist
2 · Task management and mobile execution	UC-03	Bulk assign generated tasks	Manager
	UC-04	Execute a task offline, on mobile	Field Worker
3 · Environmental monitoring and IPM	UC-05	IoT anomaly detection and alert generation	System
	UC-06	Record a treatment application with PHI / REI holds	Agronomist or Worker
4 · Harvest, QC and lot management	UC-07	Harvest produce with the PHI gate	Worker
	UC-08	FEFO picking with override	Warehouse Worker
5 · Sales and order fulfilment	UC-09	Place a sales order with ATP and credit check	Sales Manager
	UC-10	Handle a delivery rejection	Driver / Manager
6 · Finance and invoicing	UC-11	Auto-generate an invoice and record payment	System / Finance Officer
	UC-12	View the 12-month cash flow projection	Owner / Finance Officer
7 · Compliance and traceability	UC-13	Run a traceability query (mock recall)	QA Officer
	UC-14	Handle a failed water test	QA Officer
8 · Analytics and strategic re-planning	UC-15	Review plan economics at completion	Owner / Finance Officer
	UC-16	Record a disposal and update ATP	Agronomist / Manager
9 · Water and energy management	UC-17	Record an irrigation event with drain metrics	Worker / Agronomist
	UC-18	Record the monthly energy meter reading	Worker / Finance
10 · Workforce and payroll	UC-19	Process payroll with mixed pay types	Finance Officer

Module	ID	Use case	Primary actor
	UC-20	Assign a pesticide task to a certified worker only	Manager

4 Module 1 · Crop planning and activation

WHERE EVERY LATER NUMBER STARTS

A plan that is activated with a rationale, a capacity check and a seed reservation is a plan whose economics can be judged at the end. These two use cases make sure nothing is grown that was not decided.

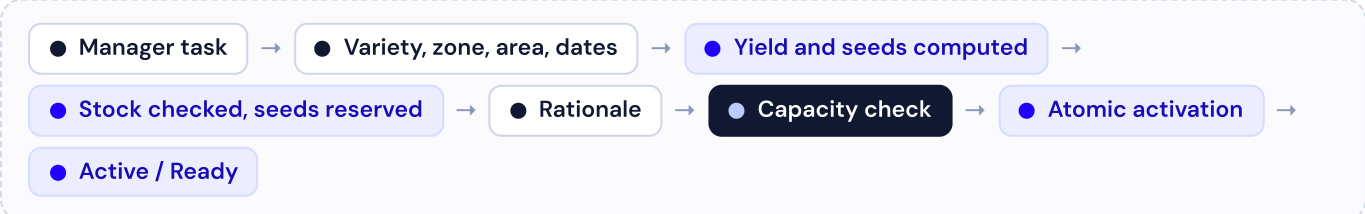
UC-01

Create and activate a crop plan

Primary actor	Agronomist (P-3)
Secondary actors	Manager (P-2), System
Preconditions	Zone exists and is registered. Variety exists with growth days above zero and a target yield. Warehouse has sufficient seed stock.
Trigger	Manager identifies a market shift, or the system's calendar reminder fires.

Main flow

1. Manager creates a task, **Design or adjust the crop plan for zone X**, assigned to the Agronomist.
2. Agronomist opens the task and goes to **Crop Plans**, **New Plan**.
3. Agronomist enters Variety, Zone, Area (m²), Planned start date, Planned end date.
4. System calculates the **expected yield** (area × the variety's kg/m²) and the **seeds needed** (area × plant density).
5. System checks warehouse stock for the required seeds.
6. Stock is sufficient: the system **reserves** the required seeds.
7. Agronomist completes the mandatory **Selection rationale**: demand basis, expected price, expected yield, climate fit, buyer standard, alternatives considered.
8. Agronomist saves the plan as **Draft**.
9. System validates **zone capacity**: no overlapping active plans beyond the zone's productive area, net of aisle space.
10. Agronomist clicks **Activate**.
11. System performs the **atomic activation**: validates rationale and capacity, generates tasks from templates, inserts them as pending, notifies the Manager, writes the audit log.
12. System sets the plan status to **Active / Ready**.



Alternative flows

Insufficient stock	The system calculates the exact shortage and creates a procurement task for the Warehouse team. Work continues in parallel: the warehouse receives stock while the Agronomist designs irrigation and scouting schedules. Once stock arrives, the flow resumes at step 6.
Missing rationale	Activation is blocked with the message “Selection rationale is required before activation.”
Zone capacity exceeded	The system returns `ZONE_CAPACITY_EXCEEDED`, naming the conflicting plans and dates. The Agronomist adjusts area, dates or zone.
Duplicate activation (retry)	The system detects the idempotency key and absorbs the replay silently. No duplicate tasks.

Postconditions

Plan status Active · Tasks generated, pending · Seeds reserved · Audit log written · Manager notified

RULES IT ENFORCES

- Selection rationale required before activation.
- Zone capacity: the combined area of active plans never exceeds the productive area.
- Seeds are reserved at activation and never double-counted.
- Activation is atomic and idempotent.

WHAT PROVES IT Activate a plan with sufficient stock and a complete rationale: tasks exist as pending, seeds are reserved, the Manager is notified and one audit record is written; a second Activate changes nothing.

UC-02

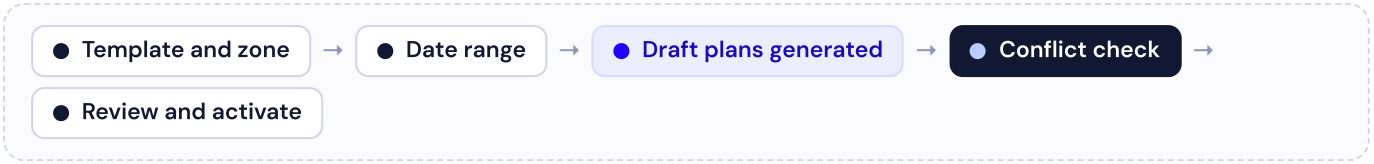
Apply a rotation template to a zone

Primary actor	Agronomist (P-3)
Secondary actors	System
Preconditions	A rotation template exists with an ordered variety sequence, durations and turnarounds. The zone is empty: no active plans.
Trigger	The Agronomist decides to plan a full season for a zone.

Main flow

1. Agronomist goes to **Crop Plans**, **Rotation Templates**.
2. Selects a template and a target zone.
3. Enters the start and end dates for the rotation range.
4. System generates a sequence of **draft plans** for the entire period, including the turnaround gaps.

5. System validates that no conflicts exist with existing plans.
6. Agronomist reviews the generated plans and activates them individually, or in bulk.



Alternative flows

Conflict detected	The system highlights the conflicting plans on the Gantt view. The Agronomist adjusts dates or zone.

Postconditions

Multiple draft plans created in sequence

No zone capacity violations

RULES IT ENFORCES

- Zone capacity.
- Turnaround gaps are part of the sequence, not an afterthought.

WHAT PROVES IT Apply a three-variety template to an empty zone for a season: three draft plans exist back to back with the template's turnarounds, and none overlaps another plan.

5 Module 2 · Task management and mobile execution

THE PLAN BECOMES WORK

Tasks are generated, not typed. They are assigned in bulk, gated by certification and PPE, and executed on a phone that may have no signal. The sync rules decide who wins when two devices disagree.

UC-03

Bulk assign generated tasks

Primary actor	Manager (P-2)
Secondary actors	System, Workers (P-4)
Preconditions	The plan is active. Tasks have been generated. Workers exist with valid certifications.
Trigger	The Manager reviews the morning dashboard and sees unassigned tasks.

Main flow

1. Manager goes to **Tasks**, **Unassigned**.
2. Filters by task type (Irrigation, for example) and date range (the next 7 days).
3. Selects all filtered tasks, 45 of them.
4. Assigns them to a worker or a team.
5. System validates that each worker holds the required skill or certification for each task.
6. System assigns the tasks and pushes notifications to the workers' mobile apps.

Alternative flows

Worker lacks certification	The system blocks the assignment for that worker and shows the reason: "Worker X lacks valid certification for pesticide application (expires 2026-08-01)." The Manager chooses another worker.
Task requires PPE	The system flags the task. The worker must acknowledge the PPE requirements before starting.

Postconditions

Tasks assigned · Workers notified · Certification gates enforced

RULES IT ENFORCES

- Certification gate on every assignment.
- PPE acknowledgement before a flagged task can start.

WHAT PROVES IT Bulk-assign a week of irrigation tasks: every assignment to a certified worker succeeds, every assignment to an uncertified one is refused by name, and each worker's phone shows the new tasks.

UC-04

Execute a task offline, on mobile

Primary actor	Field Worker (P-4)
Secondary actors	System
Preconditions	The worker has the mobile app installed and is logged in. The task is assigned. The device may have no network connection.
Trigger	The worker opens the app to start work.

Main flow

1. Worker opens the app: at most three taps to task start.
2. Selects the assigned task.
3. Taps **Start**; the system records `started_at` with the client timestamp.
4. Worker performs the work. For irrigation: litres, duration, EC, pH.
5. Worker attaches a photo where required.
6. Worker taps **Complete**; the system records `completed_at`.
7. If offline, all data is queued locally with idempotency keys.
8. When connectivity returns, the app syncs automatically.
9. System absorbs the sync: the earliest client timestamp wins for `started_at`, the latest wins for `progress_pct`, and completed status never reverts.

Alternative flows

Blocking a task	The worker taps **Block**. The system requires a photograph; without one the block is refused.
Sync conflict	Two devices edited the same task. The conflict rules apply: earliest start, latest progress, completion never reverts. No data is lost.
Duplicate sync	The idempotency key matches an existing record. The system absorbs it silently.

Postconditions

Task log written to `task_logs` · Sync state visible on the app · No duplicate records

RULES IT ENFORCES

- Idempotent sync.
- Conflict resolution by field.
- A block needs a photograph.

WHAT PROVES IT Start and complete a task with the radio off, then reconnect: one task log, correct timestamps, no duplicate; a second device's stale edit cannot un-complete it.

6 Module 3 · Environmental monitoring and IPM

THE GREENHOUSE WATCHES ITSELF

Sensor readings are judged against the setpoint band of the crop's current stage, not the variety's average. One open alert per zone, parameter and rule; a treatment that follows places its own holds.

UC-05

IoT anomaly detection and alert generation

Primary actor	System (IoT and rules engine)
Secondary actors	Manager (P-2), Agronomist (P-3)
Preconditions	IoT sensors are active and reporting. Stage-specific setpoint profiles exist for the active plan.
Trigger	A sensor reading breaches a threshold.

Main flow

1. A sensor reports data: temperature, humidity, CO_2, VPD.
2. System evaluates it against the **stage-specific** setpoint band, not the variety-level one.
3. System calculates the rate of change.
4. Anomaly detected: for example, temperature above the maximum for the fruiting stage.
5. System checks for an existing open alert on the same zone, parameter and rule.
6. None exists: the system creates a **Field Alert** with a severity.
7. Manager or Agronomist receives the notification.
8. Manager reviews the alert and authorises an IPM action.
9. System generates a treatment task.

Alternative flows

Duplicate alert	An open alert already exists on the same zone, parameter and rule. The system updates it instead of duplicating it.
No anomaly	The system updates crop progress: growth %, days to harvest.
Sensor offline	The system raises a sensor uptime alert.

Postconditions

One open alert per zone, parameter and rule

Treatment task generated if action is required

Crop progress updated if there is no anomaly

RULES IT ENFORCES

- Stage-specific setpoints.
- Alert de-duplication.
- Sensor uptime is monitored.

WHAT PROVES IT Push a fruiting-stage temperature above its band twice in a row: exactly one open alert exists, it carries the severity, the Manager is notified once, and authorising it creates one treatment task.

UC-06

Record a treatment application with PHI / REI holds

Primary actor	Agronomist (P-3) or Worker (P-4)
Secondary actors	System
Preconditions	The treatment product register exists with PHI days and REI hours, both mandatory. A scouting observation or an alert triggered the need.
Trigger	A pest or disease threshold is breached.

Main flow

1. Agronomist goes to **Crop Protection**, **New Treatment**.
2. Selects Plan, Zone, Product, Applicator, Dose, Water volume, Area, Equipment, Weather.
3. System validates: the product is approved for this crop and the dose is within range.
4. Agronomist saves the application.
5. System decrements product stock, creates an expense record, computes the **PHI expiry date** and the **REI expiry time**, places the PHI hold on the plan (blocks harvest) and the REI hold on the zone (blocks task assignment).
6. System logs the application with an audit trail.

Alternative flows

Biological control preferred	If the threshold's action level is "biological" and a biological product exists, the system drafts a biological treatment task, not a chemical one.
PHI override	The Agronomist or Owner overrides the PHI. The system requires a written reason and writes an audit record flagged `override_food_safety`, which appears on the compliance dashboard.

Postconditions

Treatment recorded | PHI and REI holds active | Stock decremented | Expense created | Audit log written

RULES IT ENFORCES

- PHI gate.
- REI gate.
- Product approved for the crop, dose in range.
- Food-safety overrides are flagged and carry a reason.

WHAT PROVES IT Record a treatment with a 7-day PHI: the plan cannot be harvested for 7 days, the zone cannot take assignments until the REI expires, product stock and expenses moved, and the audit trail shows the application.

7 Module 4 · Harvest, QC and lot management

WHERE THE LOT IS BORN

Harvest is gated by the PHI hold, graded by QC, and written once as an immutable lot. Picking follows first-expired-first-out, and every departure from it is a documented override.

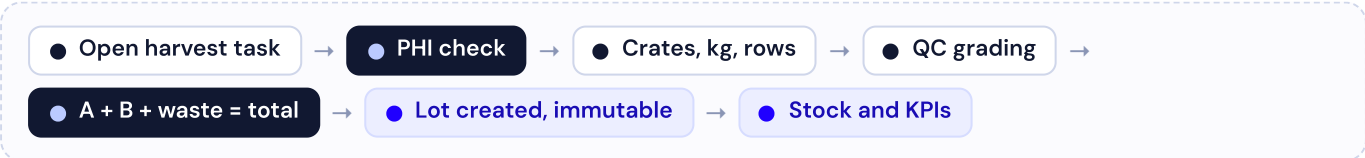
UC-07

Harvest produce with the PHI gate

Primary actor	Worker (P-4)
Secondary actors	QC Officer (P-7), System
Preconditions	Harvest task assigned. The crop is at maturity.
Trigger	The harvest task becomes due, or the worker starts it manually.

Main flow

1. Worker opens the harvest task on mobile.
2. System checks the PHI status on the plan.
3. PHI is clear: the worker proceeds.
4. Worker harvests and logs crates, gross kg, rows.
5. QC Officer logs the grading breakdown: Class A kg, Class B kg, Waste kg.
6. System validates: A + B + Waste = total kg.
7. System creates a **Lot** with an immutable code: `{SITE}-{YY}{DDD}-{ZONE}-{VARIETY}-{SEQ}`.
8. System updates warehouse stock referencing the lot.
9. System computes the KPIs: Grade A share, waste %.



Alternative flows

PHI active	The system blocks the harvest and shows the exact release date: "Harvest blocked. PHI active until 2026-09-20."
Grades do not sum	The system rejects with a field-level error in both languages: "Grade totals (A + B + Waste) must equal total kg."
High waste	If waste % exceeds the threshold, the Manager is prompted to open an investigation; the system links to the IoT data and the task history.

Postconditions

Lot created, immutable | Inventory updated with the lot reference | QC batch recorded | KPIs updated

RULES IT ENFORCES

- PHI gate.
- Grades must sum to the total.
- Lot codes are immutable.
- High waste prompts an investigation.

WHAT PROVES IT Harvest a plan whose PHI expired yesterday: one lot exists with a well-formed code, stock carries the lot, Grade A share and waste % are on the dashboard; the same harvest a day earlier is refused with the release date.

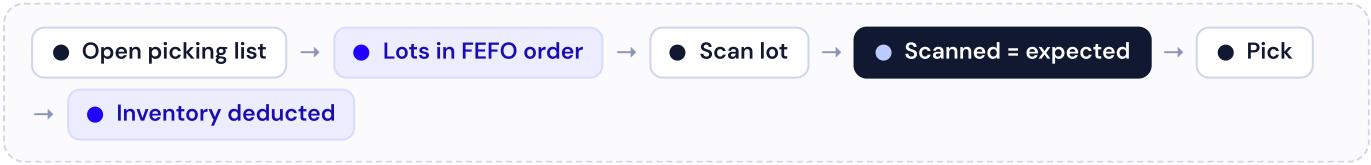
UC-08

FEFO picking with override

Primary actor	Warehouse Worker (P-4)
Secondary actors	System
Preconditions	Order confirmed. Lots exist in inventory with harvest dates and shelf life.
Trigger	A picking list is generated for a delivery run.

Main flow

1. Worker opens the picking list.
2. System lists the lots in **FEFO** order: earliest `harvest_date + shelf_life_days` first.
3. Worker scans the lot code to confirm the correct lot.
4. System validates that the scanned lot matches the FEFO-ordered lot.
5. Worker picks the stock.
6. System deducts from inventory.



Alternative flows

FEFO override	The worker needs a different lot (a damaged lot, a customer request). The system requires an explicit override with a reason and writes an audit record.
Wrong lot scanned	The system rejects: “Scanned lot does not match FEFO order. Expected lot X, scanned lot Y.”

Postconditions

Stock deducted from the correct lot | FEFO compliance, or a documented override

RULES IT ENFORCES

- FEFO order.
- No negative stock.
- Overrides carry a reason.

WHAT PROVES IT Pick against two lots of the same variety: the earlier-expiring lot is offered first, scanning the other is refused, and an override with a reason is the only way through.

8 Module 5 · Sales and order fulfilment

PROMISE WHAT YOU CAN DELIVER

An order is confirmed only against available-to-promise stock and forecast, and only inside the customer's credit. A rejection at the gate becomes a complaint, a credit note and a fill-rate adjustment in one step.

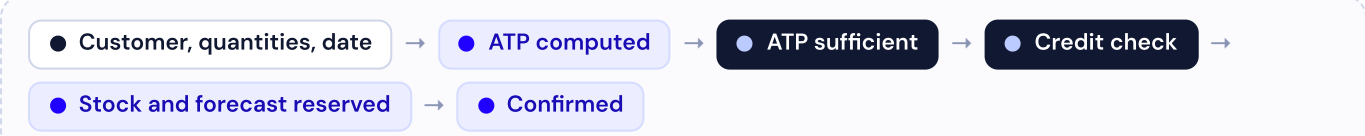
UC-09

Place a sales order with ATP and credit check

Primary actor	Sales Manager (P-5)
Secondary actors	Finance Officer (P-6), Manager (P-2), System
Preconditions	The customer exists with a credit limit and payment terms. A price list exists.
Trigger	A customer places an order.

Main flow

1. Sales goes to **Sales and Orders**, **New Order**.
2. Selects the Customer, enters quantities and the requested delivery date.
3. System checks **ATP**: unreserved lot stock within shelf life, plus forecast harvest from active plans distributed by the harvest curve, minus existing reservations, minus contract commitments.
4. ATP is sufficient.
5. System checks the **credit limit**: current balance + new order ≤ credit limit.
6. The credit check passes.
7. System reserves stock: specific lots in FEFO order where available, a forecast reservation otherwise.
8. Order status = **Confirmed**.



Alternative flows

ATP insufficient	The system shows the available quantity. Sales can split the order: reserve the available portion now, forecast-reserve the remainder. Status = Partially Reserved.
Credit limit exceeded	The order holds at `pending_credit_review`. Finance is notified. Manager or Finance can override or request payment.
Contract commitment	Contract-committed volume is reserved ahead of spot sales. The system shows Committed, Forecast Available and Uncommitted Surplus.

Postconditions

Order confirmed or held | Stock or forecast reserved | Credit check audited

RULES IT ENFORCES

- Available to promise.
- Credit limit.
- Contract commitments come first.
- FEFO reservation.

WHAT PROVES IT Place an order for more than the free stock but less than stock plus forecast: it confirms as partially reserved. Place one that breaches the credit limit: it holds for Finance, and nobody can confirm it without an override.

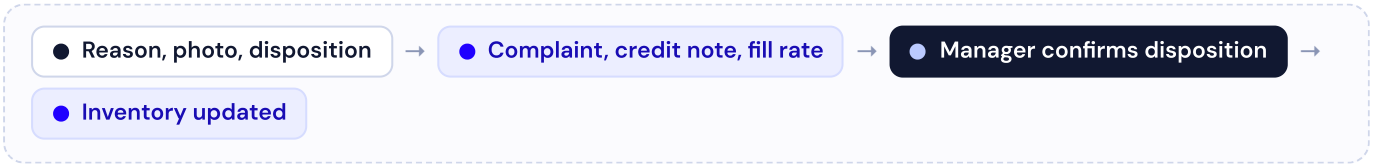
UC-10

Handle a delivery rejection

Primary actor	Driver (P-4) / Manager (P-2)
Secondary actors	Sales (P-5), Finance (P-6), System
Preconditions	A delivery is in progress. The customer rejects part or all of the shipment.
Trigger	The customer refuses the delivery at the gate.

Main flow

1. Driver records the rejection: reason, photo, disposition.
2. System creates a **complaint record**, a **credit note** linked to the invoice, and a **fill-rate adjustment**.
3. Manager reviews the rejection and confirms the disposition: return to stock, disposal, or other.
4. System updates inventory accordingly.



Postconditions

Credit note issued | Complaint logged | Fill rate updated | Inventory adjusted

RULES IT ENFORCES

- No negative stock.
- Every rejection is a complaint with evidence.

WHAT PROVES IT Reject half a delivery at the gate: one complaint with the photo, one credit note on the invoice for exactly the rejected quantity, the fill rate falls, and the returned crates are back in stock or written off, as the Manager decided.

9 Module 6 · Finance and invoicing

DOCUMENTS THAT CANNOT LIE

An invoice is issued from delivered quantities, only when the company profile is complete and only with line items. Payment posts atomically. The cash projection flags the months that will go negative, and why.

UC-11

Auto-generate an invoice and record payment

Primary actor	System / Finance Officer (P-6)
Secondary actors	Manager (P-2)
Preconditions	Delivery completed with a valid proof of delivery. The company profile is complete: legal name, tax number, bank, account.
Trigger	The proof of delivery is verified.

Main flow

1. System auto-generates an invoice from the delivered quantities.
2. System validates that the company profile is complete.
3. System validates that the invoice has line items.
4. System issues the invoice and generates the PDF.
5. System adds it to Accounts Receivable and updates the ageing report.
6. Finance receives payment from the customer.
7. Finance records the receipt: the system **atomically** reduces A/R and credits cash in one operation.
8. System updates the financials: loan principal, debts.

Alternative flows

Incomplete company profile	The system refuses the invoice and shows the missing fields: “Legal name, TIN, bank account required.” No document is issued.
Zero-line invoice	The system refuses: “Invoice has no line items. A document that itemises to nothing is not a document.”
Partial payment	The system records the partial payment, adjusts the A/R balance and leaves the remainder outstanding.

Postconditions

Invoice issued | A/R updated | Cash credited | Financial statements accurate

RULES IT ENFORCES

- Document issuance requires a complete company profile.
- A zero-line invoice is refused.
- Payment posting is atomic.
- Every figure is falsifiable against its source document.

WHAT PROVES IT Verify a POD with a complete company profile: an invoice PDF exists and ages in A/R. Record a partial payment: A/R falls by exactly that amount in the same transaction that credits cash.

UC-12

View the 12-month cash flow projection

Primary actor	Owner (P-1) / Finance Officer (P-6)
Secondary actors	System
Preconditions	Invoices, payment orders, loan schedules, payroll runs and budgeted expenses exist.
Trigger	The Owner opens the finance dashboard.

Main flow

1. System computes a 12-month forward projection: invoice due dates adjusted by each customer's average days to pay, scheduled payment orders, loan repayments, supplier debts, payroll runs, budgeted expenses.
2. Months with a projected negative closing balance are flagged.
3. Owner clicks a flagged month to see the driving line items.
4. Owner reviews and acts: delay a supplier payment, accelerate a customer collection.

● Projection computed → ● Negative months flagged → ● Click a month → ● Act on the drivers

Postconditions

The Owner has visibility of the cash runway | Negative months identified with their causes

RULES IT ENFORCES

- Due dates are adjusted by observed days to pay, not by terms alone.

WHAT PROVES IT Open the projection with a large loan repayment three months out: that month is flagged, and clicking it lists the repayment as the driver.

10 Module 7 · Compliance and traceability

ONE LOT, BOTH DIRECTIONS, IN SECONDS

Every lot carries its history forward and back. A mock recall is a scheduled exercise; a failed water test is a real one, and the system flags the affected lots before anyone has to remember which they were.

UC-13

Run a traceability query (mock recall)

Primary actor	QA Officer (P-7)
Secondary actors	Manager (P-2), System
Preconditions	Lots exist with full history: plan, zone, seed batch, treatments, water tests, workers, equipment, inventory transactions, orders, customers, deliveries, invoices.
Trigger	A mock recall is scheduled (every 6 months by default), or a real recall event.

Main flow

1. QA initiates a trace query for a specific lot code.
2. **Backward trace**, returned within 10 seconds: crop plan, zone, seed batch and seed supplier; all treatments with their PHI status; all irrigation events and the water tests covering them; all workers involved; all equipment used.
3. **Forward trace**, returned within 10 seconds: inventory transactions, order items, orders, customers, deliveries, invoices.
4. System records the elapsed time from initiation to the complete customer list.
5. System exports a customer notification list.

Postconditions

Trace complete within 10 seconds, or within 4 hours for a full mock recall including notification

Elapsed time recorded

Export available

RULES IT ENFORCES

- Lot immutability.
- Full lineage kept on every lot.

WHAT PROVES IT Trace any shipped lot: both directions return in under 10 seconds and the export names every customer who received it.

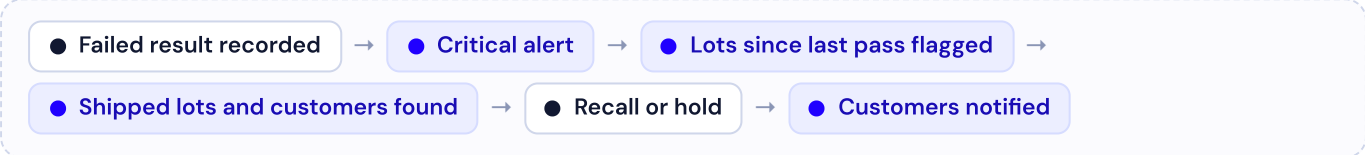
UC-14

Handle a failed water test

Primary actor	QA Officer (P-7)
Secondary actors	Agronomist (P-3), Manager (P-2), System
Preconditions	The water source is registered and in use. Water quality test results are received.
Trigger	The lab reports a failed test, for example E. coli detected.

Main flow

1. QA records the failed test result.
2. System raises a **critical alert**.
3. System flags every lot harvested since the previous passing test on that source.
4. System identifies the already-shipped lots and their customers.
5. QA or the Manager initiates a recall or a hold.
6. System notifies the affected customers.



Postconditions

Critical alert active · All affected lots flagged · Customers identified · Recall initiated

RULES IT ENFORCES

- Water-test rule: every lot since the last passing test is suspect until dispositioned.

WHAT PROVES IT Record a failed test on a source with two harvests since the last pass: both lots are flagged, the one already delivered lists its customer, and the hold blocks the other from picking.

11 Module 8 · Analytics and strategic re-planning

CLOSE THE LOOP

A completed plan is judged against the rationale it was activated with. A disposal reduces what Sales can promise within one cycle, so the ATP screen never shows a crop that no longer exists.

UC-15

Review plan economics at completion

Primary actor	Owner (P-1) / Finance Officer (P-6)
Secondary actors	Agronomist (P-3), System
Preconditions	The plan is complete. All costs allocated. All invoices issued.
Trigger	The plan completes: all tasks terminal, no open alerts, final QC recorded.

Main flow

1. System computes gross revenue from invoiced lots at the realised price.
2. System subtracts labour, energy, water, input and packaging costs.
3. System calculates **contribution**, **contribution per m²**, and **contribution per m² per day** including turnaround days.
4. System decomposes cost per kg into its five components.
5. System shows expected (from the rationale) against actual, side by side.
6. Owner and Finance review.

Postconditions

- Plan economics computed
- Zone released
- Turnaround sanitation tasks generated
- Data feeds the next plan's rationale

RULES IT ENFORCES

- Economics are computed only when the plan is terminal.
- Turnaround days count against the zone.

WHAT PROVES IT Complete a plan: its contribution per m² per day is on the dashboard next to the rationale's expected figures, the zone is free, and the sanitation tasks exist.

UC-16

Record a disposal and update ATP

Primary actor	Agronomist (P-3) / Manager (P-2)
Secondary actors	Sales (P-5), System
Preconditions	An active plan with remaining forecast yield. Disease or damage confirmed.
Trigger	The Agronomist determines that part of the crop must be destroyed.

Main flow

1. Agronomist goes to **Crop Protection**, **Disposal**.
2. Records Plan, Zone, Area affected, Reason, Quantity (kg or % of area).
3. System immediately reduces the plan's remaining forecast yield.
4. System updates ATP within one aggregation cycle.
5. Sales sees the reduced availability on the ATP screen.
6. System computes the crop-loss KPI.

Alternative flows

No disposal recorded	Ghost inventory remains on the ATP screen, Sales oversells, and the customer rejects at delivery. This is the failure the use case exists to prevent.

Postconditions

Forecast yield reduced · ATP updated · Crop-loss KPI updated · No ghost inventory

RULES IT ENFORCES

- Disposal feeds ATP within one cycle.

WHAT PROVES IT Dispose of 20 % of a plan's area: the forecast falls by the matching yield, the ATP screen shows less within a cycle, and the crop-loss KPI moves.

12 Module 9 · Water and energy management

LITRES AND KILOWATT-HOURS PER KILOGRAM

Irrigation is judged against the recipe, deliberate flushes do not raise alarms, and energy is allocated to zones by submeter or by area and occupancy, with the method shown on the economics view.

UC-17

Record an irrigation event with drain metrics

Primary actor	Worker (P-4) / Agronomist (P-3)
Secondary actors	System
Preconditions	An active plan with a nutrient recipe: target EC and pH, drain EC and pH.
Trigger	An irrigation task is due.

Main flow

1. Worker logs volume (litres), method, duration, EC and pH in, drain EC and pH, drain %.
2. System evaluates the drain metrics against the recipe.
3. Within target: no alert.
4. System links the event to the task log.
5. System computes litres per kg harvested.

Alternative flows

Flush cycle	Drain EC deliberately above target, matching a flush recipe. No alert.
Deviation	Drain EC outside target and not a flush recipe. The system raises a warning.

Postconditions

Irrigation event recorded · Water per kg KPI updated · No false alerts for deliberate flushes

RULES IT ENFORCES

- Drain metrics are judged against the active recipe.
- Flush recipes suppress alerts.

WHAT PROVES IT Log a flush and a real deviation on the same day: only the deviation raises a warning, and both events appear on the task log with litres per kg updated.

UC-18

Record the monthly energy meter reading

Primary actor	Worker (P-4) / Finance (P-6)
Secondary actors	System
Preconditions	The energy meter is registered. A tariff exists with peak and off-peak windows.
Trigger	The monthly meter-read task auto-generates.

Main flow

1. Worker receives the recurring meter-read task.
2. Enters the meter reading (kWh).
3. System calculates consumption × tariff as an expense.
4. System allocates it to zones by submeter, or by area × occupancy days where only a master meter exists.
5. System shows the allocation method on the economics view.
6. System computes kWh per kg and the heating share of total energy.

Recurring task → Reading in kWh → Consumption × tariff → Allocated to zones → Method shown → kWh per kg

Alternative flows

Missed reading — The task is not completed within 7 days. The system raises a warning; energy cost per kg is unavailable for that period.

Postconditions

Energy expense recorded · Cost allocated to zones · kWh per kg KPI updated

RULES IT ENFORCES

- The allocation method is always visible.
- A missed reading is flagged, not guessed.

WHAT PROVES IT Enter a reading for a site with one master meter and three zones: the expense splits by area and occupancy days, the economics view says so, and kWh per kg appears for each zone.

13 Module 10 · Workforce and payroll

PAY BY THE HOUR, THE DAY OR THE KILOGRAM

Three pay types run in one payroll, leave and sick days are paid where they have a time basis, and a task that needs a licence cannot be given to someone whose licence has expired.

UC-19

Process payroll with mixed pay types

Primary actor	Finance Officer (P-6)
Secondary actors	Manager (P-2), System
Preconditions	Worker time logs exist. Harvest kg recorded for piece-rate workers. Pay types configured.
Trigger	The payroll period ends.

Main flow

1. Finance opens **Payroll**, **Run Payroll**.
2. System calculates: **hourly** = (hours - overtime) × rate + overtime × rate × multiplier, overtime inclusive of total hours; **daily** = days × daily rate; **piece-rate** = harvested kg × rate per kg.
3. System shows each worker's gross pay.
4. Finance reviews and approves.
5. System generates the payslips.

Alternative flows

Leave or sick day	Paid at the base rate for hourly workers only; daily already pays by the day; piece-rate has no time basis.
Missing time logs	The system flags the incomplete records and blocks payroll until they are resolved.

Postconditions

Payroll processed · Payslips generated · Labour cost allocated to plans

RULES IT ENFORCES

- Payroll is blocked by incomplete time logs.
- Labour cost lands on the plans that used it.

WHAT PROVES IT Run a period with one worker of each pay type: three correct gross figures, one payslip each, and the labour cost visible on the plans they worked.

UC-20

Assign a pesticide task to a certified worker only

Primary actor	Manager (P-2)
Secondary actors	System, Worker (P-4)
Preconditions	The task requires a specific certification, for example a pesticide applicator licence. Worker certifications are recorded with expiry dates.
Trigger	The Manager assigns a pesticide application task.

Main flow

1. Manager selects the task and chooses a worker.
2. System validates that the worker holds a valid, unexpired certification for pesticide application.
3. Certification valid: the assignment succeeds.
4. Worker receives the notification.

● Choose worker → ● Certification valid and unexpired → ● Assigned → ● Notified

Alternative flows

Certification expired	The system blocks the assignment: “Worker X’s pesticide certification expired on 2026-08-01. Cannot assign.”
Certification expiring soon	The system warns: “Worker X’s certification expires in 25 days. Renewal task auto-generated.”

Postconditions

Task assigned only to a certified worker

Renewal task generated 30 days before expiry

RULES IT ENFORCES

- Certification gate.
- Renewal tasks 30 days ahead.

WHAT PROVES IT Assign the same task to a certified, an expiring and an expired worker: the first succeeds, the second succeeds with a warning and a renewal task, the third is refused by name and date.

14 Summary matrices

Use cases by persona

Persona	Use cases
Owner (P-1)	UC-12, UC-15
Manager (P-2)	UC-01, UC-03, UC-05, UC-06, UC-10, UC-13, UC-16, UC-20
Agronomist (P-3)	UC-01, UC-02, UC-06, UC-16, UC-17
Worker (P-4)	UC-04, UC-07, UC-08, UC-10, UC-17, UC-18
Sales (P-5)	UC-09, UC-10
Finance (P-6)	UC-11, UC-12, UC-15, UC-19
QA (P-7)	UC-07, UC-13, UC-14
System	UC-05, UC-11 (auto-generation)

Use cases by business rule

Rule	Covered by
Selection rationale before activation	UC-01
Zone capacity	UC-01, UC-02
PHI gate	UC-06, UC-07
REI gate	UC-06
Failed water test flags every lot since the last pass	UC-14
Hygiene (dispatch block)	Dispatch phase
No negative stock	UC-08, UC-10
FEFO	UC-08
Credit limit	UC-09
Disposal feeds ATP	UC-16
Sync conflict resolution	UC-04
Certification gate	UC-03, UC-20
A block needs a photo	UC-04
Falsifiability of every figure	UC-11
Atomic posting	UC-11
Document issuance needs a complete profile	UC-11
Zero-line invoice refused	UC-11

The KPIs the system computes on its own

Grade A share and waste %
At harvest, from the QC grading (UC-07).

Fill rate
Adjusted by every delivery rejection (UC-10).

Litres per kg harvested
From every irrigation event (UC-17).

kWh per kg and heating share
From the monthly meter reading (UC-18).

Contribution per m² per day
At plan completion, turnaround included (UC-15).

Crop loss
From every disposal (UC-16).

Trace time
Recorded on every traceability query (UC-13).

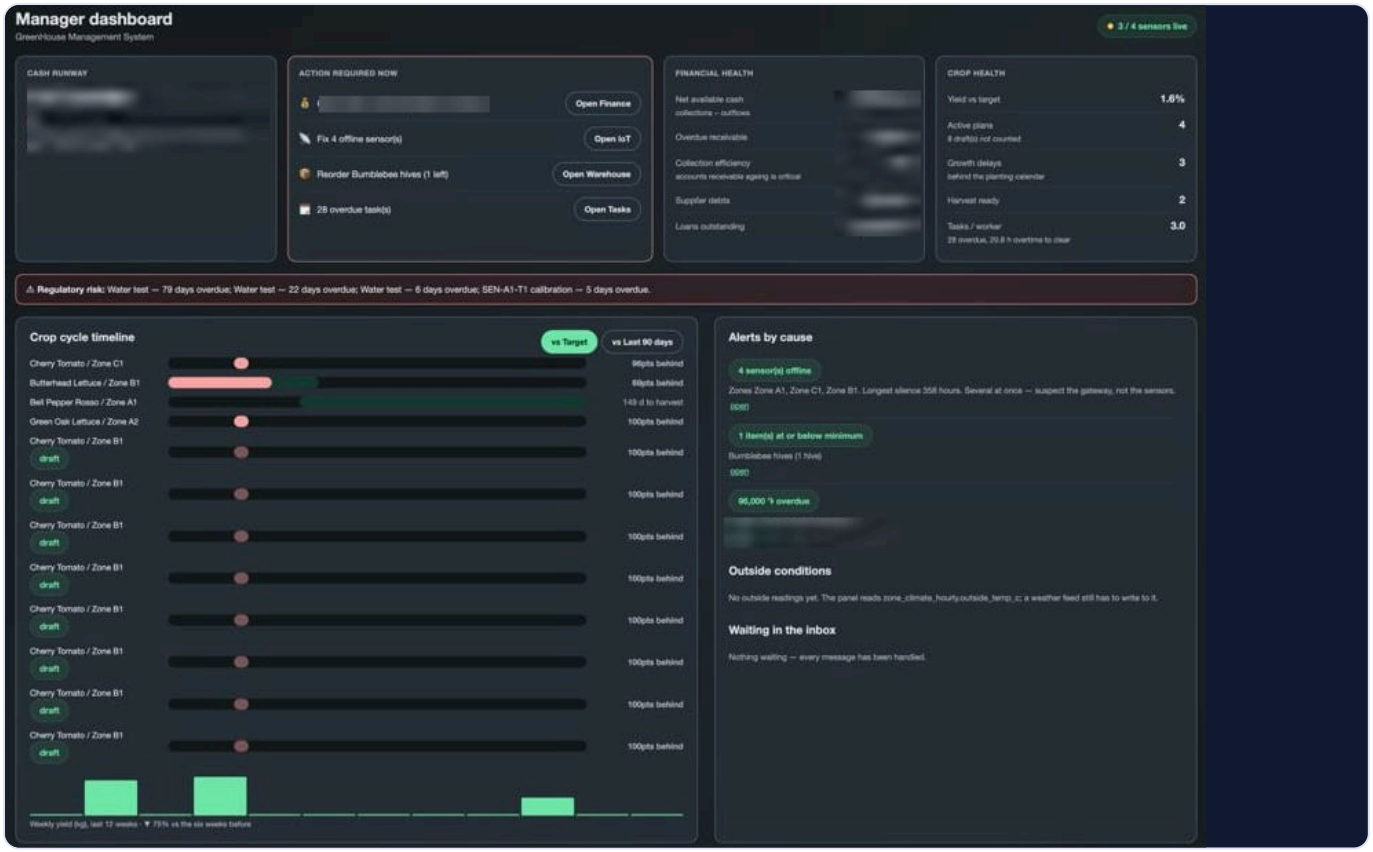
Days to pay, per customer
Observed, and used to time the cash projection (UC-12).

15 How to use these use cases

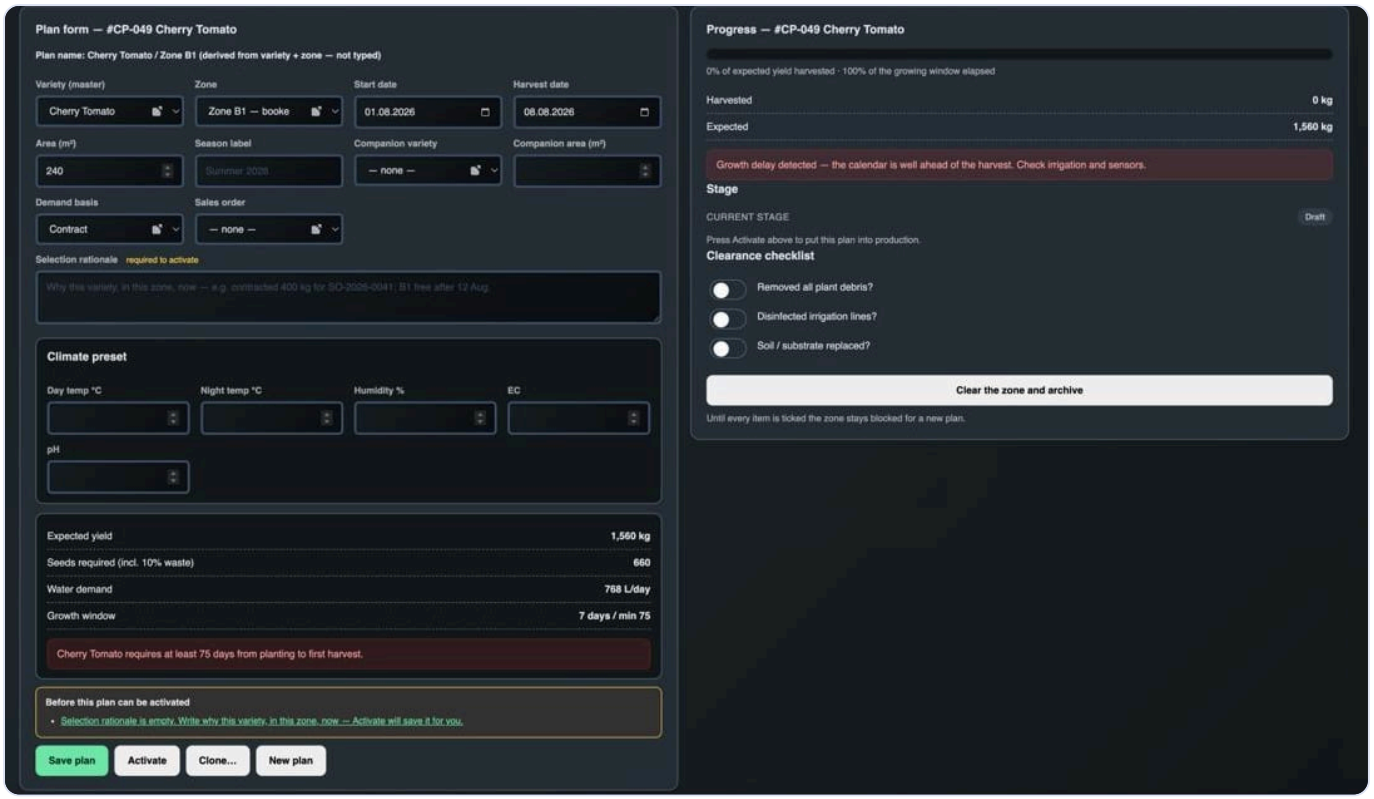
- **For development.** Each use case maps directly to a feature. The main flow gives the happy path; the alternative flows give the edge cases that must be handled.
- **For testing.** Each use case is a test script. Walk through the main flow, then deliberately trigger each alternative flow. *What proves it* tells you when you are done.
- **For training.** Use these as the basis for user manuals. Each persona gets a subset (see the matrix). A worker only needs UC-04, UC-07, UC-08, UC-10, UC-17 and UC-18.
- **For prioritisation.** The use cases are ordered by the release plan. UC-01 to UC-08 are the core loop and harvest. UC-09 to UC-12 are sales and finance. UC-13 to UC-16 are compliance and analytics. UC-17 to UC-20 run alongside.
- **For auditing.** Every use case names the rules it enforces. An auditor can trace from a rule (the PHI gate) to the use case (UC-07) to the sentence that proves it, to the test result.

16 Screens from the system

Screens from the greenhouse system. Customer, staff and supplier names and the cash figures are blurred.

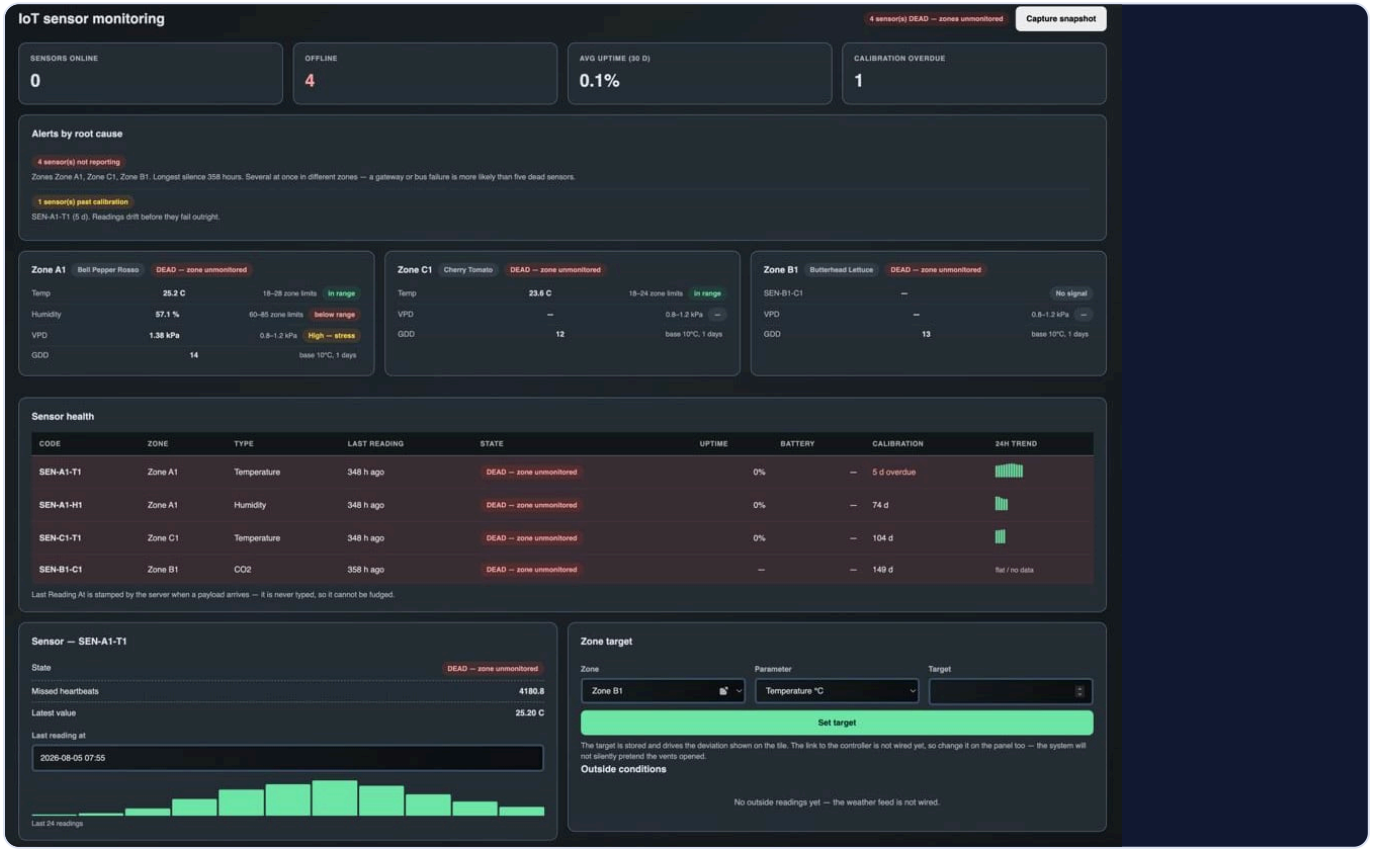


Manager dashboard
What needs action now, the regulatory risk line, crop cycles against target and alerts grouped by cause.



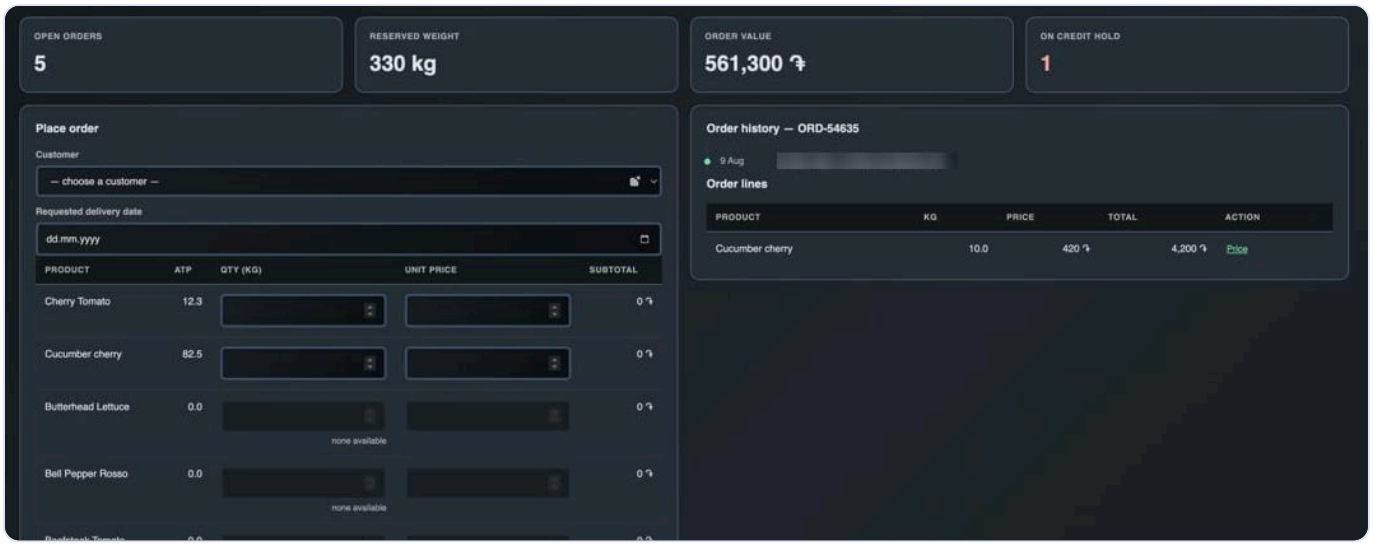
Crop plan gates

The plan will not activate: this variety needs at least 75 days from planting to first harvest, and the selection rationale is empty.



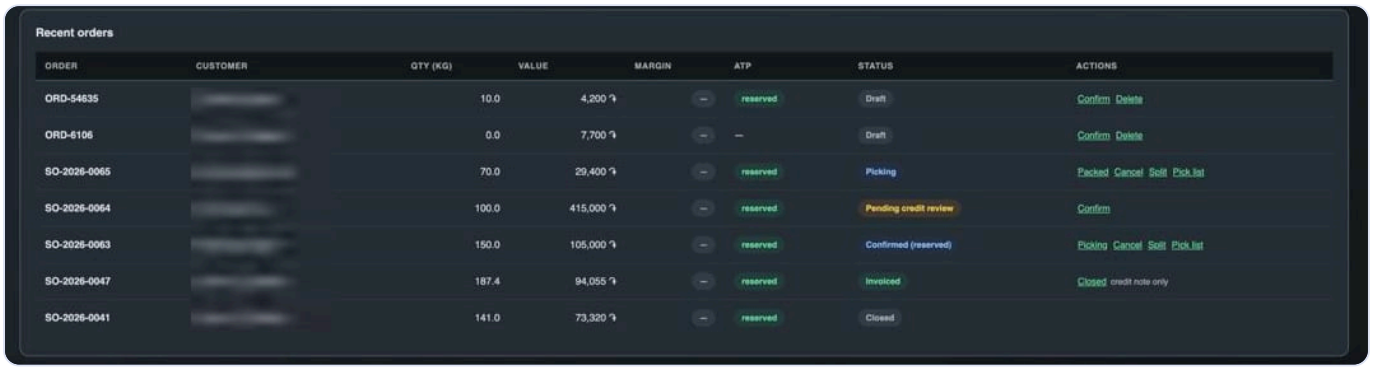
IoT sensor monitoring

Silent sensors are grouped by root cause, so a gateway failure reads as one problem. Calibration is tracked per sensor.



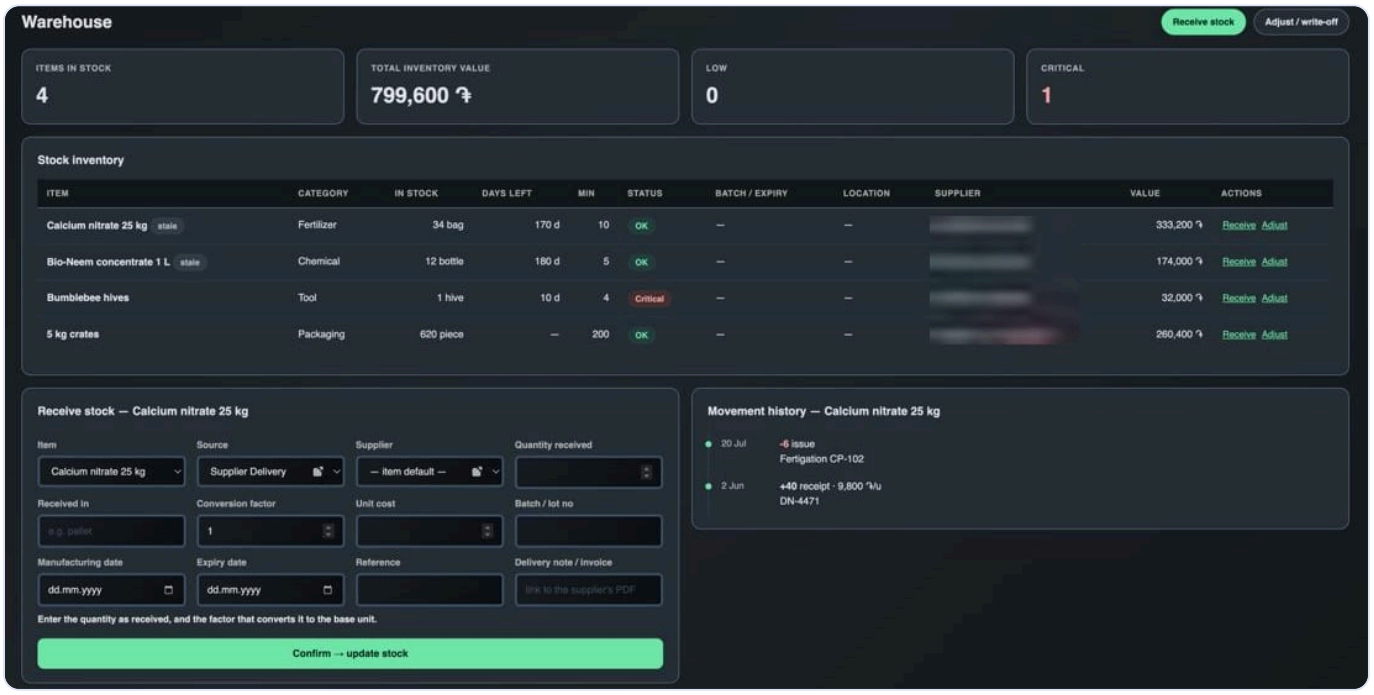
Available to promise

Every product shows what can still be promised. A product with nothing available cannot be ordered.



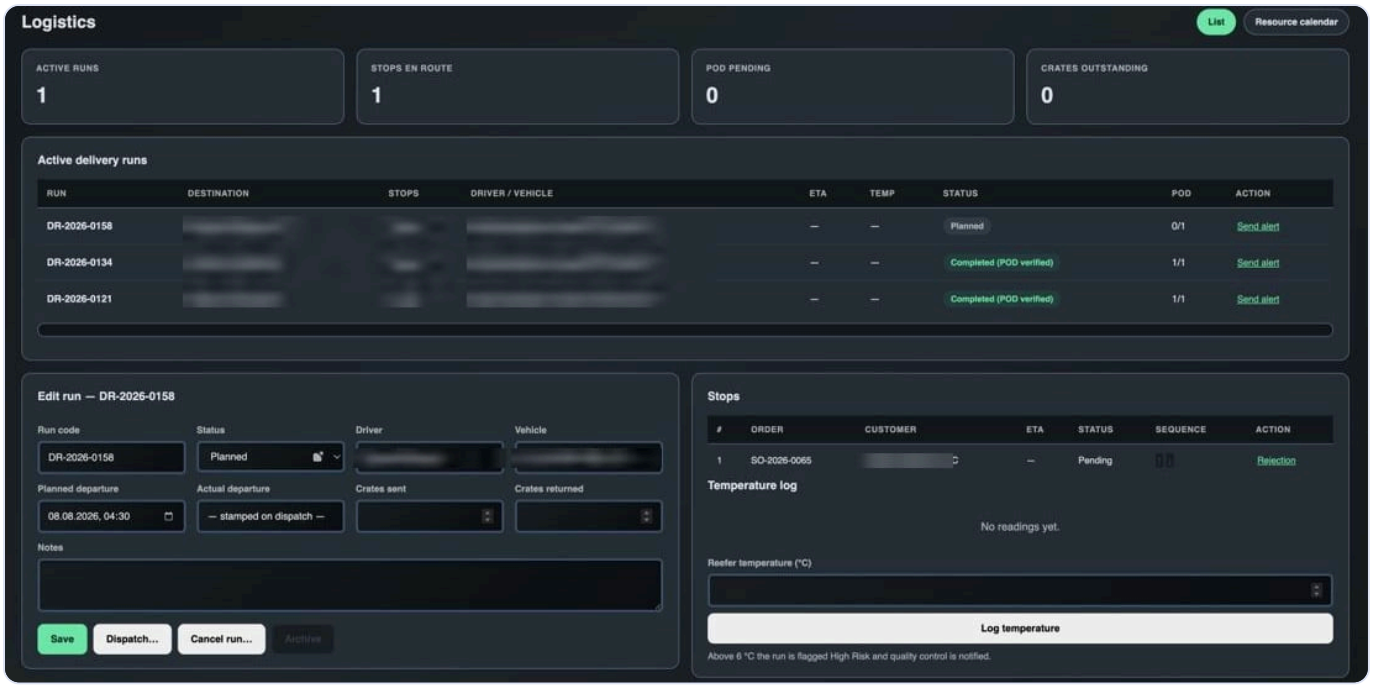
Order register

Orders carry their value, reservation and status, including the ones waiting in credit review.

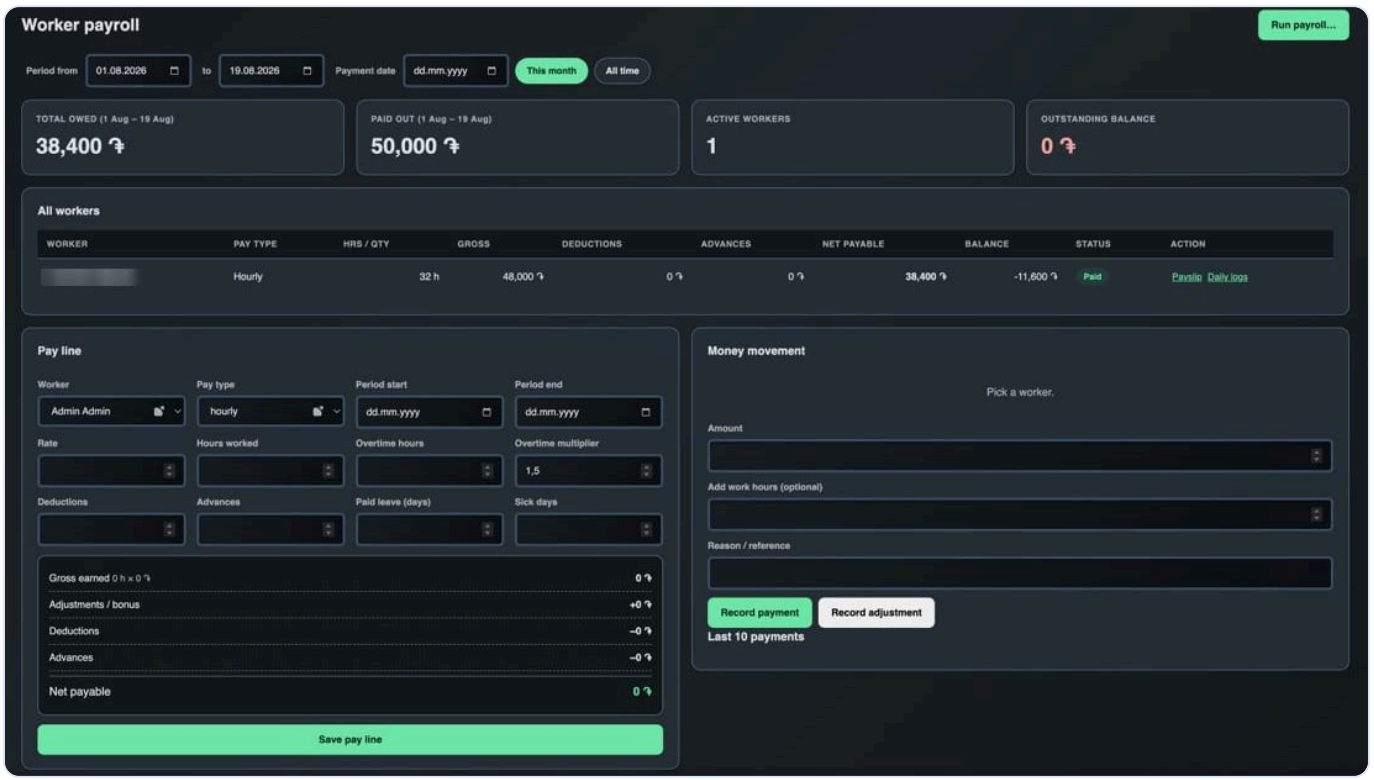


Warehouse

Days of cover, minimums and a critical flag per item, with the receipt form and movement history beside them.



Logistics
Delivery runs with stops, proof of delivery and a reefer temperature log. Above 6 °C the run is flagged high risk.



Worker payroll
Gross, deductions, advances and net payable for the period, with every money movement on record.

About this document

Compiled in September 2026 from the product requirements of the greenhouse deployment (version 4) and the use-case walkthroughs held with the operating team. Rule and acceptance identifiers from the requirements are translated into words here so that the document stands on its own.

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