

Sprayers 101

Drone Productivity Calculator

Quick user guide | Version 3.0

Purpose: Plan a rectangular spray-drone mission, compare fixed and movable tender strategies, and understand the trade-offs among productivity, ferrying, tender moves and refill effort.

What the calculator does

The calculator builds an exact route from the treatment dimensions and operating settings. It tests the permitted tender and refill strategies, estimates total operation time, and recommends the fastest valid scenario. Results update automatically as entries change.

Feature	What it provides
Four operating scenarios	Fixed or movable tender, each with either run-until-empty or forced-refill operation.
Route and timing model	Interior passes, optional headlands, turns, ferry travel, service stops, water retrieval, tender moves and optional flight refinements.
Operational comparison	Productivity, time saved, refill difference, tender moves, ferry distance, average tank residual and suggested fill.
Mission planning output	Recommended sortie details, time by activity, tested scenarios and a downloadable mission report.

The five-step workflow

Step	Purpose	Main entries
1. Treatment	Define the mission	Field size, pass direction, flight speed, swath, spacing, application rate, tank, turns and headlands.
2. Tender	Plan servicing	Tender position, ferry speeds, service time and refill strategy.
3. Crew	Set constraints	Water support, crew arrangement and whether the tender may move.
4. Advanced	Optional refinement	Acceleration, deceleration and payload effects. Defaults are suitable for an initial comparison.
5. Results	Compare outcomes	Recommendation, productivity, moves, time saved, refill difference, sortie details and activities.

Using the calculator

1. Define the treatment and flight plan

Enter treatment length and width. Choose whether passes run along the longer or shorter dimension. Enter realistic flight speed, effective swath, pass spacing, application rate and tank capacity. Select zero, one or two headland passes.

2. Set the tender and service plan

Choose the starting tender position. Enter loaded and empty ferry speeds and the time needed to refill and exchange batteries. Under Refill strategy, compare both return rules or restrict the calculation to Fly until empty or Force refill at the tender-side edge.

3. Describe water support and crew

Enter tender water capacity and water-source round-trip time. One crew member performs both pilot and mixer/loader duties, so water retrieval and tender movement pause the operation. With two crew members, the pilot continues flying while the mixer/loader services the drone and may reposition the tender.

4. Decide whether the tender may move

Choose Keep the tender fixed or Allow the tender to move. With one crew member, enter the time required for each move. Movable-tender scenarios test equal divisions of the turning edge from halves through ninths; intervals shorter than 100 m are excluded.

5. Review or refine advanced settings

The advanced section is collapsed initially. Open it only when aircraft-specific acceleration, deceleration or payload information is available.

6. Read the mission recommendation

Start with the recommended scenario and the four supporting findings. Use Refills vs. fixed tender with Time saved vs. fixed tender to judge whether a modest time saving justifies additional service stops.

7. Expand the tested scenarios

Select Show all tested scenarios to compare every valid option allowed by the selected refill strategy and tender-mobility setting.

8. Download the report

Use Download report to save the mission summary. Open the HTML report in a browser, then print it or save it as a PDF if desired.

Tip: Test both pass directions on rectangular fields. Total sprayed distance may be similar, but turn count, tender-edge length, ferrying and refill opportunities can change.

Understanding the results

Result	Meaning
Recommended scenario	The fastest valid scenario tested under the selected operating constraints.
Productivity	Treatment area divided by estimated total operation time.
Tender moves	Number of tender relocations in the recommended scenario.
Time saved vs. fixed tender	Difference between the recommendation and the fastest valid fixed-tender reference.
Refills vs. fixed tender	Difference in service stops. Refills are counted as sorties minus the final completed sortie.
Sorties	Number of loaded flights required to complete the treatment.
Forced	Tender-side returns made before the next complete out-and-back pair could be finished.
Avg. left	Average tank volume remaining at service stops, excluding the final completed sortie.
Suggested fill	Tank capacity minus average residual plus a 5 L reserve. Shown only for forced-refill scenarios.
vs. ref.	Percentage difference in total time from the fixed-tender reference; positive is slower and negative is faster.

How the four scenarios differ

Scenario	Return rule	Tender
1. Fixed, empty	Return when the tank is empty.	Tender remains at the selected starting position.
2. Fixed, forced	Return at the tender-side edge when the next full out-and-back pair cannot be completed.	Tender remains fixed.
3. Movable, empty	Run until empty, then ferry from the empty point to the current tender position.	Tender may move among tested positions.
4. Movable, forced	Use the forced-refill rule at the tender-side edge.	Tender may move among tested positions.

Using the mission report

The report summarizes the recommendation, time by activity, tender positions and the sortie sequence. Use it to communicate and stage the operation. Program the aircraft with the manufacturer-approved mission-planning software and confirm the route, field boundaries, obstacles and operating settings before flight.

Important: This calculator is a planning and teaching tool. Actual performance varies with aircraft, weather, terrain, payload, battery condition and work practices. Confirm applicable regulations, pesticide label directions, aircraft limitations, environmental conditions and site-specific risks before an application.

Quick checks before relying on a result

- Use measured treatment dimensions.
- Keep pass spacing at or below the effective swath width.
- Use realistic ferry speeds and service times rather than aircraft maximums.
- Confirm that the selected crew arrangement reflects who will actually pilot, mix, load, retrieve water and move the tender.
- Treat Suggested fill as an average planning value; final and transition sorties may require different volumes.
- Compare time savings with extra refills and tender moves, not productivity alone.