Measure irrigation in the field

Four field checks for discharge, applied depth, distribution uniformity, and root-zone soil-water status.

Start with one question: Is discharge correct? How much water was applied? Is application uniform? What is the root-zone soil-water status? Choose the field check that answers that question.

01 TIMED-VOLUME DISCHARGE

$$Q = V / t$$

Q is flow; V is collected volume; t is collection time. For U.S. gallons collected over seconds: **Q (gpm) = 60V / t**.

- Use a calibrated container.
- Collect a complete fill and time accurately.
- Repeat at least three times under steady conditions.

02 APPLIED IRRIGATION DEPTH

$$d = V / A$$

U.S.: **d (in) = gallons / [area (ac) x 27,154]**. Metric: **d (mm) = m³ / [area (ha) x 10]**.

- Use the actual irrigated or wetted area.
- Net depth = gross depth x application efficiency.
- Record flow, runtime, area, and efficiency source.

03 CATCH-CAN UNIFORMITY

$$DU_{lq}\ (\%) = 100 \times x_{lq} / \bar{x}$$

The low-quarter mean is the mean of the lowest 25% of valid catches. Christiansen uniformity: **CU (%) = 100[1 - Σ|x_i - $\bar{x}$|/(n x $\bar{x}$)]**.

- Use identical, level cans on a representative grid.
- Record wind, pressure, duration, and anomalies.
- Report mean catch depth along with uniformity.

04 ROOT-ZONE SOIL-WATER STATUS

$$SWD = \Sigma(\theta_{FC} - \theta_v)\Delta z$$

For layers below field capacity, this estimates water missing relative to field capacity. Use volumetric water contents as decimals; set negative layer deficits to zero. It is not ET or a direct sensor reading.

- Sample multiple depths and representative locations.
- Use site-specific field-capacity values when available.
- Do not insert tension readings (kPa) into this water-content equation.

DO NOT ASK ONE CHECK TO ANSWER ANOTHER QUESTION

01 Discharge
Needs runtime and irrigated area before it can become applied depth.

02 Applied depth
A field average can hide poor distribution across the evaluated area.

03 Uniformity
Does not show total applied depth unless mean catch is also reported.

04 Root zone
Does not identify ET or system application by itself.

Oregon State University

AgroHydrology Research & Innovation Lab
Biological & Ecological Engineering (BEE)
Central Oregon Agricultural Research and Extension Center (COAREC)

Contact
Floyid Nicolas, Ph.D.
floyid.nicolas@oregonstate.edu | 541-475-7107
Accessible format available upon request.

Field protocols

A repeatable method is more useful than a precise-looking number with undocumented conditions.

01 Timed volume

FIELD KIT

Calibrated container, stopwatch, field sheet, PPE as needed

1. Choose a safe collection point with steady flow.
2. Time a complete fill; avoid estimating partial seconds.
3. Repeat at least three times and calculate the average.
4. Record pressure, operating set, and any change during collection.

02 Flow and runtime

FIELD KIT

Flow measurement, runtime record, actual irrigated area

1. Confirm the measured flow represents the complete operating set.
2. Calculate volume from flow x runtime using consistent time units.
3. Divide by the actual irrigated or wetted area, not the parcel area.
4. Report gross depth; document the efficiency used to estimate net depth.

03 Catch-can test

FIELD KIT

Matched cans, ruler or scale, grid, pressure and wind readings

1. Place identical cans on a regular grid that represents the evaluated area.
2. Level cans and avoid canopy interception or splash between cans.
3. Run long enough to obtain measurable depths; record start/end pressure and wind.
4. Flag spills or disturbances. Do not remove a value without documenting why.

04 Root-zone status

FIELD KIT

Probe/auger or calibrated sensor, depth marks, soil limits, field sheet

1. Identify whether the method reports water content or water tension; do not mix the units.
2. Sample more than one representative location and depth in the active root zone.
3. For a deficit calculation, use layer-specific volumetric content and field capacity.
4. Interpret tension against a field-appropriate threshold; do not use kPa in the deficit equation.

Quality rule: A result represents only the locations, depths, operating conditions, and time observed. Repeat the test when wind, pressure, flow, system configuration, or field conditions change materially.

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Interpret, report, and verify

A defensible result includes the number, units, field conditions, assumptions, and limitations.

REPORT THESE WITH EVERY RESULT

- Measurement method, date, operator, site, system, and operating set.
- Value and units, including whether depth is gross or net and whether DU is a ratio or percent.
- Number and location of replicates, mean, variability, and any excluded observation with reason.
- Pressure, runtime, wind/weather, delivery window, wetted area, crop stage, and sampled depth when relevant.
- Efficiency, field-capacity, rooting-depth, or other assumptions and their sources.
- The management decision made and when the measurement should be repeated.

COMMON ERRORS TO AVOID

False precision: Reporting more decimals than the field method supports.

Wrong area: Using total parcel area instead of the evaluated irrigated or wetted area.

Mixed units: Combining seconds and minutes, gallons and cubic feet, or inches and feet.

Gross vs. net: Applying efficiency twice or not at all.

Unrepresentative sampling: Relying on one emitter, one can, one depth, or one sensor location.

Silent data removal: Discarding spills, plugged nozzles, or outliers without documentation.

Minimum field record

Record enough context to reproduce the result. Verify safety and system limits before changing irrigation operation.

FIELD / DATE / OPERATOR

CROP / STAGE / METHOD

RESULT / UNITS / CONDITIONS

DECISION / RETEST DATE

TECHNICAL REFERENCES

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02 Christiansen, J.E. **(1942).** Irrigation by sprinkling. California Agricultural Experiment Station Bulletin 670.

03 Merriam, J.L., & Keller, J. **(1978).** Farm irrigation system evaluation: A guide for management. Utah State University.

04 ASABE. **(2020).** Field test procedure for determining irrigation water distribution uniformity of center pivot and lateral move systems (ANSI/ASAE S436.2).

05 USDA NRCS. **(2026).** Conservation Practice Standard 449: Irrigation Water Management. National Engineering Handbook Part 623, Chapter 9 (Water Measurement) and Part 652 (Irrigation Guide).

06 U.S. Bureau of Reclamation. **(2001).** Water Measurement Manual, 3rd ed., revised reprint.

07 Datta, S., & Taghvaeian, S. **(2023).** Soil water sensors for irrigation scheduling in the United States: A systematic review of literature. *Agricultural Water Management, 278*, 108148.

08 OSU Extension Service. Soil-plant-water relationships (EM 9544).

09 OSU Extension Service. Irrigation water scheduling (EM 9717).

10 OSU Extension Service. Soil moisture monitoring (EM 9868).

11 OSU Extension Service. Irrigation technologies (EM 9867).

12 OSU Extension Service. Developing an irrigation water management plan (EM 9873).

Calculators and current links

Use the calculators for transparent conversions, then compare the result with field and system observations.

- Confirm units and gross-versus-net basis.
- Document the input source and date.
- Investigate disagreement before changing operation.

Scan for AGHRI calculators and current links.

osuagrohydrology.com

Source links and technical content reviewed August 2026. Tool interfaces, recommendations, and external links may change.

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