



Environmental Analysis Program

Pomona College
Biogeochemistry Laboratory

SOP-L420

Soil Labile Amino-Nitrogen – Solvita SLAN Test

Standard Operating Procedure

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1. Purpose

This procedure describes the determination of soil labile amino-nitrogen (amino-N) using the Solvita SLAN test (Woods End Laboratories) (Brinton, 2016b). The SLAN test measures a chemically labile fraction of organic nitrogen present in soil humus as amino-sugars and related amino compounds. These forms represent a “potentially available” nitrogen pool that lies between the immediately available mineral nitrogen (NH_4^+ and NO_3^-) measured by conventional extraction and the total nitrogen pool measured by combustion or Kjeldahl digestion.

The test uses alkali hydrolysis with 2 mol L⁻¹ NaOH to release NH_3 from amino-N compounds in soil (Mulvaney & Khan, 2001). The liberated NH_3 diffuses into a Solvita gel probe during a 24-hour room-temperature incubation. The color change of the gel is proportional to the quantity of labile amino-N and is quantified using the Solvita Digital Color Reader (DCR) in NH_3 mode, yielding results in mg kg⁻¹ amino-N.

The SLAN procedure is chemically analogous to the Illinois Soil Nitrogen Test (ISNT), which uses the same 2 mol L⁻¹ NaOH reagent but requires heating. The SLAN test offers two practical advantages over the ISNT: heating is not needed, and fewer reagents are required (Moore et al., 2019a). In combination with the Solvita CO₂ Burst test ([SOP-L408](#)), SLAN provides a complementary assessment of biological soil fertility by pairing a measure of microbial activity (CO₂ respiration) with a measure of organic nitrogen reserves (Brinton, 2016a).

This SOP is distinct from [SOP-L408](#), which measures microbial CO₂ respiration from rewetted soil, and from [SOP-L403](#), which measures immediately available mineral nitrogen by KCl extraction.

2. Scope

- **Applies to:** Air-dried, sieved mineral soils from all EA Program sites; assessment of organic nitrogen reserves and humus quality; screening for management effects on labile nitrogen pools
- **Does not apply to:** Measurement of immediately available mineral nitrogen (NH_4^+ or NO_3^- ; see [SOP-L403](#) or [SOP-L404](#)); total soil nitrogen determination (see [SOP-L407](#) and elemental analysis); compost maturity testing (see [SOP-L413](#)); field-moist soils (samples must be air-dried before testing)
- **Location:** EA Program laboratory, SGM 133

3. Responsibilities

Role	Responsibility
Lab PI	Approve SOP, ensure training compliance

Role	Responsibility
Lab Manager verify probe expiration dates	Maintain SLAN kit inventory, prepare and store NaOH solution,
Trained Personnel	Perform assay, record and report results
New Students	Complete training before independent use

4. Definitions

- **Alkali-hydrolyzable nitrogen (AHN):** The fraction of organic nitrogen released by hydrolysis in sodium hydroxide solution; operationally defined by the extraction conditions; highly correlated with amino acid nitrogen and microbially available N (Mulvaney & Khan, 2001).
- **Amino acid nitrogen:** Organic nitrogen in the form of free amino acids and simple peptides; the most labile fraction of soil organic nitrogen; the primary substrate measured by the Solvita SLAN test.
- **Diffusion cell:** The sealed incubation jar used in the Solvita SLAN test in which NaOH releases NH_3 from hydrolyzed soil nitrogen into the headspace, where it is captured and measured by a gel probe.
- **Digital Color Reader (DCR):** The Solvita handheld device that reads gel probe color and converts it to a numerical amino-N concentration (mg kg^{-1}); set to NH_3 mode for SLAN measurements.
- **Gel probe (SLAN):** The colorimetric sensor in the Solvita SLAN test that changes color in proportion to accumulated NH_3 ; read with the DCR after exactly 24 hours of incubation.
- **Labile amino nitrogen (LAN):** The nitrogen fraction estimated by the Solvita SLAN test; a proxy for readily mineralizable organic nitrogen; expressed as mg N kg^{-1} dry soil (Moore et al., 2019b).
- **Nitrogen mineralization:** The biological conversion of organic nitrogen to inorganic forms (NH_4^+ and eventually NO_3^-) by soil microorganisms; the primary process by which plant-available N is replenished from organic matter; positively correlated with LAN (Moore et al., 2019a).

5. Safety and Hazards

Hazards

- **Chemical:** Sodium hydroxide (NaOH) at 2 mol L^{-1} is strongly corrosive and can cause severe burns to skin, eyes, and mucous membranes. Handle with care; refer to the NaOH Safety Data Sheet (SDS) posted in the lab. The SLAN test requires use of a strong reagent and is not intended for casual or unsupervised use.
- **Biological:** Soil samples may contain soil-borne pathogens. Wash hands thoroughly after handling soil.
- **Physical:** Minor risk of glass breakage from incubation jars. Handle jars carefully.

5.1. Required PPE

- ☐ Nitrile gloves (chemical-resistant)
- ☐ Safety glasses or splash goggles
- ☐ Lab coat

5.2. Emergency Procedures

- For NaOH contact with skin, immediately flush the affected area with copious water for at least 15 minutes. Remove contaminated clothing.
- For NaOH contact with eyes, flush with water at the eyewash station for at least 15 minutes and seek medical attention.
- For spills, neutralize with dilute acid (e.g., 0.1 M HCl or vinegar) or contain with absorbent material, then clean up and dispose per institutional guidelines.
- Refer to [SOP-L002 Laboratory Safety](#) for general emergency procedures.

6. Equipment and Materials

6.1. Equipment

Item	Notes
Solvita SLAN test kit	Includes NH ₃ gel probes, incubation jars with silicone-gasketed lids, 50 mL plastic beakers, color chart, and manual
Solvita Digital Color Reader (DCR)	Set to NH ₃ mode; calibrate per manufacturer instructions
Incubation jars (~250 mL)	Glass with silicone-gasketed screw-top lids; provided with kit
Analytical balance (0.01 g)	See SOP-L102
Graduated cylinder (25 or 50 mL)	For dispensing NaOH solution
Timer	24-hour countdown
Lab notebook or data sheet	For recording results

6.2. Consumables and Reagents

Item	Notes
Solvita NH ₃ gel probes	One per test; store sealed at room temperature in the dark; check expiration dates
50 mL plastic beakers (cups)	Provided with kit; one per test
Sodium hydroxide (NaOH), 2 mol L ⁻¹	Prepare from ACS-grade NaOH pellets; see Section 5.1

6.3. Reagent Preparation

2 mol L⁻¹ NaOH solution:

1. Weigh 80.0 g of ACS-grade NaOH pellets.
2. Dissolve in approximately 800 mL of deionized water in a 1 L volumetric flask or heat-resistant beaker. The dissolution is exothermic; add pellets slowly and stir.

Warning

Always add NaOH to water, never water to NaOH. Use a heat-resistant container and allow the solution to cool to room temperature before bringing to final volume.

3. Bring to a final volume of 1000 mL with deionized water.
4. Transfer to a labeled, tightly sealed polyethylene bottle. NaOH solutions absorb CO₂ from the atmosphere; keep sealed when not in use.
5. Label with: reagent name, concentration, date prepared, preparer's initials, and expiration date (6 months from preparation).

7. Procedure

7.1. Sample Preparation

1. Use soil that has been air-dried and sieved through a 2 mm sieve per [SOP-F400](#). Do not grind the soil.
2. If samples were stored at 4 °C after sieving, allow them to equilibrate to room temperature (20–25 °C) for at least 30 minutes before beginning the assay.
3. Gently mix each sample to ensure homogeneity before weighing.

Note

The SLAN test is designed for air-dried soil. Results from field-moist soil are not comparable to published SLAN norms or the manufacturer's interpretation guidelines (Brinton, 2016b).

7.2. Incubation Setup

1. Weigh 4.0 g of air-dried, sieved soil into a clean 50 mL plastic beaker. Record the exact mass to 0.01 g.
2. Place the beaker containing soil inside a clean, dry 250 mL incubation jar.
3. Using the graduated cylinder, add 20 mL of 2 mol L⁻¹ NaOH directly to the soil in the beaker.
4. Remove a fresh NH₃-sensitive gel probe from its sealed foil packet. Inspect the gel: it should be uniform in color with no cracks, discoloration, or signs of prior exposure. Discard any compromised probes.

5. Place the gel probe in the air space surrounding the plastic beaker. The gel face must be exposed to the headspace and must not contact the NaOH solution or the soil.
6. Seal the jar immediately and securely with the silicone-gasketed lid.
7. Record the jar number, sample ID, soil mass, and start time.

! Important

Work efficiently once the NaOH is added. NH_3 begins volatilizing immediately upon contact with the soil; seal the jar as quickly as possible to capture the full emission.

7.3. Incubation

1. Place sealed jars at room temperature (20–25 °C), shielded from direct sunlight and drafts.
2. Incubate undisturbed for 24 hours.
3. Do not open, move, or disturb jars during incubation.

7.4. Reading Results

1. After exactly 24 hours (± 30 minutes), open the jar and immediately remove the gel probe.
2. Read the probe promptly; prolonged exposure to ambient air will alter the gel color.

Using the Solvita Digital Color Reader (DCR – recommended):

3. Set the DCR to NH_3 mode.
4. Insert the gel probe into the DCR and record the numerical reading.
5. The DCR reading corresponds to amino-N concentration in mg kg^{-1} per the manufacturer's calibration (Brinton, 2016b).

Using the Solvita Color Chart (visual – semi-quantitative only):

3. Compare the gel probe to the Solvita NH_3 color chart.
4. Record the color number.

💡 Tip

Read probes within 2 minutes of opening the jar. The DCR is strongly recommended for all quantitative work; the color chart provides semi-quantitative screening only.

7.5. Recording Results

Record the following for each test:

- Date and time (start and end of incubation)

- Sample ID, site, and depth
- Soil mass (g)
- NaOH volume added (mL)
- DCR reading (NH₃ mode) or color chart number
- Amino-N concentration (mg kg⁻¹)
- Any anomalies (unusual soil color or odor, probe defects)

7.6. Cleanup

1. Carefully pour the NaOH-soil slurry into the designated waste container. Do not pour corrosive solutions down the drain without neutralization (see Section 8).
2. Rinse plastic beakers and incubation jars with deionized water. Dry completely before reuse.
3. Dispose of used gel probes in standard trash.

8. Quality Control and Acceptance Criteria

8.1. QC Requirements

QC Element	Requirement
Duplicates	At least 1 per 10 samples; RPD within 15%
Blank	One jar with 20 mL NaOH, no soil, and a gel probe per batch; probe should show no or minimal color change
DCR calibration	Calibrate per manufacturer instructions before each batch; set to NH ₃ mode
Gel probe storage	Store sealed in foil at room temperature, away from light; check expiration dates; never use expired probes
NaOH solution	Verify 2 mol L ⁻¹ ; check expiration; keep tightly sealed

8.2. Corrective Actions

- If the blank reading exceeds baseline by more than one color increment, check for NH₃ contamination sources (nearby ammonium reagents, compost, inadequate ventilation) and repeat the batch.
- If duplicate RPD exceeds 15%, re-run the sample pair. Persistent poor precision may indicate sample heterogeneity; increase homogenization effort before weighing.
- If NaOH solution appears cloudy or shows precipitate, prepare a fresh solution.

8.3. Limitations

The SLAN test does not detect nitrate or urea, and normal ammonium fertilizer rates do not interfere with the measurement. Known limitations include:

- The test may not be sensitive in very low-organic-matter soils (e.g., sandy soils with less than 1% SOM), where results may fall below the detection limit.

- Color matching by visual chart is subjective; the DCR is required for quantitative reporting.
- SLAN measures a chemically defined labile N pool, not the biologically available fraction directly; interpret alongside other soil health indicators.

8.4. Interpretation Guide

SLAN Amino-N (mg kg^{-1})	Interpretation	Implication
Less than 30	Very low	Severely depleted organic N reserves; management intervention warranted
30–60	Low	Limited labile N pool; consider cover crops or organic amendments
60–120	Moderate	Adequate organic N reserves for many soils
120–200	High	Good labile N pool; indicative of healthy humus
Greater than 200	Very high	Abundant organic N reserves; common in high-SOM, no-till, or prairie soils

Thresholds are approximate guidelines adapted from Woods End Laboratories and published field studies (Moore et al., 2019c, 2019b). Interpret SLAN values in the context of soil organic matter content, soil texture, and management history.

8.5. Complementary Tests

Parameter	SOP / Method
Microbial respiration (CO_2 Burst)	SOP-L408
Mineral nitrogen (NO_3^- , NH_4^+)	SOP-L403
Nitrate quick test	SOP-L404
Soil organic matter (LOI)	SOP-L406
Total C and N	SOP-L407 and elemental analysis
pH and electrical conductivity	SOP-L402

9. Waste Disposal

Waste Type	Disposal Method
NaOH-soil slurry	Neutralize with dilute HCl to ~pH 7 before draining, or collect in labeled corrosive waste container per SOP-L006
Used gel probes	Standard trash
Deionized water rinses	Drain
Incubation jars and beakers	Wash, rinse with DI water, and reuse
Unused NaOH solution (expired)	Neutralize before disposal per SOP-L006

10. References

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11. Related SOPs

SOP	Title	Relationship
F400	Soil Sampling and Processing	Sample collection and preparation
L002	Laboratory Safety	Required safety training
L400	Soil Moisture (Gravimetric)	Moisture correction for dry-mass basis
L403	Nitrate and Ammonium (KCl)	Complementary mineral N test
L404	Nitrate Quick Test	Complementary field N screening
L406	Loss on Ignition (SOM)	Complementary organic matter index
L407	Total Carbon	Complementary total C and N
L408	Solvita CO ₂ Burst	Paired biological activity test

12. Training Record

Before performing the Solvita SLAN test independently, personnel must:

1. Read this SOP in full
2. Complete [SOP-L002 Laboratory Safety](#) training
3. Review the Solvita SLAN Official Instructions manual (included in the kit or available from [solvita.com](https://www.solvita.com))
4. Demonstrate safe handling and preparation of 2 mol L⁻¹ NaOH solution
5. Observe a trained operator perform the full procedure from sample weighing through DCR reading

6. Perform at least one test under supervision with acceptable QC results (duplicate RPD within 15%; blank within acceptable range)
7. Be signed off by the PI or lab manager