Soil Analysis Application Package for Cannabis

Procedures for Soil Extractions and Analysis for PO_4-P, NO_3-N, K, Ca, Mg, pH and Conductivity

Nutrient Summary for Cannabis:

Nitrogen, phosphorus and potassium are the three main nutrients your cannabis needs and are expressed in the N-P-K fertilizer ratio. Cannabis requires a higher nitrogen ratio during the vegging and early flowering stage as nitrogen is the main component for growth. During the flowering stage a lower nitrogen and higher phosphorus ratio is optimal. Optimal nutrient ratios vary depending on the variety of the strain of cannabis.

Soil Extractions:

Mehlich 2 Extraction for Soil (Calcium + Magnesium, Phosphorus and Potassium):

The Mehlich 2 soil extractant is used for extracting calcium and magnesium, phosphorus and potassium from soils. It is suitable for all classes of soils. With highly calcareous soils, calcium and magnesium results will be artificially high.

Before extraction, dry the soil sample, then screen it to a fineness of 0-2 mm using the Hach Soil Sieve. Careful preparation is important to assure volumetric measurement of the soil sample.

For more information on soil extractions, refer to the SIW-1 Soil and Irrigation Water Manual, PN 2496088, SIW-1 Manual.

Reagents:

- 2266349 = Mehlich 2 Soil Extractant, 500-mL
- 27200 = DI water, 3.78 L (or equivalent)

Apparatus:

- 1862400 = Round Mixing Bottle, 25-mL
- 590900 = Polyethylene Bottle, 200-mL
- 591200 = Sprinkler with Screen (flip cap for bottle)
- 217240 = Graduated Cylinder, 25-mL
- 50658 = Circular Filter Paper, 100/pk
- 2415582 = Polyethylene Funnel, 82-mm
- 2657202 = Soil Scoop, 2-gram
- 4615900 = Soil Sieve

Preparing the Mehlich 2 Extractant:

1. Measure 20 mL of the Mehlich 2 Soil Extractant Concentration into a 25-mL graduated cylinder.
2. Transfer the extractant concentration to one of the flip-top dispensing bottle.
3. Add deionized water to the dispensing bottle until the volume reaches the bottom of the neck, ~200 mLs. Invert several times to mix.

Mehlich 2 Extraction Procedure:

1. Using the 2-gram scoop, measure 1 scoop of the prepared soil sample into a round sample bottle.
2. Using the 25-mL graduated cylinder measure 20 mLs of the diluted Mehlich 2 soil extractant into the cylinder, and transfer to the sample bottle.
3. Repeat steps 1-2 for each soil sample being extracted.
4. Cap and shake the sample bottle for 5 minutes.
5. Using the plastic funnel and filter paper (fold the round filter paper in half twice forming a triangular shape). Open the filter in a manner that forms an inverted cone.
6. Filter the contents of the bottle into another round sample bottle.
7. Use this filtered extract for the calcium and magnesium, phosphorus and potassium analysis.

Soil Extractions (continued):

Calcium Sulfate Extraction for Soil (Nitrate-Nitrogen):
The Calcium Sulfate Extraction is used to extract nitrate-nitrogen from soils and can be used for all classes of soils.

Before extraction, dry the soil sample, then screen it to a fineness of 0-2 mm using the Hach Soil Sieve. Careful preparation is important to assure volumetric measurement of the soil sample.

For more information on soil extractions, refer to the SIW-1 Soil and Irrigation Water Manual, PN 2496088, SIW-1 Manual.

Reagents:

- 1232120 = Calcium Sulfate Powder, 20 grams
- 27200 = DI water, 3.78 L (or equivalent)

Apparatus:

- 1862400 = Round Mixing Bottle, 25-mL
- 217240 = Graduated Cylinder, 25-mL
- 50658 = Circular Filter Paper, 100/pk
- 2415582 = Polyethylene Funnel, 82-mm
- 51100 = Measuring Spoon, 0.1-gram
- 2657205 = Soil Scoop, 5-gram
- 4615900 = Soil Sieve

Aqueous Extraction Procedure:

1. Using the 5-gram scoop, measure 2 scoop of the prepared soil sample into a round sample bottle.
2. Using the 0.1-gram plastic spoon, add 1 level spoonful of Calcium Sulfate to the round sample bottle containing the sample.
3. Using the 25-mL graduated cylinder measure 20 mLs of DI water and transfer it to the round mixing bottle.
4. Repeat steps 1-3 for each soil sample being extracted.
5. Cap and shake each bottle vigorously for 1 minute.
6. Using the plastic funnel and filter paper (fold the round filter paper in half twice forming a triangular shape). Open the filter in a manner that forms an inverted cone.
7. Analyze this extract for nitrate-nitrogen within 2 hours. If this is not possible, then the extract may be refrigerated for 24 hours before analysis.

Aqueous Extraction Method for Soil (Conductivity and pH):
Use the Aqueous Extraction method to prepare the soil sample for conductivity and pH. The soil suspension does not need to be filtered to determine these parameters, the measurement can be made directly in the suspension.

Before extraction, dry the soil sample, then screen it to a fineness of 0-2 mm using the Hach Soil Sieve. Careful preparation is important to assure volumetric measurement of the soil sample.

For more information on soil extractions, refer to the SIW-1 Soil and Irrigation Water Manual, PN 2496088, SIW-1 Manual.

Reagents:

- 27200 = DI water, 3.78 L (or equivalent)

Apparatus:

- 108041 = Polyethylene Beaker, 50-mL
- 217240 = Graduated Cylinder, 25-mL
- 2657205 = Soil Scoop, 5-gram
- 4615900 = Soil Sieve
- 56162 = Stainless Steel Spatula, 3" Blade

Aqueous Extraction Procedure:

1. Using the 5-gram scoop, measure 4 scoop of the prepared soil sample into a 50-mL beaker.
2. Using the 25-mL graduated cylinder measure 20 mLs of DI water and transfer it to the 50-mL beaker.
3. Repeat steps 1-2 for each soil sample being extracted.
4. Using the spatula, stir the contents of the beaker for 1 minute at 10-minute intervals over a 30-minute period.
5. After 30 minutes, use the prepared sample for the conductivity and pH measurements.

   Note: Because conductivity is affected by small concentrations of KCl resulting from the pH determination, measure the conductivity of the sample prior to measuring pH.

Analytical Procedures:

Phosphate-Phosphorus Method 10209:
TNT843 (0.05-1.5 mg/L PO_4-P), TNT844 (0.5-5.0 mg/L PO_4-P) or TNT845 (2-20 mg/L PO_4-P)

Dilute the Mehlich soil extraction solution down to one of the concentration ranges listed for PO_4-P reagent sets. For example, take 1 mL of sample and dilute it up to 25 mLs with DI water in a 25-mL graduated cylinder. Multiply the final concentration reading by 25 for the non-diluted concentration value. Multiply this example concentration value by 10 to correct for the soil extraction (20 mL / 2 g = 10). Ensure that the DR spectrophotometer is reporting as PO_4-P.

Nitrate-Nitrogen Method 10206:
TNT835 (0.2-13.5 mg/L NO_3-N) or TNT836 (5-35 mg/L NO_3-N)

Dilute the Calcium Sulfate soil extraction solution down to one of the concentration ranges listed for NO3-N reagent sets. For example, take 1 mL of sample and dilute it up to 25 mLs with DI water in a 25-mL graduated cylinder. Multiply the final concentration reading by 25 for the non-diluted concentration value. Multiply this example concentration value by 10 to correct for the soil extraction (20 mL / 10 g = 2). Ensure that the DR spectrophotometer is reporting as NO_3-N.

Potassium Method:
Concentration range: 0.8-55 mg/L K

Reagents:

- 2268732 = Alkaline EDTA Solution, 100-mL
- 1432298 = Potassium 2 Reagent Solution Pillows, 25/pk
- 1432396 = Potassium 3 Reagent Powder Pillows, 50/pk
- 27200 = DI water, 3.78 L (or equivalent)

Apparatus:

- 189640 = Graduated Mixing Cylinder, 25-mL, with glass stopper
- 2495402 = Sample Cell, 10-mL matched pair, 2/pk

Analytical Procedure:
Start Program 905 on a DR spectrophotometer

1. Add 3 mLs of the Mehlich 2 soil extraction solution to the 25-mL graduated cylinder.
2. Add DI water to the 21-mL mark on the cylinder. Cap the cylinder with the stopper and invert to mix.
3. Add 1 Potassium 2 Reagent Solution Pillow and 3 mLs of the Alkaline EDTA Solution to the cylinder, stopper and invert several times to mix. Allow the solution to react for 3 minutes.
4. Add the contents of 1 Potassium 3 Powder Pillow, stopper the cylinder and shake vigorously for 10 seconds. Allow the solution to react for at least 3 minutes but no longer than 10 minutes. If potassium is present a white turbidity will develop.
5. Transfer the reacted sample to a 10-mL sample cell.
6. Fill another 10-mL sample cell with DI water and zero the instrument.
7. Place the reacted sample cell into the cell compartment and press read.
8. Multiply the mg/L concentration from the spectrophotometer by 83.3 to correct for the soil extraction and sample dilution.

For more information on this soil procedure, review page 37 of the SIW-1 manual, SIW-1 Manual.

Calcium and Magnesium (Mg by difference):
Total hardness Method 8213

- Reagent set: 2448100 (100-4000 mg/L $CaCO_3$)
- Dilute the Mehlich soil extraction solution following the Digital Titrator method and select the appropriate sample volume for the perceived concentration range. Multiply the concentration value by 10 to correct for the soil extraction (20 mL / 2 g =10).

Calcium hardness Method 8204

- Reagent set: 2447500 (100-4000 mg/L $CaCO_3$)
- Dilute the Mehlich soil extraction solution following the Digital Titrator method and select the appropriate sample volume for the perceived concentration range. Multiply the concentration value by 10 to correct for the soil extraction (20 mL / 2 g =10).

pH Method 8156:
(0 - 14 pH Units)

- Direct measurement using the aqueous soil extraction solution, see the Aqueous Extraction Procedure above for more information.

Conductivity Method 8160:
(0.01 µS/cm - 200 mS/cm)

- Direct measurement using the aqueous soil extraction solution, see the Aqueous Extraction Procedure above for more information.

Procedures:

Phosphate-Phosphorus:
- TNT843 Procedure
- TNT844 Procedure
- TNT845 Procedure

Nitrate-Nitrogen:
- TNT835 Procedure
- TNT836 Procedure

Potassium:
- Potassium Procedure

Total Hardness:
- Total Hardness Procedure

Calcium Hardness:
- Calcium Hardness Procedure

pH:
- pH Procedure

Conductivity:
- Conductivity Procedure

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