Application Information: Soil pH measurement

Why measure soil pH values?

- The appropriate ground pH value is paramount to providing for the perfect plant nutrient intake: If the pH value falls into the wrong range, the plants will be unable to absorb the optimum amount of nutrients even though the soil offers the nutrients in sufficient quantities.
- There is a myriad of ground-dwelling organisms keeping the soil healthy provided they can live in the proper pH environment.
  Soil is much more as a mixture of organic material and minerals. Sustainable yield depends above all on life in the soil pH is an indicator for its vitality and the basis of life of the important microorganism!
- Different plants need different pH values (primarily, slightly acidic, e.g. pH6 - pH7).

Suitable devices and electrodes

As a rule, all pH measuring devices made by GHM-GREISINGER are fit to be used for this purpose.
We recommend the following devices:

- **G 1500 –SET100** (including GE 100 electrode, calibration solutions, KCL, suitcase): premium pH measuring device as an affordable basic package
- **GMH 3531**: easy-to-use pH measuring device including temperature compensation via temperature probe, dual display and automatic calibration for superior accuracy.
- **GMH 5531**: waterproof and impact-resistant pH measuring device for heavy-duty use in the field including temperature compensation via temperature probe, dual display and automatic calibration for superior accuracy.

When performing pH measurements of the soil, we recommend using these pH electrodes in particular:

- GE 100: standard electrode, application in solutions (method 1), 2 ceramic diaphragms
- GE 101: insertion electrode, application in solutions and directly in the soil (in combination with an insertion spike), 2 ceramic diaphragms

Recommended accessories / packages:

- For **GMH 3531 or GMH 5530: supplementary set GMH 55 ES** (including electrode GE 100-BNC, temperature probe GTF55B, case GKK 3500 and GAK 1400 (see above))
- Soil measurement solution CACL (0.01 molar $CaCl_2$ solution)
- Distilled/deionised water
- Beaker with volume graduation markings: Method 1 / insertion spike VD120: Method 2

Preparing the device:

Regular calibration is an essential requirement for accurate measurement results. We recommend performing calibrations for pH7 and pH4 as specified in the operating manual of the respective device.

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Method 1: Measurement with soil measurement solution

- Take the necessary soil samples (e.g. from a soil depth of 5 cm),
- Remove rocks and coarse roots, loosen/crumble
- Mix soil with soil measurement solution and stir.
  Mixing ratio: 1 : 2.5,
  e.g. 50 ml soil, 125 ml soil measurement solution.
- Wait for 10 minutes
- Record stable measurement value *1)

Advantage: **highly accurate and meaningful measurements**

GMH 3531
+ GFH 1 electrode holder

Method 2: Measurement directly in the soil

(only with electrode and insertion spike VD120)
remove topmost soil layer (5 cm) if necessary.

- Insert the VD 120 insertion spike into the measuring point
- If the soil is dry: Moisten the measuring point with distilled water or, better still: Soil measurement solution,
- Insert the electrode (without using force! The use of force may destroy the electrode despite its rugged design!)
- Wait for a suitable amount of time, record stable measurement value *1)

Advantage: **direct on-site measurement**

Disadvantage: not as accurate as method 1, electrode diaphragms may clog more easily

VD120

GE 101

GMH 3531 + GE 101

Further methods

In practice, other methods, e.g. with KCL instead of CaCl, are also common. For comparable measurements, a comparable method must also be used!

After the measurements

Thoroughly rinse the electrode (preferably using distilled/deionised water).
Slip on the protective cap including a sufficient amount of KCL solution.
Store the electrode - ideally upright (cable facing up).

Resolution and accuracy of the measurement results

Listing the pH values to the tenth decimal place (e.g. “pH 6.7”) is sufficient.
We recommend applying method 1 to achieve the most accurate results. The hundredth decimal place during soil measurements is a helpful indicator as to how stable the measurement value is.

An accuracy better than 0.2 pH is attainable - especially when applying method 1.
The significance of the measurement hinges, however, on other factors including

- Sampling operation/measuring point: Is this representative?
- Number of measurements: The more measurements you take, the greater the reliability of the analysis results.
- The care you exercise while measuring and the proper condition of the equipment you use.
- Temperature. To allow for proper comparability of the measured values, we recommend a sample temperature range between 20-25 °C.

To attain the highest possible level of accuracy and comparability of the values, we recommend that you take the measurements following the specifications given in DIN 10390.

*1) Temperature compensation is key both during the calibration and during the measurement: The device automatically balances the behaviour of the electrode provided you specify the temperature.

- G 1500: Enter the temperature manually using the keys -> device will then compensate automatically.
- GMH 3531 / 5530 or G 1501: Temperature input and compensation are carried out automatically by the external probe (durable stainless steel probe which you can also insert directly into the soil when applying method 2) or manually by using the keys.

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