Soil pH-H_2O and pH-KCl, EC

Introduction
Soil acidity can influence plant growth significantly. Acid soils are defined as any soil that has a pH of less than 7.0 (neutral). The method described here is modified from Reeuwijk (2002).

Principle
The pH of the soil is potentiometrically measured in the supernatant suspension of a 1:2.5 soil:liquid mixture. The liquid is either destilled water (pH-H_2O) or a 1 *M* KCl solution (unbuffered).

Protocol
1. Transfer 10.0 g air-dried fine soil (< 2mm) into 50-ml centrifuge tubes with screw lids. Include two blanks. Register sample weight (resolution 0.01 g)
2. Add 25 ml 1 *M* KCl and close the flasks.
3. Place the flasks in the rotor shaker and extract for two hours.
4. Dismount the flasks from the shaker. Before opening the flasks for measurement, shake by hand once or twice.
5. ONLY FOR pH-H_2O: Immerse the conductivity electrode in the suspension and read the conduxctivity.
6. Immerse pH electrode in upper part of suspension.
7. Read pH when the reading has stabilized. (NOTE: The reading is considered stable when it does not change more than 0.1 unit per 30 seconds)

Calculations
None

Materials and reagents
OBS: <u>Only use acid washed glass and plasticware</u>.
- Scale (resolution 0.01 g)
- 1.0 *M* KCl. Dissolve 373 g KCl in distilled water and make up to 5 liter
- Rotor shaker
- Centrifuge tubes, 50 ml, with screw caps (OBS: acid washed)
- pH-meter with glass-calomel electrode
- Conductivity meter

Safety

- No extraordinary safety requirements

Interpretation of pH and conductivity:

Soil pH is among the important environmental factors which can influence plant growth. Initially, each type of soil has a certain level of acidity and pH depending upon its composition, native vegetation, and rainfall amounts, however, various factors over time cause changes in soil pH. Leaching, erosion, and plant uptake of basic cations (calcium, Ca^{2+}; magnesium, Mg^{2+}; potassium, K^{+}), decay of plant residues, and plant root exudates are all means by which the soil pH is increased. However, a common source of acidity comes from H^{+} ions that are released when high levels of aluminium (Al^{3+}) in the soil react with water molecules. This is illustrated by the reaction

$$Al^{3+} + H_2O \quad \leftrightarrow \quad AlOH^{2+} + H^{+}$$

As the pH decreases below 5.5, the availability of aluminium and manganese (Mn) increase and may reach a point of toxicity to the plant. Excess Al^{3+} in the soil solution interferes with root growth and function, as well as restricting plant uptake of certain nutrients, namely, Ca^{2+} and Mg^{2+}. Acid soils also causes P to form insoluble compounds with aluminum and iron. The availability of micronutrients increases as soil pH decreases, except for molybdenum. Microorganisms associated with nitrification require a certain soil pH range of 5.5 to 6.5 to function efficiently. Also, the activity of bacteria (*Rhizobia* species) which are responsible for nitrogen fixation in legumes decreases when the pH drops below 6.0. Microbes responsible for the breakdown of plant residues and soil organic matter are also affected by acid soils.

Reference:

Reeuwijk, LP van (2002) – Editor. Procedures for Soil Analysis. 6th edition. – Technical Paper/International Soil Reference and Information Centre,Wageningen, The Netherlands.