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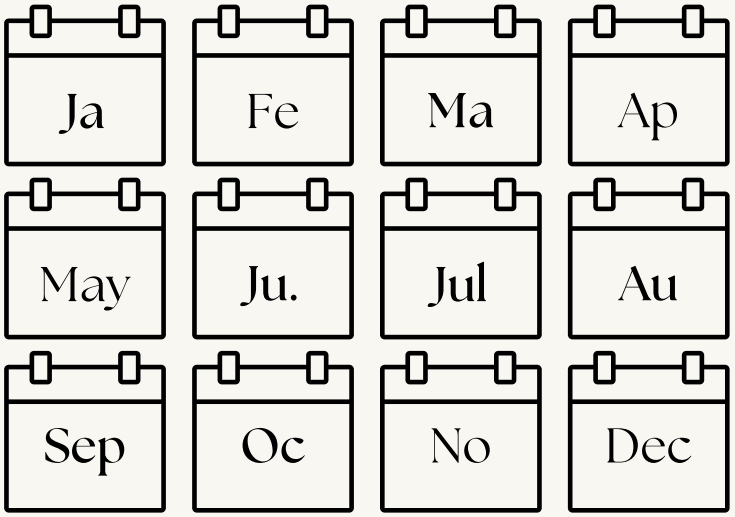
Sheet Legend

- Symbolises that no equipment is required for this test
- *Weed infestation sheet* : in this case no usual scoring curve (more is better, less is better or optimum range) does not reflect the elements highlighted by this test

When to sample ?



Ja → January
Fe → February
Ma → March
Ap → April
May
Ju. → June
Jul → July
Au → August
Sep → September
Oc → October
No → November
Dec → December

Best period/conditions to conduct the test

Not perfect conditions but the test could still be conduct/test to be repeated in green month if possible

Test can't be hold/won't be relevant.

Time

<15 minutes

15 minutes

15 < test < 30 minutes

30 minutes

30 minutes

1 hour

++

More than 1 hour

CROSSROADS project

Infiltration test

Sheet

SCORING SYSTEM :

More is better

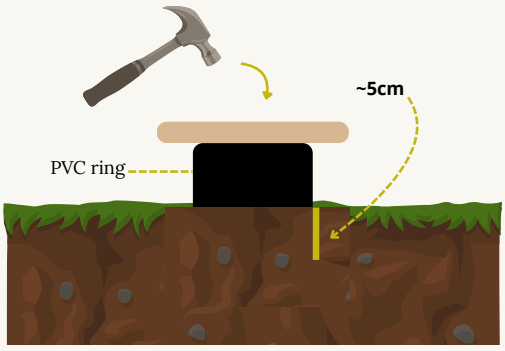
HIGHLIGHTS ...

The complexity of the structure of the soil and give initial information about the capacity of the soil to supply resources, such as water, nutrients etc.

PROTOCOL

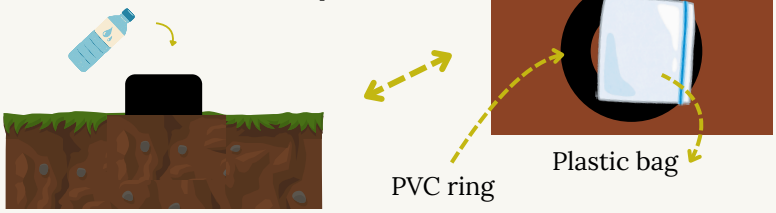
Step 1 :

Remove all plant residues of the test area. With the help of the hammer and the block of woods, **push** the PVC ring (here 20cm) for about 5cm into the soil.



Step 2 :

Place a plastic bag inside the PVC ring and **slowly pour** the entire bottle of water on the plastic bag (the latter reduce the risk of splash). Once done, **gently squeeze** the plastic bag to allow the water to seep in.



Step 3 :

Repeat the second step until the infiltration speed of each bottle stabilises. Then **calculate** the infiltration rate (method opposite).

1st calculation :

Fraction of an hour = cumulative infiltration time (minutes)/60

2nd calculation :

Infiltration rate = Number of centimetres spilt/ **fraction of an hour**

Reminder : one bottle = 1 cm spilt

Step 4 :

Compare the result to the following table to start the interpretation of this test.

Soil texture				
Sand	Sandy loam	Loam	Clay loam	Clay
>3	2-3	1-2	0.5-1	0.1-0.5
Infiltration rate (cm/hour)				

Note: The amount of water poured on the soil depends on the PVC ring diameter. In all cases, the quantity spilled must represent a water depth of 1 cm.

EQUIPMENT REQUIRED

Hammer / Bottles of water / PVC ring /Block of wood / Plastic bag

TIME :

Per sample :

With repeats :

COST :

It may be advisable to purchase the PVC ring for several farms. The total cost of the ring depend on its diameter, but for a test, farmers need less than 50cm of PVC, which should cost them less than 3 US dollars (the limit set for the heat map).

WHEN TO SAMPLE ?

If the soil is too dry, pour the contents of the first bottle without taking it into account when calculating the penetration speed. If the field is too wet, wait two days or more.

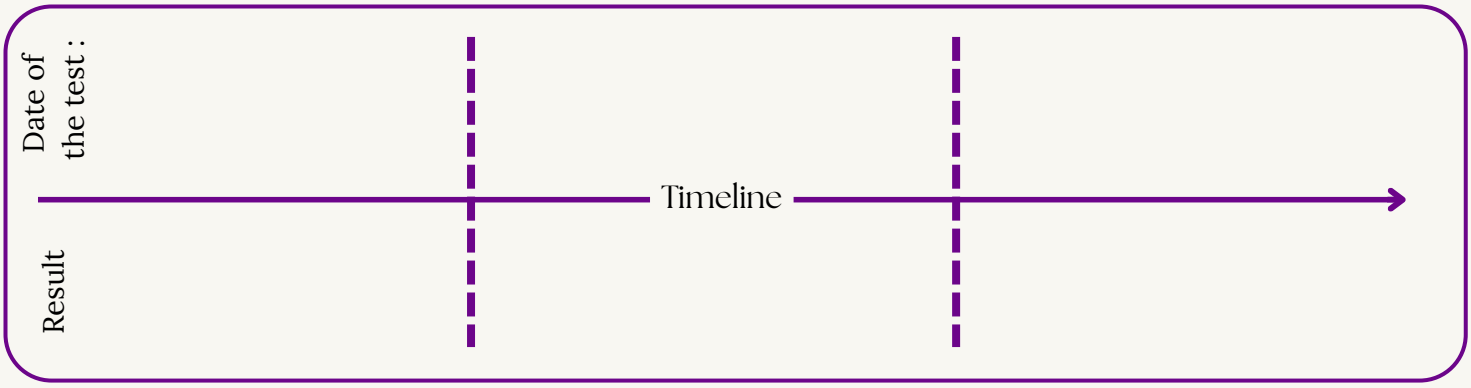
FURTHER INFORMATION :

Another alternative	It is possible to determine this capacity more qualitatively. With the same PVC ring, pour a bottle (500mL) of water and wait for the surface to be glistening, record the time. This alternative approach recognises that this amount of water will need more than 3 minutes to infiltrate completely for a low quality of soil but less then a minute for a high soil quality. The latter result will mean your soil will absorb rainfall more quickly, resulting in less run off and erosion **(Soil care Inc., 2024)**.

SCORING CARD

	Low soil quality	Medium soil quality	High soil quality
Thresholds	Measured infiltration rates differ greatly from the reference values. Infiltration class is very rapid (>50 cm/hour) or impermeable (< 0.0038 cm/hour).	Measured infiltration rates differ slightly from the reference values. Infiltration class is rapid (15 - 50 cm/hour) or very slow (0.0038 - 0.15 cm/hour).	Infiltration rates varies within the ranges of the reference values. Infiltration class is moderately rapid (5-15 cm/hour), moderate (1.5-5 cm/hour), or moderately slow (0.5-1.5 cm/hour)
Interpretation	Water entering too slowly may lead to ponding on level fields or to erosion from surface runoff on sloping fields. It can also increase the risk of asphyxiation of the plant (during rainy periods) or, on the contrary, limit the quantity of water available to the plant. Irrigation may then become essential, depending on the period of the year and the crop.	This infiltration rate doesn't show the capacity of the soil to properly absorb water during more extreme weather events. However, unlike slower speed soils, this type of soil can still build up a minimum stock of water for the crop, thanks to its texture, porosity and rather average structure. Irrigation may become a more occasional need.	With this infiltration rate, the risks of erosion or flooding are greatly reduced. This indicator shows that the overall soil structure is good (which can be confirmed using the Vess test), and that there is sufficient organic matter for the crop to grow properly.

NOTES



References :

Angulo-Jaramillo R., Bagarello V., Di Prima S., Gosset A., Iovino M., et Lassabatere L., 2019. Beerkan Estimation of Soil Transfer parameters (BEST) across soils and scales. Journal of Hydrology, 576, p. 239-261. DOI : 10.1016/j.jhydrol.2019.06.007

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Rakotondrazafy N., Félix-Faure J., Thoumazeau A., et Brauman A., 2025. Protocols / Documentation - BIOFUNCTOOL® a new framework to assess the impact of land management on soil quality. https://www.biofunctool.com/documentation/protocols

Soil care Inc., 2024. Northern Rivers Soil Health Card. https://www.soilcare.org/soil-health-card.html

USDA, 2001. Soil Quality Test Kit Guide. https://www.nrcs.usda.gov/sites/default/files/2022-10/Soil%20Quality%20Test%20Kit%20Guide.pdf

Wood M., 2018. Water infiltration test | AHDB. https://ahdb.org.uk/knowledge-library/water-infiltration-test

CROSSROADS project

Penetration resistance test

Sheet

SCORING SYSTEM :

More is better

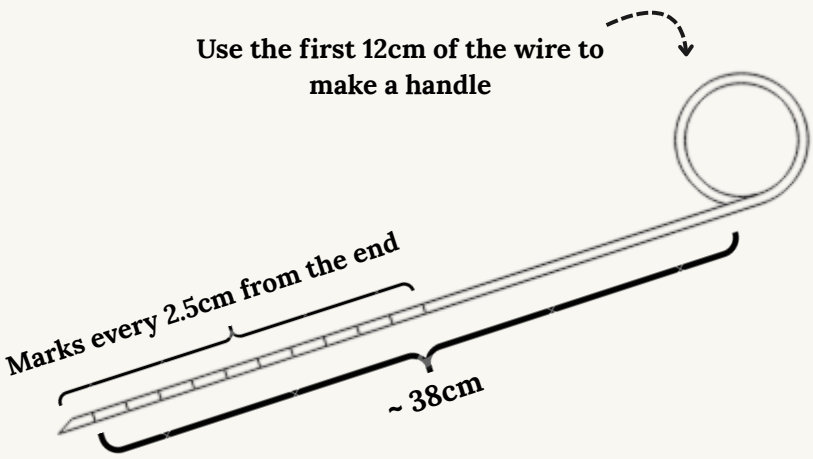
HIGHLIGHTS ...

Assess soil compaction and therefore the difficulty that plant roots will have in developing. This is also a good indicator of water infiltration capacity, and erosion consequences.

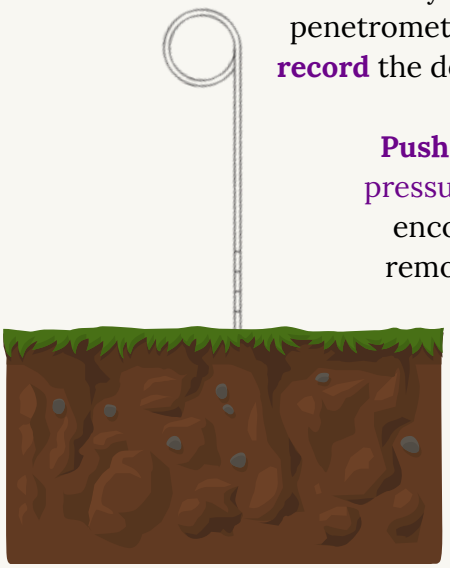
PROTOCOL

Step 1 :

Take about 50cm of fencing wire to make your own **homemade penetrometer** (according the infos given below).



Step 2 :



Push your homemade penetrometer into the soil and **record** the depth of penetration.

Push only with a moderate pressure, once the resistance encountered is too great, remove the penetrometer.

Note : If you hit a rock or a root, choose another spot.

EQUIPMENT REQUIRED

Fencing wire / Ruler

TIME :

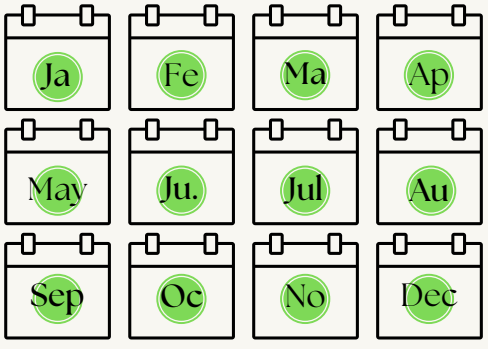
Per sample :

With repeats :

COST :

Although this test is a much cheaper alternative to using penetrometers, it may be advisable to purchase fencing wire for several farms. The total cost of the spool is almost £10, whereas the cost per metre of spool is only £0.46 [1].

WHEN TO SAMPLE ?

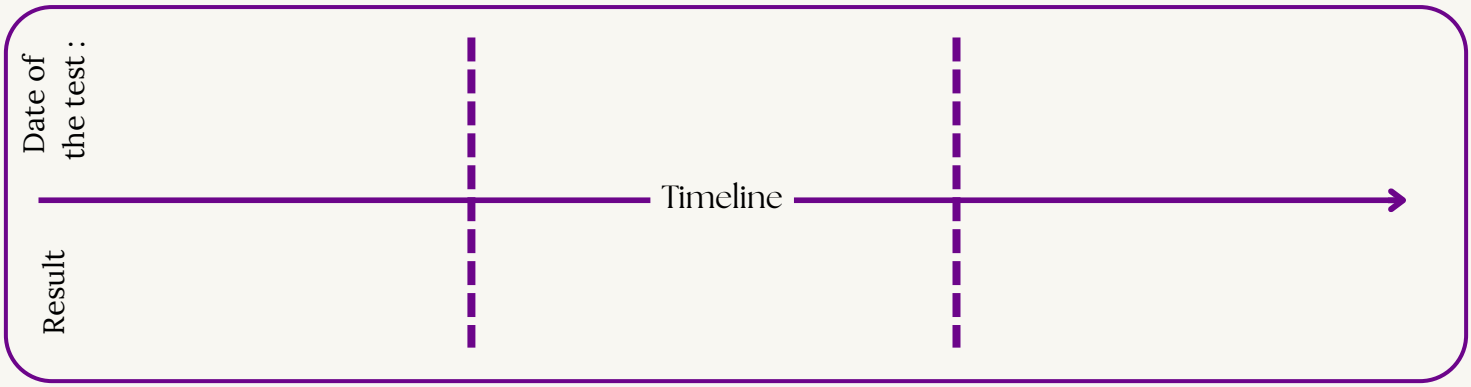


SCORING CARD

Ref : (Soil care Inc., 2024)

	Low soil quality	Medium soil quality	High soil quality
Thresholds	Penetrates to less than 5 cm	Penetrates more than 5 but less than 20 cm	Penetrates to 20 cm or more.
Interpretation	Could be an index of a plough sole, itself a sign of an over-working system. It could also be interpret as an important lack of soil organic matter or a sign of great erosion. This result could explain a root system underdeveloped, but can also cause low infiltration capacity.	Without causing excessive yield losses under the usual climatic conditions. This result shows that the soil structure is not optimal, either because of a lack of organic matter or else, for either root development or water infiltration.	The easier it is to penetrate the soil, the better the deep root development and water infiltration.

NOTES



References :

Chaudhary R.S., Jayaraman S., K. Sinha N., Lakaria B.L., Mohanty S.R., Singh A.B., Mohanty M., Hati K.M., Singh R.K., et Patra A.K., 2022. Participatory Soil Quality Assessment Using Low-Cost Tools under Contrasting Management Practices in a Vertisol. Agricultural Research, 11 (4), p. 642-651. DOI : 10.1007/s40003-021-00598-0

NSW government, [s d]. DIY Field Soil Tests - Local Land Services. https://www.lls.nsw.gov.au/regions/north-west/articles-and-publications/diy-field-soil-tests

Soil care Inc., 2024. Northern Rivers Soil Health Card. https://www.soilcare.org/soil-health-card.html

Reference for the fencing wire :

https://www.amazon.co.uk/3mm-20m-Garden-Wire-Galvanised/dp/B002ANC2K6

CROSSROADS project

pH strips

Sheet

SCORING SYSTEM :

Optimum range

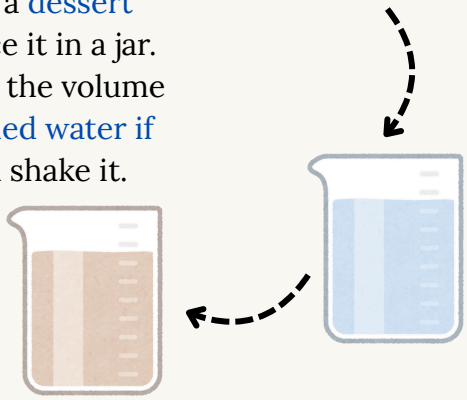
HIGHLIGHTS ...

pH is a key parameter for nutrient availability, microbiodiversity abundance, and can be important in determining the species/varieties to be planted.

PROTOCOL

Step 1 :

Take a soil sample equivalent to a dessert spoon and place it in a jar. Then add twice the volume of water (distilled water if possible) and shake it.

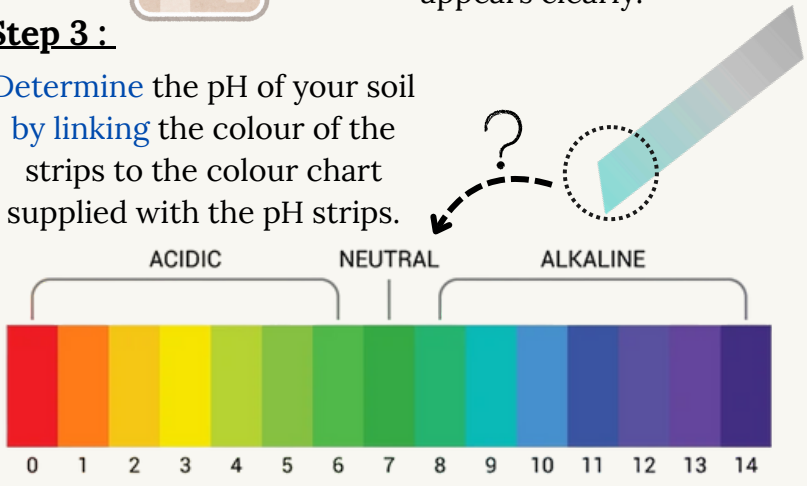


Step 2 :

Once the water and soil sample have separated, insert the end of the strips into the liquid (above the soil). When the liquid rises slightly above the paper, remove it and wait 60 seconds until the colour appears clearly.

Step 3 :

Determine the pH of your soil by linking the colour of the strips to the colour chart supplied with the pH strips.



Ref: Shutterstock

EQUIPMENT REQUIRED

pH strips / Jar / Water

TIME :

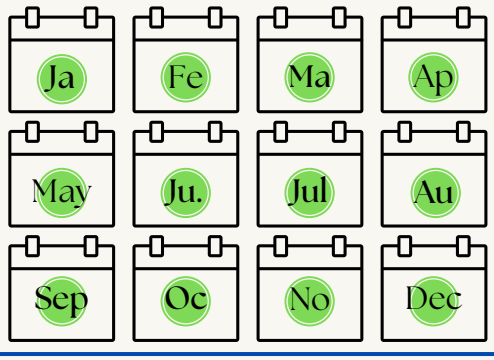
Per sample :

With repeats :

COST :

pH strips can be found in the UK very easily on the Internet for a range of prices from 4£ to 6£ (for 100 to 5 m strips) [1,2]. Therefore the price per test is expected to be under 3 US dollars.

WHEN TO SAMPLE ?



FURTHER INFORMATION :

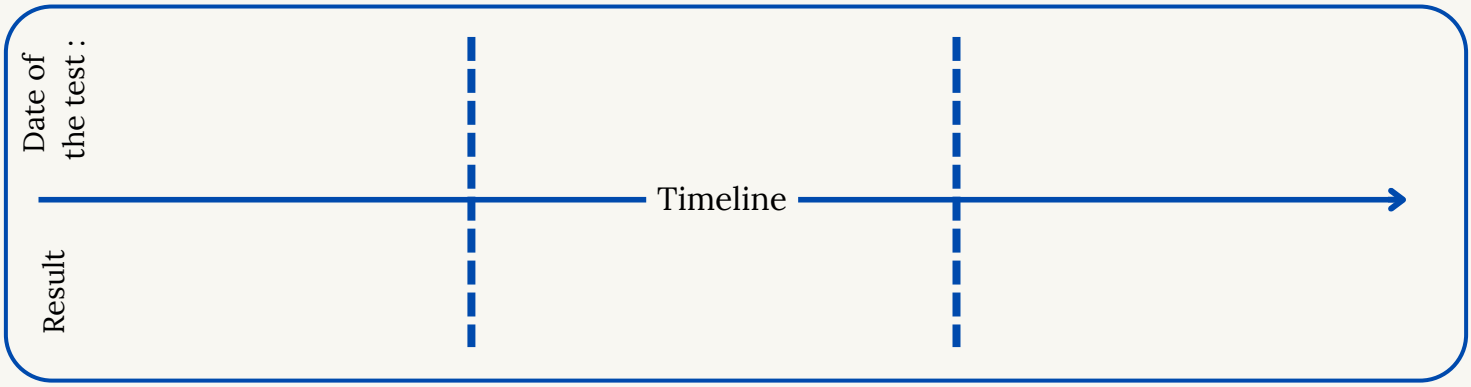
SOCIT app	This app developed in Scotland by the James Hutton Institute (Apple & Android) can also be used to assess the pH of your soil. More destructive than the pH strips method, it's also less expensive, as a cell phone is the only equipment required.

SCORING CARD

Ref : (Mulat et al, 2021)

	Low soil quality	Medium soil quality	High soil quality
Thresholds	pH is below 4 or above 9	pH between 4 and 6 or between 7 and 9	pH between 6 and 7
Description	Soil is very acidic (below 4) or very alkaline (above 9). Essential nutrients availability decreases significantly, which can cause major yield losses. The soil organic matter becomes more complex to decompose. At those pH levels, microbiodiversity is less effective or even nonexistent.	Soil is moderately acidic or moderately alkaline. Chemical reactions begin to make the essential nutrients less available and the soil organic matter decomposition less effective.	This pH range allows a wide range of plants to grow properly, without limiting the yield.

NOTES



References :

AHDB, [s d]. Soil pH and liming recommendations for arable and grass systems | AHDB. https://ahdb.org.uk/knowledge-library/soil-ph-and-liming-recommendations-for-arable-and-grass-systems

AHDB, 2023. The soil health scorecard | AHDB. https://ahdb.org.uk/knowledge-library/the-soil-health-scorecard

Mulat Y., Kibret K., Bedadi B., et Mohammed M., 2021. Soil quality evaluation under different land use types in Kersa sub-watershed, eastern Ethiopia. Environmental Systems Research, 10 (1), p. 1-11. DOI : 10.1186/s40068-021-00224-6

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Soil Science Society of America, [s d]. Soil pH activity. https://www.soils4teachers.org/files/s4t/In-Service%20Materials/soil-ph-activity.pdf

SRUC, 2016. Valuing your soil : practical guidance for Scottish farmers. https://www.sruc.ac.uk/research/research-facilities/dairy-research-facility/technical-notes/

[for the pH strips]

[1]https://www.amazon.co.uk/strips-litmus-Universal-Indicator-Cosmetic/dp/B0BZ7XF7DN?source=ps-sl-shoppingads-lpcontext&ref_=fplfs&psc=1&smid=A1MVUNTFL81WVM

[2] https://www.amazon.co.uk/Simplex-Health-Universal-Alkaline-Testing/dp/B014J9WQVS?source=ps-sl-shoppingads-lpcontext&ref_=fplfs&psc=1&smid=A3P5ROKL5A1OLE

CROSSROADS project

Root system development test

Sheet

SCORING SYSTEM :

More is better

HIGHLIGHTS ...

Soil structure and stability, but also gives insights into nutrient and water availability in the soil.

PROTOCOL

Note : To assess the root development of grasslands, the sample used for the Vess test could be remobilised in order to limit the impact of such destructive test on the studied area

Step 1 :

Using a spade, **clear** the soil around the base of the plant to make it easier to **remove**.

Step 2 :

Assess the root system by looking at :

- the lenght
- number
- density
- and diversity

of the roots.

Note : Some pictures are available for the comparison in (Regenerative Organic Alliance, 2020 ; Shepherd, 2000) to help score this test.

EQUIPMENT REQUIRED

Spade / Ruler (optional)

TIME :

Per sample :

With repeats :

COST :

It is assumed that the required equipment is already available for the stakeholder or provided by external workers. The cost of this test is therefore zero.

WHEN TO SAMPLE ?

During the harvest.

FURTHER INFORMATION :

Root nodules

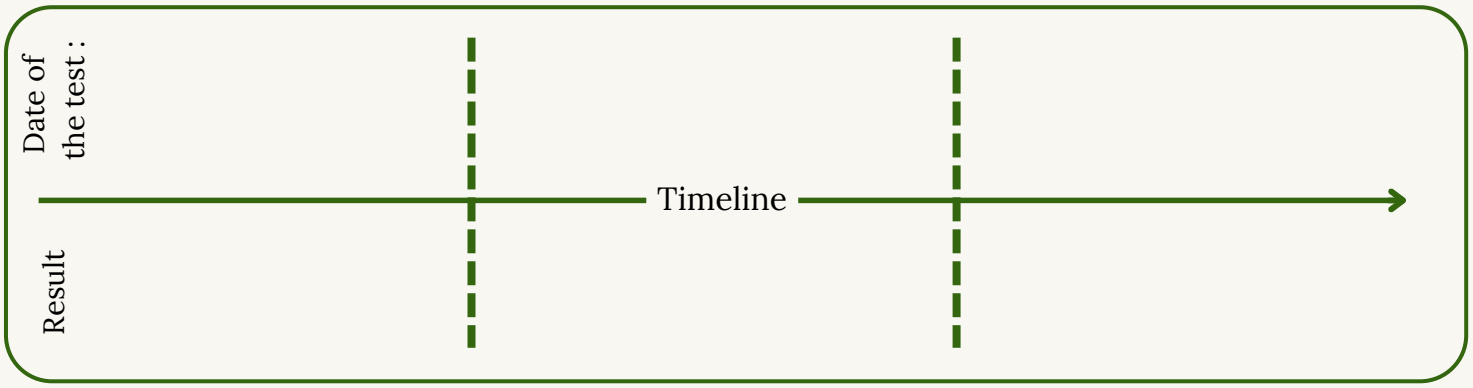
As well as the development of the root system, another criterion can be assessed in this test: the presence or absence of nodules on the roots. These are found on legumes (beans, chickpeas, etc.) and indicate the presence of good microbiodiversity. This symbiosis between the plant and a bacterium gives the plant access to a wider pool of nitrogen.

SCORING CARD

Ref : (Regenerative Organic Alliance, 2020)

	Low soil quality	**Medium soil quality**	**High soil quality**
Description	Roots are lacking, especially fine roots, seem restricted (low density) and not well branched.	Roots are somewhat restricted (low to medium density) and there are some fine roots.	Roots are abundant, branched, and unrestricted (medium to high density).
Interpretation	This restriction could be physical (poor soil structure), chemical (poor nutrient pool) biological (poor microbiodiversity) or a combination of those elements. And impact severly the crop yield.	Without having a strong impact on crop yield, looking at the properties of the area (structure, nutrient pool, etc.) could help increase the latter.	Good root development could translate to a good structure, high organic matter content, or even an active microbial population.

NOTES



References :

Anbarasan S. et Ramesh S., 2021. The Role of Plant Roots in Nutrient Uptake and Soil Health. Plant Science Archives, 6. DOI : 10.51470/PSA.2021.6.1.05

Regenerative Organic Alliance, réal., 2021a. How to Measure Root Growth: Soil Health Tests for Agroforestry Producers. https://www.youtube.com/watch?v=YShglVriT6w

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Regenerative Organic Alliance, 2020. Soil sampling guidelines. https://regenorganic.org/wp-content/uploads/2020/10/ROC_Soil_Sampling_Guidelines.pdf

Shepherd G., 2000. Visual soil assessment: field guide for cropping. , p. 1-84. https://orgprints.org/id/eprint/30582/

CROSSROADS project

Slake test

Sheet

SCORING SYSTEM :

More is better

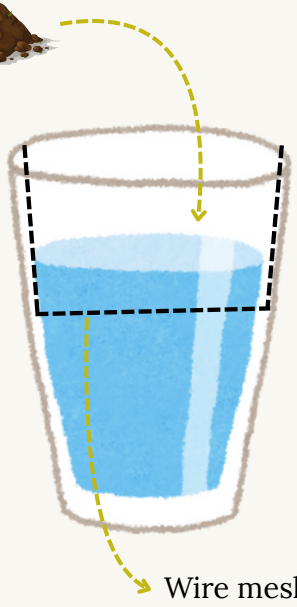
HIGHLIGHTS ...

By assessing the capacity of soil aggregates to reduce degradation, this test provides a good insight into a soil's structural stability.

PROTOCOL

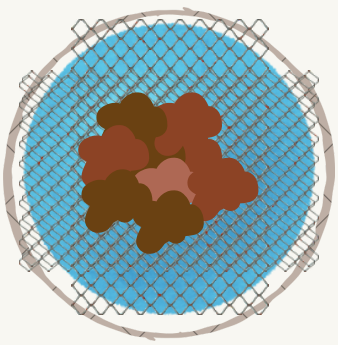
Step 1 :

Collect samples of soil (the size is of little importance). **Prepare** your jar by placing the wire mesh (from 0.5 to 1cm), formed into a basket. Add also the water, so that once the sample has been placed, the latter will be completely under water.



Note: Better to be done when the soil is dry otherwise the results won't be relevant.

Step 2 :



Put the sample on the wire mesh simultaneously and start the stopwatch.

EQUIPMENT REQUIRED

Spade / Glasses of water / Wire mesh (from 0.5 to 1cm) / Cell phone

TIME :

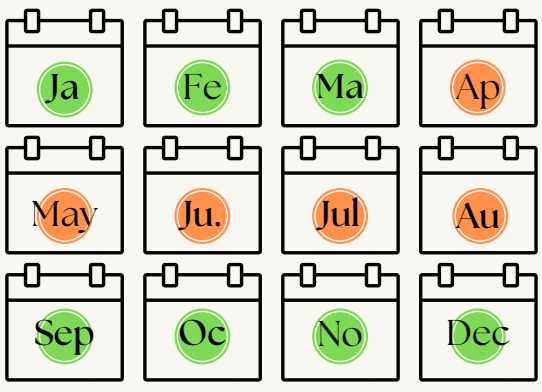
Per sample :

With repeats :

COST :

It may be advisable to purchase the wire mesh for several farms. Its total cost is £12, whereas would need around 50cm maximum, making a total of £1 [1].

WHEN TO SAMPLE ?



FURTHER INFORMATION :

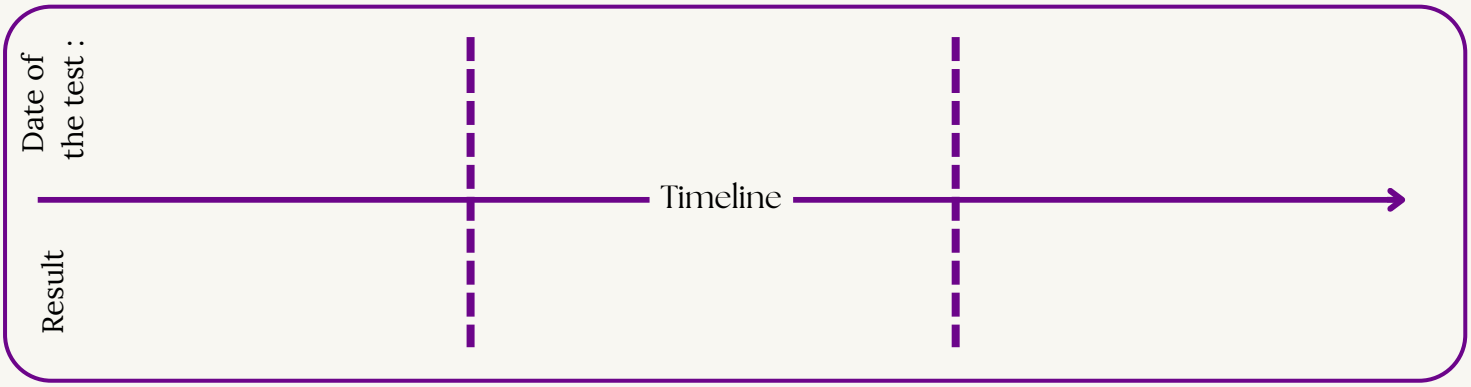
Slake app	This app (available on IOS and Android) allows users to determine the aggregate stability of a soil quickly and easily and is even less destructive than the slake test itself. The trend and results obtained with this app are therefore comparable with the in-the-field test.

SCORING CARD

Ref : (Pioli, 2023 ; ValentBioSciences, réal., 2020)

	Low soil quality	Medium soil quality	High soil quality
Thresholds	The sample falls apart and disintegrates in less than 2 minutes.	The sample falls apart and disintegrates in 2-10 minutes. **Or** a small portion of the sample remains intact (<50%).	The sample falls apart and disintegrates in more than 10 minutes. **Or** a great portion of the sample remains intact (>50%).
Interpretation	Underline the poor stability of a soil (poor microbiodiversity, lack of organic matter), maybe caused by intensive cropping and/or intensive tillage. This soil is more susceptible to the effects of erosion and its capacity to infiltrate and retain water is greatly reduced (poorly developed pore network).	Underline a pore network that does not allow a high water infiltration or retention capacity but also show a moderate resilience to erosion.	Underline the great stability of a soil (with great amount of organic matter and great microbiodiversity). It is highly resistant to erosion (by water or wind) and has a high water infiltration and retention capacity (developed pore network).

NOTES



References :

Herrick J.E., Whitford W.G., de Soyza A.G., Van Zee J.W., Havstad K.M., Seybold C.A., et Walton M., 2001. Field soil aggregate stability kit for soil quality and rangeland health evaluations. CATENA, 44 (1), p. 27-35. DOI : 10.1016/S0341-8162(00)00173-9

Pioli S., 2023. Field exercises | Global Soil Partnership | Food and Agriculture Organization of the United Nations | Aggregate Stability: Slake test. https://www.fao.org/global-soil-partnership/soil-doctors-programme/educational-material/field-exercises/en/ .

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Soil quality for environmental health, 2011. Soil Quality: Indicators: Slaking. http://soilquality.org/indicators/slaking.html

USDA, 2001. Soil Quality Test Kit Guide. https://www.nrcs.usda.gov/sites/default/files/2022-10/Soil%20Quality%20Test%20Kit%20Guide.pdf

ValentBioSciences, réal., 2020. Slake Test Demonstrates Soil Stability. https://www.youtube.com/watch?v=FKa2oIgRuPY

Vidacycle, 2022. Slake (Wet Aggregate Stability) – Soilmentor. https://soils.vidacycle.com/soil-tests/1-2-slake-0-8/

Reference for the sieve :

[1] https://www.amazon.co.uk/Space-IOT-Rodent-Prevention-Filling-Squirrel/dp/B0CS6Q6YNV/ref=sr_1_7?adgrpid=160571570106&dib=eyJ2IjoiMSJ9.PcQGg6iN98wVwldVauuyfFd7aiHaFfPB2iqV1YWt0froRgYvMAoVPmxOzxIjlC8y3jvLDohZIZJFFOVUJowb9LyUl5Ir9axgG89eh7RbT8szrKHKfKeu_aiGWB-sy9YNoqwnkcMaNBJS_nrXcXHCjl76vixOIUmHjcpwUBtq29qEzvQOvWHRoKRJWooY3FtQz89o9oxAq1HTtzeHAJsjN5iCNZTC8VJoJ15wkiXOoBEjGE1Y_HOqTS6d5HAS3KGAJLf_iqWwlrEHP2Zp8oNV7JyA113Ctnh_E8sTxBQH2GM.G-48Vgd8lsx235ZuQ7y_0faHuA8gMGNOobf5lFel1zk&dib_tag=se&gad_source=1&hvadid=696509802190&hvdev=c&hvexpln=69&hvlocphy=1006779&hvnetw=g&hvocijid=2424995356416143207--&hvqmt=e&hvrand=2424995356416143207&hvtargid=kwd-320765358715&hydadcr=22612_2214453&keywords=wire%2Bmesh%2Bamazon&mcid=5bd37bc30c173075af4772b177236724&qid=1752744619&sr=8-7&th=1

CROSSROADS project

SOCit app – SOC test

Sheet

SCORING SYSTEM :

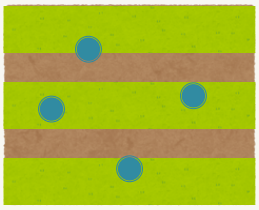
More is better

HIGHLIGHTS ...

The amount of soil organic carbon is often described as the most important parameter of the soils. It influences soil structure, soil texture, and soil infiltration rate.

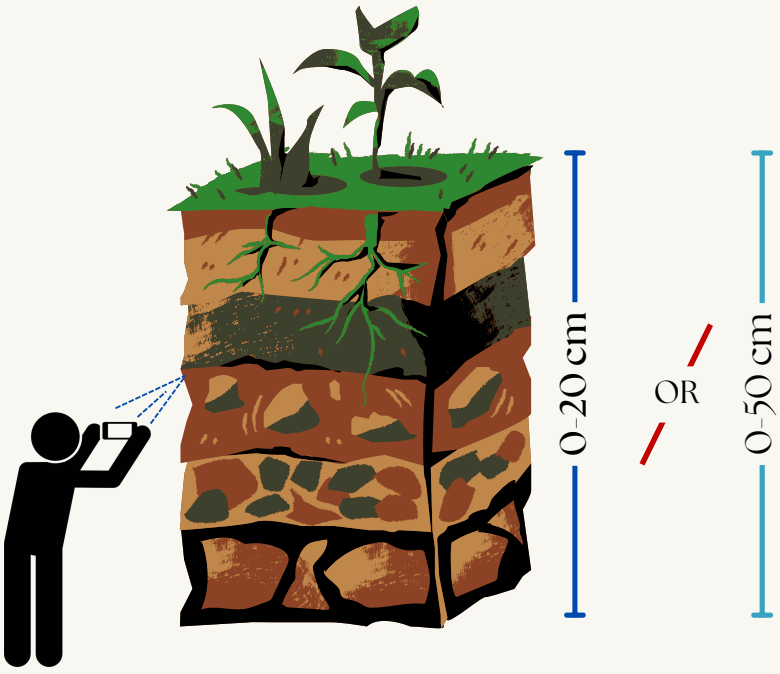
PROTOCOL

Step 1 :



Legend :
- Possible sample area
- Crop lines
- Plough lines or animal pathway

Dig a soil profile at a key point on your plot (as shown above). The depth of your soil profile depends on whether you want to assess the topsoil organic carbon or the topsoil and subsoil organic carbon.



Step 2 :

Take a picture of the soil profile with the SOCit app. This will estimate the soil organic carbon.

Note : Pay attention to the way you realise the soil profile. It needs to as straight as possible. To be accurate, the picture must include the entire profile without being askew or showing too much plant cover (if present).

EQUIPMENT REQUIRED

Cell phone

TIME :

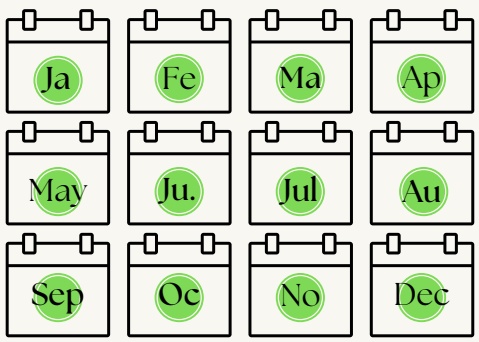
Per sample :

With repeats :

COST :

It is assumed that the required equipment is already available for the stakeholder or provided by external workers. The cost of this test is therefore zero.

WHEN TO SAMPLE ?



Note : Better to be done during intercropping season to reduce the impact on crop yield.

FURTHER INFORMATION :

Soil colour

The soil organic matter could also be assessed qualitatively thanks to the farmers' knowledge. Therefore, if you do not have access to a cell phone you can still assess the organic carbon content of the soil. The only difficulty here is to make sure that the adjectives chosen (to describe a precise soil profile) are consistent between farmers.

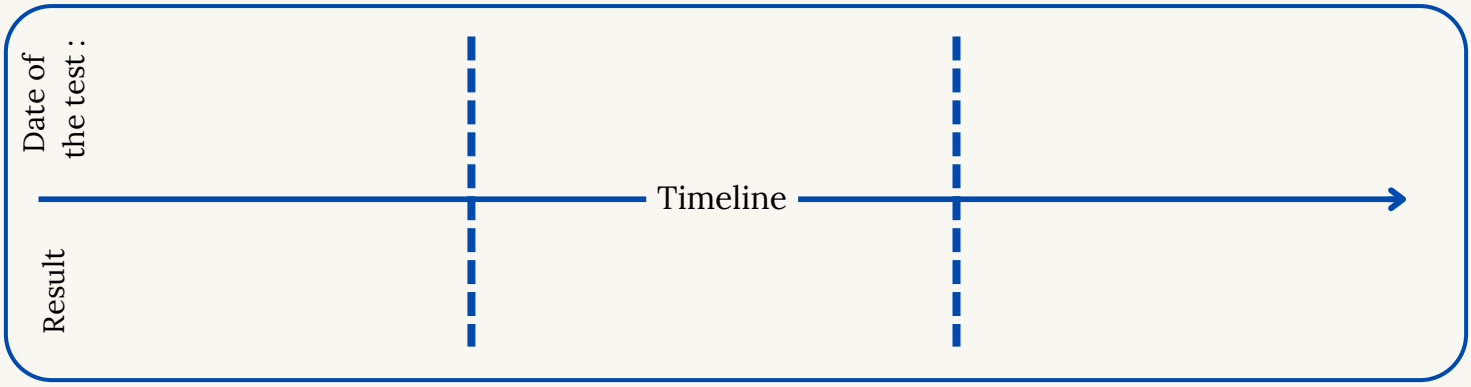
(see the sheet associated with this indicator)

SCORING CARD

Ref : (Mulat et al, 2021)

	Low soil quality	**Medium soil quality**	**High soil quality**
Thresholds	Between 1 and 3.5% of organic matter.	Between 3.5 and 6.5% of soil organic matter.	More than 6.5% of soil organic matter.
Description	May be linked to intensive cropping. Such a small share of soil organic carbon could lead to poor structure, low plant water availability, etc., which could therefore lead to an important decrease in the yield.	The soil, without presenting big issues in terms of structure, available water, available nutrients, etc., still needs to be enriched in order to obtain a medium to good crop yield.	The availability of nutrients is favoured, the abundance of microbiodiversity is also favoured, the structure and the aggregate stability are more important, etc. All of this is in favour of a higher yield.

NOTES



References :

Aitkenhead M., Cameron C., Gaskin G., Choisy B., Coull M., et Black H., 2018. Digital RGB photography and visible-range spectroscopy for soil composition analysis. Geoderma, 313, p. 265-275. DOI : 10.1016/j.geoderma.2017.11.020

Aitkenhead M., Coull M., Gwatkin R., et Donnelly D., 2016. Automated Soil Physical Parameter Assessment Using Smartphone and Digital Camera Imagery. Journal of Imaging, 2 (4), p. 35. DOI : 10.3390/jimaging2040035

Aitkenhead M., Donnelly D., et Coull M., 2022. SOCiT app - Bioregions. https://bioregions.efi.int/socit-app/

Aitkenhead M.J., Poggio L., Wardell-Johnson D., Coull M.C., Rivington M., Black H.I.J., Yacob G., Boke S., et Habte M., 2020. Estimating soil properties from smartphone imagery in Ethiopia. Computers and Electronics in Agriculture, 171, p. 105322. DOI : 10.1016/j.compag.2020.105322

Mulat Y., Kibret K., Bedadi B., et Mohammed M., 2021. Soil quality evaluation under different land use types in Kersa sub-watershed, eastern Ethiopia. Environmental Systems Research, 10 (1), p. 1-11. DOI : 10.1186/s40068-021-00224-6

The James Hutton Institute, 2022. SOCiT : Information & Computational Sciences. https://ics.hutton.ac.uk/socit/

CROSSROADS project

Teabag index

Sheet

SCORING SYSTEM :

More is better

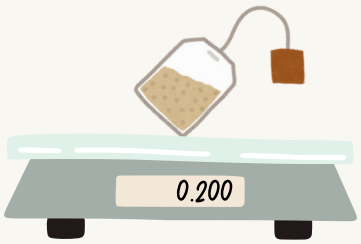
HIGHLIGHTS ...

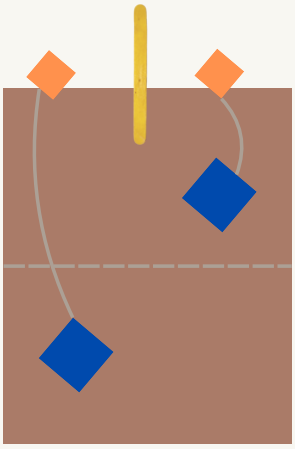
Highlights the richness of soil microbiodiversity, essential for soil balance and health.

PROTOCOL

Step 1 :

Weigh each tea bag before burying

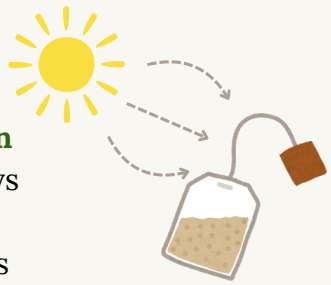




Step 2 :

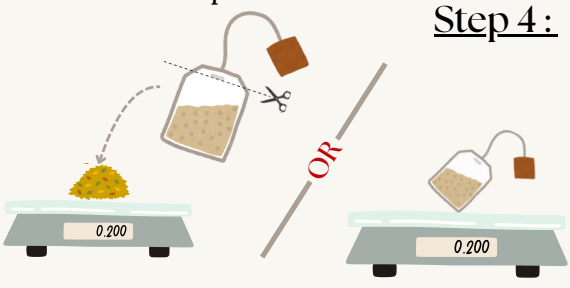
Bury **several tea bags** in the soil (with a marker stick to find them later). Leave **for a period** of **1-90 days**. Put tea bags at different depth to get more information.

Step 3 :



Dry the tea bag under the sun (between few hours to few days depending of the tea bag moisture). **Clean it** as much as possible.

Step 4 :



Weigh each tea bag and **compare it** to the initial weight.

EQUIPMENT REQUIRED

- Lipton Green tea bag, product number EAN 87 10908 90359 5
- Lipton Rooibos tea bag, product number EAN 87 22700 18843 8
- a stick
- a balance (as precise as possible)

Note : the test can be conducted with other brands than Lipton tea as long as green and rooibos tea are studied

TIME :

Per sample : (for the manipulation only)

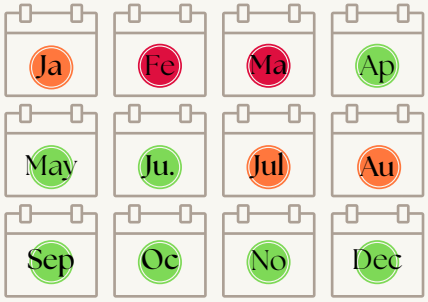
With repeats :

COST :

It depends on the tea brand chosen. In the European market, for a package of 20 to 30 bags, the price could vary from £2 to £7.

The balance is the most expensive item that the farmers must obtain.

WHEN TO SAMPLE ?



(linked to the hotest periods of the year)

FURTHER INFORMATION :

Soil your undies test

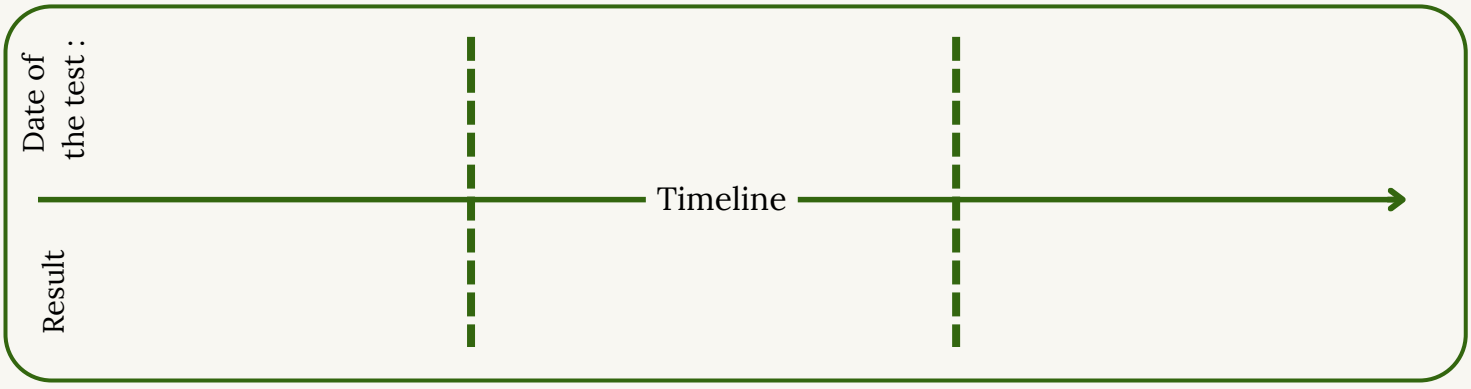
With less equipment, this test could replace the tea bag index (for the poorest farmers in particular). Using the same protocol, the trends revealed by the latter are the same. Instead of burying a tea bag, you bury a pair of cotton pants. The more decomposed the pants are after a period of 3 months, the greater the microbiodiversity of the soil.

SCORING CARD

Ref : (Tresch et al, 2021)

	Low soil quality	Medium soil quality	High soil quality
Description	Neither green nor Rooibos tea shows decomposition indices (broken leaves ...) and both are still in their original shape.	Green tea shows signs of decomposition and has lost up to 50% of its original mass, while Rooibos is tea still in its original shape.	Green tea lost around 50% of its original mass (optimum after 3 months in the soil). Rooibos shows first signs of degradation (broken tea leaves, ...)
Interpretation	The microbiodiversity of soil is very limited or even non-existent, and does not even allow the decomposition of simple organic material.	The microbiodiversity of soil enables the decomposition of simple organic matter. But still limited to enable the decomposition of more complex organic material.	The microbiodiversity of soil is rich and important, and enables the decomposition of simple and complex organic matter.

NOTES



References :

Mori T., Ono K., et Sakai Y., 2023. Testing the Tea Bag Index as a potential indicator for assessing litter decomposition in aquatic ecosystems. Ecological Indicators, 152, p. 110358. DOI : 10.1016/j.ecolind.2023.110358

Nachimuthu G., Hundt A., Palmer B., Schwenke G.D., et Knox O.G.G., 2022. Cotton strip assay detects soil microbial degradation differences among crop rotation and tillage experiments on Vertisols. Journal of Microbiological Methods, 200, p. 106558. DOI : 10.1016/j.mimet.2022.106558

Pino V., McBratney A., O'Brien E., et Ng W., 2021. Boosting soil citizen-science using Tea Bag Index method towards soil security in Australia. Soil Security, 5, p. 100016. DOI : 10.1016/j.soisec.2021.100016

Tea tales project, 2024. Teabag Index. https://teabagindex.org/

Tresch S. et Fliessbach A., 2021. Decomposition study using tea bags : a method to study soil quality. https://www.fibl.org/fileadmin/documents/shop/1098-teabag.pdf

CROSSROADS project

Texture triangle test

Sheet

SCORING SYSTEM :

Clay (%)
Silt (%) → Optimum range
Sand (%)

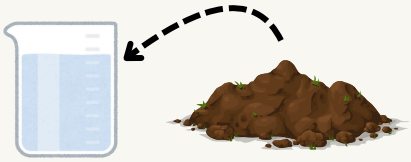
HIGHLIGHTS ...

The texture of the soil, which plays a key role in water retention, workability, soil structure etc.

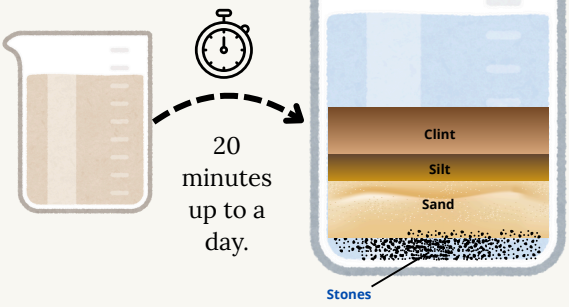
PROTOCOL

Step 1 :

Collect some topsoil and remove any debris, etc. **Place** it in a big glass or jar, add water (so that the sample is fully underwater) and **shake.**



Step 2:



20 minutes up to a day.

Wait until each different sized particles have separated from the others, and measure the height of yeach layer.

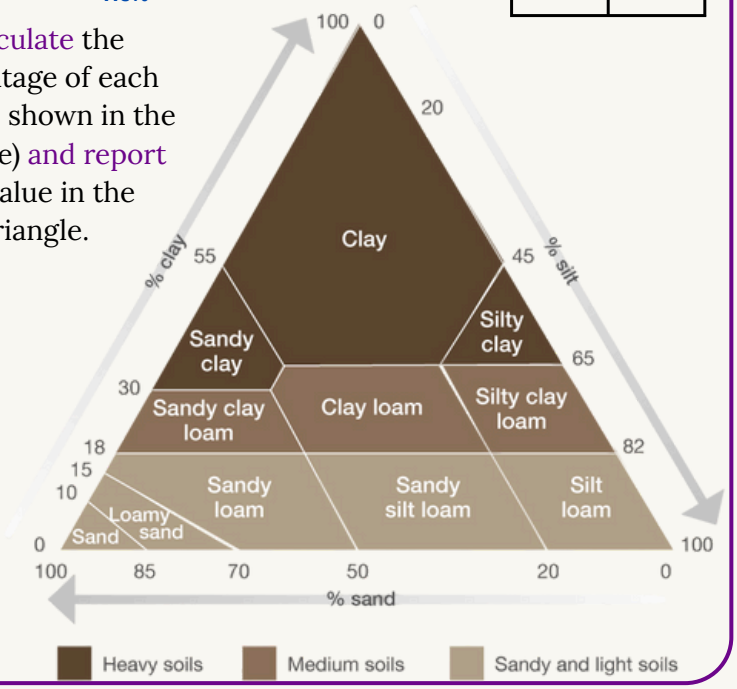
Step 3 :

$$Hc\% = \frac{100\ \% \times Hc}{Htot} = \frac{100\ \% \times 3}{10}$$

$$Hc\% = 30\ \%$$

Htot	Hc
100 %	?

Calculate the percentage of each layer (as shown in the example) and report the value in the triangle.

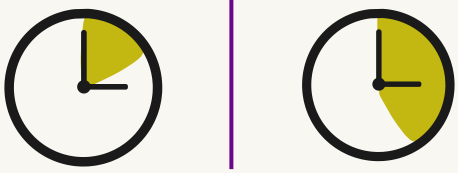


EQUIPMENT REQUIRED

Glass (or jar) of water / ruler / cell phone

TIME :

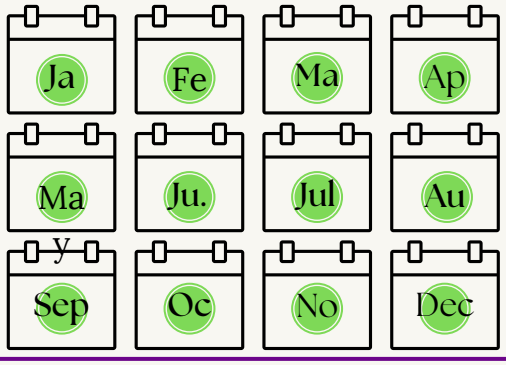
Per sample : (for the manipulation only) **With repeats :**



COST :

It is assumed that the required equipment is already available for the stakeholder or provided by external workers. The cost of this test is therefore zero.

WHEN TO SAMPLE ?

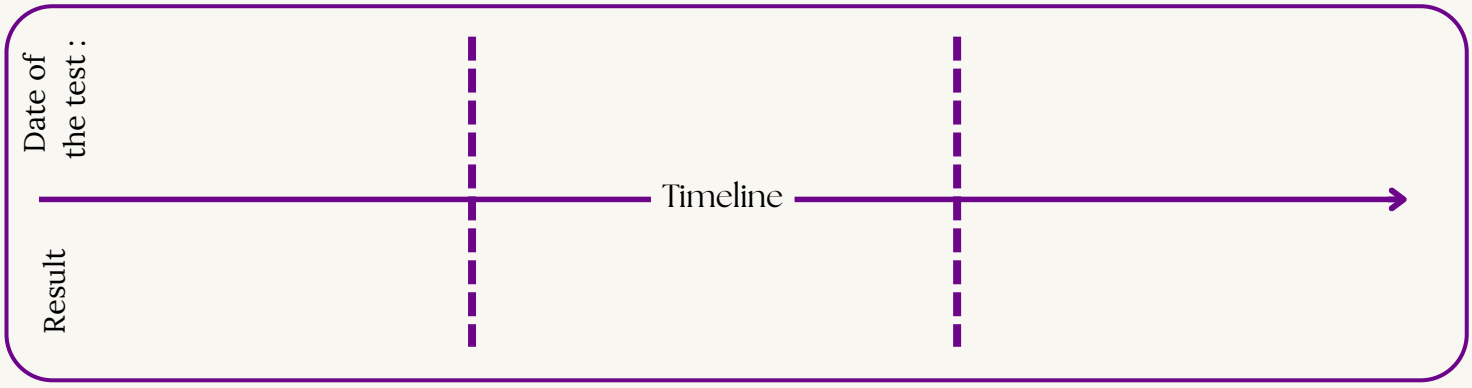


SCORING CARD

Ref : (Endrias et al, 2024 ; Queensland Government, 2025)

	Low soil quality	Medium soil quality	High soil quality
Thresholds	**Sand → lower than 20% or more than 70%** **Silt →** lower than 7% or more than 30% **Clay → lower than 15% or more than 45%**	**Sand → 20 to 40% or 50 to 70%** **Silt →** 7 to 15% or 20 to 30% **Clay → 15 to 25% or 30 to 45%**	**Sand → 40 to 50%** **Silt → 15 to 20%** **Clay → 25 to 30%**
Interpretation	Root growth moderately to severely restricted or not. Low plant available water. Drainage capacity high or really restricted.	Moderate plant available water. Root growth moderately restricted and or little resistance to root growth. Moderate to high drainage capacity.	Root growth not restricted. Moderate to high plant available water. Moderate to high drainage capacity.

NOTES



References :

AHDB, [s d]. How to determine soil texture | AHDB. https://ahdb.org.uk/knowledge-library/how-to-determine-soil-texture

Endrias M., Assen M., et Legass A., 2024. Impacts of land use and management methods on soil quality dynamics in central highlands of Ethiopia. Environmental Monitoring and Assessment, 196 (9), p. 1-22. DOI : 10.1007/s10661-024-13003-4

FAO/GSP, 2020. Soil testing methods manual. 1re éd.Rome, Italy : FAO, 105 p. ISBN 978-92-5-131195-0

Queensland Government, 2025. Soil texture | Soil properties. https://www.qld.gov.au/environment/land/management/soil/soil-properties/texture

Rajendra T.C., Gomez C., Dharumarajan S., et Kumar D.N., 2025. Assessing soil texture classification accuracy based on VNIR lab spectroscopy. Chemometrics and Intelligent Laboratory Systems, 263, p. 105419. DOI : 10.1016/j.chemolab.2025.105419

CROSSROADS project

Simplified TSBF (Tropical Soil Biology and Fertility) test

Sheet

SCORING SYSTEM :

More is better

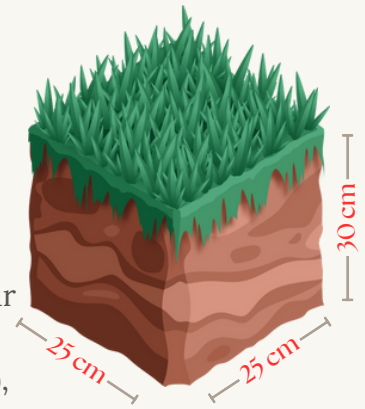
HIGHLIGHTS ...

Highlights the richness of soil fauna to the naked eyes , essential for nutrient cycling, organic matter decomposition, etc.

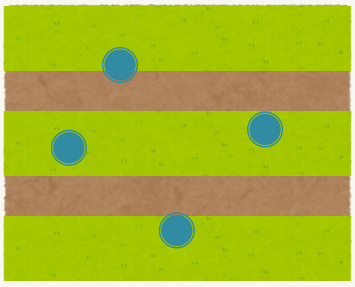
PROTOCOL

Step 1 :

Take a soil sample to the measurements shown opposite. And repeat it at least twice for each area studied.



Note : Make sure to not take your sample on the visible path of animals (in the case of pastures), or to take it in a line parallel to the sowing line (where the plough pass), and finally avoid the boundaries of the land studied.



Legend :

- Possible sample area
- Crop lines
- Plough lines or animal pathway

Step 2 :

Gently break up clods and soil aggregates with your fingers to extract all macrofauna (insects or other animals) contained in the soil sample.

Step 3 :

Identify (using a determination key) and **record** each species in a table.

EQUIPMENT REQUIRED

Spade / Plastic bag or storage box

TIME :

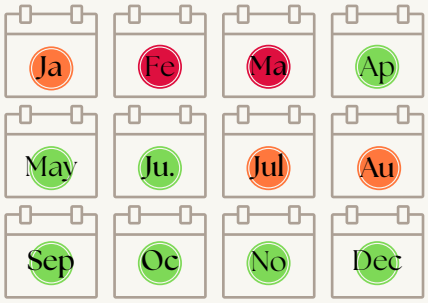
Per sample :

With repeats :

COST :

It is assumed that the required equipment is already available for the stakeholder or provided by external workers. The cost of this test is therefore zero.

WHEN TO SAMPLE ?



(linked to the hotest periods of the year)

FURTHER INFORMATION :

The pitfall trap

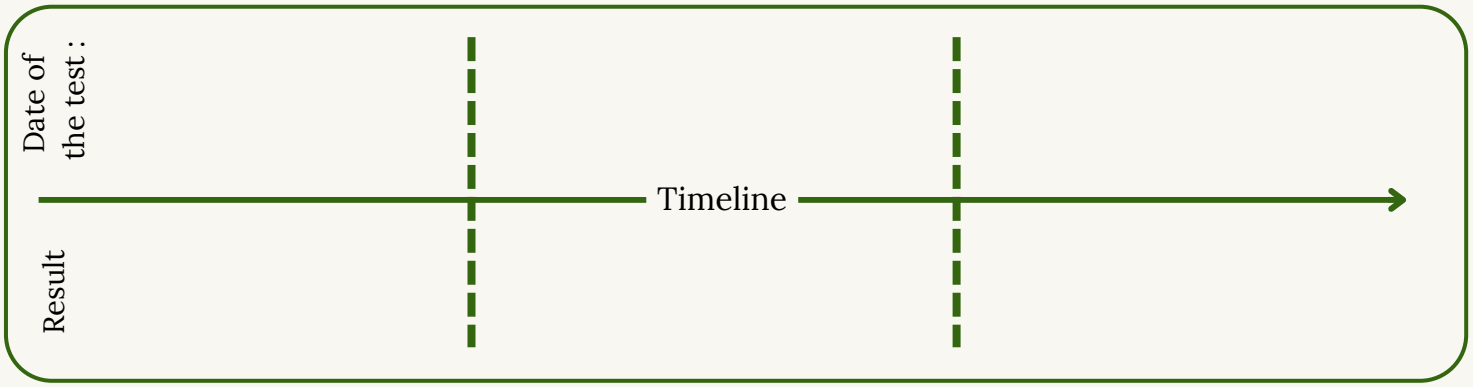
The macrofauna living above ground also really important for the soil health. The pitfall trap assesses this indicator quite simply with a simple jar buried in the ground (the top of it needs to be at the soil level). By leaving it for a few days, with a little water to trap all the organisms that fall into it, this test takes less time than the TSBF test.

SCORING CARD

Ref : (Masebo et al, 2024 ; AHDB, 2023)

	Low soil quality	**Medium soil quality**	**High soil quality**
Description	Low specific abundance (maximum 2) and low relative abundance (less than 5 individuals).	Few species were found (between 3 and 6) with low to medium (5 to 10 individuals) abundance.	A wide range of species were found (more than 6) with low to high (more than 10 individuals) abundance.
Interpretation	May be linked to intensive cropping. The result will be less bioturbation of the organic matter, or even less aggregates stability, etc., which could have a serious impact on crop yield.	Without causing any major losses in terms of yield, this type of soil does not allow its potential macrofauna to develop properly. This could indicate that the organic matter content is too low, that the structure has very little oxygen, is too compact, etc.	The high abundance of species and individuals is a good indicator of soil stability, richness in terms of organic carbon, etc., which enhances crop yield.

NOTES



References :

AHDB, 2023. The soil health scorecard | AHDB. https://ahdb.org.uk/knowledge-library/the-soil-health-scorecard (Consulté le 13 juin 2025).

Anderson J. et Ingram J., 1994. Tropical Soil Biology and Fertility: A Handbook of Methods. Soil Science, 157, p. 265. DOI : 10.2307/2261129

Andriamampianina J., Charles A., Cornaert L., Maubé B., et Willaume C., 2018. Caractérisation de la macrofaune du sol (méthode TSBF) | SECuRE. https://www.secure.mg/fiches-rapports-techniques/descripteur-1-caracterisation-de-la-macrofaune-du-sol-methode-tsbf

Angst G., Potapov A., Joly F.-X., Angst Š., Frouz J., Ganault P., et Eisenhauer N., 2024. Conceptualizing soil fauna effects on labile and stabilized soil organic matter. Nature Communications, 15 (1), p. 5005. DOI : 10.1038/s41467-024-49240-x

Brenner K., 2020. How to Make a Pitfall Trap – Migratory Legends. https://www.metrofieldguide.com/how-to-make-a-pitfall-trap/

Masebo N., Birhane E., Takele S., Belay Z., Lucena J.J., Perez-Sanz A., et Anjulo A., 2024. The diversity and abundance of soil macrofauna under different agroforestry practices in the drylands of southern Ethiopia. Agroforestry Systems, 98 (2), p. 441-459. DOI : 10.1007/s10457-023-00921-4

Orgiazzi A., Bardgett R.D., Barrios E., Behan-Pelletier V., Briones M.J.I., Chotte J.-L., De Deyn G.B., Eggleton P., Fierer N., Fraser T., Hedlund K., Jeffery S., Johnson N.C., et Jones A., 2016. Global Soil Biodiversity Atlas - ESDAC - European Commission. Publications Office of the European Union. Luxembourg : , 176 p. ISBN 978-92-79-48169-7

CROSSROADS project

Vess test

Sheet

SCORING SYSTEM :

More is better

HIGHLIGHTS ...

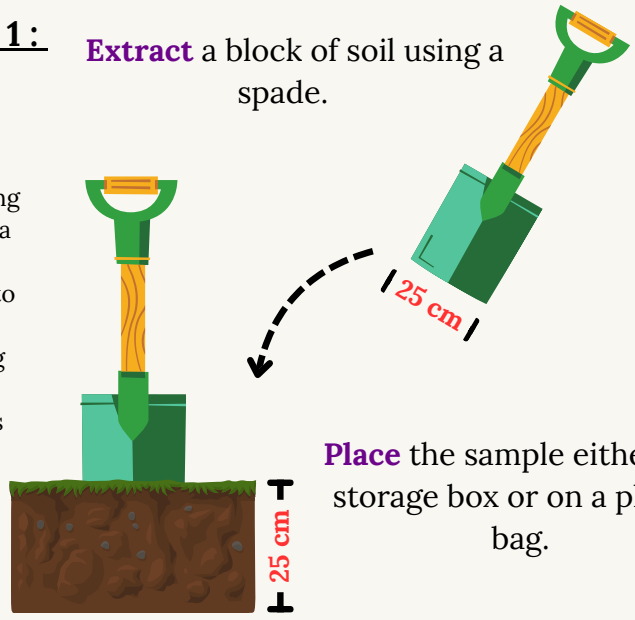
By assessing the aggregates and the porosity, the Vess test provides insight into soil structure.

PROTOCOL

Step 1 :

Extract a block of soil using a spade.

Note : Avoid trampling the area to be tested to avoid biasing the results

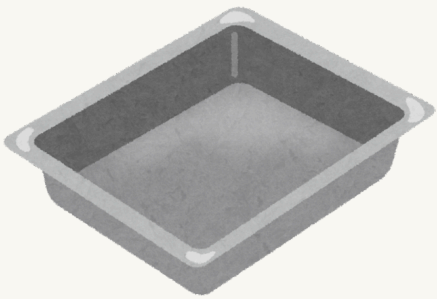


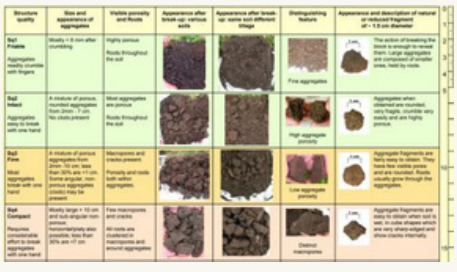
Place the sample either in a storage box or on a plastic bag.

Note : By avoiding placing it directly on the surface of the soil, and thus contaminating the sample taken, it can be used for other tests.

Step 2 :

Match the soil to the pictures, category by category, to determine which fits best and therefore **score** soil.





EQUIPMENT REQUIRED

Spade / Plastic bag or storage box / Cell phone / Ruler

TIME :

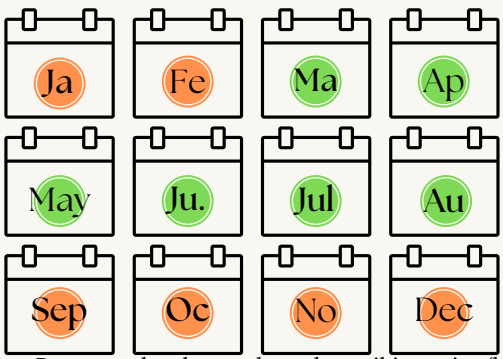
Per sample :

With repeats :

COST :

It is assumed that the required equipment is already available for the stakeholder or provided by external workers. The cost of this test is therefore zero.

WHEN TO SAMPLE ?



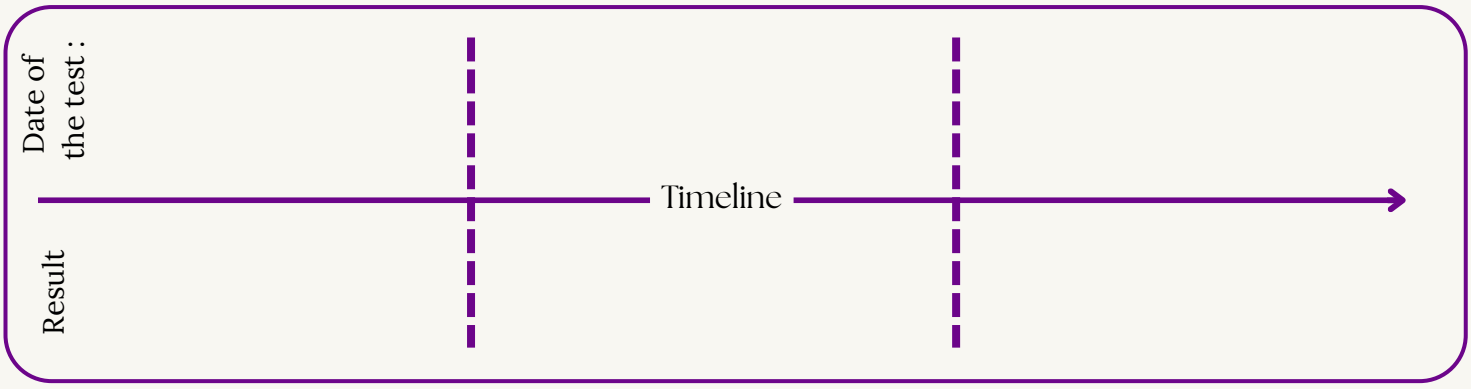
Note : Better to be done when the soil is moist (but not wet)

SCORING CARD

Ref : (SRUC, 2016)

	Low soil quality	Medium soil quality	High soil quality
Thresholds	Overall score of 4 or 5	Overall score of 3	Overall score of 1 or 2
Interpretation	With its high compaction this soil is difficult to cultivate. It's poor porosity is a limiting factor for the proper development of the root system, but also limits water infiltration, and can even lead to an oxygen-poor environment. This has an impact on the ability of crops to absorb moisture and nutrients, and therefore on the crop yield.	An average soil structure, with aggregates that are not very friable, have limited infiltration and restricted root development. This can have an impact on crop yields. These phenomena can be exacerbated over time and by climatic conditions.	The rounded aggregates with their multiple pores allow roots to develop easily, as well as ensuring good infiltration. All of this finally ensures that the root network develops properly and does not restrict the growth of the crop.

NOTES



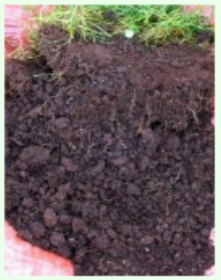
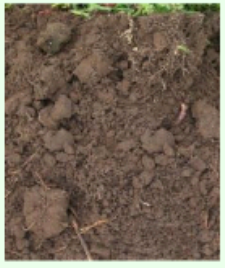
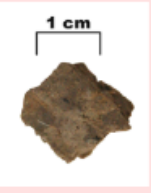
References :

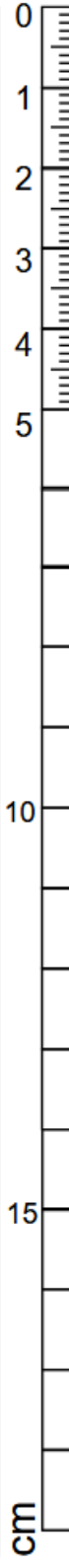
Ball B., Guimaraes R., Batey T., et Munkholm L., 2012. Visual Evaluation of Soil Structure - Vess Chart. https://soils.vidacycle.com/wp-content/uploads/2019/08/VESS_score_chart.pdf

Mutuku E.A., Vanlauwe B., Roobroeck D., Boeckx P., et Cornelis W.M., 2021. Visual soil examination and evaluation in the sub-humid and semi-arid regions of Kenya. Soil and Tillage Research, 213, p. 105135. DOI : 10.1016/j.still.2021.105135

Rakotondrazafy N., Félix-Faure J., Thoumazeau A., et Brauman A., 2025. Protocols / Documentation - BIOFUNCTOOL® a new framework to assess the impact of land management on soil quality. https://www.biofunctool.com/documentation/protocols

SRUC, 2016. Valuing your soil : practical guidance for Scottish farmers. https://www.sruc.ac.uk/research/research-facilities/dairy-research-facility/technical-notes/

Structure quality	Size and appearance of aggregates	Visible porosity and Roots	Appearance after break-up: various soils	Appearance after break-up: same soil different tillage	Distinguishing feature	Appearance and description of natural or reduced fragment of ~ 1.5 cm diameter
Sq1 Friable Aggregates readily crumble with fingers	Mostly < 6 mm after crumbling	Highly porous Roots throughout the soil			 Fine aggregates	 The action of breaking the block is enough to reveal them. Large aggregates are composed of smaller ones, held by roots.
Sq2 Intact Aggregates easy to break with one hand	A mixture of porous, rounded aggregates from 2mm - 7 cm. No clods present	Most aggregates are porous Roots throughout the soil			 High aggregate porosity	 Aggregates when obtained are rounded, very fragile, crumble very easily and are highly porous.
Sq3 Firm Most aggregates break with one hand	A mixture of porous aggregates from 2mm -10 cm; less than 30% are <1 cm. Some angular, non-porous aggregates (clods) may be present	Macropores and cracks present. Porosity and roots both within aggregates.			 Low aggregate porosity	 Aggregate fragments are fairly easy to obtain. They have few visible pores and are rounded. Roots usually grow through the aggregates.
Sq4 Compact Requires considerable effort to break aggregates with one hand	Mostly large > 10 cm and sub-angular non-porous; horizontal/platy also possible; less than 30% are <7 cm	Few macropores and cracks All roots are clustered in macropores and around aggregates			 Distinct macropores	 Aggregate fragments are easy to obtain when soil is wet, in cube shapes which are very sharp-edged and show cracks internally.
Sq5 Very compact Difficult to break up	Mostly large > 10 cm, very few < 7 cm, angular and non-porous	Very low porosity. Macropores may be present. May contain anaerobic zones. Few roots, if any, and restricted to cracks			 Grey-blue colour	 Aggregate fragments are easy to obtain when soil is wet, although considerable force may be needed. No pores or cracks are visible usually.



CROSSROADS project

Weed infestation

Sheet

SCORING SYSTEM :

(here the weeds are only considered as bioindicator)

HIGHLIGHTS ...

Some soil properties (pH, water retention capacity, etc), thanks to the presence of some plants, that can be considered as bioindicators.

PROTOCOL

Step :

Walk through the field or pasture as shown in Figure 1. As soon as you find a weed, remove it and identify it. .

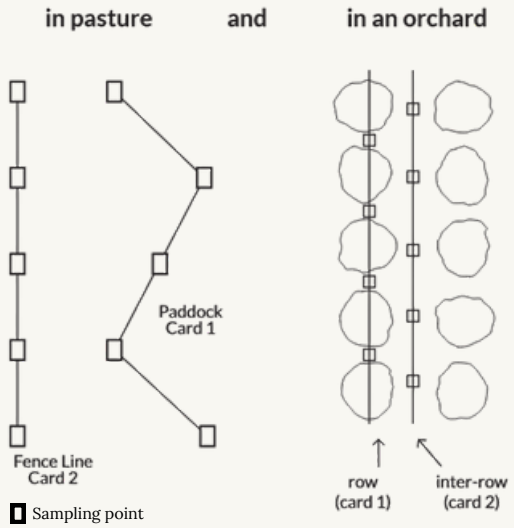


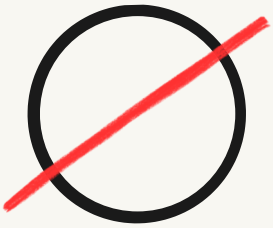
Figure 1. Sampling points layout (Soil Care Inc., 2024)

For greater accuracy, when sampling, you can note the diversity and abundance of each weed in each area, enabling the farmer to respond more effectively (biological control, weeding, etc.)

Example of a common weed in Ethiopia (Guji et al, 2019). Drymaria cordata (Caryophyllaceae) known to prefer loamy soil, neutral to alkaline soil (pH around 6.5) Ref → Useful tropical land website

Note : This sheet and its associated protocol are just an example of how to carry out this test. The dialogue between farmers and extension workers must remain paramount. Changes can be made to this sheet without affecting the reliability of the results.

EQUIPMENT REQUIRED



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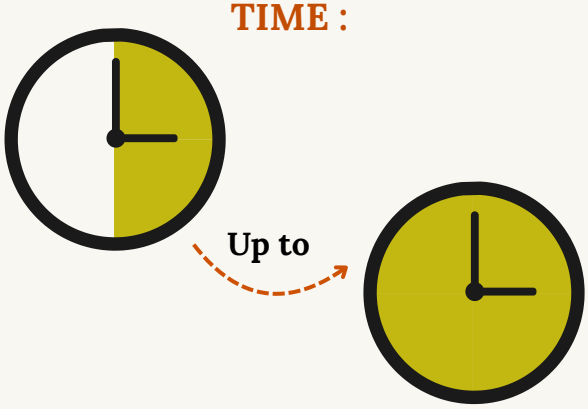
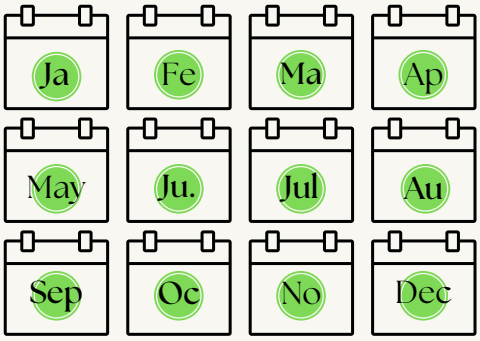


(depending on the size of the farm)

COST :

Besides a spade, this series of tests requires no other equipment. The cost of this test is therefore zero.

WHEN TO SAMPLE ?



CROSSROADS project

Crop appearance

Sheet

SCORING SYSTEM :

Optimum range

HIGHLIGHTS ...

The height, the density of a crop but also the colour of their leafs are are all indicators that the soil is too acidic, too lacking in nutrients etc.

PROTOCOL

Step : Walk through the field or pasture as shown in Figure 1. As soon as you see a plant with unusual signs (spots on the leaves, unusual height, etc.), write it down on a sheet of paper and try to figure out what's causing it (lack of water, nutrient deficiency, etc.).

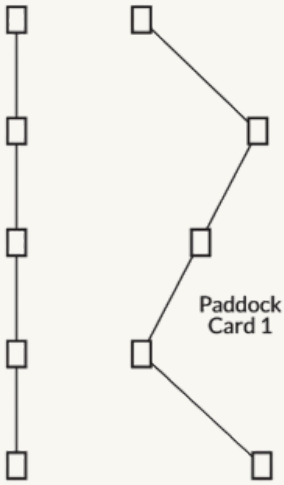


Figure 1. Example of sampling points layout (Soil Care Inc., 2024)

For greater accuracy, when sampling, it is possible to note the diversity and abundance of these signs for each area, thus enabling the farmer to respond more effectively (fertilisation, addition of organic matter, etc.).

Example of phosphorus deficiency in corn: the tips of the leaves turn purple.

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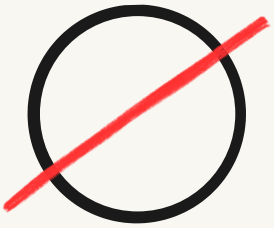
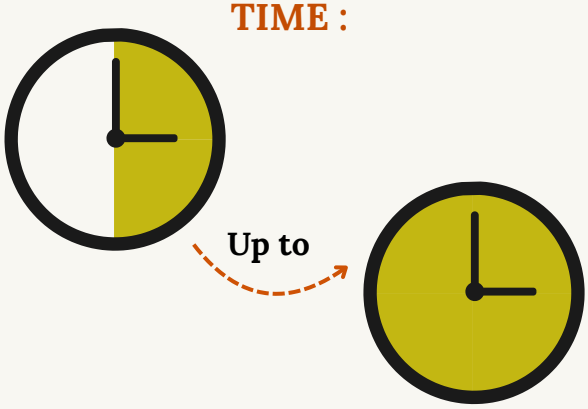
EQUIPMENT REQUIRED



TIME :



(depending on the size of the farm)

COST :

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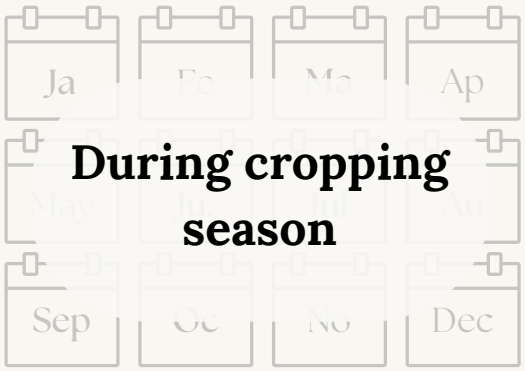
WHEN TO SAMPLE ?



CROSSROADS project

Soil colour

Sheet

SCORING SYSTEM :

More is better

HIGHLIGHTS ...

The amount of soil organic carbon is often described as the most important parameter of the soils. It influences soil structure, soil texture, and soil infiltration rate.

PROTOCOL

Step : Walk across the field or pasture as shown in Figure 1 and observe the colour of the soil surface and/or its top few centimetres.

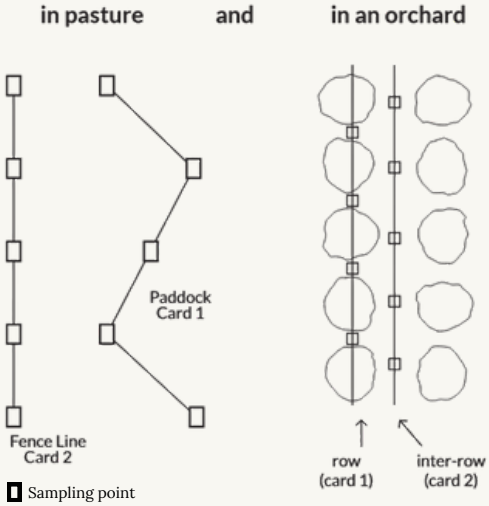


Figure 1. Example of sampling points layout (Soil Care Inc., 2024)

For greater accuracy, when sampling, it is possible to note the diversity and abundance of the different soil type and their associated colour, thus enabling the farmer to respond more effectively (fertilisation, addition of organic matter, etc.).

Example of a Vertisol, one of the main soil type found in Ethiopia. With its black colour, the soil shown here could be classified as 'high soil quality' according to (Tesfahunegn et al, 2011).

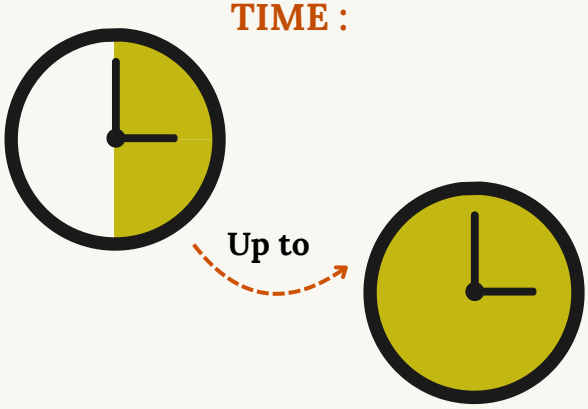
(ISRIC)

Note : This sheet and its associated protocol are just an example of how to carry out this test. The dialogue between farmers and extension workers must remain paramount. Changes can be made to this sheet without affecting the reliability of the results.

EQUIPMENT REQUIRED

Spade

TIME :

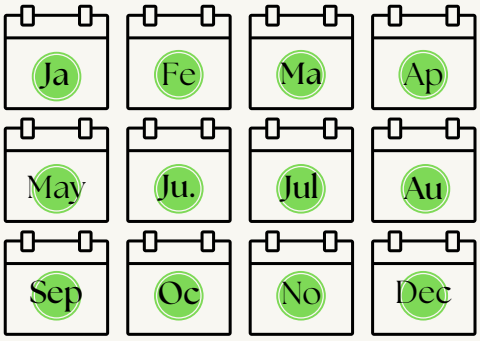


(depending on the size of the farm)

COST :

Besides a spade, this series of tests requires no other equipment. The cost of this test is therefore zero.

WHEN TO SAMPLE ?



CROSSROADS project

Stoniness

Sheet

SCORING SYSTEM :

Less is better

HIGHLIGHTS ...

The effect of water erosion.

PROTOCOL

Step :

Walk across the field or pasture and observe the the presence or absence of stones or pebbles.

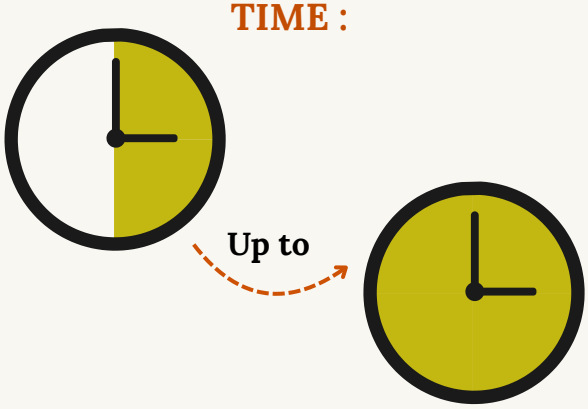
(Tesfahunegn et al, 2011).

Note : This sheet and its associated protocol are just an example of how to carry out this test. The dialogue between farmers and extension workers must remain paramount. Changes can be made to this sheet without affecting the reliability of the results.

EQUIPMENT REQUIRED

Spade

TIME :



(depending on the size of the farm)

COST :

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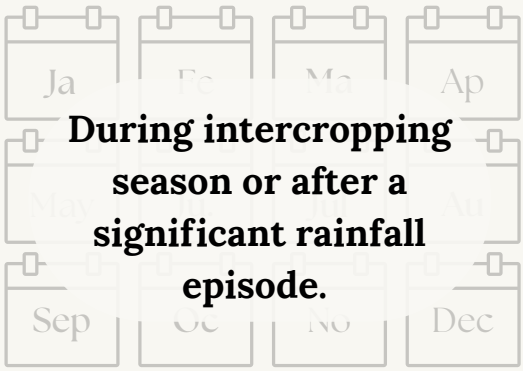
WHEN TO SAMPLE ?



During intercropping season or after a significant rainfall episode.

CROSSROADS project

Rills and Gullies

Sheet

SCORING SYSTEM :

Less is better

HIGHLIGHTS ...

Water erosion consequences at different stages, rills indicates current and reversible erosion issue while gullies indicates past and non-reversible erosion issue.

PROTOCOL

Step :

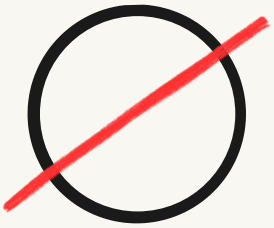
Walk across the field or pasture and observe the the presence or absence of rills and/or gullies.

Rills

Gullies

Note : This sheet and its associated protocol are just an example of how to carry out this test. The dialogue between farmers and extension workers must remain paramount. Changes can be made to this sheet without affecting the reliability of the results.

EQUIPMENT REQUIRED



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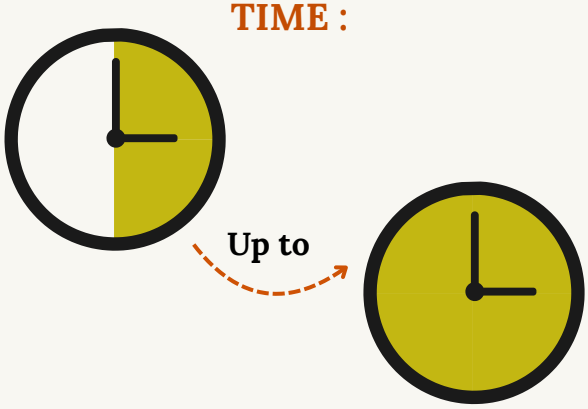
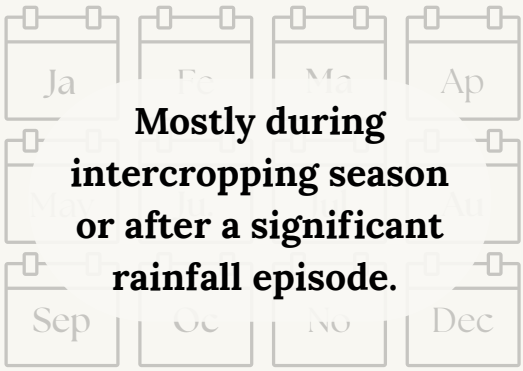


(depending on the size of the farm)

COST :

Besides a spade, this series of tests requires no other equipment. The cost of this test is therefore zero.

WHEN TO SAMPLE ?

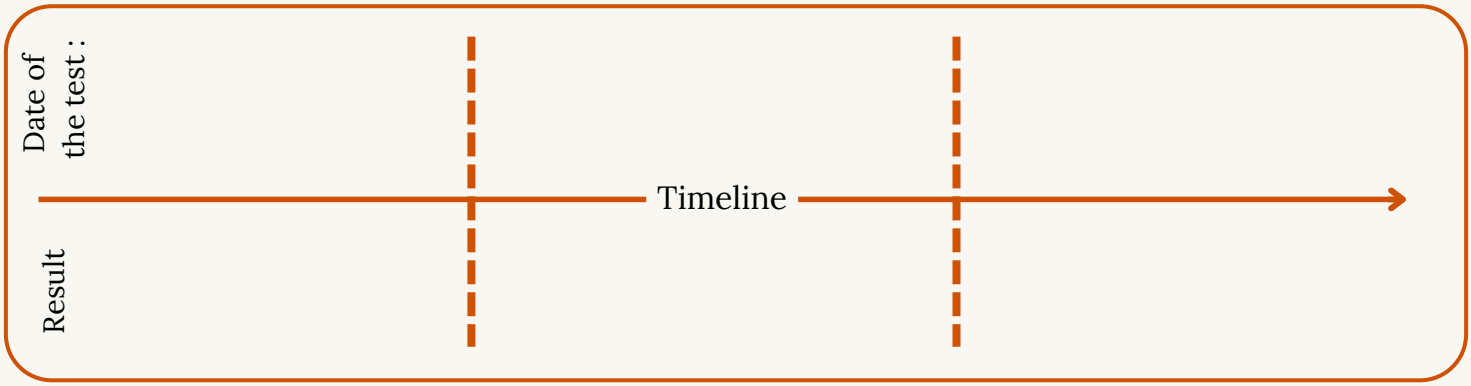


Mostly during intercropping season or after a significant rainfall episode.

SCORING CARD

	Low soil quality	Medium soil quality	High soil quality
Thresholds	No scoring card will be proposed for this category of indicators and tests. In fact, these will have to be constructed alongside the farmers themselves, with the help of extension, which will mean complying with the point ; "Respond to Ethiopian farmers' needs and site specific" in the specifications. A few examples can nevertheless be found in the following papers and form a solid basis for further work (Tesfahunegn et al, 2011 ; Getahun et al, 2025)		
Description			

NOTES



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