

The following examples are intended to help with categorising the observations.

It is not always possible to categorise all parameters. For example, shortly after sowing or in many vegetable crops, the root systems are naturally underdeveloped without this being indicative of a soil health problem. Moreover, earthworms are only active in spring and autumn so are rarely found outside these periods. Drought also means that many parameters (e.g. strength of binding of the aggregates, earthworms etc.) are not meaningful.

The respective fields can then be left blank in the data entry sheet.

To assess whether the conditions are suitable for a spade test a simple in-hand compaction check is recommended. This test can also be used to assess the suitability of the topsoil's and the sub-soil's condition for tillage and driving upon. It is described below. Furthermore, you find explanations and sample images of the observations that can be entered in the form. The letters refer to the corresponding sections in the form.

**Estimate the workability of the soil using the in hand compaction check<sup>1</sup>**

Designation	hard	brittle	malleable
Observation	Chunks of earth can only be broken apart with difficulty	Chunks of earth «crumble» between the fingers when pressed	the soil is kneadable to mushy
Consequence	Do not cultivate; the soil is mechanically crushed by the cultivation equipment and thus severely damaged (high energy input). Ideal for driving on: The floor is stable.	Ideal processing: The soil breaks up along its own separating surfaces. Driving on possible: However, the soil is at risk of compaction if heavy machinery or unfavourable tyres are used.	Do not cultivate: The soil is deformed and compressed. Do not drive on: The soil is permanently compacted.

<sup>1</sup> Hasinger G., Keller T., Marendaz E., Neyroud J.-A., Vökt U., Weisskopf P., 1993: Bodenbeurteilung im Feld. Federal Office for the Environment, Forests and Landscape. (publisher). Jaudas R., 2020: Driving and working the soil. Edition-Imz, teaching aid.

**PROPERTIES OF THE SURFACE**

**Problem areas can be:** stunted plant growth, soil erosion, pooled water, «tramlines», localised drought stress, mouse damage, trampling damage by livestock.

**General comments:** E.g. time and duration of the last temporary grassland ley, specific forms of management, mulch, organic farming, grazing system, grass growth, etc.

**SOIL SURFACE: Assessment of condition**

**A GROUND COVER (radius 1 m)**



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## B SOIL SURFACE COVERING (if bare or residue easily removable)

Degree of decomposition of the aggregates is caused by precipitation, evaporation of moisture, freeze thaw, trampling or traffic.

intact, easily recognisable,  
Permeable surface



Aggregates partly washed out,  
surface nevertheless rough/uneven



Aggregates washed out, surface silty,  
kneaded, few permeable

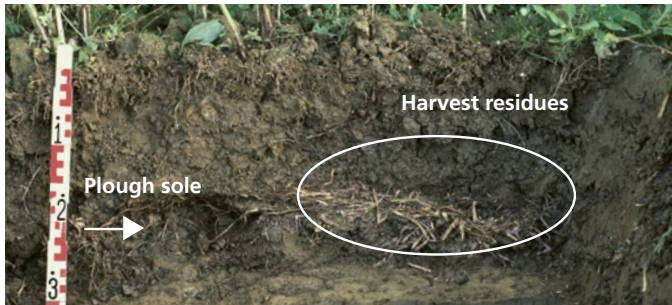


closed crust, aggregates  
deposited sediments, compacted,  
very poorly permeable



## OBSERVATIONS WHILST EXCAVATING

C Plough pan D Undegraded crop residues, straw mattress



E Rust stains or grey-greenish colour tones



F Earthworms (individuals/ducts/faeces/casts), earthworms are naturally inactive in summer and winter.



## SPADE TEST SOIL SAMPLE – Assessment of the condition (each layer separately)

### What is a soil aggregate?

A unit or body of soil particles that adhere together (e.g. due to clay, humus or lime bridges, biological cementation, kneading...) and between which cracks and pores have formed.

### How do I recognise the soil aggregates?

As a rule, the aggregates detach when the spade test block is dropped from hip height onto a hard surface (drop test). The soil block can also be broken by hand (easy separation/breaking without great effort).

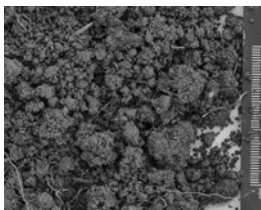
Soil is often a very heterogeneous mixture of aggregates of different sizes. In the spade test, the aggregates that make up the largest volume proportion of the respective soil layer are assessed.



## G SIZE OF THE AGGREGATES

Note: it is not meaningful for assessing the natural quality of the soil structure to compare the size of the aggregates directly after tillage. However, it can then be used to evaluate the result of the tillage.

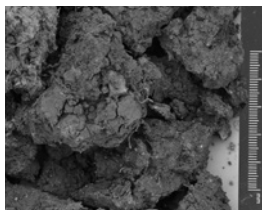
mostly smaller than 1 cm



mostly 1–2 cm



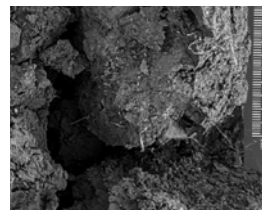
mostly 2–5 cm



mostly larger than 5 cm

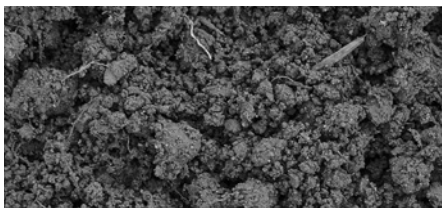


< 10 cm



## H SHAPE OF THE AGGREGATES

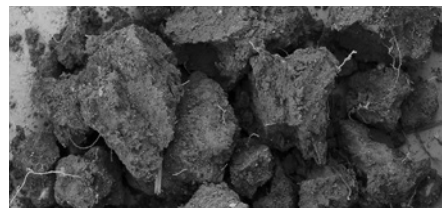
roundish



angular to rounded



sharp-edged



## I POROSITY OF THE AGGREGATES

The porosity describes the cavities in the soil. Larger pores are clearly visible to the eye. They are very important for the circulation of air and the infiltration of water in the soil, for soil biology and for good root development. If the soil consists of very small aggregates or unaggregated, fine material, the porosity of the entire layer is assessed.

porous, many pores



few pores, macropores



dense, no pores or only single



## J FIRMNESS OF THE AGGREGATES

The observed firmness is strongly dependent on the level of soil moisture. As a characteristic to describe the soil quality, it should only be assessed under optimum, slightly moist conditions (very dry = too hard, wet = too soft). The firmness can be easily estimated by pressing an aggregate with two fingers.

## K ROOTING

many, evenly distributed, finely branched



few, evenly distributed



unevenly, root-free zones



## M VESS grade (VESS2020: [www.strudel.agroscope.ch](http://www.strudel.agroscope.ch))

If required and the VESS method (visual evaluation of soil structure) is known, a VESS score can be recorded:

**Sq1:** Size of aggregates < 1, shape roundish, porous, crushable or disintegrating with little force, many roots, evenly distributed.

**Sq2:** Size of the aggregates 2–5 cm or smaller, roundish, porous, crushable with little force, evenly distributed roots.

**Sq3:** mostly > than 5 cm, angular to rounded, few pores, few roots, evenly or unevenly distributed.

**Sq4:** mostly > 10 cm, sharp-edged, can only be crushed with great force, dense, unevenly distributed roots, kinked, root-free.

**Sq5:** like Sq4, more pronounced, larger aggregates.

## Imprint



Project funded by the Federal Office for Agriculture, FOAG.

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The method was developed in co-operation with numerous partners and on the basis of known spade sampling methods. For more information visit our website.

Version July 2023, [www.spatenprobe.ch](http://www.spatenprobe.ch)