ROYAL Eijkelkamp
Meet the difference

Wet sieving apparatus

Manual

Meet the difference

Royal Eijkelkamp
Nijverheidsstraat 9, 6987 EN
Giesbeek, the Netherlands

T +31 313 880 200
E info@eijkelkamp.com
I royaleijkelkamp.com

M-0813E

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On these operating instructions

☞ **When the symbol shown on the left is placed before a piece of text, this means that an important instruction follows.**

When the symbol shown on the left is placed before a piece of text, this means that an important warning follows pointing out a risk of injury to the user or damage to the device.
The user is always responsible for it own personal protection.

Text **Text in italics means that the actual text is shown on the display screen or instrument.**

1. Introduction

The wet sieving apparatus is used to determine the aggregate stability of a soil, which is the resistance of soil structure against mechanical or physico-chemical destructive forces.

Soil structure is one of the main factors controlling plant growth by its influence on root penetration, soil temperature and gas diffusion, water transport and seedling emergence and therefore it is an important soil characteristic for farmers.
Soil structure is defined by the combination or arrangement of primary soil particles into compound elements, which are separated from adjoining structural elements by surfaces of weakness.

Soil texture, soil structure, and the type of clay mineral, organic matter content and type, cementing agents and cropping history influence the aggregate stability. Among the mechanical destructive forces are soil tillage, impact of heavy machinery, treading by animals and raindrop splash. Physico-chemical forces are e.g. slaking, swelling and shrinkage, dispersion and flocculation.

Slaking is the process of structure breakdown under the influence of wetting of soil aggregates, due to swelling of clay minerals, dissolving of cementing agents, air explosion or reduction in pore water suction. Slaking may result in the formation of a superficial crust, reducing water infiltration and enhancing sediment loss by downward transportation with surface runoff water.

2. Applications

Due to the impact of aggregate stability on plant growth and soil loss, applications of the wet sieving apparatus are the fields of agriculture and land conservation. This method to determine aggregate stability will be especially useful for researchers and scientists on soil erosion, land degradation and conservation, agriculture, sustainable agriculture.
Scientists on salinization problems may have advantage determining wet aggregate stability using wet sieving, to control deterioration of soil structure or to determine possible impacts of amelioration practices on aggregate stability.
Determining aggregate stability will give information on the sensitivity of soils to water and wind erosion, which might be prevented e.g. by mulching the soil surface. Information on soil aggregate stability will improve tillage programs, adapted to the specific soil type and crop demands.

3. Operating principles

The wet aggregate stability is determined on the principle that unstable aggregates will break down more easily than stable aggregates when immersed into water.
To determine the stability, 8 sieves (with 60 Mesh screen) are filled with a certain amount of soil aggregates. These sieves are placed in a can filled with water, which will move up and downward for a fixed time. Unstable aggregates will fall apart and pass through the sieve and are collected in the water-filled can underneath the sieve. After this fixed time, the cans are removed and replaced by new water filled cans. Now, all aggregates are destroyed. Sand grains and plant roots will remain on the sieve and only aggregates are considered. After drying the cans with the aggregates, the weight of both stable and unstable aggregates can be determined.

Dividing the weight of stable aggregates over total aggregate weight gives an index for the aggregate stability.

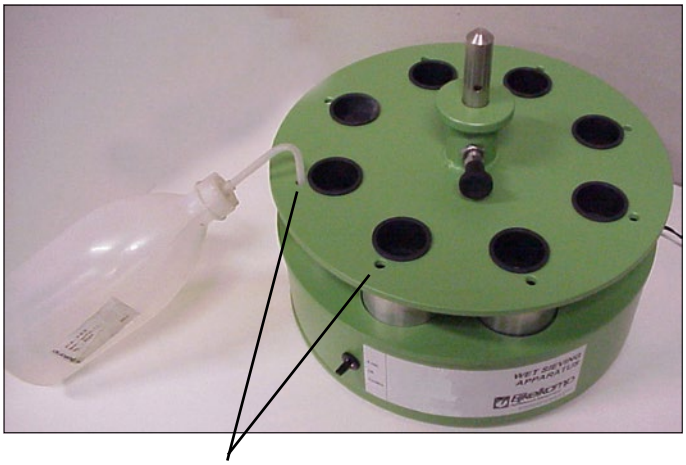
☞ **To prevent slaking of the aggregates when putting the filled sieves into the water filled cans, the aggregates are pre-moistened with water vapour, using a humidifier or a very fine plant sprayer.**

4. Procedure

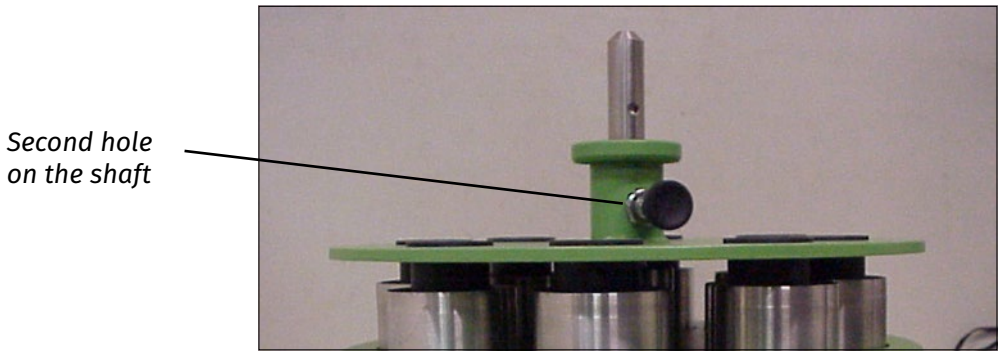
Determining aggregate stability using the wet sieving apparatus:

1. Weigh 4.0 grams of 1- to 2- mm air-dried aggregates into the sieves.
2. Pre-moistened the aggregates. Depending on the sample leave the sample 5-10 minutes before submerging them.
3. Place the sieves in the sieve holder.
4. Place the weighed (numbered) cans.
5. Place the sieve holder on de build-in stop.
6. Place sufficient distilled water into the cans to cover the soil. The water can be put into the cans through the special can-fill openings in the sieve holder. During the sieving it is important that the samples are moved under water (so add enough water to the boxes).

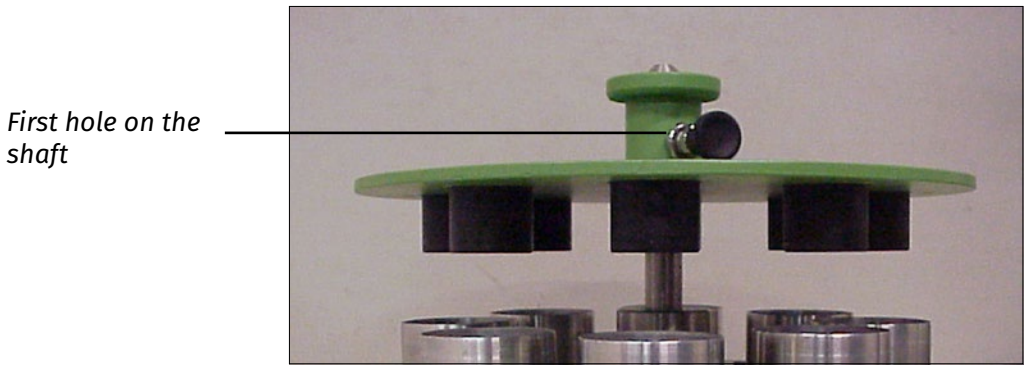
Build-in stop


Can-fill openings

7. Place the sieve holder in the working position by putting the sieve holder in the second hole on the shaft



8. Check if the mains switch is in the "*Off*" position
9. Put the Adapter into a wall plug
10. Start the motor by putting the mains switch into "*3 min*" position and allow it to raise and lower the sieve-holder for 3 min. ± 5 s. (stroke = 1.3 cm, at about 34 times/min) At the end of this time the motor will stop automatically.
11. Raise the sieve holder out of the water and place it in the leak out position, by putting the sieve holder in the sieve holder in the first hole on the shaft.



When there is no water leaking out of the sieves anymore, than take the (numbered) cans (containing the particles and aggregate fragments that have broken loose from the aggregates and come through the sieves) on a tray.

12. Replace these cans with another set of weighed (numbered) cans
13. Fill the cans with a dispersing solution (containing 2 g sodium hexametaphosphate/L) for soils with pH > 7 or 2 g NaOH/L for soils with pH< 7. (for the filling procedure see point 4 and 5).
14. Place the sieve holder in the working position
15. Start the motor by putting the mains switch into "*Continue*" position and continue sieving until only sand particles *(and root fragments*) are left on the sieve. If some aggregates remain stable after 5 to 8 min of sieving in the dispersing solution, stop the sieve by putting the mains switch in the "*Off*" position, and rub them across the screen with a rubber tipped rod until they are disintegrated.
16. Continue sieving until materials smaller than the screen openings have gone through.

☞ **To disperge the aggregates can take some time (the more clay the longer it takes); there is no standard reacting time. Use of the reagent in combination with washing is the best method to be sure that all the aggregates are disperged.**

17. Raise the sieve holder and place it in the leak out position.
    When there is no dispersion solution leaking out of the sieves anymore, than take the (numbered) cans and place them on a separate tray. These cans contain the materials from the aggregates that were stable, except for sand particles too large to get through the screen.
18. Both sets of cans are placed in a convection oven at 110 °C until the water has evaporated.
19. The weight of the materials in each can is then determined by weighing the can, plus contents, and subtracting the weight of the can. In the cans, which were filled with dispersing solution, there will be 0.2g of the dispersing solute along with the soil. Consequently, 0.2 g should be subtracted from the weight of the contents to obtain the soil weight.
20. The fraction stable is equal to the weight of soil obtained in the dispersing solution cans divided by the sum of the weights obtained in the dispersing solution cans and distilled water cans.

Dispersion of the aggregates may also be achieved using an ultrasonic probe, in which case, the dispersing solution can be distilled water rather than the sodium salt solution, which eliminates the need for the 0,2 g correction indicated in step 19.

The test procedure is now:

Step 1 to 10 see above
11. Fill the cans with distilled water (for the filling procedure see point 4 and 5)
12. Than held the ultra sonic probe into the water for 30 s at a medium frequency
13. Place the sieve holder in the working position
14. Start the motor by putting the mains switch into "*Continue*" position and continue sieving until only sand particles (and root fragments) are left on the sieve. If some aggregates remain stable after 5 to 8 minutes of sieving in the dispersing solution, stop the sieve by putting the mains switch in the "*Off*" position, and rub them across the screen with a rubber tipped rod until they are disintegrated.
15. Continue sieving until materials smaller than the screen openings have gone through.
16. Raise the sieve holder and place it in the leak out position.
    When there is water leaking out of the sieves anymore, than take the (numbered) cans and place them on a separate tray. These cans contain the materials from the aggregates that were stable, except for sand particles too large to get through the screen.
17. Both sets of cans are placed in a convection oven at 110 °C until the water has evaporated.
18. The weight of the materials in each can is then determined by weighing the can, plus contents, and subtracting the weight of the can. The fraction stable is equal to the weight of soil obtained in the "ultra sonic probe" cans divided by the
    sum of the weights obtained in the "ultra sonic probe" cans and distilled water cans.