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Mini rainfall simulator for assessing soil erodibility

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Introduction

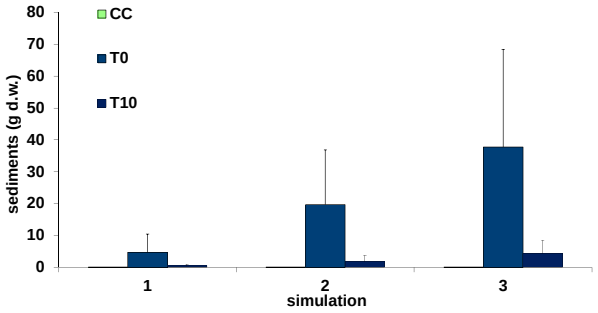
- The mini rainfall simulator (*Eijkelkamp Soil & Water*) is a small portable rainfall simulator to determine erosion and water infiltration characteristics of soils.
- Advantages of the mini rainfall simulator include:
  - Suitable for soil conservation surveys
  - Light and easy to handle in the field
- Practical experience over the last decade has shown that the used 'standard' shower is a reliable method to assess differences in erodibility due to soil type and/or land use.

Soil erosion study in olive groves

The study on soil erosion in olive groves was performed in Ferrandina-Southern Italy. *((Palese A.M., Ringersma J., Baartman J.E.M., Peters P., Xiloyannis C., 2015. Runoff and sediment yield of tilled and spontaneous grass-covered olive orchards grown on sloping land. Soil Research, 53: 542–552).* The propensity to erosion of a steep rain-fed olive grove (mean slope ~10%) with a sandy loam soil was evaluated by measuring runoff and sediment load under extreme rain events. Two types of soil management were compared: spontaneous grass as a ground cover (CC) and tillage (1 day (T0) and 10 days after tillage (T10).

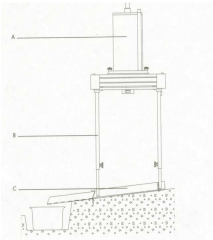
Results:

Sediment load in the cover cropped plots was virtually non-existent. In every simulation, it was less than one gram, and it was practically impossible to separate it well from the run-off. The tilled fields did produce sediment, showing a trend of increasing sediment production from the first simulation to the next. The average weights of sediment for T0 are 4.74 g; 19.69 g and 37.78 g for the first, second and third simulations respectively.
The sediment loads generated during T10 start from 0.41 g to 1.80 g and finish at 4.34 g.



Technical design:

The mini-rainfall simulator:
- Sprinkler (A) with a built-in pressure regulator for the production of the standard rain shower
- Adjustable support (B) for the sprinkler
- Ground frame (C), which is placed on the soil and prevents the lateral movement of water from the test plot to the surrounding soil.



Characteristics:

Total rainfall during simulation	18 mm
Duration of the simulation	3 min
Rainfall intensity	360 mm h^{-1}
Total volume of simulation	1125 ml (375 ml min^{-1})
Average fall height	0.4 m
Diameter of drops	5.9 mm
Mass of drops	0.1 g
Number of capillary tubes	49
Kinetic energy of rain	4 J m^{-2} mm^{-1}
Kinetic energy of rain shower	72 J m^{-2}
Surface area of test plot	0.0625 m^2

Conclusions:

This small-scale study has shown that sloping olive-groves are more susceptible to water erosion than grass-covered groves. Cover cropped and tilled microplots were subjected to extreme rainfall simulations because of the increasing frequency of intense rain events occurring in Mediterranean environments that cause serious damage to people and its environment. Under our experimental conditions CC microplots showed only one-third the surface runoff of that produced by the tilled microplots. Soil losses in the CC microplot due to erosion were non-existent, and so differed considerably from the tilled microplots.

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