

Greece study site experiment: DIFFERENCES BETWEEN ORANGE AND AVOCADO ORCHARDS ON SOIL EROSION RATES

The problem

Oranges are a major crop in the Chania Prefecture of Crete. Severe market competition has, however, led to severe reductions in prices, leaving little or no profit for orange growers.

The proposed solution

Avocado plantations have recently been proposed as a sustainably profitable alternative to oranges, but little is known about their soil erosion rates or their effect on soil quality. The yield is expected to be profitable after the fifth year of application.

The aim of the experiment was to compare the erosion rates as well as other soil quality parameters between a field that has remained an orange grove for 45 years, and one that was converted to an avocado farm 20 years ago.

The experimental plots were located on a farm in Koufos, Alikianos.



Figure. Orange orchard plot



Figure. Avocado trees plot

Experimental design

The experiment compared an orange orchard area, served as the Control plot, with a rotation crop area of avocado trees, served as the treatment (SICS). The orange orchard variety was *Citrus × sinensis*, whereas the crop switch variety was *Persea Americana*, and the plots were located on a family conventional farm of 0.5 ha.

The following measurements were taken:

- Soil texture
- Saturated hydraulic conductivity
- Water stable aggregates
- Bulk density
- Mineral Nitrogen
- Available Phosphorous
- Exchangeable Potassium/Sodium/Magnesium
- SOC
- Soil pH
- Soil electrical conductivity
- Earthworm numbers
- Weather (rain rate, temperature)

Soil loss rate assessments were undertaken through soil pins measurements.



Results

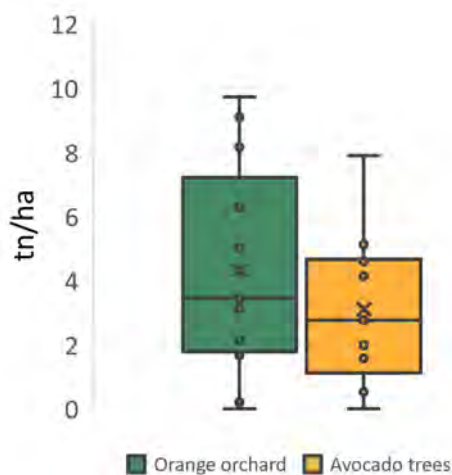


Figure 1. Soil erosion (tn/ha)

Field measurements showed that the crop switch to avocado trees reduced mean soil erosion compared to the orange orchards (Control), over 2.5 years of monitoring (Fig 1).

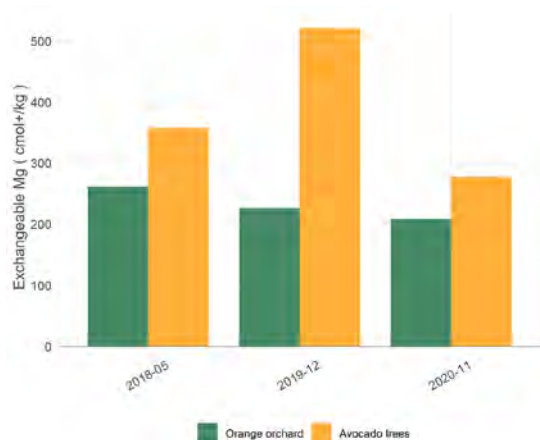


Figure 3. Exchangeable Magnesium

The exchangeable magnesium was higher in the avocado trees compared to the orange orchards, during the 3-year monitoring (Fig. 3).

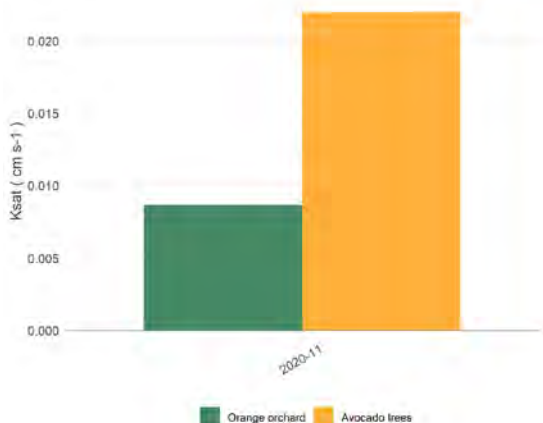


Figure 2. Saturated hydraulic conductivity (cm/sec)

The saturated hydraulic conductivity was considerably higher in the avocado tree plot compared to the orange tree plot, in the 2020 measurement (Fig 2).

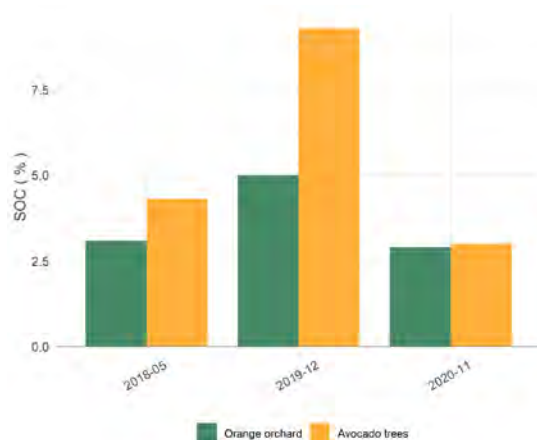


Figure 4. Soil Organic Carbon (%)

The soil organic carbon rate was also higher in the avocado trees, compared to the orange orchards (Fig. 4).

Greek study site experiment:

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Results

An extreme rainfall event occurred on 26/10/2017, leading to more than 2 kg of soil trapped in the sediment fences of 3 m² area, corresponding to about 7 tn/ha.



Figure. Orange orchard sediment fence (left) and Avocado trees sediment fence (right) after the 26/10/2017 rain event

Further extreme precipitation events, which caused severe flooding in the wider area, occurred in February 2019, triggering further erosion in the field.



Figure. New erosion marks within the field area

Soil loss rate monitoring revealed that the application of no-till treatment reduced mean soil erosion over 25%, roughly from 4.7 to 3.4 tn/ha, during the 2.5 years experiment (May 2018 to December 2020).

Key findings

- The biological health and condition of the avocado plot were inferior to the orange tree plots according to the earthworm density experiment.
- Water and solute movement, as well as soil aeration were positive for both cultivations, as identified by the top and bottom soil bulk density experiments.
- High content of soil organic carbon concentration was measured at both plots. Orange orchards presented reduced soil organic carbon compared to avocado trees, during the 3-year monitoring, probably due to higher inputs.
- The level of weed infestation was 10% less in the avocados field compared to the orange trees field.
- Electric conductivity values indicate high salinity levels in both plots. Even higher values were observed for avocado trees.

Conclusions

Avocado farms, besides significantly more profitable than orange plantations, can also maintain good soil quality overall.

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