

# Greece study site experiment: EFFECTS OF VETCH COVER CROP ON SOIL EROSION RATES IN VINEYARDS

## The problem

Vineyards in Crete are susceptible to soil loss due to erosion. There is a need to find practices that prevent soil erosion without reducing the profitability of the vineyards.

## The proposed solution

The simplest and most natural way to prevent erosion is through planting vegetation. Cover crops keep ground covered during storm events, heavy rainfall, and high winds, all of which can cause erosion. They do so by establishing root systems which stabilise the soil and prevent erosion. Moreover, cover crops can reduce the need for fertilizer. For example, leguminous cover crops fix N, thus providing an organic source of this nutrient.

This experiment tested the use of a vetch cover crop in a vineyard compared to no vetch. Vetch is a nitrogen fixing cover crop. The experimental plots were located in vineyards in Alikampos, Crete, Greece.



Vineyard in Crete.

## Experimental design

The experiment compared a vetch cover crop with a no vetch plot. The grape variety was *Vitis vinifera* and the plots were located on a corporate organic farm of 0.46 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 cross sections measurements.



Positions of the cross sections in which soil erosion measurements were taken.



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## Results

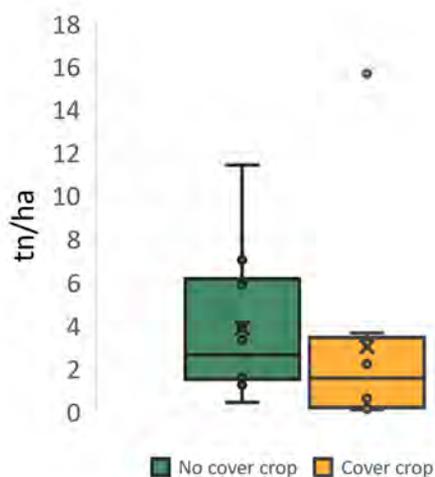


Figure 1. Soil erosion (tn/ha)

The application of the vetch treatment had a direct impact on soil erosion over the 2-year monitoring period. Soil erosion was reduced by 20% on average (Fig 1).

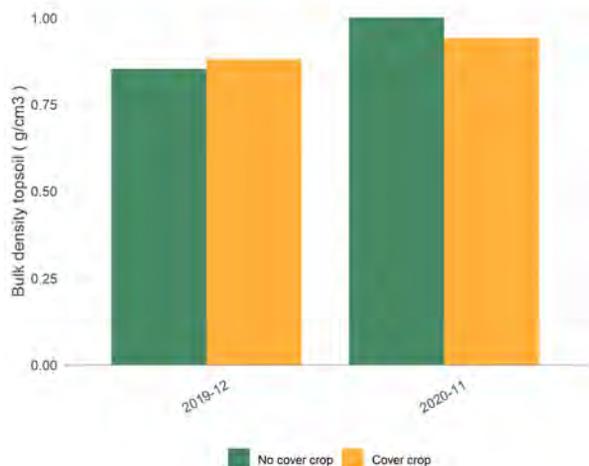


Figure 3. Bulk density of the topsoil (g/cm<sup>3</sup>)

The bulk density of the top soil (10-20cm) was slightly lower in the vineyard with the cover crop by the end of 2020, a good indicator of soil functioning (Fig 3).

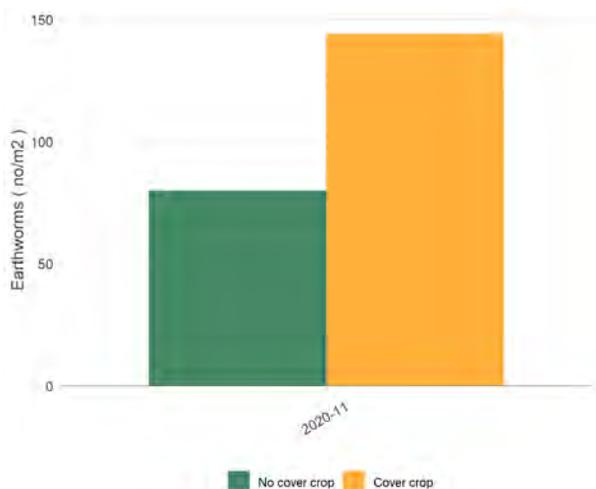


Figure 2. Earthworm numbers

The number of earthworms (soil health indicator) were considerably higher in the vineyard with the cover crop applied (Fig 2).

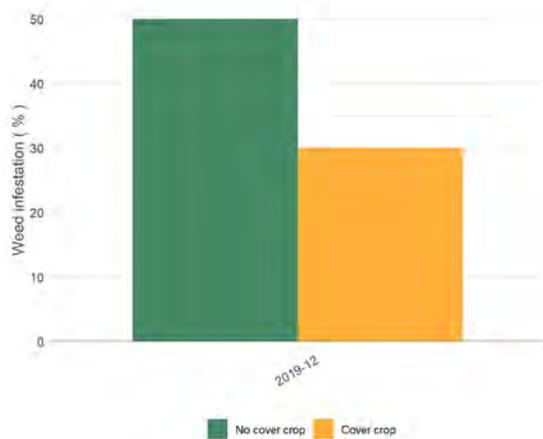


Figure 4. Weed infestation (%)

The percentage of weed infestation was 20% less in the vineyard with the cover crop (Fig 4).



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## Results

Extreme storm events occurred on 15/02/2019 and 24/02/2019. The nearby rain station recorded an exceptional accumulation of 726.2 mm during this period. These events created soil erosion rills in the examined field. In the vetch plot, the rills were shorter compared to the no vetch plot.



Rills in the no vetch plot (left) and Vetch plot (right) caused by surface water

- Soil loss rate monitoring revealed that the application of the vetch treatment reduced mean soil erosion by over 16% (roughly from 3.7 tn/ha in the no vetch plot to 3.1 tn/ha in the Vetch plot), during the 2 years experiment (January 2019 to December 2020).
- In 2020, top & bottom soil bulk densities of Vetch plot were lower compared to the no vetch plot, indicating improved water and solute movement, as well as soil aeration.



Earthworm density experiment

## Key findings

- Cover crops led to significantly less soil erosion.
- Soil aggregate stability test resulted in good soil stability and resistance to erosion for both plots, however, for the vetch applied plot, slaking effect was slightly less observed, indicating better structure maintenance.
- The biological health and condition of the vetch cover plots were clearly better compared to the no vetch.
- High content of soil organic carbon concentration was measured at both plots.
- Water and solute movement as well as soil aeration was slightly improved where cover crops were grown.

## Conclusions

- Vetch application is an inexpensive solution and is recommended to control soil erosion.
- The correct application of cover crop is a determinant in improving soil quality.

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