

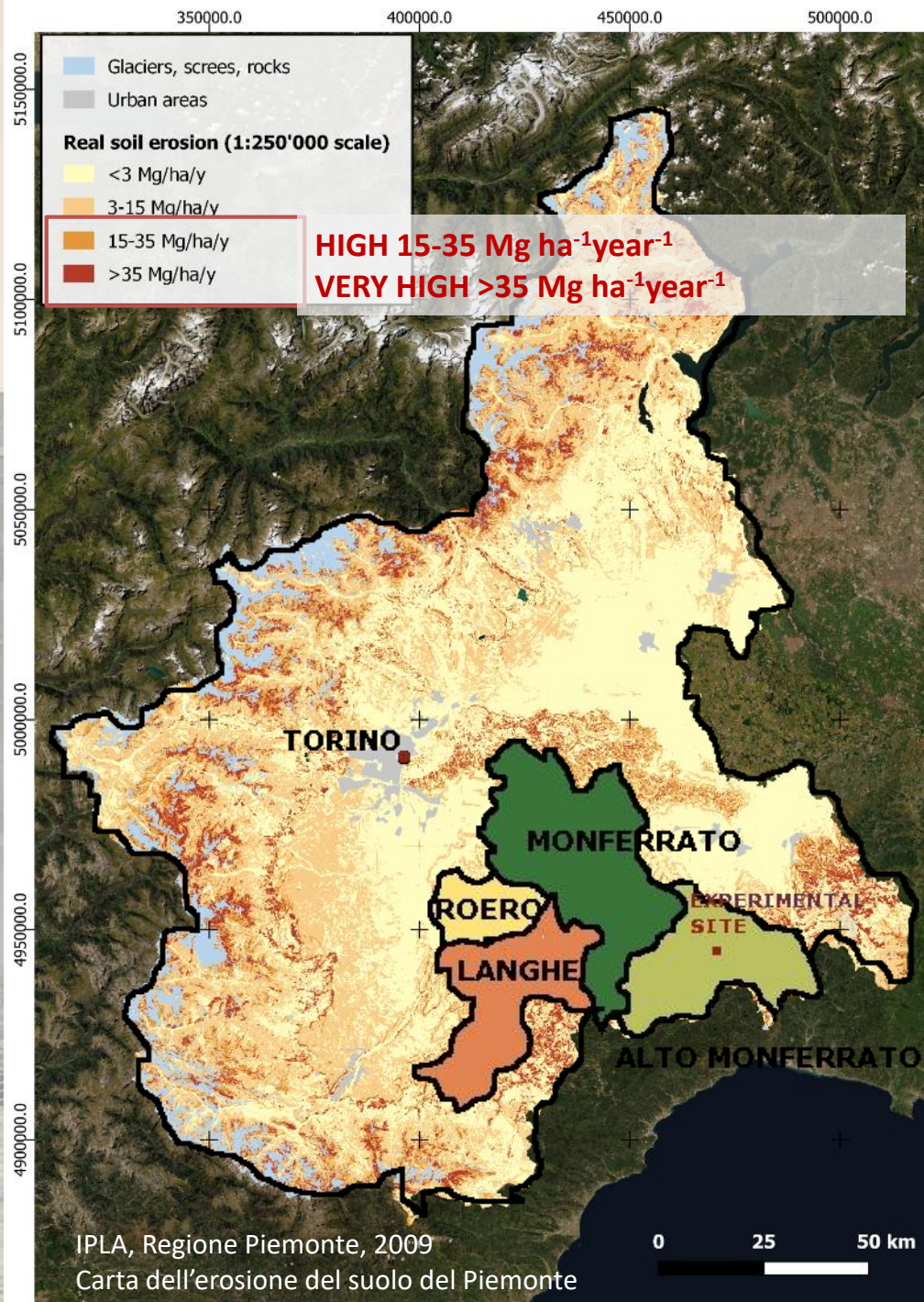
Soil erosion control in vineyards

Marcella Biddoccu

marcella.biddoccu@cnr.it



Institute of Sciences and Technologies for
Sustainable Energy and Mobility
(formerly IMAMOTER)



Piemonte (Piedmont) is a region with

- large production of high quality wines (> 40.000 ha, 17 PGI, 42 PDO)
- mainly concentrated in hilly areas with high erosion risk

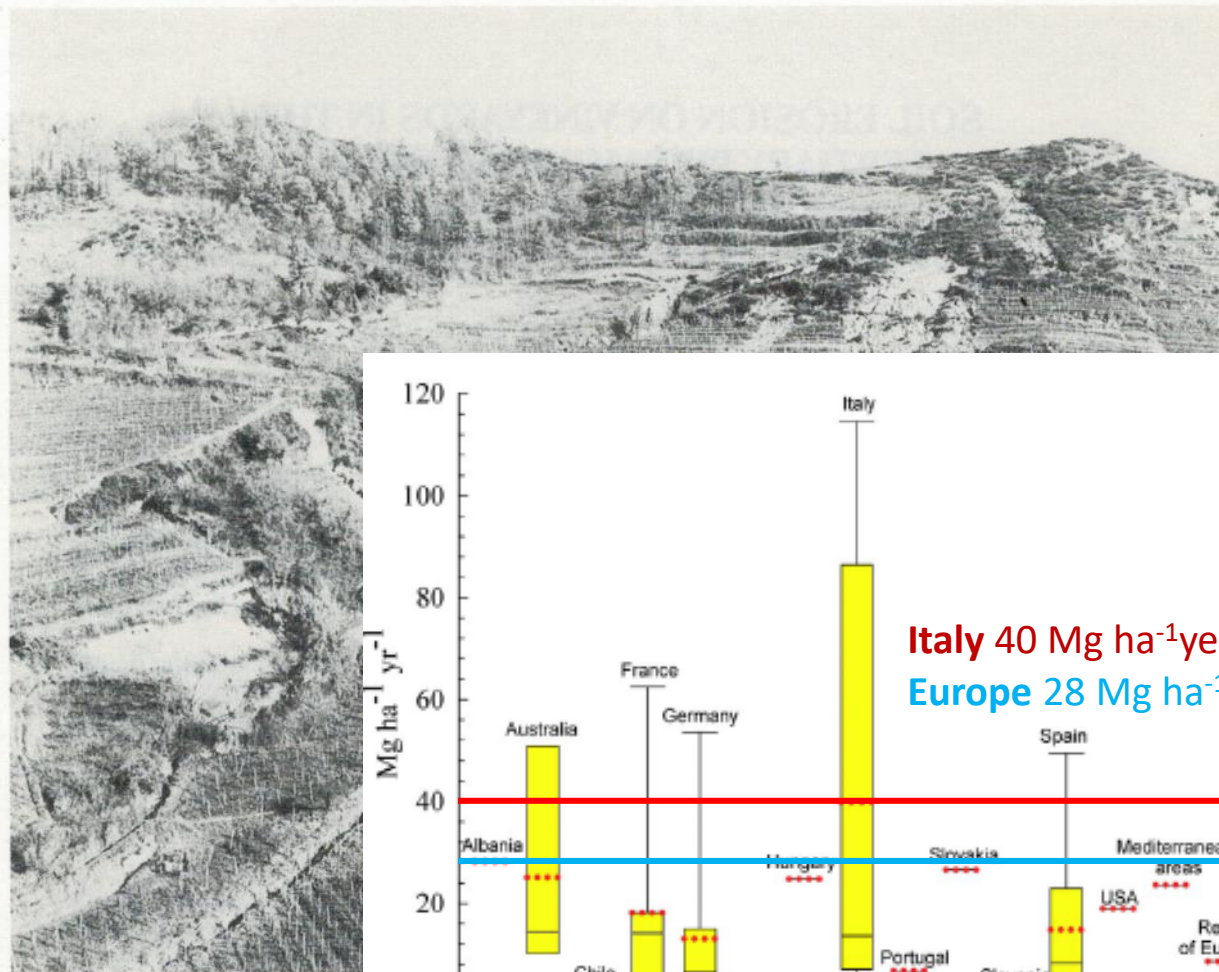


Fig. 8. Soil erosion rates in vineyards by country or regions.

Rodrigo-Comino, 2018. Five decades of soil erosion research in "terroir". The State-of-the-Art <https://doi.org/10.1016/j.earscirev.2018.02.014>

47,4 Mg ha⁻¹ y⁻¹

Clay loam
Slope 20 %

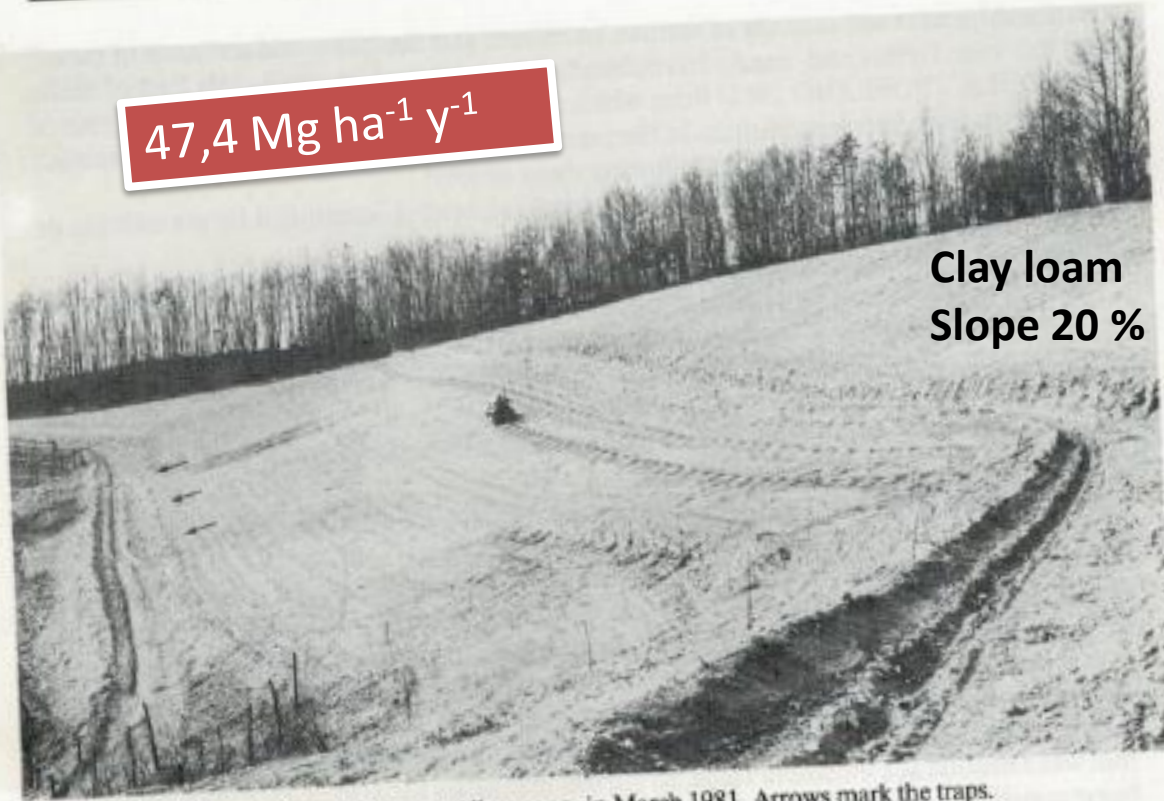


Photo 2: The experimental slope at Albugnano, in March 1981. Arrows mark the traps.

In 1981-1982 in the Vezzolano vineyard «14» Tropeano measured very high erosion rates in a recently planted vineyard, with bare soil, with 83 tons of soil washed away in the first year

Tropeano, D. (1983). Soil erosion on vineyards in the tertiary Piedmontese basin (northwestern Italy): Studies on experimental areas. Catena Supplement, 4, 115-127.

Questions:

Why so high erosion rates
in vineyards ?

Solutions to reduce erosion

How effective are different solutions ?

Are wine-growers aware about risks
and solutions?



Why so high erosion rates in vineyards ?

Natural factors

Clay loam soil → high erodibility

Hilly landscape → slope >15%

Long-lasting or intense rainfall →
high erosivity

Vineyard management

Increasing mechanization →
soil profile disturbance and soil
compaction (favouring runoff)

→ **Vineyard configuration / row
orientation**

→ **Soil management: bare soil or
ground cover**



San Damiano d'Asti (AT)





Piemonte, Italy

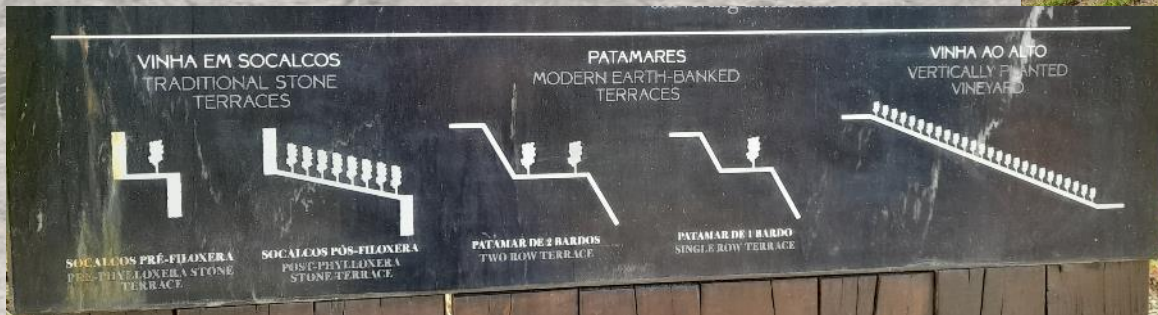


Mosel, Germany

Row arrangement plays a fundamental role in controlling surface water flow and soil erosion processes



Douro, Portugal





**Solutions
to reduce
erosion**



**Permanent grass
cover
(spontaneous)**

VS

**Contour rows
(with small earth
embankments)**

VS

**Rows along the
slope**



**Bare soil by
mechanical
cultivation (with
chisel)**

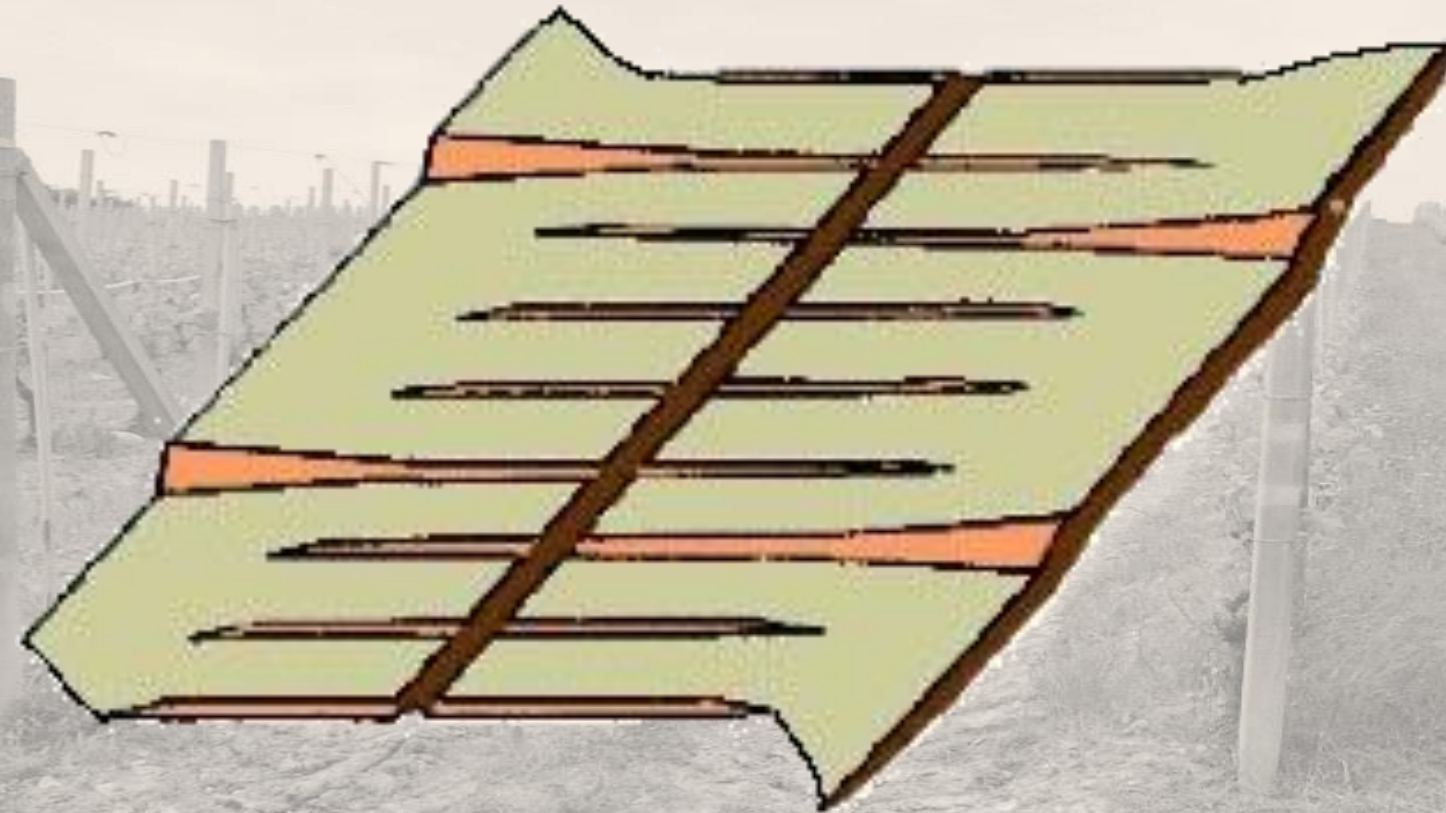


Row arrangement along contour lines Vezzolano vineyard «14»

The original slope was 36%.
The vineyard was cultivated up to 1 m and then it was set up with «Rows joined at groups» (Lisa, 1969) with small embankments.

Rows were arranged perpendicular to the slope and were grouped by four with **slope <15%**, in order to make easier the tractor's traffic.

Water flows along the rows and in channels along roads every 40-60 m.



VEZZOLANO FARM

Vezzolano Farm (1992-1996)

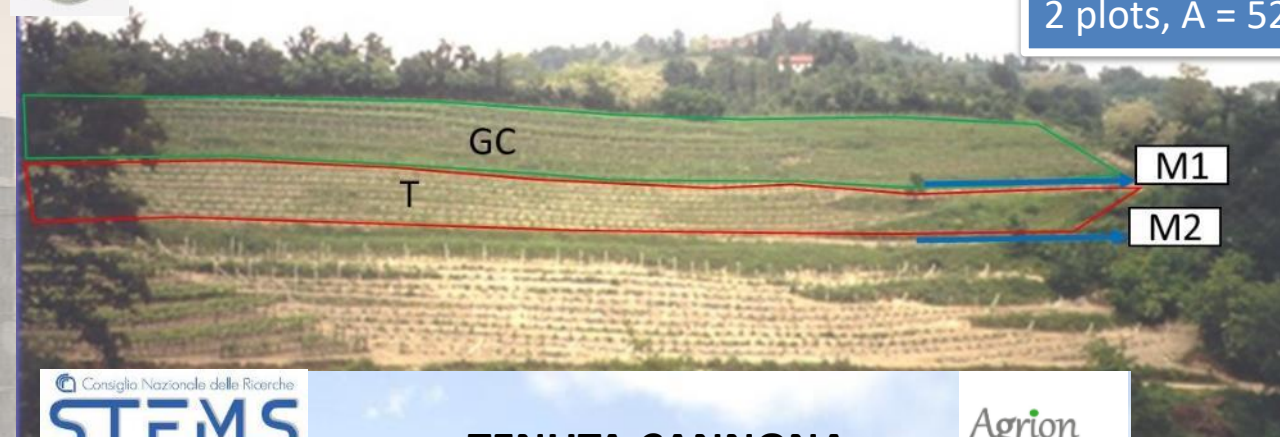
MAP (1962-2004) = 846 mm

Silt loam

Original slope = 15-35 % → 15%

Contoured rows on terraces

2 plots, A = 5200 m²



TENUTA CANNONA



Tenuta Cannona

MAP (2000-2018) = 828 mm

Clay to clay-loam

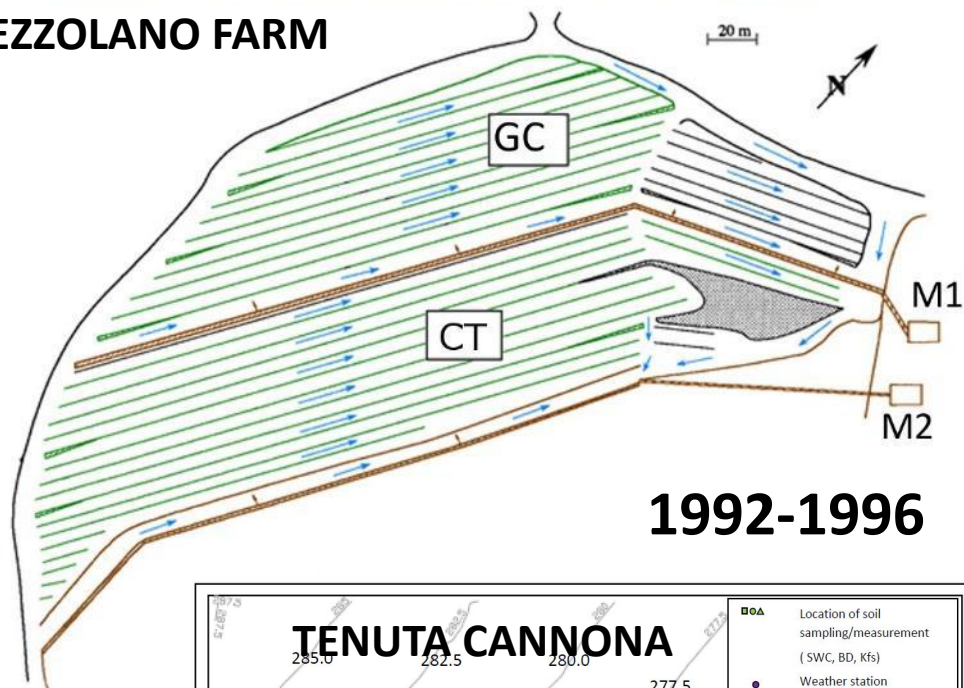
Slope = 15%

Up-and-down rows

2 plots, A = 1221 m²

	CT = conventional tillage	GC = grass cover
Vezzolano Farm Contoured rows	autumn ploughing and summer hoeing	Spontaneous grass cover mowed and chopped 2-3 times per years
Tenuta Cannona Up-and-down rows	Cultivated with chisel, 0.25 m depth, spring and autumn	Spontaneous grass cover, mulched, spring and autumn (occasionally in summer)

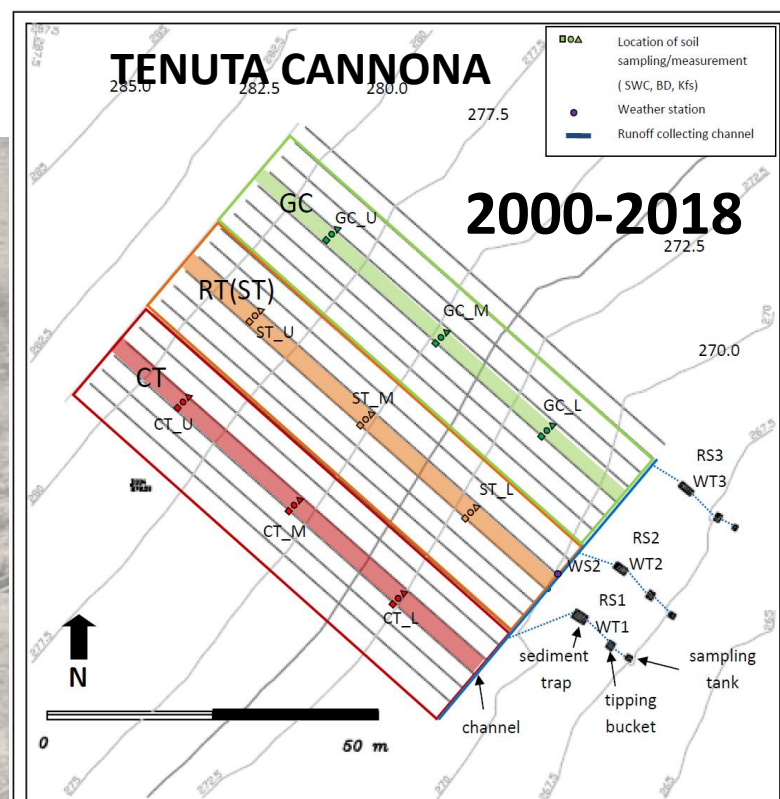
VEZZOLANO FARM



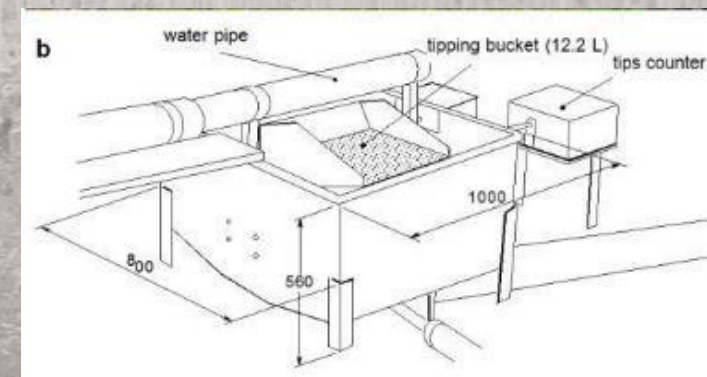
1992-1996

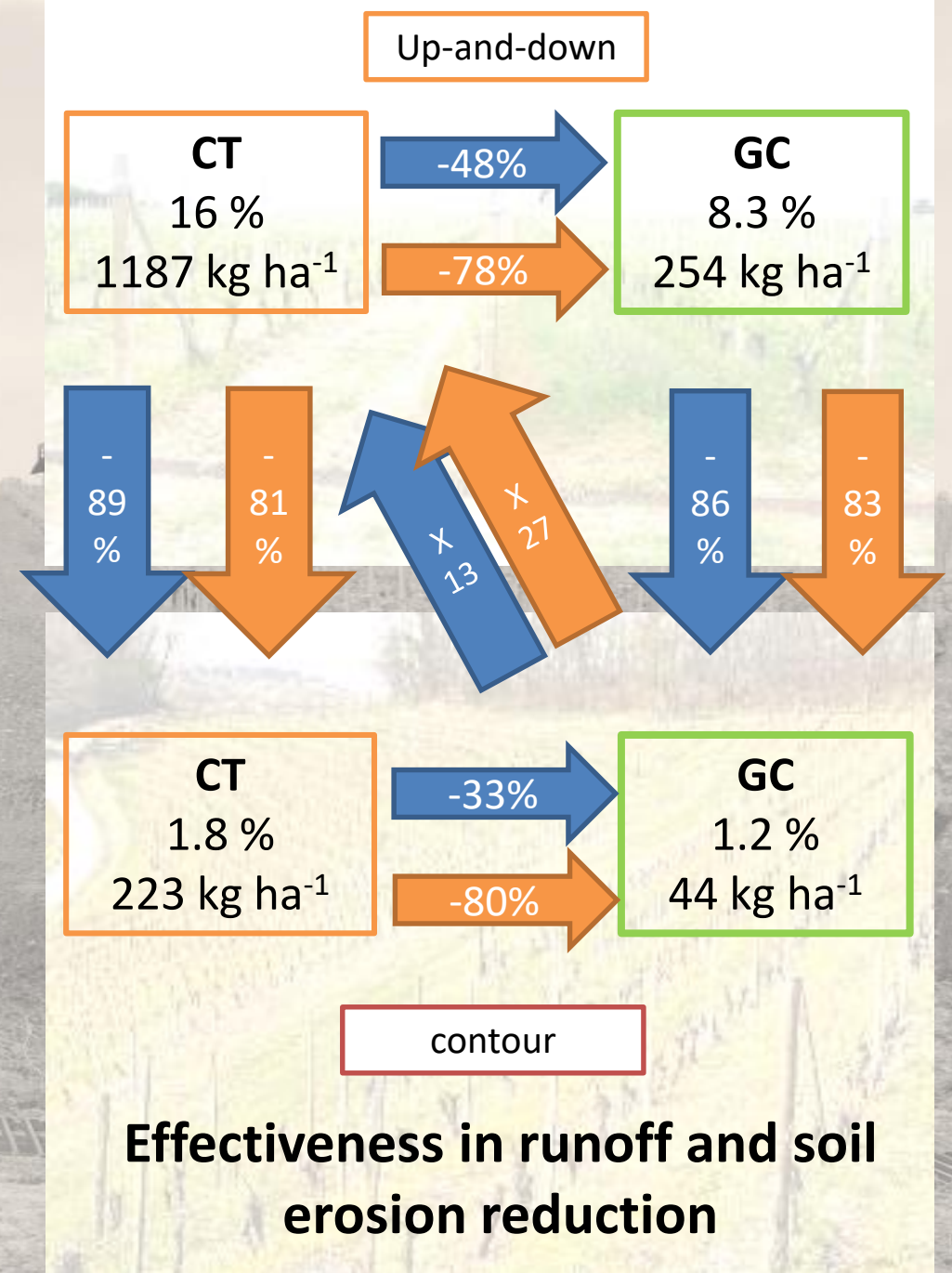
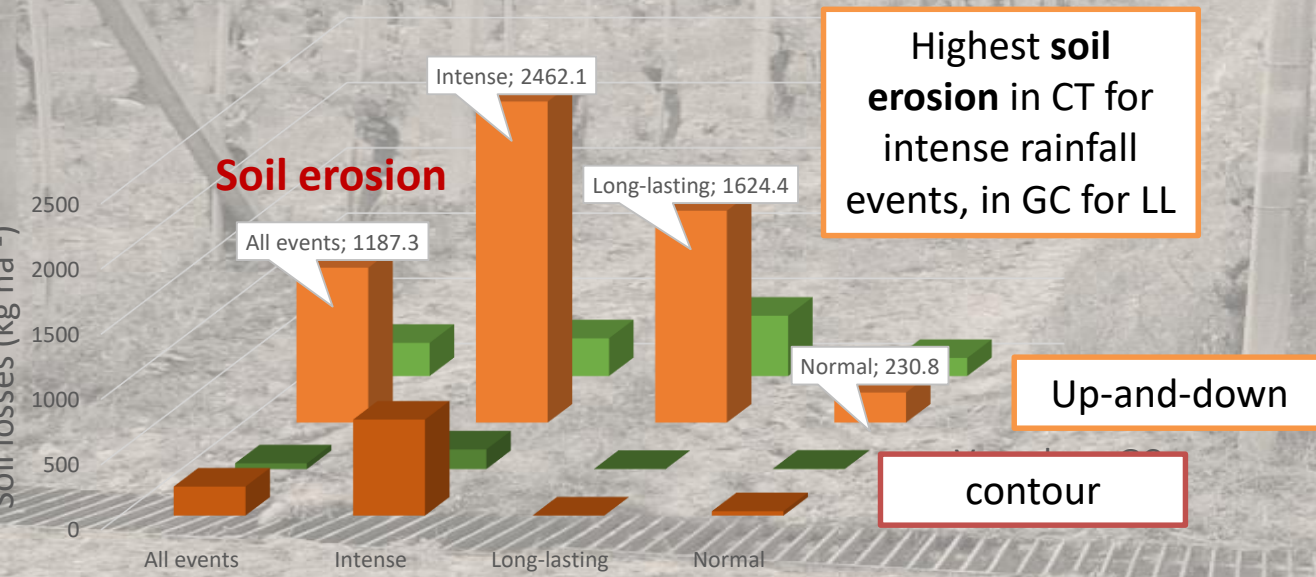
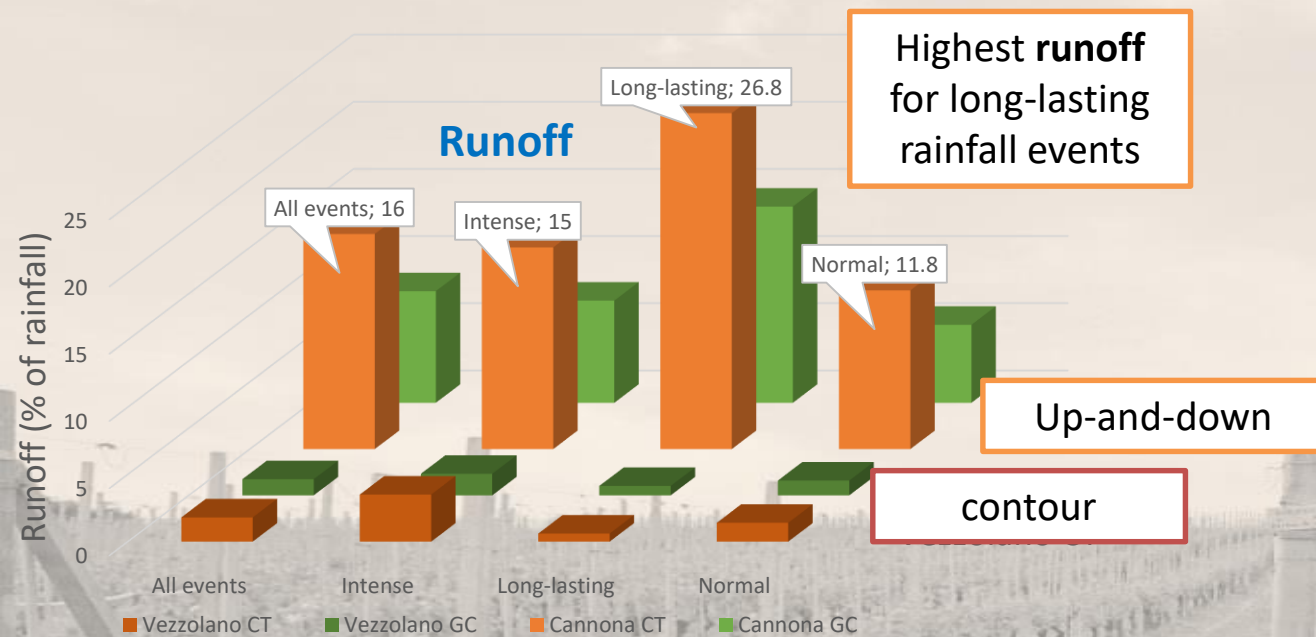


RUNOFF AND SOIL EROSION MEASUREMENTS



2000-2018

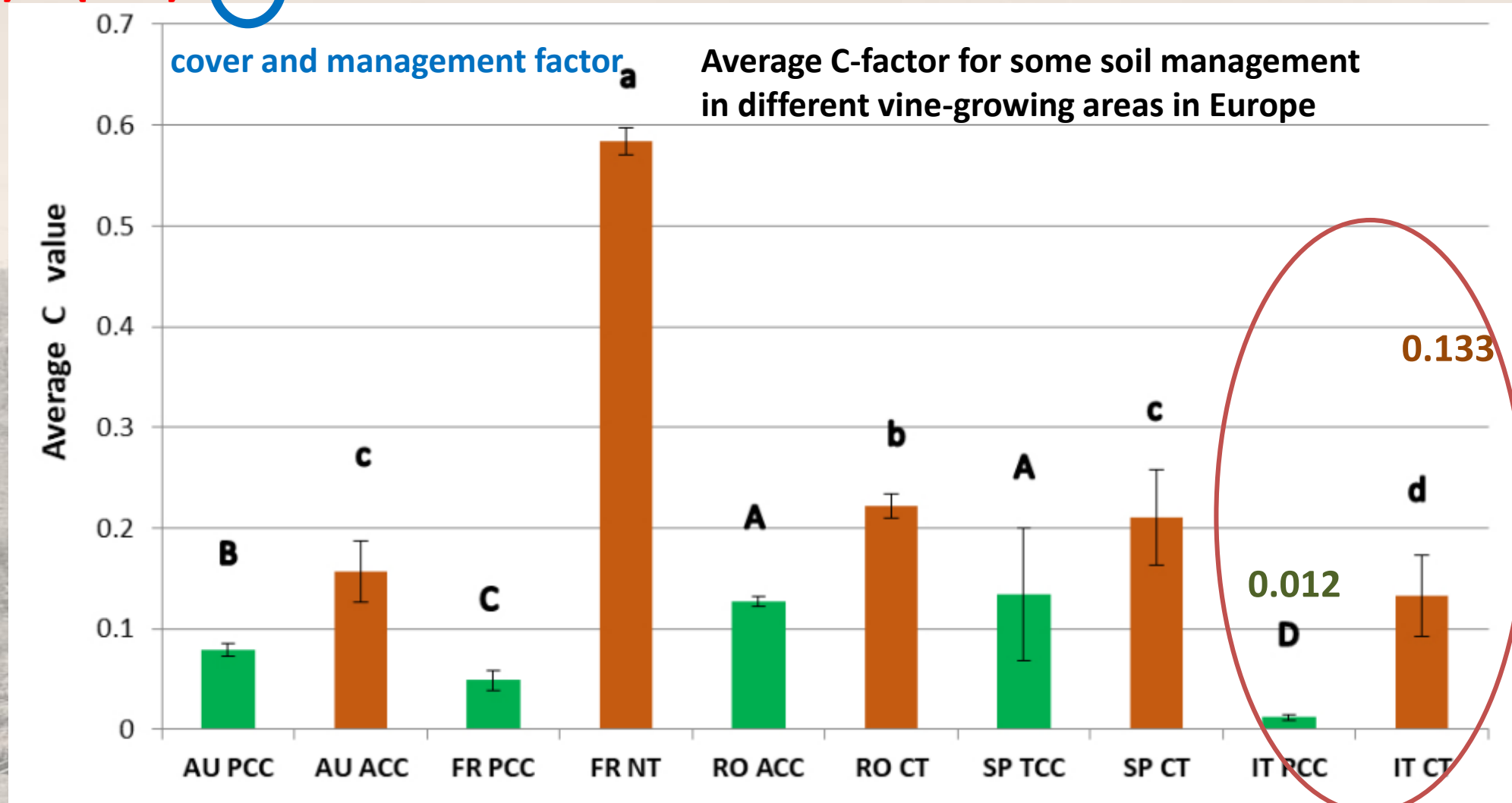




RUSLE

$$A = (R \times K) \times (L \times S) \times C \times P$$

ORUSCAL (Orchard RUSle CALibration) is a tool that allows calibration of the RUSLE C-factor for specific soil management in orchards and vineyards.



Gómez Calero, José Alfonso; Biddoccu, Marcella; Guzmán, Gema; 2020; ORUSCAL: RUSLE calculator for orchards; DIGITAL.CSIC; Version 4; <http://dx.doi.org/10.20350/digitalCSIC/12552>
Biddoccu, M et al., Evaluation of soil erosion risk and identification of soil cover and management factor (C) for RUSLE in European vineyards with different soil management, International Soil and Water Conservation Research, <https://doi.org/10.1016/j.iswcr.2020.07.003>

IN-GEST SOIL

Innovation in viticulture soils management
trought the adoption of good practices and tools to support field
activities



FEASR Fondo europeo agricolo per lo sviluppo rurale:
l'Europa investe nelle zone rurali



Are wine-growers aware about risks and solutions?

Survey and focus groups among
wine-growers revealed...

63%

Observed channel formation and
depositions after rainfall events

38%

considered erosion as a soil
degradation process affecting their
vineyards



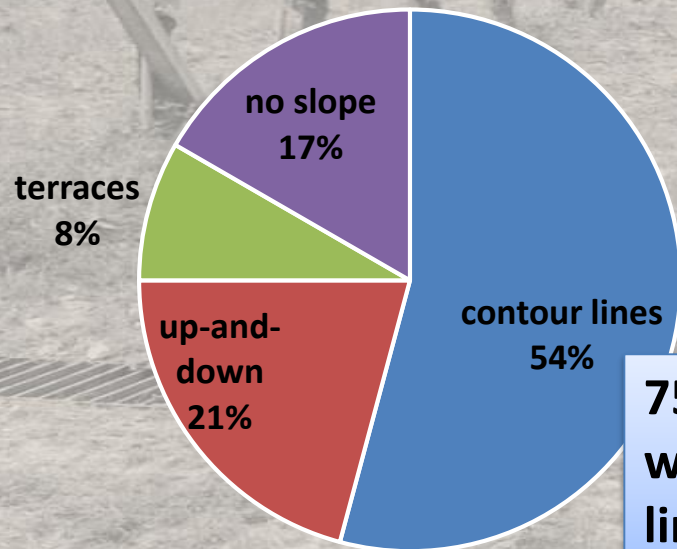
IN-GEST SOIL



13% Adopt mainly bare soil (mechanical)



61% Adopt permanent grass cover



75% of sloping vineyards with rows along contour lines or terraces

11%

Use specific seeds mixture for cover crops

- Soil erosion is still a problem in access roads also for safety
- Intense use of tractors worsens soil erosion
- Worries about water scarcity and extreme rainfall events

IN-GEST SOIL

Different soil management using spontaneous grass and green manure cover crops are tested for:

- Erosion control
- Soil compaction reduction
- Water infiltration and retention
- Soil quality (organic matter, C, nutrients...)
- Vine and wine production



Emerging machines for grass control under wine rows without use of chemicals



High pressure water



**Mechanical weeds with
extendible wires**



Hot foam




Surface tillage



electro-herbicide technology

**Test and demonstration
activities at Vezzolano
Farm**

C-factor ?



Grazie per l'attenzione!

*"Treat the earth well: it was not given to you by
your parents, it was loaned to you by your
children"*

Ancient American Natives Proverb