

The problem

Soil erosion occurs when particles of soil are either washed or blown away from the land. Erosion effects crop production negatively, due to the washing away of soil and plants in case of water erosion, and due to abrasion of seedlings during wind erosion. Subsequent sedimentation may also impact crop yield. Erosion rates on arable land in the EU are considered to be around 3.6 ton ha⁻¹ yr⁻¹.



HOW CAN SOIL-IMPROVING CROPPING SYSTEMS BE USED TO PREVENT & REMEDIATE EROSION?

Soil improving cropping systems (SICS) are specific combinations of (1) crop types, (2) crop rotations and (3) management techniques aimed at halting soil degradation and/or improving soil quality and at the same time having positive impacts on profitability and sustainability. They need to be suited individually to each farm's local environment. The key principles are:

-  Maintaining ground cover
-  Decreasing or slowing down the run-off of water
-  Decreasing the wind speed at the soil surface

SICS Component	Basic principle
Long and diverse crop rotations	Adds soil structure and organic matter for water absorption and retention
Smart irrigation	Saves water and applies when most needed
Minimum tillage	Improves soil biodiversity and structure
Vegetative strips, hedges, agroforestry	Reduces wind speed, helps soil absorb excess water, improves soil structure
Crop residues and mulches	Adds organic matter for water absorption and retention
Stony soils	Reduces wind speed and slows run off

CROP ROTATIONS

Crop rotations are an integral part of SICS and can prevent soil erosion through, for example, alternating deep-rooted and shallow rooted plants or alternating a series of crops with a period of grassland (grass-ley) and introducing cover crops.



Choice of crops	The crop choice in a rotation is important. Some crops are inherently more sensitive to erosion than others, especially row crops and crops that have poor cover during the most erosive period of the year, such as maize that is grown on slopes. From the viewpoint of erosion control, crops should be chosen that quickly produce significant ground cover.
Cover crops	Cover crops are grown to provide vegetative cover between rows of main crops in orchards and vineyards or between periods of regular production to prevent erosion. Some cover crops such as alfalfa and clover also replenish the nitrogen supply of the soil. Cover crops used should be established easily, provide quick ground cover and eliminate other vegetation. Which species is most suitable depends on local conditions such as climate, soil and farming system. For water erosion, short cover is preferable, while for wind erosion high cover is better.
Fallow crops	Fallow crops can allow the soil to recuperate if the fallow period is long enough. On soils with very poor structural stability, consider moving towards ley-arable rotations.



TILLAGE MANAGEMENT

Tillage management is another essential SICS tool which can prevent and help remediate erosion through allowing soil organisms to be minimally disturbed and soil organic matter to build up.



Conservation tillage	This can include no-tillage, reduced-tillage, ridge-furrow systems, hillocks and mulch tillage. Studies suggest that conservation tillage can reduce yields but this varies strongly on crop type, tillage technique, soil texture and crop rotation.
Contour tillage	Planting in rows that run laterally around a hill have been shown to reduce runoff and decrease the risk of water erosion. To prevent erosion in places where water concentrates grassed waterways can be used.

CROP RESIDUES AND MULCHES

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Crop residues	Covering the soil with plant residue will protect the soil from raindrop impact, reduces the velocity of wind and water and can enhance soil structure, thereby greatly reducing erosion. It also decreases soil temperature and increases soil moisture. Crop residue mulch should cover about 75% of the soil. Mulches can also be made from inorganic materials and gravel.
Applying organic manure or soil stabilisers	This improves the structure and cohesion of the soil and increases water retention.
Maintaining soil stoniness	Any practice that increases the soil surface roughness can prevent soil erosion e.g. stones.



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LANDSCAPE MANAGEMENT

Landscape management provides a holistic view of SICS and helps to integrate a number of larger components across the farm. This includes trees and shrubs as well as strips of perennials or alternative crops through fields. Creating continuity throughout the farm further helps mitigate erosion and run-off.



Agroforestry	Trees grown in strips between crops, around fields or scattered within fields. These can help reduce wind speed as well as improve soil structure and organic matter to prevent erosion.
Shelterbelts	Rows of trees placed at right angles to the major wind direction. Grids of shelterbelts are good for variable winds. The belt is dense enough to result in a large decrease of wind speed, but not so dense that air cannot move through it. Windbreak effectiveness extends as far leeward as 15 to 20 times the height of the windbreak, and windward for about twice its height.
Hedges	These managed trees or shrubs help to slow wind at field boundaries and add organic matter to reduce erosion.
Strip cropping	Strips of low and high cover crops (e.g. clover and wheat). These reduce the rate of sediment movement down the slope, where deposition high on the slope is more beneficial than lower down. On steep slopes or if there is no alternative method of preventing erosion, planting fields in long strips alternated in a crop rotation system (strip farming) has proven effective.
Grass strips	Perennial strips in-between crops which are not cultivated. These areas act like strip crops (above) and maintain undisturbed soil biodiversity and organic matter.
Terracing	Many farmers have successfully combated erosion by planting in flat areas created on hillsides in a step-like formation (terrace farming).

For more information see the SoilCare website:

<https://www.soilcare-project.eu/>



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