

Strategic tillage in Conservation Agriculture

Problem

Promoting the uptake of conservation agriculture (CA) practices among farmers can face some resistance, because the complete suppression of tillage may cause soil compaction, crop debris accumulation (causing issues with crop emergence), increase of weed pressure, and increased risk of herbicide resistance. On the other hand, some pro-intensive CA farmers feel that tillage may destroy the benefits accumulated after years of CA.

Solution

Strategic tillage (ST) in the form of an occasional soil disturbance can be an alternative to the strict no-tillage principle of CA to achieve the benefits of both management systems. The timing and number of tillage operation will depend on soil type, tillage costs and erosion risk. Results from ConServeTerra on-station and on-farm studies in Morocco, Spain, Tunisia, and Turkey show that there are significant differences in structure and soil organic matter content between CA and conventional tilled systems, and that the occasional use of ST in CA has some beneficial effects, particularly for weed management and to reduce soil compaction. Furthermore, negative effects normally last less than a year. The equipment used must be appropriate to the specific aim, whether to reduce soil compaction, debris accumulation, nutrient stratification, or weeds.

Practical recommendation

- The cost of cultivation and the risk of erosion should be considered when planning ST:
 - ST needs to be applied wisely and occasionally (e.g. once every five to ten years) to be effective.
 - ST should avoid periods of the year during which the soil is prone to wind or water erosion.
- ST as a pragmatic approach to CA has some clear advantages, which may help the promotion of CA:
 - The effect of ST on crop yields is positive in many cases, but the effects are dependent on the amendment of well-diagnosed specific problems.
 - ST helps to redistribute nutrients in the soil profile, as well as incorporates manure, liming and crop residues
 - If ST is properly planned, it is a pragmatic tool against soil compaction and for integrated weed management, whether to avoid the development of a massive weed population or for strategic management in some crops.

Depending on the problem the farmer is facing, the machine to be used will vary and there are a number of things to consider. These are displayed in Table 1.

Table 1: Problems, type of solution and practical recommendations for the implementation of strategic tillage.

Problem	Solution	Practical recommendations
Soil compaction	Decompactor or Yeoman's plow Subsoiler Interrow ripper Rotavator	<ul style="list-style-type: none"> The appropriate machine depends on site characteristics (e.g. clay content and compaction severity and depth). Apply before sowing, the exact time depends on the sowing time. Shallow decompaction is where the top 10 cm of soil is turned over. Do not use deep ripping or subsoiling if it can bring salts, rocks or carbonates to the soil surface that may negatively affect crop growth.
Crop debris accumulation / Organic matter stratification	Fast harrow Disk harrow Vibrocultivator / Cultivator Chisel	<ul style="list-style-type: none"> Apply either before sowing, or after harvest to break-up or to incorporate residues. Immediately after harvest it may be a useful option to reduce chances of summer-wildfire propagation. Take care when the soil is wet. To avoid soil compaction, wait several days after rainfall.
Weed control	Mouldboard tillage Disc plough or harrow Sweep blades Duckfoot harrow Inter-row weeder	<ul style="list-style-type: none"> Turning over the soil may be necessary to destroy short-lived seed banks. ST is a useful option for inter-row weed control in row-sown crops, particularly in organic systems, where it can favor increasing crop diversification in rotations. Avoid shallow ploughing, As it can promote weed germination. As harrows can spread perennial weeds through rhizomes; vertical cutting tools should be used. Take care when the soil is wet. To avoid soil compaction, wait several days after rainfall.



Picture 1. Fast harrow ST (Photo: Màrius Solé)



Picture 2: Cultivator ST to reduce crop debris load (Photo: José M. Blanco-Moreno)

Further information

Weblinks

- Check the [Organic Farm Knowledge](#) platform for more practical recommendations.
- <https://www.fao.org/conservation-agriculture/overview/conservation-agriculture-principles/en/>

About this practice abstract and ConServeTerra

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and adoption of CA principles in the Mediterranean area by understanding constraints and developing best management strategies under local conditions.

Project website: <https://conserveterra.org/>

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