Reduced Tillage

As one of the six soil health principles of Regenerative Agriculture it's important to consider where and when it's possible to reduce or eliminate tillage. No-till practices protect the soil surface, so water tends to infiltrate instead of running off. It is also used to help maintain and support the soil biology, with benefits in terms of fungal relationships essential for nutrient uptake and carbon sequestration. Reduced tillage (often referred to as Conservation tillage) practices include no-till, strip-till, ridge-till, mulch-till, and vertical/shallow-till. Each has specific applications which would increase their suitability for different production systems, including crop type, soil type, weather patterns and climate, and equipment availability, among other factors. They all leave plant residue on the ground that serves as mulch and protection for the soil.

Benefits

- Greatly reduced soil erosion
- Less disturbance of soil microbiology
- Increased soil organic matter
- Improved water conservation
- Improved wildlife habitat and biodiversity
- Lower production costs through reduced fuel and labor requirements
- Reduction of CO_2 emissions
- Improved carbon sequestration when using methods with the least soil disturbance

Investments or Considerations

- New equipment or alterations of old ones
- Need for alternative weed reduction strategies using some methods
- Crop yields are often lower during transition (often offset later by lower costs)
- Adding winter cover crops may provide more beneficial results (higher crop yields and reduced weed pressure)
- Time and effort to learn how to transition to a new system
- Increased management as changes sometimes introduce new challenges

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Types of Reduced Tillage

No Tillage
The soil is left undisturbed except for injection of fertilizers, if used. Minimal disturbance occurs at planting by coulters or seed disk openers on seeders or drills.

Strip Tillage
Minimum tillage technique that disturbs only the seed row. Most beneficial in cooler, poorly drained soil.

Ridge Tillage
Minimum tillage with crops seeded and grown on ridges or shallow raised beds. Best for cold and wet soils as it provides better drainage and a warmer environment.

Mulch Tillage
Most of the soil surface is disturbed using chisels, field cultivators, disks, sweeps, or blades and left with more than 30% crop residue cover after planting. Most like conventional tillage but does provide benefits in terms of reduced soil erosion and increased soil organic matter.

Vertical/Shallow Tillage
The soil is shallowly tilled while mixing and chopping residue into the topsoil using knives, coulters or small forward-facing discs. It does not invert or disturb lower layers of soil but does disturb the top few inches. NRCS considers this a mulch tillage technique.

Resources and Implementation Guides

The Economics of On-Site Conservation Tillage
A paper by Kevin P. Boyle, agricultural economist with NRCS and the West National Technology Support Center about the economic benefits of conservation tillage. https://bit.ly/3pnaf2Q

Strip-Tillage in California's Central Valley
A publication from UC Davis detailing the benefits and problems encountered with strip tillage and how to make it work. https://bit.ly/2SSCnhS

Tillage Intensity and Conservation Cropping in the United States
Publication by the USDA on how conservation tillage used along with other soil cover practices can lead to a range of soil health benefits. https://bit.ly/3z11nnJ

Research

Luna, J. et al. 2012. Conservation tillage for organic agriculture: Evolution toward hybrid systems in the Western USA. Renewable Agriculture and Food Systems. 27(1): 21-30. https://bit.ly/3wSof7g

Minoshima, H. et al. 2007. Soil Food Webs and Carbon Dynamics in Response to Conservation Tillage in California. Soil Science Society of America Journal. 71, 3: 952-963. https://bit.ly/3vQ2yVk

Mitchell, J. et al. 2012. Evolution of Conservation Tillage Systems for Processing Tomato in California's Central Valley. Horticulture Technology. 22(5). https://bit.ly/3yVCMkd

Nandan, R. et al. 2019. Impact of conservation tillage in rice-based cropping systems on soil aggregation, carbon pools and nutrients. Geoderma. 340: 104-114 https://bit.ly/3uJa8Q8

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https://bit.ly/2RAVJYz