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Effects of Zero Tillage (No-Till) Conservation Agriculture on soil physical and biological properties and their contributions to sustainability

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Not cultivating soil, rotating crops over the years, and leaving crop residues on the surface in the practice of zero tillage/conservation agriculture (ZT/CA) reverses the historically accelerating degradation of soil organic matter (SOM) and soil structure, while increasing soil biological activity by a factor of 2 to 4. The results of this are many: (a) not cultivating reduces soil compaction, leaving old root holes to facilitate internal drainage, averts the pulverization of soil aggregates and formation of pans, reduces draft power for planting and gives shelter, winter food and nesting sites for fauna, (b) crop residues on the surface practically eliminate wind and water erosion, reduce soil moisture loss through the mulch effect, slow spring warm-up (possibly offset by a lower specific heat demand with less water retention in surface soil) and act as a reserve of organically-compounded nutrients (as they decompose to humus), (c) more SOM means higher available water and nutrient retention, higher biological activity year round (enhancing biological controls), higher levels of water-stable aggregates and a positive carbon sink in incremental SOM. The positive impacts for society are: (i) more and cheaper food, (ii) reduced flood and drought-induced famine risks, (iii) a positive carbon sink in SOM and possible reductions in NO_2 emissions, (iv) cleaner water and greater aquifer recharge due to reduced runoff, (v) cleaner air through effective elimination of dust as a product of cultivation (vi) less water pollution and greater aquifer recharge from reduced rainfall runoff, (vii) farm diesel consumption halved, (viii) reduced demand for (tropical) de-forestation, by permitting crop expansion on steeper lands, (ix) increased wildlife populations (skylarks, plovers, partridge and peccaries) and (x) an improved conservation mindset in farmers. It is notable that, in spite of successful practitioners in all European countries, mainstream adoption is still to come: Europe′s ZT/CA area is 1.35 million hectares, while the world area is now some 125 million and growing at a rate of 7 million hectares per year. More scientific measurements of the benefits of this system are required, both to assist adoption and to trigger policy measures. In the EEC, CAP reform (greening) needs to consider making environmental services payments for these social benefits since a reduction in single farm payments is ineluctable and carbon footprint reduction is of the essence, in the face of constantly-rising fuel prices and the need to cut GHG emissions. Therefore, as the principal farm tool which offers an effective and immediate solution towards positive changes in soil quality, productivity and sustainability, ZT/CA adoption needs financial incentives, which have high economic and environmental returns to society.