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Will no-till be the new panacea for degraded tropical landscapes?

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General knowledge based on the good agricultural soils in temperate climates is that no-till and conservation-till practices increase infiltration of the rainwater and decrease runoff and erosion. Experiments in the semi-humid Ethiopian highlands do not often show the same benefits and in many cases no-till actually increases runoff above conventional and deep tillage. In contrast, for conservation-tillage with mulch at the surface, more of the water infiltrates and enhances plant growth

Reduced tillage systems increase infiltration through soil fauna that form soil macropores through which rainwater flows to the subsoil bypassing the soil matrix with limited conductivity. Most degraded soils (at least in the Ethiopian highlands) have a hardpan at shallow depths restricting downward movement of water. Runoff on conventionally tilled soils is caused by saturation excess when the perched water table in the plowed soil layer reaches the surface. Thus, the amount of runoff is determined by the water free pore space in the surface layer. Since this pore space is less under no-till, no-till has greater amounts of runoff than conventional till.

Under mulch tillage, organic matter is introduced at the surface and soil fauna becomes well-developed which will improve the soil structure and porosity of the soil. This structure will be maintained because the mulch decreases the sediment concentration in the water and the pores will remain open. Under conventional tillage sediment concentrations are high and any pores formed will be filled up with sediment. Our expectation is that since organic matter under mixed farming is used to feed the cattle, widespread implementation of no-till and conservation tillage will be limited to areas with high value crops in which farmers can afford using organic matter as a mulch.