Climate smart solution at stake: **No-till agriculture**

No-till agriculture is one of the 'climate-smart' solutions promoted as a panacea for problems such as hunger and climate change. Several voices advocate no-till as a way to benefit from international climate finance and existing and future carbon markets. But is no-till really a solution to reduce hunger in the world and mitigate climate change? And should no-till farming benefit from existing and future carbon markets? A study commissioned by MISEREOR to Andreas Gattinger et al. from the Research Institute of Organic Agriculture (FiBL) titled '*No-till agriculture – a climate smart solution?*' reveals that no-till, when integrated into organic farming systems, can have positive effects for soils with regard to water and soil conservation and can therefore have positive effects for food security in a changing climate. The study, however, underscores that the mitigation potential of no-till is overestimated by far, and that the method sometimes even has contrary outcomes for the climate.

No-till(age) already practised widely today

No-till agriculture is a soil cultivation system by which seeds are deposited directly into untilled soil. Conventional tillage completely inverts the soil, while no-till practice causes only negligible soil disturbance and the residues from previous crops remain largely undisturbed at the soil surface as mulch.

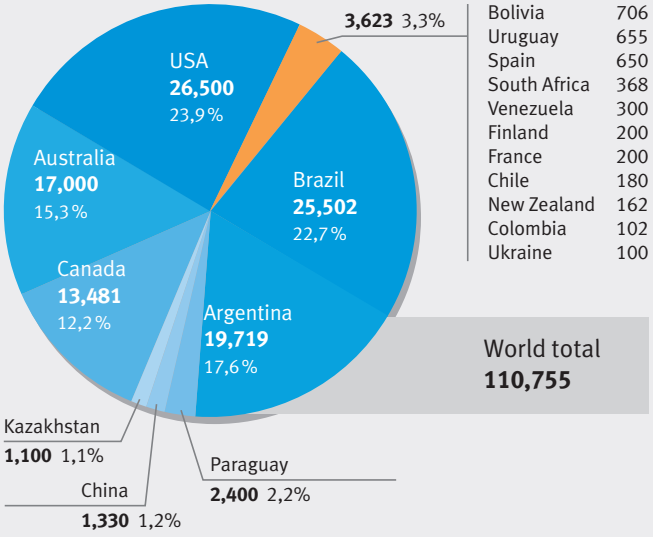
Today, it is estimated that there are around 111 million hectares of farmland under no-till worldwide – which is about 8% of global cropland. However, one has to distinguish between '*large-scale no-till*' – used in industrialised and monoculture-oriented agriculture – and '*small-scale no-till*' practised by smallholder farmers in developing countries, where farming systems integrate livestock and rotation crops. The USA, Canada, Australia and Argentina account for nearly 70% of the global no-tillage area. Large-scale farming dominates in these countries. The adoption of no-till in developing countries, where the method is practised on just 3% of the area, is negligible compared to industrialised and emerging countries, where the settings are completely different.

Highly variable effects for the climate

No-till seems to be an appropriate strategy for adapting agriculture to climate change, as it reduces soil erosion rates and improves water retention. Furthermore no-till agriculture is promoted by various international research and development organisations as an effective method to mitigate climate change. In theory, its mitigation potential seems high, as less soil disturbance can increase organic matter and thus store carbon in soils, a process known as carbon sequestration, and decrease emissions of greenhouse gases from soils. Fuel and synthetic fertiliser savings are other possible positive effects.

However, these causal relations are not quite that simple. No clear scientific evidence exists so far as to whether no-till stimulates carbon sequestration in agricultural soils globally or not.

Extent of no-tillage adoption worldwide (x 1,000 ha) for the year 2008/2009



Data compiled from Derpsch et al. (2010), mainly based on estimates made by farmer organizations and agro-industry.

Mitigation measure and impact	Scientific evidence
Soil carbon sequestration	No clear evidence
Reduction of N_2O emissions and enhancement of CH_4 uptake from soils	N_2O reduction only after 10 years of adoption for humid climate regimes, no reduction for dry climate Enhanced CH_4 uptake
Reduction of fossil fuel use	Consumption decreased by 36-70%
Reduction of CO_2 and N_2O due to reduced use of synthetic nitrogen fertiliser	Uncertain, especially for smallholders and only effective when legumes are part of crop rotation

No to little effect | Little effect | High effect

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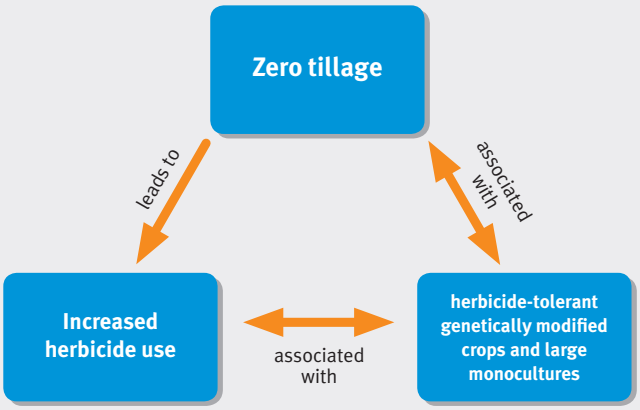
Most positive examples only consider carbon changes in topsoil, and thus ignore soil carbon redistribution processes in deeper layers. It is furthermore still uncertain how no-till farming influences the fluxes of greenhouse gases such as methane and nitrous oxide from soil. No-till in industrialised agriculture can deliver fuel savings of more than 50% by less use of heavy machinery.

Highly variable effects on yields

The reported effects on yields are as uncertain as the effects on climate. Especially in the first years of no-till application, yields tend to be highly variable and can even be lower in developing countries. Furthermore, the potential of no-till is limited in drought-prone areas, particularly in the semi-arid tropics.

The generation of biomass is crucial for no-till farming, as crop residues are to remain as mulch on the soil surface. However, biomass production in dry areas is limited and is needed to feed livestock in the dry season. Thus, in many mixed farming systems, particularly in semi-arid areas where livestock is important, the opportunity costs of retaining crop residues may be too high in relation to the potential benefits, which are often difficult to quantify. It can be concluded that the claimed potential of no-till to sequester carbon seems to be overestimated, especially in the light of the absence of conclusive scientific evidence.

Interactions between zero tillage (= no-till) and increased herbicide use, herbicide-tolerant GMO crops and large-scale mono-cropping systems



Source: Author's own graphics

Scarcely feasible for small-scale farmers

As stated above, no-till is often practised in large-scale agriculture and linked to unsustainable farming systems such as monocultures, use of genetically modified crops and increased herbicide application. But farmers are often not skilled in handling toxic agrochemicals putting at risk their health and natural water sources. This high external input agriculture is furthermore not feasible for the vast majority of small-scale farmers worldwide, who lack the financial means. High investments may lead to debts when climatic extremes destroy yields, and by this even increasing vulnerability to climate change. The inclusion of no-till in sustainable farming systems still needs further research. Today, the potential benefits of no-till for small-scale farmers are low.

Ploughing the fields – a thing of the past?

Conclusions

No-till farming should be kept out of the carbon markets. Although there is a potential for no-till to be an effective strategy for adaptation to climate change by increasing, in some cases, farmers' resilience to climate change, its contribution to mitigation is not backed by science.

Since no-till is currently often practised in high external input agriculture, it is still not clear to which extent small-scale farmers can benefit from it. Moreover, since no-till is linked to unsustainable farming practices, such as the use of pesticides and genetically modified organisms, it can even pose a threat to the natural resources smallholders depend on.

MISEREOR therefore recommends not to consider no-till practices in general as climate smart technology, and to support no-till practices only when they are linked to a holitic organic farming approach.

The full report **'No-till – a climate smart solution?'** is available at: http://www.misereor.de/fileadmin/redaktion/MISEREOR_no%20till.pdf

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