Conservation Agriculture with regard to no-tillage

Since the late 1950s agricultural production on arable land has been strongly intensified. Switzerland is characterized by sloping and undulating areas as well as a cool and wet climate with annual precipitations of 1000 mm and more. Therefore, soil erosion is a major concern in arable farming. In addition, axle-loads of farm machinery have increased significantly during the last decade resulting in pronounced soil compaction and decreased soil quality. As a consequence of primarily physical soil stress brought about by tillage and transport operations, the fertility of arable soils is at risk. A strategy of action introducing a practicable cropping system, which combines the conservation of natural resources with economic benefits, was required. Conservation agriculture – in particular "zero tillage" based on Manitoban experiences from the early 1980s (Sturny, 1982) - fulfils both these criteria.

Experimental Approach and Results
No-tillage and conventional plough tillage are being compared in a crop rotation without fallow period and application of mineral fertilizer only, in the long-term field trial «Oberacker» at the Inforama Ruetti in Zollikofen (near Berne) since 1994. The slightly humic sandy loam is a deep and nutrient-rich soil. The results obtained so far show continuous no-tillage of long duration to be an alternative to traditional plough tillage: no-tillage is ready to be put into agronomical practice, it leads to a biologically active soil of stable structure and thus of high load capacity, reduces the risk of soil erosion, the number of vehicle crossings and the consumption of fuel and presents an overall more favorable life cycle assessment (Schaller et al., 2006).

After a 7-year conversion period, slightly higher plant yields of comparable quality were obtained in no-tillage, due to more soil water being preserved and continually delivered to plant roots, as well as to a higher N-efficiency. In both cropping systems only about 60% of the standard amounts of N-fertilizer were applied. Both systems are being established further and optimized with regard to environmental sustainability and energy consumption by including more legume crops, applying ammonium-based N-fertilizer, and by significantly reducing the application of glyphosate in no-tillage and the tillage intensity in conventional plough tillage (Sturny et al., 2007).

Applications and Implications for Conservation Agriculture
In the canton of Berne, conservation tillage is being encouraged with financial incentives since 1993 (Schwarz et al., 2007) – including a farmer-to-farmer approach. The farmers involved commit to loosening their soils just superficially during the transition phase from a plough to a
no-tillage system or to refrain from soil loosening by direct seeding or planting right away without any soil disturbance. Innovative private contractors made a valuable contribution to promoting no-tillage techniques among farmers. At the same time, countrywide awareness about no-tillage was successfully raised through consulting, publications, field trials and demonstration plots, field days as well as the national discussion platform SWISS NO-TILL (http://www.no-till.ch). The area under no-tillage increased constantly, reaching 17,000 ha or nearly 5% of the arable land. In some parts of Switzerland the proportion of no-tillage fields has reached 10% (Schneider et al., 2010).

Article 77a/b in the Federal Law on Agriculture establishes the provision of federal funds (80%) to supplement the cantonal incentives (20%) since 2008. The canton of Berne therefore launched a 6-year “Soil Support Program” by farmers and soil experts to pursue a comprehensive and sustainable problem-solving approach to soil protection at the interface of water and air. It is based on voluntary participation and allows for financial incentives to implement different measures related to cropping systems that protect the soil (mulch-tillage, strip-tillage, no-tillage), to restore organic matter (crop rotation, soil cover over winter, undersown cover crops, abandonment of herbicides, manure composting) and to encourage ammonia-reducing techniques for the application of liquid manure (umbilical application system, soil-conserving undercarriages). This catalogue of measures is part of the program concept which, together with educational and extension components, constitutes an overall farmer-to-farmer approach, along with monitoring soil impact that includes plant protection and exposure measurements. Following completion of the program in 2015, these measures should be economically feasible without additional incentives and be pursued further. It thus provides the means to extend conservation agriculture to the entire area of arable land. Today about 7% of the Bernese cropland is under no-tillage agriculture.

Conclusion
On a national level within the agricultural policy and the payments framework for 2014-2017, a new tool including “payments for efficient use of resources” was introduced in 2014 providing several measures derived from the Bernese incentive Soil Support Program.

References