University of Kassel
Department of Organic Agricultural Sciences

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VERSITÄT

Untersuchung zu Controlled Traffic Farming und satellitenbasierten Lenksystemen

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Abstract

This thesis deals with Controlled Traffic Farming (CTF) cropping systems based on per-manent, satellite-guided tramlines for all farming operations. Can CTF reduce soil stress and improve the efficiency of direct drilling cropping systems? Besides agronomic and soil physical parameters, the effects of guidance systems and possibilities of implementing CTF in practice were examined.
Analysis of a CTF implementation under European conditions with the use of standard machinery show that it is possible to mechanise CTF cropping systems for permanent grassland, combinable crops and maize with currently available machinery and with rela-tive ease on both smaller and larger fields. With sugar beet and potatoes, trade-offs may be necessary. In general, CTF cropping systems require careful planning and implementation in practice.
In a three-year field trial (winter wheat, winter barley, temporary ley with a clover-grass mixture) on a loamy soil, CTF direct drilling was compared with conventional randomly trafficked direct-drilling and ploughing cropping systems. CTF was shown to differentiate into non-, medium and intensively trafficked variants. On the available compact soil with an annual precipitation of 1150mm, the differences between non-trafficked surfaces and those trafficked with low contact-surface pressure were fairly slight. After three years, penetration resistance and carbon dioxide content in the soil air exhibited significantly improved values, although soil density and porosity did not show a clearly interpretable trend. Because of suboptimal emergence rates in some cases, no general agronomic trends could be deduced. Nevertheless, intensive spraying-and-spreading traffic on tram-lines produced clearly negative soil physical and agronomic effects. It would therefore be

appropriate to use permanent tramlines in particular for spraying and spreading opera-tions.
The examination of guidance-system effects revealed significant advantages in stress relief for the driver and a higher guidance accuracy, especially when driving with large working widths without track markers. Most other measuring parameters were slightly more advantageous with guidance systems than without, but did not differ significantly. The tractor drivers and properties of the natural environment such as field shape had a substantially higher impact.
Overall, CTF in combination with further soil-protection measures enhances the ability to prevent soil compaction, reduces the need for energy-intensive soil tillage, and promotes the development of a stable soil structure with a higher bearing strength. Together with seedbed preparation adapted to crops and cropping systems and with the mechanical cultivation operations that are more easily performed in straight rows, favourable conditions arise for the design of agronomically more efficient, more ecologically sustainable cropping systems.