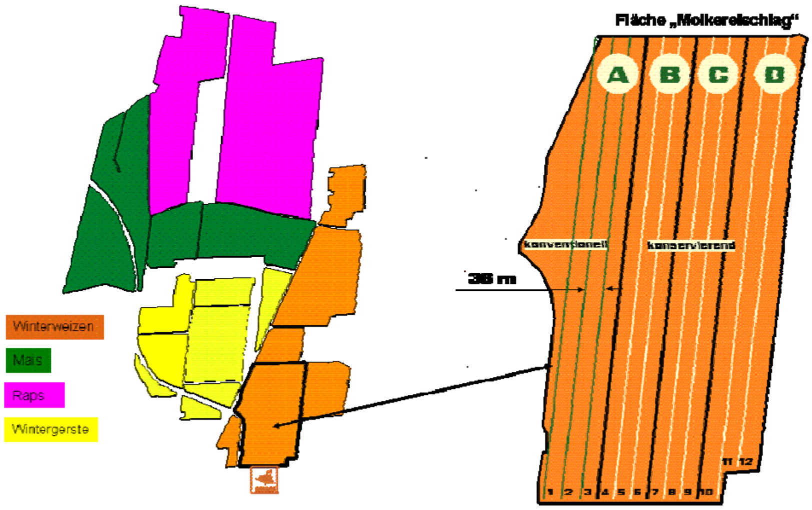
Save with a system

Introduction

The amount of fuel consumption directly affects the variable production costs resulting in about 40 % of the total farm costs. Though, the production costs clearly increased recently the further reduction of the variable costs is desirable.

On principle there are manifold possibilities to minimise costs like changing the arable farming method or reduction of operational passes. On the trial sites of the AG Kitzen (Region Leipzig), which are run in co-operation with AMAZONE and the FAL Braunschweig this problem is dealt with since some years.

Test structure



Picture 1: Arrangement and structure of the trial site "Molkereischlag"

For the operational pass primary soil tillage the trial site (approx. 40 ha) is divided into four blocs (Blocs A-D). While block A is cultivated conventionally using the plough, the blocs B-D are cultivated in conservation soil tillage with rotary-disc harrow combination (block B, C) and the compact disc harrow (bloc D) at decreasing operational intensity. Within the individual blocs three different sowing technologies are integrated, again with decreasing operational intensity (**picture 1**).

Implement technology and operational passes

Soil tillage

Stubble working is made via compact disc harrow with a medium working depth of 6 - 7 cm. The following primary soil tillage is differentiated by system and intensity.

Bloc A is cultivated conventionally with an average ploughing depth of 22-25 cm followed by a re-consolidation with a packer. In the blocs B and C the four row cultivator-disc harrow combination is used at working depths of 20-22 cm and 13-15 cm. Bloc D with the minimum working intensity is cultivated for a second time with the compact disc harrow at a working depth of 8-10 cm.

Sowing

For sowing three seed drills were used. In the first variation sowing is done using a universal joint shaft driven sowing combination. For the second variation a trailed sowing combination with integrated disc harrow unit is used. In variation 3 sowing is carried out only with a solo seed drill.

Tractors

Standard tractors with a special measuring technology and capacities of 125kW and 220kW were used. The parameters fuel consumption, speed, universal joint shaft capacity and traction had to be determined.

Determination of fuel consumption

At the tractor technology the flow- and return flow hose for the fuel flow are interrupted in order to install oval turning counters with the aid of quick couplers. The oval turning counters measure the flow- and return flow volume.

Registration of speed

For the registration of speed without slip an optical sensor is attached to the tractor. This Correvit L-400 has an impulse output of 400 impulses per metre. Via a frequency entry of the data logging these impulses are entered. The impulse width allows for the calculation of the actual speed.

Measuring the universal joint shaft capacity and traction

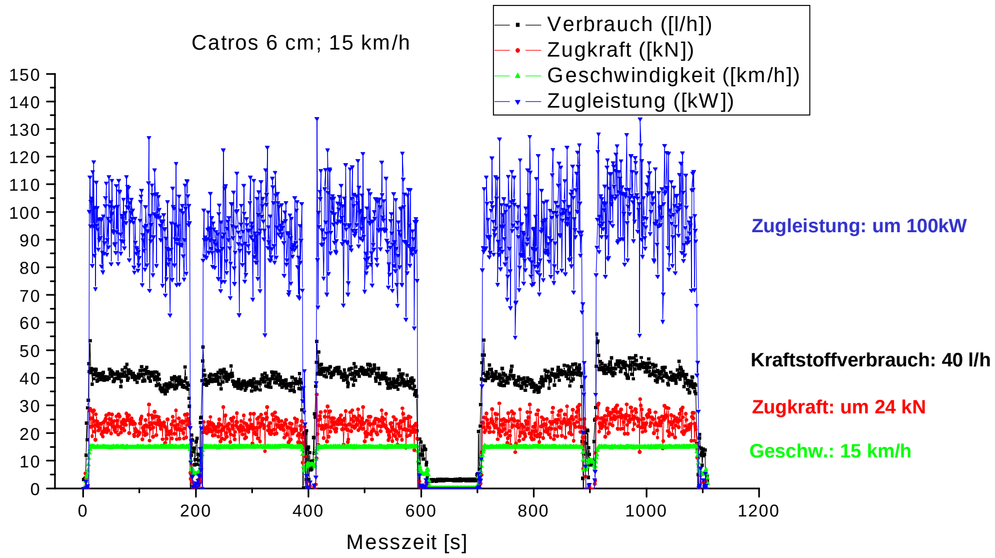
For the registration of the universal joint shaft capacity a universal joint shaft hub was fitted to the towing vehicle. This is positioned between universal joint shaft stub and PTO shaft and measured the rev. speed and the torque. In this way a telemetry data transfer on to the stator of the measuring shaft is carried out and an amplification in an analogous voltage signal. The registration of the traction requires the installation of a pulling eye which is provided with strain gages.

Measurement series for traction and bearing pressures in the three point

For the registration of traction and bearing pressures multicomponent transducers are installed on the lower and upper link arms. With the aid of an angle position transducer the relevant position of the lower link is registered.

Example for a measuring travel

The series of numbers created with the aid of a data recording are processed with a specific computer programme. The results are graphic data interpretations for the individual operational passes (**picture 2**).

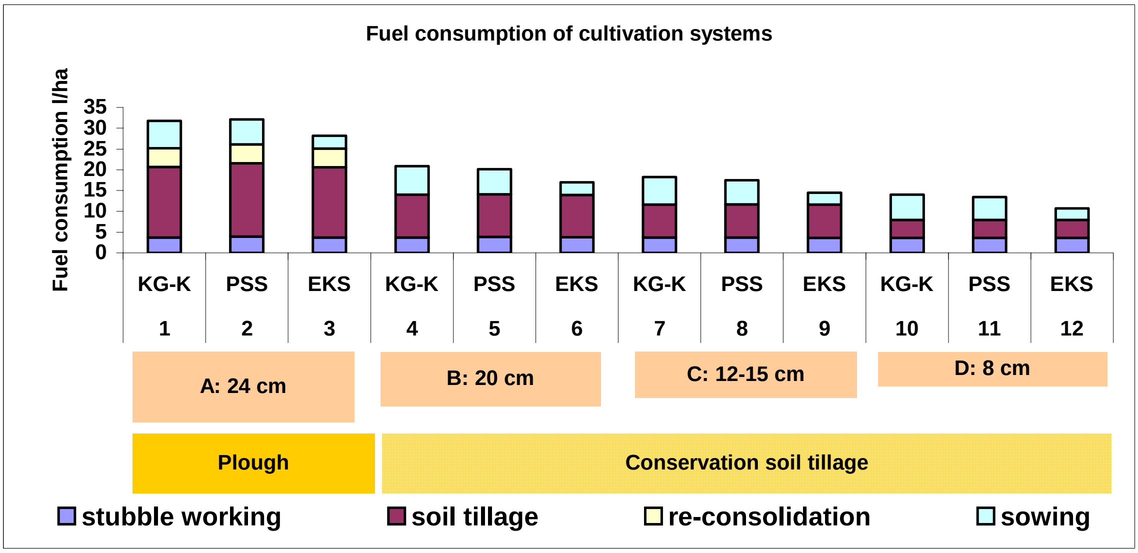


Picture 2: Graphic illustration of a measuring travel

Results

Fuel consumption of the cultivation systems

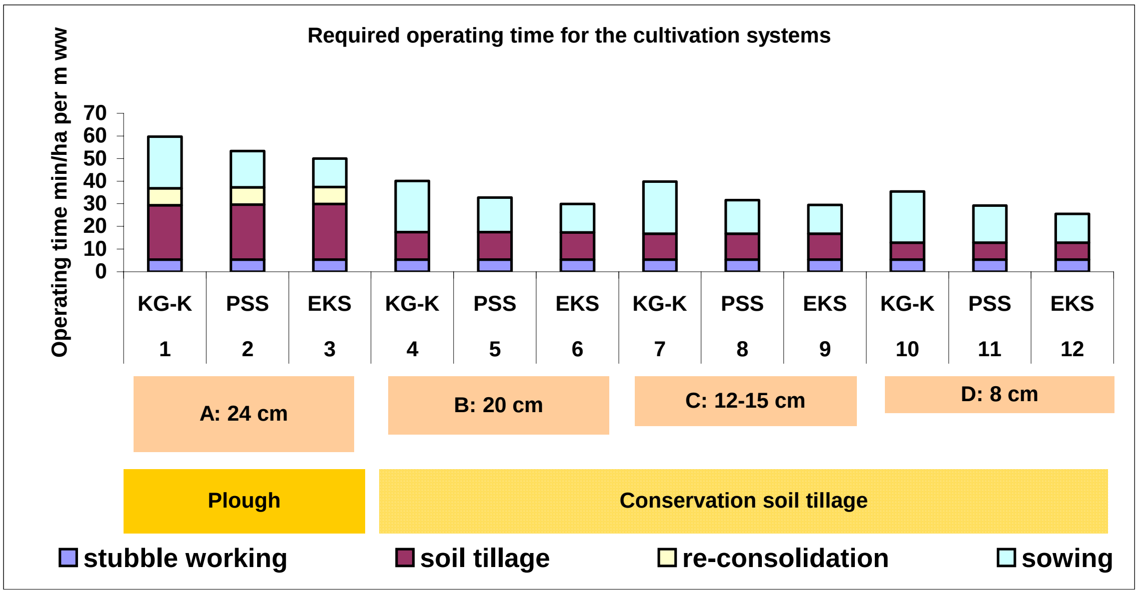
The reflection on the values shows clear differences in fuel consumption. In bloc A with conventional cultivation under consideration of the sowing technology the consumption amounts to between 28.2 and 32.2 l/ha (**picture 3**). This represents the highest fuel consumption at the at the same time highest stage of intensity. The lowest consumption figures can be observed in bloc D where as the blocs B and C are placed in between. Depending on the intensity of the sowing technology the area cultivation requires 10.7-14.0l/ha at a working depth range of just 8 cm.



Picture 3: **Fuel consumption at different cultivation systems**

Required operating time

The increased operating intensity at soil tillage and sowing results in general in an increased operating time requirement (**picture 4**). On principle, however, the total operating time requirement of a cultivation system is more affected by the operational pass primary soil tillage. Between the system of the highest and the system of the minimum intensity there is a difference of 30 minutes operating time. This means a proportional drop of operating time requirement of 50 %.

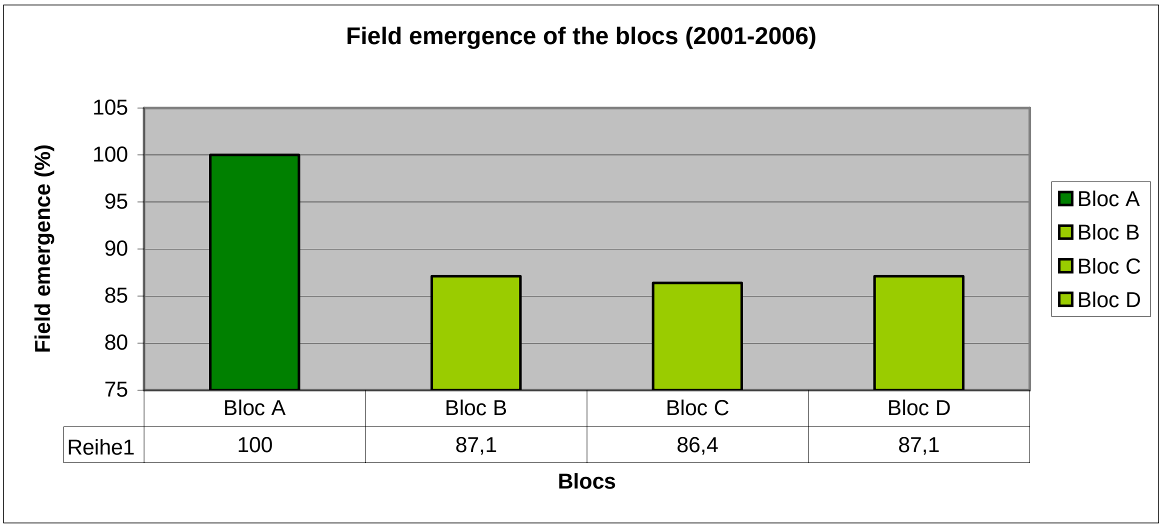


Picture 4: **Required operating time of the different cultivation systems**

Field emergence

The valuation on the trial sites is carried out per square meter with relevant repeats.

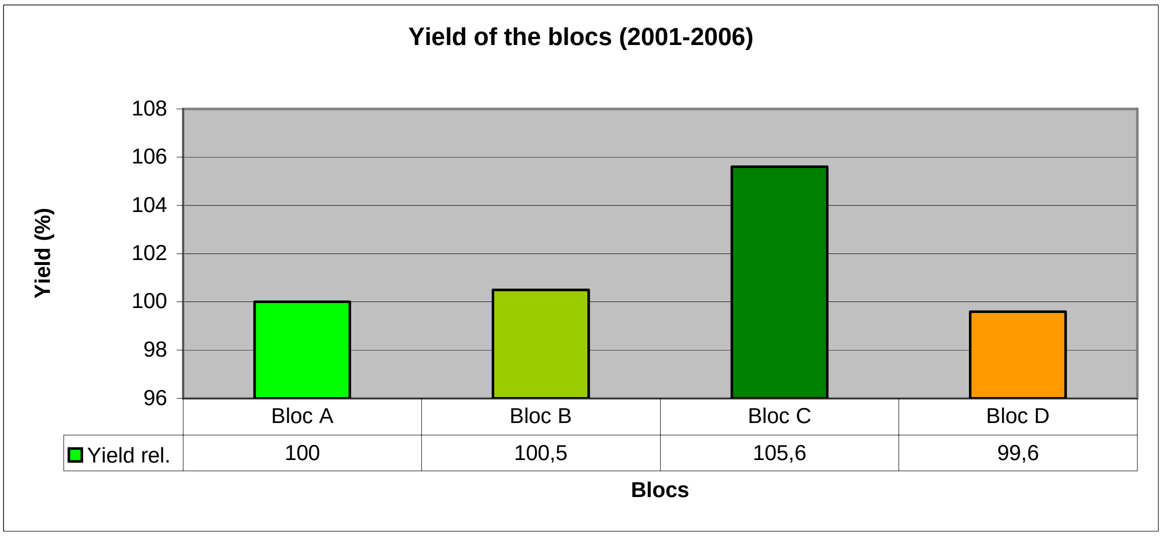
The field emergence in the average of the years shows an obvious tendency in favour of the conventional cultivation (**picture 5**). The minor straw coverage at the time of cultivation does not result in any negative effect in the emergence behaviour of the crops. The conservation cultivation results in a slightly less field emergence as the degree of straw coverage affects the emergence behaviour. Amazingly no deterioration of field emergence can be realised at a further drop of the operational intensity (blocs C and D). Obviously also a working depth of 8-10cm is sufficient in order to establish even crops.



Picture 5: Field emergence within the inspection period 2001-2006

Acreage yield

The reflection on acreage yields results in a completely new situation (**picture 6**).



Picture 6: Yield development in the inspection period 2001-2006

The conservation cultivation systems which were behind at the time of valuation result in partly clearly increased yields compared with the conventional cultivation system. Here bloc C with just 13-15cm working depth comes off best with a by 5.5 % increased yield. To some extent the decreasing operational intensity results in increased yields due to a better water availability. A too minor operational intensity (bloc D) results in a yield drop in spite of best water availability. In this case the disadvantage of too high a straw coverage in the top soil predominates.

Summary

Main objective of the long term test is to determine by means of different cultivation systems with graded intensities of soil tillage and sowing the effect on yield relevant and economic parameters.

During the inspection period switching from conventional to conservation cultivation always resulted in less field emergence. More straw coverage on the soil surface and degeneration products freed from straw rotting were detected to be the main reasons. However, between the graded intensities of the conservation cultivation system the field emergences only vary to a minimum extent.

The acreage yields in the inspection period at comparable working depth resulted in no significant differences between the conventional and the conservation cultivation method. At the further reduction of the operational intensity within the conservation system the yield level initially clearly increased (bloc C). Then the yield level dropped heavily (bloc D). So, the system with the lowest intensity also always resulted in the lowest yield.

On closer inspection of the economic parameters above all fuel consumption and operating time requirement are of great interest for the user. Whereas due to congruent objectives and implements at stubble working there are minimum differences bigger differences are evident at the operational pass primary soil tillage by the use of different technology. The use of the plough for primary soil tillage results both at fuel consumption and also at operational time the highest values. By using the cultivator-disc harrow combination and the compact disc harrow in conservation cultivation systems the fuel consumption can be reduced considerably, in the ideal case by up to 70%.

The similar is valid for the operating time requirement. Here savings of up to 65% are realistic. At the sowing technology the saving potential is mainly restricted to the operating time. Bigger differences at fuel consumption, however, could not be observed. The use of different seed drills resulted in a difference of operating times of up to 45%.

Sources

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