Frederik Schulten-Baumer, Oliver Schmittmann and Peter Schulze Lammers

Parallel Tracking Systems – Acceptance and Benefits

Parallel tracking systems can help saving labour and increase efficiency of resources in agricultural business. An interrogation of farmers and contractors delivered important results about acceptability and estimated benefits of parallel tracking systems. Based on the collected data economic calculations with varying premises and varying crop-rotations have been made. In result these calculations showed minimum time of mission which is necessary for cost recovery. Beside this the non-monetary aspect of driver relaxation achieved by the use of parallel tracking systems was one of the most important aspects mentioned by the respondents.

Keywords:
parallel tracking systems, GPS

Abstract
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The technological progress in agriculture – as in other business too – is one of the most important factors for increase of efficiency. Innovations in agricultural technology were characterised by raising capacity of agricultural machinery in the past. Estimations about the further rise of capacity have almost always been exceeded. A a consequence less personnel is needed for crop-farming, but demands on machine operators graduation keep rising. Multi taskings have to be done, such as supervising the multi information display or checking the working quality of the machine, even on driving the machine at high speed. Because of these demands automated steering of the vehicles could be an ease for the driver, but realisation of these systems is a great challenge for agricultural engineers.

Mechanical guidance systems were developed years ago and still are in use with great success. By using the Global Positioning System (GPS) and improving its positioning-accuracy by signal correction services, parallel tracking systems become applicable in agriculture.

Through automation or semi-automation of the steering agricultural vehicles can operate more precisely even in successive traces. Because of this – and due to the price-trend of parallel tracking systems in the last two years – various savings provide a fast break-even-point for parallel tracking systems. Some of the positive aspects of parallel tracking systems as relief of the driver and environmental advantages through precise field operations can also be achieved but not quantified monetarily.

Motivation for the study

The use of parallel tracking systems in agriculture is manifold. Support of vehicle-steering can be used for different operations in crop- or grassland-farming. By the use of these systems two main questions about the reliability have to be answered:

- Are there significant differences in the use of parallel tracking systems between crop-farming and grassland-farming?

Are there only economical reasons for the investment in parallel tracking systems?

The quantum of resource-savings by the use of parallel tracking systems has to be figured out as well as time-savings during the labour-process. These savings can't be quantified in most cases. Other authors have chosen the predefined deviances from the target-line (by not using parallel tracking systems) for calculation of the break-even-point.

Objective

The collected data from agricultural business was used to give an overview on acceptance, sustainability, and range of use of Parallel Tracking Systems. Saving of fuel and other resources was expected to be figured out. By the use of the collected data a realistic calculation of the break-even-point of different Parallel Tracking Systems was aimed to be achieved as well as a minimum acreage for efficient use of parallel tracking systems.

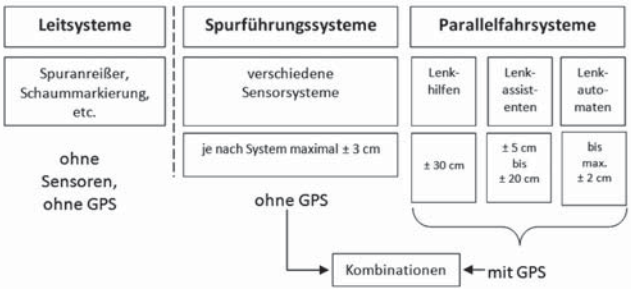
Methods

The survey was addressed to users/operators of Parallel Tracking Systems and potential operators who do not use these systems yet. From the collected data conclusions of the economic benefits are to be drawn. After weighting the advantages and disadvantages of different data acquisition methods, data acquisition was carried out by quantitative paper- and pencil-interviews. The main reason for the application of this method was to get access to a high number of farms.

The number of operators in Germany using Parallel Tracking Systems is unknown.

Customer data collected by the manufacturers was not considered in order to prevent the survey from being biased.

Fig. 1



System and differentiation of 'steering assistances'

A questionary was compiled for users and also for farmers who do not use parallel tracking systems. The theoretical observation base contained farmers and contractors in Germany.

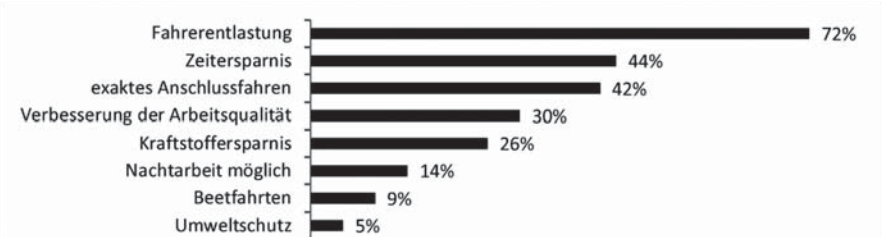
A profitability analysis was made by an investment appraisal considering three examples of crop rotations. In a sensitivity analysis the initial conditions were varied and the consequences for the required cultivation area for an efficient use of Parallel Tracking Systems were proved.

Results and discussion

Most operations in crop- and grassland-farming can be done faster and more efficient through exact junction of the areas treated by agricultural machinery. The interrogation of farmers and contractors (see fig. 2 and fig. 3) resulted in a very positive stance on Parallel Tracking systems. Half of the respondents who haven't used Parallel Tracking Systems yet responded that they intend an acquisition during the next five years. Working assistance was quoted as one of the main advantages of Parallel Tracking Systems, even more then cost reduction. High costs for the acquisition of Parallel Tracking Systems were quoted as the main disadvantage. Even though occasionally interference of GPS-signal was reported Parallel Tracking Systems users were satisfied with the systems' performance. The users' average evaluation of possible savings achieved by Parallel Tracking Systems are summarised in the table below.

By a differentiated view on the different kinds of Parallel Tracking Systems the estimation of the respondents for possible savings were lower for guiding systems then for automated steering systems. The results of the interrogation were used for a model-calculation of the minimum annual acreage for amortization of Parallel Tracking Systems. This

Fig. 2

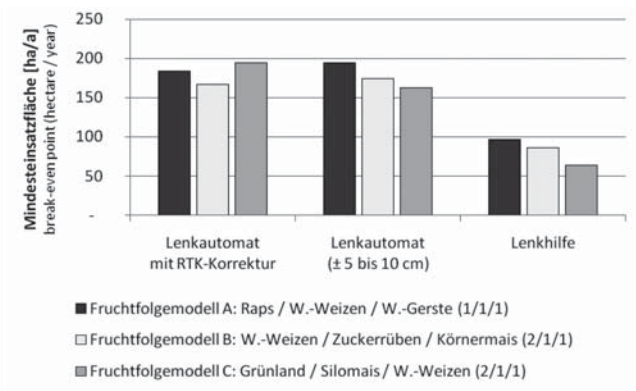


Advantages of Parallel-Tracking-Systems

Fig. 3

Disadvantages of Parallel-Tracking-Systems

Fig. 4



Hectare need for break even using Parallel-Tracking-Systems in different crop rotations

calculation was done for three different crop-rotations; results of this calculation are shown in Fig. 4.

General results of the economy of Parallel Tracking Systems can be rough estimated only, because basis of the calculation differs from farm to farm. This can be explained by the fact that range of use is depending on various factors such as crop-rotation. Accuracy of positioning has to be estimated for every farm separately. This accuracy is influenced by different sources e.g. driver's experience or visibility conditions. For a general result of economy overlapping of joint planes would have to be estimated by a random check. Same check would have to be done for overlapping of joint planes on different Parallel Tracking Systems. However the results of the interrogation show that acquisition of Parallel tracking Systems is not only influenced by monetary factors. Driver relaxation and increasing comfort of driving were mentioned as main aspects for buying a Parallel Tracking System.

Additional interrogations dealing with non-monetary advantages of Parallel Tracking Systems could deliver data for a benefit analysis. The main problem of this data is the subjective estimation of non-monetary benefit by the users. General results of these advantages can only be achieved particularly. If Parallel Tracking Systems achieve a significant reduction of resources and costs a benefit in environmental protection is achieved as well through savings of pesticides and fertilisers. This advantage could be quantified by economic benefit analysis. Tis kind of analysis has successfully been done for other processes in Precision Farming such as site-specific fertilization to figure out appropriation of this technology with agricultural policy funds.

Table

Final summary table of named possible savings

	Lenkhilfe	Lenkautomat
Diesel	3,1%	5,9%
Zeit	2,7%	6,7%
Pflanzenschutzmittel	2,0%	8,0%
Düngemittel	0,8%	4,6%
Saatgut	0,0%	2,6%

Autoren

Dipl.-Ing. agr. Frederik Schulten-Baumer has done the research on the economy of Parallel Tracking Systems during his diploma-thesis at Institute of Agricultural Engineering (University of Bonn)

Dr. agr. Oliver Schmittmann is senior researcher at Institute of Agricultural Engineering (University of Bonn), Nussallee 5, 53115 Bonn, Germany

Prof. Dr.-Ing. Peter Schulze Lammers is head of the department Technology of Crop Farming at Institute of Agricultural Engineering (University of Bonn), Nussallee 5, 53115 Bonn, Germany