Possibilities and challenges of modelling the agricultural tracks at field scale

Katja Augustin, Michael Kuhwald & Rainer Duttmann

References:

Grant No.: 031B0684C
Objective of Modelling with FiTraM

Gather Input Data

- measure machinery characteristics
- weighing the axle load
- record route using (RTK) GPS

Results

- wheel tracks for every axle
- spatial wheel load and soil stress
- spatial number of wheel passes

Ex.: modelled wheel tracks of maize overloading vehicle
Characteristics of Work Processes – Possibilities and Challenges

Lifting implement (tillage, sowing)
- P: Modelling the dynamic changes
- C: smooth transition of the wheel load
- M: geometrical calculation + empirical assumptions

Payload/Unload (harvest, sowing, spraying, fertilizer)
- P: dynamic changes in wheel load/soil stress
- C: calculate the real payload/unload
- M: linear calculation + averaging

Reversing (all work processes)
- P: dynamic changes in wheel load/wheel passes
- C: “pretty” mapping of the tracks when reversing for short periods
- M: geometrical calculation + empirical assumptions
Potential Uses

Validation

Position accuracy during turning

Compared to manual GPS recording of tracks

Front axle

Rear axle

Intensive areas

Areas with more than 5 Mg wheel load and 5 wheel passes

Further Processing

sugar beet harvest

Comparison of the average maize yield from different measuring stations and methods

<table>
<thead>
<tr>
<th>Recorded by</th>
<th>Average harvest [t/ha]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modelling (linear) *</td>
<td>53.15</td>
</tr>
<tr>
<td>Biogas plant</td>
<td>51.40</td>
</tr>
<tr>
<td>Hand harvest</td>
<td>45.59</td>
</tr>
<tr>
<td>Machine recording</td>
<td>65.56</td>
</tr>
</tbody>
</table>

*based on average from Biogas plant

crops:

2 x winter wheat
maize
sugarbeet