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Analysis of Influencing Factors on Infield-Logistics: A Survey of Different Farm Types in Germany

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Abstract : The Management of machine fleets or autonomous vehicle control will considerably increase efficiency in future agricultural production. Especially entire process chains, e.g. harvesting complexes with several interacting combine harvesters, grain carts, and removal trucks, provide lots of optimization potential. Organization and pre-planning ensure to get these efficiency reserves accessible. One way to achieve this is to optimize infield path planning. Particularly autonomous machinery requires precise specifications about infield logistics to be navigated effectively and process optimized in the fields individually or in machine complexes. In the past, a lot of theoretical optimization has been done regarding infield logistics, mainly based on field geometry. However, there are reasons why farmers often do not apply the infield strategy suggested by mathematical route planning tools. To make the computational optimization more useful for farmers this study focuses on these influencing factors by expert interviews. As a result practice-oriented navigation not only to the field but also within the field will be possible. The survey study is intended to cover the entire range of German agriculture. Rural mixed farms with simple technology equipment are considered as well as large agricultural cooperatives which farm thousands of hectares using track guidance and various other electronic assistance systems. First results show that farm managers using guidance systems increasingly attune their infield-logistics on direction giving obstacles such as power lines. In consequence, they can avoid inefficient boom flippings while doing plant protection with the sprayer. Livestock farmers rather focus on the application of organic manure with its specific requirements concerning road conditions, landscape terrain or field access points. Cultivation of sugar beets makes great demands on infield patterns because of its particularities such as the row crop system or high logistics demands. Furthermore, several machines working in the same field simultaneously influence each other, regardless whether or not they are of the equal type. Specific infield strategies always are based on interactions of several different influences and decision criteria. Single working steps like tillage, seeding, plant protection or harvest mostly cannot be considered each individually. The entire production process has to be taken into consideration to detect the right infield logistics. One long-term objective of this examination is to integrate the obtained influences on infield strategies as decision criteria into an infield navigation tool. In this way, path planning will become more practical for farmers which is a basic requirement for automatic vehicle control and increasing process efficiency.

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