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Study of combine remote monitoring systems for fuel consumption and environmental impact control

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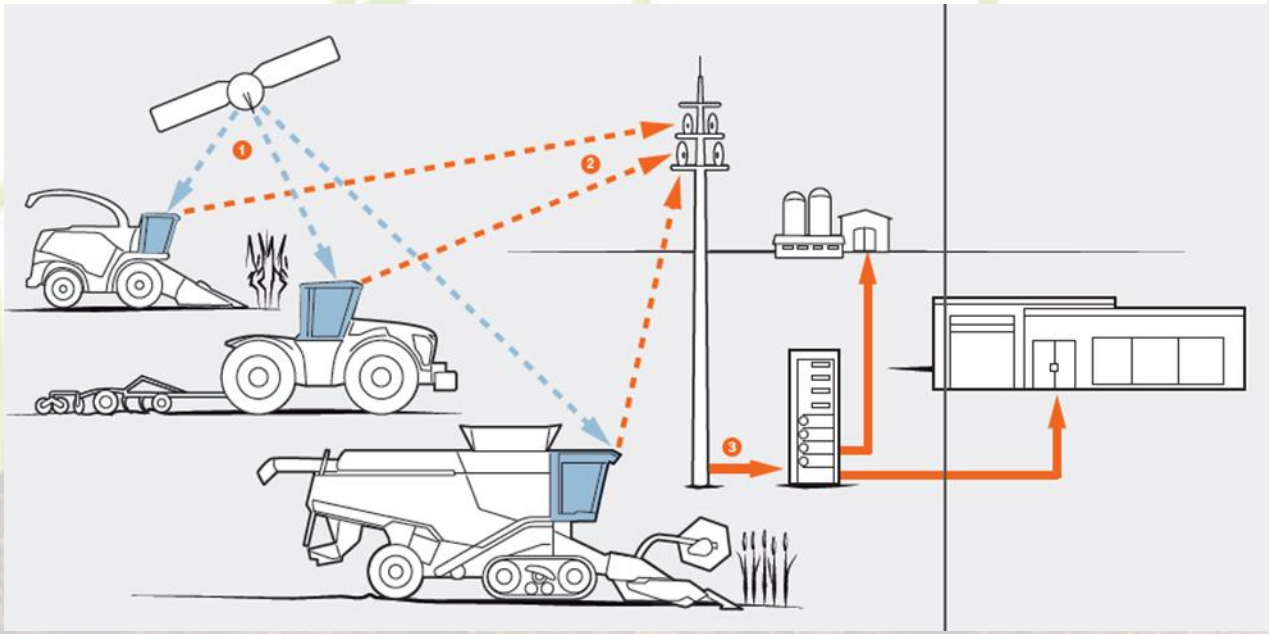
Introduction

The European Union's Green Deal calls for action to promote climate change mitigation. European Commission adopted a set of proposals to make the EU's climate, energy, transport, and taxation policies fit for reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. The agriculture sector more widely offers remote sensing systems in modern intelligent farming systems. With the development and complexity of information systems, there are problems with the analysis and use of telemetry data. With the development and complexity of information systems, there are opportunities for the analysis, use and application of telemetry data.

Telemetry system

Telemetry system records data concerning more than 200 different parameters and automatically transmits it to the web server at regular intervals via the mobile phone network. The use of telemetry system improves work processes and allows analyse the operating time. Detailed analysis of the machine performance and adjustment parameters provides machine optimisation possibility.



Source: EASY – Efficient agriculture systems, 2017

Telemetry system

Telemetry system can access all the key information about machine functionality via the internet at any time from any location. This information includes the machine‘s current location and a comprehensive overview of performance and machine data and service information and conduct an initial diagnostic check.

https://www.claas.de/unternehmen/historie/news_stories/die-telematics-evolution-von-claas/2346156

Materials and Methods

For the research, the sets of harvesting process data of three identical Lexion 770 TT (Terra Trac) combines, collected and stored in the Telemetry system, were taken.

Technical characteristics of Lexion 770 TT combine harvesters:

OM502 LA engine power – 405 kW, threshing drum width – 1700 mm, 445 mm diameter rotors for post-threshing grain separation – 2 rotors, grain cleaning – 8 turbine fans, grain tank volume – 12.500 l, cutterbars model V1050 – effective cutting width 10.67 m

https://www.worldofmods.com/farming-simulator-2015/harvesters/71085-claas-lexion-770-tt-conspeed-vario.html

Materials and Methods

Using data collected and stored on the Claas Telemetry Platform.

Total	Canola	Cleaning by blowing	Edible beans	Oats	Peas	Wheat

Total	Average
Engine hours	246:19 h
Total working hours	152:55 h
Crop yield	2747.82 t
Area	520.08 ha
Total distance traveled in field	880.81 km
Fuel consumption, field	6666.5 l
Average yield	5.28 t/ha
Throughput per hour	17.97 t/h
Fuel consumption per weight	2.43 l/t
Fuel consumption per area	12.82 l/ha
Fuel consumption per working hour	43.59 l/h
Fuel consumption, transport	494.5 l
Fuel consumption, total	7161 l

Results and Discussions

Telemetry data of combine harvesters obtained after harvesting winter wheat.

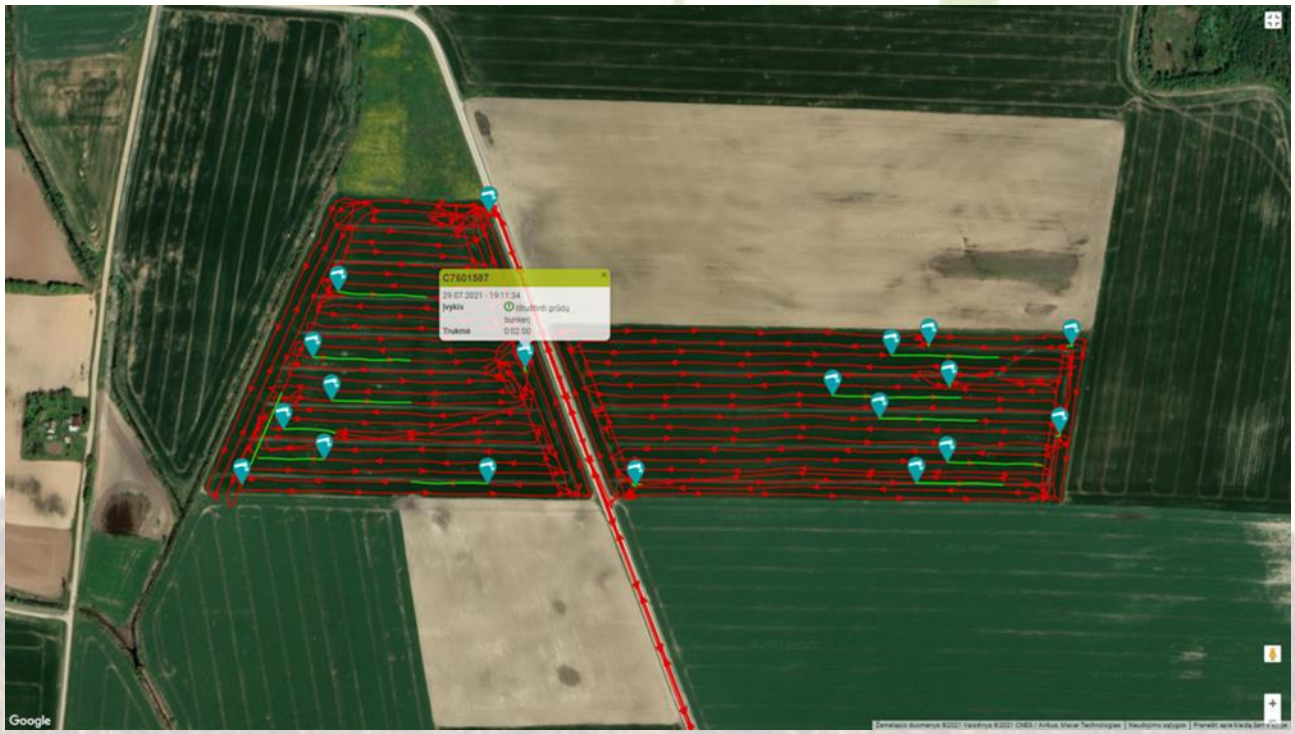
Combine harvester	Quantity of unloaded grain tanks of wheat, units	Harvested crop	Harvested area, ha	Harvesting capacity, ha/h	Fuel consumption		Average crop yield, t/ha
					l/ha	l/t	
LEX770 No.1	268	W.wheat	339.10	3.56	25.6	3.43	7.46
LEX770 No.2	448	W.wheat	619.66	5.00	19.8	2.90	6.83
LEX770 No.3	331	W.wheat	352.89	4.64	21.9	2.47	8.87

Working hour's distribution (Telematics)

Total	Average
Unloading portion during travel	2 %
Unloading portion while idle	3 %
Turnaround time portion	10 %
Process time portion	52 %
Idle time portion	18 %
Travel time portion	13 %
Idle time with full grain tank portion	2 %

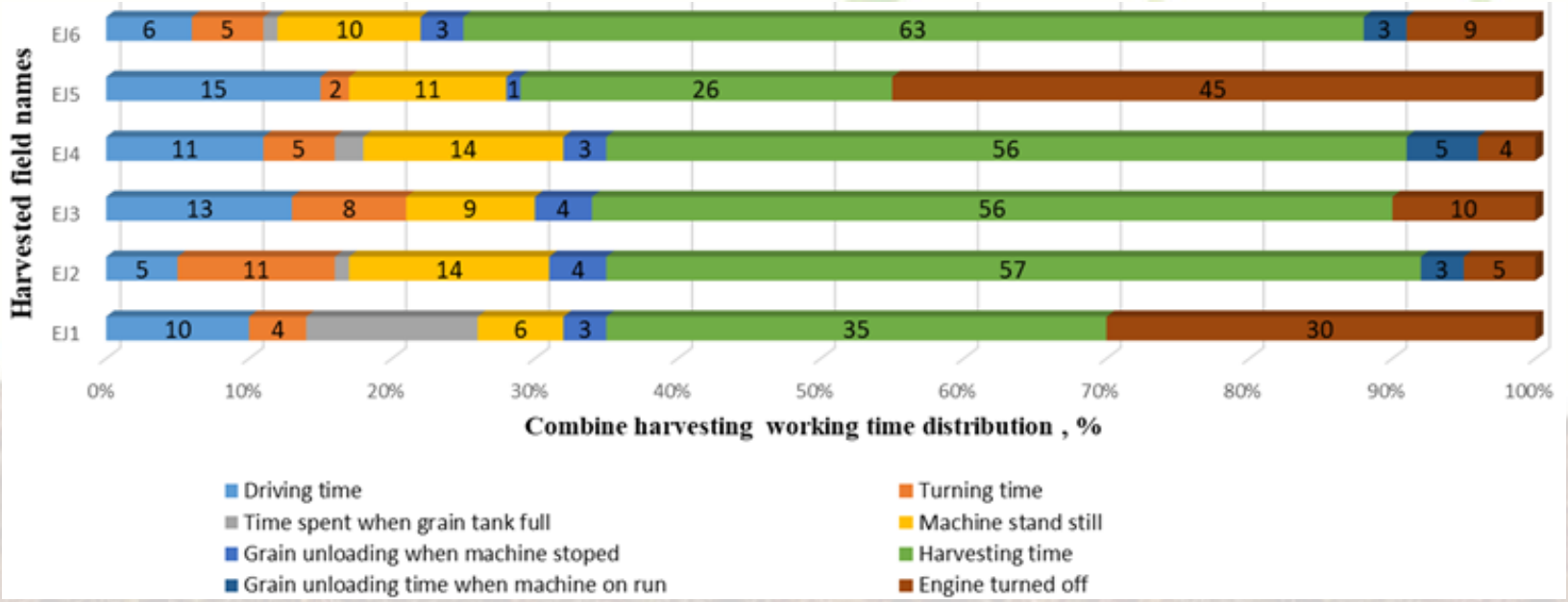
Results and Discussions

The visual distance graph of the combine driving route provided on the telemetry platform used to determine the distance travelled when unloading grain while the combine was running .



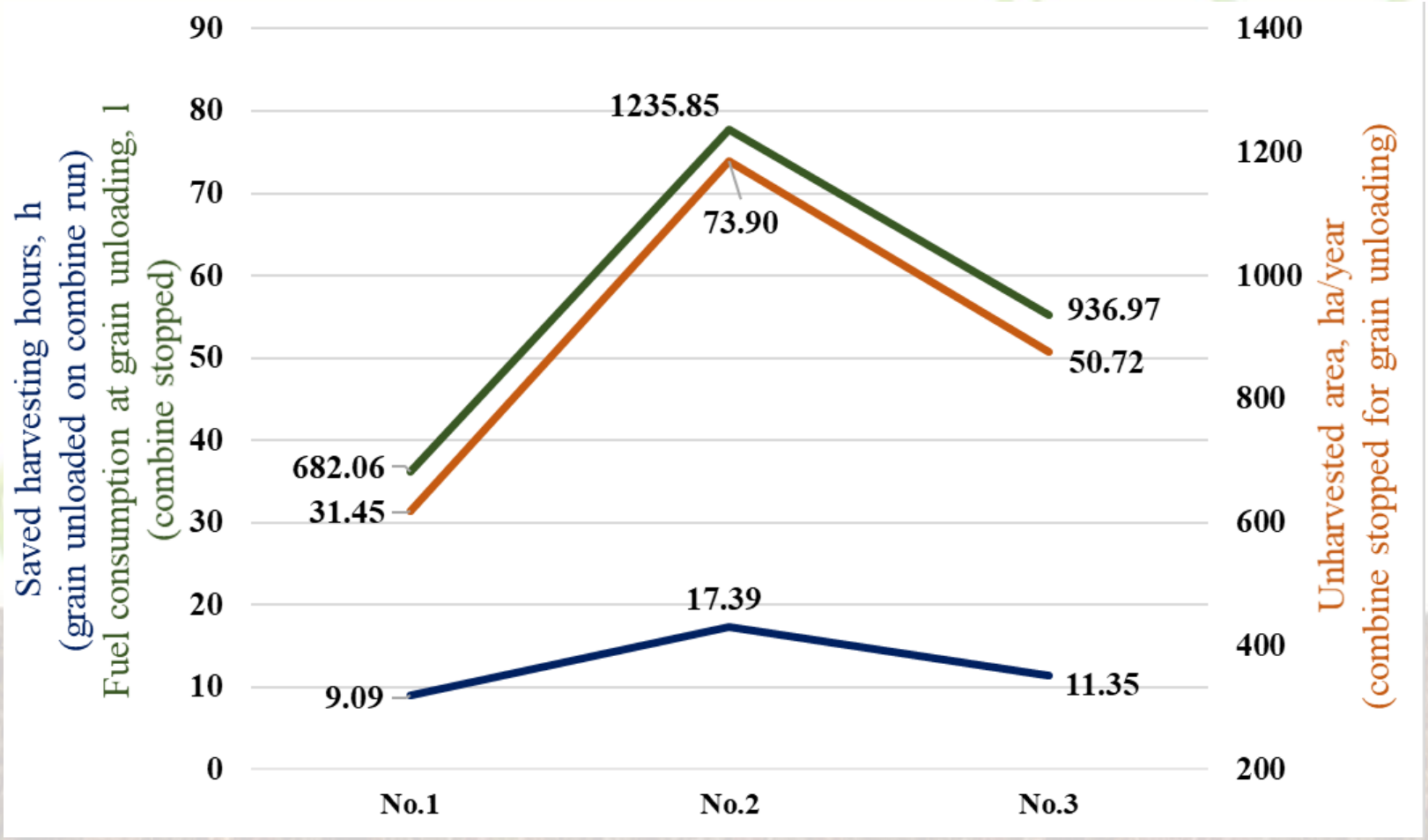
Results and Discussions

The analysis of the data of the Telemetry system showed that the efficiency of the combine and the reduction of fuel consumption significantly depend on the organization of working processes. The data of the structure working time in Telemetry were showed that the combine devoted from 35 to 57 % of the total day working time to the technological process.



Results and Discussions

Fuel consumption and unharvest area dependences on grain unloading process.



Conclusions

- The result‘s analysis has shown, that use of automatic steering mode global warming emission reduced by 2.45 % compared to manual steering mode. Accordingly, the diesel fuel consumption at automatic steering mode was reduced by 9.45 %.

- The analysis has shown, that the structure of work processes provides detailed information that allows decisions to be made to increase the overall productivity of the machine and to optimize work processes.

- In summary, it can be said that the data analysis of combine remote monitoring systems help us to reduce fuel consumption and the environmental pollution.

Source: https://www.foodandfarmingtechnology.com/news/data-analytics/dataconnect-goes-live-enabling-greater-multi-brand-fleet-efficiency.html

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Thank You

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