

**Project “Gate of Innovations” - The Centre for knowledge accumulation, transfer,
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**THE AUTOMATIC STEERING SYSTEM FOR TRACTORS AND THE
MANAGEMENT SYSTEM OF AUTOMATIC SPRAYER BOOM SECTION**

The methodology of innovation research



Figure 1. Visualization of acquired equipment.

Production research data and its interpretation

Technological card of the field

Field of the research: 20 hectares

Cultivated plants: winter wheat

Variety: Skagen

Sowing rate: 200 kg/ha

Sowing Date: September 10, 2018



Figure 2. Technological tracks in 20 hectare field.

Table 1. Winter wheat was fertilized with.

Date	Name of fertilizer	Type of fertilizer	Amount
2018 09 10	NPK16-16-16	Complex fertilizers	250 kg/ha
2019 03 30	Ammonium nitrate	Nitrogen fertilizer	150 kg/ha
2019 04 10	Ammonium sulphate	Nitrogen fertilizer + sulphur	130 kg/ha
2019 04 27	Ammonium nitrate	Nitrogen fertilizer	200 kg/ha

Table 2. Winter wheat treated with these plant protection products (PPP).

Date	Name of PPP	Type of PPP	Amount
2018 09 30	Komplet	Herbicide	0,45 l/ha
2019 04 25	Stabilan 750 SL	Growth regulator	1,2 l/ha
2019 05 06	Epox top + MOXA	Fungicide + growth regulator	2 + 0,25 l/ha
2019 05 25	Orius 250 EW + Cerone 480 SL	Fungicide + growth regulator	1 + 0,5 l/ha



Figure 3. Agricultural machinery used: Tractors Class AXION 850 and MTZ892.

The farm duplicated its work of spraying fertilisers and crop protection products on a 20-hectare field without using ASS and SMS. Therefore, due to the overlap of up to 0.5 m in the technological tracks, the cultivated field of 20 hectares needed resources for an area of 20.41 hectares, or 0.41 hectare more than the actual size of the field.

The overlap of technological tracks without using the ASS and SMS equipment was 2.04 percent. When the farm started using ASS and SMS, this overlap was eliminated reducing the cost of field maintenance.

Table 3. The costs of winter wheat fertilization using different machinery management.

Fertilizer	Amount, kg per hectare	Average price per kg, Eur	Cost per field, Eur, working without the system	Cost per field, Eur, using ASS and SMS
NPK16-16-16	250 kg/ha	0,32	1 632,58	1 600,00
Ammonium nitrate	150 kg/ha	0,23	704,05	690,00
Ammonium sulphate	130 kg/ha	0,19	504,06	494,00
Ammonium nitrate	200 kg/ha	0,32	1 306,06	1 280,00
In total, Eur			4 146,75	4 064,00
Difference, Eur				82,74

Table 4. Cost of treating winter wheat with PPP using different machinery management.

PPP	Amount, litre per hectare	Average price per litre, Eur	Cost per field, Eur, working without the system	Cost per field, Eur, using ASS and SMS
Komplet	0,45 l/ha	46,87	430,42	421,83
Stabilan 750 SL	1,2 l/ha	2,09	51,18	50,16
Epox top	2 l/ha	14,05	573,44	562,00
MOXA	0,25 l/ha	27,12	138,36	135,60
Orius 250 EW	1 l/ha	9,89	201,83	197,80
Cerone 480 SL	0,5 l/ha	10,97	111,93	109,70
In total, Eur			1 507,16	1 477,09
Difference, Eur				30,07

Evaluating the use of plant protection products in the field under different machinery management, it is obvious that the use of ASS and SMS allowed to save plant protection products for 1.50 EUR/hectare or reduced the cost of field plant protection products by about 2 percent.

Cost category	Cost per field, Eur, working without the system	Cost per field, Eur, using ASS and SMS
Fertilizer costs, Eur	4 146,74	4 064,00
Plant protection products costs, Eur	1 507,16	1 477,09
In total	5 653,90	5 541,09
Difference, Eur		112,81

Estimating the cost of the 20 ha field where fertilizers and plant protection products were sprayed using machinery with installed ASS and SMS, the cost of the products was EUR 5 541,09. The difference is 112.82 Eur (5.6 Eur/hectare), or about 2 percent, comparing operations on a 20 hectare field using ASS and SMS, and the technology used before.

Conclusions

1. The automatic steering system (ASS) allowed to save 2.04 percent (in terms of area) duplication of fertilization and spraying costs in fields.
2. Accurately formed (with the ASS) technological tracks and Sprayer Management System (SMS) reduced the maintenance cost per hectare of winter wheat crop by EUR 5.6, or about 2 percent, compared to previously used plant care and work organization technology.
3. The ASS and SMS made it easier for the Farm to comply with environmental requirements, which contributes to sustainable farming.
4. The investment helped to save human resources, as well as to facilitate and speed up the work of a tractor driver.
5. The promotional events organized by the Farm in 2017-2018, helped to popularize precision farming in Lithuania.