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Valtra technology contribute to making farming profitable across the world every day. Valtra is the main source of power on the field and in outdoor livestock operations. In order to quantify the value that Valtra technology is providing to farmers a “Whole farm” approach must be made. It is too simple just focusing on one crop because most farmers are growing multiple crops in order to reduce financial risks and run a sustainable farm operation. The sustainable term covers both the environmental concerns and the profitable farm operation that can support the farm financially into the future.

Farm case description

This whitepaper will cover a farm based on an arable farm in central Europe that operates 45 ha owned plus 135 ha of rental farmland. The average field size is 5 ha. Conventional dryland farming practice on a clay loam soil type with annual precipitation of 850 mm.

The crop rotation is based on the common crops and farming practice for the region and follows the sequence shown in Table 1.

Table 1: Crop rotation.

Crop		Yield (ton/ha)	Ha
Winter wheat	1	8.5	32
Corn/Sugar beet	2	50/90	60/6
Winter wheat	3	8.5	32
Barley	4	6.5	40
OSR/Canola	5	4.5	30
Total			200

Fieldwork documentation has been been done with pen and paper. On rainy days or in the wintertime the documentation is put into compliance reports as well as paper work for applying for the subsidies etc. For additional documentation, a simple FMIS is used.

The farmer is fulltime occupied within the farm operation with occasional assistance from family or hired labour. The farm operates two Valtra tractors, N134 and T214. The additional farm equipment are shown in Table 2.

The tractors are equipped with the following Valtra technologies:

- Valtra Guide, RTK, Wayline Assistant
- Valtra Section Control (SC)
- Valtra Variable Rate Control (VRC)

Table 2: Equipment list for the farm case.

Equipment	Working width (m)	Technology
Combine	5	Yield monitor
Seeder	3	VRC
Sprayer	24	SC, VRC
Fertilizer spreader	24	SC, VRC
Plough	2	
Cultivator	3	
Roller	6	
Seedbed cultivator	6	

The farm operation is categorized as 2-3 technology stage, see Figure 1.

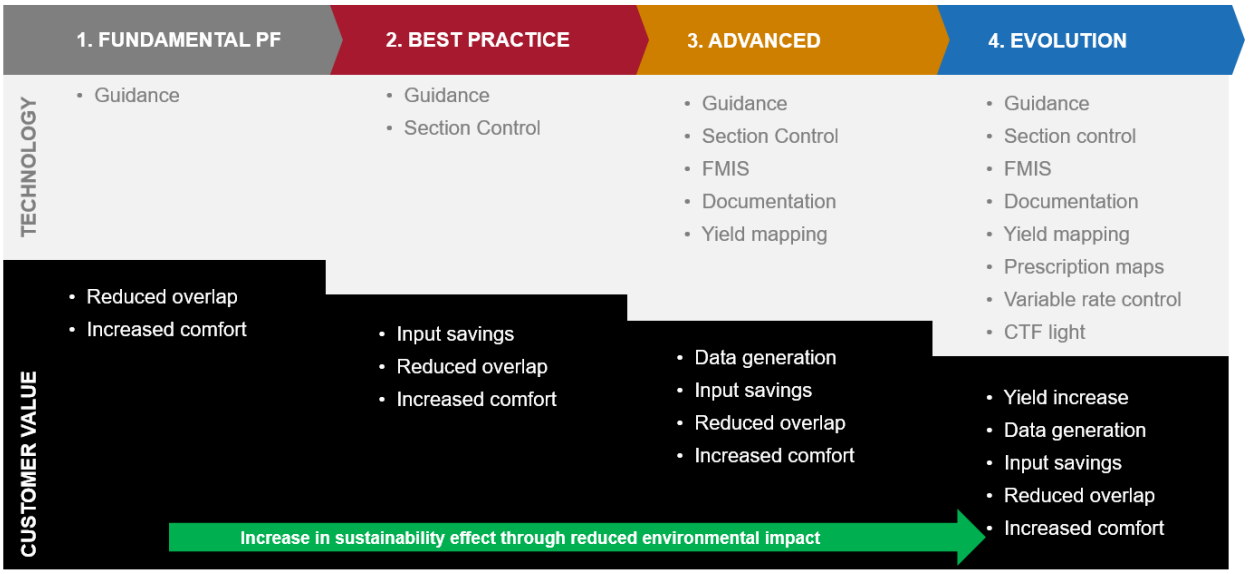

Figure 1: Valtra technology stage description.

Method

In order to understand the technology impact on farm level each technology is calculated separately and summarised in the results section.

Technologies that are considered:

- Valtra Guidance
- Valtra Section Control
- Valtra VRC

Results

The results section covers the calculations for each technology on farm level.

Valtra Guide

The guidance system on the two Valtra tractors contribute to increased field efficiency and reduce operational cost. The guidance systems are affecting most of the field operations in a positive way. Some of the benefits are difficult to quantify in monetary units. One example could be that when the Valtra N Series is used for seeding using the

guidance system the combine efficiency is increasing because it is easier to steer the combine manually when the crop rows are straight and thereby keep a 100% full working width.

One other often referred to soft benefit of the guidance system is reduced fatigue during fieldwork. This could have a significant impact on overall farm operation because the owner/farmer and a large range of farm management tasks can be solved from the tractor cab when the need for manual steering is reduced with most of the fieldwork.

In general, manual steering will result in 3-10 % overlap. The use of guidance with RTK (CM) accuracy will reduce overlapping by 3 %. Table 3 shows the values for individual field operations.

Table 3: Estimated overlap reduction due to guidance (RTK).

Field operation	Overlap reduction
Seeding	3,0%
Tillage	5,0%
Fertilizer spreading	3,0%
Crop care	3,0%
Harvest	1,0%
Avg.	3,0%

The savings due to reduced overlap using guidance on the case farm with the crop rotation shown in Table 1 is displayed in Table 4.

Table 4: Savings due to reduced overlap when using guidance.

Reduced overlap savings per year		
Fuel	l/ha	504
Time	H/ha	25
Input	EUR/ha	4194

The annual fuel savings at an estimated 0.75 EUR/l results in 378 EUR/year fuel cost reduction.

The time saved due to reduced overlap using guidance can be calculated with an estimated labour cost of 15 EUR/h to 370 EUR/year. This saving can be difficult to calculate exactly for this type of farm due the nature of being an owner/operator farming practice so an hourly value is difficult to estimate. It is common to set the value of time saved in owner/operator farming practice significantly higher than regular farm labour. This will result in the farmer being able to invest 25 hours on other farm activities than field operations or spend this time with the family. What is the value of an extra 25 hours with your family each year?

The input saving by reducing overlap results in roughly 4200 EUR annual savings on seed, fertilizer and crop care. The input savings aspect can be a subject for discussion. Some farmers will not experience large savings if the input are purchased based on the precise field sizes. Here the improved accuracy will improve the infield distribution through reduced overlap. Overlapping seed row will always return lower yield compared to optimum plant pacing. Guidance result in cost saving due to reduced overlap by 4900 EUR/year through fuel, labour and input savings.

Valtra Section Control

Section Control can have a significant impact on input savings or as above described improved in-field distribution. The use of Section Control is often linked to GNNS signal from the on-board guidance system so the side-to-side overlap between the swaths must be considered to be eliminated. The Section Control will have a significant impact on end and point row where the swaths meets the headland. In order to better understand the impact of this technology on farm level the attention should be focused on the field shapes that is given on the farm. Most farms will have field that are not 100% square and then Section Control will outperform any farmer’s ability to turn sections on sprayers and fertilizer spreaders on and off.

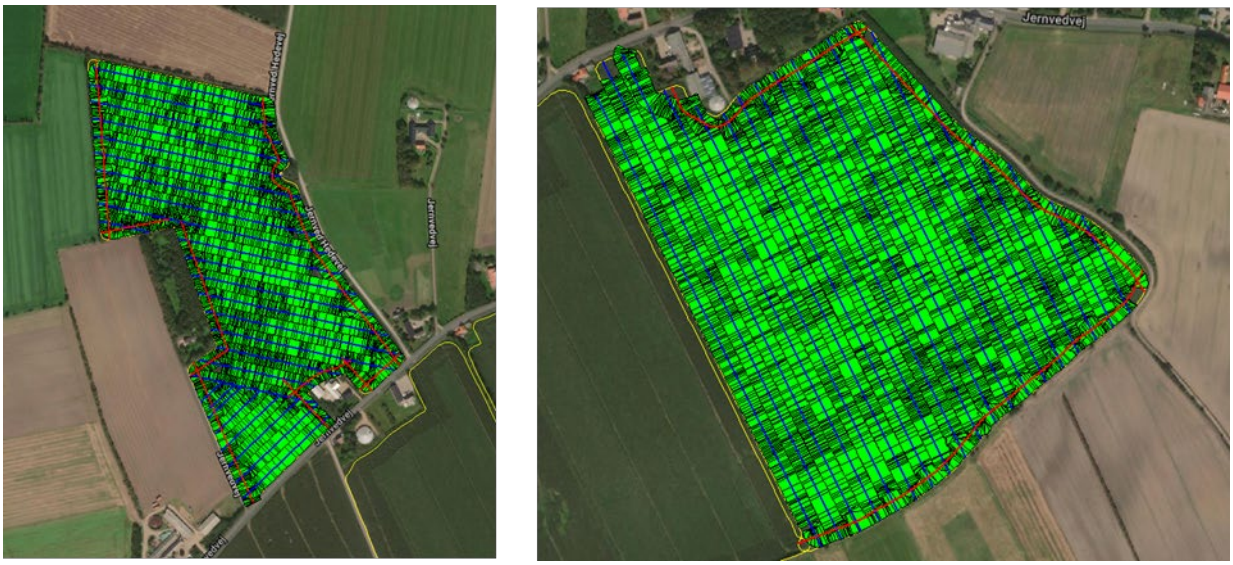

Figure 2: Left field size 14,66 ha, Sprayed area 17,36 ha. Right field size 21,18 ha sprayed area 22,12 ha.

Figure 2 shows two different field shapes that has been sprayed with a 24-meter sprayer without section control. The sprayed area is 5 % and 18 % larger than the field boundary size.

When Section Control is engaged, the overlapped area is eliminated by Section Control in order to have 100 % coverage that is field size plus 3 %. The result for the two example fields here would be a 2 % and 15 % input saving by using Section Control. On average, most farmers will experience input savings in the order 5-15 % depending on the field shapes. Square field results in lower cost savings. Overlapping can also affect crop yield due to overlapping this could be over applying fertilizer resulting in flattened crops resulting in yield loss. One other case could be overlapping herbicide application resulting in crop growth stagnation and result in lower than optimum yield.

Based on the case farm the input reduction of average 5 % across all field results in 1410 EUR/year seed, 2170 EUR/year fertilizer and 1360 EUR/year crop care savings. The total cost reduction due to Section Control is 4940 EUR annually if the Section Control feature is enabled on seeder, fertilizer spreader and crop sprayer.

Valtra Variable Rate Control – VRC

The use of Valtra VRC technology is an effective tool for yield optimization. VRC technology should not be considered as a cost reduction. VRC technology is used for redistribution of input within field boundaries. The yield impact by the use of VRC technology is estimated to be in the 1%-5% range. The impact on farm level differ significantly between farms due to practice differences. For the farm case, here the impact is in the low end due to the farming practice where the farmer is operation the key field operations like seeding, fertilizer spreading and crop care. Based on memory the inputs are adjusted during the field operation given there is no outside interference that will disturb the

operation like a phone call from the COOP that want to advertise cheap fertilizer. For the calculation on the case farm an estimated yield increase of 1% compared to the farmer doing the adjustment self.

The use of Valtra VRC will result in an annual yield increase on 2500 EUR. Note that for a farm practice where contractor or unskilled farm labour are doing the field operations the yield increase for 200 ha will be close to 12500 EUR/year.

Conclusion

Based on the above calculation the cost reduction due the use of the three technologies in focus is: Guidance 4900 EUR/year, Section Control 4940 EUR/year and VRC 2500 EUR/year.

Total 12340 EUR annual cost savings based on the use of Valtra technology. Based on the assumption that the average gross margin including operational cost* are 343 EUR/ha for the case farm the cost savings are equivalent to farming 35 ha extra.

* The gross margin including operational cost is calculated before tax, subsidies, land rent and housing costs.

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