

High accuracy steering of agricultural machines

Steering a machine with an accuracy to within a few centimetres opens many opportunities, such as controlled traffic farming where most of the productive land is never compressed by traffic.



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■ “Dear farmer! Lean back in your seat, turn on your radio and let your tractor do the driving.”

That is the message for many tractor drivers. After take off in Australia and in the USA auto steering systems are now spreading to the rest of the world, including Europe. In Denmark alone around 200 tractors are now equipped, so the driver can relax, but at the same time be assured that the machine is set to optimum performance. With manual steering 70 percent of the driver’s attention is used to steer the tractor. In addition, the quality of steering decreases with long working hours and especially when working in the dark.

Overcoming the overlap during seeding is the main economical driving force for auto steering investments. Measurements in Danish fields show an overlap between one and eight percent.

The same overlap will occur during plant protection and fertilisation operations that use tram lines laid out during seeding. Between harvest and seeding there are no tram lines. Overlap during tillage and other post harvest operations are typically between 5 and 10 percent.

Figure 1 shows a calculation of the cost of auto steering and the savings due to diminishing the overlap. The yearly costs of auto steering are calculated to 4.000 € based on six years depreciation of a 20.000 Euro investment. A yearly fee of 1.000 € for correction signals is included in the calculation. For operations between harvest and seeding an overlap percentage of five percent is used. Savings include both reduction of labour costs as well as machinery and product savings deriving from not overlapping seed and plant protection products.

In the example 400 hectares are required for

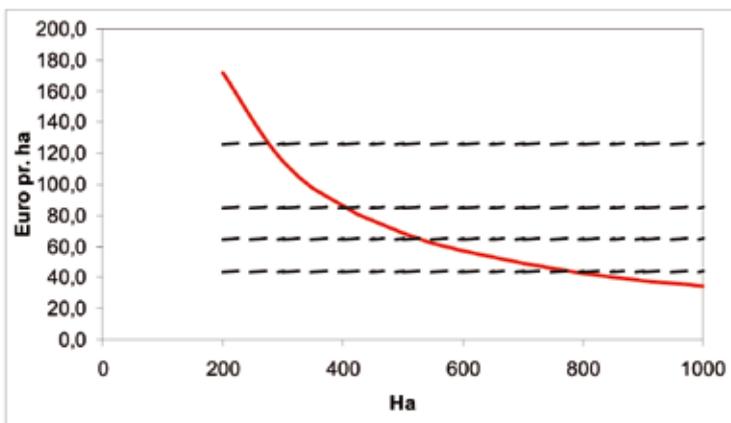


Figure 1. Example of calculation of costs of auto steering. Savings depend largely on the percentage of overlap made without auto steering. Results depend naturally on the machinery used on the farm.

positive results if the overlap when seeding is three percent. A larger area is required if overlap without automatic steering is less than three percent.

Automatic boom section control

Overlap is not only a question of overlap by seeding. It is also important to start and stop the application right at the ends and at irregular borders of the fields. Systems that automatically open and close boom sections are now being introduced. In a small, irregular field total overlap can be as much as 10 percent. Auto steering and automatic boom section control can reduce this overlap to a few percent causing major savings and minimising impact on the environment.

Automatic boom section control is very popular on sprayers in Australia. This will soon be the case in Europe as well but hopefully for manure spreaders too. When liquid manure is applied, the timing of opening and closing a 24 metre boom positioned behind a big tank 10 metres behind the driver is difficult. More manufacturers of manure spreaders are working on implementing automatic boom section control.

Controlled traffic farming

A hot topic is controlled traffic farming where farm machines always drive in the same tracks. The technique requires high accuracy auto steering with repeatable accuracy. By using the same tracks for all field work, the farmer avoids problems of soil compression resulting from heavy farm machinery.



Figure 2. Auto steering means that all drivers can drive perfectly straight. And the driver can relax. He can optimise the machine or he does other work as speaking in his mobile.

Controlled traffic farming was developed in Australia where it is now in use on two million hectares. As the major part of the field never gets compressed, increased yields are often seen once the soil has had a chance to regenerate itself. Typical results from Australia show yield increases of 10-15 percent using controlled traffic farming. However, climate, soil and yield levels are different in Europe, which is why field tests must also be done here. The aim is to build up more expertise and develop new technology on the basis of both Australian and European experiences.

Danish experiences with controlled traffic farming are currently being collected on three different types of farms. One grows vegetables; one is a traditional pig farm growing grain crops, while the third farm is an organic dairy farm producing grass. Grass is very sensitive to compressed soils, and the farmer reports good yields and very homogeneous fields after converting to controlled traffic farming.

Accuracy of implements

A tractor may drive with an accuracy of two centimetres, while the accuracy of a mounted implement will often be lower, for example five centimetres. Systems are being introduced in which GPS in the tractor is supplemented with a GPS receiver on the implement. Implement positions are then adjusted either by an implement frame that can be shifted sideways or by use of discs mounted behind the implement. Cheaper systems will be introduced, where inaccuracies of the implement will be corrected by shifting the tractor sideways – a cheaper, but I expect, not quite as accurate a solution.

In 2006 we tested a system in which maize was planted with auto steering followed by inter-row hoeing with GPS and steering discs mounted on the implement. Measurements showed that an implement can run repeatedly in the same positions, but the test also showed that it is not an easy job to calibrate a system in which different machines are to run in the same positions.

Automatic steering of machines by use of satellite guidance will increasingly be used in agriculture and elsewhere. There are major benefits from precise steering both financially and environmentally. Systems may become cheaper, but they will most certainly become more accurate and functionality will increase.

Don't wait for the future to pass by. Automatic steering of agricultural machines will be part of future farming. ■