

ROBOTTI can...

the facts booklet of how ROBOTTI can contribute to the green transition



AGROINTELLI



ROBOTTI can **improve yields**

Intelligent and automated implements connected to ROBOTTI for a sustainable intensification of arable farming, enable site specific optimization of field operations. E.g. seed drill depth control gives 15% increased accuracy when comparing to the conventional seed drill, which results in better and more robust yields.



Fact box:

- The light weight ROBOTTI enables the farmer the possibility to start the season earlier, with e.g. early seeding, which can increase yields up to 38%.
- Autonomous field work allows for frequent and high precision:
 - Mechanical weeding during the early growth period which is key in optimizing yield.
 - Single crop plant application of nutrients lowering the weed competitiveness while increasing the nutrient use efficiency.
 - Targeted weed control, leaving ecosystem service plants resulting improved ecosystem stability.
- ROBOTTI's ability to turn in narrower headlands and its narrow wheel tracks improve yield per hectare.

Sources:

- Kirkland, K.J. et al., 2000, "Alternative Seeding Dates (Fall and April) Affect Brassica napus Canola Yield and Quality", *Canadian Journal of Plant Science*, Vol. 80, no 4.
- Adeux, G. et al., 2019, "Mitigating crop yield losses through weed diversity. *Nature Sustainability*", 2(11), pp.1018–1026.
- Blaix, C. et al., 2018, "Quantification of regulating ecosystem services provided by weeds in annual cropping systems using a systematic map approach", L. Rew, ed. *Weed research*, 58(3), pp.151–164.
- Juventia, S.D. et al., 2021, "Spatial and genetic crop diversity support ecosystem service delivery: A case of yield and biocontrol in Dutch organic cabbage production", *Field crops research*, 261, p.108015.

ROBOTTI can **reduce soil compaction**

Soil compaction is caused by frequent traffic with heavy machinery. Compaction of the soil has a direct impact on crop yield, but it also affects a range of soil ecosystem services.

The innovative design of ROBOTTI is based upon the idea of embracing the standard implements and utilizes the well-known implements as an integral part of the robot. ROBOTTI is a modular system that brings intelligence to known implement designs. The embracing design enables a very lightweight construction that results in total weight per working meter typically 2 to 3 times lower compared to a tractor with the same implement. This significantly reduces the soil compaction.



2 ZERO HUNGER



15 LIFE ON LAND



Fact box:

- Wheel load of more than 3 tons (on average) compacts the subsoil and reduces yields from 4 % up to even 50 % for specific crops.
- ROBOTTI has a weight of half the weight of a comparable tractor with same effect.
- Nitrous oxide emissions occur as a direct consequence of soil compaction in the wheel tracks; reducing the compaction in the wheel tracks with ROBOTTI track looseners can reduce the emission by up to 70 %.
- Less soil compaction directly impacts the resilience of the soil to support more intense rainfall with a larger water holding capacity, reducing the risk of water erosion.

Sources:

- Schjønning, P., et al., 2016, "Soil precompression stress, penetration resistance and crop yields in relation to differently-trafficked, temperate-region sandy loam soils", *Soil and Tillage Research*, 163, 298–308.
- Murdock, L.W. & J. James, 2008, "Compaction, Tillage Method, and Subsoiling Effects on Crop Production", *University of Kentucky Cooperative Extension Service Bulletin: AGR-197*.

ROBOTTI can **improve soil health**

ROBOTTI enables precision farming practices for all types of field operations – from soil preparation to plant care. Through site specific optimization, e.g. tillage operations, ROBOTTI can ensure minimum disturbance of the soil, reducing carbon release. It has a positive impact on soil biodiversity, both in terms of quantity and variety.



Fact box:

- ROBOTTI enables a more healthy and sustainable soil management, as non-compacted soil has significantly lower risk of soil erosion from both wind and water and in addition, it has a much higher water holding capacity.
- ROBOTTI enables high resolution site-specific farm management practice based upon data on soil, residue and crop conditions.



Sources:

- “Fact sheet – Loss of Soil Biodiversity”, RE CARE, project funded by the European Commission FP7 Programme, ENV.2013.6.2-4 “Sustainable land care in Europe”. <http://recare-hub.eu/tools-and-outputs/fact-sheets>

ROBOTTI can minimize the use of fossil fuels

ROBOTTI can run on HVO biodiesel, which saves up to 90% of CO2 emissions during operations. Moreover, the CO2 emissions in the diesel engine's manufacturing phase are 60% lower than emissions when manufacturing batteries.

There is more energy per weight unit in biodiesel than lithium batteries and thereby ROBOTTI is much lighter.



7 AFFORDABLE AND
CLEAN ENERGY



12 RESPONSIBLE
CONSUMPTION
AND PRODUCTION



Fact box:

- 10% less diesel used for the same operation compared to tractor-based operation.
- 7.5 % on average less distance driven per area unit thanks to in-field route planner optimizer.
- Modern combustion engine can run on biodiesel (HVO: Hydrotreated Vegetable Oil).



Sources:

- Pedersen, J., et al., 2016, "Evaluation of the Optimized Infield Route Planner (ORP) tool", report, Teknologisk Institut.
- <https://www.ok.dk/erhverv/produkter/braendstof/hvo-biodiesel>

ROBOTTI can **help limit chemicals use**

Thanks to intelligent systems used with ROBOTTI, conventional spraying can be done in a more sustainable way by spot spraying or band spraying with low water use, without covering the whole field, and reducing the risk of chemical leaching. In case of spot spraying and intelligent cameras, single weeds can be detected and sprayed. Instead, band spraying in row crops reduce not only the herbicide input, but also the input of insecticides or fungicides.

There are also chemical-free and cost-efficient solutions for integrated ROBOTTI weed management based on non-chemical measures such as repetitive mechanical weeding throughout the season.



3 GOOD HEALTH
AND WELL-BEING



6 CLEAN WATER
AND SANITATION



Fact box:

- In case of the common weed, thistle, it is possible to reduce herbicide use by 88% if mapping thistles while performing the first weed control with ROBOTTI and then using the obtained data when spot spraying.
- When spot spraying, it is possible to reduce the water volume rate to 40-50 l/ha, which leads to CO2 emission reduction by 29%, due to reduced transportation to/from the filling location, and reduction of costs by up to 26%.
- Band spraying with ROBOTTI reduces 60% to 85 % of herbicide use and cost, depending on the plant type and size.



Sources:

- Ruigrok, T., et al., 2020, "Application-Specific Evaluation of a Weed-Detection Algorithm for Plant-Specific Spraying", *Sensors* 2020, 20(24), 7262.
- Sørensen, C.G., 2021, "Optimizing operational performance of field spraying from a task time and capacity perspective", *Scientific Report*, Aarhus University, Department of Electrical and Computer Engineering.
- Secher, B., 2019: "Field testing Agointelli Robotti 2019 in sugar beet cultivation".
- <https://www.danfoil.dk/hvorfor-vaelge-danfoil/klare-fordele.aspx>

ROBOTTI can **increase biodiversity** **in the fields**

Using ROBOTTI for standard field operations enables the farmer to practice completely new farming systems as strip cropping or mixed cropping. Such systems have multiple, different crops within the same field, creating barriers to diseases and assuring better living conditions for useful insects (natural predators) within a field. This is significantly reducing the need of chemicals- insecticides and fungicides, while improving yields.



Fact box:

- Strip cropping is a polyculture production system, where crops are planted in strips, resulting in higher biodiversity above and below ground.
- Strip cropping results in up to 50% less aphids in the field compared to traditional systems.
- Fungi infections are confined to small areas, minimizing significantly the potential negative yield impact.
- Higher resistance of crops against plagues and diseases followed by soil quality and benefits from increased agroecosystem biodiversity.



Sources:

- Yaoyun, Z., 2019, "Effects of strip diversification on crop performance in strip cropping system in the Netherlands", Student report, Wageningen University, Farming Systems Ecology.
- Schoorlemmer, H. & Apeldoorn, D., 2019, "EIP-AGRI Workshop Cropping for the future", Power Point, Wageningen University & Research Business unit Field Crops.
- Hondebrink, M. et al., 2019, "SureVeg - Overview of farmers expected benefits of diversification. - Report on national stakeholder involvement", Louis Bolk Institute, The Netherlands.

ROBOTTI can **improve working conditions**

ROBOTTI is able to work 24/7 and can be deployed any time of the day. From the agronomical point of view, it is beneficial to perform some operations at night. Possible reasons include rising temperatures, heat illness prevention or avoidance of pests. Often wind speed is lower during the night-time and the air moisture is higher, which are the optimal conditions for spraying, but not attractive working time for most workers.

8 DECENT WORK AND
ECONOMIC GROWTH



Fact box:

- Repetitive work is considered as one of the physical ill health risks; for the field operations that ROBOTTI replaces, uniform repetitive work (like monotonously driving tractor) is 100% removed.
- Using ROBOTTI for spraying does not expose the operator to chemical exposure.
- Operations can be performed at the optimal time of day.
- Less employee management for operation managers.



Sources:

- <https://aghealth.ucdavis.edu/news/night-work-growing-trend-western-agriculture>

AGROINTELLI is a Danish field robotics company, producing autonomous field robots. Its goal is to make global food production more reliable, sustainable and profitable by offering a generic automated farming system for arable farms. AGROINTELLI's initial product is ROBOTTI. The users of ROBOTTI are both organic and conventional farmers. ROBOTTI can assist small and big farmers, multiple cropping systems, ensuring high capacity and efficiency.

ROBOTTI is ready to assist the farmers, supporting a reduction of the agricultural climate impact and simultaneously supporting diversity in flora and fauna. We support the transition of farming!

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