THORVALD

From research to commercial deployment

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On Agri-Food Robotics

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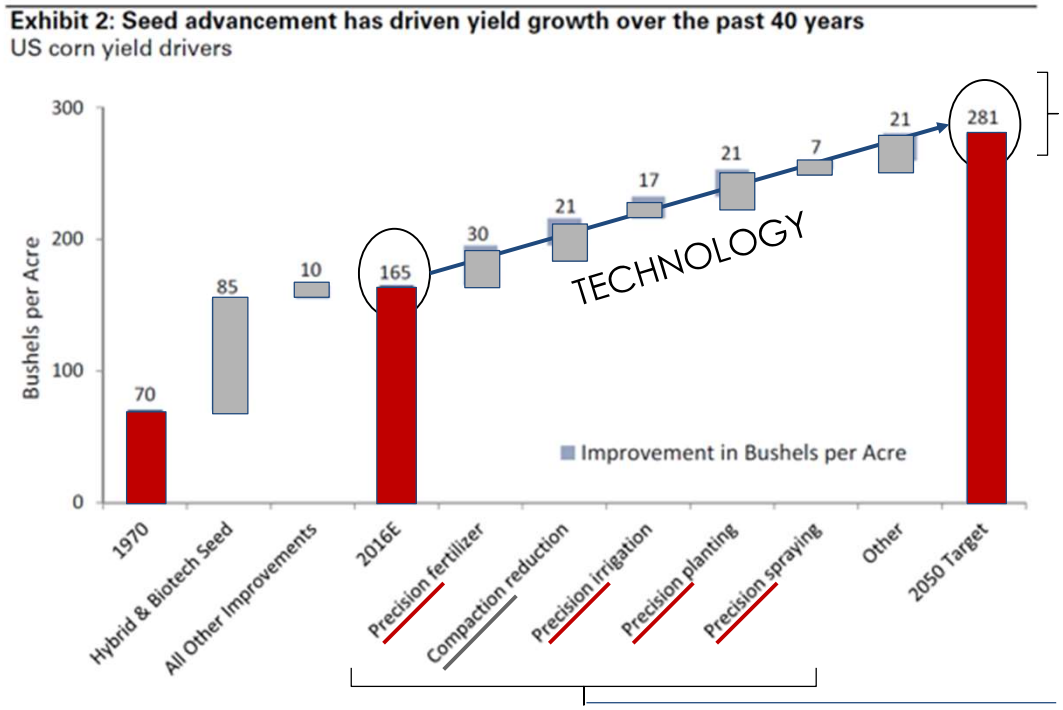
70% increase of food is needed by 2050 and the shift in agriculture will come from precision farming and compaction reduction



Source: Goldman Sachs

A 70% increase in food production is needed by 2050

Due to a growing population the world needs to increase the food production by 2050 with 70%

Precision and compaction reduction

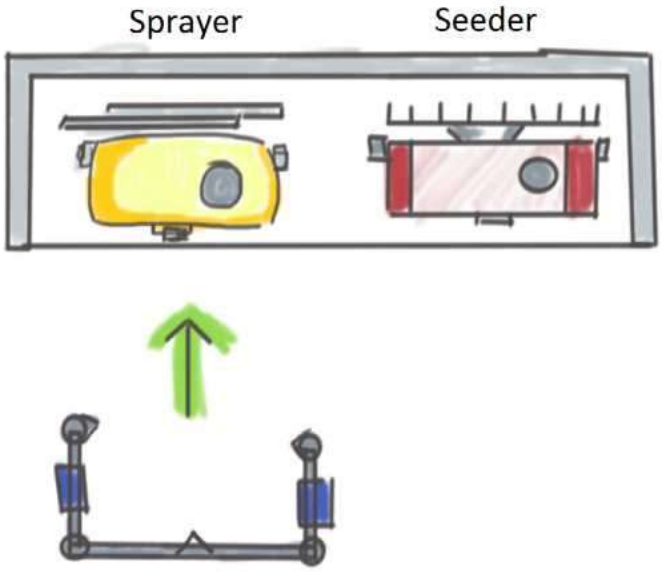
The increase in food production is expected to come from precision farming and soil compaction reduction.

THORVALD

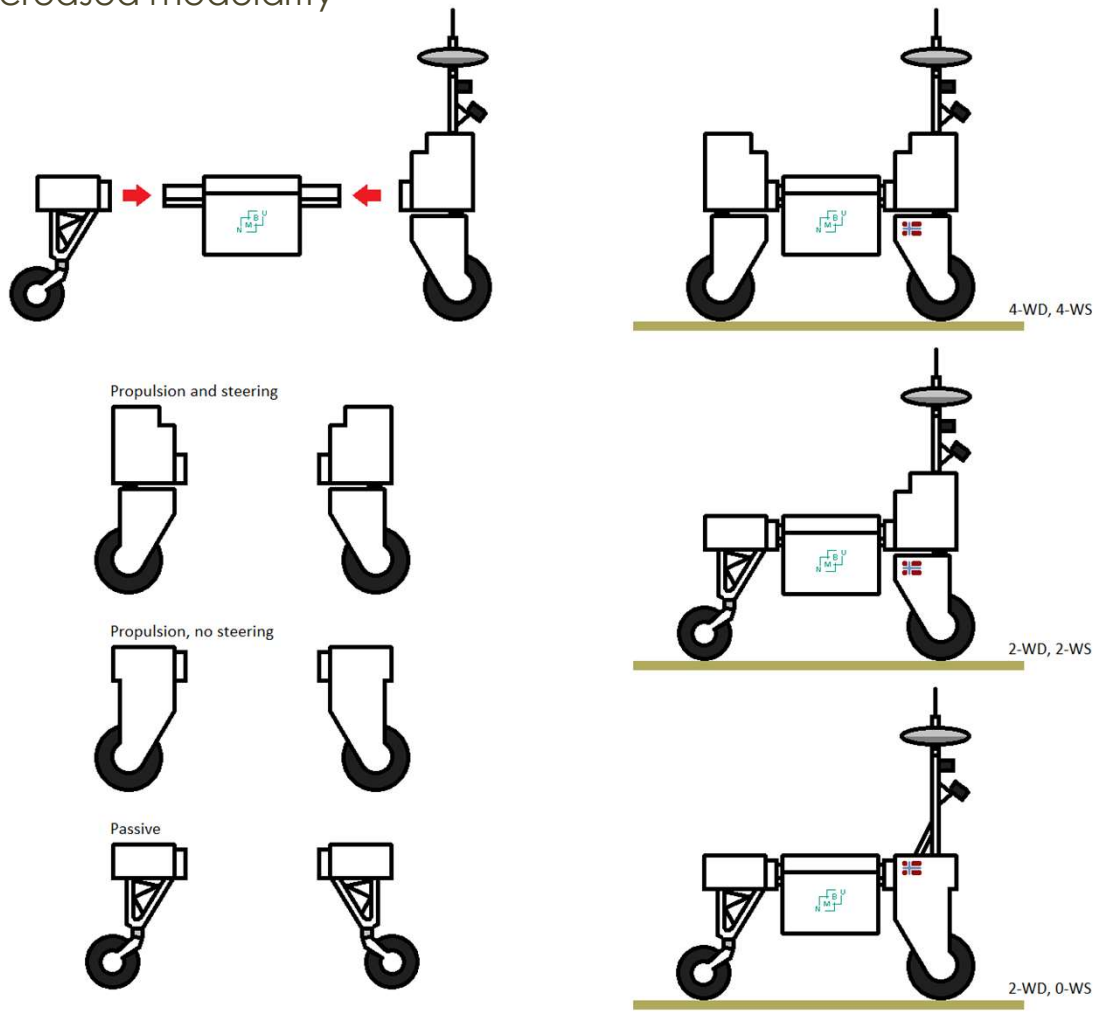
The original **Thorvald** platform started as a master thesis in 2014 at the **Norwegian University of Life Sciences**

They set out to build a **small** but strong, mobile, **autonomous robot** capable of performing a wide range of **different tasks** in the field.

Designed and manufactured a prototype in four months



New concept with increased modelarity

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Meet Thorvald –
the modular agricultural multipurpose robot

A: Battery enclosure
B: Drive module
C: Steering module
D: Suspension module

THORVALD

Modular robotic platform

Basic modules, advanced software

Scalable in production

Thorvald and Applications

Applications:
In-field logistics
Soil moisture mapping
Soil compaction mapping
UV light treatment
Grass cutting
Phenotyping
Food processing
Mechanical weeding
Strawberry harvesting

IUK Funded Projects

Finished projects

Autonomous robots to support fruit picking

Ongoing projects

GRASP-berry: High speed picking soft fruit robots

The First Fleet. The world's first fleet of multi modal soft fruit robots

BerryPredictor: Improving harvest forecasts, yield predictions and crop productivity by monitoring and optimising zonal phytoclimates in covered strawberry production

Development and field testing of the next generation of vision-guided weeding systems

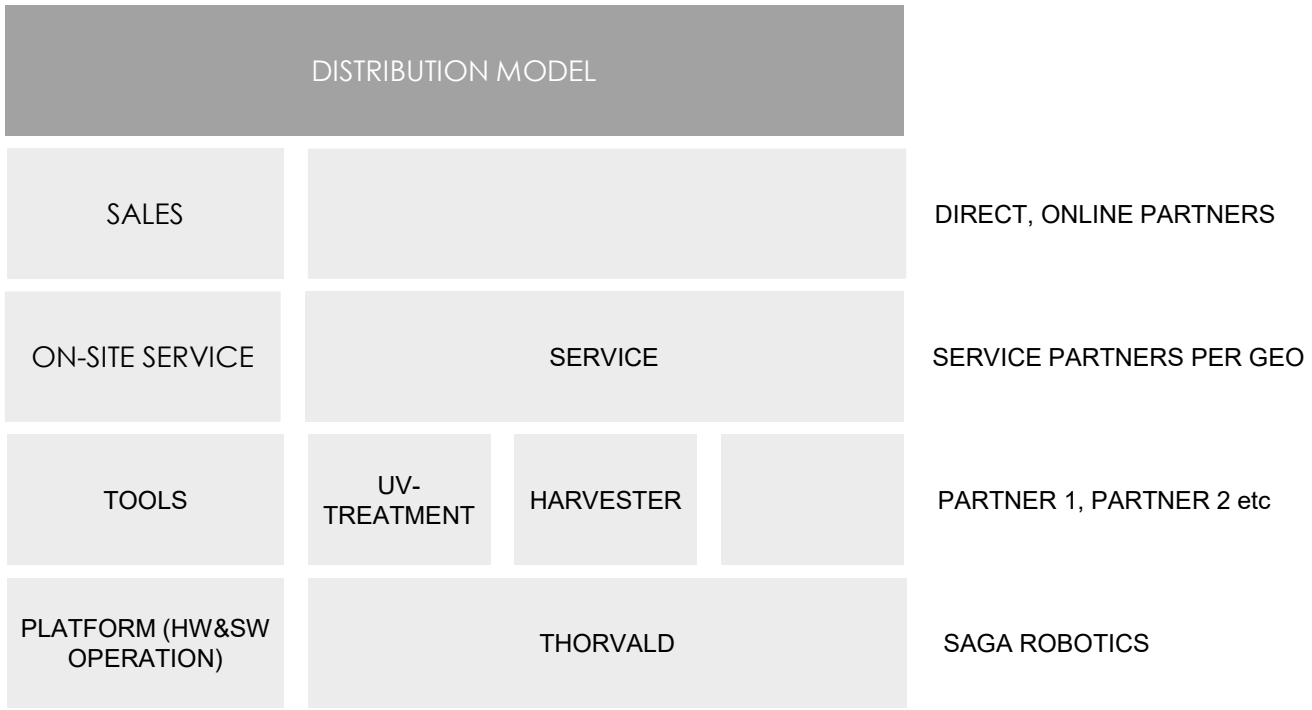
Other projects

H2020 – BACCHUS

Various projects funded in Norway

Assuring Autonomy – MeSAPrO - Medium-sized AGV for soft-fruit production

Service delivery and distribution model (partner model)

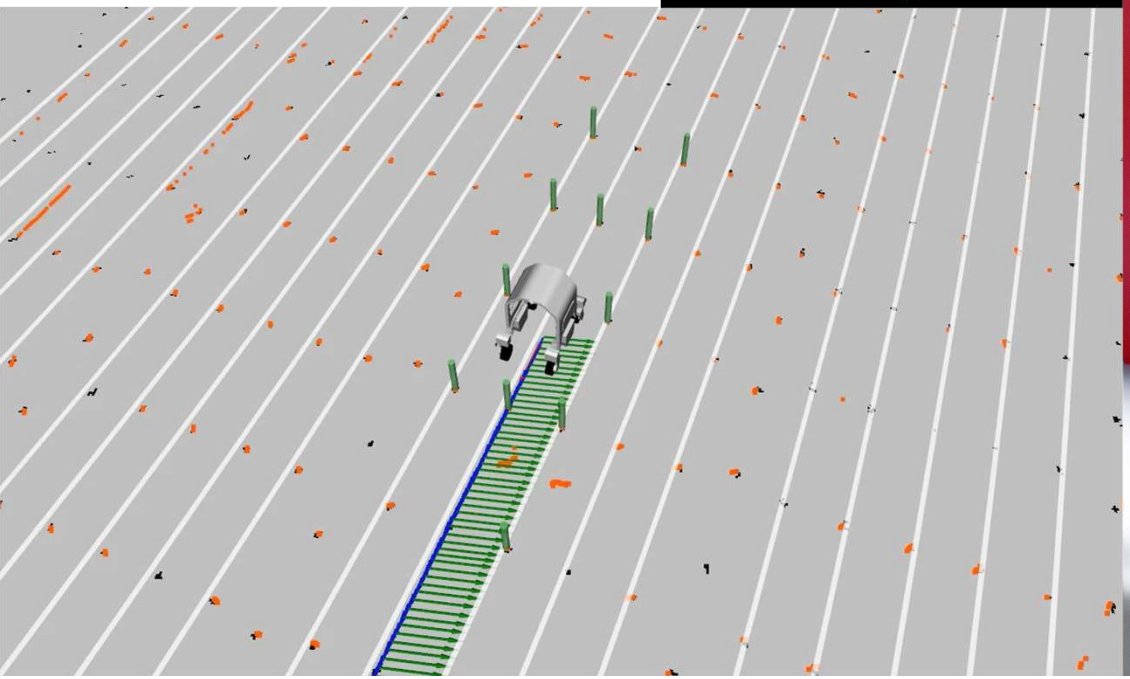


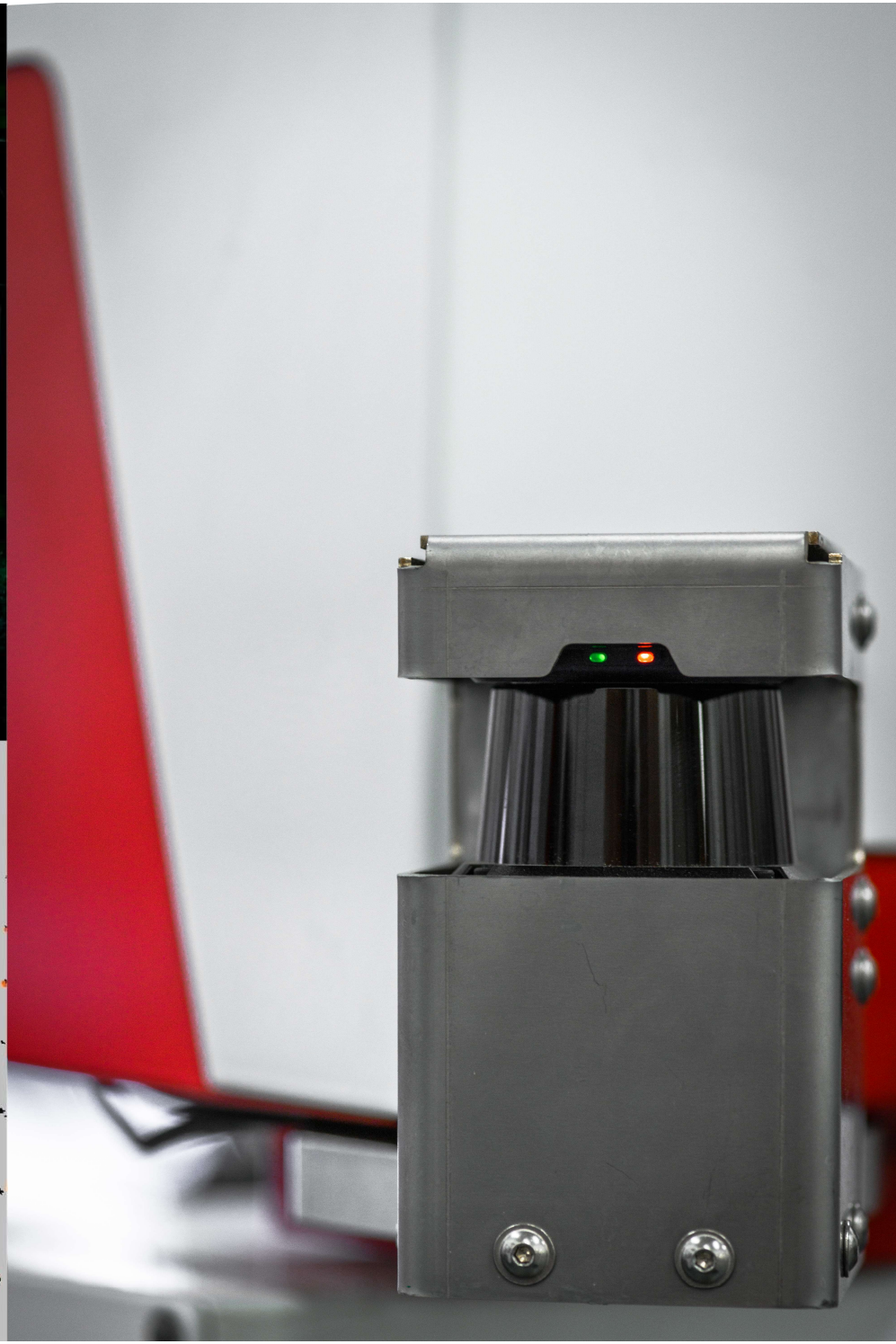
Autonomous Navigation

MEL (Michael's Epic Localization)
- GNSS
- 2D LIDAR

Machine learning and SVM

Optimization in simulation





Autonomous UV treatment

Light treatment by Thorvald controls powdery mildew in strawberry production

01 Allows the farmer to control powdery mildew in strawberries without the use of pesticides

02 Saves time and money spent in applying pesticides, as the UV-treatment is autonomous.

03 No yield loss due to stop in harvesting for using pesticides

04 Environmental solution and allowed in organic growing

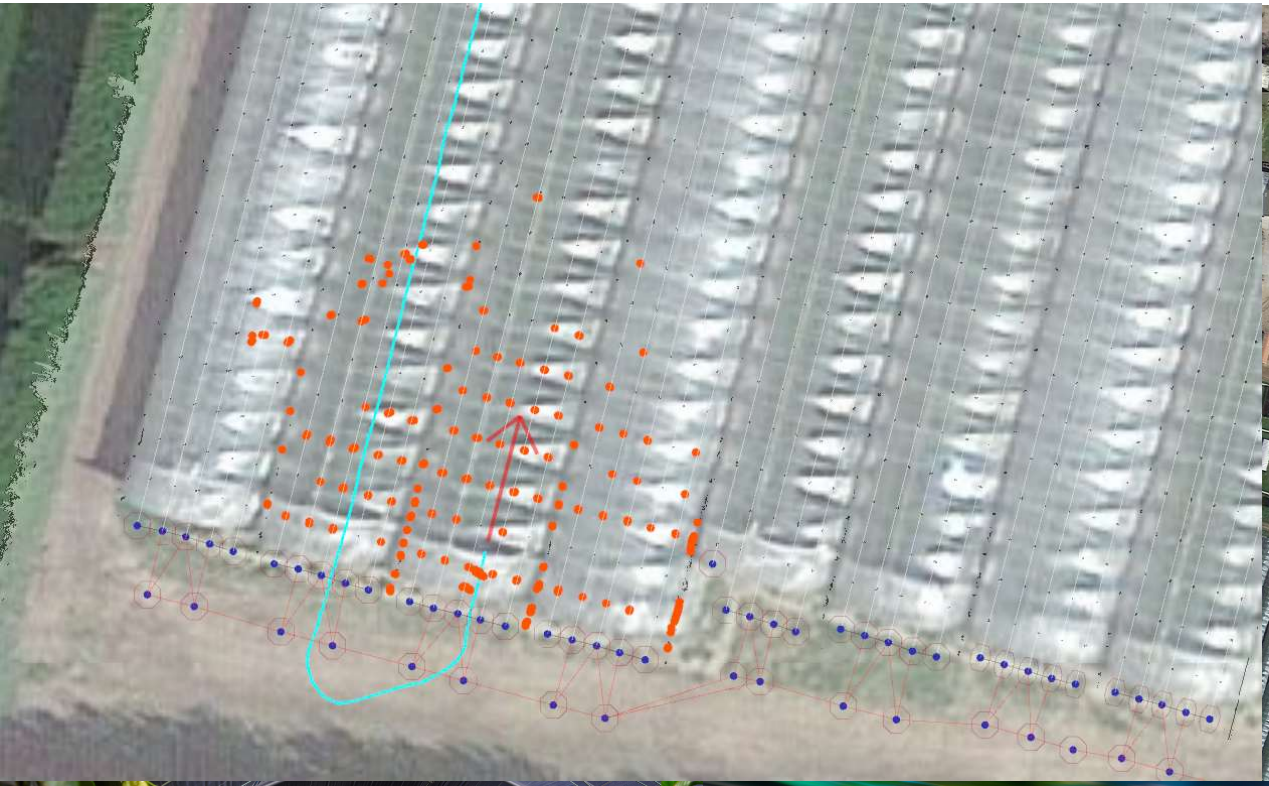
05 Likely that there is a positive effect on shelf life as well.

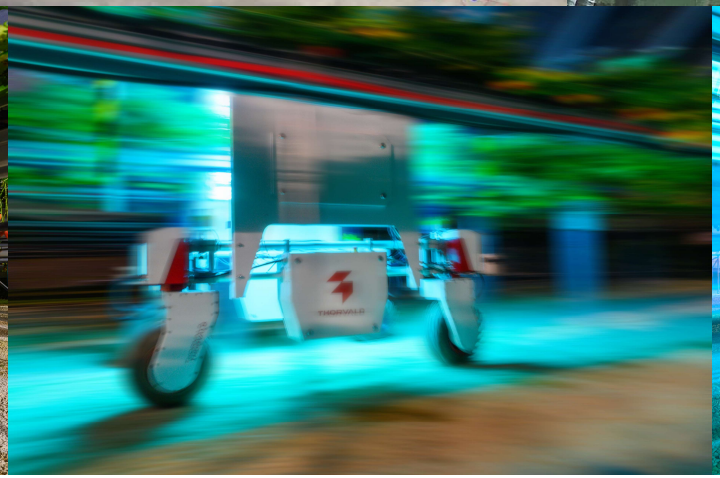
06 UV customers will be given first priority to the robotic harvester.

The job gets done by itself and it actually works. This is the start of the future of farming.

Commercialization of Autonomous UV treatment

- **UV robots deployed in Norway, the UK and the US**





"WITH ROBOTS, LIKE THORVALD, WE USE LESS ENERGY, GET A BETTER OVERVIEW OF PRODUCTION, USE LESS PESTICIDES AND SAVE MORE LABOUR WHILE WE TAKE BETTER CARE OF THE SOIL WHICH AGAIN GIVE BIGGER CROPS."

Simen Myhrene, Strawberry farmer and user of Thorvald's services

Selling agricultural services by the hectare

UV-treatment

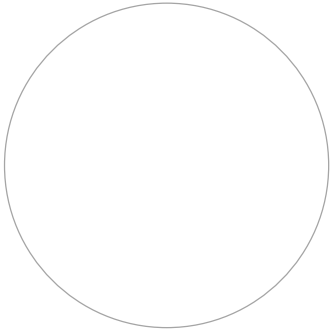
Commercialization 2019
UV-treatment will be sold
per hectare

UV-treatment in a nutshell
UV-light controls mildew on plants. Thorvald drives on its own with a specially designed UV-lamp.
UV-treatment is done at night
Saga Robotics arranges the setup, and the robot initiates by itself when it is due time.
The intensity of the UV light is optimized for each individual crop.

Fruit harvester

Commercialization 2020-21
Fruit harvesting will be sold
per kilo

Fruit harvesting in a nutshell
Strawberry harvesting is manually done today leaving farmers at high risk with the lack of labour in agriculture today



Near future services

2020+
Could be sold
per hectare, kilo, hour etc

Services to be implemented
This can be services such as cutting grass for forage, spraying and picking fruits, automated harvesting, mechanical weeding, in-field transportation of crates, data collection and crop prediction

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