



FarmDroid – Experiences of using FarmDroid FD20 Field Robot in Finnish Conditions

*Sami Talola, Arvo Ekman
Sugar Beet Research Center (SjT)*

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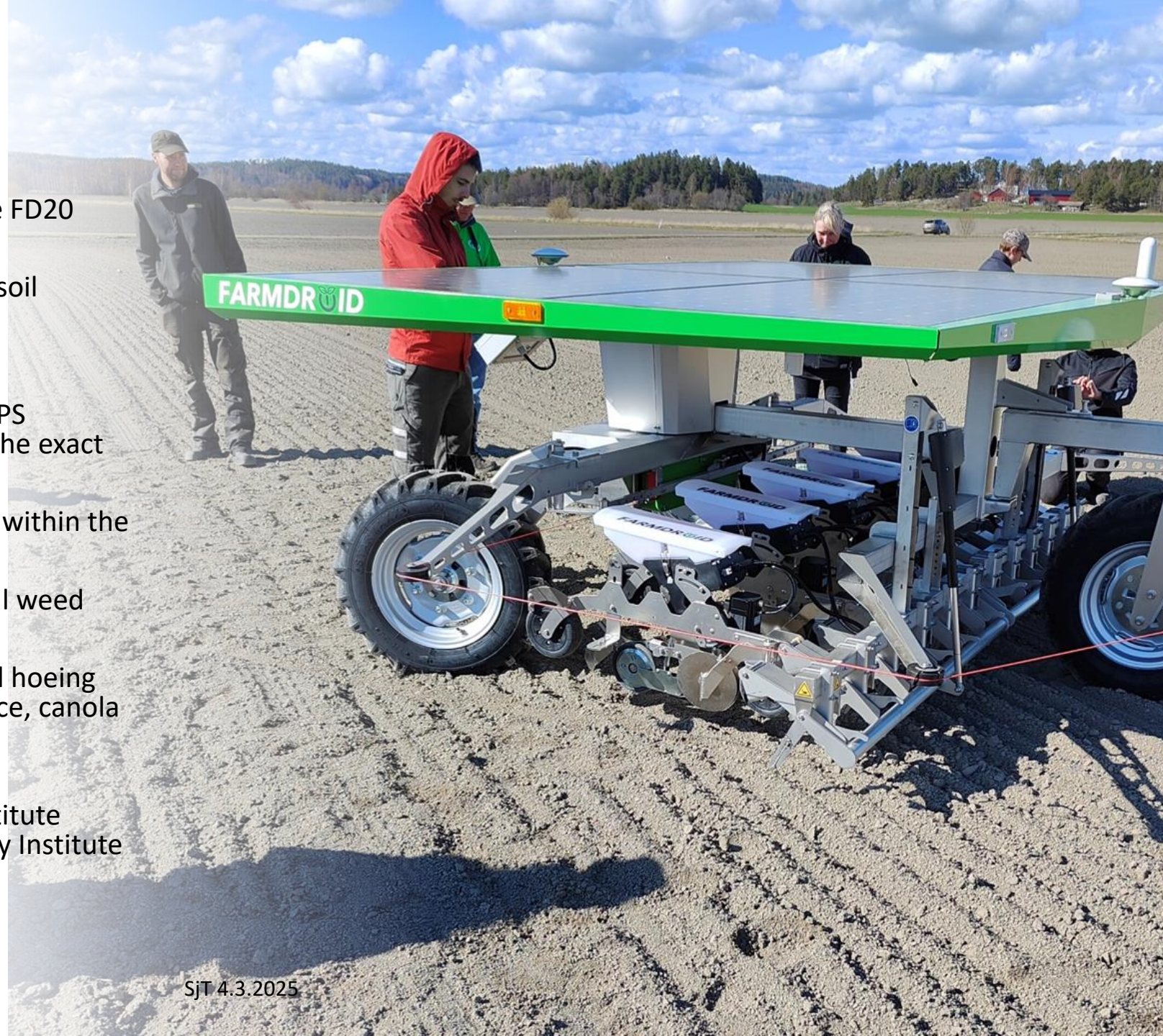
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1. Introduction

- The Sugar Beet Research Center acquired the FD20 field robot in April 2023.
- The lightweight robot does not compact the soil structure and operates on solar energy.
- Four solar panels charge the batteries.
- The precise RTK (Real Time Kinematic) and GPS technologies allows the robot to remember the exact location of each seed that it has sown.
- Precise weeding both between the rows and within the rows between the crops.
 - => This can reduce the need for chemical weed control
- The robot is capable of automatic drilling and hoeing for example sugar beet, onion, spinach, lettuce, canola and rapeseed.
- The robot was tested on Sjt's trial fields in collaboration with the Natural Resources Institute Finland (Luke) and the Finnish Work Efficiency Institute (TTS) as part of the PeltoRobo project.





2. Experiences of using FD20 Fieldrobot

- The sugar beet was drilled on April 27, 2023.
- Due to the cool and windy spring weather, the sugar beet was drilled slightly deeper than usual, at a depth of 4.5 cm.
- The trial plot was about 2 hectares,
- The experiments compared the robot's drilling and hoeing with the work that was done by using conventional machines.
- On the FarmDroid trial plot, fertilization was done before sowing (Juko fertilizer drill).
- The PeltoRobo-project studied also the effect of different starting times of hoeing on weed control.
- The FD robot proved to be well-suited for sugar beet drilling and hoeing on clay soil in 2023.

Hoeing

”Too late”



”a better timing for starting hoeing”



The Hoeing Results

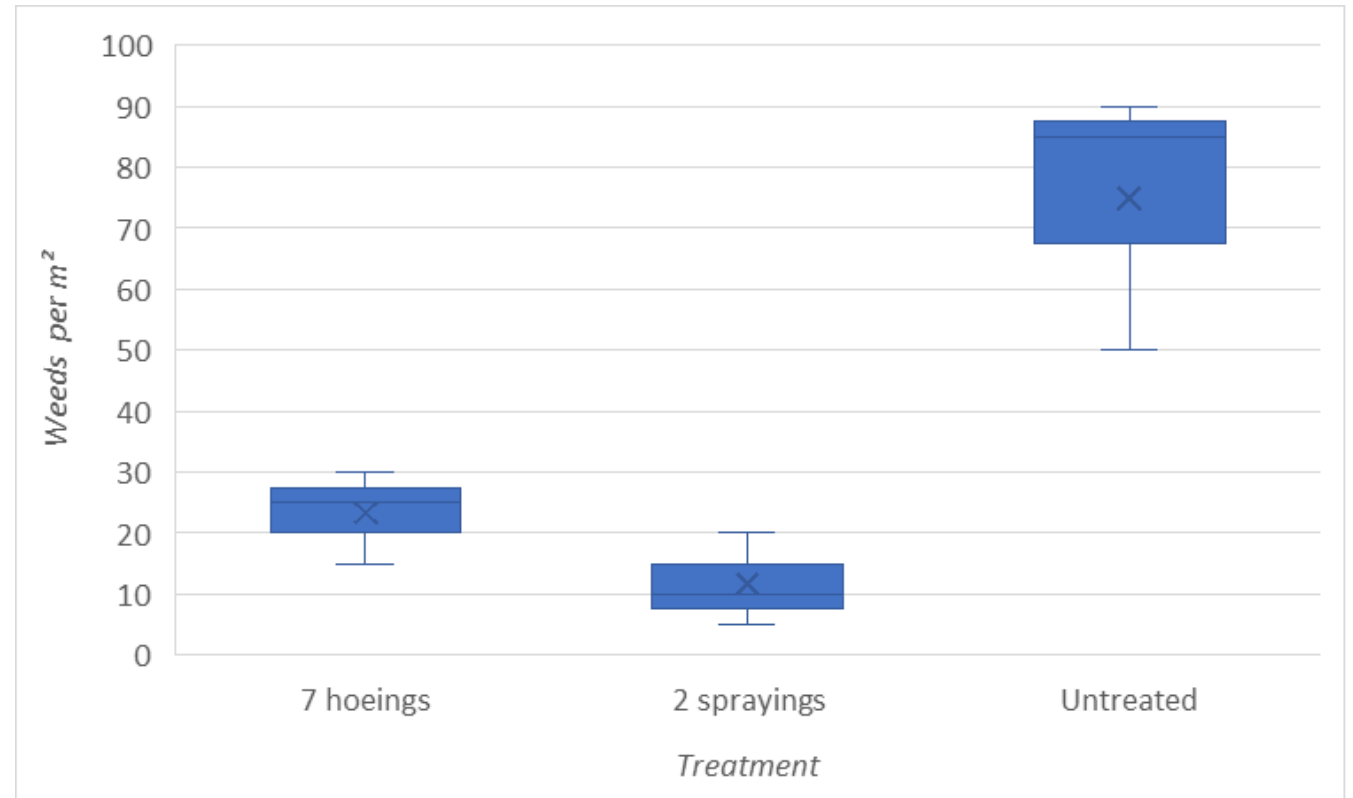
Best result with chemical plant protection

- **2 spray treatments:** avg. **12 weeds/m²**
- **7 hoeing treatments:** avg. **23 weeds/m²**
- **Untreated:** avg. **75 weeds/m²**

The hoeing result was influenced by:

- **Hoe spacing adjustments. Adjusting all robots' settings carefully is important**
- **Late start of hoeing**
- **Weed pressure**

The number of weeds were counted on August 25, 2023, from three spots per treatment



3. Drilling of Winter Rapeseed



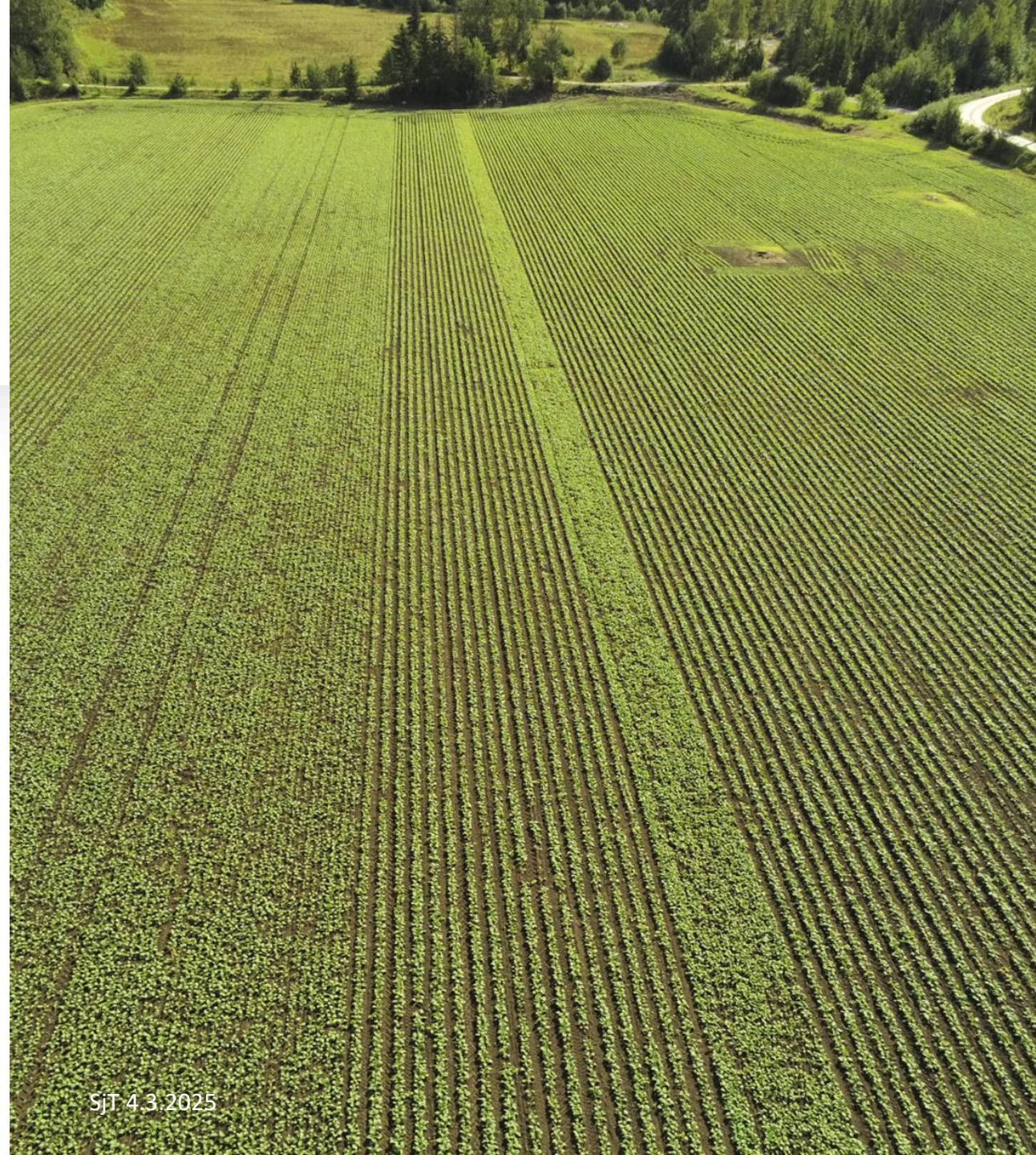


3. Experiences with Using the FD20 Field Robot for Winter Rapeseed Sowing

- Precision drilling allows for the desired amount of growing space between seeds and sowing rows.
- The goal of precision drilling was to achieve a suitably sparse, soil-covering and strong-rooted crop.
- Winter rapeseed was sown on July 27–28, 2023, after the sugar beet hoeing season.
- The aim of the experiment was to test the suitability of FD20 for Finnish conditions and to explore how the robot's capacity can be effectively utilized throughout the growing season.

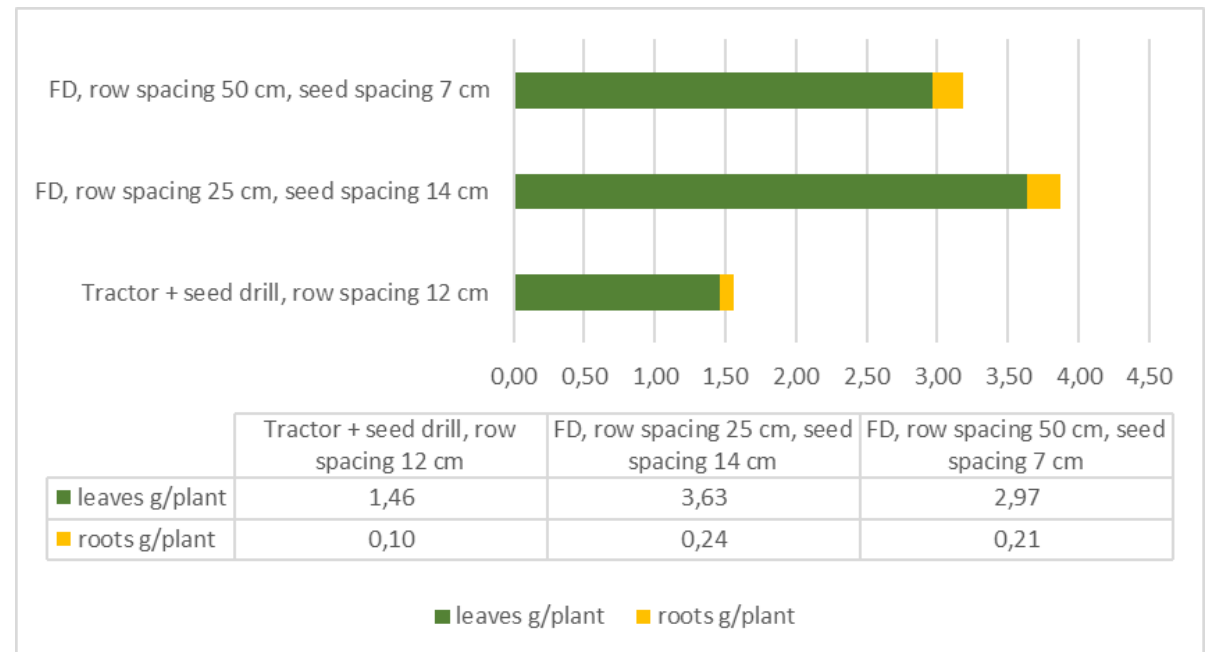
3. Experiences with Using the FD20 Field Robot for Winter Rapeseed Drilling

- The experiment also compared drilling with the FD at different row spacings (25 cm and 50 cm) to conventional sowing with a tractor and Juko seeder-fertilizer drill (row spacing 12 cm).
- The sowing test was carried out in collaboration with the Finnish Work Efficiency Institute (Työtehoseura) and the Natural Resources Institute Finland (Luke) as part of the PeltoRobo project.
- Based on the results, the FD was well suited for early drilling of winter rapeseed in clay soil.



3. Experiences with Using the FD20 Field Robot for Winter Rapeseed Sowing

- The effects of different sowing methods were monitored by comparing the dry weight of plants, root length and thickness.
- Crop samples were taken on August 30, 2023 from the 3 spot
- The ice cover on the field surface and the spring frosts killed the rapeseed seedlings during the winter.





*The ice cover on the field and the
spring frosts killed the rapeseed
seedlings during the winter
(2023-2024)*

4. Test and trial plans for spring 2025

- The experiments with the field robot continue as part of the cultivation method trial.
- The experiment compares sugar beet sowing performed with a field robot to conventional sowing done with a AgXeed Tempo seed drill and tractor with Monosem seed drill.
- The AgXeed sowing test will be done in collaboration with the Hankkija.
- New FD20 spot-spraying system will be tested also
 - Weed spraying experiment with the FD20
 - Herbicide free weed control
 - Cattle slurry + Nitrogen/micro-nutrients fertilization (liquid) with the FD20
 - Mineral fertilizer to the field surface using a surface spreader



AgXeed+Tempo	Tr+Monosem	Farm-Droid FD20							
Seeding test strip	Seeding test strip								
	Fertilizer trial	Mineral F	Slurry	Slurry	Mineral F	Mineral F	Slurry	Mineral F	Slurry
		1	1	2	2	3	3	4	4
			FD+N	FD+N			FD+N		FD+N
		An untreated test area (without herbicides)							



5. Additional Literature

PeltoRobo-project:

Reetta Palva, Eerikki Kaila, Borja Garcia-Pascual and Victor Bloch 2024.
Assesment of the Performance of a Field Weeding Location-Based Robot Using YOLOv8. *Agronomy* 2024,14,2215.

Thank You

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