



PROJECT NO: FP6 - 513195

EcoWetSow

Significantly increasing productivity & cost efficiency for the 130.000 European SMEs in the ecological agricultural & farming community, by an innovative wet-sowing technology involving sub-surface injection at a preset depth with a precisely controlled novel mixture of seeds and manure.

Co-operative Research (CRAFT)

Horizontal Research Activities Involving SMEs

Publishable Final Activity Report

Date of issue of this report: June, 2008

Period covered: from June 2006 to December 2007

Start date of project: June 15th. 2005

Duration: 30 months

Project Coordinator: Agromiljø AS

Version Final

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1 Project Objectives and Partnership

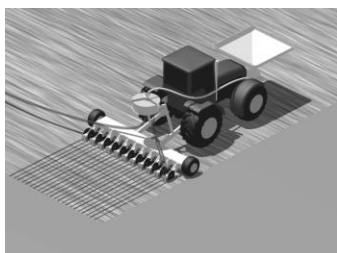
The overall objective for this project is to develop new wet sowing machine/ system, which inject seed and manure into the soil at proper dosage and depth in the same run.

Overall Project Objectives

The main objectives for the project are to:

- achieve an high evenness of wet-sowing the field
- become able to inject seeds to a pre-set depth with a variance of max. $\pm 1,5$ cm
- have seed measurement system able to measure the number of seeds flowing through the dosage system
- achieve a wet-sowing (sowing/manuring) capacity of min. 7 hectare/hour
- have maximum cost of operation of € 112 pr. Hectare
- secure no mal-sowing of stripes/areas by securing an outlet level from each opening/hose of at least 80 % of nominal amount through continuous monitoring

The new sowing machine is build based on the following principle:



- must handle all type of seed combinations
- manure supplied trough a drag hose system or from a tank
- all functions must be monitored continuously from the tractor
- operation width 3m or 6 m
-

SME CONTRACTORS:

- 1 Agromiljø AS
- 2 Lykketronic AS
- 3 Capflow SA
- 4 Agrofinal s.r.o.
- 5 Rebruk Farm
- 9 Doda Aldo & C.snc
- 10 Jæren Forsøksring

OTHER ENTERPRISE/ENE USER CONTRACTORS:

RTD PERFORMER CONTRACTORS:

- 7 The National Institute of Technology (TI)
- 8 Production Engineering Research Association (PERA)

2 Description of the work performed and end results

This report is an overview of the work performed and end result for the whole project period. Detailed results can be found in deliverable reports and activity reports for reporting period 1 and 2 respectively.

Summarizing the work performed during 1st project period it comprises enhanced scientific understanding of seed manure and mixing technique as well as image sensing technologies and plough shares variables and development of a mixing unit for seed and manure. System integration was started already in period 1 in order to be able to run real life tests and make needed modifications as early as possible.

The camera chosen for use in the EcoWetSow project was the Micron MT9V022, due to its superior color depth and frame rate for the price and with a Digital Signal Processor (DSP). The hardware for attaching the camera to the wet sowing machine

The camera is required to be attached to the seed hopper mechanism in such a way that it allows seed flow to be accurately measured. It has been developed a column for dispensing and observing seeds in order to adjust the flow rate and the speed. The camera mounting rig was constructed to be able to translate vertically along the column and to be secured in any location. The seed flow can be adjusted by means of an aperture underneath the hopper.

Efficient algorithms for counting seed flow have been developed and tests have shown that they are reliable and perform well in coping with seeds up to the speed of 4000 seeds a second. In cases where seeds overlap each other or form clusters, it would be really be difficult for the algorithm to count the individual seed in the cluster. We have inserted a function that allows the algorithm to individually count seeds in a cluster by providing a range area of each seed and it estimates how many seeds are in a cluster. This works well for small clusters of seeds but may not for too many and too large. It is the RTD partner Pera in cooperation with the SME partner Capflow that has performed all work related to the vision sensing system.

One of the subsystems on the EcoWetSow sowing machine is the seed dosage system. It is responsible for delivering very accurate amount of seed, less than 2 % deviation from set-point value, to the mixing unit. The SME partner Agrofina, manufacture of seed feeding units, has taken an active roll in the choice of seed feeder unit. They have worked out technical and cost based analysis together with Agromiljø, in order to find the optimal solution for the EcoWetSow sowing machine. The research resulted in the seed feeder unit MISTRAL, which was considered the best choice for use and integration in the EcoWetSow project. Performance tests have shown a deviation < 2% in the seed feeder system. The project has archived a very accurate seed feeding system with a relative simple and low cost application.

The mixing unit has resulted in European Patent EP 1519647. The development and design of the mixing unit has proved to be very effective and safe. The production costs are reasonable, which all together gives a very successful development.

The consortium has developed a user interface to the control system, which allows the user to control and monitor the different sub-systems. A specification of the interfaces and calculation requirements on the control system has been worked out. All the used components have been listed and a cost calculation of the developed system has been worked out.

The control system has been designed and developed in close cooperation with the co-ordinator company Agromiljø. The project partners have contributed with their expertise and competence within their field. Lykkotronic has provided the project with a specification of a proposed commercial system based on the stock in-line products and has reviewed and analysed the implementation of the control system.

The developed system is a working prototype, which means that some of the parts need to be adapted to reach serial production status. The control system is running on a laptop and needs to be ported to a more robust system; however a control system has been specified in detail in a task report. The cabling and the system installation have also improvement potential concerning reliability and dependability. This will be an issue for a post-project together with the data and experiences collected from the industrial validation.

The SME partners Rebruk and Jæren forsøksring have taken part in field tests of the machine and contributed with general knowledge regarding sowing.

During the project period, the consortium has developed a complete wet-sowing machine with all sub-systems integrated. The developed Eco Wet Sow machine is working very well. The prototype machine has been tested in the field. Several test fields have been sowed with the machine and the yields have been good.

3 Impact

The wet-sowing technology enables very good yield, reduced costs and at the same time reducing emissions to air and water. The wet-sowing technology allows several conventional sowing operations to be performed at the same time and by that both saving time for the farmers and reducing emission of greenhouse gases due to less use of fossil fuels. By injecting the manure sub-soil water pollution/eutrophication due to reduced washing out of nitrogen compounds is reduced and also the emission of ammonia and other nitrogen compounds to air are reduced.

Another positive environmental side of the wet-sowing method is that the manure is being injected sub-surface and by that avoiding odor problems to the surroundings.

4 Dissemination and use

Exploitable knowledge and its use

Exploitable Knowledge	Exploitable Product(s) or Measure(s)	Sector(s) of Application	Timetable for Commercial Use	Patents or Other IPR protection	Owner and Other Partners Involved
A: Enhanced understanding of various image sensing technologies	Algorithms for seed counting	Agriculture	For immediate use		Capflow
B: Design of a blending unit	Mixing method for seed and manure	Agriculture	Ready for market	European Patent EP 1519647	Agromiljø
C: Height/depth measurements	Sensor for height measurement	Agriculture	For immediate use	Pending Norwegian Patent	Agromiljø

	for accurate positioning of rolling plough shares.			Application. Title: "Anordning ved dybdekontroll av en nedfelingslabb."	
D: Vehicle instrumentation	Control system	Agriculture	For immediate use		Agromiljø, Lykketronic
E: Adapt a sensor technology for monitoring the outflow of seed-manure slurry blend through outlet nozzles	Clog sensors including monitoring system	Agriculture	For immediate use	Pending Norwegian Patent Application. Title: "Anordning ved sålabb for nedfelling av partikler og fluid"	Agromiljø, Lykketronic
F: Design of seed drills for sowing cereals leguminous, oil plants and grass	A seed dosage system	Agriculture	Ready for market		Agrofinal
G: Control of Manure installation	Remote Control of Stationary Manure Installation	Agriculture	For immediate use		Agromiljø, Doda
H: Increased knowledge of Sowing	Test Field sowed by the EcoWetSowing machine.	Agriculture	For immediate use		Agromiljø, Rebruk, Jæren Forsøksring

4.2 Dissemination of knowledge

Overview Table

Planned/actual dates	Type	Type of audience	Countries Addressed	Size of Audience	Partner responsible / involved
September 2005	Demonstration for Estonian scientists, Rebruk Farm.	Scientists	Estonia	20	Rebruk
October 2005	Ecologic symposium, Umeå, Sweden	Scientists from the Nordic countries	Nordic	60	Agromiljø
October 2006	Trade show Agrisjå, Trøndelag, Norway	Farmers and agricultural industry	Norway	< 30 000	Agromiljø
November 2006	Agricultural Trade	Farmers and	Norway	< 40 000	Agromiljø

	show, Agroteknikk-messa, Lillestrøm	agricultural industry			
June 2007	Nordic Agricultural Scientists Union, Copenhagen, Denmark	Scientists	Europe	300	Agromiljø
June 2007	Swedish Institute of Agricultural -and Environmental engineering	Scientists	Sweden	300	Agromiljø
June 2007	University of Aarhus, Denmark	Scientists	Denmark	100	Agromiljø
September, 2007	Plastic Industry Trade show, Trondheim, Norway	Plastic industry professionals	Norway	150	Agromiljø
November 2007	Trade show, Agrovisjon, Stavanger, Norway	Farmers and agricultural industry	Norway	6500	Agromiljø

4.2 Publishable results

The project has resulted in one patent: European Patent EP 1519647, which describes the developed blending unit (see Section 1: B: Design of blending unit).

At the moment there are two patents that are pending; one regarding the clog sensors and one regarding the rolling plough shares. It is decided by the consortium not to describe the content of these applications while the patents are pending.

Due to the fact that there are two patents that are pending, it has been decided by the consortium not to publish any material or disclose the sowing system yet. The partners fear that the ideas and prototype may be copied by larger competitors in the agricultural equipment sector.