Dock-cutter field trials

Design of field trial

An area of 4 m in diameter is selected. It is randomly selected, but it has to be exposed to dock-pressure to a moderate extent. Inside the area the docks are located and treated (drilled/cut) by the dock-cutter, which is attached to a small loader (present at most Danish farms). Photos from the drilling on the location of Låsby (2nd farm) are placed in the appendix.

1st farm

The dock-cutter was tested at Martin Brun's organic farm in Give on the 4th of April 2017 (see table on page 3). The docks were on an early stage of growth and did not extent over the rest of the vegetation. Hence, it was harder to recognize them than it would have been a few weeks later. This affected the time consumption.

In the first field only 1 trial was made as weed control had been performed a few days earlier. Thus, the recognition wasn't easy. Only 2-3 docks were found and treated in the trial area and even fewer around the area. The second field was characterized by large dock-colonies. 2 trial areas were carefully chosen, as areas within the large colonies would be too time-consuming (another kind of soil-tillage would be preferable) while the area still had to be moderately pressured by the weed. On field two a grass-clover mixture with herbs (Plantain, Chicory, and Caraway) were sown. Some of the docks might have been neglected due to its uniformity with the herbs. Recognition of the docks in the field was more time-consuming than the actual drilling of the docks.

On the dock-cutter a small box for grass-seeds is attached, which is supposed to automatically sow grass-seeds on the bare ground where the docks was treated. It is an important function, as it provides competition for the dock-seeds that often sprouts later in the growing season. With adequate competition for the dock-seeds there is a real possibility of getting rid of the weed in the location where the treatment is attempted. During the field trial, however, the automatic application of grass seed stopped working and grass-seeds were applied manually. The problem with the device is not addressed, as manual application worked out alright for the field trial purpose.

The field trials were performed in spite of abovementioned issues and the trial areas should be recognizable again in the autumn and next spring as GPS-coordinates for each location were logged (see Photo 1). The process didn't seem to be time-consuming compared to manually removal of the docks since the drilling itself didn't take more than 20-30 seconds per dock.

The farmer was pleased with the result but had some difficulties seeing the dock-cutter as a very good solution to his dock problems. Reasons: It took a lot of time, a person and a machine was occupied for hours (expensive), the machine was putting further pressure on the soil (which could cause soil-compaction), and there is no guarantee the docks is removed permanently.

He sees however some potential in a robot that is able to recognize and treat docks itself as it would certainly ease the work on the farm.

2nd farm

At Ove Mikkelsen's machine factory in Låsby between Silkeborg and Aarhus in Eastern Jutland the dock-cutter was tested on the 23th of May 2017 (see table on page 3). The docks were on an advanced stage of growth as the field around the property was grazed by horses, and they seem to prefer other vegetation over the docks. Hence, they were about 30-40 cm. tall and easy to locate.

The dock cutter was only tested in one field and only two trials were made. Only 2 and 4 docks were found and treated in the two trial areas respectively. The field was not characterized by large dock-colonies but by a high biodiversity with several species of plants. The 2 trial areas were randomly chosen in the field and the docks were easily recognized.

As the docks were threated grass seeds were spread manually to provide competition for the dock-seeds. GPS-coordinates for each location were logged (see Photo 2) so it is possible to locate the area again later. The process of cutting the docks wasn't time-consuming compared to manually removal of the docks. As the machine is out there the drilling didn't take more than 20-30 seconds per dock.

The owner of the field was pleased with the result but he had some possible changes/modifications that he wanted to add to the cutter. It would be smart to attach the cutter differently and possibly so that it was possible to attach it to both sides of the mounting bar. The suggestions for modification will be taken into account when/if the dock cutter is commercialized.

Results

The results are presented in the 2nd table. On the first location one field was ploughed due to poor germination and growth and thus no data were collected. On the other field it was hard to find the old drilling area due to troubles with the Gps-coordinates. They were found, however, and no new germination of docks was observed where the docks were drilled earlier. A few new docks with no connection to the drilled docks had germinated in the area. Hence, for this location and trial the dock cutter did its job and was well evaluated. See an example of an old drilling area now covered with grass on photo 3.

The second trial area was visited on the 16th of June. No new docks had germinated even though the soil was still partly bare where the drilling was performed. This is good news and a little surprising as the docks were tall and had already produced a lot of seeds when drilled in May 2017.

	Field trial					
	Test of Dock Cutter					
Field no.	**Date**	**Field description**	**Trial no. (Ø 400)**	**Location**	**Number of docks**	**Time consumption**
1	4th April 2017	Weed control was just performed in the field, which made the docks hard to recognize from other herbs.	1	Photo 1	2-3	Short time
2	4th April 2017	Field with grass-clover and herbs for grassing. In this stage of growth Chicory, Plantain, and Docks looks alike.	2	Photo 1	5	Longer time. Hard to find the docks at early growth stage.
2	4th April 2017	Field with grass-clover and herbs for grassing. In this stage of growth Chicory, Plantain, and Docks looks alike.	3	Photo 1	4	
1	23th May 2017	Permanent grass. Grazed by horses so the docks were tall and voluminous. The grass was not cut and no weed control was performed since at least spring 2016.	4	Photo 2	4	2 min. (20-30 sec. pr. dock)
1	23th May 2017	Permanent grass. Grazed by horses so the docks were tall and voluminous. The grass was not cut and no weed control was performed since at least spring 2016.	5	Photo 2	2	1 min. (20-30 sec. pr. dock)

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	Results					
	Test of Dock Cutter					
Field no.	**Date**	**Field description**	**Trial no. (Ø 400)**	**Location**	**Number of docks**	**Time consumption**
1	26th May + 16th June 2017	Field was ploughed due to poor germination and growth.	1	Photo 1	0	No data
2	26th May + 16th June 2017	Troubles with Gps-coordinates made the recognition of the trial area difficult, as new grass and clover was covering the soil. A few new docks (not drilled) have germinated in the field trial area since last visited.	2	Photo 1	0 (3-4 new)	Longer time. Hard to locate old drilling area.
2	26th May + 16th June 2017	Troubles with Gps-coordinates made the recognition of the trial area difficult, as new grass and clover was covering the soil. A few new docks (not drilled) have germinated in the field trial area since last visited.	3	Photo 1	0 (2-3 new)	
1	16th June 2017	No new docks have germinated even though the soil was still partly with no vegetation.	4	Photo 2	0	No time
1	16th June 2017	No new docks have germinated even though the soil was still partly with no vegetation	5	Photo 2	0	No time

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Photo 1: The farm in Give where the Dock cutter was tested. The stars represent the locations in which the practical testing was performed.

Photo 2: The property in Låsby where the Dock cutter was tested. The stars represent the locations in which the practical testing was performed.

Photo 3: An old drilling area now covered with grass on the organic farm in Give. No new germination of docks was observed in the area.

Photo 4: Area where a full-grown dock was drilled on the location in Låsby. No new recolonization of docks was observed in the area.

Appendix