

## Den Europæiske Landbrugsfond for Udvikling af Landdistrikterne: Danmark og Europa investerer i landdistrikterne



**Miljø- og Fødevareministeriet**  
Landbrugsstyrelsen



Den Europæiske Landbrugsfond  
for Udvikling af Landdistrikterne

**LDP 2020**



Se EU-Kommissionen, Den Europæiske Landbrugsfond for Udvikling af Landdistrikterne

STØTTET AF

# **Promille**afgiftsfonden for landbrug

## XII Longevity of seeds of blackgrass following different stubble cultivation treatments

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Blackgrass (*Alopecurus myosuroides*) is a primarily winter annual grass weed typically found in crop rotations with a high proportion of winter cereals in areas of the country with clayey soil types. Blackgrass is considered an increasing problem in grass seed production. The purpose of the present study was to test the influence of different stubble treatments on the longevity of newly shed seeds of blackgrass. Two types of experiments were conducted, a field experiment using normal tillage implements and a small plot field experiment simulating the influence of various tillage treatments on placement of seeds in the soil profile. In the experiment simulating tillage treatments, samples of seeds were placed at distinct soil depths and the longevity of the seed samples following these treatments was assessed. In the field experiment using relevant tillage implements, the working depth of the implement was controlled, but the influence on the placement of the seeds in the soil profile following the treatment was not assessed. However, assessing blackgrass seedling emergence and longevity in the two types of studies gives an indication of how seed incorporation in the soil profile is influenced by the tillage implements. In both experiments newly harvested seeds of blackgrass were used.

The field experiment was carried out in a stubble field after harvest of winter barley and removal of the straw. Treatments, assessments and applications are shown in Table 1.

**Table 1.** Treatments, assessments and applications in the field experiment.

Activity	Timing
Harvest of winter barley and removal of straw	28 July
Distribution of blackgrass seeds on stubble	28 July
1 <sup>st</sup> stubble treatment	28 July
2 <sup>nd</sup> stubble treatment	21 August
1 <sup>st</sup> count of germinated blackgrass seedlings	20 September
Glyphosate application to control blackgrass	22 September
Seedbed preparation	17 October
2 <sup>nd</sup> count of germinated blackgrass	17 January 2018

Blackgrass was sown in the stubble at a rate corresponding to approximately 200 seeds per m<sup>2</sup>. The different stubble treatments included in the field trial are shown in Table 2. The implements used for stubble treatment and seedbed harrowing are shown in photos 1-3. The seedbed preparation should have been carried out a few days after the glyphosate application. However, due to the wet autumn this treatment was delayed for almost a month. The seedbed treatment in mid-October included driving with either a seedbed harrow or a direct drilling machine but without sowing of a crop. Seedlings of blackgrass were counted two times in the experiment (Table 3). The first assessment in mid-September shows the influence of the stubble cultivation treatments on the establishment of blackgrass seedlings, and the late assessment in January was taken as an indicator of the effect of the stubble cultivation treatments on the longevity of blackgrass seeds. The main conclusion from the results of the first assessment date in 2017 (Table 3) is that there was a reduced number of plants in treatments with stubble harrowing to 5 and 10 cm depth compared to treatments with no cultivation at all and the shallow treatments with the flex-tine weeder. This is probably caused by a deeper incorporation of a proportion of the seeds by the stubble harrowing. The results of the second assessment in January show very small numbers of

blackgrass generally and only small and non-significant differences between most treatments. The density of seedlings at this assessment date is taken as an indication of the longevity of seeds of blackgrass following the different stubble treatments. The density was, however, generally very low, and therefore no significant differences between stubble treatments were found.

**Table 2.** Stubble treatment – timing, implement and tillage depth.

Treatment number	Immediately after harvest (28 July)	Approximately 3 weeks after harvest (21 August)	Seedbed mid-October (17 October)
1.	None	None	2 x seedbed harrowing 2-4 cm
2.	2 x flex-tine weeder 1-2 cm		2 x seedbed harrowing 2-4 cm
3.	2 x flex-tine weeder 2-4 cm		2 x seedbed harrowing 2-4 cm
4.	2 x stubble harrowing 5 cm		2 x seedbed harrowing 2-4 cm
5.	2 x stubble harrowing 10 cm		2 x seedbed harrowing 2-4 cm
6.		2 x flex-tine weeder 1-2 cm	2 x seedbed harrowing 2-4 cm
7.		2 x flex-tine weeder 2-4 cm	2 x seedbed harrowing 2-4 cm
8.		2 x stubble harrowing 5 cm	2 x seedbed harrowing 2-4 cm
9.		2 x stubble harrowing 10 cm	2 x seedbed harrowing 2-4 cm
19.	2 x flex-tine weeder 1-2 cm	2 x flex-tine weeder 1-2 cm	2 x seedbed harrowing 2-4 cm
11.	None	None	No-till drilling
12.	2 x flex-tine weeder 1-2 cm		No-till drilling

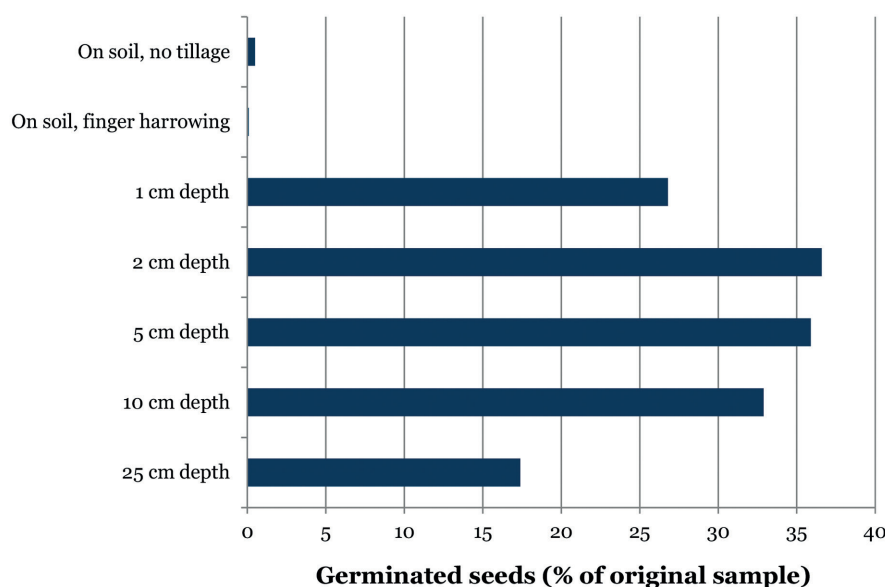
**Table 3.** Density of blackgrass seedlings following different stubble cultivations in 2017.

Immediately after harvest (28 July)	Approximately 3 weeks after harvest (21 August)	Seedbed mid-October (17 October)	No. of blackgrass seedlings per m <sup>2</sup> (20 September)	No. of blackgrass seedlings per m <sup>2</sup> (17 January)
None	None	Seedbed harrow 2-4 cm	9.0	1.0
Flex-tine weeder 1-2 cm		Seedbed harrow 2-4 cm	3.5	0.5
Flex-tine weeder 2-4 cm		Seedbed harrow 2-4 cm	6.5	1.0
Stubble harrow 5 cm		Seedbed harrow 2-4 cm	3.5	0.5
Stubble harrow 10 cm		Seedbed harrow 2-4 cm	2.0	2.0
	Flex-tine weeder 1-2 cm	Seedbed harrow 2-4 cm	9.0	1.5
	Flex-tine weeder 2-4 cm	Seedbed harrow 2-4 cm	9.0	4.0
	Stubble harrow 5 cm	Seedbed harrow 2-4 cm	4.0	0.5
	Stubble harrow 10 cm	Seedbed harrow 2-4 cm	5.0	2.5
Flex-tine weeder 1-2 cm	Flex-tine weeder 1-2 cm	Seedbed harrow 2-4 cm	16.0	3.0
None	None	No-till drilling	9.5	3.0
Flex-tine weeder 1-2 cm		No-till drilling	9.5	2.5
LSD (p=0.05)			6.9	3.3

It cannot be precluded that some dormant seeds are remaining in the soil, and this would especially be expected following the two deeper stubble cultivations to 5 and 10 cm depth.

The small plot field experiment was carried out using seeds from the same seed lot. Samples of 400 seeds were counted and placed either at the soil surface or buried at different depths in the first week of August. Two treatments included placement of the seeds at the soil surface. In the first treatment, seeds were left directly at the soil surface, whereas in the second treatment a shallow harrowing was carried out with the fingers to mimic shallow soil tillage. The treatments with placement of seeds at the soil surface was carried out in small pots, whereas the treatments including burial at different depths were carried out using samples with seeds mixed with soil and placed in fabric mesh bags. By the end of September all samples were collected from the field and a germination test was carried out in the laboratory. During the germination test soil samples were kept moist to ensure optimal conditions for

germination. The number of germinated seedlings was counted when emergence ceased, and this figure (Figure 1) is taken as an indication of the influence of the various field treatments on the longevity of blackgrass seeds. The result is very close to the results seen with Italian ryegrass in 2015-2016. The lowest viability was found in seeds left at the surface, and there was no-significant influence of finger harrowing. Viability was generally much higher in seeds incorporated compared to seeds at the soil surface. The highest viability was found in seeds placed at 2, 5 and 10 cm depth, but a high viability was also found in seeds recovered from 25 cm depth and even from 1 cm depth. Obviously it seems that the “finger harrowing” had a limited influence on seed placement and hence longevity.



**Figure 1.** Germination of seeds of blackgrass from samples kept at different soil depths in the field from beginning of August to the end of September 2017. The figure show the number of plants in the germination test as a percentage of the original seed sample. LSD =7.5.



Stubble harrow.



Seedbed harrow.



Flex-tine weeder.

## **Conclusion**

The results of the two experiments are parallel and support the general conclusion that stubble treatment strategy can have a large influence on the persistence of newly shed seeds. The longevity of blackgrass seeds was very limited at the soil surface. When seeds were incorporated, a much higher percentage of the seeds survived. An important question is how superficial stubble treatments influence incorporation of seeds and hence longevity. The experiment with full-scale tillage implements as well as the experiment with simulated “finger harrowing” showed that there was no negative influence of a shallow tillage probably because neither the “finger harrowing” nor the flex-tine weeder incorporates the seeds. The same conclusion was seen in 2015-2016 testing the longevity of seeds of Italian ryegrass.