

Germination and dormancy of susceptible and non-target site resistant blackgrass phenotypes

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INTRODUCTION

Blackgrass (*Alopecurus myosuroides*) is the most important herbicide resistant weed in Europe. In Denmark, the first case of blackgrass resistant to fenoxaprop-P-ethyl was reported in 2001. Knowledge of differences in the biology of herbicide-resistant and -susceptible phenotypes can support the development of more effective weed resistance management strategies.

OBJECTIVE

To determine seed dormancy level and germinability of susceptible (S) and resistant (R) blackgrass phenotypes from two Danish populations (ID33 and ID914).

MATERIALS AND METHODS

The S and R phenotypes of each population were identified and isolated through segregation using a plant cloning technique to obtain seed lot with similar genetic background (Vila-Aiub et al., 2005). Seeds of the 4 populations were produced under cold glasshouse conditions. Germinability of both dormant (freshly harvested) and non-dormant (6-week-oven stored seed at 35 ± 2 °C) seeds were examined under controlled condition (17/10°C, 14/10 h day/night) in 2012 and the experiment was repeated in 2013. A three parameters log-logistic model was fitted to the number of germinated seeds according to the time-event approach (Ritz et al., 2013).

RESULTS

The final germination (GR_{max}) of all phenotypes increased significantly after six weeks storage in the oven in 2012. In contrast no differences were observed between GR_{max} of freshly harvested and 6-week-oven stored seed lots in 2013.

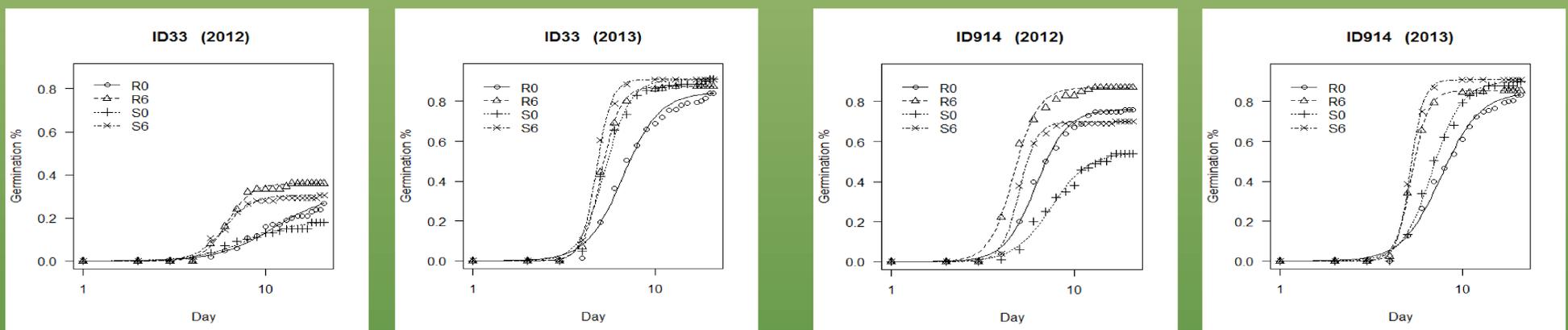
The low dormancy of seeds in 2013 could be caused by warm and dry weather conditions during seed maturation (June-July) in contrast to 2012 where June and July were colder and wetter. The GR_{max} of R phenotype of both populations was higher than of S phenotype in 2012. While no significant difference in the GR_{max} was observed between R and S phenotypes of both populations in 2013.

The time taken to reach 50% of the final germination (GR_{50}) for all phenotypes decreased significantly after six weeks storage in the oven in both years. The S phenotypes of both populations showed significantly faster germination (lower GR_{50}) than the R phenotypes in 2013 while no significant differences in the GR_{50} were observed between R and S phenotypes of both populations in 2012 except for the freshly harvested seeds of population ID914. This information can be implemented in models that predict proportion of resistant population.

LITERATURE CITED

Vila-Aiub M.M., Neve P., Steadman K.J., Powles S.B. (2005). Journal of Applied Ecology 42:288-298.

Ritz C., Pipper C.B., Streibig J.C. (2013). European Journal of Agronomy 45:1-6



Germination pattern of freshly harvested (0) and six-week-oven stored (6) seeds of S and R phenotypes segregated from population ID 33 and ID914 in 2012 and 2013. Curves were adjusted by the log-logistic model according to the event-time approach. described in the Table 2.

Estimated parameters by log-logistic model for R and S phenotypes of population ID 33 in 2012 and 2013.

phenotype	2012						2013					
	GR50		GR max		GR50		GR max		GR50		GR max	
	0 week	6 week	0 week	6 week	0 week	6 week	0 week	6 week	0 week	6 week	0 week	6 week
S	7.95 (1.2)	ns	6 (0.4)	0.19 (0.04)	ns	0.31 (0.05)	5.3 (0.1)	*	4.8 (0.06)	0.91 (0.03)	ns	0.91 (0.02)
R	11.2 (.2)	*	6.2 (0.3)	0.31 (0.06)	ns	0.36 (0.05)	6.6 (0.2)	*	5.1 (0.09)	0.84 (0.02)	ns	0.88 (0.02)

*, statistically significant differences (P=0.05) between rows 0 and 6 week) and column (S and R phenotypes). ns, not significant
Values in parenthesis represent standard error.

Estimated parameters by log-logistic model for R and S phenotypes of population ID 914 in 2012 and 2013.

phenotype	2012						2013					
	GR50		GR max		GR50		GR max		GR50		GR max	
	0 week	6 week	0 week	6 week	0 week	6 week	0 week	6 week	0 week	6 week	0 week	6 week
S	7.4 (0.4)	*	5 (0.1)	0.54 (0.05)	*	0.70 (0.04)	6.8 (0.2)	*	5.2 (0.06)	0.90 (0.02)	ns	0.91 (0.02)
R	6.3 (0.3)	*	4.7 (0.1)	0.78 (0.04)	*	0.87 (0.03)	7.6 (0.3)	*	5.3 (0.08)	0.84 (0.03)	ns	0.85 (0.02)

*, statistically significant differences (P=0.05) between rows 0 and 6 week) and column (S and R phenotypes). ns, not significant
Values in parenthesis represent standard error.