

## Problematic weed species in organic arable agriculture around the Baltic Sea - an expert database

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### Abstract

Weeds are a perpetual challenge in Organic agriculture. However, they serve multiple ecosystem services and a low competitive weed cover can be tolerated. Adding to this, is the fact that only a few species prove problematic for both the crop and the farmer. The international PRODIVA project researches the effect of crop diversity strategies on the diversity of weed communities, hypothesizing that by increasing the weed diversity, the development of problematic weeds will be mitigated. A preparatory study was conducted to list the most problematic weed species in spring sown cereals in the countries involved with PRODIVA. For this a literature review was conducted in all participating countries, collecting local sources including grey literature. This was combined with the opinion of local extension services and other weed experts. From this a list of 10 most problematic weeds was deduced for each country. We found both annual and perennial species to be mentioned as problematic. A majority of the more problematic species were shared between countries, such as *Cirsium arvensis*, *Elytrigia repens* and *Chenopodium album*. Still, all countries revealed to have individual weed challenges as well. These findings are published as a folder that will be available to local stakeholders.

### Introduction

Weeds remain to be the main constrain on organic crop productivity (Penfold et al. 1995; Clark et al. 1998; Turner et al. 2007; Alroe und Halberg 2008). Despite many non-herbicide reduction strategies are available and utilized, a total eradication of the weed flora will never be achieved. Moreover this leads to highly diverse weed communities within arable fields (Hald 1999) and increased ecosystem services of arable fields (Marshall et al. 2003). Turner et al (2007) showed, the majority of farmers have a tolerant attitude towards this increased weed presence. Thus a weed cover, within manageable limits, is not considered a concern to the farmers and prove positive for biological parties. What tends to pose a challenge is the build-up of certain weed species with the characteristics of highly competitive with the crop, hard to control, build high biomass and/or cover and/or are in other ways decreasing yields. Therefore we consider these specific weeds to be problematic. These species often are perennial weeds, such as *Rumex spp.*, *Cirsium arvensis*, *Elytrigia repens* and

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some specific annuals, such as *Alopecurus myosuroides* and *Chenopodium album*. Especially perennials can be a challenge in organic arable systems (van Elsen 2000).

### Materials and methods

The CORE Organic PRODIVA project, a collaboration between international weed research institutions, aims to improve utilization of crop diversification strategies for weed management in northern European organic arable cropping systems. The overall aim is to support organic agriculture with knowledge and tools for the exploitation of crop diversification methods to improve weed management and still maintain a diverse weed flora. Thus, it is hypothesised, a diverse cropping system will lead to a diverse weed communities and therefore mitigate the development of problematic weed species. To kick-start the research an expert database was compiled with the objective to create an understanding of the current knowledge on local problematic weed species, persistent in organic production in the Baltic Sea region.

A literature review was conducted in the national literature from all countries involved in the PRODIVA project. Sources considered were scientific literature, specialized literature, grey literature and the knowledge of extension services and specialist in the field. Studied was the current state of weed populations and which species were considered 'problematic' considering crop-weed competition, weed cover and controllability. This focussed on organically grown spring sown cereals. Project partners from the involved countries conducted this search themselves locally, collected information and submitted this to the University Rostock where it was analysed. From this, information on weed species lists were composed based on the frequency of a weed species mentioned and how problematic they are. Furthermore, the weed species were divided into five types loosely based on the categorization of character trades from Holzner and Glauning (2005), so to make identification as a 'problematic' weed species more comprehensive.

The results and information has been prepared as a folder that will be publically available in all languages of nations involved and English and will be made accessible to stakeholders, such as extension services and farmers in their local languages. Furthermore, the results found will be used as reference weed species for the other experiments, surveys and results within the PRODIVA project.

### Results and discussion

After analysing the data and listing the weed species (Table 1), the species were divided in five groups, based on competition trades. The three annual weed types are: The Bodybuilders, Early Birds and Plebeian. The Bodybuilders being weeds species that develop a lot of biomass rapidly and are highly competitive. The Early Birds, these annuals rely on a quick establishment in spring and can be competitive during the establishment of the crop. This type also includes the more flexible and opportunist annuals. The Plebeian are annuals that are visibly present and can occur in high densities, but rarely have a competitive impact. The two perennial types are: the Indestructibles and the Grassland species. The indestructibles are a category of perennial that often have persistent root systems and are resilient, hard to control and can be strong competitors. The Grassland species are common weeds in grassland systems. They are seen wandering into the arable fields, benefiting of the grass-clover ley often implemented in organic crop rotations. Although the types are based on the system proposed by Holzer and Glauning (2005) in the more southern continental

region of Austria, the types described here are corrected for the more northern boreal-maritime climate found in the Baltic Sea region.

**Table 1: Problematic weed species most often mentioned in national literature and by local extension services. Divided into annuals and perennials. Germany (DE), Denmark (DK), Sweden (SE), Finland (FI), Latvia (LV) and Poland (PL).**

Latin Name	DE	DK	SE	FI	LV	PL	Weed type
Annuals							
<i>Chenopodium album</i>	x	x	x	x	x	x	Bodybuilder
<i>Polygonum spp.</i>	x	x	x	x	x	x	Bodybuilder
<i>Centaurea cyanus</i>	x	x	x		x	x	Bodybuilder
<i>Galeopsis spp.</i>		x	x	x	x	x	Bodybuilder
<i>Stellaria media</i>	x	x		x		x	Early bird
<i>Galium aparine</i>	x		x			x	Early bird
<i>Raphanus raphanistrum</i>	x					x	Bodybuilder
<i>Sinapis arvensis</i>		x	x				Bodybuilder
<i>Galeopsis tetrahit</i>			x			x	Bodybuilder
<i>Matricaria inodora</i>		x				x	Early bird
<i>Apera spica-venti</i>	x				x		Early bird
<i>Lamium purpureum</i>				x	x		Early bird
<i>Viola arvensis</i>				x	x		Early bird
<i>Spergula arvensis</i>			x	x			Plebeian
<i>Alopecurus myosuroides</i>	x						Bodybuilder
<i>Avena fatua</i>				x			Bodybuilder
<i>Anthemis arvensis</i>						x	Early bird
<i>Papaver rhoeas</i>	x						Early bird
<i>Galinsoga parviflora</i>						x	Early bird
<i>Erysimum cheiranthoides</i>				x			Plebeian
<i>Fumaria officinalis</i>					x		Plebeian
<i>Anchusa arvensis</i>	x						Plebeian
<i>Matricaria discoidea</i>			x				Plebeian
<i>Myosotis arvensis</i>				x			Plebeian
<i>Brassica rapa ssp. Campestris</i>		x					Bodybuilder
<i>Thlaspi arvensis</i>			x				Early bird
<i>Veronica arvensis</i>					x		Plebeian
<i>Amsinckia micrantha</i>		x					Plebeian
Perennials							
<i>Elytrigia repens</i>	x	x	x	x	x	x	Indestructibles
<i>Cirsium arvensis</i>	x	x	x	x	x	x	Indestructibles
<i>Equisetum arvense</i>		x	x	x	x	x	Indestructibles
<i>Sonchus arvensis</i>		x	x	x	x		Indestructibles
<i>Rumex spp.</i>	x		x	x			Indestructibles
<i>Tussilago farfara</i>		x	x	x			Grassland
<i>Ranunculus repens</i>			x	x			Grassland
<i>Taraxacum officinale</i>			x	x			Grassland
<i>Artemisia vulgaris</i>		x			x		Grassland

Most of the most problematic weeds stem from the categories of Bodybuilders and Indestructibles, this most likely due to their high competitiveness and amount of control measures required. This is coherent with the sentiment expressed by farmers in the study from Turner (2007). Species belonging to these weed types are mentioned to be 'problematic' in the majority of countries. The country specific species are more often member of the Early Birds or Plebeians or even Grassland species. This is probably caused by the distribution of weed species and their specific adaption to their local environment, such as climatic conditions and soils. We have to consider that the competitiveness of weeds relies heavily on local conditions as well, but the similarities are noteworthy.

The folder presenting these findings is published on Organic Eprints in autumn of 2016. For more information on the running project PRODIVA please visit the website: <http://coreorganicplus.org/research-projects/prodiva/>. The project runs from 2015-2018.

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