Evidence of development of resistance to ALS inhibitors in Latvia

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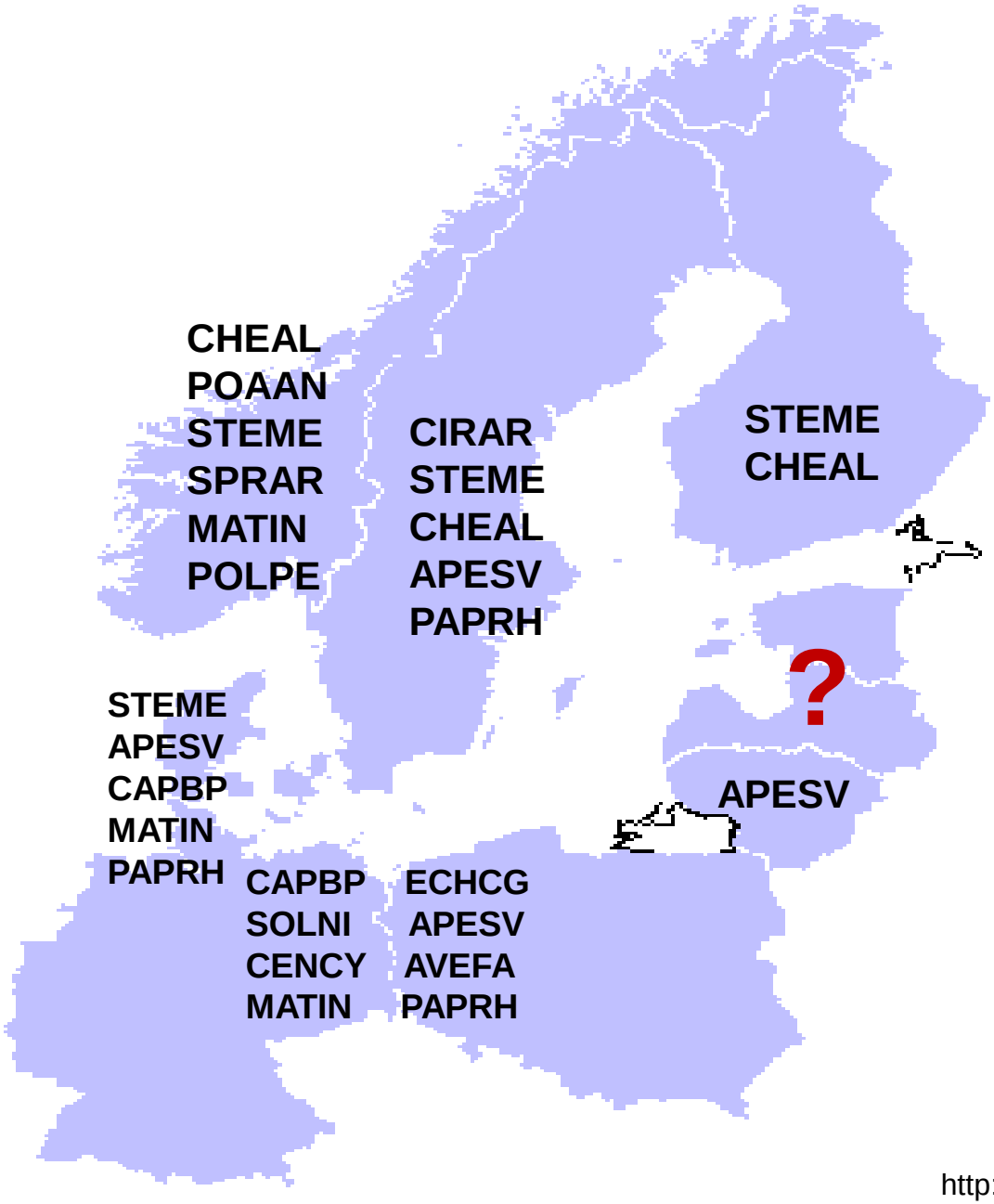
NORBARAG meeting, 1-2 March 2017

Nordic Baltic Resistance Action Group

Herbicide-resistant species



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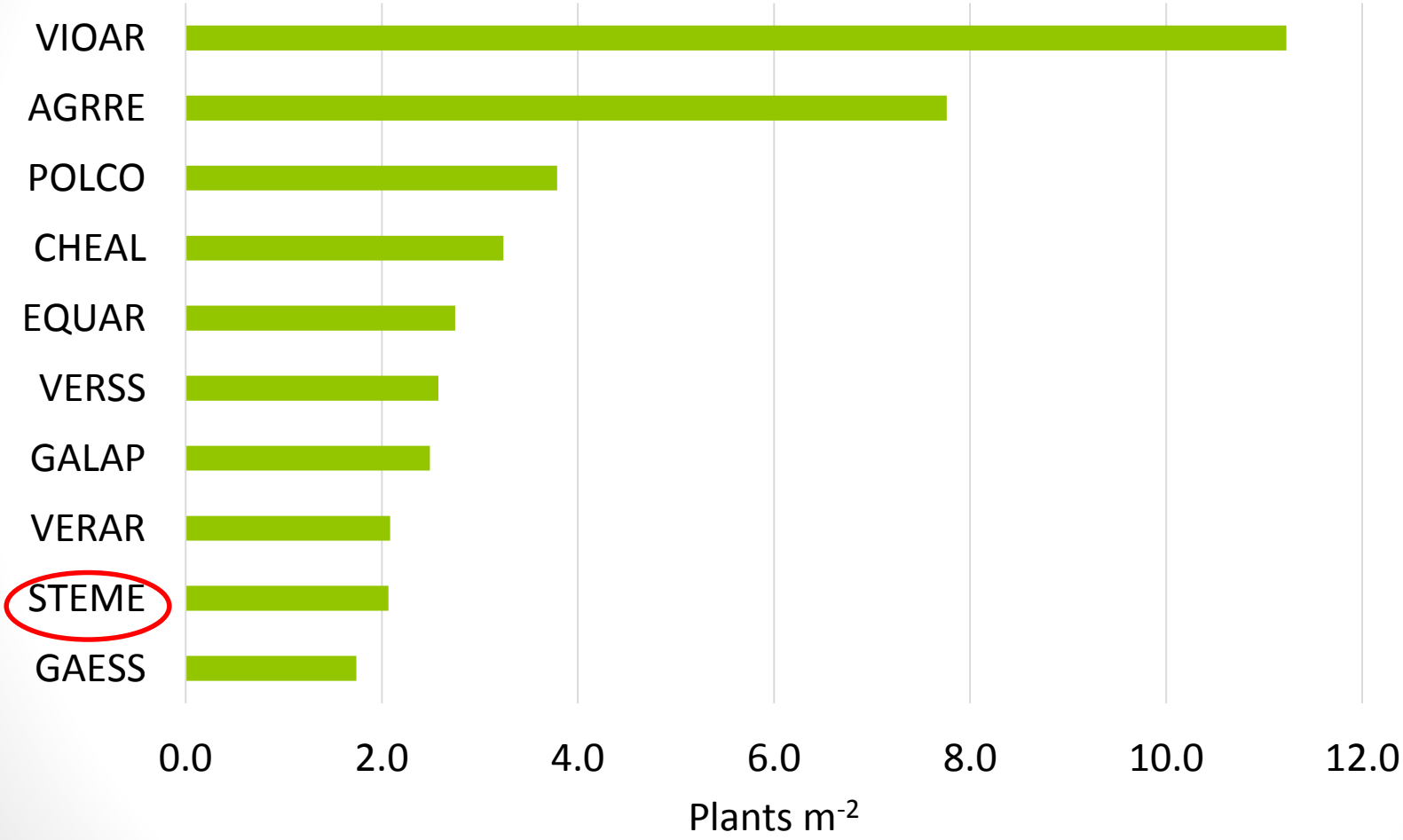
Current situation in Latvia:

- Seed samples were collected in the fields where herbicide efficacy was lower than expected in 2013-2016:
  - three samples of wild oat (*Avena fatua*);
  - two samples of silky bent grass (*Apera spica-venti*);
  - two samples of common chickweed (*Stellaria media*), repeatedly in the same field.
- Pot trials and DNA analysis for target-site resistance was performed by the company IDENTXX (Germany).

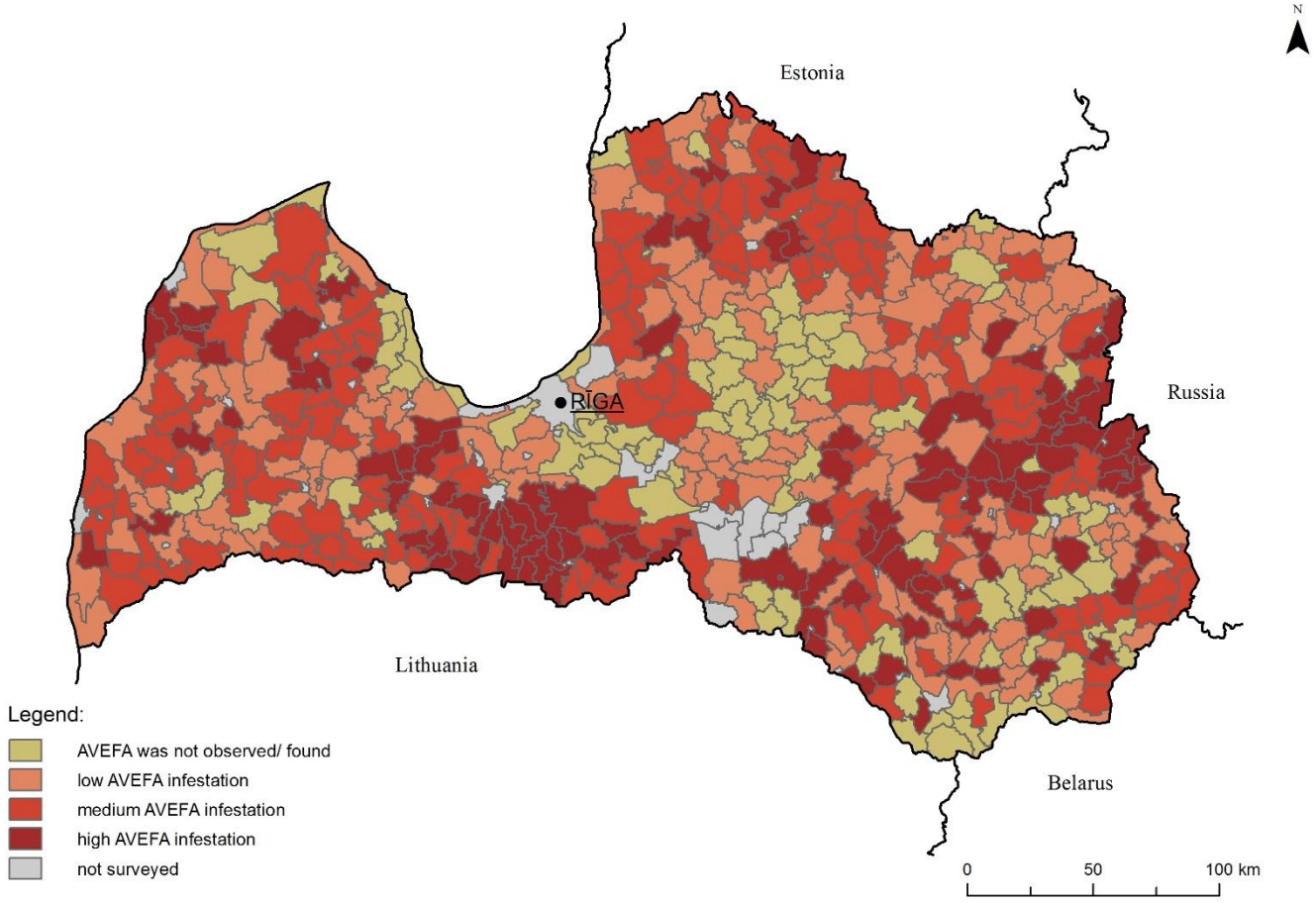
Seed sample collection sites

10 weed species with highest average density in Latvia, 2013-2015



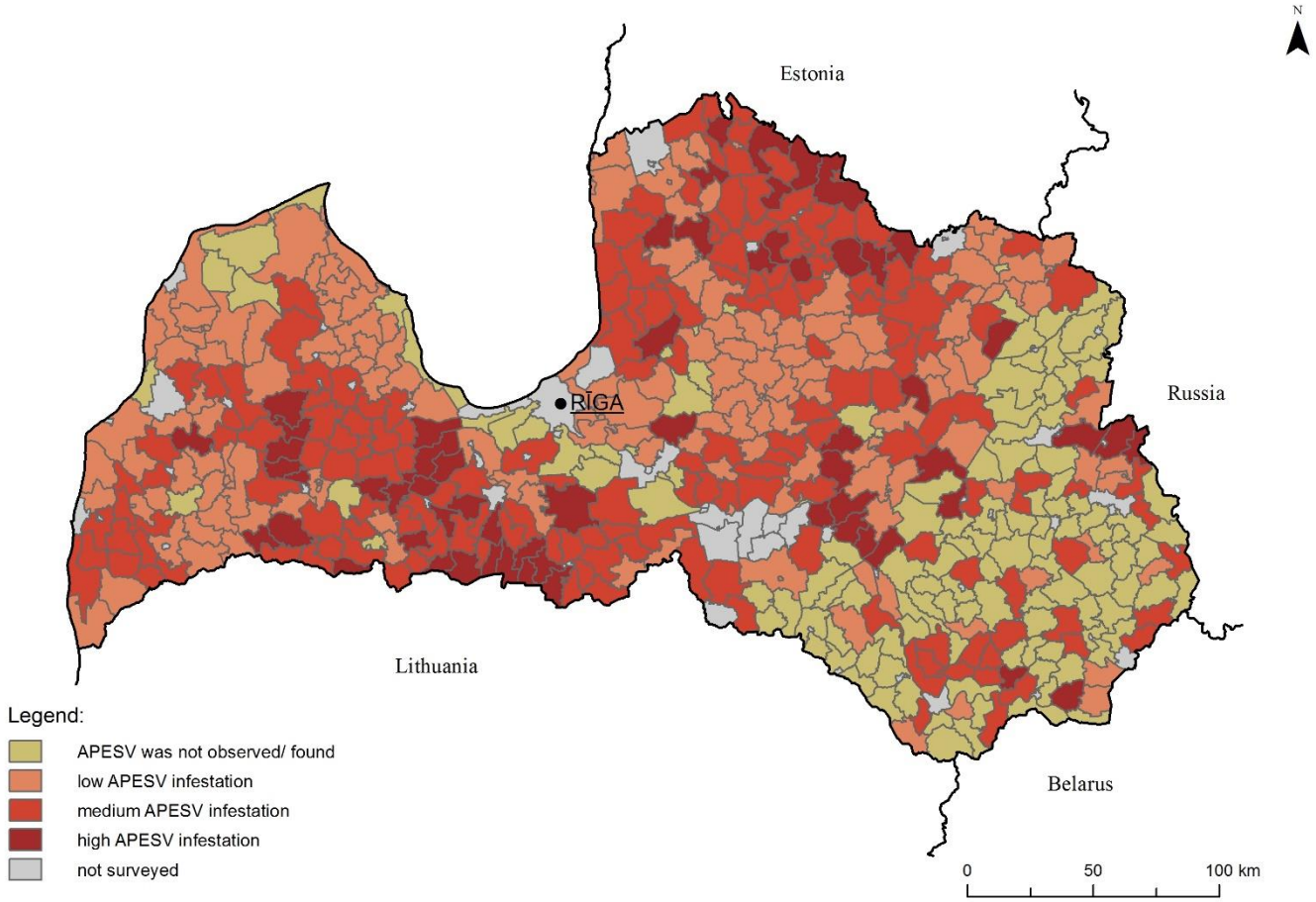
Current situation in Latvia:

Infestation with wild oat (*Avena fatua*) in 2015-2016



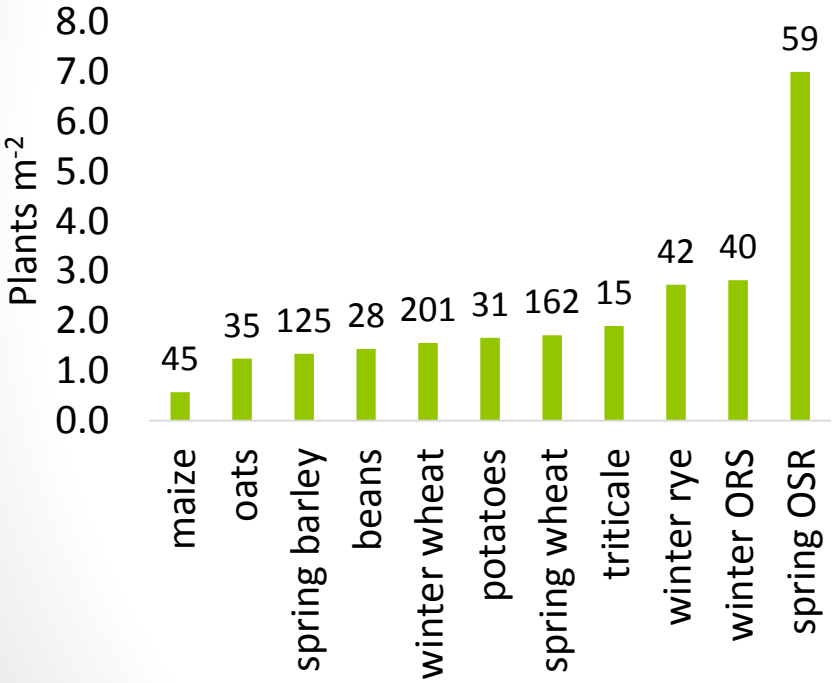
Current situation in Latvia:

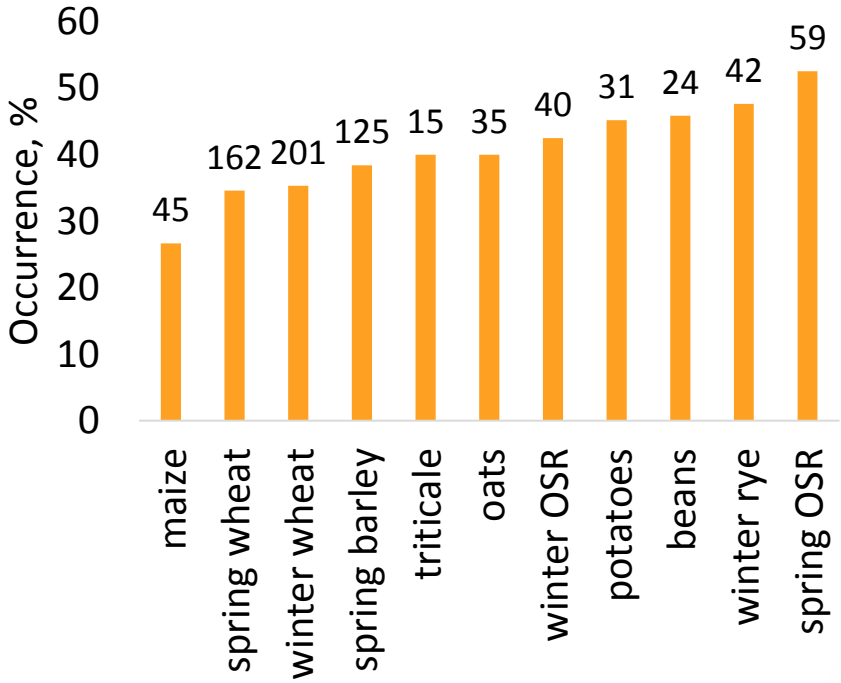
Infestation with silky bent grass (*Apera spica-venti*) in 2016



Current situation in Latvia:

Occurrence and density of common chickweed (*Stellaria media*) in 2013-2015





51 farms x 6 fields x 3 years

Seed collection in potentially resistant weed populations

Apera spica-venti seeds were collected in the fields, where ALS inhibitors (B group) or ACC inhibitors (A group) were used repeatedly for several years.

Year	Crop	Active ingredients used	HRAC group of the a.i.
Penkule 1			
2015.	**Winter wheat**	Sulfosulfuron	B
2014.	Winter wheat	Iodosulfuron-methyl-sodium + mesosulfuron-methyl + diflufenican sulfosulfuron	B+B+F1 B
2013.	Winter OSR	Metazachlor Quizalofop-ethyl	K3 A
2012.	Winter wheat	triasulfuron tribenuron-methyl	B B
2011.	Winter wheat	sulfosulfuron tribenuron-methyl	B B
Penkule 2			
2015.	**Winter wheat**	fenoxaprop-p-ethyl	A
2014.	Winter OSR	Metazachlor Quizalofop-ethyl	K3 A
2013.	Winter wheat	sulfosulfuron tribenuron-methyl	B B
2012.	Winter wheat	triasulfuron tribenuron-methyl	B B
2011.	Winter wheat	sulfosulfuron tribenuron-methyl	B B

Seed collection in potentially resistant weed populations

Dow AgroSciences

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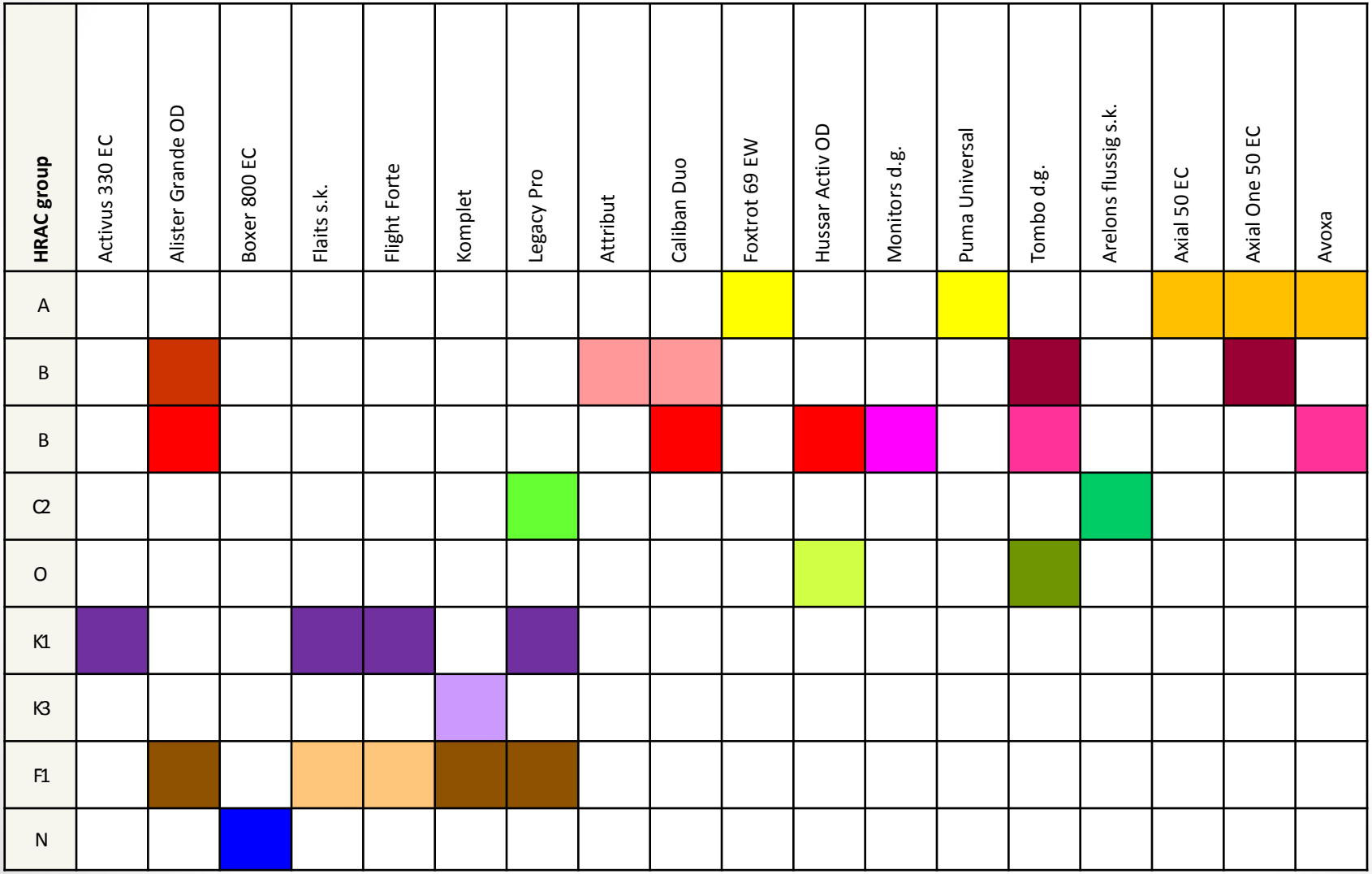
Year	Crop	Active ingredients used	HRAC group of the a.i.
Penkule 1			
2015.	Winter wheat	Sulfosulfuron	B
2014.	Winter wheat	Iodosulfuron-methyl-sodium + mesosulfuron + mefenpyr-diethyl + sulfosulfuron	B+B+F1
2013.	Winter OSR	Metazachlor Quizalofop-ethyl	K3 A
2012.	Winter wheat	triasulfuron tribenuron-methyl	B B
2011.	Winter wheat	sulfosulfuron tribenuron-methyl	B B
Penkule 2			
2015.	Winter wheat	fenoxaprop-p-ethyl	A
2014.	Winter OSR	Metazachlor Quizalofop-ethyl	K3 A
2013.	Winter wheat	sulfosulfuron tribenuron-methyl	B B
2012.	Winter wheat	triasulfuron tribenuron-methyl	B B
2011.	Winter wheat	sulfosulfuron tribenuron-methyl	B B

Detected resistance to Iodosulfuron-methyl-sodium (B group).

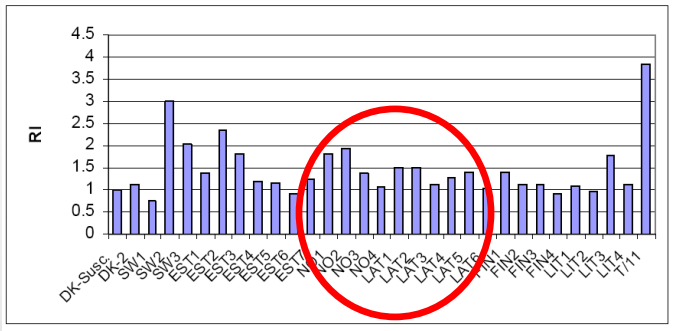
Reduced efficacy (75-80%) when treated with full recommended dose

No resistance detected

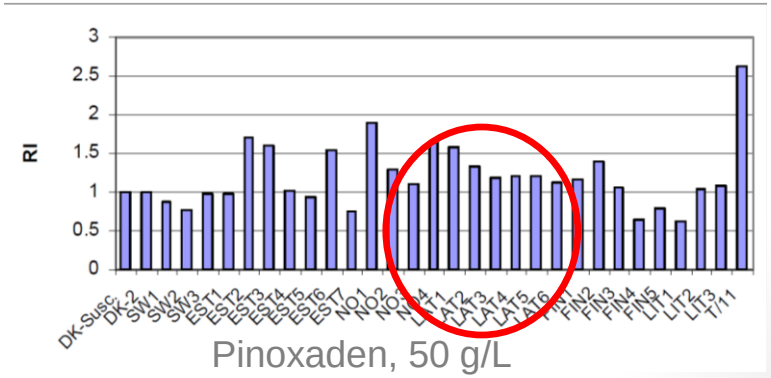
Products registered in the Latvian market for control of *Apera spica-venti*



Tests of resistance in *Avena fatua* in 2008



Phenoxaprop-ethyl, 69 g/L



Pinoxaden, 50 g/L

Herbicide susceptibility of wild oats from seven countries. S.K. Mathiassen, J. Netland, K. Jahr, L. Talgre, Z. Mintale, O. Auskalniene, M. Koppel, S. Junnila, H. Hallqvist & P. Kudsk

Seed collection in potentially resistant weed populations

Avena fatua seeds were collected in the fields, where ALS inhibitors (B group) or ACC inhibitors (A group) were used repeatedly for several years.

Year	Crop	Active ingredients applied	HRAC group of the a.i.
Naujene			
2013.	**Winter wheat**	pyroxsulam+florasulam+aminopyralid	B+B+O
2012.	Spring wheat	pyroxsulam+florasulam+aminopyralid	B+B+O
2011.	Winter wheat	pyroxsulam+florasulam+aminopyralid	B+B+O
Viļaka			
2013.	**Spring wheat**	fenoxaprop-p-ethyl	A
2012.	Spring OSR	fluazifop-p-butyl	A
2011.	Spring wheat	pinoxaden	A
Nīcgale			
2013.	**Spring barley**	fenoxaprop-p-ethyl	A
2012.	Spring wheat	fenoxaprop-p-ethyl	A
2011.	Spring wheat	No data	nav datu

Seed collection in potentially resistant weed populations

Avena fatua seeds were collected in the fields, where ALS inhibitors (B group) or ACC inhibitors (A group) were used repeatedly for several years.

Year	Crop	Active ingredients applied	HRAC group of the a.i.
Naujene			
2013.	Winter wheat	pyroxsulam+florasulam+aminopyralid	B+B+O
2012.	Spring wheat	pyroxsulam+florasulam+aminopyralid	B+B+O
2011.	Winter wheat	pyroxsulam+florasulam+aminopyralid	B+B+O
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2013.	Spring barley	fenoxaprop-p-ethyl	A
2012.	Spring wheat	fenoxaprop-p-ethyl	A
2011.	Spring wheat	No data	nav datu

No resistance detected

No resistance detected

No resistance detected

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Products registered in the Latvian market for control of *Avena fatua*

Herbicide mode of action	HRAC group	Attribut	Foxtrot 69 EW	Monitors d.g.	Puma Universal	Axial 50 EC	Axial One	Avoxa	Tombo d.g.
ACC inhibitors	A								
ALS inhibitors	B								
	B								
Sinthetic auxins	O								

Seed collection in potentially resistant weed populations

Stellaria media seeds were collected in the fields, where ALS inhibitors (B group) were used repeatedly for several years.

Year	Crop	Active ingredients applied	HRAC group of the a.i.
Zaļenieki 2			
2016.	**Winter wheat**	Triasulfuron tribenuron-methyl florasulam	B B B
2015.	Winter OSR	metazachlor + quinmerac clopyralid cycloxydim	K3 + O O A
2014.	Winter wheat oversown with spring wheat	Triasulfuron tribenuron-methyl amidosulfuron	B B B
Zaļenieki 1			
2013.	**Winter wheat**	amidosulfuron +Iodosulfuron-methyl-sodium 2,4-D	B+B O
2012.	Winter OSR	fluazifop-p-butyl metazachlor + quinmerac clopyralid	A K3 + O O
2011.	Spring wheat	tribenuron-methyl amidosulfuron	B B
2010.	Spring wheat	amidosulfuron+Iodosulfuron-methyl-sodium 2,4-D	B+B O
2009.	Winter wheat	amidosulfuron +Iodosulfuron-methyl-sodium	B+B

Seed collection in potentially resistant weed populations

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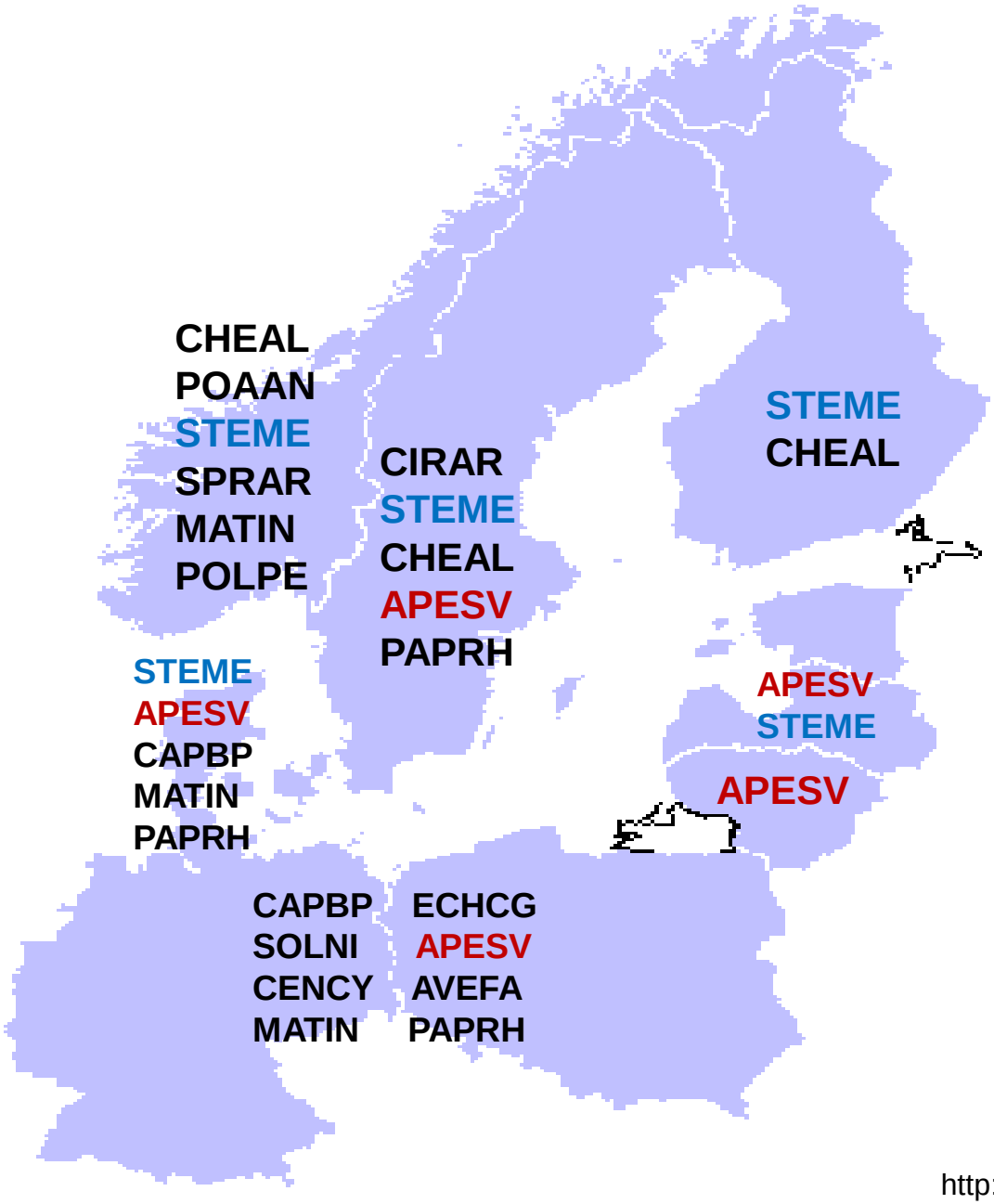
2015.		metazachlor + quinmerac clopyralid cycloxydim	K3 + O O A
2014.	Winter wheat oversown with spring wheat	Triasulfuron tribenuron-methyl amidosulfuron	B B B
Zaļenieki 1			
2013.	Winter wheat	amidosulfuron +Iodosulfuron-methyl-sodium 2,4-D	B+B O
2012.	Winter OSR	fluazifop-p-butyl metazachlor + quinmerac clopyralid	A K3 + O O
2011.	Spring wheat	tribenuron-methyl amidosulfuron	B B
2010.	Spring wheat	amidosulfuron+Iodosulfuron-methyl-sodium 2,4-D	B+B O
2009.	Winter wheat	amidosulfuron +Iodosulfuron-methyl-sodium	B+B

Detected resistance to sulfonylurea subgroup herbicides (B group).

The target site mutation can spread within the population with continuing resistance pressure

Herbicide-resistant species



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Acknowledgements

The project **Integrated pest management for weed control in arable crops for sustainable use of the environment and resources** was supported by European Agricultural Fund for Rural Development (EAFRD).

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