



Science For A Better Life



Weed Genomics. From Herbicide Resistance Diagnostics to the Discovery of New Targets or New Modes of Actions.

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Global Herbicide Resistance Challenge May, 2017



Forward-Looking Statements

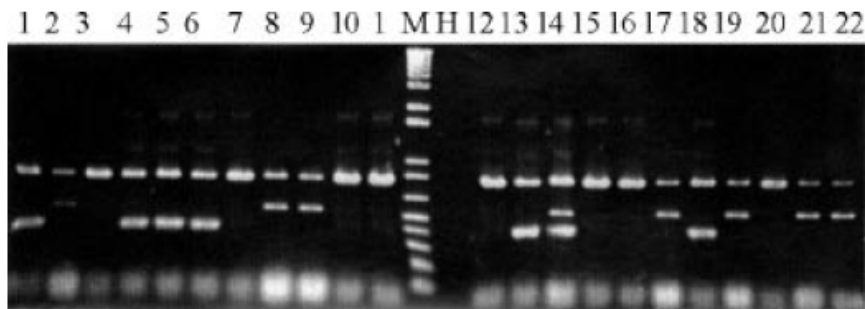
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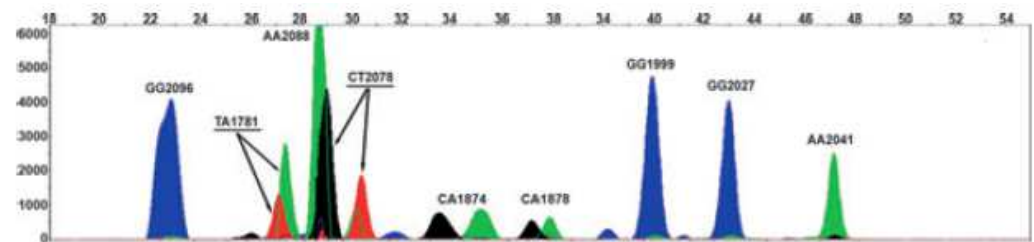
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Target Site Resistant Assessment

Mutations – Gene Copy Number – Target Gene Expression



Allele-specific PCR analysis (Délye et al. 2002)

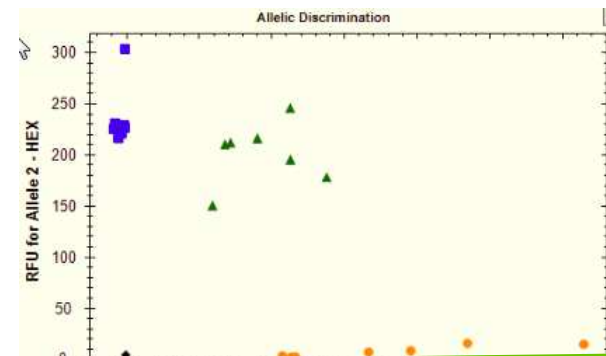
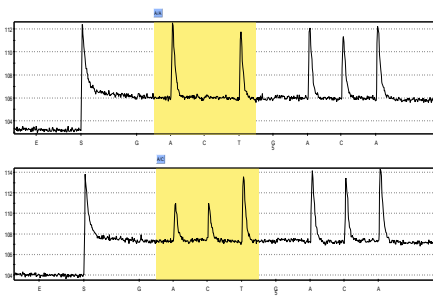


Multiplex PCR (Alarcon-Reverte et al. 2012)



A/A
susceptible
homozygous

A/C
resistant
heterozygous



MySeq (Illumina)

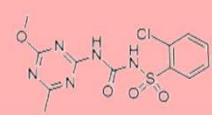
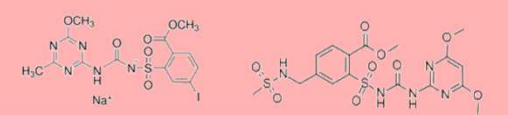
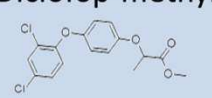
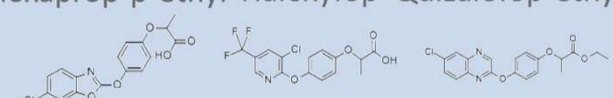
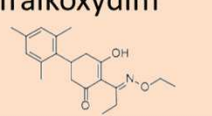

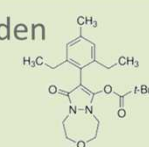
Technology to analyze gene copy number or gene expression or SNPs evolve fast, can be automatized. Therefore, TSR should be assessed to characterize resistant populations.

Non Target Site Resistant Assessment

Herbicide Detoxification, i.e. Metabolic Resistance – Gene Discovery



❖ Complex process under the control of several genes and still poorly understood. Very diverse because not related to a given target but to the chemistries. First genes start to be functionally characterized. Could be added to the TSR marker set.

	Resistant	No prominent differences
SU	Chlorsulfuron 	Iodosulfuron Mesosulfuron-methyl 
FOP	Diclofop-methyl 	Fenoxaprop-p-ethyl Haloxypop Quizalofop-ethyl 
DIM	Tralkoxydim 	Sethoxydim 
DEN		Pinoxaden 

Activity of a LOLRI Cyp81A1 On different herbicides

Gonzalez et.al. Wednesday.

Non Target Site Resistant Assessment

Herbicide Detoxification, i.e. Metabolic Resistance (2)



❖ Genes overexpressed in resistant plants but not shown to be able to detoxify a given herbicide could be good markers if validated.

Population	Metabolic Resistance to:	CYP72A1	CYP72A2	NMO	GT	GST
		Fold Change Relative to VLR1 (Australian Susceptible) – qRT-PCR				
France 2005	Diclofop	4	6	2	1	-4
France 2006	Diclofop	5	2	2	60	2
France 2007A	Diclofop + ALS	7	6	4	174	9
France 2007B	Diclofop + ALS	5	7	5	60	3
France 2008	Diclofop + ALS	23	14	30	292	14
France 2009	Diclofop + ALS	9	4	6	107	18
France 2010	Diclofop + ALS	3	2	6	25	6
France 2010	Sensitive	2	1	2	14	3
Australia SLR31	Sensitive	2	1	1	3	1



The Plant Journal (2014)

doi: 10.1111/tpj.12514

RNA-Seq transcriptome analysis to identify genes involved in metabolism-based diclofop resistance in *Lolium rigidum*

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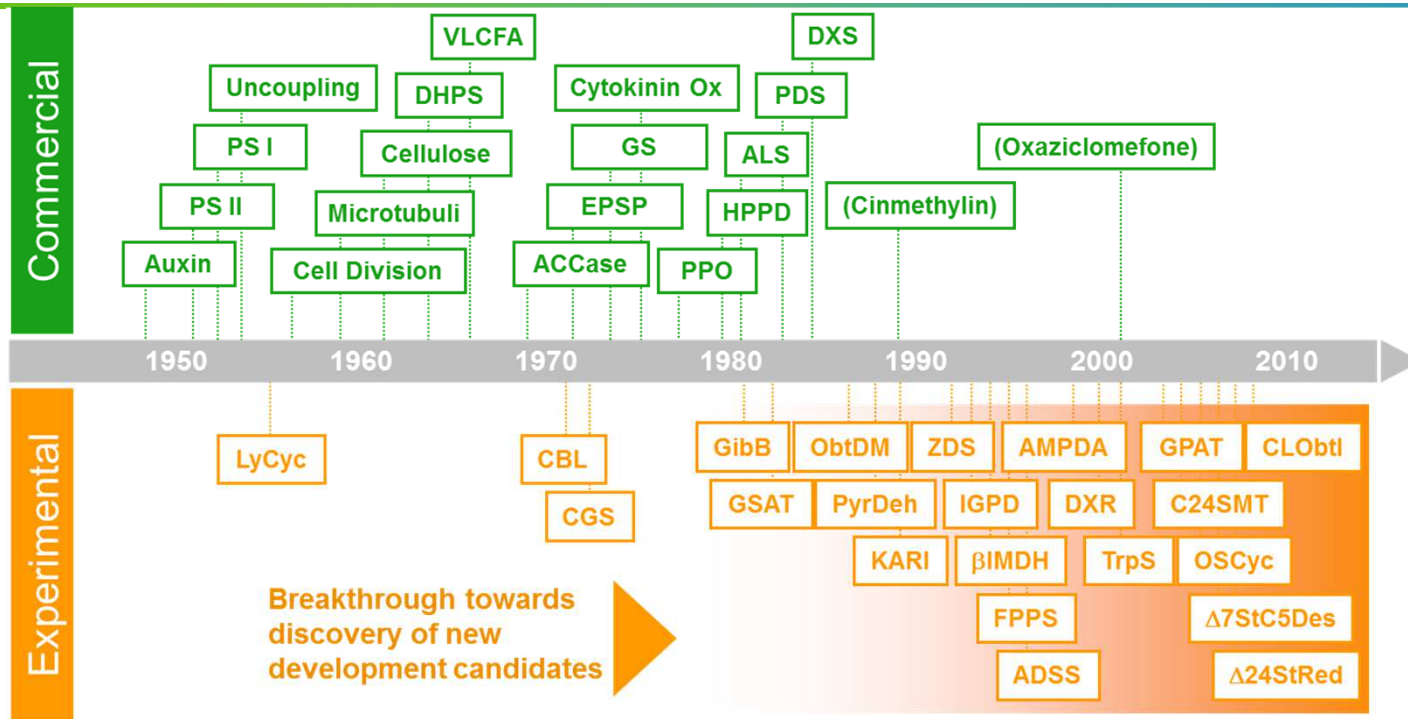
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In LOLSS resistant to diclofop, a set of markers was validated on field populations, but the marker was not found!

New Target Discovery

Potential is there but.....



Many herbicide target sites discovered, but over half never made it to market

Summary



- ❖ Genomics is essential to:
 - ❖ Discover new targets for novel herbicides
 - ❖ Discover the mode of action, i.e. the target of novel chemistries
 - ❖ Discover markers for herbicide resistance diagnostics
 - ❖ Discover new potential herbicide tolerance genes used in GMO crops
 - ❖ Discover novel genes involved in stress regulation
- ❖ Weed genomic sequences are essential and fully complementary of reference transcriptomes
- ❖ Transcriptome analysis is key to understand many aspects of weed biology.



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Any
questions?

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Thank you!

GHRC, May 2017