



Echinochloa crus-galli



E. phyllopogon



E. oryzoides

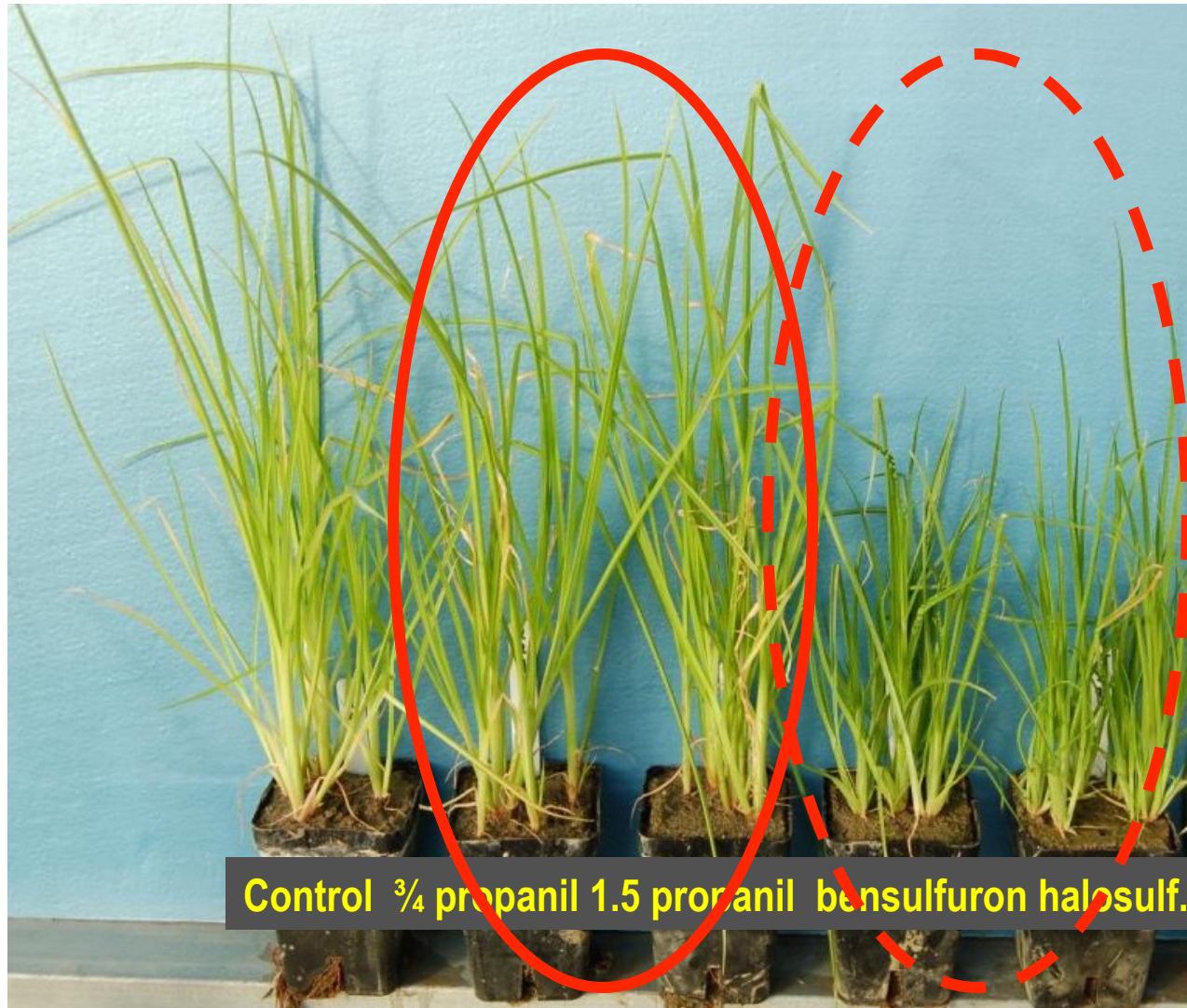
Weed Control in Rice 2014

Albert Fischer
Whitney Brim De Forest
Rafael Pedroso
Rocío Alarcón-Reverte

Resistance Testing 2013

		Resistance					
	No. Samples	Propanil	Londax	Cerano	Clincher	Granite GR	Regiment
Bulrush	2	1	0				
Smallflower	26	21	21			14	
Watergrass	11	8		0	7	8	8
Sprangletop	4			1	3		

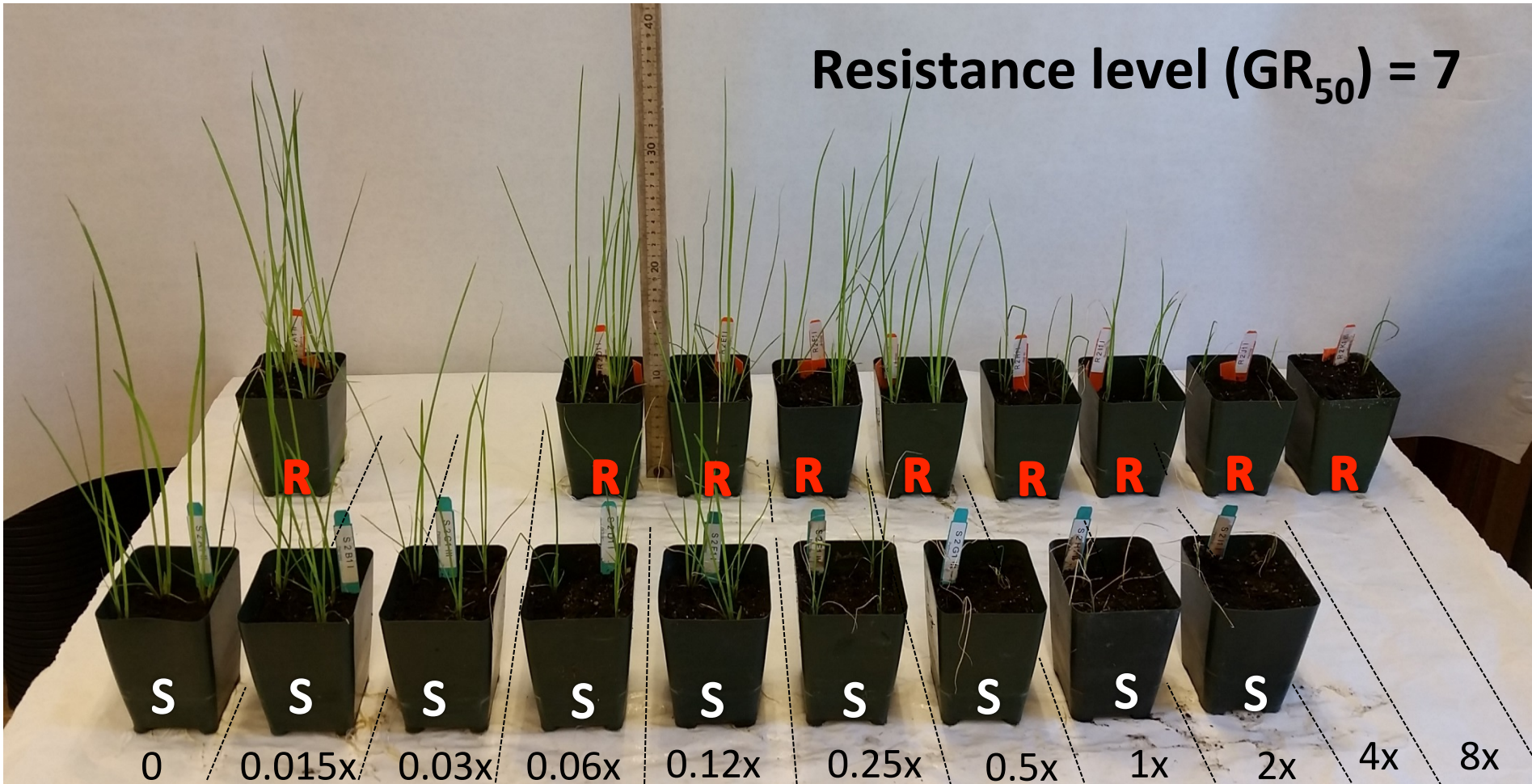
Londax and propanil resistance in Riecefieled bulrush

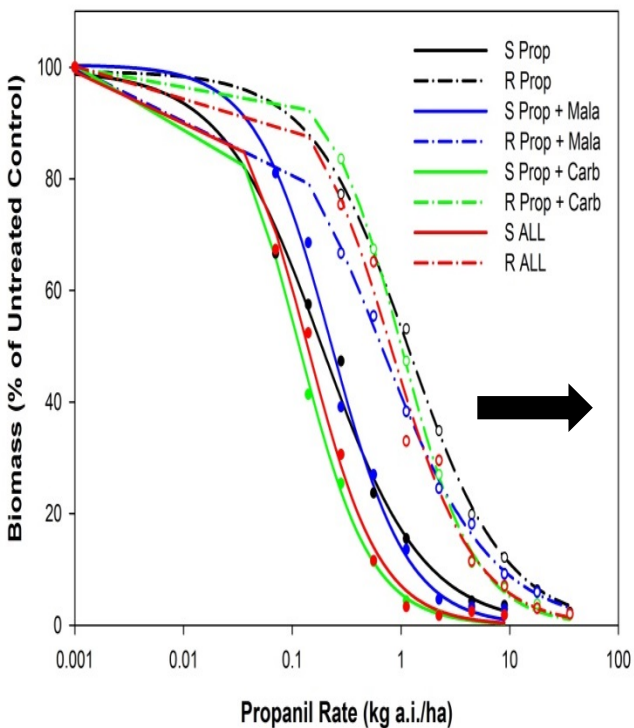


Control $\frac{3}{4}$ propanil 1.5 propanil bensulfuron halo sulf.

Dose-response to propanil

Rafael Pedroso





Biotype	Treatment	GR ₅₀ (kg a.i./ha)
R	propanil	1.1 ± 0.3
R	propanil + carbaryl	1.0 ± 0.2
R	propanil + malathion	0.7 ± 0.2

Resistance is not due to enhanced ability to detoxify propanil

psbA Gene Sequence: A mutation at the herbicide target in photosynthesis

201	GGT GTA GCT GGT GTA TTT GGC GGT TCC CTA	TTC	AGT GCT ATG CAT GGT TCT TTG	ATA	GTA ACC	220
	G V A G V F G G S L	F	S A M H G S L	V	I T	
221	TCT AGT TTG ATC AGG GAA ACC ACT GAAA AC GAATCT		GCT AAT GAG GGT TAC AGA TTC GGT			240
	S S L I R E T T E N E S A N E G Y R F G					
241	CAAGAGGAAGAACT TAC AAT ATC GTAGCT GCT CAT GGT TAT TTT		GGC CGA TTA ATC TTC			260
	Q E E E T Y N I V A A H G Y F G R L I F					
261	CAATAT GCT AGT TTC AAC AAT TCT CGT TCT TTA CAT TTC TTC		TTG	GCT GCT TGG CCT GTA		280
	Q Y A S F N N S R S L H F F	L	A A W P V			

PSII-Inhibitors Binding Region (Phe₂₁₁ to Leu₂₇₅)

Valine₂₁₉ to Isoleucine
(ATA in R plants)

Unlike rice and grasses, resistance relates to the MODE OF ACTION OF PROPANIL

1) Change Herbicide Mode of Action

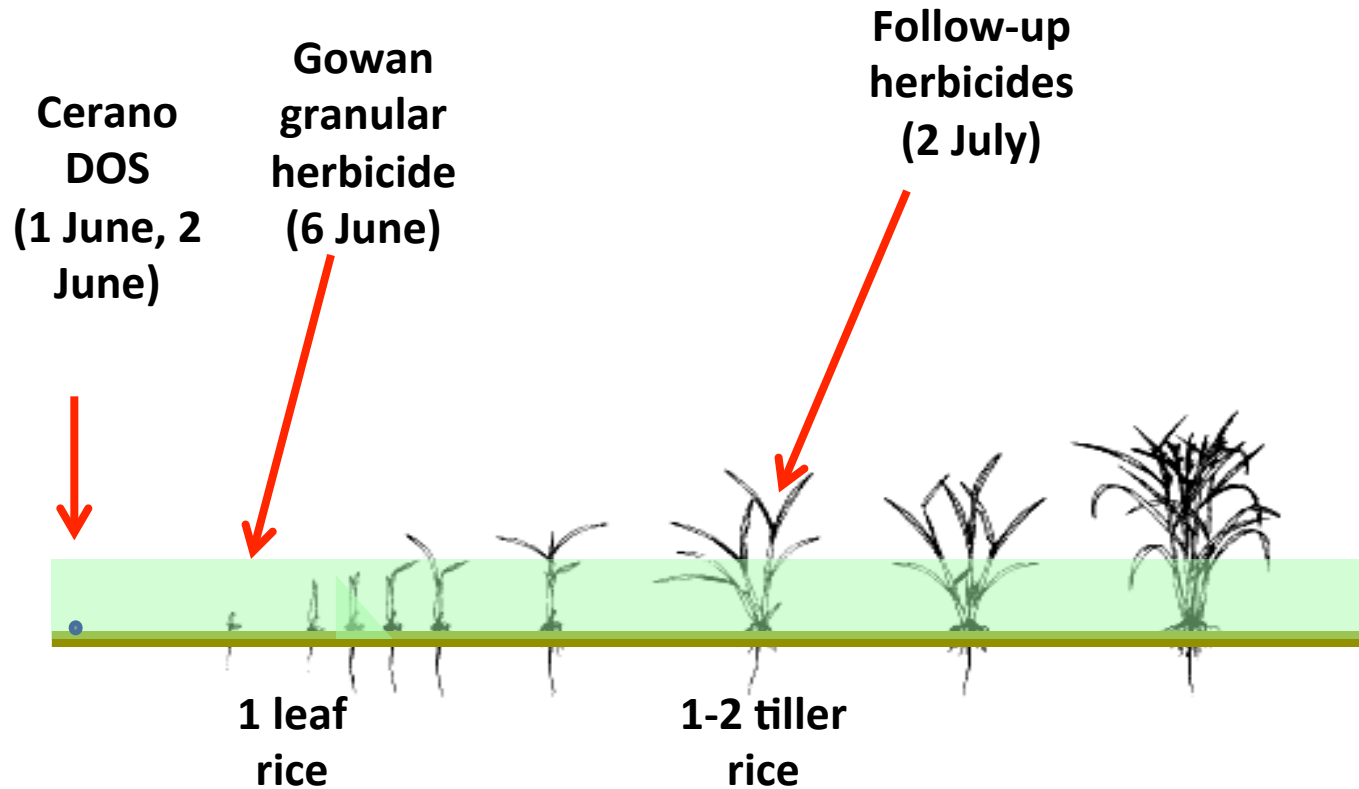
~~ALS-inhibitors~~ ~~Propanil (PSII)~~

Other herbicides still effective: **carfentrazone (& PPOs),
benzobicyclon, triclopyr (Grandstand)**

2) Resistance gene presumably maternally inherited

- Not carried by pollen: Spread by seed movement

Options of resistant sedges

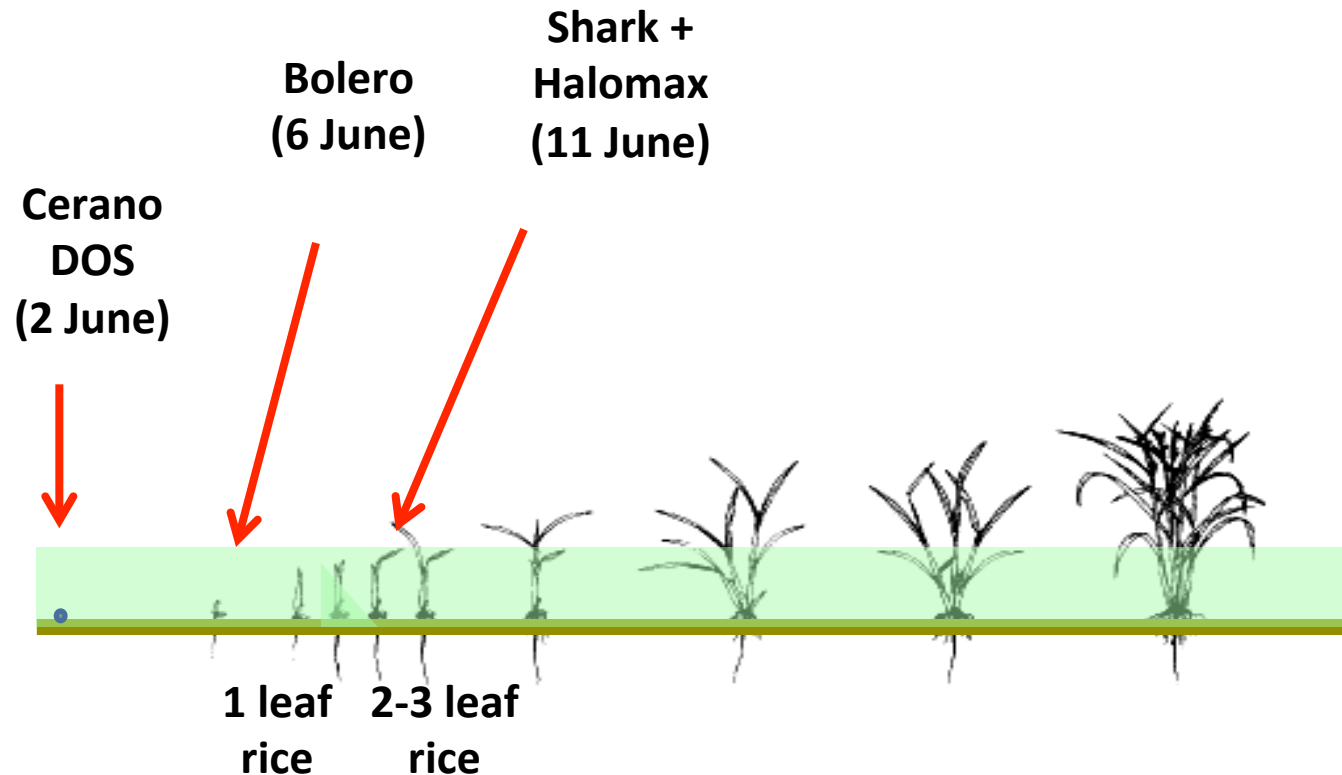


Gowan (Butte) granule in Continuous Flood

Treatment	Rate (product/acre)	WGR	BULRSH	SMLFLW	Yield (lb/A)
Weed Control (%) 10-July (40 DAS)					
Untreated (weed cover %)		32	10	2	2700
GWN-10380	7.5 lb	88	100	100	7700
GWN-10380 fb. SWham + Grdstd	7.5 lb fb. 6 qt + 8 oz	99	100	100	8700
GWN-10380 fb. Regiment	7.5 lb fb. 0.67 oz *	97	100	100	7600
GWN-10380 fb. Clincher	7.5 lb fb. 15 oz	97	100	100	8100
GWN-10380 fb. Granite SC	7.5 lb fb. 2.8 oz	98	100	100	8300
Cerano fb. GWN-10380	12 lb fb. 7.5 lb *	99	100	100	7700
LSD (P=0.05)					700

* Some damage to rice observed.

Options for Propanil-Resistant Sedges



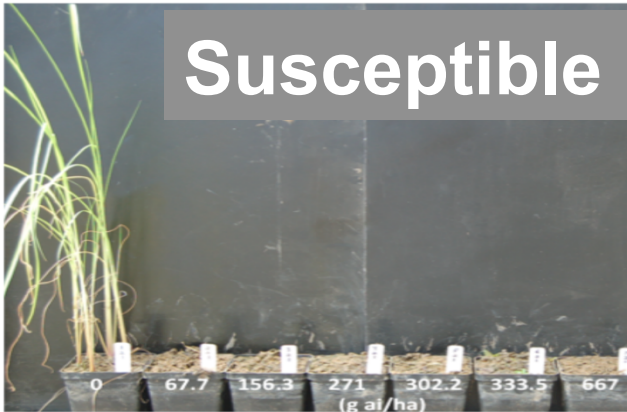
Options for Propanil-Resistant Sedges

Treatment		WGR	BULRSH	SMLFLW	DUCK	Yield (lb/A)
Weed Control (%) 10-July						
Untreated (Weed Cover %)		28	6	2	21	5400
Cerano fb. Halomax + Shark	10 lb fb. 1oz + 7oz	97	100	100	99	6000
Bolero fb. Halomax + Shark	23 lb fb. 1oz + 7oz	96	100	100	100	6600
LSD (P=0.05)						1700

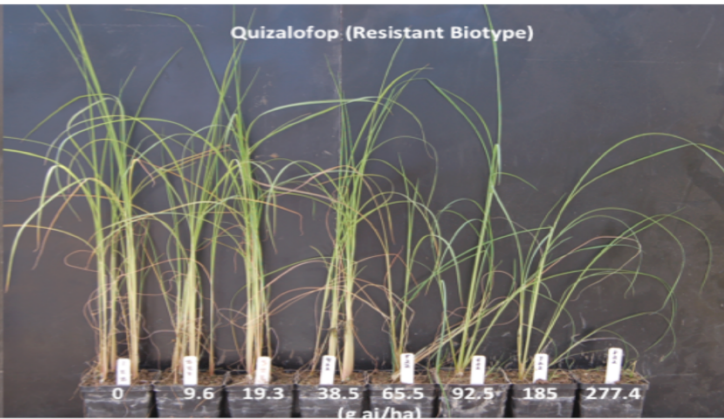
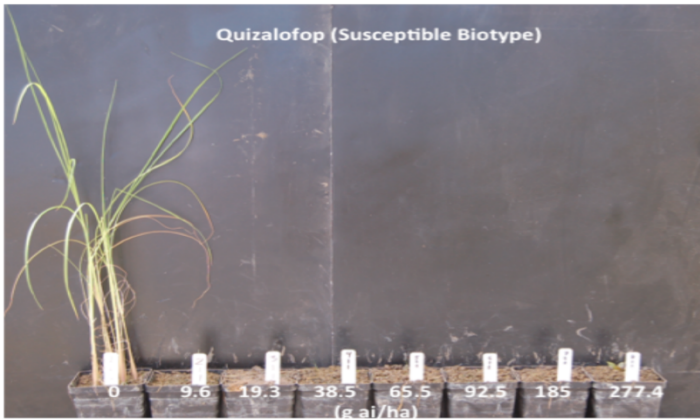
Resistance of *Leptochloa fusca* spp.
fasicularis (**sprangletop**) to
clomazone and ACCase inhibitors

Whitney Brim-DeForest,
Rocio Alarcón-Reverte,
Albert Fischer

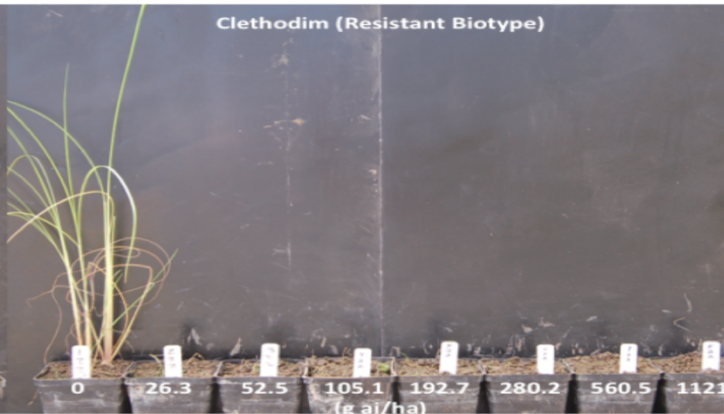
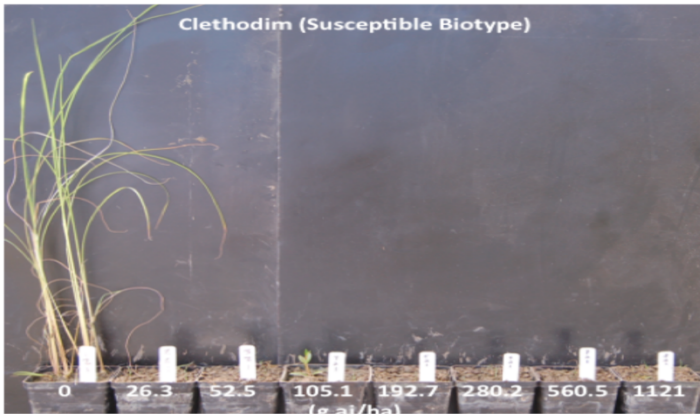
**Cyhalofop
(Clincher)**



Quizalofop



Clethodim



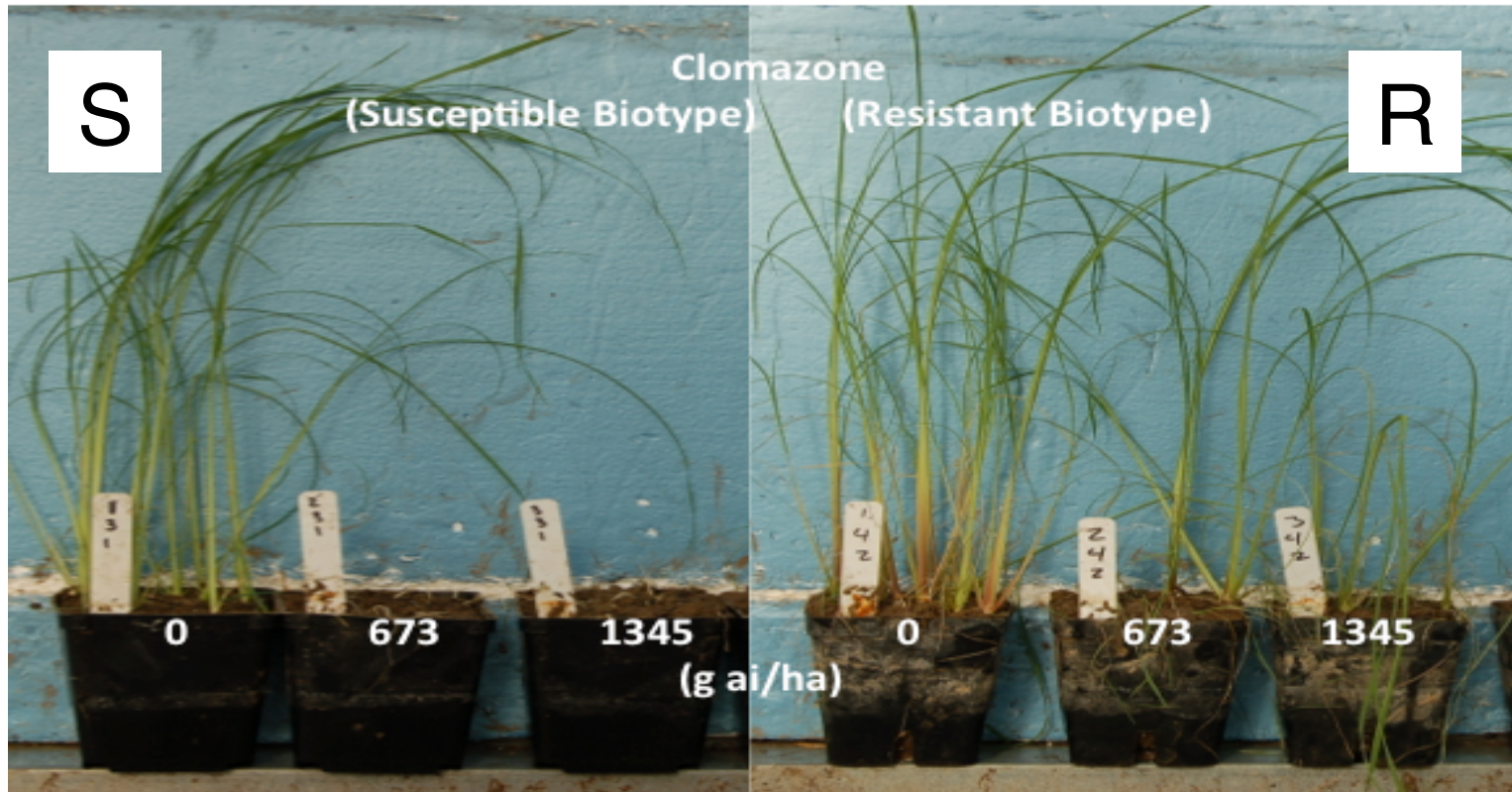
ACCase gene: Target-Site Mutation

F(S)	GGATTACCTTTGTTTATCCTTGCTAACTGGAGAGGCTTCTCTGGTGGACAAAGAGATCTG
	G L P L F I L A N W R G F S G G Q R D L
RI1	GGATTACCTTTGTTTATCCTTGCTAACTGTAGAGGCTTCTCTGGTGGACAAAGAGATCTG
	G L P L F I L A N C R G F S G G Q R D L

Trp2027Cys

Mutation associated with resistance to “fops”

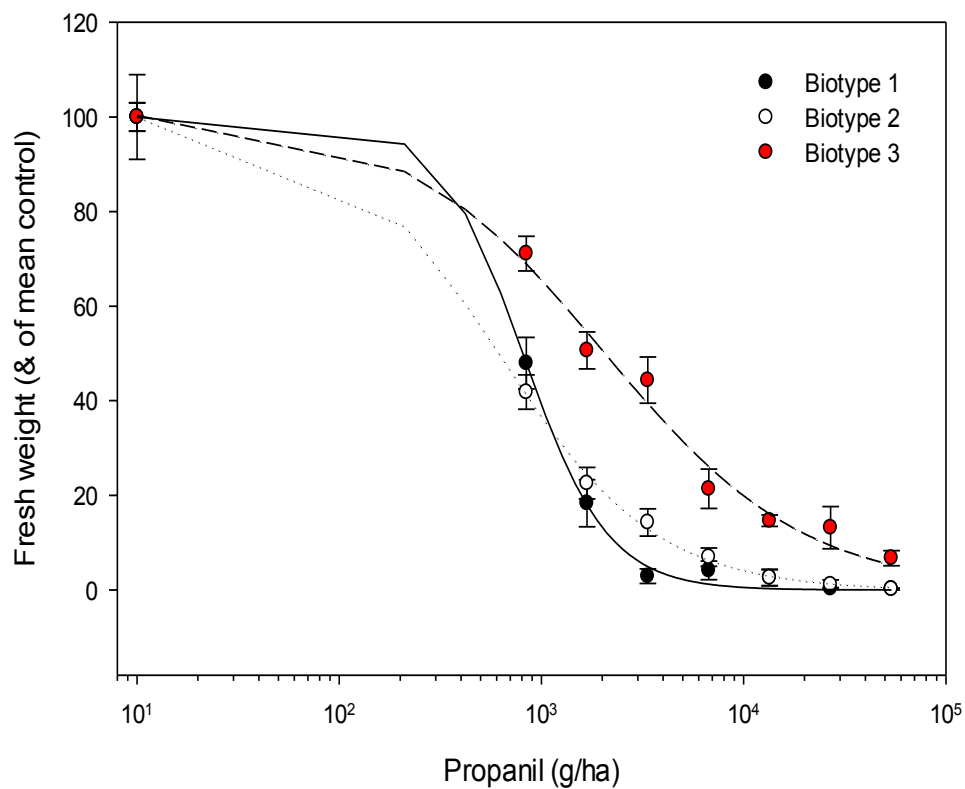
Cerano Resistance in Sprangletop



Options for resistant Sprangletop

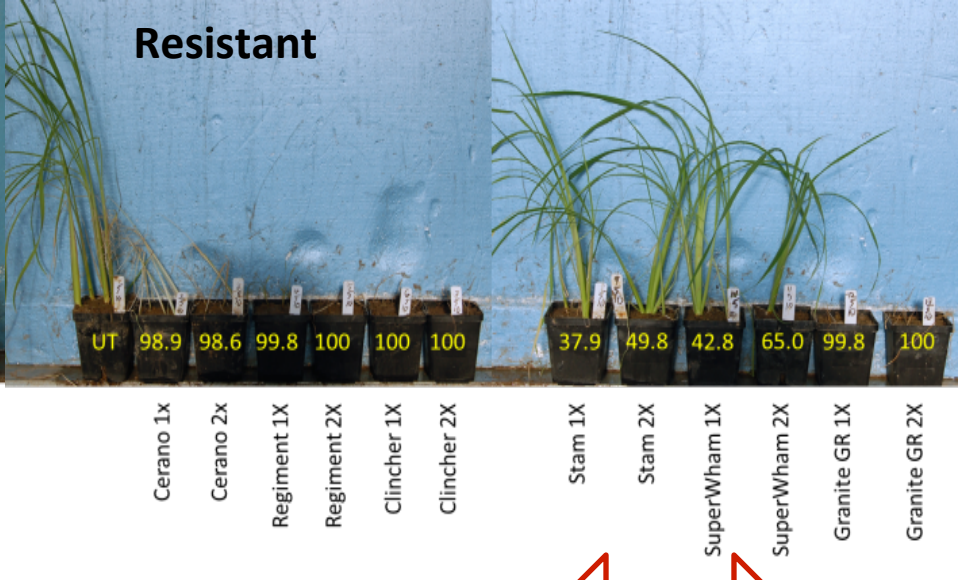
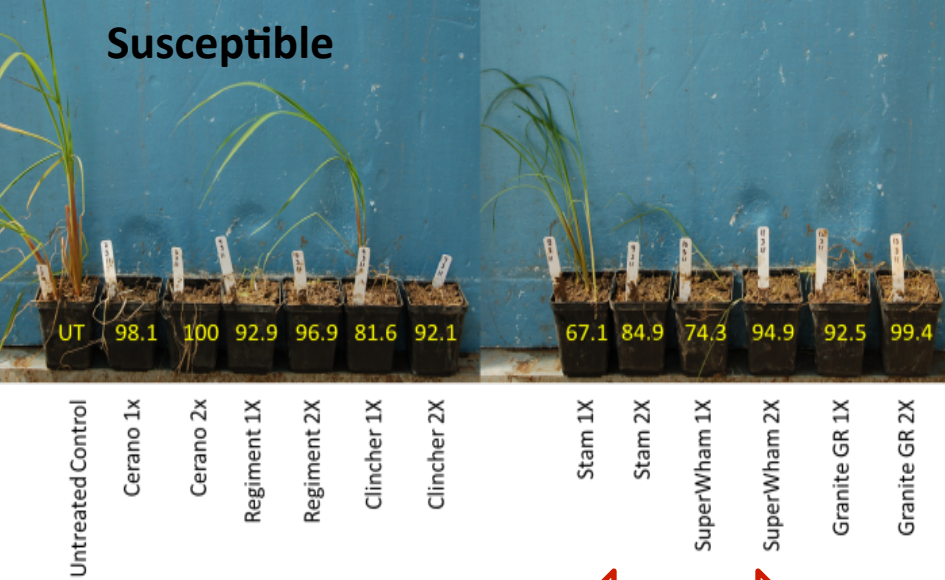
- Pendimethalin (Prowl)
- GWN-10380
- Abolish/Bolero

Late Watergrass resistance to propanil

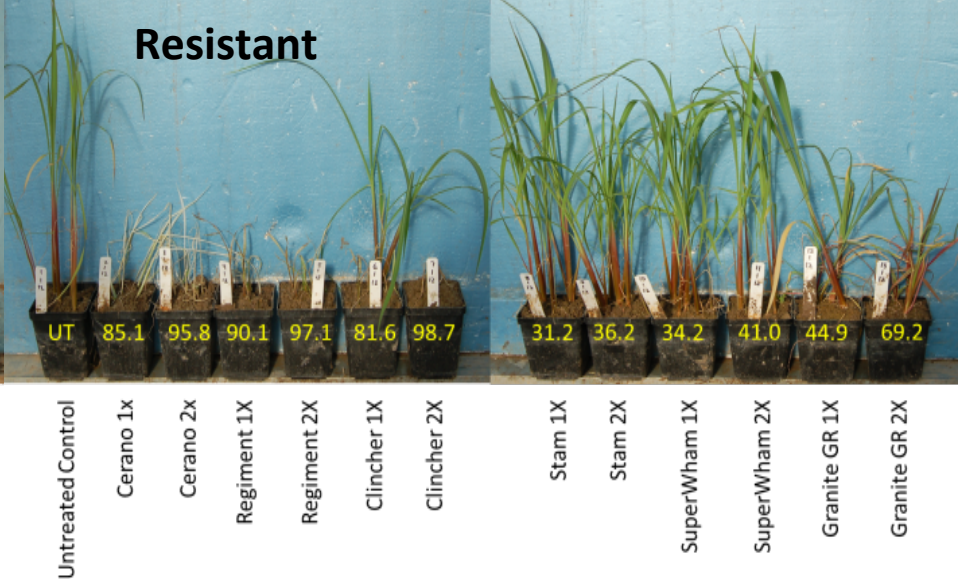
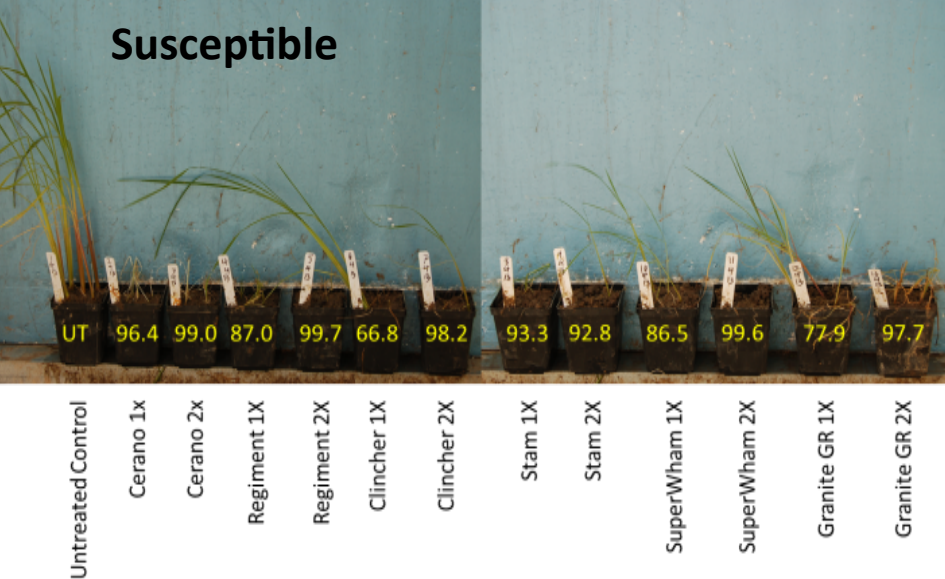


Biotype	ED50±95%CI (g/ha)	R/S
1	809.3	-
2	612	-
3	2051	3.4 (P<0.05)

Early watergrass



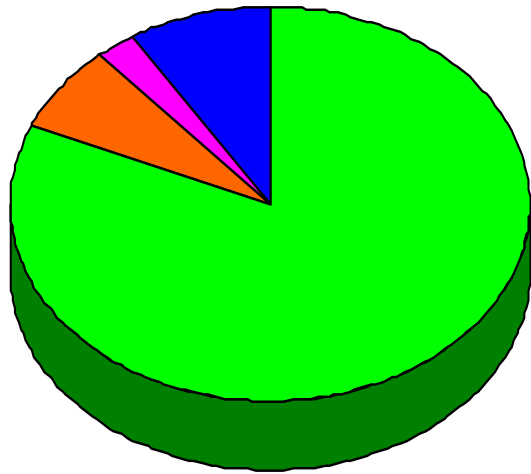
Barnyardgrass



propanil

propanil

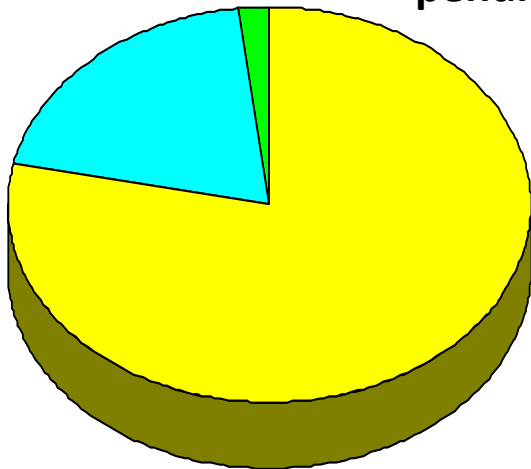
WATER SEEDED



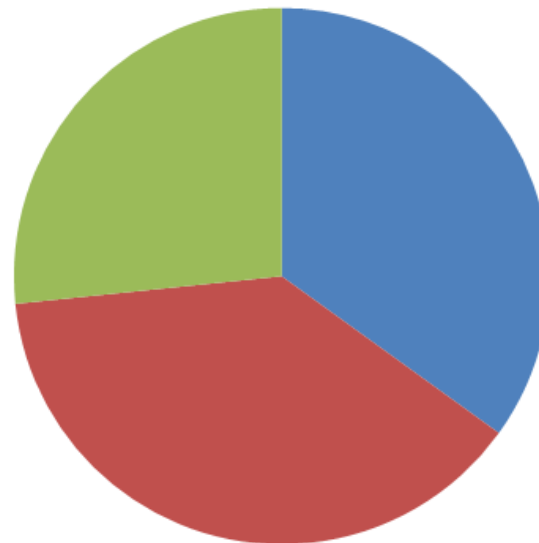
- Smallflower
- Ricefield bulr.
- Redstem
- Ducksalad
- Barnyardgrass
- Sprangletop

DRY SEEDED

pendimethalin

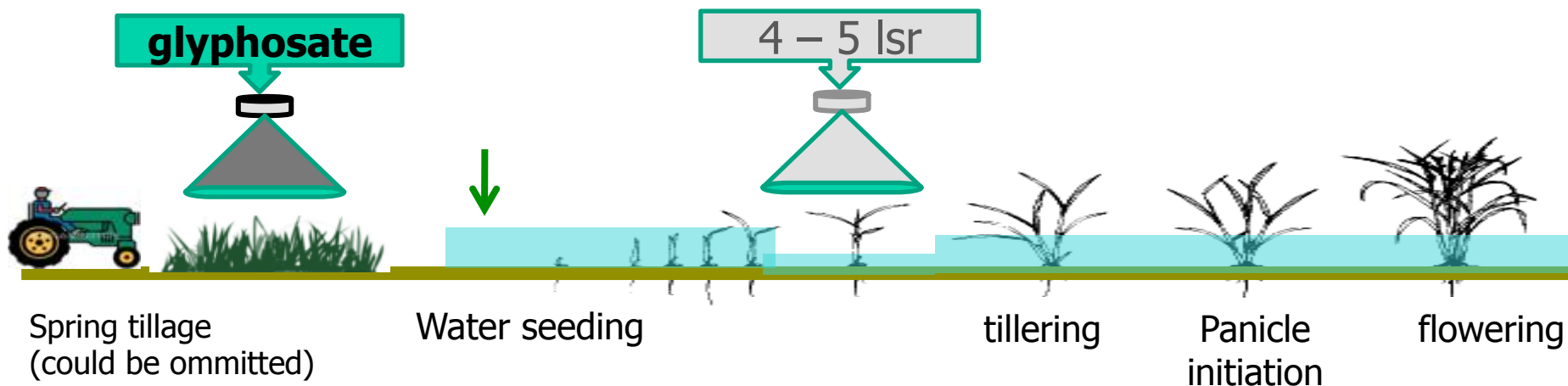


Late WG



- Continuous Flood
- Pin-Pt/Leathers
- Drill seeded

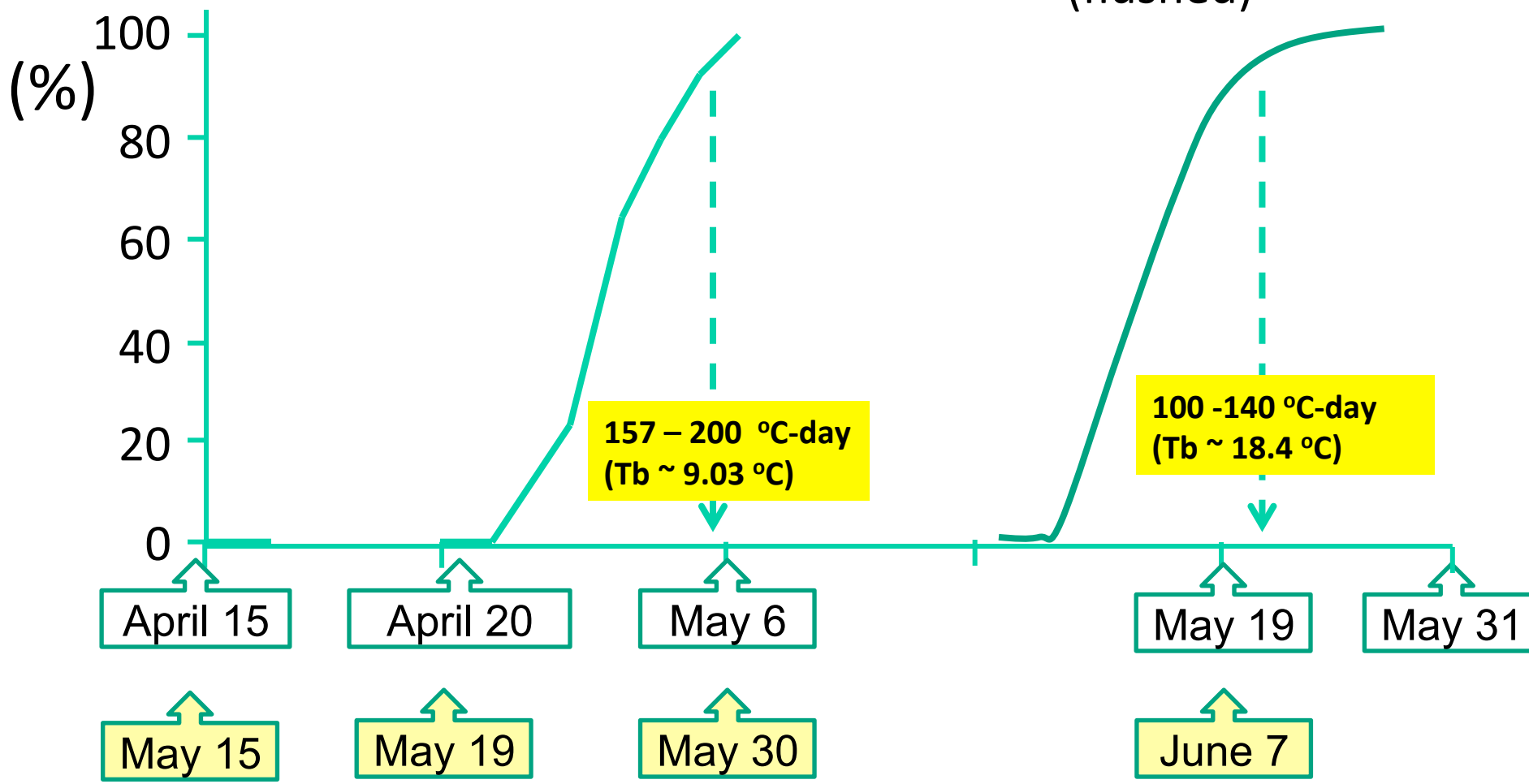
Stale seedbed control of multiple herbicide resistant late watergrass ("mimic")



Emergence

Late watergrass (and “mimic”)

*Smallflower
umbrellasedge
(flushed)*



Conclusions

Weeds have demonstrated they can evolve resistance to any herbicide

New herbicides will be difficult to come by: we must protect their use

✓ **...the more diversified weed control techniques are, the longer their usefulness will be**