Smallflower umbrellasedge resistance to propanil

Seed was collected from eight grower fields where resistance was suspected.

5 plants per pot with microwaved soil kept near saturation, 4 replications

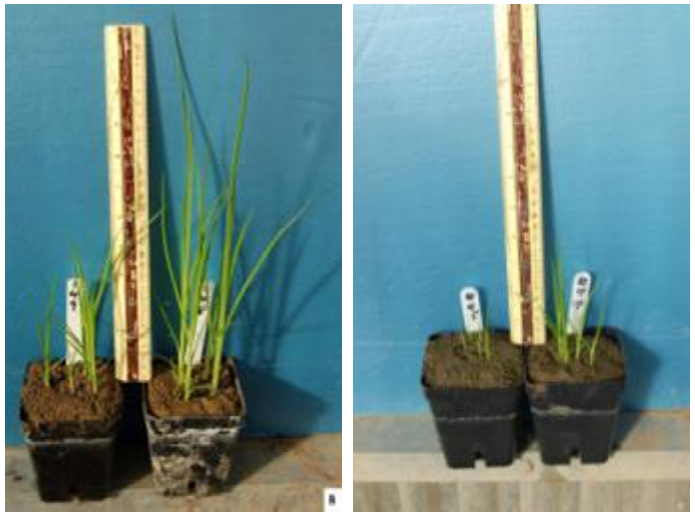
Herbicides:

- **SuperWham! CA**
- **Riceshot 48 EDF**
- **UltraStam 80 EDF**

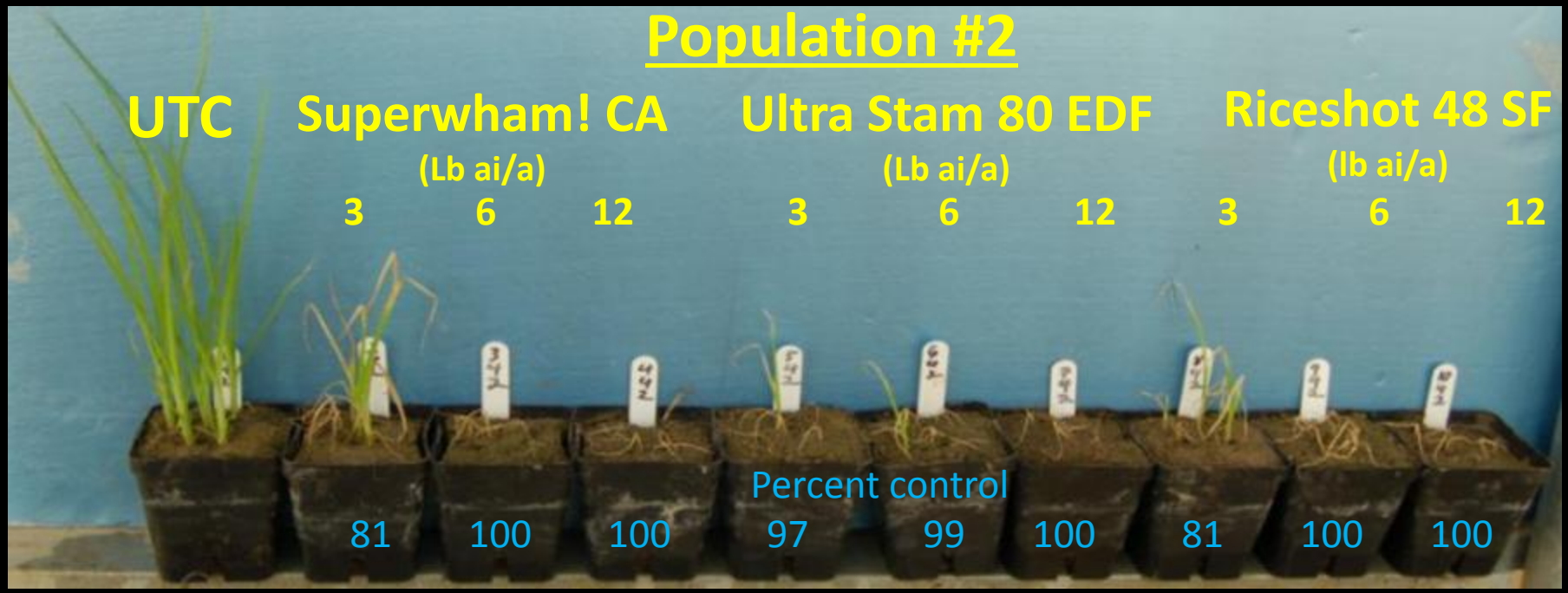
Rates: 3, 6, 12 lb ai/acre + 1.25% crop oil concentrate

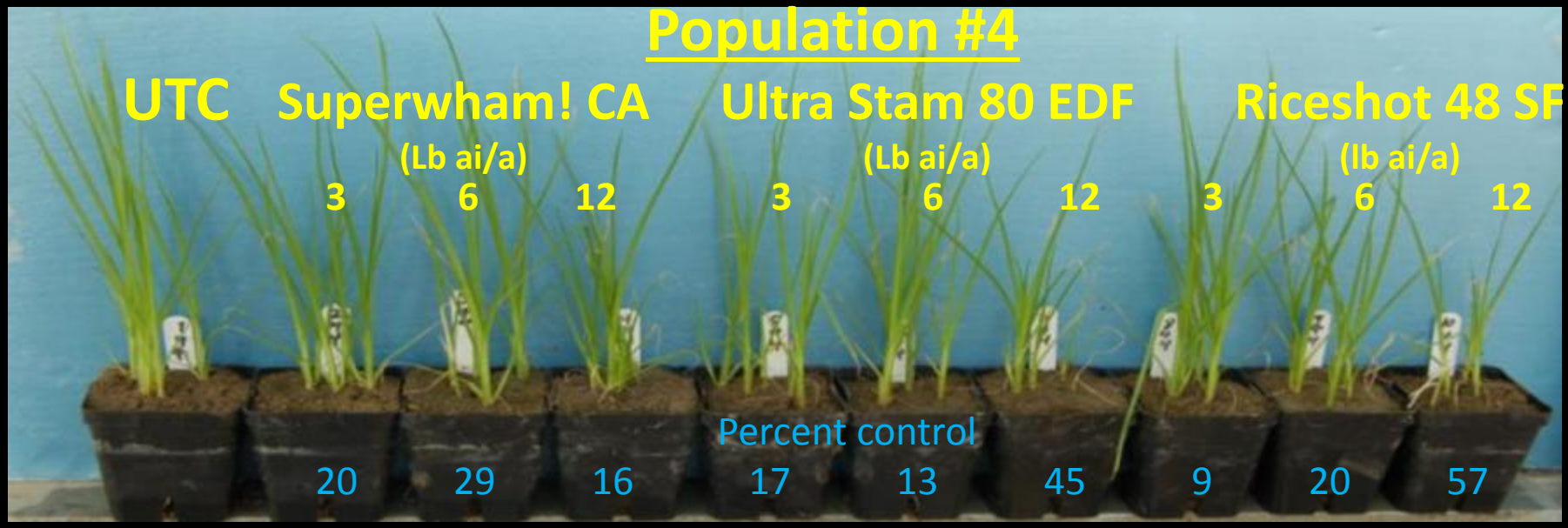
High spray coverage: 40 gallons/acre with 8001-EVS nozzle

Fresh weight 17 DAT; percent control



4-5 leaf stage and **1 in** tall


Population #2
UTC
Superwham! CA
(Lb ai/a)
3
6
12
Ultra Stam 80 EDF
(Lb ai/a)
3
6
12
Riceshot 48 SF
(lb ai/a)
3
6
12
Percent control
81
100
100
97
99
100
81
100
100


Population #4
UTC
Superwham! CA
(Lb ai/a)
3
6
12
Ultra Stam 80 EDF
(Lb ai/a)
3
6
12
Riceshot 48 SF
(lb ai/a)
3
6
12
Percent control
20
29
16
17
13
45
9
20
57

Smallflower umbrella sedge: efficacy of propanil formulations

Table 2. Control of smallflower umbrellasedge with three different propanil formulations (Superwham! CA, Ultra Stam 80 EDF, and Riceshot 48 SF). Data (expressed as percent of the untreated control) are averages across three herbicide rates (0.5X, 1X, and 2X; for X = 6 lb propanil/acre)

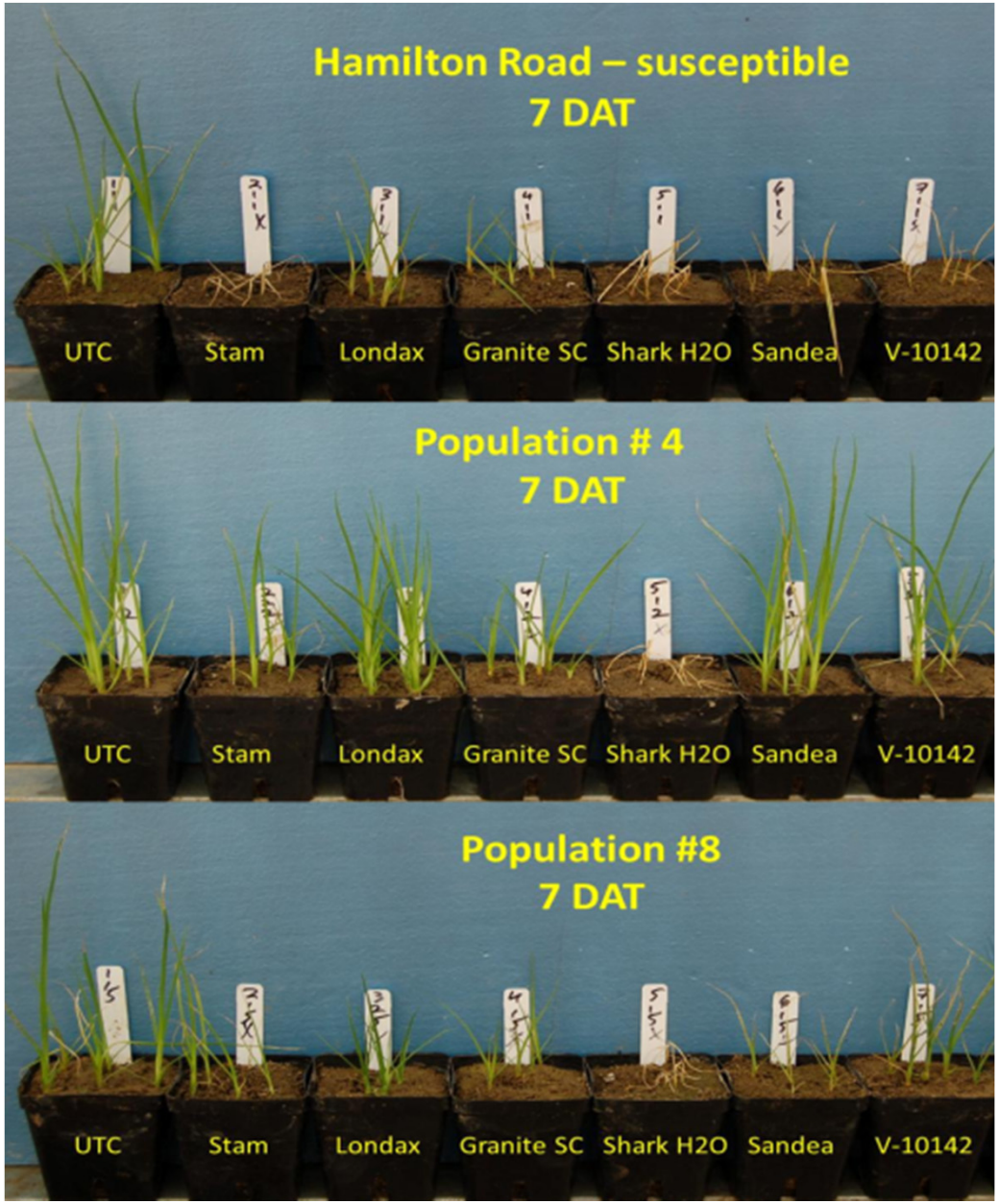
Propanil formulation	Weed Control
	-------(%)-------
Riceshot 48 SF	48 A[1]
Superwham! CA	46 A
Ultra Stam 80 EDF	33 B

[1.] Values followed by the same letter are not statistically different according to Tukey's HSD; P = 0.05.

Smallflower cross- resistance testing

Foliar applied Herbicides:

1. Untreated control
2. Stam – 6726 g ai/ha
3. Londax – 70g ai/ha
4. Granite SC – 35g ai/ha
5. Shark H2O – 224g ai/ha
6. Sandea – 52.5g ai/ha
7. V-10142 – 336g ai/ha



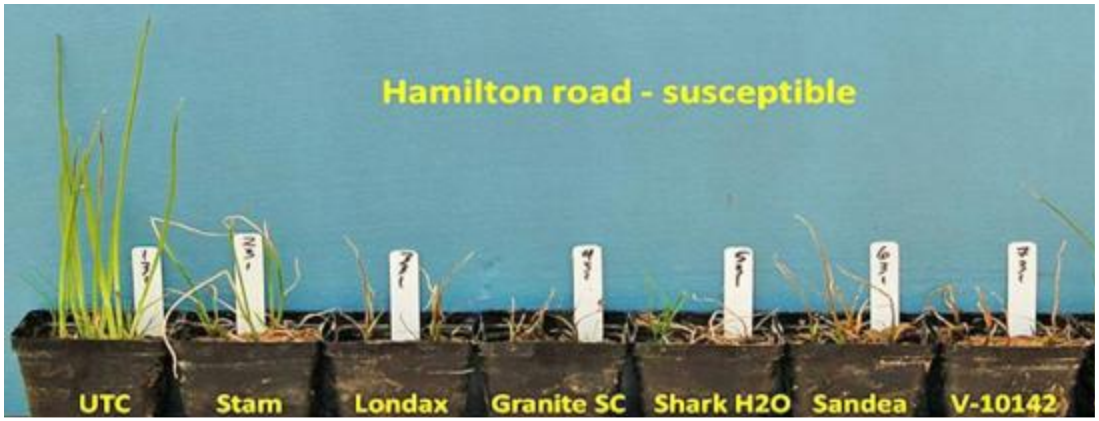
Smallflower cross- resistance testing

Herbicide	Susceptible (HR)	Pop. #4	Pop. #3	Pop. #6	Pop. #8
	---------- %Control ----------				
Stam	**99** a	**7** cdef	**26** bcdef	**63** abcdef	**37** abcdef
Londax	**95** a	**0** f	**0** f	**46** abcdef	**64** abcdef
Granite SC	**98** a	**78** abcdef	**79** abc	**85** ab	**86** ab
Shark	**100** a	**100** a	**100** a	**100** a	**100** a
Sandea	**95** a	**46** abcdef	**16** bcdef	**88** ab	**97** a
Imazosulf.	**100** a	**14** bcdef	**68** abcde	**73** abcd	**95** a

=Resistant

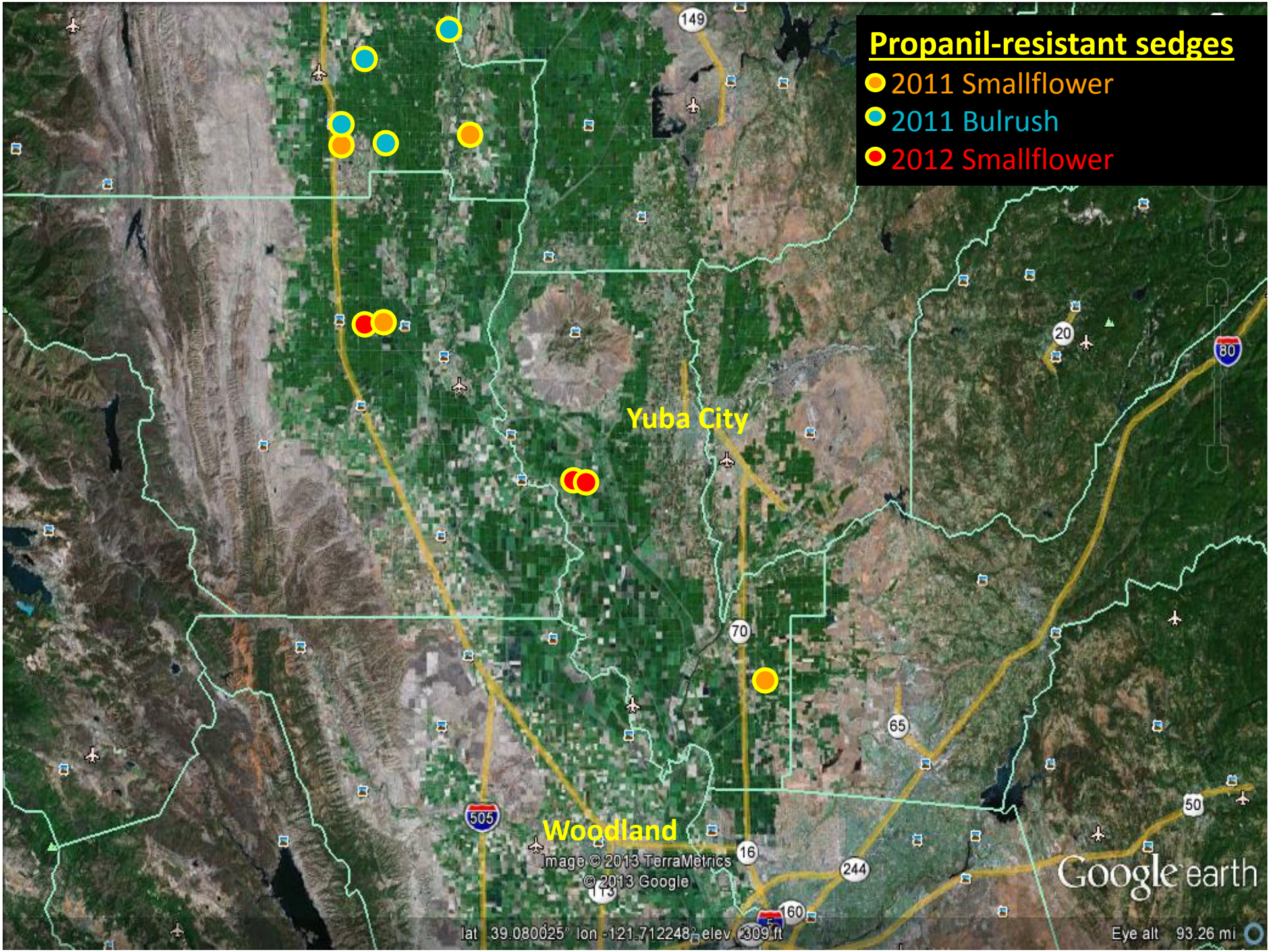
=moderately R

Riecefield bulrush propanil resistance & cross-resistance



Riecefield bulrush propanil resistance & cross-resistance

	Population#						
	S		3	4	6	5	7
Stam	71 ABCD	AB	61 BCDE	68 ABCD	82 ABC	25 EFG	12 GH
Londax	100 A	AB	13 FGH	14 FGH	68 ABCD	67 ABCD	42 DEFG
Granite	100 A	A	82 ABC	98 A	100 A	98 A	98 AB
Shark	100 A	A	100 A	100 A	100 A	100 A	100 A
Sandea	100 A	A	48 CDEFG	50 CDEF	100 A	100 A	100 A
Imazosulf.	100 A	A	100 H	12 GH	100 A	99 A	93 AB


Propanil-resistant sedges
2011 Smallflower
2011 Bulrush
2012 Smallflower
Yuba City
Woodland
Image © 2013 TerraMetrics
© 2013 Google
Google earth
lat 39.080025° lon -121.712248 elev 309 ft
Eye alt 93.26 mi

Resistant Weed Testing

Seed species:_____

Identification:

Date:_____

Submittee Name:_____Phone #:_____

Grower Name:_____Phone #:_____

Address:_____

Site Location:

GPS coordinates (if available):_____

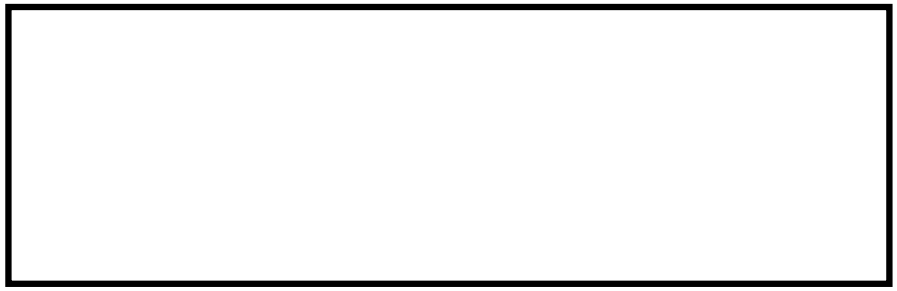
Township, Section, Range:_____

Nearest road and cross road:_____

Field number (grower identification):_____

County: _____

Please draw a brief map of field with location of sampling



Field history:

When was resistance suspected at this site?_____

What % of farm is suspected to be resistant?_____

Size of farm?_____

Acreage of each area sampled:_____

Herbicides for which resistance is suspected:_____

Herbicides used in past: _____

Herbicides used this season (also, application rate and method):_____

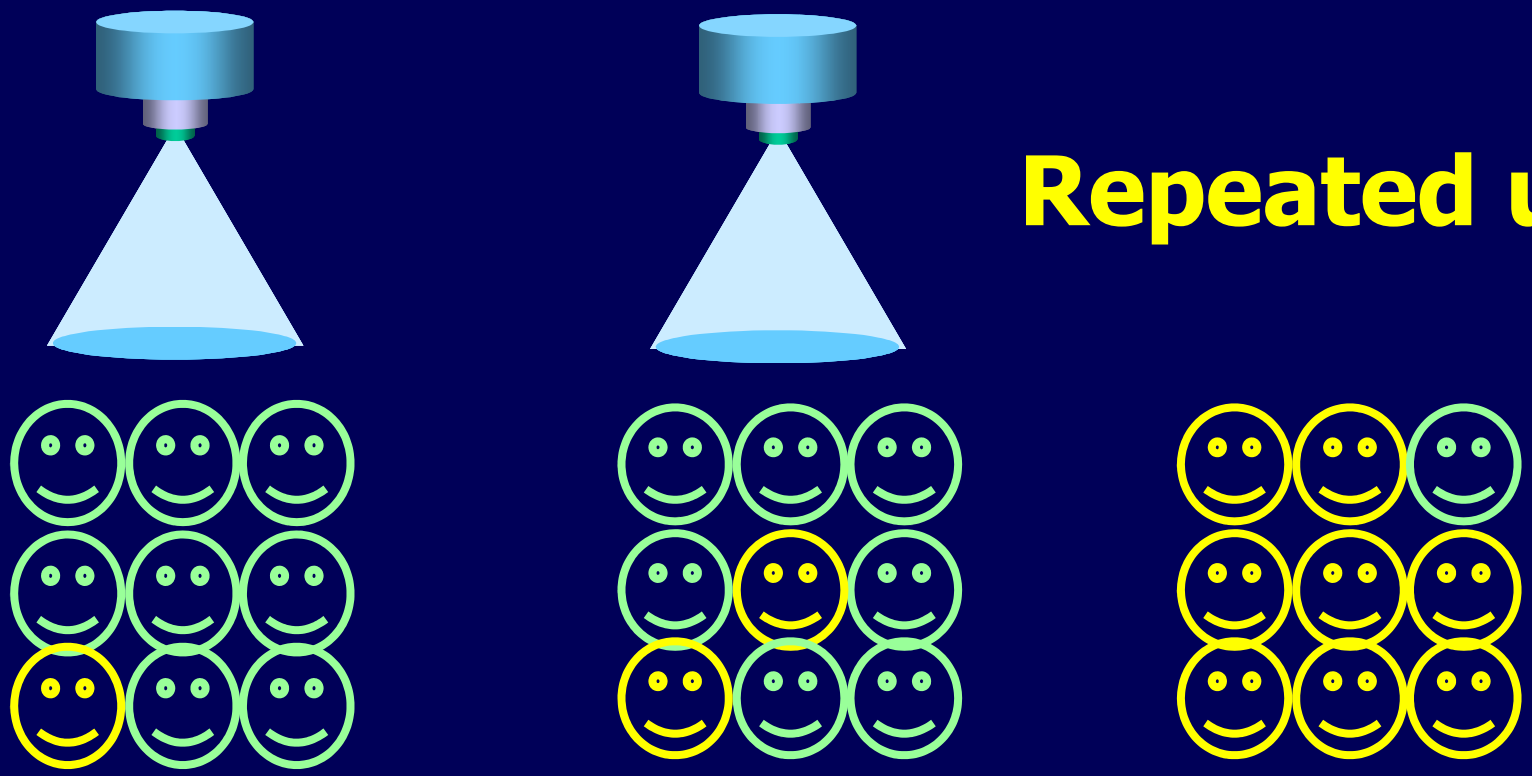
Water management at this site:

Source of water: Pump_____Canal_____Both_____

Irrigation management: Continuous flood_____Pinpoint_____ Leathers' method_____

Was your water compromised or lost at any time of the season? Yes____No____

Resistance: a Selection process



Repeated use

Random mutant

Resistance is a decision by the user, not by the herbicide


UTC
¾ Stam
1½ Stam


UTC
¾ Stam
1½ Stam

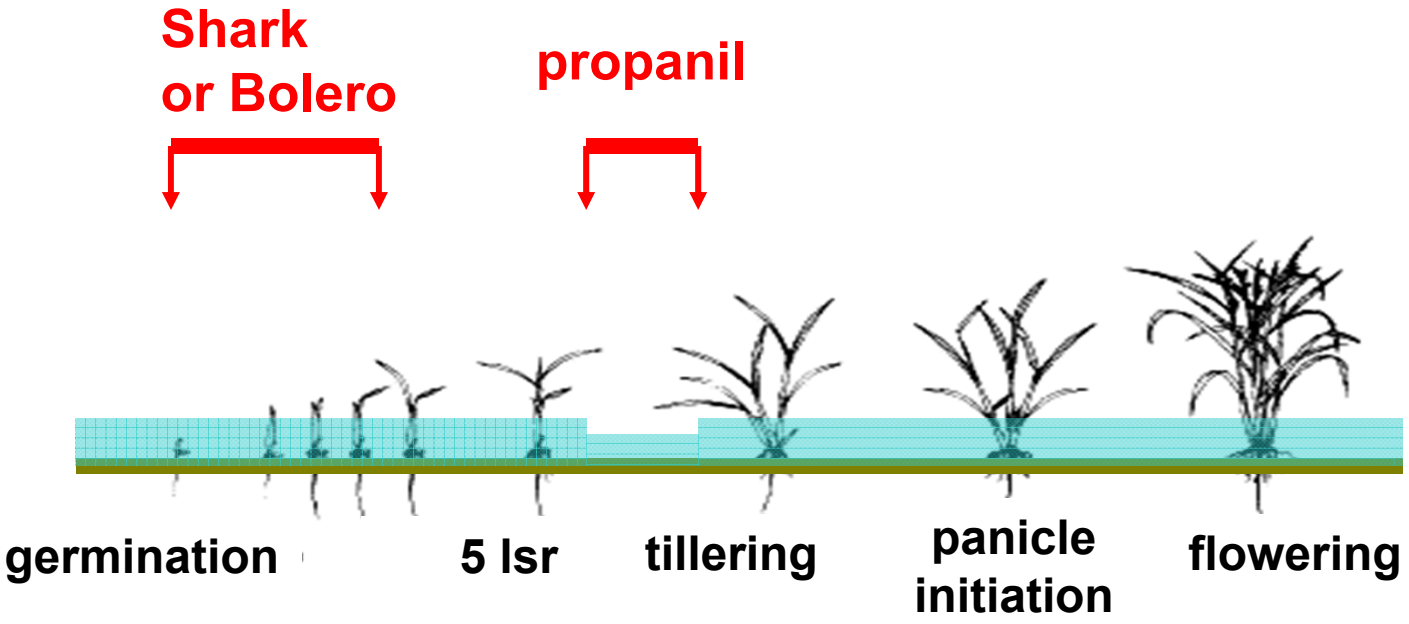
Management

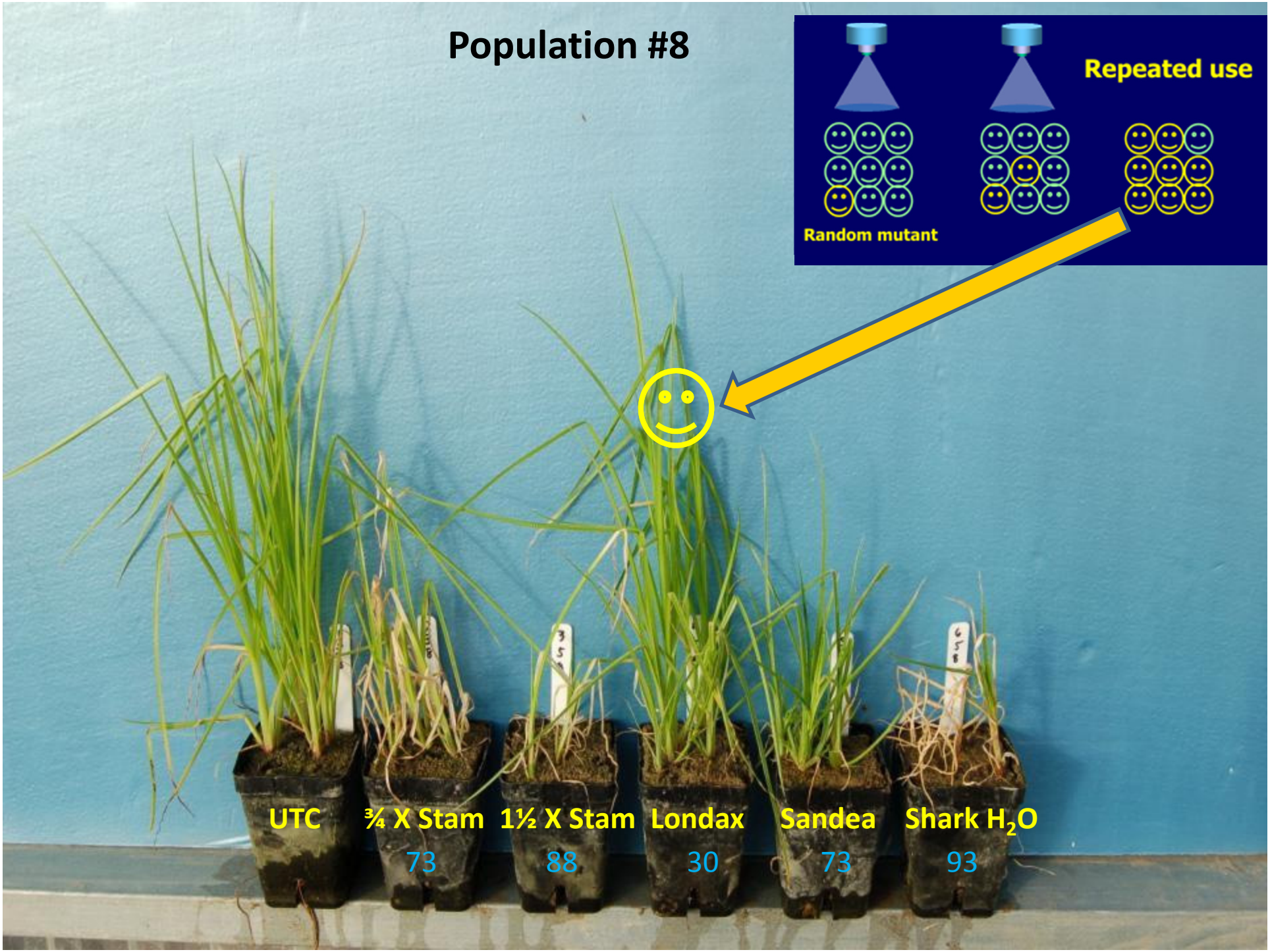
Herbicide use

- Avoid repeated use of herbicides with the same mechanism of action (MOA)
- Use different MOAs effective on same weeds

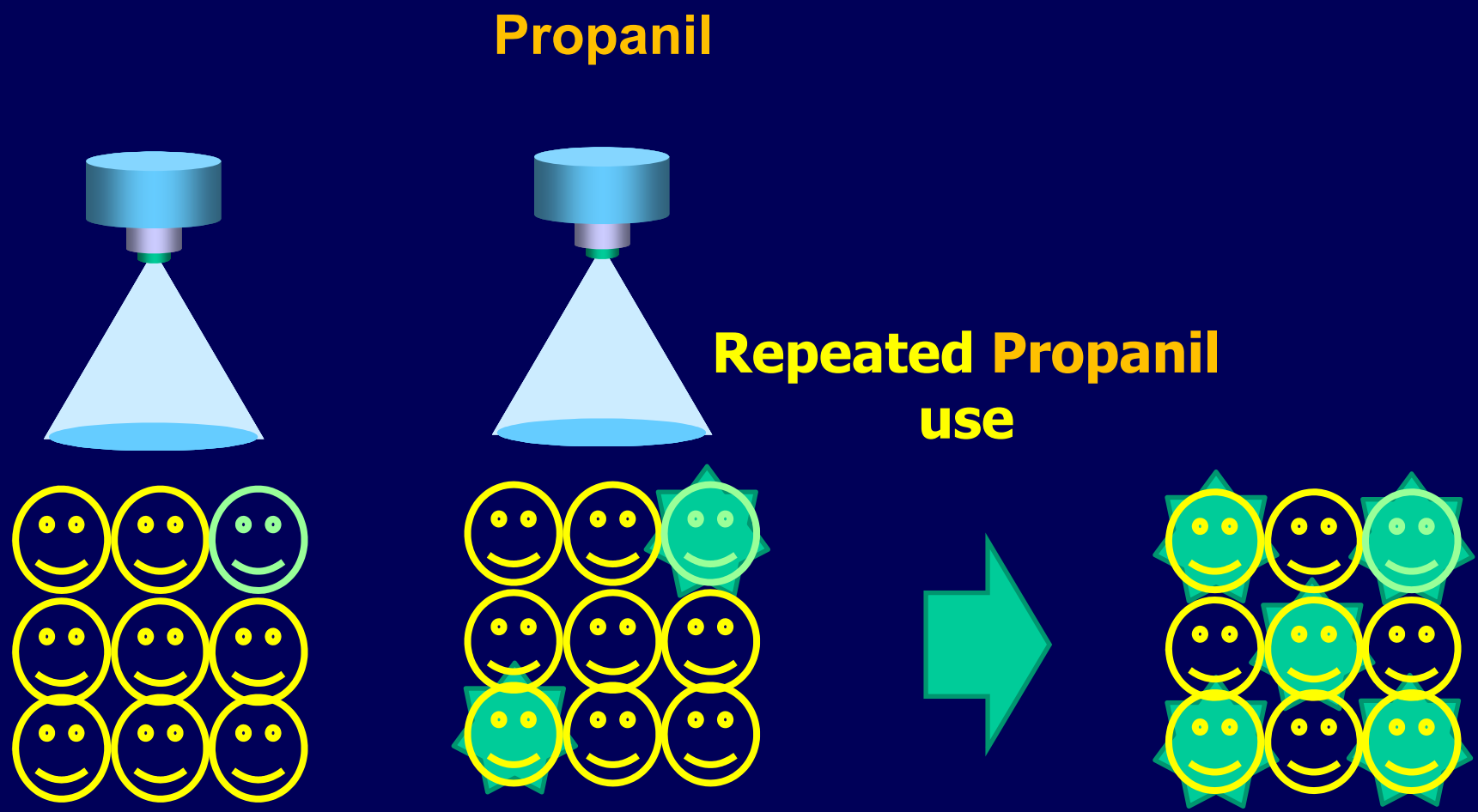
  mixtures & sequences
- Avoid low rates: Use **labeled rates and**

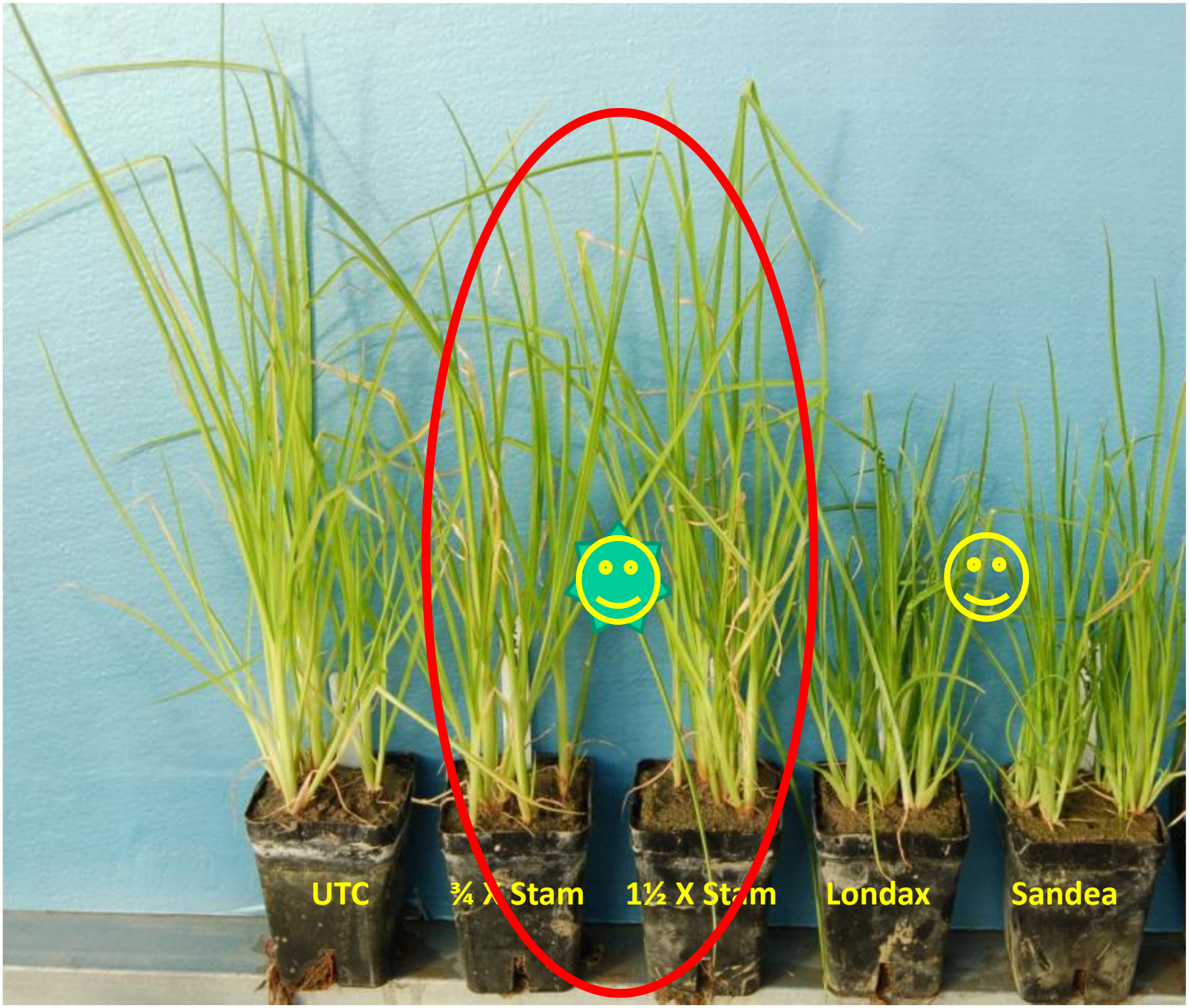
  change to herbicides of different MOA

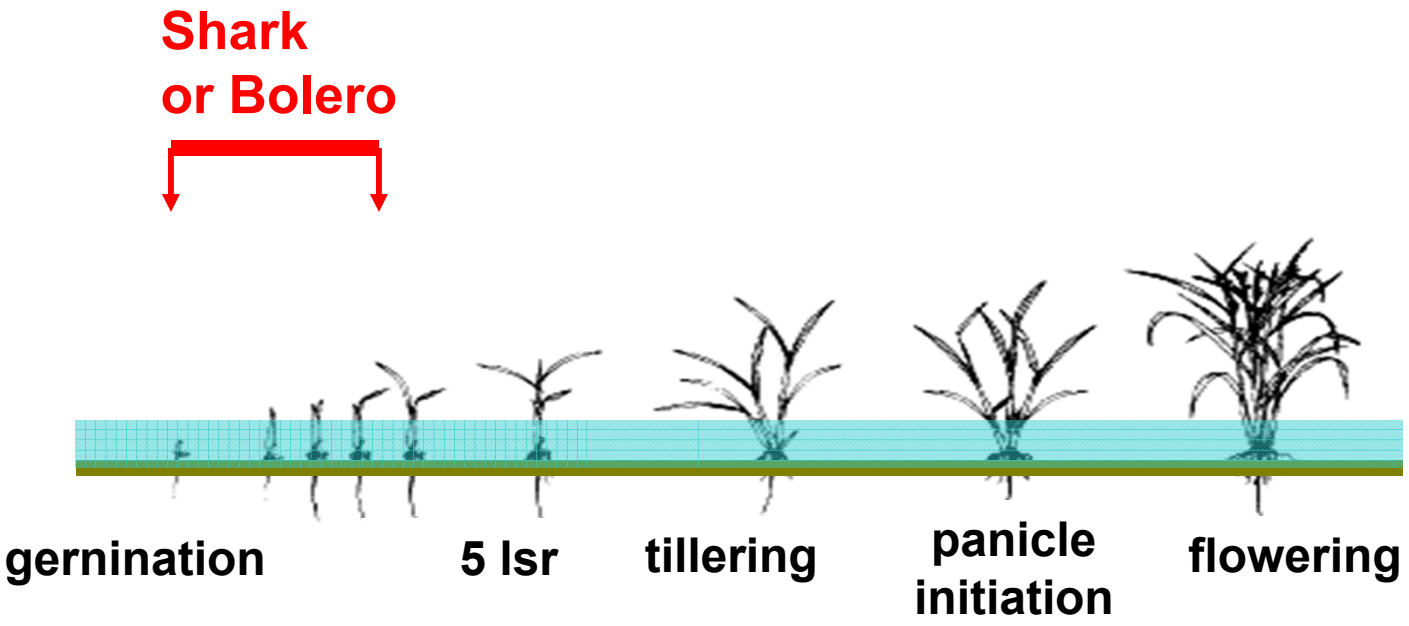

Shark
or Bolero
propanil
germination
5 lsr
tillering
panicle
initiation
flowering

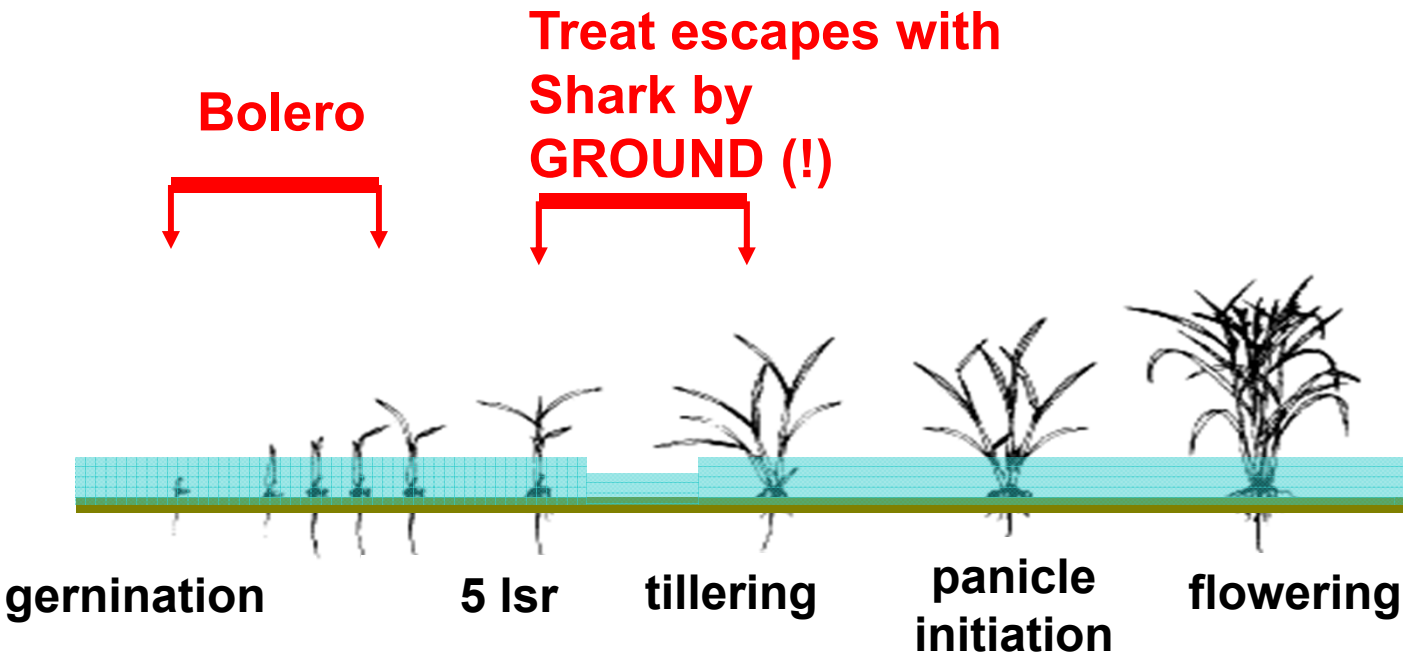

Population #8
Repeated use
Random mutant
UTC
¾ X Stam
73
1½ X Stam
88
Londax
30
Sandea
73
Shark H_2O
93

Resistance: a Selection process




UTC
¾ X Stam
1½ X Stam
Londax
Sandea


Shark
or Bolero
gernination
5 lsr
tillering
panicle
initiation
flowering

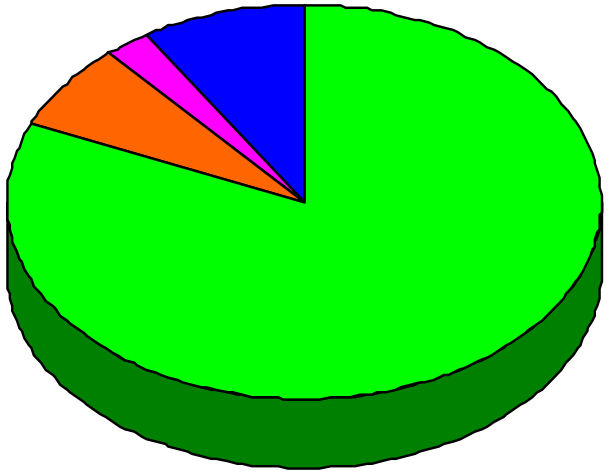

Bolero
Treat escapes with Shark by GROUND (!)
gernination
5 lsr
tillering
panicle initiation
flowering

Management

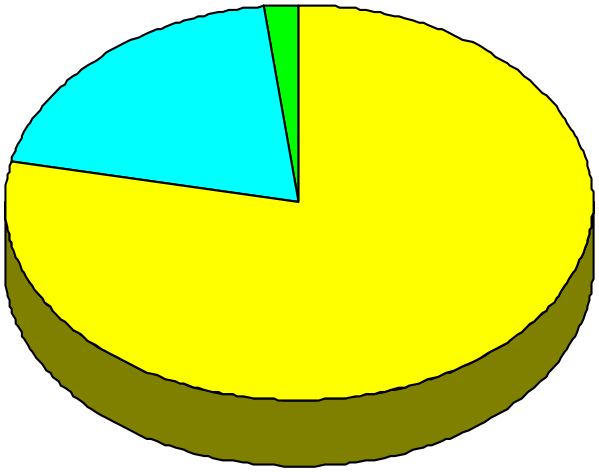
- ✓ Maintain low weed infestations
- ✓ Control all weed escapes & late-season flushes
- ✓ Harvest affected checks last
- ✓ Diversify control techniques:
  - Use *many little hammers* rather than just one

2004 - 2006

WATER SEEDING



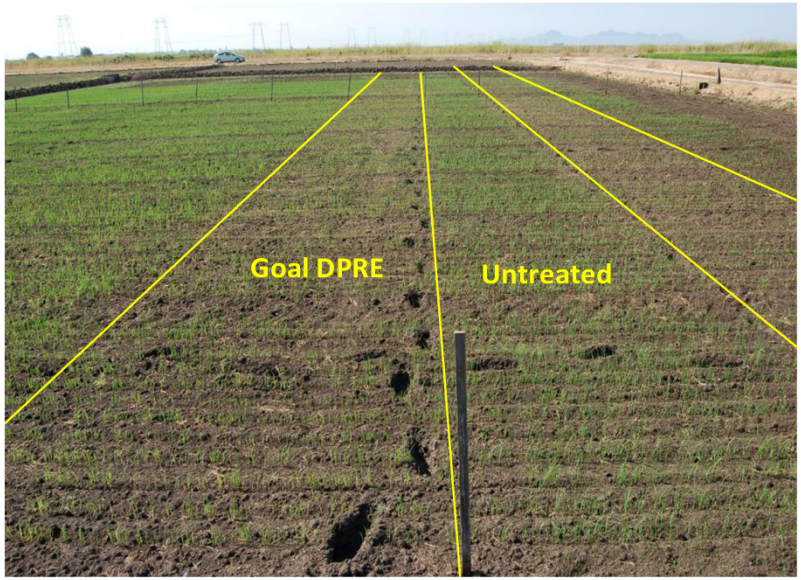
DRY SEEDING

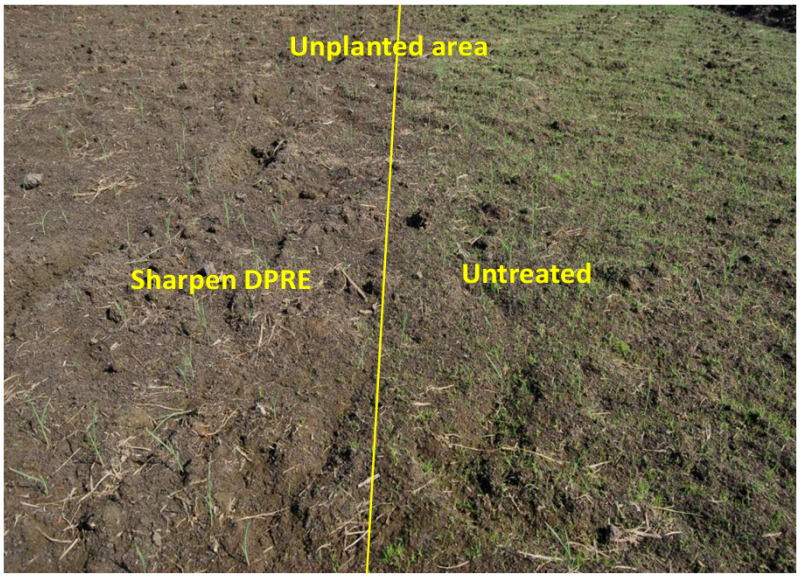


- *Smallflower*
- *Rfld. bulrush*
- *Redstem.*
- *Ducksalad*
- *Barnyardgrass*
- *Sprangletop*

Goal (oxyfluorfen) and Sharpen (saflufenacil) in drill-seeded rice

- Rice drilled; water -flushed, then allowed to drain.
- Goal and Sharpen applied after rice imbibition & prior to rice emergence.

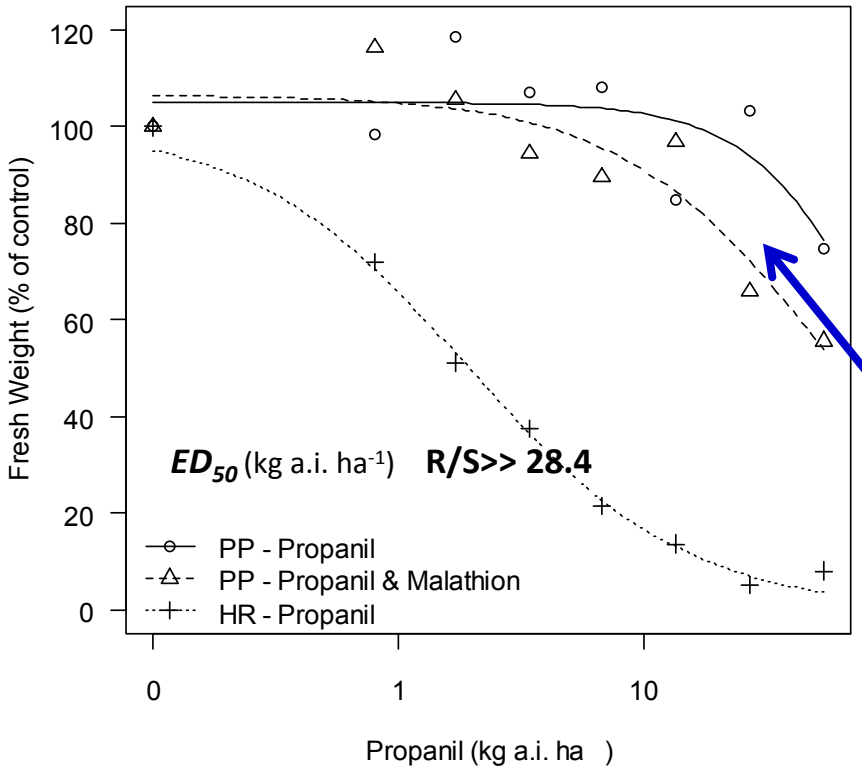


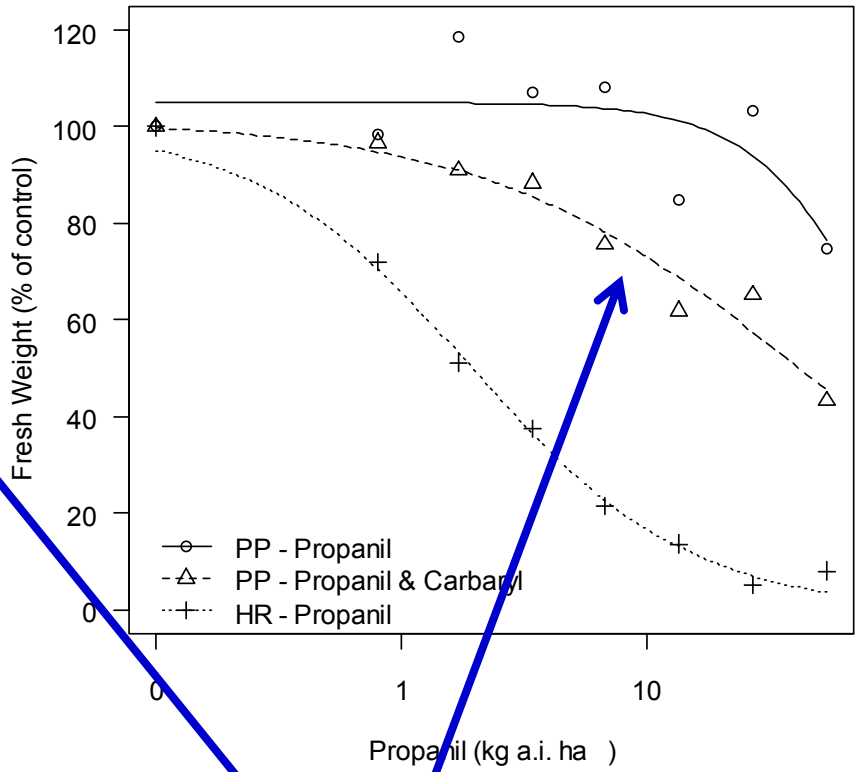


Later evaluation of weeds

	Mean plants per ft^2				
	Watergrass	Bulrlush	Smallflower	ducksalad	waterhyssop
Untreated	10	15	12	10	0
Goal	5	32	4	3	3
Sharpen	4	2	3	2	1

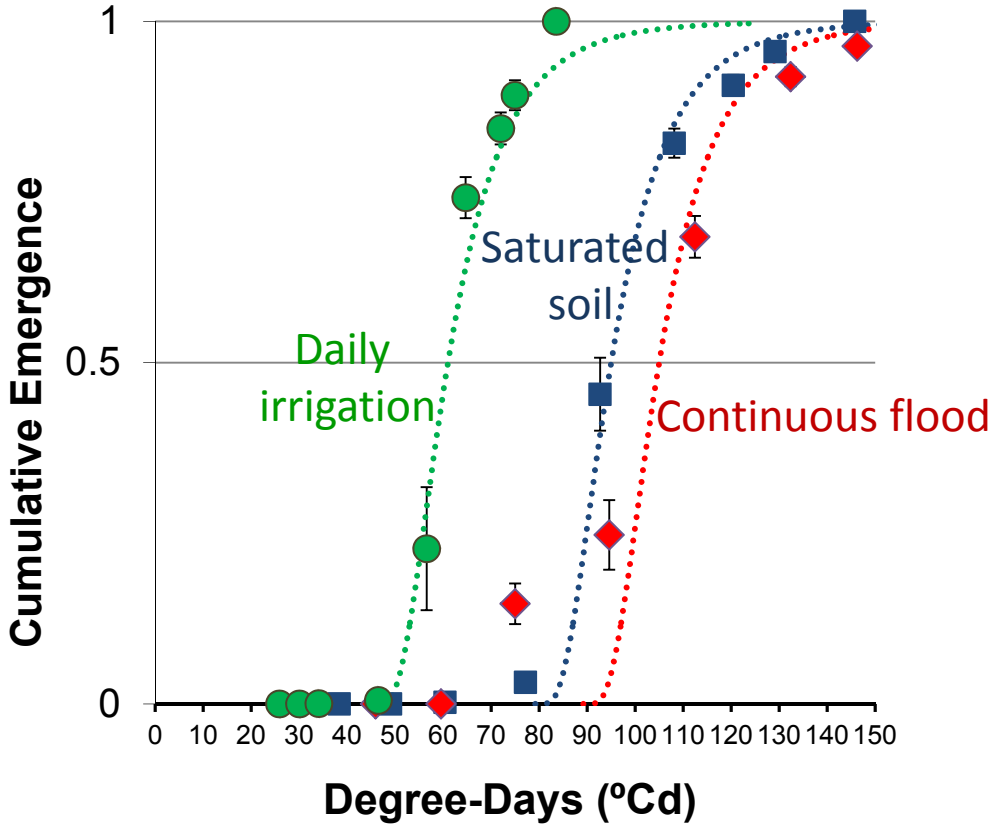
- **No significant rice stand reduction** with either herbicide
- Bulrush apparently germinated later and was missed by Goal


Fresh Weight (% of control)
120
100
80
60
40
20
0
0
1
10
Propanil (kg a.i. ha)
ED_{50} (kg a.i. ha^{-1}) R/S>> 28.4
PP - Propanil
PP - Propanil & Malathion
HR - Propanil


Fresh Weight (% of control)
120
100
80
60
40
20
0
0
1
10
Propanil (kg a.i. ha)
PP - Propanil
PP - Propanil & Carbaryl
HR - Propanil

Synergists???

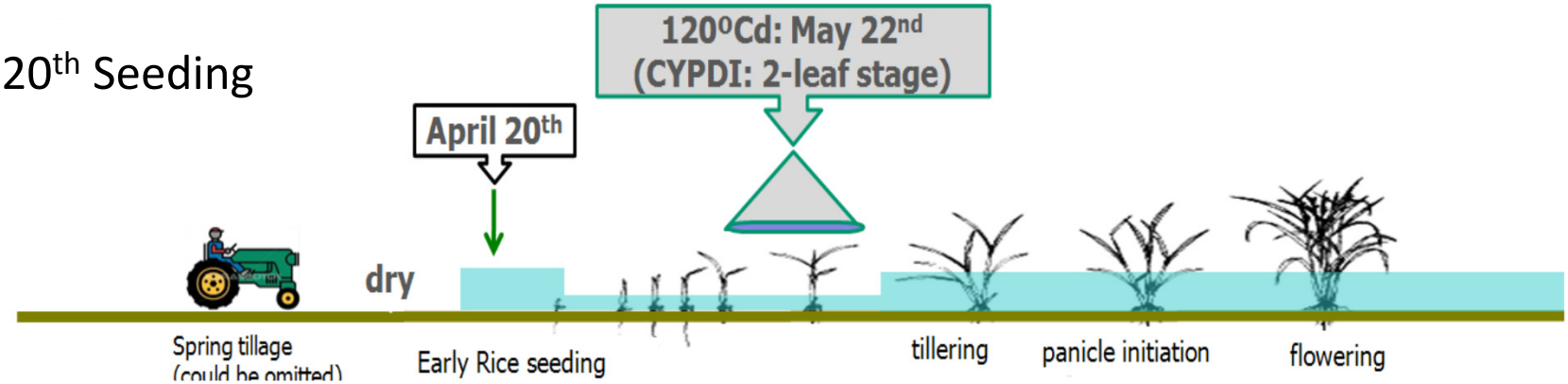
Smallflower: Predicting emergence for better control timing



Thermal time $\Theta_{T\,(g)} = (T-T_b)\, t_{(g)}$

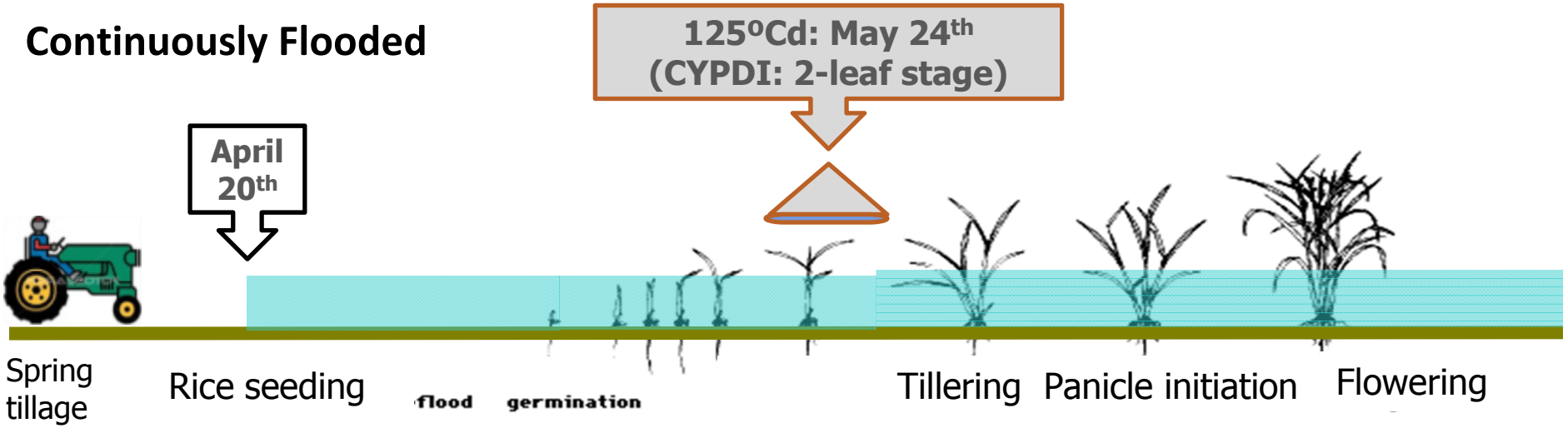
Example

April 20th Seeding

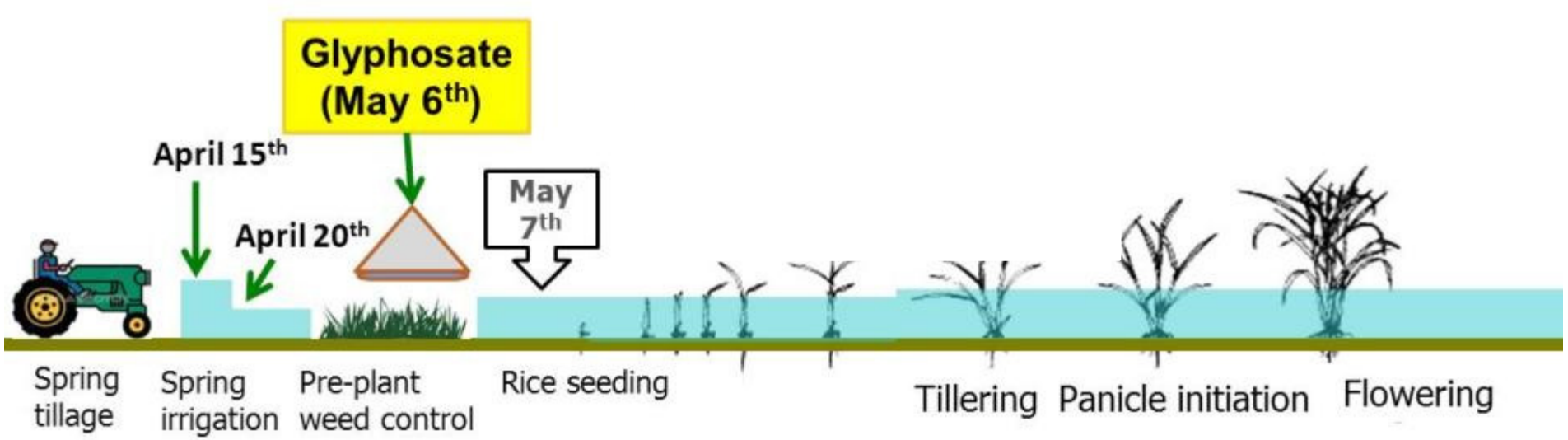


Early Rice Seeding (April 20th)

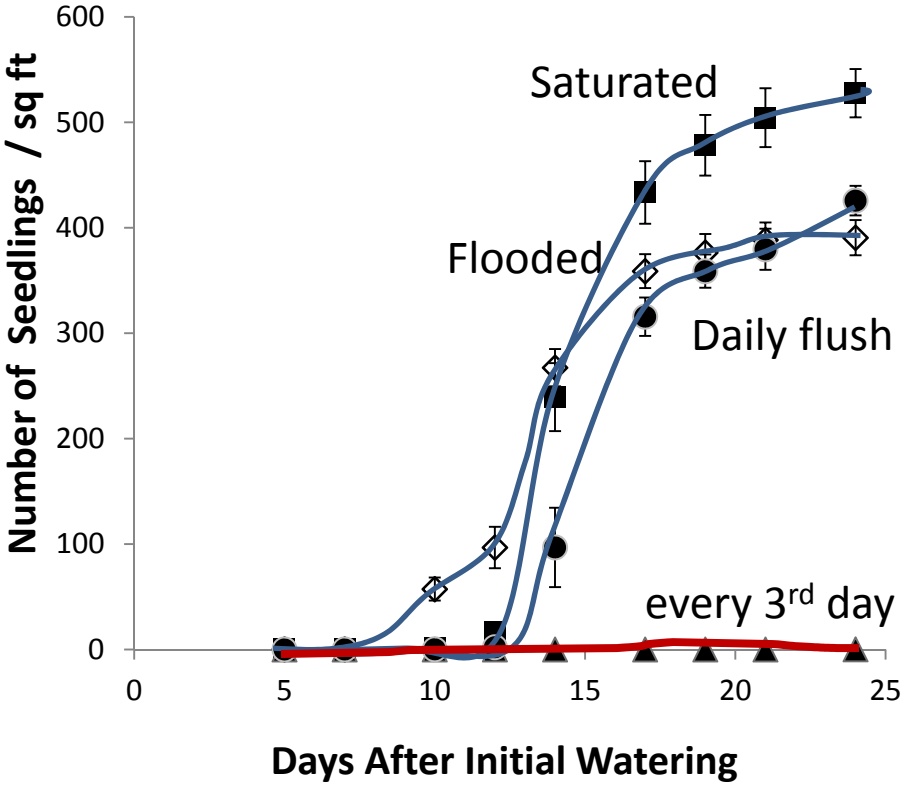
Continuously Flooded



Continuously Flooded with Stale Seedbed for Mimic control



Smallflower umbrella sedge emergence was strongly suppressed by drought



Opportunity?