# Sakura®, Boxer Gold®, and Trifluralin: Potential for evolution of resistance in annual ryegrass and resistance management strategies

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AHRI AUSTRALIAN HERBICIDE RESISTANCE INITIATIVE

THE UNIVERSITY OF WESTERN AUSTRALIA
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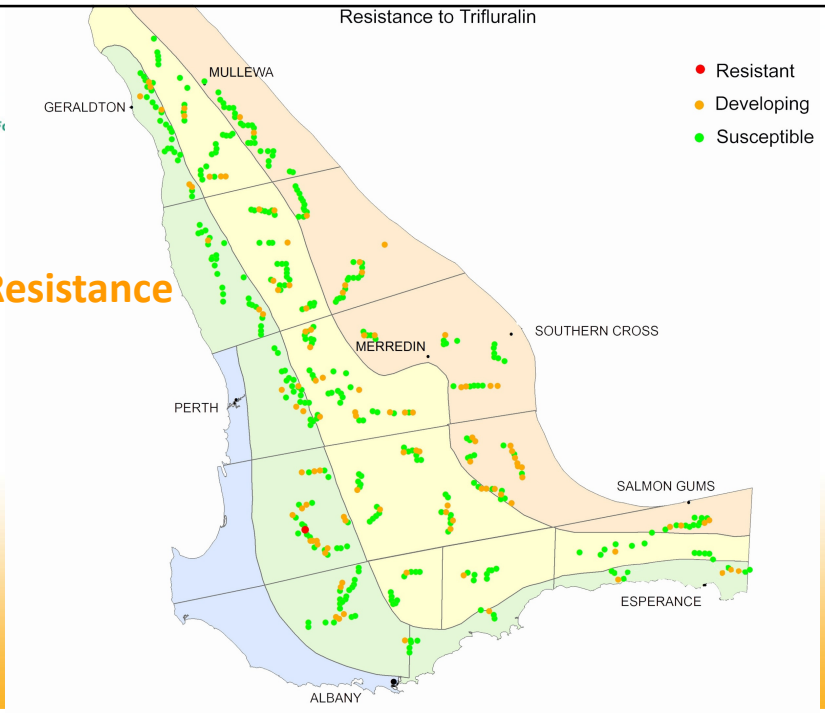
## Trifluralin Resistance



## Trifluralin Resistance – An Increasing Problem

- WA 2003 survey (Owen et al, 2007)
  - 24% of populations developing resistance
  - 1% resistant
- SA surveys (Boutsalis and Preston 2010)
  - 27% of populations resistant

## Sakura® and Boxer Gold®

- Alternatives for pre-emergence ryegrass control
- Question:
  - How to best use these 3 options to manage resistance in ryegrass?
- Sakura® and Boxer Gold® - new products with no known resistance

## Sakura®

- Active ingredient pyroxasulfone
- Pre-emergence, wheat selective
- Group K, inhibitor of cell division, very long chain fatty acids
- Active on wide range of grass species including ryegrass
- Expected 2012

## AHRI Research Overview - Sakura®

- New herbicide, no known resistance
- Evaluate resistance potential before commercialisation
- Resistance evolution at high rate
  - Major effect gene(s)
- Resistance evolution at low rate
- Objective: Maximize Sakura® sustainability
- First ever project to evaluate a new herbicide in this way!

## High Rate

- 2.7 ha
  - 30,000 seeds/$m^2$
  - 65 million germinable seeds
- 400 g pyroxasulfone/ha

## 65 million ryegrass:

- Massive mortality
  - 99.999%
- Very few survivors
  - 22
- All 22 grown for seed to test next generation

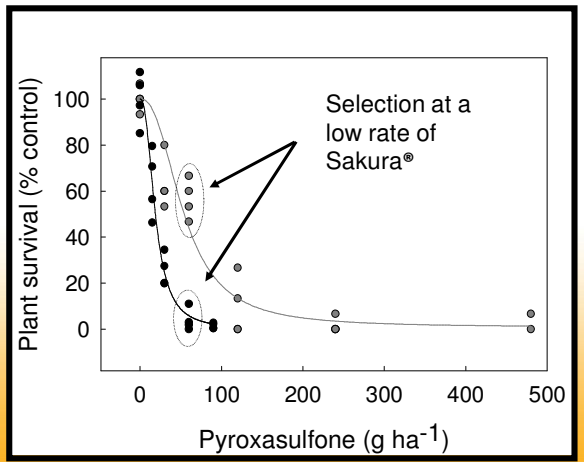
## Progeny Tests

- No evidence of increased resistance in progeny of any field-surviving individuals
- Out of 65 million seedlings, no major effect resistance genes
- Strongly resistant individuals are very rare

## Low Rate Screening

- Pot experiments with plants grown outdoors over winter
- Plants sprayed with sub-optimal pyroxasulfone rates
- Low rate survivors crossed together
- Repeat process on progeny

## Two Populations: Susceptible (•) or multi-resistant (•)




## Low Rate Selection of an S Population

| Selection Cycle | $LD_{50}$ (g/ha) | Resistance Index |
|---|---|---|
| 0 | 27 | |
| 1 | 27 | 1 |
| 2 | 45 | 1.7 |

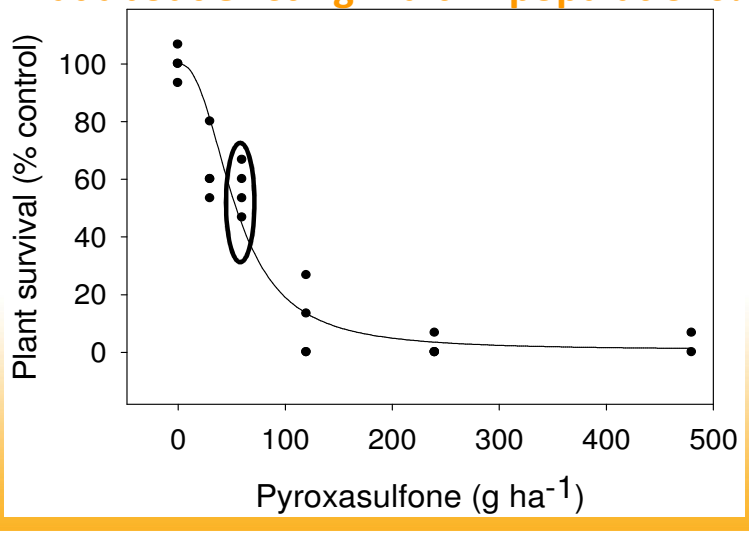
# Sakura® at 90 g/ha


***Low level resistance evolved in an S population***

## Conclusions for Susceptible Populations

- No major effect resistance found in 65 million individuals
  - For comparison: Group B resistance is about 1 in 100,000
- Low rates - only low level resistance evolved
- First selection occurred at a cut rate
  - Very important – Always use full label rate!

## What about existing multi-R populations?




## Low Rate Selection of a Multi-Resistant Population

| Selection Cycle | $LD_{50}$ (g/ha) | Resistance Index |
|---|---|---|
| 0 | 47 | |
| 1 | 106 | 2.2 |
| 2 | 127 | 2.6 |
| 3 | 208 | 4.2 |

## Pyroxasulfone 120 g/ha


***Resistance rapidly evolved in a multi-R population***

## Conclusions for Multiple-Resistant Populations

- MR populations exist
  - Controlled at full label rate
- Make sure Sakura® is used at the full label rate

## Summary

- Take home message:
  - Sakura® is a good herbicide
  - But just like any herbicide, resistance is possible and diversity is key
    - Always use full label rate
    - Rotate between Sakura®, Boxer Gold®, and trifluralin
    - Cropping diversity
    - Seed bank management

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