

WAHRI 2006



WA Herbicide Resistance Initiative (WAHRI)

- ❖ GRDC & ARC funded:
multi-disciplinary research team
**From molecular resistance mechanisms
to on-farm management**
- ❖ Providing underpinning science
- ❖ Training is a key component
(post-grad, under-grad, industry)
- ❖ Crucial that WAHRI interacts closely with
the cropping industry

WA wheat belt

- ❖ In 1970, all weeds were herbicide susceptible
- ❖ In 2006, over 12 m Ha > 80% of all *Lolium* plants are multiple-resistant to at least the ALS & ACCase herbicides
- ❖ High levels of resistance in *Raphanus*



WAHRI 2007

Director
Professor Stephen Powles

Research Fellows/Associates

Dr Michael Walsh	Dr Qin Yu	Dr Roberto Busi	Dr Danica Goggin	Dr David Minkey	Dr Linh Nguyen
<i>Resistance Management</i>	<i>Resistance Biochemistry</i>	<i>Resistance Evolution</i>	<i>Seed Dormancy Biochemistry</i>	<i>Extension</i>	<i>Molecular genetics</i>

PhD Students		
Shane Friesen <i>Resistance biochemistry</i>	Catherine Borger <i>Salsola biology</i>	Sudheesh Manalil <i>Resistance evolution</i>

Administration
Robert Barrett-Lennard

Grad Research Officer/Assistant	
Mechelle Owen	Roslyn Owen

2007 Fourth Year Research Project Students	
Megan Pearce <i>Resistance mechanisms in wild radish</i>	Kent Stone <i>Resistance mechanisms in wild radish</i>

Visitors
Dr Ibrahim Abdallah
Dr Martin Vila Aiub



Program 1

Resistance Evolution

1) Fitness costs of resistance mechanisms

- multi-resistant ryegrass
- clethodim-resistant ryegrass
- target/non-target site resistant ryegrass

2) Inheritance of resistance

3) Resistance gene flow via pollen movement

4) Herbicide rates & resistance evolution

5) Resistance modelling

- RIM, WRIM
- Resistance population genetics modelling





Program 2

Resistance Mechanisms

Lolium rigidum

- 1) Molecular bases of paraquat & glyphosate resistances
- 2) Identifying cytochrome P450 genes
- 3) Mutations endowing ACCase & ALS resistance



ARC Linkage with VABC

2 post-docs: molecular biology of resistance

ARC Discovery

Molecular basis of *Lolium* dormancy



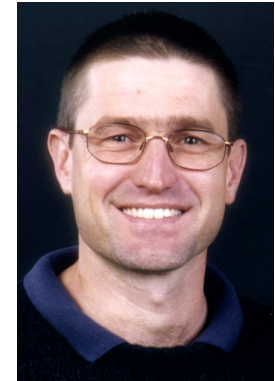
Dr Linh
Nguyen

Raphanus raphanistrum (wild radish)

Biochemical/molecular basis of resistance ⁷

Program 3

Resistance Management



- 1) **Agronomic management of resistance**
 - identifying new herbicide options (KI 485)
- 2) **Quantifying resistance across WA wheat belt**
 - Lolium, Raphanus & Avena
- 3) **Weed seed management at harvest**
 - burning windrows
 - separation of weed seeds at harvest
 - weed seed destruction by novel methods
- 4) **ARC Linkage with Kings Park**
 - Buterolide role in cropping





Program 4

Extension & Economics



- 1) **RIM for Australian cropping**
- 2) **Multi species RIM**
- 3) **Extension for improved management**
- 4) **WAHRI website**
<http://wahri.agric.uwa.edu.au>

***Lolium* target-site based resistance to ACCase-inhibiting herbicides**

Mutations identified in CT domain:

¹⁷⁸¹Ile → Leu some Fop and Dim R

²⁰⁴¹Ile → Asn some Fop only R

²⁰²⁷Try → Cys

²⁰⁷⁸Asp → Gly

²⁰⁸⁸Cys → Arg

²⁰⁹⁶Gly → Ala

Resistance gene identification requires genomics research & infra-structure - big \$\$\$\$.

- ❖ **Resistance gene identification
needs collaboration**
- ❖ **Challenge is gene identification
in highly genetically diverse
*Lolium & Raphanus***
- ❖ **Much genomics research focussed on
self-pollinated crops & Arabidopsis**

**P450 enzymes endow
metabolism-based,
non-target site
herbicide resistance**

**New ARC grant with VABC
will tackle identification of
P450 genes**