



# VALUE ADDED WHEAT CRC PROJECT REPORT

## Industry Forum

**18 May 2004**

**Compiled by: Clare Johnson**

**Date: May 2004**

**VAWCRC Report No: 27a  
Copy No: 1**

**CONFIDENTIAL  
(Not to be copied)**

Value Added Wheat CRC has taken all reasonable care in preparing this publication. Value Added Wheat CRC expressly disclaims all and any liability to any person for any damage, loss or injury (including economic loss) arising from their use of, or reliance on, the contents of this publication.



**Industry Forum**  
**18 May 2004, 9am – 2.10pm**

**Review of Value Added Wheat CRC**  
**2004-05 Annual Operating Plan Projects for Industry**

**Venue: CRC Headquarters**  
**Riverside Corporate Park**  
**1 Rivett Road, (cnr Rivett Rd and Julius Ave) North Ryde**  
**(in BRI Australia Building)**

**TIMETABLE**

<b>8.45am</b>	<b>Arrival- Tea &amp; Coffee</b>	
<b>9.00-9.40am</b>	<b>Introduction</b>	<b>Bill Rathmell</b> <b>Peter Vaughan</b>
<b>9.40-10.20am</b>	<b>Program 3</b>	<b>Peter Sharp</b>
<b>10.20-10.30am</b>	<b>Morning Tea</b>	
<b>10.30-11.10am</b>	<b>Program 4</b>	<b>John Oliver</b>
<b>11.10- 11.50am</b>	<b>Program 2</b>	<b>Di Miskelly</b>
<b>11.50-12.30pm</b>	<b>Program 1</b>	<b>Neil Howes</b>
<b>12.30-1.30pm</b>	<b>Lunch</b>	
<b>1.30pm – 2.10pm</b>	<b>Program 5</b>	<b>Clare Johnson</b>

## Industry Forum

18 May 9am – 2.10pm

A Review of Value Added Wheat CRC  
2004-05 AOP Projects for Industry



## Overview of Programs

Bill Rathmell  
Managing Director  
Value Added Wheat CRC

## CRC Business Areas

- ★ New wheat germplasm and varieties
- ★ Processing improvements
- ★ Wheat quality diagnostics
- ★ Qualified technicians and scientists
- ★ Technology transfer for industry profit

“Step-change” science for a mature industry



- ★ Overview of CRC activities for operating plan 2004/5
- ★ Links to current commercialisation activities
- ★ Links to future product outcomes from the CRC
- ★ PV: Research Targeting & Commercialisation Update



## Five Wheat CRC Programs interlinked

- ★ Program 3 – Advanced wheat genetics and proteomics
- ★ Program 4 – New wheat germplasm and niche varieties

Producing improved and novel wheat-based ingredients

- Profit opportunities for growers
- Consistent supply and quality
- New product opportunities
- Turning wheat research to profit through value chain

## Program 3 & 4 outcomes (past and future)

- ★ Knowledge for wheat improvement (genes, proteins)
- ★ Advanced techniques for wheat improvement (genetics, proteomics, Triticarte)
- ★ Gene discovery and marking in response to industry needs
  - Genes relating to product colour, processing and stability
- ★ Adapting and stabilising germplasm for Australian production
  - Sprout tolerance and other agronomic benefits
- ★ Commercially valuable varieties (improved conventional and new products)
  - Biscuit soft wheats, QAL2000, QALBis (supply, quality for processing)
  - Waxy and other starch modified wheats (novel/nutriceutical products)

Five Wheat CRC programs interlinked

★ Program 2 – Processing improvements

Integrated approach to ingredient and processing technology

- Consistent quality and reduced costs in processing
- Maintenance of product quality
- New product opportunities



Program 2 outcomes (past and future)

- ★ Ingredient and process control systems (blending, OptiDough)
  - Reduced costs and giveaway for maintained quality
- ★ Definition of quality in processing (gluten, chlorination)
  - Enhanced traditional and new products
- ★ Product and process microbiology
  - QA, product safety and shelf life



Five Wheat CRC programs interlinked

★ Program 1 – Measuring (diagnosis) of wheat quality

Better assessment throughout value chain

- Marketing opportunities for growers
- Faster breeding of new wheat types
- Improvement of transport, storing and blending regimes
- Fitness for efficient processing



Program 1 outcomes (past and future)

- ★ Rapid lab based quality diagnosis (breeders, processors)
- ★ Rapid test-kits (WheatRite, ReadRite)
- ★ High technology components for variety/quality diagnosis (identity preservation, quality maintenance)



Five Wheat CRC Programs interlinked

★ Program 5 - Education and Technology Adoption

Qualified technical people for a changing value chain

Introducing profitable technology innovations

Quality assurance

Faster technology uptake means more benefits



Program 5 outcomes (past and future)

- ★ Trained personnel
- ★ Technology transfer (breeders, OptiDough)
- ★ Agronomy knowledge and on-farm QA (GreatGrain)



Relationship between AOP Research Projects, Wheat Value Chain and Core Partners

\*\*

Changes in 04/05 Annual Operating Plan

- ★ Increased focus on delivery of commercial outcomes
- ★ Income production for the CRC
- ★ Budgetary problems force re-focussing
- ★ Continuing discussions with commercial partners/potential sponsors
  - New diagnostics, new wheats
  - (Goodman Fielder/Uncle Toby's/Arnott's/external)



Programs 3 & 4

- ★ Reduced budget on long-term aspects
  - Proteomics pipeline closed, genetic work moved into Triticarte
- ★ Tighter management of breeding towards commercial targets
  - Marker efforts deployed into breeding



Program 2

- ★ Commercially driven focus on modified starch wheats
  - Amylose wheat work increased
  - Other ingredient projects have finished/not started
- ★ Budgetary discipline on process control work (OptiDough delivery)
  - Limited industry capacity to take up outputs
- ★ Commercial sponsorship of microbiology work sought
  - Existing/new CRC partners



Program 1

- ★ Budgetary focus on breeder diagnostics requirements (budget reductions)
  - Commercial sponsorship of quality work (industry grants and funds)
- ★ Critical Path Analysis of variety diagnostic work
  - Speeding product delivery – strong commercial “pull”



Program 5

- ★ Focus on hitting targets for trained technologists
- ★ Maintain technology transfer functions (important for Triticarte & OptiDough)





## Commercial Elements of Wheat CRC AOP

**Peter Vaughan**  
Commercial Director  
Value Added Wheat CRC

## Commercial Elements of Wheat CRC AOP

### Project Proposal:

- ★ Relevance to industry problem – demand driven research
- ★ Value to industry – potential market size for IP
- ★ Freedom to operate – existing and background IP
- ★ People, technical and environmental risks
- ★ Who will adopt the IP developed
- ★ IP being generated and how protected
- ★ Competitive/Complementary research in market



## Commercial Elements of Wheat CRC AOP

### Quarterly Reports:

- ★ Progress
- ★ Milestones: Achieved? How well? Why? Impact on milestones?
- ★ Major achievements
- ★ Issues inhibiting progress
- ★ Critical decision points for research direction
- ★ IP protection or technology transfer required
- ★ Reviewed at Senior Management Group Meetings



## Methods of Commercialisation

- ★ License to CRC Participant
- ★ License to External Organisation
- ★ Joint Venture
- ★ Contract Research/Project Sponsorship (share of IP developed with the sponsor)
- ★ Outright Sale of IP
- ★ "Spin Off" Company



## Current Commercialisation Activities

### Soft Wheat Program – QAL2000<sup>A</sup> and QALBis<sup>A</sup>:

- ★ Licence Agreements with Austrains International
- ★ Production, Marketing and Distribution of seed
- ★ Production, Accumulation and Distribution of grain
- ★ Minimum Performance requirements
- ★ End Point Royalty - \$2.00 per tonne



## Current Commercialisation Activities

### Soft Wheat Program – QAL2000<sup>A</sup> and QALBis<sup>A</sup>

- ★ Value Generation – NPV \$3.5m
- ★ Grain Production and Royalty – 4,500t - \$9,000 (2001); 6,000t. - \$12,000 (2002); 3,500t. - \$7,000 (2003)
- ★ Potential Demand – 50,000 tonnes
- ★ Industry Value - \$50 per tonne produced – grower options, freight savings, continuity of supply
- ★ Breeder training – important for industry
- ★ 2 promising lines – VAW11 and VAW35



### Current Commercialisation Activities

#### OptiDough™ Project 2.4.17 (2.1.4)

- ★ Value Generation – NPV \$1.3m.
- ★ Dough Module has been installed and demonstrated to work at two Goodman Fielder Bakeries
- ★ Aim to “roll out” in 4-6 GF bakeries in next year
- ★ Commercialisation arrangements being negotiated
- ★ Intellectual Property – Software®; Know How/Confidential Information



### Current Commercialisation Activities

2002/03 Project 3.1.1 - NPV -\$630,000

2004/05 Project 3.4.5 - Joint Venture - Triticarte Pty Ltd:

- ★ Business - whole genome genotyping service
- ★ Joint Venture Agreement between Value Added Wheat CRC and DArT Pty Ltd
- ★ Term - Commenced 1 July 2003 for a period 5 years; then to be determined
- ★ Co-investment from GRDC – Shareholder through the VAWCRC
- ★ Priority business for Wheat CRC

### Current Commercialisation Activities

#### Other Activities

- ★ C-Qentec Diagnostics - WheatRite® and ReadRite®
- ★ Antibody Diagnostics – Projects 3.1.2 – 1.1.2 – 1.2.3 – NPV \$250,000
- ★ Micro Instrument - Z-arm mixer
- ★ Germplasm licensing
- ★ Double Haploid Service – NPV -\$970,000



### Future Commercial Opportunities

- ★ Soft Wheats – new lines
- ★ Germplasm – various quality traits identified and being progressed; QWCRC germplasm
- ★ Antibody Research – pipeline to produce antibodies
- ★ Triticale Breeding Program

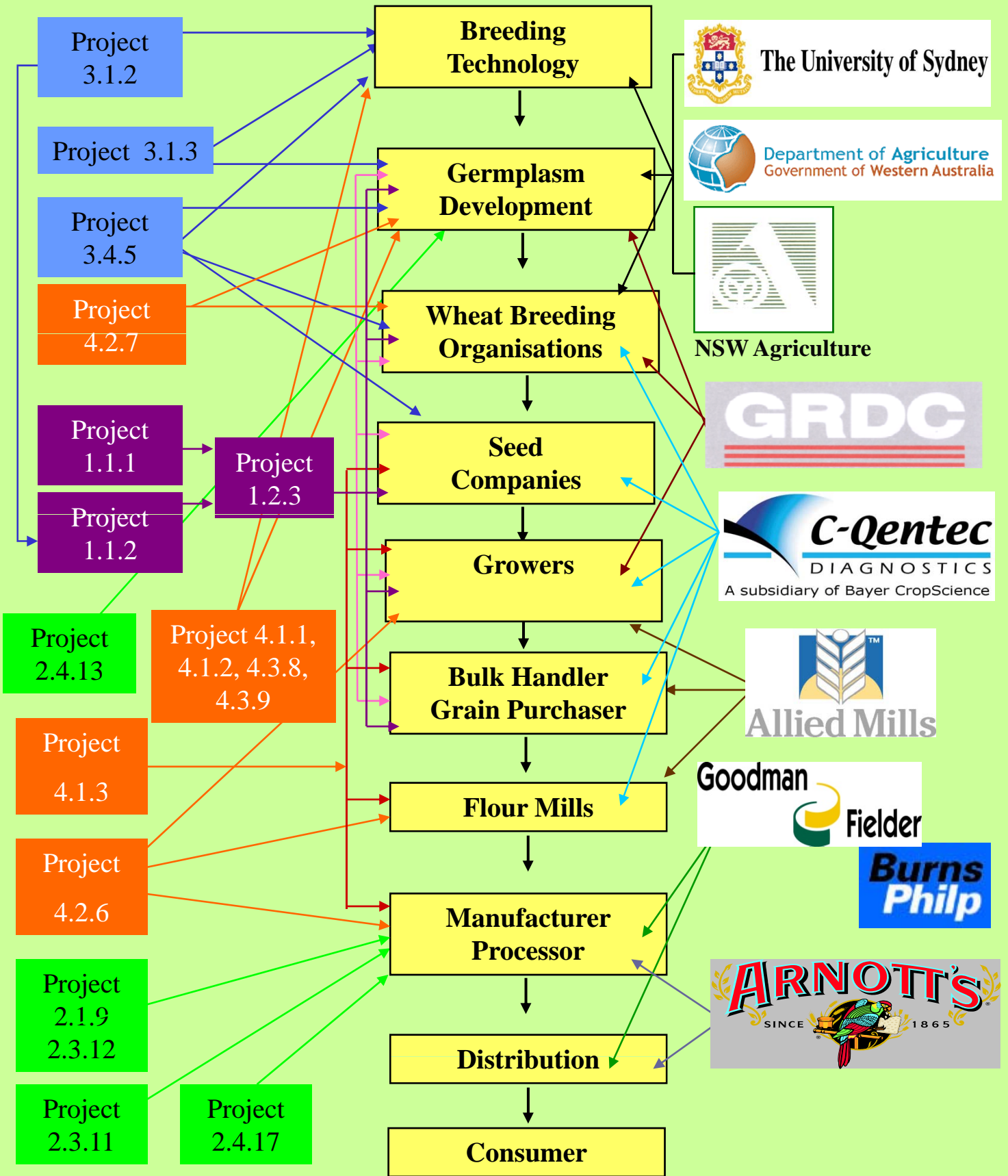


### Wheat Value Chain Players

Supply Chain	AWB	GrainCorp
Biotechnology/Gene Discovery	Syngenta	??
Breeding	LongReach	SunPrime/Access Genetics
Commercialisation	AWB Seeds	SunPrime/Planttech (Grains Trust)
Retail	Landmark GrainCorp, etc	Landmark, Elders, CRT,
Grower	Access to	Access to
Grain Purchaser	AWB	GrainCorp
Marketer	AWB	Domestic or AWB
End User	Domestic/ International	Allied Mills



## Relationship between AOP Research Projects, Wheat Value Chain and CRC Core Partners







VAWCRC Industry Forum  
18 May 2004

## Program 3 Genomics and Proteomics

Peter Sharp  
Manager, Program 3

### Program 3 Genomics and Proteomics

★ General aim : use the tools of genomics and proteomics to

- provide tools for wheat breeders for selection
- provide new variation in wheat
- discover wheat grain proteins related to quality or useful in cultivar identification



### Relationships

★ Program 3 has strong interactions with:

- Program 1, especially work on protein rapid separation, and Antibody Diagnostics
- Program 4, Germplasm Development



### Project 3.1.2 Wheat Grain Proteomics

★ Dr Daniel Skylas and PhD student (X Mak)

★ Located at Australian Proteome Analysis Facility

★ 4 major areas

- protein targets for cultivar diagnostics
- analysis of a quality-related protein
- proteins of germ and bran (PhD)
- proteomics of black point (PhD)



### Project 3.1.2 Wheat Grain Proteomics

#### Progress

- ★ Protein Targets
  - 6 +/- differences, transferred to Diagnostics
- ★ Quality related protein
  - 2 proteins variant
  - mapped on chromosomes (3 DH populations)
  - comparison of proteins across cultivars strongly suggests relation to dough properties
  - quality assessment of 2 DH populations to confirm this started
  - potential IP considerations



### Project 3.1.2 Wheat Grain Proteomics

#### Progress

- ★ PhD student
  - identified germ and bran specific proteins
  - identified proteins potentially related to black point in bread wheat - now to expand to durum wheat
  - will identify germination specific proteins



### Project 3.1.2 Wheat Grain Proteomics

#### Plans

- ★ Need to decrease activity
  - funding
  - lead time to, and within Diagnostics
- ★ PhD student completes March 2005



### Project 3.1.2 Wheat Grain Proteomics

#### Plans

- ★ Other work continues for 04-05, then planned to stop
  - find new potential diagnostic targets  
screen wider range of cultivars, simple extraction
  - complete quality-related protein work
  - protein modification of grain proteins  
(nitrosylation of tyrosine, oxidation)  
? occurs  
? related to G/E quality variation



### Project 3.1.3 Targeted Mutagenesis

- ★ Dr Chong-Mei Dong, TO, and PhD student (J Dalton-Morgan)
- ★ Located at Plant Breeding Institute, Cobbitty
- ★ Single thrust:
  - use targeted mutagenesis to generate new variation (quality-related genes)
- ★ In collaboration with Cibus (San Diego)



### Project 3.1.3 Targeted Mutagenesis

#### Progress

- ★ Proof of principle gained in wheat using a model target system
- ★ This used to optimize some tissue culture and biolistic bombardment parameters
- ★ Targeting of wheat gene > herbicide resistance undertaken to produce first example



### Project 3.1.3 Targeted Mutagenesis

#### Plans

- ★ Complete herbicide gene targeting
  - need to produce fertile whole plants with mutant change using lmi gene mutation
- ★ Undertake refinements of method
  - improved plant growth/tissue culture conditions
  - possibility of microspore culture



### Project 3.1.3 Targeted Mutagenesis

#### Plans

- ★ Targeting of wheat genes
  - GBSS/waxy genes  
have selection possibilities with antibodies
  - Purindolines (hardness-softness) genes (PhD student)  
confirmation of Pin gene theories  
new PinA, PinB gene combinations
- ★ Look for possibility of external \$\$
  - Cibus, others(?)



Project 3.4.5 Markers and Triticarte

- ★ **Two sites**
  - PBI Cobbitty, and DArT in CAMBIA premises, Canberra
- ★ **Staff**
  - PDF + TO (Cobbitty),
- ★ **2 major marker types**
  - STMP microsatellites, DArT arrays



Project 3.4.5 Markers and Triticarte

- ★ **Major reorganization of marker work:**
  - changes in personnel (departure of M Hayden)
  - incorporation of 3.1.1 Markers and Mapping and 3.2.4 Triticarte Operations
  - GRDC \$s to set up Triticarte service provision company for barley and wheat
  - increased confidence in DArT technology



Project 3.4.5 Markers and Triticarte

**Progress**

- ★ **STMP microsatellites**
  - now have bank of ~1,000 very good SSRs, some now into multiplex groups, many mapped on chromosomes
- ★ **DArT array work**
  - have barley array
  - ~900 barley DArT elements placed on well-known barley map
  - will be published soon; major impact



Project 3.4.5 Markers and Triticarte

**Progress**

- ★ **DArT array work - Barley**
  - finished NSW Ag F2 population
  - currently mapping other breeders populations
- ★ **Diversity analysis ~5 customers serviced so far including overseas customers**



Project 3.4.5 Markers and Triticarte

**Progress**

- ★ **DArT array work - Wheat**
  - have increased number of clones to increase polymorphisms available ~10,000 clones
  - have demonstrated good diversity
  - mapping Halberd x Cranbrook DH at present
  - major importance in convincing potential customers
  - PhD student studying improvements to DArT process



Project 3.4.5 Markers and Triticarte

**Plans**

- ★ **Drivers**
  - need to fit to CRC budget
  - increased confidence in DArT (STMP insurance)
- ★ **Changes**
  - reduction of PDF in STMP at end 2004
  - new PhD student in DArT (data handling)



Project 3.4.5 Markers and Triticarte

**Plans**

- ★ Main task - Gaining and Servicing Customers
  - demonstration of wheat DArT map  
October WBA/Cereal Chemistry meeting important
  - customers for STMP service  
rust genes, sprouting, LMA
  - continue development of barley DArT service



Summary

- ★ Focusing on important outcomes to ensure delivery/returns within life of CRC
- ★ External sources of funding
- ★ Building customer base for Triticarte





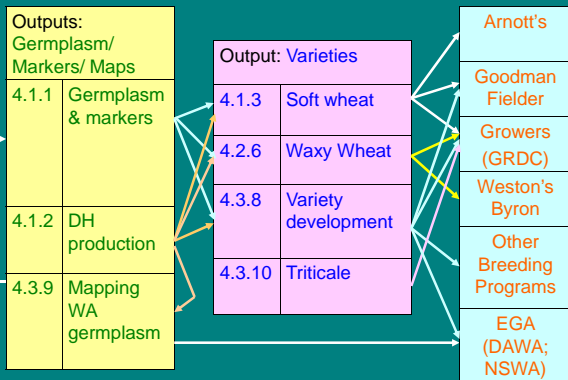
VAWCRC Industry Forum  
18 May 2004

## Program 4 Germplasm & Varieties

John Oliver  
Manager, Program 4

## Outline of Program 4

- ★ Portfolio of 8 projects
- ★ Target: Varieties with improved/ novel traits
- ★ Clients: Amott's, Allied Mills, Goodman Fielder, NSWA, DAWA, Uni Sydney, GRDC



## 4.1.1: New genetic variation and markers for quality traits

**Project Leader: Matthew Turner**

**Aims:**

- ★ Identification of new/ extremes in variation.
- ★ Identification of associated molecular markers

**Research conducted by:**

University Sydney; NSWA (Menangle)

**Outcomes:**

Improved varieties progressed through other projects



## 4.1.1: New genetic variation and markers for quality traits

**Major achievements to date**

- ★ Extremes in variation identified & progressed to 4.3.8
  - Null PPO: Varieties for WSN; pastries; frozen products
  - Large grain size: Production consistency; breakfast cereals
- ★ Molecular markers for PHS identified & available for use
  - Production consistency
- ★ Markers for Spica form of LMA & new theory on expression
  - No expressor's released
- ★ Methodologies for characterising influence of grain constituents on pasta quality
  - Better durum varieties & pasta quality



## 4.1.1: New genetic variation and markers for quality traits

**Plans for 2004-05**

- ★ Identifying novel sources of variation for Blackpoint tolerance & investigate biochemistry during grain filling
  - Consistency of supply; reduced downgrading
- ★ Study effects of high amylose starches, pentosans fractions, HMW/LMW ratios of pasta rheology
  - Better durum varieties & pasta quality
- ★ Validate new theory on LMA expression
  - Consistency of supply; No expressors released
- ★ Transform QTLs for seed dormancy to molecular markers
  - Consistency of supply; reduced downgrading
- ★ Identify QTLs for starch granule size distribution
  - Starch, brewing, milling industry advantages



## 4.1.2: Rapid Breeding Technologies

**Project Leader: Nizam Ahmed**

**Aims:**

- ★ DH populations produced for other projects
- ★ Target cost = \$15/DH
- ★ Opportunities = Fee for service

**Research conducted by:**

University of Sydney

**Outcomes:**

Speed varieties to market through other projects



## 4.1.2: Rapid Breeding Technologies

**Major achievements to date**

- ★ Approx 8,000 DH produced in 2002-03
  - operating cost \$16 / DH line
- ★ 6,000 DH harvested in 2003-04 (to 31 March)
  - ★ operating cost \$19 / DH line
- ★ Improvements to temperature control of glasshouse
- ★ New cool room
  - Projects 4.1.1, 4.1.3, 4.2.6, 4.3.8 can be progressed.



## 4.1.2: Rapid Breeding Technologies

**Plans for 2004-05**

4.1.1	PPO; Large grain size	2,000
4.1.3	Soft wheats	5,000
4.2.6	Waxy	120
4.2.7	Sprouting	300
4.3.9	Cdx x Rvs; Aja x 2046	500
5.1.3	HMWGlU	600
Contract	Longreach; GrainGenes	1,250
TOTAL		9,770
Estimated Cost per DH		\$18.60
Income from contract production		\$23,250



## 4.1.3: Soft Wheat Program

**Project Leader: Helen Allen**

**Aims:**

- ★ To breed soft biscuit wheats for Arnott's
  - Low protein soft & High protein soft
- ★ Target WA market opportunities

**Research conducted by:**

NSWA; University Sydney

**Outcomes:**

Improved soft biscuit wheat varieties



## 4.1.3: Soft Wheat Program

**Major achievements to date**

- ★ Produced QAL 2000; QALBis; QALClub
- ★ VAW11 & VAW35 close to release
  - Improvement in soft wheat quality available
- ★ Consolidated effort between VAWCRC & NSW
  - Efficiency of selection
- ★ New method for selecting wheats for cracker production
  - Effectiveness of selection for HPS type
- ★ In spite of WSMV lines trialled in WA
  - Expansion of income base



## 4.1.3: Soft Wheat Program

**Plans for 2004-05**

- ★ Trial program:
  - F3 & F4 at Cobbitty
  - DT, S1 & S2 at Wagga & Narrabri
  - S3: Narrabri, Trangie, Coleambally, Wagga, Benerambah
  - Selected lines for evaluation in WA
- ★ Pure seed production of VAW11 & VAW35 at Menangle
  - New soft wheats released Dec 2004
- ★ Blending experiments with super weak wheat
  - Guidance on ingredient wheat opportunity
- ★ Investigate potential of high b-granule soft wheats for crackers, cakes and noodles
  - New wheat types



### 4.3.8: Development of adapted germplasm & varieties with novel characters

**Project Leaders:** Matthew Turner, Akram Khan

**Aim:**

- ★ Coordinate the rapid introgression of novel economically important quality and processing characters from other projects into elite backgrounds

**Research conducted by**

University of Sydney; NSW (Menangle, Tamworth)

**Outcomes:**

Better, new varieties for all market sectors



### 4.3.8: Development of adapted germplasm & varieties with novel characters

**Major achievements to date**

- ★ Null PPO: 2 synthetics with null PPO crossed with Lang
  - Varieties for YAN, frozen doughs
- ★ Low B-granules: Doubled haploids of **Vulcan x Kewell** & **Vulcan x Outlier67** and F5 seeds of **QAL2000 x Outlier67** cross being progressed.
  - Varieties for starch industry & biscuit manufacture
- ★ Large grain size: Doubled haploids of a **65mg synthetic x Lang** and crosses with a large range of material being progressed
  - Consistency of production; breakfast cereals
- ★ DM5637\*B8: (combines sprouting tolerance; blackpoint; low PPO; no LMA) DH from crosses made with Wyalkatchum, H45 being progressed
  - Quality of Wyalkatchum & H45 improved



### 4.3.8: Development of adapted germplasm & varieties with novel characters

**Plans for 2004-05**

Null PPO	Lang, Qalbis, Chara, Lorikeet, DM5637*B8	YAN, pastries, frozen doughs
Low Pentosans	Bowie, Qalbis	Arnott's LPS
High pentosans	Lang, Chara, Kukri	AH, APH grades
Large grain	Qalbis, Chara, Lang, Lorikeet	All grades
DM5637*B8	Wyalkatchum, H45	AH grades
Starch granule size	Durums, Qal2000	Pasta, Arnott's soft



### 4.3.9: Marker validation and identification for key quality attributes in WA germplasm

**Project Leader:** Michael Francki

**Aims:**

- ★ Discovery / Validation of marker sets associated with
  - Flour Colour
  - Null 4A GBSS
  - Flour extraction
  - Water absorption
  - Grain size

**Research conducted by**

DAWA

**Outcome:**

Framework maps of 5 populations; QTLs controlling variation



### 4.3.9: Marker validation and identification for key quality attributes in WA germplasm

**Major achievements to date**

- ★ Framework microsatellite maps of WAWHT2046 x Carnamah Westonia x Janz
- ★ DNA submitted to DArT for integration of microsatellite maps
  - Marker assisted selection facilitated



### 4.3.9: Marker validation and identification for key quality attributes in WA germplasm

**Plans for 2004-05**

- ★ Complete framework microsatellite maps of
  - Ajana x WAWHT2046
  - Cadoux x Reeves
- Markers for selection of
  - Flour Colour
  - Null 4A GBSS
  - Flour extraction
  - Water absorption
  - Grain size



### 4.3.10: Dual Purpose Triticale

**Project Leader: Norm Darvey**

**Aims:**

- ★ Breeding of dual purpose triticales with resistance to the three rusts primarily for NSW

**Research conducted by:**  
University of Sydney

**Outcomes:**

Triticales with improved grazing habit to suit a range of sowing dates



### 4.3.10: Triticale & Rye

**Major achievements to date**

- ★ Over past three years the National Triticale Program has released:
  - 3 dual purpose triticales: Hilary, Jackie, Eleanor,
  - 1 main season triticale: Prime 322
- Improved varieties for the industry



### 4.3.10: Triticale & Rye

**Plans for 2004-05**

- ★ Increase and release of AT519
- ★ Increase of AT528 for 2006 release.
- ★ Early- mid generation testing at Cobbitty, EMAI and Cowra
- ★ Year 1 Advanced testing at Cootamundra, Cowra
- ★ Year 2 Advanced testing at several NSW sites and 2 sites in Victoria
- ★ Measurement of amylose content
- ★ Measurement of bread potential
- New dual purpose triticale with improved productivity for the feed industry







VAWCRC Industry Forum  
18 May 2004

## Program 2 Products and Processing

Di Miskelly  
Manager, Program 2

## Program 2 Products and Processing

**Aims:**  
to generate knowledge

- ★ for enhancement of the processing performance of wheats
- and
- ★ for the creation of new and improved products



Continuing		Project leader
2.1.9 *	Gluten structure and modification for ingredient use	Ian Batey
2.3.11	Extended shelf life bread and baked goods	Ailsa Hocking
2.3.12	Wheat quality for starch and gluten production	Ian Batey
completed		
2.1.1	Blending – consequences for wheat breeding	Geoff Cornish
2.1.4	Optimisation of key stages of the baking process	Thomas Adamczak
2.1.5 *	Australian wheat for sponge and dough breadmaking process	Ken Quail
2.1.6 *	Strategies to replace flour chlorination as a treatment for cake flours	Ken Quail
new		
2.4.13	High amylose wheats -breeding, nutrition and interactions	Les Copeland Matthew Turner
2.4.17	Commercialisation of OptiDough	John Kalitsis

## 2.1.9 Gluten structure and modification for ingredient use

**Leader:** Ian Batey

- Aims:**
- ★ extended training of pdf
  - ★ add value to commercial gluten
  - ★ develop methods to modify gluten



**Collaborators:**  
CSIRO Foodscience North Ryde & Werribee, Manildra, VAWCRC

## Relevance to industry problem

- ★ Acquire new knowledge of gluten chemistry and use to improve application of gluten in food product development

**Value to industry:**

Potential to expend modified gluten market to 20,000t



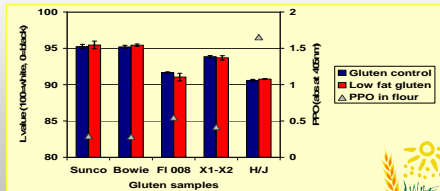
## Outcomes to date

- ★ Lipids
  - Contribute to gluten colour (yellowness)
  - Play important role in gluten formation and its physical properties
- ★ Removal of lipids
  - Promising solution: addition of salt in washing process



### Outcomes to date

- ★ Polyphenol oxidase
  - Contributes to flour colour, likely to gluten colour (greyiness)



### Future work

- ★ Seek/widen the use of other mineral salts
- ★ Investigate the use of enzyme inhibitors
- ★ Explore chemical and enzymic reagents to increase recovery and nutritional quality of gluten
- ★ Fundamental study – protein/protein, protein/lipid interaction in gluten
- ★ Study the use of gluten-based ingredients as encapsulants



### 2.3.11 Extended shelf life bread and baked goods

**Leader:** Ailsa Hocking

**Aims:**

- ★ extend shelf life bread and baked goods by traditional means
- ★ develop predictive modeling tool for mould growth in MAP baked goods

**Collaborators:** CSIRO Foodscience North Ryde, GF



### Relevance to industry problem

- ★ Bread returns significant cost to industry
- ★ predictive model offers possibility of “preservative free”

**Value to industry:** decrease in returns of 5%= saving of \$5 million pa



### Outcomes to date

- ★ project commenced Jan 04
- ★ 5 spoilage organisms in study
- ★ trials with preservative combinations- lab and bakery
- ★ pH important in enabling effectiveness of preservatives
- ★ need to consider effect on yeast, quality and shelf life



### Future work

- ★ continue preservative/ baking work
- ★ boundary modeling component



### 2.3.12 Wheat quality for starch and gluten production

**Leader:** Ian Batey

**Aims:**

- ★ determine wheat quality characteristics for starch/gluten manufacture
- ★ identify effects of genotype, environment, storage and milling on quality
- ★ develop strategies to improve wheat for starch/gluten manufacture

**Collaborators:** CSIRO Foodscience North Ryde, Allied Mills, Penfolds

### Relevance to industry problem

- ★ Traditional dough testing methods unable to predict plant processing performance
- ★ need to source appropriate wheat for milling for starch/gluten

**Value to industry:**  
estimated reduction of amount of small granule starch by 1% = \$1million saving



### Outcomes to date

- ★ project commenced Feb 04
- ★ chemist completed training in cereal methods
- ★ literature survey completed
- ★ samples from 03/04 sourced

**Future work**

- ★ test varieties and grades from 03/04 harvest
- ★ characterise "good" and "bad" flours



### 2.4.13 High amylose wheats -breeding, nutrition and interactions

**Includes elements from 2.2.10, 5.3.7)**

**Leaders:** Les Copeland, Matthew Turner

**Aims:**

- ★ integrated project
- ★ produce wheat varieties with higher amylose content
- ★ use in further nutrition studies
- ★ explore starch/lipid interactions

**Collaborators:** SU, EMAI, PBI Cobbitty, NSW Agriculture



### Relevance to industry problem

- ★ High amylose starches have unique properties eg dietary fibre and resistant starch
- ★ protein functionality maintained in high amylose wheats
- ★ need to understand interactions between amylose/lipids

**Value to industry:**

- ★ new niche market
- ★ health benefits
- ★ training for 4 PhD students (2.2.10 continuation)



### Future work

- ★ survey of amylose in germplasm
- ★ breeding hard and soft high amylose wheats
- ★ analysis of starch/lipid complexes
- ★ influence of starch lipid complexes on nutritional components during storage
- ★ effect on intestinal health and immune function



#### 2.4.17 Commercialisation of OptiDough

**Leader:** John Kalitsis

**Aims:** Roll out Optidough - Optimum Water Addition Module into 5 GF bakeries

**Collaborators:** BRI, GF



#### Outcomes to date

- ★ DPO hardware and software installed at Sydney bakery - commercial rollout trial
- ★ Training manual and documentation completed

#### Future work

- ★ rollout





VAWCRC Industry Forum  
18 May 2004

## Program 1 Diagnostics

Neil Howes  
Manager, Program 1

## Aims of Diagnostics Program

- ★ To develop diagnostic methods that will be applied by the Australian Wheat Industry, and where feasible Commercialise world-wide.

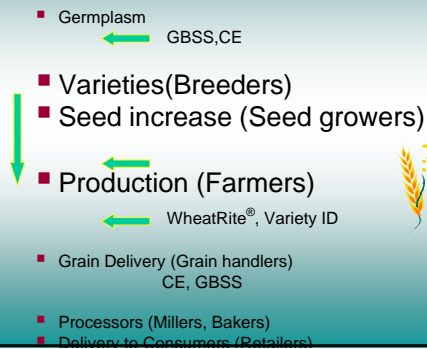


## Quality of Projects

- ★ Unique or leading edge research
- ★ Delivering novel products/services for grains industry
- ★ Exploiting advantages of technology-low cost or fast tests



## Value Chain (increasing value)



## Diagnostic Projects

Project 1.1.1: Protein Separation Methods  
Ian Batey - CSIRO N Ryde/ SARDI, Adelaide

Project 1.1.2: Antibody Diagnostics  
James Chin - NSWAg EMAI/SARDI, Adelaide

Project 1.2.3: Diagnostics Delivery  
Felice Driver - C-Qentec, Sydney/SARDI Adelaide



## Protein Composition Analysis

### Research Plan

- ★ Evaluate Capillary Electrophoresis (CE) and Fast Mini-Gels
- ★ Evaluate other small scale testing methods
- ★ Test-drive a package of tests with wheat breeding programs

## Composition Analysis

### Conclusions

- ★ CE and Mini-gels methods suitable for regional laboratories
- ★ Will identify most varieties
- ★ Will identify only some quality related characteristics
- ★ Not suitable for on-the-spot testing
- ★ Difficult to commercialize



## Project 1.1.1

### Future

- ★ Reduced funding-retain expertise in separation methods
- ★ Focus on providing a fee-for-service
- ★ New research funded through plant breeding PhD projects
- ★ Continue support of other VAWCRC projects

## Antibody Diagnostics

### Research plan

- ★ Develop novel peptide immunisation strategies
- ★ Optimise yield of Monoclonal Antibodies
- ★ Develop other immunisation strategies
- ★ Epitope mapping to protect IP



## Antibody Diagnostics

### Progress

- ★ Improved Hybridomas
- ★ Synthetic peptides optimized
- ★ Other immunization strategies successful
- ★ New variety specific antibodies produced
- ★ Epitope mapping of GBSS 4A and 7A completed



## Variety ID and Quality

### Progress

- ★ **Serpins 1a and 3: Serine Proteases**  
Split of Australian varieties  
Water soluble  
3-4% flour protein
- ★ **Role in quality**
- ★ Serpin 1a and pan-serpin antibodies produced
- ★ Two new variety specific antibodies; common epitopes with LMW glutenins



## Variety ID and Quality

### Future Targets

- ★ **Serpin 3a/b: Serine Protease**
- ★ **Branching Enzyme I**  
split of Australian varieties
- ★ **Branching Enzyme II**  
Role in amylose/amylopectin synthesis
- ★ **Purindoline A**  
Split of Australian varieties, role in hardness



## Diagnostics Delivery

### Existing Tests

- ★ **Wheat-Rite**  
(Rain-damage test: field, silo, processor): Marketed by C-Qentec
- ★ **LMA(Late Maturity Amylase)**  
Breeder test kits: marketed by VAWCRC to AGT, EGA, Sunprime, CSIRO; supplied to GRDC funded testing  
50,000 tests in 2003/4
- ★ **Wheat-Rye Translocations**  
QDPI, Sunprime, CIMMYT?  
5,000 tests in 2003/4



## Antibody Diagnostics

### Existing Tests

- ★ **GBSS Null4A-Starch Quality**  
Breeder test format; commercialization awaiting IP protection  
Silo and Processor test to be developed in Wheat-Rite format
- ★ **GBSS Null7A –Identification of Waxy Wheats**  
Breeder test format for breeding, seed purity, processing quality control

## Antibody Diagnostics

### Future Tests

- ★ **Starch Quality**  
Combined GBSS Null4A, 7A, and 7D  
Silo and Processor test to be developed in Wheat-Rite format
- ★ **Soft Wheat Quality**  
Combined GBSS null4A, 1RS(Rye) with 1-2 additional antibodies to identify specific soft wheats ( Bowie, Qual2000, QualBis, Rosella types).  
Wheat-Rite format for processing quality control



## Antibody Diagnostics

### Future Tests

- ★ **Serpins**  
Initially breeders kits; include in variety ID
- ★ **Variety ID**  
Incorporate 1RS, GBSS-4A Serpin 1a, 3a/b, LMWGS(15F7), into a multi-strip 5min test



## Variety ID - Serpins

### ***Bold for GBSS Null4A, 1RS Red, (softs)***

- ★ **Serpin1a/serpin 3a(fast):** Perenjori, H45, Dollarbird, Diamondbird (*Grebe, Arrino*).
- ★ **Serpin1a/serpin 3b**  
Sunstar, Sunvale, **Sunsoft**, Sunco, Tasman, Janz, Kukri, Westonia, Kalingari, **Bowie**, Cadoux, Krichauff, Yanac, Yitpi, Wyuna (Snipe, **Sunsoft**, Thornbill, **Triller**, Lorikeet Rosella).
- ★ **Serpin 1a Null**  
**Halberd**, Cranbrook, **Frame**, **Camm**, **Trident**, **Tatiara** (Datatine, Corrigin)

## Conclusions

- ★ Antibody discovery good progress
- ★ Breeder screening kits
  - Value to breeding programs; strong IP protection
- ★ Variety Identification
  - Concept valid, feasibility of combining still to be demonstrated.
  - World leader in technology
- ★ Protein composition and small scale tests
  - Difficult to protect IP and commercialize



VAWCRC Industry Forum  
18 May 2004

## Program 5 Education & Technology Adoption

Clare Johnson  
Manager, Program 5

## Education & Technology Adoption

Program Manager: Clare Johnson

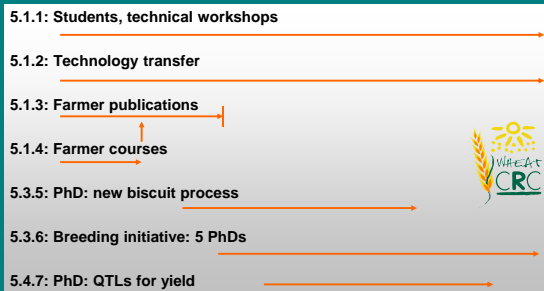
### Projects:

- ★ 5.1.0: Program management
- ★ 5.1.1: Student and industry training
- ★ 5.1.2: Technology transfer of VAWCRC outcomes
- ★ 5.1.3: (completed) Farmer workshops
- ★ 5.3.5: PhD project - Novel process
- ★ 5.3.6: New generation plant breeders
- ★ 5.4.7: PhD project - QTLs for yield and screenings



## A balanced program addressing strategic industry requirements

2002/2003 2003/2004 2004/2005 2005/2006 2006/2007 2007/2008



## 5.1.0: Program Management

- ★ Identify, maintain and resource effective initiatives
- ★ Ensure regular reporting against objectives for each project
- ★ Maintain awareness of issues affecting the industry, and progress of VAWCRC R&D.
- ★ Interact constructively with Commercialisation.
- ★ Maintain awareness of appropriate technologies and delivery vehicles.



## 5.1.0: PhD tally management

Target = 30 PhD/Masters students, 6 in industry labs

- ★ Funded 5 PhDs directly through Program 5 (+ 3 in 2005/06)
- ★ Incur underspends in 2003-04, 2004-05, 2006-07 and 2007-08
- ★ Apply the savings vs 3 extra PhDs to be recruited in Research Program during 2004-2005
- ★ Tally (incl. 2005/06) = 27 of the 30 PhDs required in term of CRC
- ★ Total 11 supported by Education Program budget



## 5.1.1: Student & researcher training

- ★ Technical workshops for professional scientists (VAWCRC, USyd, Curtin and RACI-CCD)
- ★ Publish and promote technical manuals
- ★ Undergraduate scholarships in plant breeding
- ★ Summer scholarships
- ★ Workshops on IP, professional development, and presentation skills for postgraduate students





## Technical workshops

### Satellites to RACI / WBA "Seeding the Future" 2004

#### Last year

- ★ NIR
- ★ Pre-screening for breeders

#### Full day workshop (Feb 2004)

- ★ Genomics

#### This year

- ★ GeneFlow graphical genotyping and DArT for breeders
- ★ Grain morphology and electron microscopy

#### Full day workshop (Feb 2005)

- ★ Topics being evaluated

★ Workshop manuals feed into Grad. Cert. course



## Student training

### Undergraduate:

- ★ Undergraduate scholarship (Agric.) at Sydney University
- ★ Undergraduate scholarships (breeding) at USyd and UWA
- ★ Vacation scholarships on relevant projects

### Postgraduate:

- ★ Communication / presentation skills
- ★ IP
- ★ Grant applications, project & budget management
- ★ Management / professional development



## 5.1.1 budget



Undergraduate scholarships	\$17,160
Summer scholarships	\$8,800
Postgraduate targeted training	\$25,500
Postgrad. professional development	\$5,000
Postgrad. presentation skills	\$3,740
Technical workshops and manuals	\$16,600
PhD advertising	\$12,000
<b>CASH TOTAL</b>	<b>\$88,800</b>
<b>PLUS IN-KIND</b>	<b>\$98,058</b>

## 5.1.2: Technology transfer

- ★ Support IT development for Triticarte
- ★ Expand and run Graduate Certificate in Cereal Science, incorporating CRC outcomes
- ★ Develop a supporting methods course
- ★ Publications:
  - Triticarte web
  - protein analysis software
  - population breeding text
  - high school plant breeding promotional booklet
  - wheat variety web
  - promotional flyers and posters
- ★ Keep Participants informed of progress and facilitate uptake
- ★ Sponsor relevant industry conferences



## Develop Graduate Certificate in Cereal Science

### Charles Sturt University, running 2004

- ★ Units 1&2 - Cereal Science: 1990 KSU course, updated with Wheat CRC etc. research: basic properties, quality specs, blending, processing (consulted Industry, Rice CRC etc)
- ★ Unit 3 – Grain storage and food safety: Wheat CRC studies on milling and product safety, our grain storage CD ROM, GMO policy and detection, and identity preservation/QA
- ★ Unit 4 - Early stage quality testing: NIR, Abs, microarray, micro-scale testing, valid experimental design, BioIT, and breeding technologies (consulting relevant experts)



## 5.1.2 budget



DArT programming	\$50,000
Grad. Cert. Cereal Science course development and technology transfer	\$8,760
Grad. Cert. registrant sponsorships	\$4,300
Industry conference sponsorships	\$6,150
Conference/expo travel	\$3,000
Publications/decision support	\$20,000
<b>CASH TOTAL</b>	<b>\$92,210</b>
<b>PLUS IN-KIND</b>	<b>\$5,485</b>

### 5.1.3: Farmer workshops

Ends 30 June 2004

**Outputs:**

- ★ 6 TOPACTIVE workshop kits - producing and marketing quality grain
- ★ FertiPlan software
- ★ WA wheat database
- ★ Mix Master: value chain marketing course
- ★ WA publications: green manure & protein, south coast WA



### 5.3.5: Novel products from novel process

**PhD project**

- ★ Investigate the potential of wheat with high swelling starches for puffing
- ★ Develop formulation and processing technique for novel products
- ★ 50% supported by Westons FIG



### 5.3.5 budget



PhD student Wendy Newton, includes operating	\$31,171
Technical training allowance	\$1,500
<b>CASH TOTAL</b>	<b>\$32,623</b>
<i>PLUS IN-KIND</i>	<i>\$70,837</i>

### 5.3.6: New generation plant breeders

**5 PhD projects**

**Started 2004:**

- ★ Sprouting tolerance, rust resistance (PBIC)
- ★ Doubled haploid production efficiency, disease resistance (PBIC)

**July 2005 start:**

- ★ Male sterile technique, disease res., quality, abiotic stress (AgWA)
- ★ *Septoria nodorum* blotch resistance (AgWA)
- ★ Increase Falling No. in soft wheats (AgWA/Curtin)
- ★ International visits in 2005/06 (PBIC) and 2006/07 (AgWA)



### 5.3.6 budget



2 PhD scholarships, PBIC	\$46,588
2 students' operating, PBIC	\$20,000
<b>CASH TOTAL</b>	<b>\$66,588</b>
<i>PLUS IN-KIND</i>	<i>\$53,783</i>

### 5.4.7: QTLs for yield, screenings

**PhD project with SunPrime**

- ★ Lynn Madden part-time PhD
- ★ Using SunPrime advanced lines
- ★ Share information on QTLs for yield, milling yield, screenings
- ★ Use of Triticarte will be required
- ★ 50% supported by each VAWCRC, SunPrime



### 5.4.7 budget



50% scholarship	\$12,500
50% operating, to be used for Triticarte genotyping	\$5,000
<b>CASH TOTAL</b>	<b>\$17,500</b>
<b>PLUS IN-KIND</b>	<b>\$10,225</b>

### Total Program 5 Budget



Expenditure	\$	% of VAWCRC's cash budget 2004-2005
<b>Program 5 Cash</b>	<b>\$382,335</b>	<b>6.8%</b>
<i>Program 5 In-Kind</i>	<i>\$238,388</i>	<i>N/A</i>
Postgraduate students in Research Program	\$527,154	9.4%
<b>Total cash spent on Education</b>	<b>\$909,489</b>	<b>16.2% **</b>

\*\* under CRC program, 20% is expected

### Income from Education & Technology Transfer



#### Courses

- \* Average 78% cost recovery, 22% subsidy Av. \$12,480/yr

#### Sales of publications

- \* Grain storage CD 2003/04 \$1,360
- \* NIR manual, first 2 weeks \$217
- \* More planned

#### External grants

- \* Westons' FIG pays 50% of 5.3.5 (\$43,907 over 3 yrs) \$14,636/yr
- \* SunPrime pays half of 5.4.7 (\$52,500 over 3 yrs), **saves \$17,500/yr**

TOTAL BENEFIT approx. \$47,000/yr

### Meeting industry needs

- \* **Comments on Program 5?**

