



tyriandiagnostics

Developing rapid point of need testing for
crop quality

Ausbiotech 2009

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Crop Quality

Provides information at multiple levels:

- Nutritional properties
- Disease status
- Pesticide residues
- Soil health
- Other...

Implications

- Use
- Pricing
- Biosecurity



Who cares about crop quality?

- **Primary producers**
 - Harvest or plough?
 - Treat with pesticides, fertilizers, fungicides etc?
 - At risk from imported pests and diseases?
- **Grain elevators**
 - Fit for purpose
- **Traders**
 - Am I getting what I am paying for?
- **Government agencies, e.g. quarantine**
 - Safety for product importation
 - Protecting Australia's disease-free status

Many tests in use

- Require:
- Expertise
 - Expensive equipment
 - Time

2009 Soft Red Winter Quality Summary

	Composite Average			East Coast ^a			Gulf Ports ^a		
	2009	2008	5-Year	2009	2008	5-Year	2009	2008	5-Year
Wheat Grade Data									
Test Weight (lb/bu)	57.6	59.2	59.5	59.2	60.5	59.6	57.3	58.9	59.5
Test Weight (kg/hl)	75.8	77.9	78.3	77.8	79.6	78.4	75.4	77.6	78.3
Damage - Total (%)	2.4	0.9	0.8	1.8	0.7	1.0	2.5	0.9	0.8
Foreign Material (%)	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Shrunken and Broken (%)	0.7	0.5	0.6	0.6	0.4	0.5	0.8	0.5	0.6
Total Defects (%)	3.1	1.4	1.5	2.4	1.2	1.6	3.2	1.4	1.4
Grade	3	2	2	2	1	2	3	2	2
Wheat Non-Grade Data									
Dockage (%)	0.8	0.9	0.9	1.1	0.9	0.7	0.8	0.9	0.9
Moisture (%)	12.8	13.0	13.1	13.1	12.6	13.1	12.8	13.1	13.1
Protein (%) 12%/0% mb	10.0/11.4	9.8/11.1	10.0/11.3	10.9/12.4	9.9/11.3	10.0/11.3	9.8/11.1	9.8/11.1	10.0/11.3
Wheat Ash (%) 14%/0% mb	1.56/1.82	1.55/1.80	1.54/1.79	1.55/1.80	1.48/1.72	1.48/1.72	1.57/1.82	1.56/1.81	1.55/1.80
1000 Kernel Weight (g)	30.8	35.3	33.5	32.9	36.8	34.6	30.4	35.1	33.2
Wheat Falling Number (sec)	325	325	341	322	352	333	325	320	343
Kernel Size (%) lg/med/sm	0/19/0/1	85/14/0/1	83/16/0/1	83/16/0/1	89/10/0/1	85/14/0/1	80/19/0/1	85/14/0/1	83/16/0/1
Single Kernel Hardness	20.1	14.4	18.2	25.9	18.2	17.3	18.9	13.7	18.5
Single Kernel Weight (mg)	30.6	32.4	30.9	32.2	35.3	34.0	30.2	31.9	30.2
Single Kernel Diameter (mm)	2.26	2.26	2.16	2.35	2.39	2.34	2.25	2.24	2.12
Sedimentation (cc)	12.3	11.6	13.2	16.7	13.0	14.1	11.4	11.3	13.0
DON (ppm)	1.8	0.6	0.5	1.5	0.7	0.4	1.9	0.6	0.5
Flour Data									
Lab Mill Extraction (%)	67.2	68.6	69.4	66.9	69.8	69.2	67.3	68.4	69.5
Flour Color - *L	93.3	93.8	93.3	93.2	94.0	93.4	93.3	93.8	93.3
Flour Color - *a	-3.1	-3.0	-3.1	-3.0	-3.0	-3.1	-3.1	-3.0	-3.1
Flour Color - *b	8.3	8.2	8.2	7.9	8.2	8.1	8.4	8.2	8.2
Flour Protein (%) 14%/0% mb	8.2/9.5	8.2/9.5	8.3/9.7	8.8/10.3	8.3/9.7	8.4/9.8	8.0/9.3	8.2/9.5	8.4/9.7
Flour Ash (%) 14%/0% mb	0.45/0.52	0.43/0.50	0.43/0.50	0.44/0.51	0.42/0.49	0.42/0.49	0.45/0.52	0.43/0.50	0.43/0.50

From U.S. Wheat Associates. 2009 Crop Quality Report for Soft Red Winter Wheat

Point of Need Testing

Adds value if delivers:

- Speed
- Simplicity
- Reliability
- Relevance
- Accuracy

Advantages:

- Allows decisive action:
 - No lag time in waiting for lab results
- Empowers multiple stakeholders, e.g.
 - Farmers
 - Buyers
 - Govt agencies

DiagnostIQ™

Rapid, robust, sensitive, point-of-need platform suitable for complex samples in a patented format.



DiagnostIQ™ - point-of-need platform



Sample and
conjugate
addition



Press
chamber down
to bind capture
agent



Read
Result



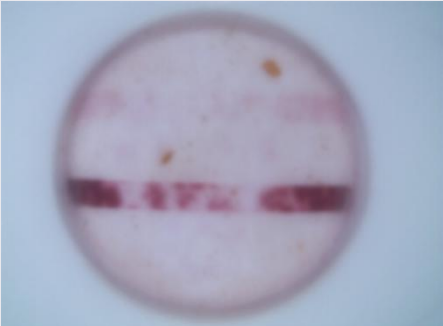
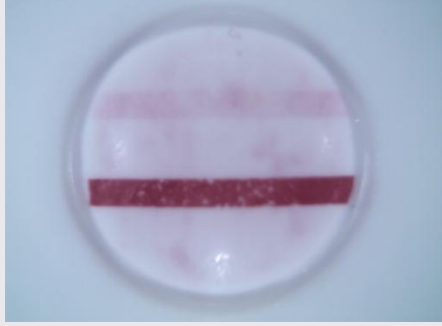
DiagnostIQ™ - Advantages

- Rapid Ease of Use
 - True point-of-need
 - Complete in ≤ 5 mins
- Sensitivity
 - Highly sensitive for a range of targets (< 5 ng/mL for proteins, < 200 ppb for small molecule targets)
 - Quantitative or qualitative results
- Versatility
 - Tolerant for a broad range of sample volumes
 - Crude sample tolerance
- Protection
 - Independent IP position – multiple jurisdiction protection to 2022



DiagnostIQ™ - crude sample analysis

DiagnostIQ provides clear results for even the most complex samples

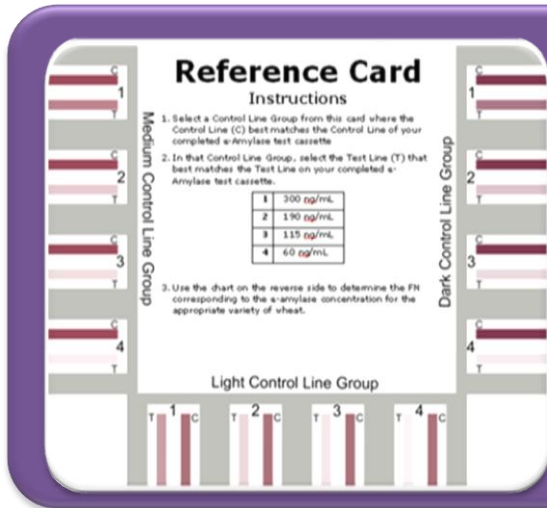
Matrix	Standard Flow Through	DiagnostIQ™ - Advanced Flow Through
Buffer		
Wheat		

DiagnostIQ - Quantitation



Portable Reader

- Quantitative results



Colour card

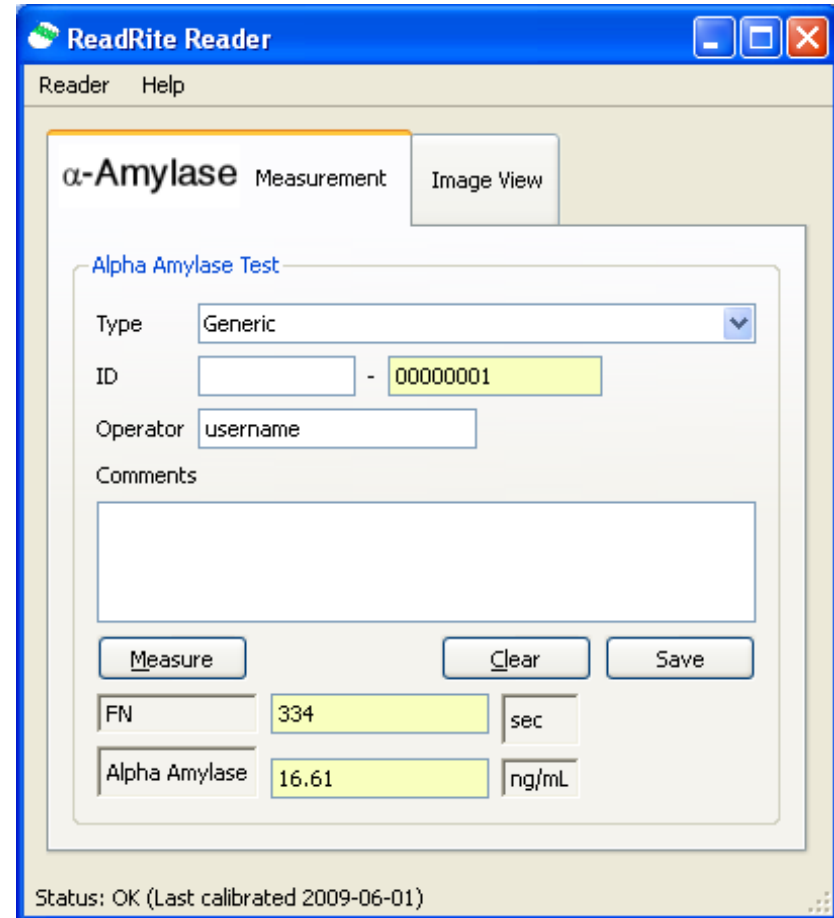
- Semi-quantitative analysis

Grain Pre-sprouting

- Rain-damaged grain, e.g. wheat is susceptible to pre-sprouting.
- Pre-sprouting results in an increase in production of amylase – an enzyme that breaks down starch.
- The level of starch in grain determines market and hence price. i.e. levels of α -amylase directly related to wheat quality.
- Current test: Hagberg Falling Number
 - Laboratory setting
 - Indirect measure of amylase



- Tyrian has developed ReadRite Alpha Amylase® (RR-AA)
- Direct, specific measurement of α -amylase in grain (immunoassay).
- Measures the level of rain damage in wheat using our DiagnostIQ™ format.



The screenshot shows the ReadRite Reader software interface. The window title is "ReadRite Reader" and it has a menu bar with "Reader" and "Help". The main content area is titled "Alpha Amylase" and has two tabs: "Measurement" (selected) and "Image View". Below the tabs is a section titled "Alpha Amylase Test" containing the following fields and controls:

- Type: A dropdown menu set to "Generic".
- ID: A text field with a hyphen and a yellow-highlighted field containing "00000001".
- Operator: A text field containing "username".
- Comments: A large empty text area.
- Buttons: "Measure", "Clear", and "Save".
- FN: A text field with a yellow-highlighted field containing "334" and a unit field containing "sec".
- Alpha Amylase: A text field with a yellow-highlighted field containing "16.61" and a unit field containing "ng/mL".

At the bottom of the window, the status bar reads: "Status: OK (Last calibrated 2009-06-01)".

ReadRite Alpha Amylase Test

RR-AA has advantages of speed and versatility over the current product to provide an accurate result for rain-damaged grain at multiple points in the grain handling process

- **Commercial partnership with Bayer CropScience AG**
 - Tyrian receives payment for test development, supply of manufactured products, licensing fees and royalties on test sales
- **Substantial market opportunity for product**
 - Estimated market size in North America, EU and Australia up to 17 million tests p.a.
- **Tyrian and Bayer plan to develop a portfolio of agricultural diagnostic tests**
 - Second diagnostic test for crop quality with significant global market
 - Prototype tests under evaluation by Bayer



Competitive Landscape

Feature	ReadRite® -AA(FNE)	RVAcP	Hagberg FN
Capital Costs (US \$)	\$1,000	\$55,000	\$25,000
Equipment maintenance	Negligible	Considerable	Considerable
Consumables per test	\$18	\$1.75	-
Clean up by laboratory staff	None, disposable	None, disposable	Tubes need to be washed
Portability	Portable	Laboratory based	Laboratory based
Assay Performance time	Rapid <5 minutes	Rapid < 4 minutes	Can take considerable time to set up, run and clean up
Can Provide Amylase result	Yes	No	No
Requires moisture analysis	No	Yes	Yes
Can be performed at multiple sites in the wheat delivery chain	Yes	Not easily	Not easily
Result able to be ascertained without equipment	Yes	No	No
Global Acceptance	Not yet	Not yet	Yes
High training requirement	No	No	Yes
Need to adjust calculations for altitude	No	No	Yes
Reader adaptable for other diagnostic applications on the DiagnostIQ platform	Yes	Not applicable	Not applicable

Independent Validation

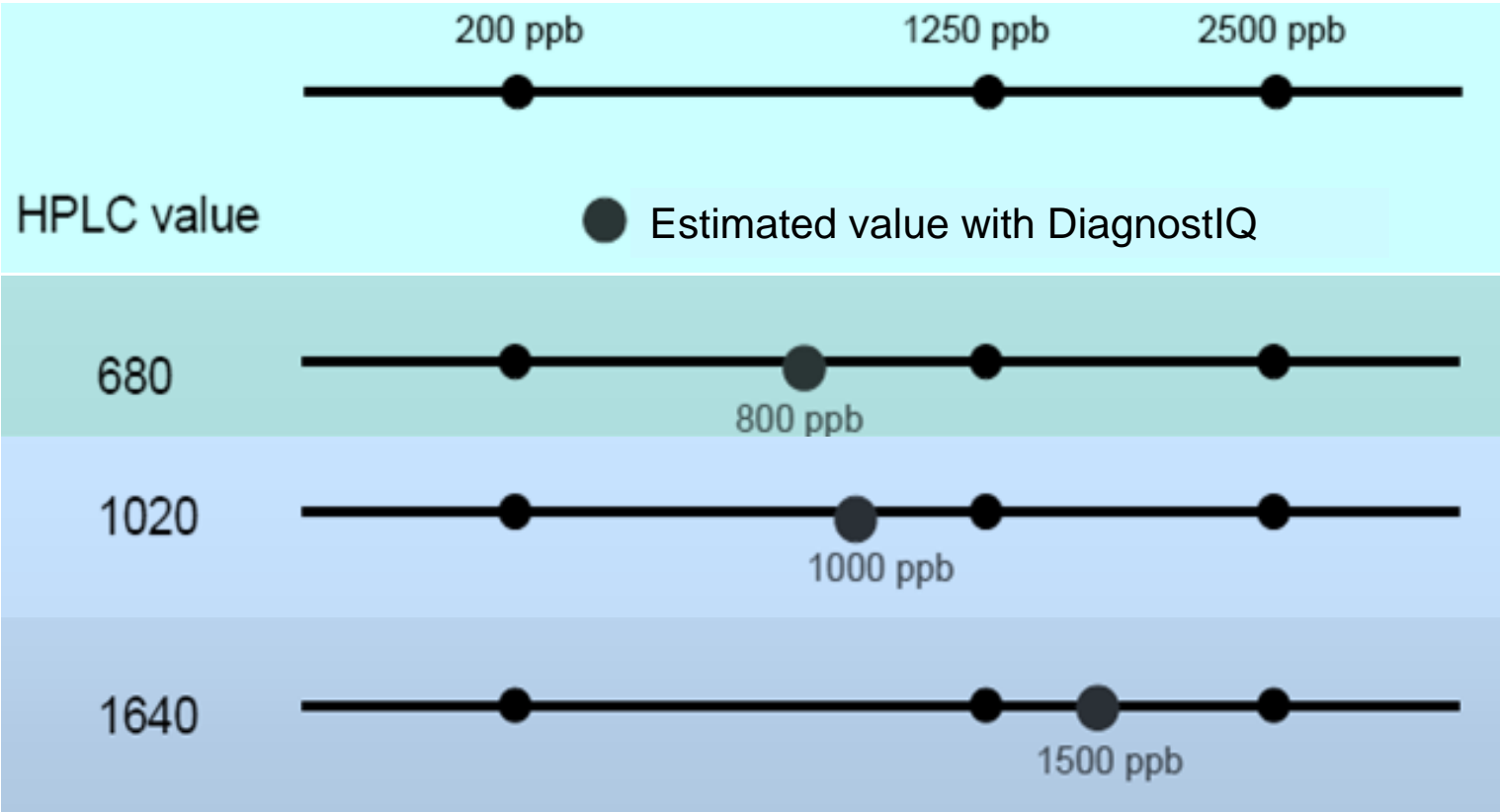
- Validation by independent agency (Canada)
- Compared RR-AA to current gold standard.

Outcomes:

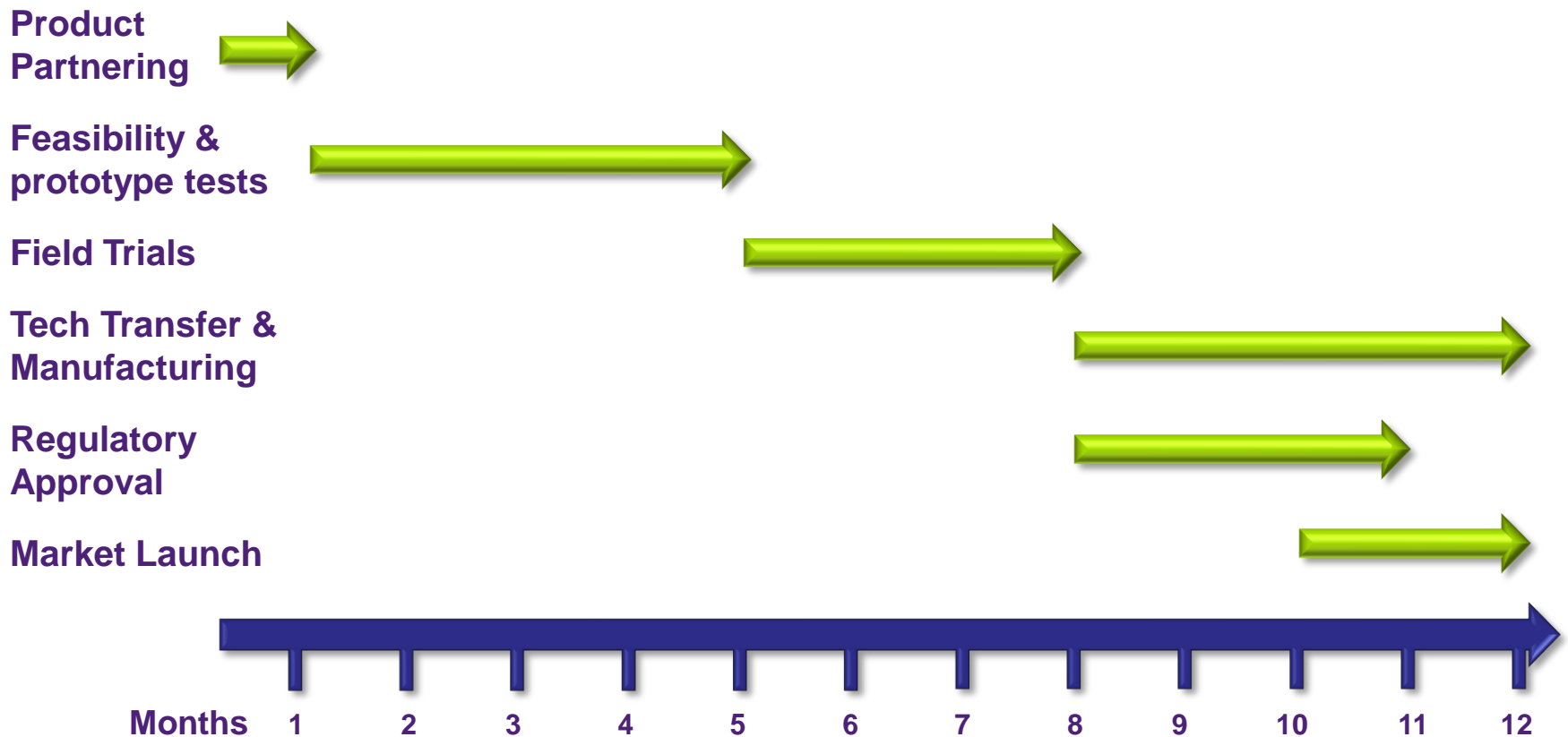
- Strong correlation between RR-AA output and Hagberg falling number (~95%).
- Excellent reproducibility (e.g. > 99% reader to reader)
- RR-AA a simple, objective and economical testing solution for use at the grain silos and transport points.

Grain Quality: Product 2

In development: Semi-quantitative analysis using a colour card



Typical Product Timeline



Building a business in Ag Dx Market

Advantages:

- New markets for point of need Dx
- No regulatory requirements for IVDs
- Increasing regulation for food quality
- Provides setting for biosecurity testing of crops

Challenges:

- New market for point of need Dx
- Sample complexity e.g. flour,
- Seasonality
- Accessing samples in Australia, e.g. quarantine

Application to Biosecurity

- Suitable for detection of infectious agents, toxic molecules, etc.
- Rapid diagnosis
- On-site testing
- Disposable
- Quantitative results

