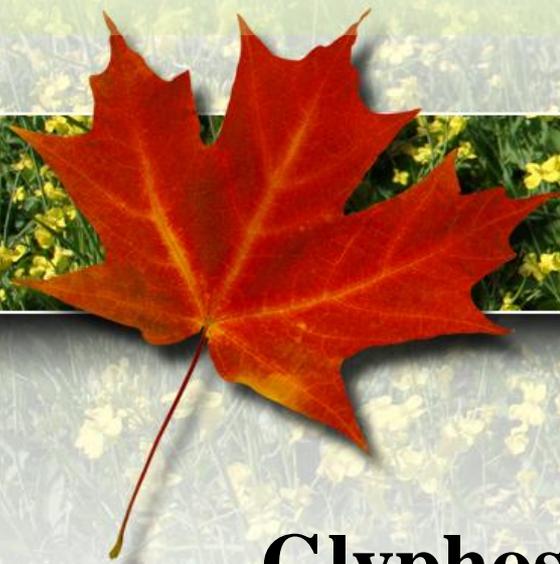




Agriculture and
Agri-Food Canada

Agriculture et
Agroalimentaire Canada



Glyphosate: Timing of Preharvest Applications and Understanding Pesticide Maximum Residue Limits (MRL's)

Eric Johnson

Canada 

Outline

- 1. Maximum Residue Limits**
- 2. Timing of Pre-Harvest Glyphosate**
- 3. Update on Glyphosate Resistant Weeds**



Maximum Residue Limits (MRL's)

1. Residue expected when using “good agricultural practices” – and recommended rates
2. **NOT** a human dosage, **NOT** a safe limit for consumption
3. MRLs are combined with consumption of food to measure against acceptable daily intake (risk cup) over a lifetime
4. All Foods (MRL X Quantity Consumed)~ ADI



Pre-harvest Interval

- Pre-harvest Interval (PHI) is the time between the last application of the pesticide and harvest. PHI values are usually given in days.
- Harvest is the cutting of the crop or removal of the produce from the plant. It includes swathing, straight combining or grazing.



Pre-harvest interval (PHI) for various insecticides registered in canola

Insecticide	PHI
Cygon / Lagon	21
Decis	7
Lorsban	21
Malathion	7
Matador	7
Monitor	10



Canadian Glyphosate MRLs

- Beans 2 ppm
- Lentils 4 ppm*
- Wheat/Peas 5 ppm
- Canola 10 ppm

*20 years of cargo analysis; 1.2-3.7 ppm



EU vs. Canada - MRLs

	<u>Europe</u>	<u>Canada</u>
• Beans	2 ppm	2 ppm
• Lentils	0.1 ppm	4 ppm
• Wheat/Peas	10 ppm	5 ppm
• Canola	10 ppm	10 ppm



Proper timing of pre-harvest glyphosate

- Grain moisture should be less than 30%
- Cereals – hard dough stage – a thumbnail impression remains on seed



Physiological Maturity of Wheat

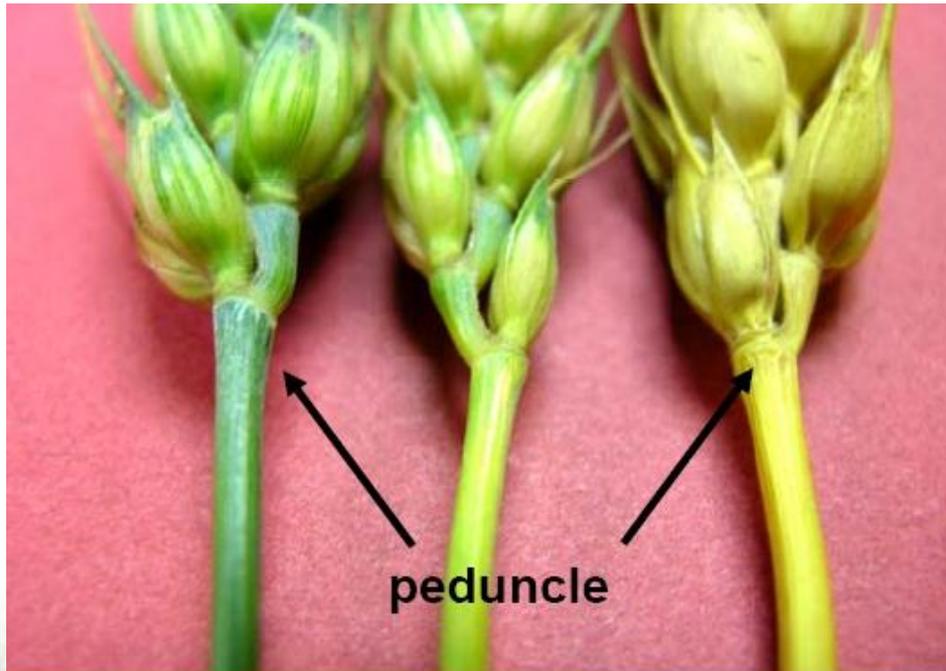


Figure 1. Wheat spikes before (left) and at (right) physiological maturity.

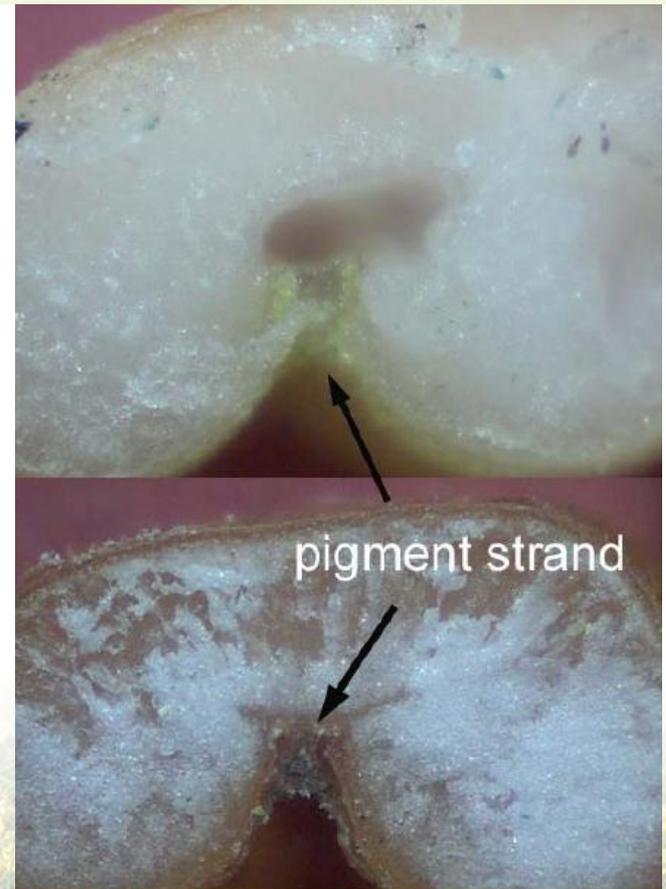


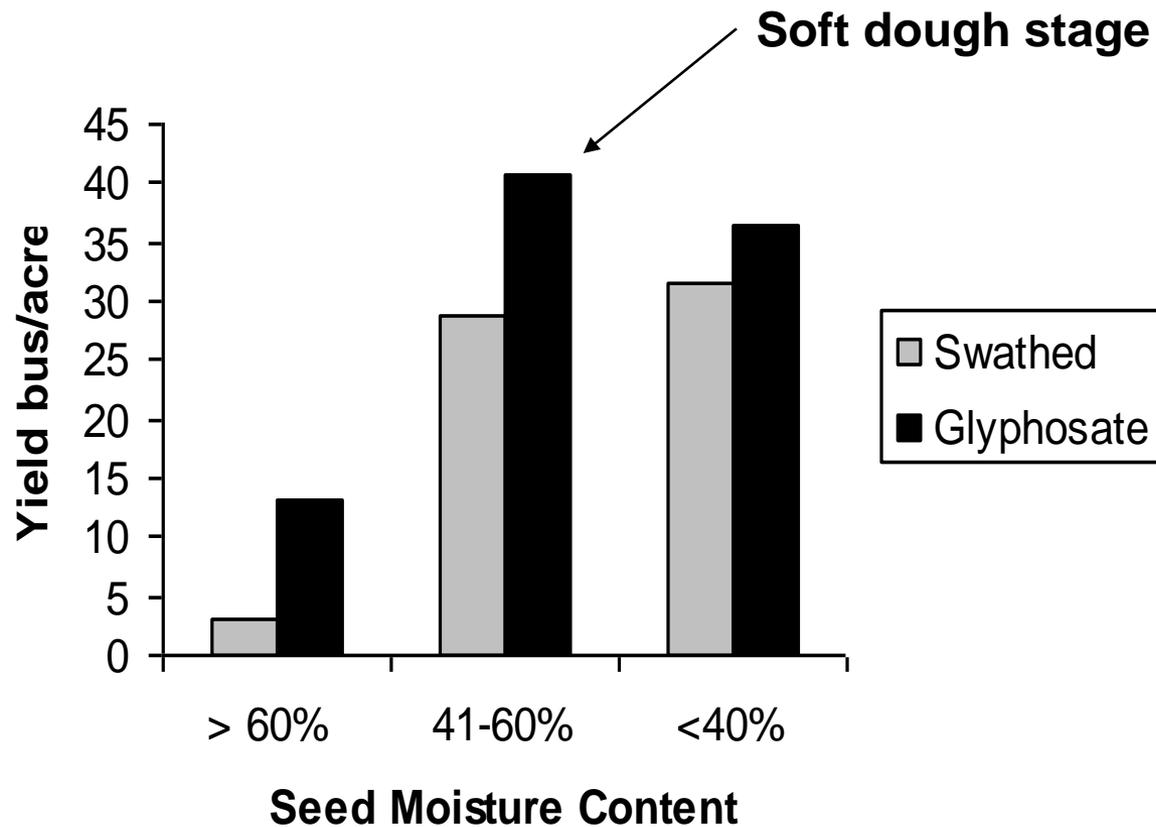
Figure 2. Cross-section of wheat kernel showing presence of pigment strand at base of crease. Lower image shows dark color of the physiologically mature kernel.

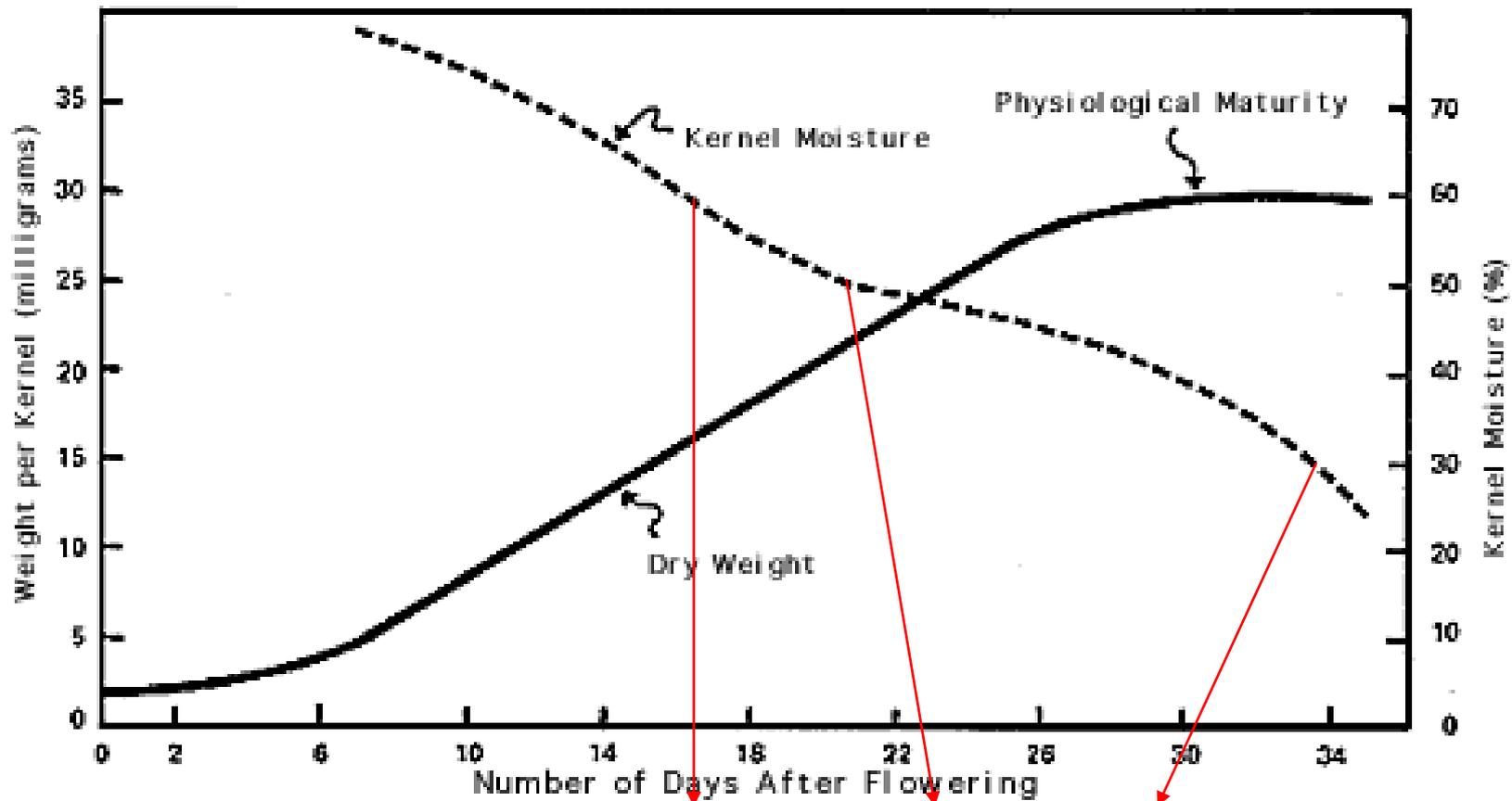




SWATHING VS PRE-HARVEST GLYPHOSATE EFFECT ON YIELD OF SPRING WHEAT

Adapted From Darwent et al. 1994.





Watery ripe



Late milk



Soft dough



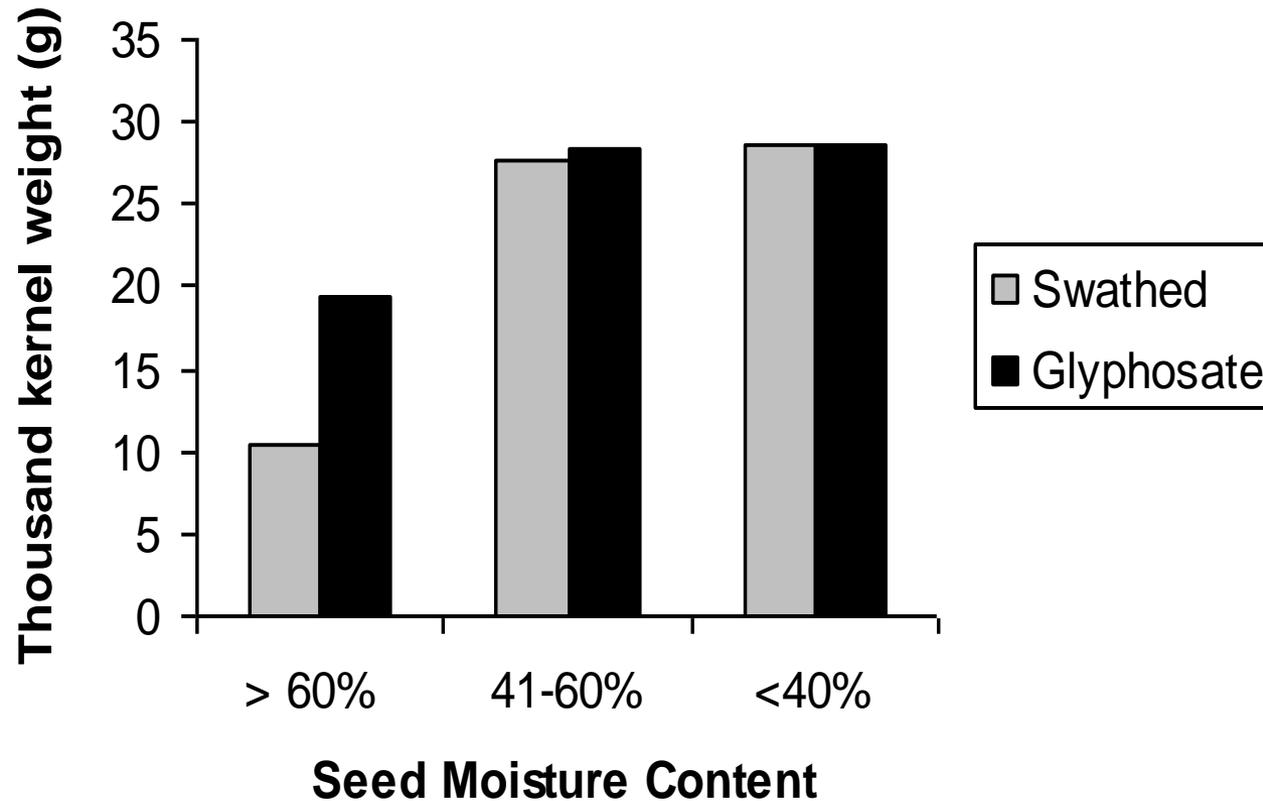
Hard dough



Ripe

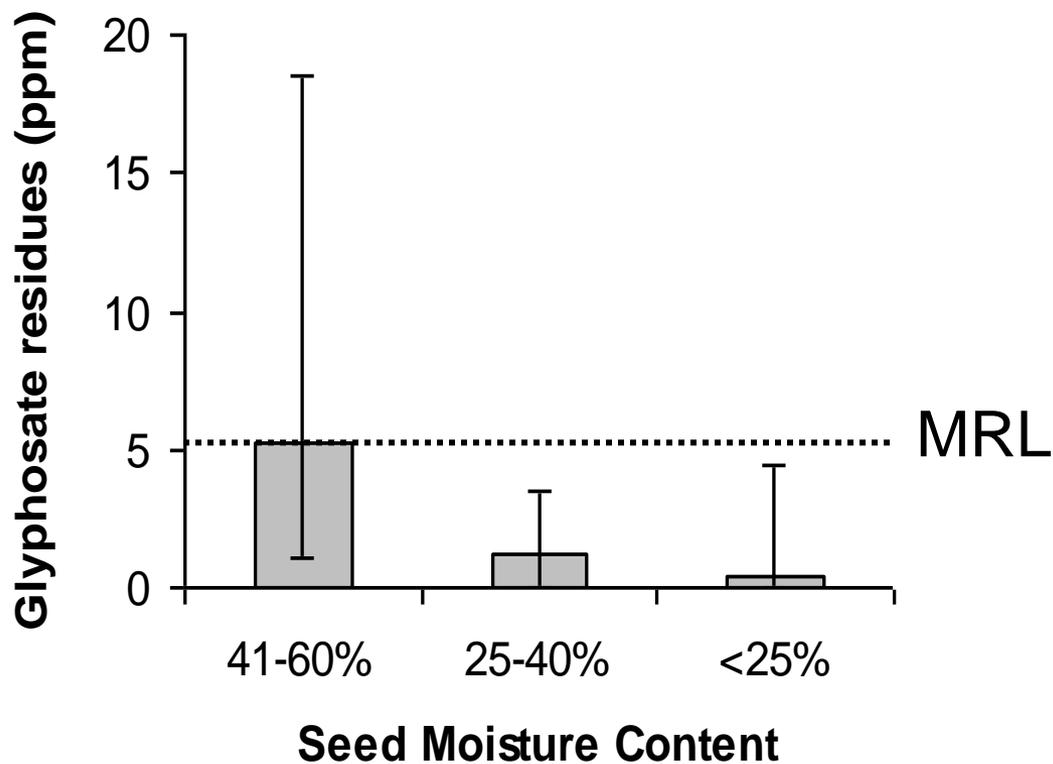
SWATHING VS PRE-HARVEST GLYPHOSATE EFFECT ON THOUSAND KERNEL WEIGHT OF SPRING WHEAT

Adapted From Darwent et al. 1994.



TIMING OF PRE-HARVEST GLYPHOSATE EFFECT ON GLYPHOSATE RESIDUES IN SPRING WHEAT SEED

Adapted From Cessna et al. 1994.

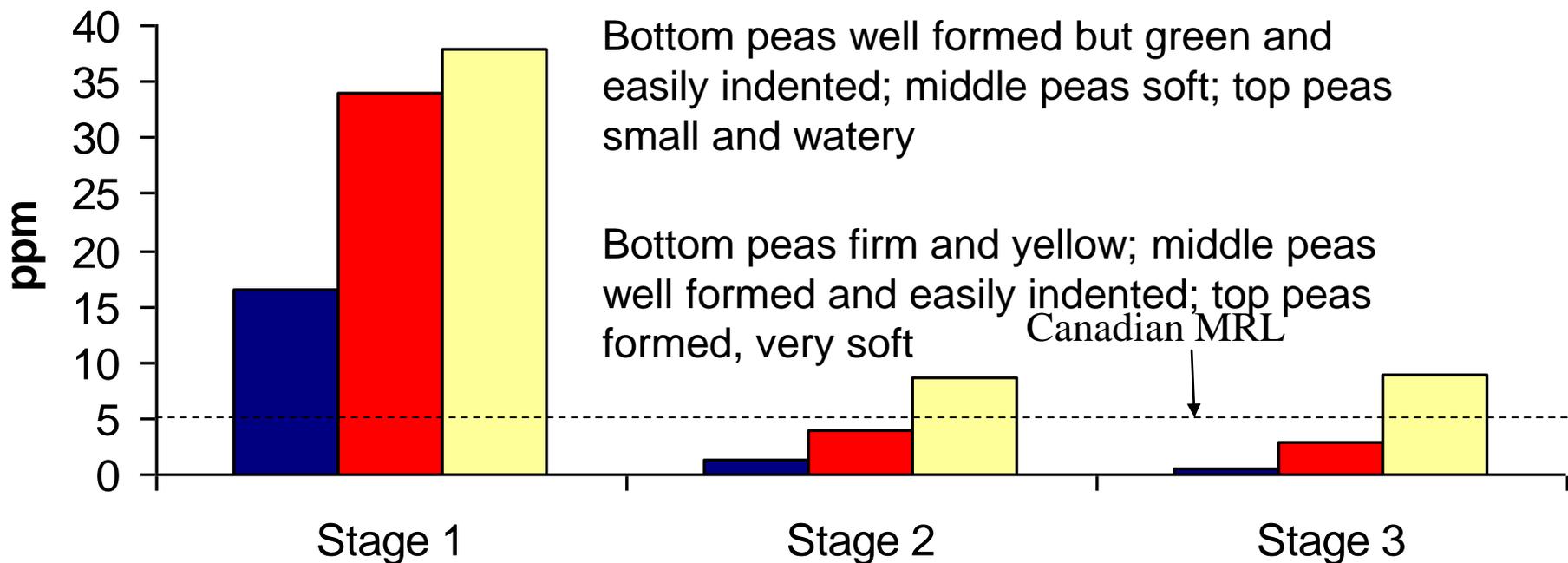


Proper Application Rates for Pre-Harvest Glyphosate

Formulation (g/l)	Rate (L/acre)
356-360	1.0
400	0.81
480	0.76
500	0.73
540	0.67

Effect of timing and glyphosate rate on glyphosate residue level in field pea seed (adapted from Cessna et al. 2002).

■ 0.5 (.33) ■ 1 (0.67) ■ 1.9 (1.3)



Bottom peas well formed but green and easily indented; middle peas soft; top peas small and watery

Bottom peas firm and yellow; middle peas well formed and easily indented; top peas formed, very soft

Canadian MRL

Timing

Bottom peas hard and yellow; middle peas firm and yellow; top peas firm and easily indented



Proper timing for Field peas

- 75 to 80% of pods are brown



Pre-harvest glyphosate in canola

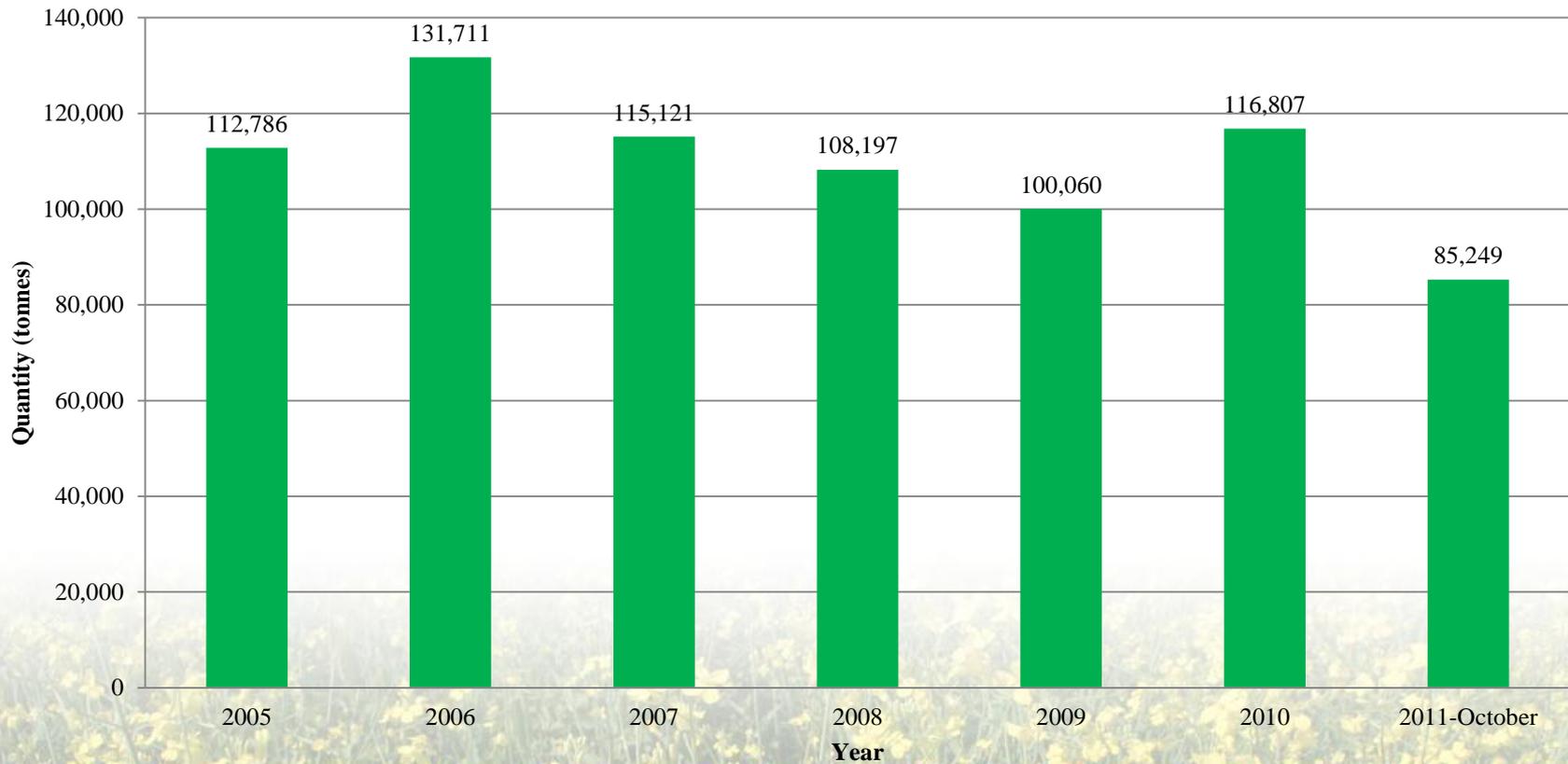
- A maximum of 1.0 L/acre (356-360 g/l) or 0.67 L/acre (540 g/l) is allowed per season in Roundup Ready canola.



The Lentil Situation



Quantity of Canadian Lentil Exports to to the EU 27



Timelines

- February 2011: EU detects Glyphosate on Organic lentils; public notification made
- March: Increased testing of EU lentil imports – more positives found – EU customers increasingly concerned
- April: CICILS and Canadian and US industries respond
- April: Canadian and US industry meet with customers in 4 EU countries.
- May: CICILS/Pulse Canada meeting with EU Regulators



Timelines

- May: Monsanto delivers data package for MRL application in EU. Starts review process.
- November: Expected European Food Safety Agency (EFSA) Report
- January 2012: EFSA recommends MRL of 10-15 ppm.
- **March 22-23: Earliest possible date for approval by EU standing committee**



Codex – International Standards

- No Codex MRL for glyphosate, but requested in April
- Recommendation of 5 ppm **March/July 2012** decisions
- No Codex MRL for several new product registrations
- Codex; backlogged and out of step with global joint reviews



Challenge in Measuring Residue

- Variability in test result higher when a small sample is drawn
- Using a reference sample, test results varied from 24-38%
- Zero glyphosate sample tested from <0.01 - 0.348 ppm

Challenge: regulations state a maximum while tests will give a range



Bottom line

- Glyphosate MRLs for lentil in EU – marketing problem over the last year.
- If approved, EU MRL will be set at level that removes market risk for Canadian lentils – in time for 2012 crop?
- Harmonization of new product registrations and establishment of MRLs at CODEX – slow, but will help reduce future MRL problems.



HEAT: Harvest Aid/ Desiccant Relative Days to Harvest



REGLONE

HEAT (+/- GLYPHOSATE)

GLYPHOSATE

UNTREATED

Pre-harvest
Treatment
Applied

Relative Days to Harvest

HEAT provides Fast, Complete Crop Dry-down



HEAT: Harvest Aid/ Desiccant Pre-Harvest Application



Pulse Crops

Field Peas

Lentils

Dry Beans

Soybeans



Oilseed

Sunflower*

*Glyphosate is not registered for pre-harvest use



HEAT: Harvest Aid/ Desiccant Lentils – 12 Days

 **BASF**
The Chemical Company

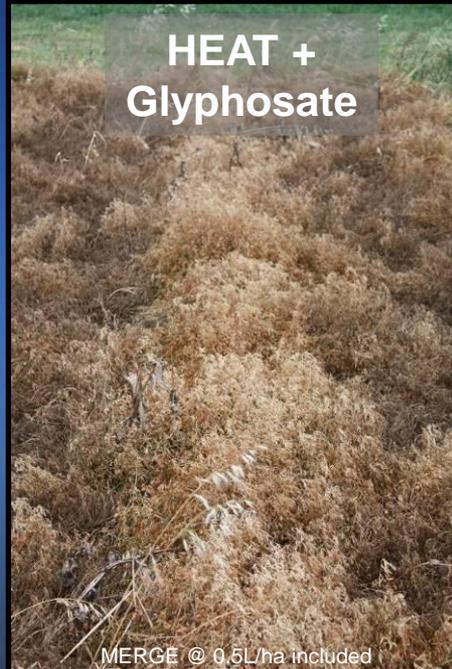
Untreated



Glyphosate



HEAT +
Glyphosate



Reglone



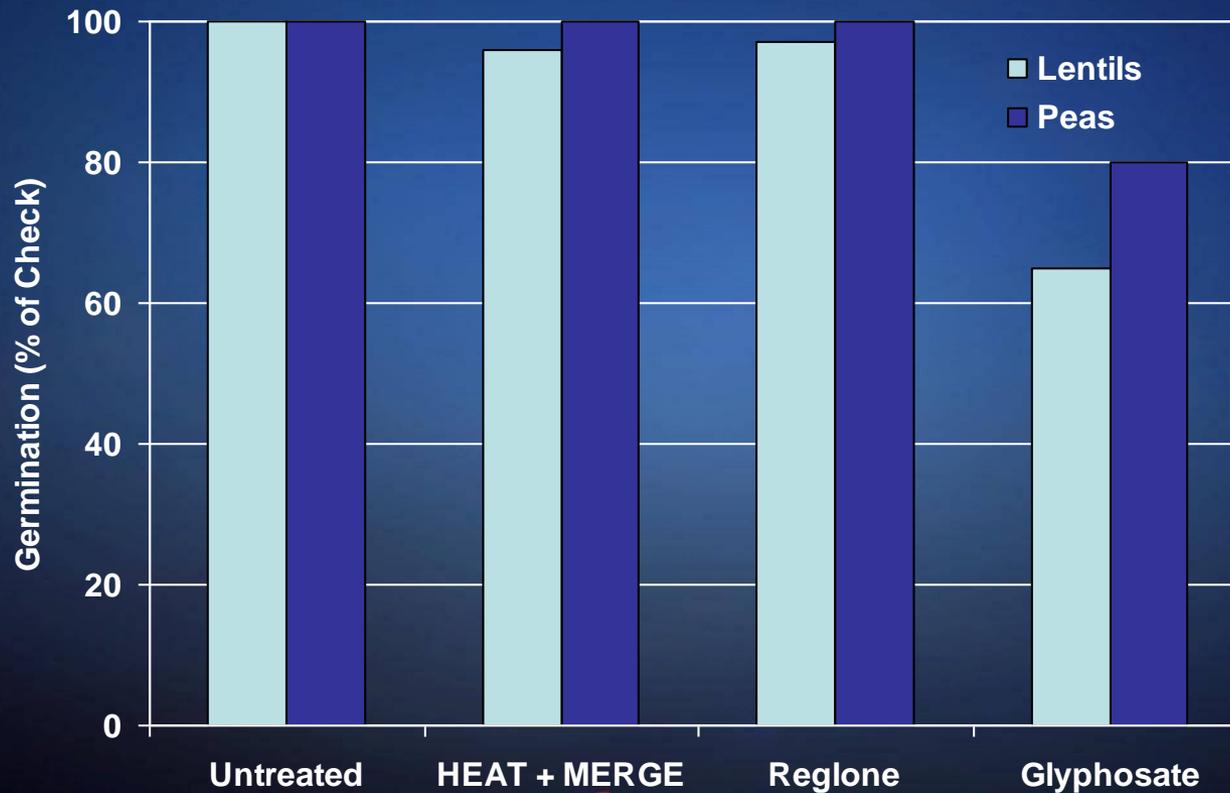
2010 BASF
Internal Trials

HEAT provides Fast, Complete Crop Dry-down

HEAT™ 
POWERED BY
KIXOR® HERBICIDE

HEAT: Harvest Aid/ Desiccant Seed Germination – Lentils/ Peas

Effect of Pre-harvest Treatment on Seed Germination



2009/10 BASF
Internal Trials
Lentils N=5
Peas N=8

HEAT + MERGE Can be Applied to Seed Crops

HEAT: Harvest Aid/ Desiccant Application Rates

 **BASF**
The Chemical Company

- HEAT + Glyphosate

- ❖ 1 Jug of HEAT Treats 40 acres

- Add 1 L/ac of glyphosate (360 g/L equivalent)
- Add 200 ml/ac of MERGE
 - (1 jug of Merge per 1 jug HEAT)
- Apply in 10 - 20 IMP gallons of water



- HEAT

- ❖ 1 Jug of HEAT Treats 30 acres

- Add 400 ml/ac of MERGE
 - (2 jugs of Merge per 1 Jug HEAT)
- Apply in 10 – 20 IMP gallons of water



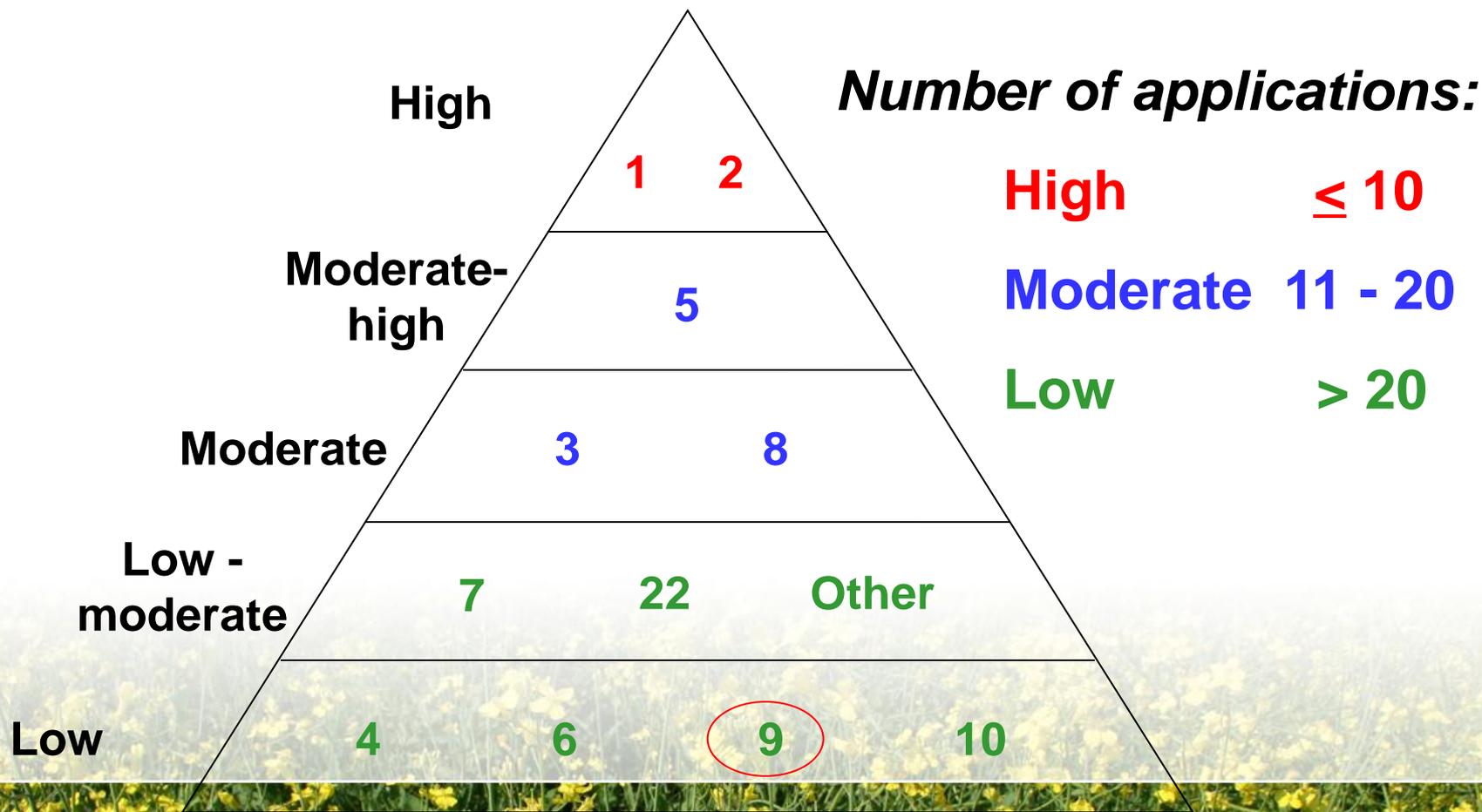
HEAT™ 
POWERED BY
KIXOR® HERBICIDE

Pesticide MRLs

- Growers need to pay attention to PHI's. Food safety is becoming an increasing issue worldwide.
- Follow label guidelines for timing and rates.
- Check with dealer to see if MRL issue with glyphosate and lentil has been resolved. Also, Heat MRL's need to be established and accepted.



Risk of selection for resistance by herbicide group



Kansas: confirmed glyphosate resistance in kochia in 2007

**In corn, cotton, soybean,
cropland: up to 500 sites,
covering up to 10,000 acres**



Source: Westra, Colorado State Univ.; Stahlman, Kansas State

GR kochia in southern Alberta: 3 chem-fallow fields in close proximity to each other



Agricultural and non-agricultural land uses reporting glyphosate-resistant *L. rigidum* in Australia. From Preston (2009).

	Situation	Number of sites
Grain Production	Chemical fallow	28
	Winter grain Production	19
Horticulture	Tree crops	4
	Vine crops	15
Other	Driveway	1
	Fence line & crop margin	25
	Irrigation channel	8
	Airstrip	1
	Railway right-of-way	1
	Roadside	1

Managing glyphosate resistant weeds in Australia

Christopher Preston

School of Agriculture, Food and Wine, University of Adelaide

Predicting weeds at risk for glyphosate resistance

- Currently 21 GR weed species worldwide, but only two in E. Canada – giant ragweed and Canada fleabane in RR soybean in Ontario (www.weedscience.org)
- Glyphosate selection pressure is greatest at in-crop herbicide application for top 10 annual weed species except kochia
- In the Grassland region, the top three weeds predicted at greatest potential risk of glyphosate resistance are **kochia**, wild oat, then green foxtail
- In the Parkland region, **wild oat, green foxtail, and cleavers** are the top three species



Delaying glyphosate resistance in pulses

- Tank-mix glyphosate in pre-seed burnoff
 - Heat
 - CleanStart
- Use glyphosate tank-mixes in chem-fallow
 - Heat, CleanStart, dicamba
 - New formulation of dicamba called Distinct (not yet registered) will provide better control of kochia in chem-fallow than dicamba.



Pre-seed recommendations for sustainable glyphosate

- Canola
 - Cleanstart – if volunteer canola present, target the 1-leaf stage
- Wheat / Barley
 - Glyphosate / 2,4-D – outside the kochia area / won't reduce risk of GR cleavers
 - Glyphosate / Dicamba – risk of GR cleavers
 - Glyphosate / Bromoxynil / Bromoxynil-MCPA – risk of GR cleavers & kochia
 - CleanStart – reduces risk of GR cleavers and kochia
 - Glyphosate + Heat – reduces risk of GR cleavers and kochia



Pre-seed recommendations for sustainable glyphosate

- Pulse Crops
 - CleanStart
 - Heat



<http://www.weedtool.com>

- Objectives:
- (1) tool for producers to assess their risk of glyphosate resistance on a field-by-field basis;
- (2) raise awareness for proactive resistance management in western Canada
- Producer answers 10 questions related to crop production system, tillage system, and glyphosate usage (each question with four possible answers)
- Tool indicates relative risk of glyphosate resistance based on the 10 responses



Glyphosate Resistance Summary

- First cases of a glyphosate-resistant weed in western Canada confirmed in 2012
- Kochia was predicted in 2010 to be the top weed at risk
- Field-to-field spread of GR kochia may be rapid
- Urgent call to action: collaboration among all stakeholders to manage the problem
- *Future proposed research:*
 - expanded field survey in S. Alberta
 - field trials: dose-response, alternative herbicides
 - mechanism of resistance

Thank you!

