Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

PGDC Plenary Session February 2015

Key strategies for managing field crop diseases in western Canada

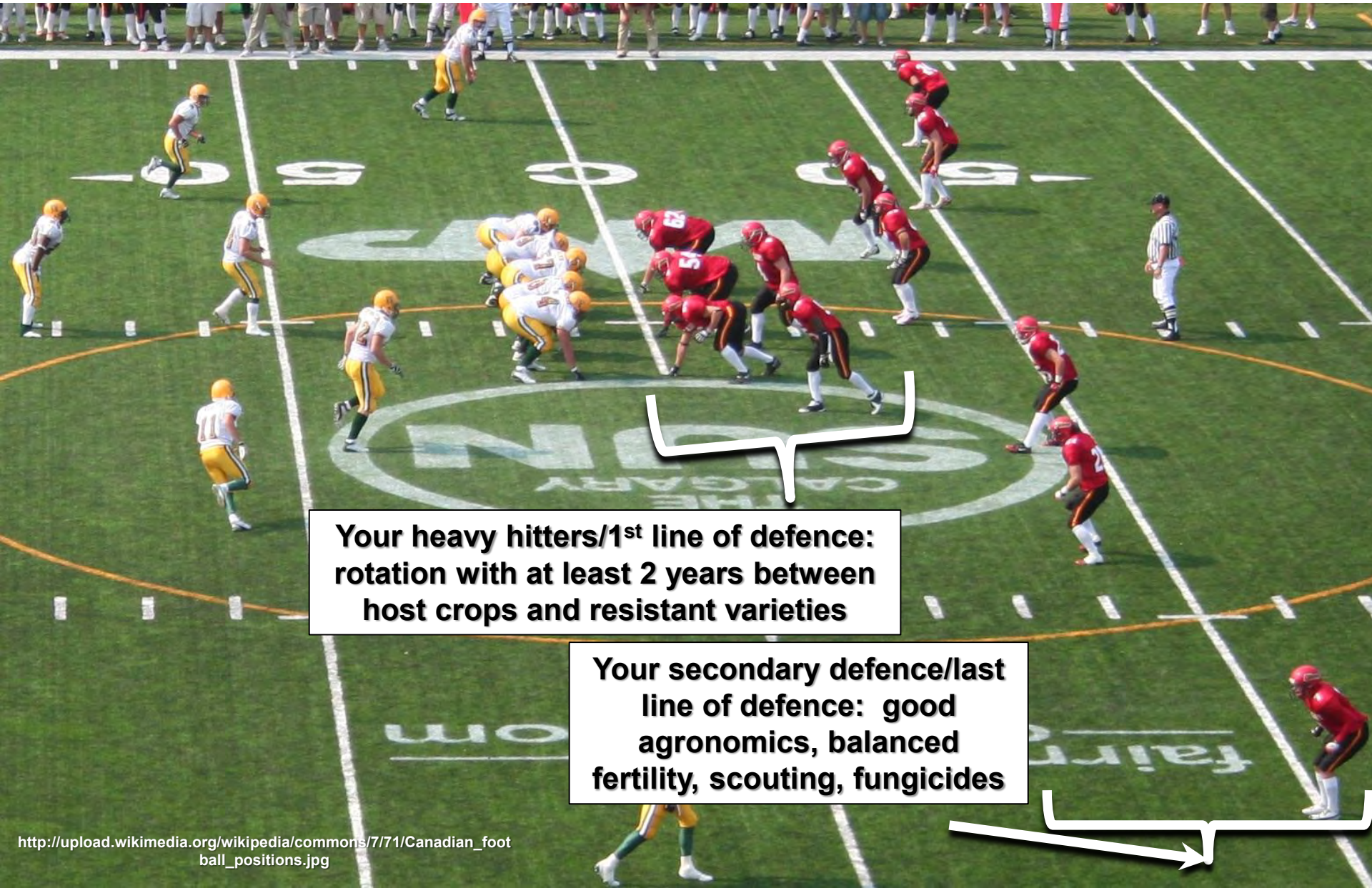
T.K. Turkington, K. Xi, H.R. Kutcher, G. Peng, R. Martin, K. Kumar, A. Akhavan, and S. Strelkov

Canada

Acknowledgements

- AAFC/AARD/U of A colleagues & technical staff
- Alberta Barley, Western Grains Research Foundation, Alberta Wheat Commission, Ducks Unlimited, Atlantic Grains Council
- AAFC Barley DIAP/Cluster, Rahr Malting, BASF, Bayer CropScience
- PGDC
  - Tom Fetch

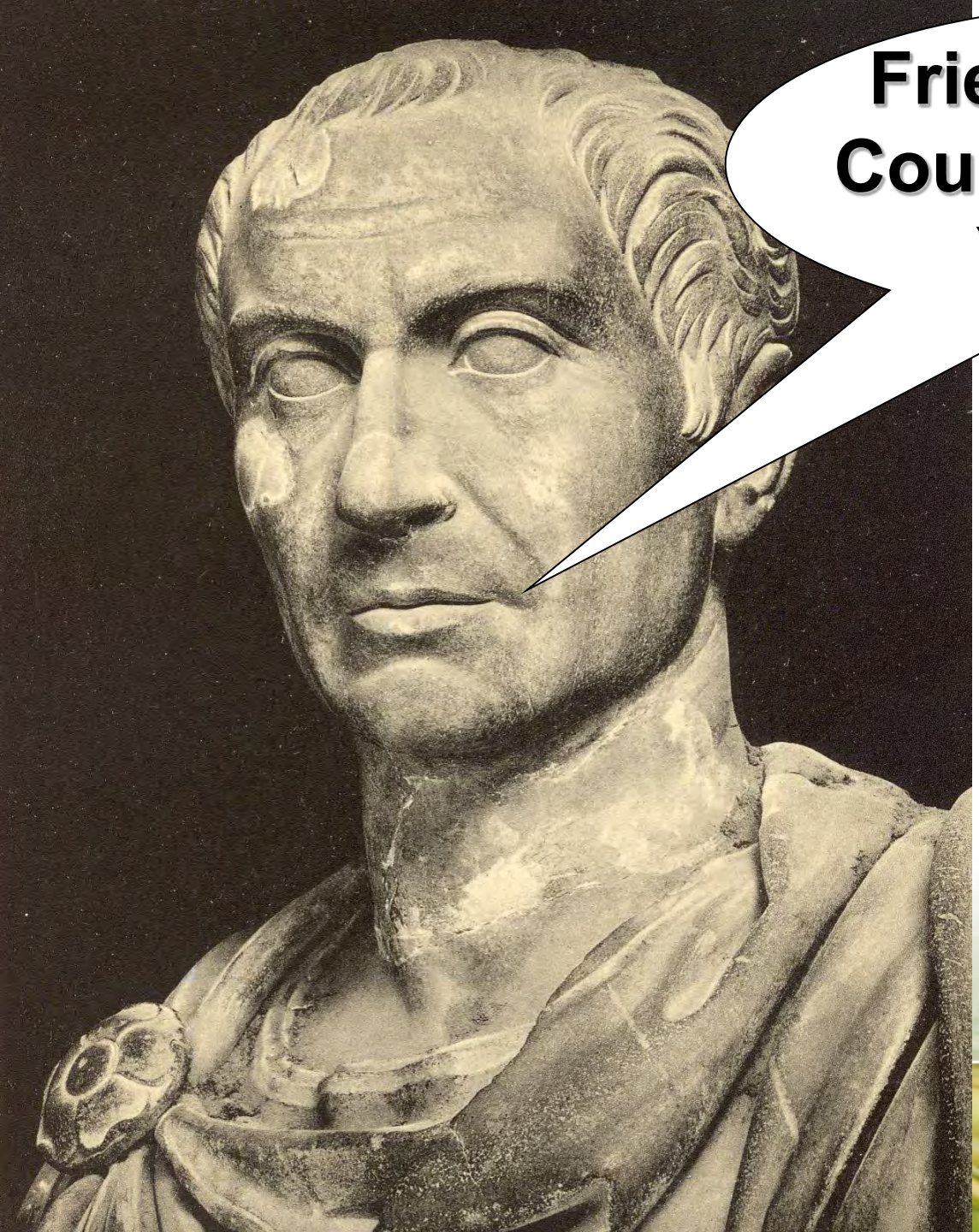
The Plant Disease Playing Field



Your heavy hitters/1st line of defence: rotation with at least 2 years between host crops and resistant varieties

Your secondary defence/last line of defence: good agronomics, balanced fertility, scouting, fungicides

http://upload.wikimedia.org/wikipedia/commons/7/71/Canadian_football_positions.jpg



Johnio O'Donovanicus Roman Agronomist (Roman Dept. of Agric.)

Factors influencing current canola/cereal rotations

- Commodity prices
- Other market factors
- On-farm needs
- Lack of comfort and/or success with alternative crops

Neil Harker – a weedy guy outstanding in the field

One year between host crops is not enough for elimination of crop residues harbouring cereal leaf diseases and FHB

Leaf Spot and Stripe Rust Reactions of Wheat Varieties For Alberta

Based on Varieties of Cereal and Oilseed Crops For Alberta - 2015, AARD Agdex 100/32

T.K. Turkington[1], and K. Xi[2]

[1]Agriculture and Agri-Food Canada Lacombe, AB; [2]Alberta Agriculture and Rural Development (AARD), Lacombe, AB

*Wheat Leaf Spot and Stripe Rust Reaction**

Very Good (VG)		Good (G)		Fair (F)
Poor (P)				Very Poor (VP)

Wheat and Triticale

CWRS	Leaf Spot	Stripe Rust
5602HR	MS	I
5603HR	MR	MS
5604HR CL	MS	XX**
5605HR CL	MS	I
AAC Bailey	I	XX**
AAC Brandon	I	MR
AAC Elie	I	MR
AAC Redwater	MS	MR
AC Barrie	MS	S
AC Eatonia	MS	I
AC Elsa	I	I
AC Intrepid	MS	MR
AC Splendor	I	I
Alvena	XX**	I
Carberry	MS	MR
Cardale	MS	MR
CDC Abound	MS	MS
CDC Go	S	MR
CDC Imagine	MS	I
CDC Kernen	MS	I

CWGP	Leaf Spot	Stripe Rust
AAC NRG097	I	S
AAC Proclaim	I	MS
CDC NRG003	MS	XX**
Minnedosa	MS	MR
NRG010	I	R
Pasteur	I	MR
SY087	I	MR
CWWS		
AAC Iceberg	MS	MR
CDC Whitewood	MS	I
Snowbird	S	MS
Snowstar	I	MS
Whitehawk	MS	MS
CWAD		
AAC Current	I	MR
AAC Marchwell	MS	R
AAC Raymore	I	MR
AC Avonlea	MS	I
AC Navigator	S	R
Brigade	I	MR

- **Disease resistance may be useful**
- **But …**
  - **Resistance may not be a disease management strategy when:**
    - **The variety you want/need to grow doesn't have resistance to the diseases you are concerned about**

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Snowstar	I	MS
Whitehawk	MS	MS

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Brigade	I	MR

Scald resistant variety?

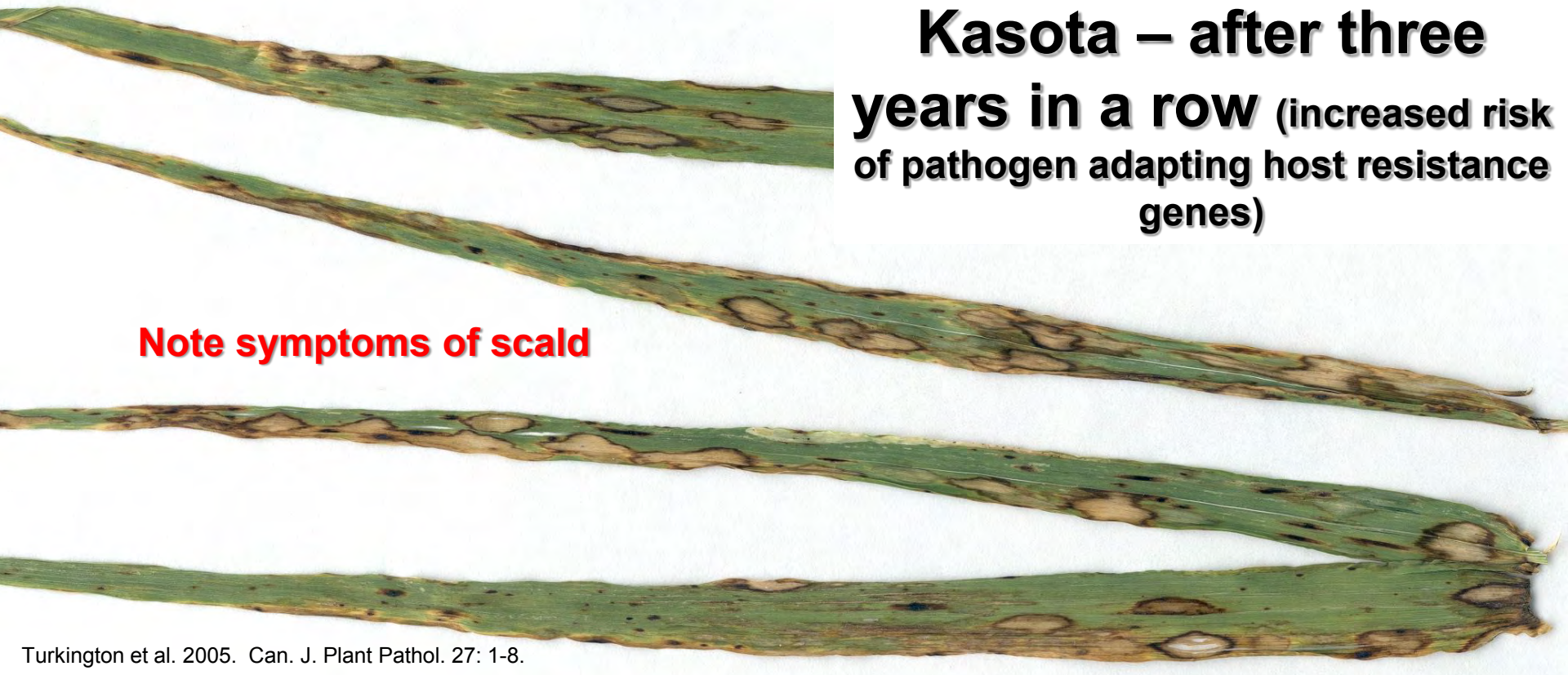
Scald susceptible variety?

Note symptoms of scald

Turkington et al. 2005. Can. J. Plant Pathol. 27: 1-8.

Barley cultivar Kasota (scald resistant) – after one year

Kasota – after three years in a row (increased risk of pathogen adapting host resistance genes)



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Turkington et al. 2005. Can. J. Plant Pathol. 27: 1-8.

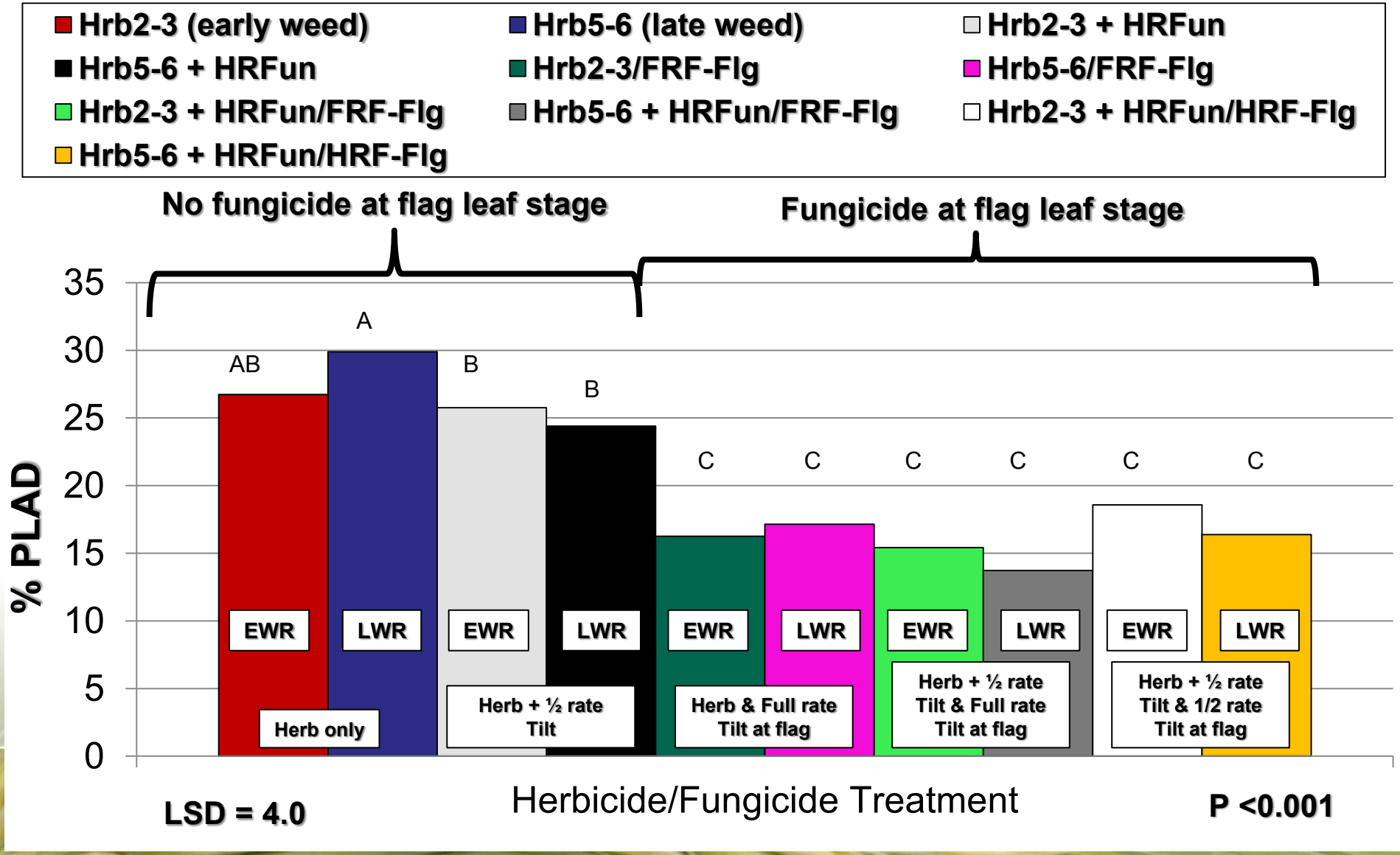
What is your target when using fungicides for cereal disease management?

- **Leaf disease target: minimize disease during grain fill**
- **FHB target: minimize disease at flowering and during grain fill (can be a hard target to hit)**

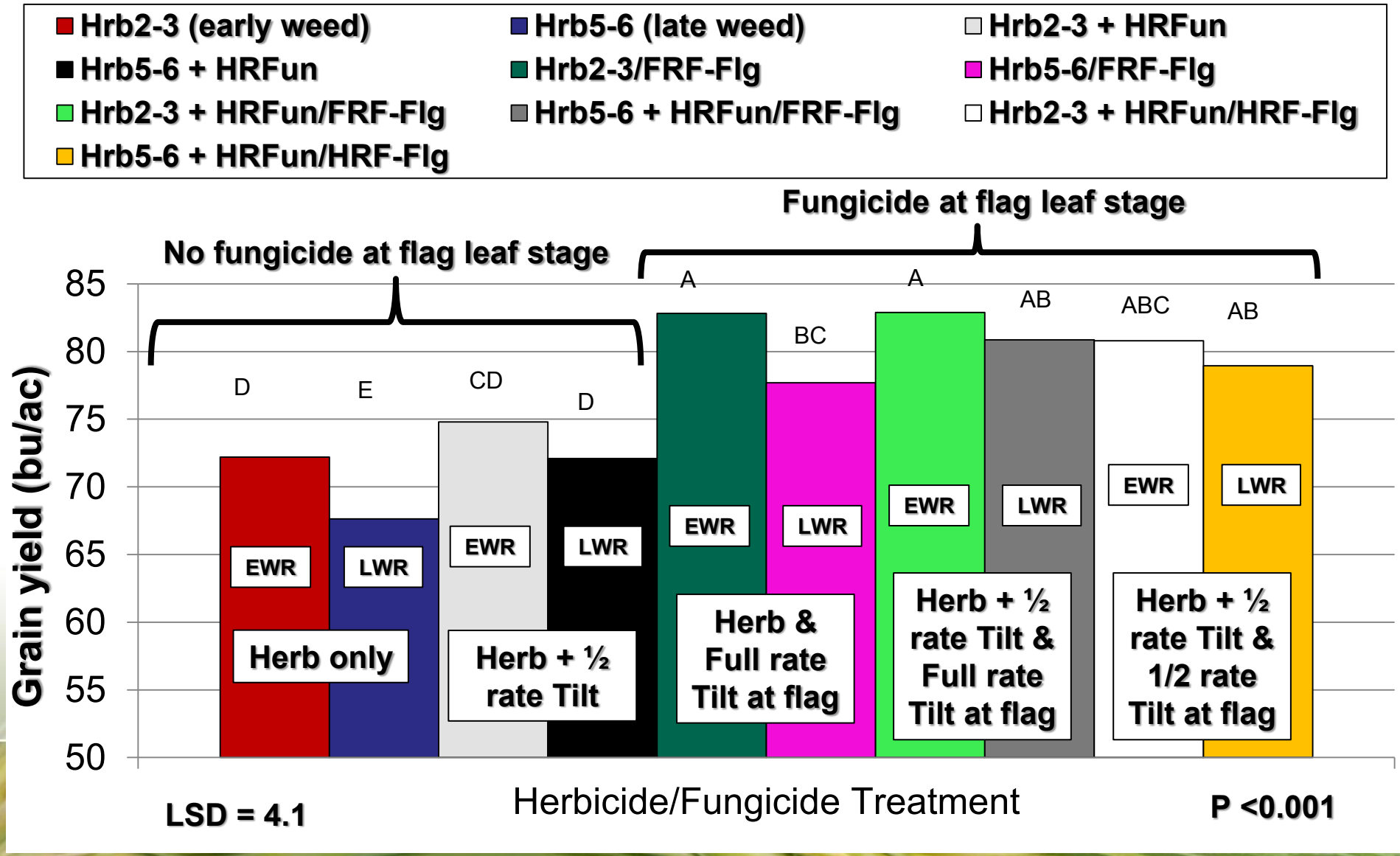
Kelly with his kin-folk at the Boise Gun Club Thanksgiving Turkey Shoot, November 2014, Boise, Idaho. Note - no turkeys were harmed, just clay pigeons. Kelly's haul was one frozen turkey and one frozen ham.

Over the last 5-10 years there has been an interest in targeting cereal leaf diseases by applying fungicide with herbicides at early crop growth stages. Is this the best target for cereal leaf disease management?

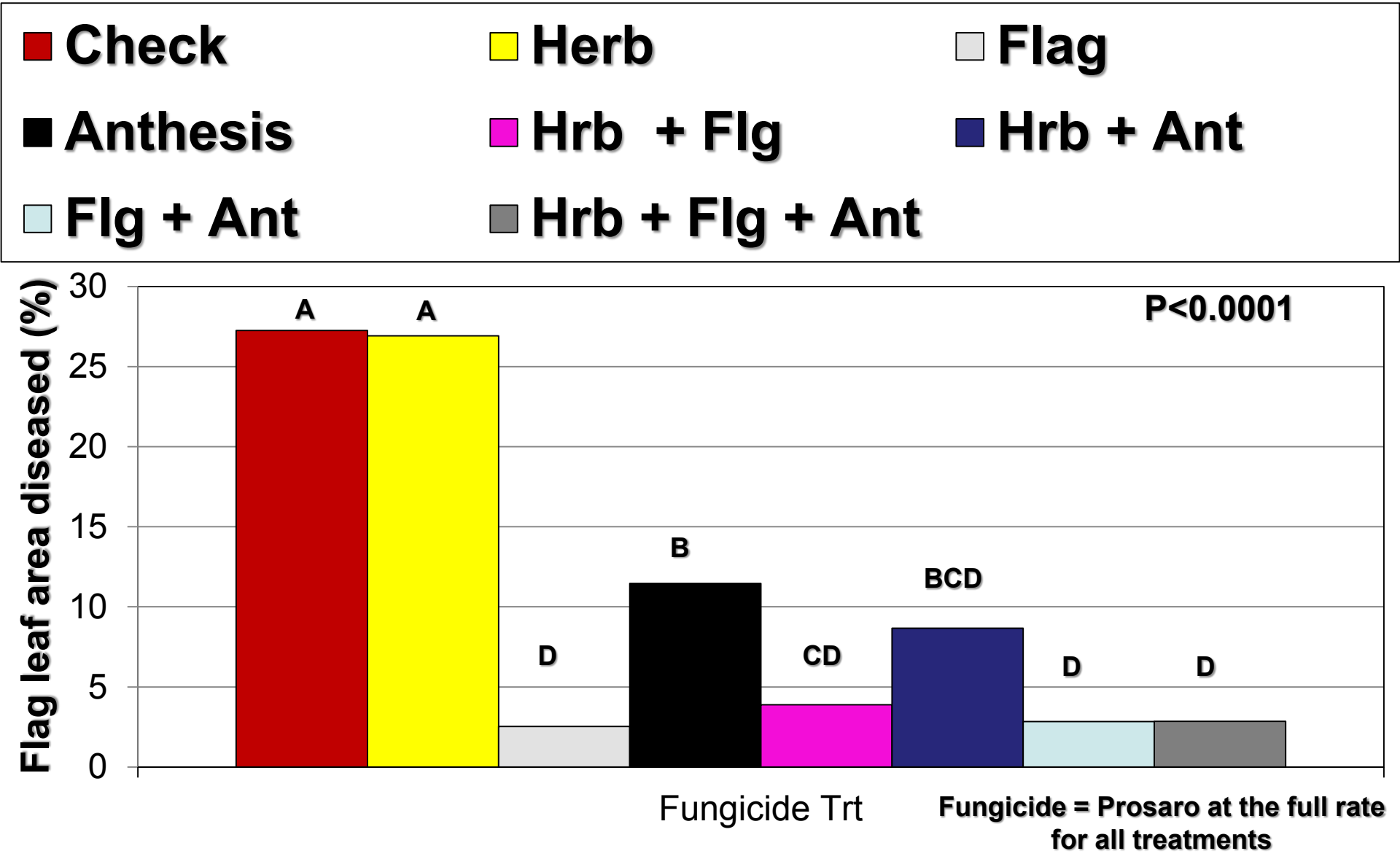
Percentage leaf area diseased, penultimate leaf, AC Metcalfe, herb./fungicide exp., 13 site yrs, 2010-2012



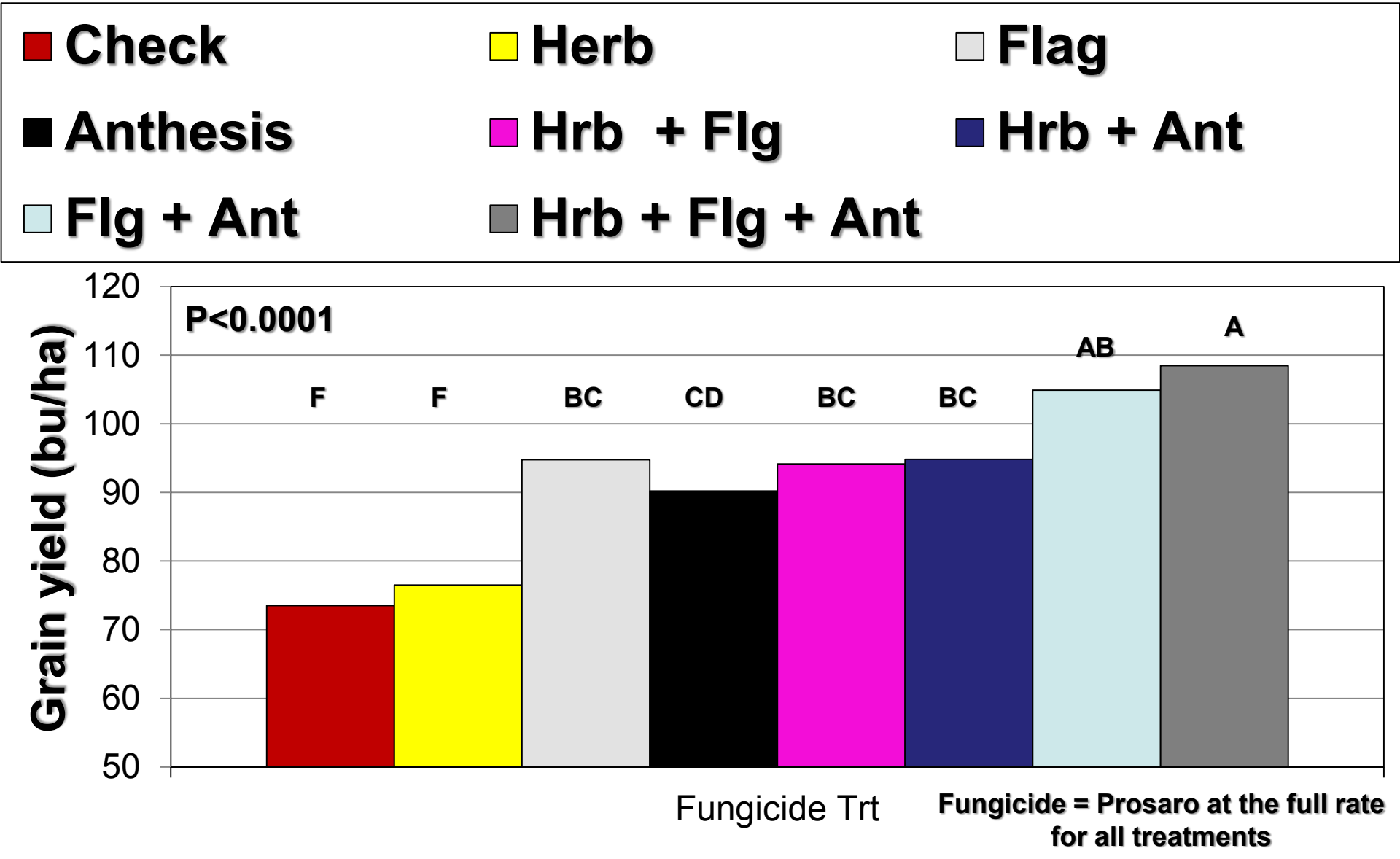
Yield (bu/ac) and herb./fungicide treatment, 13 site years, AC Metcalfe barley, 2010-2012



Flag leaf area diseased (%), Harvest wheat, fungicide timing experiment, Lacombe 2013



Grain yield (bu/ha), Harvest wheat, fungicide timing experiment, Lacombe 2013



Leaf position and contribution to yield in wheat

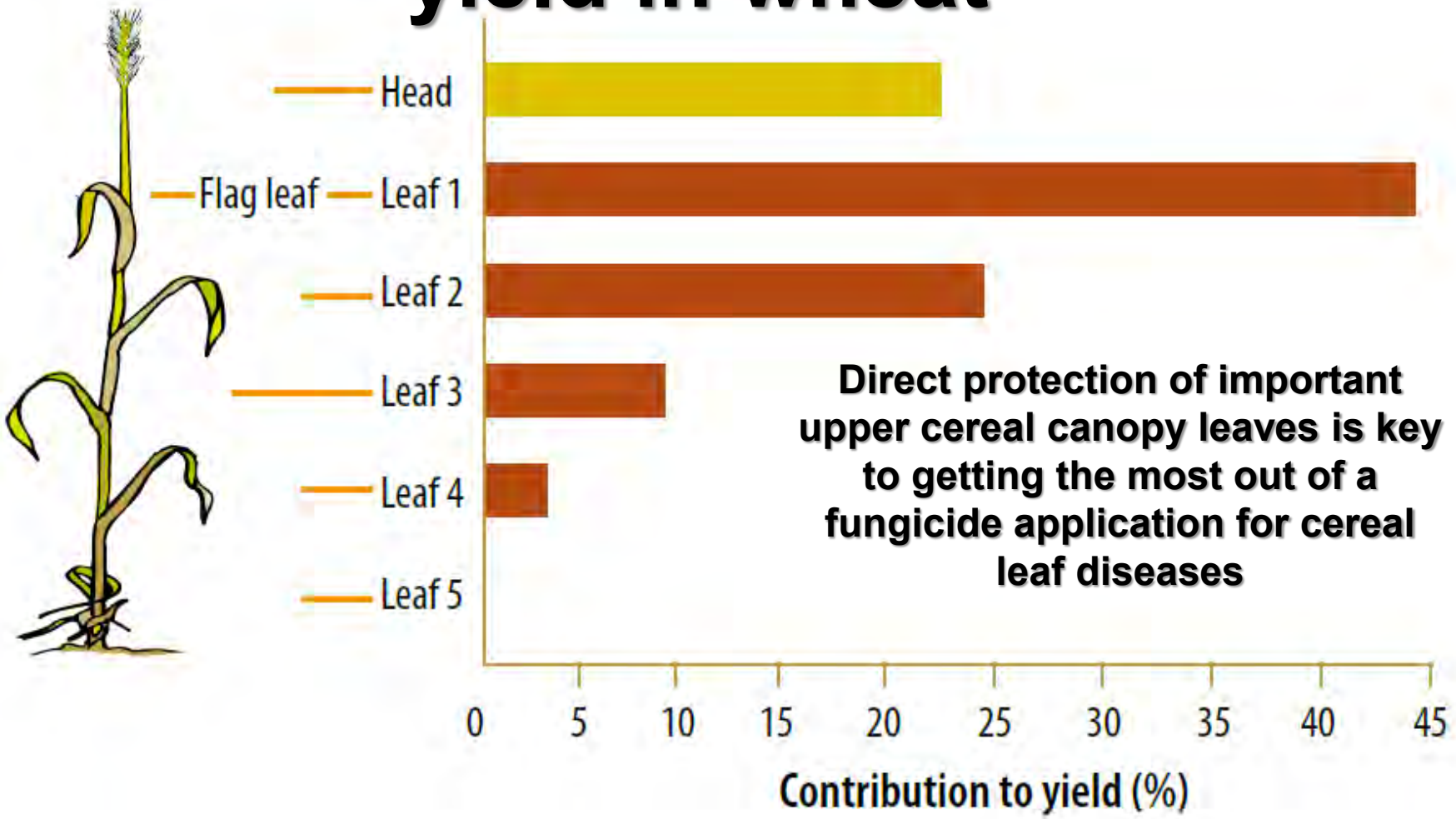


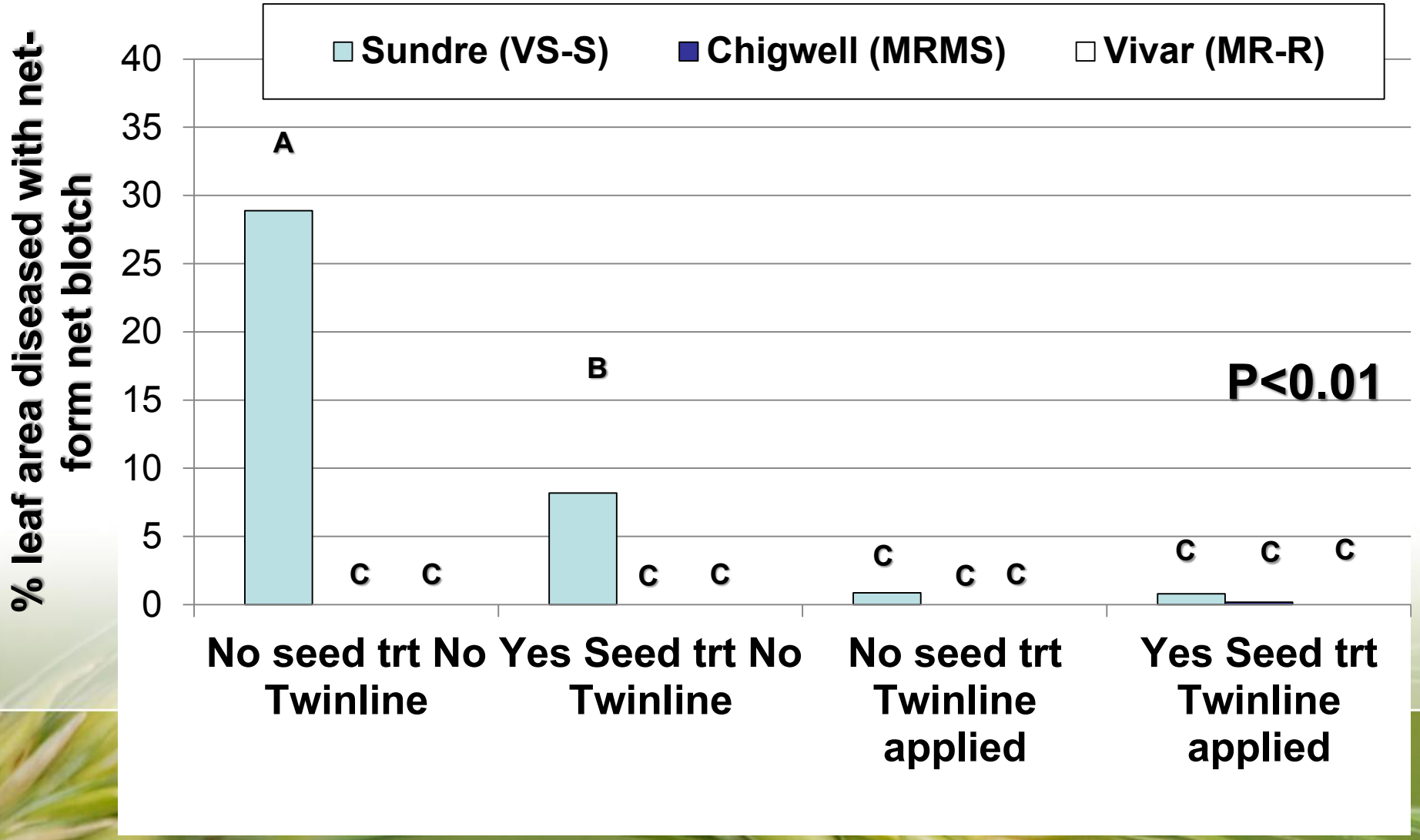
Figure 4-2: Photosynthetic contribution of plant parts.
Source: Based on N Fettell, 2006, NSW Department of Primary Industries technical update.

Wheat growth and development, NSW Department of Primary Industries, 2007

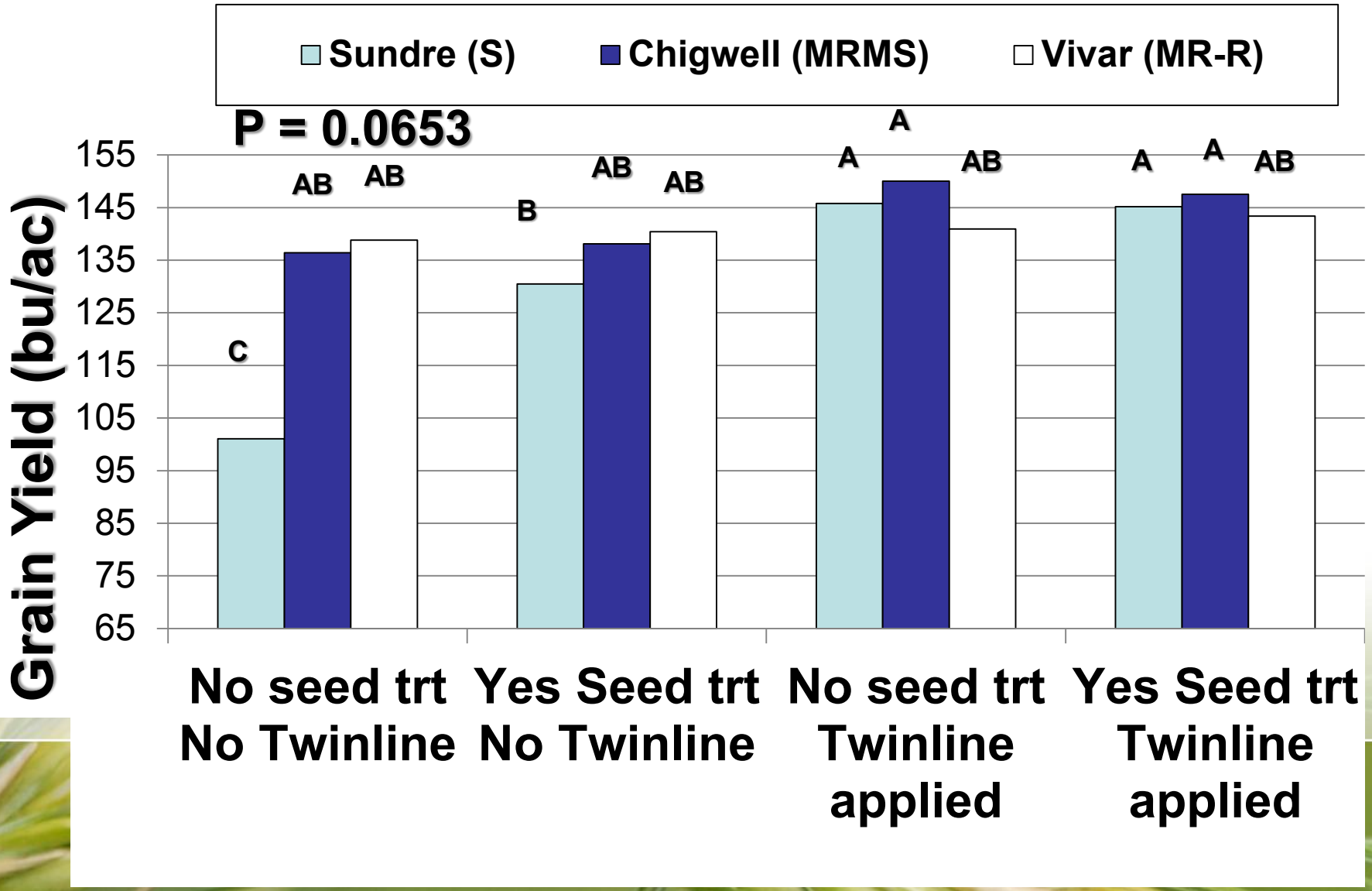
Trial 65, Seed Treatment, Variety Resistance and Fungicide

- Seed treatment
  - Insure at 600 ml/100 kg seed
    - Triticonazole, pyraclostrobin, metalaxyl
- Flag leaf
  - Twinline at 202 ml/ac
    - Metconazole, pyraclostrobin
- Variety resistance
  - Lacombe (scald)
    - Xena (S)
    - Busby (MRMS)
    - Gadsby (MR-R)
- Variety resistance
  - Melfort/Charlottetown (net form net blotch)
    - Sundre (VS-S)
    - Chigwell (MRMS)
    - Vivar (MR-R)
- Percentage leaf area diseased
  - Early and late
- Grain yield/ kernel characteristics

Barley Test 65, AB, 2013, Melfort, SK, Seed Treatment, Variety, Fungicide, % Leaf Area Diseased, Flag – 1, Soft Dough Stage

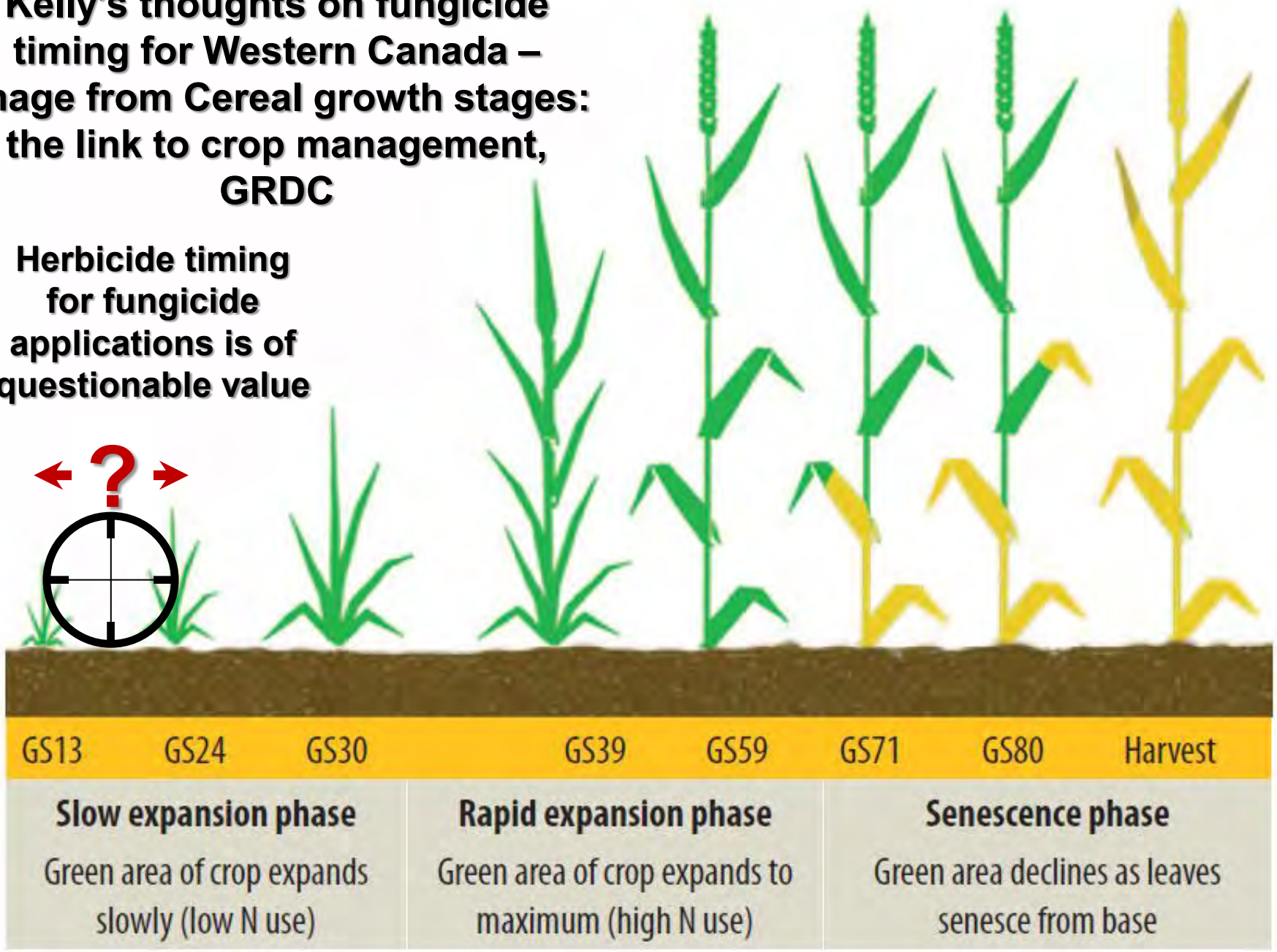


Barley Test 65, Melfort, SK, 2013, Seed Treatment, Variety, Fungicide, Yield (bu/ac)



Kelly's thoughts on fungicide timing for Western Canada – Image from Cereal growth stages: the link to crop management, GRDC

Herbicide timing for fungicide applications is of questionable value



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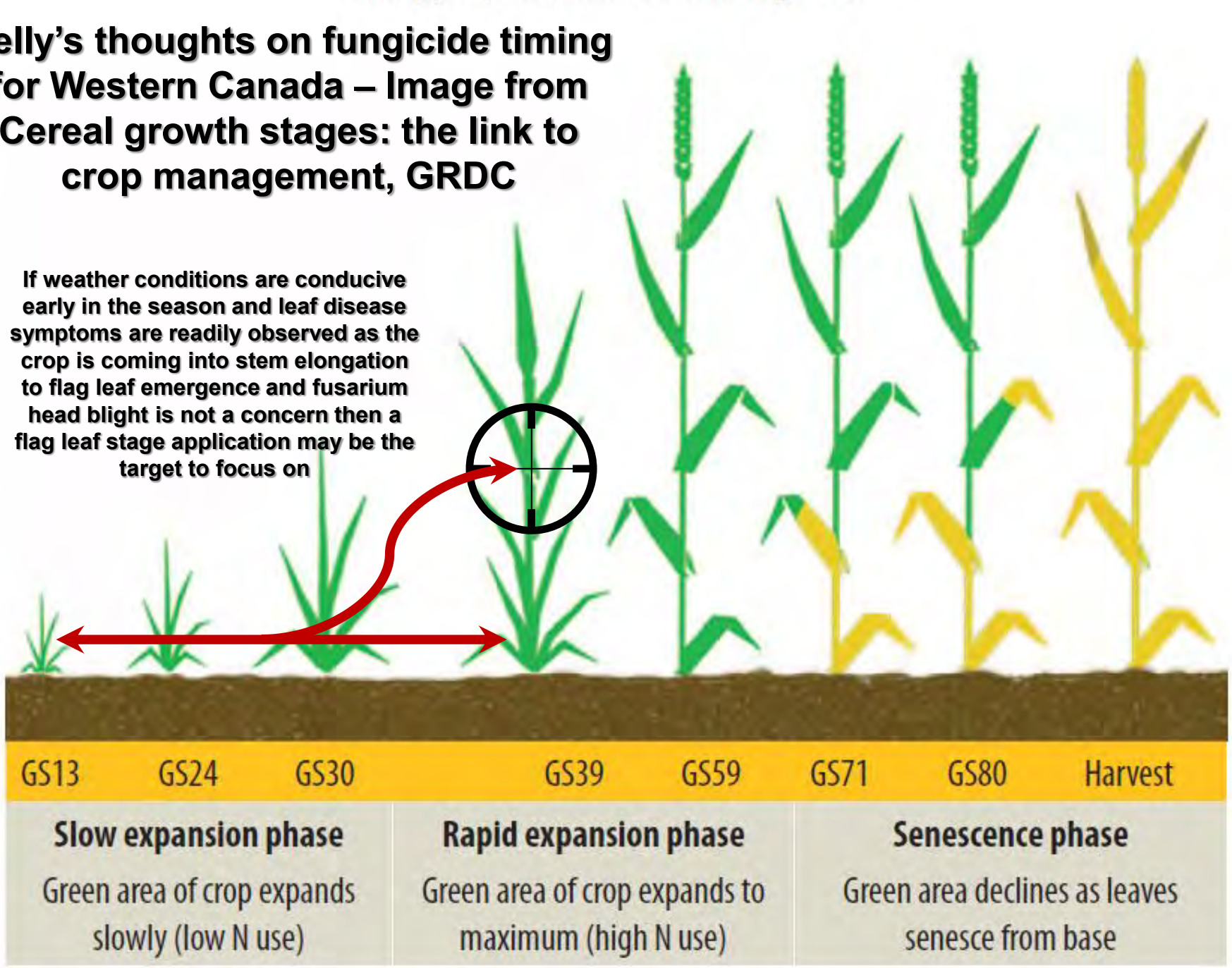
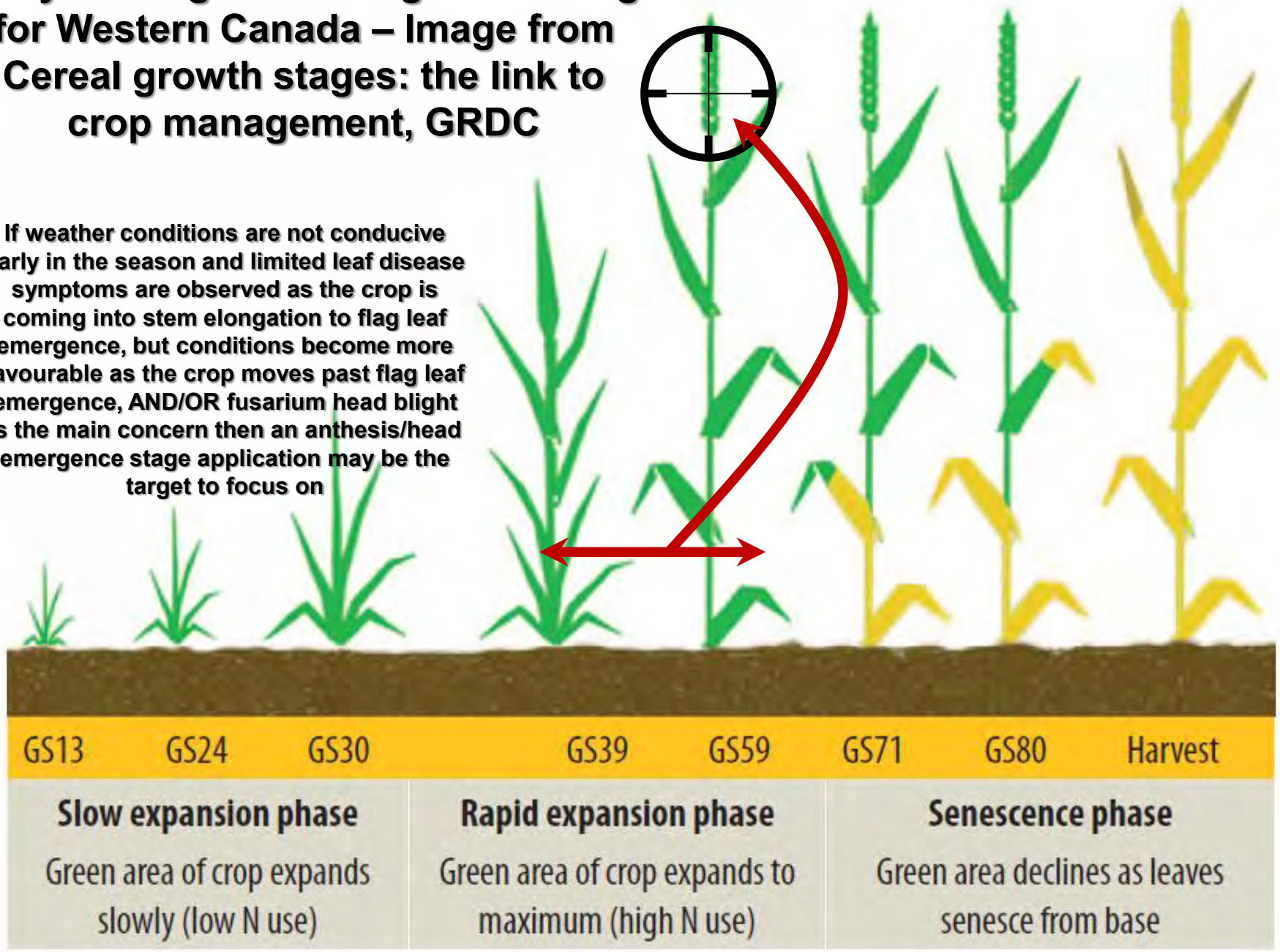


Kelly's thoughts on fungicide timing for Western Canada – Image from Cereal growth stages: the link to crop management, GRDC

If weather conditions are not conducive early in the season and limited leaf disease symptoms are observed as the crop is coming into stem elongation to flag leaf emergence, but conditions become more favourable as the crop moves past flag leaf emergence, AND/OR fusarium head blight is the main concern then an anthesis/head emergence stage application may be the target to focus on



Canopy expansion in relation to growth

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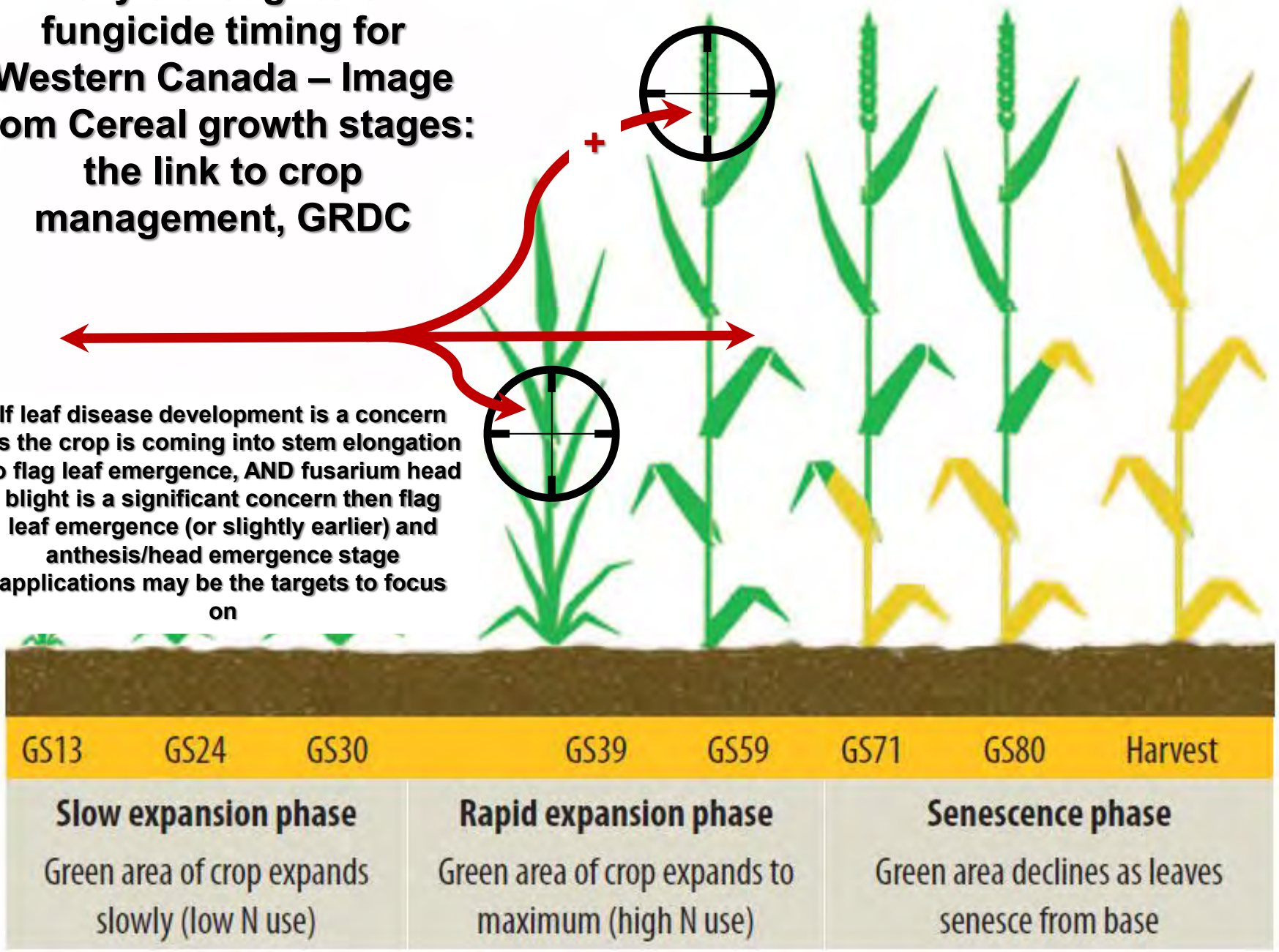


If leaf disease development is a concern as the crop is coming into stem elongation to flag leaf emergence, AND fusarium head blight is a significant concern then flag leaf emergence (or slightly earlier) and anthesis/head emergence stage applications may be the targets to focus on

Tight rotation, susceptible variety … no worries, choose the right target and hit it good, hit it real good with fungicide! Problem solved … ???

Brother: Brent T.

Nephew: Kyle W. – Armoury

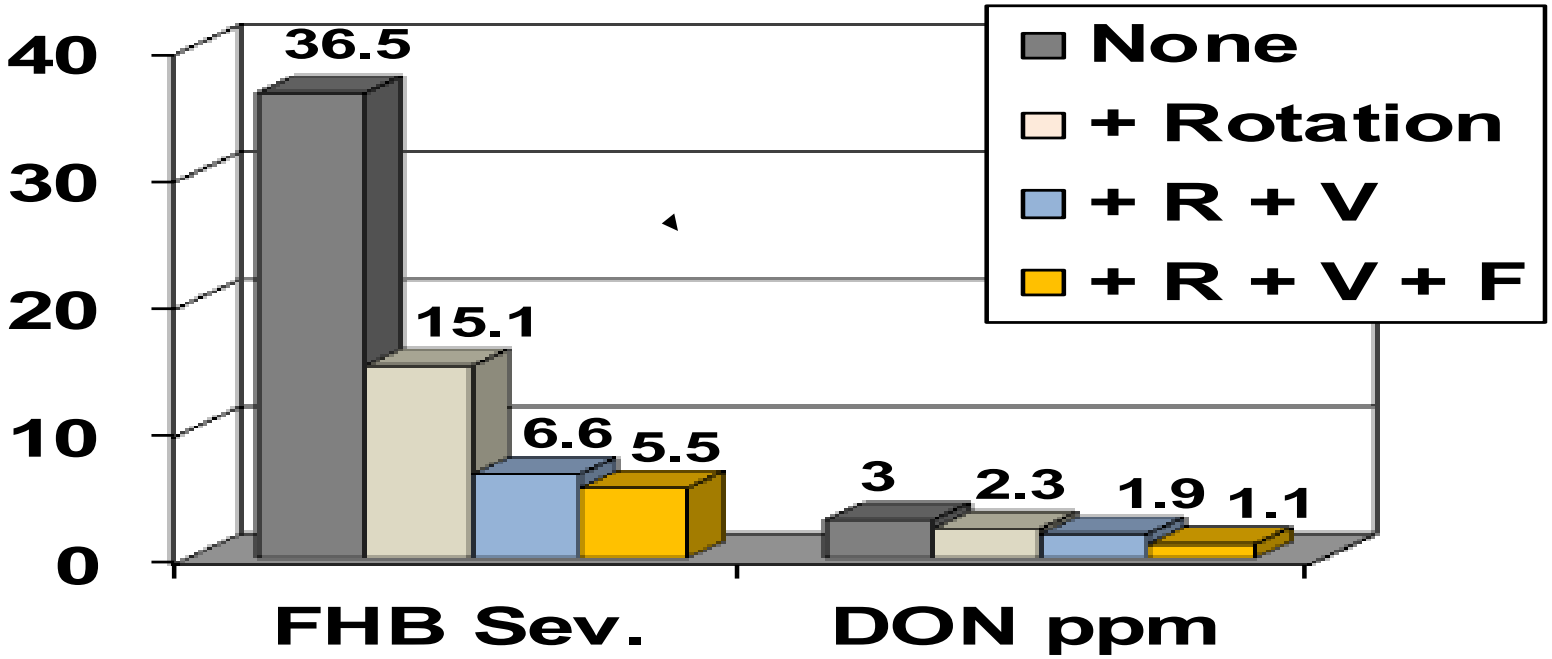
Kelly T.

Photo by C. Fisher (Brother-in-law), Boise Gun Club Thanksgiving Turkey Shoot, 2014

Fusarium head blight and fungicides

- Focus on application technology and agronomics
  - Head coverage & timing will be key issues
- Level of control
  - FHB ~ 50% (suppression at best)
  - Leaf spots ~ 80%
  - Stripe rust ~ >90%
- Don’t rely only on fungicides
  - Rotation + resistant variety + fungicide
  - Irrigation management
  - Good agronomics

2007 Example: Durum Integrated Study, ND, 3 strategies



None = wheat on wheat, Monroe susceptible variety and no fungicide
+ R = Rotation = Canola previous crop
+ V = More resistant variety = Divide
+ F = Fungicide trt added = Prosaro

NDSU Extension Service
North Dakota State University

Data from Scott Halley, Langdon REC

From M. McMullen, NDSU

Experience over the last several years in Saskatchewan has shown that even when using a resistant variety, avoiding host-on-host rotations, and using fungicide – when the weather is favourable and *F. graminearum* is well-established significant yield and grade losses from fusarium head blight will still occur!

Table 5. Mode of action of major fungicides classes, their FRAC code and resistance risk. For additional information, see the FRAC Code List.

FRAC Code	Chemical Class	Mode of action / inhibition	Resistance risk
1	Benzimidazoles	Beta-tubulin biosynthesis	high
2	Dicarboximides	NADH cytochrome c reductase in lipids	high
3	Azoles, Pyrimidines	C-14 demethylation in sterol biosynthesis	medium
4	Phenylamides	RNA polymerase	high
5	Morpholines	^8 and ^7 isomerase and ^14 reductase in sterol biosynthesis	low-medium
7	Carboxamides	Succinic acid oxidation	medium
9	Anilinopyrimidine	Methionine biosynthesis	medium
11	Strobilurins	Mitochondrial synthesis in cytochrome bc1	high
16	Various chemistry	Melanin biosynthesis (two sites)	medium
40	Carboxylic acid amides	Cell wall formation in Oomycetes	low-medium
M1	Inorganics	Multisite contact	low
M3	Dithiocarbamates	Multisite contact	low
M5	Phthalimides	Multisite contact	low

Morton, V. and Staub, T. 2008 A Short History of Fungicides. Online, APSnet Features. doi: 10.1094/APSnetFeature-2008-0308.

Michael D. Flowers, Dept. of Crop and Soil Science
Oregon State University, 107 Crop Science Building, Corvallis, Oregon 97331-3002
T 541-737-9940 | F 541-737-1589 | Mike.Flowers@oregonstate.edu

February 20, 2015

To: Willamette Valley Wheat Growers and Industry Reps
From: Chris Mundt, Mike Flowers, Nicole Anderson and Clare Sullivan, OSU

RE: Disease Update

Stripe rust continues to develop in susceptible and moderately susceptible wheat varieties in western Oregon. Typical rust hot spots are not yet visible, but rust continues to build on individual leaves. Current weather conditions are very favorable for continued disease expression. Continue scouting all fields and treating as necessary. If favorable weather continues persist, multiple fungicide sprays prior to flag leaf emergence may be required to control stripe rust on susceptible varieties.

Septoria is also present in these wheat fields. The recent dry weather has slowed disease development, but there is sufficient Septoria in the canopy for it to develop rapidly once the rains return. Survey data from last year indicate that the Septoria present in these fields are resistant to strobilurin fungicides. In addition, resistance is building to the triazole fungicides. So, only apply early fungicides to fields were stripe rust is present. Also it is important to limit applications of the new SDHI fungicides to 1 per year. Apply the SDHI fungicides at flag leaf emergence in combination with strobilurin and/or triazole fungicides.

Oregon State University Update, February 20, 2015

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Chris Mundt, Mike Flowers, Nicole Anderson and Clare Sullivan, OSU

Oregon State University Update, February 20, 2015

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Chris Mundt, Mike Flowers, Nicole Anderson and Clare Sullivan, OSU

Key cereal fungicides may be banned as EU tightens rules, Farmers Weekly

Thursday 23 October 2014 9:20 David Jones (http://www.fwi.co.uk/author/david-jones/)

Many leading cereal fungicides are likely to be banned by the European Union due to their perceived effect on human health, prompting calls for growers to lobby Brussels.

The European Commission is currently looking for views on how to regulate so-called endocrine disruptor pesticides which may interact with the human hormone system.

Its proposals could result in the loss of the azoles, which are used in most cereal fungicides, and also pyrethroid insecticides, so growers and agronomists are being urged to give their views.

The EU is looking to tighten up rules about these pesticides amid growing concern about the increase in hormone-related diseases such as cancer and diabetes.

The potential loss of azoles would be a big blow to growers as they are contained in products such as Proline and Ignite and in SDHI-azole combinations Aviator, Adexar and Seguris. The potato blight fungicide mancozeb could also be lost to growers.

"Even in the best-case scenario, we will lose products such as mancozeb and the older azoles," Julian Little, a Bayer CropScience spokesman, told a recent briefing.

If the commission takes a more draconian approach, all the azoles would be lost and also the pyrethroids and mancozeb.

Use all of the tools in the disease management toolbox

Know your plant diseases so that you can use the most appropriate management strategies

"Hot oil! We need hot oil! ... Forget the water balloons!"

The best defence against plant disease is to know your adversary and use a combination of strategies!

Photo by Louis Christ

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Thank you!

For more information, please contact:

kelly.turkington@agr.gc.ca

403-782-8138

Canada