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Agronomy Update 2014



Understanding the nature and role of fungicides

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Canada 

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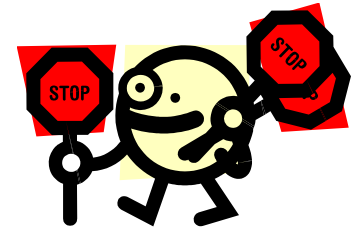
Classifying fungicides: Mobility

- **Contact or protectant fungicides**
 - Remain on the outside of the plant
 - Target spores and germination
 - Repeated applications
 - Need to maintain level of activity
- **Systemic or penetrating fungicides**
 - Move into plant tissue that has been treated
 - Translaminar, limited movement (locally systemic)
 - Xylem-mobile
 - Move throughout the plant via xylem (stem or root application)
 - Movement within treated leaf, but not between leaves
 - Targets spore germination and/or hyphae
 - Protectant and curative activity



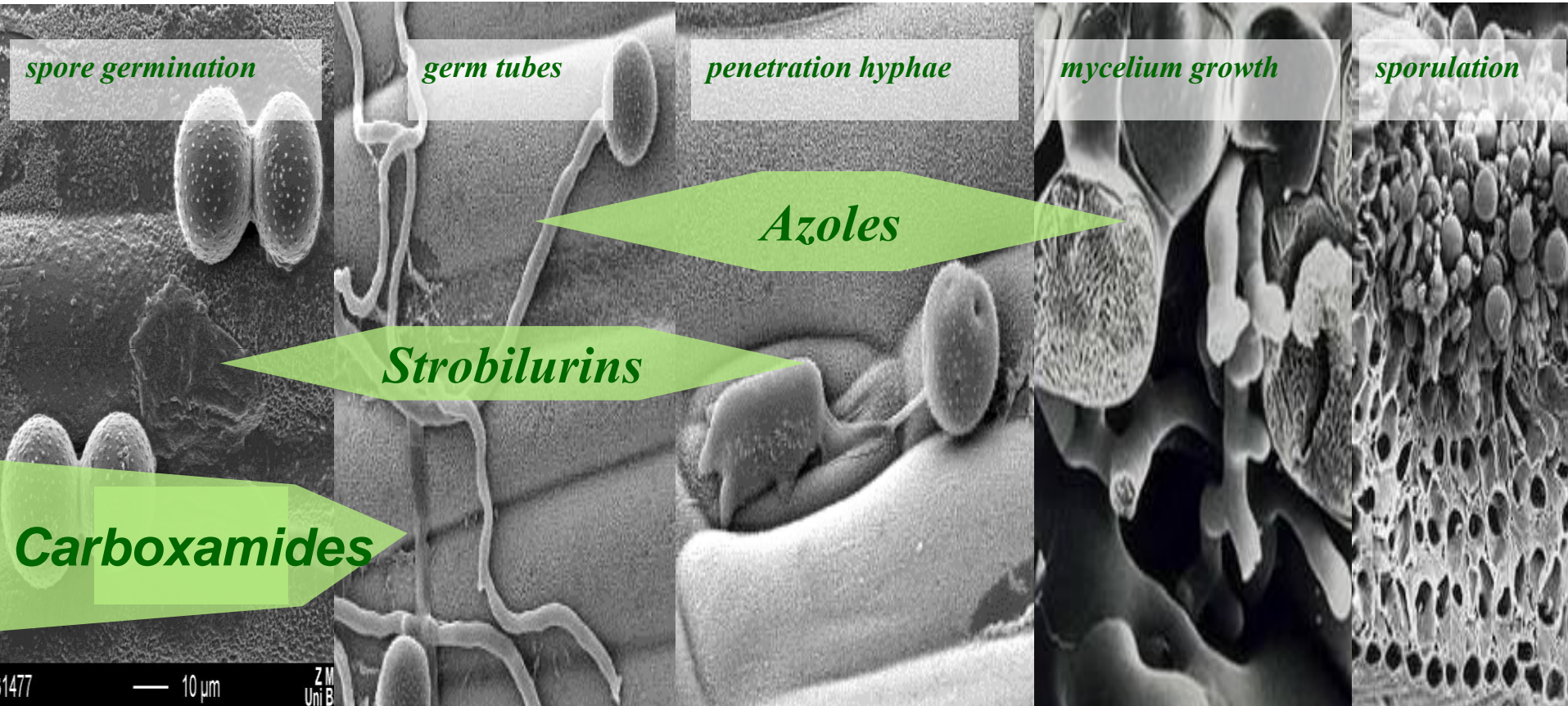
Classifying fungicides: Role

- **Preventative role**
 - Provide a fungicidal barrier
 - Prevent infection of treated plant tissue
 - Mainly contact/protectant fungicides, but also systemic fungicides
- **Curative role**
 - Systemic
 - Penetrate plant to limit further pathogen development (early infections, kick-back action)
 - May limit pathogen sporulation
 - Limited eradicant activity
 - Especially with well-established infections



Fungicide effective during these stages

Fungal growth beyond
chemical control



No disease symptoms present

**LESIONS
APPEAR**

Courtesy R. Trischuk, BASF

www.usask.ca

With info from the wheat disease management guide, Spring 2013, HGCA (www.hgca.com)

Classifying fungicides: Breadth of activity

- **Single-site fungicides**
 - **Active against specific targets in the pathogen**
 - **Very targeted toxicity and thus limited negative impact on the plant**
 - **Mainly systemic fungicides**
 - **Greater risk of pathogen developing resistance**



Classifying fungicides: Breadth of activity

- **Multi-site fungicides**
 - Active against multiple targets in the pathogen
 - May affect several different classes of fungi
 - Mainly contact fungicides
 - Lower risk of pathogen developing resistance
 - Tend to be the older products



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

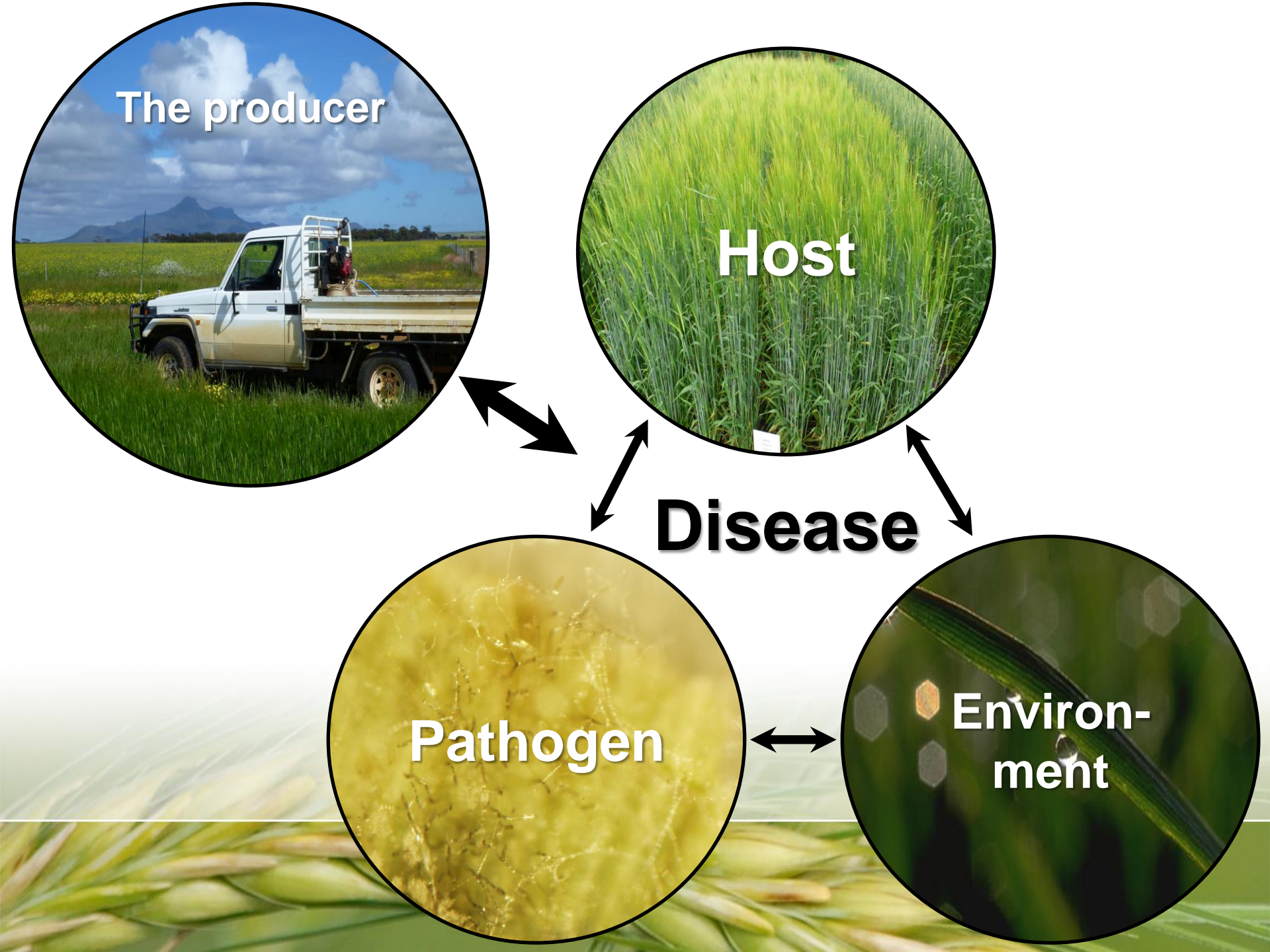
The producer

Host

Disease

Pathogen

**Environ-
ment**



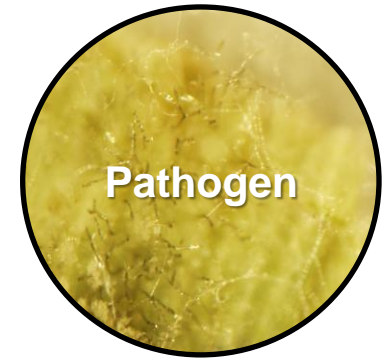
Making the most of a fungicide application: the host

- **Host resistance or susceptibility**
 - Influences fungicide need/rate/timing
 - Influences key disease issues
 - Can influence fungicide choice and timing
- **Is there a key host growth stage where disease has the biggest impact on yield**
 - Influences timing and application technology
- **What is the crop yield potential**
 - Influences the economics of spraying



Making the most of a fungicide application: the pathogen

- **Source of inoculum**
 - Influences fungicide efficacy
- **Monocyclic or polycyclic disease**
 - Influences timing
- **Are symptoms due to a pathogen**
 - Influences the need for fungicide
- **Nature of the pathogen and development**
 - Influences the ability of the pathogen to adapt to the fungicides being used
 - Influences fungicide efficacy



Making the most of a fungicide application based on the environment

- **Are weather conditions conducive or restrictive to disease development**
 - Influences inoculum production, infection potential, and disease development
- **Weather conditions prior to, during, and after the fungicide is applied**
 - Influences ability to spray the field or type of application used
 - Influences fungicide application success, persistence and period of activity



Making the most of a fungicide application: the fungicide

- **What is the nature of the fungicide and multiple versus single modes of action**
 - Influences efficacy and range of activity
 - Influences risk of fungicide resistance
- **How mobile is the fungicide in the plant**
 - Influences fungicide efficacy, persistence, and period of activity
 - Influences application technology
 - Influences the extent to which target plant tissues are protected



**Disease severity, herbicide/fungicide timing trial, AC Metcalfe
barley, penultimate leaf, Lacombe late July 2010**



Full rate Tilt at flag leaf stage



Check no fungicide

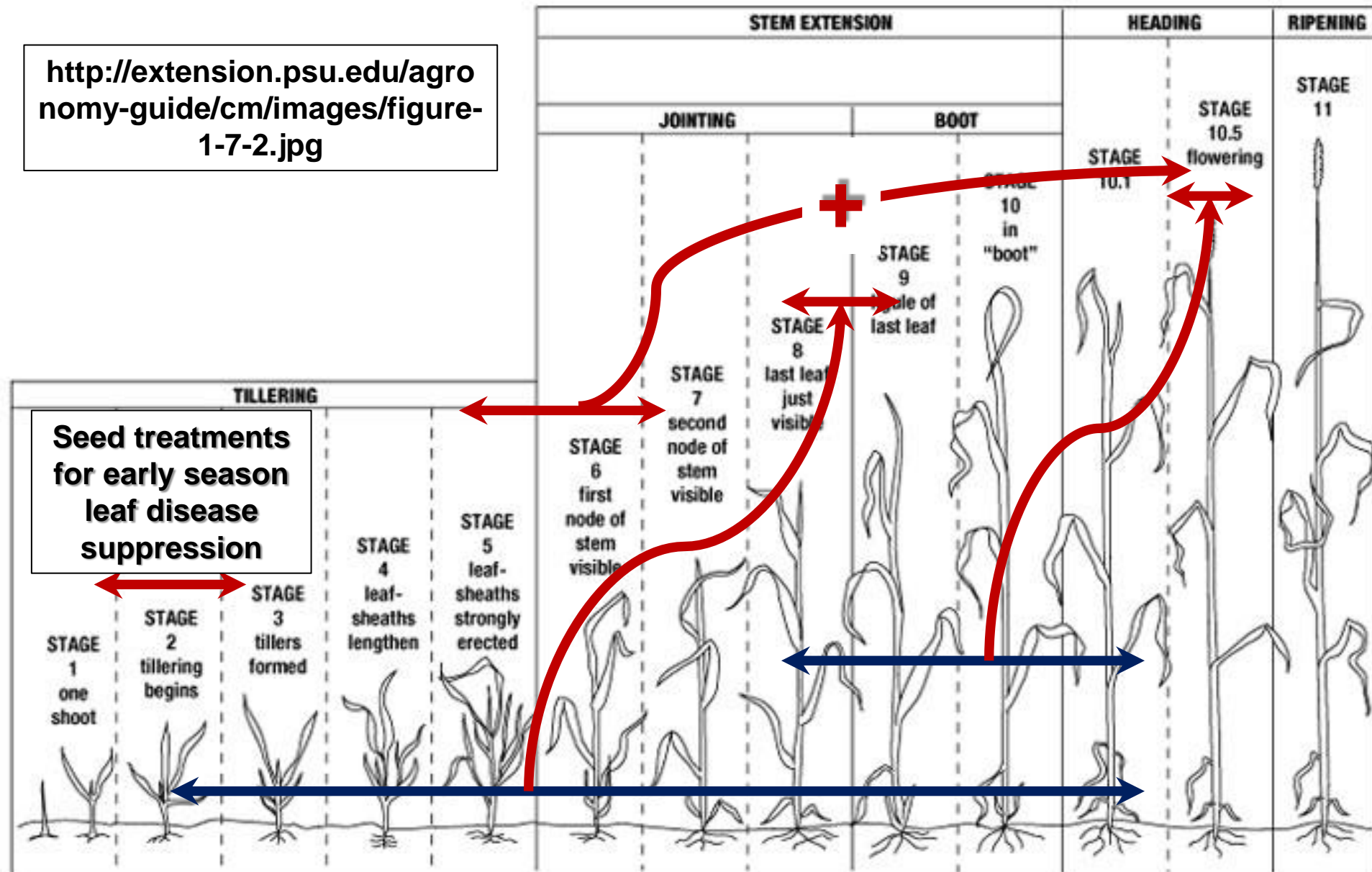


Half rate Tilt at 2-3 leaf stage

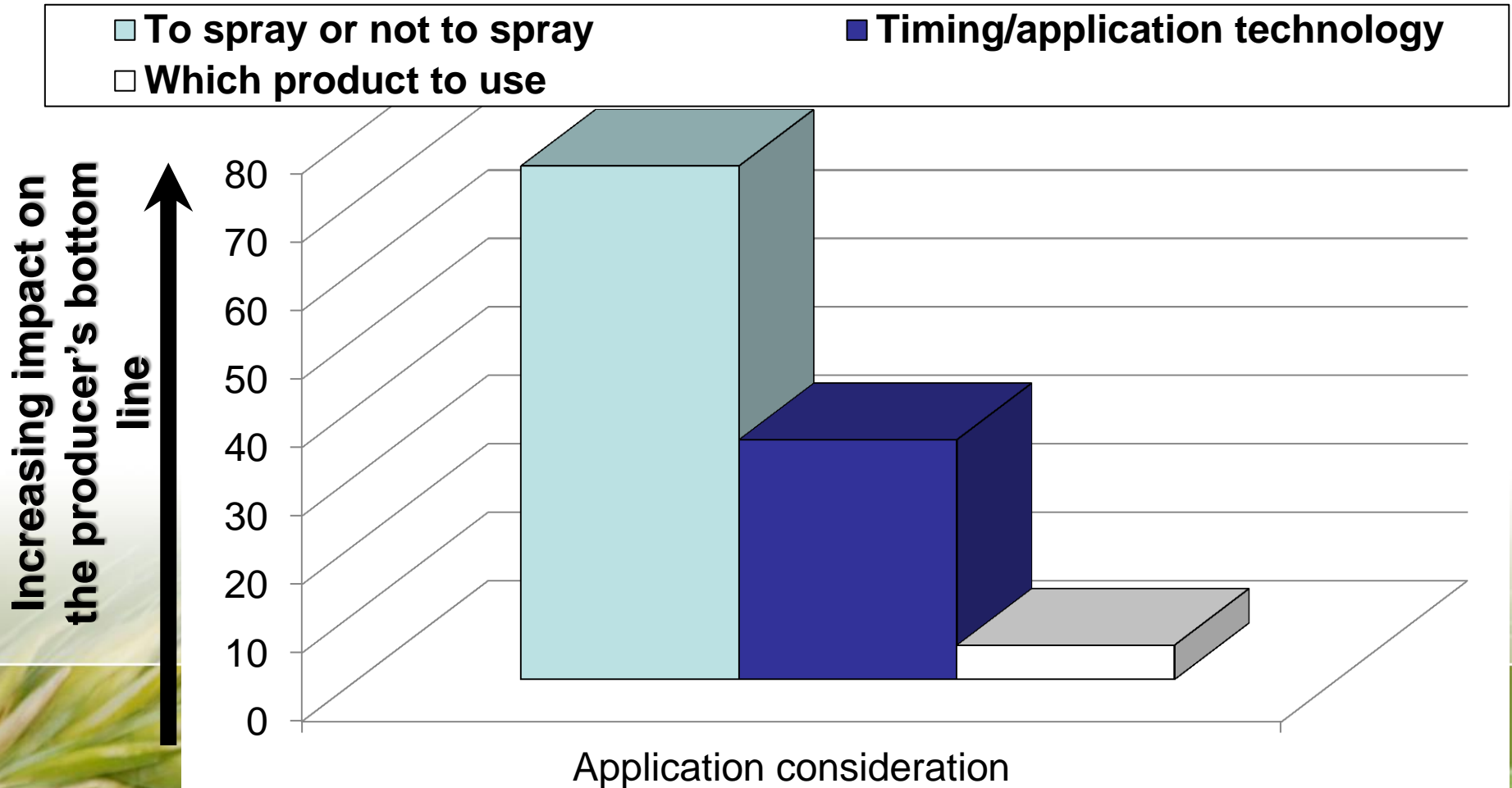
Integrating knowledge regarding fungicide action, yield contributors, plant growth stage, disease levels, and weather

Figure 1.7-2. Growth stages of cereals.

<http://extension.psu.edu/agronomy-guide/cm/images/figure-1-7-2.jpg>



Factors influencing the economics and potential return from spraying fungicides (G. Hollaway, DPI Victoria, Australia)



Realistic expectations from foliar fungicide application

- **Effective tool for some diseases**
- **Timing can have a huge impact**
 - Too late and disease established on key tissues
 - Too early and fungicide activity/concentration may become limited or key plant tissues not protected
- **Is your target actually a fungal disease**
 - Foliar fertilizer injury or abiotic/biotic issue?
 - E.g. foliar copper mixed with fungicide
- **Environmental impacts/nature of fungicide**
- **Fungicide application does not mean a completely disease free crop**





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Thank you!

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