4-2015

2015 Pesticide Safety: Fruit rot management

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Fruit rot management

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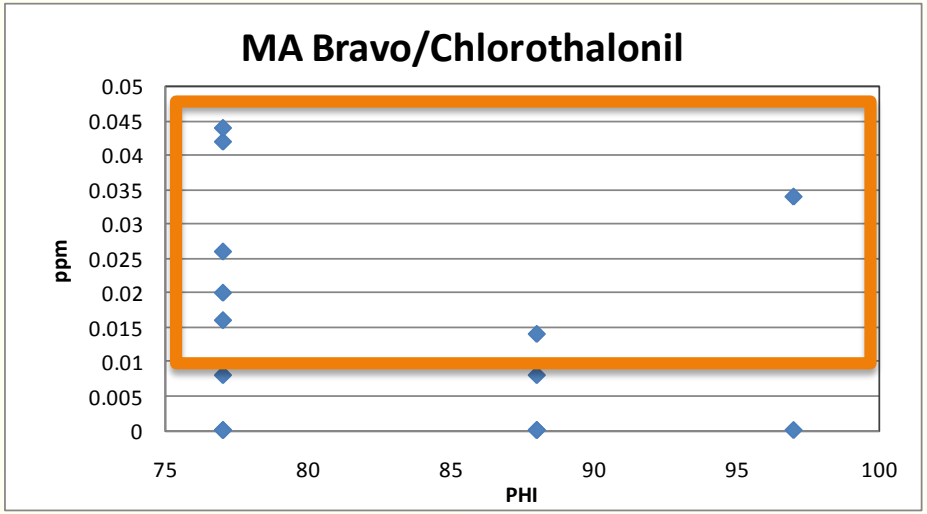
East Wareham, MA

Bravo – Chlorothalonil

(F. Caruso 2010 Results)

LOC	PHI	PPM	# Apps	LAD
MA	77	0.026	3	06/29/10
MA	77	0.042	3	06/29/10
MA	77	<0.01 ppm	3	06/29/10
MA	77	0.016	3	06/29/10
MA	77	0.02	2	06/29/10
MA	77	<0.01 ND	2	06/29/10
MA	77	0.008	1	06/29/10
MA	77	0.044	1	06/29/10
MA	88	<0.01 ppm	2	06/18/10
MA	88	0.014	2	06/18/10
MA	88	<0.01 ppm	1	06/18/10
MA	88	0.008	1	06/18/10
MA	97	<0.01 ppm	1	06/09/10
MA	97	0.034	1	06/09/10



50% of detections >0.01 ppm

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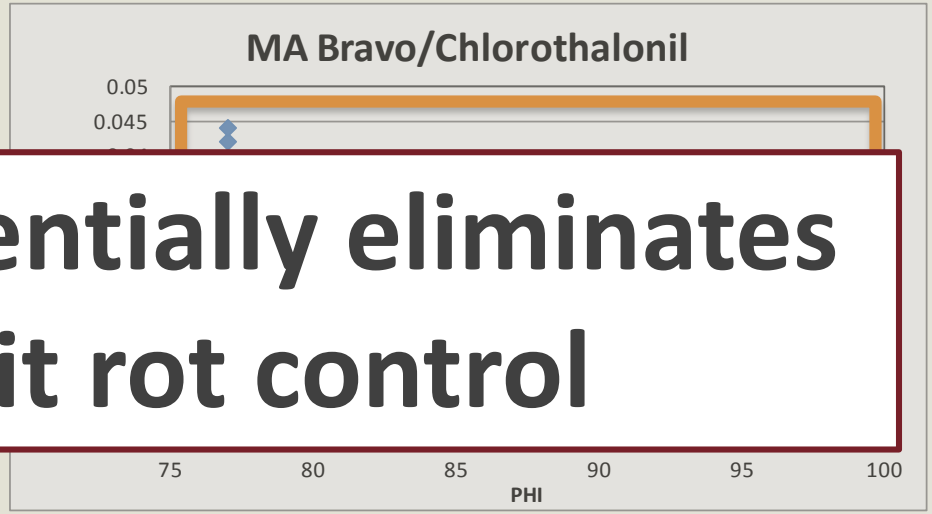
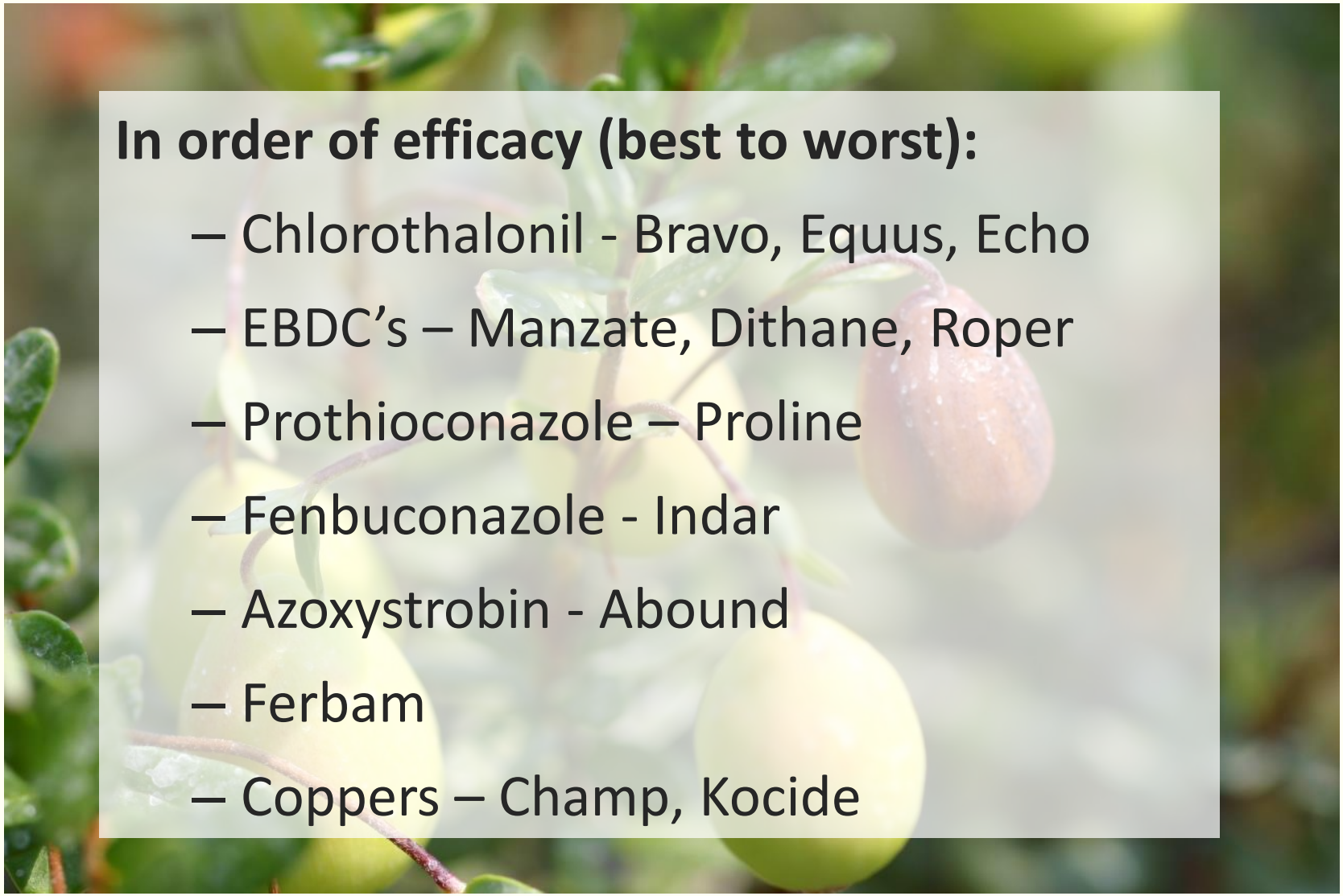


The new MRL essentially eliminates Bravo for fruit rot control

50% of detections >0.01 ppm

Efficacy – the overall effect of a fungicide on the level of disease



In order of efficacy (best to worst):

- Chlorothalonil - Bravo, Equus, Echo
- EBDC's – Manzate, Dithane, Roper
- Prothioconazole – Proline
- Fenbuconazole - Indar
- Azoxystrobin - Abound
- Ferbam
- Coppers – Champ, Kocide

Fungicides available for fruit rot

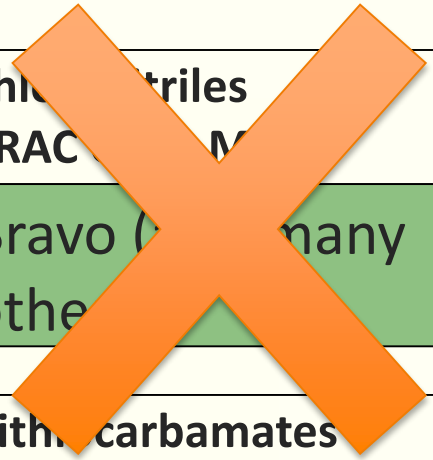
DMI FRAC Code 3
Indar Proline

QoI FRAC Code 11
Abound Evito

polyoxins FRAC Code 19
Tavano

chl[illegible]triles FRAC [illegible] M
Bravo ([illegible]many other[illegible]

dith[illegible]carbamates FRAC Code M3
Mancozeb Ferbam



High risk
Medium risk
Low risk

Fungicides available for fruit rot

DMI
FRAC Code 3

Indar

Proline

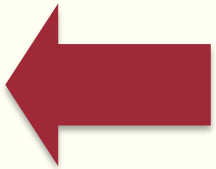
QoI
FRAC Code 11

Abound

Evito

polyoxins
FRAC Code 19

Tavano/Oso



chl[illegible]triles
FRAC [illegible] M[illegible]

Bravo ([illegible]many other[illegible]

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Ferbam

Efficacy unknown
$$$

Fungicides available for fruit rot

DMI
FRAC Code 3

Indar

chl… …triles
FRAC … M

Bravo (… …many …

Only 4 effective fungicides against fruit rot

Abound
Evito

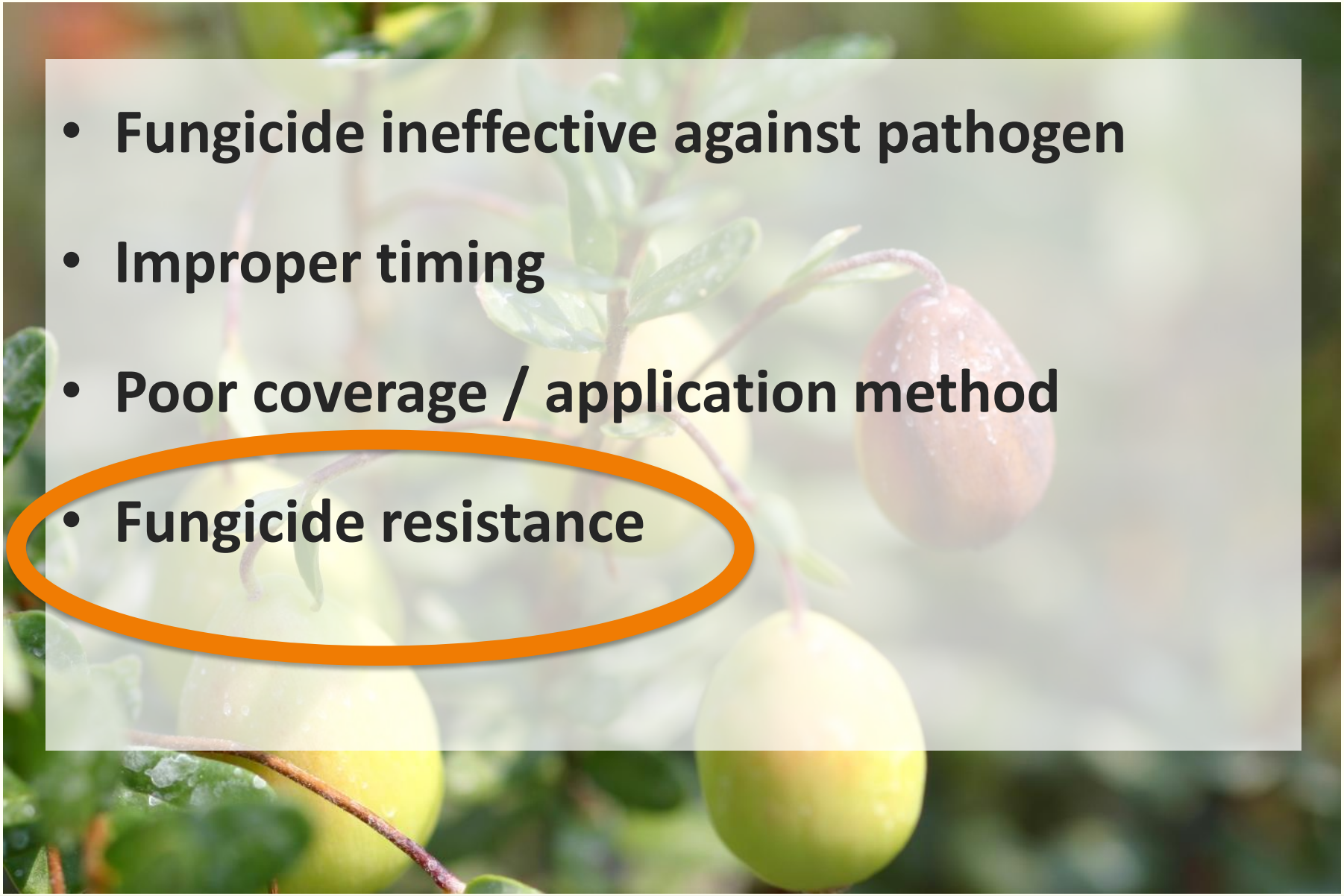
Ferbam

polyoxins
FRAC Code 19

Tavano/Oso

Efficacy unknown
$$$

Why do fungicide applications fail?



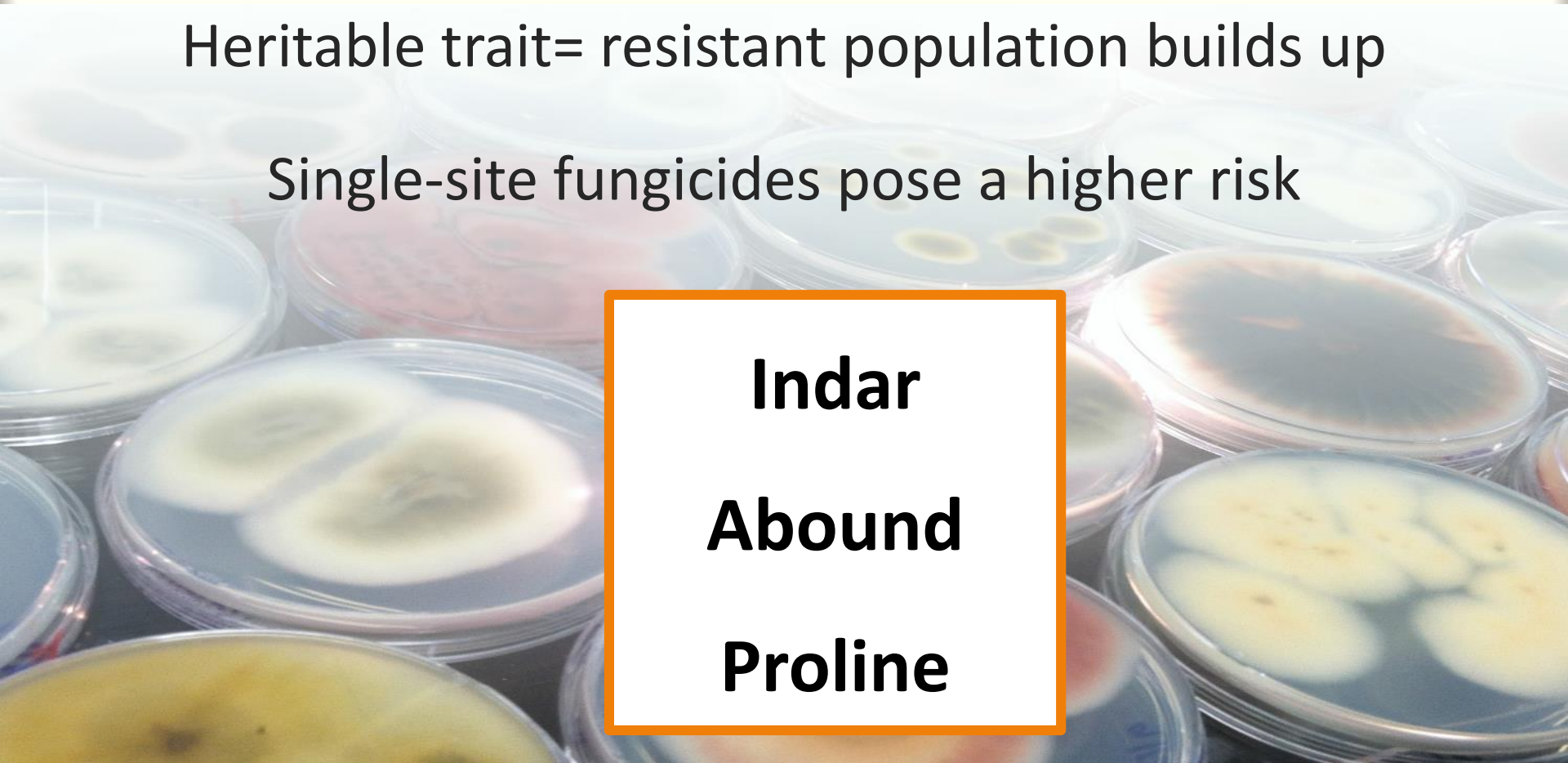
- Fungicide ineffective against pathogen
- Improper timing
- Poor coverage / application method
- Fungicide resistance

Fungicide resistance

Fungal pathogen= less sensitive to fungicides

Heritable trait= resistant population builds up

Single-site fungicides pose a higher risk



Indar

Abound

Proline

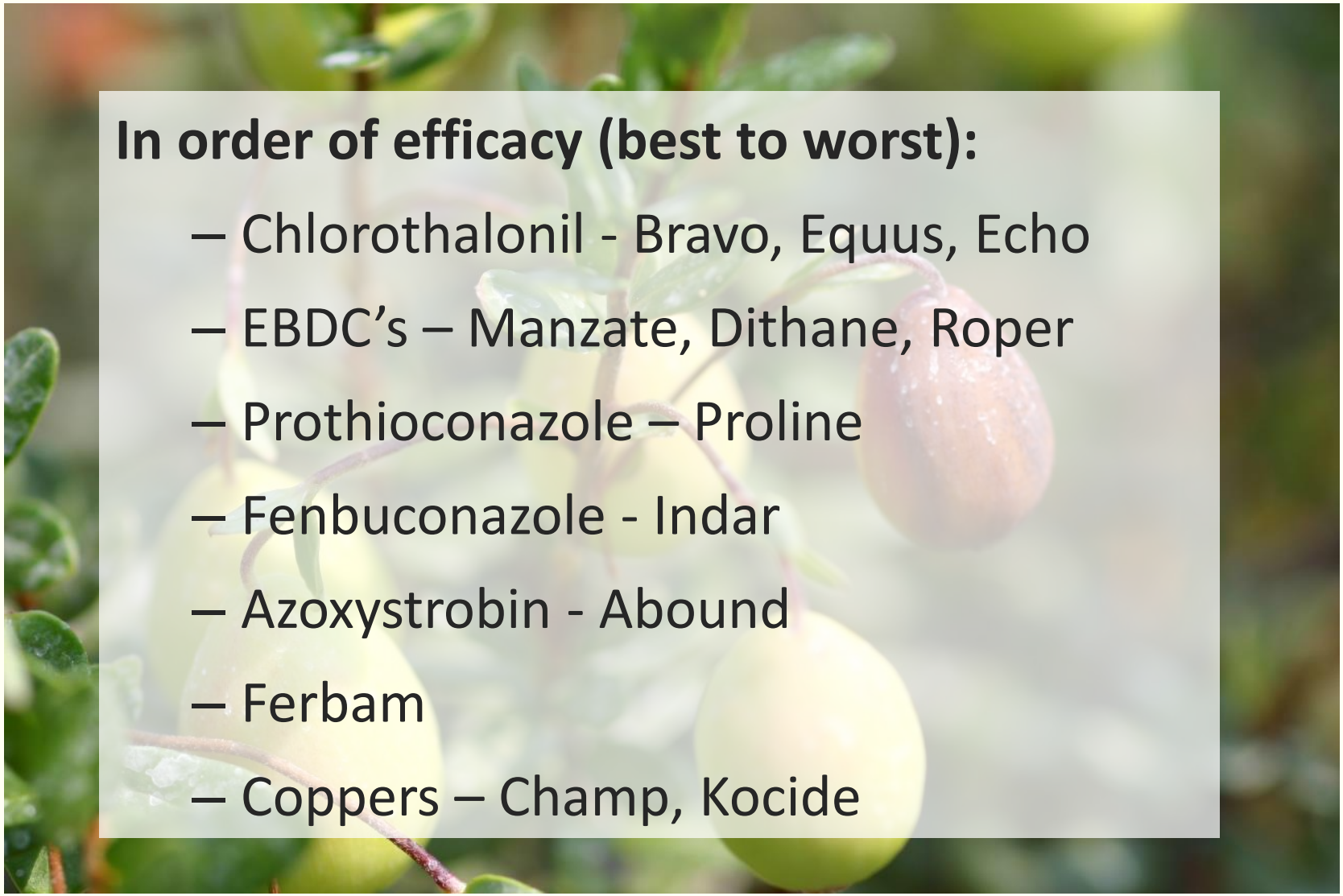
Risk factors

- **Pathogen diversity**
- **Single-site fungicides**

Storage Rot
Allantophomopsis lycopodina
Allantophomopsis cytisporea
Coleophoma empetri
Fusicoccum putrefaciens
Phyllosticta elongata
Phyllosticta vaccinii
Physalospora vaccinii
Strasseria geniculata

Field Rot
Coleophoma empetri
Colletotrichum accutatum
Colletotrichum gloesporioides
Fusicoccum putrefaciens
Phomopsis vaccinii
Phyllosticta vaccinii
Physalospora vaccinii

Efficacy – the overall effect of a fungicide on the level of disease



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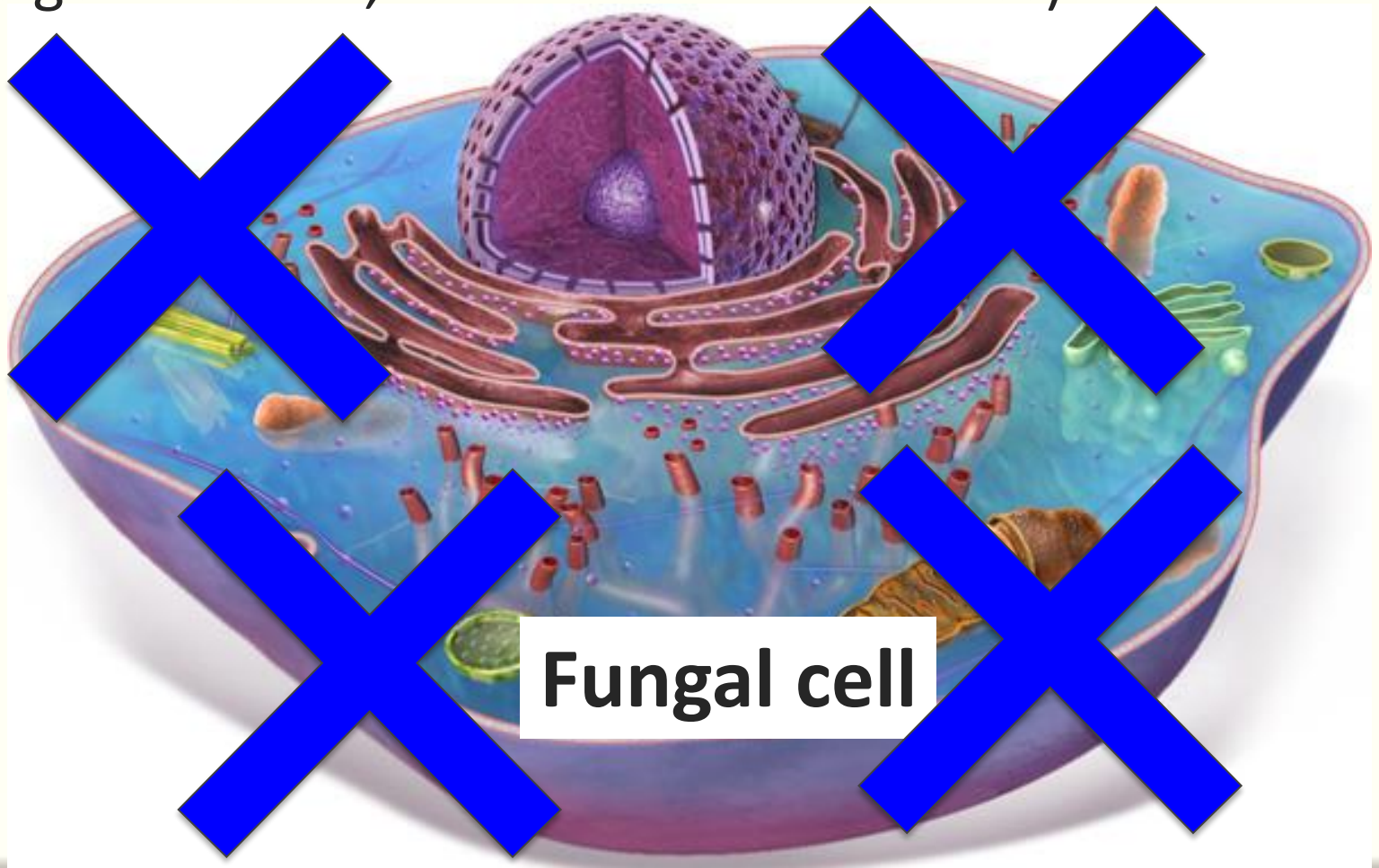
Chlorothalonil and mancozeb

FRAC codes M5 and M3

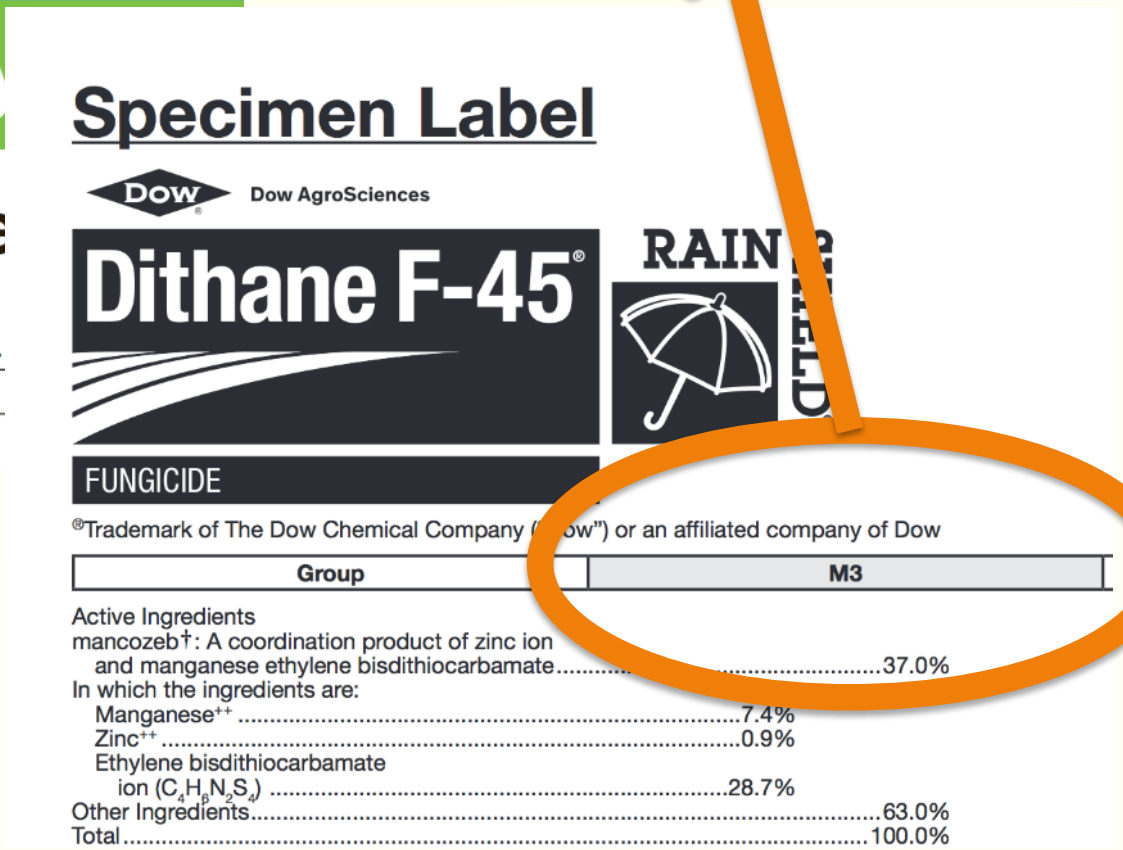
Multi-site: multiple targets (enzymes, metabolic pathways, spore germination, toxic to cell membranes)



FRAC code

Fungicide Resistance Action Committee

Classifies fungicides by mode of action



Specimen Label

DOW Dow AgroSciences

Dithane F-45®

RAIN

FUNGICIDE

®Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow

Group	M3

Active Ingredients

mancozeb†: A coordination product of zinc ion and manganese ethylene bisdithiocarbamate 37.0%

In which the ingredients are:

Manganese^{++} 7.4%

Zinc^{++} 0.9%

Ethylene bisdithiocarbamate ion ($C_4H_6N_2S_4$) 28.7%

Other Ingredients 63.0%

Total 100.0%

FRAC code

Fungicide Resistance Action Committee

Groups fungicides according to their mode of action

Different FRAC codes represent different modes of action

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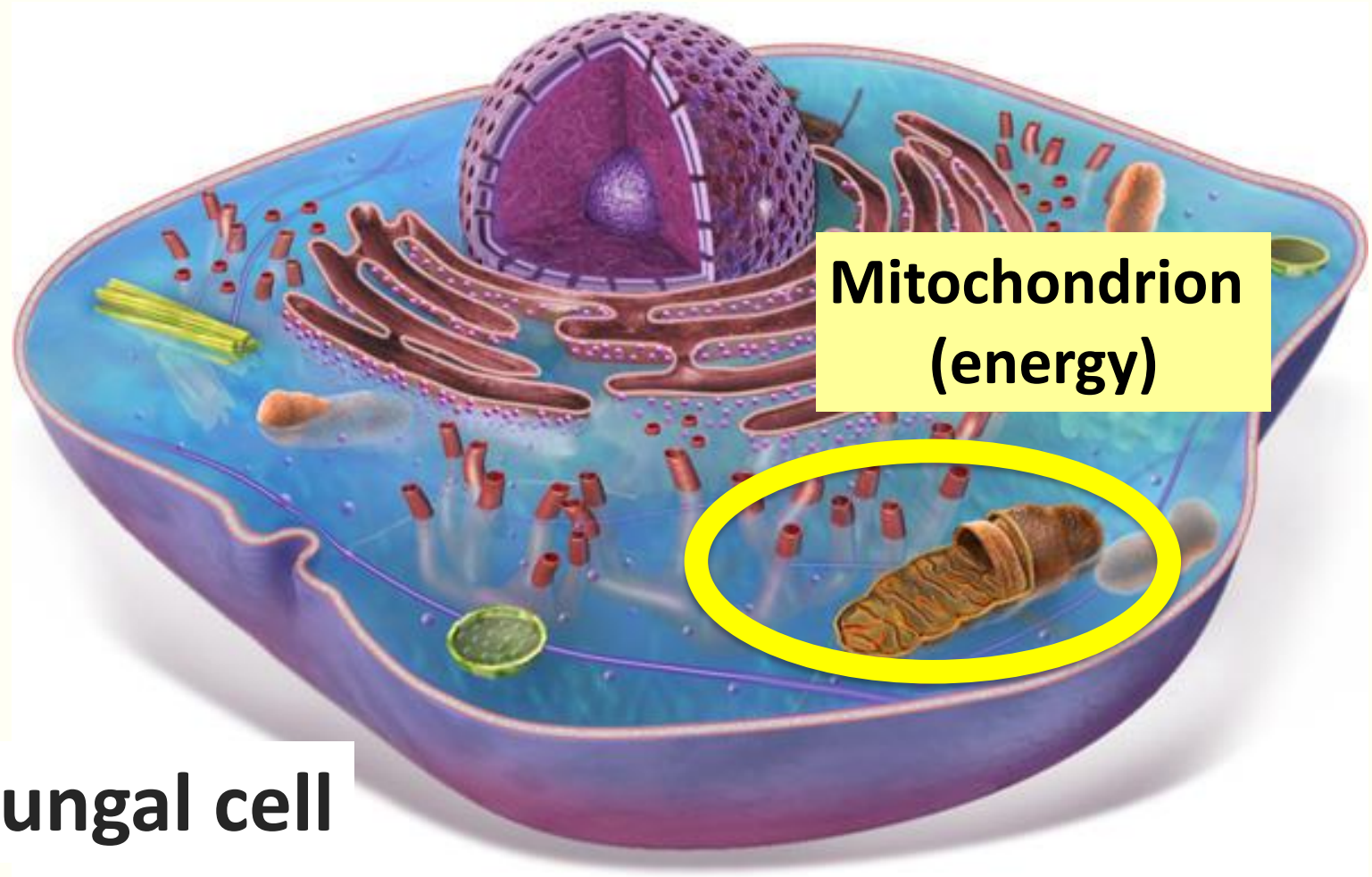
Other Ingredients	63.0%
Total	100.0%

QoI (Strobilurins)

FRAC code 11

Single-site: target the mitochondrion



FRAC code
GROUP 11

Different trade names, same mode of action

Contains 2.08 lbs. of active ingredient per gallon
*IUPAC

Loveland PRODUCTS

Satori® FUNGICIDE

LECI-TECH INSIDE

GROUP 11 FUNGICIDE

Broad spectrum fungicide for control of plant diseases.

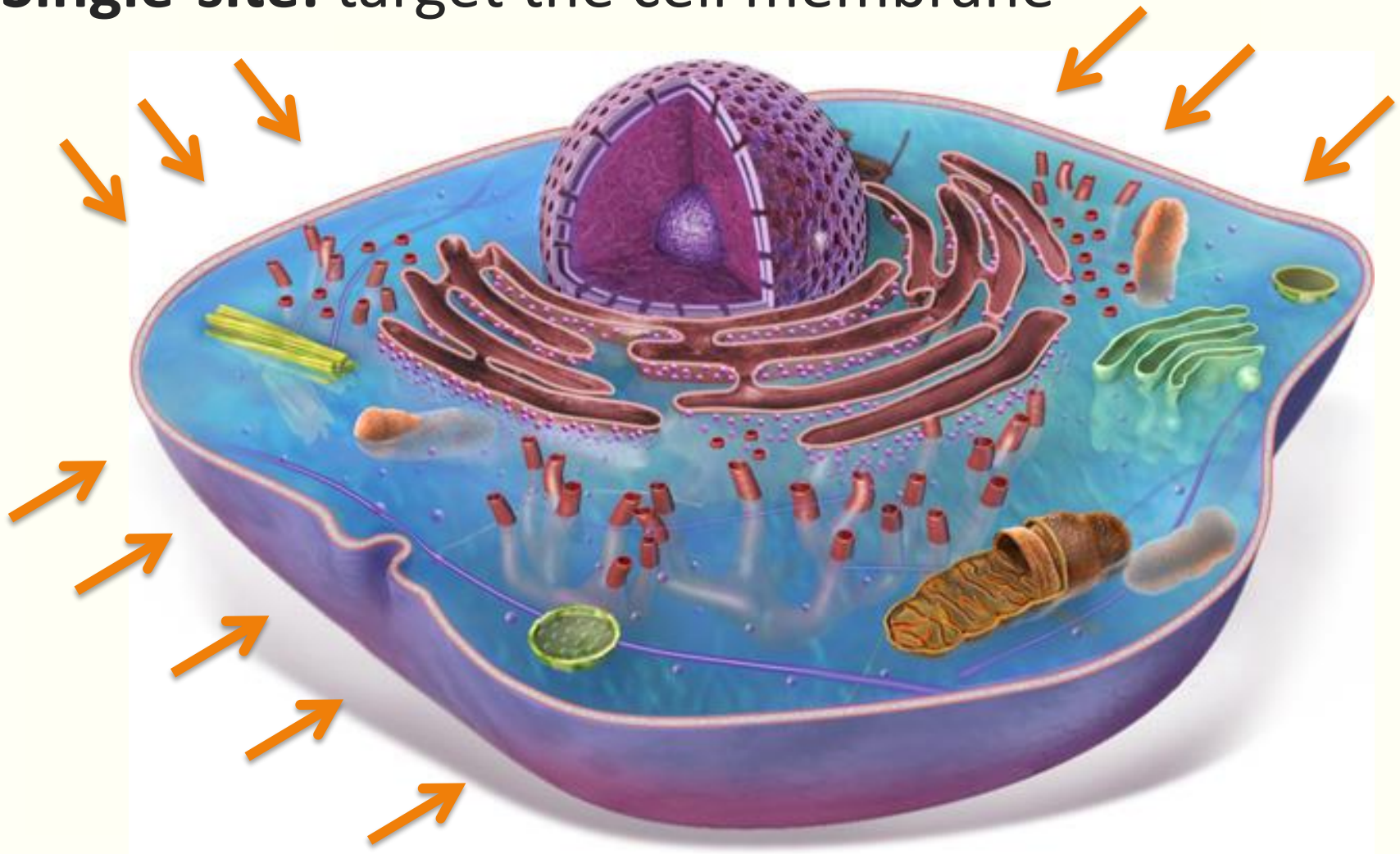
ACTIVE INGREDIENT:	
Azoxystrobin:	
methyl (E)-2-{2-[6-(2-cyanophenoxy) pyrimidin-4-yloxy]phenyl}-3-methoxyacrylate	22.9%
OTHER INGREDIENTS:	77.1%
TOTAL	100.0%

Contains 2.08 pounds of active ingredient per gallon.

DMI fungicides

FRAC code 3

Single-site: target the cell membrane



DOW®

Dow AgroSciences

Inda

Fungicide

ACTIVE CONSTITUENT: 24

BAYER

PROLINE®

480 SC Fungicide

Net Contents:

2.5 Gallons

GROUP 3 FUNGICIDE

For control of specified diseases on listed crops.

ACTIVE INGREDIENT:

Prothioconazole, 2-[2-(1-Chlorocyclopropyl)-3-(2-chlorophenyl)-2-hydroxypropyl]-1, 2-dihydro-3*H*-1,2,4-triazole-3-thione **41.0%**

INERT INGREDIENTS: **59.0%**

100.0%

Contains 4 pounds Prothioconazole per gallon

KEEP OUT OF REACH OF CHILDREN

CAUTION

FOR ADDITIONAL PRECAUTIONARY STATEMENTS: See Inside Booklet.

110307E 05/11

DOW®

Dow AgroSciences

Inda

Fungicide

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FRAC code
GROUP 3

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Contains 4 pounds Prothioconazole per gallon

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110307E 05/11

Standard fungicide approach

Applications

Early bloom 1	Early bloom 2	Early/mid bloom 1	Mid/out bloom 2	Mid/out bloom 3

5 applications

Standard fungicide approach

Applications

	Early bloom 1	Early bloom 2	Early/mid bloom 1	Mid/out bloom 2	Mid/out bloom 3
5 applications	Indar/Abound	Indar/Abound	Bravo	Bravo	Bravo
4 applications					
3 applications					

Areas with **moderate** to **high** fruit rot

The # of out-of-bloom applications may depend on cultivar

More resistant:
Early Black
Howes
Mullica Queen

Standard fungicide approach

Applications

Early bloom 1	Early bloom 2	Early/mid bloom 1	Mid/out bloom 2	Mid/out bloom 3
Indar/Abound	Indar/Abound	Bravo	Bravo	Bravo
Indar/Abound	Indar/Abound	Bravo	Bravo	
Indar/Abound	Indar/Abound	Bravo		

Single-site fungicides

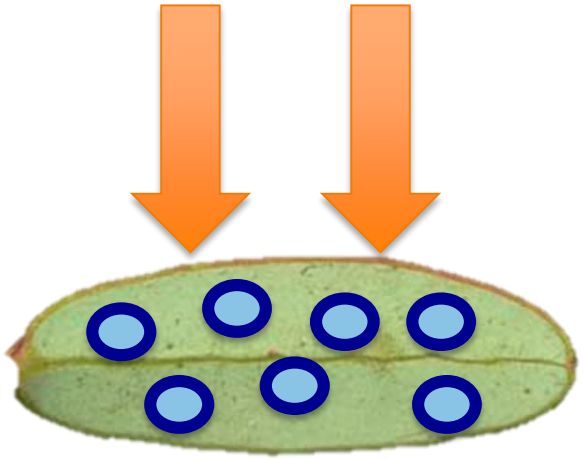
Medium-high risk of resistance

Multi-site fungicides

Low risk of resistance ‘cleanup application’

Single-site fungicides (Indar, Abound, Proline)

Medium-high risk of resistance



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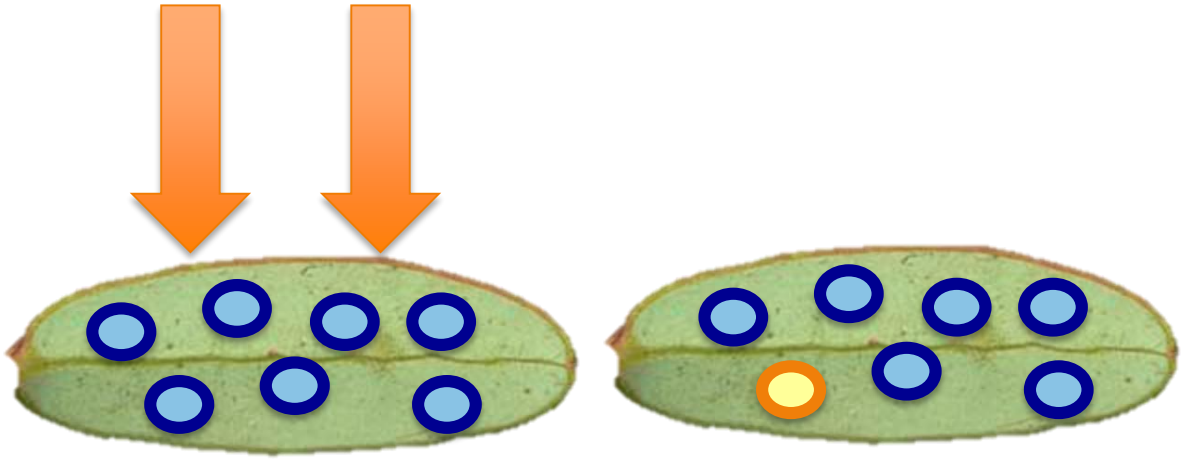

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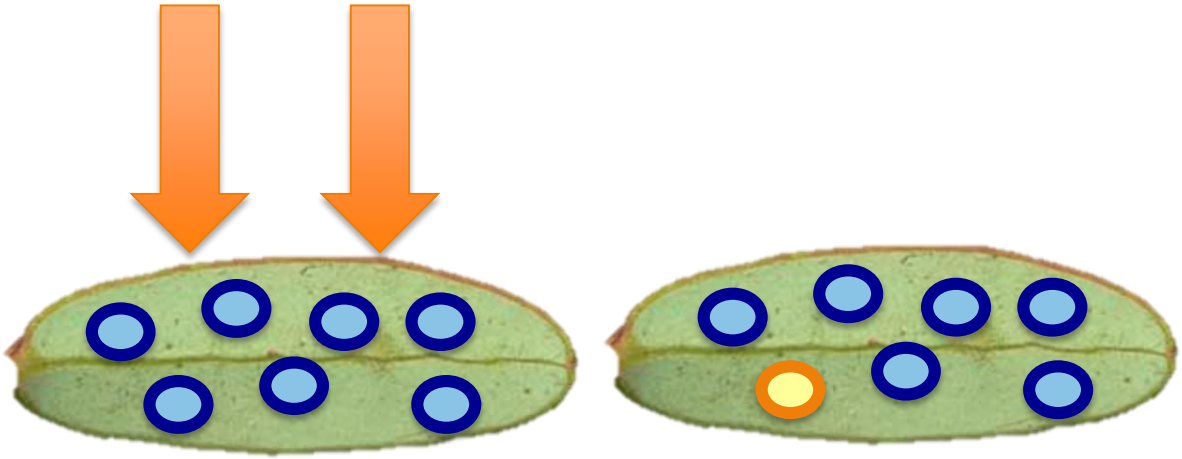

Indar (FRAC 3) + Abound (FRAC 11)
or
Proline (FRAC 3) + Abound (FRAC 11)

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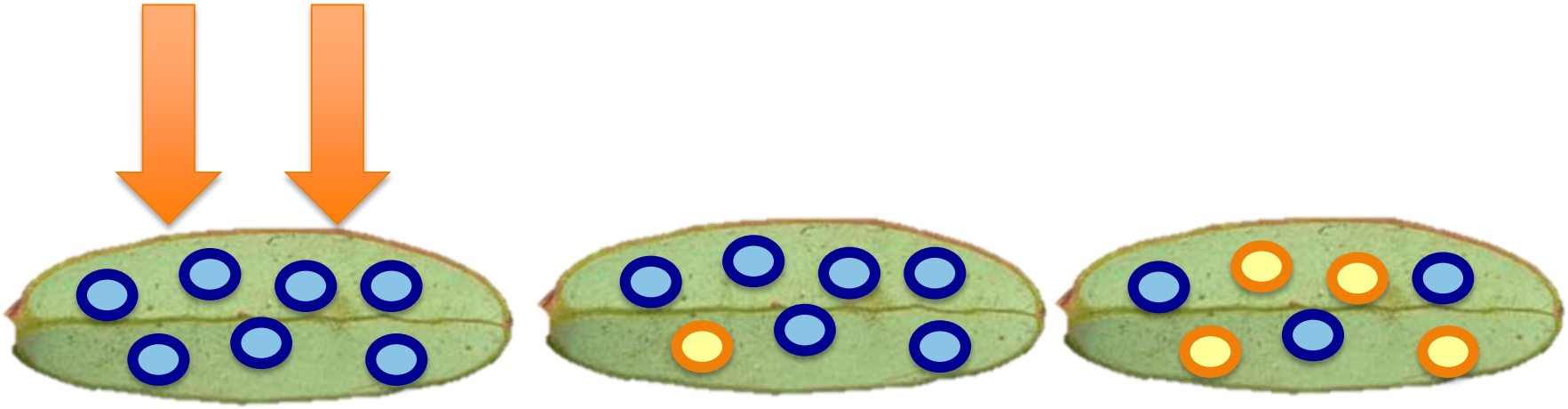

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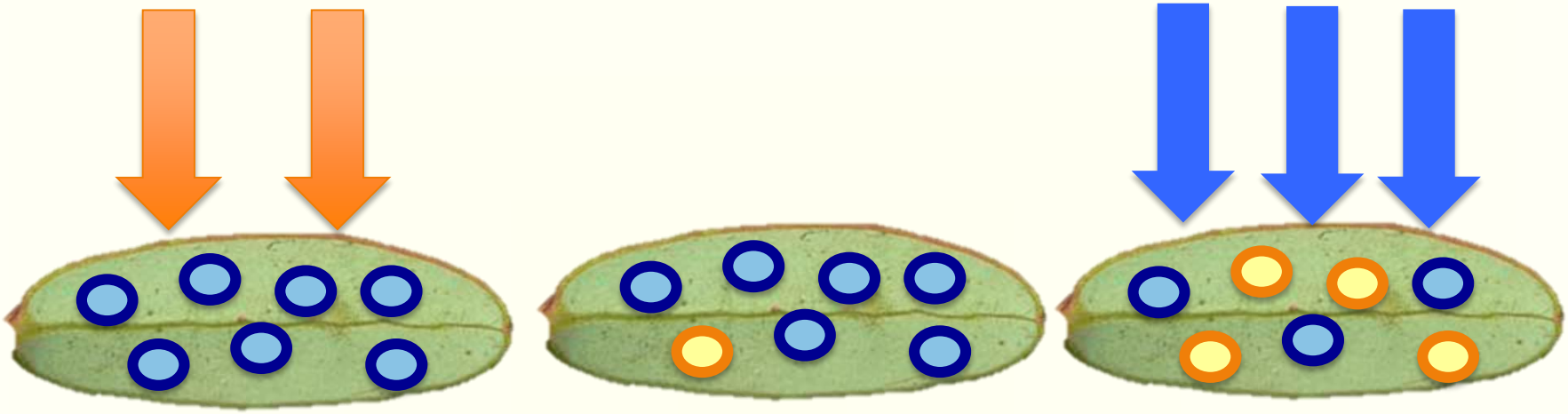
Single-site fungicides (Indar, Abound, Proline)

Medium-high risk of resistance

Multi-site fungicides

Low risk of resistance

'cleanup application'



Indar (FRAC 3) + Abound (FRAC 11)

or

Proline (FRAC 3) + Abound (FRAC 11)

Combine or alternate modes of action

Use FRAC codes for guidance

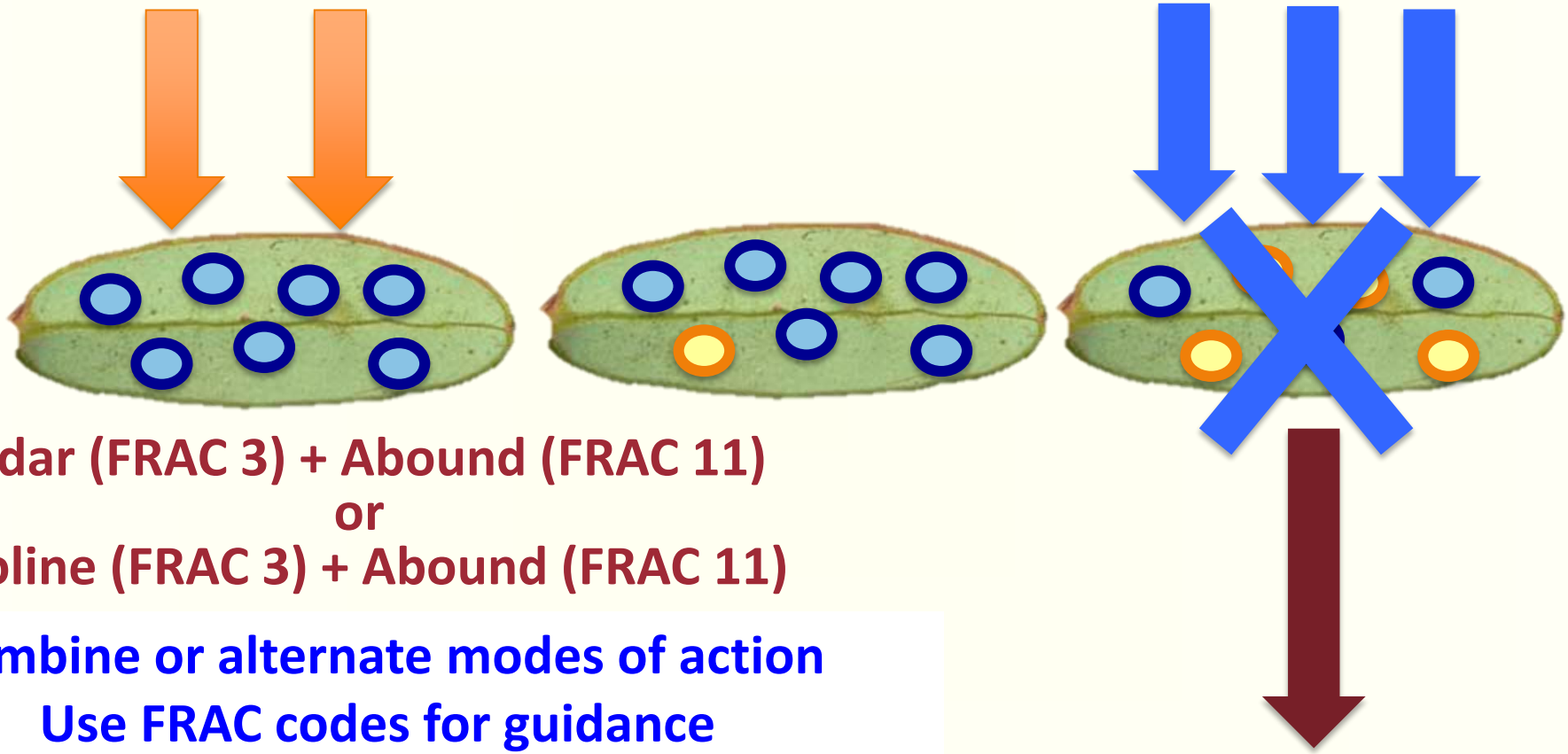
Single-site fungicides (Indar, Abound, Proline)

Medium-high risk of resistance

Multi-site fungicides

Low risk of resistance

'cleanup application'



Indar (FRAC 3) + Abound (FRAC 11)
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Proline (FRAC 3) + Abound (FRAC 11)

Combine or alternate modes of action
Use FRAC codes for guidance

No carryover of resistant pathogens to next growing season

Single-site fungicides (Indar, Abound, Proline)

Medium-high risk of resistance

Multi-site fungicides

Low risk of resistance

'cleanup application'

Last application of the growing season should be a multi-site fungicide (Bravo or Mancozeb)

Combine or alternate modes of action

Use FRAC codes for guidance

No carryover of resistant pathogens to next growing season

Standard approach- No Bravo

	Early bloom 1	Early bloom 2	Early/mid bloom 1	Mid/out bloom 2	Mid/out bloom 3
5 applications					

Proline/Abound

Proline/Abound

FRAC 3 and FRAC 11

Standard approach- No Bravo

Early bloom 1	Early bloom 2	Early/mid bloom 1	Mid/out bloom 2	Mid/out bloom 3
Indar/Abound				

Areas with **moderate** to **high** fruit rot

Mancozeb (e.g., Dithane and Manzate) can affect fruit color and fruit size (long-term)

Standard approach- No Bravo

Early bloom 1	Early bloom 2	Early/mid bloom 1	Mid/out bloom 2	Mid/out bloom 3
Mancozeb	Indar/Abound	Indar/Abound	**Mancozeb**	**Mancozeb**
Indar/Abound	**Mancozeb**	Indar/Abound	**Mancozeb**	
Indar/Abound	Indar/Abound	**Mancozeb**		

If spraying 2 mancozeb~ first application can be **In bloom**

Next targets?

Table 2: The potential impact of the new regulation on fungicides as assessed by the UK CRD.

Most likely to be eliminated by hazard criteria	Additional fungicides that may be eliminated depending on definition of cut-off criteria for endocrine disruption	Fungicides likely to be identified as Candidates for Substitution (assuming not already eliminated, and depending on endocrine disruptor definition)
Bitertanol	Difenoconazole	Chloropicrin
Carbendazim	Folpet	Chlorothalonil
Cyproconazole	Fluquinconazole	Cyproconazole
Dinocap	Fuberidazole	Cyprodinil
Epoxiconazole	Metiram	Dimoxystrobin
Fenbuconazole		
Flusilazole	Penconazole	Famoxadone
Iprodione	Prochloraz	Fenbuconazole
Mancb	Propiconazole	Fluquinconazole
Mancozeb	Prothioconazole	
	Tetraconazole	Propiconazole
	Thiram	Silthiofam
	Triadimenol	Tetraconazole
	Triticonazole	Triazoxide

Bravo

Indar

Proline

EBDCs

Opportunities

- **Focus on proper timing and coverage of fungicide apps**
- **Cultural practices**
  - Monitor weather conditions (e.g., KQF & scald)
  - Avoid pathogen buildup (e.g., trash flood)
  - Late water(?)
- **Plant health and IPM (Integrated Pest Management)**
  - Drainage
  - Nutrition
  - Weed/insect control

Summary

- Newer fungicides= higher risk of resistance
- Resistance management= fungicide durability
- Alternate/mix modes of action (use FRAC codes)
- End of season= multi-site fungicide application
- Integrated Pest and Disease Management