Cornell Cooperative Extension
Cornell Vegetable Program

Managing Stemphylium Leaf Blight of Onion in the Face of Severe Fungicide Resistance in New York

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2023 National Allium Research Conference
San Antonio, Texas: November 29, 2023

Onion Production in New York State

- Pungent dry bulbs onions (cooking/stored)
- Most important vegetable crop in New York Sate
- Accounts for **97%** of the onion production in the Northeast U.S.
- **$80.2 million** farm-gate (2022)
- **170,000 tons**
- **7500 acres**
- Predominantly grown on muck soils where production is unique & intensive

SLB Symptoms: **Target Spots**

Tan

Black

Purple

Photos: C. Hoepting

SLB Symptoms: Spore colonization of necrotic leaf tip tissue “dirty tips”

Tan “dirty tips”

Tan & Black “dirty tips”

Photos: C. Hoepting

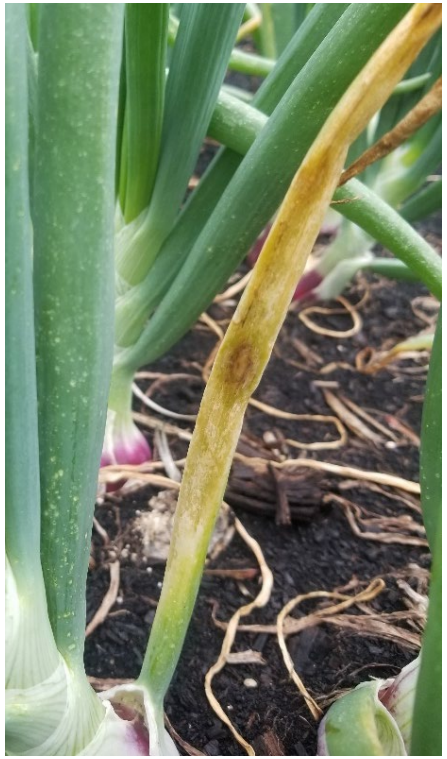
SLB Symptoms: **Excessive Leaf Dieback**

- > 30% leaf dieback prior to lodging
- Onions may “die dying standing up”
- May <u>double</u> incidence of bacterial bulb rot (Hoepting, 2015)

Photos: C. Hoepting

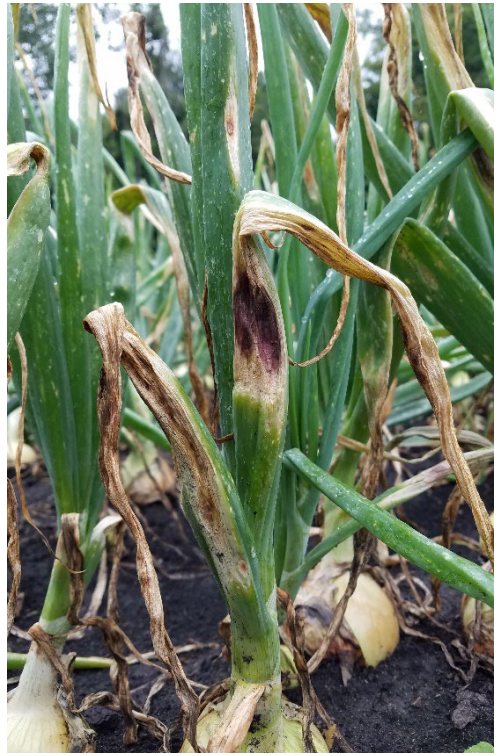
SLB Symptoms: **Primary**

Black/dark spores, concentric rings



Greasy,
water-soaked tissue

Target lesions on
green tissue



Purple, black target
lesions,
Excessive leaf dieback

Photos: C. Hoepting & S. Caldwell

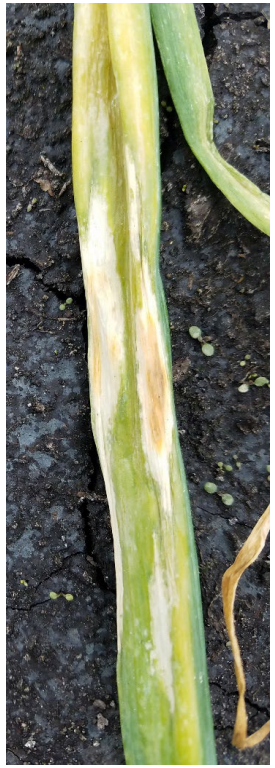
SLB Symptoms: **Secondary**

Herbicide Injury

Disorganized tan coloration

SLB attacking necrotic Tissue (Goal pig-tailing)

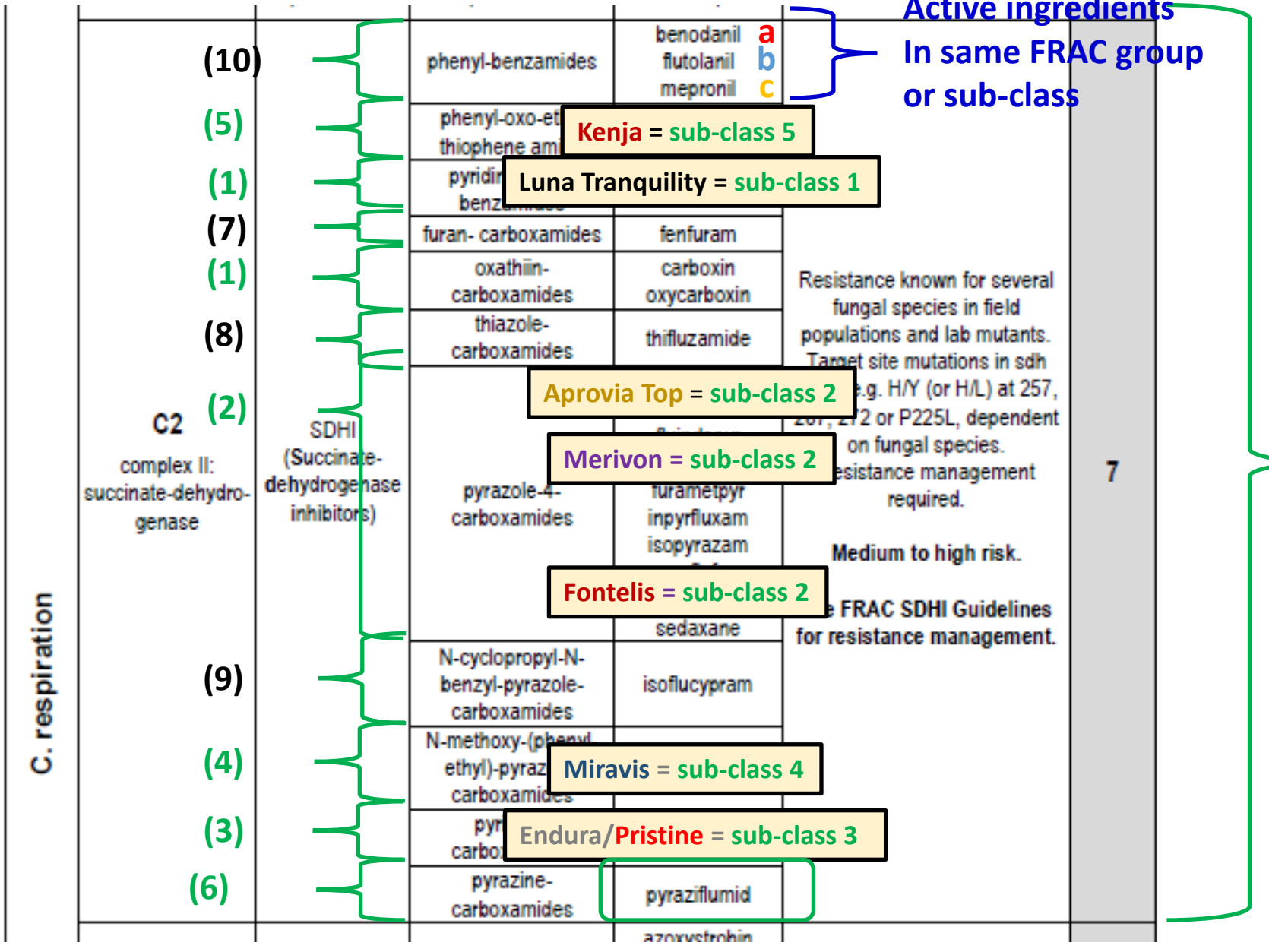
IYSV Lesions



downy mildew

Photos: C. Hoepting

SLB Onion Fungicides FRAC Codes: FRAC 7 Sub-Classes



FRAC 7

Sub-classes are numbered

a.i. within same sub-class are lettered (a, b, c)

SLB in New York Timeline: **2012**

2012

1st Detection

Typical Fungicides Used:	
Bravo 1.5 pt + Scala 9 fl oz	**M5**, **9**
Quadris/Quadris Top	**11 ± 3**
Pristine	**7(1) + 11**
Rovral	**2**
Manzate Max	**M5**

Photo: C. Hoepting

SLB in New York Timeline: **2013**

Hoepting, 2013

2012

2013

1st Detection

FRAC 2 & 9 perform poorly in trials

Untreated

Scala 18 fl oz (9)

Rovral 1.5 pt (2)

Photos: C. Hoepting

SLB in New York Timeline: **2013**

Hoepting, 2013

2012 2013

1st Detection

FRAC **2 & 9** perform poorly in trials

FRAC **3 & 7** look great in trials

Untreated

Merivon
9 fl oz
7(2) + 11

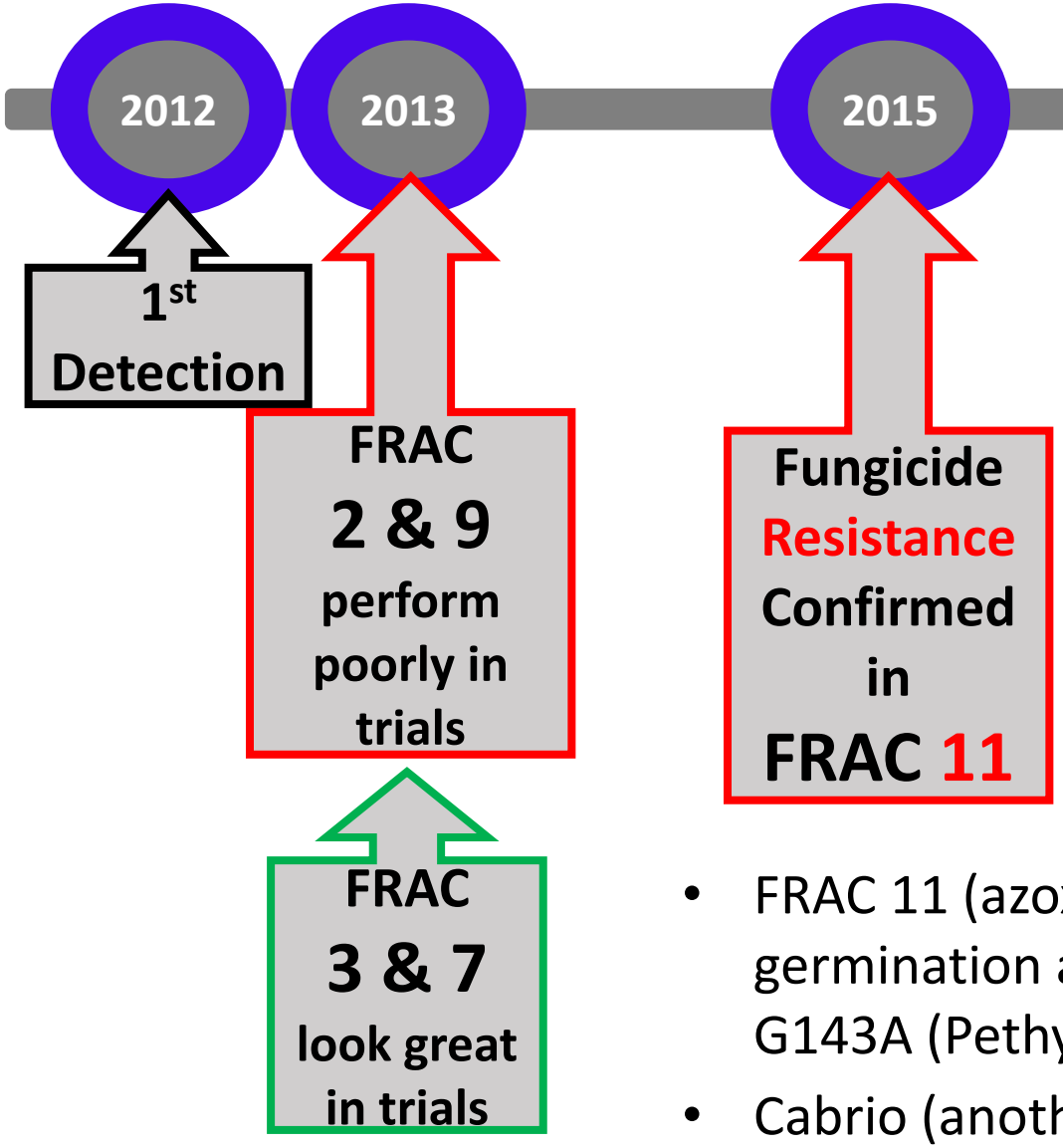
Luna Tranquility
16 fl oz
7(1) + 9

Inspire Super
20 fl oz
3 + 9

FRAC 7s labeled in NY: **Endura and Pristine** – FRAC **7(3)**

Photos: C. Hoepting

SLB in New York Timeline: 2015



Quadris 11 fl oz
(11)

Quadris Top 14 fl oz
(11 + 3)

Hoepting, 2015

- FRAC 11 (azoxystrobin) fungicide resistance confirmed via conidial germination assays and detection of target site gene mutation in G143A (Pethybridge & Hay).
- Cabrio (another FRAC 11) failed to control SLB in field trial.

Photos:
C. Hoepting

SLB in New York Timeline: 2016

Hoepting, 2016

2012

1st Detection

2013

FRAC 2 & 9 perform poorly in trials

FRAC 3 & 7 look great in trials

2015

Fungicide Resistance Confirmed in FRAC 11

2016

FRAC 2 + 9 look great in trials

Rovral 1.5 pt (2)

Scala 18 fl oz (9)

Scala 9 fl oz + Rovral 1 pt (9 + 2)

Luna Tranquility 16 fl oz 7(1) + 9

- Scala + Rovral looked better than either alone.
- As good as Luna Tranquility.

Photos: C. Hoepting

SLB in New York Timeline: 2017

2012 | 2013 | 2015 | 2016 | 2017

1st Detection

FRAC 2 & 9 perform poorly in trials

FRAC 3 & 7 look great in trials

Fungicide Resistance Confirmed in FRAC 11

FRAC 2 + 9 look great in trials

Luna Tranquility and Merivon labeled in New York.

Sample Spray Program "The Cadillac"

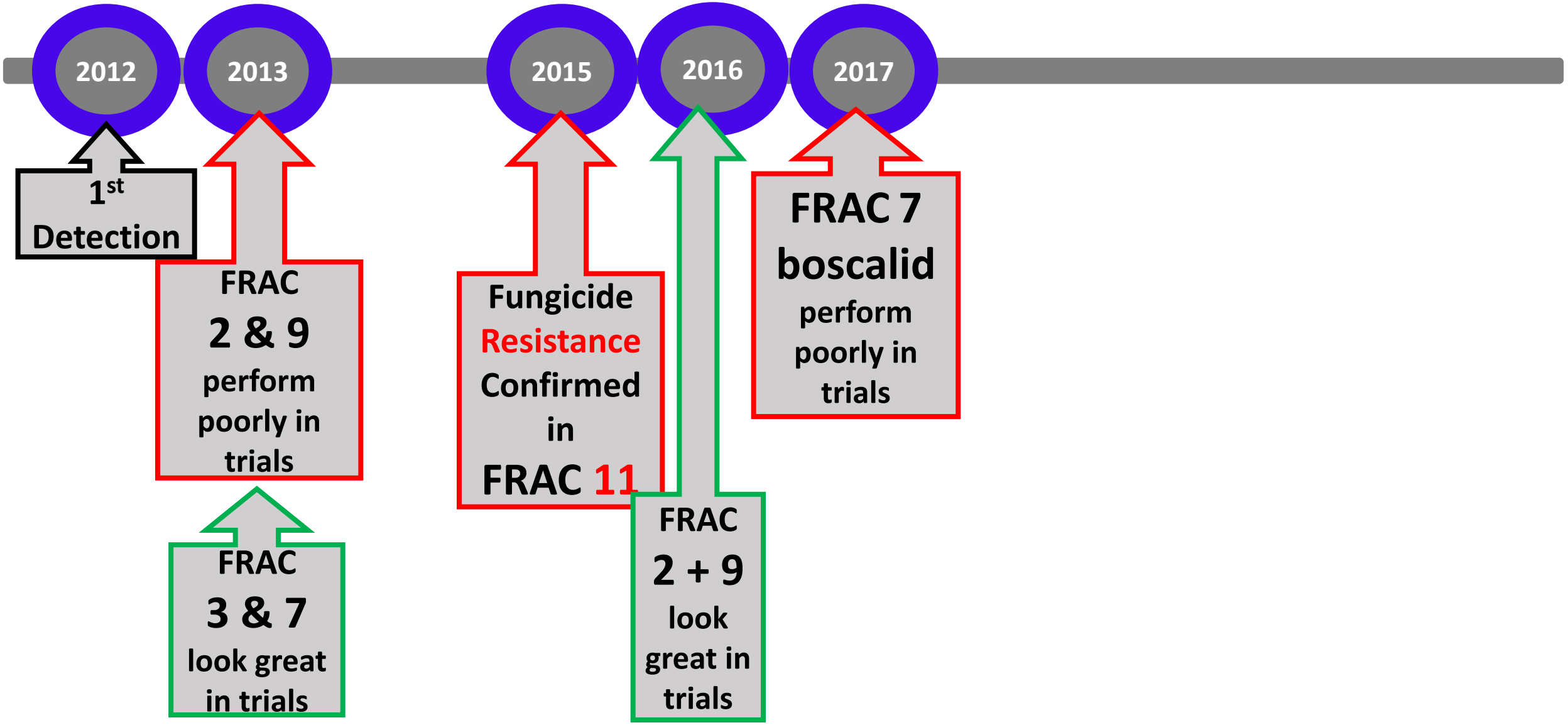
Week 1	Inspire Super 20 fl oz	3b	9
Week 2	Luna Tranquility 16 fl oz	7 (1)	9
Week 3	Merivon 9 fl oz	7 (2)	11
Week 4	Inspire Super 20 fl oz	3b	9
Week 5	Luna Tranquility 16 fl oz	7 (1)	9
Week 6	Merivon 9 fl oz	7 (2)	11
Week 7	Inspire Super 20 fl oz	3b	9
Week 8	Luna Tranquility 16 fl oz	7 (1)	9

No more then 2 apps/FRAC.

SLB in New York Timeline: **2017**

- FRAC 3 & 7 fungicide programs were working great!
- Cool wet year
- Disease control excellent
- Big bulbs & big yields
- Best crop in my 20-year career!
  - Jumping for joy!

SLB in New York Timeline: 2017



SLB in New York Timeline: **2017**

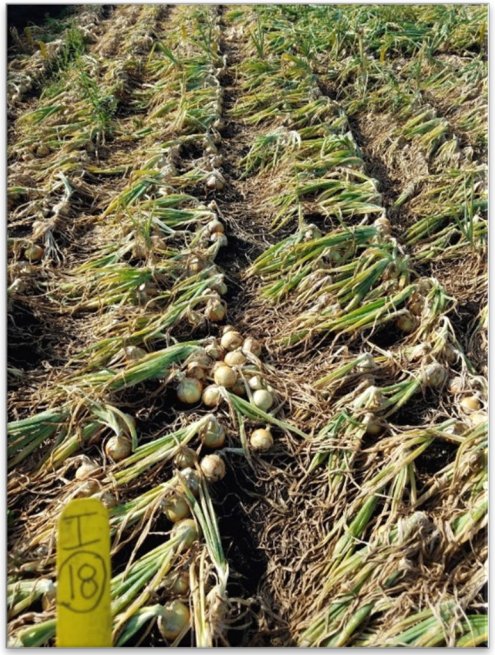
79%

Luna Tranquility
16 fl oz
7(1) + 9

55%

Merivon
9 fl oz
7(2) + 11

48%

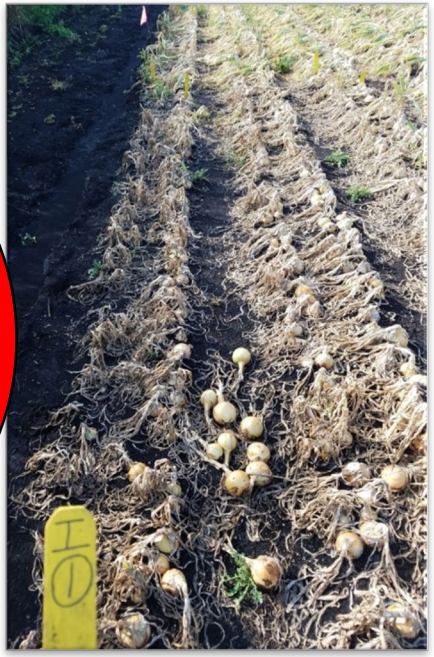


Tilt 8 fl oz
3a

35%

Endura 6.8 oz
7(3)

3%



Untreated

Hoepting, 2017

Hoped that there would not be cross-resistance among FRAC 7 sub-classes

Photos: C. Hoepting

SLB in New York Timeline: 2017

2012 2013 2015 2016 2017

1st Detection

FRAC 2 & 9 perform poorly in trials

FRAC 3 & 7 look great in trials

Fungicide Resistance Confirmed in FRAC 11

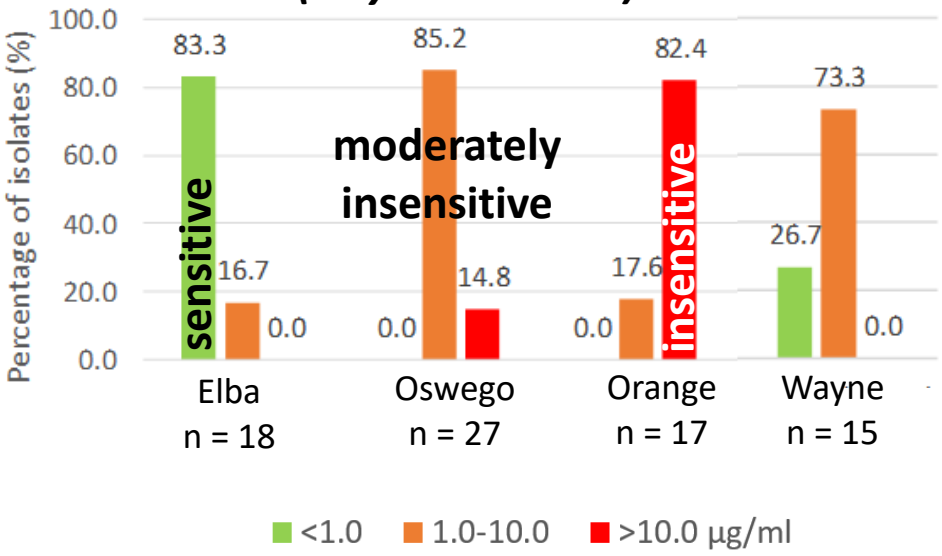
FRAC 2 + 9 look great in trials

FRAC 7 boscalid perform poorly in trials

Fungicide Resistance Confirmed in FRAC 2 & 9

FRAC 2

Fungicide Sensitivity (Mycelial Growth Assay)
(Hay et. al. 2017)



Highly variable among regions

SLB in New York Timeline: 2017

2012 | 2013 | 2015 | 2016 | 2017

1st Detection

FRAC 2 & 9 perform poorly in trials

FRAC 3 & 7 look great in trials

Fungicide Resistance Confirmed in FRAC 11

FRAC 2 + 9 look great in trials

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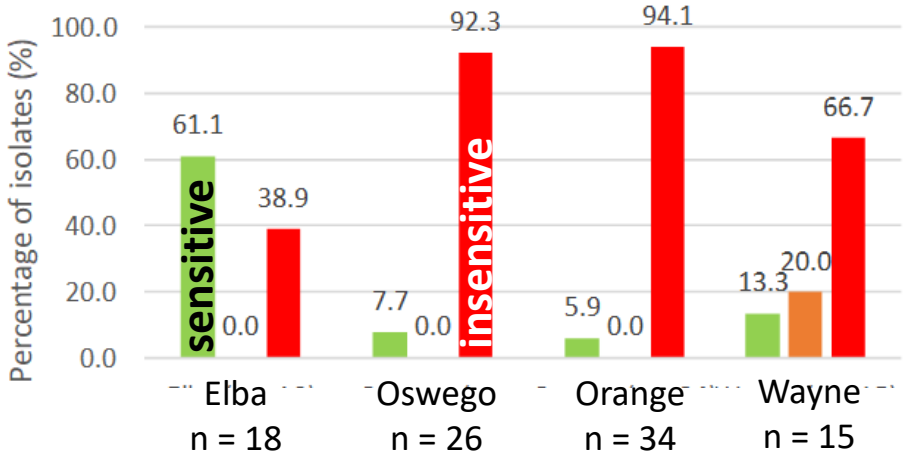
Fungicide Resistance Confirmed in FRAC 2 & 9

FRAC 9

Fungicide Sensitivity (Mycelial Growth Assay)
(Hay et. al. 2017)



Highly variable among regions

SLB in New York Timeline: **2018**

(Hoepting, 2018)

2017

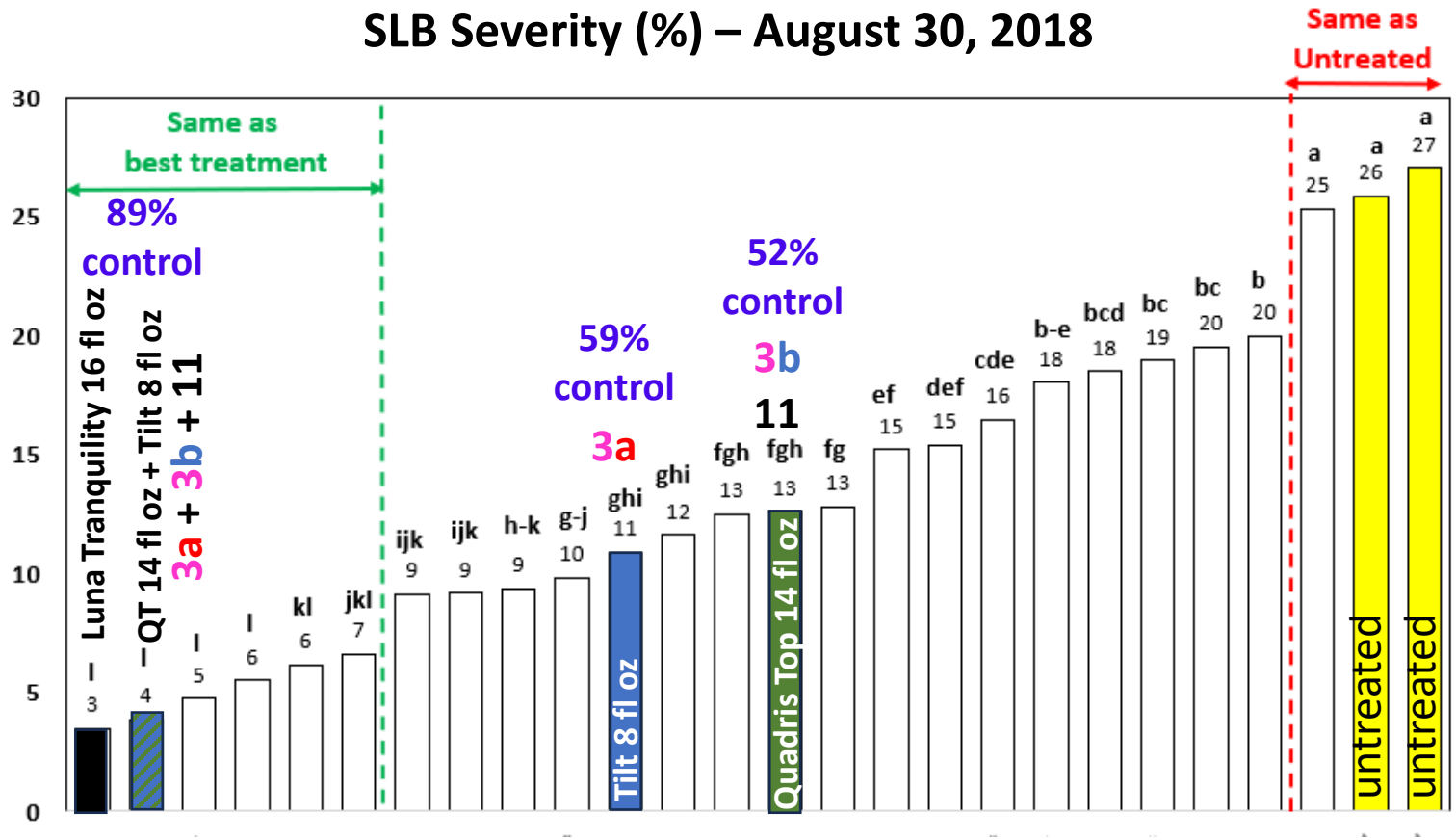
FRAC 7 boscalid perform poorly in trials

Fungicide Resistance Confirmed in FRAC 2 & 9

2018

FRAC 3 + 3 look great in trials

SLB Severity (%) – August 30, 2018



FRAC 3 + 3 significantly better than FRAC alone.

SLB in New York Timeline: 2018

(Hoepting, 2018)

2017

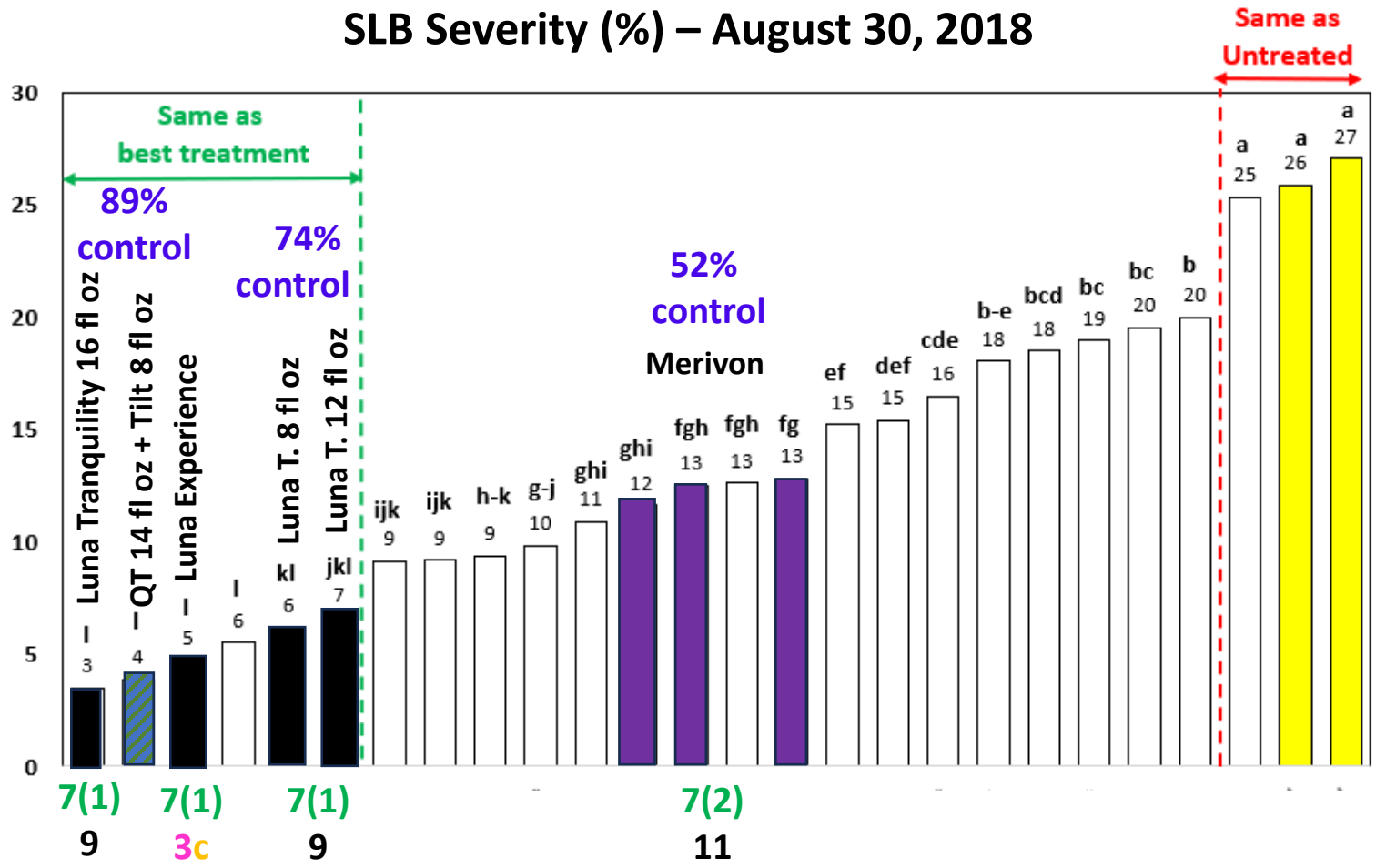
FRAC 7 boscalid perform poorly in trials

Fungicide Resistance Confirmed in FRAC 2 & 9

2018

FRAC 3 + 3 look great in trials

FRAC 7 Merivon perform poorly in trials



Luna FRAC 7 performing well

SLB in New York Timeline: **2018**

(Hoepting, 2018)

2017

2018

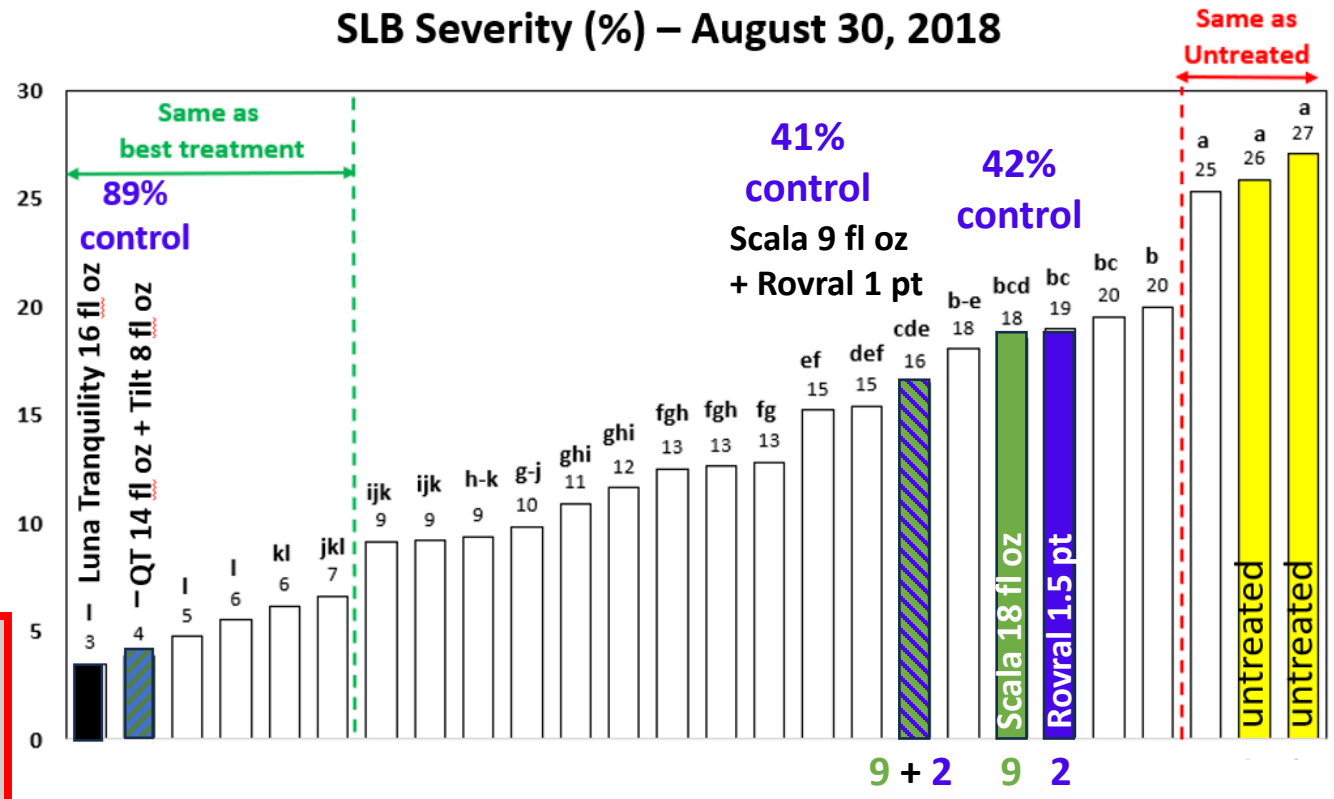
FRAC 7 boscalid perform poorly in trials

Fungicide Resistance Confirmed in **FRAC 2 & 9**

FRAC 3 + 3 look great in trials

FRAC 7 Merivon perform poorly in trials

FRAC 2 + 9 perform poorly in trials

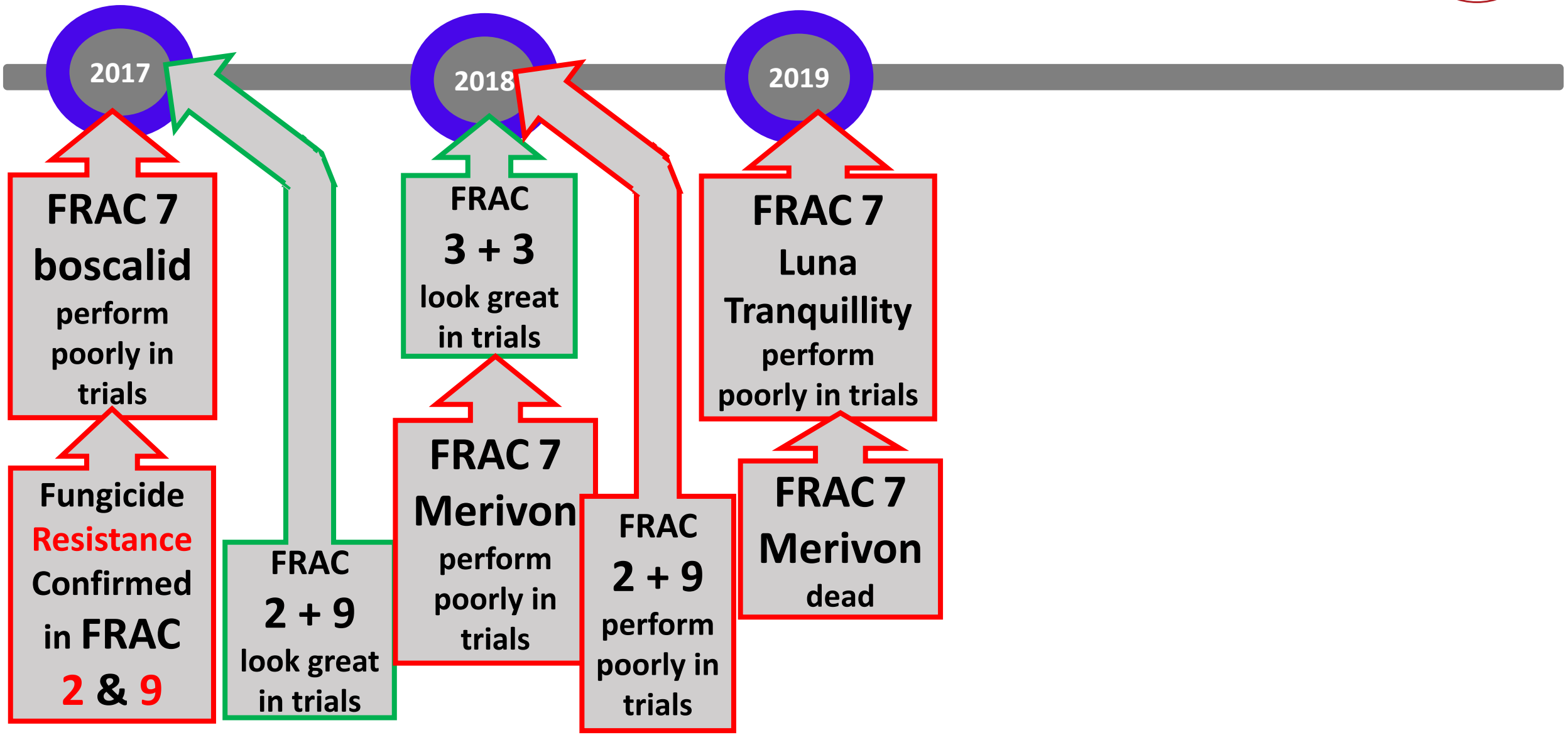


No Significant difference between Scala, Rovral and Scala + Rovral.

SLB in New York Timeline: **2019**
New Spray Recommendations

- **No more than <u>3 apps per FRAC</u> per season** (FRAC 2, 3, 7 & 9)
- Use high rates of FRAC 3
- Rotate sub-classes/active ingredients within FRAC group
  - Luna Tranquility – **7(1)** alt. Merivon – **7(2)** **- 2018**
  - Tilt (FRAC **3a**) alt. Quadris Top – (FRAC **3b**)
- Best performing treatments:
  - Quadris Top + Tilt (FRAC **3b** **+** **3a**)
  - Luna Tranquility 16 fl oz (FRAC **7(1)** **+** **9**)

SLB in New York Timeline: 2019 & 2020



SLB in New York Timeline: **2020**

Luna Tranquility slipped

- Middle-of-the-pack/
- Significantly better than nothing
- No difference between rates
- Significantly less green foliage than best treatments.

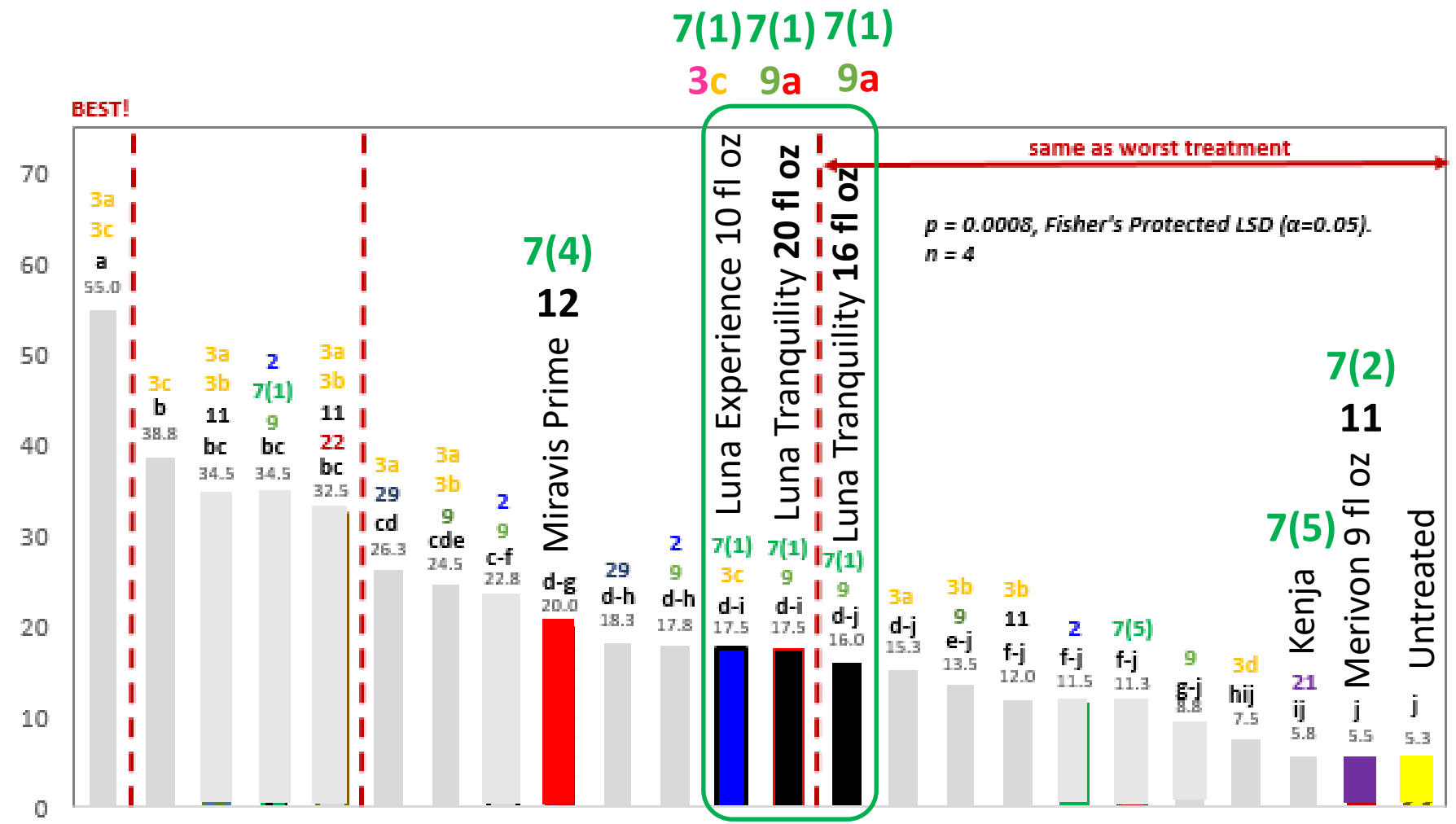
Merivon dead

- Not significantly different than untreated

Other FRAC 7s

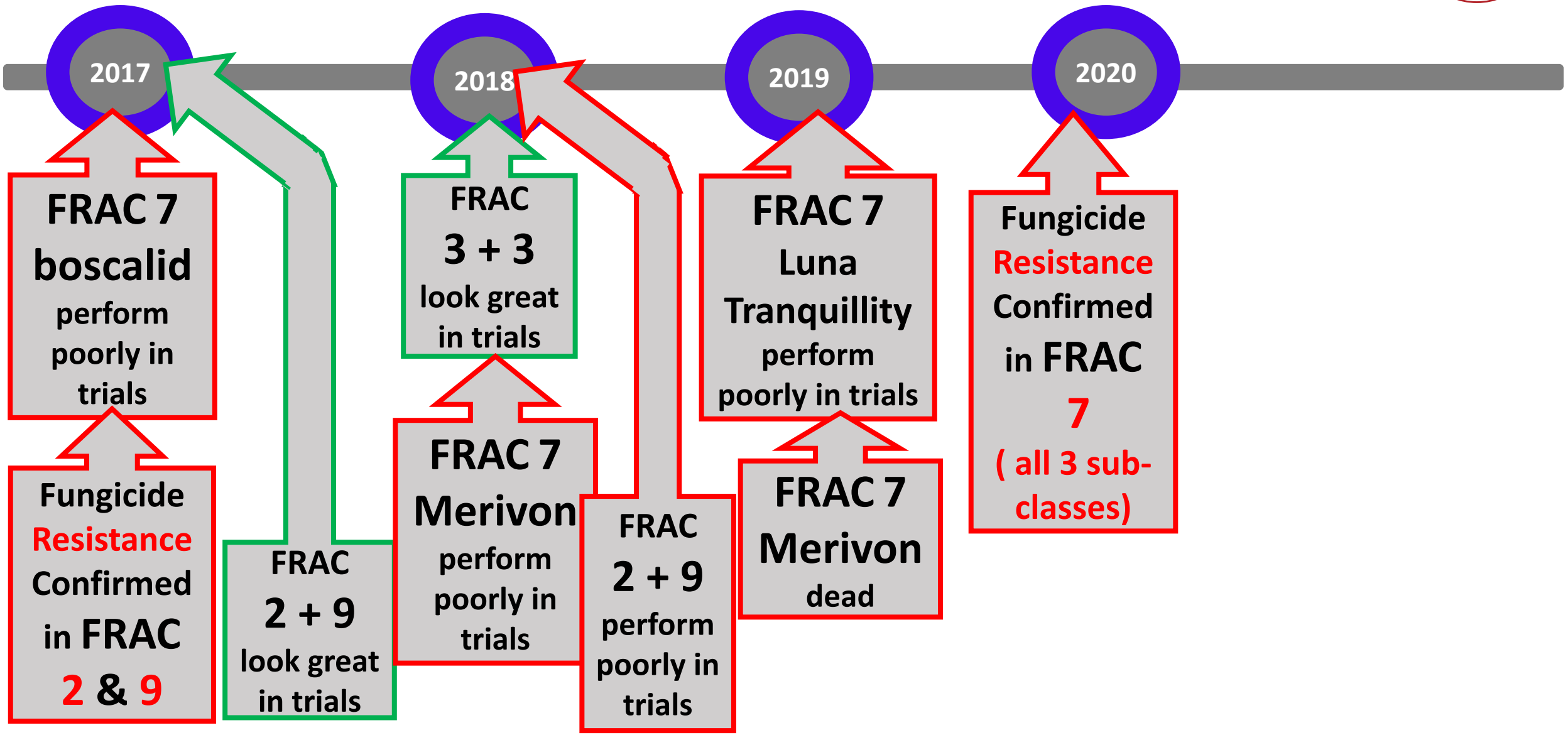
- Miravis Priime **7(4) + 12** similar to Luna products.
- Kenja **7(5)** not different than untreated

% Green Foliage/Plot – Sep 6, 2020 (Elba)

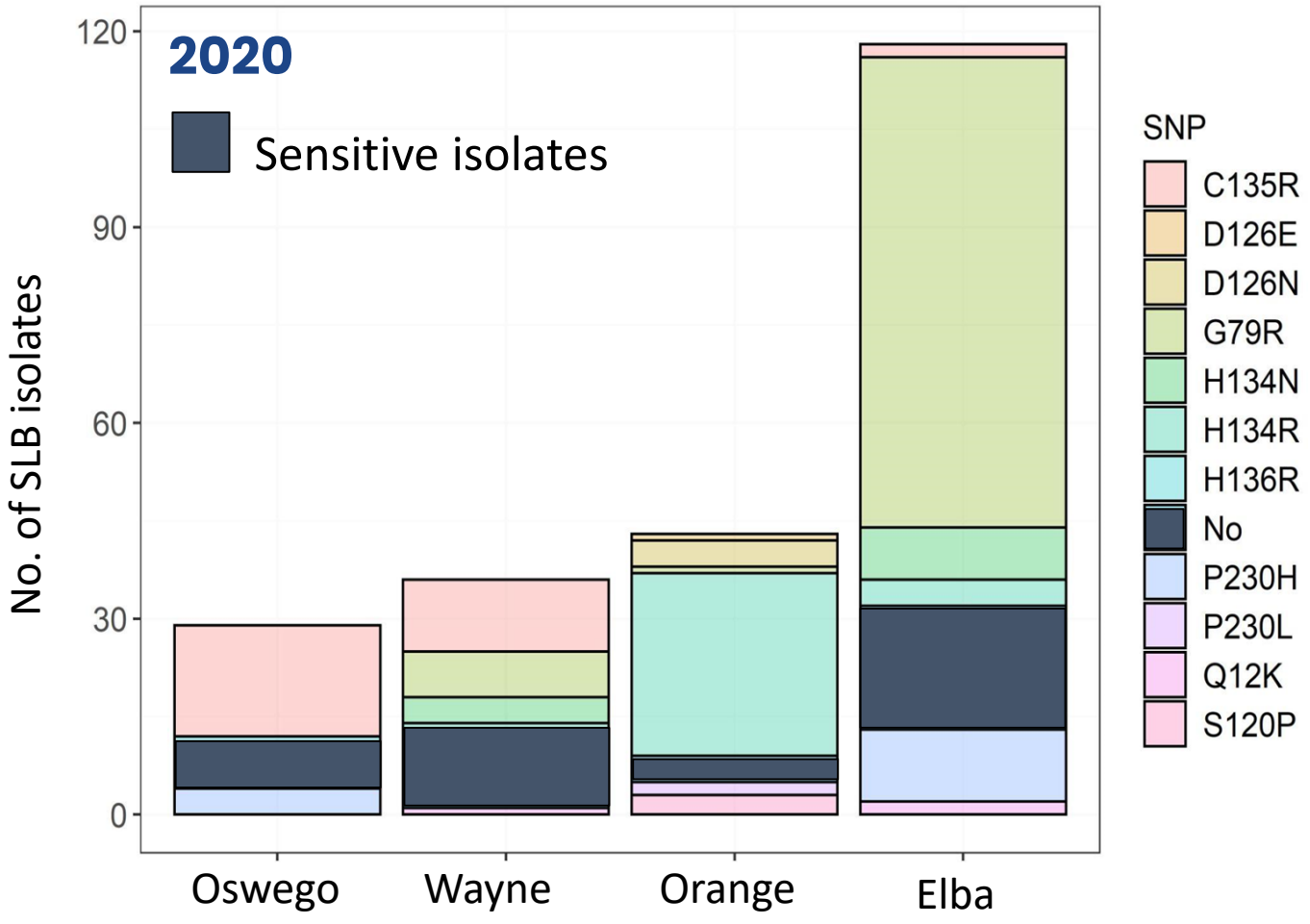


Hoepting et. al. 2020

SLB in New York Timeline: 2019 & 2020



SLB in New York Timeline: **2020**



- 11 types of FRAC 7 gene mutations were detected.
- Gene mutations that confer highest levels of fungicide resistance found in high frequency.
- Cross-resistance among FRAC 7 sub-classes detected.
- Frequency of FRAC 7 gene mutations varied by region.

Heck et. al. 2020

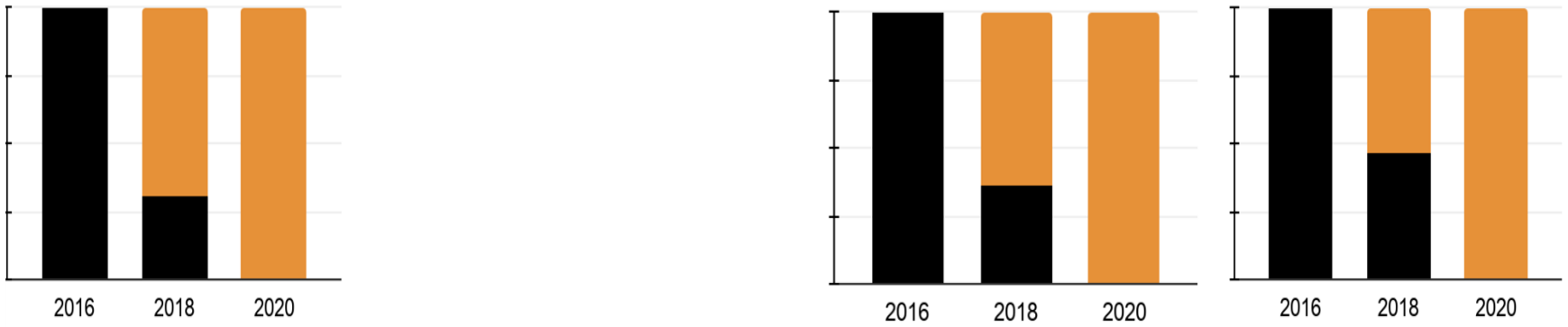
Relationship Between Fungicide Use and FRAC 7 Fungicide Resistance By Region

2017-2018: Fungicide Programs that used > 3 apps of FRAC 7/season

Never — Always

Light — Heavy

Wayne Co. | Oswego Co. | Elba



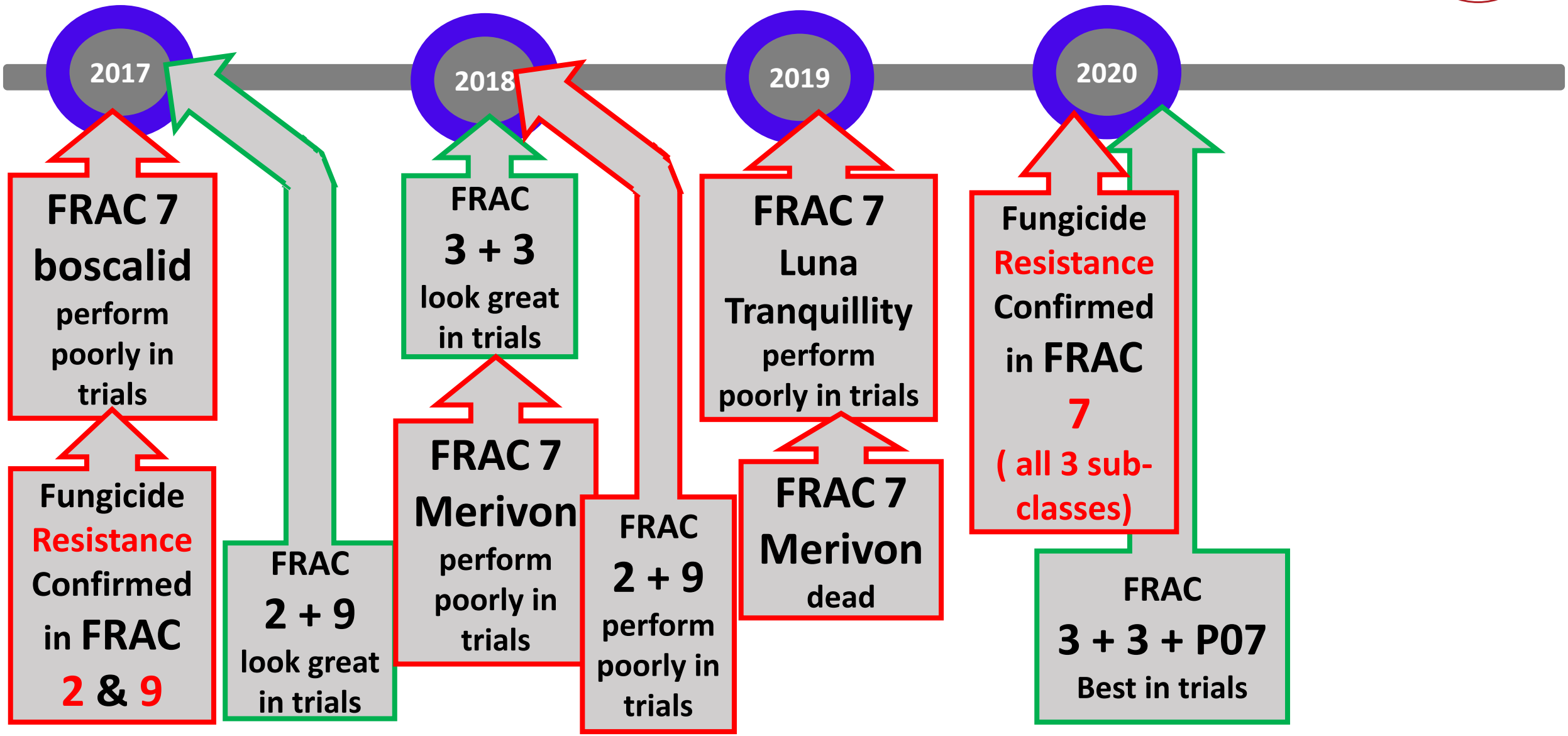
No difference among geographic regions despite different FRAC 7 fungicide use.

Presence of gene mutations in *sdh* genes (% of isolates tested)

- Sensitive (FRAC 7 works)
- Gene mutations that confer FRAC 7 resistance

Hoepting Onion Scouting Program 2017-2018

SLB in New York Timeline: 2020



SLB in New York Timeline: **2020**

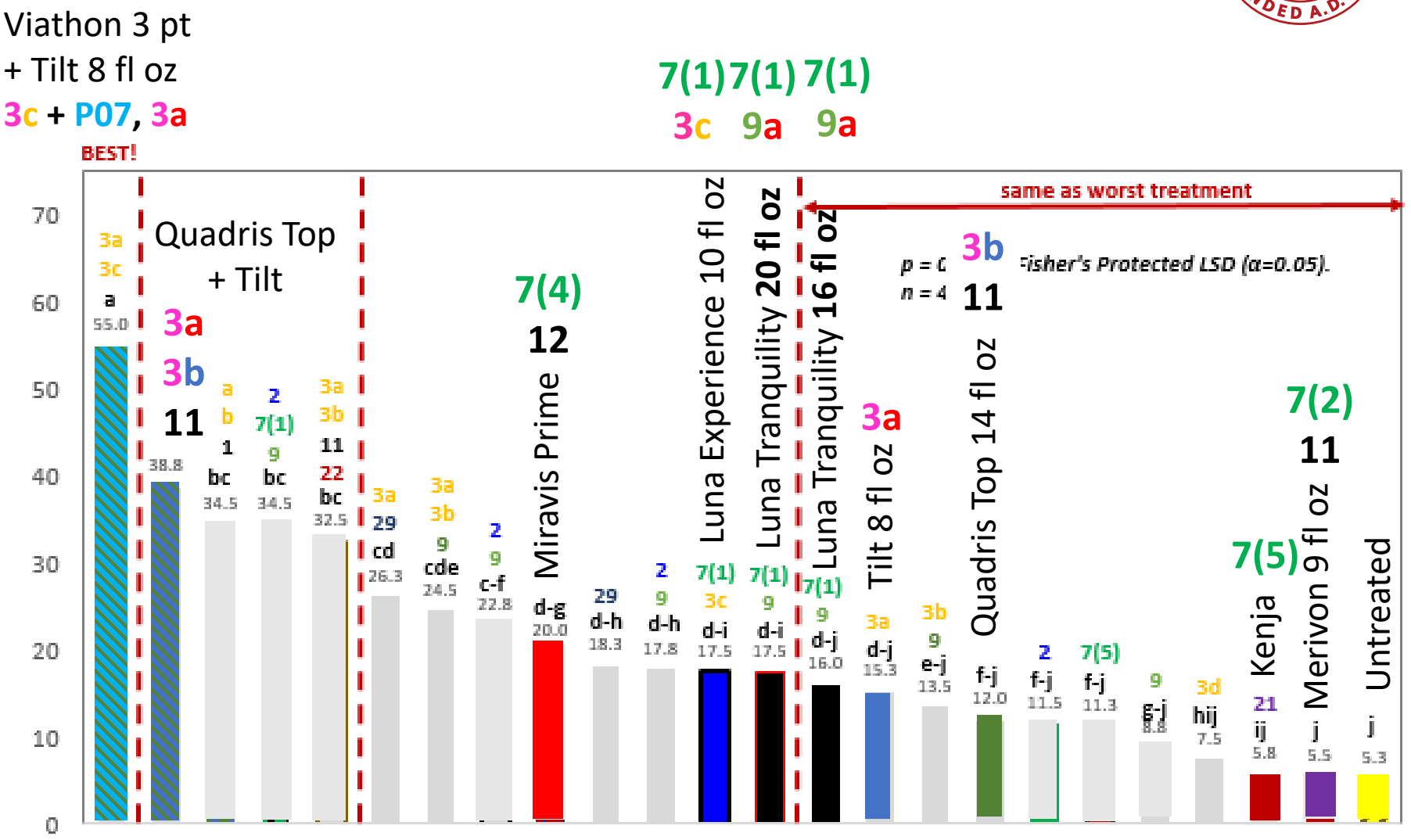
FRAC 3 + 3

Quadris Top 14 fl oz
+ Tilt 8 fl oz **3b + 11, 3a**

FRAC 3 + 3 + P07

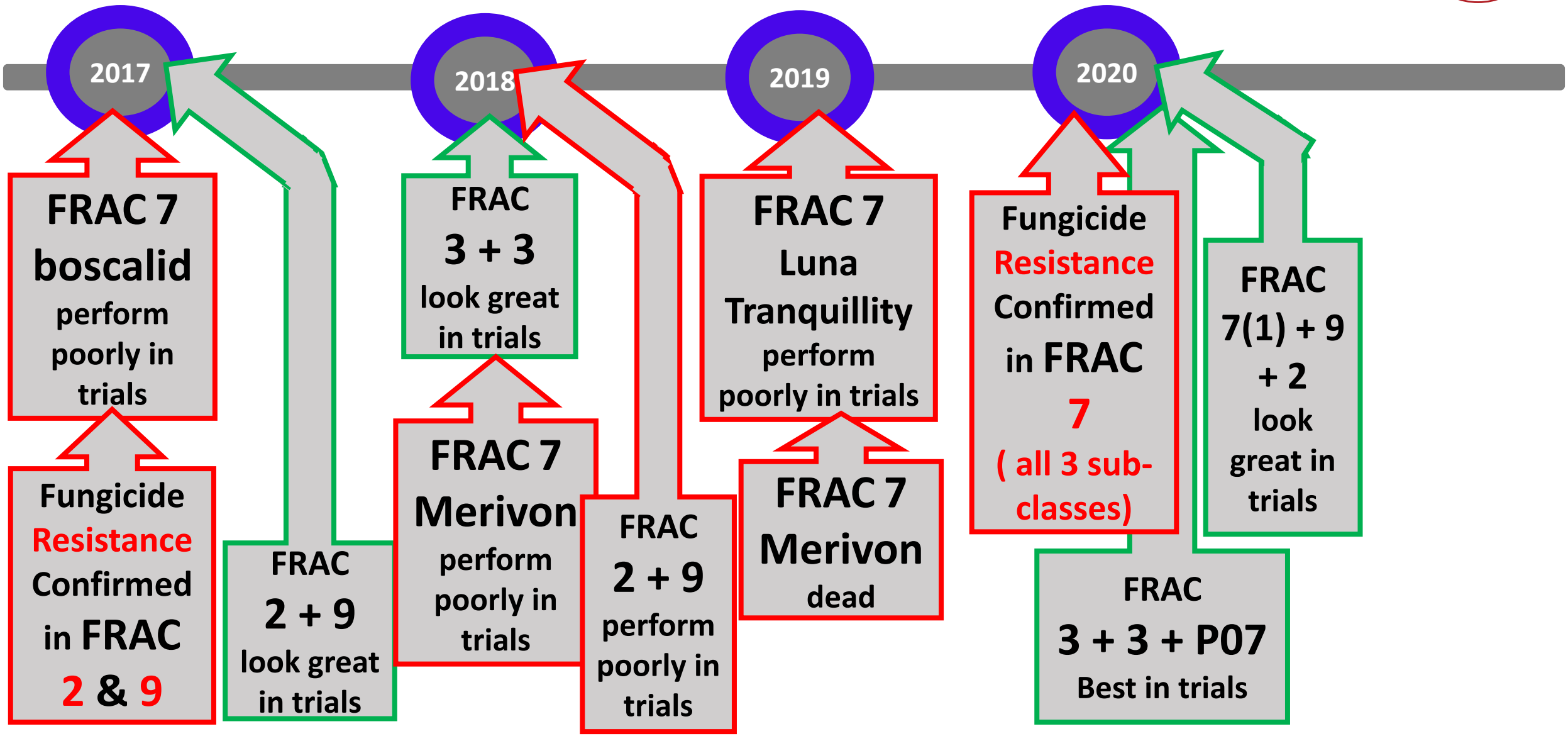
Viathon 3 pt
+ Tilt 8 fl oz
3c + P07, 3a

Significantly better than all other treatments in the trial.



Hoepting et. al. 2020

SLB in New York Timeline: 2020



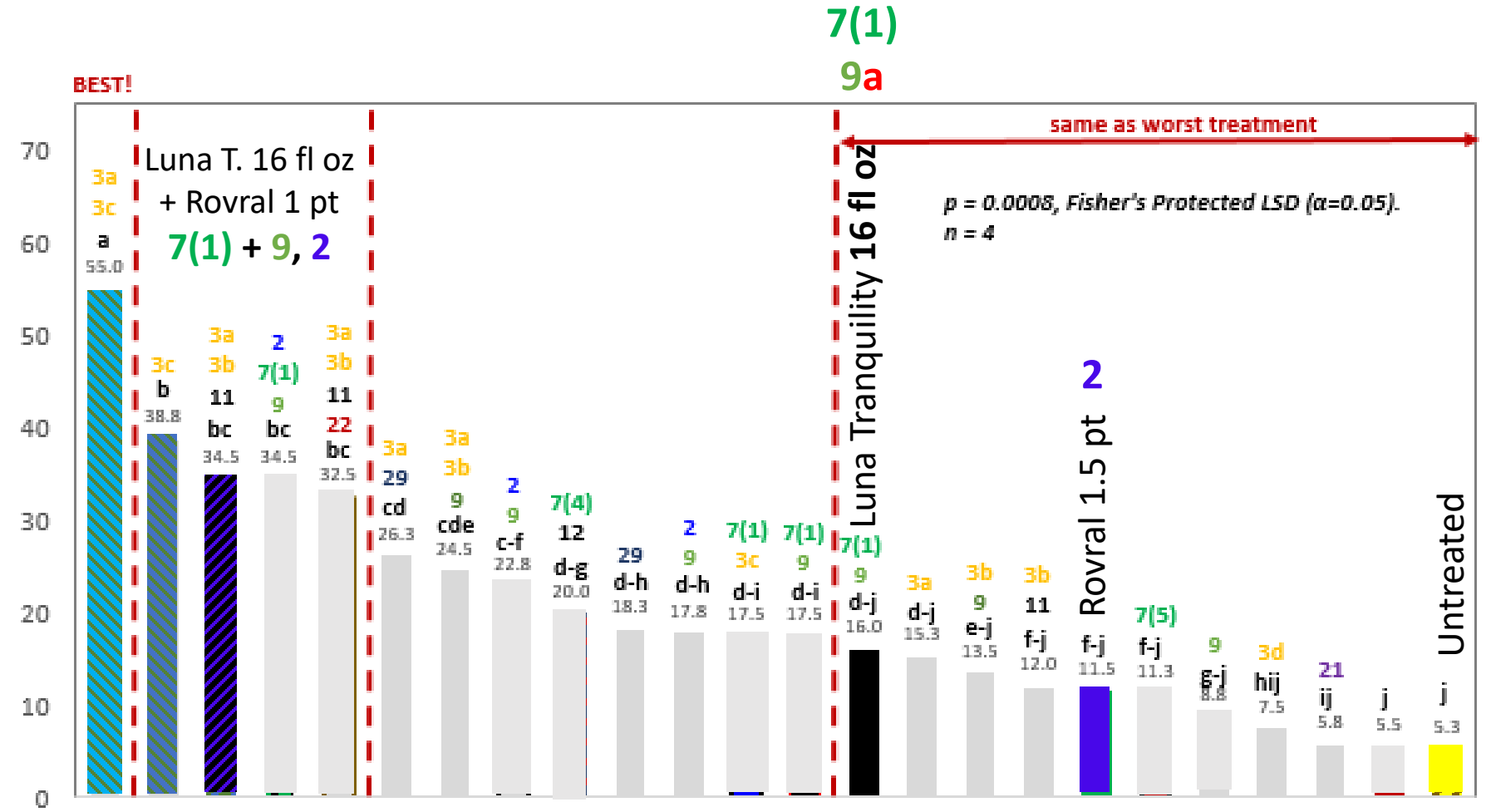
SLB in New York Timeline: **2020**

FRAC 7(1) + 9 + 2

Luna Tranquility 16 fl oz
+ Rovral 1 pt
7(1) + 9, 2

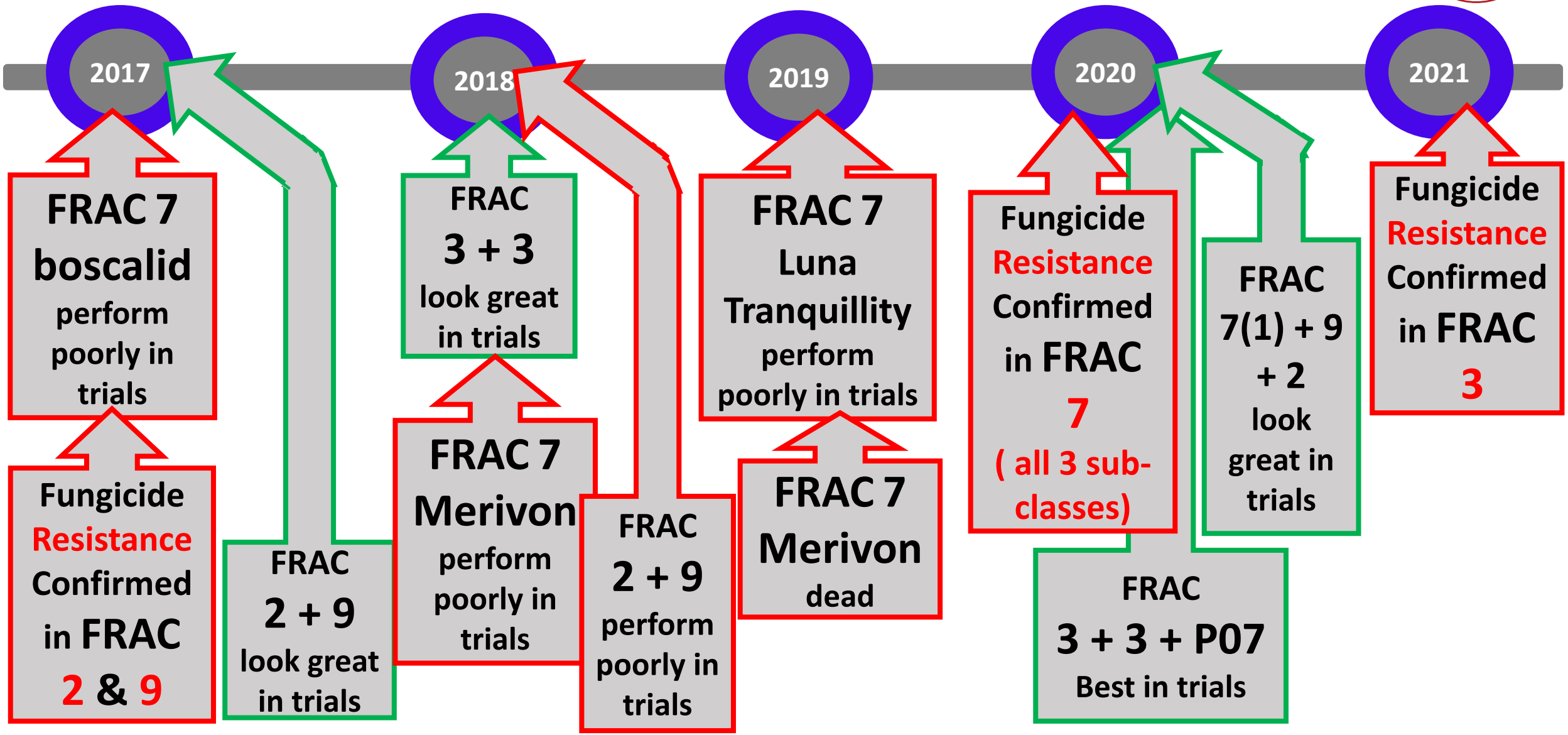
As good as FRAC 3 + 3
(Quadris Top + Tilt)

% Green Foliage/Plot – Sep 6, 2020 (Elba)



Hoepting et. al. 2020

SLB in New York Timeline: 2021



2016-2021 FRAC 3 Fungicide Sensitivity Testing

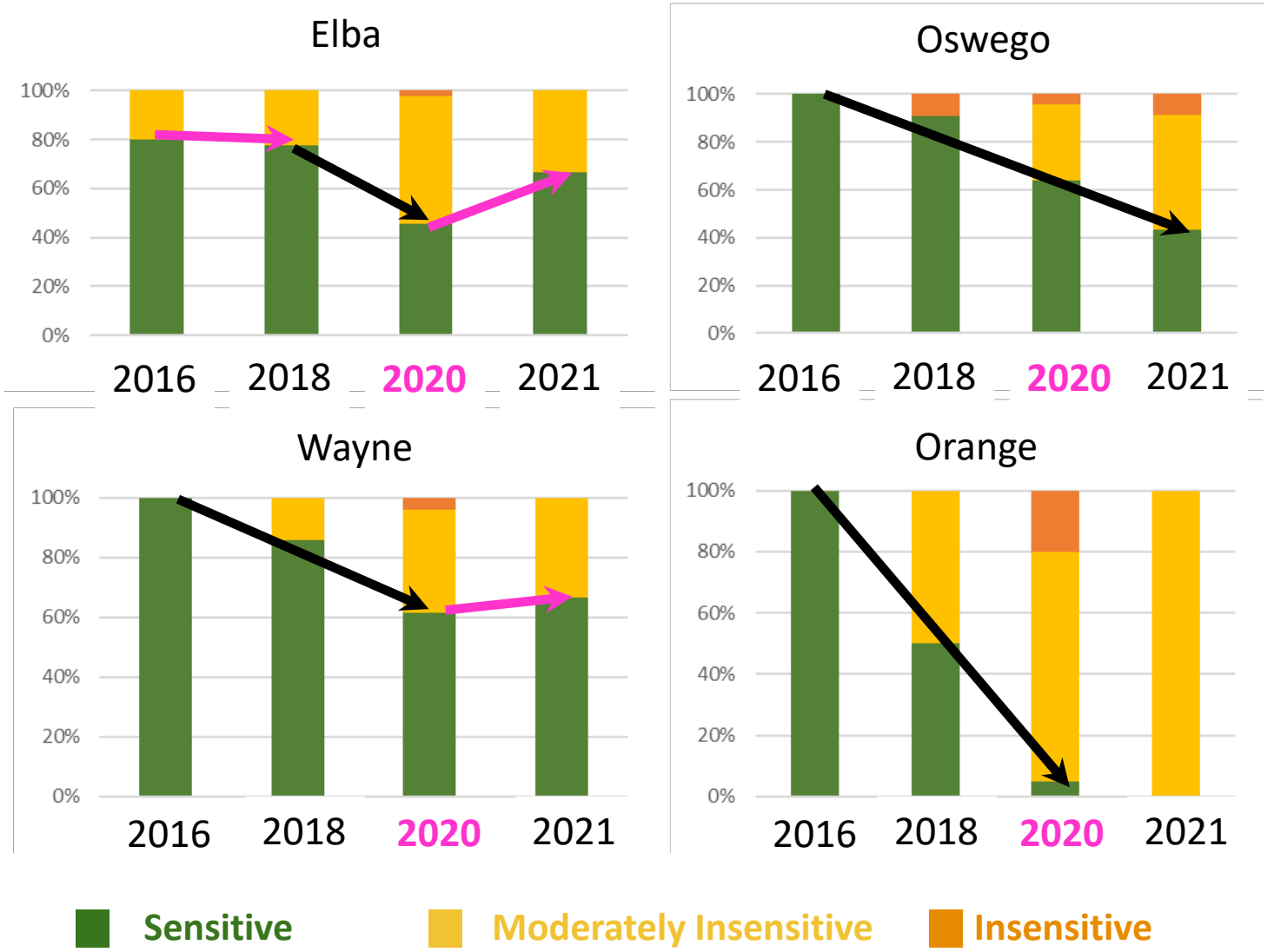
3b

(Quadris Top, Inspire Super)
difenaconazole

Differences among regions

Similar trends among regions for:

- FRAC 3a (Tilt – propiconazole)
- FRAC 3c (Viathon – tebuconazole)



Heck et. al.

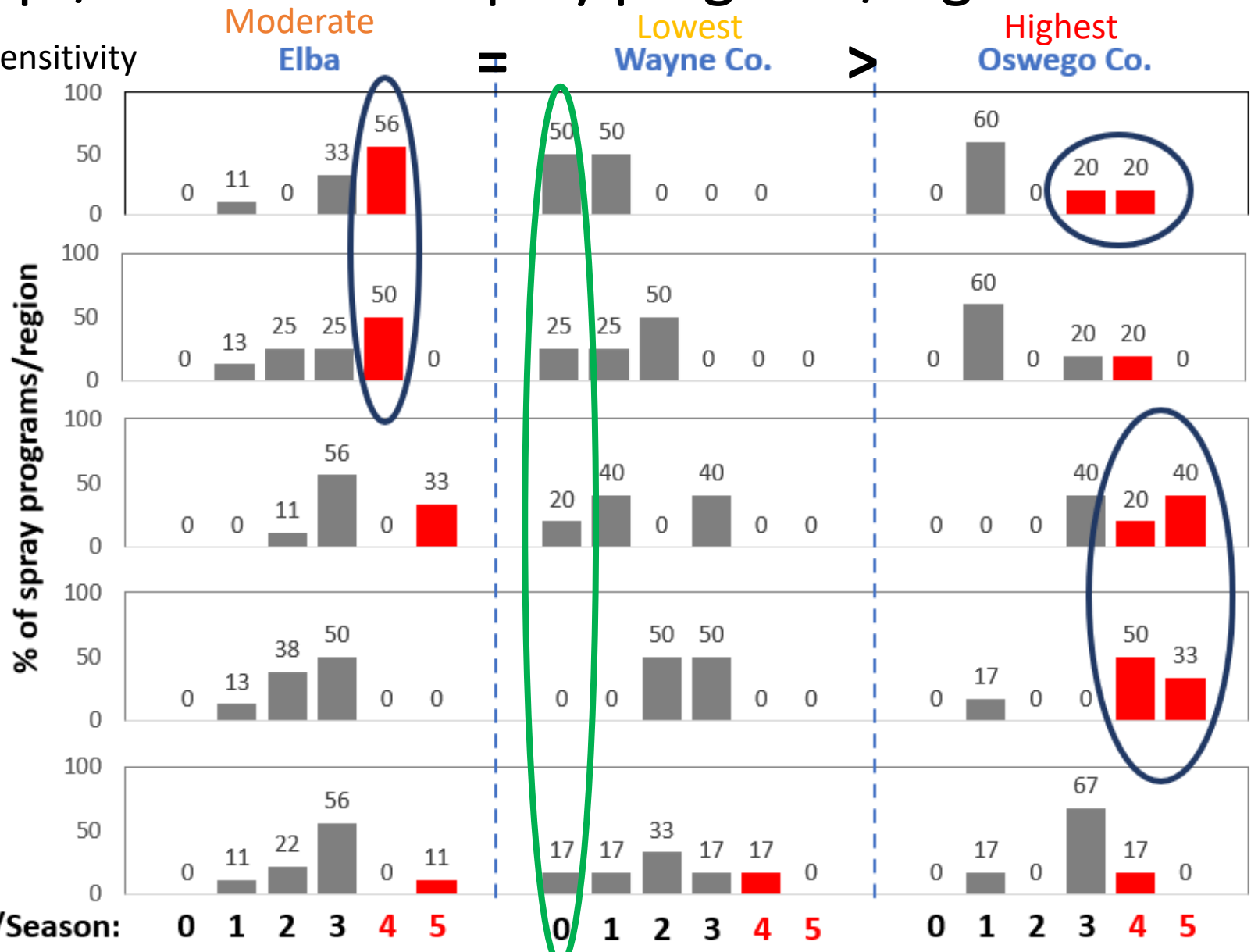
FRAC 3 Fungicide Use 2018-2021 (CVP Onion Scouting Program):

No. of FRAC 3 apps/season - % of spray programs/region

FRAC 3 fungicide use:
Bioassay results: fungicide sensitivity

Highest FRAC 3 use in region also had highest FRAC fungicide insensitivity (Oswego).

Interesting: Wayne had less FRAC 3 use than Elba, but both regions have same level of fungicide insensitivity.



Hoepting Onion Scouting Program

SLB in New York Timeline: 2021-2023

- Figured out that **FRAC P07** has plant health benefits
  - E.g. Rampart, Reveille, etc. (a.i. phosphorous acid, potassium phosphite)
  - Helping to keep foliage green, especially during the home stretch
  - Has activity on SLB (does not prevent infections, but does reduce target spots and leaf dieback)
  - Low risk of fungicide resistance
  - Used as a tank mix partner, not alone

August 12, 2021 (Elba)

Untreated

Rampart 3 qt

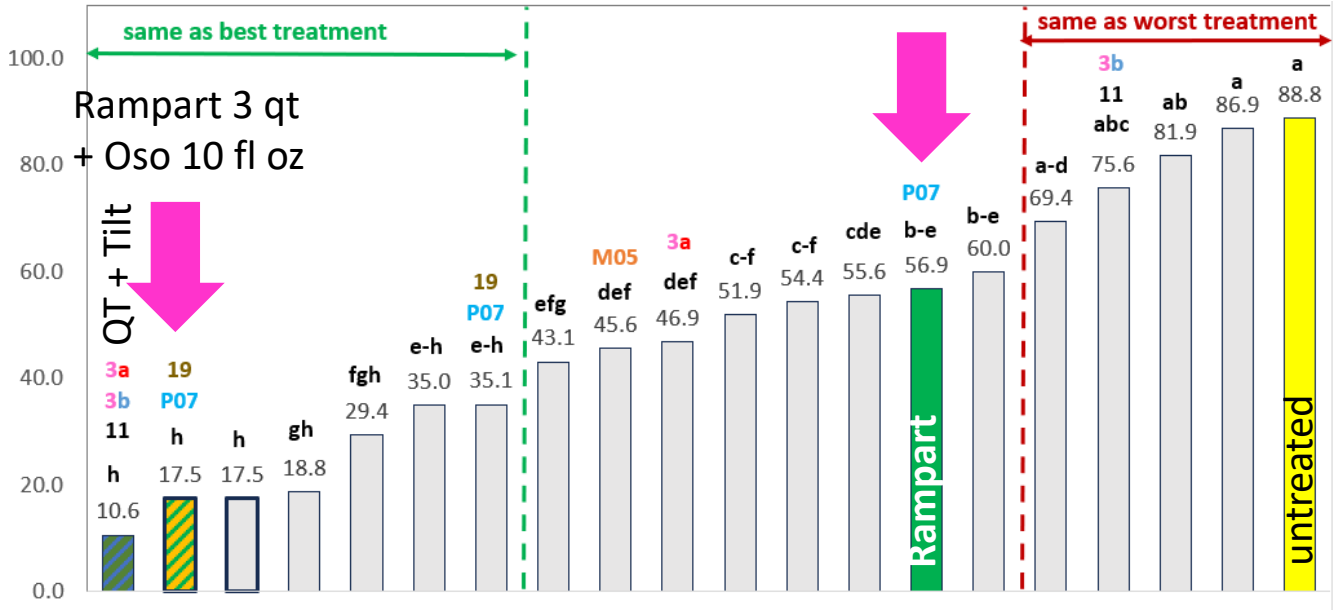
Hoepting et. al. 2021

Photos: C. Hoepting

SLB in New York Timeline: 2022-2023

- Identified that **FRAC 19** has some activity on SLB
  - a.i. polyoxin D zinc salt
  - E.g. **Oso, Ph-D**
  - **<u>Medium</u> risk for fungicide resistance**
  - Does not work alone.
  - When tank mixed with FRAC P07 product, reduces SLB target spots and spore colonization of necrotic leaf tips.
  - Used as a tank mix partner

% SLB target spots – Aug 11 (Oswego)

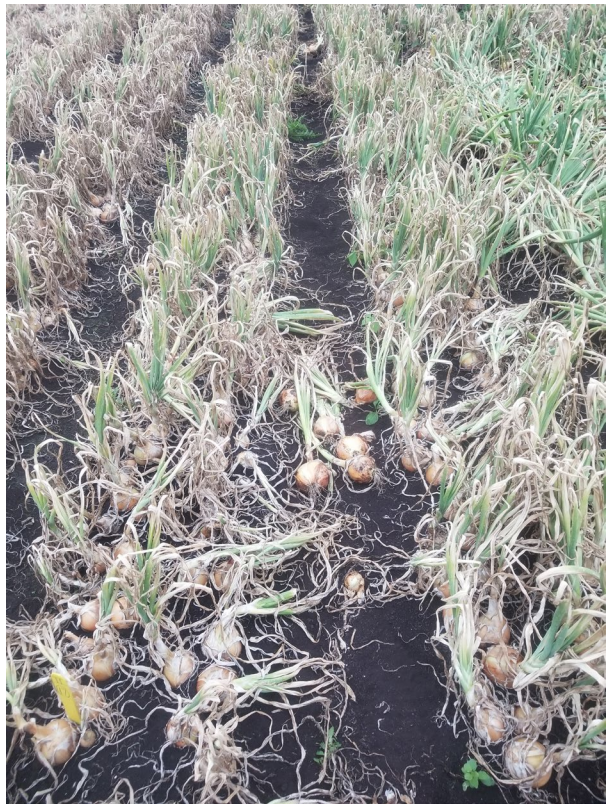


Hoepting et. al. 2022

SLB in New York Timeline: **2022-2023**

- Miravis Prime + Rovral numerically better than Luna Tranquility + Rovral
- Suspect that FRAC 9 is dead (completely resistant)
- FRAC 12 may have some useful activity

Elba, August 30, 2023



Miravis Prime 11.4 fl oz
+ Rovral 1.5 pt
7(4) + 12 + 2

Luna Tranquility 16 fl oz
+ Rovral 1.5 pt
7(1) + 9 + 2

Hoepting et. al. 2023

Photos: C. Hoepting

SLB in New York Timeline: **2022-2023**

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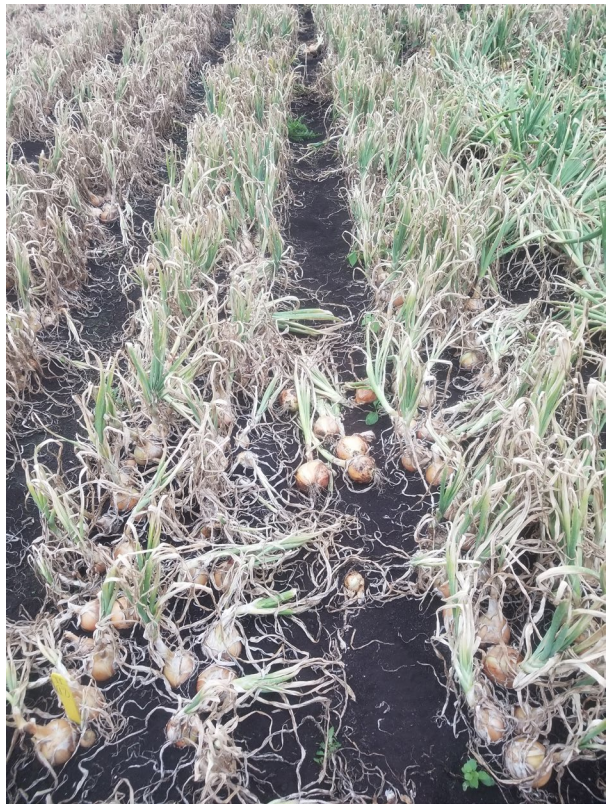

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Hoepting et. al. 2023

Photos: C. Hoepting

SLB in New York Timeline: **2022-2023**

Of the FRAC 3 products, Tilt is better than Quadris Top and Inspire Super, while Viathon is the best (due to FRAC P07).

August 31, 2023, Wolcott

Untreated

Inspire Super 20 fl oz
3b + 9

Quadris Top 14 fl oz
3b + 11

Tilt 8 fl oz
3a

Viathon 3 qt
3c + P07

Hoepting et. al. 2023

Photos: C. Hoepting

SLB in New York Timeline: **2022-2023**

We see a bigger jump between single FRAC 3 and double FRAC 3 + 3 than between FRAC 3 + 3 and quadruple FRAC 3 (3 + 3 + 3 + 3).

August 31, 2023, Wolcott

Untreated

Tilt 8 fl oz
3a

Viathon 3 qt
3c + P07

Viathon 3 qt + Tilt 8 fl oz
3c + P07 + 3a

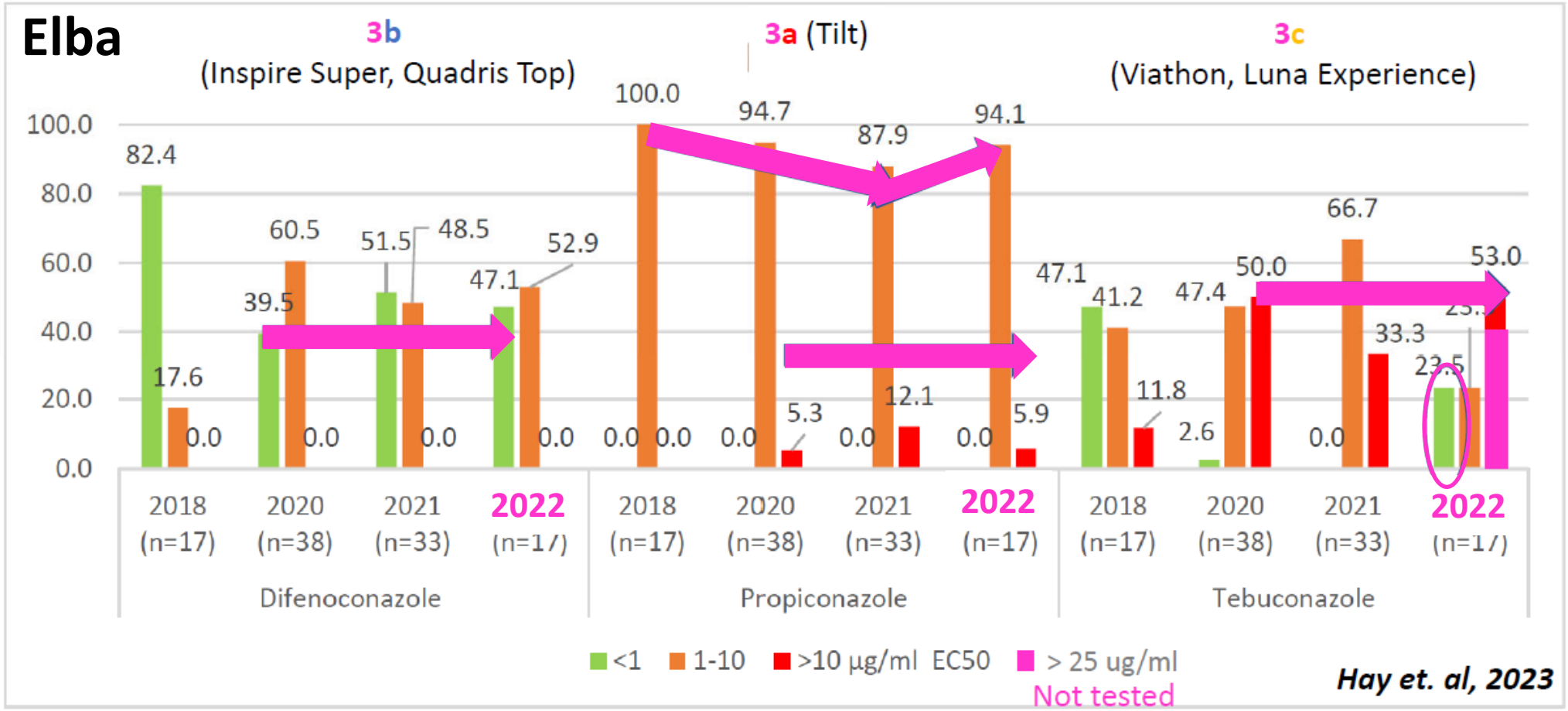
2x 3c + P07 + 2x 3a

Hoepting et. al. 2023

Photos: C. Hoepting

SLB in New York Timeline: **2022-2023**

SLB fungicide resistance to FRAC 3 appears to have “halted” with judicious fungicide use (No more than 2 apps of FRAC 3/season).

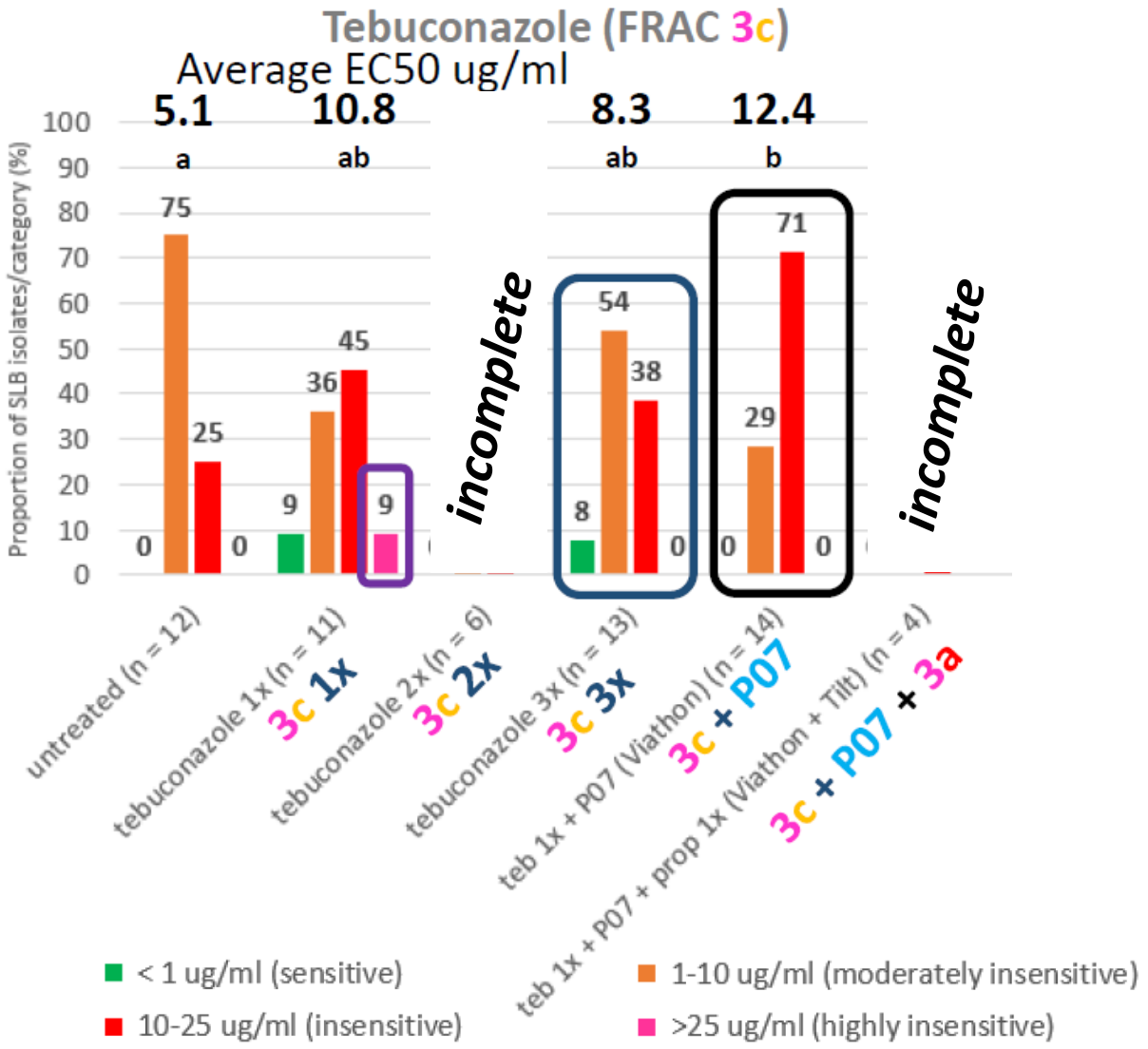


SLB in New York Timeline: 2022-2023

After 8 weekly sprays in an on-farm fungicide trial:

- No significant difference between 1x and 3x rates of 3c.
- 1x rate let highly insensitive isolates through, while 3x rate did not. **Missing 2x rate.**
- 1x + P07 (Viathon) did not let highly insensitive isolates through, but also not significantly different than 1x. Not “guarding” against fungicide resistance.

Hoepting, Heck & Hay, 2022-2023



SLB in New York Timeline: 2022-2023

2023 SLB Fungicide Recommendations:

- Best performing treatments (not as good as they once were):
  1) Double FRAC 3-product treatments that include Tilt (3a) and/or Viathon (3c + P07).
  2) Miravis Prime (FRAC 7 + 12) + Oso 6.5 fl oz (**FRAC 19**)/Rovral (**FRAC 2**) +/- **FRAC P07**.
- No more than 2 apps of FRAC 3 + 3 per spray season.
- Used Low-Risk for fungicide resistance tank mixes when SLB pressure low/secondary
  - E.g. Bravo + FRAC P07 (Rampart, Reveille)
- Making weekly spray decisions was challenging

SLB in New York Timeline: **The Future**

Promising results in 2023 on-farm onion fungicide trials:
FRAC 3 a.i. that is not “broken” (yet!)

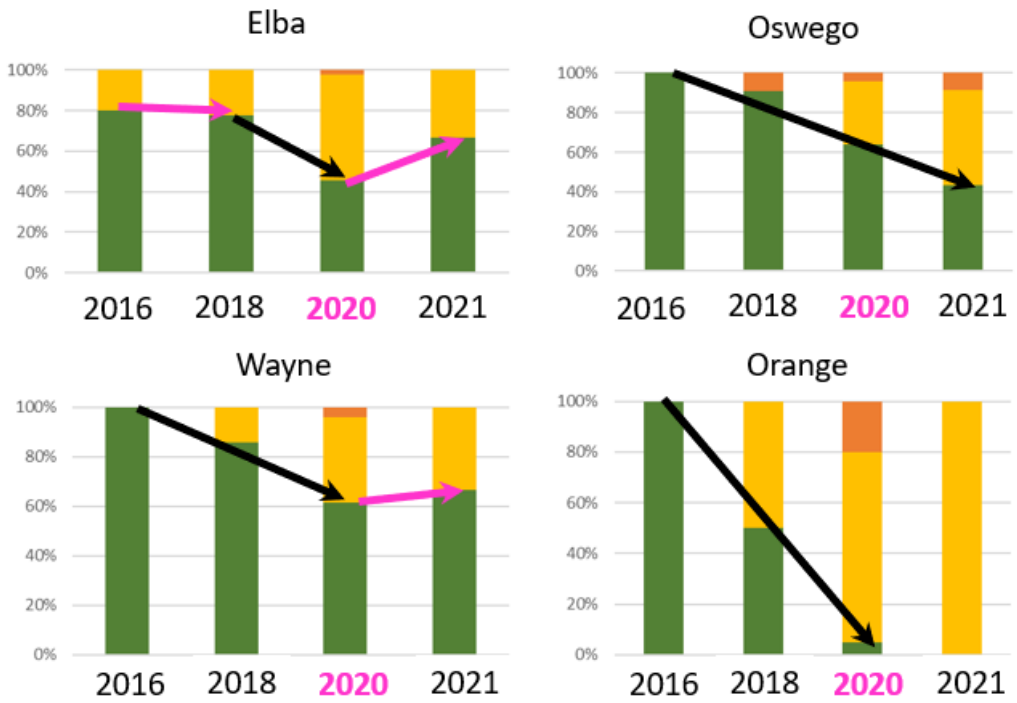
Wolcott 2023

Elba 2023

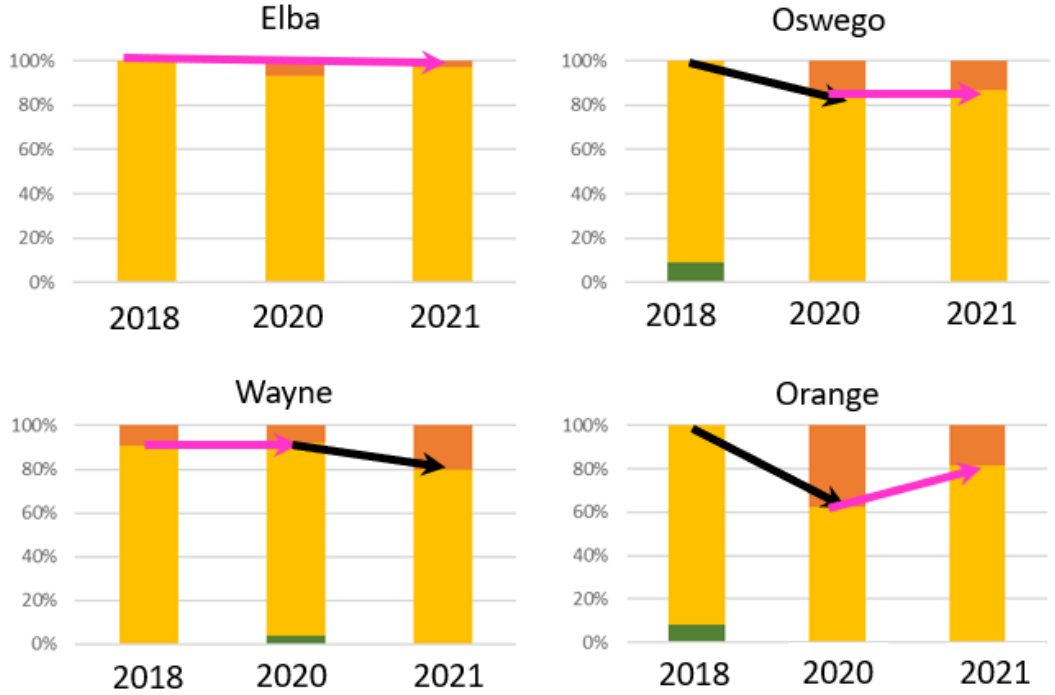
Photos: C. Hoepting

SLB in New York Timeline: 2022-2023

3b: Inspire Super/Quadris Top



3a: Tilt



Sensitive Moderately resistant Highly resistant

Tilt "holding on" better in *in vitro* fungicide sensitivity assays too.

Heck, Hay & Hoepting

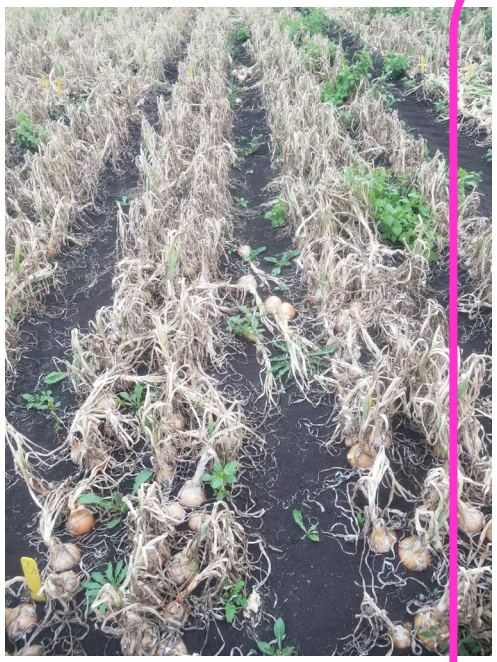
Onion Fungicide Trial, **Elba 2023**

Hoepting et. al. 2023

Tilt

3a

3e



3f

3g

Viathon + Tilt

3c + P07 + 3a

- 3e, 3f and 3g are FRAC 3 active ingredients that have never been trialed or used in onion.
- 3e and 3f looked like untreated checks.
- 3g looked like SLB was not resistant to it.

Photos: C. Hoepting

Onion Fungicide Trial, **Wolcott 2023**

Hoepting et. al. 2023

Tilt

3a

3e

Not trialed
in Wolcott

3f

3g

Viathon + Tilt

3c + P07 + 3a

- Same findings in Wolcott trial location.
- 3g is not labelled in onion. Best case scenario is that the company will get it labeled in time for 2024 growing season.

Photos: C. Hoepting

SLB in New York Timeline: **The Future**

Onion growers looking at FRAC 3g pots in onion fungicide trial in Wolcott. Photo: C. Hoepting

Resource: Cornell Onion Fungicide "Cheat Sheet" Updated annually ~ June

Cornell Onion (Dry Bulb) Fungicide "Cheat Sheet" for Control of Leaf Diseases in New York, 2022

Compiled by Christy Hoepting, CCE Cornell Vegetable Program (June 2022). Results based mostly on on-farm field trials (Hoepting et. al. 2021)

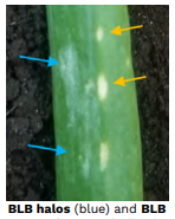
Product/Tank Mix and Rate/A	Active Ingredient	FRAC[1]		Relative Performance E: Excellent; VG: Very Good; G: Good; F: Fair; P: Poor; Fail				Activity on DM[2]	Maximum Allowable/ Season	
		Code[3]	Risk of Fungicide Resistance Rating	BLB[4] halos	BLB necrotic spots	SLB[5] target spots	SLB leaf dieback		Rate/ Acre	No. Apps (max. rate)
Protectants – Multi-site Mode of Action										
Bravo 3 pt[6]	chlorothalonil	M05	very low	VG	G-VG	Fail-P	Fail-P	No	20 pts	6 (3 pt)
Bravo 1.5 pt	chlorothalonil	M05	very low	F	F-P	Fail	Fail-P	No	20 pts	6 (3 pt)
e.g. Manzate Max[7]	manzozeb 1 lb	M03	very low	VG[8]	Fail	Fail	Fail	Yes	24 qts	10 (2.4 qt)
e.g. Manzate Max	mancozeb 3 lb	M03	very low	VG	Fail	Fail	Fail	Yes	24 qts	10 (2.4 qt)
FRAC 2 and 9										
Rovral 1.5 pt	iprodione	2	medium-high	G (Oswego) Fail (Elba)	Fail	Fail-P	G-F	No	7.5 pts	5 (1.5 pt)
Scala 18 fl oz	pyrimethanil	9a	medium	G (Elba) Fail (Oswego)	Fail-P	variable	Fail	No	54 fl oz	3 (18 fl oz)
Scala 9 fl oz + Rovral 1 pt	pyrimethanil + iprodione	9a 2	medium + medium-high	G	F	P-Fail	G-F	No	54 pts 10 pts	6 (9 fl oz) 10 (1 pt)
FRAC P07										
Rampart,	phosphorous acid	P07	low	Fail	na[9]	na	G	Yes	?	? (6 pt)
Reveille, etc.	potassium phosphite	P07	low	Fail	na	na	G	Yes	28 pt	7 (4 pt)
FRAC 3										
Tilt 8 fl oz[10]	propiconazole	3a	medium	Fail	P-Fail (Elba) VG (Oswego)	P-Fail (Elba) VG (Oswego)	P G (Oswego)	No	16 fl oz	2 (8 fl oz)
Quadris Top 14 fl oz	difenaconazole + azoxystrobin	3b 11	medium + high	Fail-P	F	P-Fail	P	No Yes	56 fl oz	4 (14 fl oz)
Inspire Super 20 fl oz	difenaconazole + cyprodinil	3b 9b	medium + medium	Fail	VG	P-F	Fail (Elba) F (Oswego)	No	80 fl oz	4 (20 fl oz)
Viathon 3 pt	tebuconazole + phosphorous acid	3c P07	medium + low	Fail	VG	G	VG	No Yes	6 pts	2 (3 pts)
Cevya 5 fl oz	mefentrifluconazole	3d	medium	Fail	Na	Na	Fail	No	15 fl oz	3 (5 fl oz)
Quadris Top 14 fl oz + Tilt 8 fl oz	difenaconazole + azoxystrobin + propiconazole	3b + 11 3a	medium + high medium	P-Fail	VG-E	F-G G (Oswego)	VG	Yes No	--	2
Viathon 3 pt + Tilt 8 fl oz	tebuconazole + phos. acid + propiconazole	3c + P07 3a	medium + low medium	Fail	E	G	E-VG	Yes No	--	2
Cevya 5 fl oz + Rampart 3 qt/A	Mefentrifluconazole phosphorous acid	3d P07	medium low	Fail	na	Na	G	No Yes	--	3

1 **FRAC**: Fungicide Resistance Action Committee
2 **DM**: Downy mildew. If fungicide treatment does not have activity on DM, grower may want to add a fungicide with activity on DM to tank mix.
3 **FRAC codes**.Numbers in brackets represent active ingredients that belong to different sub-classes of FRAC 7. The letters a, b, c, etc. following the FRAC 3 & 9 codes indicate different active ingredients within the same sub-class
4 **BLB**: Botrytis leaf blight. See photos for more on the difference between halos and spots.
5 **SLB**: Stemphylium leaf blight. See photos for target spots and "dirty tips". SLB has developed fungicide resistance of FRAC groups 2, 3, 7, 9 and 11 in New York muck-onion production.
6 Example trade name for products with these active ingredients; several products are available.
7 Example trade name for products with these active ingredients; several products are available.
8 Mancozeb 1 lb/A only provides very good control when BLB halo pressure is low.
9 na: No trial data available to comment.
10 Example trade name for products with these active ingredients; several products are available.

table continued from previous page

Product/Tank Mix and Rate/A	Active Ingredient	FRAC[1]		Relative Performance E: Excellent; VG: Very Good; G: Good; F: Fair; P: Poor; Fail				Activity on DM[2]	Maximum Allowable/ Season	
		Code[3]	Risk of Fungicide Resistance Rating	BLB[4] halos	BLB necrotic spots	SLB[5] target spots	SLB leaf dieback		Rate/ Acre	No. Apps (max. rate)
FRAC 7										
Luna Tranquility 16 fl oz	fluopyram + pyrimethanil	7(1) 9a	high* + medium	G	VG	F	P (Elba) G (Oswego)	No	54.7 fl oz	3 (16 fl oz)
Luna Experience 10 fl oz	fluopyram + tebuconazole	7(1) 3c	high* + medium	G-F	VG	F	G	No	25.6 fl oz	2 (12.8 fl oz)
Merivon 9 fl oz	fluxapyroxad + pyraclostrobin	7(2) 11	high* + high	VG-E	Fail	Fail	Fail	No Yes	33 fl oz	3 (11 fl oz)
Miravis Prime 11.4 fl oz	pydiflumetofen + fludioxonil	7(4) 12	high* + low-medium	VG-E	F	P-F	G (Elba) VG (Oswego)	No	34.2 fl oz	3 (11.4 fl oz)
Luna Flex 13.6 fl oz	fluopyram + difenaconazole	7(1) 3b	high* + medium	na	na	na	na	No	27.2 fl oz	2 (13.6 fl oz)
Luna Tranquility 16 fl oz + Rovral 1 pt	fluopyram + pyrimethanil + iprodione	7(1) + 9a 2	high* + medium + medium-high	VG-G	VG	F VG (Oswego)	VG-E	No	--	3
Luna Experience 12.8 fl oz + Rampart 3 qt	fluopyram + tebuc. + phosphorous acid	7(1) + 3c P07	high* + medium low	na	na	na	E-VG	--	--	--
Miravis Prime 11.4 fl oz + Rovral 1 pt	pydiflumetofen + fludioxonil + iprodione	7(4) + 12 2	high* + low-med + medium-high	VG-E	na	na	VG-G	No No	--	3
FRAC 29 and 19										
Omega 16 fl oz	fluazinam	29	low	E	F	Fail	G[11]	Yes	96 fl oz	6 (16 fl oz)
Oso 6.5 fl oz	polyoxin D zinc salt	19	medium	Fail	Fail-P	P-F	P-Fail	No	78 fl oz	6 (13 fl oz)

11 In 2020, Omega was rated has having fair performance for keeping foliage green. It is suspected that since it was excellent on BLB halos and pressure was high, that this contributed to higher plant health ratings in 2021.
* FRAC rates FRAC 7 as "medium-high". Given our experience with FRAC 7 and SLB, we ranked it as "high" instead.



BLB halos (blue) and **BLB necrotic spots** (yellow)

SLB sporulation of necrotic leaf tips, **"dirty tips"**

Tan, black and purple **SLB target spots.**

Photos by Christy Hoepting, CCE Cornell Vegetable Program

https://cvp.cce.cornell.edu/

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Fight the Blight!

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