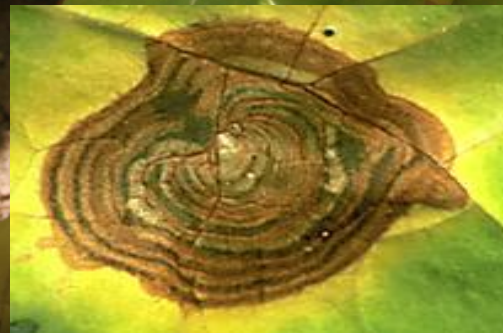




Excalia & Quash: Potential New Tobacco Leaf Spot Fungicides?

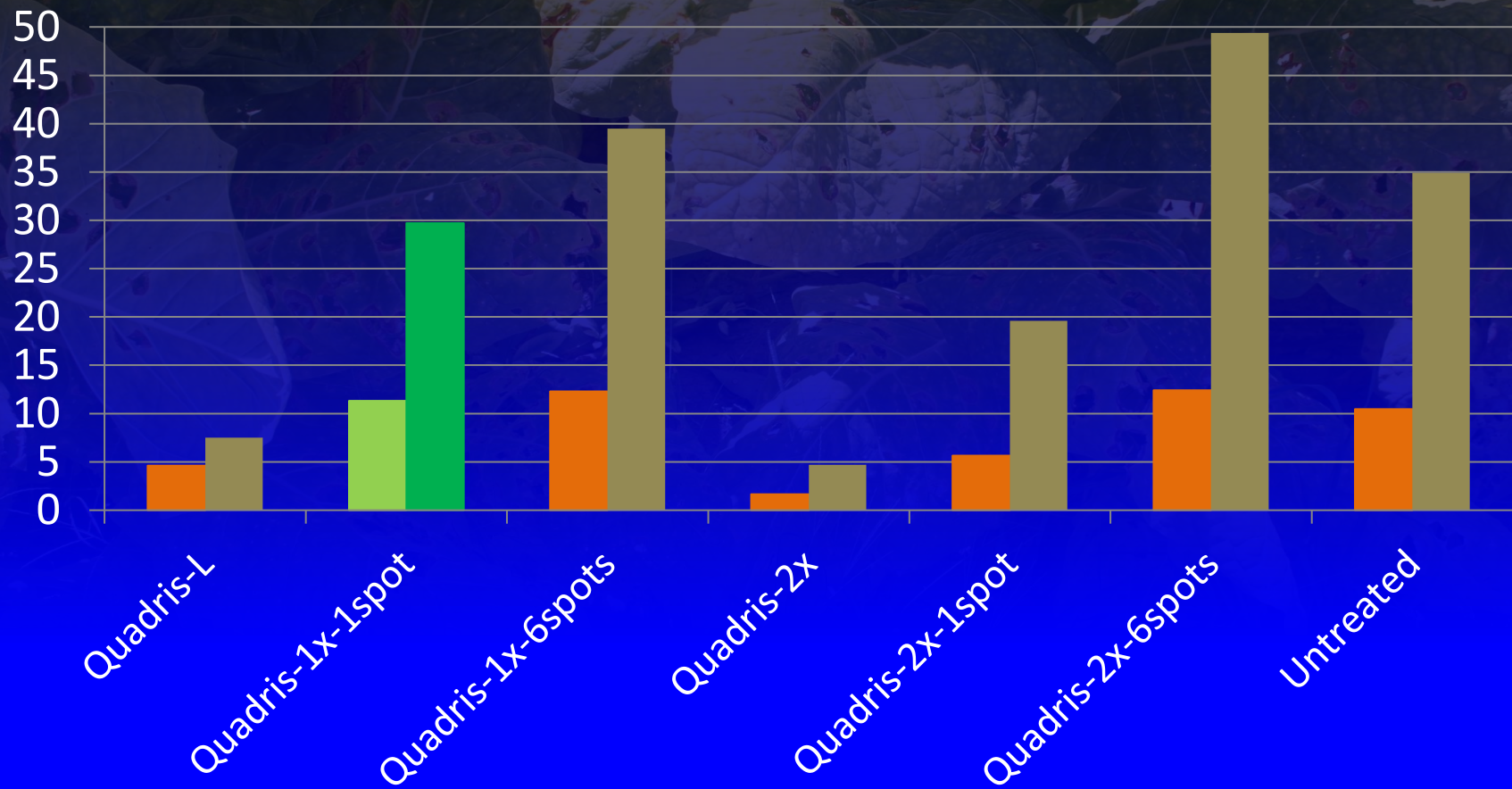
C. S. Johnson and T. David Reed
Virginia Tech So. Piedmont Center
Blackstone VA

Target Spot (*Thanatephorus cucumeris*)



2006-2007 Target Leaf Spot Fungicide Tests

% Lower Leaf Area Damaged, 1st week of August



Target Spot Management

Issues with Quadris (FRAC-11) for Target Spot Management:

— Leaf residues

- Number (1-3) & timing of application(s)
- “Other Uses”?
 - “plant health”
 - » Increase yield when no disease
 - » Delay harvest (green-up)

— Fungicide resistance

- Emerging?

Materials & Methods: *Experimental Design*

Small plot field experiments

- Virginia Tech So. Piedmont AREC near Blackstone, VA in 2015-2020.
- Randomized complete block design with 5 replications.
- 3-row (40 ft) plots, with fungicide sprays applied to, & data collected only from, center row.

Materials & Methods: *Fungicide Treatments*

Fungicide Product	Fungicide Class (FRAC Code)	Active Ingredient	Years Tested
Penncozeb	M-03	Mancozeb	2019 & 2020
Quadris	11	Azoxystrobin	2015 - 2020
Fontelis	7	penthiopyrad	2015 – 2017
Excalia	7	inpyrfluxam	2017 - 2020
Velum	7	fluopyram	2019
Quash	3	metconazole	2015 – 2017 2019 - 2020
Topgard	3 (DMI)	Flutriafol	2019
Lucento	3 & 7	Flutriafol & bixafen	2019
Actigard	P-01	Acibenzolar-S-methyl	2017 & 2020

Materials & Methods: *Biocontrol Treatments*

Biocontrol Product	Type of Activity (FRAC Code)	Active Ingredient	Years Tested
Actigard	(P-01)	Acibenzolar-S-methyl	2017 & 2020
Oxidate	Disinfestant	Hydrogen peroxide & peroxyacetic acid	2017
Lifeguard	Bacterium	<i>Bacillus mycoides</i> Isolate J	2017 - 2020
Regalia	Giant Knockweed extract	<i>Reynoutria sachalinensis</i>	2017
Double Nickel	Bacterium	<i>Bacillus amyloliquefaciens</i> D747	2018
Stargus	Bacterium	<i>Bacillus amyloliquefaciens</i> F727	2018

Materials & Methods: *Product Application*

- Spray equipment
 - CO₂-pressurized backpack sprayer, ~35 psi
 - 3 TX-12, TX-18 tips, 13" apart
 - All sprays centered over the row
- Spray volume: 40-50 gallons/acre

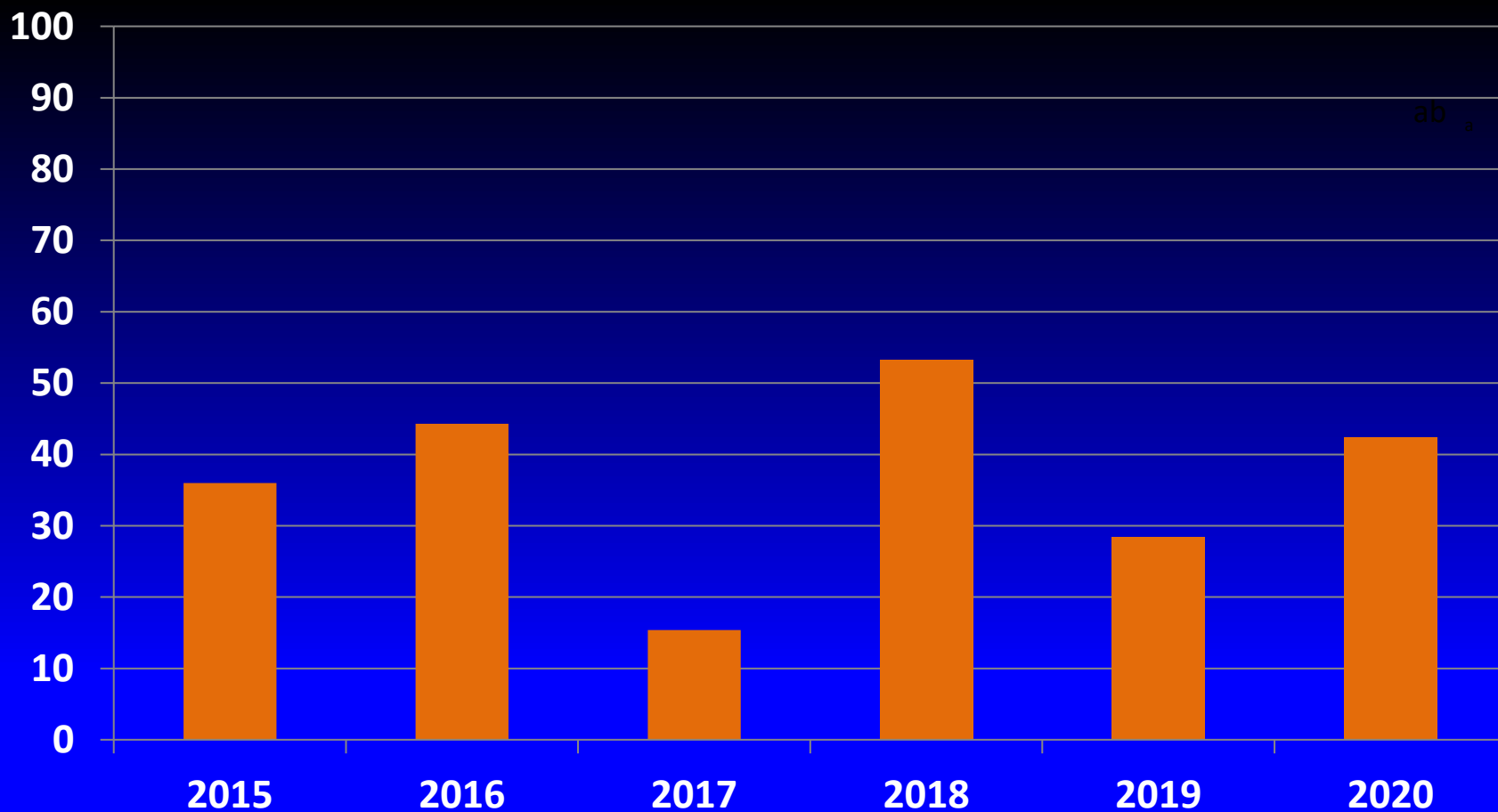
Materials & Methods: *Data Collected*

% Leaf Area Damaged (%LAD)

- % LAD estimated directly by pairs of observers
- 4 rated plants/plot spaced regularly within center row
- 3 stalk positions: Lower, Middle, Top
- ~4 leaves rated by each observer
- Analyzed average rating for each stalk position
- Data arc-sine transformed prior to ANOVA & Waller-Duncan LSD (k-ratio = 100).

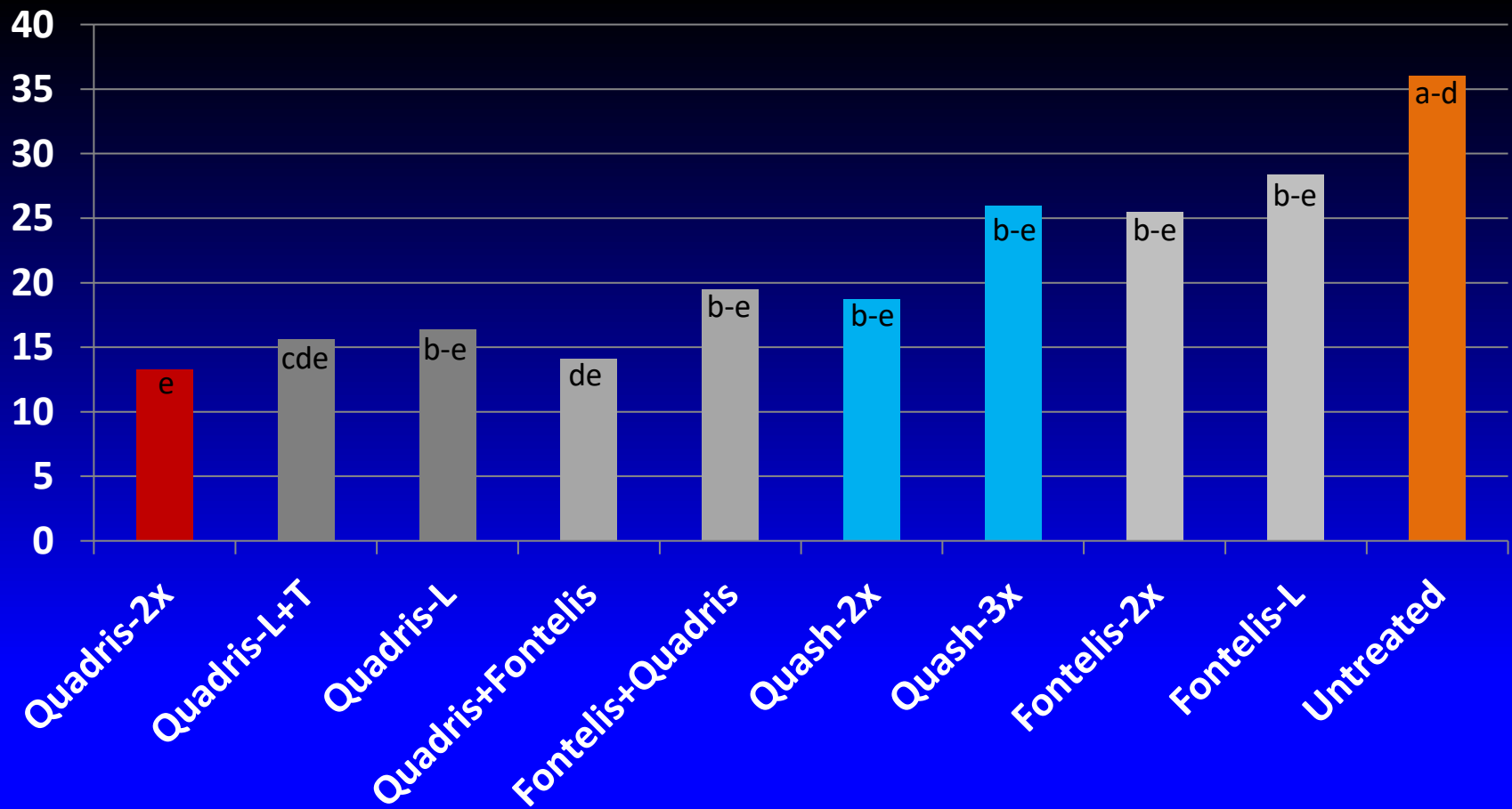
2015-2020 Target Leaf Spot Fungicide Test

% Lower Leaf Area Damaged: Untreated Controls



2015 Target Leaf Spot Fungicide Test

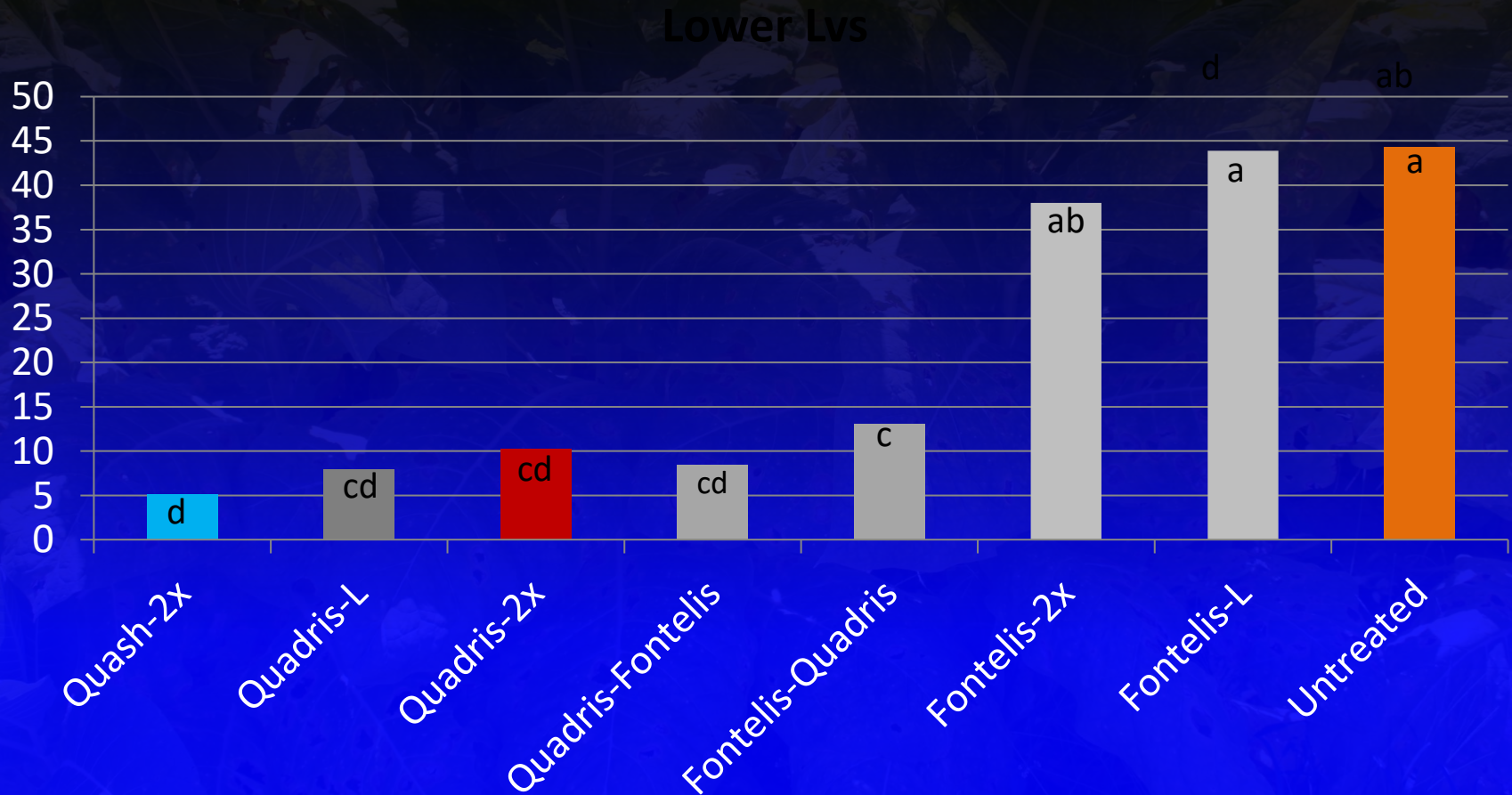
% Lower Leaf Area Damaged, 23 July



Means followed by the same letter(s) are not significantly different based on Student-Newman-Keuls t-test ($P \leq 0.05$).

2016 Target Leaf Spot Fungicide Test

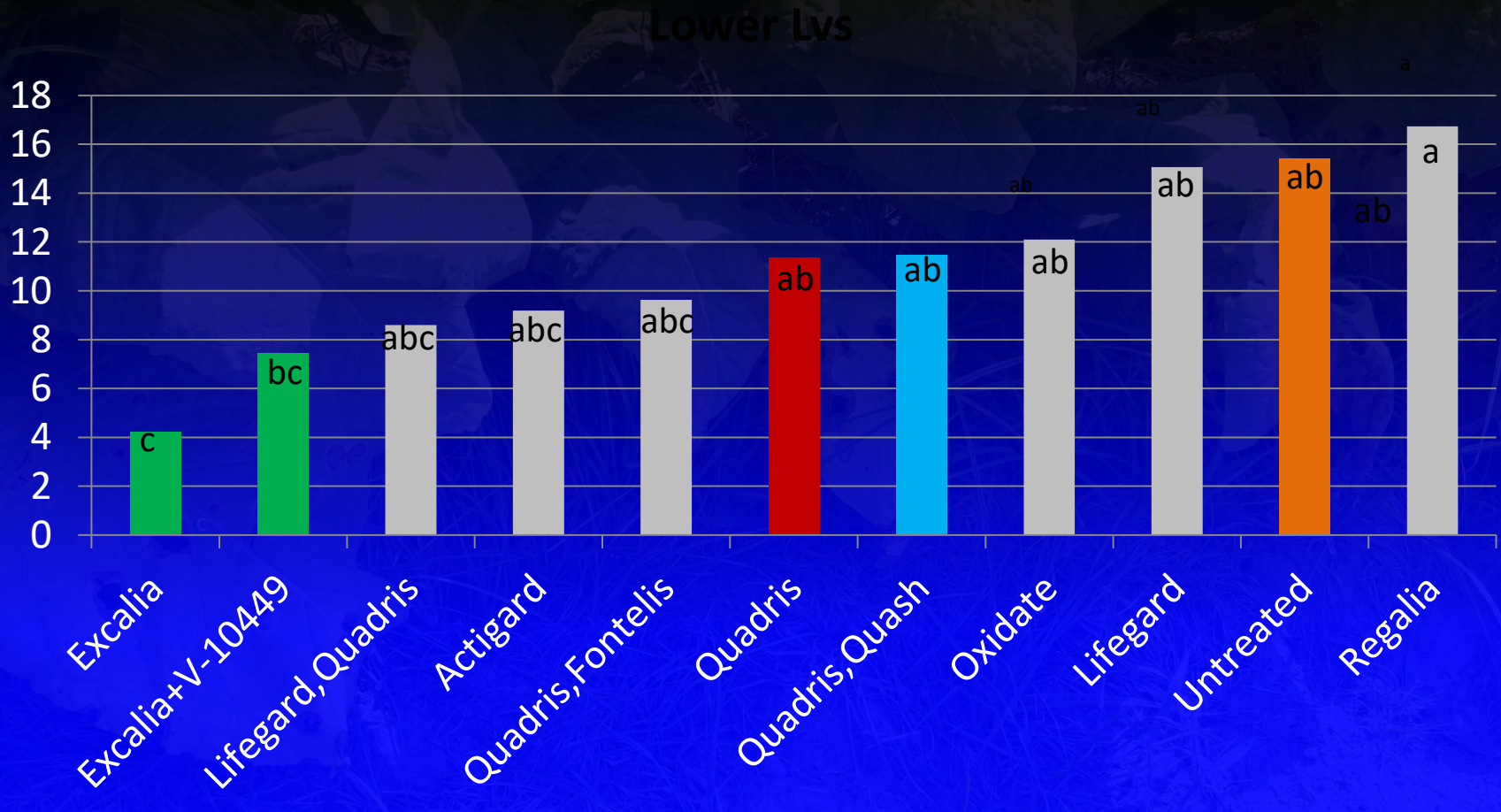
% Lower Leaf Area Damaged, 22 July



Means followed by the same letter(s) are not significantly different based upon Waller-Duncan t-test (K-ratio = 100).

2017 Target Leaf Spot Fungicide Test

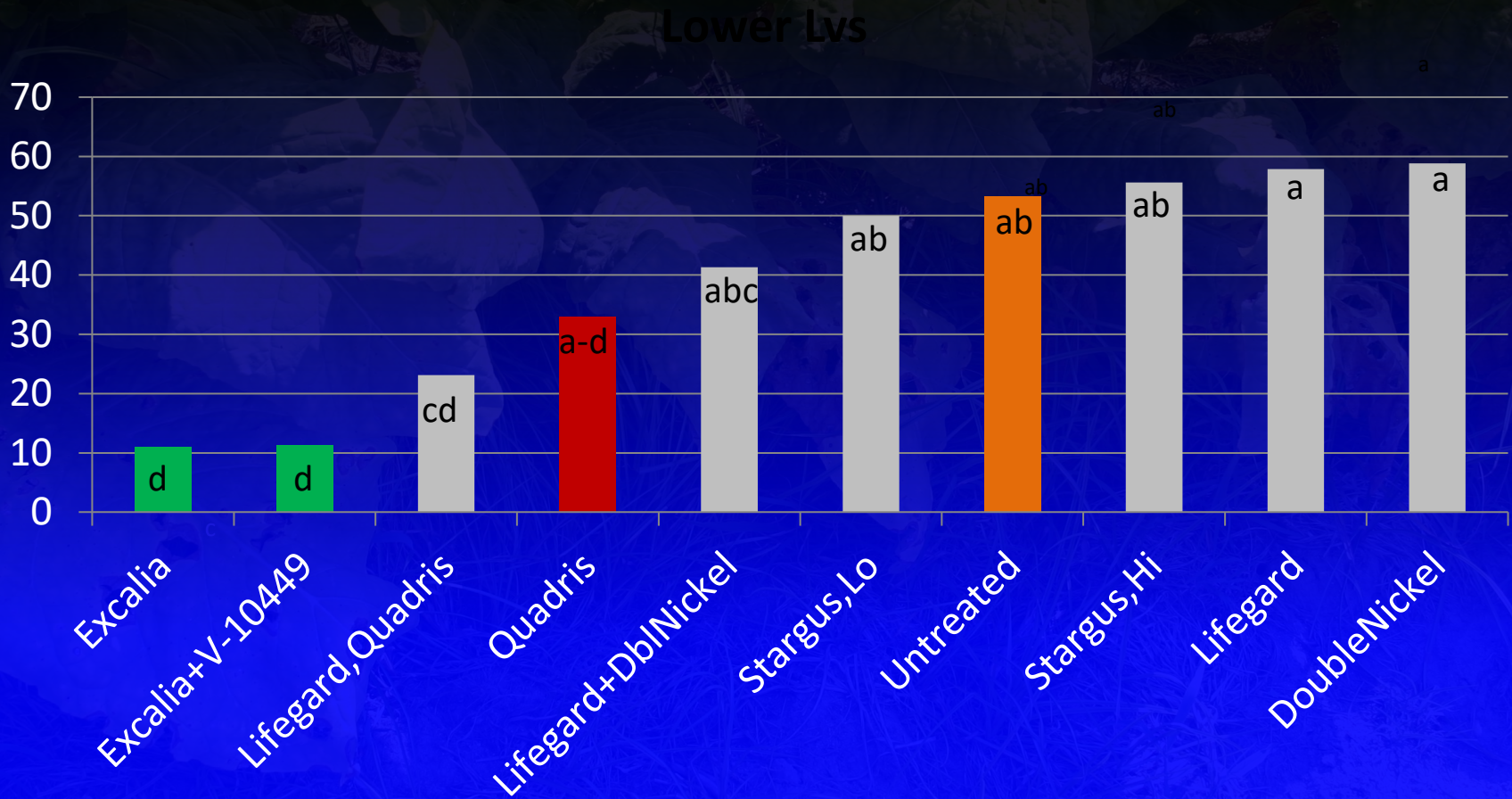
% Lower Leaf Area Damaged, 27 July



Means followed by the same letter(s) are not significantly different based upon Waller-Duncan t-test (K-ratio = 100).

2018 Target Leaf Spot Fungicide Test

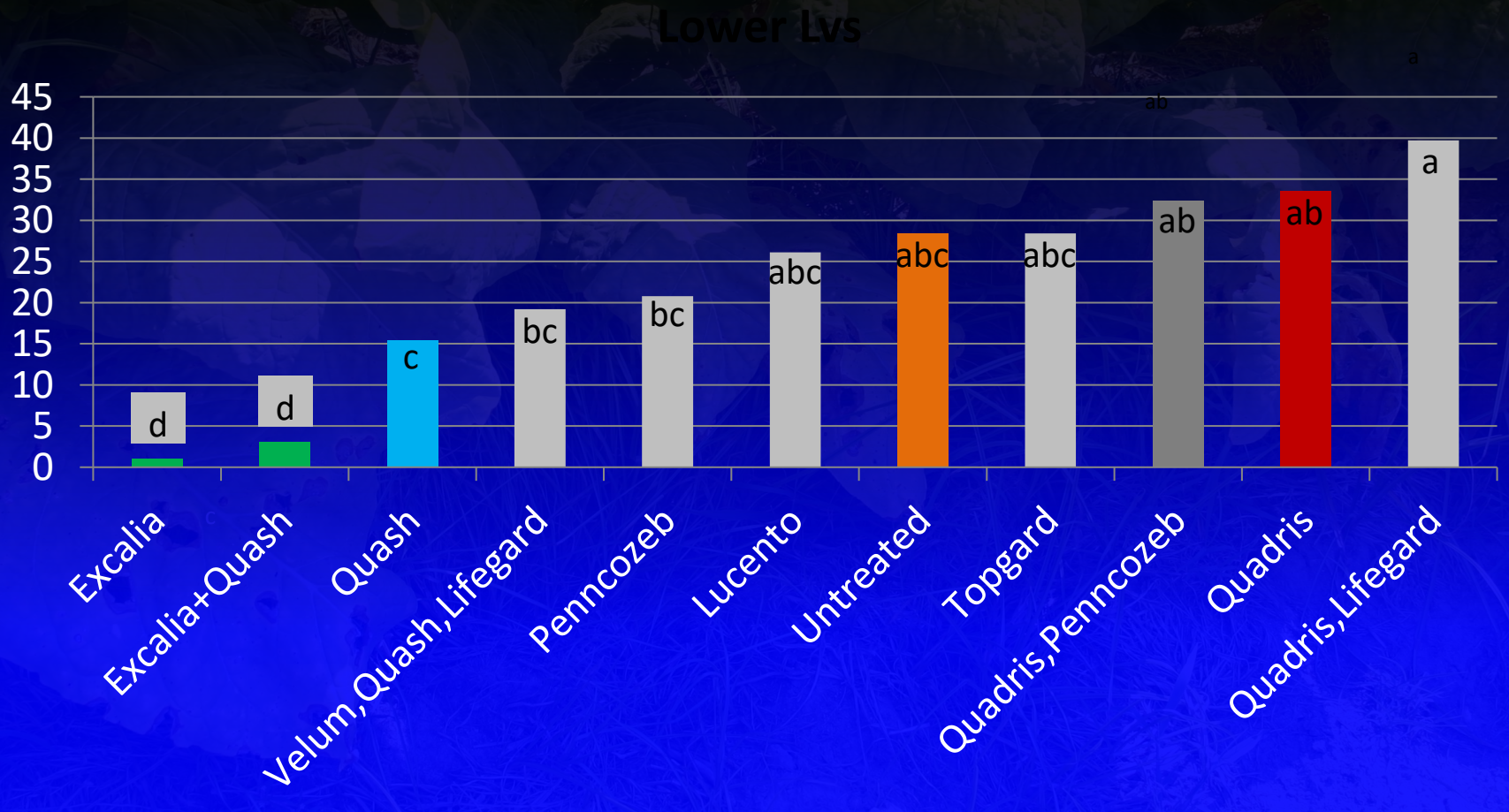
% Lower Leaf Area Damaged, 23 July



- Means followed by the same letter(s) are not significantly different based upon Waller-Duncan t-test (K-ratio = 100).
- -NuFilm surfactant added to Stargus & Double Nickel spray applications.

2019 Target Leaf Spot Fungicide Test

% Lower Leaf Area Damaged, 22 July

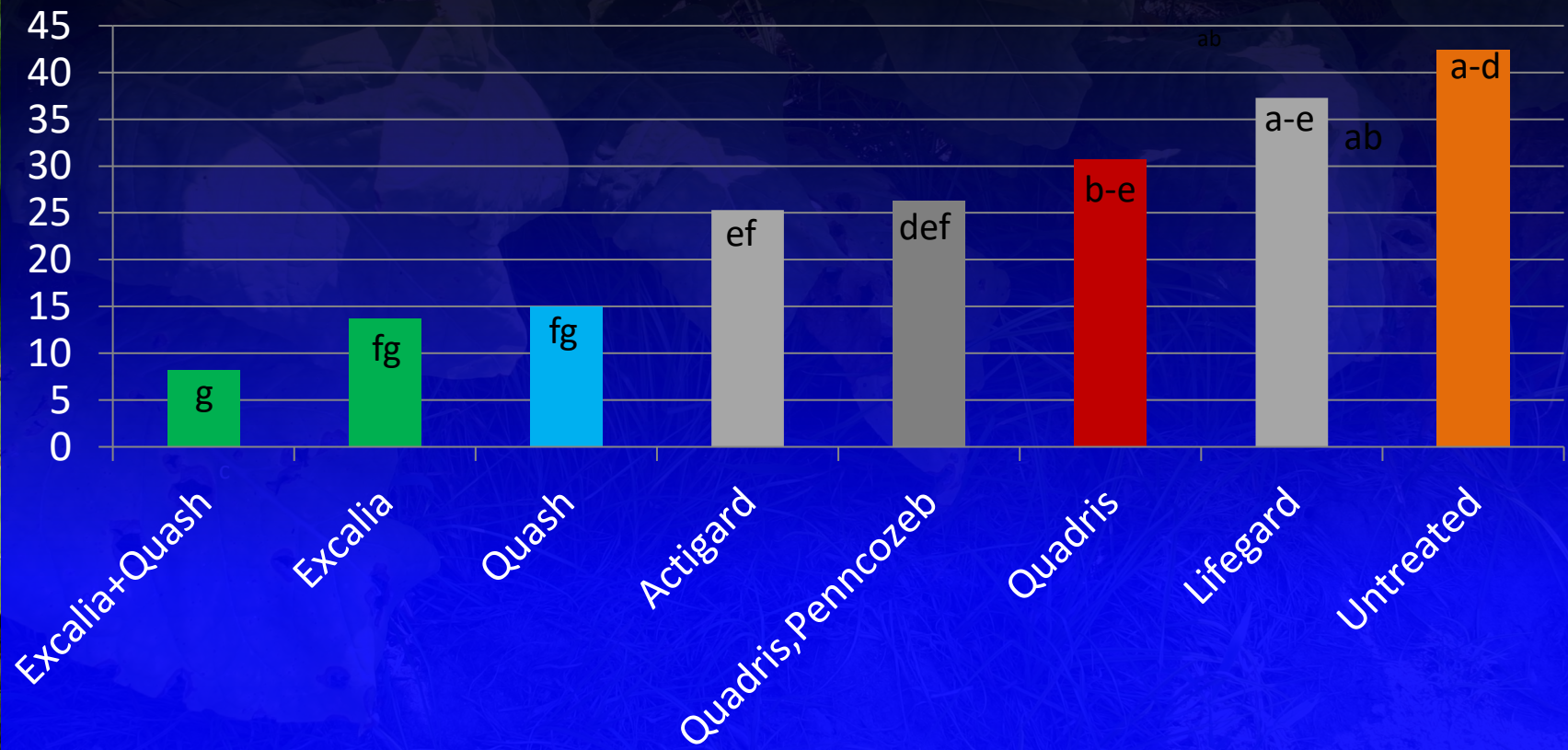


Means followed by the same letter(s) are not significantly different based upon Waller-Duncan t-test (K-ratio = 100).

2020 Target Leaf Spot Fungicide Test

% Lower Leaf Area Damaged, 17 July

Lower Lvs



Means followed by the same letter(s) are not significantly different based upon Waller-Duncan t-test (K-ratio = 100).

% Lower Leaf Area Damaged: Excalia (FRAC-7)

Fungicide Product	2017	2018	2019	2020	Mean
Excalia	4.2 c	11.0 d	1.0 d	13.7 fg	7.5
Quadris	11.3 ab	33.0 a-d	33.5 ab	30.7 b-e	27.1
Untreated Control	15.4 ab	53.2 ab	28.4 abc	42.4 a-d	34.8

Yield Results (lb/A)

Excalia (FRAC-7)

Fungicide Product	2017	2018	2019	2020	Mean
Excalia	3,093	3,559	3,623	3,093	3,342
Quadris	3,236	3,236	3,343	3,425	3,358
Untreated Control	3,231	3,231	3,124	3,210	3,226

Apparent numerical treatment differences were never statistically significant

% Lower Leaf Area Damaged: Quash (*FRAC-3*)

Fungicide Product	2016	2019	2020	Mean
Quash	5.1 d	15.4 c	15.0 fg	11.8
Quadris	10.2 cd	33.5 ab	30.7 cde	24.8
Untreated Control	44.3 a	28.4 abc	42.4 a-d	38.4

Yield Results (lb/A)

Quash (FRAC-3)

Fungicide Product	2016	2019	2020	Mean
Quash	3,770	3,463	3,133	3,455
Quadris	3,773	3,389	3,425	3,529
Untreated Control	3,654	3,341	3,210	3,402

Apparent numerical treatment differences were never statistically significant

% Lower Leaf Area Damaged:
Excalia (FRAC-7) with Quash (FRAC-3)

Fungicide Product	2019	2020	Mean
Excalia+Quash	3.1 d	8.2 g	5.6
Excalia	1.0 d	13.7 fg	7.4
Quash	15.4 c	15.0 fg	15.2
Quadris (FRAC-11)	33.5 ab	30.7 cde	32.1
Untreated Control	28.4 abc	42.4 a-d	35.4

Yield Results (lb/A) Excalia (FRAC-7) with Quash (FRAC-3)

Fungicide Product	2019	2020	Mean
Excalia+Quash	3,683	3,140	3,412
Excalia	3,623	3,093	3,352
Quash	3,463	3,133	3,298
Quadris (FRAC-11)	3,389	3,425	3,407
Untreated Control	3,341	3,210	3,276

Apparent numerical treatment differences were never statistically significant

Summary & Conclusions

- **Excalia (FRAC-7)** significantly reduced Target Spot in every year tested.
- **Quash (FRAC-3)** usually reduced Target Spot, sometimes similarly to Quadris, sometimes better.
- **Quadris (FRAC-11)** also continued to reduce Target Spot damage, not always significantly, and less than Excalia.

Summary & Conclusions

- Other fungicides & biocontrol treatments sometimes reduced damage numerically, but rarely resulted in consistent & statistically significant differences compared to the untreated control.
- Reduced Target Spot damage often did NOT increase yield. Such numerical increases were often not statistically significant, perhaps due to variable disease pressure.

Summary & Conclusions

- **Excalia (FRAC-7)**, **Quash (FRAC-3)**, & **Quadris (FRAC-11)** are all potentially useful fungicides for Target Spot control.
- **FRAC-7** & **FRAC-3** fungicides are also subject to fungicide resistance risk in pathogen populations. If registered, tobacco growers could use 3 different fungicide codes (modes of action) to improve Target Spot control consistently, while at the same time avoid the rise of fungicide-resistance strains in the pathogen population.

Acknowledgements

- Financial & Product Support:
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 - So. Piedmont Center staff