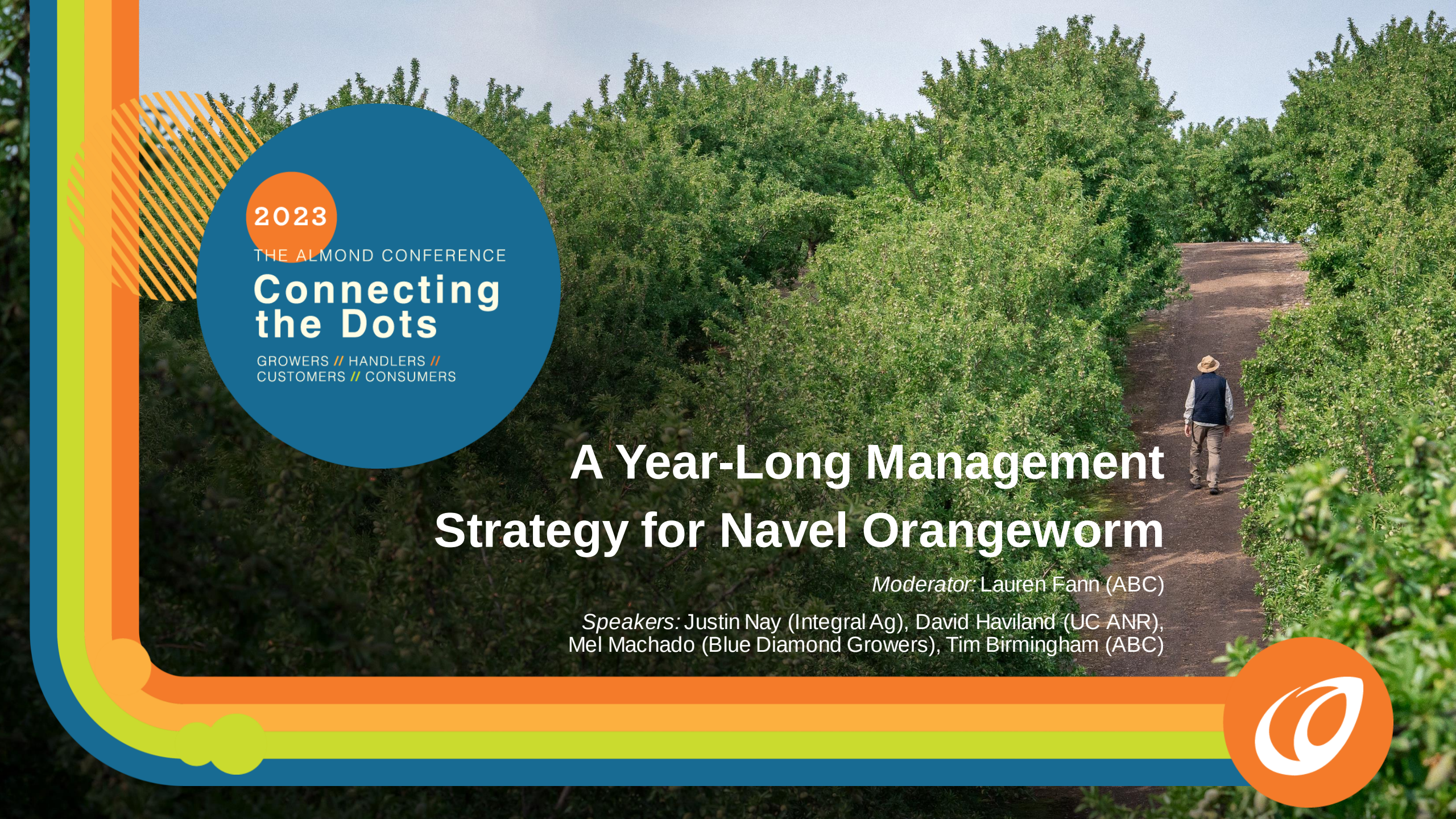


A Year-Long Management Strategy for Navel Orangeworm

Moderator: Lauren Fann (ABC)

Speakers: Justin Nay (Integral Ag), David Haviland (UC ANR), Mel Machado (Blue Diamond Growers), Tim Birmingham (ABC)

2023

THE ALMOND CONFERENCE

Connecting the Dots

GROWERS // HANDLERS // CUSTOMERS // CONSUMERS

Navel orangeworm in 2023: What happened and what to do about it

David Haviland, UCCE Kern Co.

Four Pillars of NOW Management

Integrated pest management program

01 Winter sanitation

02 Mating disruption

03 Insecticides

04 Timely harvest

Four Pillars of NOW Management in 2023

Integrated pest management program

01 Winter sanitation- less investment due to low prices/rain

02 Mating disruption- seen as a cost instead of an investment

03 Insecticides- spray timings/programs out of whack

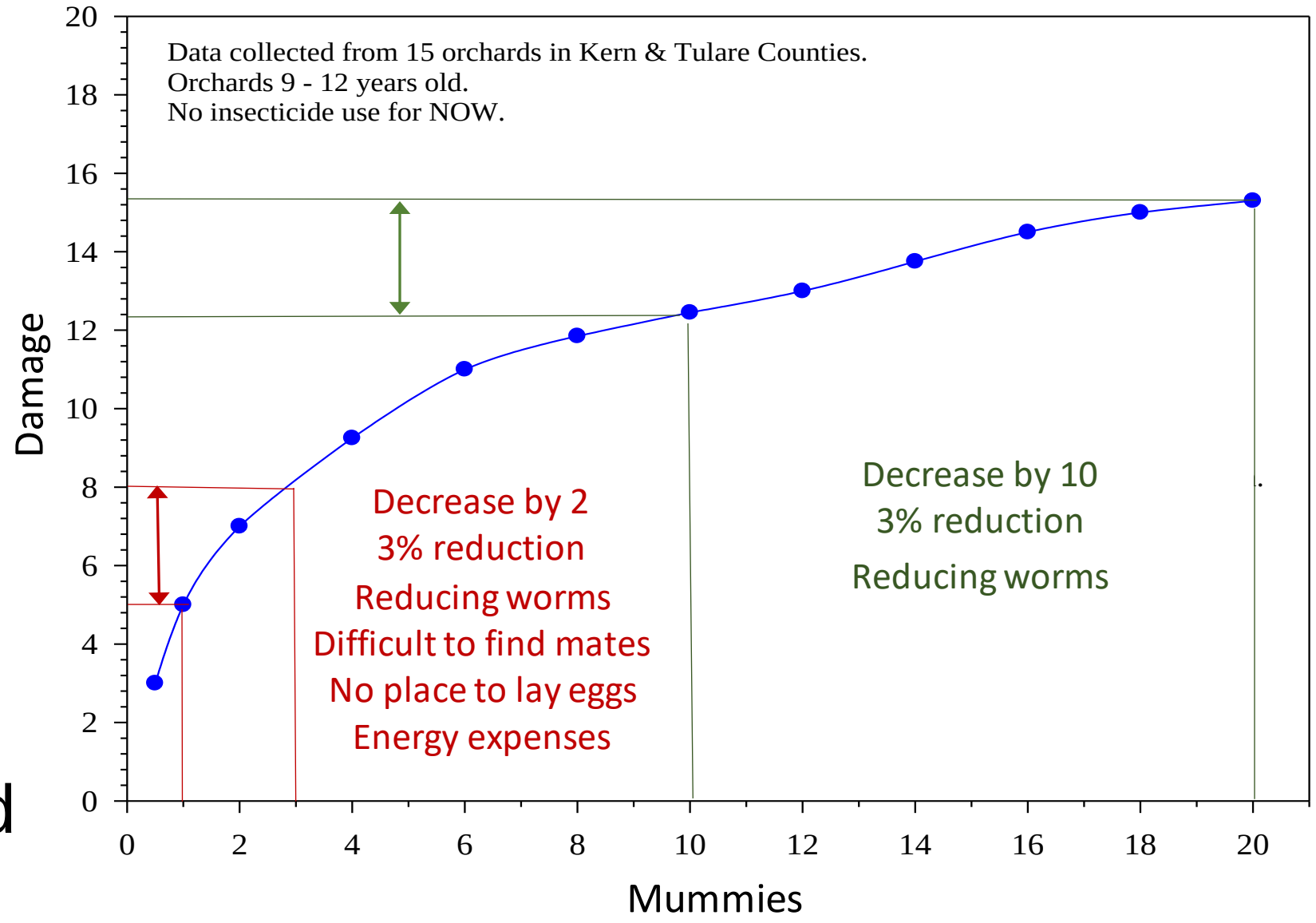
04 Timely harvest- literally impossible in 2023

Sanitation

Four major steps

1. Shaking
2. Poling
3. Blowing
4. Mowing

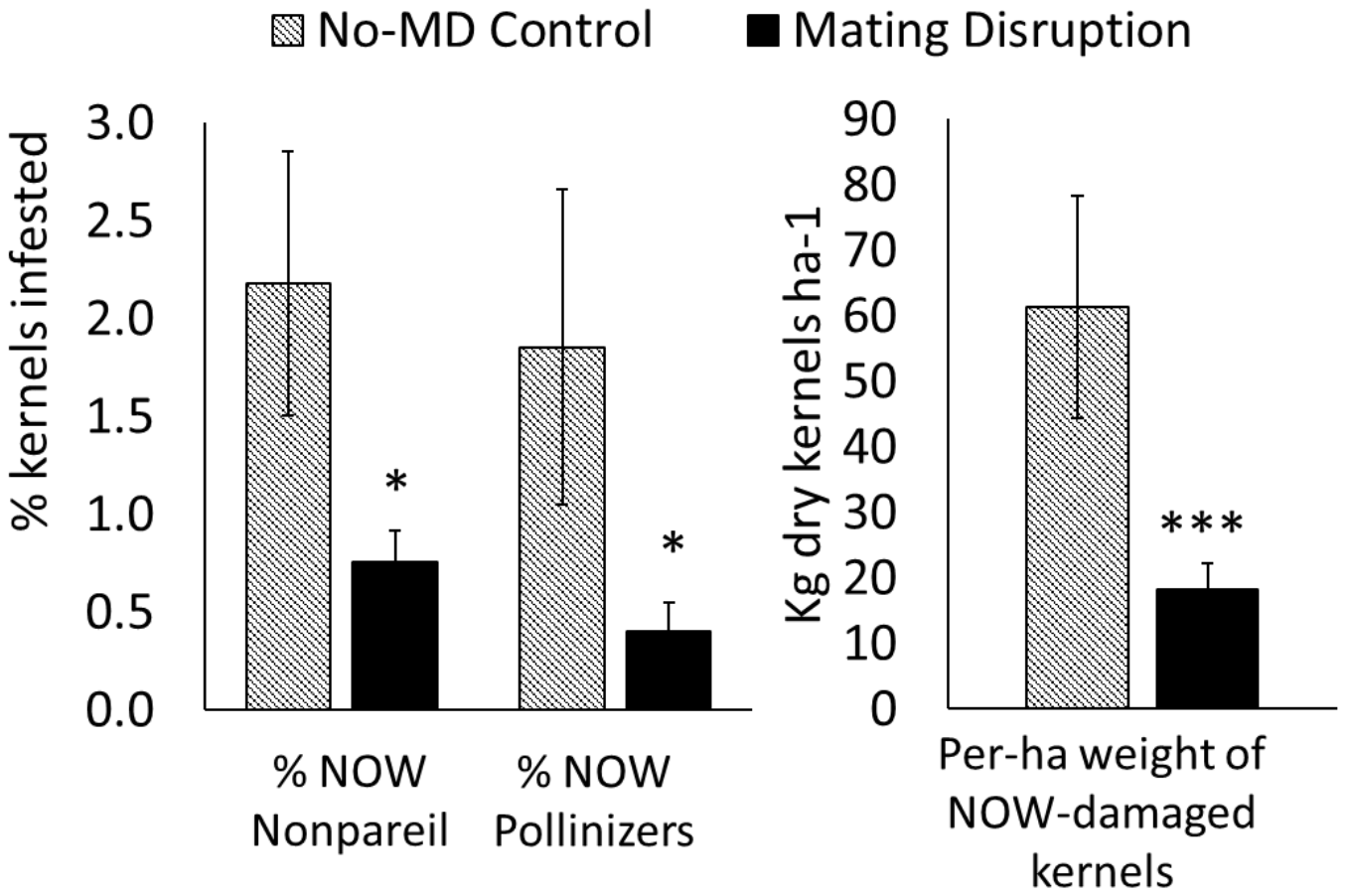
All are needed



Mating disruption

Season long programs

1. Effective
2. Predictable

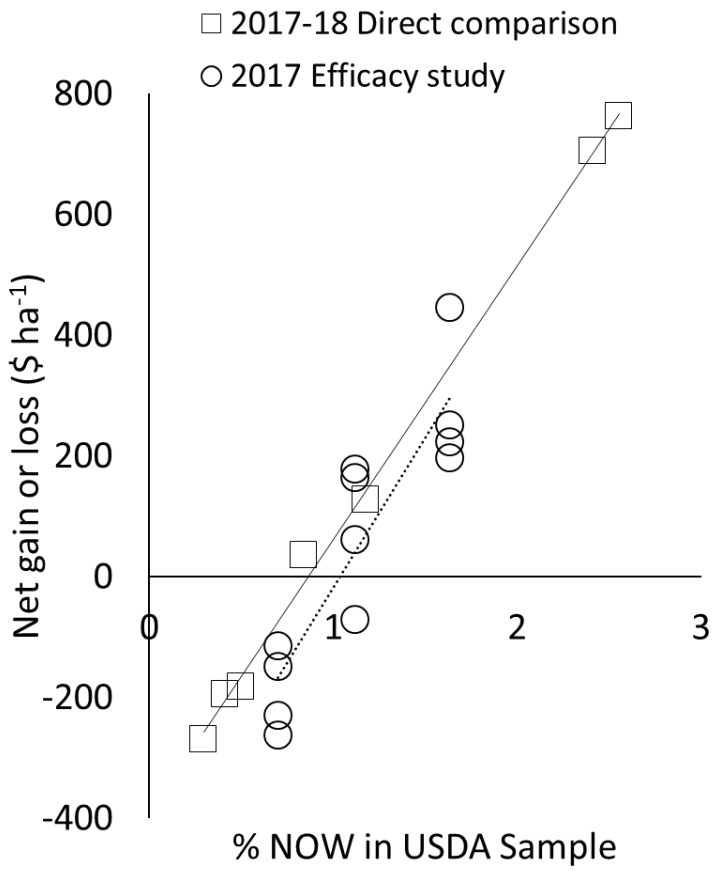


Harvest data from 12, ~40-100 ac side-by-side demonstrations

Mating disruption

Season-long programs

1. Effective
2. Predictable
3. Affordable



Break-even points

No MD- 1%

MD- 0.5%

What does 4% USDA damage cost?

4% weight not paid
+ 4% left in field
+ 8% loss in bonuses
(12¢ on $1.60/lb)
= 16% economic loss

Mating disruption should be seen more as an investment than as an expense

Insecticides

Integrated pest management

Normal year	2023
• Synchronized split	• Non-synchronized split (long bloom)
• In early July	• In mid July
• At the start of the 2nd flight	• Not synchronized with the start of the 2nd flight
• HS spray plus ~2 wk later covers 2nd gen.	• HS spray plus ~2 wk later (if made) were out of whack

Timely harvest

Timely (NP harvest before third flight)	Not Timely (NP harvested after third flight)
July worms mostly in NP NP get harvested Nuts windrowed and piled Worms fumigated (99% control) Minimal third flight NP protected from 3rd flight Minimal 3rd flight impact on pollinizers	July worms mostly in NP Worms hatch into huge 3rd flight NOW reinfest nonpareil NOW heavily infest pollinizers

Timely harvest

Timely (NP harvest before third flight)	Not Timely (NP harvested after third flight)
July worms mostly in NP NP get harvested Nuts windrowed and piled Worms fumigated (99% control) Minimal third flight NP protected from 3rd flight Minimal 3rd flight impact on pollinizers	July worms mostly in NP Worms hatch into huge 3rd flight NOW reinfest nonpareil NOW heavily infest pollinizers
Timely harvest of pollinators before the fourth flight has the same effect	Delayed harvest of pollinizers contributes to a massive fourth flight and reinfestation

2023

Four Pillars of NOW Management in 2024

Integrated pest management program

01 Winter sanitation- Do it. Reset the clock. Two/tree. Destroy.

02 Mating disruption- View it as and investment

03 Insecticides- Stay the course, 2023 was an anomaly, decide how many/when to make sprays

04 Timely harvest- Hope for a return to normal dates, be ready to shake when the tree is ready

Connecting the Dots 2023

Thank you

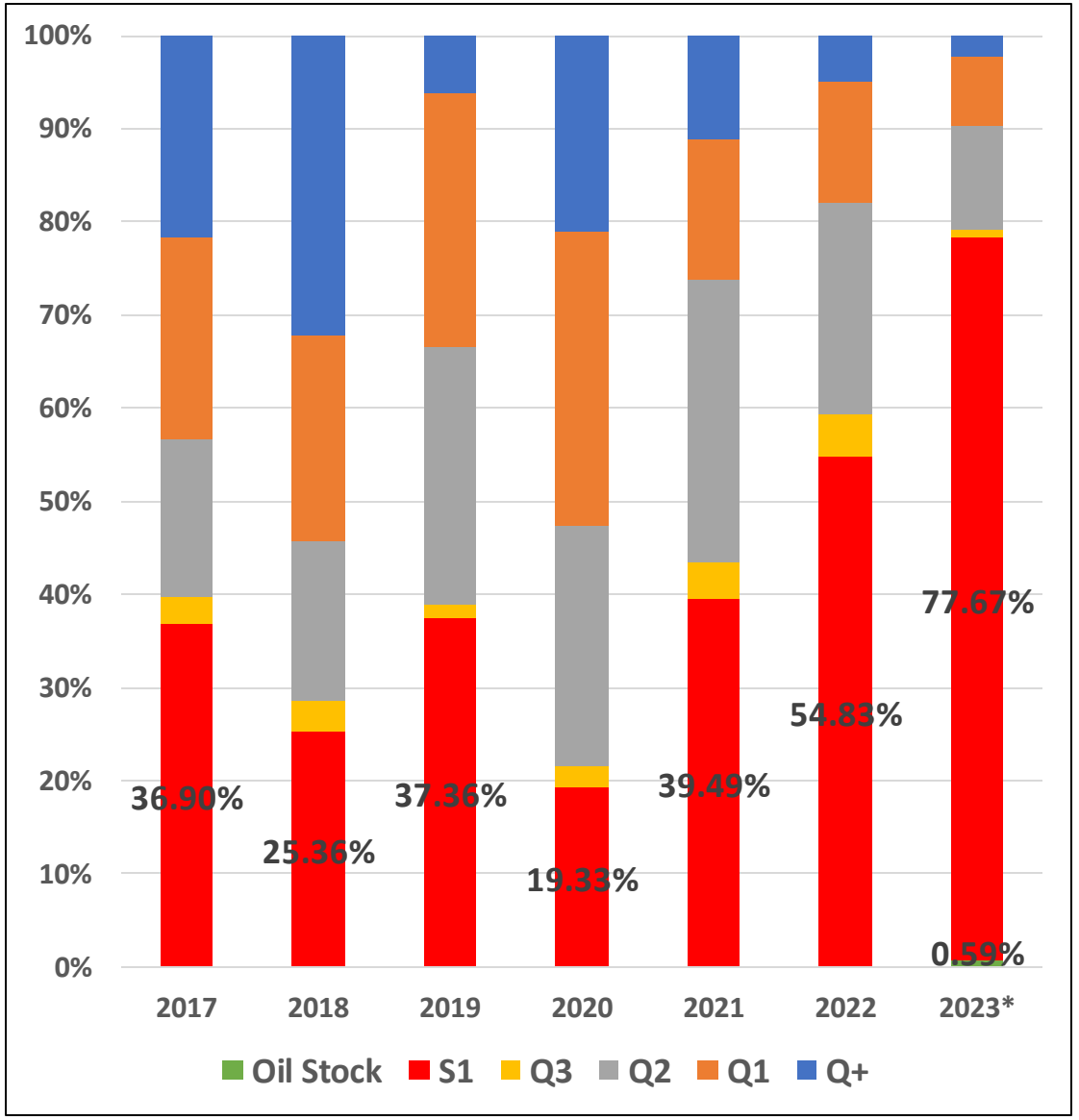
california almonds
Almond Board of California

Power in Partnership

BLUE DIAMOND GROWERS

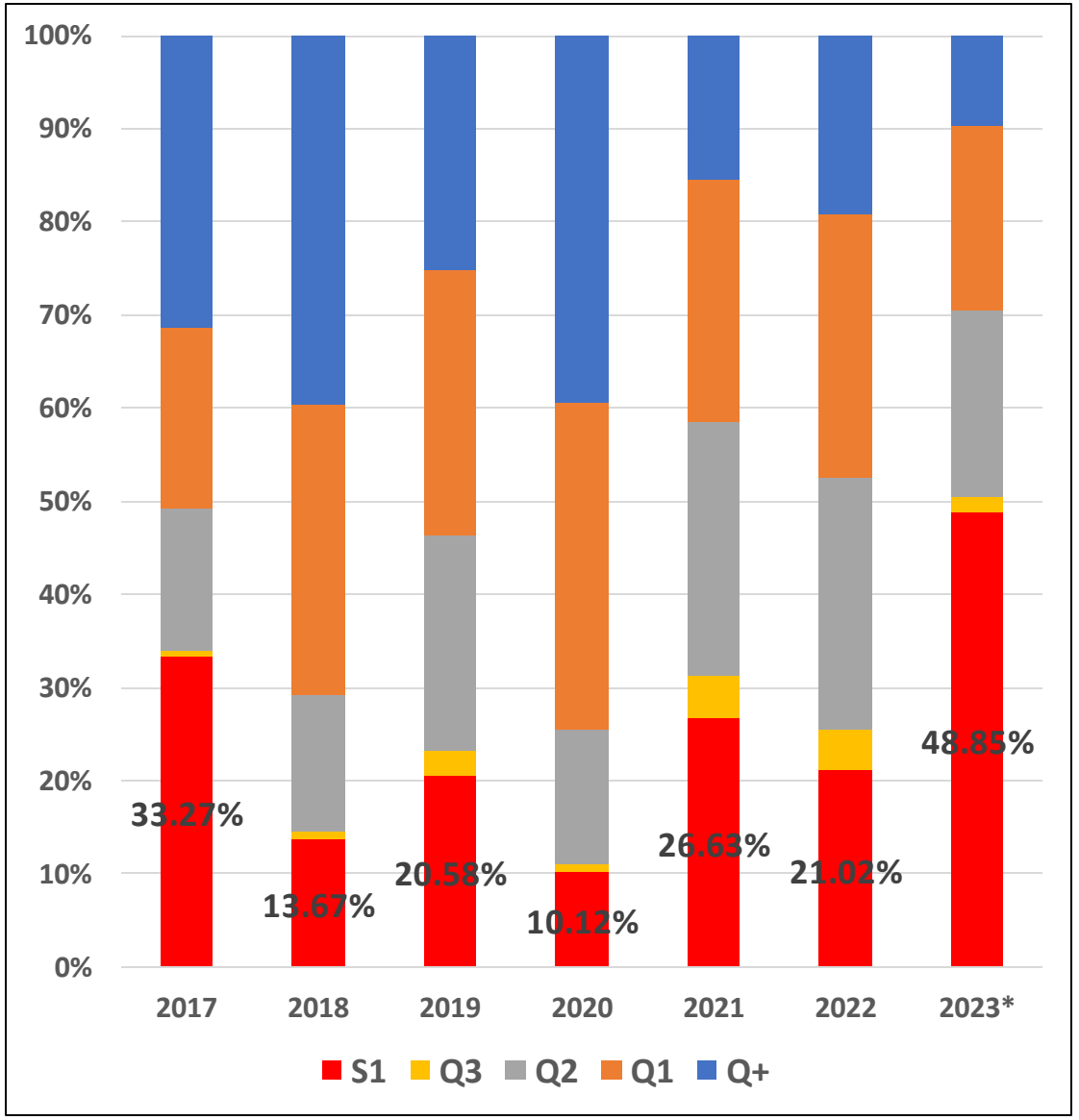
2023 Crop Quality & Implications

Northern Region Nonpareil Meats (as of 11/9/23)



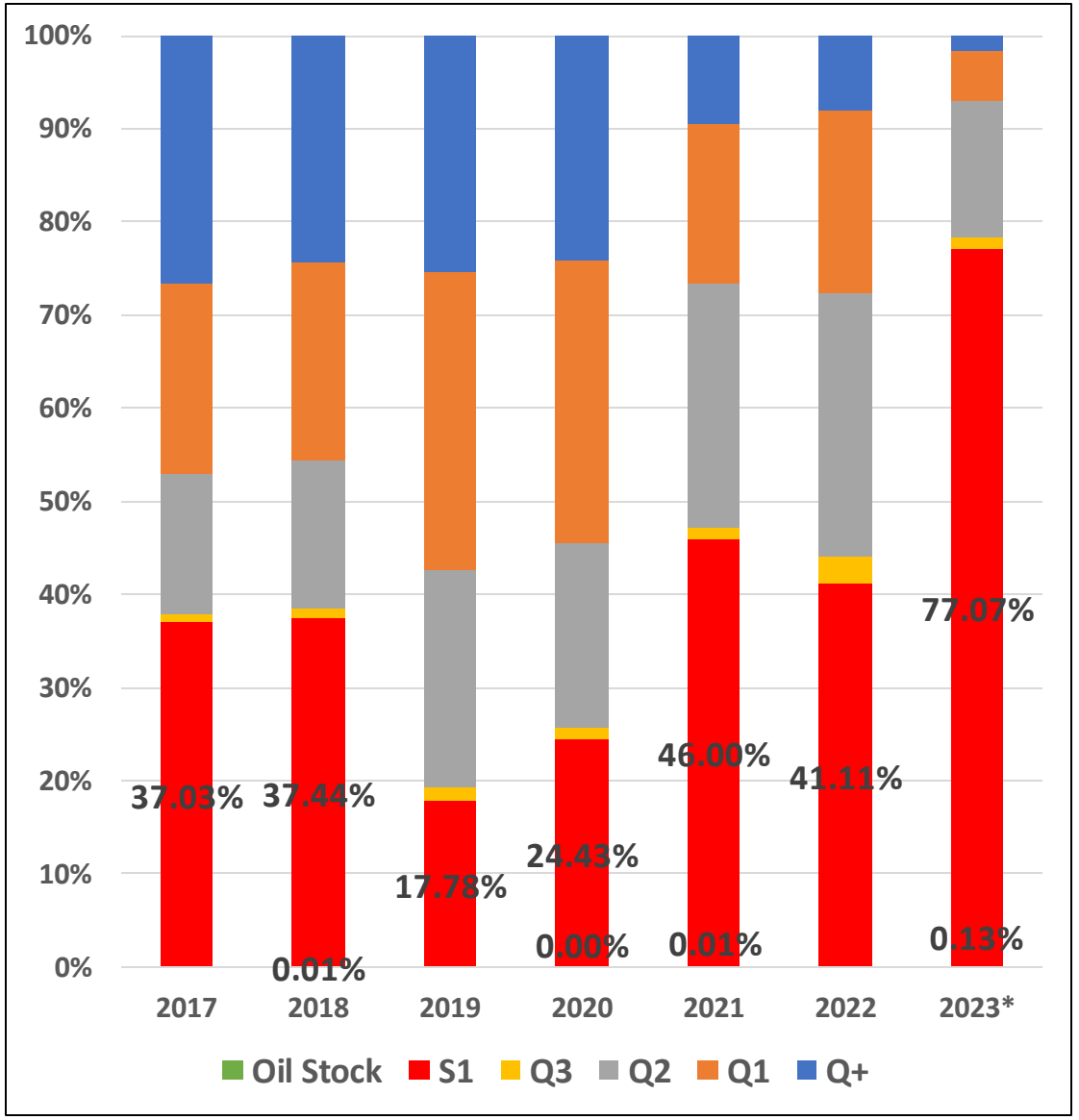
Grade	2017	2018	2019	2020	2021	2022	2023
Q+	$0.172	$0.176	$0.169	$0.173	$0.174	$0.171	$0.175
Q1	$0.144	$0.145	$0.139	$0.142	$0.139	$0.137	$0.137
Q2	$0.107	$0.109	$0.106	$0.109	$0.108	$0.098	$0.102
Q3	$0.074	$0.082	$0.076	$0.082	$0.077	$0.079	$0.073
S1	$0.011	$0.008	$0.006	$0.023	$0.010	$0.007	($0.005)

Central Region Nonpareil Meats (as of 11/9/23)



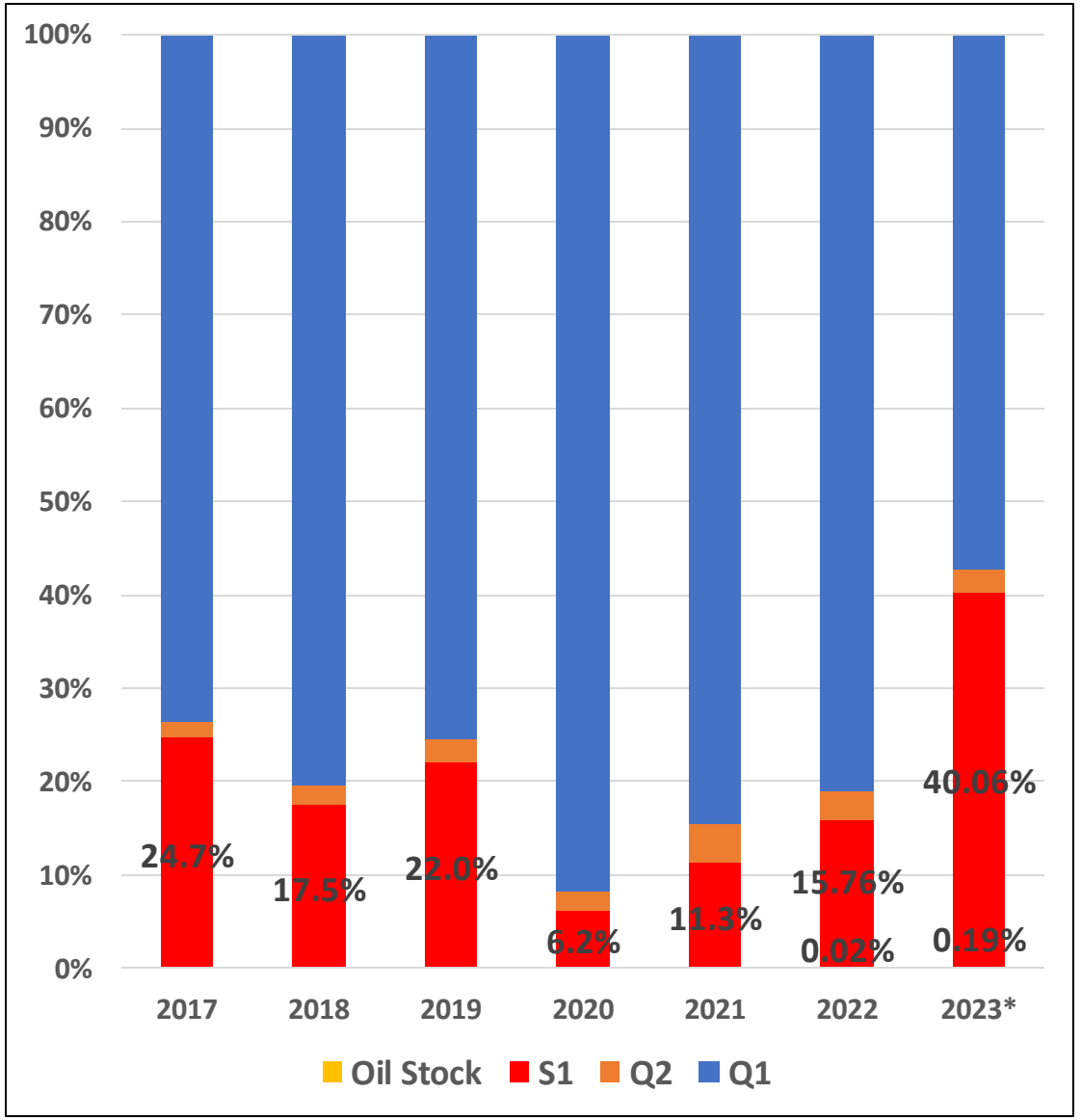
Grade	2017	2018	2019	2020	2021	2022	2023
Q+	$0.171	$0.174	$0.173	$0.174	$0.172	$0.172	$0.171
Q1	$0.141	$0.144	$0.142	$0.144	$0.140	$0.142	$0.139
Q2	$0.107	$0.109	$0.108	$0.111	$0.107	$0.108	$0.101
Q3	$0.081	$0.084	$0.077	$0.089	$0.079	$0.083	$0.074
S1	$0.029	$0.036	$0.028	$0.040	$0.029	$0.030	$0.011

Southern Region Nonpareil Meats (as of 11/9/23)



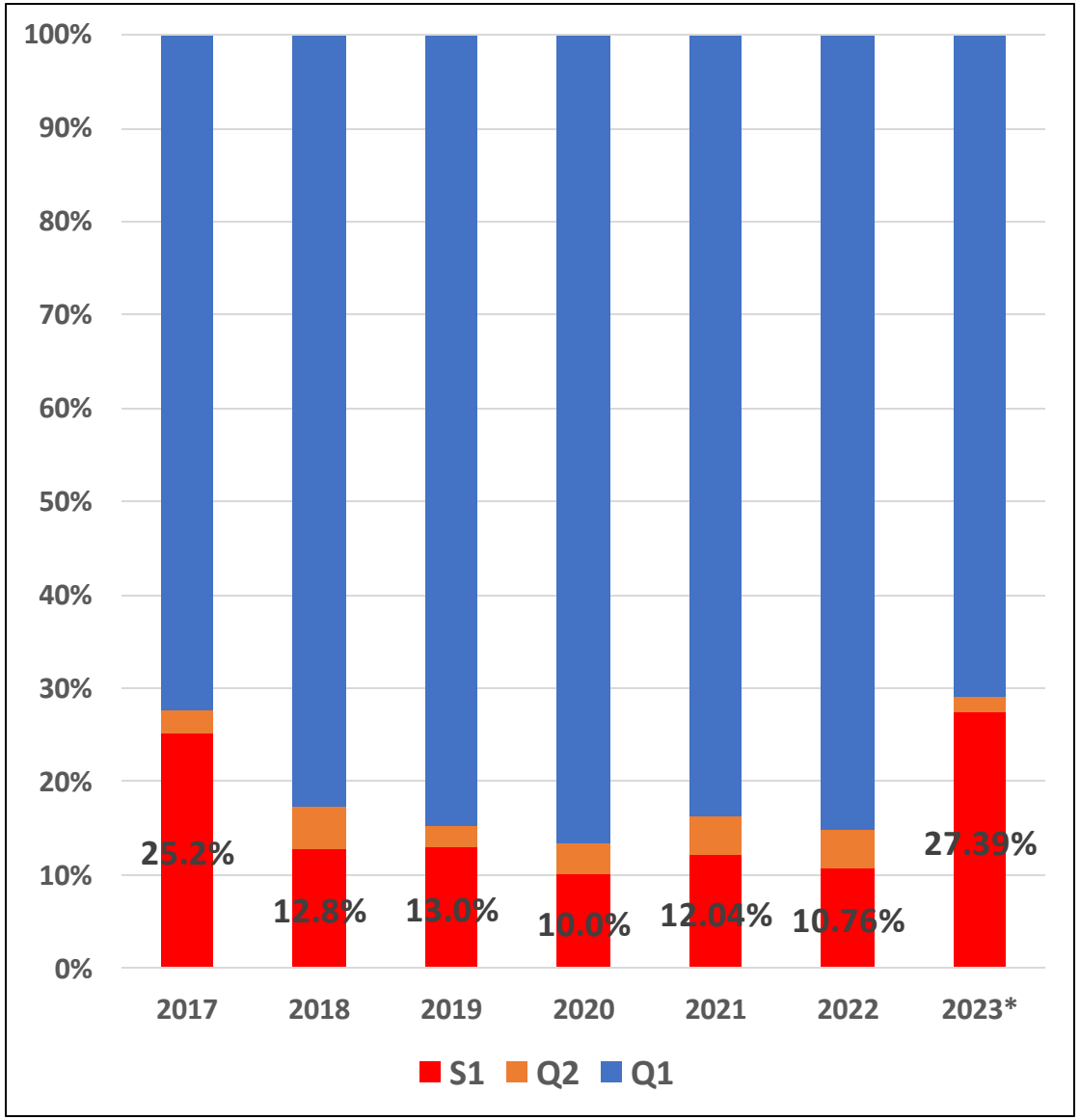
Grade	2017	2018	2019	2020	2021	2022	2023
Q+	$0.172	$0.171	$0.173	$0.173	$0.170	$0.160	$0.154
Q1	$0.142	$0.141	$0.143	$0.142	$0.140	$0.131	$0.126
Q2	$0.108	$0.106	$0.109	$0.107	$0.105	$0.099	$0.096
Q3	$0.081	$0.077	$0.087	$0.080	$0.076	$0.072	$0.071
S1	$0.023	$0.020	$0.027	$0.027	$0.020	$0.021	$0.006

Northern Region Nonpareil Inshell (as of 11/9/23)



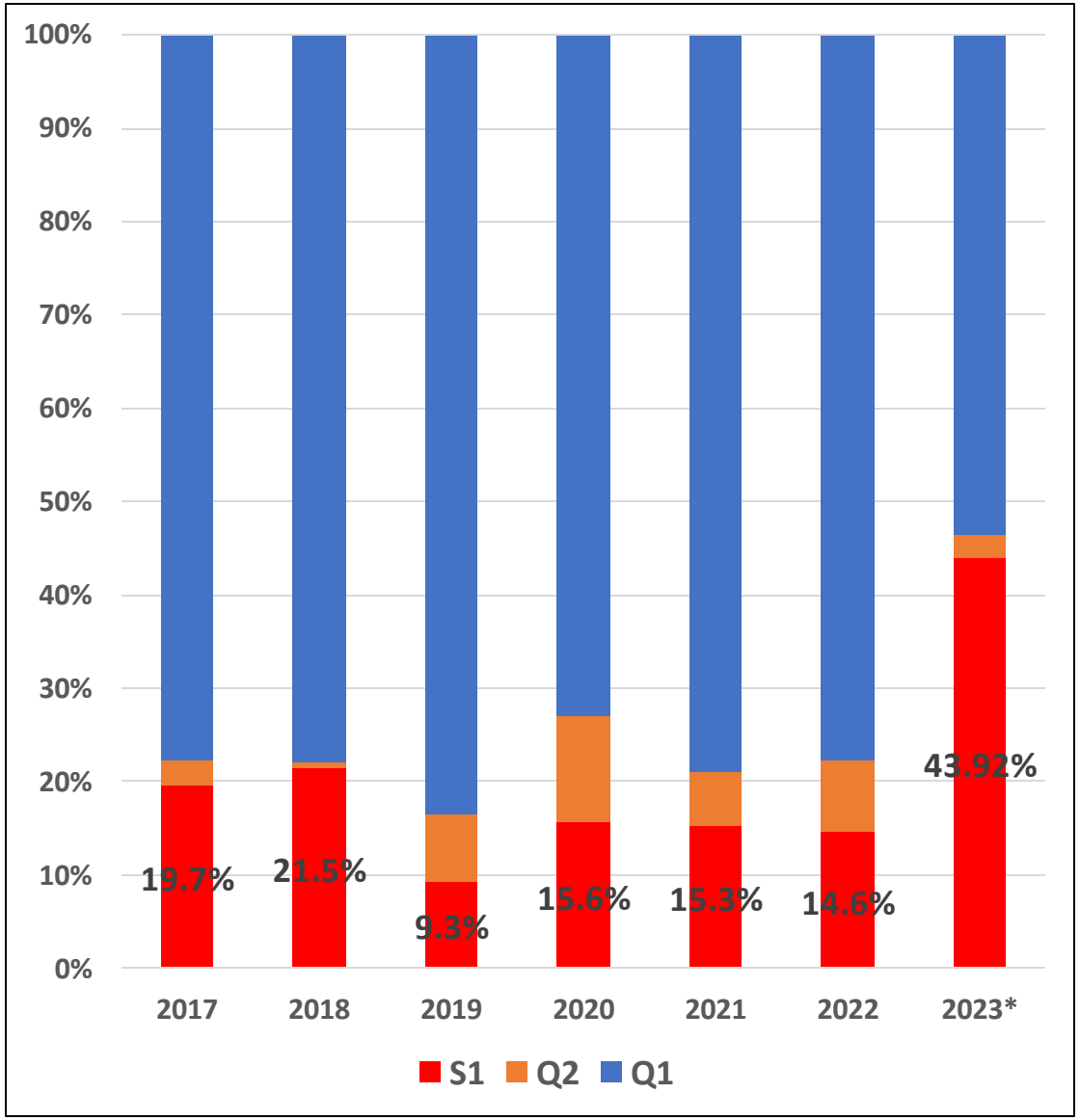
Grade	2017	2018	2019	2020	2021	2022	2023
Q1	$0.199	$0.200	$0.200	$0.204	$0.200	$0.193	$0.185
Q2	$0.160	$0.163	$0.160	$0.165	$0.154	$0.160	$0.141
S1	$0.011	$0.009	$0.010	$0.028	$0.017	$0.008	($0.007)

Central Region Nonpareil Inshell (as of 11/9/23)



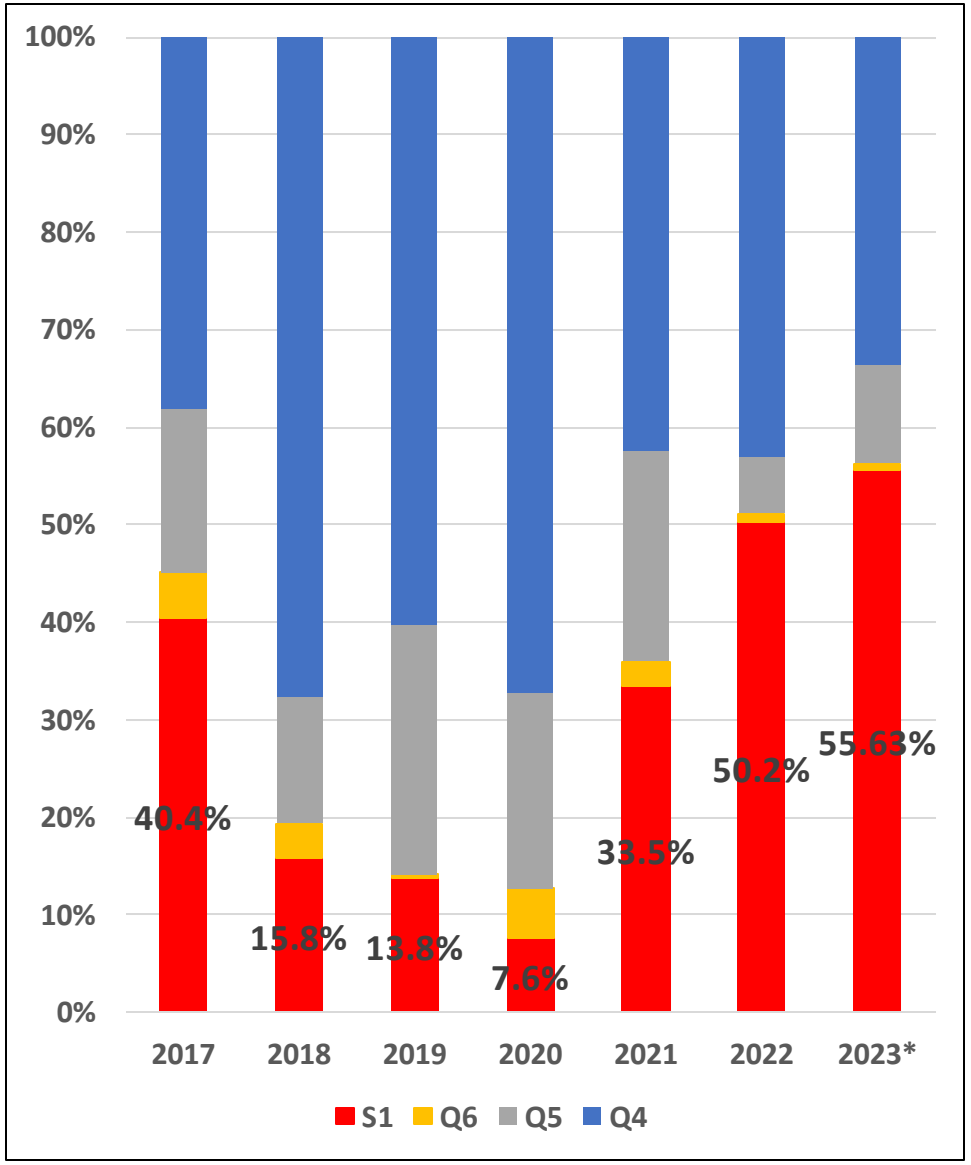
Grade	2017	2018	2019	2020	2021	2022	2023
Q1	$0.197	$0.199	$0.201	$0.204	$0.195	$0.197	$0.188
Q2	$0.160	$0.163	$0.164	$0.166	$0.161	$0.157	$0.149
S1	$0.011	$0.020	$0.016	$0.034	$0.012	$0.020	$0.008

Southern Region Nonpareil Inshell (as of 11/9/23)



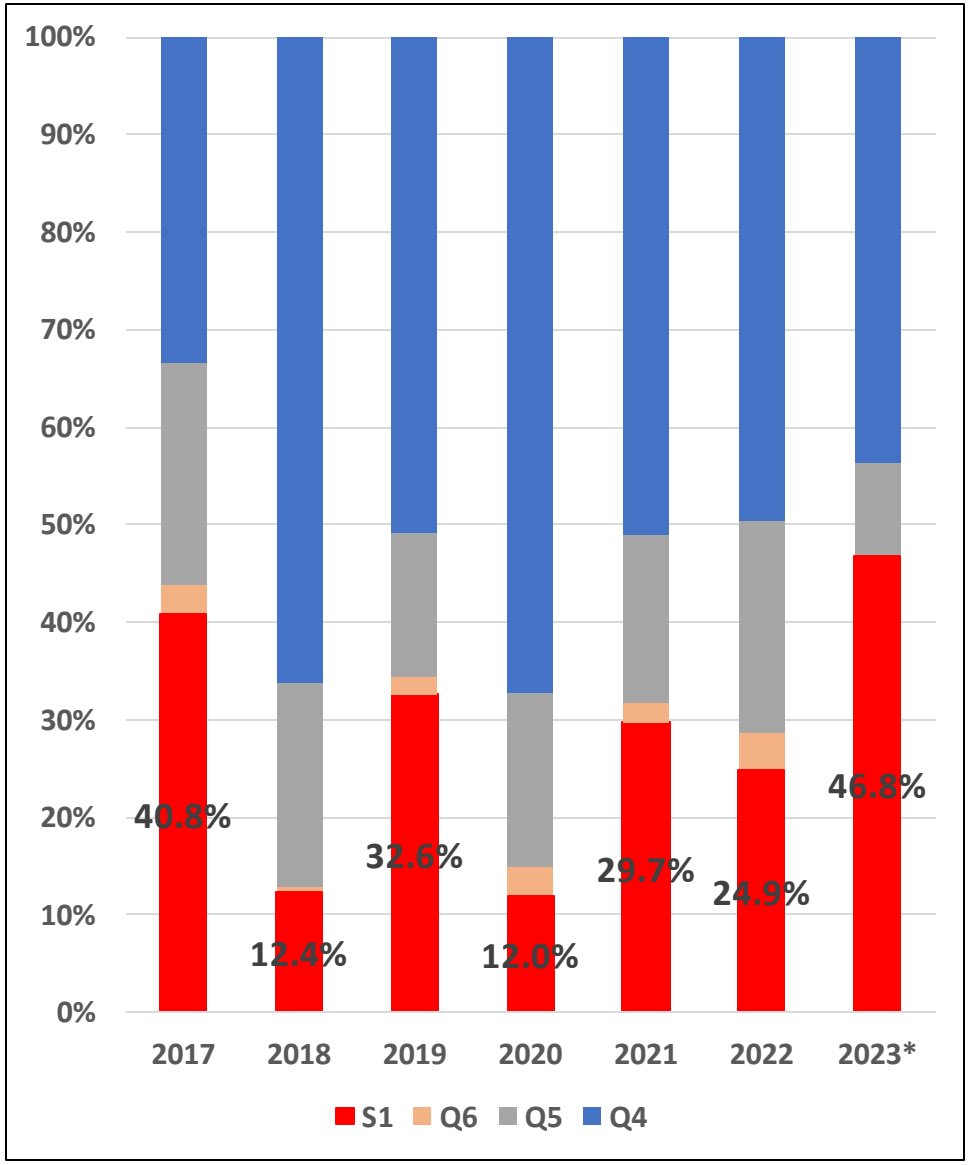
Grade	2017	2018	2019	2020	2021	2022	2023
Q1	$0.196	$0.195	$0.200	$0.198	$0.194	$0.171	$0.169
Q2	$0.165	$0.156	$0.166	$0.165	$0.159	$0.130	$0.143
S1	$0.014	$0.017	$0.013	$0.033	$0.015	$0.017	$0.000

Northern Region Monterey Meats (as of 11/9/23)



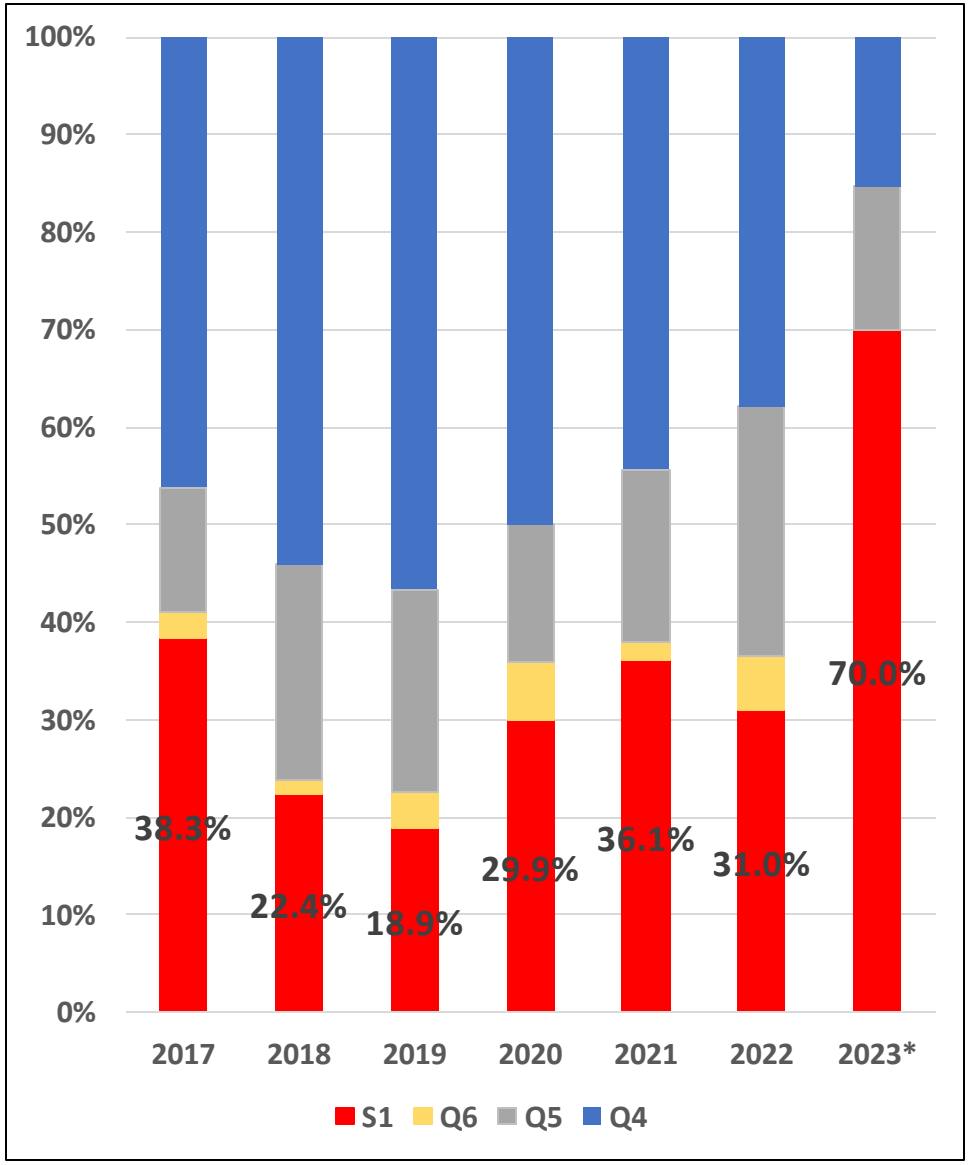
Grade	2017	2018	2019	2020	2021	2022	2023
Q4	$0.117	$0.122	$0.115	$0.122	$0.110	$0.103	$0.101
Q5	$0.094	$0.092	$0.087	$0.098	$0.080	$0.080	$0.068
Q6	$0.080	$0.076	$0.062	$0.083	$0.084	$0.078	($0.017)
S1	$0.001	$0.016	$0.016	$0.025	$0.005	$0.002	$0.006

Central Region Monterey Meats (as of 11/9/23)



Grade	2017	2018	2019	2020	2021	2022	2023
Q4	$0.110	$0.117	$0.115	$0.119	$0.096	$0.114	$0.102
Q5	$0.084	$0.088	$0.091	$0.095	$0.066	$0.087	$0.075
Q6	$0.069	$0.076	$0.080	$0.077	$0.069	$0.076	
S1	$0.010	$0.017	$0.021	$0.025	($0.012)	$0.018	($0.002)

Southern Region Monterey Meats (as of 11/9/23)



Grade	2017	2018	2019	2020	2021	2022	2023
Q4	$0.116	$0.117	$0.119	$0.120	$0.104	$0.107	$0.098
Q5	$0.095	$0.085	$0.094	$0.098	$0.069	$0.075	$0.042
Q6	$0.085	$0.069	$0.079	$0.081	$0.060	$0.062	$0.084
S1	$0.020	$0.021	$0.029	$0.024	$0.001	$0.018	($0.012)

Reject Economics

Comparative Values at Varying Reject Levels

		Yield	1,900									
		Price	$ 1.60									
Total Meat Pounds	RJS%	RJS Wt	Sheller Loss	TGM	Base	Total Premium		Total Value	Loss	Incremental Loss	Value/TGM	Opportunity Loss
						Rate	Amount					
1,900	0.00%	-	-	1,900	$ 3,040.00	$0.1300	$247.00	$3,287.00			**$1.730**	**$0.000**
1,900	1.00%	19	19	1,862	$ 2,979.20	$0.1750	$325.85	$3,305.05	$18.05		**$1.775**	**$0.010**
1,900	2.00%	38	38	1,824	$ 2,918.40	$0.1150	$209.76	$3,128.16	($158.84)	($176.89)	**$1.715**	**($0.084)**
1,900	3.00%	57	57	1,786	$ 2,857.60	$0.0500	$89.30	$2,946.90	($340.10)	($181.26)	**$1.650**	**($0.179)**
1,900	4.00%	76	76	1,748	$ 2,796.80	$0.0450	$78.66	$2,875.46	($411.54)	($71.44)	**$1.645**	**($0.217)**
1,900	5.00%	95	95	1,710	$ 2,736.00	$0.0350	$59.85	$2,795.85	($491.15)	($79.61)	**$1.635**	**($0.259)**
1,900	6.00%	114	114	1,672	$ 2,675.20	$0.0250	$41.80	$2,717.00	($570.00)	($78.85)	**$1.625**	**($0.300)**
1,900	7.00%	133	133	1,634	$ 2,614.40	$0.0150	$24.51	$2,638.91	($648.09)	($78.09)	**$1.615**	**($0.341)**
1,900	8.00%	152	152	1,596	$ 2,553.60	$0.0050	$7.98	$2,561.58	($725.42)	($77.33)	**$1.605**	**($0.382)**
1,900	9.00%	171	171	1,558	$ 2,492.80	($0.0050)	($7.79)	$2,485.01	($801.99)	($76.57)	**$1.595**	**($0.422)**
1,900	10.00%	190	190	1,520	$ 2,432.00	($0.0150)	($22.80)	$2,409.20	($877.80)	($75.81)	**$1.585**	**($0.462)**
1,900	11.00%	209	209	1,482	$ 2,371.20	($0.0250)	($37.05)	$2,334.15	($952.85)	($75.05)	**$1.575**	**($0.502)**
1,900	12.00%	228	228	1,444	$ 2,310.40	($0.0350)	($50.54)	$2,259.86	($1,027.14)	($74.29)	**$1.565**	**($0.541)**
1,900	13.00%	247	247	1,406	$ 2,249.60	($0.0450)	($63.27)	$2,186.33	($1,100.67)	($73.53)	**$1.555**	**($0.579)**
1,900	14.00%	266	266	1,368	$ 2,188.80	($0.0550)	($75.24)	$2,113.56	($1,173.44)	($72.77)	**$1.545**	**($0.618)**
1,900	15.00%	285	285	1,330	$ 2,128.00	($0.0650)	($86.45)	$2,041.55	($1,245.45)	($72.01)	**$1.535**	**($0.656)**
1,900	16.00%	304	304	1,292	$ 2,067.20	($0.0750)	($96.90)	$1,970.30	($1,316.70)	($71.25)	**$1.525**	**($0.693)**
1,900	17.00%	323	323	1,254	$ 2,006.40	($0.0850)	($106.59)	$1,899.81	($1,387.19)	($70.49)	**$1.515**	**($0.730)**
1,900	18.00%	342	342	1,216	$ 1,945.60	($0.0950)	($115.52)	$1,830.08	($1,456.92)	($69.73)	**$1.505**	**($0.767)**
1,900	19.00%	361	361	1,178	$ 1,884.80	($0.1050)	($123.69)	$1,761.11	($1,525.89)	($68.97)	**$1.495**	**($0.803)**
1,900	20.00%	380	380	1,140	$ 1,824.00	($0.1150)	($131.10)	$1,692.90	($1,594.10)	($68.21)	**$1.485**	**($0.839)**

Assumes Nonpareil Meat Deliveries

Assumes full premium for Chipped & Broken and Foreign Material = $.055

2023 Crop Quality Considerations

- Poor Winter Sanitation (Mummy Shaking & Destruction)

2023 Crop Quality Considerations

- Prolonged Bloom

2023 Crop Quality Considerations

- Prolonged Hull Split
  - June/July Heat Further Extends Hull Split
  - Difficult NOW Treatment Timing

2023 Crop Quality Considerations

- Poor Grower Decisions
  - Low pricing – Tough Economics

2023 Crop Quality Considerations

- Unprecedent Number of Abandoned/Unharvested Orchards

Extreme Inoculum Load

2023 Crop Quality Considerations

- Significant Navel Orange Worm Populations & Damage

Extreme Damage

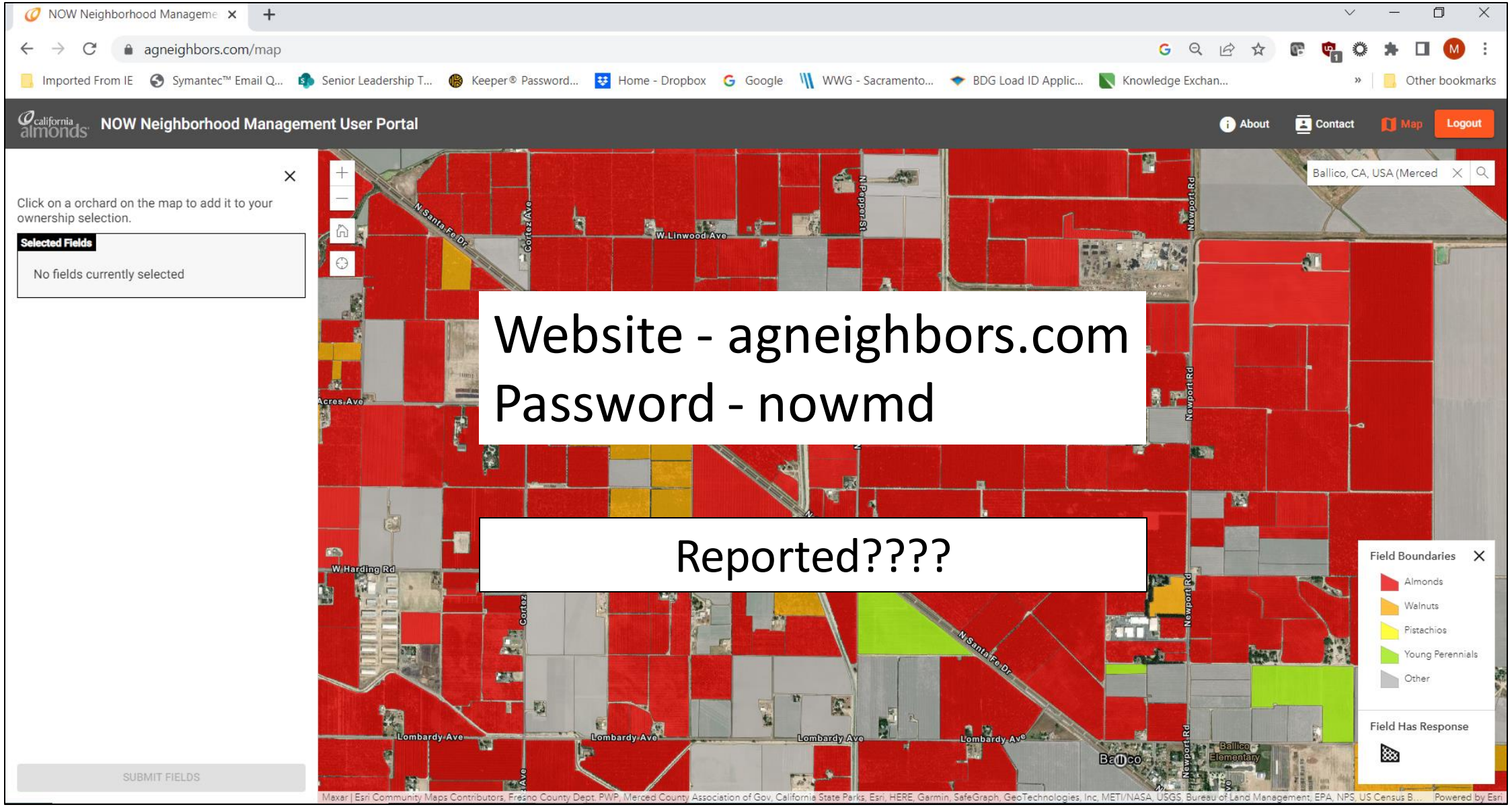
Rejects – The End Result…

- Everybody Has a Crappy Neighbor
  - Abandoned Orchards
  - Challenges & Decisions
  - Reduced Inputs
    - How Much Did That Cost Savings Cost You?
    - Disruption, 3 Hull Split Treatments
      - 5% to 25% Rejects
  - Difficult Treatment Timing
    - Significant Damage & Losses
    - NOW Population Overpowered Traditional Controls

What Can We Do???

- Reduce the Inoculum
  - **Sanitation**
  - **Eliminate “Abandoned” Orchards**
  - **Disruption**

Neighborhood Mating Disruption



What Can We Do???

- Reduce the Inoculum
  - Sanitation
  - Eliminate “Abandoned” Orchards
  - Disruption
- Proper Application Technique
  - Coverage, Coverage, Coverage
    - Timing
    - Watch the Tops of the Trees
  - Coverage, Coverage, Coverage
    - Aerial Application
    - https://youtu.be/chvEcpvAOXo

Coverage…

Coverage…

Coverage…

NOW Mitigation

Navel Orange Worm

Power in Partnership

BLUE DIAMOND GROWERS

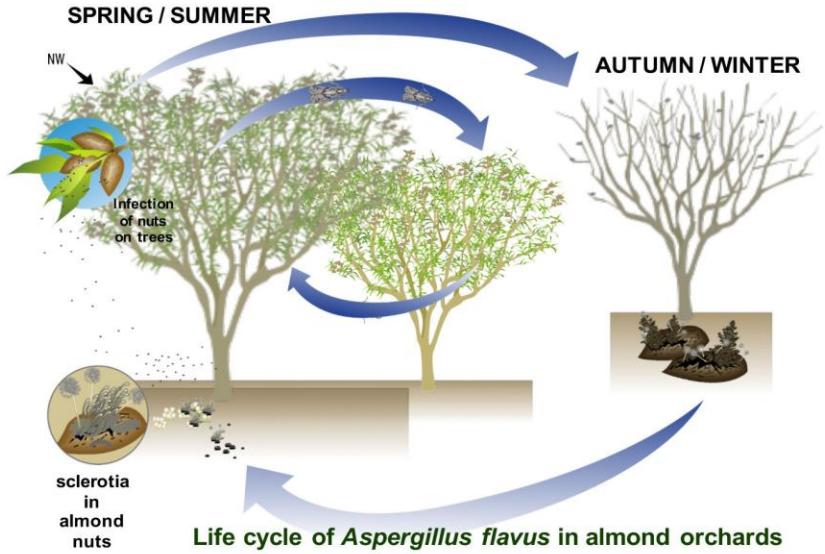
2023 Crop Quality & Implications

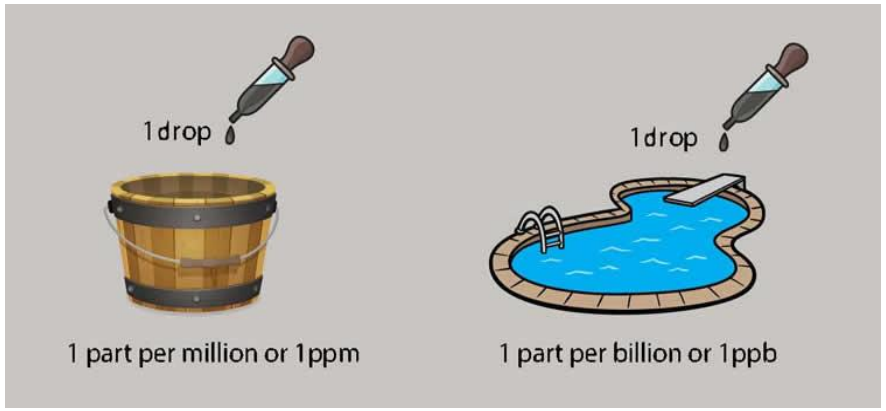
Aflatoxin – Post Harvest

Tim Birmingham

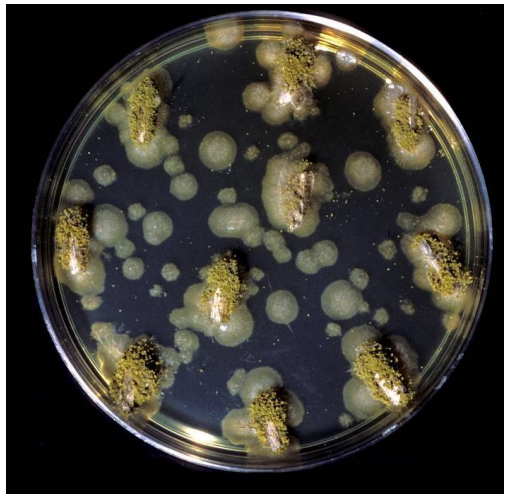
Understanding Aflatoxin

- *Aspergillus flavus and Aspergillus parasiticus* are two mold species commonly found in almond orchards
  - Given right conditions, and a host, they can grow and produce a chemical compound known as aflatoxin
  - Aflatoxin is a potent carcinogen
- Aflatoxin is widely regulated given its prevalence in various crops grown around the world
  - US – 20 PPB Limit
  - EU – 10 PPB Total; 8PPB B1
- Aflatoxin is measured in parts per billion
  - PPB equivalent to:
    - 1 drop in an Olympic size pool
    - A pinch of salt to a 10 ton bag of potato chips
- Correlation between aflatoxin levels and serious damage
- Not uniformly distributed in the lot





Association of NOW with aflatoxigenic Fungi



A. flavus

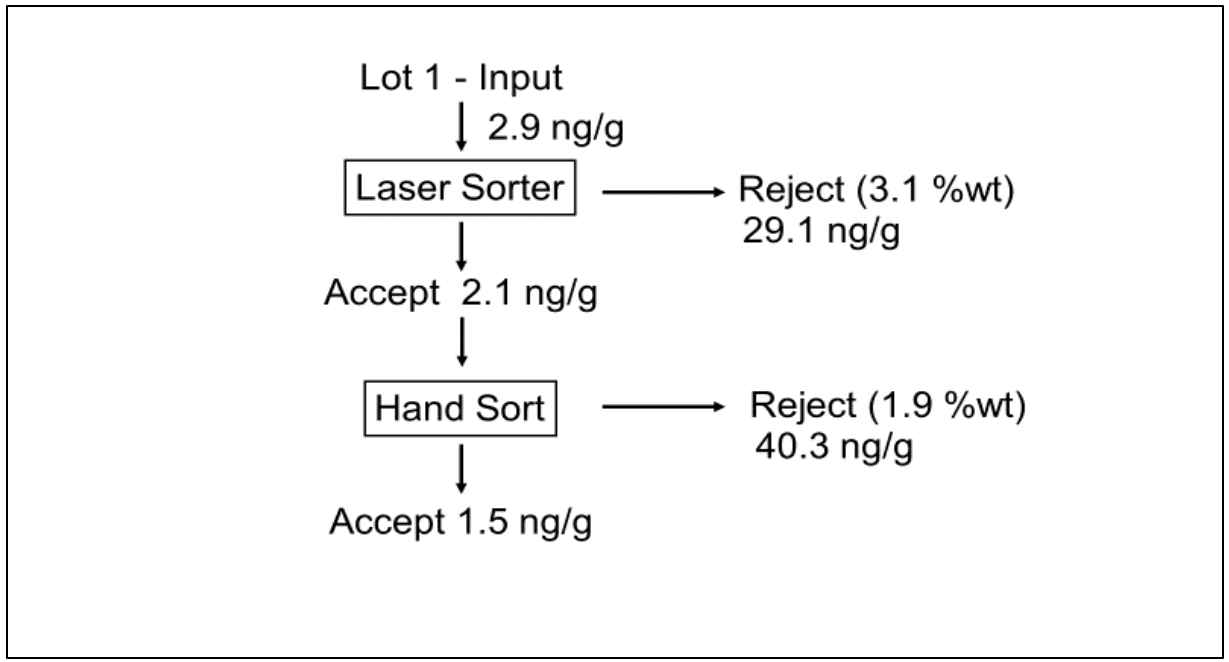
Aflatoxin Correlation with Serious Damage

Aflatoxin by Grade Factor Study: 50 Almond Lots (44,000 Pound Lots)

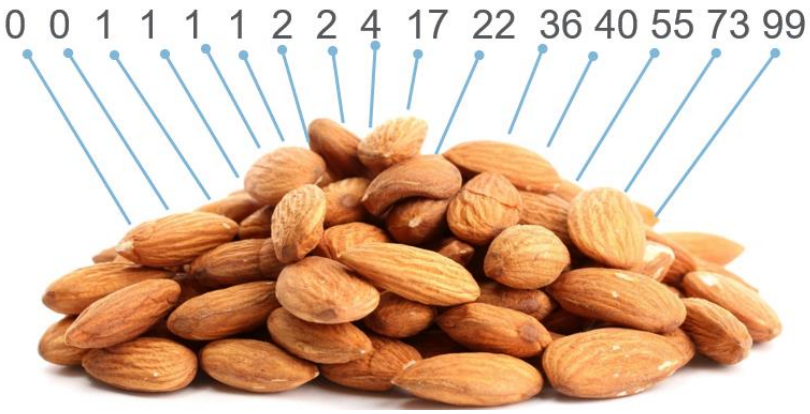
Grade Category	Weight (%)	Aflatoxin (%)
High Quality	83.7	3.2
Mechanical Damage (Chip/Scratch)	7.4	7.9
Insect Damage	7.2	76.3
Other defects (i.e.. Gummy/Shrivel)	1.5	11.8
Mold	0.2	0.8
Total	100.0	100.0

Whitaker et al., 2010. Correlation between aflatoxin contamination and various USDA grade categories of shelled almonds. J. AOAC Int. 93(3):943-947

Post Harvest Control – Sorting to Remove Serious Damage

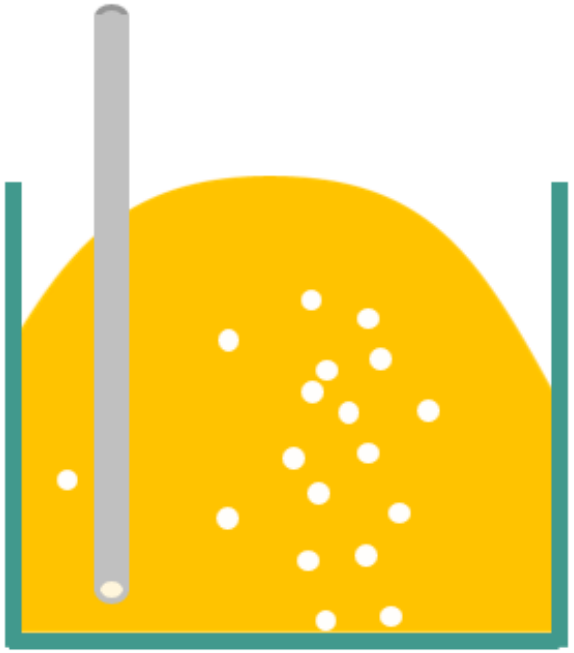


Testing for Aflatoxin in a Lot

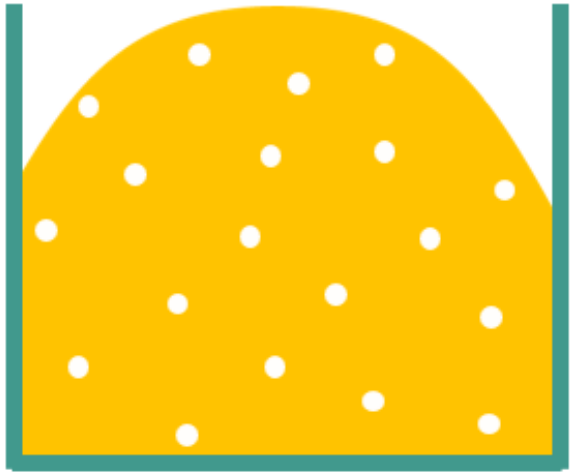


Aflatoxin distribution in a lot is typically non-homogenous

Size of sample and how it is drawn will impact variability



NON-HOMOGENEOUS

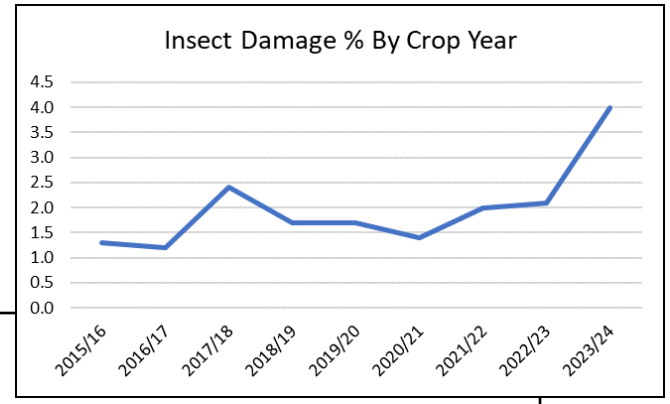


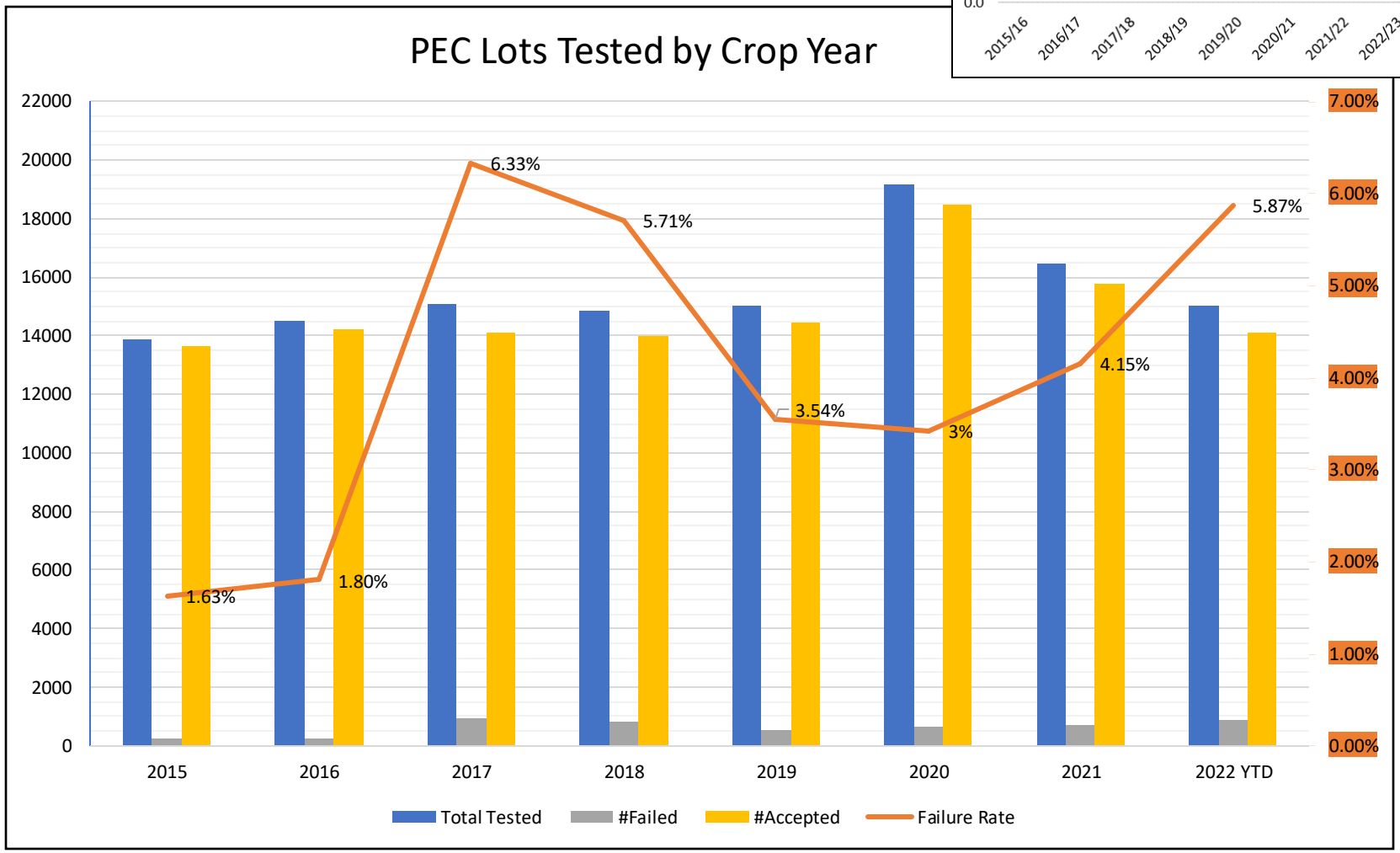
HOMOGENEOUS

Aflatoxin is not typically distributed uniformly throughout the lot

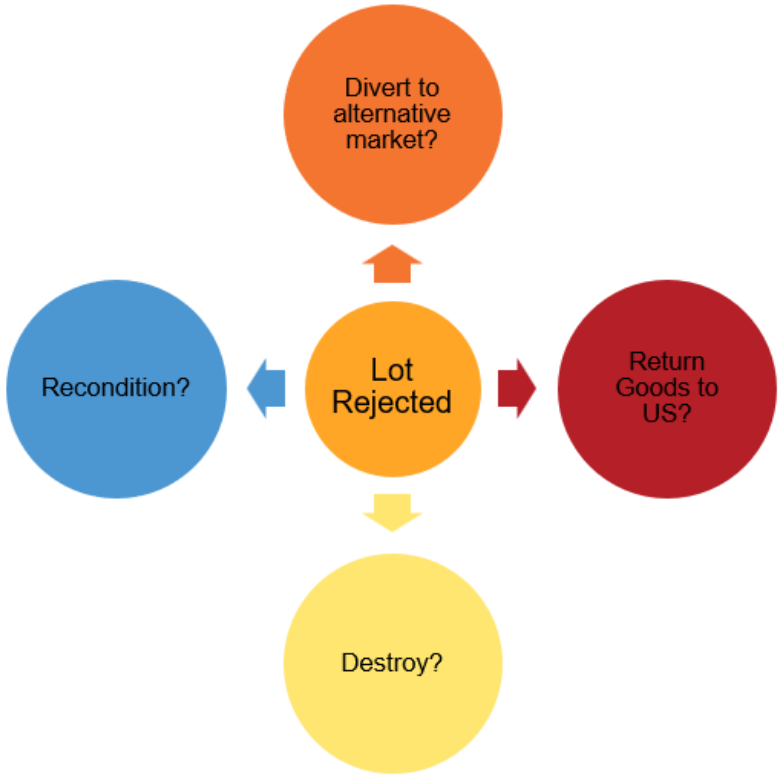
Handlers Devote Significant Resources Towards Testing for Aflatoxin

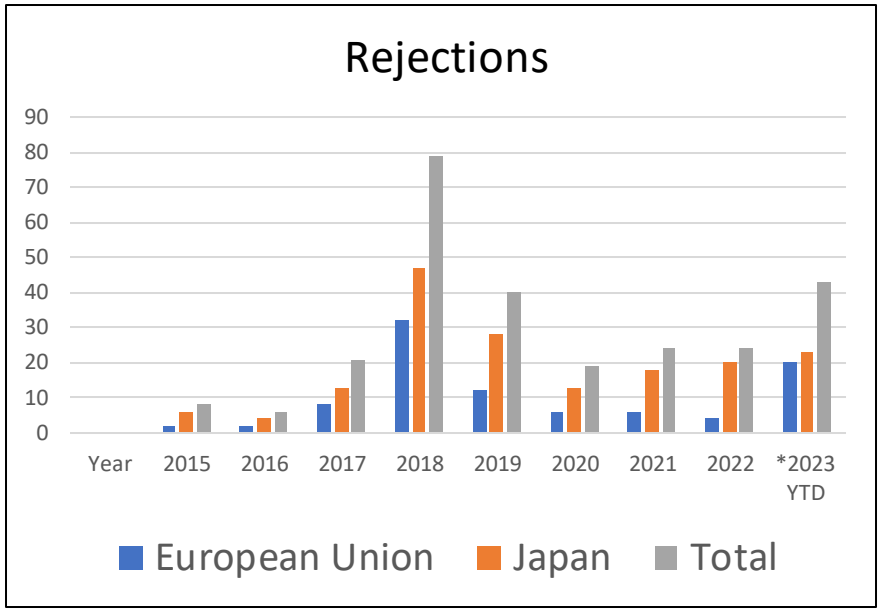
20 Kg Sample made up of 22-Incremental Samples for EU PEC Program

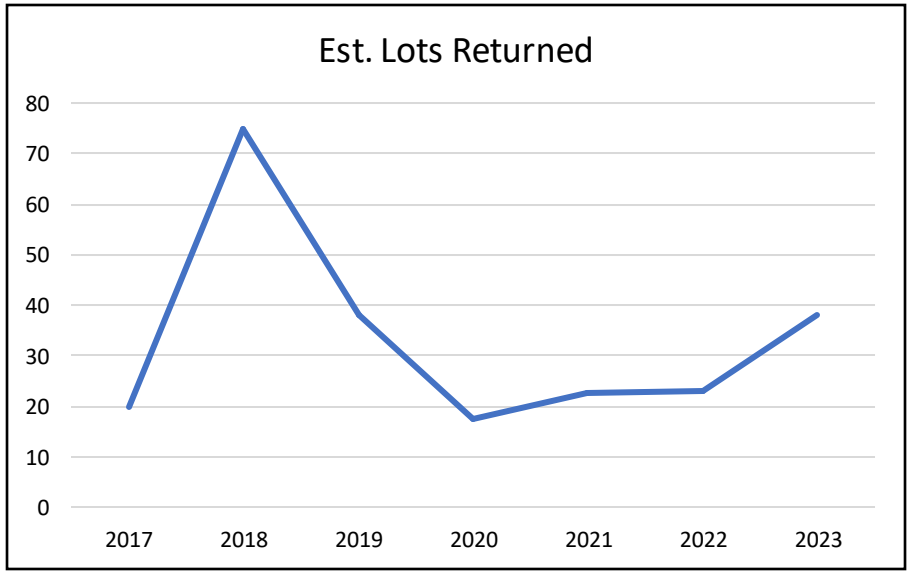




Dealing with a Failed Lot in a Foreign Country







All are costly / timely propositions– Most come back to US.

Bringing the Goods Back to the U.S.

1. Get the product back onto US soil
2. Prepare & Submit a reconditioning plan
   - Only required if Detention Notice is received by FDA
3. Reconditioning – Carrying out the Plan

Note: If aflatoxin rejection >20PPB in foreign port expect and prepare for FDA detention notice "Notice of FDA Action" upon return


california almonds
Almond Board of California
Thank you