

Control of Codling Moth in Pears Using Granulosis Virus

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Lake, Mendocino, Sacramento, Sutter-Yuba and El Dorado Counties

Treatments

Conventional (9 Orchards):

- Granulosis virus + normal or reduced standard program
- Standard grower program (various with or without MD)
- MD alone or untreated controls (small plots)

Organic (5 Orchards):

- Granulosis virus + standard program
- Standard Program (MD, Surround, Oil, Entrust)
- MD alone (no puffers)
- NO UNTREATED CONTROLS

Design

- Demonstration (IR-4); one trial replicated
- 5 acre treatment areas, grower-applied (Cyd-X, Certis USA)
- Granulosis Virus applied @ 3oz/acre
 - Most orchards 6x, 2x per hatch
 - One organic orchard every other row every other week through CM season
- No added sticker (e.g. NuFilm 17) per Certis
- Analysis = GLC Proc, SAS; $p=0.05$; conventional and organic separate data transformed prior to analysis means; separated by LSD

Data Collection and Results

- Flights (1XL,1XH,10XH(MD),DA)
- 1st generation – tree (%/1000) - NS
ground (%/500) – NS
- 2nd generation – pre-harvest tree (%/2000) – NS
- 2nd/3rd generation - post-harvest tree (%/300)
 - Conventional – NS
 - Organic – p=0.03

2005 CM Granulosis Virus (GV) Demonstration Trial

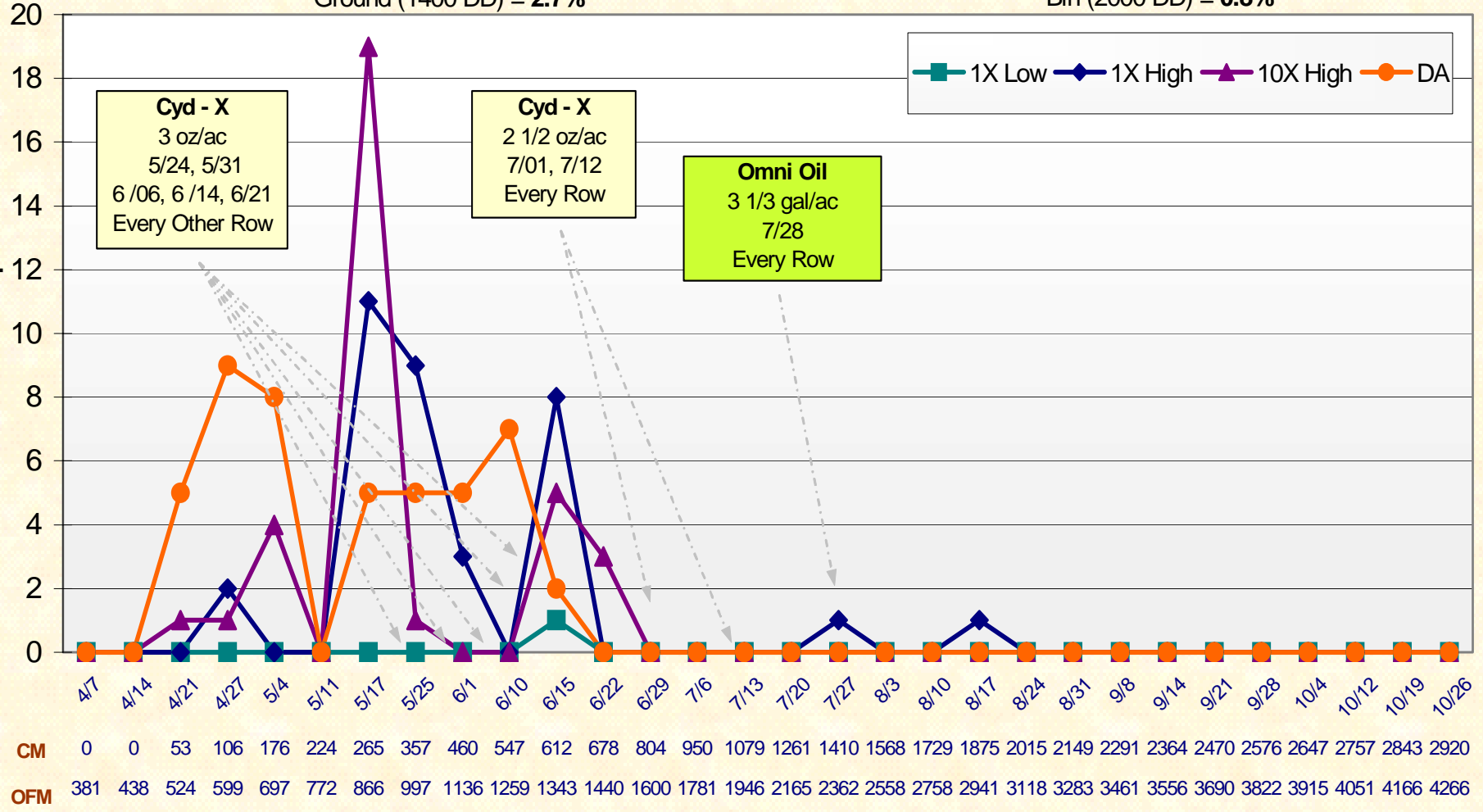
Average Codling Moth Trap Catches

Potter Valley Orchard # 1, Mendocino County

GV Treatment

CM Damage: 1st Generation (1000 DD) = **0.1%**,
Ground (1400 DD) = **2.7%**

Preharvest (1700 DD) = **0.0%**, Post Harvest (2570 DD) = **1.0%**
Bin (2000 DD) = **0.8%**



CM	0	0	53	106	176	224	265	357	460	547	612	678	804	950	1079	1261	1410	1568	1729	1875	2015	2149	2291	2364	2470	2576	2647	2757	2843	2920
OFM	381	438	524	599	697	772	866	997	1136	1259	1343	1440	1600	1781	1946	2165	2362	2558	2758	2941	3118	3283	3461	3556	3690	3822	3915	4051	4166	4266

CM Biofix: 4/16/05

Date / Degree Days

2005 CM Granulosis Virus (GV) Demonstration Trial

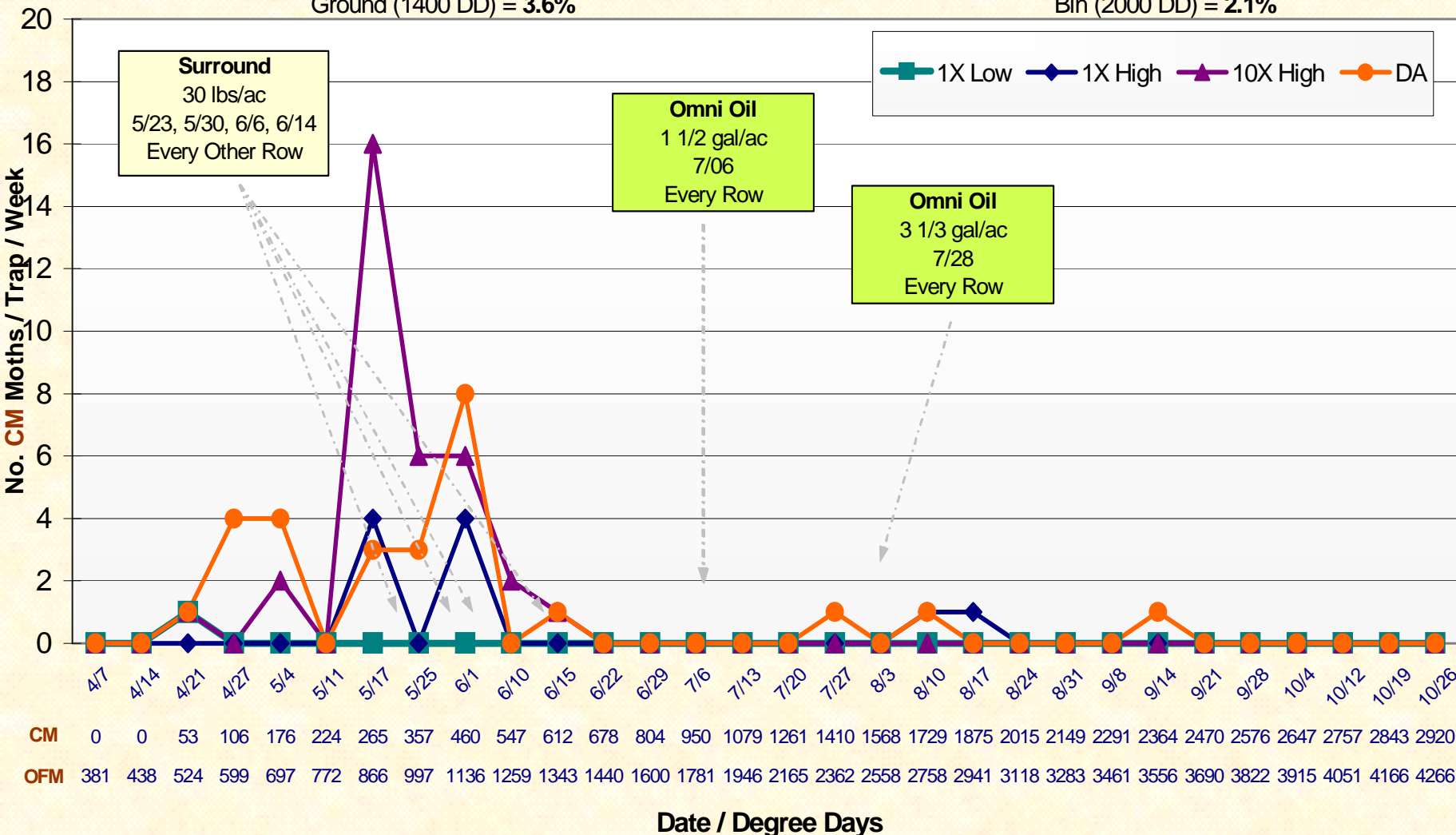
Average Codling Moth Trap Catches

Potter Valley Orchard # 1, Mendocino County

Grower Standard Treatment

CM Damage: 1st Generation (1000 DD) = **0.1%**,
Ground (1400 DD) = **3.6%**

Preharvest (1700 DD) = **0.0%**, Post Harvest (2570 DD) = **3.3%**
Bin (2000 DD) = **2.1%**



CM	0	0	53	106	176	224	265	357	460	547	612	678	804	950	1079	1261	1410	1568	1729	1875	2015	2149	2291	2364	2470	2576	2647	2757	2843	2920
OFM	381	438	524	599	697	772	866	997	1136	1259	1343	1440	1600	1781	1946	2165	2362	2558	2758	2941	3118	3283	3461	3556	3690	3822	3915	4051	4166	4266

CM Biofix: 4/16/05

2005 CM Granulosis Virus (GV) Demonstration Trial

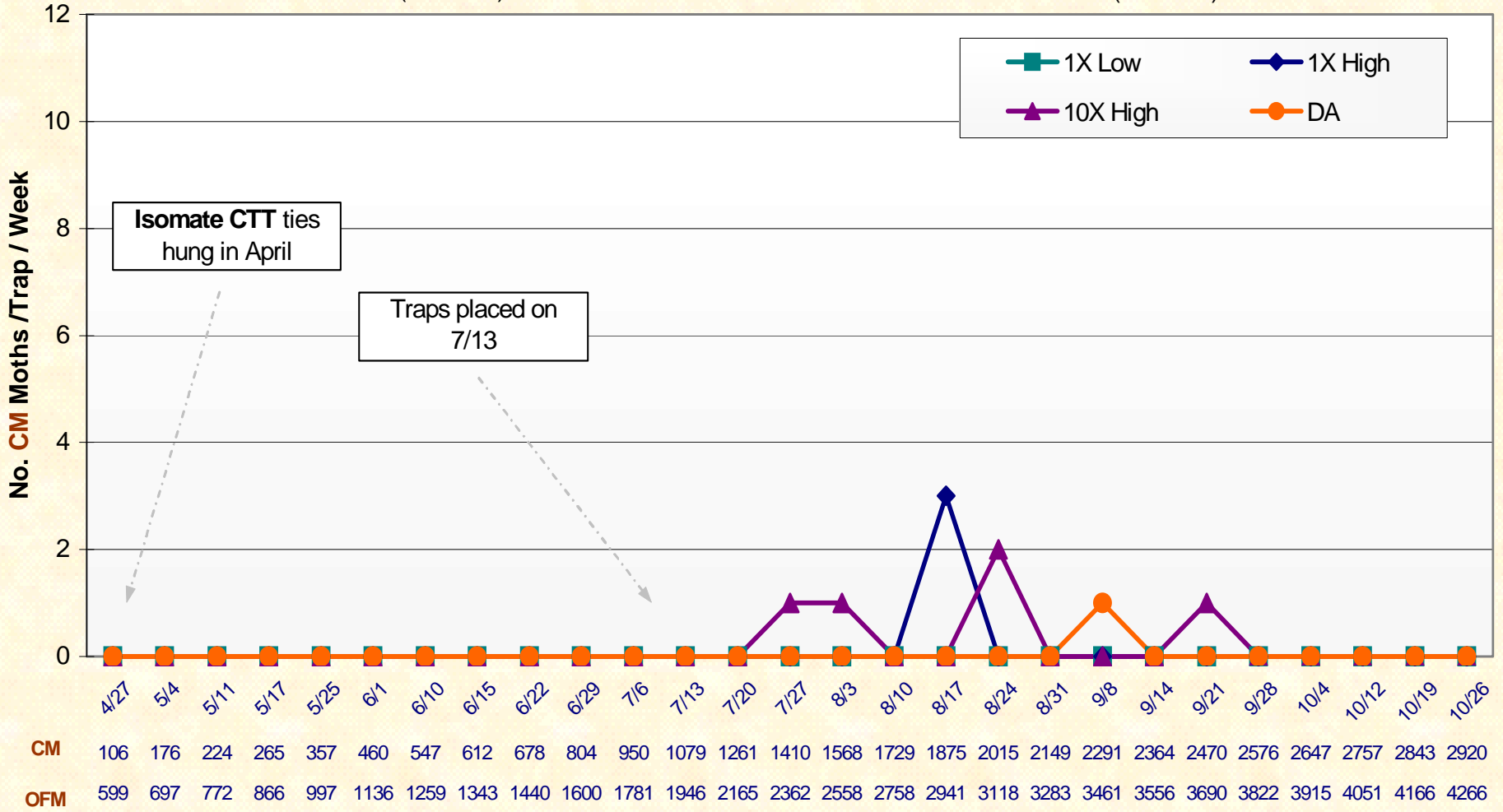
Average Codling Moth Trap Catches

Potter Valley Orchard # 1, Mendocino County

Mating Disruption Only Treatment

CM Damage: 1st Generation (1000 DD) = **0.0%**,
Ground (1400 DD) = **5.7%**

Preharvest (1700 DD) = **0.3%**, Post Harvest (2570 DD) = **1.5%**
Bin (2000 DD) = **2.8%**



CM	106	176	224	265	357	460	547	612	678	804	950	1079	1261	1410	1568	1729	1875	2015	2149	2291	2364	2470	2576	2647	2757	2843	2920
OFM	599	697	772	866	997	1136	1259	1343	1440	1600	1781	1946	2165	2362	2558	2758	2941	3118	3283	3461	3556	3690	3822	3915	4051	4166	4266

CM Biofix: 4/16/05

Date / Degree Days

2005 CM Granulosis Virus (GV) Demonstration Trial

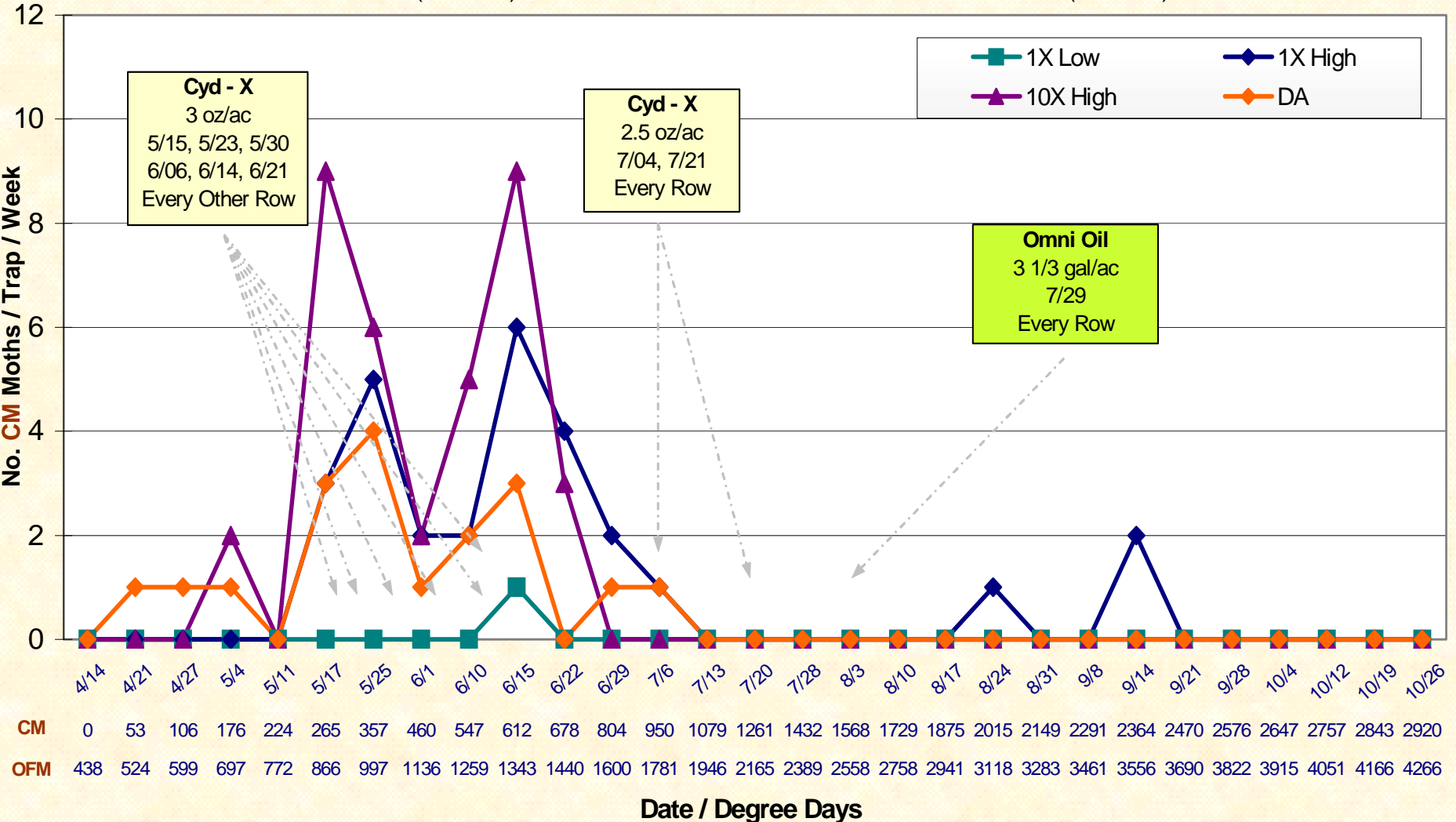
Average Codling Moth Trap Catches

Potter Valley Orchard # 2, Mendocino County

GV Treatment

CM Damage: 1st Generation (1000 DD) = **0.1%**,
Ground (1400 DD) = **7.8%**

Preharvest (1700 DD) = **0.3%**, Post Harvest (2570 DD) = **1.7%**
Bin (2000 DD) = **1.6%**



CM	0	53	106	176	224	265	357	460	547	612	678	804	950	1079	1261	1432	1568	1729	1875	2015	2149	2291	2364	2470	2576	2647	2757	2843	2920
OFM	438	524	599	697	772	866	997	1136	1259	1343	1440	1600	1781	1946	2165	2389	2558	2758	2941	3118	3283	3461	3556	3690	3822	3915	4051	4166	4266

CM Biofix: 4/16/05

2005 CM Granulosis Virus (GV) Demonstration Trial

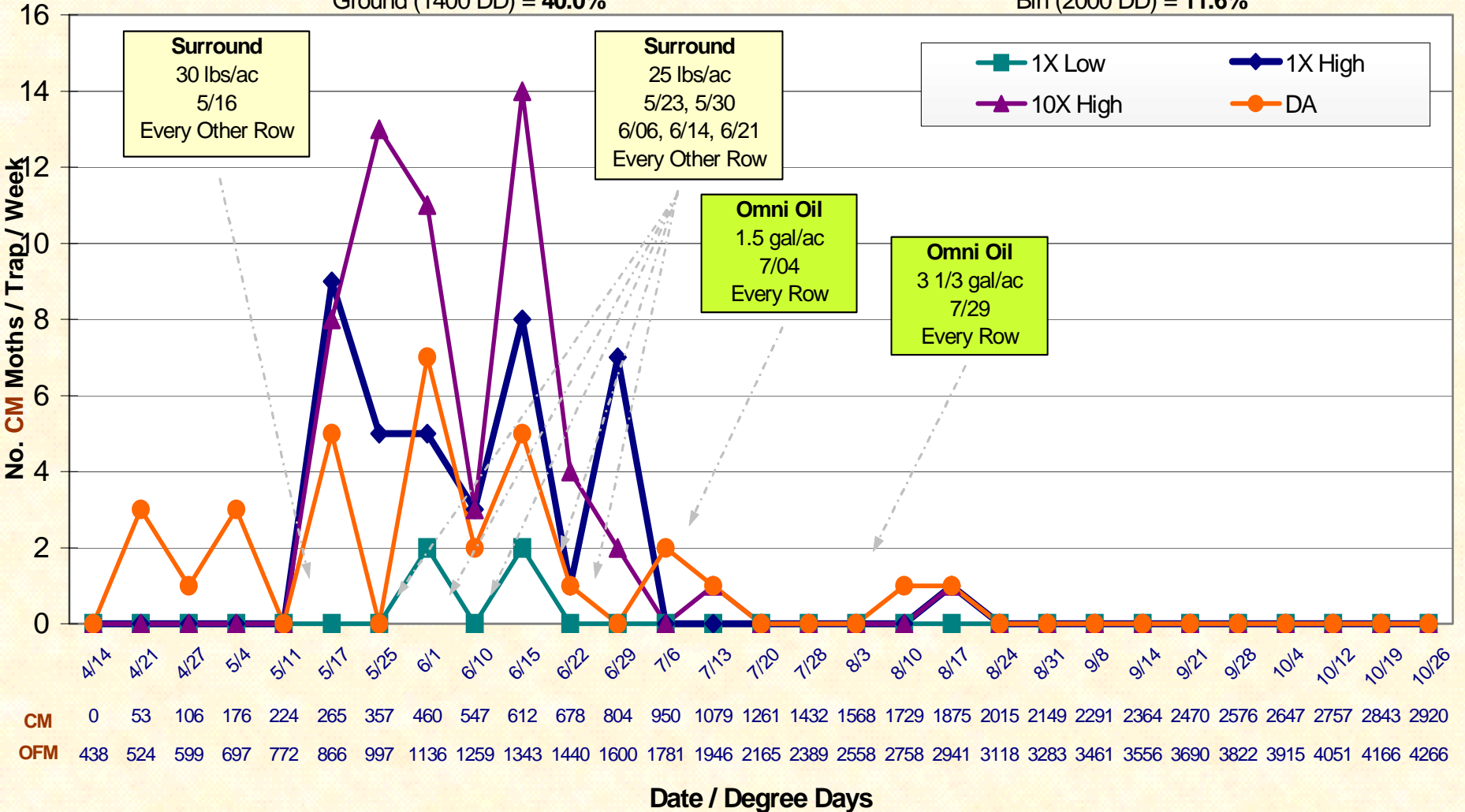
Average Codling Moth Trap Catches

Potter Valley Orchard # 2, Mendocino County

Grower Standard Treatment

CM Damage: 1st Generation (1000 DD) = **0.4%**,
Ground (1400 DD) = **40.0%**

Preharvest (1700 DD) = **7.8%**, Post Harvest (2570 DD) = **8.7%**
Bin (2000 DD) = **11.6%**



CM Biofix: 4/16/05

2005 CM Granulosis Virus (GV) Demonstration Trial

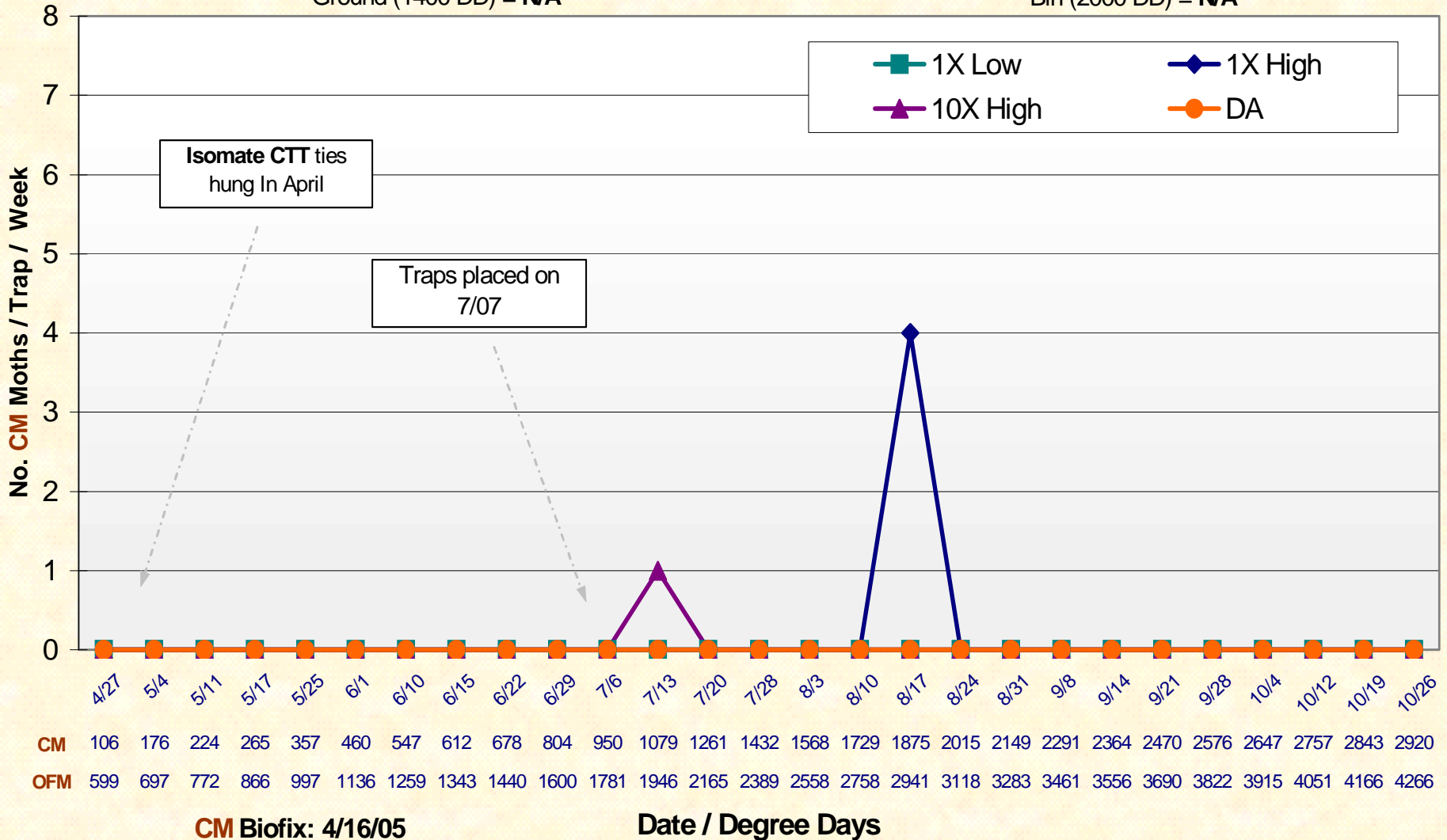
Average Codling Moth Trap Catches

Potter Valley Orchard # 2, Mendocino County

Mating Disruption Only Treatment

CM Damage: 1st Generation (1000 DD) = **29.6%**,
Ground (1400 DD) = **N/A**

Preharvest (1700 DD) = **12.9%**, Post Harvest (2570 DD) = **N/A**
Bin (2000 DD) = **N/A**



2005 CM Granulosis Virus (GV) Demonstration Trial

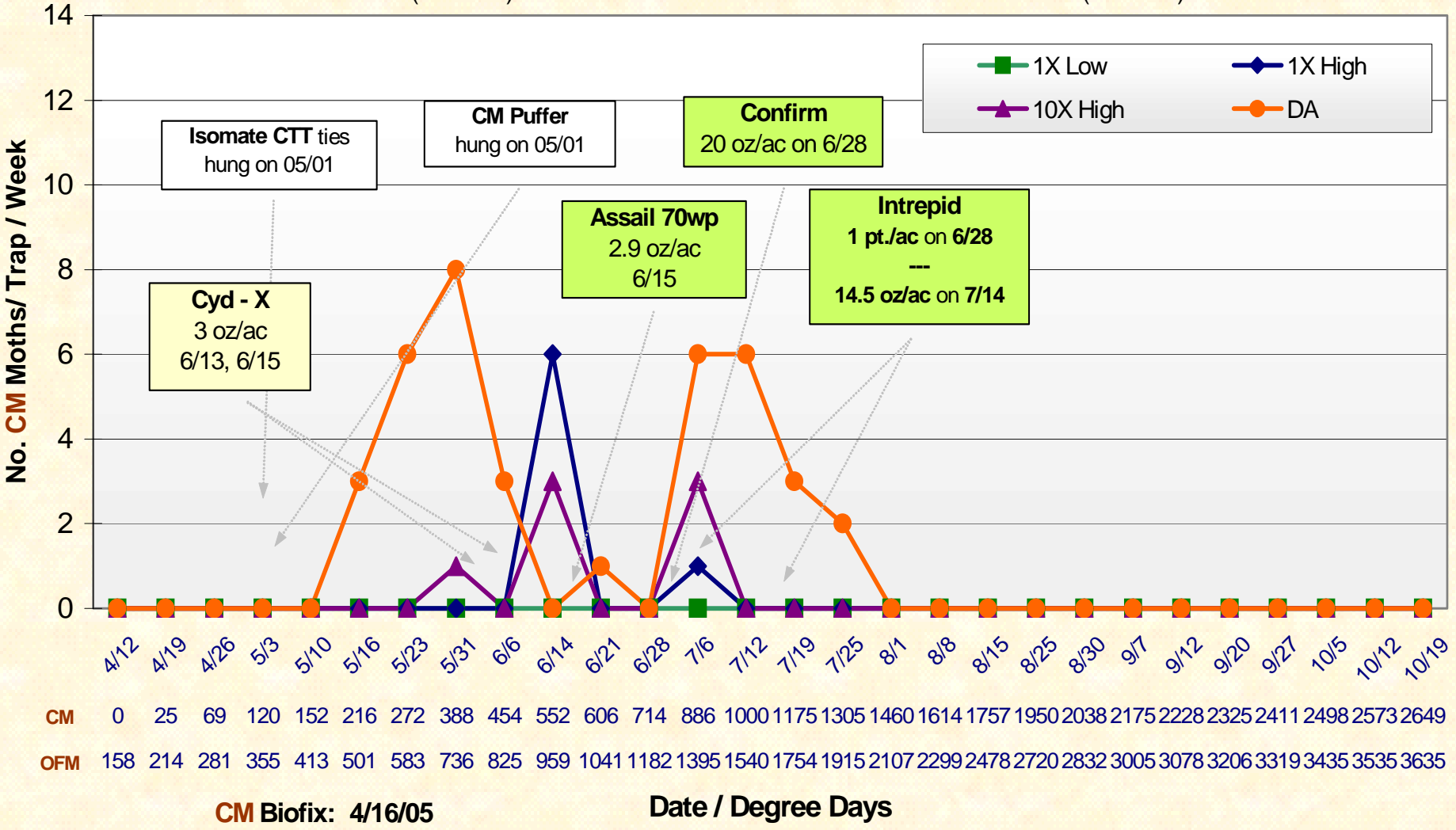
Average Codling Moth Trap Catches

Upper Lake Orchard, Lake County

GV Treatment

CM Damage: 1st Generation (940 DD) = **0.6%**,
Ground (1340 DD) = **0.4%**

Preharvest (1640 DD) = **0.3%**, Post Harvest (2420 DD) = **0.7%**
Bin (1900 DD) = **0.9%**



CM	0	25	69	120	152	216	272	388	454	552	606	714	886	1000	1175	1305	1460	1614	1757	1950	2038	2175	2228	2325	2411	2498	2573	2649
OFM	158	214	281	355	413	501	583	736	825	959	1041	1182	1395	1540	1754	1915	2107	2299	2478	2720	2832	3005	3078	3206	3319	3435	3535	3635

CM Biofix: 4/16/05

Date / Degree Days

2005 CM Granulosis Virus (GV) Demonstration Trial

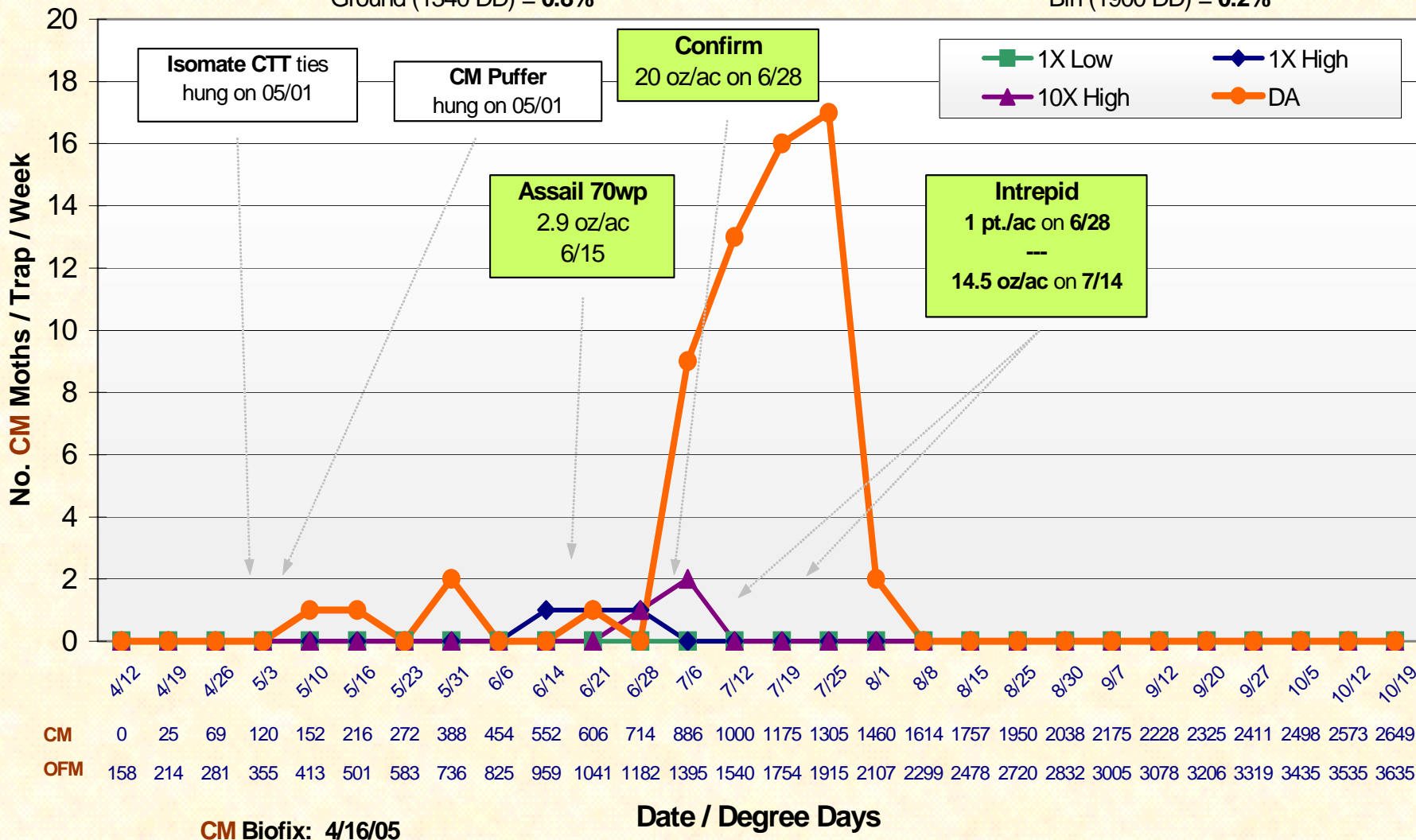
Average Codling Moth Trap Catches

Upper Lake Orchard, Lake County

Grower Standard Treatment

CM Damage: 1st Generation (940 DD) = **0.2%**,
Ground (1340 DD) = **0.8%**

Preharvest (1640 DD) = **0.5%**, Post Harvest (2420 DD) = **2.0%**
Bin (1900 DD) = **0.2%**



CM Biofix: 4/16/05

2005 CM Granulosis Virus (GV) Demonstration Trial

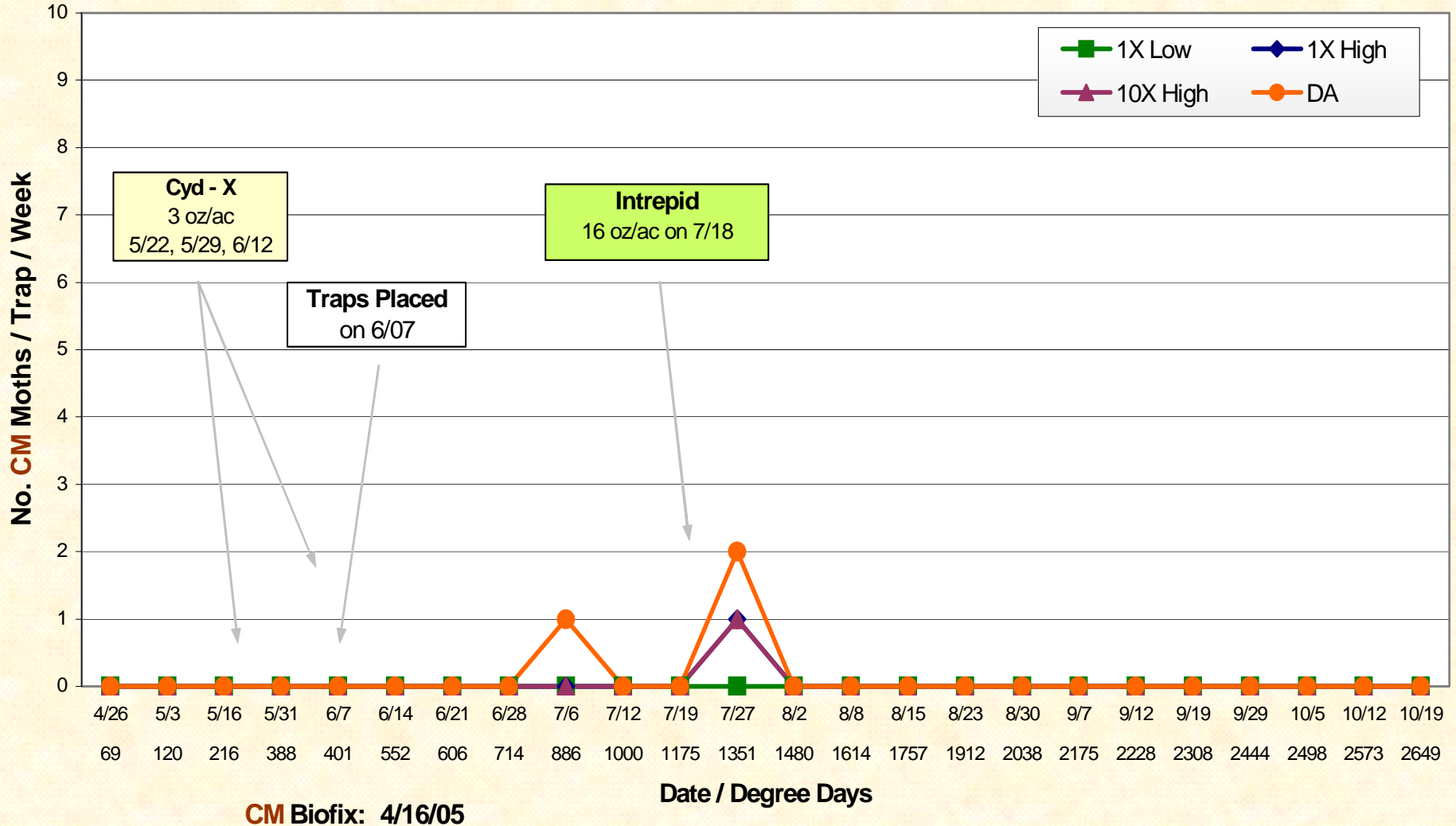
Average Codling Moth Trap Catches

Lakeport Orchard, Lake County

GV Treatment - North Section

CM Damage: 1st Generation (940 DD) = **0.0%**,
Ground (1340 DD) = **0.0%**

Preharvest (1640 DD) = **0.1%**, Post Harvest (2420 DD) = **0.0%**
Bin (1900 DD) = **2.9%**



2005 CM Granulosis Virus (GV) Demonstration Trial

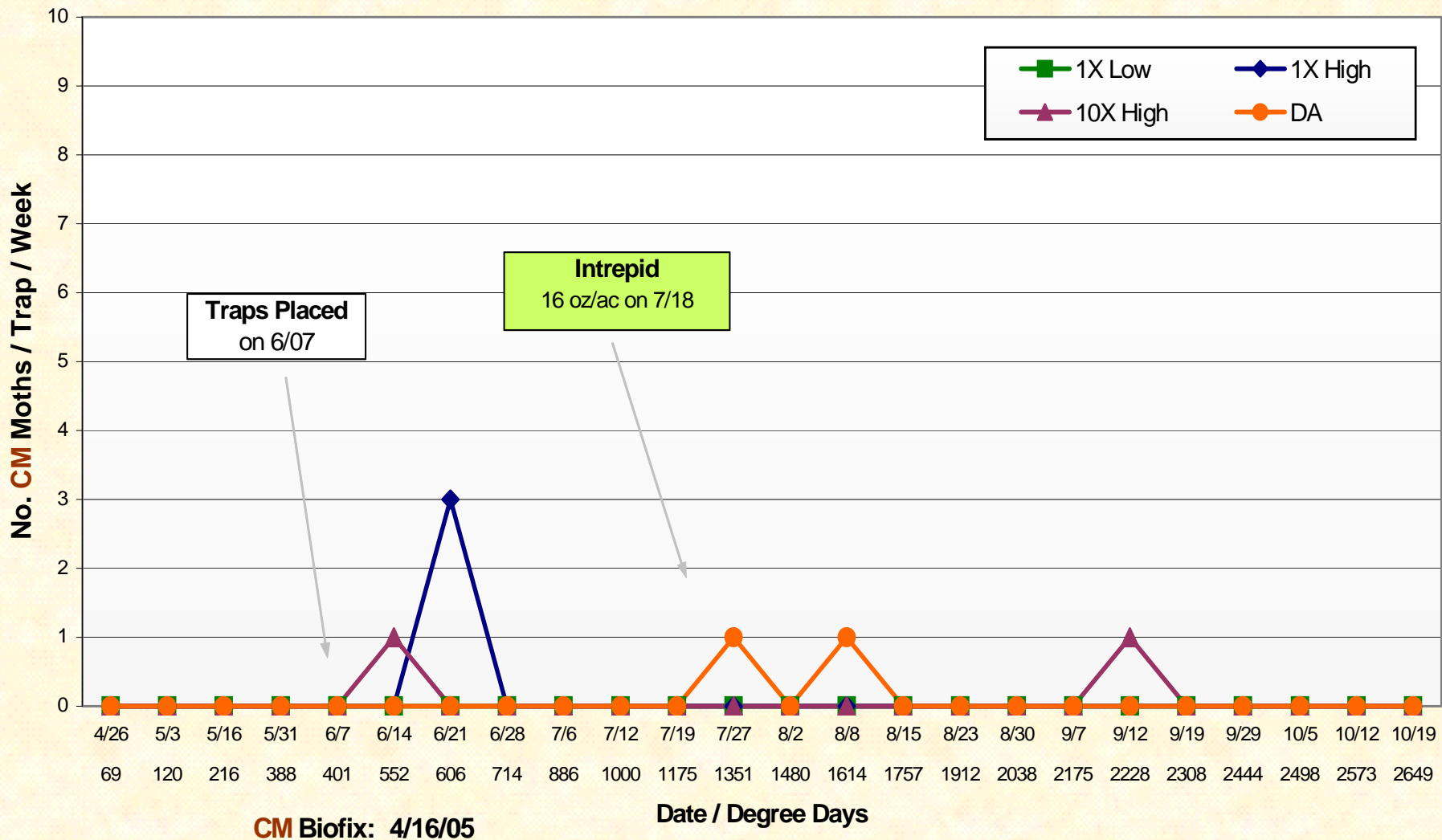
Average Codling Moth Trap Catches

Lakeport Orchard, Lake County

Grower Standard Treatment - North Section

CM Damage: 1st Generation (940 DD) = **0.0%**,
Ground (1340 DD) = **0.0%**

Preharvest (1640 DD) = **0.2%**, Post Harvest (2420 DD) = **10.3%**
Bin (1900 DD) = **11.2%**



2005 CM Granulosis Virus (GV) Demonstration Trial

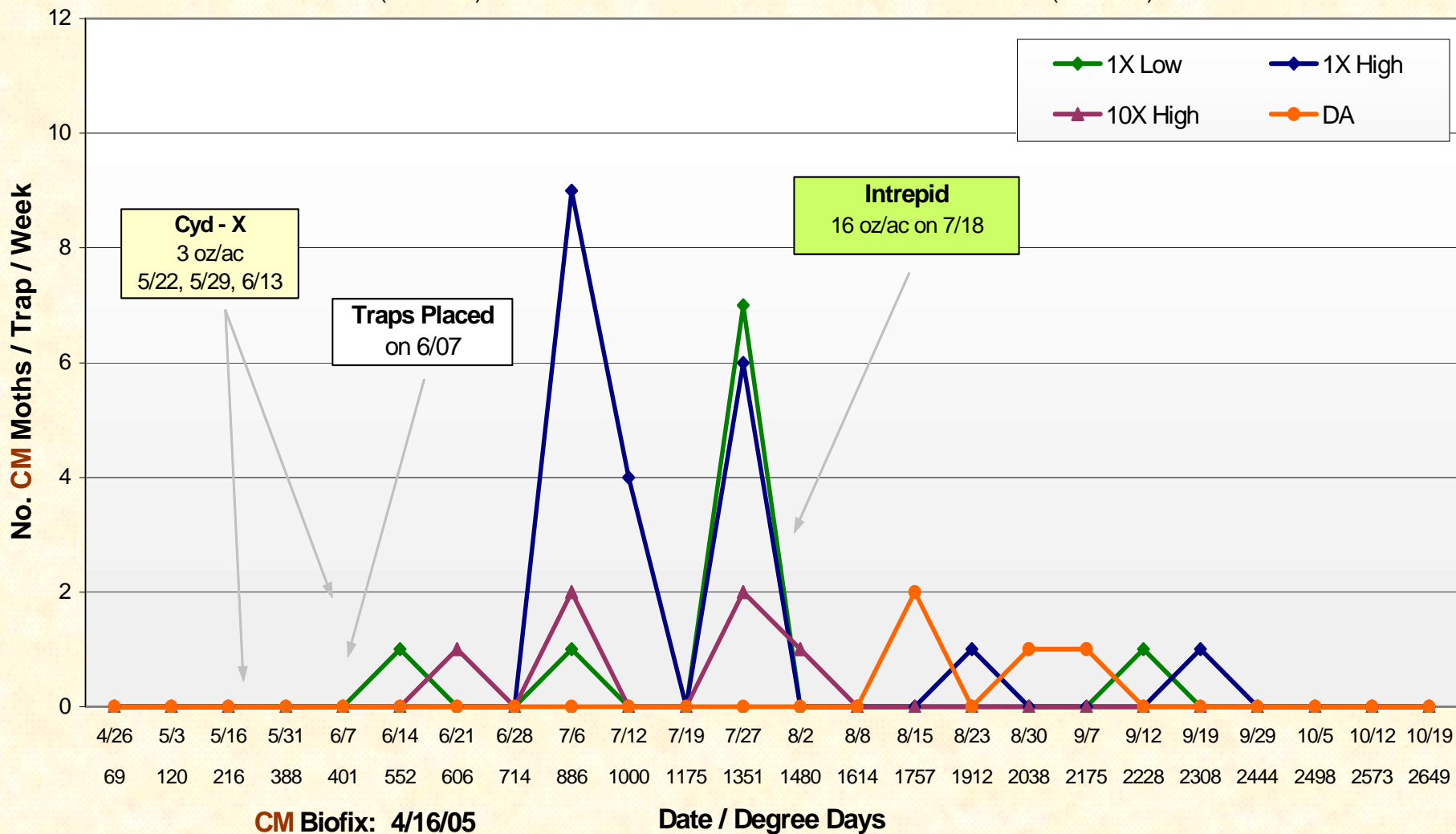
Average Codling Moth Trap Catches

Lakeport Orchard, Lake County

GV Treatment - South Section

CM Damage: 1st Generation (940 DD) = **0.0%**,
Ground (1340 DD) = **0.0%**

Preharvest (1640 DD) = **0.6%**, Post Harvest (2420 DD) = **0.0%**
Bin (1900 DD) = **15.7%**



2005 CM Granulosis Virus (GV) Demonstration Trial

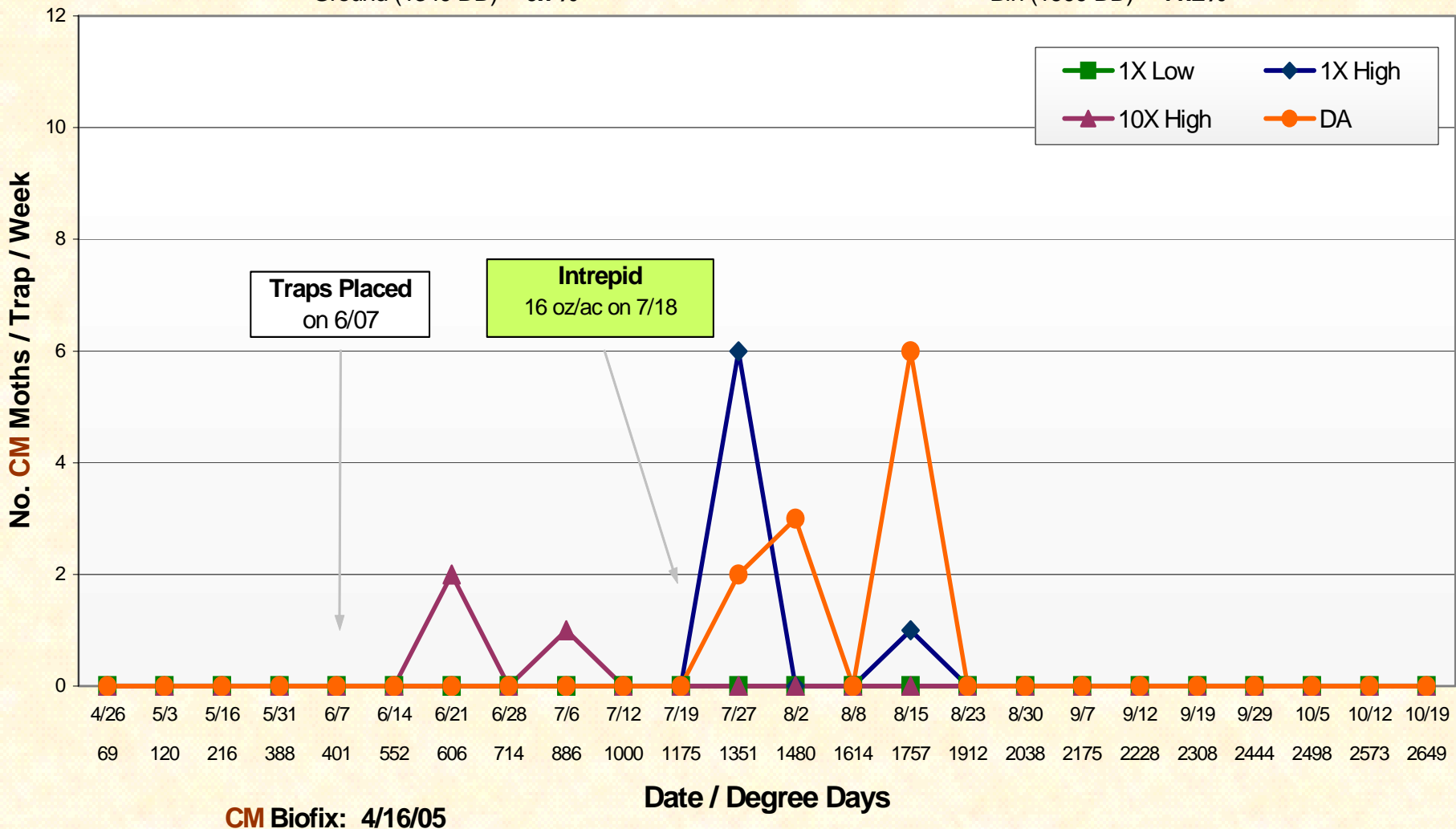
Average Codling Moth Trap Catches

Lakeport Orchard, Lake County

Grower Standard Treatment - South Section

CM Damage: 1st Generation (940 DD) = **0.0%**,
Ground (1340 DD) = **6.7%**

Preharvest (1640 DD) = **0.8%**, Post Harvest (2420 DD) = **10.3%**
Bin (1900 DD) = **11.2%**



Mean Percent Codling Moth Damage

1st Generation, June-July, 2005-Conventional

SITE	Tree(%/1000)			Ground (%/500)		
	GV	G	C	GV	G	C
El Dorado						
1	0.9	1.2	12.6	-----	-----	-----
2a	2.3	3.0	23.7	-----	-----	-----
2b	-----	7.7	10.4	-----	-----	-----
3	0.5	0.5	-----	-----	-----	-----
Lake						
1	0.6	0.2	-----	0.4	0.8	-----
2	0.0	0.0	3.7	0.0	0.0	4.3
3	0.0	0.0	4.2	0.0	6.7	0.0
Sutter-Yuba (MD also)						
1	0.0	0.0	0.0	-----	-----	-----
2	0.0	0.0	0.0	-----	-----	-----
3	0.0	0.0	0.0	-----	-----	-----
	A	A	B	-----	-----	-----

p<.0001

p=0.56

Mean Percent Codling Moth Damage

2nd generation, July-August 2005

Pre-Harvest Fruit Count - Conventional

Site	% Damage/2000		
	GV	G	C
El Dorado			
1	1.1	1.7	10.6
2a	1.7	3.1	---
3b	0.4	0.5	---
Lake			
1	0.2	0.5	---
2	0.1	0.2	0.9
3	0.6	0.8	1.6
Sutter-Yuba (MD also)			
1	0.2	0.0	0.0
2	0.1	0.4	0.4
3	0.1	1.1	0.7
	A	AB	B (MD=A)

ANOVA

P=0.13

Mean % Codling Moth Fruit Damage

2nd generation August-Sept 2005

Harvest Bin Count - Conventional

Lake County (% Damage/1000)			
Site	GV	G	C
1	0.9	0.2	0.1
2	2.9	11.2	6.5
3	11.0	No Fruit	8.0

P>.99

Mean Percent Codling Moth Damage

2nd, 3rd Generation, September 2005

Post-harvest Tree Fruit Count - Conventional

Site	% Damage/300		
	GV	G	C
Lake			
1 (w/MD)	0.7	2.0	----
2	0.0	10.3	13.2
3	No Fruit	----	----
Sutter-Yuba (w/MD)			
1	1.0	2.3	0.7
2	0.7	0.3	7.7
3	15.0	31.3	34.3

ANOVA

P=0.66

Mean Percent Codling Moth Fruit Damage

1st Generation, June-July 2005

Tree Fruit Count-Organic

	Tree (%/1000)			Ground (%/500)		
Site	GV	G	MD	GV	G	MD
Lake	0.5	0.3	0.2	1.0	4.6	15.0
Mendocino						
1	0.1	0.1	0.0	2.7	3.6	5.7
2	0.1	0.4	29.6	7.8	40.0	---
Sacramento						
1	1.7	5.0	---	14.4	33.2	---
2	0.0	0.1	0.2	---	---	---
ANOVA	p=.55			p=.42		

Mean Percent Codling Moth Fruit Damage

2nd generation, July-August 2005
Pre-harvest Tree Fruit Count Organic

	Damage (%/2000)		
Site	GV	G	MD alone
Lake	0.8	1.2	0.1
Mendocino			
1	0.0	0.0	0.3
2	0.3	7.7	12.9
Sacramento			
1	4.3	11.9	----
2	2.9	2.2	5.7
ANOVA	p=.62		

Mean Percent Codling Moth Fruit Damage
Late 1st - 2nd generation, August-Sept. 2005
Harvest Bin Count - Organic

	Damage (%/1000)		
Site	GV	G	MD alone
Mendocino			
1	0.8	2.1	2.2
2	1.6	11.6	48.9
ANOVA	p=x0.50		

Mean Percent Codling Moth Damage

2nd - 3rd generation, September 2005

Post-Harvest Tree Fruit Count - Organic

	Damage (%/2000)		
Site	GV	G	MD alone
Lake	2.7	5.3	0.0
Mendocino			
1	1.0	3.3	1.5
2	1.7	8.7	No Fruit
	A	B	A
ANOVA	p=.03		

Conclusions

- Orchard variability and varying grower standard regimes precluded significance
- Absolute damage % favored granulosis virus
- Differences among treatments cumulative
- Post-harvest damage indicates possible reduced emergence spring 2006 in granulosis virus treated areas.

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- Funding from Western Region IR-4 and Gerber Products Company
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THANK YOU!!

