

A background image of a coffee plant with green leaves and small white flowers. The text is overlaid on this image.

Beauveria bassiana GHA

Persistence in the Environment

Lisa Keith
March 2016

Topics

- Sampling Methods
- Persistence (Population Dynamics) & Efficacy (Destructive)
- Prediction Model
- Rate of Infestation (Non-destructive)
- Conclusions

Tracie, Steve & Sandy W, Nick, Ray, Robbie, Andrea, Suzanne

Persistence & Efficacy of *B. bassiana* GHA

- Potential for using the commercially available *B. bassiana* GHA strain as a control method for CBB in Hawaii
- Goal: optimize effectiveness and economics for farmers
- Determine how timing and frequency of commercial *Beauveria* applications effect persistence and efficacy
- Suppression sprays
- Strip pick
- Compare 2013 to 2015
- Effect on quality/harvest



Elevation:

A. 1800 ft

B. 1547 ft

C. 624 ft (shade)

Coffee Data

- Field plot maps/Strip pick
- Persistence: *Beauveria* GHA
 - Rate: 32 oz + 8 oz surfactant in 30 gal of water/acre
- Efficacy (Destructive method)
 - % AB, % AB Dead, % CD, % Infestation
- Efficacy (Non-destructive method)
 - % Infestation, % Beauveria
- Environmental
 - Temp, % RH, Leaf moisture, Rainfall, UV
- Quality/Harvest

Field & Lab Samples per Tree

Persistence

high



middle

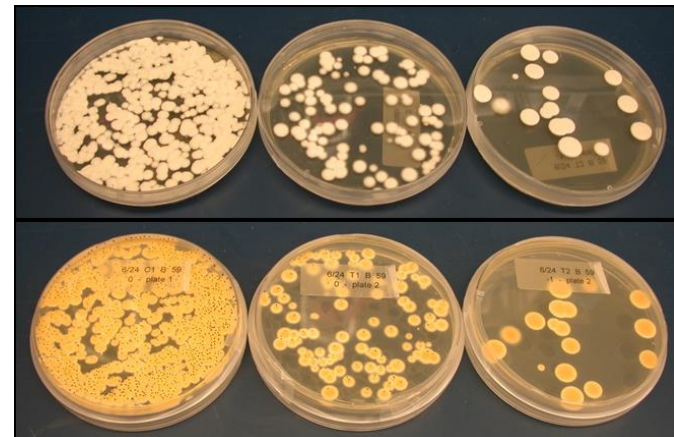
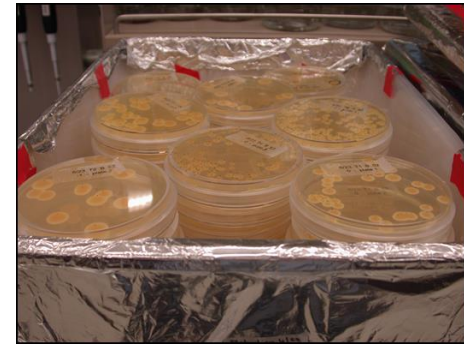


low



1 subsample = 15 random berries
10 trees

Weigh
Wash
Dilute
Plate
Count *Beauveria*



Field & Lab Samples per Tree

Efficacy: Destructive

high



middle



low



1 subsample = 10 green berries
4 trees



Dissect berries
Count beetles
AB alive/dead; CD; *Beauveria*

Field Samples per Tree

Efficacy: Nondestructive

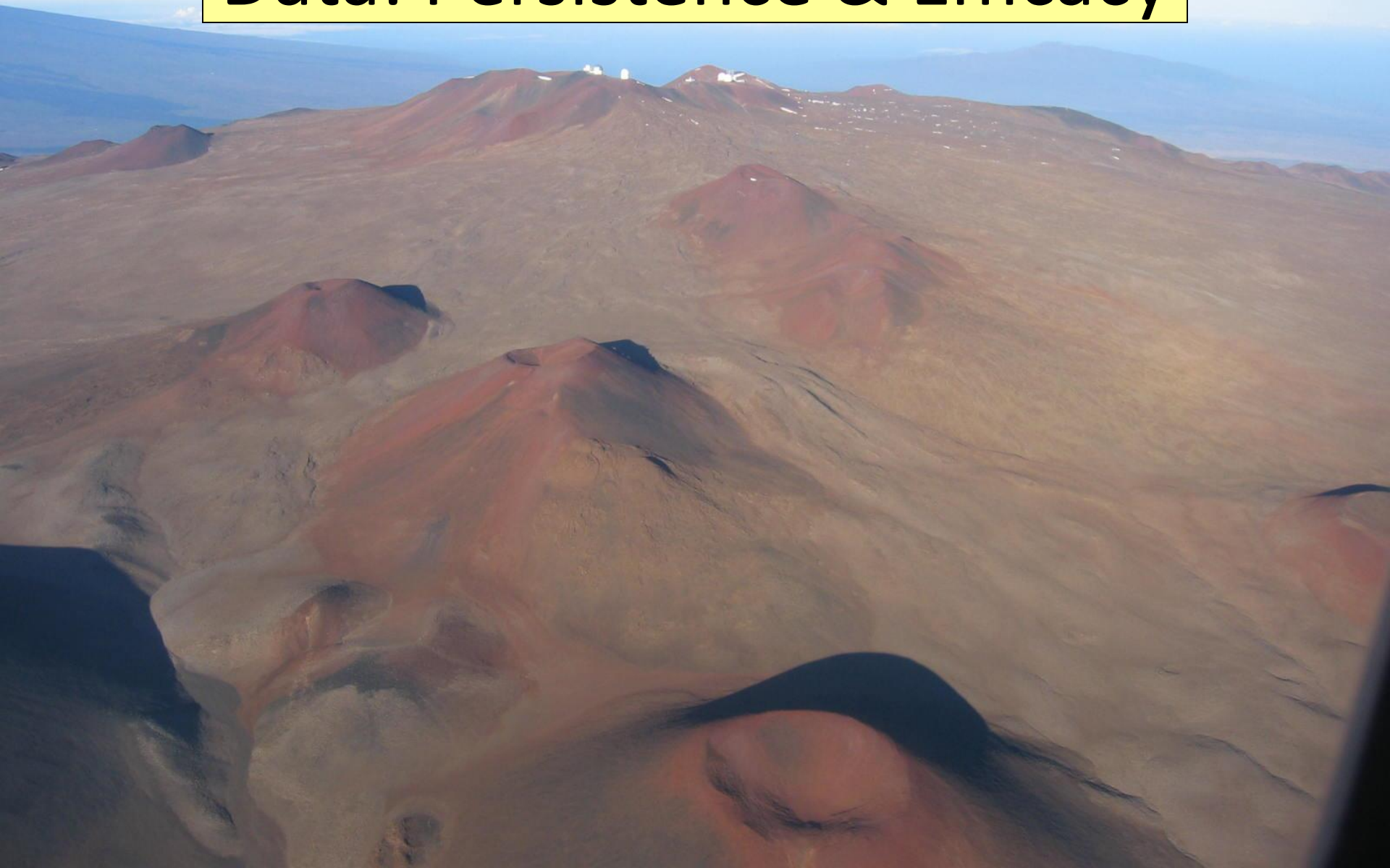


middle



1 subsample = branch
4 trees

Data: Persistence & Efficacy

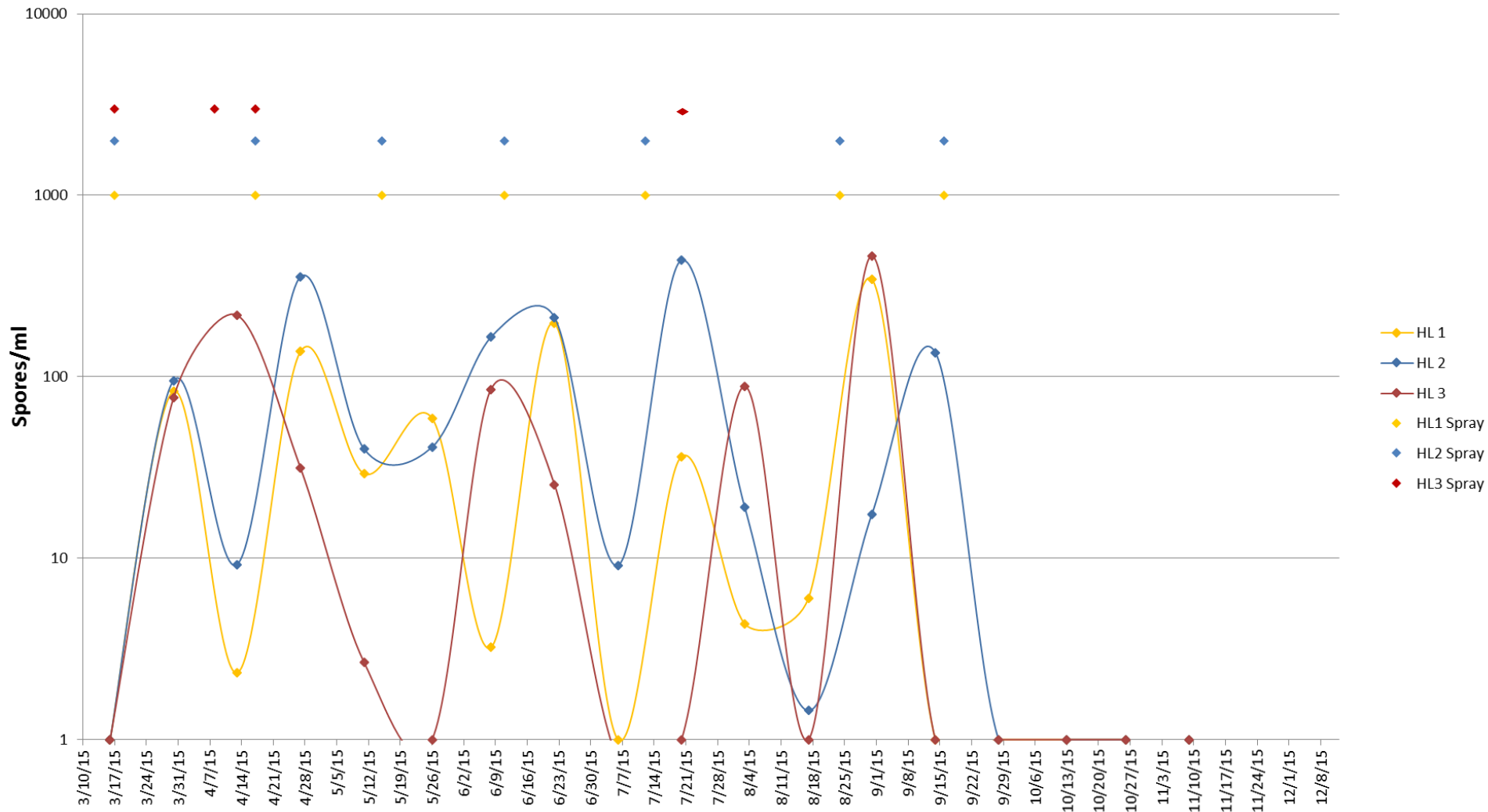


Data: Stripped, Honaunau Low, 2015

99,166 sq ft (2.2 acres); 12 people, 6 hours

	weight (g)				
HL1	Hole	No-Hole	Unsorted	Total	% Infested
			30710.9	30710.9	
Raisin	208.9	9.7		218.6	95.6
Red	12.7	0	-	12.7	100.0
Green	521.3	1284.4	-	1805.7	28.9
	weight (g)				
HL2	Hole	No-Hole	Unsorted	Total	% Infested
			20708.5	20708.5	
Raisin	943	99.19		1042.19	90.5
Red	15.6	0	-	15.6	100.0
Green	764.3	162.7	-	927	82.4
	weight (g)				
HL3	Hole	No-Hole	Unsorted	Total	% Infested
			15697.9	15697.9	
Raisin	3054	5.3		3059.3	99.8
Red	230.3	28.6	-	258.9	89.0
Green	428.1	896.1	-	1324.2	32.3

Persistence: Honaunau Low, 2015

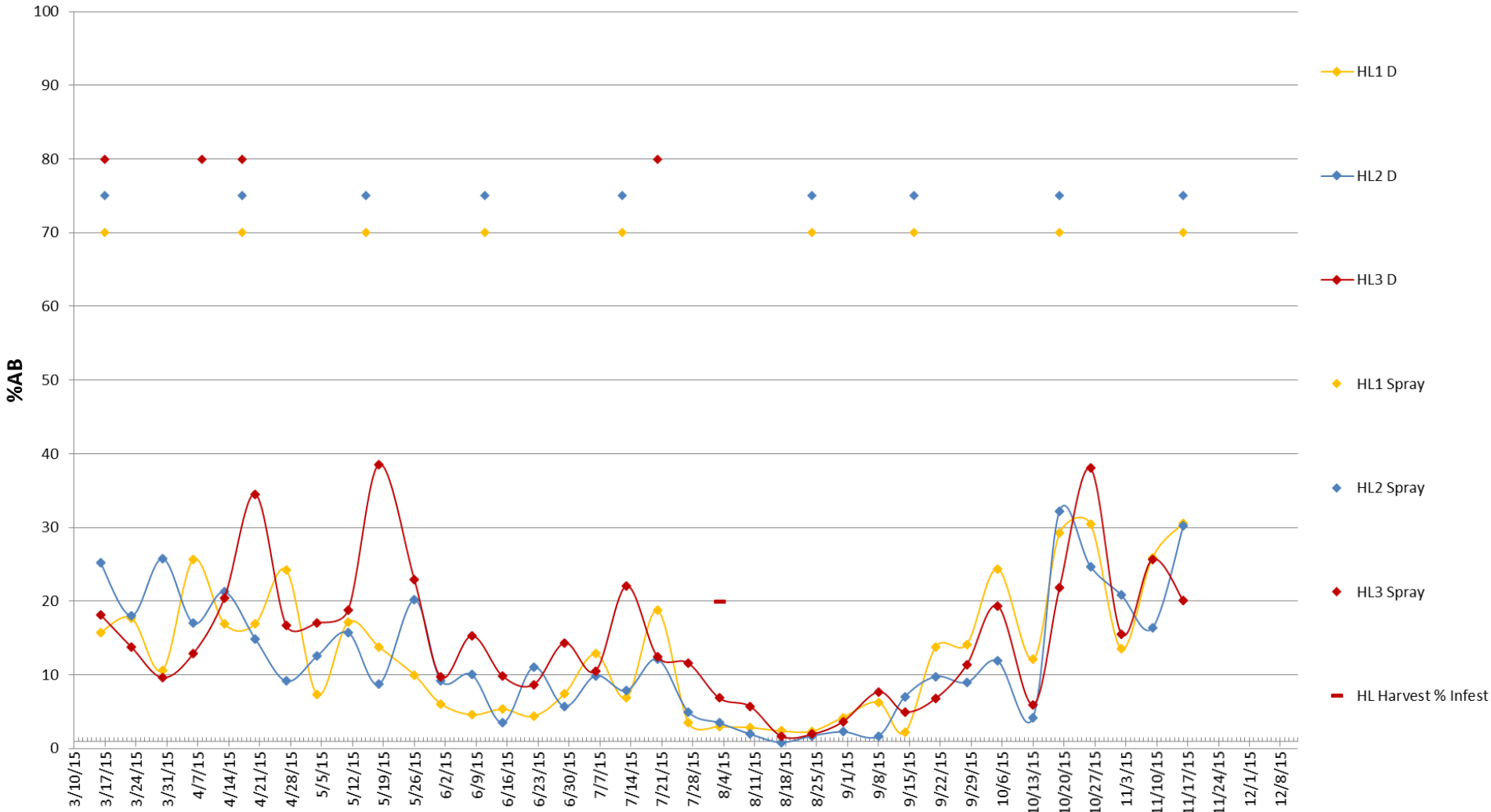


HL1, HL2: Monthly sprays
 HL3: Spray as needed

All strip picked



Efficacy: Destructive method, Honaunau Low, 2015



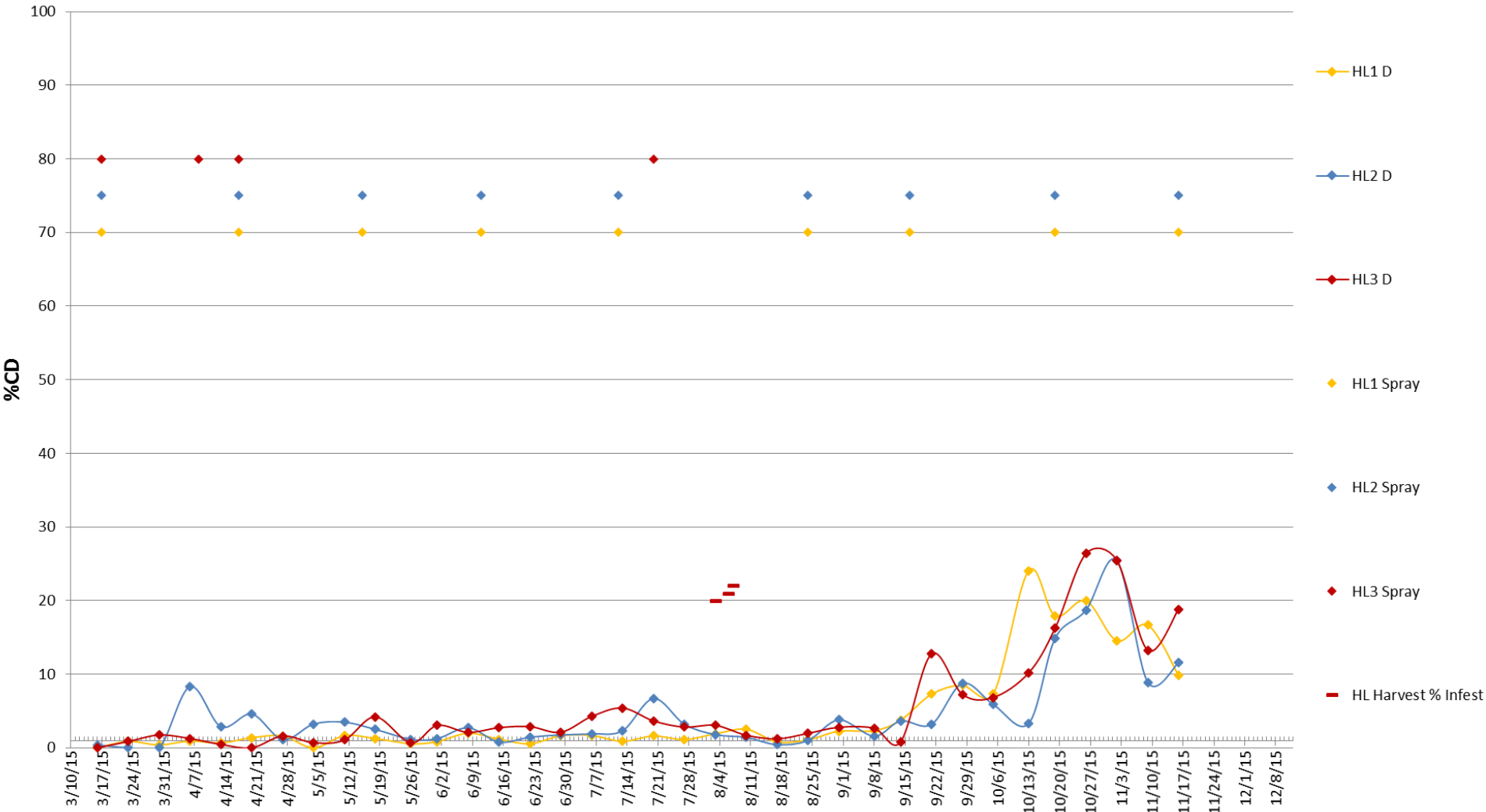
% AB

HL1, HL2: Monthly sprays
HL3: Spray as needed

All strip picked



Efficacy: Destructive method, Honaunau Low, 2015



% CD

HL1, HL2: Monthly sprays
HL3: Spray as needed

All strip picked



Data: Stripped, 2014

Honaunau Low 3
Stripped 2/20/14

14,619 sq ft (0.3 acres); 13 people, 2 hours

weight (g)

	Hole	No-Hole	Unsorted	Total	% Infested
Raisin	-	-	1424.4	1424.4	
Red	736.9	61.4	-	798.3	92.3
Green	1424.4	3036.2	-	4460.6	31.9

6683.3g
14.7lb

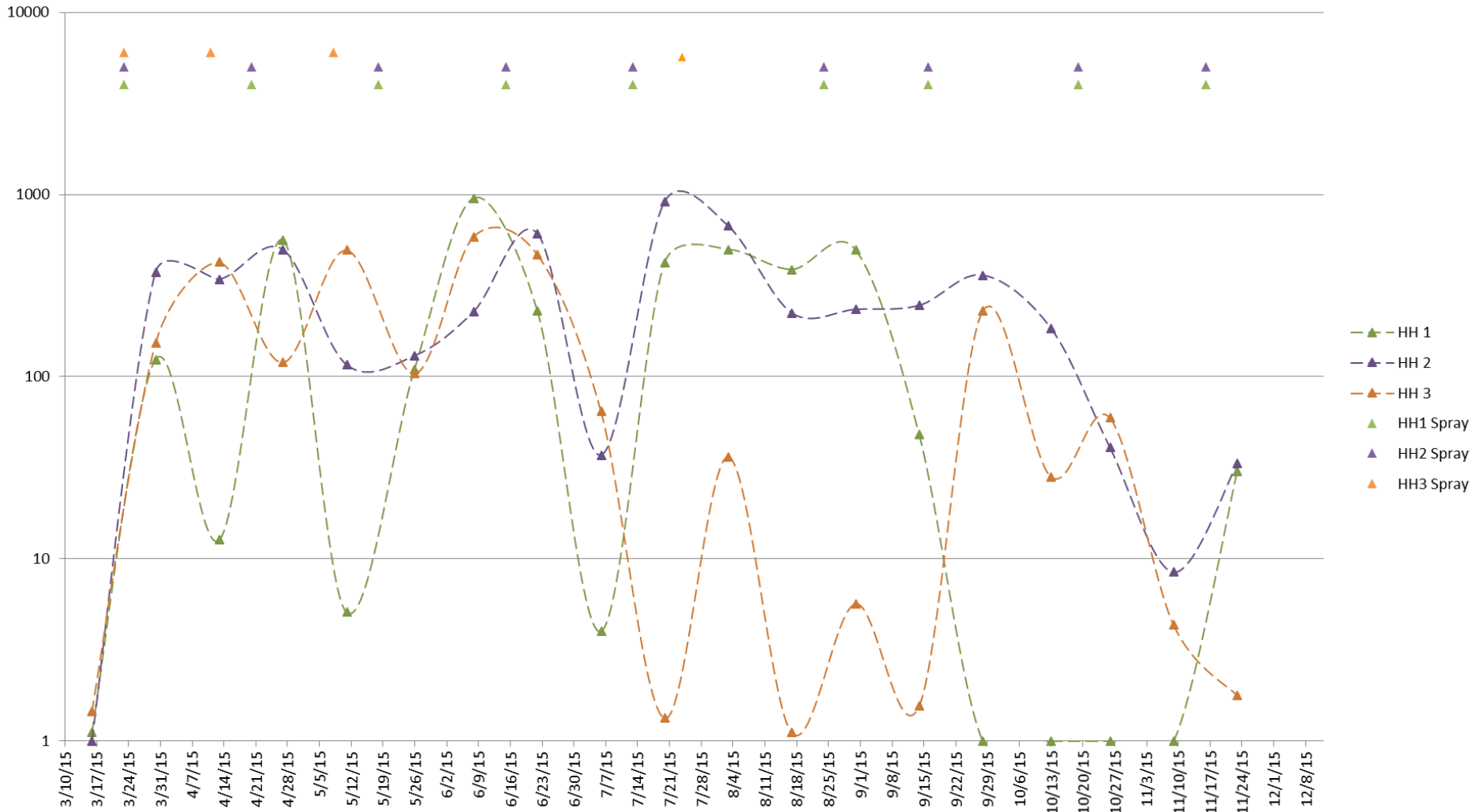
- HL1-HL3: 3 sprays total (no suppression sprays)
- HL3: strip picked
- Mid-year: 20-30% AB; 10-30% CD
- Start of harvest: 30-50% AB; 20-40% CD
- End of harvest: >50% AB; 60% CD

Data: Stripped, Honaunau High, 2015

22,080 sq ft (0.5 acres); 10 people, 6 hours

	weight (g)				
HH1	Hole	No-Hole	Unsorted	Total	% Infested
			17919.1	17919.1	
Raisin	145.9	22.3		168.2	86.7
Red	1565.4	608.5	-	2173.9	72.0
Green	936.8	864.2	-	1801	52.0
	weight (g)				
HH2	Hole	No-Hole	Unsorted	Total	% Infested
			14010.7	14010.7	
Raisin	257.6	48.1		305.7	84.3
Red	1815.9	708.4	-	2524.3	71.9
Green	709	612.8	-	1321.8	53.6
	weight (g)				
HH3	Hole	No-Hole	Unsorted	Total	% Infested
			34356.2	34356.2	
Raisin	69	163		232	29.7
Red	1172.9	76.4	-	1249.3	93.9
Green	804.2	1146.9	-	1951.1	41.2

Persistence: Honaunau High, 2015

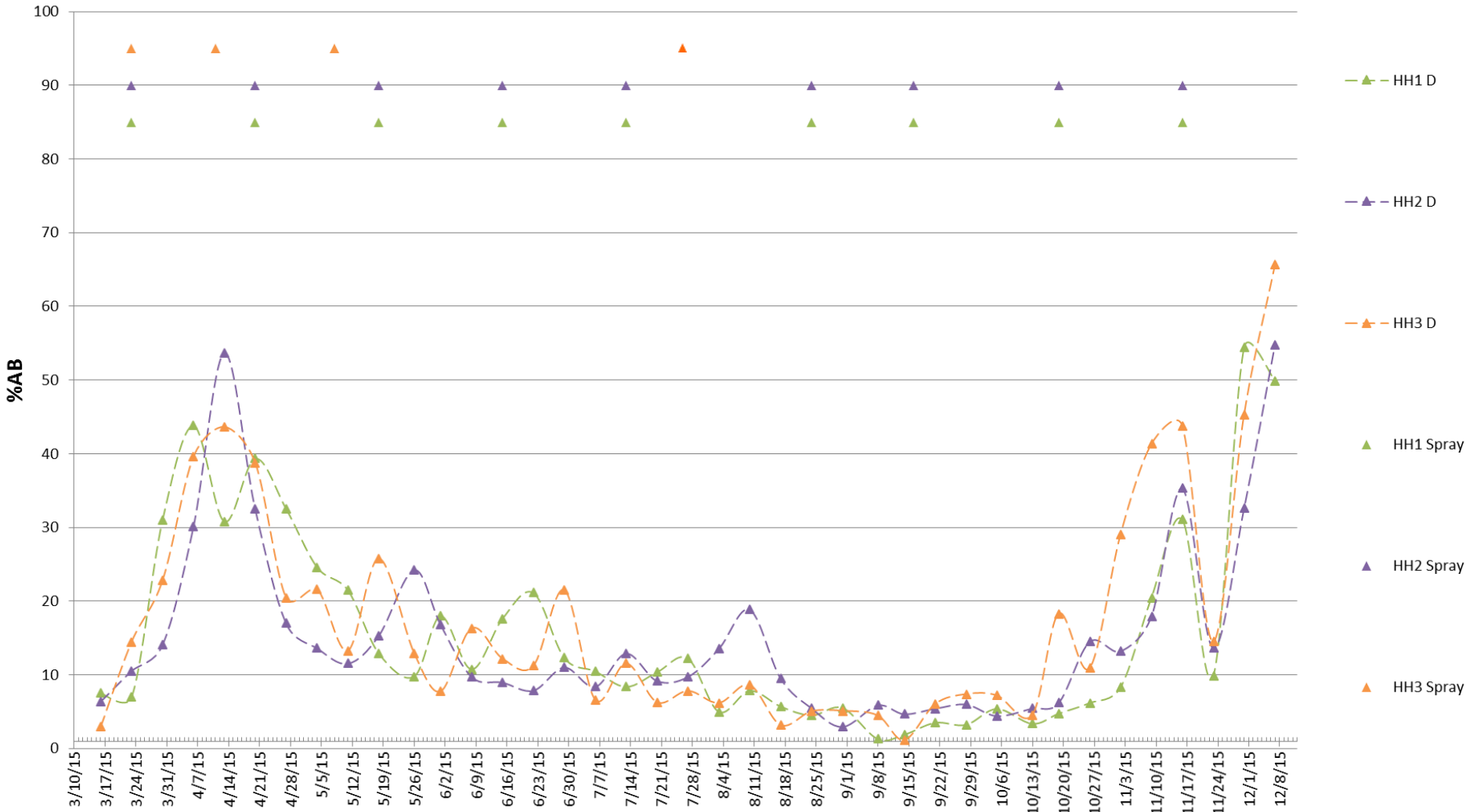


HH1, HH2: Monthly sprays
HH3: Spray as needed

All strip picked



Efficacy: Destructive method, Honaunau High, 2015



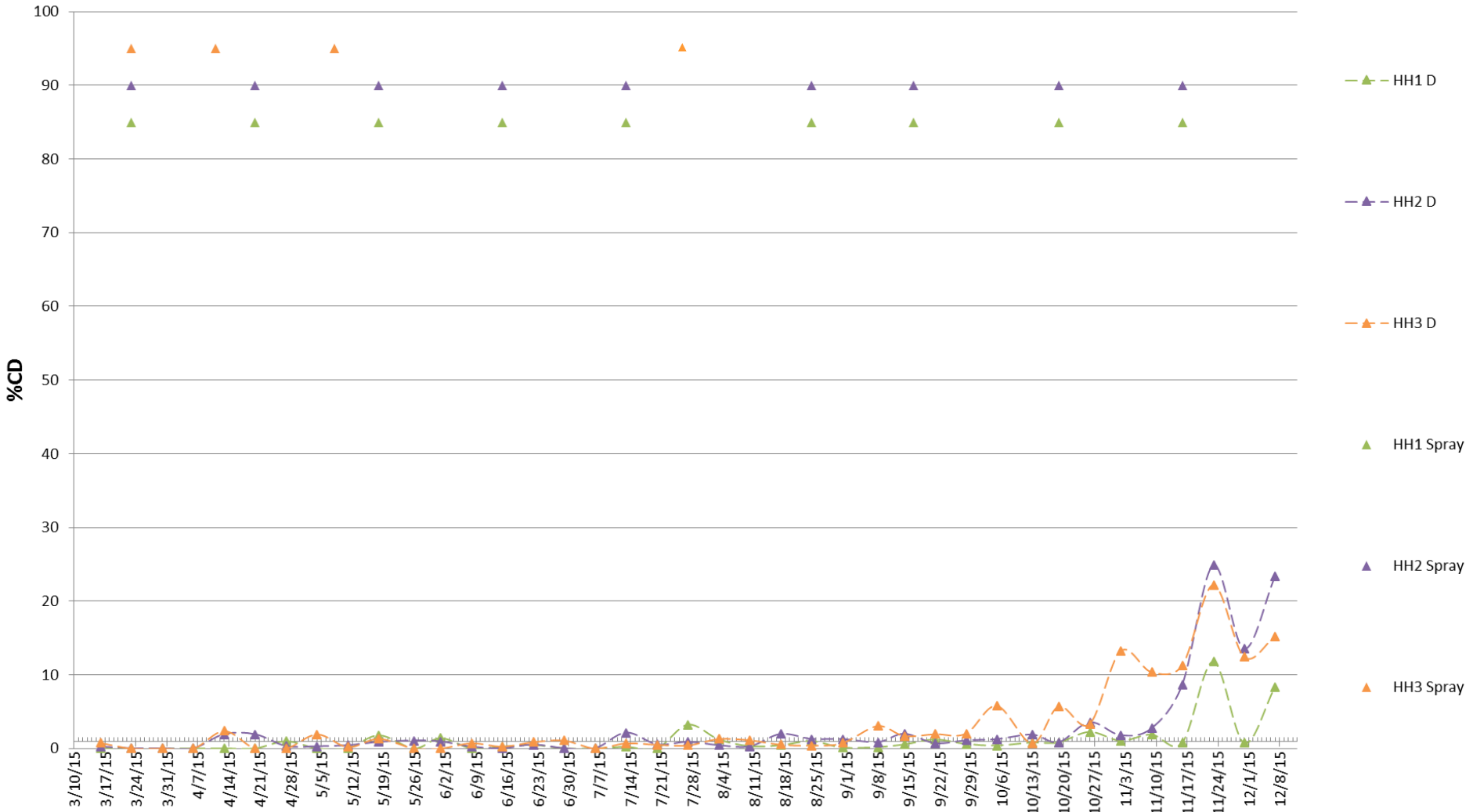
% AB

HL1, HL2: Monthly sprays
HL3: Spray as needed

All strip picked



Efficacy: Destructive method, Honaunau High, 2015



% CD

HL1, HL2: Monthly sprays
HL3: Spray as needed

All strip picked



Data: Honaunau High, 2014

Honaunau High 3

Stripped 3/7/14

8,404 sq ft (0.2 acres); 8 people, 6 hours

weight (g)

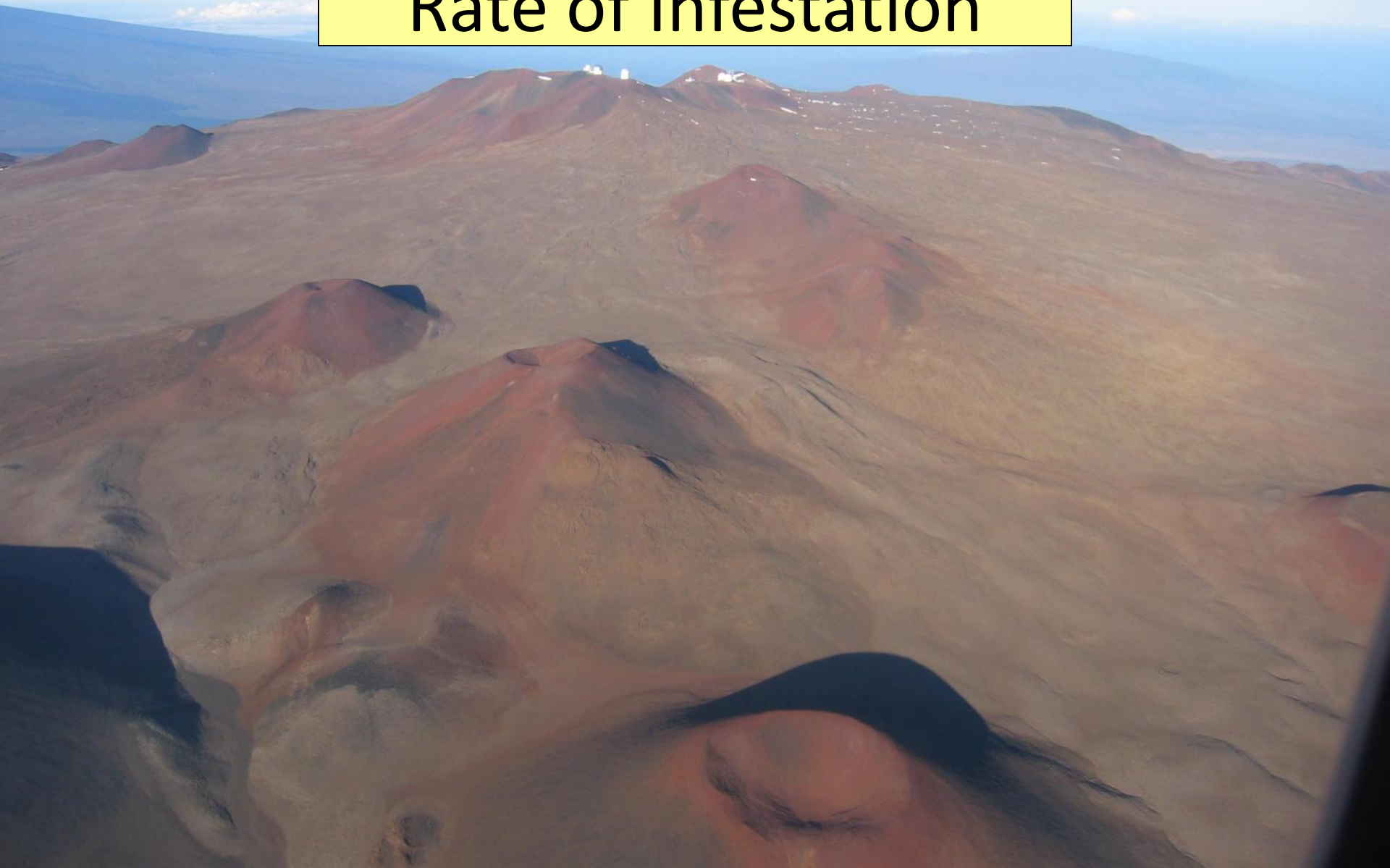
	Hole	No-Hole	Unsorted	Total	% Infested
Raisin	-	-	70.8	70.8	
Red	3008.7	1275.6	-	4284.3	70.2
Green	2907.6	4950.7	-	7858.3	37.0

12213.4g

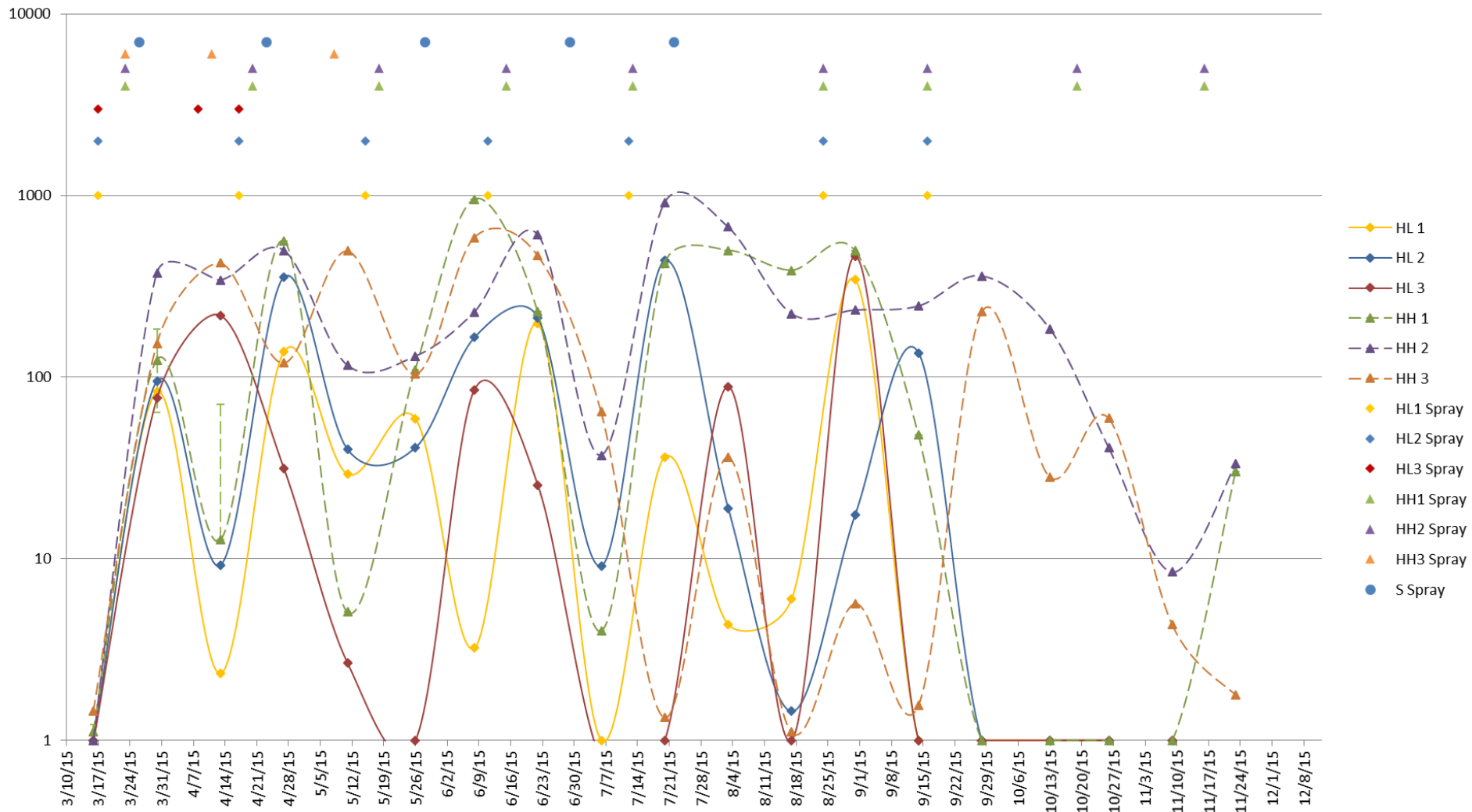
26.9lb

- Suppression sprays
- HL1: 1 spray/month; HL2: 2 sprays/month; HL3: strip picked + 1 spray/month
- Harvest: 5-20% AB; 5-10% CD

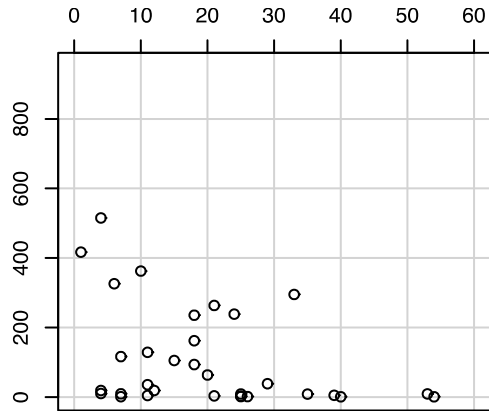
Data: Prediction Model Rate of Infestation



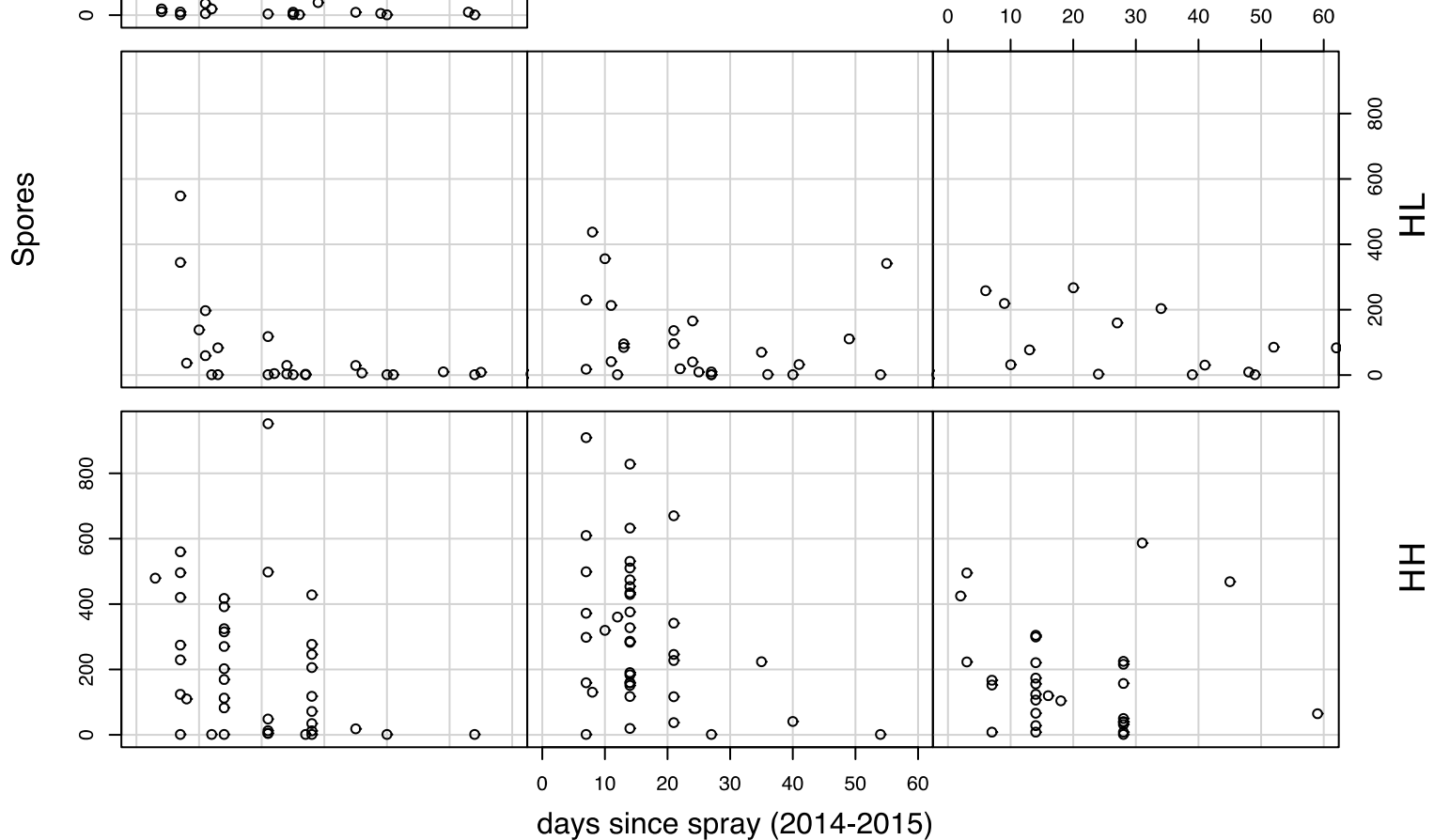
Persistence (2015), influenced by unique microclimates



Bb GHA Persistence in the Field

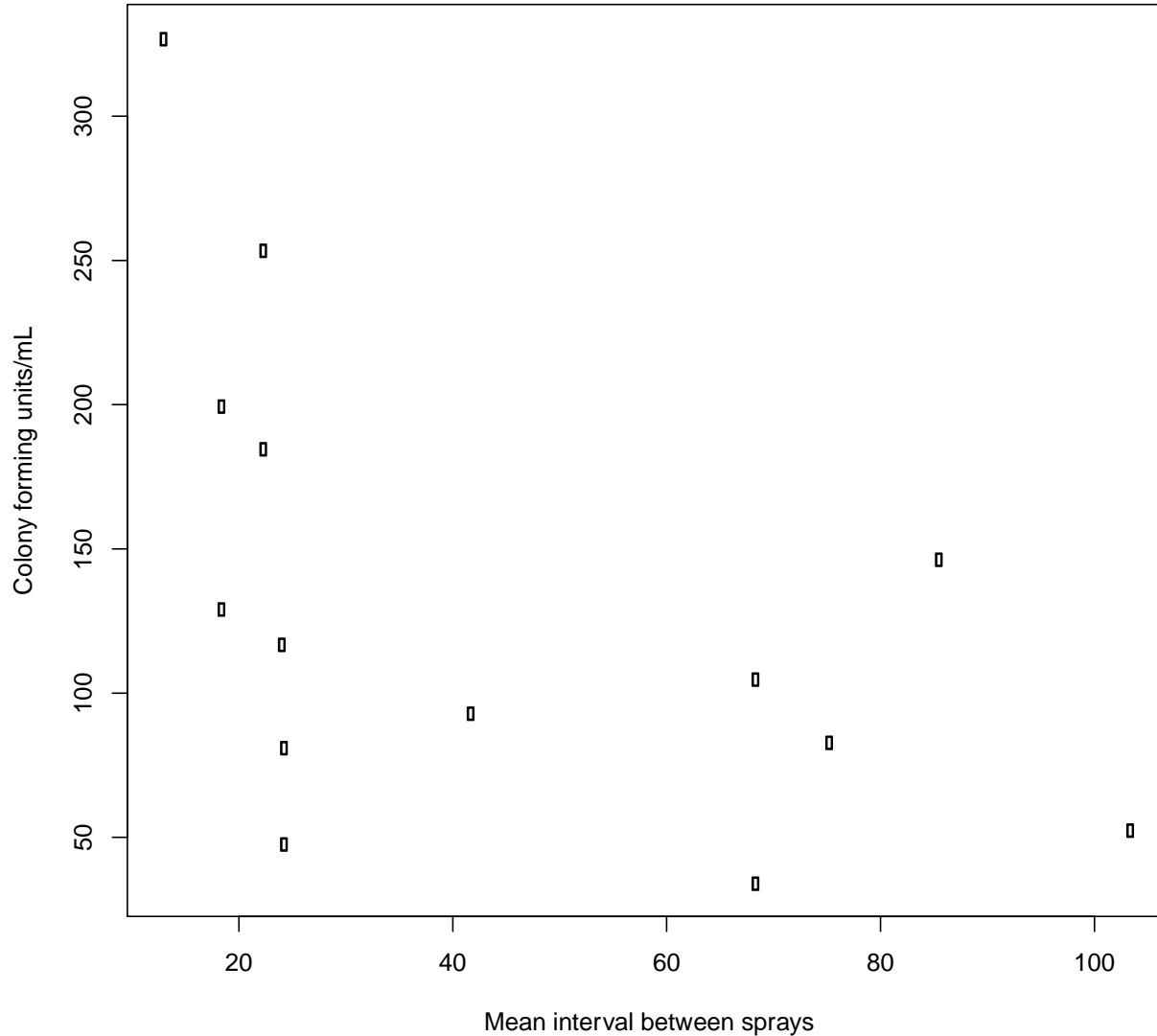


- All 2014 and 2015 data
- A strong relationship between the number of days since *Bb* spray and the number of active spores in the fields. Horizontal transmission: recycling of the product



Significant Factors on Persistence

Field averages by year (2014, 2015)



Factors Affecting Persistence

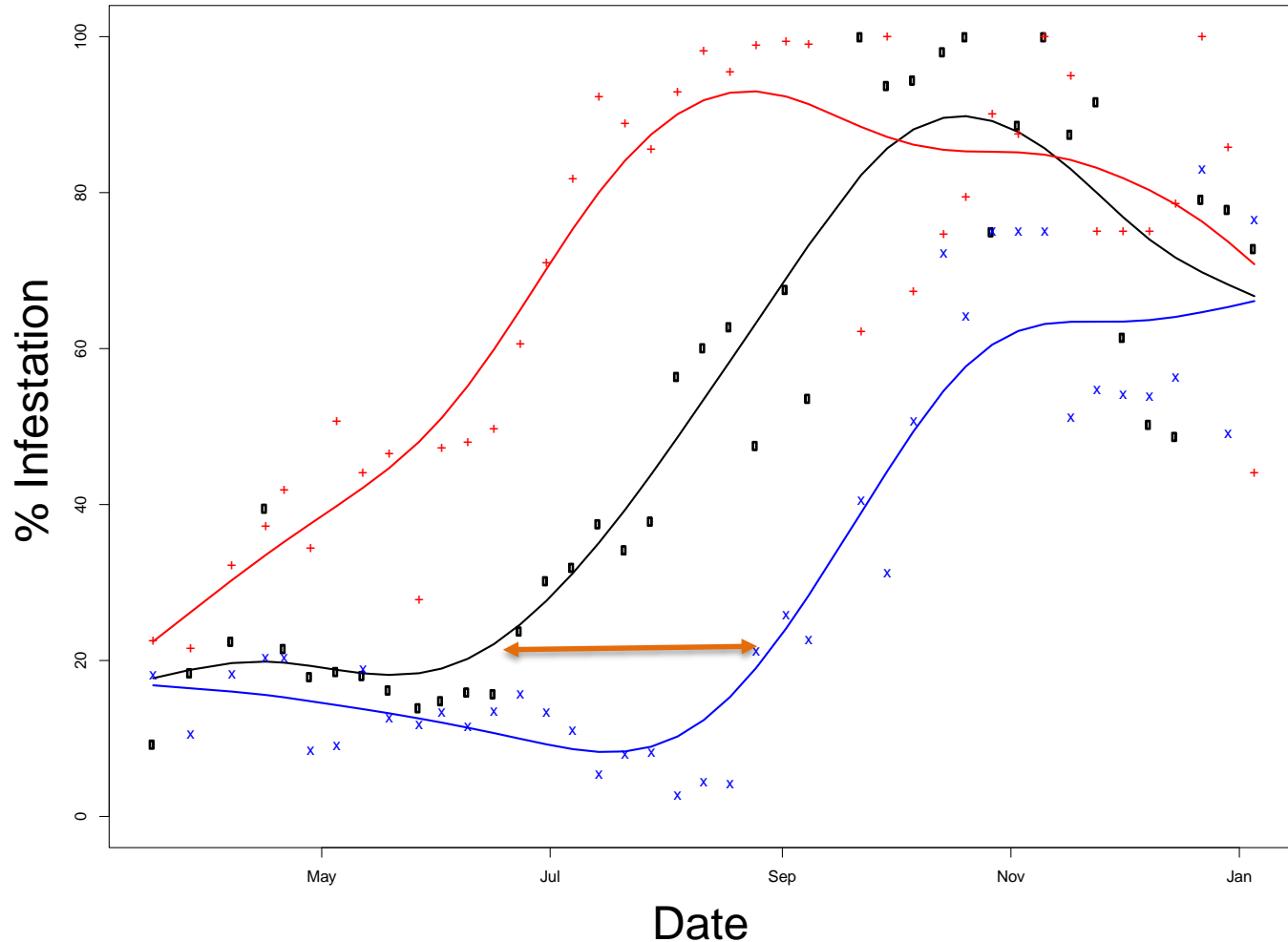
Response: log(spores)

	Estimate	SE	<i>t</i>	<i>p</i>
(Intercept)	1.795	4.237	0.4	0.6723
log(days since spray)	-0.770	0.147	-5.3	3.86E-07
Cum. Rain	-0.058	0.042	-1.4	0.1681
Mean RH	0.062	0.015	4.1	5.34E-05
Mean Temp	-0.009	0.054	-0.2	0.8662
Field	0.800	0.430	1.9	0.0647

Multiple R-squared: 0.3963

- * Significant effects of days since spray, RH
- * This model allows us to make predictions of active *Bb* in the field given weather and time since spraying

Strip Picking: Effect on CBB Spread Honaunau Low, 2014



*Non-destructive sampling: rates of infestation (start of increase; max level observed)

Conclusions/Observations

- Good CBB control can be achieved
- Difficult to give a precise recipe for success; each location is unique
- Location specific; seasons vary
- Only *Beauveria*: Not the silver bullet
- Only stripping: Not the silver bullet
- Timing versus number of applications
- Data for CBB Prediction Model

What Does The Data Tell Us?

- Knock back the existing CBB population early (strip; *Beauveria* suppression sprays)
- Increased infestation during the harvest months (strip pick sanitation)
- *Beauveria* sprays: monitor visually; spray when necessary
- “% infested” doesn’t necessarily mean you have a high % of damaged beans

Thank You Field Cooperators!

(Thanks to Nicholle, John and Glenn for excellent technical help)

Questions?