CBB Efforts at PBARC: Optimization of Microbial Control Applications for CBB Management

Lisa Keith
Research Plant Pathologist
US Pacific Basin Agricultural Research Center

Topics

- Intro to PBARC
- Area-Wide CBB Program:
  - Year 1, $1M; Year 2, $700,000
- 2013 data/2014
- Conclusions

Daniel K. Inouye Pacific Basin Agricultural Research Center (PBARC)

- We are the in-house research arm of the USDA
- 2 Research Units and 12 Scientists
- Our mission is to conduct research to develop sustainable agricultural systems and pest management programs to support the State of Hawaii, the Pacific Basin and the country/ world

USDA

PBARC Scientists Involved With CBB

Lisa Keith
Tracie Matsumoto
Nicholas Manoukis
Eric Jang
Peter Follett
Roxana Myers
Additional Team Members as Needed

* Integrated Management for control of coffee berry borer (CBB)
* PBARC working cooperatively with CTHAR, HDOA and others.
* Participation as key members of the CBB Task Force, SHAC and many farming groups

USDA

Area-Wide CBB Program

Area-Wide CBB Program

- An area-wide mitigation and management program for CBB control was established by PBARC in August 2013 with $1M received from ARS in collaboration with the University of Hawaii at Manoa
- $700,000 received in 2014
- Goal: to help growers deal with the CBB problem in an environmentally sound and economically viable way

Area-Wide CBB Program

- **Short term:**
  - Optimize the dose and use of commercial *Beauveria*
  - Map the area and extent of the infestation (ArcGIS, remote sensing)
  - Synchronize coffee blooms for harvest and sanitation
  - Utilize EPNs, predators, semiochemicals and/or pruning styles to reduce field populations of CBB
- **Long term:**
  - Use more effective *Beauveria* strains
  - Develop new attractants for mass trapping
  - Improve quarantine treatments/Prevent spread
  - Analyze the CBB genome to better understand its biology

USDA

Area-Wide CBB Program

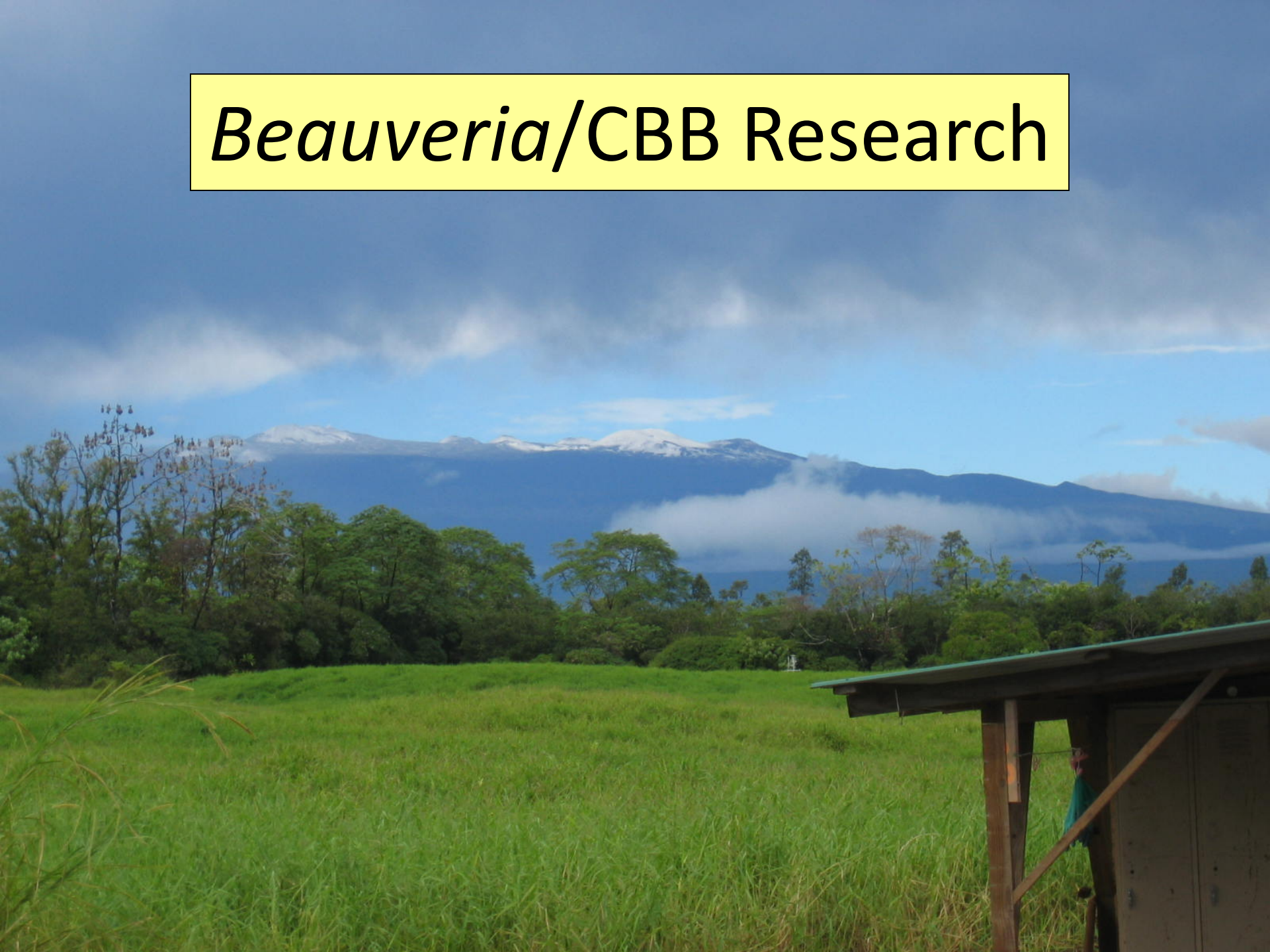
- **In collaboration with UH Manoa, CTAHR:**
  - Develop efficient and quick sampling plans for estimation of CBB damage
  - Understand phenology and spatial ecology of CBB
  - Provide area-wide education and extension outreach for mitigation and management of CBB control
  - Determine the economic analysis of CBB effects and the value of the mitigation efforts (cost/benefit analysis)

USDA

Area-Wide CBB Program: Teamwork

- **USDA/ARS:**
  - PBARC, Hilo; Ithaca, NY; Beltsville, MD
- **UH Manoa:**
  - Hilo, Kona, Oahu
- **HDOA**
- **Coffee Growers, CBB Task Force**

Beauveria/CBB Research



Goals for 2013 Season

- Determine how timing and frequency of commercial *Beauveria* applications effect persistence and efficacy

BioWorks

- How does it effect bean quality?

Elevation:
A. 1869 ft
B. 535 ft
C. 450 ft (shade)

Coffee Data

- Field plot maps
- Persistence: *Beauveria* GHA
- Efficacy (Destructive method)
  - % AB, % AB Dead, % CD, % Infestation
- Efficacy (Non-destructive method)
  - % Infestation, % Beauveria
- Environmental
  - Temp, % RH, Leaf moisture, Rainfall, UV
- Quality/Harvest

2013 Spray Schedule

Rate = 1 qt/100 gal Spray

late afternoon/early evening

once/month (1x) versus twice/month (2x)

Beauveria spray dates	Napoopoo Low		Honaunau Low		Honaunau High	
	#1	#2	#1	#2	#1	#2
4/8/13	✓	✓	✓	✓		
4/15/13	✓	✓	✓	✓		
4/22/13	✓	✓	✓	✓		
5/6/13					✓	✓
5/13/13	✓	✓			✓	✓
5/14/13			✓	✓		
5/20/13					✓	✓
5/28/13		✓		✓		
6/10/13	✓	✓	✓	✓	✓	✓
6/24/13		✓		✓		✓
7/8/13	✓	✓	✓	✓	✓	✓
7/22/13						✓
7/23/13		✓		✓		
8/5/13	✓	✓	✓	✓	✓	✓
8/19/13		✓		✓		✓
9/3/13	✓	✓	✓	✓	✓	✓
9/16/13		✓				
9/18/13				✓		✓
9/30/13	✓	✓	✓	✓	✓	✓
10/14/13						✓
10/28/13					✓	✓
11/12/13				✓		
11/14/13						✓
11/25/13					✓	✓
12/9/13						✓
12/23/13					✓	✓
1/6/14						✓
Total sprays:	**9**	**14**	**9**	**15**	**11**	**19**

Sampling Dates:
Before and after
Beauveria sprays

Sampling dates for data	Napoopoo Low		Honaunau Low		Honaunau High	
	#1	#2	#1	#2	#1	#2
4/8/13	✓	✓	✓	✓		
4/10/13	✓	✓	✓	✓		
4/15/13	✓	✓	✓	✓		
4/16/13	✓	✓	✓	✓		
4/22/13	✓	✓	✓	✓		
4/23/13	✓	✓	✓	✓		
4/24/13	✓	✓	✓	✓		
4/25/13	✓	✓	✓	✓		
4/26/13	✓	✓	✓	✓		
4/29/13	✓	✓	✓	✓		
5/2/13	✓	✓	✓	✓		
5/6/13					✓	✓
5/7/13					✓	✓
5/13/13	✓	✓	✓	✓	✓	✓
5/14/13					✓	✓
5/16/13	✓	✓	✓	✓		
5/20/13					✓	✓
5/21/13					✓	✓
5/22/13					✓	✓
5/23/13					✓	✓
5/24/13					✓	✓
5/28/13	✓	✓	✓	✓	✓	✓
5/30/13	✓	✓	✓	✓	✓	✓
6/10/13	✓	✓	✓	✓	✓	✓
6/13/13	✓	✓	✓	✓	✓	✓
6/24/13	✓	✓	✓	✓	✓	✓
6/27/13	✓	✓	✓	✓	✓	✓
7/8/13	✓	✓	✓	✓	✓	✓
7/11/13	✓	✓	✓	✓	✓	✓
7/22/13	✓	✓	✓	✓	✓	✓
7/25/13	✓	✓	✓	✓	✓	✓
8/5/13	✓	✓	✓	✓	✓	✓
8/8/13	✓	✓	✓	✓	✓	✓
8/19/13	✓	✓	✓	✓	✓	✓
8/22/13	✓	✓	✓	✓	✓	✓
9/3/13	✓	✓	✓	✓	✓	✓
9/5/13	✓	✓	✓	✓	✓	✓
9/16/13	✓	✓	✓	✓	✓	✓
9/19/13	✓	✓	✓	✓	✓	✓
9/30/13	✓	✓	✓	✓	✓	✓
10/28/13	✓	✓	✓	✓	✓	✓
10/30/13	✓	✓	✓	✓	✓	✓
11/12/13			✓	✓	✓	✓
11/14/13			✓	✓	✓	✓
11/25/13			✓	✓	✓	✓
11/28/13			✓	✓	✓	✓
12/9/13					✓	✓
12/11/13					✓	✓
12/20/13					✓	✓
12/27/13					✓	✓
1/6/14					✓	✓
1/10/14					✓	✓

USDA

Field Samples per Tree

Beauveria Persistence

high →

middle →

low →

Weigh
Wash
Dilute
Plate
Count

1 subsample = 15 berries
10 trees

Efficacy: Destructive & Nondestructive

middle ←

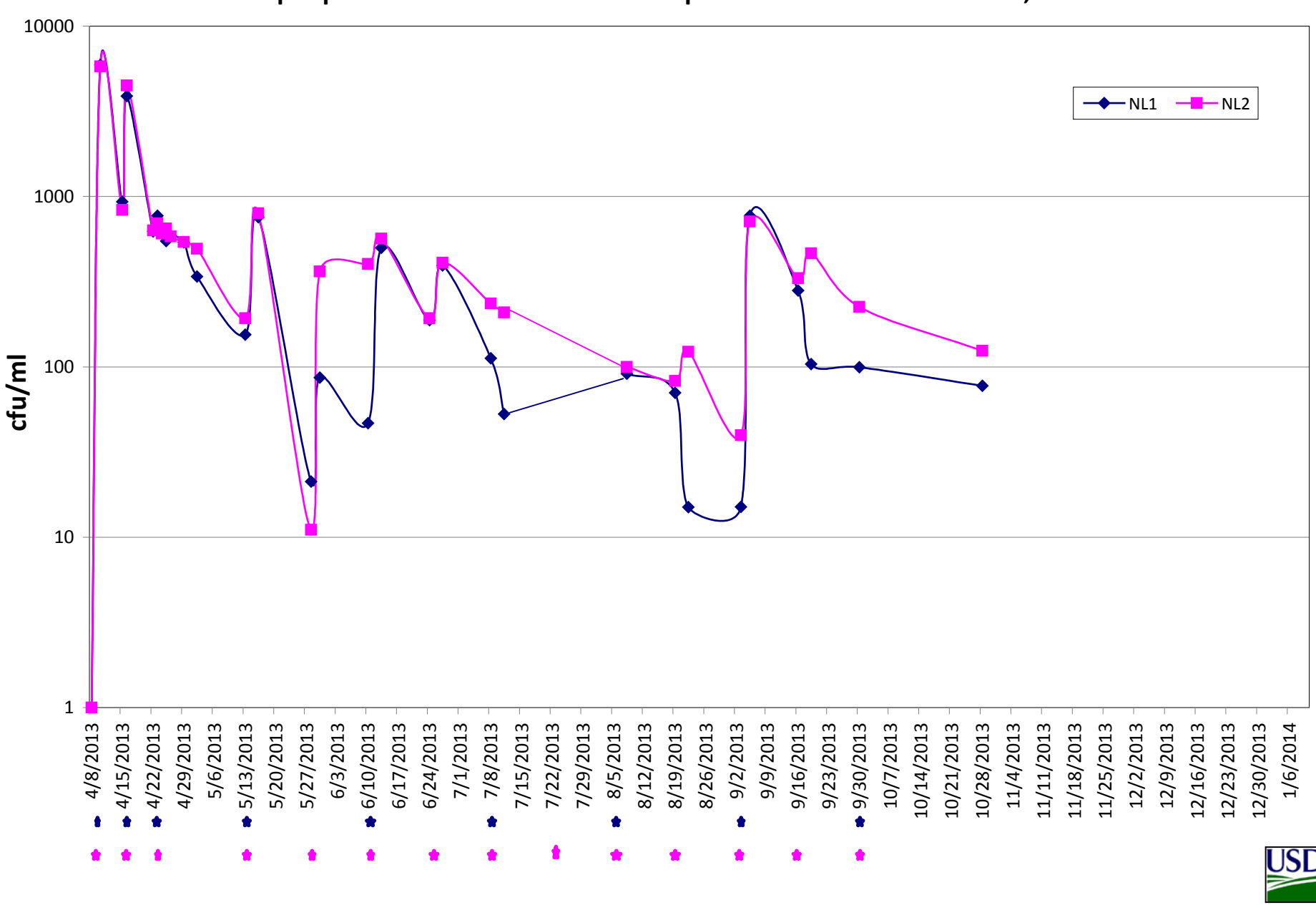
Dissect
Observe
AB alive
AB dead
CD
Beauveria

1 subsample = 10 green berries
4 trees

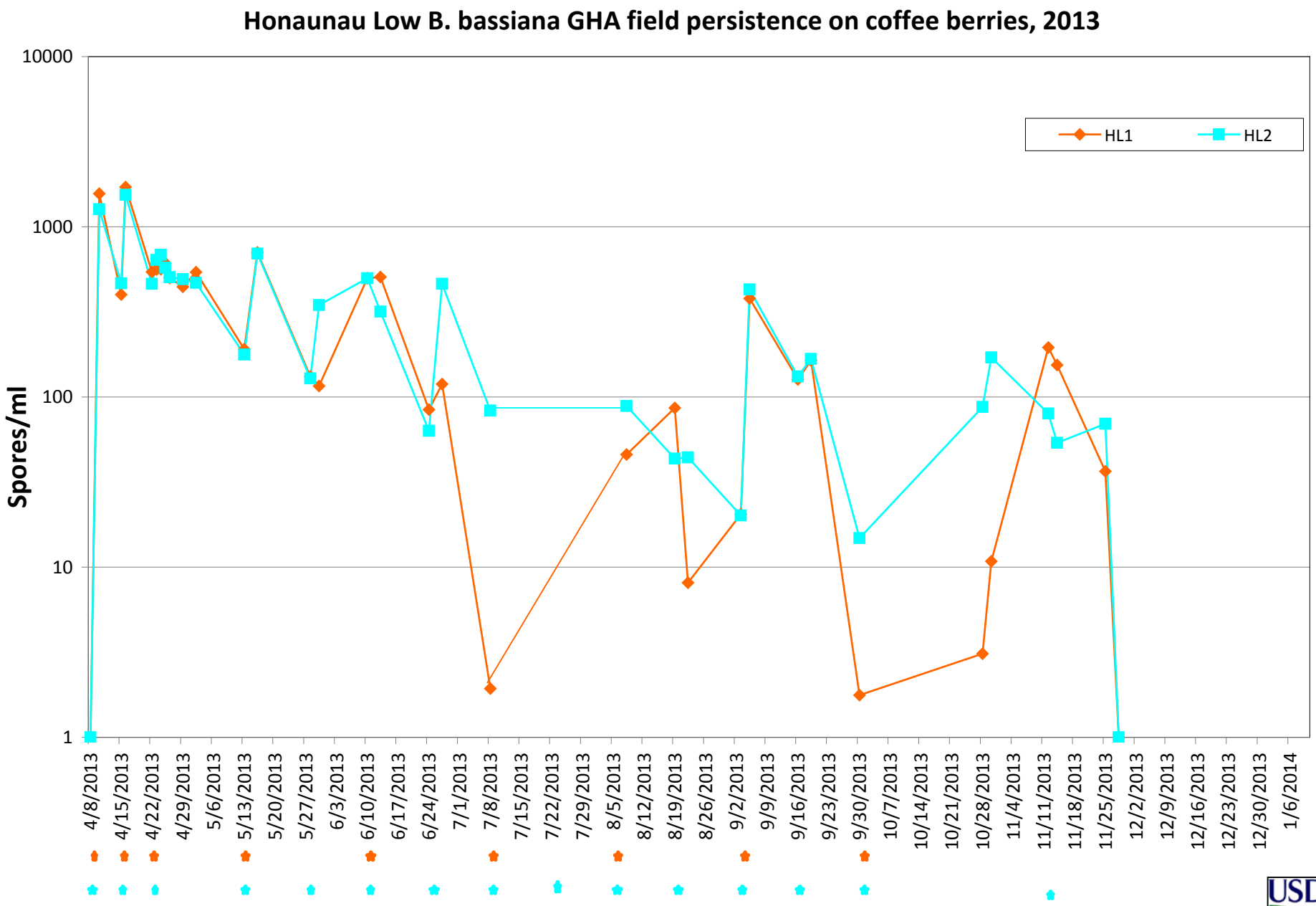
USDA

Data: Persistence

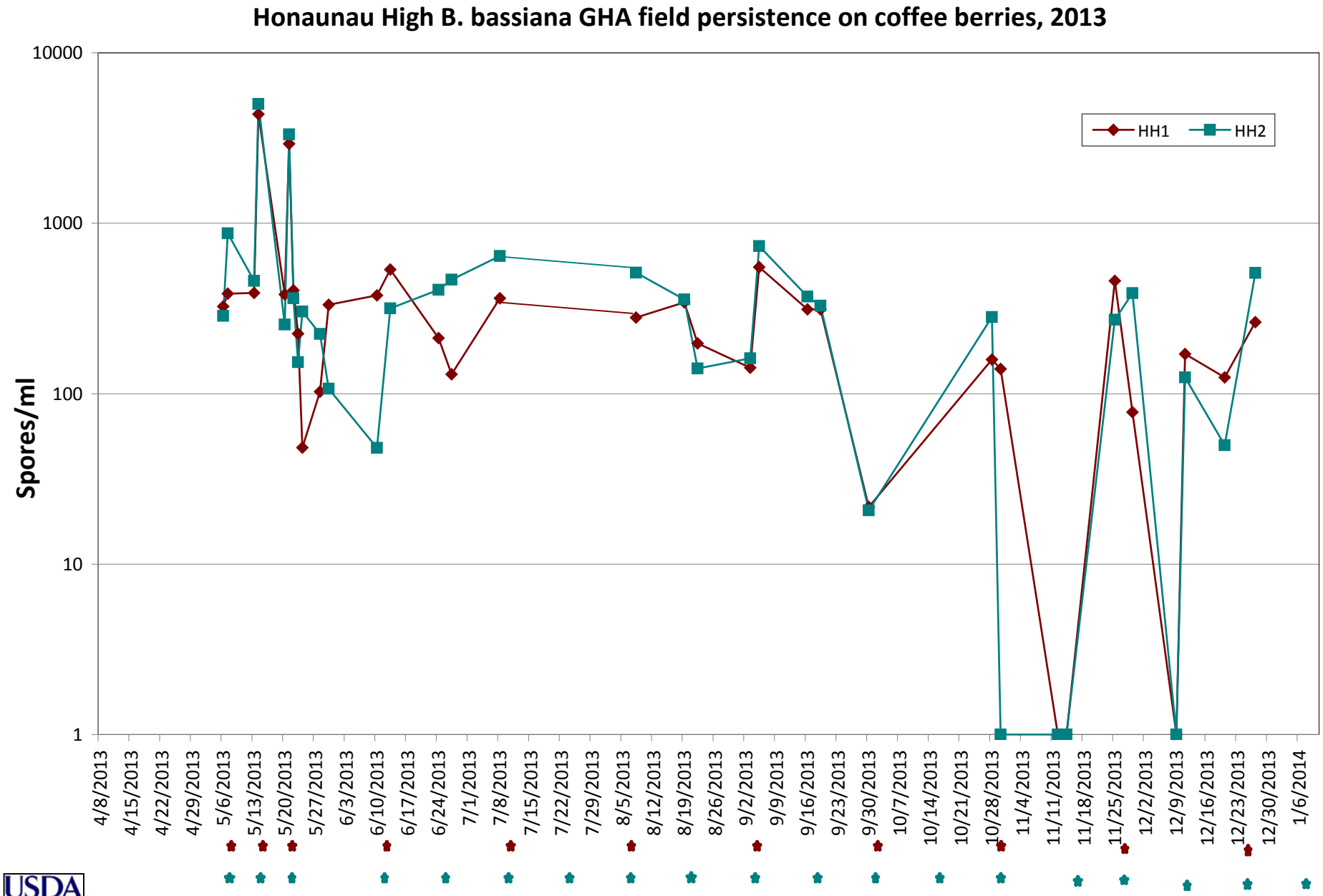
Persistence



Persistence

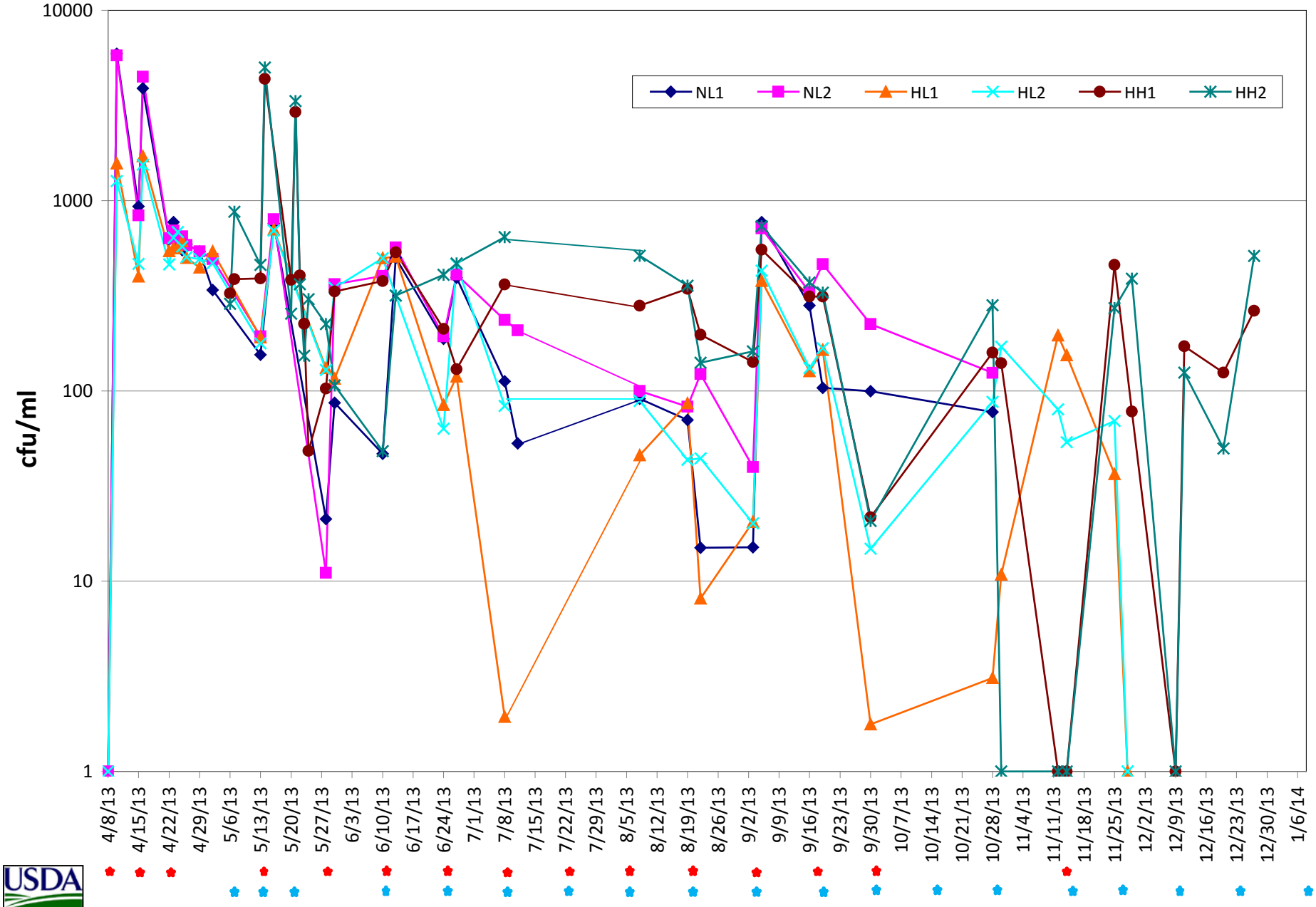


Persistence



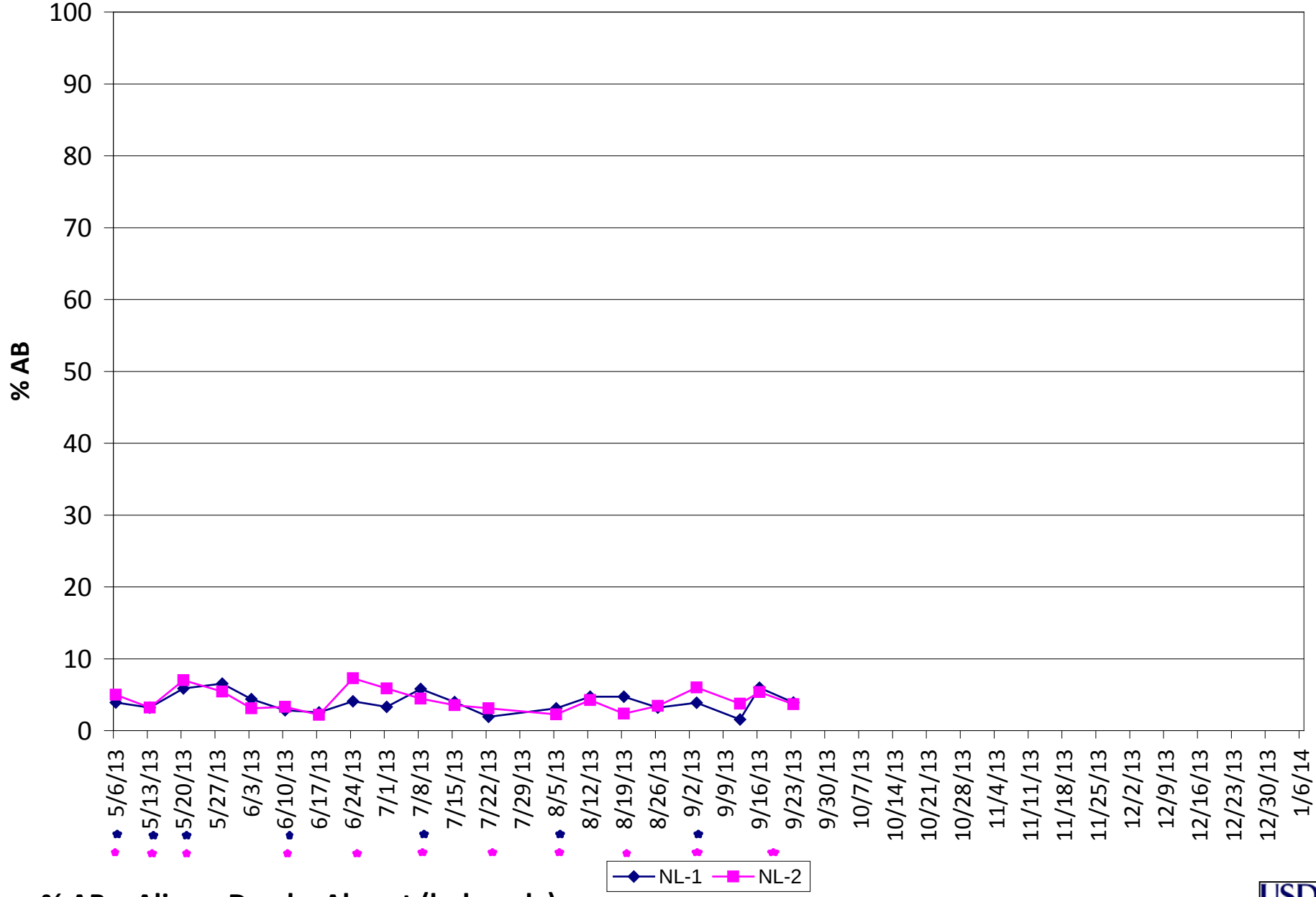
Persistence

B. bassiana GHA field persistence on coffee berries, 2013



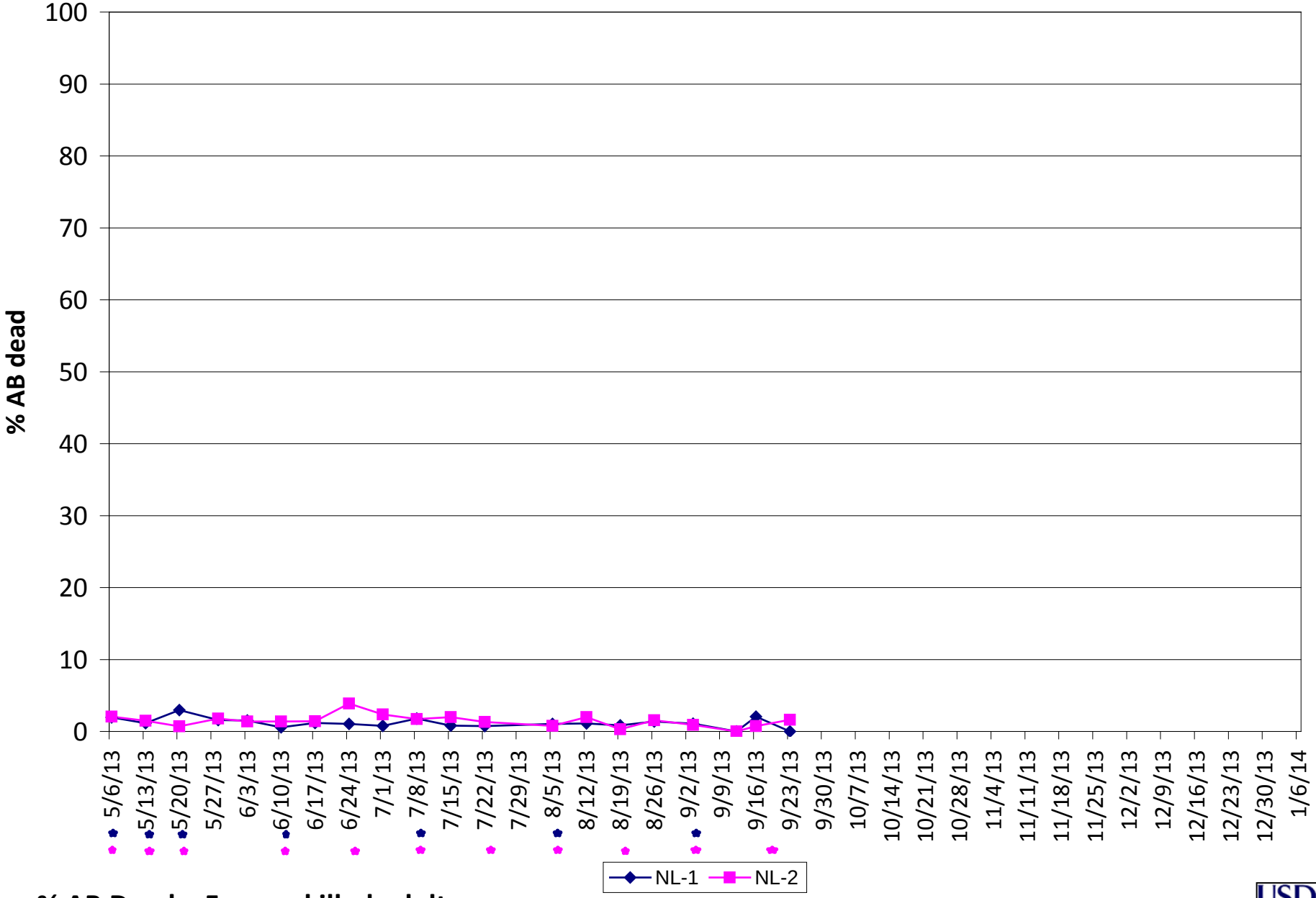
Data: Efficacy, Destructive Method

Efficacy: Destructive method, Napoopoo



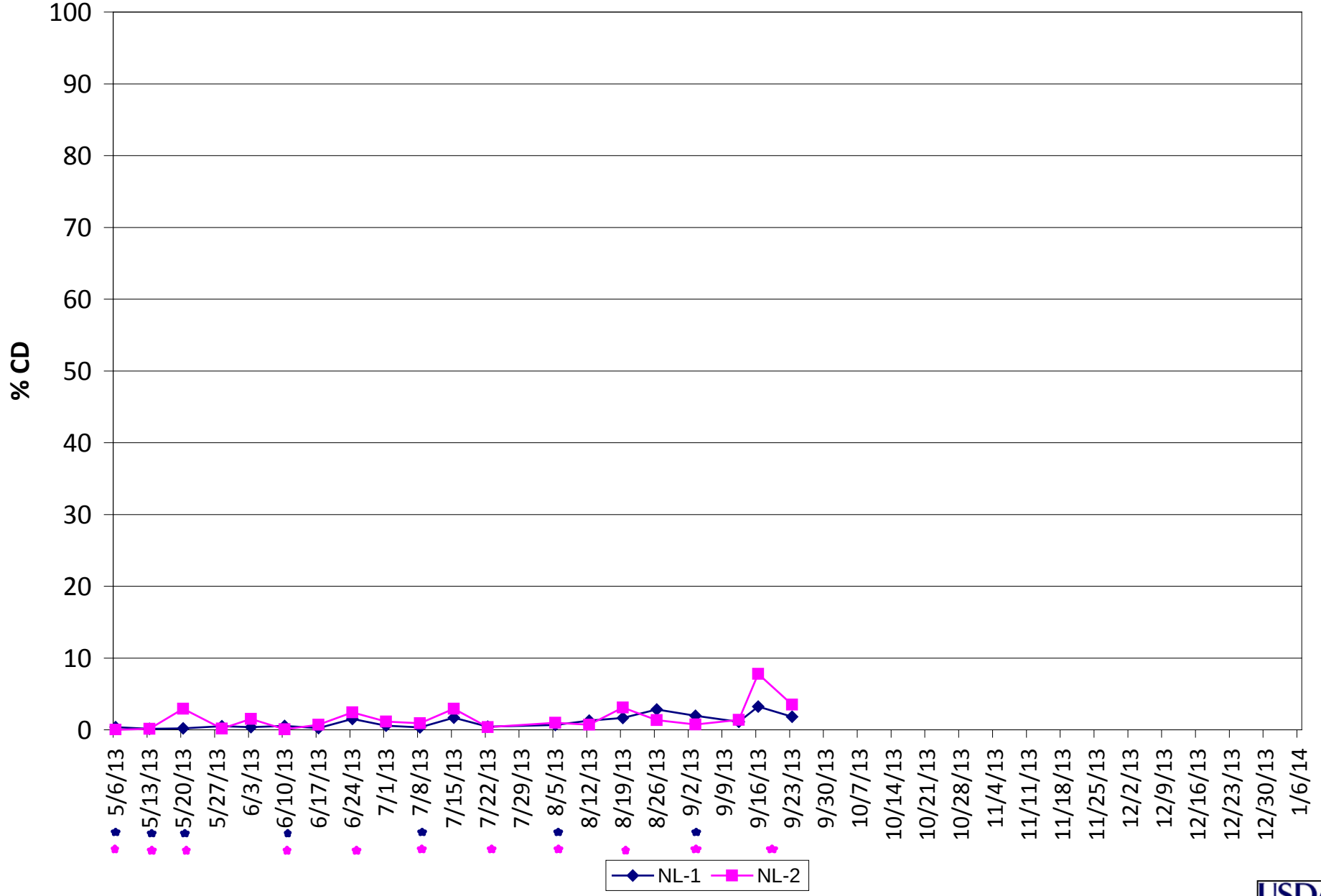
% AB = Alive + Dead + Absent (hole only)

Efficacy: Destructive method, Napoopoo

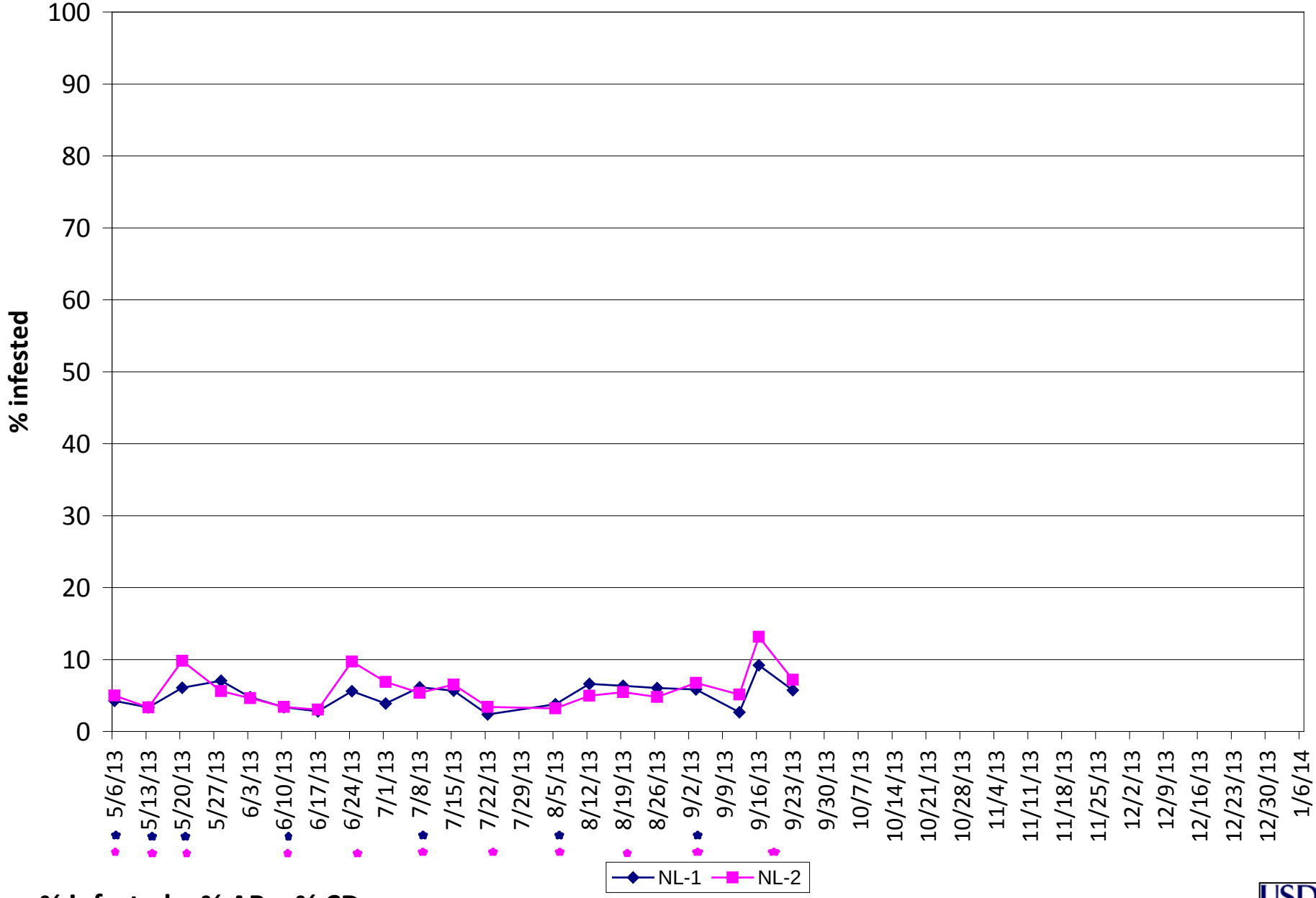


% AB Dead = Fungus-killed adults

Efficacy: Destructive method, Napoopoo

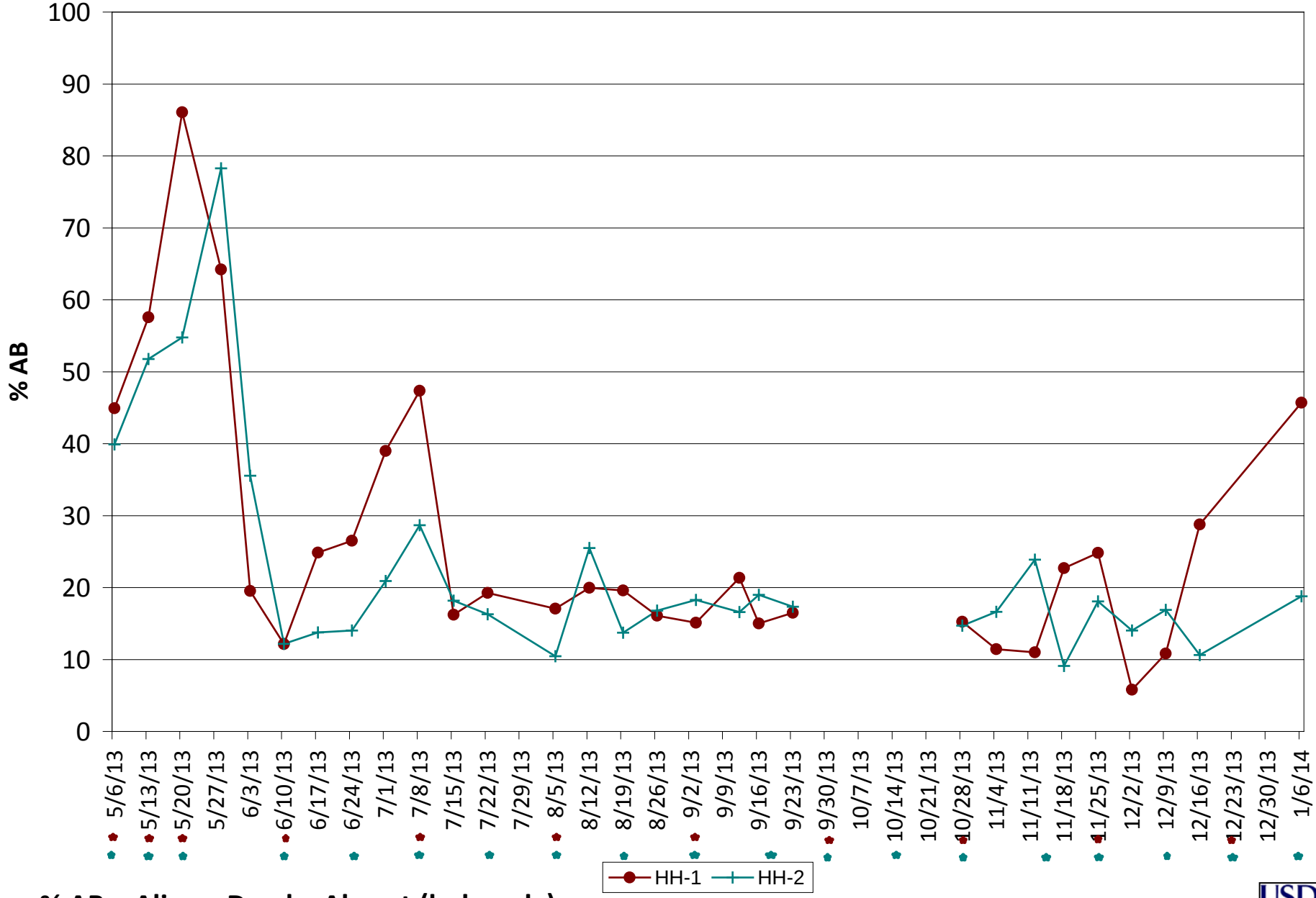


Efficacy: Destructive method, Napoopoo



% infested = % AB + % CD

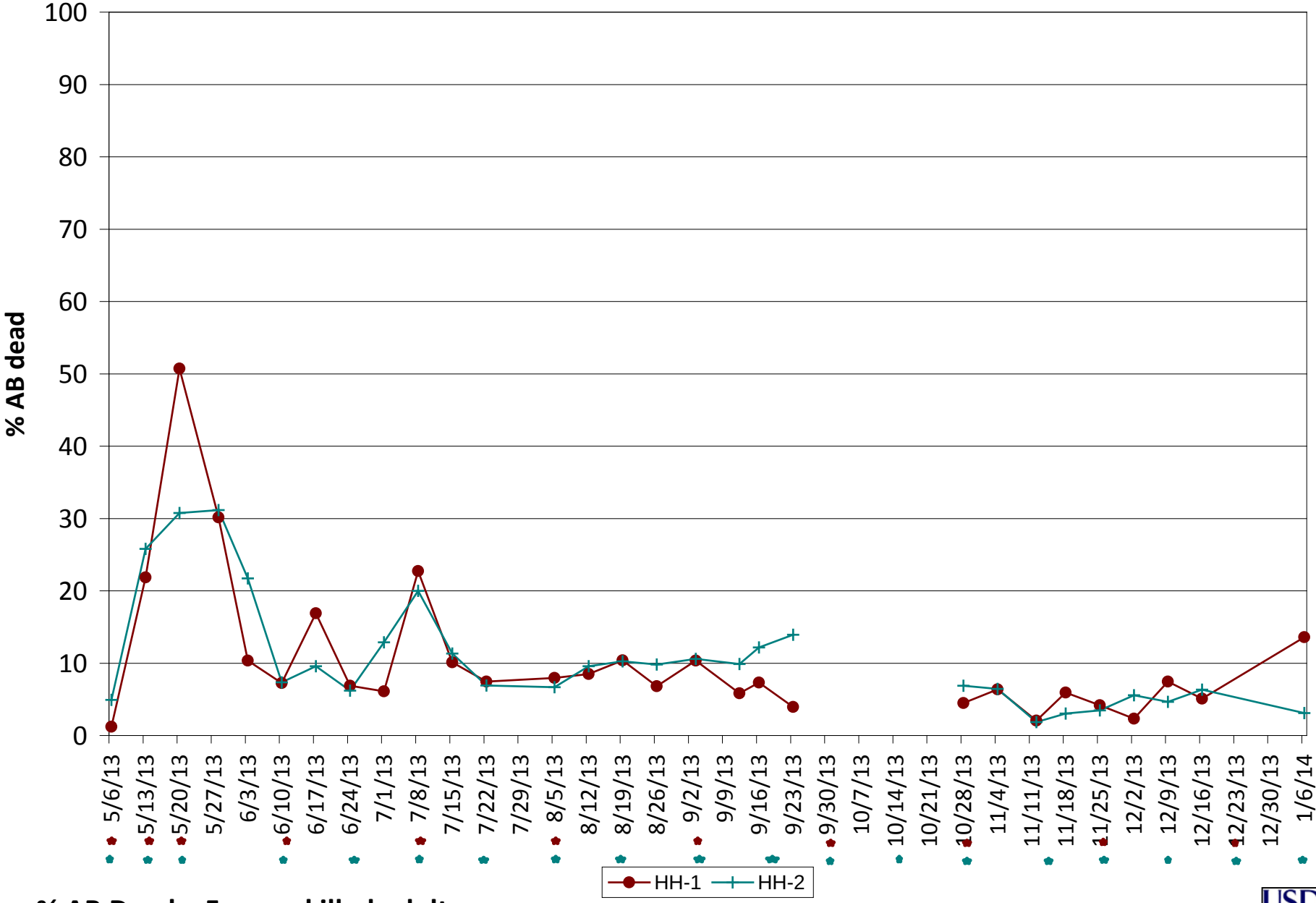
Efficacy: Destructive method, Honaunau High



% AB = Alive + Dead + Absent (hole only)

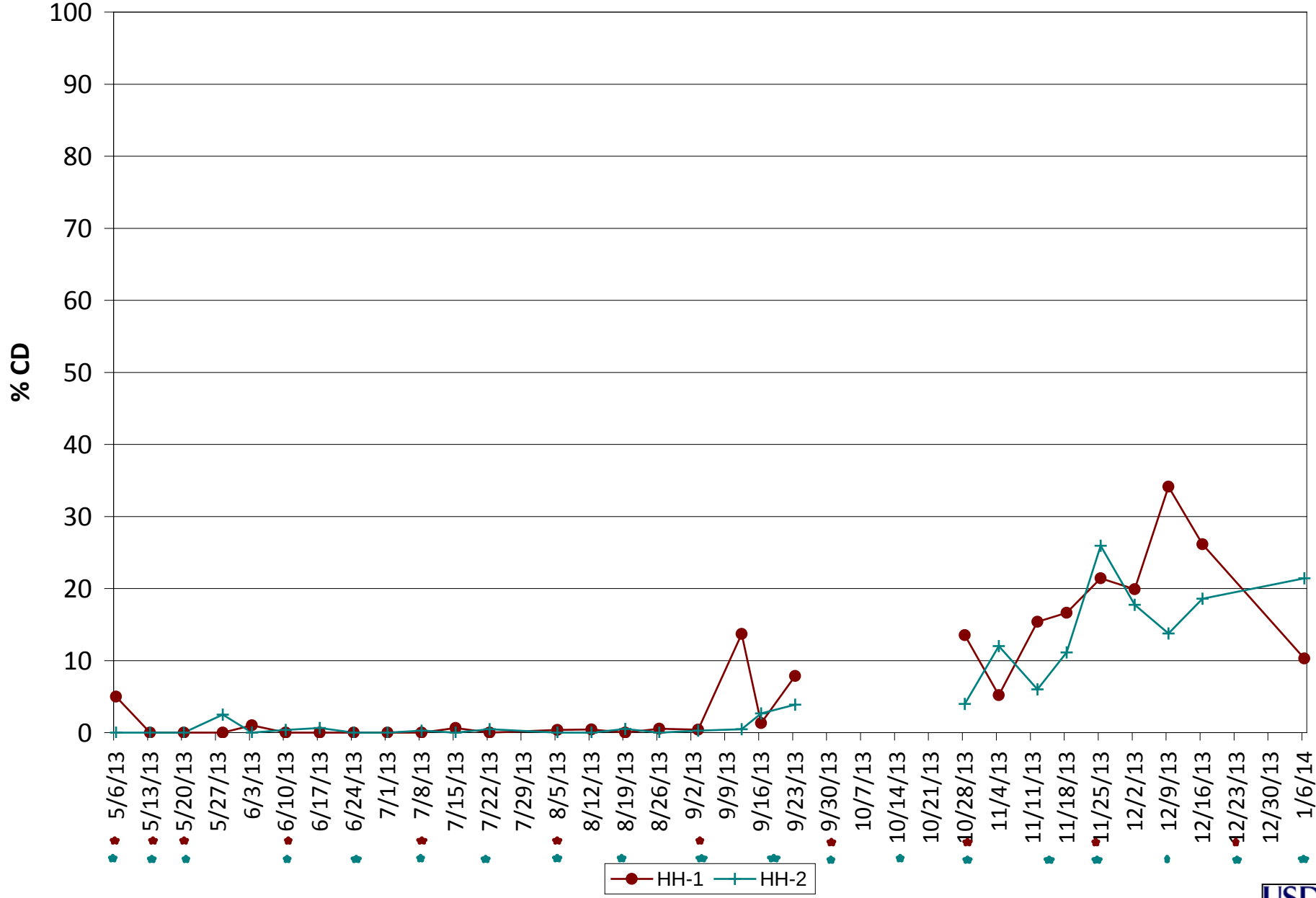
USDA

Efficacy: Destructive method, Honaunau High

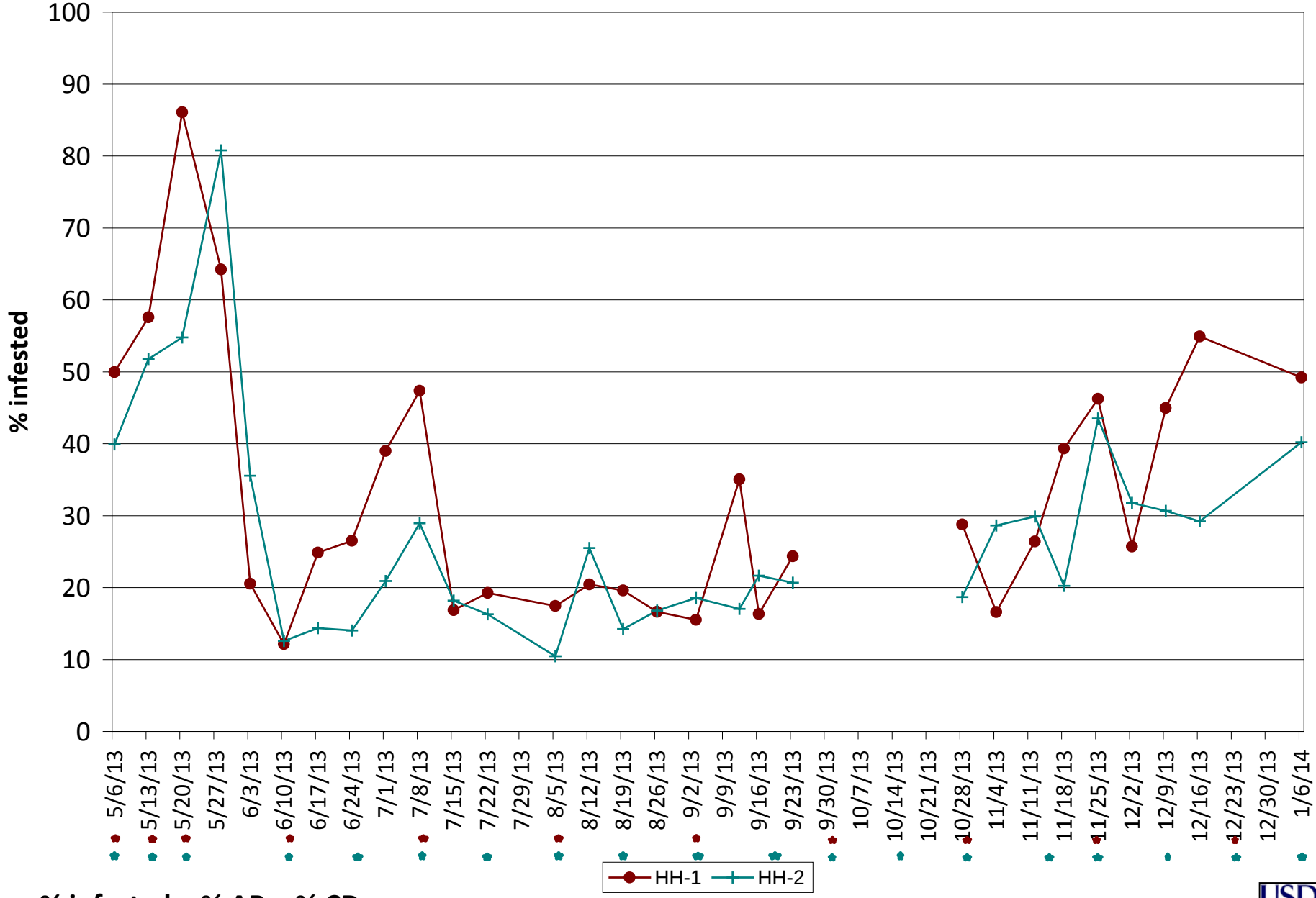


% AB Dead = Fungus-killed adults

Efficacy: Destructive method, Honaunau High

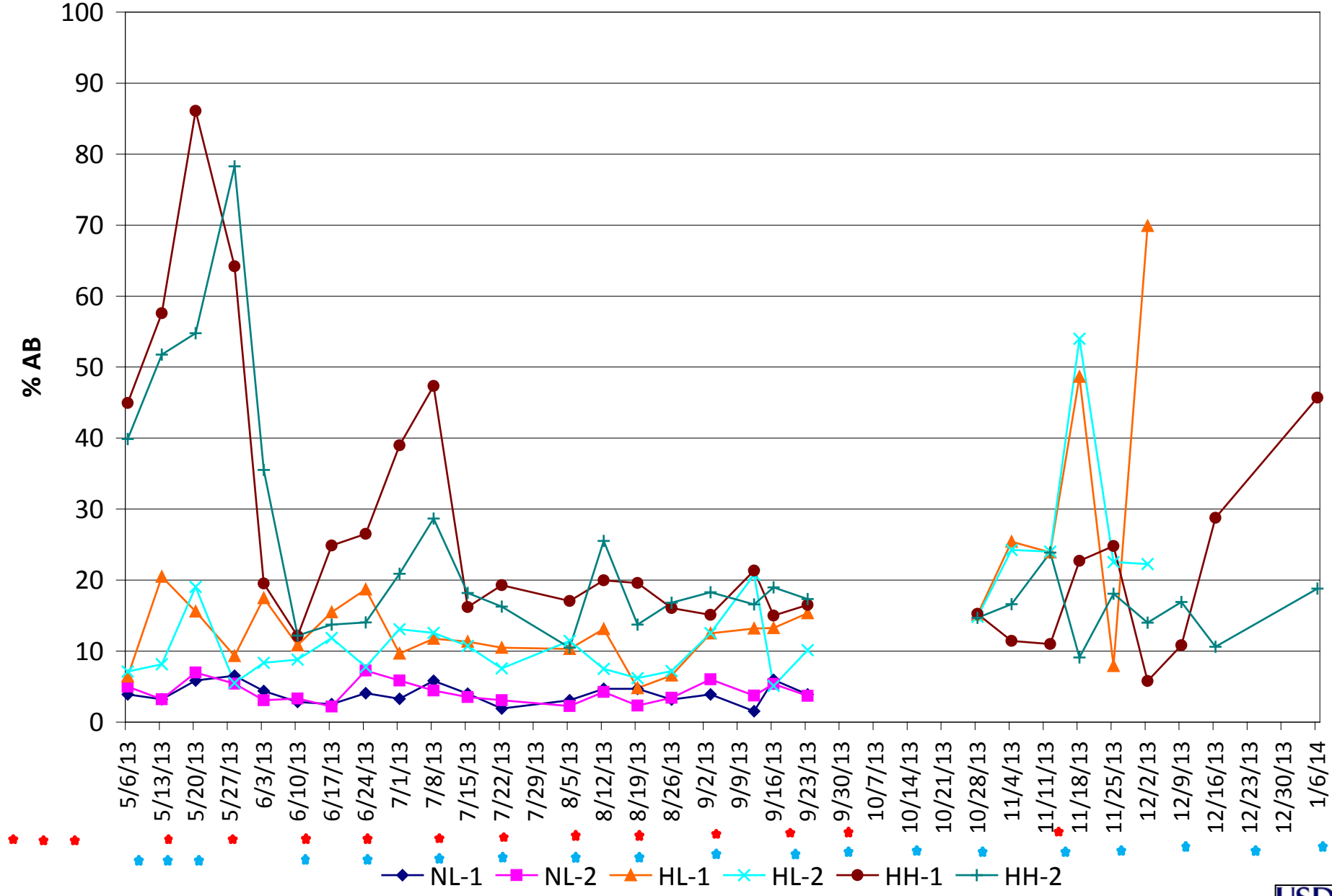


Efficacy: Destructive method, Honaunau High

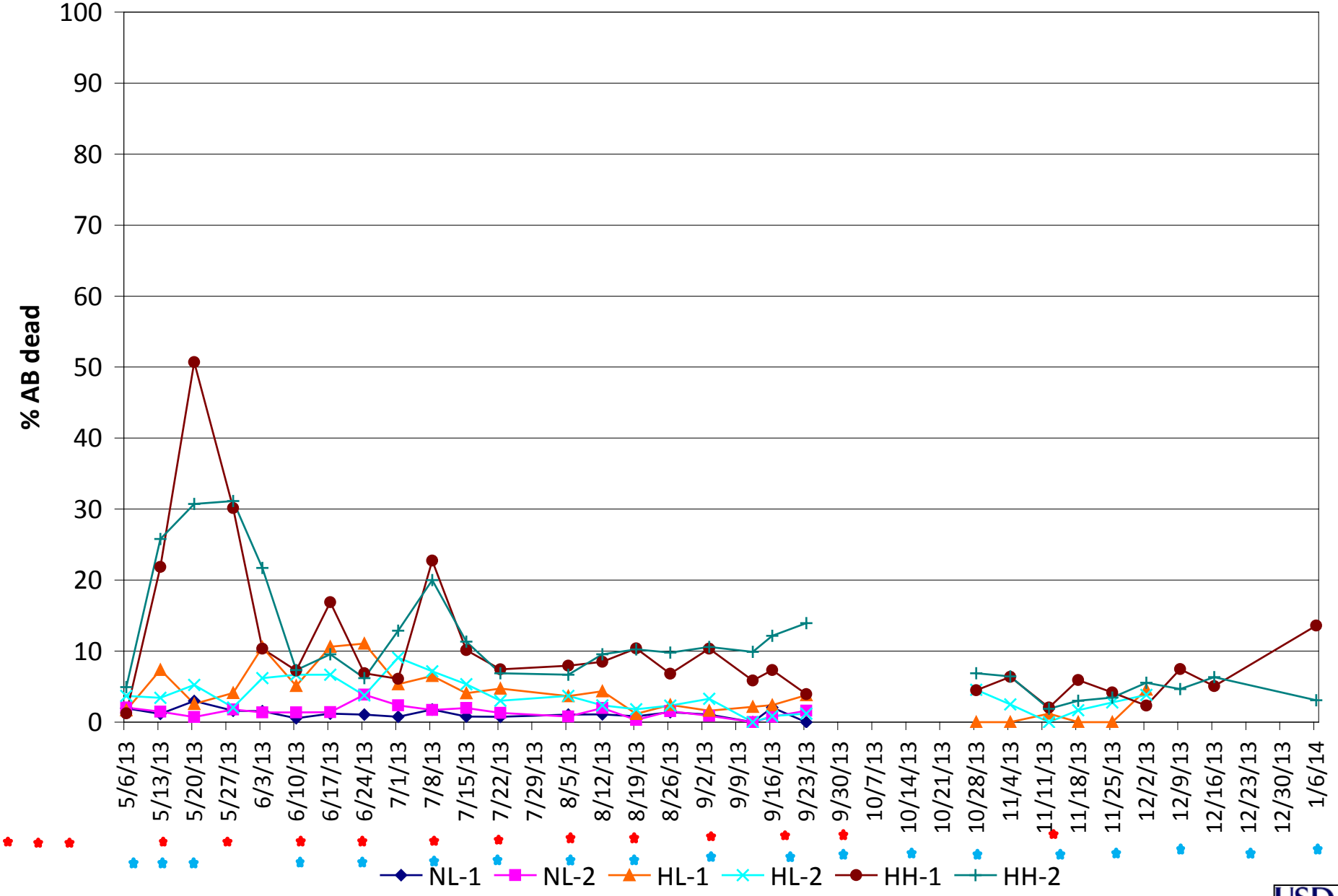


% infested = % AB + % CD

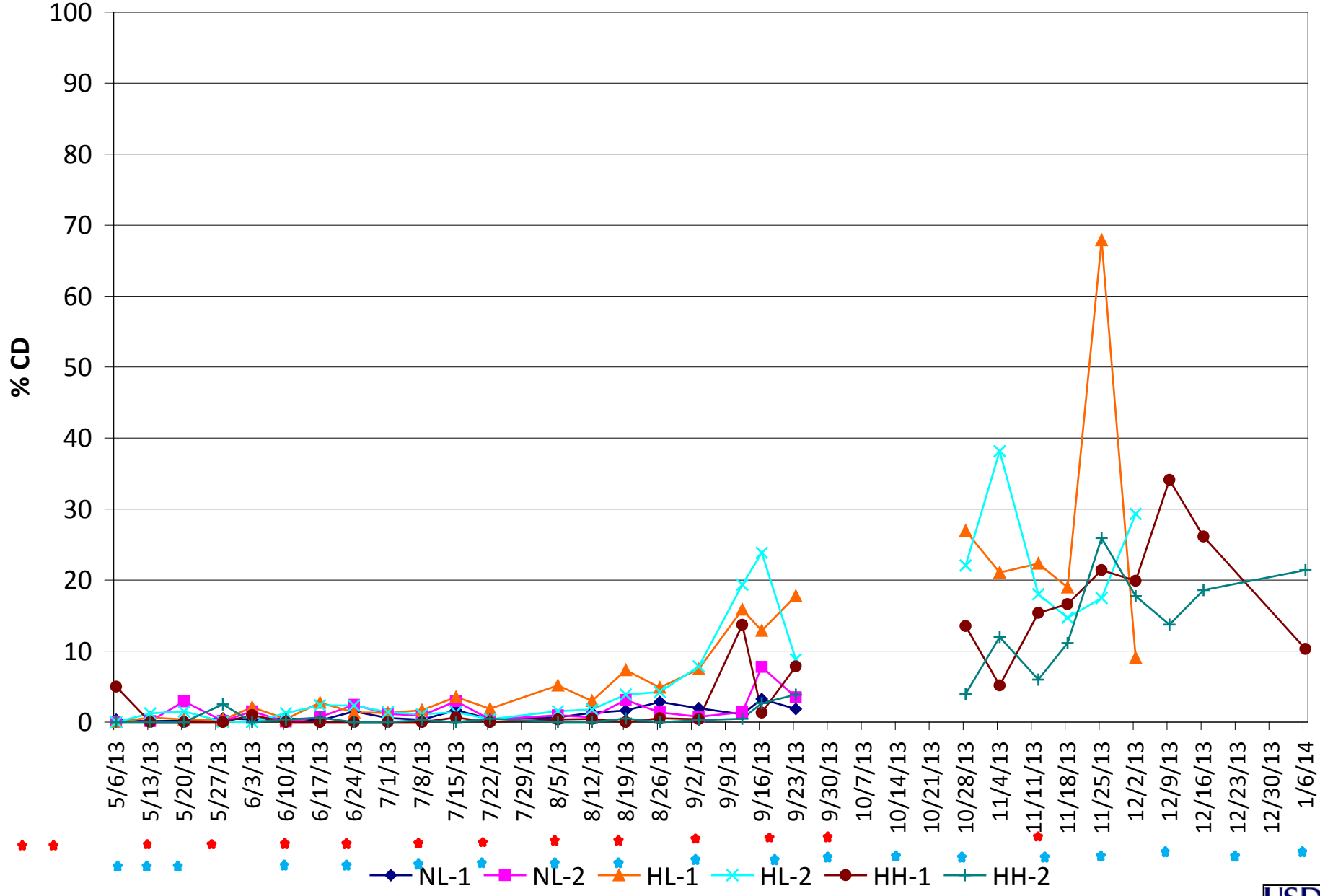
Efficacy: Destructive method



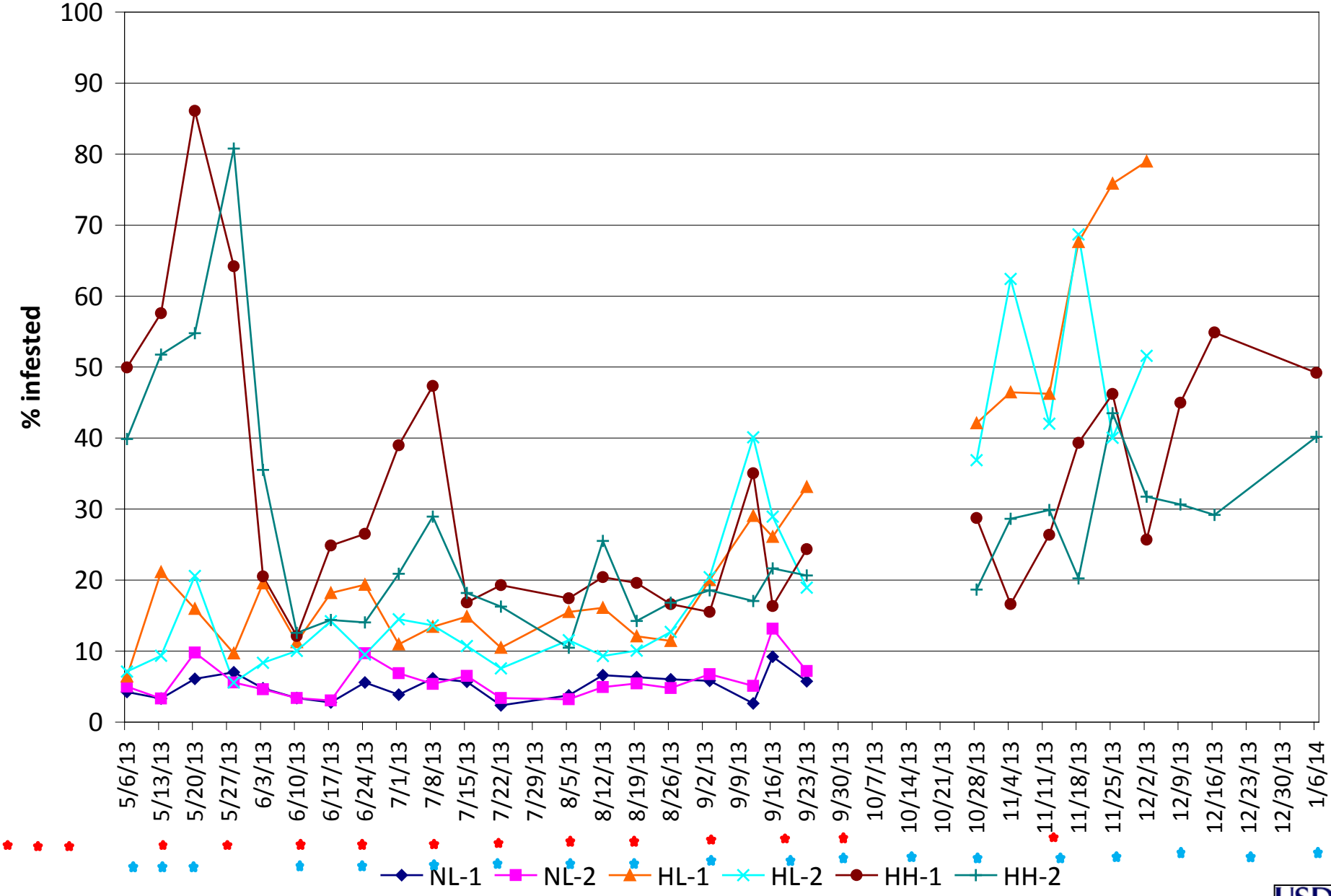
Efficacy: Destructive method



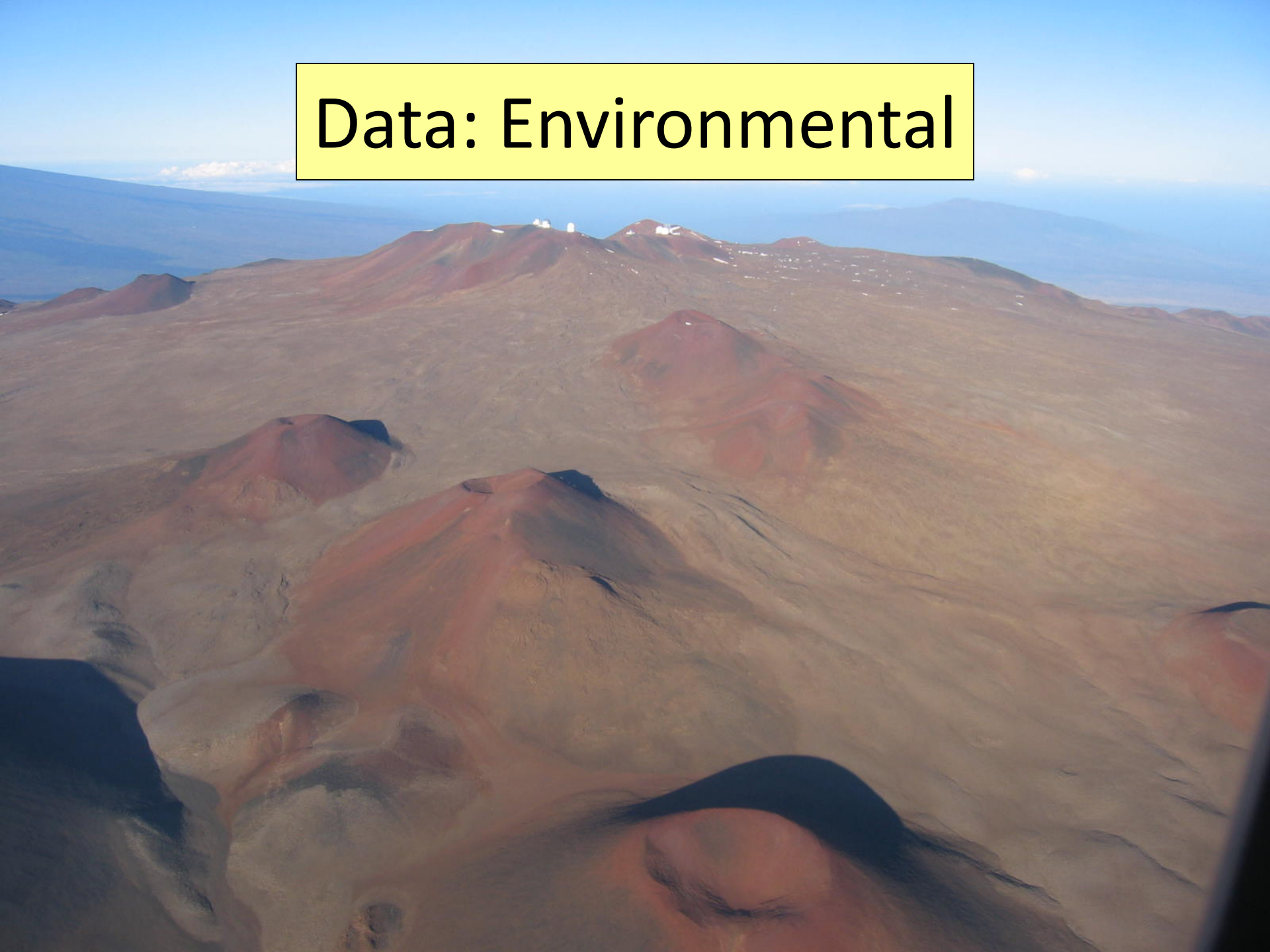
Efficacy: Destructive method

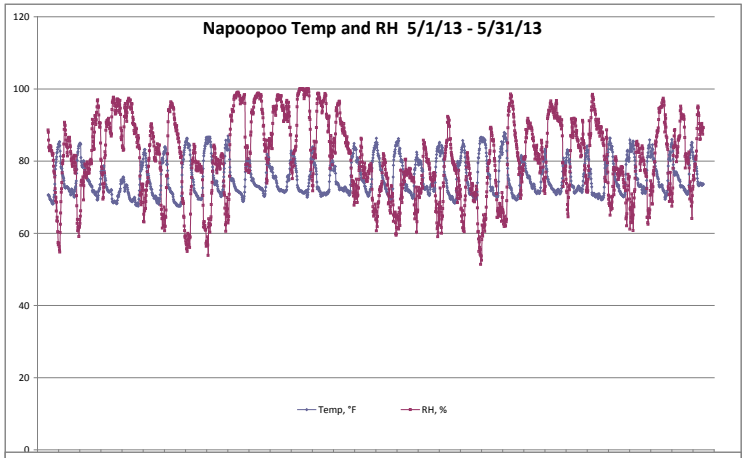


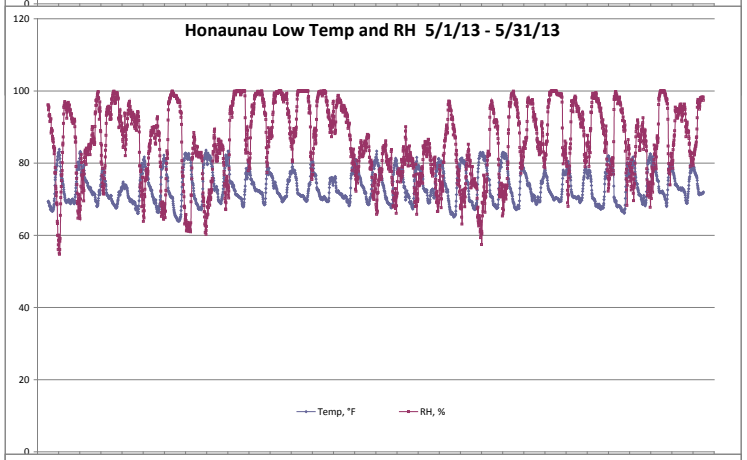
Efficacy: Destructive method

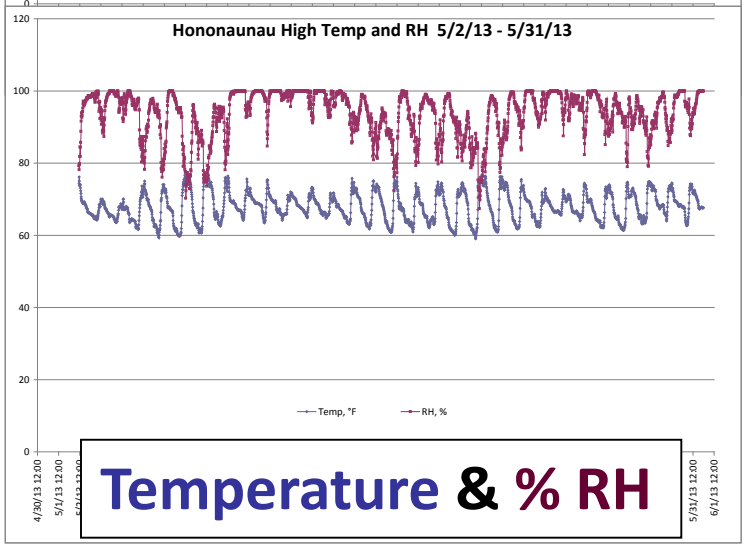


Data: Environmental

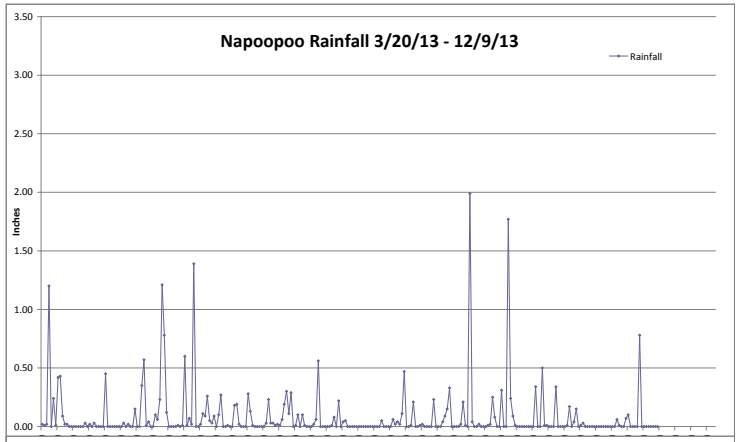


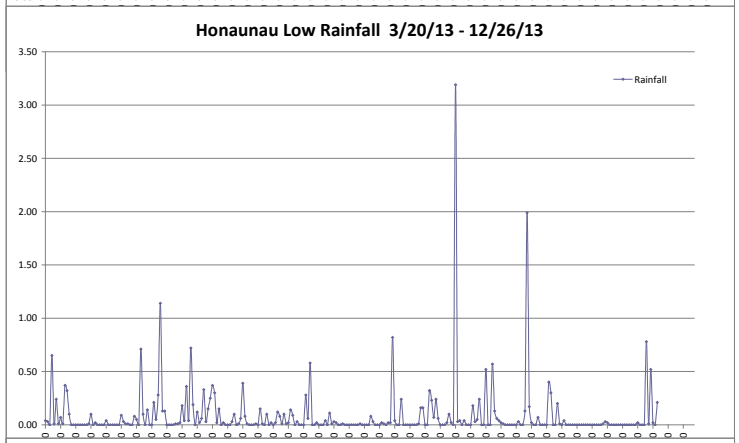


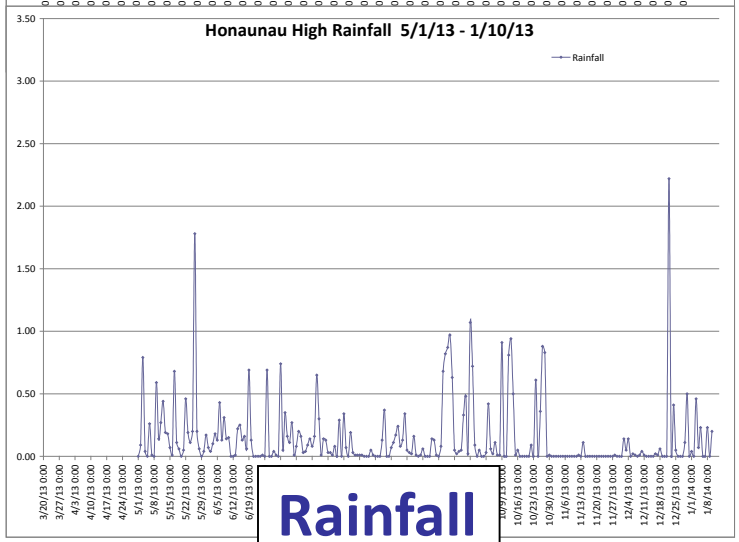




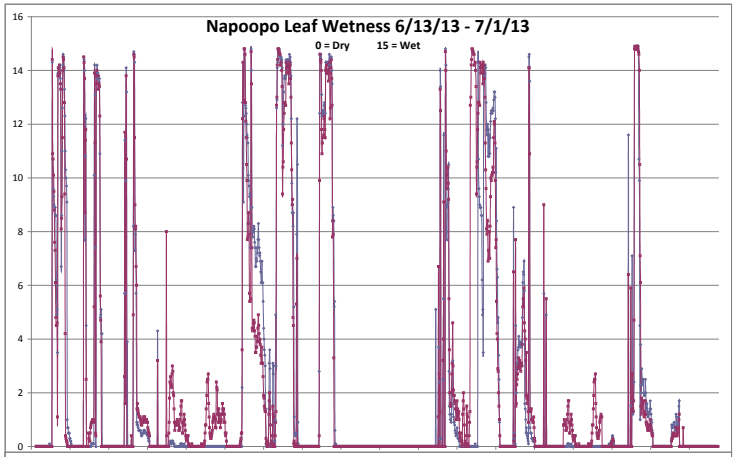
Temperature & % RH

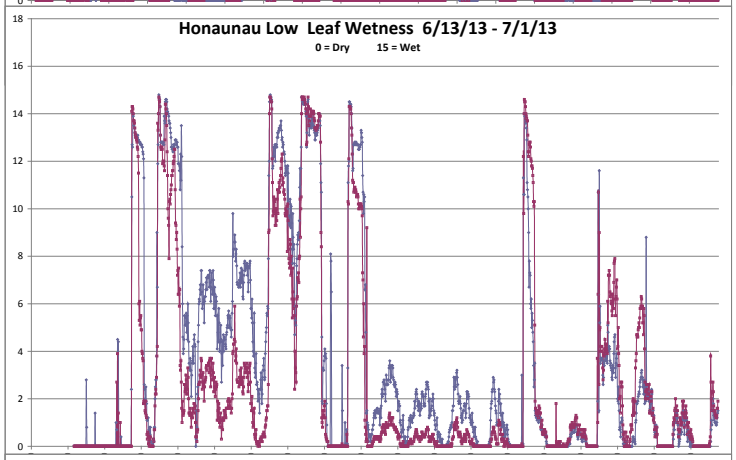


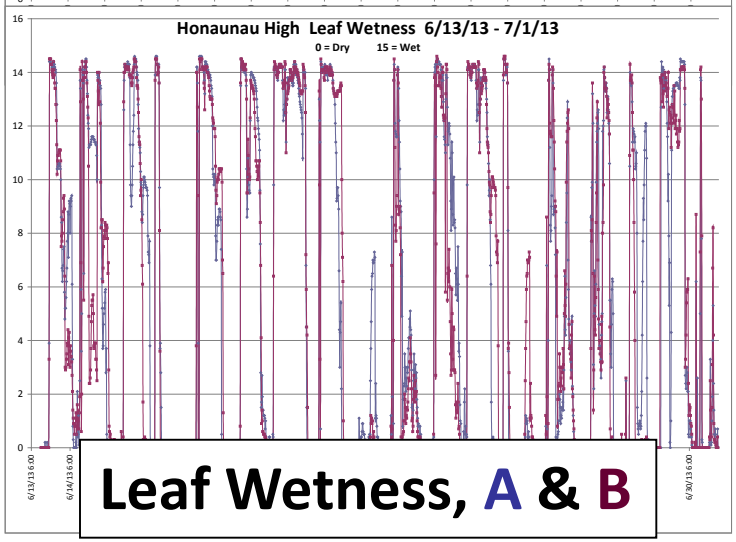




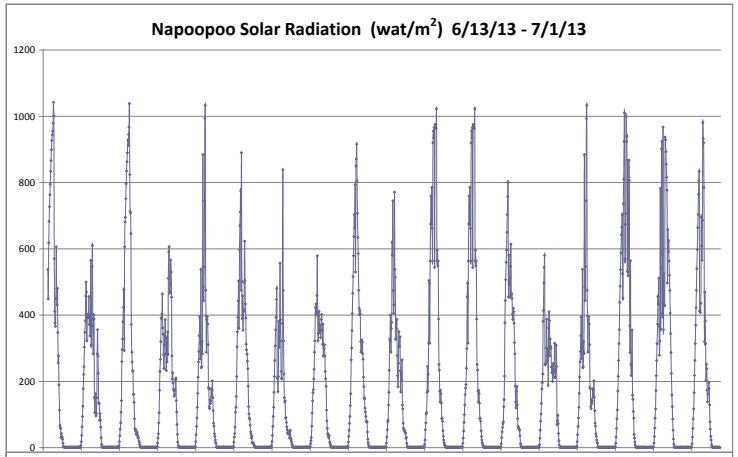
Rainfall

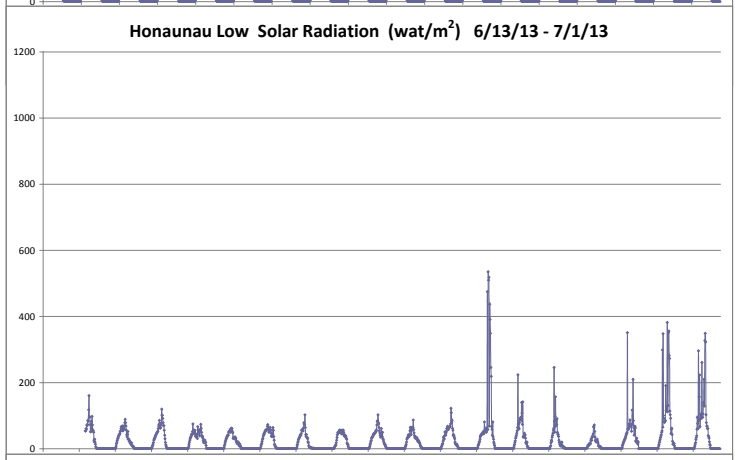


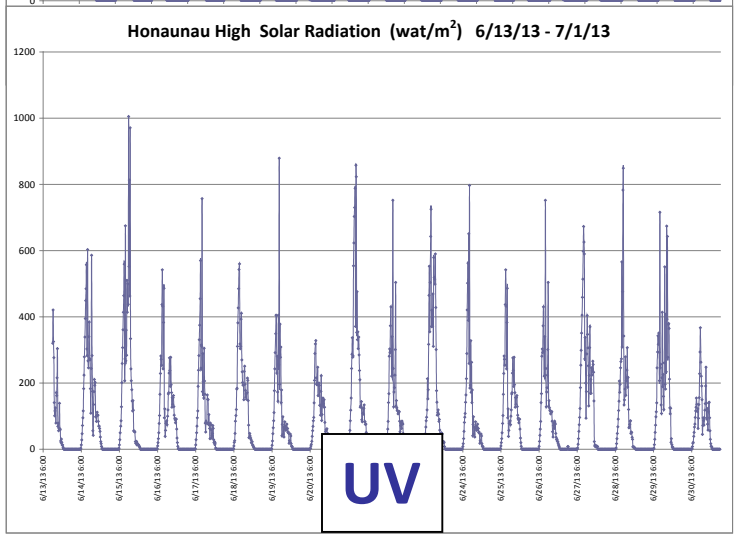




Leaf Wetness, A & B



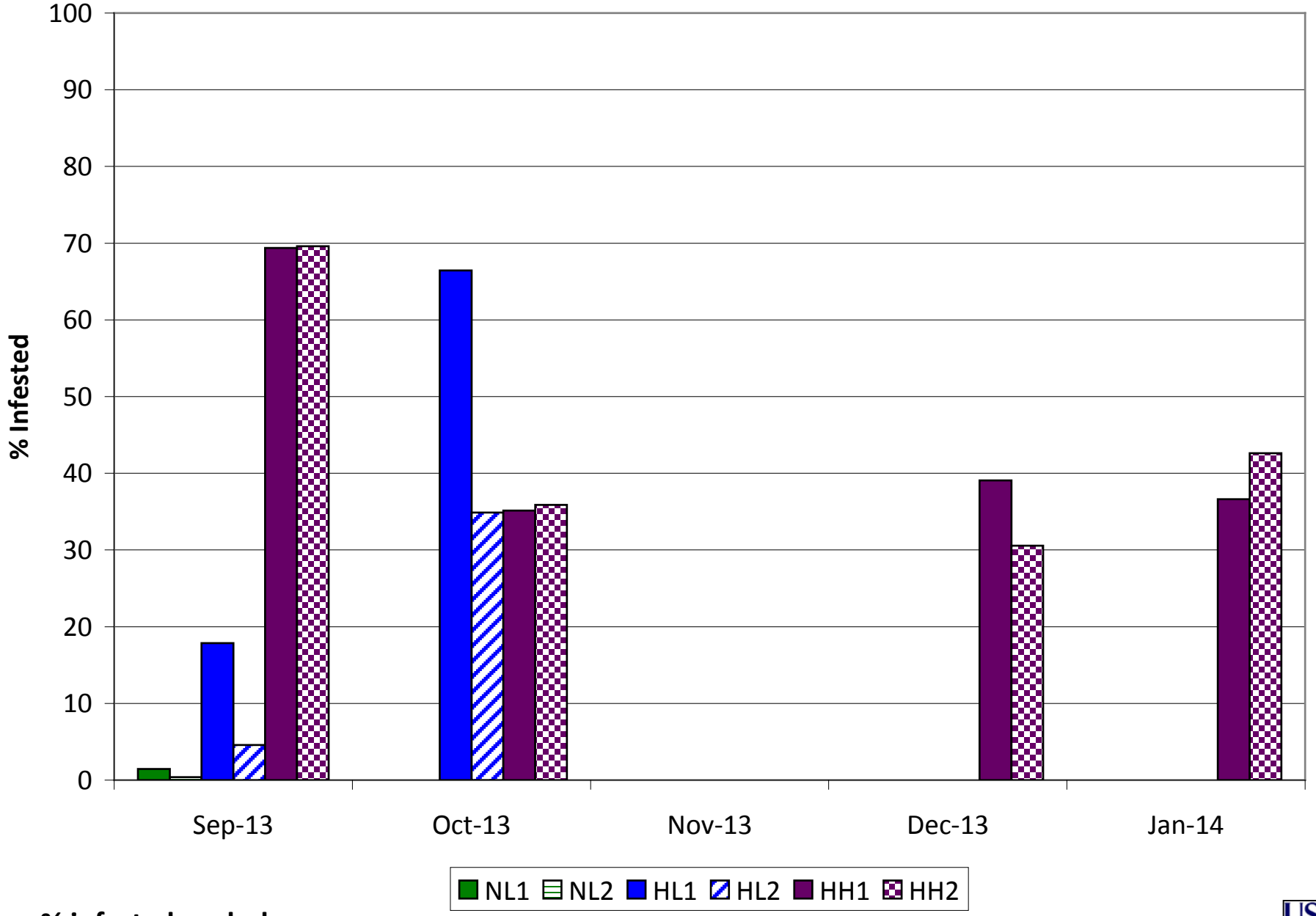




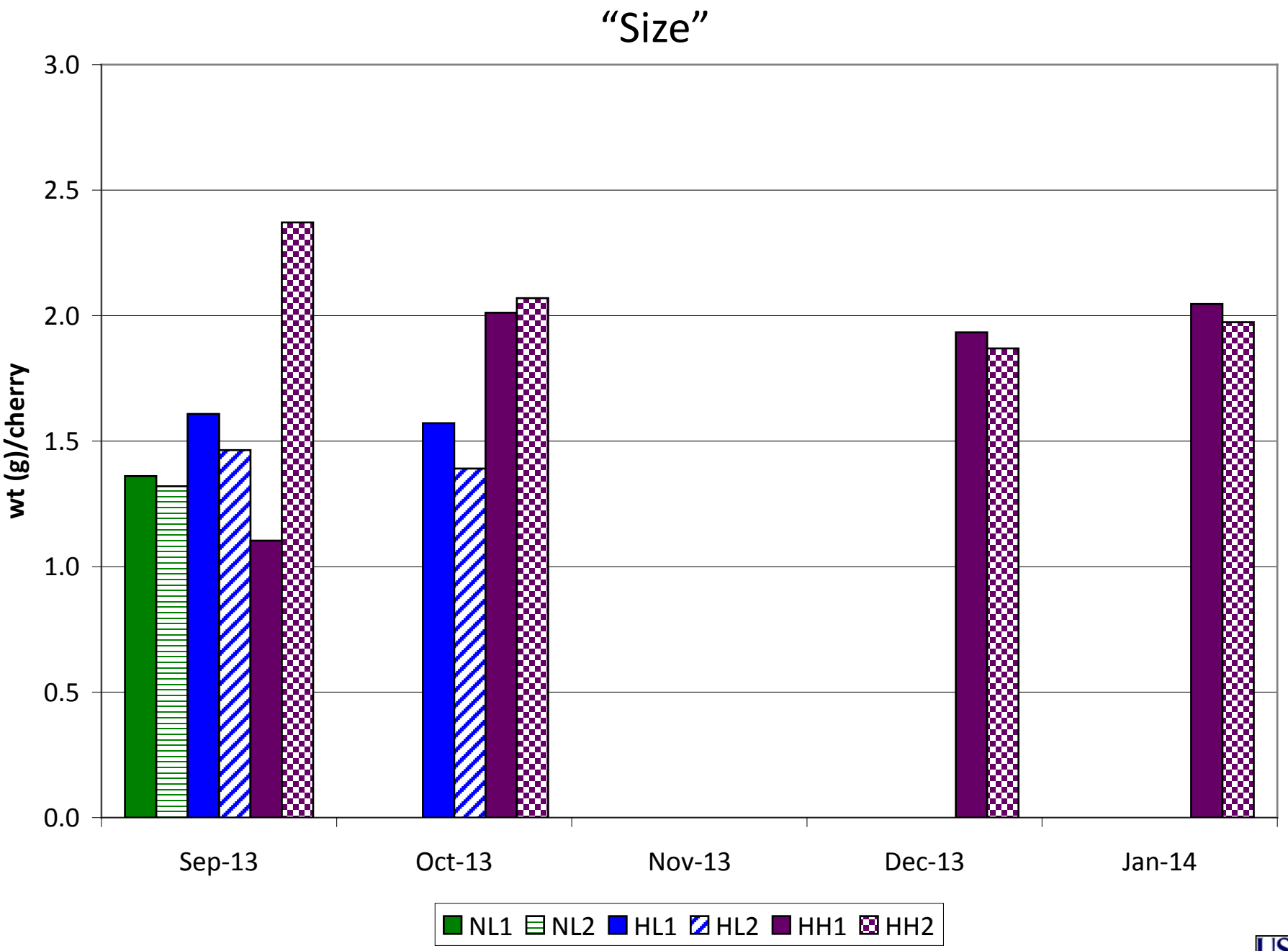
UV

Data: Harvest

“Quality”



% infested = a hole


"Size"
wt (g)/cherry
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Sep-13
Oct-13
Nov-13
Dec-13
Jan-14
NL1
NL2
HL1
HL2
HH1
HH2

Conclusions/Observations

- Temp/%RH/Rainfall
- UV, leaf wetness
- Locations are unique
- Years can very
- % fungus-killed adults*
  - Preventative v. Therapeutic
- Timing and number of applications
  - Not a substitute for sanitation

What Does The Data Tell Us?

- Knock back the existing CBB population early with multiple sprays
- Spray in the late afternoon
- *Beauveria* persistence is variable
- Monitor visually and spray as needed

What Does The Data Tell Us?

- "% infested" doesn't necessarily mean you have a high % of damaged beans
- Just because you don't see a lot of CBB "mummies" doesn't mean *Beauveria* sprays aren't working
- Be your own Sherlock Holmes, but consult with Dr. Watson


Thank You Field Cooperators!
(Thanks to Nicholle, Jim, Glenn, John)
Questions?
USDA