Managing Japanese Hops – What We Have Learned

A Brief Summary of an Intrepid Group Effort to Understand and Control a New Threat

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Aaron Cook, Western MD RC&D

Grant & CWMA Information

- Hops first came to attention on tree planting sites around 2002.
- “Blow-up” in 2003 following floods from Hurricane Isabel.
- Efforts to control it, but lacking information, controls being used often ineffective.
- MD DNR Forest Service receives grant from National Fish & Wildlife Foundation, Pulling Together Initiative.
- CWMA (Monocacy Watershed Japanese Hops Cooperative Weed Management Area Committee) is formed in 2006.

Grant & CWMA Information

- Survey of Hops locations
- Evaluation of previous control efforts
- Test control methods
  - Pre-emergent herbicide
  - Post-emergent herbicide
  - Manual, Mechanical & Cultural Controls
- Control Hops on infested sites, including use of volunteers

What is Japanese hops?

Identification, Life-Cycle, Habitat

Identification, Life-Cycle, Habitat

- Exotic invasive plant introduced from Asia.
- Introduced for ornamental / medicinal purposes.
- Can be found in MD and contiguous States along waterways, roadsides, and fencerows.
- 5-9 lobed palmate leaves.
- Climbing or trailing vine growth habit.
- Lacks tendrils, vine is covered with spinulose hairs (very irritating skin dermatitis).

Identification, Life-Cycle, Habitat

Identification, Life-Cycle, Habitat

- Very lush and green in appearance.
- Plant flowers in mid-summer and continues to flower and fruit into early autumn.
- Plant dies upon first frost (annual OR weak perennial?).
- Considered highly invasive due to its lack of natural enemies and aggressive growth habits.
- Not suitable for brewing as the female cones lack lupulin, the oily resin that gives brewing hops its distinct taste and aroma. And yet….

Identification, Life-Cycle, Habitat

…We have Japanese Beers?

Or just Japanese engineering using American parts?

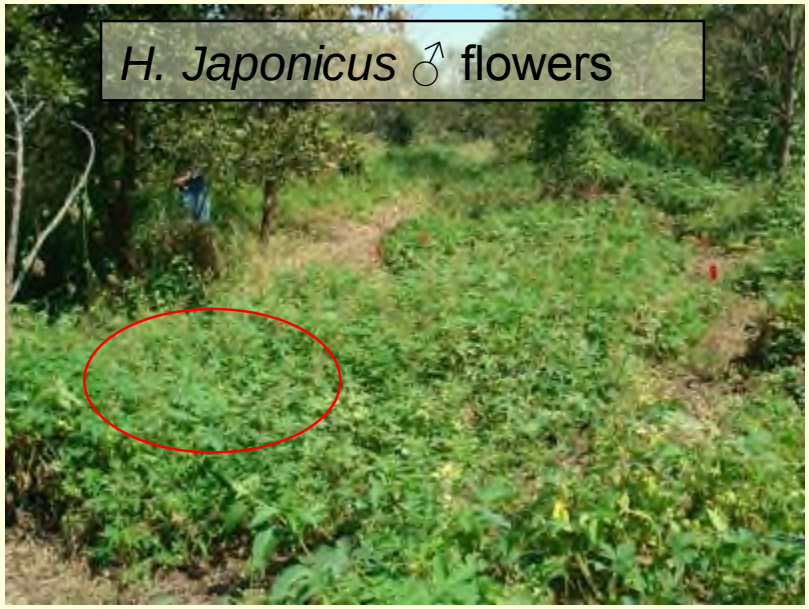
The hope is that our brewing hops is inhibiting a native eco-system in Japan.

Identification, Life-Cycle, Habitat

Wind Pollination

H. Japonicus ♂ flowers

Identification, Life-Cycle, Habitat



Identification, Life-Cycle, Habitat

H. Japonicus ♀ cones (achenes)

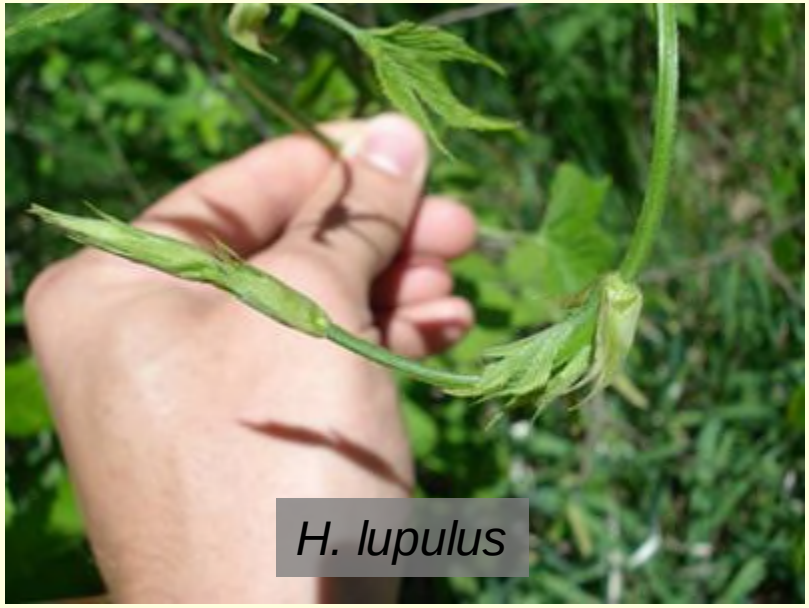
Identification, Life-Cycle, Habitat

H. Japonicus ♀ cones

Identification, Life-Cycle, Habitat

H. japonicus

New growth on both species

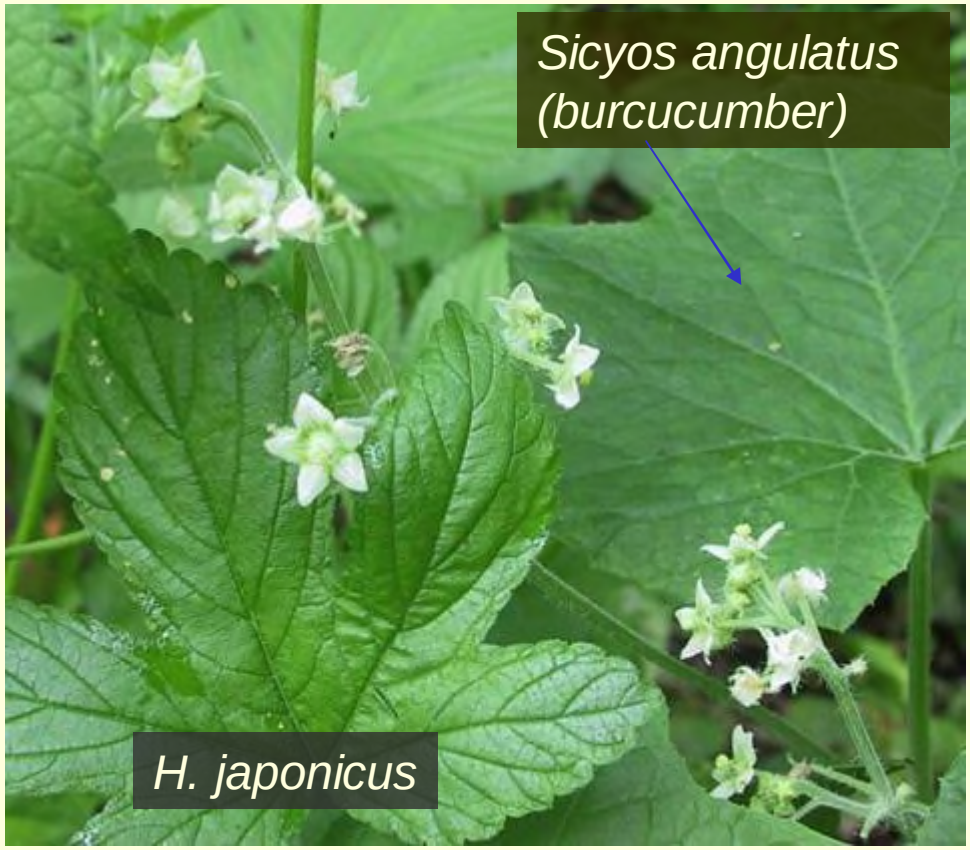


H. lupulus

Identification, Life-Cycle, Habitat

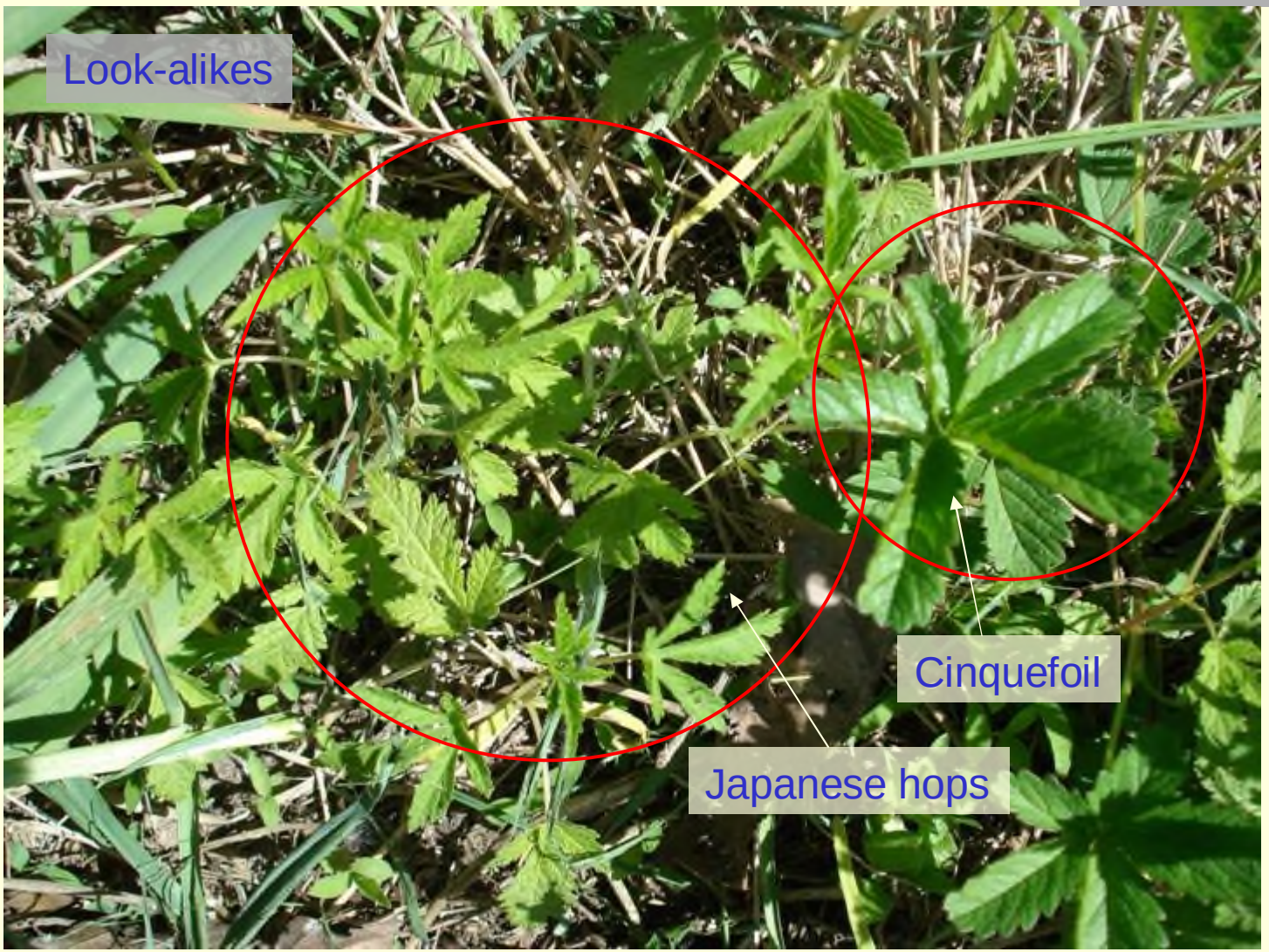
H. lupulus

Identification, Life-Cycle, Habitat



Look-alikes

Identification, Life-Cycle, Habitat



Identification, Life-Cycle, Habitat

- Hops seed remains viable for at least 3 years in soil.
- Hops seed can float.
- Hops vines can reach lengths of 10-30 feet.
- Hops thrives in full sunlight riparian areas.
- Hops is difficult to control with mechanical methods.
- Hops is very aggressive and can grow 1 foot or more a day (not sustained over season).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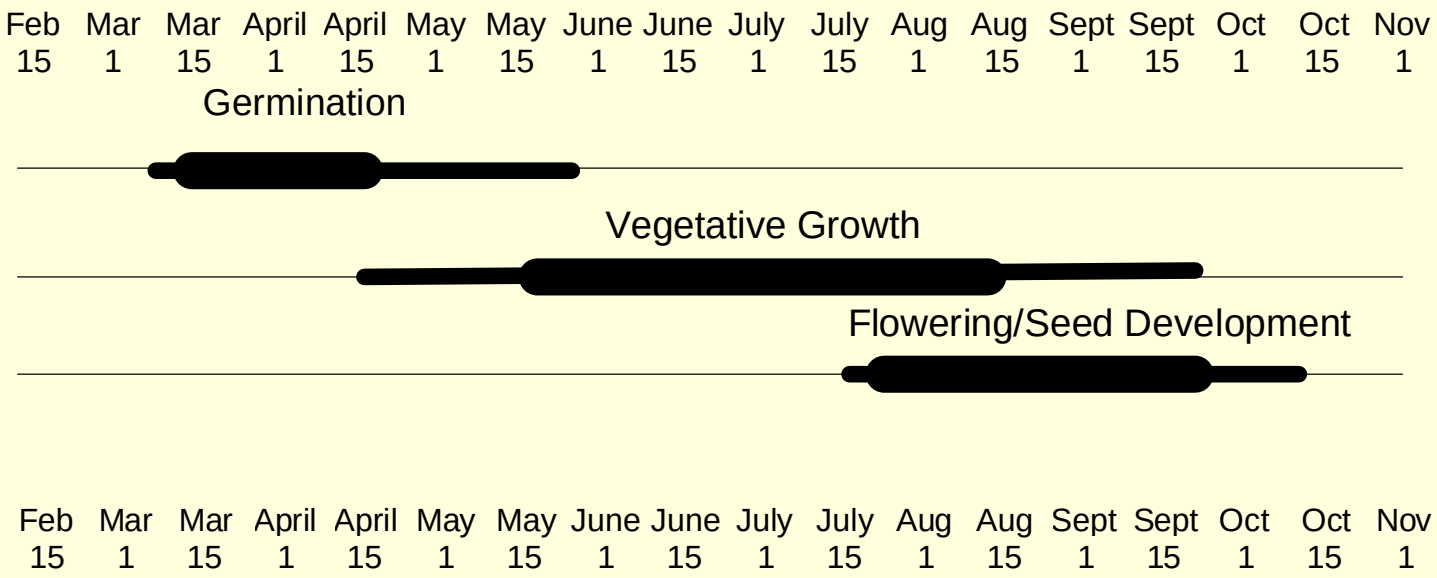
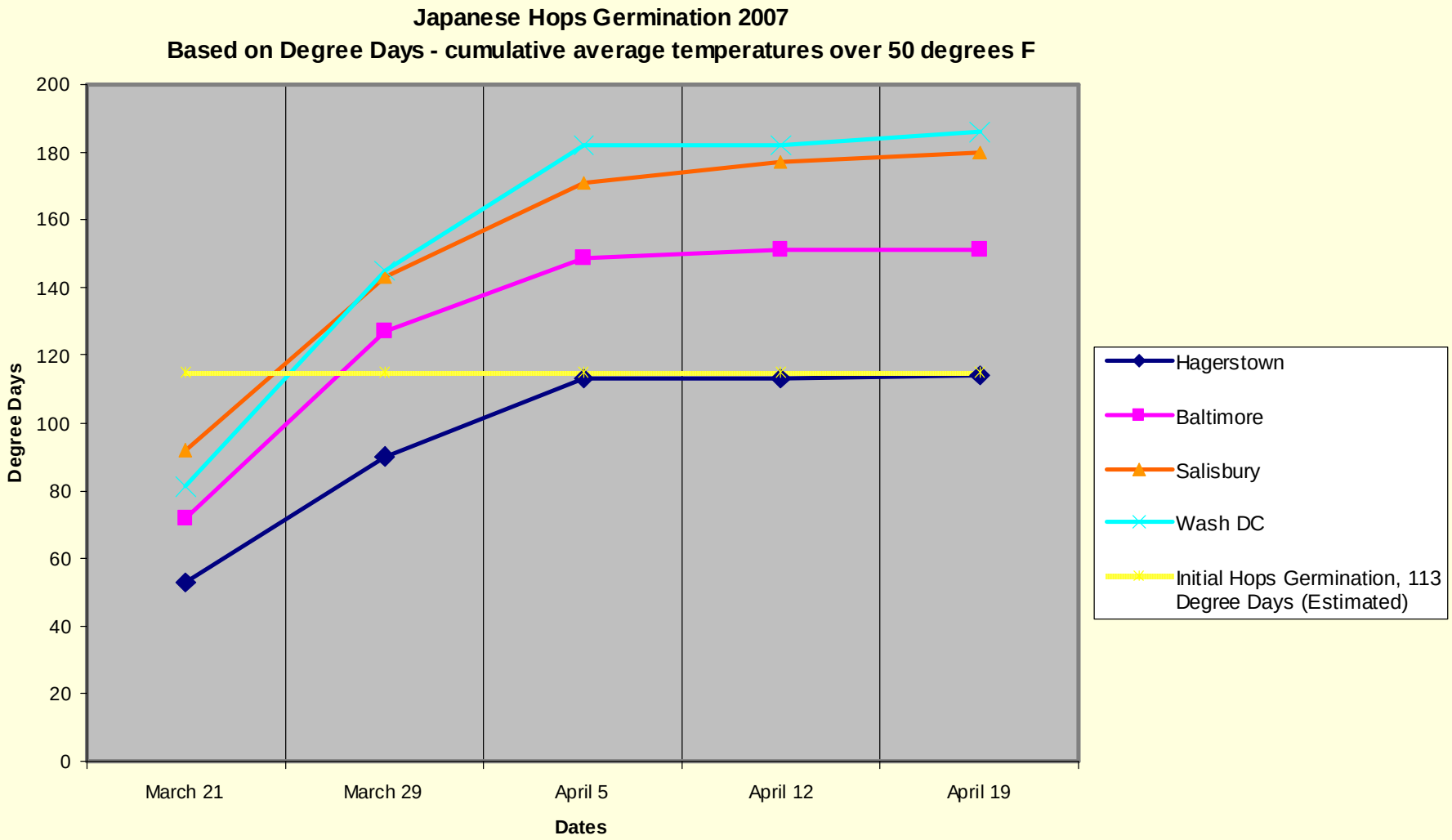
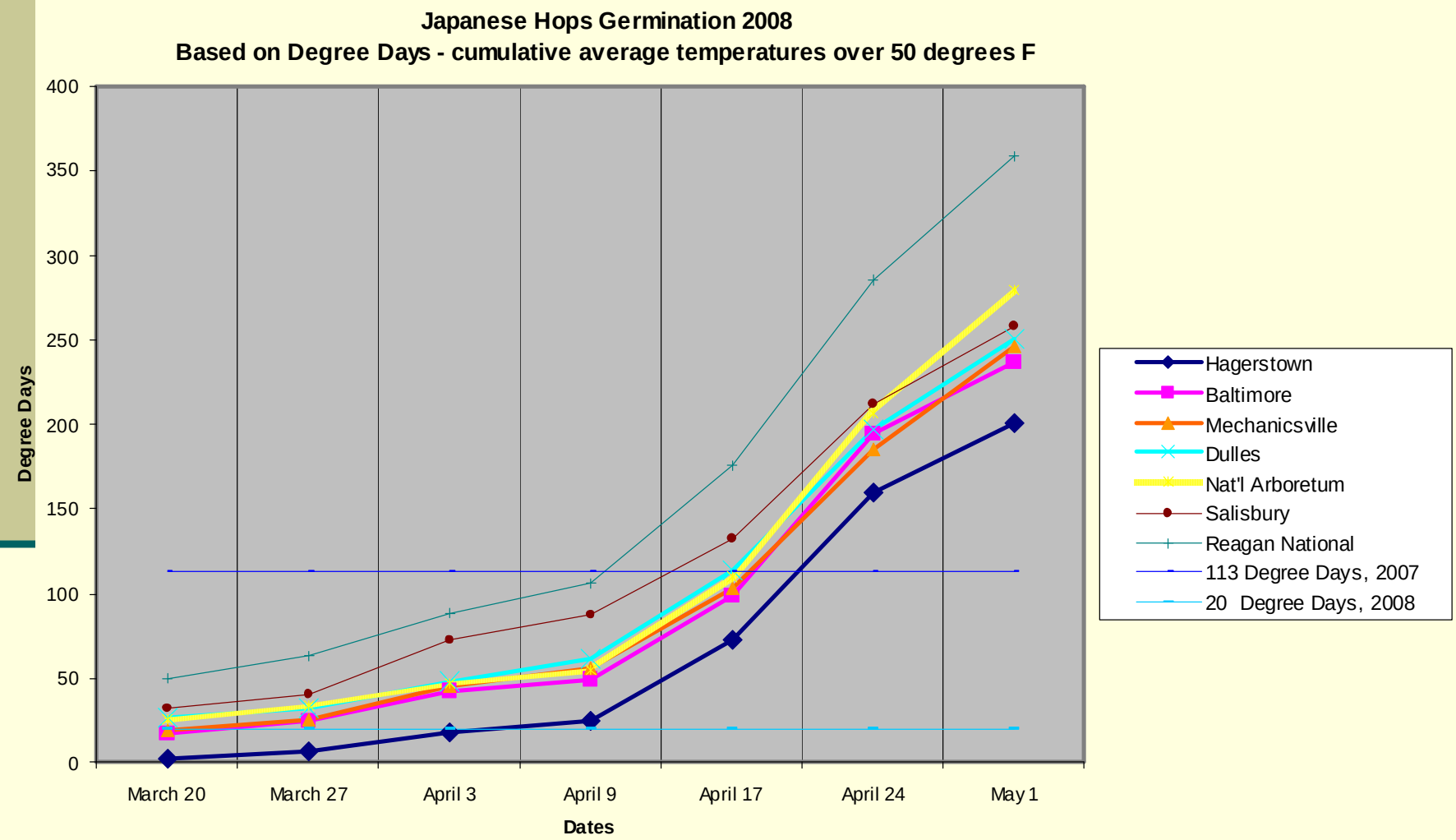
Identification, Life-Cycle, Habitat



Identification, Life-Cycle, Habitat



Identification, Life-Cycle, Habitat



Identification, Life-Cycle, Habitat

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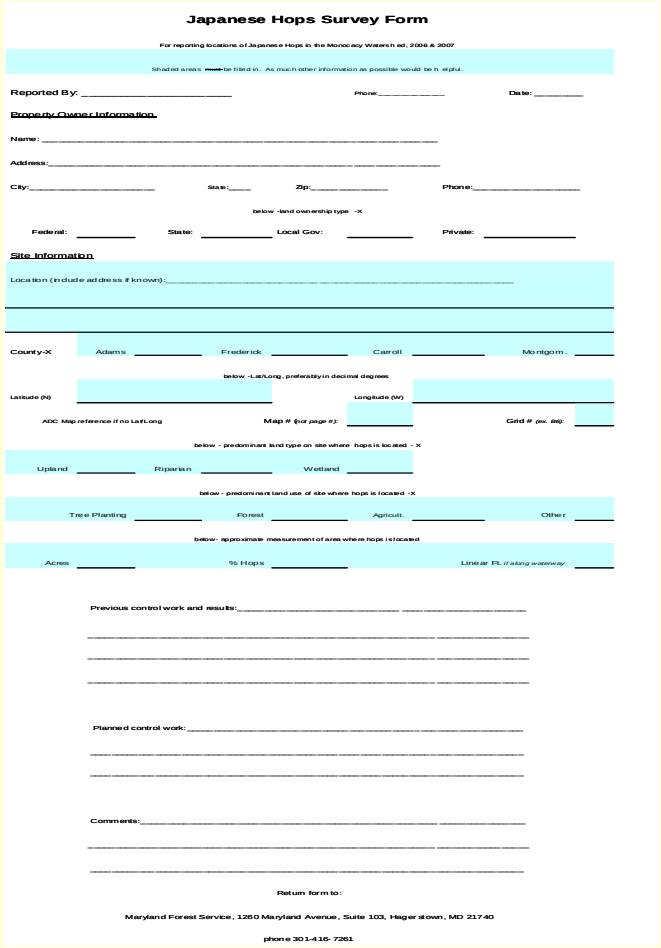
Identification, Life-Cycle, Habitat

Surveys

- Approx. 40 surveys returned.
- 270 Acres impacted by Japanese hops.
- 40% of impacted acreage is tree planting area.
- 95% of impacted land type is riparian area.
- Allowed CWMA to find testing sites.



Japanese Hops Survey Form

For reporting locations of Japanese Hops in the Monocacy Watersh ed, 2006 & 2007

Shaded areas must be filled in. As much other information as possible would be h elpful.

Reported By: _____ Phone:_____ Date: _____

Property Owner Information

Name: _____

Address:_____

City:_____ State:_____ Zip:_____ Phone:_____

below -land ownership type -X

Federal: _____ State: _____ Local Gov: _____ Private: _____

Site Information

Location (in clude address if known):_____

County-X Adams _____ Frederick _____ Carroll _____ Montgom. _____

below -Lat/Long, preferably in decimal degrees

Latitude (N) _____ Longitude (W) _____

ADC Map reference if no Lat/Long Map # (or page #): _____ Grid # (ex. 8d): _____

below - predominant land type on site where hops is located - X

Upland _____ Riparian _____ Wetland _____

below - predominant land use of site where hops is located -X

Tree Planting _____ Forest _____ Agricult. _____ Other _____

below- approximate measurement of area where hops is located

Acres _____ % Hops _____ Linear Ft. *if along waterway* _____

Previous control work and results:_____

_____

_____

_____

Planned control work:_____

_____

_____

Comments:_____

_____

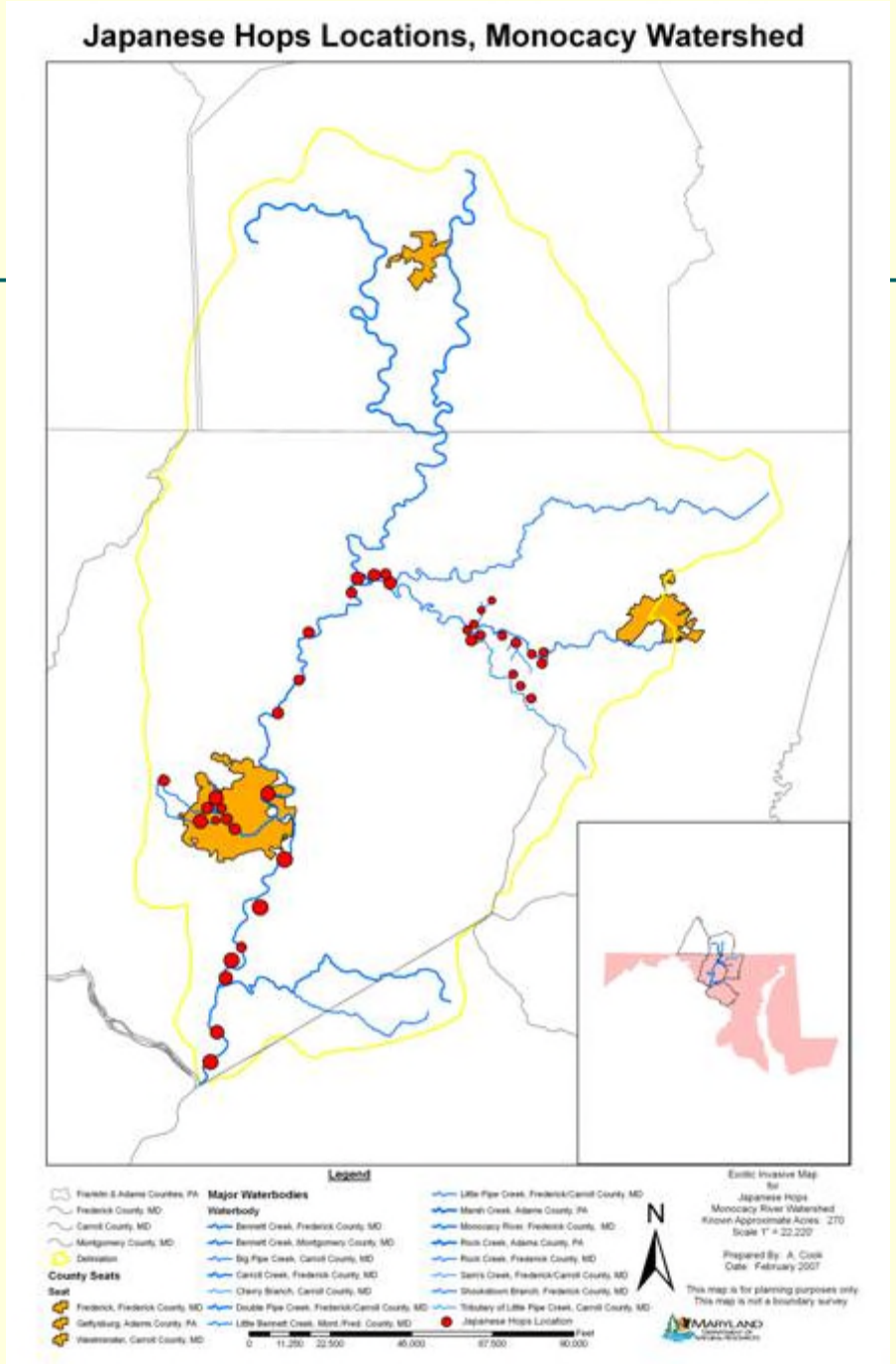
_____

Return form to:

Maryland Forest Service, 1260 Maryland Avenue, Suite 103, Hagerstown, MD 21740

phone 301-416-7261

Japanese Hops Locations, Monocacy Watershed



Japanese Hops CWMA Meeting

Control Methods

- Biological, and several other cultural control methods were also investigated.
- Throughout the growing season no biological agent created enough damage to reduce the Hops plant.
- Japanese beetles, occasional deer browsing, and powdery mildew were the only noted biological pests of Hops.

Cultural Control

- Management practices that encourage tall, fast tree growth and early crown closure, along with effective weed control, will help to shorten and eliminate the threats Hops can pose.
- Use tree shelters to help identify and protect the planted tree and exclude the Hops plant.
- Early identification of Hops and good site preparation are key to an early head start and long term success for the riparian planting.

Manual Control

- Manual Control is somewhat effective.
- Japanese Hops is small and shallow rooted, making it easy to hand pull early in the growing season when the plant is small.
- Hand pulling is very time consuming and labor intensive.
- Hand pulling is a good method for homeowners with small populations of the plant, and parks with many volunteers.

Mechanical Control

- Mechanized cutting of the Hops vines is an acceptable control.
- Most effective when the area is accessible, and the process is started early and applied often throughout the growing season.
- Problems include damage to the planting, time consuming and expensive (fuel), vines often re-sprout vigorously.

Post-Emergent Evaluations

- Post-emergent herbicides can be used in large areas where Hops is already established.
- Can be used in combination with pre-emergent herbicides.
- The ideal situation would be to make 1 application a season, which maintains adequate control.
- A more typical option would be to make at least 2 applications a season, after germination but before extensive growth, and again before seed production. (May, July).

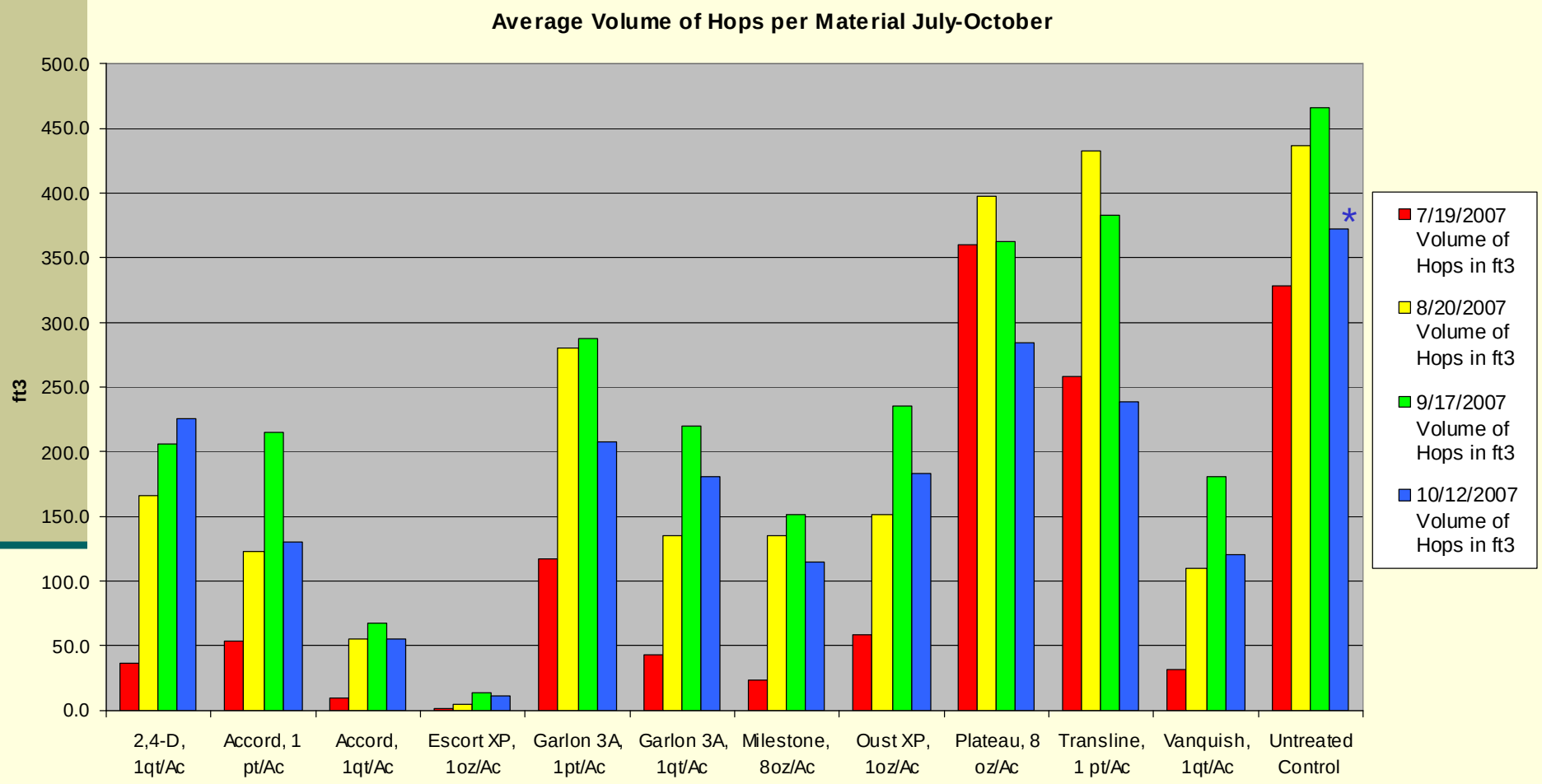
Post-Emergent Evaluations

- June 2007, 36, 11’ x 17.5’ plots were sprayed with 11 different products and 1 control (3 repetitions).
- Ground cover in test plots was inventoried prior to treatment and again each month for 5 months following treatment.
- No new seedling germination following the application in June.
- Re-growth of Hops came from roots of vine not entirely dead.

Post-Emergent Evaluations

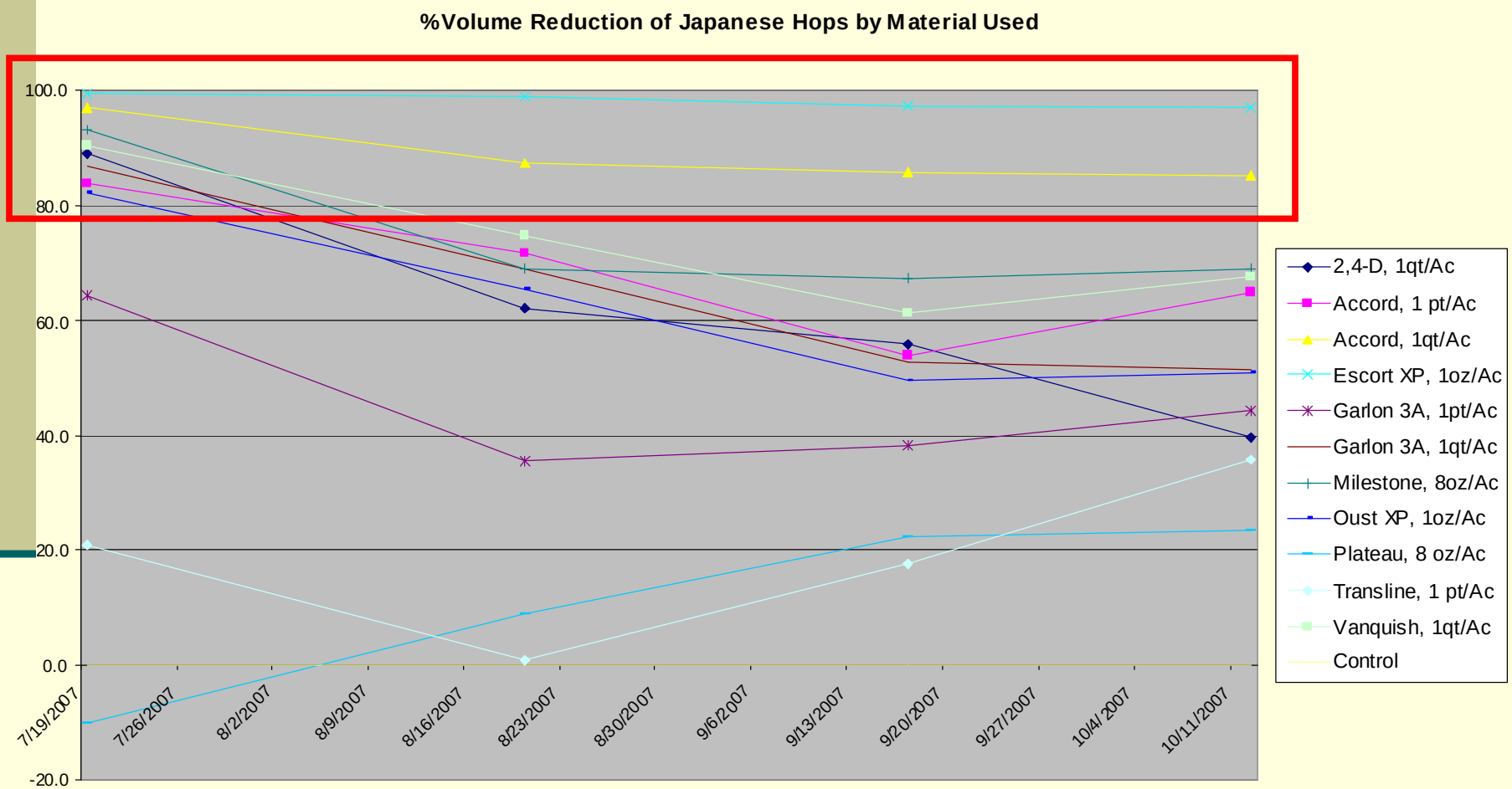
- Materials chosen for study include: Glyphosate (Accord®), Metsulfuron (Escort XP®), Dicamba (Vanquish®), 2,4-D ester, Triclopyr amine (Garlon 3A®), Aminopyralid (Milestone VM®), Sulfometuron (Oust XP®), Clopyralid (Transline®), and Imazapic (Plateau®).
- Garlon 3A®, Accord® at two rates 1pt & 1qt.
- All mixtures used a non-ionic surfactant at ½%.

Post-Emergent Evaluations



*The uniform decline in October is due to senescence of Hops

Post-Emergent Evaluations



Japanese Hops 2 and 4 weeks after treatment with 1 qt./acre of Accord

Post-Emergent Evaluations

Material	7/15/2007 Ranking	8/20/2007 Ranking	9/17/2007 Ranking	10/12/2007 Ranking	Avg. 2007 Ranking
2,4-D, 1qt/Ac	5	8	5	9	7
Accord, 1 pt/Ac	7	4	6	5	5
Accord, 1qt/Ac	2	2	2	2	2
Escort XP, 1oz/Ac	1	1	1	1	1
Garlon 3A, 1pt/Ac	9	9	9	8	9
Garlon 3A, 1qt/Ac	6	5	7	6	6
Milestone, 8oz/Ac	3	6	3	3	3
Oust XP, 1oz/Ac	8	7	8	7	8
Plateau, 8 oz/Ac	11	10	10	11	11
Transline, 1 pt/Ac	10	11	11	10	10
Vanquish, 1qt/Ac	4	3	4	4	4
Untreated Control	- -	- -	- -	- -	- -

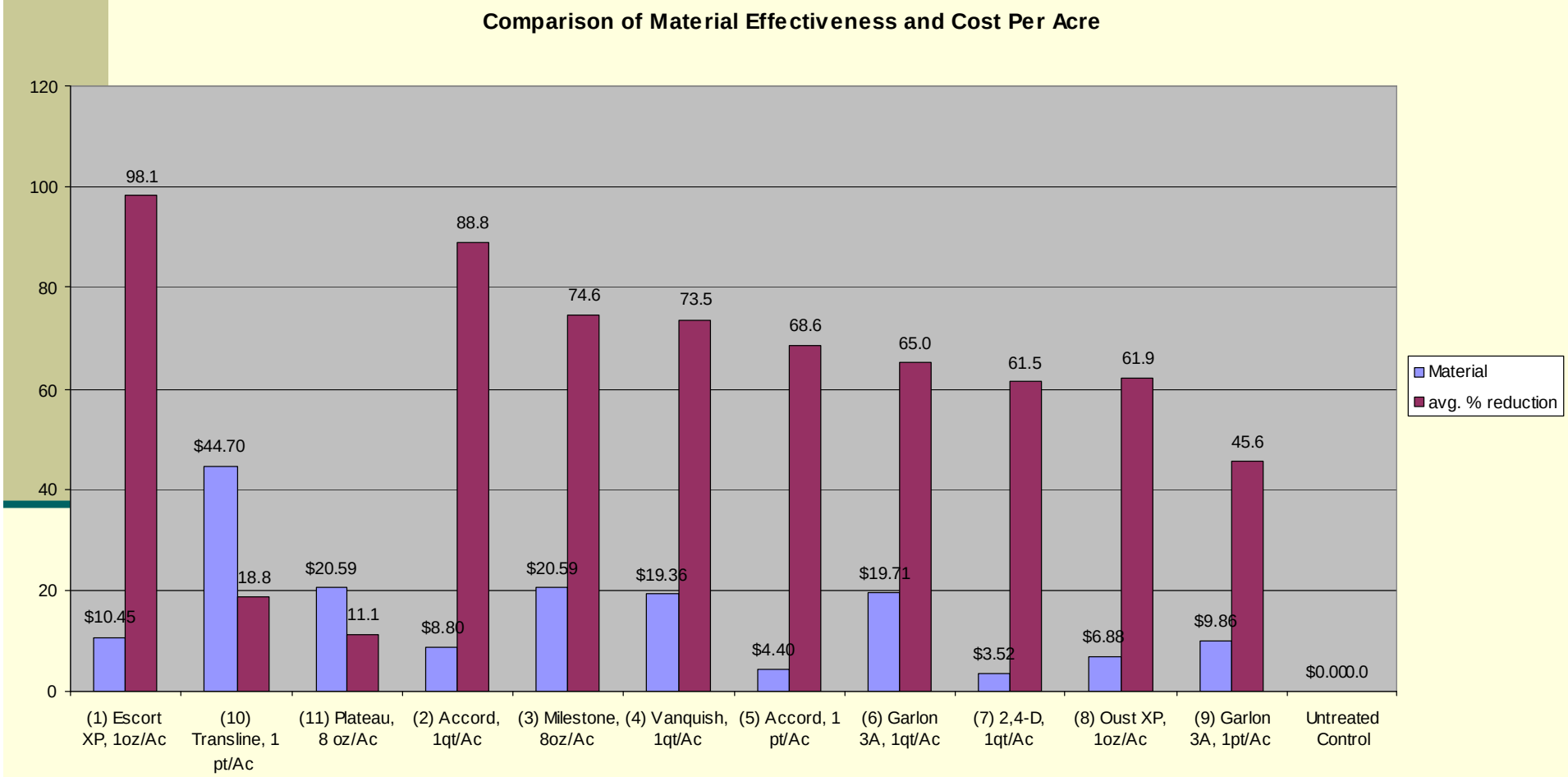
Post-Emergent Evaluations

Material	Price	Price / oz	Price / acre	Price / acre after S & H
(1) Escort XP, 1oz/Ac	$9.50 / oz	$9.50	$9.50	$10.45
(10) Transline, 1 pt/Ac	$325.00 / gal	$2.54	$2.54	$2.79
(11) Plateau, 8 oz/Ac	$300.00 / gal	$2.34	$18.72	$20.59
(2) Accord, 1qt/Ac	$32.00 / gal	$0.25	$8.00	$8.80
(3) Milestone, 8oz/Ac	$300.00 / gal	$2.34	$18.72	$20.59
(4) Vanquish, 1qt/Ac	$70.00 / gal	$0.55	$17.60	$19.36
(5) Accord, 1 pt/Ac	$32.00 / gal	$0.25	$4.00	$4.40
(6) Garlon 3A, 1qt/Ac	$72.00 / gal	$0.56	$17.92	$19.71
(7) 2,4-D, 1qt/Ac	$13.00 / gal	$0.10	$3.20	$3.52
(8) Oust XP, 1oz/Ac	$100.00 / lb	$6.25	$6.25	$6.88
(9) Garlon 3A, 1pt/Ac	$72.00 / gal	$0.56	$8.96	$9.86
Untreated Control	$0.00	$0.00	$0.00	$0.00

** As per Alenza*

10% added for S&H

Post-Emergent Evaluations



Post-Emergent Evaluations

Chemical	Product	Rate/Acre	Effectiveness*	Cost per acre**
metsulfuron	Escort XP®	1 ounce	Good	Inexpensive
glyphosate	Accord Concentrate®	1 quart	Good	Inexpensive
glyphosate	Accord Concentrate®	1 pint	Fair	Very inexpensive
aminopyralid	Milestone VM®	8 fl. oz.	Fair	Moderate
dicamba	Vanquish®	1 quart	Fair	Moderate
2,4-D	2,4-D LV 4®	1 quart	Fair	Very inexpensive
triclopyr	Garlon 3A®	1 quart	Fair	Moderate
triclopyr	Garlon 3A®	1 pint	Poor	Inexpensive
sulfometuron	Oust XP®	1 ounce	Poor	Inexpensive
clopyralid	Transline®	16 fl. oz.	Very Poor	Expensive
imazapic	Plateau®	8 fl. oz.	Very Poor	Moderate

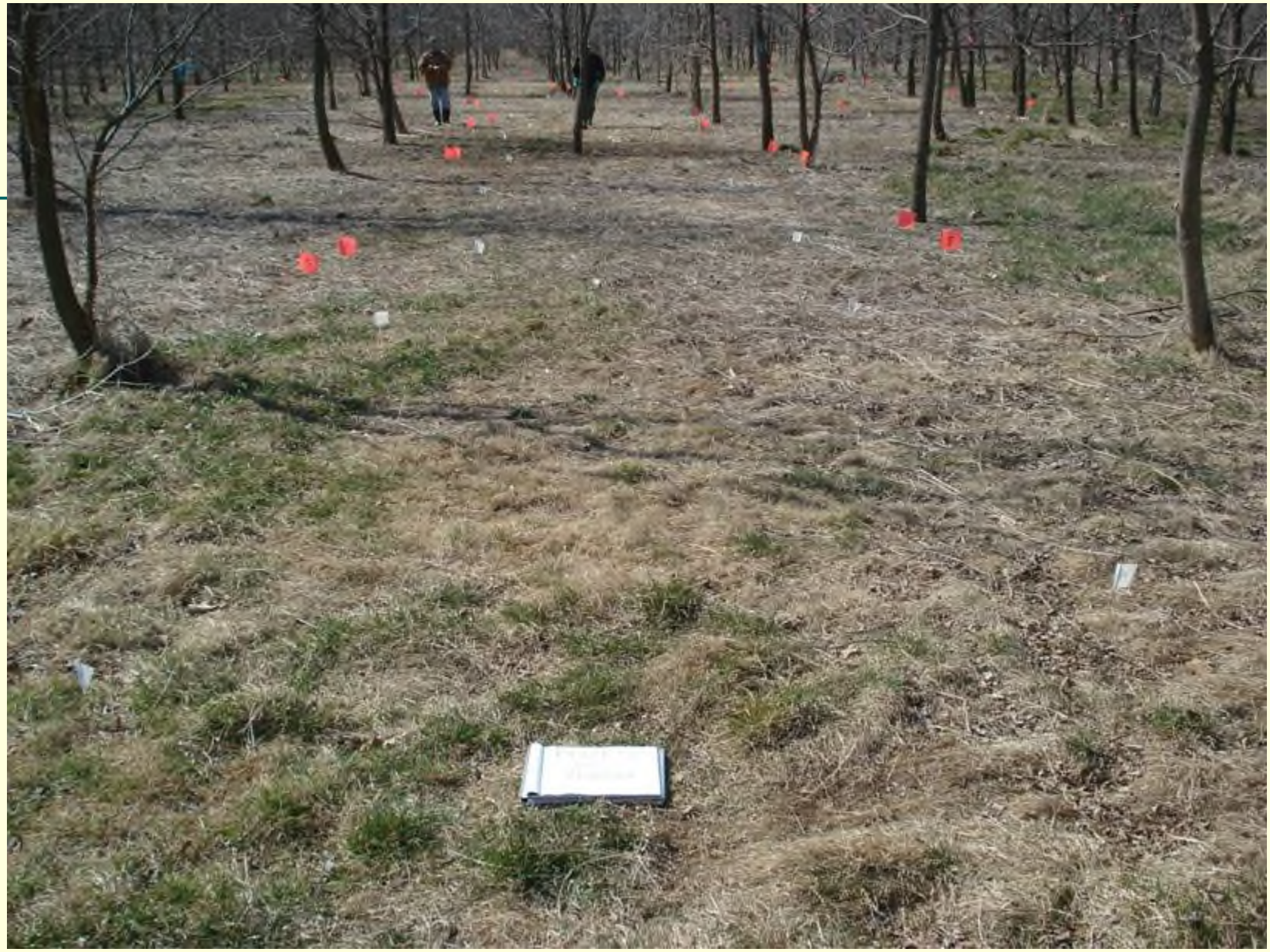
Post-Emergent Evaluations

- Manual Control is somewhat effective.
- Japanese Hops is small and shallow rooted, making it easy to hand pull early in the growing season when the plant is small.
- Hand pulling is very time consuming and labor intensive.
- Hand pulling is a good method for homeowners, and parks with many volunteers.

Pre-Emergent Evaluations

- Purpose of understanding preventative control measures.
- 27, 8’ x 12.5’ evaluation plots in which 7 pre-emergent herbicides, and control were tested in 3 repetitions.
- Ground cover in test plots was inventoried prior to treatment and will be evaluated again each month for 4 months following treatment.
- Hops germinated 3/13/2008 and has survived several heavy frosts, flooding, and dry spells.

Plot 5, 2,4-D, March - July



March

April

May

June

July

Pre-Emergent Evaluations

- Materials chosen for study include:
  - Simazine 4L® @ 4qts / Ac
  - Pendulum AquaCap® @ 4.2qts / Ac
  - Plateau® @ 8oz / Ac
  - Oust XP® @ 1oz / Ac
  - Escort XP® @ ½ oz / Ac
  - Goal 2XL® @ 2qts / Ac
  - SureGuard® @ 12oz / Ac
- 2,4-D (1qt / Ac) was applied in each plot except untreated control, following pre-emergent treatment due to germination of Hops during PE Treatment.

Pre-Emergent Evaluations

March 12, 2008

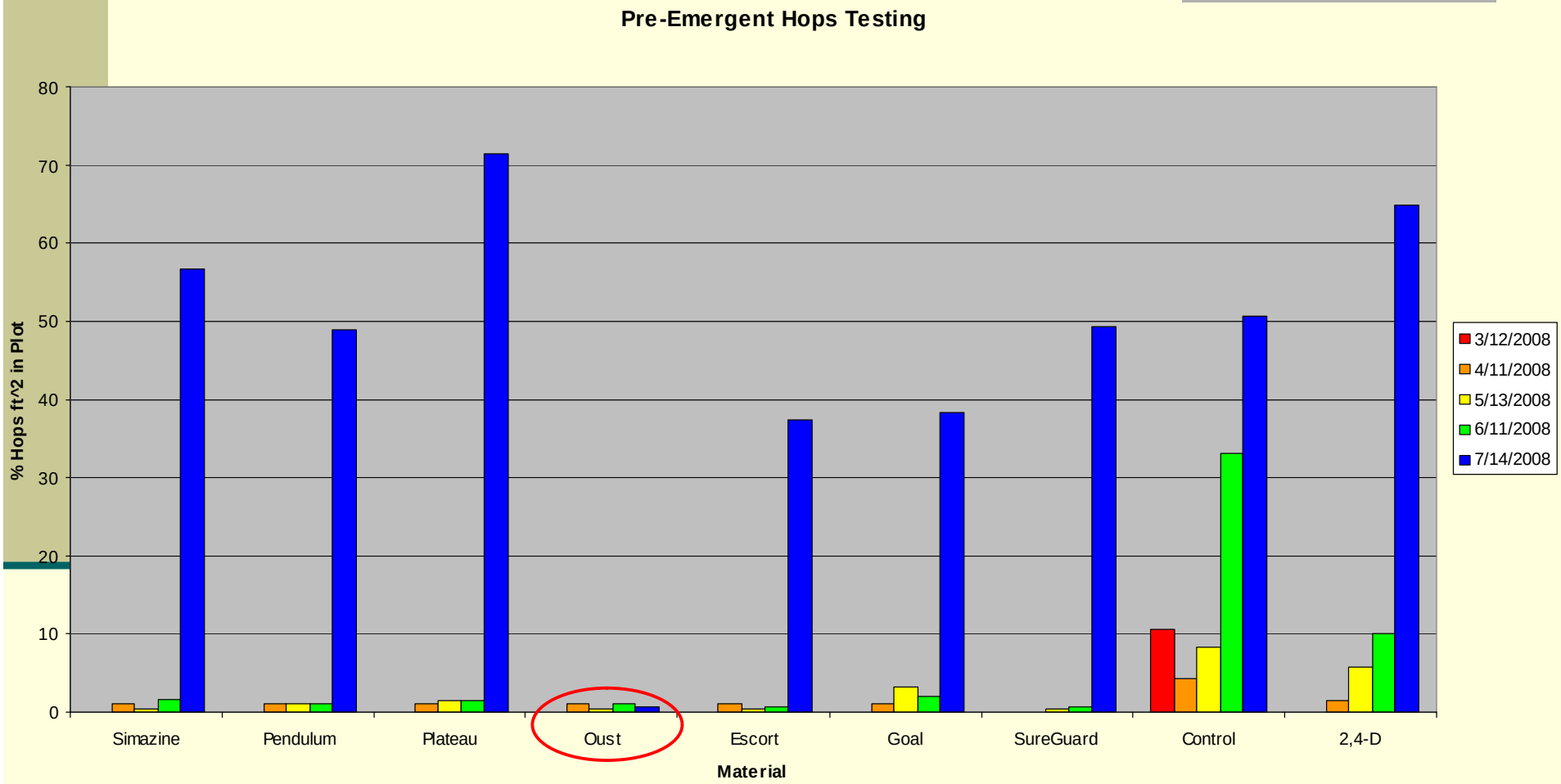
Pre-Emergent Evaluations

March 13, 2008

Pre-Emergent Evaluations

March 13, 2008

Pre-Emergent Evaluations



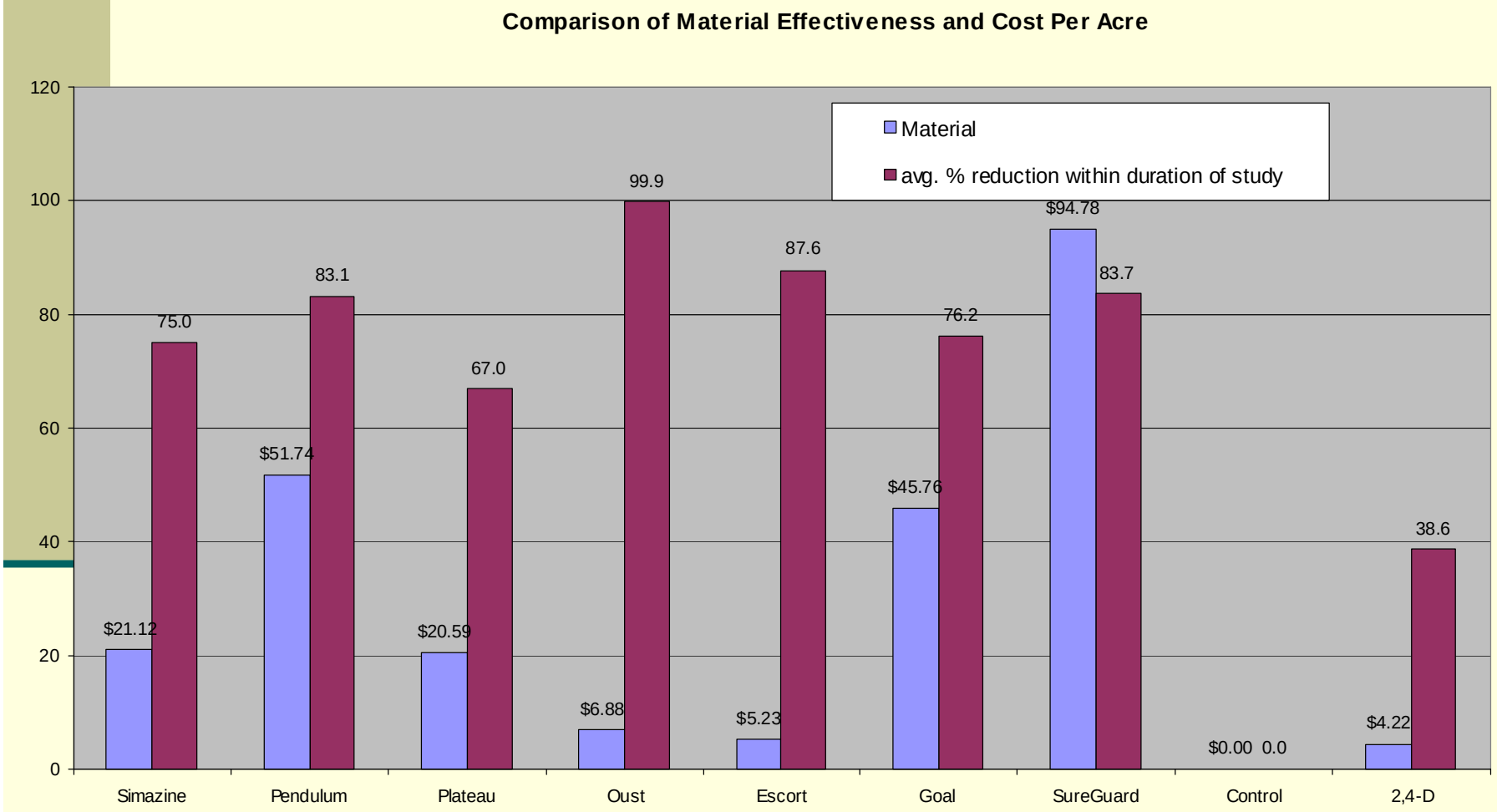
Pre-Emergent Evaluations

Material	Price	Price / oz	Rate @ oz / acre	Price / acre after S & H
Oust (1)	$100/ lb	$6.25	1	$6.88
Escort (2)	$9.50/ oz	$9.50	0.5	$5.23
SureGuard (3)	$115 / lb	$7.18	12	$94.78
Pendulum (4)	$45.00 / gal	$0.35	134.4	$51.74
Goal (5)	$83.00 / gal	$0.65	64	$45.76
Simazine (6)	$19.00 / gal	$0.15	128	$21.12
Plateau (7)	$300.00 / gal	$2.34	8	$20.59
2,4-D (8)	$14.50 / gal	$0.12	32	$4.22
Control	$0 / gal	$0.00	0	$0.00

** As per Alenza*

10% added for S&H

Pre-Emergent Evaluations



Pre-Emergent Evaluations

- From this data it appears Oust XP and Escort XP are effective and affordable chemical pre-emergent control methods.
- Manual & Mechanical Control methods are effective during this time, vigilance is paramount, especially during June and July.
- No pre-emergent herbicide appeared to inhibit flowering or sexual maturation of the plant.

Pre-Emergent Evaluations

- **Potted Study** for purpose of understanding preventative control measures, excluding other factors.
- 28, 8” diameter x 6” deep evaluation pots in which the same 7 pre-emergent herbicides, and control were tested in 3 repetitions.
- Test pots evaluated each month for 4 months following treatment.
- The hops germinated 4/4/2008, and have survived several heavy frosts, wet & dry spells, and a few falling trees.

Pre-Emergent Evaluations

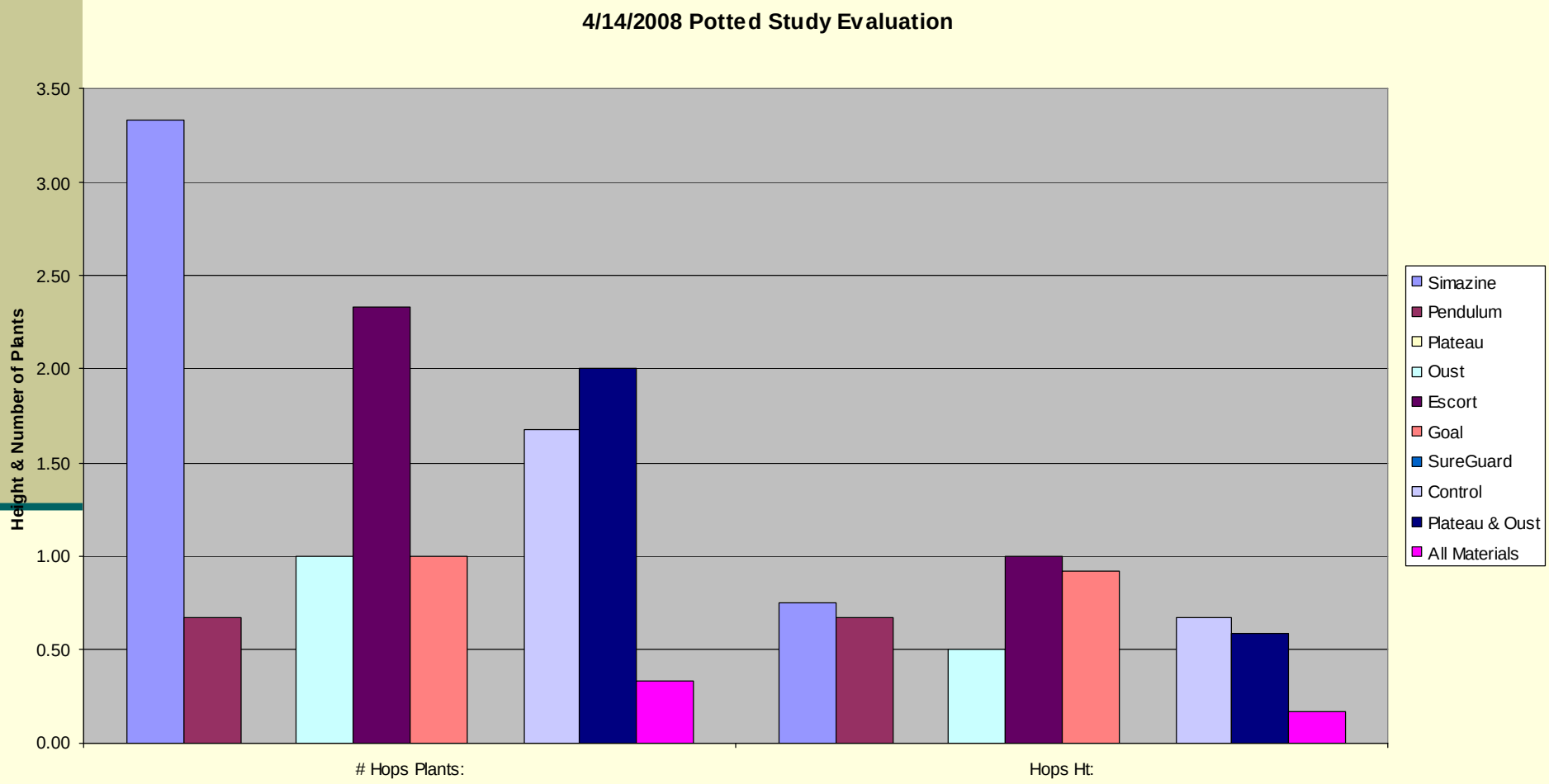
4/14/2008


25, Plateau
5/14/2008

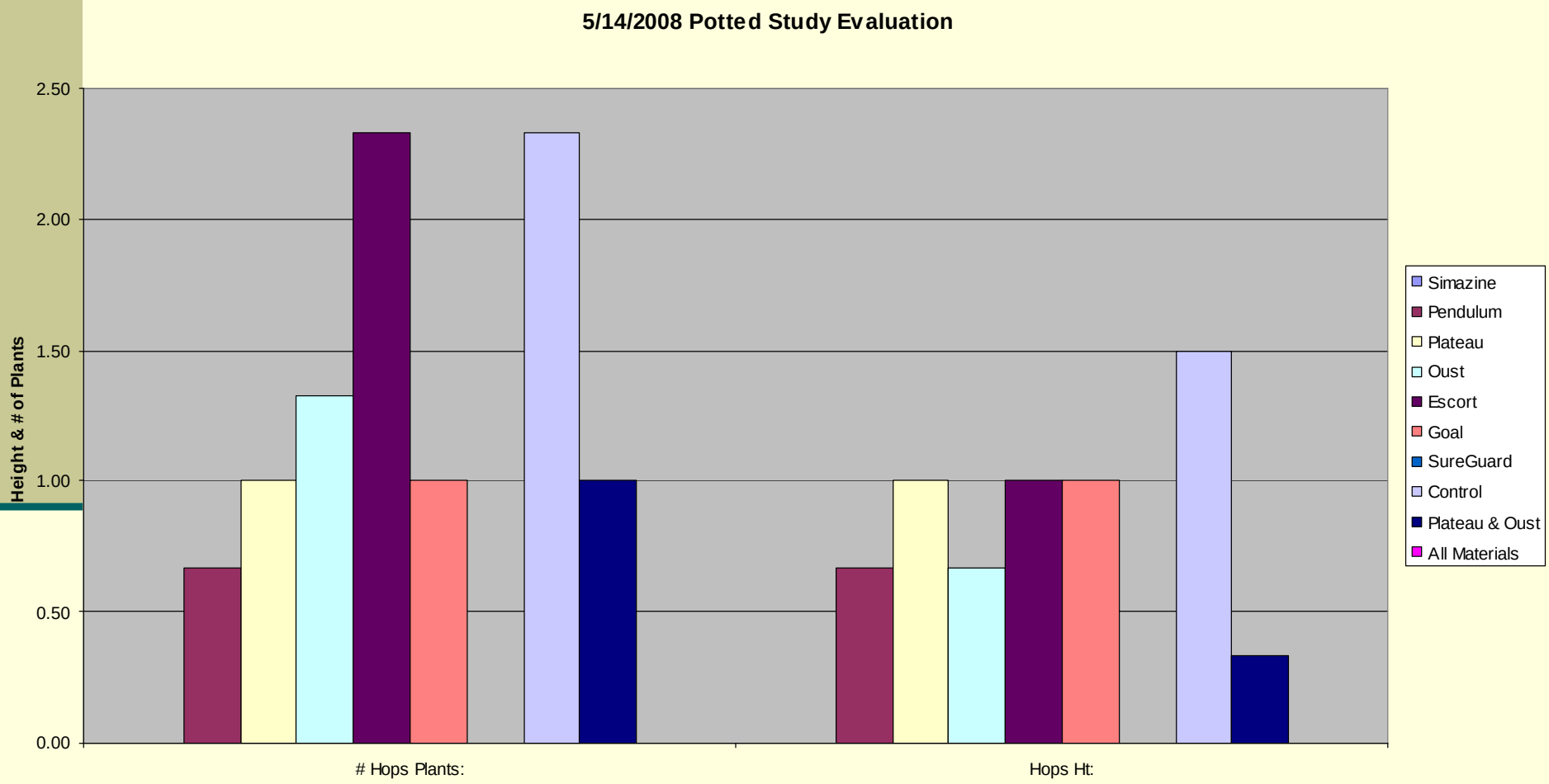

25.
Plateau
6/14/2008

Control, 7/14/2008 (Plateau had no plants)

Pre-Emergent Evaluations



Pre-Emergent Evaluations



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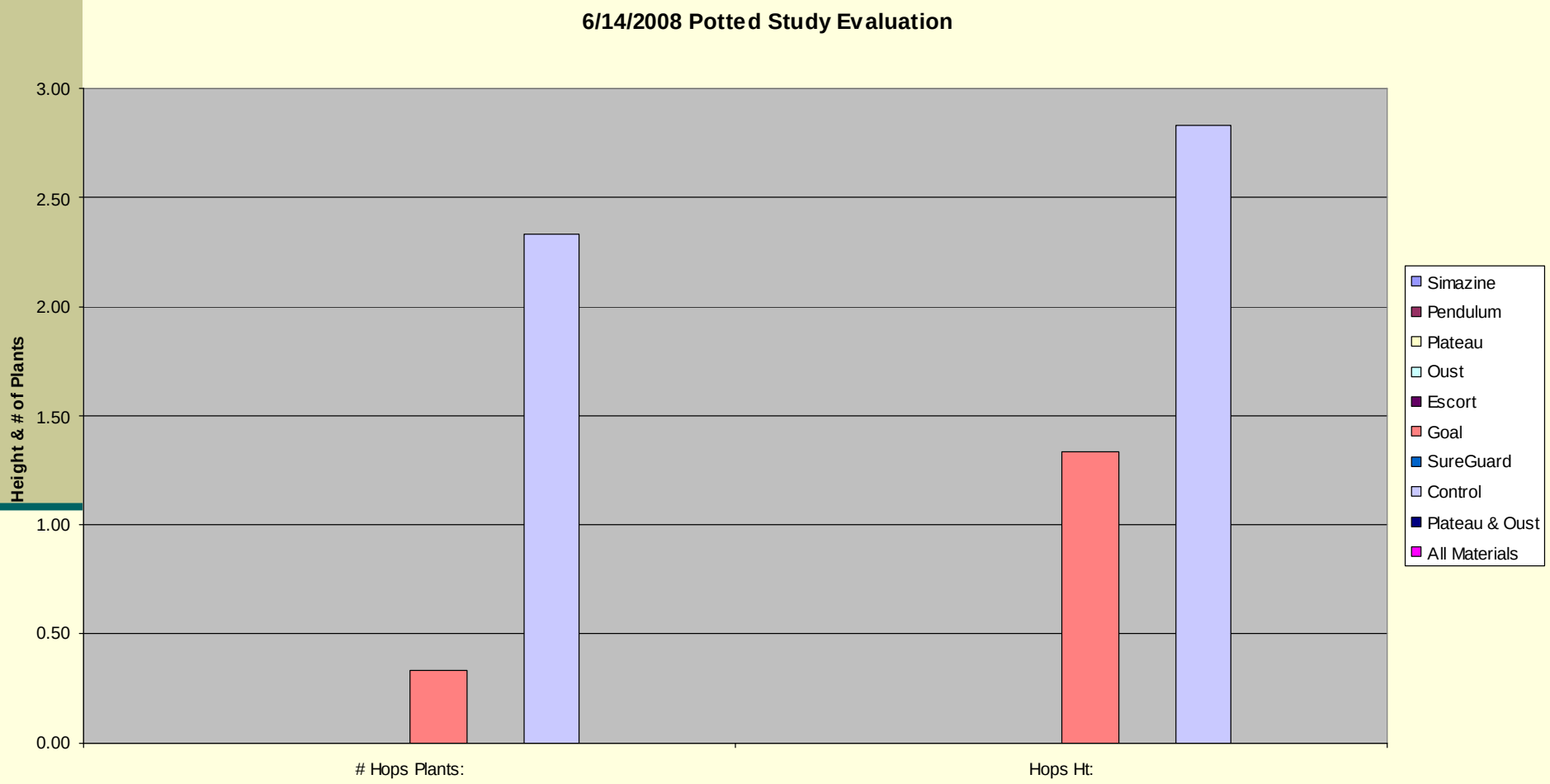
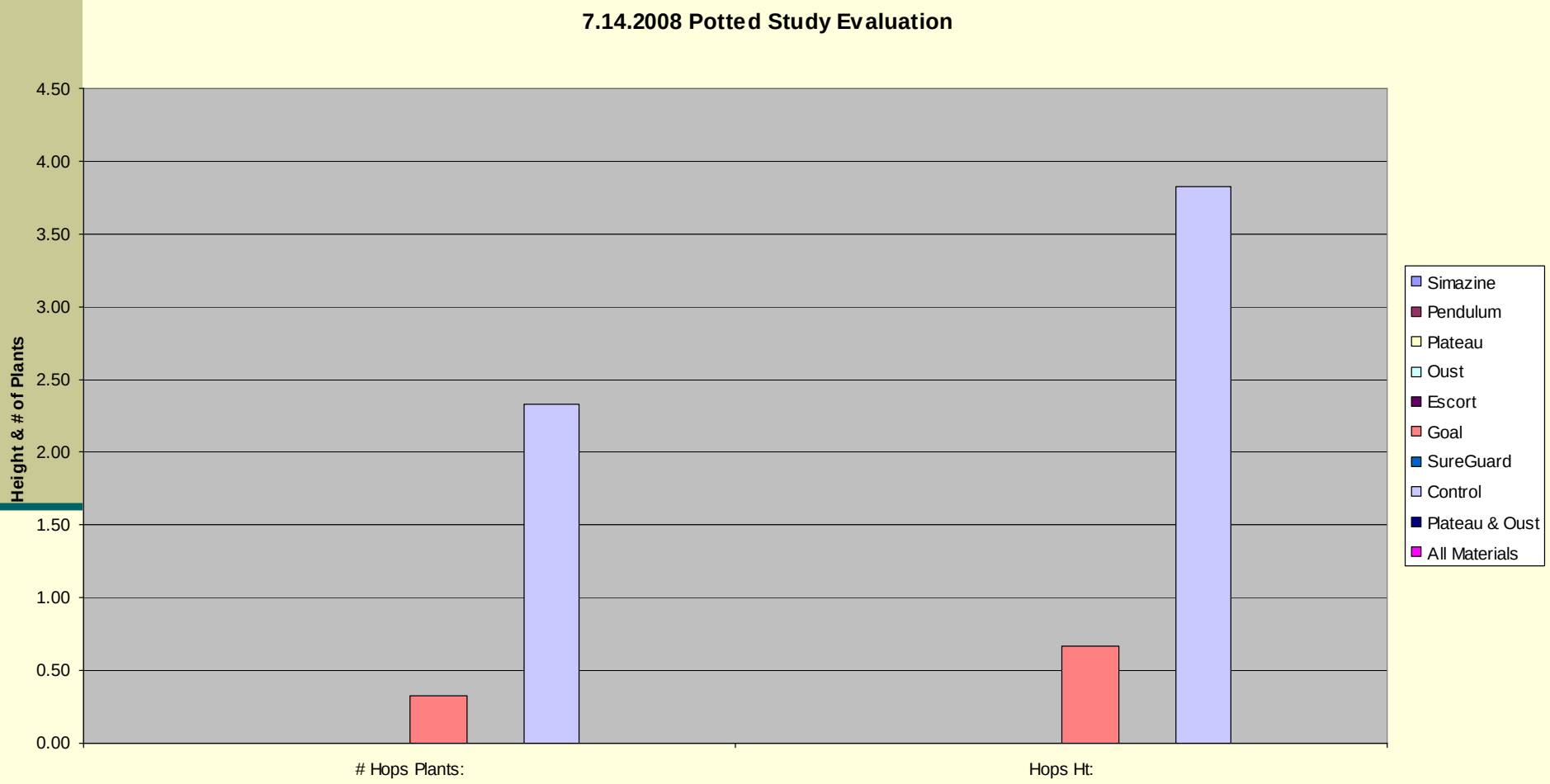


Pre-Emergent Evaluations



Pre-Emergent Evaluations

- 21.7% germination rate
- Goal only material that did not eventually kill the hops seedlings in the potted study.
- Goal also least effective (initially) pre-emergent material in the field trial.

A Hoppy Ending?

- Have learned a great deal about Hops in the Mid-Atlantic, much of which was previously unknown and based upon observations in other regions.
- Can offer effective treatments to land managers.
- Can educate land managers about ineffective treatments.
- We must continue investigating.

Questions?


Contact: Aaron Cook or
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Hagerstown, MD 21740
(301) 791 – 4010