

Controlling Japanese Hop(s)

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(formerly Md. Forest Service); and
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Need/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 information lacking, control often ineffective.
- MD DNR Forest Service applies for and receives grant from National Fish & Wildlife Foundation, Pulling Together Initiative.
- CWMA (Monocacy Watershed Japanese Hops Cooperative Weed Management Area Committee) is formed in 2006.



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from Hurricane Isabel**

**Efforts to control it, but information lacking,
control often ineffective.**



Monocacy Watershed Japanese Hops Cooperative Weed Management Area

- National Fish and Wildlife Foundation (NFWF), Pulling Together Initiative (PTI)
- Positive Factors for Acceptance??
 - Watershed-based & within Chesapeake Bay
 - Multi-State (MD & PA) and multi-County (3)
 - Threatens riparian forest buffer planting
 - Not many CWMA's around here
 - “New” exotic species
 - Good partners

Initial Partners (at application):

- Md. DNR Forest Service
- Md. DNR Wildlife and Heritage Service
- Md. Dept. of Agriculture - Weed Control
- National Park Service
- Western Maryland RC&D Council
- Potomac Watershed Partnership
 - Potomac Conservancy
 - PA Dept. of Environmental Protection
 - Ducks Unlimited
 - USDA Forest Service

Later Partners/Participants:

- PA DCNR Bureau of Forestry
- U. of Md. Cooperative Extension Service
- City of Frederick Public Works Dept.
- Frederick County Weed Control Program
- Frederick County Parks & Rec
- Monocacy-Catoctin Watershed Alliance
- Community Commons
- Friends of Waterford Park
- Frederick County Forestry Board
- Landowners

Project Summary (< 200 characters):

- In coordination with watershed organizations, control Japanese hops on 50 acres, targeting riparian forest buffers. Monitor effectiveness using multiple techniques and increase awareness through a new fact sheet and workshop.

Project Site:

- The Monocacy watershed, within Frederick and Carroll Co. in MD and Adams Co., PA. Riparian areas on private and public lands, including Monocacy Battlefield (National Park Service) and Monocacy Nat. Resource Mgmt. Area (State of MD).
- Zip codes: 21701, 21791, 21776, 21794
- Expected 8+ sites in Frederick and Carroll County, Maryland,
- 6th Congressional District

Project Period:

- July 2006 to June 2008



Objectives (<1000 characters):

- **Coordinate a weed management area** for Japanese hops, identifying infestation locations and developing structure for leadership within the Monocacy watershed.

Objectives - continued

- **Coordinate Japanese Hops control** among partners, determining effective control methods and timing, and treating at least 50 acres, with at least 1 site with community volunteers.

Objectives - continued

- **Monitor results** of control using baseline and post-control measurements both short-term and after a growing season.

Objectives - continued

- **Increase awareness** of need and techniques for Japanese hops control among landowners and managers in the Monocacy watershed and surrounding areas through a fact sheet and workshop.



Grant Funding

- Grant paid for:
 - Salary for contractual employee (part of year)
 - Vehicle expenses for contractual employee
 - Materials (some PPE, herbicide, misc.)
 - Contractual spraying of hop sites
 - Refreshments for public workshop
 - Fact Sheet
- Grant matched by:
 - Salaries of regular employees

Field Activities

- Study life-cycle, seasonality
- 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

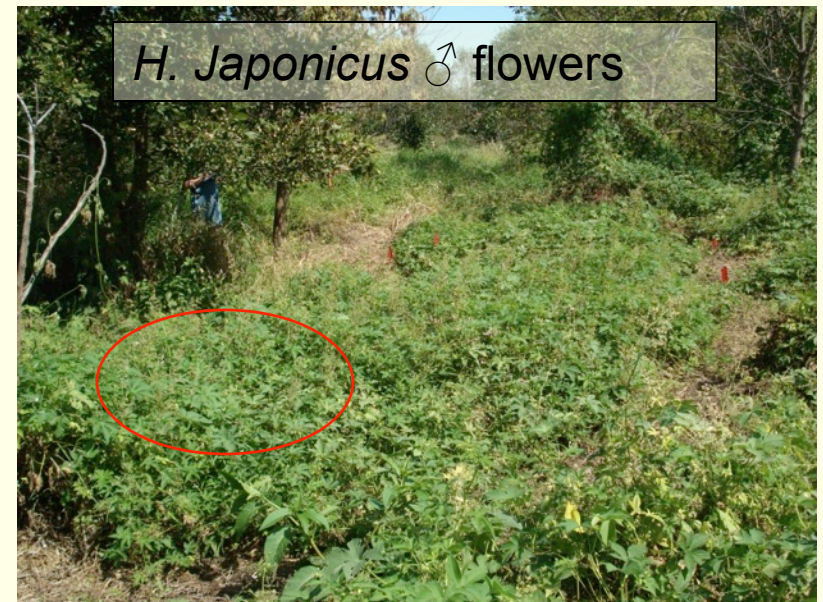


H. japonicus ♂ flowers

Wind Pollination



Identification, Life-Cycle, Habitat



Identification, Life-Cycle, Habitat



H. japonicus ♀ cones (achenes)



Identification, Life-Cycle, Habitat



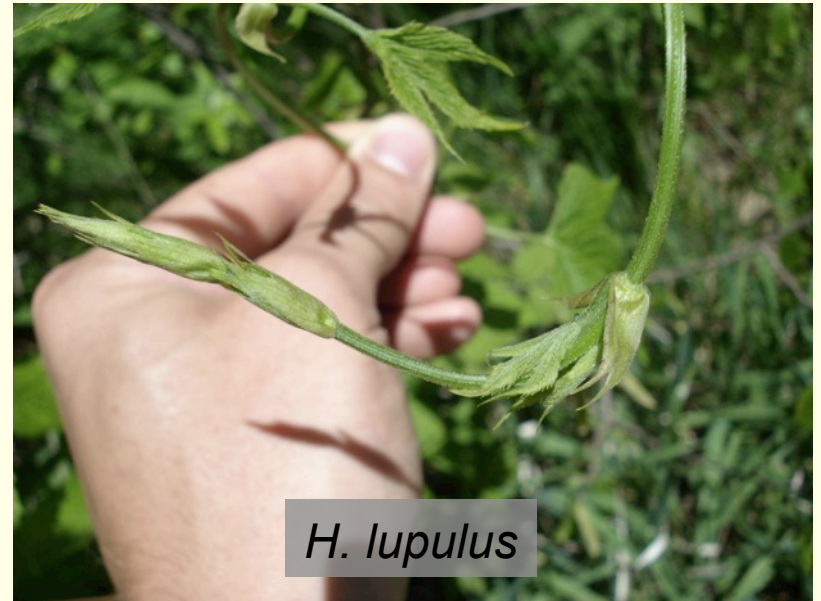
H. japonicus ♀ cones



Identification, Life-Cycle, Habitat



New growth on both species



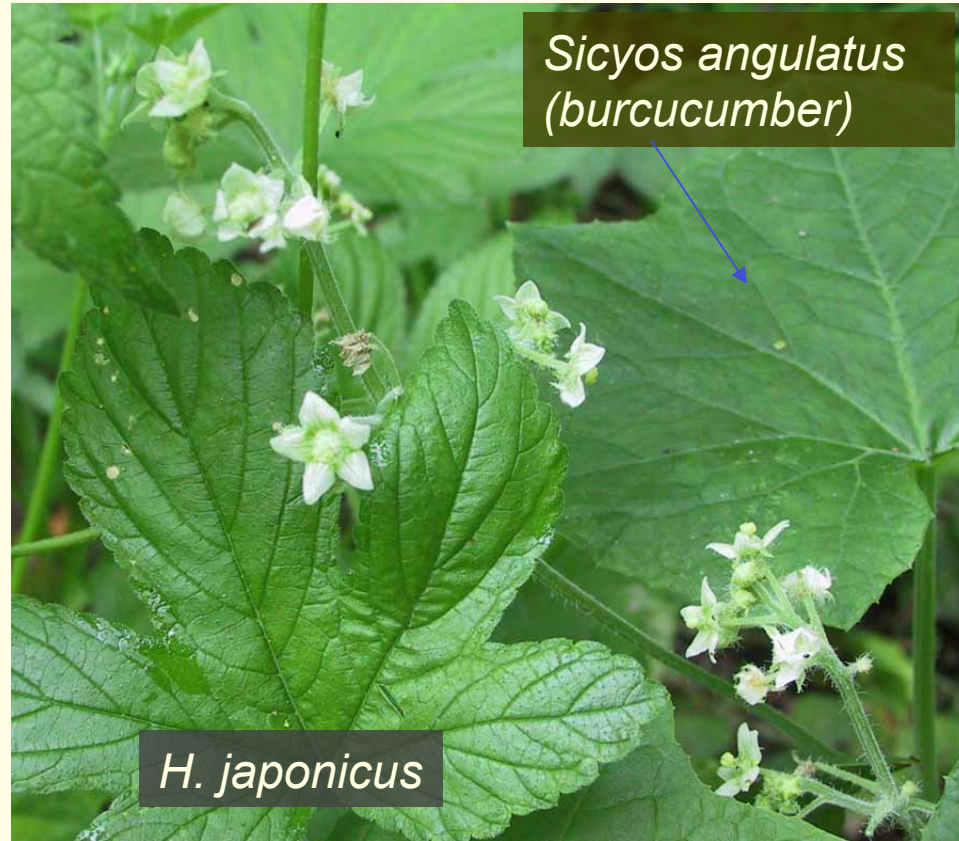
Identification, Life-Cycle, Habitat



H. lupulus

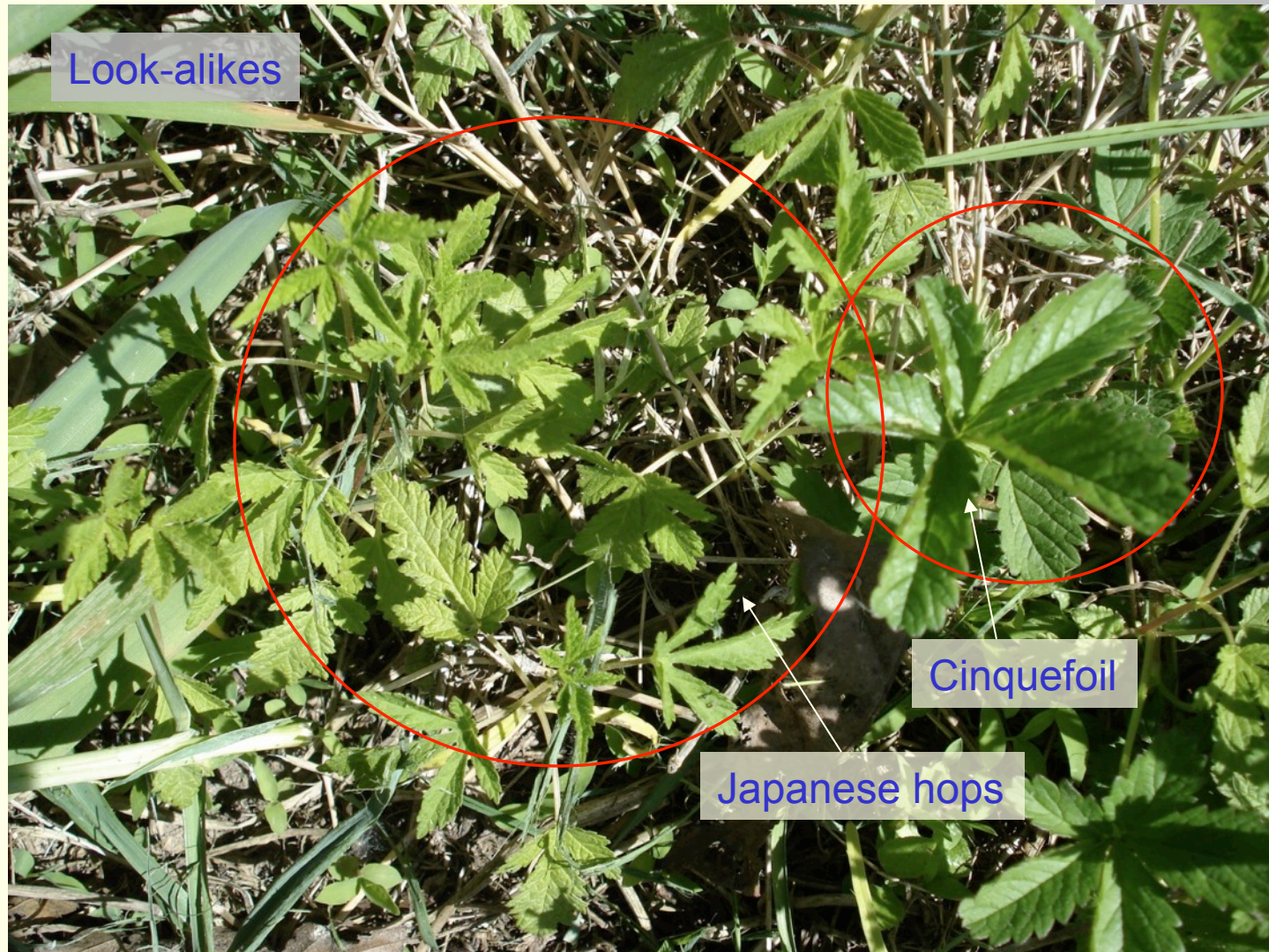


Identification, Life-Cycle, Habitat



Look-alikes

Identification, Life-Cycle, Habitat

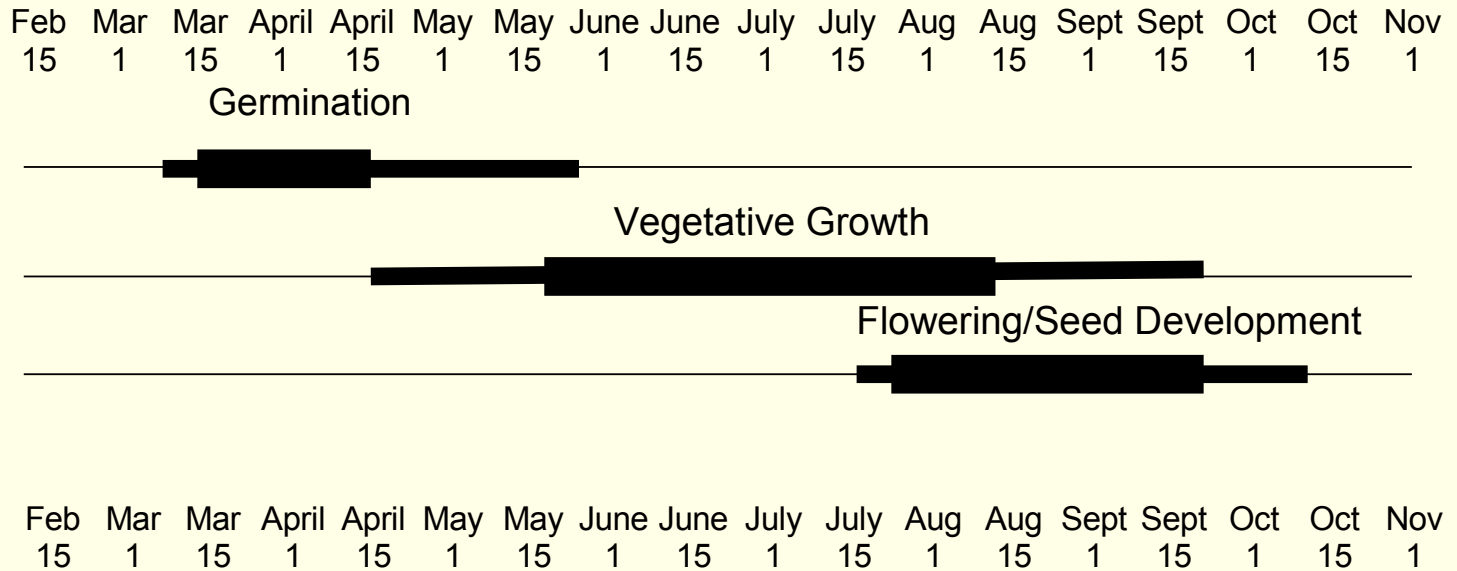


Identification, Life-Cycle, Habitat

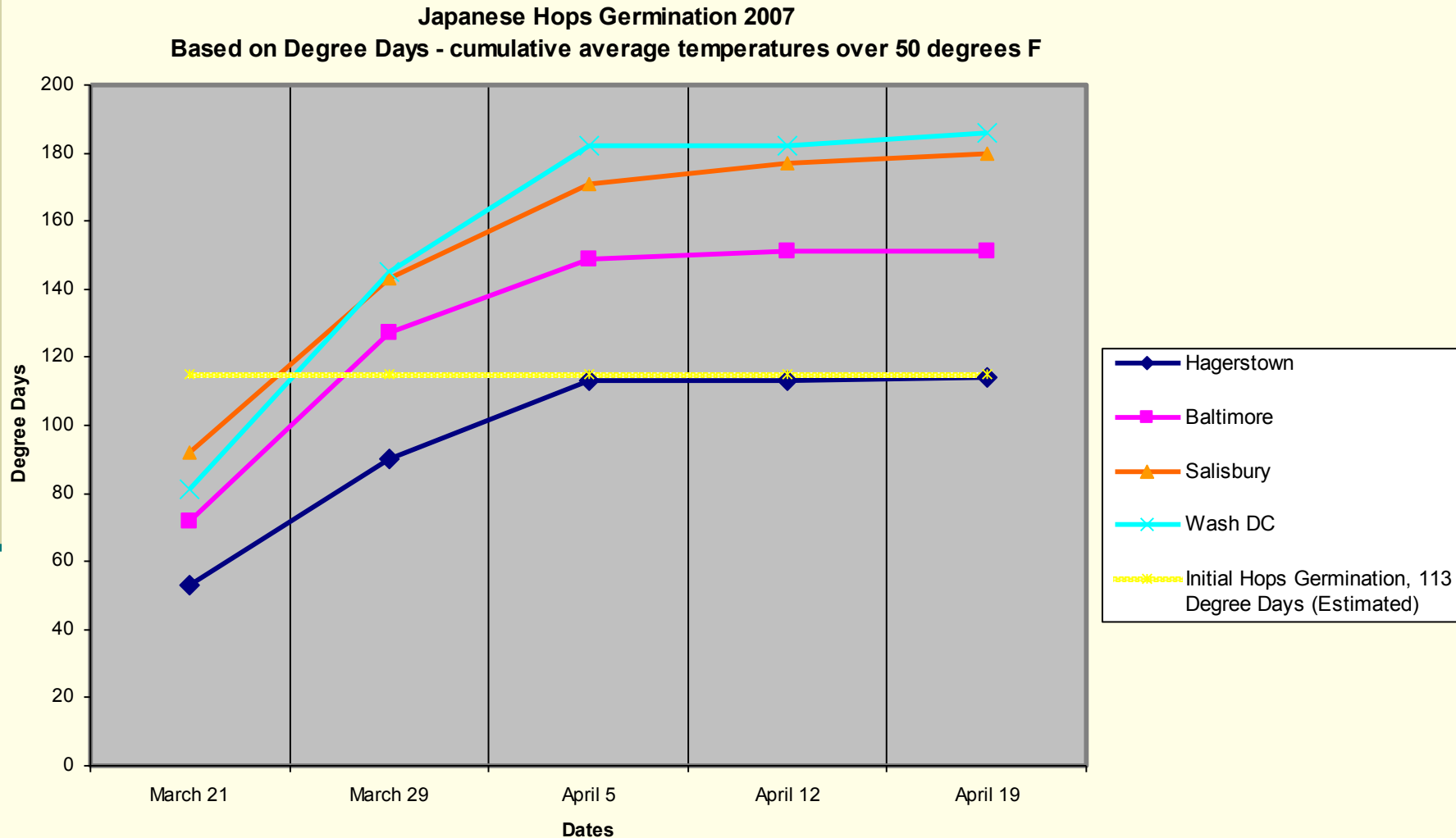
- Hops seed remains viable for at least 3 years in soil.
- Hops seed can float.
- Hops vines can reach lengths of 10-30 feet.
- Hops thrives in full sunlight riparian areas.
- Hops is difficult to control with mechanical methods.
- Hops is very aggressive and can grow 1 foot or more a day (not sustained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



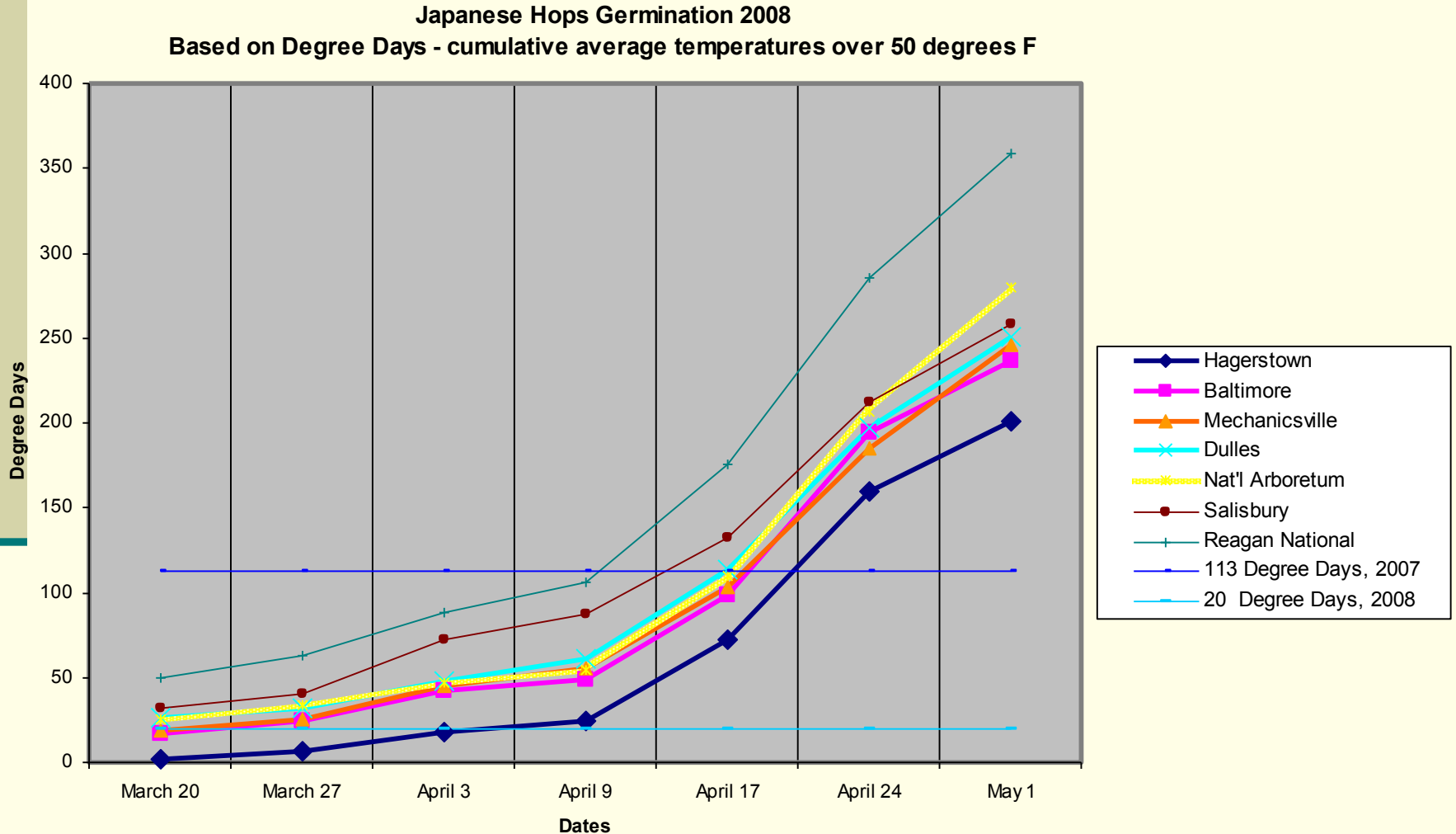
Identification, Life-Cycle, Habitat



Identification, Life-Cycle, Habitat



Identification, Life-Cycle, Habitat



Identification, Life-Cycle, Habitat



Identification, Life-Cycle, Habitat



Identification, Life-Cycle, Habitat



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 Watershed, 2008 & 2007

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

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 (include 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 # (not page #): _____ Grid # (ex. #6): _____

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 _____ Agricul. _____ Other _____

below - approximate measurement of area where hops is located

Acres _____ % Hops _____ Linear Ft. # along waterway _____

Previous control work and results: _____

Planned control work: _____

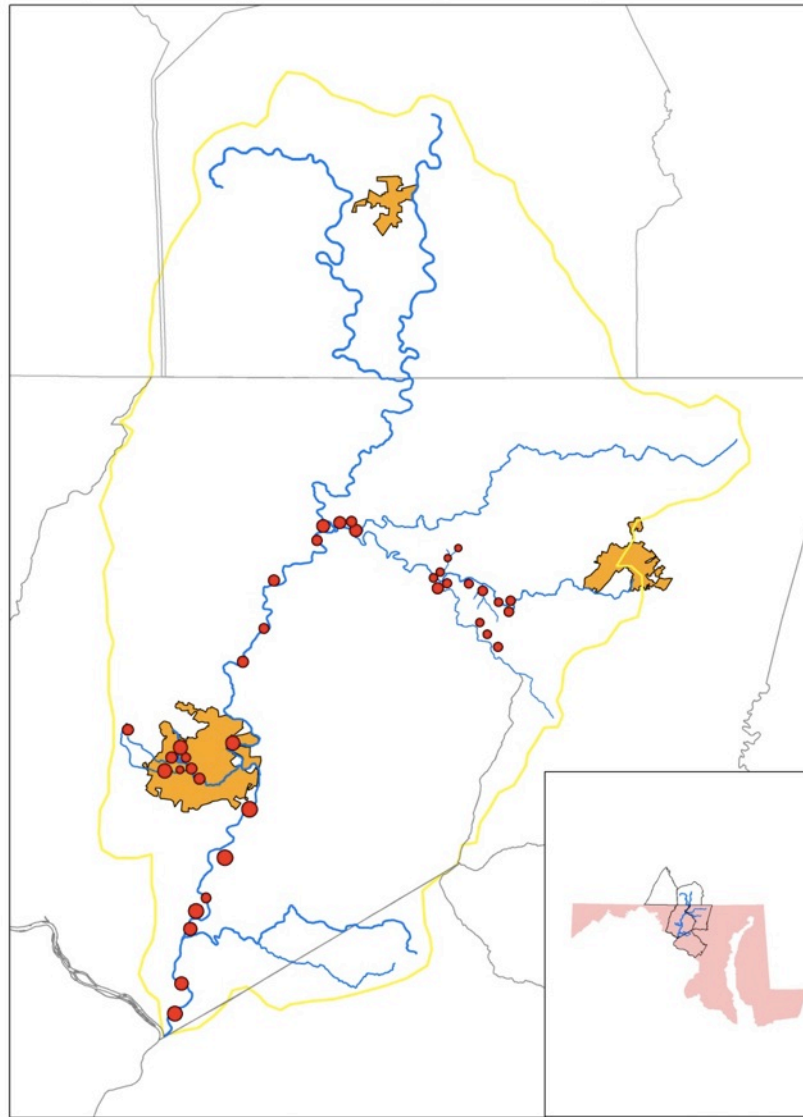
Comments: _____

Return form to:
Maryland Forest Service, 1260 Maryland Avenue, Suite 103, Hagerstown, MD 21740
phone 301-415-7261

Public Information

- What is Japanese Hops, help us find it, etc.
- Article in local newspaper
- Announcement on local radio
- Word of mouth from the 22 “opinion leaders” who attended the first meeting

Japanese Hops Locations, Monocacy Watershed



Legend

- Franklin & Adams Counties, PA
- Frederick County, MD
- Carroll County, MD
- Montgomery County, MD
- Delineation
- County Seats**
- Frederick, Frederick County, MD
- Gettysburg, Adams County, PA
- Westminster, Carroll County, MD

- Major Waterbodies**
- Waterbody
- Bennett Creek, Frederick County, MD
- Bennett Creek, Montgomery County, MD
- Big Pipe Creek, Carroll County, MD
- Carroll Creek, Frederick County, MD
- Cherry Branch, Carroll County, MD
- Double Pipe Creek, Frederick/Carroll County, MD
- Little Bennett Creek, Mont./Fred. County, MD

- Little Pipe Creek, Frederick/Carroll County, MD
- Marsh Creek, Adams County, PA
- Monocacy River, Frederick County, MD
- Rock Creek, Adams County, PA
- Rock Creek, Frederick County, MD
- Sam's Creek, Frederick/Carroll County, MD
- Shookstown Branch, Frederick County, MD
- Tributary of Little Pipe Creek, Carroll County, MD
- Japanese Hops Location



Exotic Invasive Map
for
Japanese Hops
Monocacy River Watershed
Known Approximate Acres: 270
Scale 1" = 22,220'

Prepared By: A. Cook
Date: February 2007

This map is for planning purposes only.
This map is not a boundary survey.

Japanese Hops CWMA Meeting

Control Methods

- Biological, and 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 in Reforestation Sites

- 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 sometimes effective.
- Japanese Hops is small and shallow rooted early in the growing season when the plant is small, making it easy to hand pull then.
- 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 under the right circumstances and performed the right way.
- 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

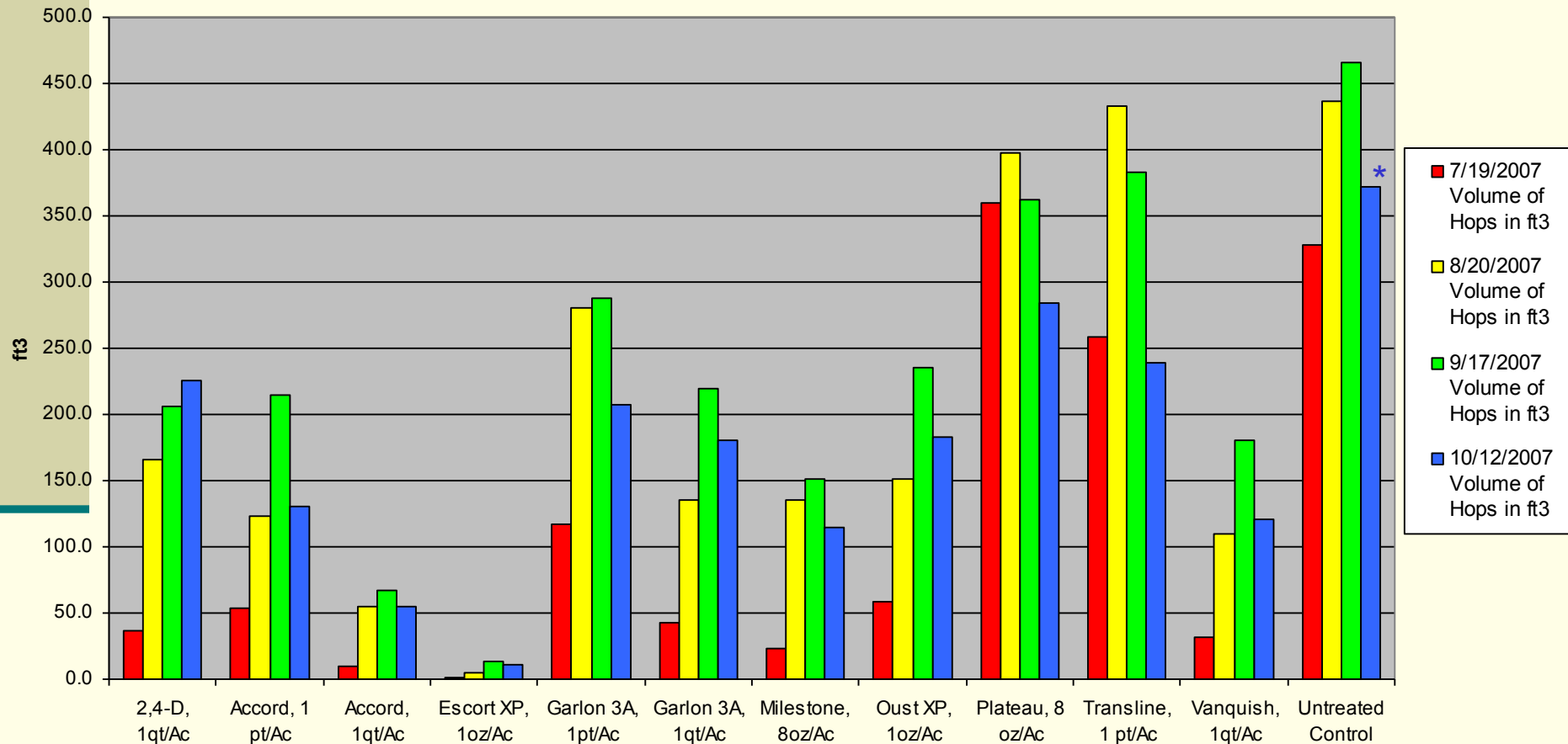
- June 2007, 36, 11' x 17.5' plots were sprayed with 11 different products and 1 control (3 repetitions).
- Ground cover in test plots was inventoried prior to treatment and again each month for 5 months following treatment.
- No new seedling germination following the application in June.
- Re-growth 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

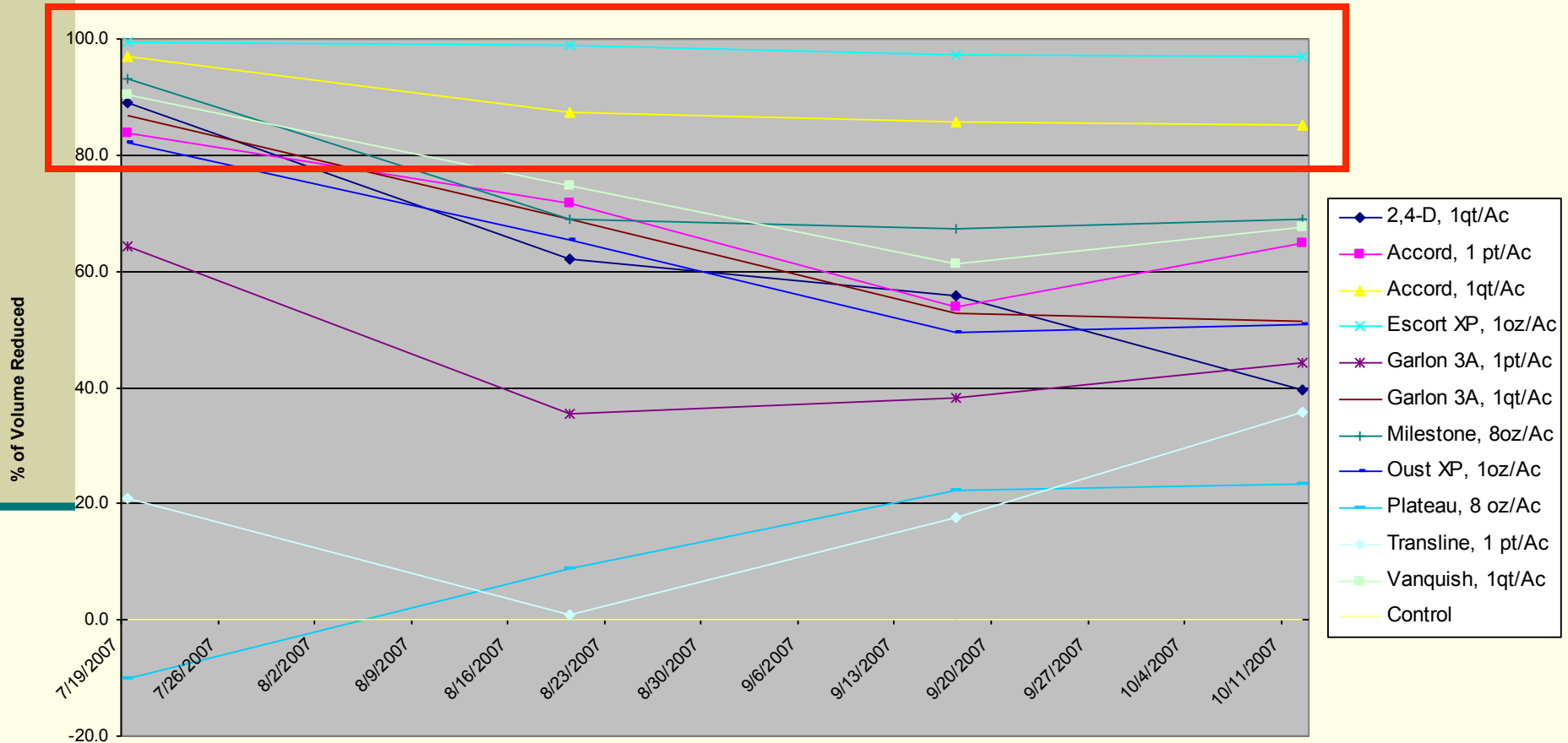
Average Volume of Hops per Material July-October



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

Post-Emergent Evaluations

% Volume Reduction of Japanese Hops by Material Used





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

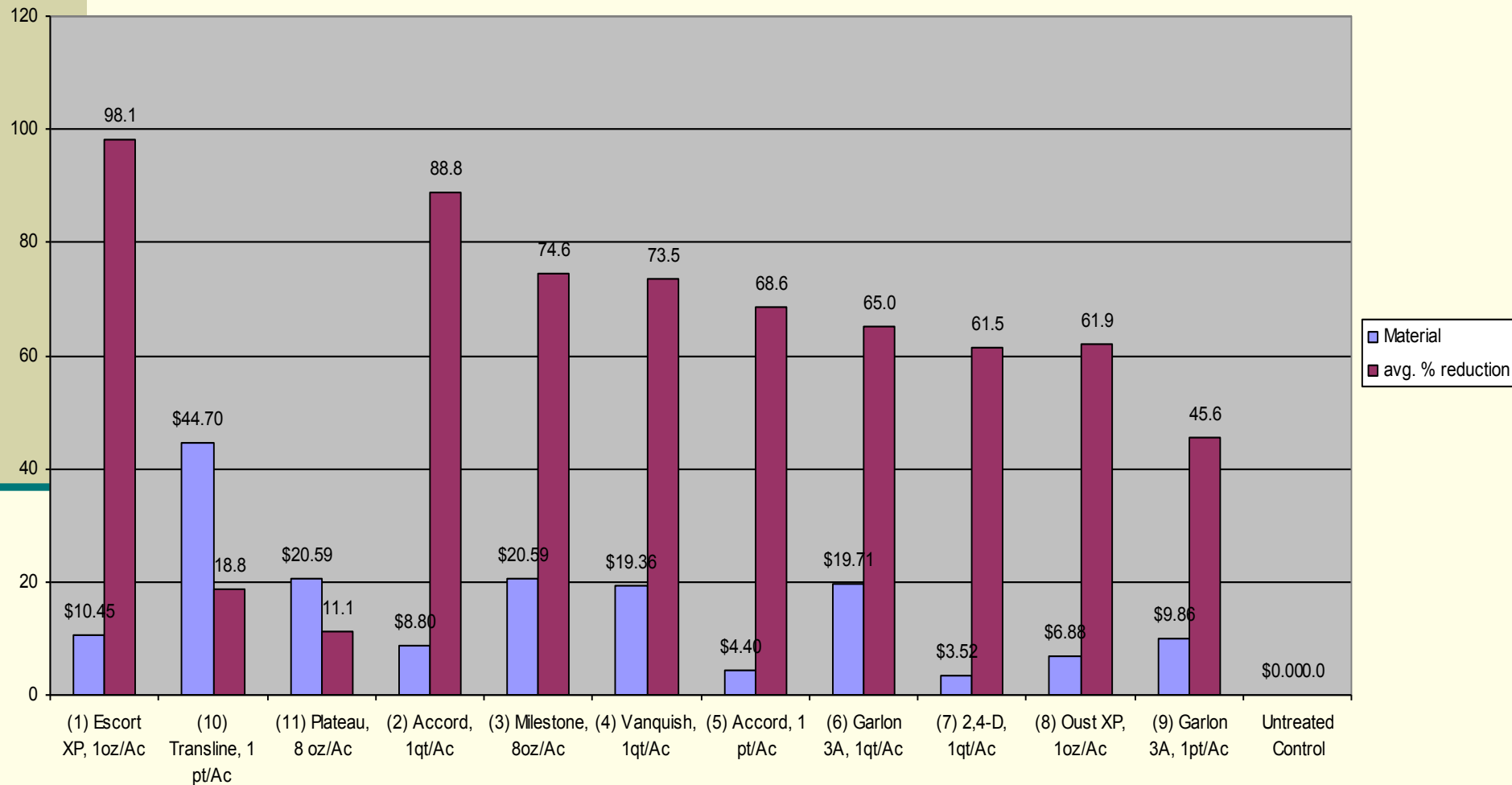
Material	Price	Price / oz	Price / acre	Price / acre after S & H
(1) Escort XP, 1oz/Ac	\$9.50 / oz	\$9.50	\$9.50	\$10.45
(10) Transline, 1 pt/Ac	\$325.00 / gal	\$2.54	\$40.64	\$44.64
(11) Plateau, 8 oz/Ac	\$300.00 / gal	\$2.34	\$18.72	\$20.59
(2) Accord, 1qt/Ac	\$32.00 / gal	\$0.25	\$8.00	\$8.80
(3) Milestone, 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

Comparison of Material Effectiveness and Cost Per Acre



Hops in Milestone Plot - 1 month after treatment



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

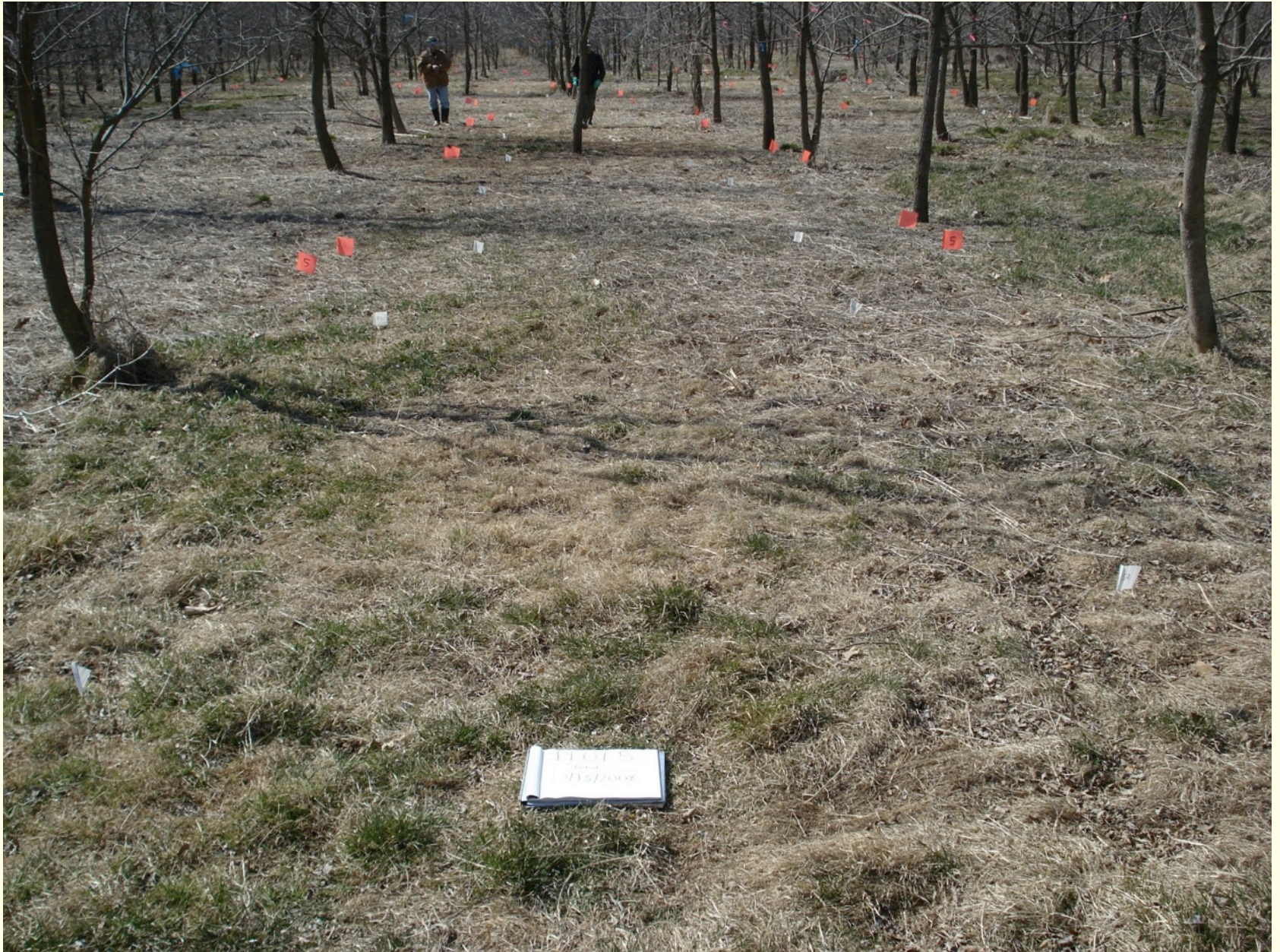
- Manual Control is somewhat effective.
- Japanese Hops is small and shallow rooted, making it easy to hand pull early in the growing season when the plant is small.
- Hand pulling is very time consuming and labor intensive.
- Hand pulling is a good method for homeowners, and parks with many volunteers.

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



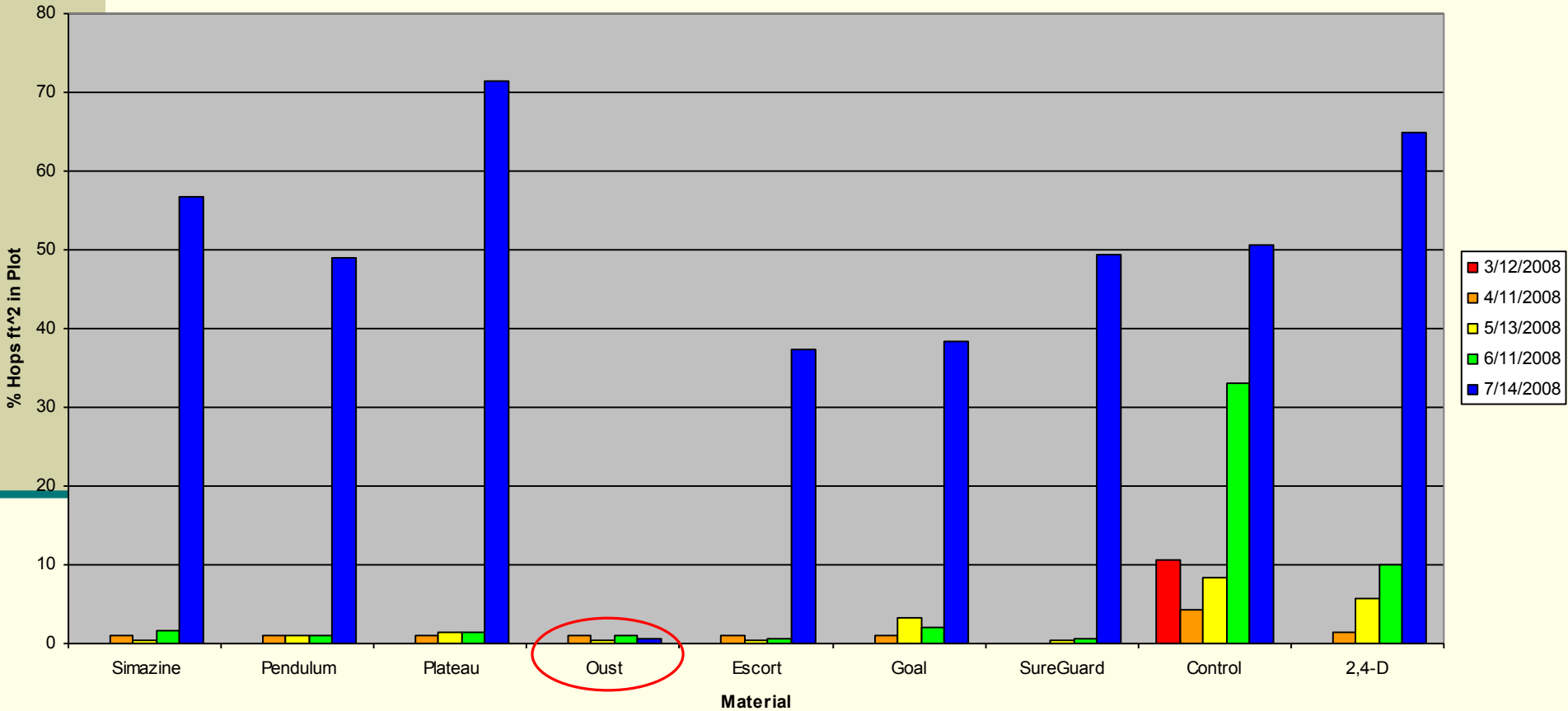
Pre-Emergent Evaluations



March 13, 2008

Pre-Emergent Evaluations

Pre-Emergent Hops Testing



Pre-Emergent Evaluations

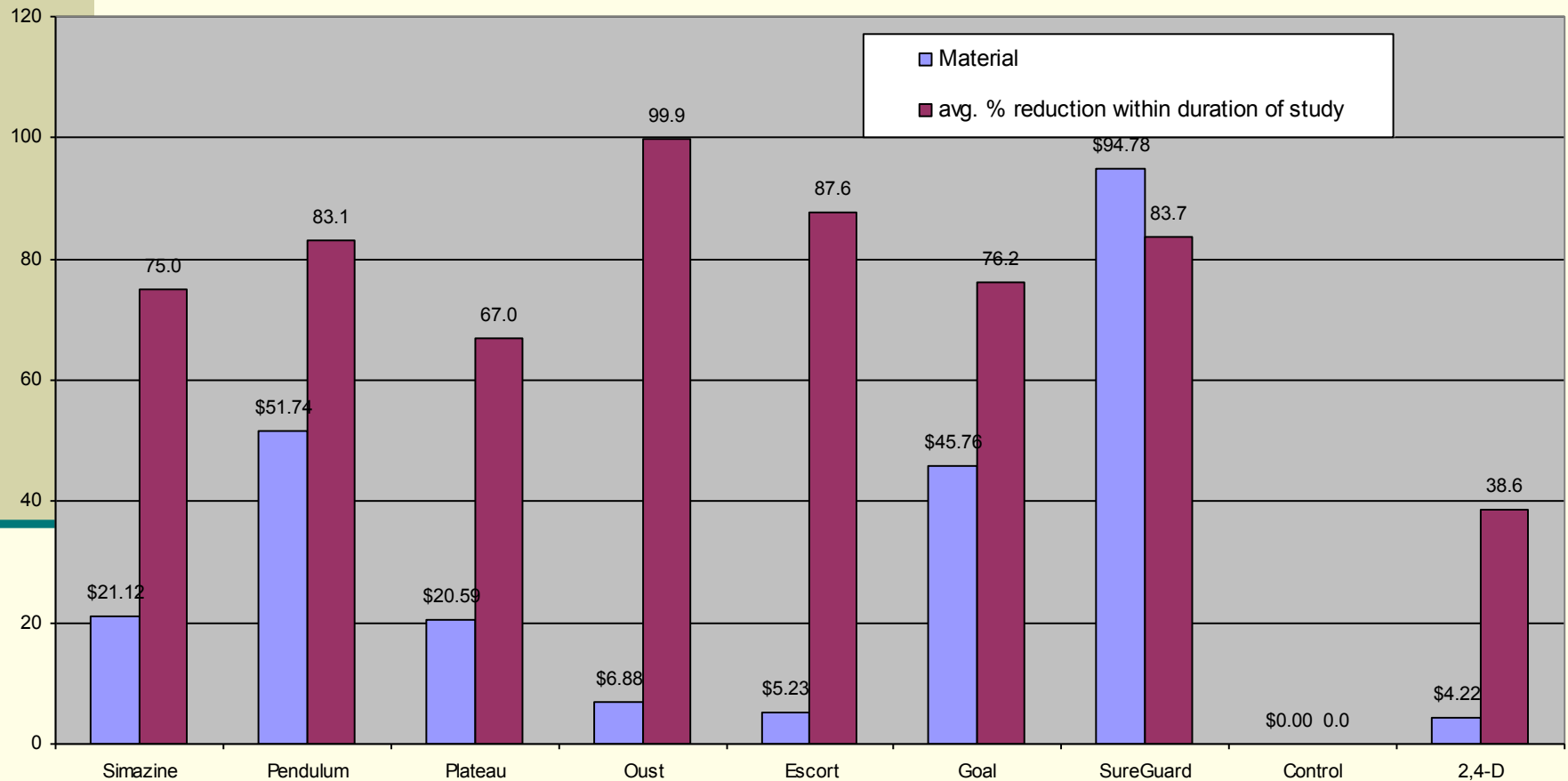
Material	Price	Price / oz	Rate @ oz / acre	Price / acre after S & H
Oust (1)	\$100/ lb	\$6.25	1	\$6.88
Escort (2)	\$9.50/ oz	\$9.50	0.5	\$5.23
SureGuard (3)	\$115 / lb	\$7.18	12	\$94.78
Pendulum (4)	\$45.00 / gal	\$0.35	134.4	\$51.74
Goal (5)	\$83.00 / gal	\$0.65	64	\$45.76
Simazine (6)	\$19.00 / gal	\$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

Comparison of Material Effectiveness and Cost Per Acre



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





5/14/2008



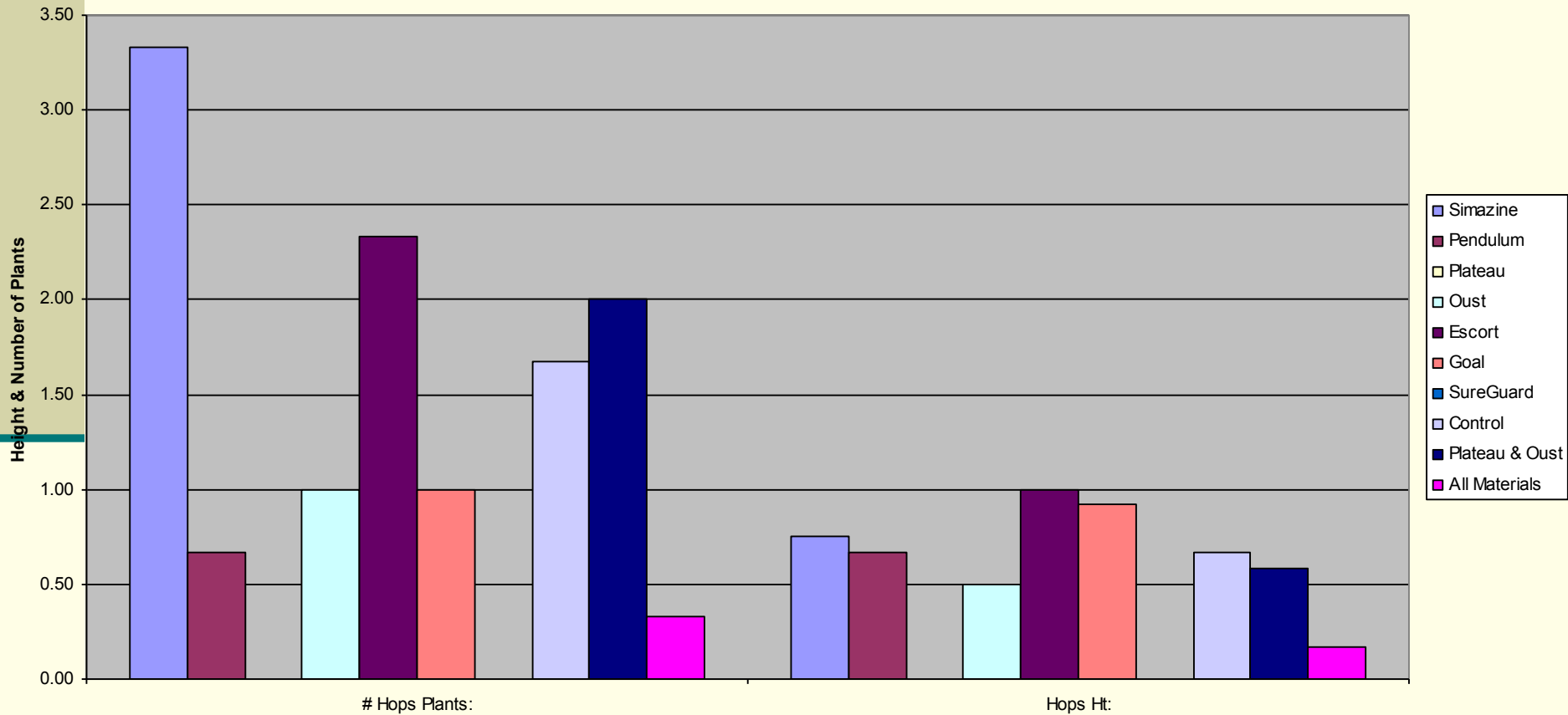
6/14/2008



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

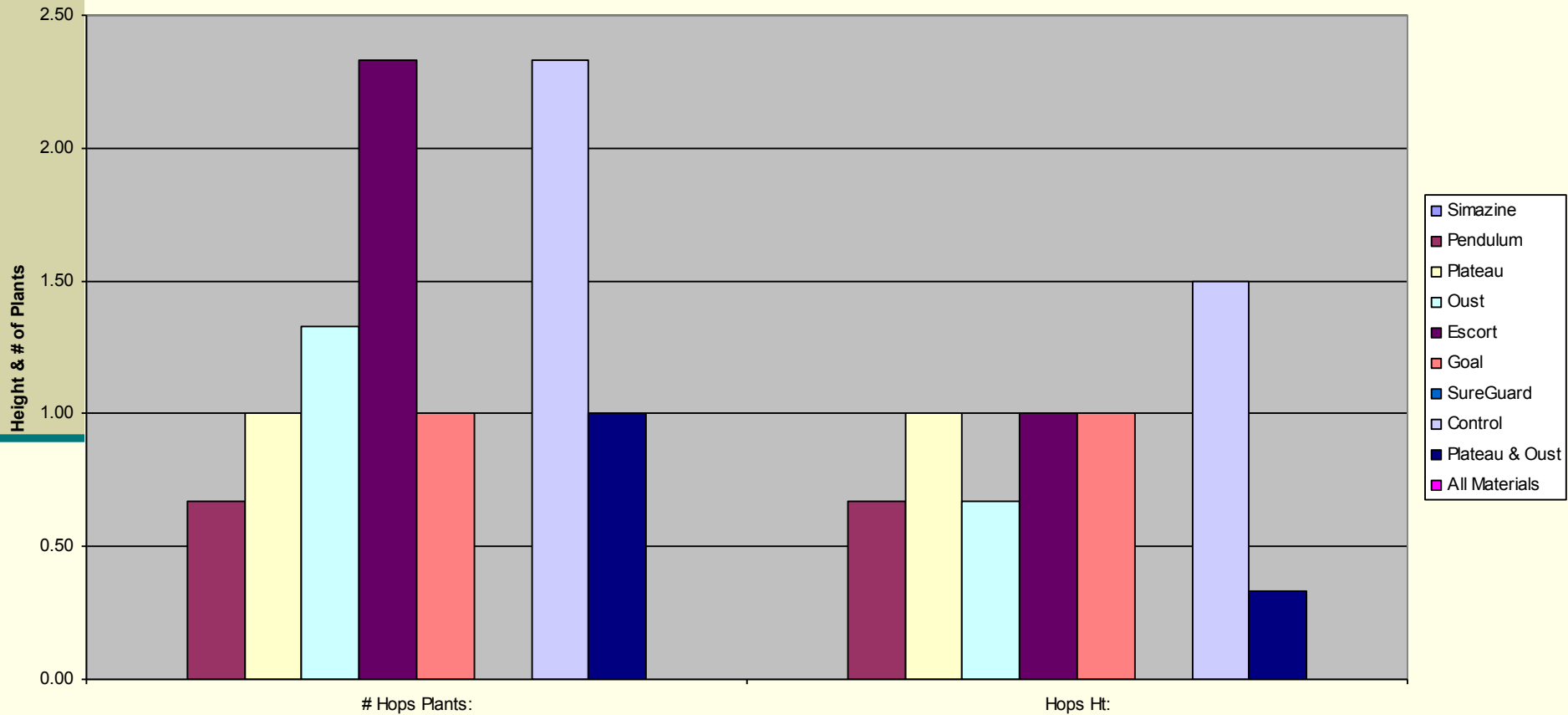
Pre-Emergent Evaluations

4/14/2008 Potted Study Evaluation



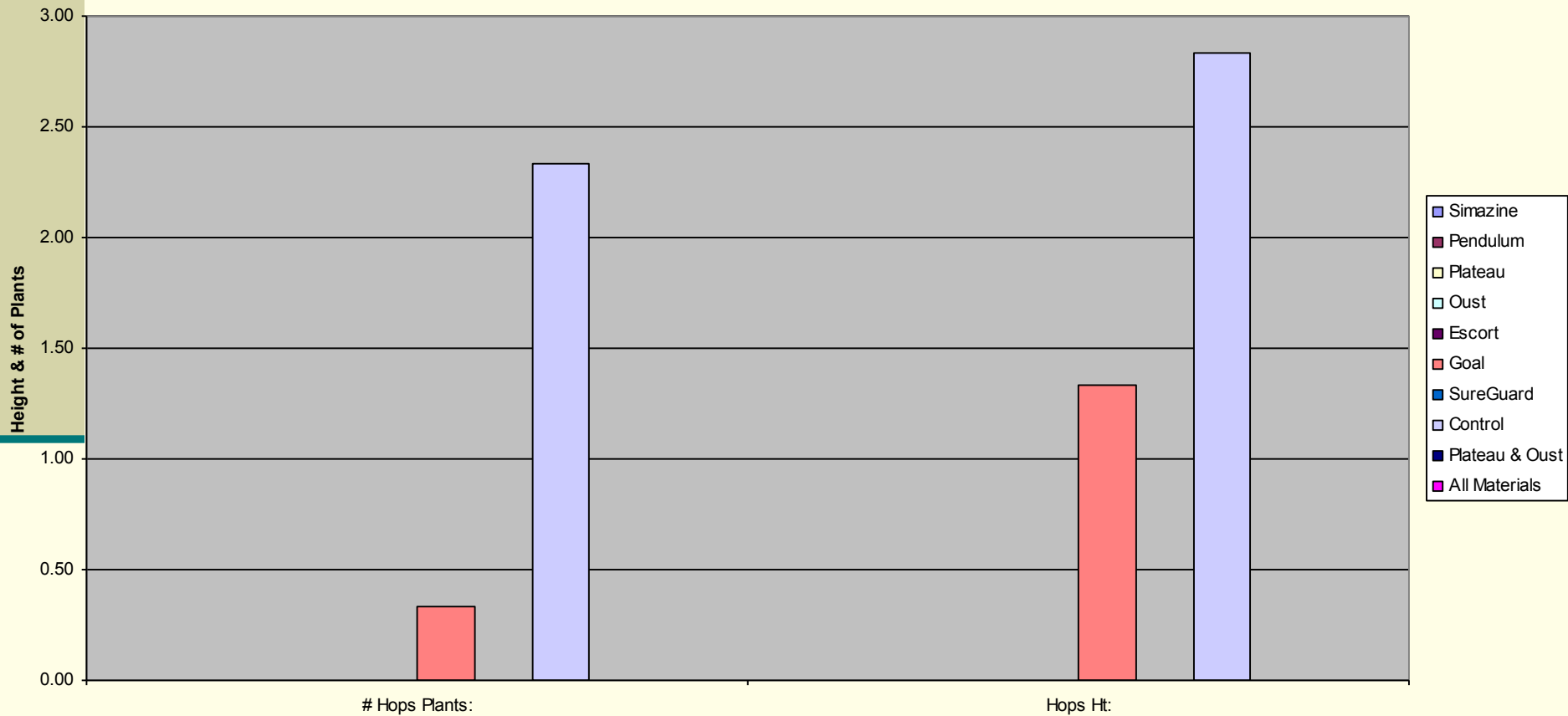
Pre-Emergent Evaluations

5/14/2008 Potted Study Evaluation



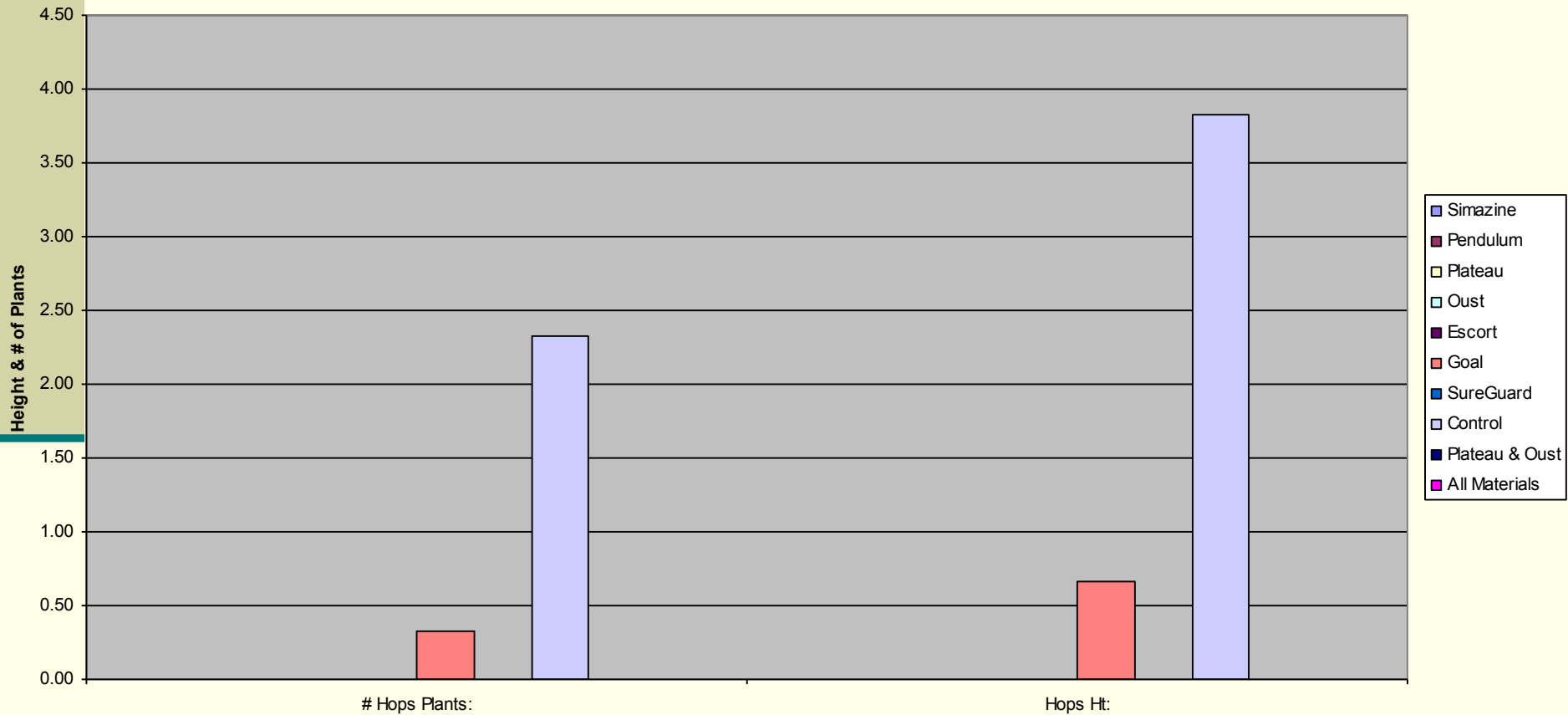
Pre-Emergent Evaluations

6/14/2008 Potted Study Evaluation



Pre-Emergent Evaluations

7.14.2008 Potted Study Evaluation



Northeast Weed Science Society Meeting, 2009

CONTROLLING JAPANESE HOPS. P.D. Pannill, U.S. Fish and Wildlife Service, and A.M. Cook, Western Maryland Resource Conservation and Development Council.

ABSTRACT

Japanese Hops (*Humulus japonicus* Siebold & Zucc.) is an invasive exotic annual vine that has recently created problems on riparian tree planting sites in Maryland and nearby States. In 2007 and 2008 research was conducted on hops-infested riparian sites in Frederick County, Maryland using various methods of control, including the use of herbicide.

Post-emergent herbicide treatments were applied in June 2007 using metsulfuron-methyl (0.6 oz ai/A), glyphosate (0.5 and 1 lb ae/A), aminopyralid (0.125 lb ae/A), dicamba (1 lb ae/A), 2,4-D (0.96 lb ae/A), triclopyr (0.375 and 0.75 lb ae/A), sulfometuron-methyl (0.6 oz ai/A), clopyralid (0.375 lb ae/A), and imazapic (0.125 lb ae/A). A non-ionic surfactant at 0.5% v/v was included, and the solution was applied at 66 gallons per acre. While most of these products appeared to have killed or severely damaged the hops plants at 1 MAT, many of them had recovered or re-grown from the roots. At 3 MAT (September) metsulfuron-methyl showed the best results at 97% control, and the higher rate of glyphosate gave control of 86%. Products moderately effective included aminopyralid (67%), dicamba (61%), 2,4-D (58%), the lower rate of glyphosate (54%), the higher rate of triclopyr (53%), and sulfometuron-methyl (50%). Products showing poor results were the lower rate of triclopyr (38%), imazapic (22%) and clopyralid (18%).

Pre-emergent herbicide applications were applied in March 2008 using sulfometuron-methyl (0.75 oz ai/A), metsulfuron-methyl (0.3 oz ai/A), simazine (4 lb ae/A), imazapic (3 oz ae/A), pendimethalin (4.2 lb ae/A), flumioxazin (6.12 oz ai/A), and oxyfluorfen (1 lb ae/A). The spray solution was applied at 100 gallons per acre. At 3 MAT all products provided control of 94% or more. However, at 4 MAT (July) hops seedlings were sprouting and growing vigorously in plots treated with every product except sulfometuron-methyl, which had a control rating of 99.9%.

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.

CWMA is done!?

- We met the deliverables of grant
- We found where much of the plant is growing
- We controlled a bunch of it, in places where controlling it made a difference (we hope)
- We know a lot more about it than before
- We know a lot more about what works and doesn't work in controlling it
- We shared that information with many "resource" people who are in a position to share it with others

CWMA is done!?! – really?

- We made many landowners, environmentally involved citizens and some of the general public aware of it
- We made the information on Japanese Hops, and how better to control it, available to anyone who seeks it
- Members of the CWMA continue to share information and ask advice

CWMA is done – really

- There is more to know, certainly a LOT more to do, and lots of people who could and should be involved, but ...
- ... unless someone wants to take up the banner of fighting the plague of Japanese hops ...
- We'll accept that we accomplished what we set out to do.

Questions?

