

# Seed Dormancy and Germination of Japanese hops (*Humulus japonicus*): A Cold Case

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# Cold Stratification

- Seeds need to be exposed to a period of colder temperatures in order to break seed dormancy and begin germination.
- Examples: tulips, lavender, and sweet peas



# Japanese hops (*Humulus japonicus*)

- ▶ Invasive species found near rivers and streams of the Eastern United States.
- ▶ Introduced from Asia as a source of tea.
- ▶ Invasive species: a plant or animal that is not native to a specific location
  - ▶ Spreading
  - ▶ Can cause damage to the environment
- ▶ Examples: Asian carp and zebra mussels



# Japanese hops (*Humulus japonicus*)

- ▶ Japanese hops are in the same genus as beer hops, but are NOT used for beer.
  - ▶ Lacking lupulin – oils and flavor.
- ▶ Is an annual vine that can grow up to 35 feet in one season.
- ▶ Competes with native species for sunlight and nutrients.
  - ▶ Overtops herbaceous vegetation and small trees.

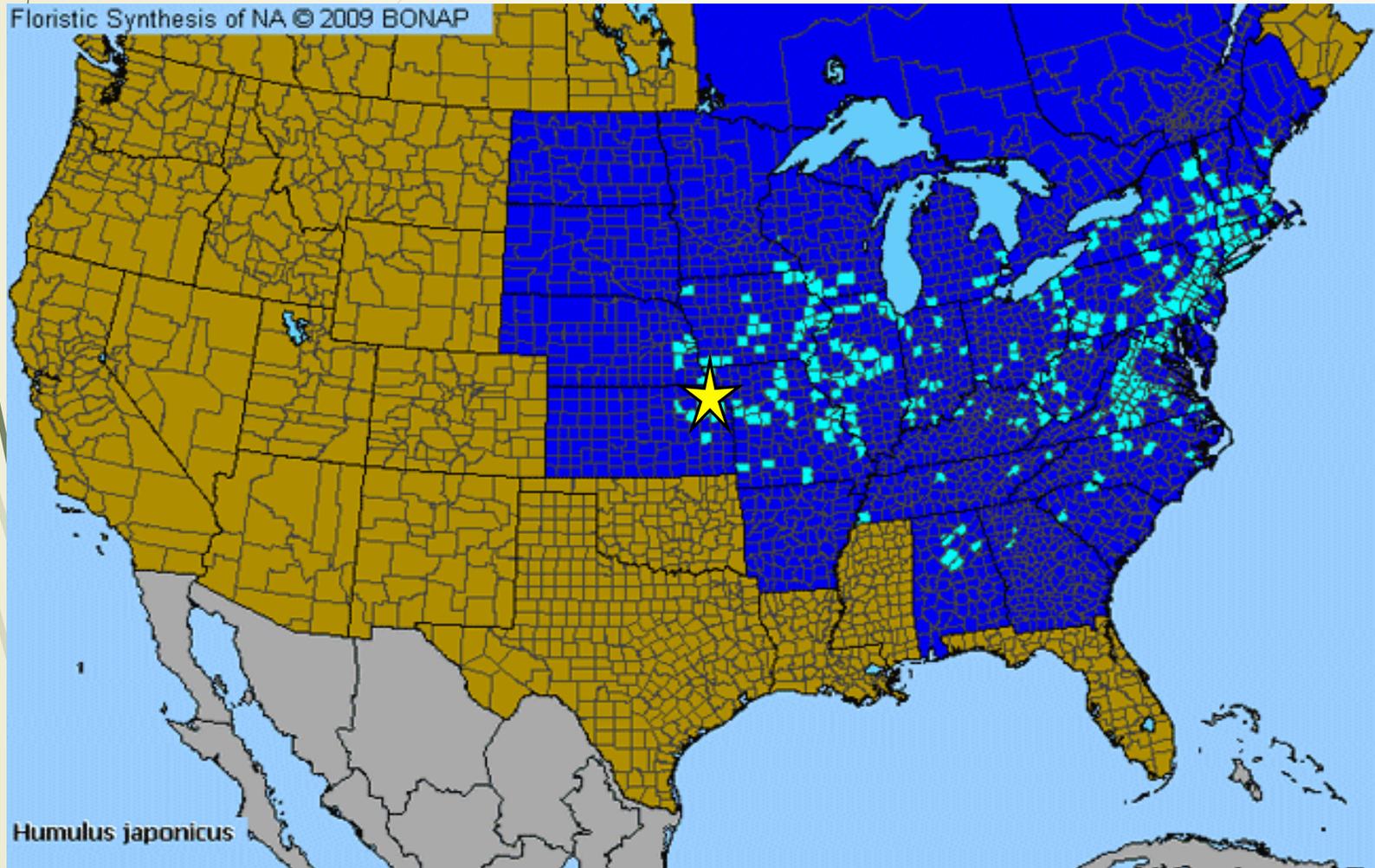


# Why is this research important?

- ▶ Purpose: Determine the key factors that break the physiological dormancy of the seeds.
- ▶ Finding what environmental conditions are conducive to the germination of *H. japonicus* seeds can help determine where *H. japonicus* may thrive.
- ▶ Understanding the ecological role of *H. japonicus* is necessary to implement a management plan.



# National Distribution of Japanese hops



# Hypotheses

- ▶ Cold stratification is possible factor in breaking dormancy.
- ▶ Field experiment:
  - ▶ Prolonged exposure to natural conditions will lead to an increase in germination.
- ▶ Controlled indoor experiment:
  - ▶ Predict an interaction between time exposure, moisture levels and temperature.



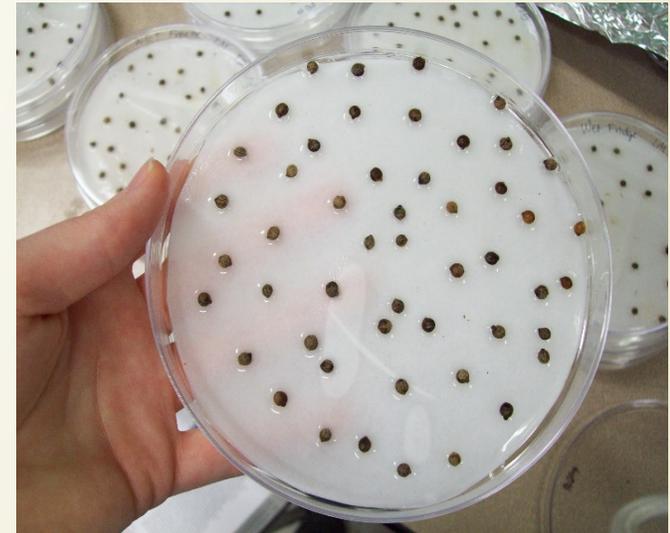
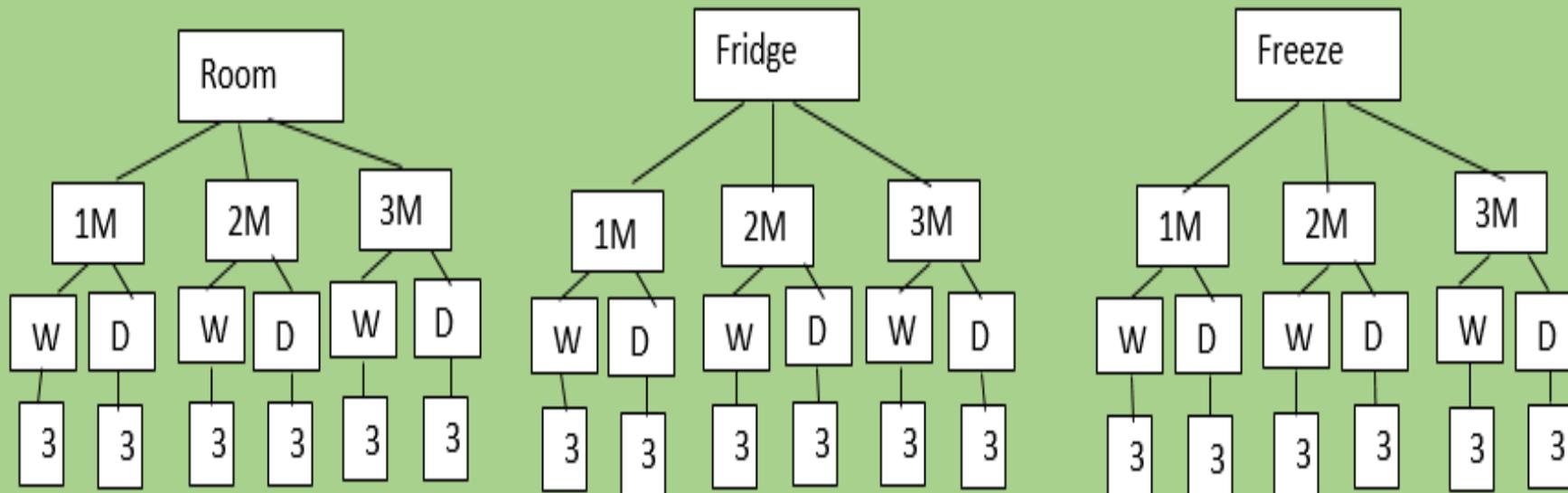
# Materials & Methods

- Collected seeds in November, 2014 near Independence Creek
  - Total sorted: 2,620 seeds
- Field experiment:
  - Seeds were buried in sand
  - Exposure to ambient conditions for 1, 2, 3 or 4 months
  - Compared to a control (zero exposure)
  - Four replications of each treatment
  - Each replication = 50 seeds



# Materials & Methods

- Indoor experiment:
  - Exposure to varying levels of temperature and moisture for different time periods



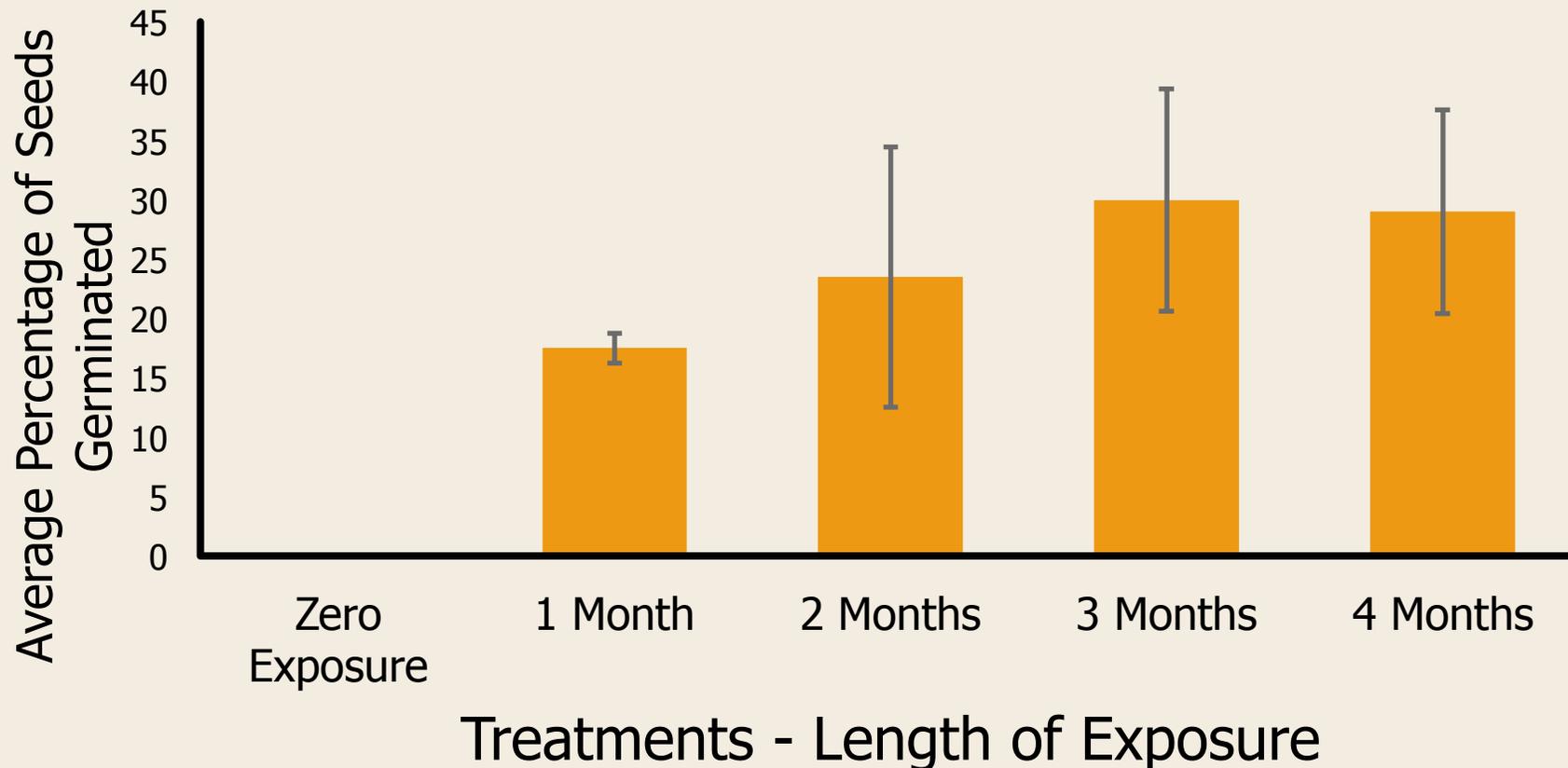
# Germination

- All of the seeds were stored and germinated at room temperature in petri dishes.
- Distilled water and filter paper were used to keep the environment moist.
- Germination was recorded daily.



# Results: Field Experiment

## Seed Germination Rates After Exposure to Natural Ambient Conditions



- One-way ANOVA
- Significance is  $<0.001$  which means that time exposure is significant!



# Results: Indoor Experiment

Average Percentage of Germinated Seeds After Exposure to the Treatments (Temperature, Moisture, & Time)

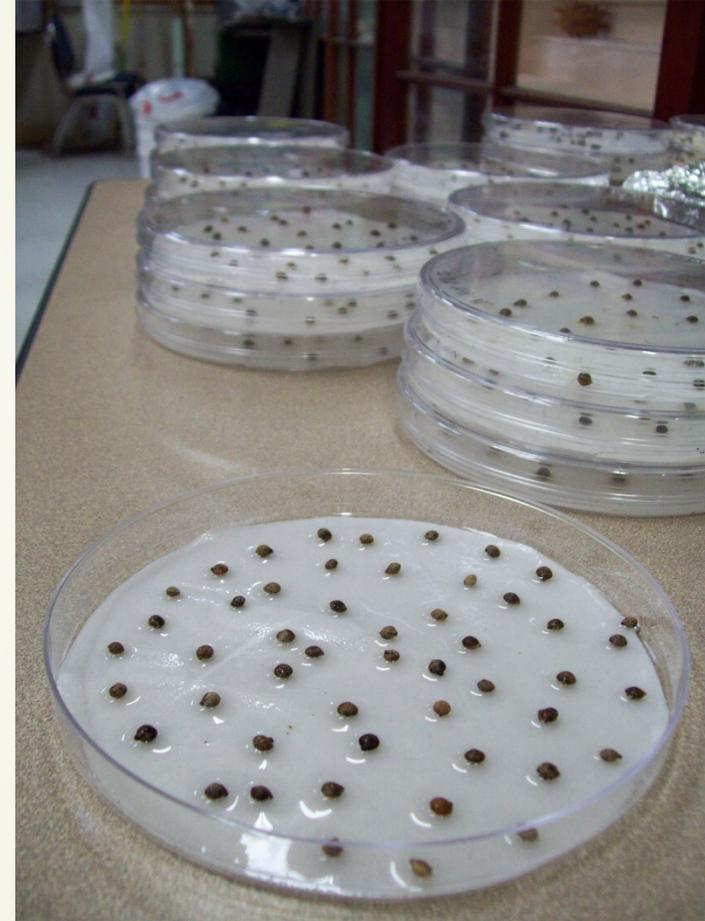
	1 Month		2 Months		3 Months	
	Damp	Dry	Damp	Dry	Damp	Dry
23.5°C Room	0	3	0	0	0	3
10.5°C Fridge	13	0	21	0	44	0
-20.0°C Freezer	0	3	0	0	0	0

- Three-way ANOVA
- Significance = 0.036 for an interaction between temperature, time exposure, and moisture

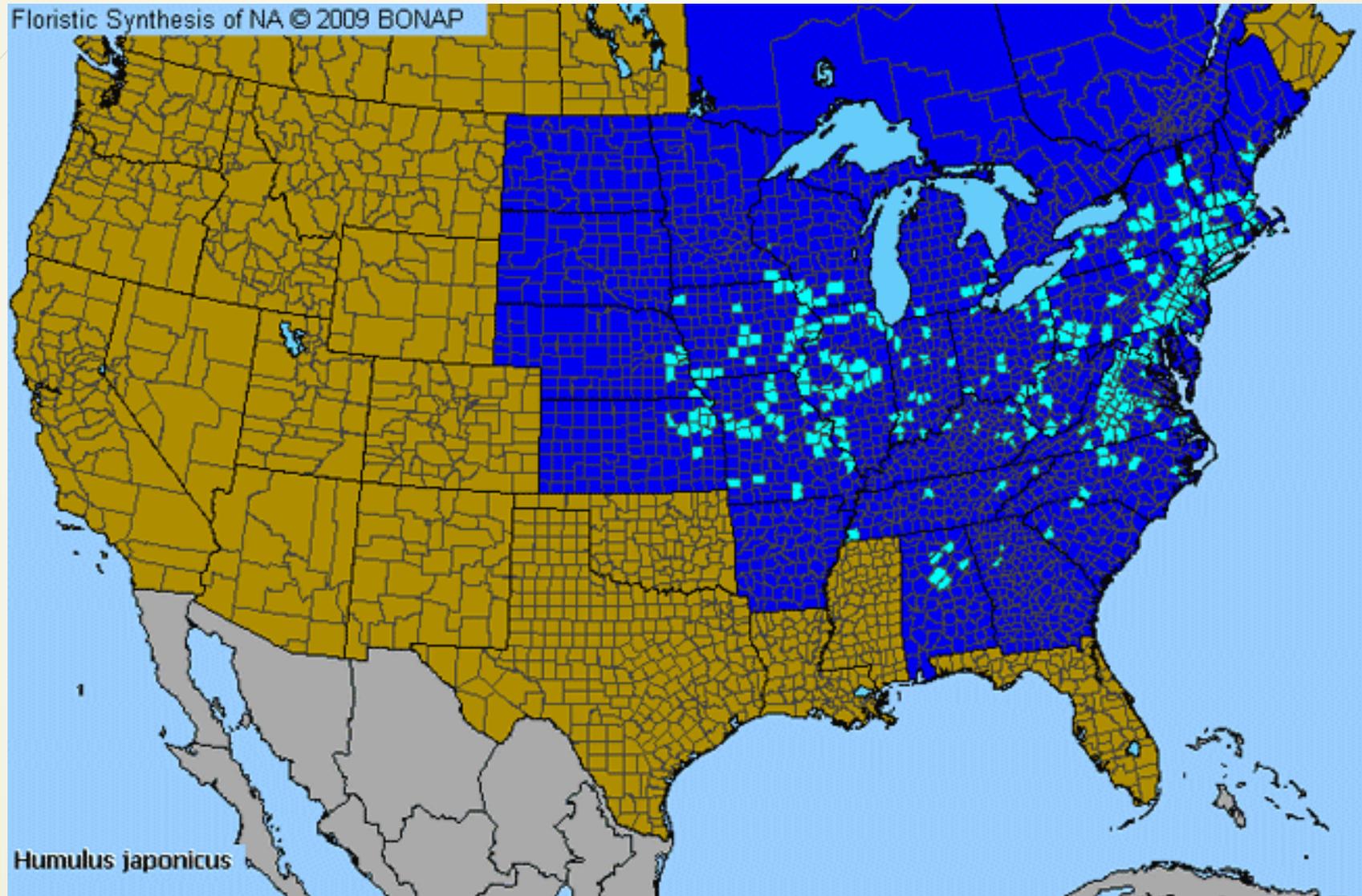


# Discussion

- ▶ Our results indicate that seed dormancy is broken by cold stratification.
- ▶ Fluctuation of temperature and moisture.
- ▶ Seed germination occurs rapidly – important role in control.



# Discussion



# Management Practices

- Will thrive in areas where cold and wet conditions are present.
- Possible Management Options:
  - Chemical methods such as spraying
  - Cultural control such as cover crops
  - Mechanical methods such as hand-pulling





# Acknowledgements



**BENEDICTINE**  
COLLEGE

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- ▶ Monks of St. Benedict's Abbey



# References



- ▶ Monocacy Watershed Japanese Hops Cooperative Weed Management Area Committee <http://www.maipc.org/Workshop2013/Pannill.JapaneseHops.pdf>
- ▶ National Park Service <http://www.nps.gov/plants/alien/pubs/midatlantic/huja.htm>
- ▶ Natural Resources Conservation Services <http://plants.usda.gov/core/profile?symbol=HUJA>
- ▶ Pennsylvania Department of Conservation [http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr\\_010262.pdf](http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_010262.pdf)
- ▶ Wisconsin Department of Natural Resources [http://dnr.wi.gov/news/mediakits/mk\\_carpcontrol.asp](http://dnr.wi.gov/news/mediakits/mk_carpcontrol.asp)

# Questions?

