Seed Biology and Management of Chinese tallowtree (Triadica sebiferia)

Heather VanHeuveln
University of Florida
Masters in Agronomy
Biology

- Family: Euphorbiaceae
- Deciduous, medium sized tree 20-50 ft.
- Monoecious
  - Dichogamous
  - Pollinated by insects
- 3-seeded capsule
  - Seeds have waxy aril
  - Hard seed coat underneath
    - Spread by water and birds
Distribution

- Commonly found along:
  - Roadways
  - disturbed areas
  - forest edges
  - waterways, including coastal areas
- Swampy to saline waters/soils
- Tolerates full sun to shady conditions
Problematic

- **Environmental**
  - High growth rate and seed production
    - Transforms wetlands/grasslands/disturbed areas quickly
    - Replace favorable hardwoods

- **Economic**
  - Conversion of pasturelands
  - Reclaiming lands
    - Regrowth common after herbicide application and trimming/mowing
    - Highly branched growth pattern
    - Resprouting and Root suckering
    - Seed bank fuels rapid repopulation post treatment
Problematic: Growth of Chinese tallow

~1 Month

~1 year

~3 Years SEEDS!
Objectives

1. Evaluate basal, hack & squirt and cut stump application methods and the use of common broadleaf tree control herbicides for Chinese tallow control

2. Determine seedling emergence patterns and seed bank longevity to define post treatment site monitoring recommendations
Objective 1

Evaluate basal, hack & squirt and cut stump application methods and the use of common broadleaf tree control herbicides for Chinese tallow control.

<table>
<thead>
<tr>
<th>Trade name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chopper</td>
<td>Imazapyr</td>
</tr>
<tr>
<td>Garlon 4</td>
<td>Triclopyr</td>
</tr>
<tr>
<td>Method</td>
<td>Aminocyclopyrachlor</td>
</tr>
<tr>
<td>Roundup</td>
<td>Glyphosate</td>
</tr>
<tr>
<td>Velpar</td>
<td>Hexazinone</td>
</tr>
</tbody>
</table>

**Reasoning**

- Evaluate existing and newly registered herbicides for Chinese tallow tree control
- Evaluate different application methods
Treatment Sites

1. WFREC; Jay, FL
2. Neal Land and Timber; Blountstown, FL
3. Paynes Prairie Preserve State Park; Gainesville, FL
Basal Bark

- Individual trees, DBH <4”
  - Spray 8-12” band at base including root crown
  - 6 reps @ each site

- Herbicide & Rates
  - Chopper - 10% in oil
  - Garlon 4 - 20% in oil
  - Method - 5% in oil
  - Method + Chopper - (5%+2.5%) in oil
Hack & Squirt

- Individual trees, DBH 2-12”
- 6 reps @ each site
- Number of hacks
  - 1: 6-9” circumference
  - 2: 10-22” circumference
  - 3: 23-34” circumference
- Herbicide & Rates

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Rate (per hack)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chopper</td>
<td>1 ml undiluted</td>
</tr>
<tr>
<td>Chopper + Method</td>
<td>0.5 ml + 0.5 ml undiluted</td>
</tr>
<tr>
<td>Garlon 4</td>
<td>1 ml undiluted</td>
</tr>
<tr>
<td>Method</td>
<td>0.5 ml undiluted</td>
</tr>
<tr>
<td>Roundup Weather Max</td>
<td>1 ml undiluted</td>
</tr>
<tr>
<td>Velpar</td>
<td>1 ml undiluted</td>
</tr>
</tbody>
</table>
Cut Stump

- Individual Trees DBH >4”
  - Cut 6” above ground
  - Herbicides applied in band around the cambium layer
    - Undiluted, 2x around
    - Within 5 minutes of cutting
    - 6 reps @ each site

- Herbicides

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Chopper + Method</th>
<th>Chopper</th>
<th>Garlon 4</th>
<th>Method</th>
<th>Roundup Weather Max</th>
<th>Velpar</th>
</tr>
</thead>
</table>

Results: Basal

- **Least Effective**
  - ≤ 90% Control
    - Chopper 10%+ oil
    - Garlon 4 20%+ oil

- **Most Effective**
  - ≥ 90% Control
    - Method 5% in oil
    - Method + Chopper (5%+2.5%) in oil
Results: Hack & Squirt

- **Least Effective**
  - \( \leq 90\% \) Control
    - Velpar
    - Garlon 4
    - Roundup

- **Most Effective**
  - \( \geq 90\% \) Control
    - Chopper
    - Chopper + Method (100%)
    - Method (100%)
Results: Cut Stump

- **Least Effective**
  - ≤ 90% Control
    - Roundup (sprouts)
    - Velpar (sprouts!)

- **Most Effective**
  - ≥ 90% Control
    - Chopper (sprouts)
    - Chopper + Method
    - Garlon 4 (sprouts)
    - Method

---

Bar graph showing the percentage control for Cut Stump Combined Site Average Control for different treatments over 6 and 8-12 months.
Resprouting

100% Control

472 chopper

462 garlon4

474 velpar

477 method 5%

461 chopper 10%

476 roundup
**Conclusions: Control Methods and Herbicide Recommendations**

**Basal Bark**
Garlon 4, Chopper-variable results

- **Hack & Squirt**
  - Velpar ineffective;
  - Roundup, Garlon 4, Chopper; Good not complete control

- **Cut Stump**
  - Velpar ineffective
  - Round up highly variable
  - Chopper, Garlon 4; Good/not complete

Method provided over 90% control over all treatment methods
Objective 2:  
Determine seedling emergence patterns and seed bank longevity to define post treatment site monitoring recommendations

1. Seed Exclusion Study  
   Monitor seedling emergence  
   Seed Bank Persistence

2. Germination Study  
   seed viability/germination influenced by time since capsule split?
Seed work justification/research gap

- Seeds are the main mechanism of spread
- Lack of information on seed bank life span
- Large amount of seed produced but
  - Seed viability
  - Seed fill
  - Seed germination timing
Monitoring Seedling Emergence and Seed Bank Decline

- **Seed Exclusion Frames**
  - 10, 1x1 meter frames
    - Fine and wide mesh screen
  - Placed under seeding trees
  - Checked once a month until seed bank exhausted
    - Seedlings counted
    - Pulled
Current Results: Monitoring Seedling Emergence and Seed Bank Decline

- Emergence occurs between March and September.
  - Starting early March
  - Peaking in April
  - Decline till September when emergence ceases

![Graph showing average seedling emergence per month at Paynes Prairie](image-url)
Seed Germination

- Collection: Every 2 weeks after capsule split for 2 months
  - 15 seed producing trees
  - Seeds collected directly from tree
  - Minimum of 50 capsules harvested
    - Stored for 10 days @ room temperature
    - Seed removed from capsule
    - Immature seeds discarded
  - 50 seeds selected from each tree and bulked
  - 100 seeds randomly selected
Seed Germination

- **Planting**
  - Sterilized potting soil
  - Planted 1 cm below surface
  - Subsurface watered
    - 1 cm water at bottom of cell (Kept moist.)

- **Growth Chamber**
  - Alternating
    - Night
      - Dark: 6pm-9am
      - Temp: 15C
    - Day
      - Light: 9am-6pm
      - Temp: 27C

- **Germination monitored daily**
  - “Germinated” upon emergence of cotyledons
  - Marked with tag and seedling removed

- **Statistics**
  - Nonparametric
  - Time event analysis
Seed Germination

- Tetrazolium Test
  - Viability test
    - Viable seeds turn pink
    - Detects respiration of living tissue
    - Non germinated seeds
Results: Seed Germination

- Basic Germination Statistics

<table>
<thead>
<tr>
<th>Collection Date</th>
<th>MGT (days)</th>
<th>% Germinated</th>
<th>% Viable</th>
<th>% Non Viable</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>40</td>
<td>9</td>
<td>23</td>
<td>67</td>
</tr>
<tr>
<td>C2</td>
<td>35.35</td>
<td>14</td>
<td>37</td>
<td>49</td>
</tr>
<tr>
<td>C3</td>
<td>42.58</td>
<td>12</td>
<td>28</td>
<td>60</td>
</tr>
<tr>
<td>C4</td>
<td>41.08</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Appears to be a dormancy mechanism
- Survival Analysis
  - No significant difference between treatments

Life-Table Survival Curves

- Treatments
  - 1: 2 wks
  - 2: 4 wks
  - 3: 6 wks
  - 4: 8 wks
Conclusion: Seed Germination

- There appears to be no significant difference between collection times and % Germination.
- Seeds germinated within 35-41 days in spring time temperatures.
- The number of viable seeds did appear to increase with later collection dates.
Future Research

- Integrating a more holistic approach
  - Maximizing control effectiveness for trees of various sizes
  - Better understand the infestation dynamics by seed viability and seedbank persistence
Recommendations

- **Chemical Control**
  - Aminocyclopyrachlor should be used if available.
    - Basal/Cutstump 5% in oil
    - Hack & Squirt 0.5 ml per hack
  - Basal:
    - Chopper+Method (5%+2.5%)
    - Chopper 10%
  - Hack n Squirt:
    - Chopper+Method (0.5ml+0.5ml)
    - Chopper 1ml
  - Cut Stump:
    - Chopper + Method (5%+2.5%)
    - Garlon 4 20%(possible sprouting)
    - Chopper 10%(possible sprouting)

- **Post-treatment**
  - Scout for/treat seedlings in July-September
Thank you... Questions?