Advances in herbicide technology for pine management

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Greetings!

Please use the Q & A function to ask questions, not the Chat. Questions will be answered after the presentation.
SAF Continuing Forestry Education Credit (CFE’s), & FL DACS Pesticide Applicator CEU’s:

- 1.0 Cat. 1 CFE approved
- 1.0 FDACS Pesticide Applicator CEU in the categories of: Forest Pest Control, Natural Areas Weed Mgmt., Private Applicator, or ROW Pest Control.

- For FDACS CEU, email cdemers@ufl.edu with pesticide applicator license #
• Please complete the very short evaluation at end of the webinar – *Thanks*!

• Presentation slides and other reading materials for this webinar are available online at:

  https://programs.ifas.ufl.edu/florida-land-steward/
Trends in Total Yield and Rotation Age for Southern Pine Plantations

Fox, Jokela, and Allen, 2004
Southern Pine Productivity Increases

Fox, Jokela, and Allen, 2004
Silvicultural Herbicide Uses

- Site Preparation
- Herbaceous Weed Control (HWC)
- Pine Release (brush)
- Mid-Rotation Release
  - Aerial Broadcast
  - Pine Understory
- Timber & Habitat Improvement

*Oust® promotes broomsedge and wiregrass.*

Photo: Pat Minogue
Herbicide Terminology

- Know generic and trade names
- Foliar or soil active
- Pre- Post-emergence
- Persistence
- Selectivity
- Toxicity
- Environmental Fate
- Mode of Action

Trade name “Arsenal”

Generic name “imazapyr”
Objectives of Site Preparation

- Ameliorate soil conditions
  - Compacted soils
  - Poorly drained soils
- Manage competition and promote desired species
- Important in natural and artificial regeneration systems, many objectives
A small amount of hardwood at stand age 3 greatly reduces yield.
Herbicide Site Preparation

“Get to the root of the problem”

- Manage brush and herbaceous weeds
- Options with and without burning
- Planting by hand or machine options
- Spring, summer, and fall treatment options
- Often combined with mechanical treatments on poorly drained (bedding) or compacted sites (disking or ripping).
## Site Prep Herbicides - Most Common

<table>
<thead>
<tr>
<th>Herbicide Generic Name</th>
<th>Trade Name (Many other generics)</th>
<th>Loblolly</th>
<th>Slash</th>
<th>Longleaf</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Product Rates Applied per Acre</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glyphosate</td>
<td>Accord® XRT II Roundup® Pro</td>
<td>4-8 quarts 2-5 quarts 4-8 quarts 2-5 quarts 4-8 quarts 2-5 quarts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triclopyr</td>
<td>Garlon® 4 Ultra</td>
<td>4-6 quarts 4-6 quarts 4-6 quarts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Hexazinone</td>
<td>Velpar® L; VU Velpar® DF VU</td>
<td>4 - 10 quarts 2.6 – 6.6 lb 4 - 10 quarts 2.6 – 6.6 lb 4 – 10 quarts 2.6 – 6.6 lb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Imazapyr</td>
<td>Chopper® Gen2 Arsenal® AC</td>
<td>32-64 oz 24-40 oz 32-64 oz 20-32 oz 32-64 oz 24-40 oz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Sulfometuron</td>
<td>Oust® XP</td>
<td>2-4.25 oz 2-4.25 oz 2-4.25 oz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Metsulfuron</td>
<td>Escort® XP</td>
<td>4 oz Maximum 4 oz Maximum NOT LABELED</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Persistent soil active herbicides.*

February 2021 – Most Common Treatments
Herbicide Site Preparation

*Spring treatment with Velpar® (hexazinone)*

- Ideal for *sandy soils*, very effective on oaks.
- Soil active herbicide, root uptake, up xylem.
- Requires rainfall to activate soil uptake.
- Enhanced growth with spring timing.
- *Granule formulation needed, ULW gone.*
Herbicide Site Preparation (rates/acre)

Foliar sprays in summer and early fall

- **Upland sites:**
  Oak, hickory, sweetgum...
  40 oz Chopper® Gen 2
  + 2 qts Accord® XRT II/Ac.

- **Flatwoods:**
  Gallberry, Saw palmetto, Lyonia, Titi, Yaupon,...
  40 oz Chopper® Gen 2
  + 2 qts Garlon®4 Ultra/Ac.
  ADD 1-5% Methylated Seed Oil (MSO) to improve absorption.
Suggested highest imazapyr product rate/acre based on timing of application and planting *loblolly pine*

<table>
<thead>
<tr>
<th>Planting</th>
<th>Herbicide Application Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June</td>
</tr>
<tr>
<td>Chopper Gen II product rate, ounces per acre</td>
<td></td>
</tr>
<tr>
<td>Nov.</td>
<td>52</td>
</tr>
<tr>
<td>Dec.-Jan.</td>
<td>56</td>
</tr>
<tr>
<td>Feb.</td>
<td>60</td>
</tr>
</tbody>
</table>

*Do not plant within 60 days after application of a 32-36 oz Chopper Gen II rate.

Tank mixes to enhance fuels for prescribed site prep burning

- Accord® XRT II (glyphosate products) increases brownout of grasses.

- Garlon® (triclopyr products), 2,4-D, or Milestone® VM Plus (aminopyralid + triclopyr) increase fuels in broadleaves.
Special Situations in Site Prep

- **Blackberry Control**
  Add 1 oz *Escort® XP* or 1.5 qts *Garlon 4®* or 7 oz *Milestone® (24-C)*

- **Pine Control**
  Add 5 qts *Accord* or 2-3 qts *Krenite®* or 7 oz *Milestone® (24-C)*

Jim Miller
Flatwoods bedding following Shear-Pile

- Poorly drained soils of lower Coastal Plain - “Spodisols”
- Two pass bedding or 1 pass w/herbicide
- Done in summer months to allow beds to settle prior to planting
Herbaceous Weed Control in newly-established pine plantations

- Widely adopted in the 1980’s
- **Spring** application (Feb.-May)
- 6-foot-wide band over rows
- Broadcast where rows are not present or have vines, grass sod, difficult access, large area
- Wait at least 1 month after planting for best tolerance.
COMP 15 Year Gains Over Non-Treated

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Height (ft)</th>
<th>DBH (in)</th>
<th>BA (ft²/Ac)</th>
<th>Merch. Vol. (tons/Ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woody Control</td>
<td>2.6</td>
<td>0.6</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>Herbaceous Control</td>
<td>3.0</td>
<td>0.3</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Total Control</td>
<td>6.3</td>
<td>1.3</td>
<td>46</td>
<td>45</td>
</tr>
</tbody>
</table>

Total control averaged 3 tons/Ac/Yr more than non-treated.

Miller et al. Southern Journal of Applied Forestry
# Herbaceous Weed Control Herbicides

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Trade Name (Many generics)</th>
<th>Product Rates/Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexazinone</td>
<td>Velpar® L VU</td>
<td>4-8 pts 1.3-1.8 lb</td>
</tr>
<tr>
<td></td>
<td>Velpar® DF VU</td>
<td></td>
</tr>
<tr>
<td>Imazapyr</td>
<td>Arsenal® AC</td>
<td>4-6 oz (6-10 Lob.) 12-20 Lob only</td>
</tr>
<tr>
<td></td>
<td>Chopper® Gen2</td>
<td></td>
</tr>
<tr>
<td>Metsulfuron</td>
<td>Escort® XP</td>
<td>0.5-1 oz Lob, Slash</td>
</tr>
<tr>
<td>Sulfometuron</td>
<td>Oust® XP</td>
<td>2-4.25 oz</td>
</tr>
<tr>
<td>Sulfometuron (12%) + Hexazinone (63%)</td>
<td>Oustar®</td>
<td>10-24 oz</td>
</tr>
<tr>
<td>Sulfometuron (56%) Metsulfuron (15%)</td>
<td>Oust® Extra</td>
<td>Loblolly 2.23-4 Slash 2.23-3</td>
</tr>
</tbody>
</table>
Herbaceous Weed Control
Slash Pine (product rates acre)

- Apply February to mid-April
- 2 oz Oust® XP+ 4 oz Arsenal® AC
- 2 oz Oust® XP + 24 oz Velpar® L
- 10-12 Oustar® VM

Arsenal® AC is most effective on sites with heavy perennial grasses.
Do not add surfactant to Arsenal.
Use lower labeled rates of Velpar® on sandy soils.
Herbaceous Weed Control
Loblolly Pine (product rates/acre)

- Apply February to mid-April
- 2 oz Oust® XP+ 4-6 oz Arsenal® AC
- 2 oz Oust® XP + 24 oz Velpar® L
- 10-12 oz Oustar®

- Loblolly is most tolerant pine to Arsenal®
Herbaceous Weed Control

Longleaf Pine (rates/Ac.)

- Apply mid-April to mid-May.
- Do not add surfactant.
- 2 Oust® XP + 24 oz Velpar® L
- 10-12 oz Oustar®

Pasture Conversion

- 4 oz Arsenal® + 2 oz Oust® XP
  applied mid-May
- **Bermuda**- Site prep first!

Check for new roots
Pine Release: Selective control of shrubs and hardwood trees

- **Selective** herbicides, pines are *tolerant*
- **Shift** species composition - *Selectivity*
- Pine release age 2-5 yr.
- Mid-rotation release
- Broadcast applications
  - Aerial by helicopter
  - Ground sprayers
# Selective Pine Release Herbicides

<table>
<thead>
<tr>
<th>Generic Name</th>
<th>Trade Name</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,4-DP</td>
<td>Weedone® 2,4DP</td>
<td>Syngenta</td>
</tr>
<tr>
<td>Glyphosate</td>
<td>Accord® XRT II</td>
<td>Corteva</td>
</tr>
<tr>
<td></td>
<td>Roundup Pro</td>
<td>Bayer</td>
</tr>
<tr>
<td>Imazapyr</td>
<td>Arsenal® AC</td>
<td>BASF</td>
</tr>
<tr>
<td>Hexazinone</td>
<td>Velpar® L</td>
<td>Bayer</td>
</tr>
<tr>
<td>Hexazinone</td>
<td>Velpar® DF</td>
<td>Bayer</td>
</tr>
<tr>
<td>Aminopyralid + Triclopyr amine</td>
<td>Milestone® VM Plus</td>
<td>Corteva</td>
</tr>
</tbody>
</table>
Pine Release – Arsenal® AC Label Rates

- **Loblolly pine** 12-20 oz/Ac.
- **Virginia pine** 12-20
- **Shortleaf pine** 12-16
- **Slash pine** 12-16
- **Longleaf pine** 12-16

- Mid-August to mid-October best application timing.
- Slash and longleaf pine ages 2-5 or after 10, no surfactant, usual rate 12 oz product/A in sandy soils of Coastal Plain.
- Loblolly 16 oz/A rate usual.
- Very broad-spectrum control.
  - Elm, redbud, locust, blackberry not controlled.
  - Add 0.5-1.0 oz Escort for locust, mimosa, blackberry control.

Photo: Jim Miller
Backpack directed foliar sprays

- Best for **targeted** applications on low brush, **less than 4 feet tall.**
- Less than 1,500 rootstocks per acre.
- Use low volumes, 10-20 gallons spray per acre (GPA).
- **Common Herbicides:**
  - Arsenal®, Chopper® Gen II
  - Garlon® 4, Garlon® 3A
  - Accord® XRT II
  - Milestone VM Plus

*Proper Personal Protective Equipment*
Soil Basal and Spot Treatments

Spring applications

- Undiluted *Velpar® L*
- Exact delivery handgun application to the base of woody vegetation
- For *trees* use 2-4 ml product per inch of stem diameter at breast height.
- For *brush* apply 2-4 ml product per 3 feet canopy width.
Mid-Rotation Release – Aerial, Selective
Favors pine diameter growth

- 10 to 20-year-old stands
- Selective control of hardwood trees and shrubs in older pine stands.
- Good return on investment in many situations.
- Late summer, early fall:
  - Arsenal® AC
  - 12-16 oz/A Slash and longleaf pine,
  - 16-20 oz/A Loblolly pine

Re-allocate available resources
Understory shrub and brush control

- Broadcast treatments made *below the pine canopy*
- 2-3 qts Garlon® 4 Ultra per acre
- 4-7.5 pints Accord XRT II plus 1-2% MSO seed oil
- 1.5-2 qts Garlon® 4 Ultra plus 32-40 oz Chopper Gen 2 for control of waxy leaf species: gallberry, yaupon, titi, etc.
- 2-3 oz Escort XP plus 32-40 oz Chopper Gen 2 for saw palmetto control.
Timber & Wildlife Stand Improvement

- Remove diseased trees, those of poor form.
- Provides dead wood for wildlife.
- Promote desired species for wildlife.
  - Red + White Oaks
  - Persimmon
  - American Beautyberry
  - Preferred Forbs
Hack & Squirt (Cut Stem)

- Used on taller vegetation, greater than 4” diameter
- Make cuts at a downward angle around the tree
- See labels regarding solution concentration, spacing between “hacks”.
- Apply 1 ml herbicide per hack
- Common Herbicides:
  - Arsenal® AC
  - Garlon® 3A
  - Weedar® 64 (2,4-D)
Basal Stem Treatment

- Spray bark of small diameter stems, < 4”d
- May be applied in dormant season
- Apply from ground to 12-15 inches high
- Use with “basal oil” or oil emulsion carrier

Common Herbicides
- Garlon® 4 Ultra
  - No residual effect
- Chopper® Gen II
  - Residual soil activity
Cut Stump

- Best for a few targeted trees
- Spray just the cambium
- Best on freshly cut stumps
- Treat all the stumps!

Common Herbicides
  - Chopper®, Stalker®
  - Garlon® 4 Ultra (ester), Garlon® 3A (amine)
  - Pathfinder® II (RTU)
  - Accord® XRT II
New Forestry Herbicide Labels
2021 Highlights

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Product Name</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aminopyralid/triclopyr</td>
<td>Milestone® VM Plus</td>
<td>Corteva</td>
</tr>
<tr>
<td>indaziflam</td>
<td>Espalande® F</td>
<td>BAYER</td>
</tr>
<tr>
<td>saflufenacil</td>
<td>Detail®</td>
<td>BASF</td>
</tr>
</tbody>
</table>
Milestone® VM Plus – (Corteva)

- Combination 1 lb triclopyr amine + 0.1 lb aminopyralid ae/gal
- For **selective control** of *broadleaf* weeds and *woody plants* in conifer forests during **site prep, directed spray, & IST**
- Site prep broadcast: up to 9 pts/Ac, 10-30 gal, add surfactant
- Directed spray: use solution 9 pts/100 gal for pine release, **selective brush and established broadleaf control**
- **IST**: i.e., cut-stump or cut-stem (hack and squirt, frill, etc.)
- Potential drift, volatile (vapors), see FL Organo-Auxin Rule

- Milestone® VM (aminopyralid alone) has State FL 24-C label for selective release in longleaf plantings
Esplanade® F - indaziflam (Bayer)

- **Selective Preemergence**, conifer and hardwood production areas, for site prep and post plant herbaceous weed control
- Not a stand-alone, mix with a postemergence herbicide
- Low use rates 3.5-7 oz/Ac; 10 oz product max per year
- **Wide-spectrum** control grasses and broadleaf weeds
- **Long residual**, half-life >150 days (WSSA 2014)
- Good tolerance to many conifer and hardwoods: Lob, Slash, Longleaf, Shortleaf, VA Pine; Sweetgum, Oak plantations
- Site Prep mixtures with imazapyr, sulfometuron, triclopyr
- HWC mixtures Velpar® DF, Oust®, Oustar®
- Toxic to fish, potential for leaching, aerial by helicopter only
- Inhibits cellulose synthesis, adds different mode of action
- Low toxicity, LD50 >2000 mg/kg
Detail® - saflufenacil (BASF)

- **Site preparation** to control wildling pines and other plants prior to planting conifers or hardwoods
  - For pine control, combine with the labeled glyphosate rate and recommended adjuvant
- Labeled for understory applications in established plantations to emerged weeds and brush
  - Combine with glyphosate or imazapyr and add adjuvant
- Protox inhibitor, inhibits chlorophyll formulation
- Degrades rapidly in the environment (DT = 1-36 days)
- Low toxicity, LD50 >2,000 mg/kg
American Tree Farm System (ATFS) Certification
2021-2025 American Tree Farm System Standards of Sustainability

• Standard 4-G for 4.2.2

• Landowners must maintain and provide documentation of pesticide (including herbicide) use on their property. Documentation must include what was applied, when, and where.

• This change can have a direct effect on certification. During the transitional period to the new Standards, if a landowner has not retained this information, they should work with their forester to develop records based on the information they have available (i.e., firsthand knowledge of what/when/why a pesticide was applied).
Sources of Additional Information

• Keyword search our Extension publications https://edis.ifas.ufl.edu/
• For up-to-date labels see http://www.cdms.net/LabelsSDS/

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HURRICANE RECOVERY

Conditions vary, landowner objectives and resources differ – a range in approaches:

- **Heavy debris, poor access:**
  - Innovations in heavy equipment
  - Aerial vegetation management using herbicides, later prescribed burning
  - *TIME*, decay, planting over 2-5 years

- **Salvaged timber, good access:**
  - Similar to typical site prep, but more need for machinery, very site specific

Timber Loss > $2 billion
Catastrophic Loss Due Hurricane

- Salvage opportunities are limited: roads blocked, bleu stain, shattered wood, decay in 3 months, markets saturated, etc..
- Fire hazard, pine beetle population growth...
- Timber does not qualify for causality loss.
- Reforestation challenges!
Mechanical site prep in hurricane recovery

- Much more expensive after hurricanes due to debris levels.
- For debris management on high debris sites (>75-100+ tons/ac) use D8’s + anchor chaining to level debris.
- Lesser debris sites may involve V-blade shearing or saw-heading, root raking, and windrowing or piling.
- Smaller piles are better than windrows if burning is done.
- Poorly drained soils will usually require bedding (or use old beds?)....
Armored Shears
Econfina Hurricane Mathew recovery, near ready to plant!
Pine Release using imazapyr (Arsenal® AC)?