

Application Methods for Forestry Herbicides

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Application Methods

- **Hand-held Techniques**
 - Backpack Foliar
 - Basal Stem
 - Hack & Squirt
 - Cut Stump
 - Soil Spot and Soil Basal
- **Ground Sprayer Machinery**
- **Aerial Application**
- **Sprayer Calibration**



Backpack 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[®] AC, Chopper[®]
 - Garlon[®] 4, Garlon[®] 3A
 - Accord[®] XRT



Proper Personal Protective Equipment

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



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”.
- Generally apply 1 ml/hack, about the same as 1 pull on a squirt bottle.
- **Common Herbicides:**
 - Arsenal[®] AC
 - Garlon[®] 3A
 - Weedar[®] 64 (2,4-D)



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**



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.

Ground Sprayer Design

Boom-less sprayers

- Cluster nozzles
- Boom-Busters
- Flooding fan nozzles



Ground Sprayer Design

Straight-stream manifold



Radiarc[®]
- controlled droplet size



Tractor Mounted Band Sprayer



- **Selective herbicides** over the top of planted trees
 - Oust[®] XP
 - Arsenal[®] AC
 - Velpar[®] L
 - Escort[®] XP
- A 4 to 6 foot wide band is common for herbaceous weed control on planted rows.
- Bands use **less herbicide** and have less environmental impact than broadcast treatment.

Aerial Herbicide Spraying



Rotor-wing aircraft

- Appropriate for **large areas** (40+ Acres), or difficult access.
- Herbicide plus burning has largely replaced mechanical forest site preparation.
- Selective herbicides can be applied **through the canopy mid-rotation**.
- Broadcast Velpar[®] or Oust[®] applications may **promote native grasses**.

Solids: Iso-Lair Bucket



Aerial Application of Solids

- **Modified seeders and fertilizer spreaders** are used to broadcast herbicide granules
- More difficult to control rate per acre and uniformity across the swath than sprays
- **Carrier evaporation is not a concern**
- **Fines or dust** in product formulations **increase potential for off-site movement**
- To avoid streaks or drift, do not apply when winds are gusty or exceed 5 mph

Fixed Wing Application



Helicopter Spraying



Rotor Vs. Fixed Wing

HELICOPTER

- Remote landing
- **Maneuverable**
- Slow air speed
- Used in sensitive areas

FIXED WING

- Greater payload
- Lower costs
- More potential for off-site movement
- **Not permitted** with some herbicides

Factors Affecting Drift Potential

- **Application parameters**, especially **droplet size** and **spraying technique** (nozzle selection, booms, aircraft, etc.)
- **Weather effects**, especially **wind speed and direction**, **height of inversion layer**
- **Tank mix effects**, **product formulations**, **surfactants**, **emulsifiers**, **drift control agents**

Small Droplets Give Good Coverage on the Leaf Surface

Droplet Diameter (Microns)	Droplets on Leaf (Per Sq. Inch)
50	92,250
100	11,750
200	1,425
400	180
800	22

Akesson and Yates, 1987, WSSA

Small Droplets Drift!!!!

Droplet Diameter (Microns)	1 mph	5 mph	10 mph
10	1.5 miles	7.5 miles	14.5 miles
100	75 feet	375 feet	750 feet
300	8 feet	42 feet	83 feet
600	2 feet	11 feet	21 feet
800	1 foot	6 feet	12 feet

Hansen, 1965; see Akesson and Yates, 1987, WSSA

Evaporation Rate & Droplet Size

20 ft, 1 mph Wind, 25C, 55%RH

**Droplet Diameter
(Microns)**

**Droplet Disappears
(Fall Distance)**

200

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150

15 ft

120

7 ft

100

3.5 ft

80

2 ft

Akesson and Yates, 1987, WSSA

Application Parameters Effecting Droplet Size Spectrum

- ❖ **Orifice size** and type of nozzle
- ❖ Nozzle discharge angle
- ❖ **Pressure** at the nozzle
- ❖ **Application height**
- ❖ Droplet shear, turbulence, airspeed
- ❖ Evaporative losses while airborne

Aerial Spray Equipment

CONVENTIONAL

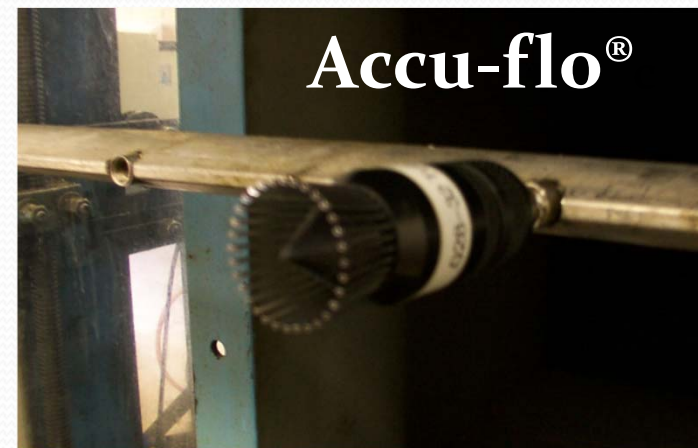
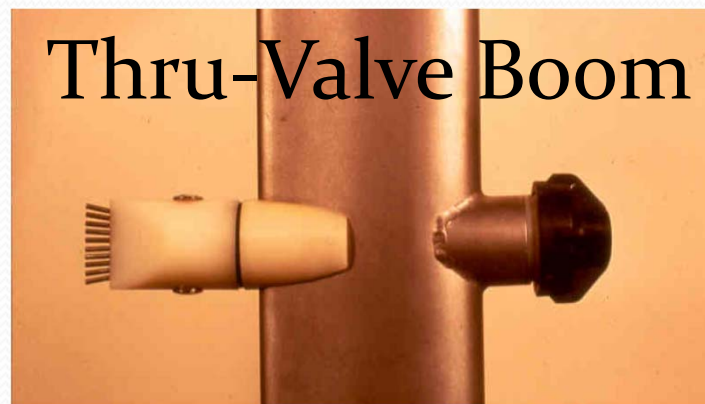
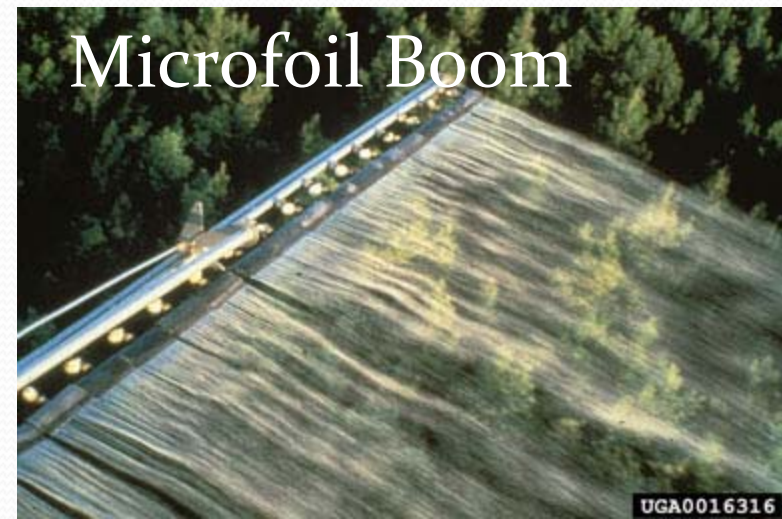
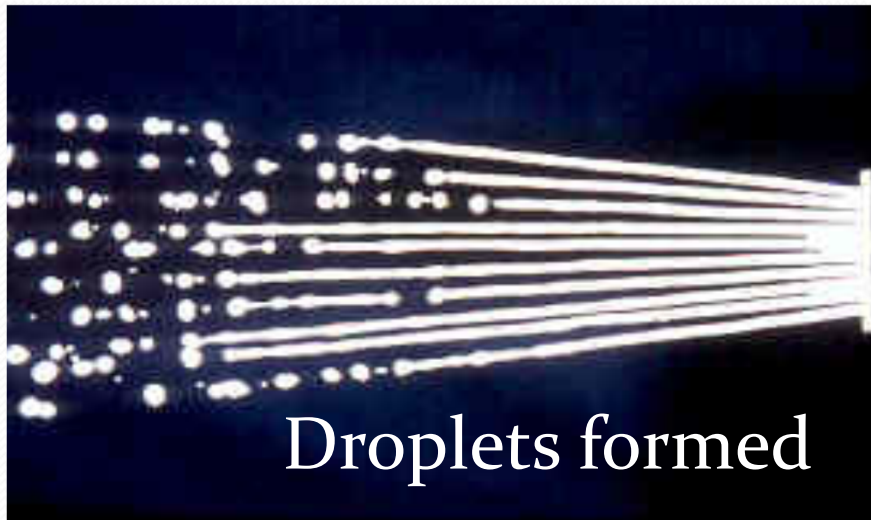
- Simplex(R) Boom
- Warnell(R) Boom
- Teejet(R) Disc-Core Nozzles
- Raindrop(R) Nozzles

CONTROLLED DROPLET BOOMS

- Microfoil(R) Boom
- Thru-Valve(R) Boom
- Microfoil(R) Nozzles
- TVB(R) Nozzles
- Accu-Flo(R) Nozzles

Advances in Aerial Application Technology

Controlled droplet size = reduced drift



GPS: Global Positioning Systems

- Documents **path of the aircraft**
- **Delineates** treatment area
- Very useful to **determine airspeed** ensure correct calibration of spray volume and herbicide rates per acre.
- Can be **integrated with injection systems** to control delivery rate.



Principles of Calibration

- Two ways recommendations are made:
 - A **percent solution basis**- “Apply a 2% solution of Accord as a directed spray to weeds and avoid any contact to longleaf seedlings.”
 - Used for **spot treatments to individual plants** or where the vegetation area is variable or difficult to ascertain (patchy).
 - A **rate per acre basis**- “Apply 2.0 pounds active ingredient per acre as a broadcast foliar spray.”
 - Used for broadcast treatments especially where **selective herbicides are being applied over tolerant crop trees or desired vegetation** and the dosage received must be carefully controlled.

Active ingredient vs. acid equivalent

- Salt = Acid + Base
- The label says “Accord[®] XRT contains 50.2% dimethylamine salt of glyphosate”
- “Accord contains 5.4 lb per gallon glyphosate dimethylamine salt (4.0 lb per gallon glyphosate acid)”
- i.e., there are 4 lb acid equivalent per gallon (ae/gal)
and 5.4 lb active ingredient per gallon (ai/gal)



How to determine your rate per acre

- Just figure out **how many gallons per acre** you are spraying at a given:

1. Ground speed
2. Swath width
3. Spray output rate

There are only two things you need to know:

- How long does it take to treat 1 acre?
- How much solution do we use in the time it takes to treat 1 acre?

Example calibration

- Four 8004 flat fan nozzles on 18 inch centers produce a six foot wide swath. The regulator is set at 25 psi and is producing 0.5 gallons/min spray output (all 4 nozzles). Pat is walking at 2.96 mph and has a metronome to keep his pace constant.
- **How long does it take to treat one acre?**

43560 sq ft/Ac divided by 6 foot swath = 7,260 ft to treat one acre.

3 mph = 15,840 ft per hour (60 min.)

15,840 ft is to 7,260 ft

60 min. Z min.?

(15,840 ft X Z min.?) = (7,260 ft X 60 min);

Z min.? = 27.5 min.

Example calibration

- Ok, so we will take 27.5 minutes to treat an acre. Our boom is applying 0.5 gallons per minute.
- **How many gallons per acre are we applying?**
 - $27.5 \text{ min./acre} \times 0.5 \text{ gallons per minute} = 13.75 \text{ gal/acre}$
- If we want to apply 2 oz Oust[®] product per acre, how many oz Oust[®] should we add to the 27.5 gallons of water in our tank?

(hint: $13.75 \times 2 = 27.5$)

Sources of Additional Information

- **Southern Regional Extension Forestry:**
<http://www.sref.info/>

Extension Forestry
Southern Regional



- **Forest Vegetation Management Website**
http://nfrec.ifas.ufl.edu/Forest_Vegetation_Management/

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