

Practicality and Costs of “Alternative” Weed Management Methods



Dr. Thaddeus Gourd, Extension Agent (Agriculture), CSU Cooperative Extension
in Adams County, Brighton, CO tgourd@co.adams.co.us

Utilizing The Atarus Stinger Steamer to Control Weeds in Plastic Culture Organic Strawberries



Atarus Stinger Weed Control Device Specifications



- Uses propane as a fuel source. Tank holds 75 gallons.
- At 1 gallon of water per minute dry steam produced at 800° F at 75 psi.
- Holds 211 gallons of water.
- Has safety sensors.
- Cost: \$15,000 for a two generator system.
- \$25,000 for new system₃

Water Quality and Quantity



- Water flow rate per minute
 - 0.74 gallons per minute to
 - 2.1 gallons per minute
- One Gallon per minute was the most efficacious cost effective flow rate (206 gallons per acre)
- Water must be filtered clean
 - Algae and sand can affect performance

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Speed of Application

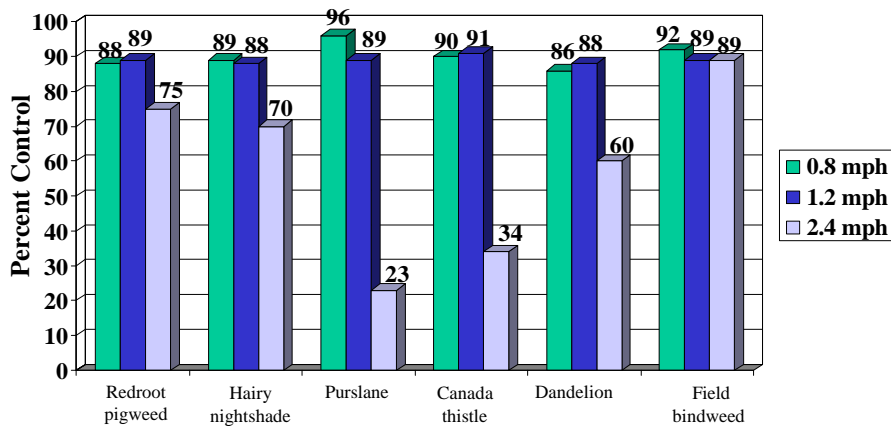


- Speed of Application
 - 0.8 mph
 - 1.2 mph
 - 2.4 mph
- Tractor speed depends on size of weeds and ambient air temperature
- Timing frequency depends on weed population and type of weeds

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Effect of Tractor Speed on Weed Control

1 Day After Application (7/26/03)



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Propane Usage



- Propane usage varied from 10.8 to 11.3 gallons per hour running two steam generators
- Below 50° F the propane flow rate was erratic
- Above 55° F no propane flow problems were observed
- Cost of propane per acre based on 6 foot rows post-directed
 - 15.3 gallons x \$1.44 = \$22.03/A

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Under High Temperatures, Weed Control Results Are Quick To See



Dandelion



Canada thistle

Two minutes after application of steam on May 29, 2003. Air temperature was 93° and humidity 16% at time of application.

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Weed Control Results



Bindweed was very sensitive to steam treatment.



Canada thistle was more tolerant of the steam treatment.

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Conclusion



- The Atarus Stinger Steamer was very effective on annual broadleaf weeds such as kochia, pigweed, hairy nightshade and purslane.
- Steam gave good control of annual rye, downy brome and bindweed.
- Good activity was seen immediately after treatment of steam on Canada thistle and dandelion; however, rapid re-growth reduced control levels.
- The Atarus Stinger Steamer application efficacy worked best on smaller weeds.
- The hotter the ambient temperature the better the control.

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Conclusion



- The Atarus Stinger Steamer uses approximately 1 gallon of **Clean** water per minute (Current water tank allows about 2 hours of treatment).
- Uses approximately 11 gallons of propane per hour (Current propane tank allows 6.8 hours of use).
- Generator positioned parallel to beds worked best.
- Cost \$66 per acre broadcast per application.

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“The Atarus Stinger uses steam-quenched combustion technology, which provides weed control without chemicals, so it fits especially well into an organic operation where spraying is not an option,” said Ian Johnstone, inventor of this technology, and manager of thermal weeding products with D.J. Batchen Pty. Ltd

Effect of the Sioux Weed Blaster Steamer on Perennial and Annual Weeds



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Sioux Weed Blaster Steamer Weed Control Device



- Uses 3 gallons of diesel as a fuel source per hour.
- Applies 2 gallons of water per minute which produces 320 degree F saturated steam at 250 psi.
- Holds 125 gallons of water.
- Cost \$5000.

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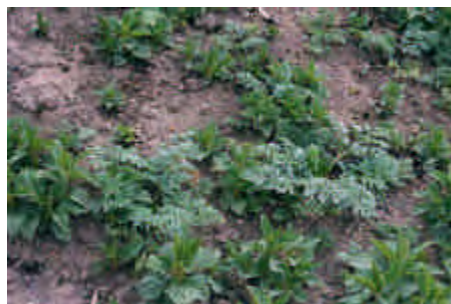
Steam Application Timings



- Steam application was applied on May 4, 2002. Each plot was treated for 30 seconds.
- The second steam application was applied on May 20, 2002. Each plot was treated for 60 seconds.
- Plot size was 4 feet by 5 feet (20 square feet).

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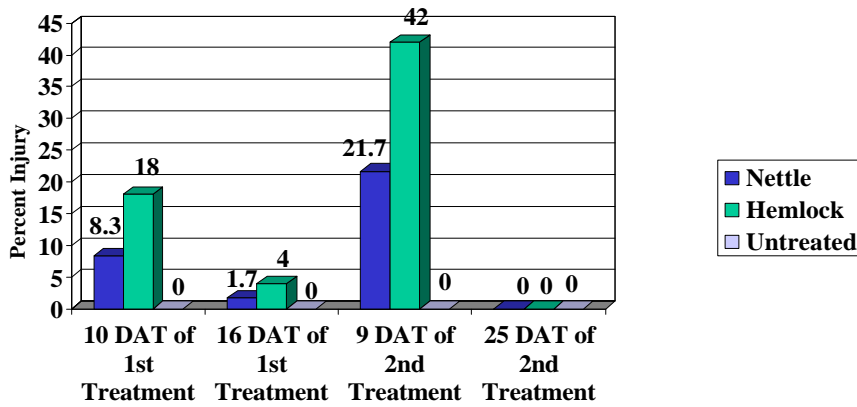
Perennial Weeds at Treatment



- Stinging Nettle *Urtica dioica* was 3 to 6 inches tall.
- Poison Hemlock *Conium maculatum* was 3 to 6 inches in size.
- Steamed plants showed a mild wilting effect immediately after application. The wilting symptoms disappeared within 2 hours of application.

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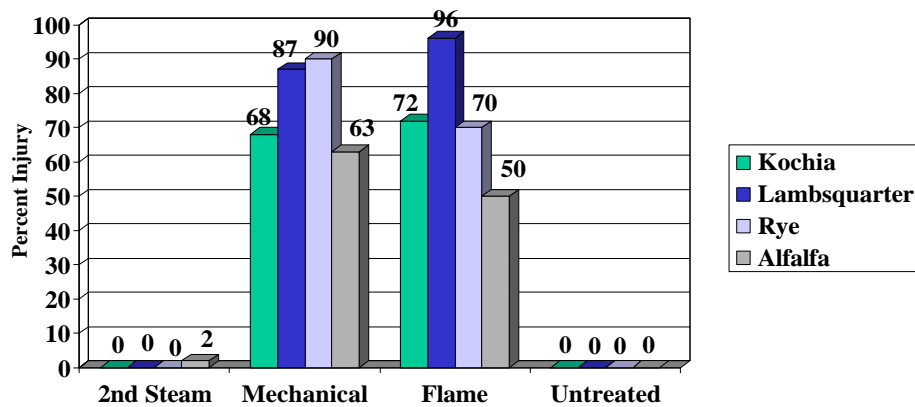
Effect of Two Steam Applications on Stinging Nettle and Poison Hemlock



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Effect of Two Treatment Applications on Weeds in a Peach Orchard

16 Days After the Second Application (5/20/02)



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Conclusion



- The Sioux Weed Blaster Steam treatments gave little to no control of Stinging Nettle following the two steam applications.
- Steam treatments gave slight control (42% injury) of Poison Hemlock 9 days after the second application but no control by 25 days after treatment.
- Cost \$218 per acre per application (3 gallons of diesel per hour) at \$2 per gallon.

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Conclusion



- The Sioux Weed Blaster Steam treatments gave little to no control (less than 10%) of kochia, lambsquarters, annual rye and alfalfa following the application of steam on three different occasions.
- The final assessment 25 days after the third steam application, showed little control of any of the weeds tested in this study.

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Weed Control Using the Atarus Ranger Propane Flamer



Atarus Ranger Thermal Weed Control Device



- Uses propane as a fuel source.
- Weighs about 40 pounds.
- Provides about 45 minutes of use per 6.6 lb tank of propane when used at high flame setting.
- Cost \$995.

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Instant Results



Treated
With Flame

Untreated

- Flame is applied to sear the kochia.
- Kochia changes color to a light yellow green just after treatment with flame.

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Instant Results



Treated
With Flame

Untreated

- Flame is applied to sear the Stinging Nettle & Poison Hemlock.
- Stinging Nettle and Hemlock changes color to a light yellow green just after treatment with flame.

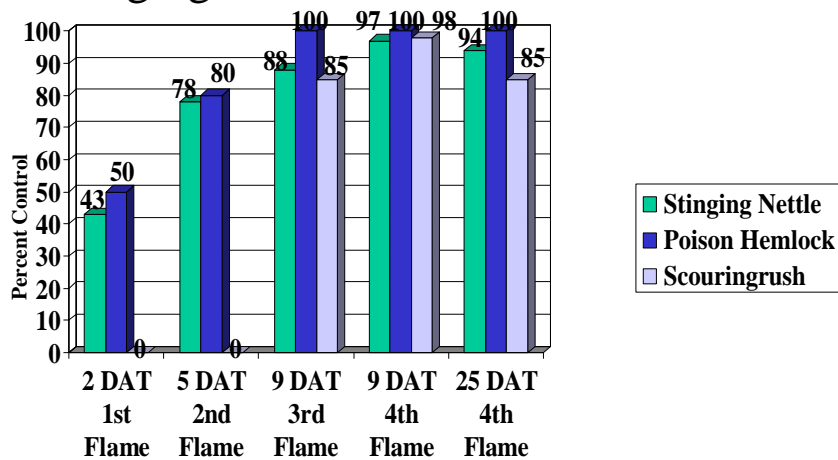
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Effect of Two Flame Applications on Kochia in a Non-Cropland Environment

Days After Treatment	Flame Application % Control	Untreated % Control
2 DAT of 1 st Application	92.5%	0
8 DAT of 1 st Application	93.25%	0
5 DAT of 2 nd Application	95.75%	0
7 DAT of 2 nd Application	98.75%	0
13 DAT of 2 nd Application	99.5%	0
17 DAT of 2 nd Application	98.0%	0
27 DAT of 2 nd Application	98.5%	0
43 DAT of 2 nd Application	98%	0
52 DAT of 2 nd Application	93.75%	0
68 DAT of 2 nd Application	93.0%	0

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Effect of Four Flame Applications on Stinging Nettle & Poison Hemlock



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Conclusion



- Flaming weeds using the Atarus Ranger effectively controlled the annual weed kochia for 68 days following the second flame application.
- When used to sear weeds, little if any smoke was produced.
- Open flame can be a concern.
- Cost \$181 per acre per application.

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Conclusion



- The Atarus Ranger Thermal Weed Control Device was very effective in flaming weeds in a non-cropland environment.
- Four applications from the Atarus Ranger flamer gave good to excellent control of stinging nettle, poison hemlock and scouringrush for 25 days following the fourth flame application.
- When used to sear weeds, little if any smoke was produced.

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Red Dragon TD-12 LPS Alfalfa Field Flamer Weed Control Device



Red Dragon TD-12 LPS Alfalfa Field Flamer Weed Control Device



- Uses propane as a fuel source.
- Designed to easily skid behind tank trailer.
- Uses 20 to 35 gallons of propane per acre depending on ground speed.
- Cost \$1800.

Field Flamer Used to Control Annual Weeds in Cilantro



Flamed prior to
crop emergence

Untreated

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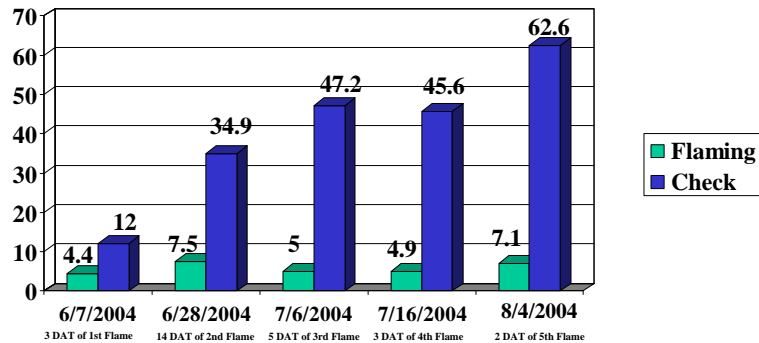
Canada Thistle Shows Injury Seconds After Flame Application



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Effect of Multiple Applications of Flaming on Canada Thistle Biomass

Above Ground Biomass in Grams Per Plant

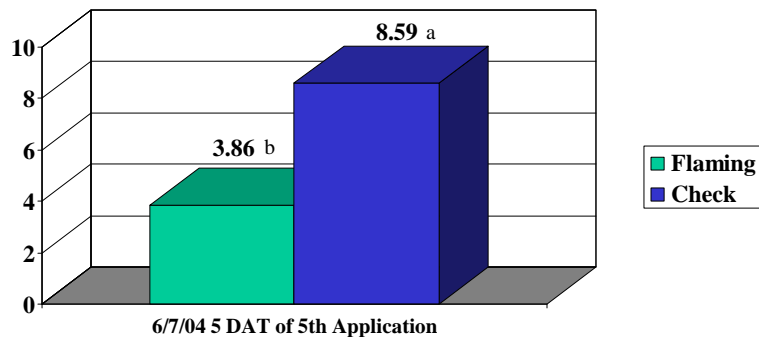


Flame Applications occurred on 6/4/04, 6/14/04, 7/1/04, 7/13/04 and 8/2/04

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Effect of Multiple Applications of Flaming on Canada Thistle Biomass

Root Biomass in Grams Per Plant



Flame Applications occurred on 6/4/04, 6/14/04, 7/1/04, 7/13/04 and 8/2/04

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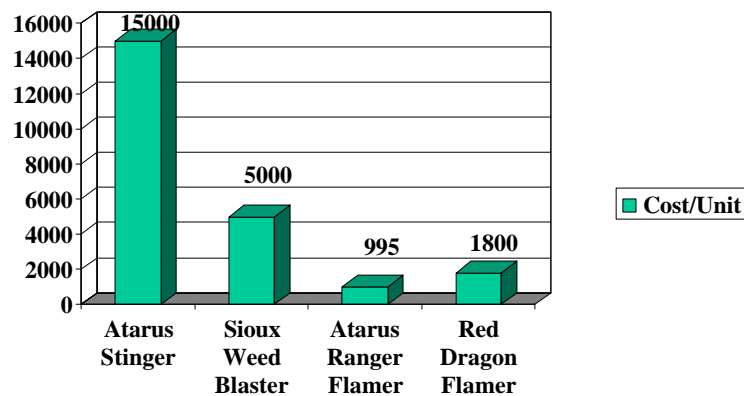
Conclusion



- The Red Dragon Alfalfa Field Flamer effectively controls annual weeds such as kochia, puncturevine, pigweed and nightshade.
- Canada thistle foliage (aboveground biomass) was reduced by 89% and root biomass was reduced by 55% after five applications.
- Cost \$50 per acre per application.

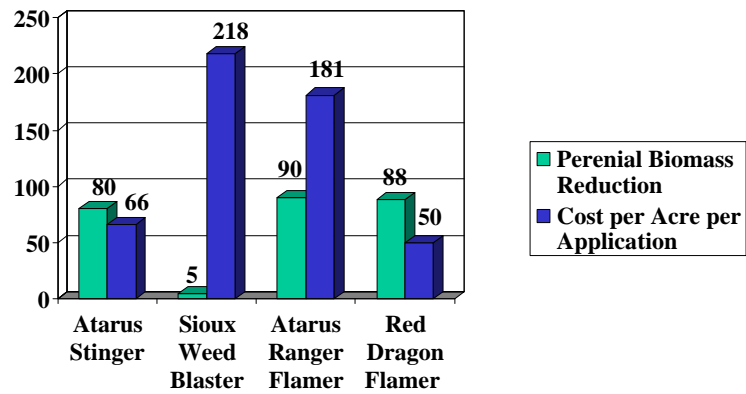
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Machine Cost Comparison



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Efficacy versus Operating Cost/A



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Acetic Acid Based Products Retail Costs

- Alldown –\$20/gal
- Burnout – \$39.95/gal
- Vinegar - \$2.50/gal

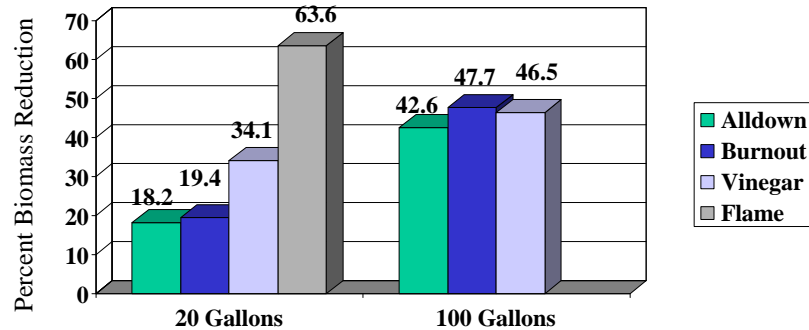
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Biomass Research Tools



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Efficacy of One Application of Acetic Acid Based Herbicides and Flame for Canada Thistle Management



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Multiple Acetic Acid Applications

- Applications of Acetic Acid Products Made on:
 - April 28, 2004 – 120 gals/acre
 - May 4, 2004 – 120 gals/acre
 - May 11, 2004 – 173 gals/acre
 - May 21, 2004 – 173 gals/acre
- Total Product Applied 585 gallons
- 3 Replicates
- Steam was applied on April 28, May 4 and May 1

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Alldown



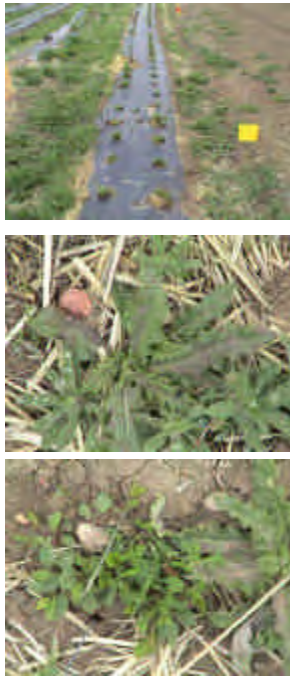
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Burnout



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Vinegar



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Steam



Untreated Check



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Steam



Vinegar



Untreated



Burnout

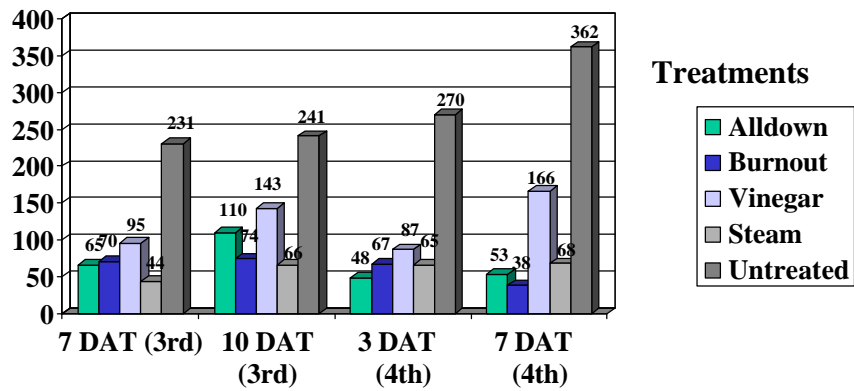


Alldown

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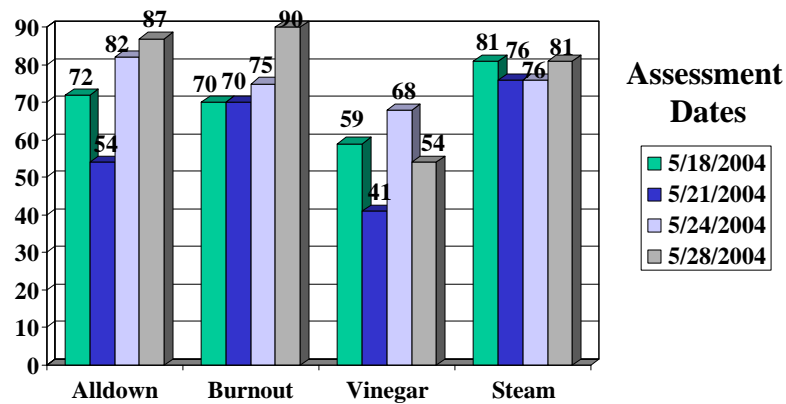
Effect of Four Applications of Acetic Acid Based Herbicides and Steam on Canada Thistle Biomass

Biomass in grams (5 plants)



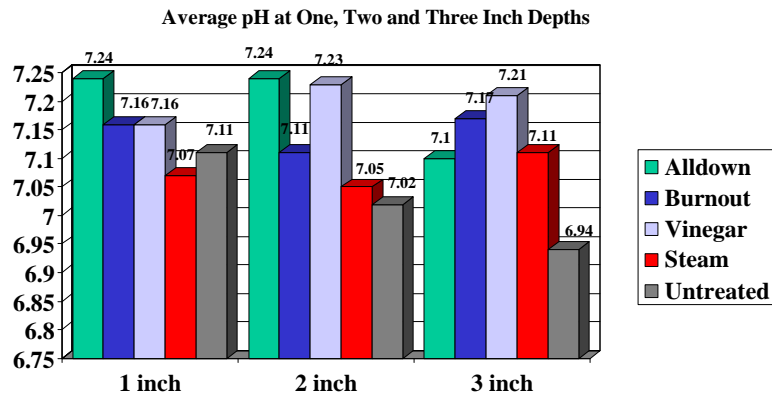
Applications occurred on 4/28/04, 5/4/04, 5/11/04, 5/21/04. Acetic acid based products total application 585 gallons. 49

Percent Biomass Reduction



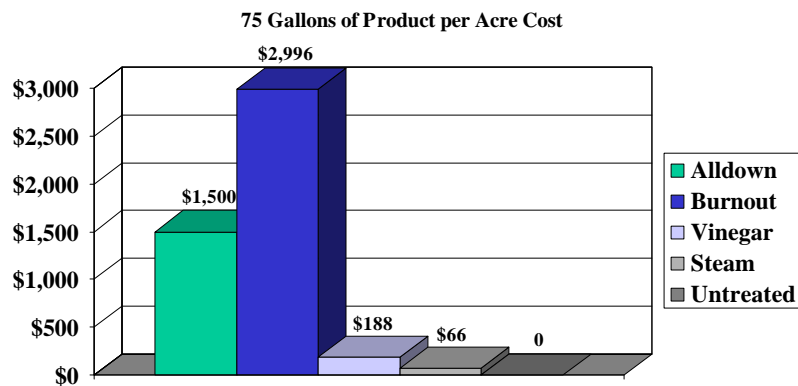
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Effect of Four Applications of Acetic Acid Based Herbicides and Steam on Soil pH In A Clay Loam Soil



Applications occurred on 4/28/04, 5/4/04, 5/11/04, 5/21/04. Acetic acid based products total application 585 gallons. 51

Cost of One Application of Acetic Acid Based Herbicides and Steam for Canada Thistle Management



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Conclusion



- Acetic Acid based Alldown and Burnout: Canada thistle foliage (aboveground biomass) was reduced by an average of over 87% after five applications.
- Vinegar reduced foliage biomass by an average of 54% after five applications.
- Acid based products are corrosive on metal sprayer parts.
- Cost ranges from \$188 for vinegar to \$2996 per acre for each application of Burnout.

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Any Questions?