ORGANIC HERBICIDES

John Roncoroni, UCCE Weed Science Advisor, Napa

'Organic' Weed Control Options

- Sanitation
- Cover cropping
- Animals
- Tillage
- Mowing
- Mulching
- Flaming or steaming
- Solarization
- Organic Herbicides

Organic Herbicides

All are contact herbicides- problem- grasses and perennials

Good spray coverage is essential -

Work best on clear sunny days

Usually work better in warm weather (80°F+)

Organic surfactants improve weed control

Repeat applications are needed for larger weeds

Active Ingredients Which May Be in Minimum Risk Pesticide Products Exempted under section 25(b) of FIFRA

- Castor Oil (U.S.P. or equivalent)
 Cedar Oil
 Cinnamon* and Cinnamon Oil * 4. Citric Acid*
- 5. Citronella and Citronella Oil 6. Cloves* and Clove Oil*
- 7. Corn Gluten Meal* 8. Corn Oil* 9. Cottonseed Oil*
- 10. Dried Blood' 11. Eugenol 12. Garlic* and Garlic Oil* 13. Geianiol14. Geranium Oil 15. Lamyl Sulfate 16. Lemon grass Oil* 17. Linseed Oil 18. Malic Acid*

- 19. Mint* and Mint Oil* 20. Peppermint* and Peppermint Oil*
- 21.2-PhenethylPropionate (2-phenylethyl propionate)
- 22. Potassium Sorbate 23. Putrescent Whole Egg Solids
- 24. Rosemary * and Rosemary Oil*
- 25. Sesame* (includes ground Sesame plant stalks) and Sesame Oil*
- 26. Sodium Chloride (common salt)* 27. Sodium Lauryl Sulfate
- 28. Soybean Oil 29. Thyme* and Thyme Oil* 30. White Pepper*
- 31. Zinc Metal Strips (consisting solely of zinc metal and impurities)

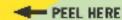
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Types of Organic Herbicides

Acidic Acid



FIRST AID

IF IN EYES:

Hold eyelds open and this hwith a steady, gentle stream of nater for 15 20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue dissing eye. Call a pulson control center or furthefor advice.

IF ON SKIN OR CLOTHING:

Take officing and indeed the ling. Binse skin immediately with plenty of water for 15-20 minutes. Call a poison control center for doctor for further treatment advice.

IF SWALLOWED:

Call a poison control center or doctor immediately for treatment advice. Here person sip a glass of water if able to swallay. On but induce somiting unless told to do so by puison control center or doctor. On not give anything by month to an unconscious person.

IF INHALED:

Move person to tresh air, it person is not breathing, call 300 or an embulance, then give artificial respiration, preferably month-formath, it possible. Call a poison control center or declor brightness treatment advice.

NOTE TO PHYSICIAN: Probable moored demage may contra-indicate life use of gastric brage.

Have the product container or label with you when calling all prison control center or dudge, or going for treatment. You may also contact 1-800-858-73/3 for emergency medical treatment.

PRECAUTIONARY STATEMENTS Hazarda to Humans and Domestic Animals DANGER

Cornosive - causes ineversible eye damage. Wear goggles or face shield when handing. Hammid if absorbed through skin.

Farmfulif swallowed. Do not get in eyes, on skin, or on clothing, in case of contact, immediately flush eyes or skin with plenty of water. Get medical attention Hintlation pensists, Wash thoroughly with scep and water after handling. Wear personal protection action of when handling and/or applying.

Personal Protective Equipment (PPE); (potators and other handers must wear appropriate protective greecer, such as or lace shield or goggles and face mask (with MSINZ/MUSII approval number professor has NSS, R-95, on P-95), long sleeved shirt and long pants, waterprontigines and shoes pins sinck.

User Safety Requirements: Follow nanotodom's in structions for cleaning/maintaining PPE. If no such instructions soist for PPE, use detergent and but nater. Seep and wish PPE separately from other bounds.

User Safety Recommendations: Densitoold:

- Week hands before eating, drinking, drawing girm, using tobacco, or using the total.
- Berrova cicthing immediately it pesticide gets inside. Then washes it in thoroughly and put on clean ciclings,

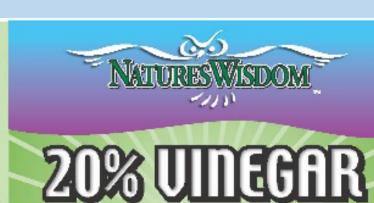
kenner PPF immediately after handing this product. Wash the rutside of gloves before removing, its sum as possible, wash thoroughly and change into okan citibities.

Environmental Hazards:

- This position is facilit to thirts equised to spay drift, direct breatment or residues on crops or weeds. Durint apply this product or allow to drift to crops or weeds if birds are actively visiting the treatment area.
- · This pesticite is train to fish and aquatioinvertebrates.
- · For terrestrial use only. Do not apply threatly to water.

DIRECTIONS FOR USE

Endangered Species Instaction Requirements: This product map have effects on endangered species. When using this product, you must follow the measures contained in the Endangered Species.



Herbicide for control of Weeds

A Horticultural Vinegar Biopesticide - for Non-Selective Control of Herbaceous Broadleaf Weeds and Weed Grasses which Surround Food crops, Non-food crops and Non-production Agricultural, Farmstead, Right-of-Way, and Institutional Land Sites

For Organic Production

Para la producción orgánica

KEEP OUT OF REACH OF CHILDREN

DANGER - PELIGRO

Constraint of the season and despite properties from a statement of the object of the season of the

Para from ethick time Alson, 10, 450 Dailese Fast D. Stall D. Fragar 1475 (78 Admiss Alaba, ethi Fragar Indialescon



Protection Bulletin furthe county in which you are applying the product. To obtain Bulletins, no more than six munits before using this product, consult http://nexu.epa.gov/espp/or salt 1-801-447-3813. Yournest use the Bulletin valid for the month in which you call apply the product.

If is a Molection of federal law to use this product in a memoral inconsistent with its lebeling, fleed the entire label before using. Ou not apply this product in a way that will contact workers on other persons, either directly or through drill. Only protected tendiers may be in the area during application. For any requirements specific to your State or Tribe, consult the State or Tribal agency responsible for pushfolder regulation.

ACRICULTURAL USE REQUIREMENTS

like this product only in a contance with its labeling and with the Worker Protection Standard, 4D CFR part 170. This Stanrand contains requirements for the protection of agricultural nodes in fame, locats, miseries and greatimises, and harders of agricultural posticides. It contains requirements to training, decontamination, notification, and emergency. assistance. It also contains specific instructions and exceplions og laining to the statements on this label about person. al protective engineer (PPE) and restricted entry interval (REL). The requirements in this look only apply to uses of this product that are covered by the Worker Protection Standard. Do not enter or allow worker entry to treated areas during the restricted entry interval (REI) of 48 hours, PPE remined. for early entry to treated areas (that is permitted under the Worker Protection Standard and that involves contact with arything that last been breated, such as plants, soil, in calm). is: • Coveralls • Waterproof gloves • Shoes plus sodes

NON-AGRICULTURAL USE REQUIREMENTS

The requirements in this lost apply to uses of this product that are NOT Within the scope of the Modern Entertion Standard (WPS) for agricultural pesticides (40 CFR Part 170). The WPS applies when this product is used to produce applicational plants on tames, turests, nonseries or greenhouses. Do not enter or at line worker entry into treated areas during the restricted-entry interval (REI) of 43 hours. Keep imported edipersions out of the treated areas and its pay has dried.

Mature's Wistom 20% Vinegar is a quick acting non schedive context herbidde containing an organic actinitor which the residues degrade promptly in the soft. I of an contact results in rapid desiccation and control of annual aceds and grasses, and top growth reduction of bethecome perennial aceds and grasses (see table helma). For control of established perennial aceds, refreelment may be necessary. Nature's Wisdom 20% Yinegar may be applied up to tau days before harvest.

TYPICAL WEEDS CONTROLLED

ANNUAL PERENNIAL ANNUAL BROADLEAF GRASSES GRASSES. WEEDS Bluegrass Crategrass Irotal sp. **Blackmedic** Ouechgiese. Unthreal 型idiggs: talian receass Blacknightshade Pus annua PERENNIAL **Greekil Jourh** BROADLEAF LIVERWORTS* Commun WEEDS "In Livervols." grombel Amaranth sep. dilute this product Hairy middishads Crawfel. at a rate of Leather Lambsquarters (skep) allhanceintle Mistardapp. Dandelon ? gallers, ef netet. thalis spp. Ground by for all other Pigareed spp. Hantain sou. week, use full Researchain. hadflar strength. Shaphanisourse liftet velch. Snartweed. Wild carrot. (targethunb). Nes. **Veletileal**

'Natural' Acids



WEED ZAP*



A NON-SELECTIVE HERBICIDE FOR ANNUAL GRASSES AND WEEDS

General Information

WEED ZAP is a contact, non-selective, broad spectrum, foliar-applied herbicide. This product will only control actively growing emerged green vegetation. It controls both annual and perennial broadleaf and grassy weeds. This product does not translocate. It will affect only those plants that are coated with the spray solution.

ACTIVE INGREDIENTS:

Clove Oil	45%
Cinnamon Oil	45%
Inert Ingredients:	
Lactose and Water.	
TOTAL	100%

This product is exempt from registration with the Federal EPA under section 25 (b) of FIFRA. WEED ZAP has not been registered with the Environmental Protection Agency JH Biotech, Inc. represents that this product qualifies for exemption from registration under the Federal Insecticide, Fungicide and Rodenticide Act.

International & United States Patents Pending

APPLICATION RATE TABLE

Mix 5 gallons of WEED ZAP concentrate per 100 gallons of spray water. Apply enough WEED ZAP to cover the entire surface of the weed. Spray to the point of run off. The use of a spreader/sticker may increase contact and efficacy of treatment.

FINAL MIX VOLUME FL. OZ.

1 Gallon	6.4	
5 Gallons	32	
10 Gallons	64	
25 Gallons	160	
aneat application as necess	any Coverage is	accential to

Repeat application as necessary. Coverage is essential to establish control.

Lot No.

CAUTION KEEP OUT OF REACH OF CHILDREN PRECAUTIONARY STATEMENTS

Off target application of WEED ZAP will result in damage to growing plants. Do not apply this product through the irrigation system.

Avoid contact with skin, eyes or clothing. In case of contact, immediately flush eyes or skin with plenty of water. Get medical attention if irritation persists.

STATEMENT OF PRACTICAL TREATMENT		
IF SWALLOWED	-Call a Physician or Poison Control CenterDrink one or two glasses of waterDo not induce vomitingIf person is unconscious, do not give anything by mouth or induce vomiting.	
IF IN EYES	 Hold eyelids open and flush with a steady, gentle stream of water for 15 minutes. Get medical attention if irritation persists. 	
IF ON SKIN	-Wash with plenty of soap and water. -Get medical attention if initiation persists.	

LIMITED WARRANT

Manufacturer or seller makes no warranty, whether expressed or implied, concerning the use of this product other than for the purposes indicated on the label. Neither manufacturer nor seller shall be liable for any injury or damage caused by this product due to misuse, mishandling or any application not specifically described on the label.

Manufactured By: JH Biotech, Inc. P.O. Box 3538. Ventua, CA 93006.

NET CONTENTS:

1 Pint (0.47 lit	er)
2.5 Gallons (9	9.45 liters)
2 x 2.5 Gallon	s (18.9 liters)
5 Gallons (18	.9 liters)
55 Gallons (2	07.9 liters)
Other:	Gallons

Weight per Gallon: 8.4 lbs.

JHBiotech Inc.

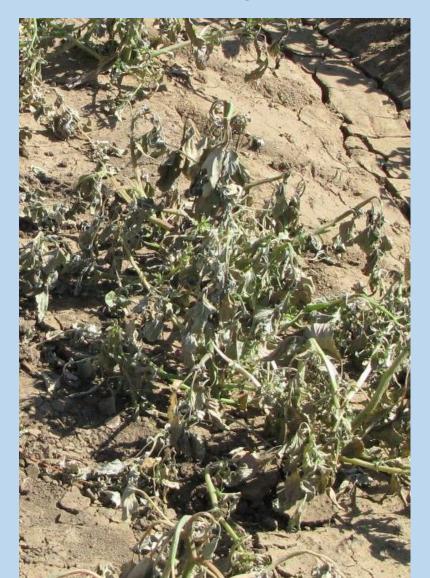
0239-D-A-1 Copyright © JH Biotech, Inc. All rights reserved.

Matratec 10%- 2DAT

Without Adjuvant



With 1%Adjuvant



Herbicidal soaps



SPECIMEN LABEL

For contact spray control or burndown of weeds and grasses for food crops, field crops, pastures, ornamentals, turf, landscapes, interiorscapes, greenhouses, non-crop areas on farmsteads and around buildings and industrial sites.

ACTIVE INGREDIENT:

Ammonium Nonanoate:	40.009	
OTHER INGREDIENTS:	60.009	
TOTAL:	100.00	

KEEP OUT OF REACH OF CHILDREN WARNING "AVISO"

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle (If you do not understand this label, find someone to explain it to you in detail.)

FIRST AID:

If in eyes

- Hold eye open and rinse slowly and gently with water for 15-20 minutes.
- Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
- Call a poison control center or doctor for treatment advice.

If inhaled

- · Move person to fresh air.
- If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.
- Call poison control center or doctor for treatment advice.

If on skin or clothing

- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20 minutes.
- Call a poison control center or doctor for treatment advice.

HOTLINE NUMBER:

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-4249300 for emergency medical achice.

Produced for: BioSafe Systems LLC 22 Meadow Street East Hortford, CT 06108 EPA Registration No. 70299-23 EPA Establishment No. 064784-OK-001

PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS AND DOMESTIC ANIMALS

Warning: Causes substantial, but temporary eye irritation. Do not get in eyes or on clothing. Wear goggles. Harmful if inhaled. Avoid breathing spray mist. Causes moderate skin irritation.

Avoid contact with skin or on clothing. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum or using tobacco. Remove and wash contaminated clothing before reuse.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Applicators and other handlers must wear: Coveralls worn over short-sleeve shirt and

- short pants • Socks and chemical resistant footwear
- Socks and chemical resistant tootwe
 Chemical resistant aloves
- Protective eyewear
- When mixing and loading wear a chemical resistant apron

Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow the manufacturer's instructions for deaning/maintaining PPE. If no such instructions for washables, use detergents and hot water. Keep and wash PPE separately from other laundry.

USER SAFETY RECOMMENDATIONS

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
 Remove PPE immediately after handling this
- Remove PPE immediately after handling this product. Wash outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS

For terrestrial uses: This pesticide is toxic to fish and aquatic invertebrates. Use care when applying in areas adjacent to any body of water. Do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwater or rinsate. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas.

This product is toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product if bees are visiting the treatment area.

DIRECTIONS FOR USE:

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area

during application. For any requirements specific to your State or Tribe, consult the State/Tribal agency responsible for pesticide regulation.

AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR Part 170. This standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, natification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE), and restrictedentry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted-entry interval (REI) of 24 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated such as plants, soil, or water is:

- Coveralls worn over short-sleeve shirt and short pants
- Socks and chemical resistant footwear
- Chemical resistant gloves
- Protective eyewear

NON-AGRICULTURAL USE REQUIREMENTS

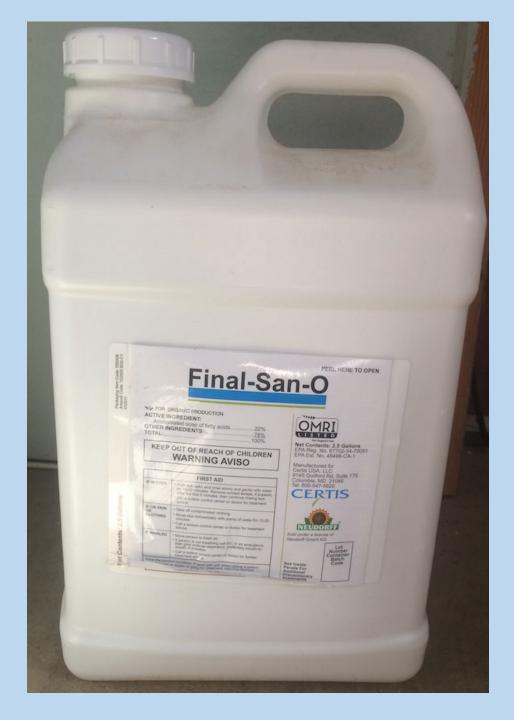
The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard for agricultural pesticides (40 CFR Part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nusseries, or creenhouses.

Keep unprotected persons out of treated areas until sprays have dried.

METHODS OF USE AND GENERAL APPLICATION INSTRUCTIONS

General Instructions:

AXXE Broad Spectrum Herbicide is a contact non-selective herbicide for spray application only to undesirable plant growth. Do not allow spray to contact any green plant parts of desirable plants. AXXE Broad Spectrum Herbicide provides control and burndown suppression of annual and perennial broadleaf and grass



Modified Natural Acids

SUPPRESS®

HERBICIDE EC

A Contact, Post-Emergent Non-Selective Herbicide for Use in Agricultural Food and Non-Food Crops

Active Ingredients:

Caprylic Acid	47%
Capric Acid	32%
Other Ingredients:	
Total1	

WARNING/AVISO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

See inside booklet for First Aid and Precautionary Statements

SHAKE WELL BEFORE USING • APPLY WITH CONTINUOUS AGITATION

Manufactured by:



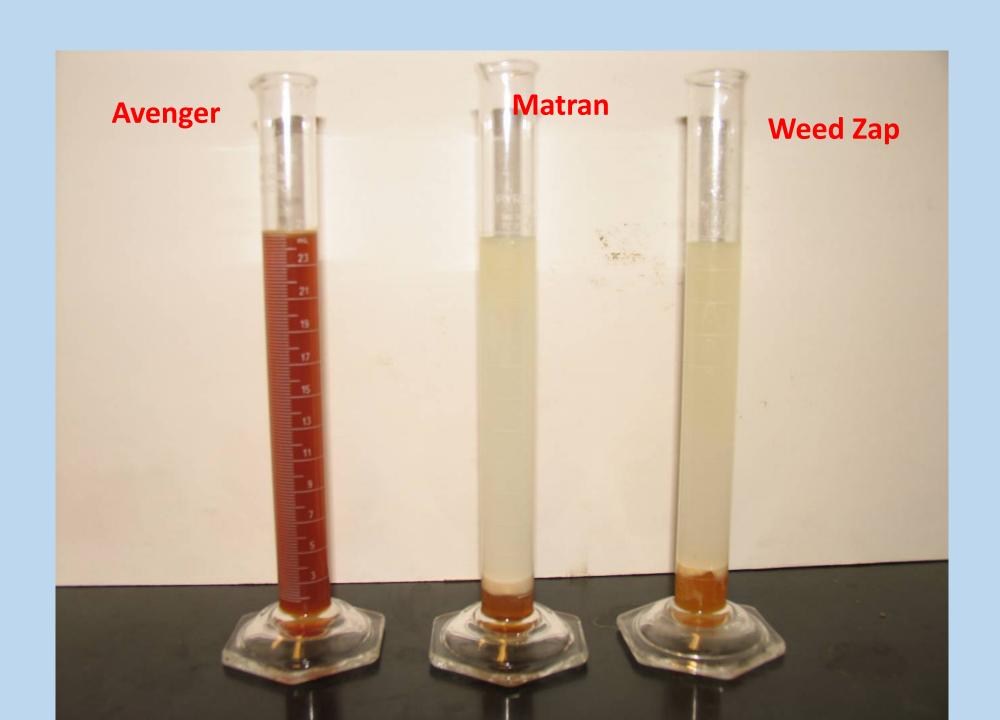
Agricultural Products 1260 Avenida Chelsea Vista, CA 92081 USA (800) 876-2767



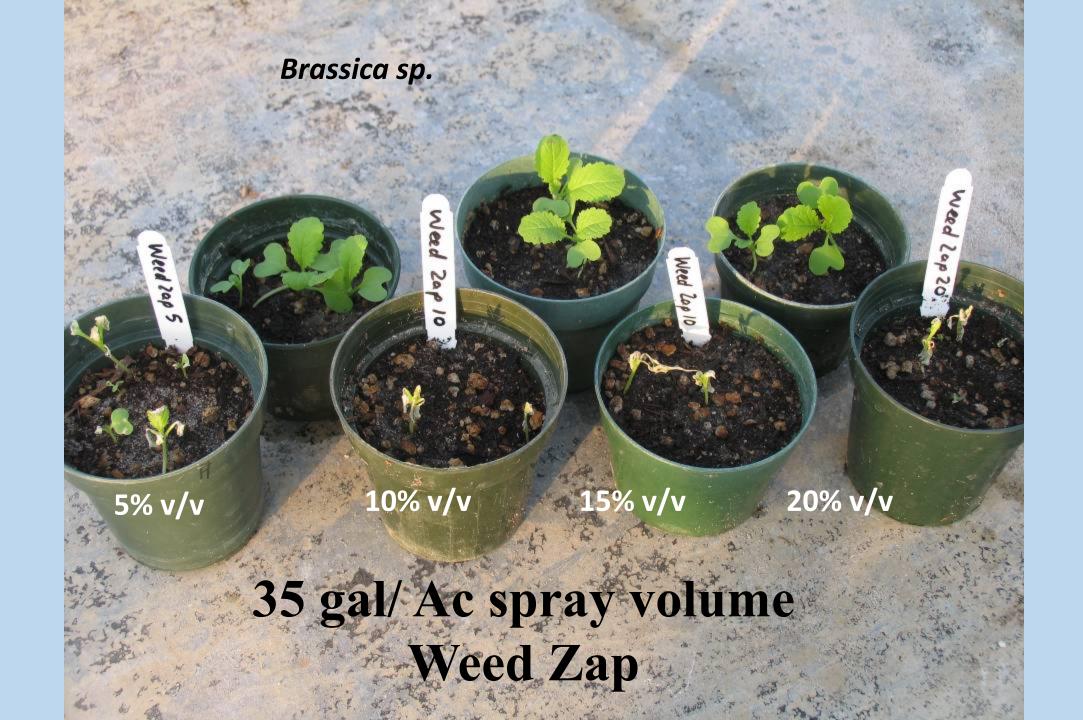
EPA Reg. No. 51517-9 EPA Est. No. 51517-CA-1

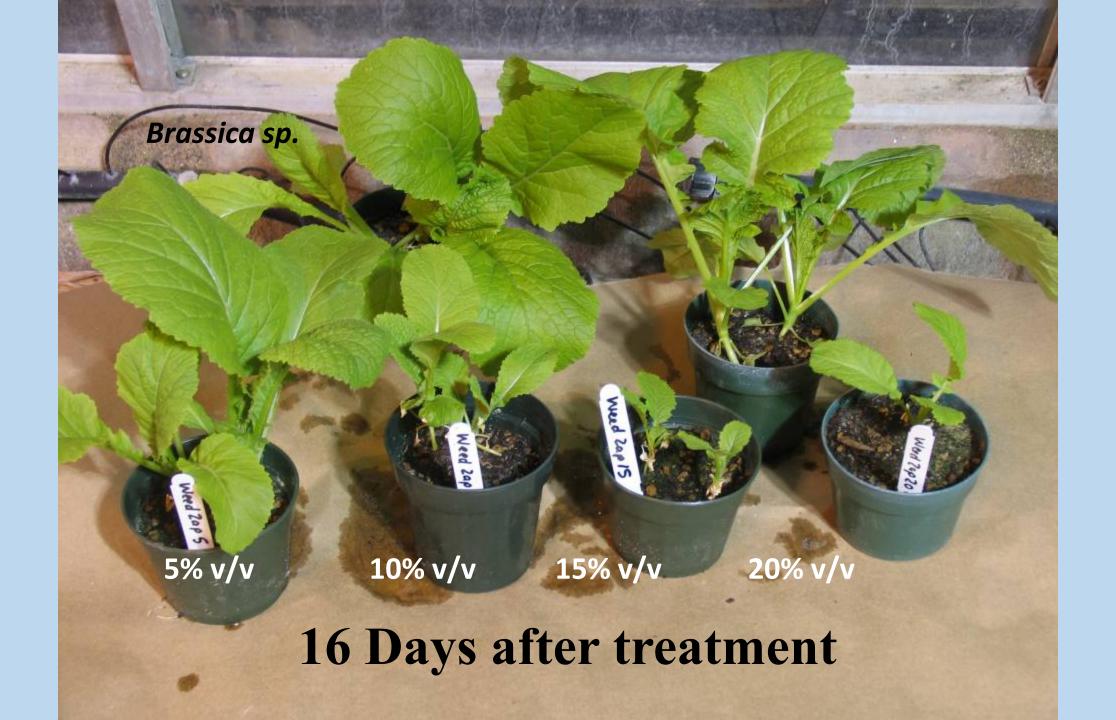
















35 Gal/Ac spray volume



70 Gal/ Ac spray volume

Greenhouse Conclusions

- Higher concentrations and spray volumes increased weed control across all products
- Spray volume had a greater impact on weed control than concentration
- Grasses are much harder to control than broadleaf weeds

Organic Adjuvants















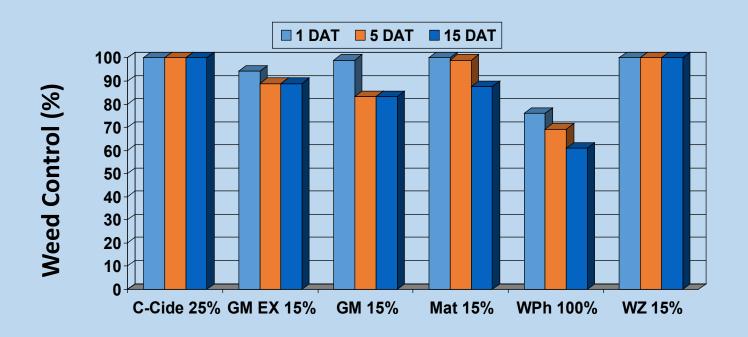
Methods for Weed Size study

- Entire trial area cultivated to remove existing weeds
- Study site irrigated to germinate weed seeds
- Study site divided into three segments, with each section treated at a different time
- Treatments applied at 14, 21 or 28 days after the initial irrigation
- All treatments applied at 650 l/ha and 1% v/v 'Natural Wet' adjuvant added to each treatment

Concentrations used in 'Weed Age' field study

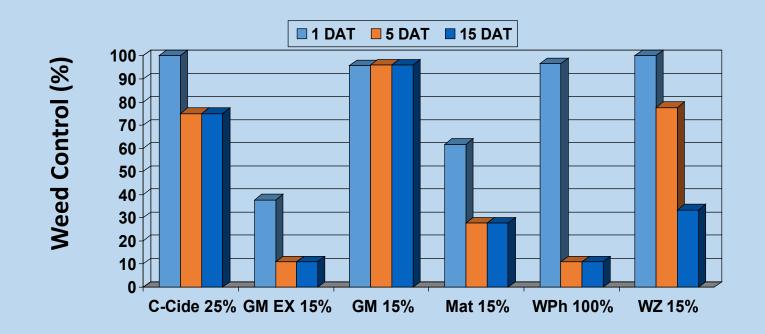
- C-Cide 25%v/v (1.25% citric acid)
- GreenMatch –15% v/v (8.25% d-limonene)
- GreenMatch EX 15% v/v (7.5% lemongrass oil)
- Matratec 15% v/v (7.5% clove oil)
- Weed Pharm 100% v/v (20% acetic acid)
- Weed Zap 15% v/v (13.5% clove + cinnamon oil)

Broadleaf Weed Control (%) at 1, 5 and 15 days after application 14 days Al



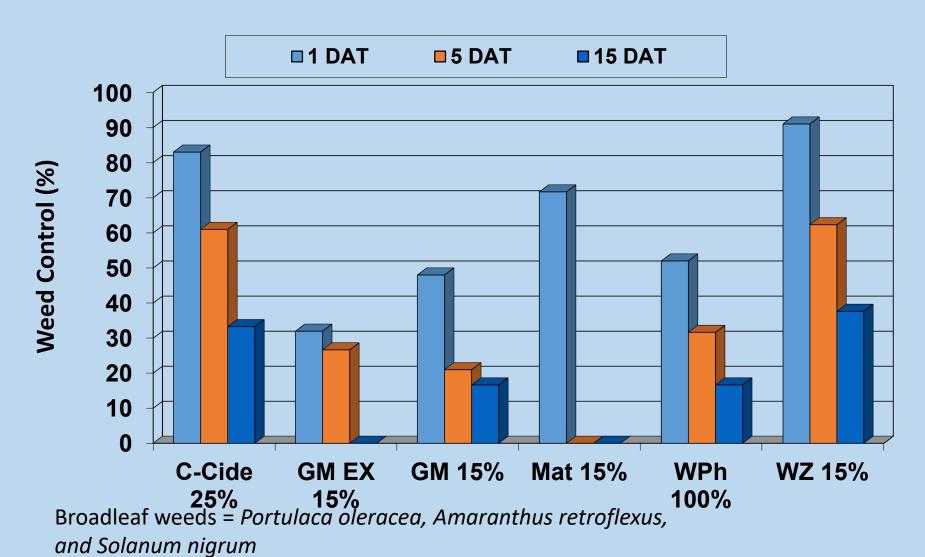
Broadleaf weeds = Portulaca oleracea, Amaranthus retroflexus, and Solanum nigrum

Broadleaf Weed Control (%) at 1, 5 and 15 days after application 21 days Al



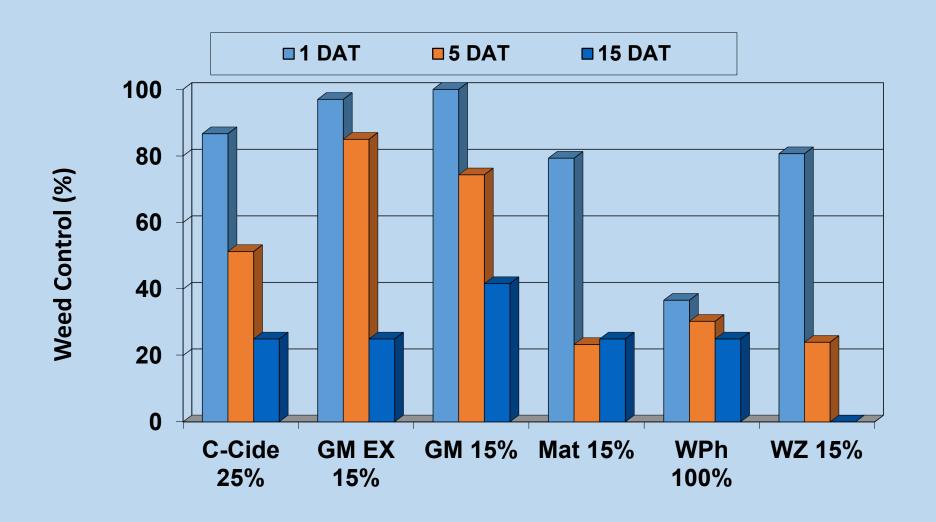
Broadleaf weeds = Portulaca oleracea, Amaranthus retroflexus, and Solanum nigrum

Broadleaf Weed Control (%) at 1, 5 and 15 days after application 28 days Al

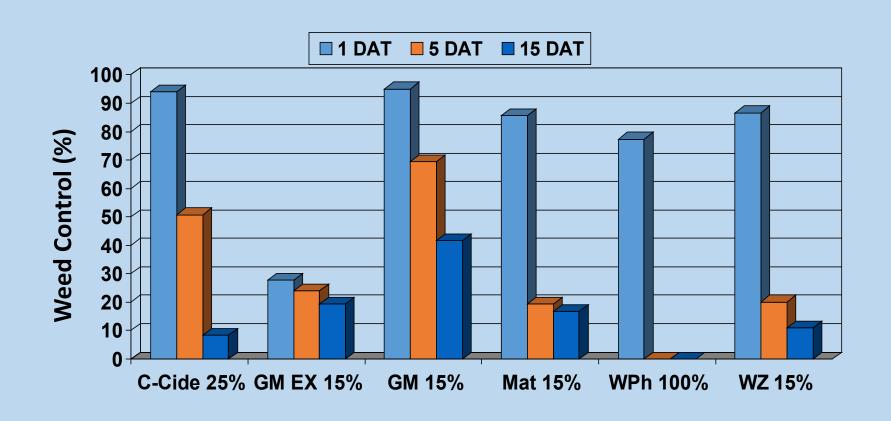


Applic. – June 29, 2009

Grass Weed Control (%) at 1, 5 and 15 days after application 14 days Al



Grass Weed Control (%) at 1, 5 and 15 days after application 21 days Al



Influence of Seasonal Timing/ Temperature on weed control

- Two trials established in the same area
 First trial started on Jan 6, 2011
 average high/low temp. = 55 F / 41F
 Second trial started on May 23, 2011
 average high/low temp. = 75 F / 50 F
- All treatments applied at 70 gal/A and 1% v/v 'Natural Wet' adjuvant added to each treatment



















Final-San-O 10% - 3 DAT - May



Final-San-O 20% v/v – 3 DAT - May

'Organic' Weed Control Options

- Sanitation
- Cover cropping
- Animals
- Tillage
- Mowing
- Mulching
- Flaming or steaming
- Solarization
- Organic Herbicides