

**NOSB NATIONAL LIST
FILE CHECKLIST**

CROPS

MATERIAL NAME: #12 Soap-based herbicides



NOSB Database Form



References



MSDS (or equivalent)



**TAP Reviews from: David Pimentel, James A.
Johnson, John Clark,
Chris Milne, Diana Tracy**

**NOSB/NATIONAL LIST
COMMENT FORM
CROPS**

Material Name: #12 Soap-based herbicides

Please use this page to write down comments, questions, and your anticipated vote(s).

COMMENTS/QUESTIONS:

Codex - Not clear

EU - Not clear - emergency only?

IFoAM - Prohibited

DE,
FK, MS, BL, JK -
~~I was~~

Non food use only

KC/DE/RC/BP/

JG/FK/BL/MS/BA/JKM

Yes

No

Roadways, ditches, rights of way, buildings, field edges
ornamental crops fails 7-4

1. In my opinion, this material is:

Synthetic Non-synthetic.

H-O

2. This material should be placed on the proposed National List as:

Prohibited Natural Allowed Synthetic.

CV/Anderton

TAP REVIEWER COMMENT FORM for USDA/NOSB

Use this page or an equivalent to write down comments and summarize your evaluation regarding the data presented in the file of this potential National List material. Complete both sides of page. Attach additional sheets if you wish.

This file is due back to us by: Aug. 5, 1996

Name of Material: Soap-based Herbicides

Reviewer Name: David Pimentel

RECEIVED JUL 25 1996

Is this substance Synthetic or non-synthetic? Explain (if appropriate)

If synthetic, how is the material made? (please answer here if our database form is blank)

This material should be added to the National List as:

Synthetic Allowed Prohibited Natural

or, Non-synthetic (This material does not belong on National List)

Are there any use restrictions or limitations that should be placed on this material on the National List?

Please comment on the accuracy of the information in the file:

Any additional comments? (attachments welcomed)

Do you have a commercial interest in this material? Yes; No

Signature David Pimentel

Date 7/11/96

Please address the 7 criteria in the Organic Foods Production Act:
(comment in those areas you feel are applicable)

- (1) the potential of such substances for detrimental chemical interactions with other materials used in organic farming systems;

Minimal

- (2) the toxicity and mode of action of the substance and of its breakdown products or any contaminants, and their persistence and areas of concentration in the environment;

Toxic to other plants.

- (3) the probability of environmental contamination during manufacture, use, misuse or disposal of such substance;

*With care there should be a minimal
Problem.*

- (4) the effect of the substance on human health;

Careful use is required

- (5) the effects of the substance on biological and chemical interactions in the agroecosystem, including the physiological effects of the substance on soil organisms (including the salt index and solubility of the soil), crops and livestock;

Toxic to crops

- (6) the alternatives to using the substance in terms of practices or other available materials; and

*Plain hot water is equally effective and
does not have any side-effects.*

- (7) its compatibility with a system of sustainable agriculture.

For total weed kill only.

TAP REVIEWER COMMENT FORM for USDA/NOSB

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This file is due back to us by: Aug. 5, 1996

Name of Material: Soap-based Herbicides

Reviewer Name: JAMES A. JOHNSON RECEIVED JUL 30 1996

Is this substance Synthetic or non-synthetic? Explain (if appropriate)

Synthetic - naturally occurring plant and animal substances
If synthetic, how is the material made? (please answer here if our database form is blank) With the presence of the proprietary active ingredient

This material should be added to the National List as:

Synthetic Allowed Prohibited Natural

or, Non-synthetic (This material does not belong on National List)

Are there any use restrictions or limitations that should be placed on this material on the National List?

None

Please comment on the accuracy of the information in the file:

very precise

Any additional comments? (attachments welcomed)

Do you have a commercial interest in this material? Yes; No

Signature James A. Johnson Date 7/29/96

Please address the 7 criteria in the Organic Foods Production Act:
(comment in those areas you feel are applicable)

- (1) the potential of such substances for detrimental chemical interactions with other materials used in organic farming systems; stable material, Flash point $>200^{\circ}\text{F}$
No known materials that are incompatible.
- (2) the toxicity and mode of action of the substance and of its breakdown products or any contaminants, and their persistence and areas of concentration in the environment; $\text{LD}_{50} > 5000$, CAUTION, unknown mode of action. It does not translocate in plant, will not move through soil to injure nearby plants. No hazardous decomposition products or polymerization.
- (3) the probability of environmental contamination during manufacture, use, misuse or disposal of such substance; low
- (4) the effect of the substance on human health;
Harmful if swallowed. May cause eye irritation. Chronic oral consumption of ethyl alcohol linked to birth defects and cancer in humans. Avoid contamination of feed and foodstuffs.
- (5) the effects of the substance on biological and chemical interactions in the agroecosystem, including the physiological effects of the substance on soil organisms (including the salt index and solubility of the soil), crops and livestock;
Avoid contamination of livestock feed and foodstuffs. Will surely knock out vegetables as quickly as weeds!
- (6) the alternatives to using the substance in terms of practices or other available materials; and flame, weeds, cultivation, mulch-plant (living & dead) and plastics
Crop rotation - hemp known to kill 95% of competitive weed, buried drip irrigation, citrus oil, other botanicals, geese
- (7) its compatibility with a system of sustainable agriculture. My bias is to not use this material in everyday organic farming. It doesn't fit the philosophy. Perhaps in an economic emergency or transitional farmers just beginning the sustainable move.

TAP REVIEWER COMMENT FORM for USDA/NOSB

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This file is due back to us by: Aug. 5, 1996

Name of Material: Soap-based Herbicides

Reviewer Name: Christopher - Paul Milne RECEIVED AUG 07 1996

Is this substance Synthetic or non-synthetic? Explain (if appropriate)

Synthetic

If synthetic, how is the material made? (please answer here if our database form is blank)

This material should be added to the National List as:

Synthetic Allowed Prohibited Natural

or, Non-synthetic (This material does not belong on National List)

Are there any use restrictions or limitations that should be placed on this material on the National List?

Yes! See attached comments

Please comment on the accuracy of the information in the file:

Any additional comments? (attachments welcomed)

Do you have a commercial interest in this material? Yes; No

Signature Christopher Paul Milne Date 8/5/96

NOSB Materials Database

1

Identification

Common Name	Soap-based Herbicides	Chemical Name	
Other Names	Superfast, Safer Home, Deck & Patio Moss Algae Killer		
Code #: CAS		Code #: Other	
N. L. Category	Synthetic Allowed	MSDS	<input checked="" type="radio"/> yes <input type="radio"/> no

Chemistry

Family	
Composition	50% Potassium Salts, 30% Alcohols
Properties	-Potassium salts of fatty acids -Clear, Colorless liquid, alcoholic odor
How Made	Made from naturally occurring plant oils and animal fats

Soluble
Vapor pressure of 100 Torr at 35°C

Use/Action

Type of Use	Crops
Specific Use(s)	Herbicide for non-food crops only. Controls: moss, algae, lichens, liverworts, chickweed, pigweed, lambsquarters, shepards purse
Action	Disrupts natural waxy protective surface of weeds, damaging cell walls, causes plant to dehydrate.
Combinations	

Status

OFPA	
N. L. Restriction	May not be used for food crops.
EPA, FDA, etc	42697-10; Superfast(42697-22); <i>EPA RED (Re-registration Eligibility Document) completed</i>
Directions	See label
Safety Guidelines	Use good ventilation, latex rubber & splash goggles. Protect from freezing
Historical status	
International status	<i>ETHANOL NOT AN ISENT OF TOXICOLOGICAL CONCERN</i> <i>AS OF NOV/1984 (54 FR 48315)</i>

NOSB Materials Database

2

OFPA Criteria

2119(m)1: chemical interactions

No reactive incompatibilities but environmental conditions, micronutrients, fertilizers and other additives may affect tendency of plants to being burned.

2119(m)2: toxicity & persistence

Active ingred. Breaks down rapidly in soil (i.e. 48 hrs.). Does not translocate in the plant. Will not move through soil to nearby plants. However, plants with hairy leaves (e.g. African Violets) can hold solution & get burned

2119(m)3: manufacture & disposal consequences

Users should not contaminate water, food or feed. Do not freeze or store in excessive heat.

2119(m)4: effect on human health

- Temporary skin irritation
- Consumption can cause birth defects and cancer
- Harmful if swallowed
- Avoid contamination of feed and foodstuff

(HERP % Human Equivalent Rodent Potency, of ethyl alcohol in wine, beer and hard liquor ranges from 0.4 to 1.6 to 1.3 respectively. For comparison, HERP % of PCBs in food was .01)

2119(m)5: agroecosystem biology Plant varieties differ in their susceptibility to burning. At higher rates of application (2%) burning and stunting are more likely.

2119(m)6: alternatives to substance

Any of a variety of NON-chemical weed control management practices.

2119(m)7: Is it compatible? It's compatibility with sustainable agriculture and organic production principle appear to stem from the fact that it may be very nearly the only chemical weed control agent available for our purposes. Its harmful effects are known and are manageable and it seems to belong to a class of substances specifically mentioned in section 2118(c)(1)(B)(i) as eligible for an exemption.

References

Ringer Corporation: 612-941-4180

Common-Sense Pest Control, Oikowski et al, 1991, Taunton Press, Newtown, CT.

Clinical Toxicology of Commercial Products, Gosselin et al, 5th ed., 1984, Williams & Wilkins.

Nutrient and Pesticide: Best Management Practices for Wisconsin Farms, WDAT-CF Tech. Bull.

STATUS OF PESTICIDES IN REREGISTRATION AND SPECIAL REVIEW, USEPA, JUNE 1994

Doc. # EPA 738-R-94-008

Soap-based Herbicides

Synthetic or Non-synthetic

I don't think there is much doubt that this product is derived by chemically changing a substance extracted from naturally occurring plant or animal sources and is therefore synthetic.

National List Considerations

It should be granted an exemption as a synthetic allowed. It appears from the literature to be one of a very few non-physical weed control agents which could plausibly be compatible with sustainable agriculture since it seems to belong to a category (i.e. "soaps") specifically mentioned in the Act under section 2118 (c) (1) (B) (i) as a category for exemption consideration.

Its health impacts are at least well demarcated and could be mitigated. The major risks are probably not to consumers but to the users of the pesticide from the inert ingredient in one of the formulations which is 30% ethyl alcohol and 3% methanol according to Gosselin's formulary for an earlier version of this Safer product. The ethyl alcohol is a serious carcinogen by the oral route, a poisoning hazard, and an irritant. The health risks are more significant for the users than for food crop consumers since it is not likely to be a persistent chemical, should volatilize readily, and will not be applied directly to food crops.

Restrictions

The purpose of maintaining this chemical on the National List is to preserve it for "emergency" not routine use. It is hazardous for the user and is only compatible with sustainable agriculture when its use "is necessary...because of unavailability of wholly natural substitute products". I recommend that its use should be conditioned with the requirement that the would-be user petition the local certification board or agency in writing and keep a record of the use, a copy of which is sent to the certification board. Since the risk for plant uptake would be related to its solubility in water, it should not be used near food crops requiring heavy irrigation, a moist environment, or within 48 hours of any appreciable rainfall, or within a week of harvesting.

Also, I would recommend that its status be reviewed in five years in order to ensure that EPA has not reclassified ethyl alcohol as a Inert of Toxicological Concern thereby rendering its exemption in conflict with 2118 (c) (1) (B) (ii). Alternatively, there could be a five-year phase-out period in order to encourage development of alternative products or formulations.

Herbicidal Soaps

03/16/92 - Soaps and Detergents for Insect Control

J. L. Capinera and O. N. Nesheim

Capinera (904/392-1901), Nesheim (904/392-4721)

VAX accounts - ENTNEM (Capinera) and ONN (Nesheim)

Dept. of Entomology/Nematology and Pesticide Coordinator's Office

There have been several questions concerning the recommendation of soaps, detergents, and vegetable oils for pest control. Some persons are concerned about their liability in making such recommendations. Federal and state pesticide laws do not permit persons who have a financial interest in such materials to make pesticidal claims in connection with their sale or distribution unless the material is registered as a pesticide. Examples of persons having a financial interest are employees of the manufacturer of such products, employees of wholesale or retail establishments where such materials are sold, and pesticide applicators who make pest control claims for trade name materials in connection with pest control services they are selling to a customer. Persons making pest control claims for a material in connection with its sale can be charged with the sale and distribution of an unregistered pesticide.

Persons who use products not registered with EPA for any use not specifically recommended on the product label would be responsible for any phytotoxicity or chemical residues that may result.

A person at his/her own discretion can use soaps, detergents, and vegetable oils for pest control purposes. It is not illegal to recommend (or suggest) the use of these materials. These materials have been used for many years by gardeners and others for pest control. Popular literature contains many references to their use and effectiveness. Evaluations of these materials for pest control has been published, also.

The effectiveness of soaps, detergents, and oils is less consistent than with chemical pesticides. Our research base also is considerably weaker than with many chemicals. Therefore, we are more comfortable with "discussing" soaps, etc. as options, than with actually "recommending" these materials. Although some growers have been quite pleased with the results of soap and oil use, some have been disappointed. Also, plant varieties differ in their susceptibility to burning induced by soaps and oils, and environmental conditions, as well as micronutrients, fertilizers, and other additives may affect tendency to burn. At higher rates of application, (2%) burning and stunting are more likely.

When discussing soaps, detergents, and vegetable oils for pest control

purposes, avoid recommending by brand name. Point out that there are registered products available that contain these materials, such as the Safer and Mycogen Soap products.

Sample footer

TAP REVIEWER COMMENT FORM for USDA/NOSB

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This file is due back to us by: Aug. 5, 1996

Name of Material: Soap-based Herbicides

Reviewer Name: John Clark RECEIVED JUL 25 1996

Is this substance Synthetic or non-synthetic? Explain (if appropriate)

If synthetic, how is the material made? (please answer here if our database form is blank)

This material should be added to the National List as:

Synthetic Allowed Prohibited Natural

or, Non-synthetic (This material does not belong on National List)

Are there any use restrictions or limitations that should be placed on this material on the National List?

Please comment on the accuracy of the information in the file:

Any additional comments? (attachments welcomed)

No review possible - too general a class. The best-known products shown clearly violate the ^{human} health effects criterion. The use of this products is wholly incompatible with an organic paradigm & inappropriate in an organic site or environment. Why would anyone petition for approval of this product under OFPA

Do you have a commercial interest in this material? Yes; No

Signature John Clark Date 7-17-96

TAP REVIEWER COMMENT FORM for USDA/NOSB

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This file is due back to us by: Aug. 5, 1996

Name of Material: Soap-based Herbicides

Reviewer Name: DIANA TRACY RECEIVED AUG 05 1996

Is this substance Synthetic or non-synthetic? Explain (if appropriate)

SYNTHETIC

If synthetic, how is the material made? (please answer here if our database form is blank)

This material should be added to the National List as:

Synthetic Allowed Prohibited Natural

or, Non-synthetic (This material does not belong on National List)

Are there any use restrictions or limitations that should be placed on this material on the National List?

NON-CROP USE ONLY

Please comment on the accuracy of the information in the file:

ACCURATE

Any additional comments? (attachments welcomed)

Do you have a commercial interest in this material? Yes; No

Signature Diana Tracy Date 7/31/96

NOSB Materials Database

1

Identification

Common Name	Soap-based Herbicides	Chemical Name	
Other Names	Superfast, Safer Home, Deck & Patio Moss Algae Killer	Code #: Other	
Code #: CAS		MSDS	<input checked="" type="radio"/> yes <input type="radio"/> no
N. L. Category	Synthetic Allowed		

Chemistry

Family	
Composition	50% Potassium Salts, 30% Alcohols
Properties	-Potassium salts of fatty acids -Clear, Colorless liquid, alcoholic odor
How Made	Made from naturally occurring plant oils and animal fats

Use/Action

Type of Use	Crops
Specific Use(s)	Herbicide for non-food crops only. Controls:moss, algae, lichens, liverworts, chickweed, pigweed, lambsquarters, shepards purse
Action	Disrupts natural waxy protective surface of weeds, damaging cell walls, causes plant to dehydrate.
Combinations	

Status

OFPA	
N. L. Restriction	May not be used for food crops.
EPA, FDA, etc	42697-10; Superfast(42697-22)
Directions	See label
Safety Guidelines	Use good ventilation, latex rubber & splash goggles. Protect from freezing
Historical status	
International status	

NOSB Materials Database

OFPA Criteria

2

2119(m)1: chemical interactions

2119(m)2: toxicity & persistence

2119(m)3: manufacture & disposal consequences

2119(m)4: effect on human health

- Temporary skin irritation
- Consumption can cause birth defects and cancer
- Harmful if swallowed
- Avoid contamination of feed and foodstuff

2119(m)5: agroecosystem biology

2119(m)6: alternatives to substance

2119(m)7: Is it compatible?

References

Ringer Corporation: 612-941-4180

RINGER CORPORATION

9959 Valley View Road, Minneapolis, MN 55344
(612) 941-4180

MATERIAL SAFETY DATA SHEET

Product Name: Safer® Superfast™ Weed & Grass Killer RTU

EPA Registration Number: 42697-22

MSDS Number: 5350, 5352, 5353, 5355

►SECTION I: IDENTIFICATION**Product Description (Ingredients):**

Potassium salts of fatty acids in a water/alcohol base. The exact composition of this material is proprietary.

►SECTION II: PHYSICAL & CHEMICAL CHARACTERISTICS

Bulk Density (H₂O=1): 1.0

Solubility in Water: Soluble.

Appearance and Odor: Clear, colorless liquid, alcoholic odor.

►SECTION III: FIRE & EXPLOSION HAZARD DATA

Flash Point (method used): > 200°F.

Extinguishing media: Use carbon dioxide or dry powder extinguisher.

Special Fire Fighting Procedures: None.

►SECTION IV: REACTIVITY DATA

Stability: Stable.

Incompatibility (materials to avoid): None known.

Hazardous Decomposition Products: None.

Hazardous Polymerization: Will not occur.

►DOT INFORMATION: Not regulated.

►SECTION V: HEALTH HAZARD DATA

OSHA PEL: 1000 ppm or 1900 mg/m³ (ethanol).

Effects of Overexposure: Product may cause irritation to eyes or skin.

Routes of Entry: Inhalation, eyes, skin.

Carcinogens: Chronic oral consumption of ethyl alcohol has been linked to birth defects and cancer in humans.

Emergency First Aid Procedures:

Eye Contact: Flush with water.

Skin Contact: Flush with water.

Inhalation: Remove from area.

Ingestion: Give demulcent (milk).

►SECTION VI: PROTECTIVE MEASURES

Ventilation: Good general ventilation is normally adequate.

Respiratory Protection: Use NIOSH-approved respiratory protection if conditions warrant.

Protective Gloves: Recommended.

Eye Protection: Recommended.

►SECTION VII: STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal. Do not reuse container.

Storage: Do not freeze or store in excessive heat.

Spills: Rinse with water and mop up.

Disposal: Dispose in accordance with all applicable federal, state and local regulations.

This information is provided in good faith, but without express or implied warranty.

Revision date: January 12, 1995
170

Emergency Phone: 1-800-228-5635, ext.

RINGER

PATENTED

HERBICIDAL SOAP

Technical Bulletin

Safe

• Superfast™ Brand Weed & Grass Killer

DESCRIPTION OF SUPERFAST™

- Superfast™ is a non-selective herbicide and will kill all plant tissue it contacts.
- Active ingredient is potassium salts of fatty acids.
- Herbicidal soap is made from naturally occurring plant oils and animal fats.

HOW IT WORKS

- Herbicidal Soap disrupts the natural waxy protective surface of the weed, damaging cell walls and causing the plant to dehydrate.
- It does not translocate in the plant.

BENEFITS OF SUPERFAST™

- Kills weeds and grasses on contact.
- Herbicidal action is rapid with results visible within hours.
- Treated areas may be replanted two days after application.
- Only those plants or plant parts directly contacted by spray will be affected.
- Will not move through soil to injure nearby plants.

PLANTS CONTROLLED

- Will damage or destroy any vegetation which it contacts.
- Kills unwanted grasses and vegetation in and around flower beds.
- Controls annual weeds such as chickweed, pigweed, lambsquarter and shepherd's-purse.

APPLICATION RECOMMENDATIONS

- Shake well before use.
- Spray weeds or grass thoroughly to ensure good control of all types of unwanted vegetation.
- Apply to weeds during early period of growth when weeds are young and succulent.
- Several treatments may be necessary to kill actively growing weeds.
- For most rapid kill, apply in warm, dry weather.

USES

- Use to kill weeds and grass growing in flower and vegetable gardens, near trees and shrubs, on side-walks and driveways.
- Use for spot treatment of weeds in lawns.
- General contact herbicide which will kill or damage all vegetation that it contacts.

STORAGE AND DISPOSAL

- Store at room temperature or cooler.
- Protect from freezing.
- Store only in original container.
- Thoroughly rinse empty container and discard in trash.

PRECAUTIONARY STATEMENTS

Superfast™ Brand ready-to-use

CAUTION: Harmful if swallowed. Avoid contamination of feed and foodstuffs. May cause eye irritation; avoid eye contact. In case of eye contact, flush eyes with plenty of water.

RELATIVE TOXICITY RATINGS

- LD₅₀ is the industry standard for measuring acute toxicity of pesticide compounds. Higher LD₅₀'s are less acutely toxic.

Terminology

LD = Lethal Dose

50 = to kill 50% of population

mg = milligrams of pesticide

kg = kilograms body weight

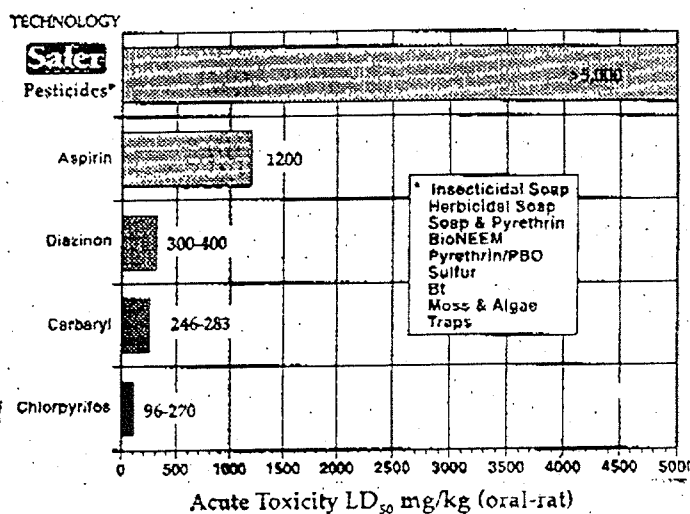
Example:

An LD₅₀ of 300 means that 300 milligrams of pesticide per kilogram of subject body weight will kill 50% of the exposed population (lab rats fed orally) immediately upon exposure.

Chart

In the chart you can see the listed Safer® products have LD₅₀'s greater than 5000 compared to other compounds at less than 1200.

Note: LD₅₀ is the most common measure of toxicity but only one of several criteria measuring toxicity of compounds.



SIGNAL WORD

- By law, one of four signal words must appear on every pesticide label to give the user some indication of the toxicity of the material.
- All pesticides are designed to kill/control pests and therefore must be used carefully according to individual product label directions.
- The four different rating levels are:
 - I. DANGER (LD₅₀ 0-50 mg/kg)
 - II. WARNING (LD₅₀ 50-500 mg/kg)
 - III. CAUTION (LD₅₀ 500-1000 mg/kg)
 - IV. CAUTION (LD₅₀ >5000 mg/kg)
- I. DANGER indicates the most toxic level and IV. CAUTION designates the lowest toxicity rating. The precautionary statements made at each level are mandatory and standard in their wording. Superfast™ Brand Weed & Grass Killer ready-to-use falls into the IV. CAUTION category.

FIELD TESTING

- Over 100 field tests in U.S. and Canada for efficacy.
- Significant reduction of weed populations in treated plots in comparison with untreated plots of annual broadleaf weeds 21 days after application.

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Reviewer Name: JAMES A. JOHNSON RECEIVED JUL 30 1996

Is this substance Synthetic or non-synthetic? Explain (if appropriate)

Synthetic - naturally occurring plant and animal substances
If synthetic, how is the material made? (please answer here if our database form is blank) but the process of the proprietary materials aren't clear.

This material should be added to the National List as:

Synthetic Allowed Prohibited Natural
or, Non-synthetic (This material does not belong on National List)

Are there any use restrictions or limitations that should be placed on this material on the National List?

Non-food crops

Please comment on the accuracy of the information in the file:

Very accurate

Any additional comments? (attachments welcomed)

Do you have a commercial interest in this material? Yes; No

Signature James A. Johnson Date 7/29/96

Please address the 7 criteria in the Organic Foods Production Act:

(comment in those areas you feel are applicable)

- (1) the potential of such substances for detrimental chemical interactions with other materials used in organic farming systems; stable material, Flash point $> 200^{\circ}\text{F}$
No known materials that are incompatible.
- (2) the toxicity and mode of action of the substance and of its breakdown products or any contaminants, and their persistence and areas of concentration in the environment; $\text{LD}_{50} > 5000$, CAUTION, unknown mode of action. It does not translocate in plant, will not move through soil to injure nearby plants. No hazardous decomposition products or polymerization.
- (3) the probability of environmental contamination during manufacture, use, misuse or disposal of such substance; low
- (4) the effect of the substance on human health; Harmful if swallowed. May cause eye irritation. Chronic oral consumption of ethyl alcohol linked to birth defects and cancer in humans. Avoid contamination of feed and foodstuffs.
- (5) the effects of the substance on biological and chemical interactions in the agroecosystem, including the physiological effects of the substance on soil organisms (including the salt index and solubility of the soil), crops and livestock; Avoid contamination of livestock feed and foodstuffs. Will surely knock out vegetables as quickly as weeds!
- (6) the alternatives to using the substance in terms of practices or other available materials; and flaming weeds, cultivation, mulch-plant (living & dead) and plastic crop rotation - hemp known to kill 95% of competitive weeds, buried drip irrigation, citrus oil, other botanicals, geese
- (7) its compatibility with a system of sustainable agriculture. My bias is to not use this material in everyday organic farming. It doesn't fit the philosophy. Perhaps in an economic emergency or transitional farmers just beginning the sustainable move