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ESTHER

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OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

January 13, 1989

MEMORANDUM

SUBJECT: Transmittal of Qualitative Use Assessment for
Simazine (080807)

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TO: Addressees

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Attached is the Qualitative Use Assessment for Simazine.
The information in this report is current as of January 13,
1989. This report contains no Section 7 or company submitted
data classified as CBI.

If there are any questions, please contact me in Room
1024A on 557-1774.

Attachment

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QUALITATIVE USE ANALYSIS OF THE
HERBICIDAL USES OF
SIMAZINE
2-CHLORO-4,6-BIS(ETHYLAMINO)-S-TRIAZINE
(080807)

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I. INTRODUCTION

Simazine may be applied preemergence, preplant incorporated, at planting, or postemergence (EPA Compendium, 1988). Simazine is widely used as a selective herbicide to control broadleaf and grass weeds in corn, citrus, deciduous fruits and nuts, olives, and perennial grasses grown for seed, turf grasses grown for sod, ornamentals, nursery plantings, Christmas tree plantations, sugarcane, asparagus, and artichokes (Beste, 1983). It is used also as a nonselective herbicide for vegetation control in noncropland. Sugarbeets, tobacco, oats, and many vegetable crops are very sensitive to simazine. It is also used to selectively control algae and submerged weeds in ponds. Water is the usual carrier for the uniform ground application of simazine. Aerial application requires considerably less water. Granules are widely used on ornamentals (Beste, 1983).

A. Chemical characteristics

Simazine is classified as an S-triazine.

B. Herbicidal activity

Simazine is absorbed mostly through plant roots (Beste, 1983). Under dry conditions, a shallow incorporation may increase its degree of weed control (Beste, 1983). As it has low adhering ability and is readily washed from foliage by rain, simazine has little or no foliar penetration. Loss of simazine from soil by photodecomposition and/or volatilization under normal climatic conditions is considered insignificant. Probably significant amounts of simazine are broken down by the activity of soil microbes (Beste, 1983). Simazine is decomposed to a small extent by ultraviolet irradiation under normal field conditions (Beste, 1983).

1. Mode of Action

Simazine inhibits the Hill reaction of photosynthesis (Beste, 1983; EPA Compendium, 1988).

2. Behavior in Soil

A Canadian soil study, comparing simazine and terbacil, showed that one year after application of 2.68 lb/A simazine to yield plots, simazine residues were highest near the soil surface (Jensen and Kimball, 1982). Also, total residues recovered from the upper 25 cm of Canadian soils was 5% or less of the simazine originally applied (Jensen and Kimball, 1982). Simazine is more readily absorbed on muck or clay soils than in soils of low clay and organic matter (Beste, 1983). In soil, simazine has little if any lateral movement (Beste, 1983).

3. Weed-resistance to Simazine

The following 14 species of triazine-resistant weeds followed by the state (shown in parenthesis) where found were identified in a Ciba-Geigy report: Poa annua (CA); Amaranthus arenicola (CO); Kochia scoparia (ID); Abutilon theophrastis, Amaranthus hybridus, Echinochloa crus-galli, Setaria faberi (MD); Panicum capillare (MI); Bromus tectorum (NE); Sicyos angulatus (OH); Chenopodium missouriense, Physalis longifolia (PA); Amaranthus powellii, Senecio vulgaris (WA) (LeBaron, 1988). Another source identified simazine-resistant weeds which include common groundsel, Senecio vulgaris, and scentless mayweed, Tripleurosorum inodorum (Anderson, 1977).

II. REGISTRATION SUMMARY

Simazine, a restricted use pesticide, is registered for use on terrestrial food crops (for example, corn, fruit and nut orchards); terrestrial nonfood crops (for example, ornamental plants and turfgrass); noncrop sites (for example, rights-of-way); aquatic nonfood sites (for example, algae control in ponds); and forestry sites (for example, white pines grown for timber).

CANCELLED USES: Prior to 1/13/89, simazine uses on the following sites have been cancelled: all alfalfa uses, drainage ditch banks, forage Bermudagrass and hay, grass grown for seed in Pacific Northwest, tree plantations grown for timber and tree seedlings.

Ranges of application rates for the site groups are listed below:

- A. Terrestrial Food Crops - 0.8 to 10 lb ai/A.
- B. Terrestrial Nonfood Crops - 0.8 to 4.0 lb ai/A
- C. Noncrop sites - 4.0 to 40.0 lb ai/A.
- D. Aquatic (Water Treatment) Sites
 - 1. Drained ponds and fish hatcheries - 8.0 to 12.0 lb ai/A.
 - 2. Ponds (including drained ponds) - 1.35 to 6.75 lb ai/A ft.
 - 3. Swimming pools - 0.03 to 0.21 lb ai/10,000 gal water.
- E. Forestry Sites - 2 to 6 lb ai/A.

Based on the EPA Compendium, simazine may be applied by ground equipment via the types of application for site categories listed below:

- A. Preplant or preemergence soil application to corn;
- B. Postemergence or dormant, band or directed spray to almond, apple, and artichoke;
- C. Postemergence split application to orange and lemon (AZ);
- D. Preemergence, band, broadcast, or directed spray to avocado (CA, FL);
- E. Postemergence, band or broadcast to pear, pecan, strawberry, and walnut;

- F. Dormant, band, broadcast, or directed spray to walnut (CA);
- G. At-planting/postharvest application to ratoon (sugarcane) crop;
- H. Band, broadcast, or soil treatment to sugarcane;
- I. Broadcast or directed spray to nursery stock, ornamental plants, and forest trees;
- J. Band or broadcast to ornamentals established for 1 year in North Central States;
- K. Band or directed spray to liner-grown ornamentals;
- L. Spreader application, broadcast to Bermudagrass;
- M. Broadcast to Bermudagrass grown for sod;
- N. Spreader application, broadcast to agricultural noncrop areas;
- O. Water treatment (includes split application, initial, maintenance, and winterizing treatments) to control algae and submerged weeds;
- P. Band, broadcast, or directed spray to trees grown for timber.

Simazine may be applied by air to:

- A. Several agricultural food crops;
- B. Four nonfood crops [grasses grown for sod (Bermudagrass, Centipedegrass, St. Augustinegrass, and Zoysia grass)]; and
- C. Agricultural noncrop areas.

Simazine may be tank mixed with the following:

- A. Paraquat, glyphosate, or oryzalin for use on almond (CA); apple; avocado (CA, FL); cherry (sour and sweet); filbert; grapes; lemon (AZ, CA); pear; pecan; plum; and walnut;
- B. Oryzalin for use on caneberry, forestry (alpine fir forest), and ornamentals (nursery stock, alpine fir);

- C. Atrazine or paraquat for preemergence use on corn;
- D. Ametryn, glyphosate, or oryzalin for postemergence use on grapefruit, orange, and peach orchards;
- E. Paraquat and glyphosate for preharvest use on macadamia nuts;
- F. Paraquat for use on olives;
- G. Glyphosate for use on peach orchards; and
- H. Glyphosate or sulfometuron methyl for use on agricultural noncrop areas (e.g., around fences) or uncultivated nonagricultural areas (e.g., highway shoulders).

Simazine may be formulated in mixtures with the following nine chemicals: amitrole, atrazine, bromacil, copper (from triethanolamine complex), paraquat dichloride, poly[oxyethylene(dimethylimino)ethylene(dimethylimino)ethylene dichloride], prometon, sodium chlorate, or sodium metaborate.

III. USE SUMMARY

PQUA for simazine includes the following use estimates: 30% on corn (field) [majority of agri. use]; 10% on alfalfa (use was voluntarily cancelled by Ciba-Geigy in 1987); <22% on fruits and nuts; 27% on aquatic sites (water treatment); 3% on noncrop sites; 1% on tree nurseries; and 9% on other nonagricultural uses (Torla, 1988). The major use of simazine is in horticultural and fruit-and-nut crops (Ahrens, 1989).

A. Terrestrial Food Crops (asparagus, corn, fruits and nuts)

1. Asparagus

Simazine is recommended for use on asparagus in NM, NY, AR; and, depending on the region, it may be used to control weeds such as annual morningglory, barnyardgrass, carelessweed, foxtails, henbit, mustard, purslane and ragweed (Lee, et al., 1988; Cornell U., 1988; Baldwin, et al., 1988).

2. Corn (field)

Simazine is recommended for use on corn in IA for no-tillage and reduced tillage weed control, in MN for use in crop rotation, also in IA, NM and NY for, depending on the region, control of annual grasses, crabgrass, fall panicum, and annual broadleaf weeds (Becker, et al., 1988; Cornell U., 1988; Lee, et al., 1988; Owen and Fawsett, 1988; Sanders, et al., 1988). Simazine may be used in several tank mixes depending on the region of the US and weed spectrum involved (Boettger, 1988; Cornell U., 1988; Owen and Fawsett, 1988). Corn resistance to simazine is controlled by a single recessive gene (Anderson, 1977).

3. Fruits and Nuts

In FL, simazine (Princep 80WP, 4L; Caliber 90 WDG, and Sim-Trol 4L) is recommended for use on citrus at 3.2 to 9.6 lb ai/A (Knapp, et al., 1988). Simazine controls annual broadleaf weeds, annual vines, and annual grasses, but does not control perennial grasses (Knapp, et al., 1988).

Simazine is recommended for use on fruits and nuts as following:

- A. Apples in Canada, WV, NY, OK, and AR for weed control (Baldwin, et al., 1988; Cornell U., 1988; Curtis and Cummings, 1981; Heeney, et al., 1981a, Heeney, et al., 1981b; OSU, 1988; Young, 1987);
- B. Peaches, plum, sweet cherries, tart cherries, pears for weed control (Baldwin, et al., 1988); Cornell U., 1988; Lee, et al., 1988; OSU, 1988);
- C. Pecans in OK and LA for weed control (OSU, 1988; Sanders, et al., 1988);
- D. Grapes in NY, LA, OK (Cornell U., 1988; OSU, 1988; Sanders, et al., 1988);
- E. Strawberries in OR and WA, cranberries in the Pacific Northwest, blackberries and blueberries in LA and NY, elderberries in NY (Burrill, et al., 1988; Cornell U., 1988; Curtis, 1980; Sanders, et al., 1988).

Benefits of simazine use in apple and peach orchards include the following:

- A. Simazine can be used in young (1 to 3 year old & older) orchards while diuron is limited to use in 3 year-old & older orchards (Majek, 1989);
- B. Simazine can be used on apple full dwarfing rootstocks (Majek, 1989);
- C. Use of reduced rates of simazine in October to November plus reduced rates of diuron in May and June allow better crop safety than higher rates (Majek, 1989);
- D. Simazine is the least expensive herbicide for control of most weeds in orchards in West Virginia (Young, 1989).

B. Terrestrial Nonfood Crops

1. Ornamental Plants and Established Turfgrass

Simazine may be broadcast to 52 species of nursery stock and broadcast or banded to 22 species of seedlings grown in the Pacific Northwest (EPA Compendium, 1988). Simazine along with oryzalin, metolachlor, and oxyfluorfen were widely used for field-grown ornamentals (Gilliam, et al., 1985). In LA and OR, simazine is recommended at the rate of 2 to 3 lb AI/A for use in field grown nursery stock that has been transplanted 1 year (Burrill, et al., 1988).

(Cont.d)

1. Ornamental Plants and Established Turfgrass

In OK, simazine is applied preemergence in March or April at rate of 1 to 1.25 lb ai/A for control of crabgrass, foxtail, and selected broadleaf weeds in turfgrass (OSU, 1988). In GA, simazine applied preemergence consistently controlled winter annual weeds in bermudagrass but did not effectively control parsley-piert and corn speedwell (Johnson, 1982).

Simazine is recommended for weed control in turfgrasses in the following states:

(A). Bermudagrass, centipedegrass, St. Augustinegrass, and zoysiagrass in AR, MS, LA and TX (Baldwin, et al., 1988; Houston, 1988; Sanders, et al., 1988; Palmer, 1988).

(B). Annual and perennial ryegrass, highland or Astoria bentgrass, fine fescues, orchardgrass, and tall fescue in OR (Burrill, et al., 1988).

The niche of simazine in ornamentals is that it has been used for preemergence broadleaf control in field-grown nursery crops and field-grown Christmas tree plantations for the last 15 years (Senesac, 1989).

C. Noncrop Sites (rights-of-way, etc.)

Simazine at rates of 4 to 40 lbs AI/A may be broadcasted on agricultural noncrop sites which include fences and uncultivated nonagricultural areas such as highway rights-of-way (EPA Compendium, 1988). In WY, simazine (Princep 80W at rates of 4.8 to 40.0 lbs AI/A applied preemergence, is recommended for control of annual weeds at 4.8 to 10.0 lbs AI/A, control of easy-to-control perennials at 10.0 to 20.0 lbs AI/A, and control of perennials at 20.0 to 40.0 lbs AI/A (Whitson, et al., 1988). In MS, simazine (80WP, 4 lb/gal, 90% DF) as a soil treatment to control all vegetation (seedling control after perennials have been controlled) at rate of 4.8 to 40.0 lb AI/A, is recommended for use in late winter or early spring (Houston, 1988). In the Pacific Northwest, simazine broadcasted in late winter or early spring west of the Cascades is recommended for use in early fall east of the Cascades at 4.8 to 18.0 lbs AI/A (Burrill, et al., 1988).

C. Noncrop Sites (Cont.d)

According to a highway rights-of-way report, simazine is used in CA, PA, and UT to kill or control all vegetation, in MD to eliminate hand-mowing, in IL to control weeds and grasses in shrub beds, and in NC it is used with surflan for preemergence weed control under guard rails and around signs (Johnson, 1987).

D. Aquatic Sites

Simazine may be applied as a water treatment to aquatic sites. Simazine may be applied at 8.0 to 12.0 lb AI/A to drained ponds and fish hatcheries; at 1.35 to 6.75 lb AI/A-ft to ponds and at 0.03 to 0.21 lb AI/10,000 gallons of water to control algae and aquatic weeds (EPA Compendium, 1988).

In LA, MS, NM, NY, OK, OR, and WY simazine (Aquazine) is recommended at rates of 1.4 to 3.4 lbs AI/A-ft of water for control of algae (scum) in ponds and is applied when 5 to 10% of the pond surface is covered with scum (Burrill, et al., 1988; Cornell U., 1988; Houston, 1988; Lee, et al., 1988; OSU, 1988; Sanders, et al., 1988).

In OK, simazine (80WP) is recommended at 0.5 ppm for control of plankton and filamentous algae, duckweed and pondweed (Potamogeton spp.) and at 1.00 ppm for control of water meal (Wolffia spp.) (OSU, 1988).

E. Forestry

Simazine may be broadcasted in southern states at rate of 4 to 6 lbs AI/A in 20 to 100 gal of water per acre in the Spring for weed control in loblolly, slash, and white pines grown for timber (EPA Compendium, 1988). Simazine may be used and in black walnut trees (grown for timber) at 2 to 4 lbs AI/A (EPA Compendium, 1988). In NY, MS and AR simazine is recommended for use on Christmas trees (Baldwin, et al., 1988; Cornell U., 1988; Houston, 1988). In WY, simazine is recommended as a preemergence application to windbreaks (tree plantings) (Whitson, et al., 1988). In OR, simazine at 2 to 3 lbs AI/A is recommended as a postemergence (preferably in early spring) application to conifer seedbeds (Burrill, et al., 1988).

IV. TABLES

On the pages that follow, note that Table I provides a numerical tally of simazine end-use products; Table II gives a summary of general use patterns of simazine single active ingredients according to 40 CFR 158; and Table III provides comments on the use profile of simazine.

Table I. Simazine - Summary of End-Use Products

Registration Type	SAI	MAI	Total
Section 3	72	15	87
Section 5	-	-	-
Section 18	-	-	-
Section 24(c)	20	1	21
Total	92	16	108

Section 3 = Federal Registration
 Section 5 = Experimental Use Permits
 Section 18 = Emergency Exemptions
 Section 24(c) = Special Local Need (SLN)

Table II. Simazine - Summary of General Use Patterns by Product (Single Active Ingredients Only) as Designated by 40 CFR Part 158 Pesticide Registration Data Requirements

Site Category	General Use Pattern				
	Terrestrial				Aquatic Nonfood Crop
	Food Crop	Nonfood Crop Ornamentals	Noncrop	Forestry	
<u>For example:</u>					
Corn	X				
Turf, Ornamentals		X			
Rights-of-Way			X		
Alpine Fir				X	
Algae Control					X

Table III. Comments on Use Profile for Chemical Simazine

B. Use Profile

Type of Pesticide:	Preplant, preemergence, postemergence, postharvest, dormant, before transplant, after transplant, and water treatment herbicide. Classified as a triazine.
Pests Controlled:	Weeds: 22 species of grasses (e.g., annual and perennial grasses, annual bluegrass, cheat, crabgrass, orchardgrass, and quackgrass); 62 species of broadleaves (e.g., annual and perennial broadleaf weeds, amaranth, common lambs quarter, nightshade, ragweed, smartweed, and wild buckwheat).
Registered Uses:	<u>Simazine may be applied on the following:</u> <u>Agricultural food crops:</u> almond, apple, apple (nonbearing), artichoke, asparagus, avocado, Bermudagrass (Coastal and Midland; forage), birdsfoot trefoil (seed crop), blueberry, broccoli (seed crop), Brussels sprouts (seed crop), cabbage (seed crop), kale (seed crop), kohlrabi (seed crop), radish (seed crop), caneberries (includes blackberry, boysenberry, dewberry, loganberry and raspberry), cherry, corn, cranberry, filbert, grapefruit, orange, grapes, lemon, macadamia nut, olives, orchardgrass (seed crop), perennial ryegrass (seed crop), tall fescue (seed crop), peach, pear, pecan, plum, strawberry, sugarcane, and walnut. <u>Terrestrial Nonfood Crops</u> Bermudagrass grown for sod, other grasses and seed crops, forest trees, ornamentals established for one year or more in North Central states, and liner grown ornamentals.

Noncrop Sites

agricultural noncrop areas: around farm buildings, equipment and fuel storage areas, fences, agricultural roadsides and lanes; driveways, patios, brick walks, gravel pathways, parking lots, and recreational areas; uncultivated non-agricultural areas: around airports, buildings, fences, roadsides, industrial sites, highway medians, lumberyards, petroleum tank yards, highway, pipeline, railroad, and utility rights-of-way, firebreaks, guardrails and military installations.

Aquatic (Water Treatment) Sites

Water treatment (to control algae and aquatic weeds) in aquaria, ornamental fish ponds, ornamental fountains, fish hatcheries, swimming pool water, utility cooling ponds and waste water treatment ponds.

Forestry Sites

forest trees, (shelterbelt use is cancelled), trees grown for timber, and Christmas tree plantations.

Principal Uses:

30% on corn (field) majority of use;
10% on alfalfa (use was voluntarily cancelled by Ciba-Geigy in 1987);
<22% on fruits and nuts;
27% on aquatic (water treatment);
3% on noncrop sites;
1% on tree nurseries; and
9% on other nonagricultural uses.

Method of Application: Ground application as preemergence or preplant soil application to bare soil prior to weed emergence, postemergence or at-planting/postemergence. Applications may be done as broadcast, band, directed spray, split application, spreader application, or water treatment for algae and aquatic weed control. May also be applied by broadcast aerial application to certain agricultural food crops and agricultural noncrop areas.

Rates of Application: Terrestrial Food Crops: 0.8 to 10 lb ai/A;
Terrestrial Nonfood Crops: 0.8 to 4.0 lb ai/A;
Noncrop Sites: 4.0 to 40.0 lb ai/A;
Aquatic (Water Treatment) Sites:
drained ponds and fish hatcheries -
0.8 to 10 lb ai/A; ponds - 1.35 to 6.75 lb
ai/A ft; swimming pools - 0.03 to 0.21 lb
ai/10,000 gal water; and
Forestry Sites: 2 to 6 lb ai/A.

Formulations: Technical (95 to 99.99% ai), Formulation Intermediate (80 to 90% ai), Granular (0.63 to 90% ai), Pelleted/Tableted (0.75 to 90% ai), Wettable Powder (3 to 90% ai), Dry Flowable (90% ai), Emulsifiable Concentrate (2 and 4 lb/gal, 1 to 34.67% ai), Flowable Concentrate (0.88 and 4 lb/gal, 0.6% ai), Soluble Concentrate Liquid (0.134, 0.317, and 4 lb/gal, 0.1 to 80% ai), Ready-to-Use (0.08 to 3.5% ai).

Mode of Activity: Inhibits the Hill reaction of photosynthesis.

C. Acceptable Ranges and Limits

Use Patterns: The use patterns currently registered are terrestrial food crop; terrestrial nonfood crop; noncrop, wide areas, and general indoor/outdoor treatments; aquatic nonfood crop; forestry.

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