



OCT 08 2000

February 23, 1999

To Whom It May Concern,

The following presentation is a position for the use of Sodium Chlorate in organic production.

Many of us cotton growers have spent years trying to make our voices heard about the need for Sodium Chlorate as a defoliant for organic cotton.

The following packet discusses the reasons for the need and includes the technical backing for the product as compared to other "allowed organic products", clearly showing that other products have "prohibited elements" in the finished product. We have also included a list of organic cotton producers who will be very glad that you have taken the time to understand our plight.

Obviously, long before now, any and all other possible available products have failed to achieve successful defoliation on our collective efforts.

Please give us the chance to discuss the need in person.

The negative position on Sodium Chlorate in the organic industry is purely political, not scientific, as you will clearly see!

Thank You,

Ed Davis
S & E Organic Farms, Inc.

Agricultural Center, 1997

L.J. Clark, Safford Agricultural Center
E.W. Carpenter, Safford Agricultural Center

Abstract

Nine defoliation treatments were applied to Pima and upland cotton to compare the treatment effects on percent leaf drop and percent green leaves left and any effects they might have on yield or fiber qualities. All of the treatments were beneficial compared to the untreated check, the treatments including Ginstar performed better than those without.

Introduction

Defoliation of cotton plants prior to harvest is a practice introduced many years ago to reduce leaf trash in the harvested cotton. At higher elevations defoliation is practiced by a smaller percentage of the growers than other parts of the state because cool temperatures at harvest time reduces the effectiveness of many of the chemicals used as defoliant and frost can effectively defoliate the plants with no cost. This study was initiated in 1991 on Pima cotton, and was expanded to include upland cotton as well. The objective of the study was to see how effective each of the defoliation treatments was under the prevailing weather conditions present this year.

Materials and Methods

The study was implemented using Pima S-6 and DP 90. Treatments were applied to plots 4 rows wide and approximately 50 feet long, in a replicated randomized complete block design. The following crop history indicates the cultural practices employed in the experiment:

Crop history

Soil type: Pima clay loam variant
 Previous crop: Cotton
 Planting date: 8 April, 1997 Rate: 25 lbs/ac
 Herbicide: 1.5 pts/ac Triflurilin applied pre-plant, Cotton Pro applied at lay-by
 Fertilizer: 100 lbs/ac urea under a green manure crop 2/10, 100 lbs/ac side dressed 6/2 and 7/14
 Irrigation: Planted into moist soil plus 7 irrigations (28 ac in + 6 in rain)
 Last date: 9 Sept
 Defoliation date: Applied 26 September (14 gal/ac, 40 psi) Observations: 3 October
 Cumulative heat units: At defoliation 3439, at obs. 3606 (=167)
 Harvest: 1st pick: 16 October 2nd pick: Not taken

The treatments listed below were applied at a rate of 14 gallons of water per acre through Teejet flat fan nozzles on 20 inch spacings over 4 rows. One week after defoliation treatments were applied each plot was evaluated to determine the amount of leaf drop and the green leaves remaining on the plants. At harvest grab samples were taken from two of the replicates to determine if the defoliant had any effect on the lint qualities.

Number	Treatment	Treatment
1	GS	Ginstar 180 EC 9 oz/ac
2	GS + NIS	Ginstar 180 EC 9 oz/ac + Bond 2 pt/100 gal
3	GS + D-RET	Ginstar 180 EC 9 oz/ac + Chemtrol 3 qt/100 gal
4	GS + PRP/2	Ginstar 180 EC 9 oz/ac + Prep ½ pt/ac
5	GS + PRP	Ginstar 180 EC 9 oz/ac + Prep 1 pt/ac

MEMORANDUM

Date: August 5, 1996

From: Brian Baker

To: The National Organic Standards Board

Subject: Salt Index

In evaluating substances considered for inclusion in the proposed National List, the Organic Foods Production Act requires the NOSB to consider the salt index.¹ The salt index is an empirically derived measure of the effect of different fertilizers on the concentration of soluble salts in soil solutions.² This index was developed by researchers to help predict the injurious effects of soluble salts in soil solutions that resulted from the use of fertilizers. The researchers found that changes in osmotic pressure in water by the different fertilizers did not adequately predict the "burn" observed in field conditions, and thus performed experiments on soil solutions in containers to measure the change in osmotic pressure related to the addition of fertilizers.

The salt index should be considered for four materials currently before the NOSB: calcium chloride, magnesium chloride, sodium chlorate and sodium chloride. Unfortunately, it appears that the salt index is available only for sodium chloride. By the specific nature of the salt index, and the language in the OFPA specifically referring to soil solutions, it is not appropriate to extrapolate from osmotic pressure in aqueous solution. Calcium chloride, magnesium chloride and sodium chlorate are all likely to have significant salt indexes, but the experiments to determine those indexes appear to have not been performed. Without calculating the salt index, researchers have noted that phytotoxicity from calcium chloride, magnesium chloride and potassium chloride will vary widely according to soil and crop. No generalization can be made about which of the three would be most or least harmful based on current data.

Recommendations

1. Calcium chloride not be added to the list of prohibited naturals.
2. Magnesium chloride not be added to the list of prohibited naturals.
3. Sodium chlorate not be added to the list of allowed synthetics.
4. Sodium chloride be added to the list of prohibited non-synthetics for all crop uses, except as an "inert" ingredient in formulated products.

¹Organic Foods Production Act, 2119(m)(5); 7 U.S.C. 6518(m)(5).

²L.F. Rader, L.M. White and C.W. Whittaker. "The Salt Index: A Measure of the Effect of Fertilizers on Concentration of the Soil Solution. *Soil Science* 55: 201-218 (1943).

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ABOUT THE CHEMICALS | Chemical Profile

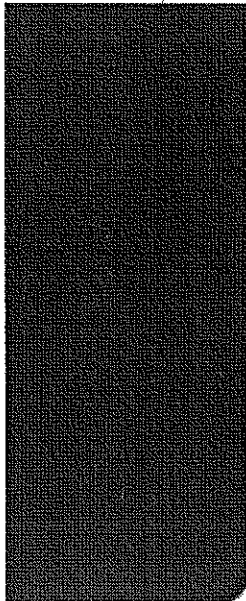
Chemical: SODIUM CHLORATE

CAS Number: 7775-09-9

Chemical Profile for SODIUM CHLORATE (CAS Number: 7775-09-9)

- [Human Health Hazards](#)
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No data on industrial use in Scorecard.

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No data on environmental releases in Scorecard.

EXTOXNET

Extension Toxicology Network

Pesticide Information Profiles

A Pesticide Information Project of Cooperative Extension Offices of Cornell University, Oregon State University, the University of Idaho, and the University of California at Davis and the Institute for Environmental Toxicology, Michigan State University. Major support and funding was provided by the USDA/Extension Service/National Agricultural Pesticide Impact Assessment Program.

EXTOXNET primary files maintained and archived at Oregon State University

Revised 9/95.

SODIUM CHLORATE

TRADE OR OTHER NAMES: The active ingredient sodium chlorate is found in a variety of commercial herbicides. Some trade names for products containing sodium chlorate include Atlacide, Defol, De-Fol-Ate, Drop-Leaf, Fall, Harvest-Aid, Kusatol, Leafex, and Tumbleaf. The compound may be used in combination with other herbicides such as atrazine, 2,4-D, bromacil, diuron, and sodium metaborate (1, 242, 205, 223).

REGULATORY STATUS: Sodium chlorate is not a restricted use pesticide. Check with specific state restrictions which may apply. Products containing the active ingredient sodium chlorate must bear the Signal Word "Warning" on their label (223).

INTRODUCTION: Sodium chlorate is a non-selective herbicide. It is considered phytotoxic to all green plant parts. It can also kill through root absorption. Sodium chlorate may be used to control morningglory, Canada thistle, johnsongrass and St. Johnswort (205, 207). The herbicide is mainly used on non-crop land for spot treatment and for total vegetation control on roadsides, fenceways, ditches, etc. Sodium chlorate is also used as a defoliant and desiccant for cotton, safflower, corn, flax, peppers, soybeans, grain sorghum, southern peas, dry beans, rice and sunflowers (1, 207). If used in combination with atrazine, it increases the persistence of the effect. If used in combination with 2,4-D, it improves performance of the material. Sodium chlorate has a soil-sterilant effect. Mixing with other herbicides in aqueous solution is possible to some extent, so long as they are not susceptible to oxidation (1)

FORMULATION: Sodium chlorate comes in dust, spray and granule formulations. There is a risk of fire and explosion in dry mixtures with other substances, especially organic materials, i.e. other herbicides, sulphur, powdered metals, strong acids, etc. (1). Marketed formulations contain a fire depressant (242).

TOXICOLOGICAL EFFECTS

- **Acute Toxicity:** The acute oral LD50 for sodium chlorate in rats ranged between 1,200-7,000 mg/kg (1, 242, 205, 223, 348). The compound was a mild skin irritant in rabbits (348). The dermal LD50 was 500 mg/kg over 24 hours (223, 348, 349). The oral LD50 was 7,200 mg/kg for rabbits (348). The acute toxicity values for mice were 8,350 mg/kg for the oral toxicity and 596 mg/kg for the intraperitoneal LD50 (348). Another study found sodium chlorate to have an oral LDlo of 700 mg/kg for dogs; and an oral LDlo of 1350 mg/kg for cats (348). A single dose of 5-10 g/person of sodium chlorate can prove to be fatal in adults, as can a single dose of 2 g/child in small children. Another source reported that a dose of 15 to 30 g/person may be fatal to humans (207). Irritation of the skin, eyes, and mucous membranes has been noted (1, 242, 205). Symptoms of oral ingestion of sodium chlorate include abdominal pain, nausea, vomiting, diarrhea, pallor, blueness, shortness of breath, unconsciousness and collapse (205, 348).
- **Chronic Toxicity:** Chronic exposure may render lack of appetite and weight loss, as well as all those symptoms listed under acute exposure to sodium chlorate. A prolonged chronic exposure to inhalation of sodium chlorate may cause mucous membrane irritation (348).
- **Reproductive Effects:** No information was available.

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Memphis, TN 38109

- Fax: 901-774-4666
- Telephone: 901-774-4370

Wilbur-Ellis Co.
320 California Street
San Francisco, CA 94104

- Fax: 415-772-4011
- Telephone: 415-772-4000
- Emergency: 209-226-1934

REFERENCES

References for the information in this PIP can be found in Reference List Number 10

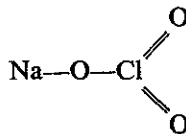
DISCLAIMER: The information in this profile does not in any way replace or supersede the information on the pesticide product label/ing or other regulatory requirements. Please refer to the pesticide product label/ing.

20 Inorganic Herbicides

Inorganic herbicides are those weed-control chemicals which contain no carbon atom in their molecules. The principal ones are the arsenicals, borates, and chlorates, but the cyanates, calcium cyanamide, and ammonium sulfamate (AMS) also fall into this group.

Most inorganic herbicides were used before the modern era of organic herbicides began with 2,4-D in the mid-1940s. Although various organic herbicides have replaced these inorganic herbicides for many uses, they are still used.

SODIUM CHLORATE



sodium chlorate

Sodium chlorate (NaClO_3) is a white, crystalline salt that looks like common table salt (sodium chloride). Weight for weight, sodium chlorate is 30-50 times more toxic to plants than sodium chloride. Sodium chlorate is very soluble in water; 100 ml of water at 0°C will dissolve 75 g. The acute oral LD_{50} is about 5000 mg/kg.

Sodium chlorate has a salty taste. "Salt-hungry" animals may eat enough to be poisoned; 1 lb of this chemical/1000 lb of animal weight is considered lethal. Also, after spraying, some poisonous plants ordinarily avoided by livestock become palatable.

Fire Danger

Sodium chlorate has three atoms of oxygen per molecule. The oxygen is easily released, making sodium chlorate a strong oxidizing agent. It is therefore highly flammable when mixed with organic materials such as clothing,

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Figure 20-1. Single plants or small patches of johnsongrass, bermudagrass, nutsedge, and many other serious perennial weeds can be destroyed by spot treating the soil with soil-sterilizing chemicals. Here, sodium chlorate is being broadcast in the stubble of tall johnsongrass. (Kentucky Agricultural Experiment Station.)

most rapid in moist soils above 70°F. As would be expected, the effects of rainfall, soil texture and structure, organic-matter content, and temperature are very important. With low rainfall, chlorate may remain toxic for 5 years or longer. In the humid Southeastern states, toxicity may disappear in 12 months on heavy soils and in 6 months on sandy soils.

Ease of leaching may be a disadvantage—heavy rains or irrigation soon after application may remove the chemical from the upper 2–3 in. of soil. Shallow-rooted weeds such as bermudagrass may escape the toxic effects of the chemical and continue to grow.

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Research

Cotton

Economic Analysis of the Harvest-Aid Decision for Cotton in West Tennessee

James A. Larson,* Robert M. Hayes, C. Owen Gwathmey, Roland K. Roberts, and Delton C. Gerloff

Economic tradeoffs influence producers' decisions in applying a harvest-aid before a once-over or twice-over harvest for cotton (*Gossypium hirsutum* L.). This decision may be affected by responses of first harvest yield and quality to the harvest-aid, cotton prices, harvest-aid treatment costs, cotton harvesting and handling costs, and weather between harvests. The objective of this study was to evaluate how these factors influence net revenues (NR) to alternative harvest-aids. Yields and fiber quality data were from a 1992 to 1994 harvest-aid study at Jackson, TN. The study evaluated 12 treatments including commercial defoliants (Folex [S,S,S,tributyl phosphorotri-thioate], Dropp [thidiazuron], Harvade [2,3 Dihydro-5 6-Dimethyl 1,4-Dithiin], and Defol [sodium chlorate]) with and without a boll opener (Prep [ethephon]). Net revenues for the treatments were estimated using North Delta price quotations, harvest-aid costs, harvesting costs, and handling costs. Dropp (0.05 lb a.i./acre) and Prep (1.0 lb a.i./acre) produced the largest positive influence on effective lint price and NR for farmers interested in once-over or twice-over harvest systems. First harvest NR was significantly higher than for no harvest-aid treatment. However, a once-over harvest using this treatment would have to be delayed from the times in this experiment to allow more bolls to open to minimize second harvest NR foregone. Dropp and Prep also produced the largest two harvest NR. The most important factors influencing NR for Dropp and Prep were a low lint trash content, which resulted in a better LEAF and lower price discounts, and higher first harvest yields.

PRODUCERS HAVE SHOWN an increasing interest in using a once-over instead of a twice-over harvest for picker-type cotton (Williford, 1992). To implement this practice, farmers are planting early maturing cultivars and using chemicals to regulate plant growth and prepare the crop for harvest (Gannaway, 1991). An integral part of a once-over harvest is the use of harvest-aid chemicals to prepare the plant for harvest. Many researchers have evaluated harvest-aids in

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cotton production (Teague et al., 1986; Whitwell et al., 1987; Hoskinson and Hayes, 1988; Crawford et al., 1989; Stair and Supak, 1992; Chu et al., 1992; Williford, 1992). Most of these studies evaluated the timing of application and the subsequent impact of the chemical(s) on yield and fiber characteristics. Harvest-aid chemicals do not cause the crop to mature earlier or to increase yield but serve to expedite the opening of mature bolls, induce the shedding of immature fruit and leaves, and hasten drying of the plant (Supak, 1991). Consequently, harvest-aid chemicals may enhance NR by reducing trash, preserving fiber quality, and increasing the proportion of total yield picked at the first harvest—thus avoiding revenue losses due to weathering between the two harvests. However, results have also suggested that a mistimed application of a harvest-aid can cause significant reductions in yield or fiber quality (Crawford et al., 1989). Delayed harvest due to inclement weather after application could also increase the loss of revenue over a crop not treated with a harvest-aid (Stair and Supak, 1992). The harvest-aid decision is influenced by price differences for variation in fiber quality (Teague et al., 1986), costs of harvest-aid treatments (Teague et al., 1986), and changes in variable and overhead costs from conducting a once-over instead of a twice-over harvest (Cooke et al., 1991). Previous studies have not systematically examined the economic tradeoffs of applying a harvest-aid followed by a once-over or twice-over harvest. The objective of this study was to evaluate factors that influence NR to harvest-aids for picker-type cotton.

ECONOMIC DECISION MODEL

Based on the factors described previously that influence revenues and costs for the harvest-aid decision, we developed the following partial budgeting (Boehlje and Eidman, 1984) equation to estimate NR for the analysis

$$\begin{aligned} \text{NR} = & (P_B + P_D)_{1st} \times H \times Y_L + P_S \times H \times Y_S \\ & (P_B + P_D)_{2nd} \times (1 - H) \times Y_L + P_S \times (1 - H) \times Y_S \\ & - \text{HAC} - C_{1st} - C_{2nd} - H \times Y_L \times (G + M) \\ & - (1 - H) \times Y_L \times (G + M), \end{aligned} \quad [1]$$

Abbreviations: HVI, high volume instrument; LEAF, leaf grade; NR, net revenue.

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SEE IMPORTANT INFORMATION ON BACK

ICSC: 1117

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993 No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and IDLH values.

International Chemical Safety Cards

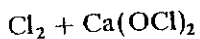
SODIUM CHLORATE

ICSC: 1117

I M P O R T A N T D A T A	<p>PHYSICAL STATE; APPEARANCE: ODOURLESS, COLOURLESS CRYSTALS OR WHITE GRANULES.</p> <p>PHYSICAL DANGERS:</p> <p>CHEMICAL DANGERS: The substance decomposes on heating above 300°C or on burning producing oxygen, which increases fire hazard, and toxic fumes (chlorine). The substance is a strong oxidant and reacts violently with combustible and reducing materials, causing fire and explosion hazard. Reacts with strong acids giving off carbon dioxide. Reacts with organic contaminants to form shock-sensitive mixtures. Attacks zinc and steel.</p> <p>OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV not established.</p>	<p>ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.</p> <p>INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly on spraying or when dispersed, especially if powdered.</p> <p>EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes, the skin and the respiratory tract. The substance may cause effects on the blood (methaemoglobinaemia) and kidneys following ingestion. The effects may be delayed. Medical observation is indicated. See Notes.</p> <p>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Repeated or prolonged contact with skin may cause dermatitis.</p>
	<p>PHYSICAL PROPERTIES</p> <p>Decomposes below boiling point at ca. 300°C Melting point: 248°C Relative density (water = 1): 2.5 Solubility in water, g/100 ml at 20°C: 100</p>	<p>Vapour pressure, Pa at °C: negligible Relative vapour density (air = 1): 3.7 Relative density of the vapour/air-mixture at 20°C (air = 1): 1.00</p>
ENVIRONMENTAL DATA		
NOTES		
<p>The substance is entirely decomposed at temperature higher than 300°C. Will turn shock-sensitive if contaminated with organic materials. Marketed formulations contain a fire depressant. Specific treatment is necessary in case of poisoning with this substance; the appropriate means with instructions must be available. Do NOT take working clothes home. Rinse contaminated clothes (fire hazard) with plenty of water.</p> <p style="text-align: right;">NFPA Code: H 1; F 0; R 2;</p>		
ADDITIONAL INFORMATION		
ICSC: 1117		SODIUM CHLORATE
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y, some two ion materials ture. Much of practice has developments n the closing he electrolytic ustic began to the great killer l typhoid was y the treatment ater with small ufacturers and ished the value early on.

of the liquid neans of trans-each. Common as to absorb the Cl(OH)_2 , to form isly transported ns the equivalent ssolved in water, and Ca(OCl)_2 :



um hypochlorite, percent available le chlorine" refers bleach equivalent determined by the late titration.)

to achieving a high in a lime-based ng a slurry of lime cooling to -10°F . ff and added to a containing CaCl_2 it to the NaOCl stals. Warming this of $\text{Ca(OCl)}_2 \cdot 2\text{H}_2\text{O}$, ercent lime as an ale, has an available percent.

chlorine monoxide tion of HOCl , which e slurry, spray-dried, product containing rine.³²

The lime-based products have the disadvantage of containing insoluble components, which has led to the necessity for settling and sludge disposal in some applications. These components are especially objectionable in laundry and dishwashing uses. A granular bleach based on LiOCl ³⁰ is quite useful in these applications because it is completely soluble. It is prepared as a 35 percent solution of LiOCl by mixing solutions of LiCl and NaOCl , from which NaCl precipitates. The solution is evaporated, and the solid (containing LiOCl and NaCl) is dried and formulated with salt cake to a white, free-flowing, granular product that retains its bleaching power (35% available chlorine) reasonably well during storage.

In the bleaching of fibers for the manufacture of paper and textiles, sodium chlorite (NaClO_2) and/or chlorine dioxide (ClO_2) often is used because of the ability to achieve excellent whiteness without as much fiber degradation as occurs in chlorine or hypochlorite bleaching. For example, in the production of kraft paper, known for its strength, the product is brown when conventional bleach is used because bleaching to whiteness would destroy its strength. By using ClO_2 , a high-strength, white product is obtained.

An additional benefit of bleaching with ClO_2 is that the waste lignin degradation products generally present fewer disposal problems than do waste products of chlorine-based bleaches.⁴⁴ Kraft pulp bleaching sequences that involved chlorine in the first stage (C), followed by caustic extraction (E), followed by two stages of hypochlorite bleaching (H), are being changed to vary the chlorine/chlorine dioxide ratio (D) in the first stage, followed by two stages of chlorine dioxide (i.e., CEHEH replaced by CDEDED). Regulations are being contemplated regarding maximum discharge levels of chlorinated organics and dioxins. Sodium hypochlorite has been linked to the formation of harmful chloroform emissions from bleach plants. It is expected that chlorine dioxide use in bleaching will increase, both as a partial substitute for elemental chlorine and as a replacement for sodium hypochlorite. It has

been shown that chlorine dioxide substitution in the first-stage bleaching sequence above the 50 percent level can reduce total organic halide (AOX) discharge by up to 50 percent and eliminate the formation of dioxins.⁴⁵ By the mid-1990s the use of oxygen and hydrogen peroxide in the lignin extraction stage (E-stage) is expected to be common, and it eventually could dampen ClO_2 demand. Also ozone bleaching may limit growth in ClO_2 bleaching.

The generation of ClO_2 from chlorate involves a complex reduction of the chlorine atom of chlorate from the +5 oxidation state to the +4 oxidation state in an acid medium. Chlorine dioxide is a very unstable molecule. It cannot be economically transported, but is easily produced in situ. Treatment of a solution of NaClO_3 and NaCl with acid (H_2SO_4 or HCl) produces ClO_2 , which is immediately absorbed for use in bleaching. The ClO_2 generator must be operated with care to avoid ClO_2 concentrations above 10 percent, which can lead to explosion from self-decomposition. The molar ratio of ClO_2 to Cl_2 formed in the generator is 2:1. If this level of Cl_2 is objectionable, the gas mixture from the generator, which is mostly air (for safety), is passed through a tower through which chilled water is circulated. This dissolves the ClO_2 , but only 25 percent of the Cl_2 ; so the remaining Cl_2 is scrubbed with alkali. This treatment raises the molar ratio to $8\text{ClO}_2:1\text{Cl}_2$.

Over the years a number of commercial chlorine dioxide generators have been developed. These generators can be classified according to the type of acid media (i.e., sulfuric acid or hydrochloric acid) and the type of reducing agent (i.e., sulfur dioxide, methanol, sodium chloride, or hydrochloric acid). In most processes, some elemental chlorine is liberated as a by-product. The generator using sulfuric acid produces sodium sulfate and/or waste sulfuric acid, which must be disposed. A new process (R-8 generator⁴⁶) has been commercialized that is capable of eliminating by-product chlorine (i.e., so that there is no hypochlorite) and produces reduced quantities of by-product salt cake.

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are used in permanent wave lotions and in oxidizing power, and care must be taken in the manufacture of dyes. The bromates storage and handling of these solids. Contact usually are sold as specialty chemicals. Both with reducing agents and combustibles can chlorates and bromates have substantial be diastrous.

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Cotton Defoliation Evaluations, 1997

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E.R Norton, Plant Sciences Department

Abstract

Three field experiments were conducted near Yuma, Coolidge, and Marana, AZ in 1997 to evaluate the effectiveness of a number of defoliation treatments on Upland (var. DP NuCotn 33b) cotton. All treatments consisted of materials commercially available in Arizona. Results reinforce general recommendations regarding the use of low rates (relative to the label ranges) under warm weather conditions and increasing rates as temperatures cool.

Introduction

Due to the rather indeterminate nature of the cotton (*Gossypium spp*) plant, crops are often still actively growing late in the growing season. As a result, many cotton growers have experienced difficulty in satisfactorily defoliating the crop in preparing for harvest. Ideally, growers would like to accomplish a complete and satisfactory defoliation with a single application of defoliant. Historically, it has often required two applications and sometimes even three or four applications to accomplish defoliation. This can be further complicated later in the fall and at higher elevations due cooler weather conditions, which serves to slow down the physiological activity of the plant and the resultant activity of chemical defoliants on both Upland (*G. hirsutum* L.) and Pima (*G. barbadense* L.) fields.

Defoliation work in this program began in 1987, when a single field experiment was conducted in the Yuma Valley to compare several defoliation treatments on a field of Pima cotton (Silvertooth and Howell, 1988). That experiment was followed by a series of at least four similar experiments each year from 1988 (Silvertooth et al., 1989), 1989 (Silvertooth et al., 1990) and 1990 (Silvertooth et al., 1991) in an effort to expand locations, and treatment comparisons. Some treatment consistencies were identified from the 1987, 1988, and 1989 experiences, which were then used for the 1990, 1991, 1992, 1993, 1994, and 1995 experimental projects (Silvertooth et al., 1992; Silvertooth et al., 1993; Silvertooth et al., 1994; Silvertooth and Norton, 1995; Silvertooth, 1996, and Silvertooth and Norton, 1997). Nelson and his associates have also conducted a number of experiments concerning defoliation factors and refinement (Nelson and Hart, 1991a; Nelson and Hart, 1991b; Nelson and Silvertooth, 1991; Nelson and Hart, 1992; Nelson and Hart, 1993; Nelson and Hart, 1994; Nelson and Hart, 1995; Nelson and Hart, 1996; and Nelson and Hart, 1996). Common treatments resulting from this earlier work include Dropp + DEF and Dropp + Accelerate combinations, with increasing rates as temperature conditions cool. The 1997 experiments represent an extension of this general project in terms of evaluating some new treatments and combinations, and attempting to refine recommendations and guidelines.

Methods

Field experiments were conducted in the Yuma Valley on the University of Arizona Agricultural Center; near, Marana AZ; and Coolidge, AZ in 1997 as outlined in Tables 1, 2, and 3. Treatments employed are listed in Tables 4, 5, and 6. In all three cases, treatments were made to Upland cotton (var. DP 33b). All treatments were applied with a ground rig, with treatments arranged in a randomized complete block design with four replications. Plots were 18, 24, and 4 rows wide at Coolidge, Marana, and Yuma respectively; and extended the full length of the irrigation run in each case.

After treatments were applied, visual estimates of percent defoliation, and the regrowth/topgrowth control ratings were made 14 days after the treatment date. Weather conditions following the defoliant treatment applications are described in terms of heat units (HU, 86/55 °F thresholds) accumulated during the 14 day period following defoliant applications. Measurements and ratings were made at multiple locations within each plot. Regrowth ratings were made on a scale of 1 - 10,

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Defoliating Cotton ¹

D. L. Wright and R. K. Sprenkel²

It takes about 5 months to grow a crop of cotton. There are many management factors that go into the production of the crop. Unlike most agronomic crops, important management decisions have to be made a couple of weeks before cotton harvest. These decisions, defoliation and boll opening, can affect quality of the crop and storage time if the crop is put into modules, as most cotton is, at harvest. Stain from poorly defoliated plants or regrowth and moisture from the green tissue cause the biggest loss in quality.

There are several ways to determine when to defoliate cotton. An old rule of thumb is to defoliate cotton when 60% of the bolls are open. Another method is nodes above cracked bolls (NACB). Research has shown that green bolls on the four nodes above the highest cracked boll can be defoliated without significant weight or quality loss. If NACB counts average five or more, defoliant applications should be delayed.

Experience with harvest aids has shown that timing of the defoliant should be based on the yield potential and quality of the mature unopened bolls as compared to the potential yield and fiber loss of the bolls which are already open. The largest bolls are generally those set early and low on the plant. Where fruit was hindered by insect damage early, it may be desirable to wait as long as possible to allow the top crop to develop and the 60% rule may not apply. A crop that fruited early and retained most of the early fruit may be ready for defoliation at 50% open bolls. Also, where large acreage has to be harvested, growers may sacrifice some of the more immature bolls that contribute little to the final yield to begin harvest before adverse weather conditions affect the overall yield and quality of the crop. Bolls set in mid-summer are usually larger and mature in 40 to 50 days, while the bolls set in August can take 60 days or longer to mature and often contribute little to final yield if the crop had a normal fruiting season. Those late flowers look attractive and may give the appearance of adding to the final yield of the crop, but should not be given preference over the fruit that was set during the first 3 to 4 weeks of bloom. It has been shown many times that the fruit set during the first 4 weeks of bloom normally contributes about 90 to 95% of the total yield of the cotton crop.

Estimating the number of mature, open bolls in the field is helpful in scheduling the defoliant and boll opener. Ten mature bolls per foot of row will produce a bale of cotton. More bolls will be needed if they are higher on the plant and less if they are lower on the plant. Counts should include (1) open boll, including cracked bolls; (2) green bolls that are mature and will string out when you cut with a knife; (3) immature bolls that you think are harvestable or will mature while conditions are favorable. The crop should be defoliated in stages where large acreages are to be harvested. Harvest aids should be applied approximately 12 to 14 days ahead of picking. A four row picker can pick about 40 acres a day in the early part of the season but will pick less later in the season.

There are different ways to defoliate cotton, and several harvest aid chemicals are available that work well in Florida. What is used depends on whether the cotton has normal growth, is rank or has weed overgrowth, and the time of year. With rank cotton and cotton that has weed overgrowth, it is usually best to use a normal rate of defoliant and then to come back with a second application to defoliate the bottom of the crop. Higher rates of harvest aids may kill the plant and cause the leaves to stay attached instead of allowing the crop to mature and form the abscission layer, resulting in leaf drop. Drought stress and cool weather can make plants more difficult to defoliate, especially where high levels of nitrogen remain in the plant. Under these conditions higher rates of Dropp or tank mixes of Dropp and Folex or Def may be required.

High residual nitrogen in the soil and plant can result in regrowth as soon as moisture is supplied. The young green leaves that appear in the terminal can stain the lint during the picking process, resulting in lower grades and the higher moisture that can cause heating in the module. Dropp and tank mixes of Roundup with other

REMARKS: Thorough coverage is essential for complete defoliation. Apply 2 to 10 gallons by air, or 10 to 25 gallons by ground of spray solution per acre. Apply to mature cotton when at least 60% of the bolls are open, or when NACB <4. Dropp suppresses regrowth for up to 3 wks after application. Do not apply Dropp alone or in combination with other products when temperatures are expected to fall below 60°F.

Temperatures below 60°F, drought stress, or rainfall within 24 hours after application may reduce effectiveness. Petroleum-based crop oils or penetrating oils will improve defoliation when low temperatures or drought stress conditions occur. Avoid spray drift to other crops and immature cotton. Use only freshly prepared spray solutions. Do not store spray mixture overnight. Follow label instructions on planting other crops where Dropp has been used.

Harvade 5F	4.9 lb/gallon	8.0 oz	0.31
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REMARKS: Must be used with 1 pt/acre of an oil-based surfactant such as Agridex, Prime Oil, Super Oil, Surf Oil, Peptoil, Clean Oil Concentrate, or Super Savol. Thorough coverage is essential for complete defoliation. Apply to mature plants when 70% of the bolls are open or when NACB <4. Do not plant rotational crops within 6 mos after use. Partial defoliation will most likely occur with one or more of the following conditions: rank growth and dense foliage, new growth and fruiting evident in terminals, bolls not 70% open, drought stress, night temperatures below 55°F for 3 or 4 nights after application, and rainfall within 6 hr after application. Do not permit spray drift to other crops. See label for complete instructions and precautions. If leaves are actively growing (juvenile foliage is present), Harvade will be less effective than other defoliants.

Dropp 50WP +Def 6 or Folex 6EC	50% wettable powder 6.0 lb/gallon	0.1 lb +1.0 pt	0.05 +0.75
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REMARKS: Best activity will be obtained when the tank mix is applied to mature cotton plants with 60% or more of the bolls open, when NACB <4, and average 24-hr temperature before and after application is above 60° F. Thorough coverage is essential for complete defoliation. The following mixing order is suggested: 1) water, 2) Dropp according to directions on the Dropp label, and 3) Def or Folex after Dropp has completely dispersed. Do not add adjuvants or use higher than labeled rates as desiccation or mixing problems may occur. See the Dropp label for rotation restrictions. Immediately clean all equipment following application of the tank mixture using clean-out instructions on the Dropp label. Follow all label directions.

Def 6 or Folex 6EC +Prep or Super Boll, or Ethephon	6.0 lb/gallon 6.0 lb/gallon	0.75 pt +1.33 pt	0.5625 +1.0
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REMARKS: This tank mixture provides good defoliation and boll-opening activity, but provides little or no regrowth suppression. Apply to cotton that is at 60% open bolls or when NACB <4. Thorough coverage is essential for complete defoliation. Use 5 to 10 gallons by air and 15 to 25 gallons by ground of spray solution per acre. Temperatures below 60° F may slow defoliation and boll-opening or reduce effectiveness. Follow all Prep, Super Boll, or Ethephon label instructions concerning clean-out procedure. Do not allow spray drift to other crops. Do not allow spray mixture to stand more than 5 to 10 minutes without agitation.

Dropp 50WP + Prepor Super Boll or Ethephon	50% wettable powder 6.0 lb/gallon	0.1 lb+1.33 pt	0.05 + 1.0
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REMARKS: This tank mixture provides good defoliation, boll-opening activity, and regrowth suppression. Apply to cotton that is at 60% open bolls or when NACB <4. Thorough coverage is essential for complete defoliation. Use 5 to 10 gallons by air and 15 to 25 gallons by ground of spray solution per acre. Do not apply Dropp when temperatures are expected to fall below 60° F, plants are under moisture stress, or if rainfall within 24 hrs after application is expected. Follow all Prep, Super Boll, or Ethephon label instructions concerning clean-out procedure. Rinse exposed acrylic plastic materials and painted surfaces with detergent and water within 1 hr after exposure to avoid damage. At the end of each day, thoroughly

actively growing. Roundup is very effective in defoliating most weeds if it is given ample time, 10 to 14 days. Roundup can be mixed with Def/Folex, Dropp, or Harvade, and Prep during defoliation with good results. Do not allow spray drift to other crops.

R - Some or all of the uses of this product are restricted.

Table 2.

Table 2. Cotton harvest-aid chemical information.			
Common Name	Trade Name(s)	Formulation	Company
S,S,S-tributyl phosphorotrithioate	Def 6Folex 6EC	6.0 lb/gallon 6.0 lb/gallon	BayerRhne-Poulenc
thidiazuron	Dropp 50WP	50% wettable powder	AgrEvo
dimethipin	Harvade 5F	4.9 lb/gallon	Uniroyal
ethephon	PrepSuper Boll	6.0 lb/gallon 6.0 lb/gallon	Rhne-PoulencGriffin
	Ethephon	6.0 lb/gallon	MicroFlo
paraquat	Starfire	1.5 lb/gallon	Zeneca
glyphosate	Roundup	4.0 lb/gallon	Monsanto

Footnotes

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2. D. L. Wright, professor, North Florida Research and Education Center and R. K. Sprenkel, associate professor, North Florida Research and Education Center, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, 32611. The use of trade names in this publication is solely for the purpose of providing specific information. It is not a guarantee or warranty of the products named, and does not signify that they are approved to the exclusion of others of suitable composition.

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Christine Taylor Waddill, Dean

Disclaimer

MATERIAL SAFETY DATA SHEET

Drexel Chemical Co.
1700 Channel Avenue
Memphis, TN 38113

Emergency Telephone No.
(901) 774-4370
1-800-424-9300 (ChemTrec)

SECTION I – GENERAL INFORMATION

TRADE NAME	DEFOL
CHEMICAL NAME	Sodium Chlorate + Urea Fire Retardant
CHEMICAL FAMILY	Inorganic Salt
EPA REG. NO.	19713-12
SIGNAL WORD	WARNING

SECTION VII – EMERGENCY PROCEDURES

Skin Contact: Wash with plenty of soap and water. Get medical attention if irritation persists.

Eye Contact: Flush with plenty of water. Get medical attention.

Ingestion: Drink promptly a large quantity of milk, egg whites, gelatin solution or if these are not available, drink large quantities of water. Avoid alcohol. Get medical attention.

SECTION II – INGREDIENTS (Class = H (Hazardous), NH (Non-Hazardous))

<u>NAME</u>	<u>CAS NO.</u>	<u>% (by wt.)</u>	<u>TLV</u>	<u>CLASS</u>
Sodium Chlorate	7775-09-9	28	N.E.	H
Inerts	N/A	72	N/A	NH

SECTION VIII- SPILL OR LEAK PROCEDURES

Steps to be taken in case of material leak or spill
Clothing contaminated with solution or spray should be washed before it dries. Absorb spills on sand or clay and put into disposable container. Flush area with water. Assure protective clothing is worn.

Waste Disposal Method
Dispose of in accordance with Local, State, and Federal Regulations.

SECTION III – PHYSICAL DATA

<u>Boiling Point</u>	>212°F	<u>Specific Gravity</u>	1.26 gms/cc
<u>Vapor Pressure</u>	Negligible	<u>% Volatiles</u>	N/A
<u>Vapor Density</u>	N/A	<u>Solubility in Water</u>	Complete
<u>pH</u>	Neutral	<u>Appearance/Odor</u>	Clear solution, transparent, very slight odor

SECTION IX – SPECIAL PROTECTION INFORMATION

Respiratory Protection	NIOSH approved respirator
Ventilation	General recommended
Protective Gloves	Rubber impervious
Eye Protection	Chemical goggles
Other	Rubber apron, coveralls, rubber boots

SECTION IV – FIRE & EXPLOSION DATA

Flash Point	>200°F (Non-combustible)
Extinguishing Media	Dry chemical, foam or water spray.
Fire Fighting Procedures	Assure self-contained breathing apparatus is worn. Fight fire from upwind.

SECTION X – SPECIAL PRECAUTIONS

Precautions To Be Taken In Handling & Storage
KEEP OUT OF REACH OF CHILDREN. FOLLOW LABEL DIRECTIONS CAREFULLY.

Handle and store in dry, cool fire resistant building. Containers should be closed when not in use. Avoid contact with skin and eyes..

D.O.T. Description	Non-Regulated
Freight Description	Agricultural Herbicide, Liquid, N.O.S.
Reportable Quantity	N/A

SECTION V – REACTIVITY DATA

Stability	Stable
Conditions to Avoid	Strong reducing agents and acids
Incompatibility	Ammonium salts or amines
Hazardous Decomposition Products	Toxic fumes of chlorine
Hazardous Polymerization	Will not occur.

SECTION VI – HEALTH HAZARD DATA

Carcinogenicity	N/A
Toxicity Data	Dermal LD50 (Rabbit) = 8,000 mg/kg Tech Oral LD50 (Rat) = 1,200 mg/kg Tech
TLV	N.E.
N.F.P.A.	Health: 2, Fire: 1, Reactivity: 0 (Rating: 4-Extreme, 3-High, 2-Moderate, 1-Slight, 0-Insignificant)
Effects of Overexposure	Skin or eye irritation. Ingestion may be moderately toxic.

The information presented herein for consideration, while not guaranteed, is true and accurate to the best of our knowledge. No warranty, or guaranty is expressed or implied regarding the accuracy or reliability of such information and we shall not be liable for any loss or consequential damages arising out of the use thereof.

Date Prepared: 1-19-00

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Dr J G Firth, *Robens Institute, UK*

Dr G Shkolenok, *UNEP/IRPTC, Switzerland*

Dr P G Jenkins, *IPCS, Switzerland*

Dr D Kello, *WHO, Denmark*

Professor Lord Lewis, *University of Cambridge, UK*

Dr A Tcheknavorian-Asenbauer, *UNIDO, Austria*

Dr M Wilkinson, *Heriot-Watt University, UK*

INTRODUCTION

Professor Lord Lewis

THE ROYAL SOCIETY OF CHEMISTRY

1994

LD_{Lo} oral dog, cat, rabbit 700, 1350, 8000 mg kg⁻¹ respectively (3,4,5).
LD₅₀ intraperitoneal mouse 596 mg kg⁻¹ (6).

Irritancy

Dermal rabbit (24 hr) 500 mg caused mild irritation and 10 mg instilled into rabbit eye (72 hr) caused mild irritation (7).

Genotoxicity

Salmonella typhimurium TA98, TA100, TA1537, TA1538 with and without metabolic activation negative, TA1535 with metabolic activation positive, without metabolic activation negative (8).

Drosophila melanogaster Bax test increased the frequency of sex-linked recessive lethals (8).

In vivo mouse bone marrow micronucleus test negative (8).

Any other adverse effects to man

A dose of 5-10 g can be fatal to adults, as can 2 g in small children (1).

Legislation

WHO Class II; EPA Toxicity Class III (1).

Limited under EC Directive on Drinking Water Quality 80/778/EEC. Pesticides: maximum admissible concentration 0.1 µg l⁻¹ (9).

Included in Schedule 6 (Release into Land: Prescribed Substances) Statutory Instrument No. 472, 1991 (10).

Any other comments

Not toxic to bees (1).

Strong oxidising agent (1).

Human health effects, experimental toxicology, physico-chemical properties reviewed (11).

Decomposes at about 300°C liberating oxygen.

References

1. *The Agrochemicals Handbook* 3rd ed., 1991, RSC, London
2. *Pharm. J.* 1960, **185**, 361
3. *Albernadern's Handbuch der Biologischen Arbeitsmethoden* 1935, **4**, 1289
4. *Pesticide Chemicals Official Compendium* 1966, 1013, Association of the American Pesticide Control Officials Inc., Topeka, KS
5. *Arch. Exp. Pathol. Pharmacol.* 1886, **21**, 169
6. *C. R. Hebd. Seances Acad. Sci.* 1963, **257**, 791
7. *Data Sheets* 21-3/71, BIOFA Industrial Bio-Test Laboratories Inc., 1810 Frontage Road, Northbrook, IL
8. *Mutat. Res.* 1981, **90**, 91
9. *EC Directive Relating to the Quality of Water Intended for Human Consumption* 1982, 80/778/EEC, Office for Official Publications of the European Communities, 2 rue Mercier, L-2985 Luxembourg
10. *S. I. 1991 No. 472 The Environmental Protection (Prescribed Processes and Substances) Regulations* 1991, HMSO, London
11. *ECETOC Technical Report No. 30(5)* 1994, European Chemical Industry Ecology and Toxicology Centre, B-1160 Brussels

S51 Sodium chlorate NaClO₂

CAS Registry No. 7758-19-2

Synonyms chlorous acid, sodium chlorite

Mol. Formula ClNaO₂

Uses In preparation of chlorine dioxide for water purification.

Physical properties

M. Pt. 180-200°C (decomp.).

Solubility

Water: 34 g 100 g⁻¹ solution at 20°C

Occupational exposure

UN No. 1496; 1908 (solution)
Conveyance classification 09
>5% available chlorine).

Mammalian and avian toxicity

Acute data

LD₅₀ oral rat, guinea pig, mouse
LD₅₀ oral ♂, ♀ rat 158, 177 mg/kg
hypnoea, anaemia, haematuria, necrosis of the heart, lung, liver, kidney and spleen

Teratogenicity and reproduction

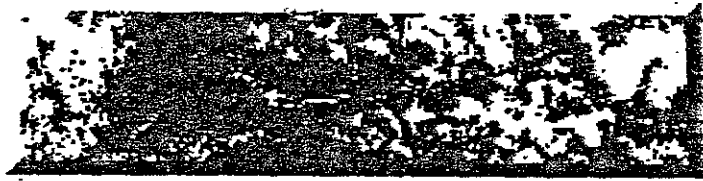
♀ Long-Evans rats were administered during a 10 days breeding period were dosed until day 40 post parturition gestation, litter size and weight of pups. Significant but inconclusive body weight depression of F₀ pups potency. Significant but inconclusive pups (4).

Irritancy

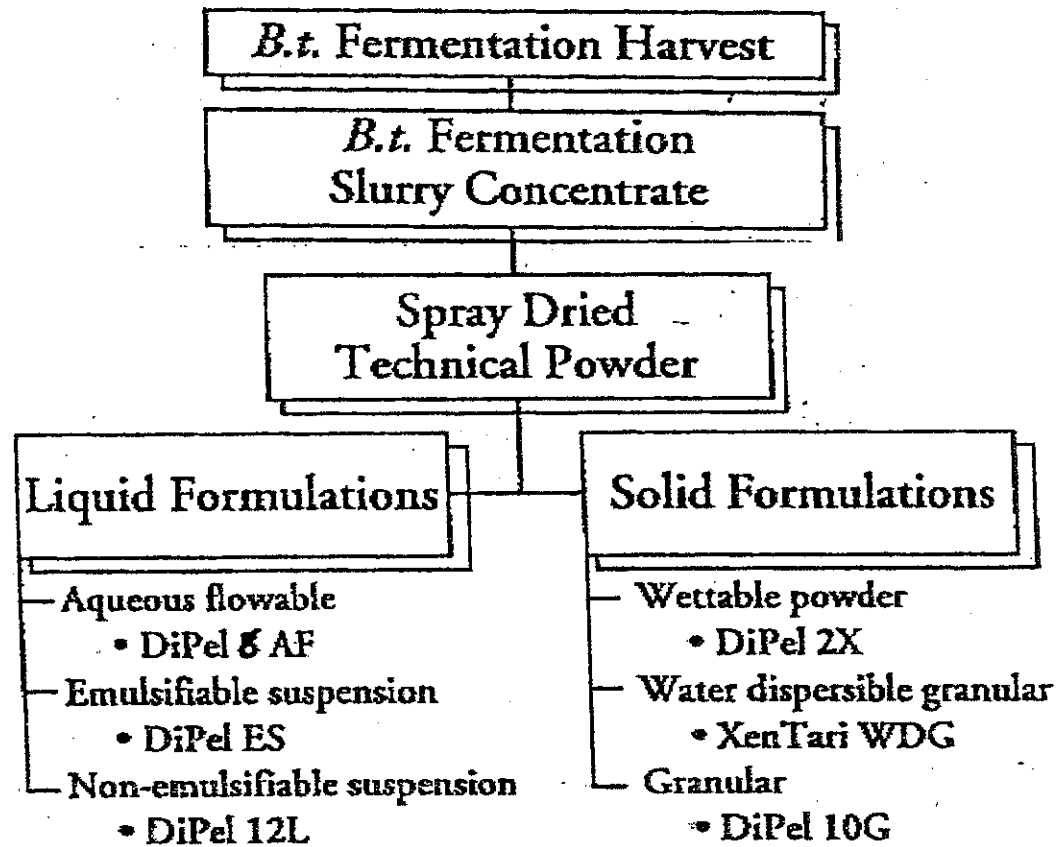
Rabbit dermal patch (dose unspecified) immediately after removal with eye (dose unspecified) caused conjunctivitis 3-8 days (3).

Genotoxicity

Salmonella typhimurium TA1538, TA1535, TA1537 with metabolic activation positive
In vitro Chinese hamster lung fibroblasts chromosomal aberrations positive
In vivo mouse micronucleus test positive intravenous administration (6)



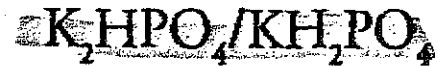
B.t. Formulation Approaches



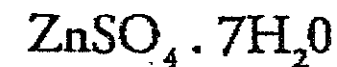
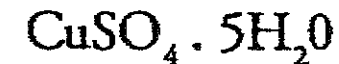
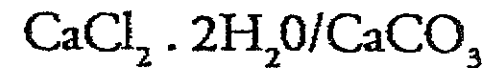
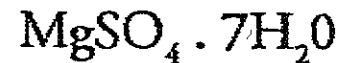
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B.t. Fermentation Media Variables

Phosphate sources:



Minerals/Vitamins:

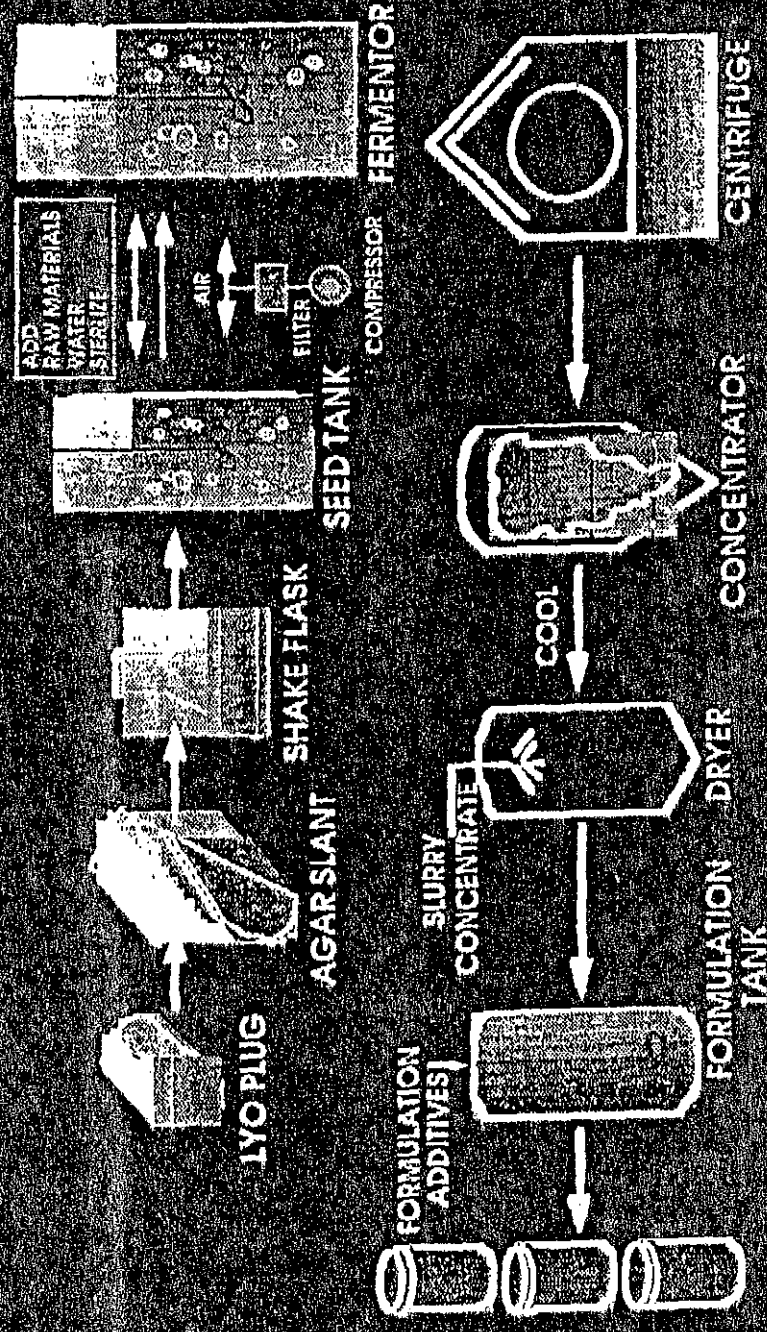


Casein

Yeast extract

03/03/2000

Dipef[®] Manufacturing Process



Dipef[®]

001082000

VINES

Crop	Disease	Rate/Acre	Use Instructions
Grape	Black Rot, Powdery Mildew, Downy Mildew	2 lbs.	Begin application at bud break with subsequent applications throughout the season depending upon disease severity. NOTE: Foliage injury may occur on copper sensitive varieties such as Concord, Delaware, Niagara, and Roselle. Either test for sensitivity or add 1-2 lbs of hydrated lime per pound of Kocide DF.
Hops	Downy Mildew	2 lbs.	Make crown treatment after pruning, but before training. After training, additional treatments are needed at about 10 day intervals. NOTE: Discontinue use 2 weeks before harvest.
Kiwi	Pseudomonas syringae, Erwinia herbicola, Pseudomonas fluorescens	6 lbs.	Apply in 200 gallons of water per acre. Make applications on a monthly basis. A maximum of 3 applications may be made.

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MISCELLANEOUS

Crop	Disease	Rate/Acre	Use Instructions
Ginseng	Alternaria Leaf and Stem Blight	2.8 lbs.	Use as a tank mix with 2 pounds Rovral® 50W in 100 gallons of water. Begin KOCIDE-Rovral applications as soon as plants have emerged in spring. Applications should be repeated every 7 days until plants become dormant in fall. If scheduled application is to be made before a rain shower, apply fungicides at least 6 hours before the rain, giving the fungicides time to dry on the plants. Use of a spreader-sticker or sticker is advised. NOTE: Alternaria Leaf and Stem Blight is most severe in humid conditions such as those found in the dense canopies of 2-, 3-, 4-year old Ginseng. It is very important that the stems be thoroughly covered with fungicide; therefore, use a spray apparatus which distributes the fungicide throughout the canopy.
Live Oak (Texas and Florida)	Ball Moss	6 lbs.	Apply in the spring when ball moss is actively growing, using 1.5 gallons of spray per foot of tree height. Make sure to wet ball moss tufts thoroughly. A second application may be required after 12 months. NOTE: Kocide DF may be injurious to ornamentals grown under Live Oaks.
Sycamore	Anthraxnose	2-3 lbs.	Apply as a full cover spray. Apply in 100 gallons of water or sufficient volume for thorough coverage. Make first application at bud crack and second application 7-10 days later at 10% leaf expansion.

ORNAMENTALS

Notice to User: Plant sensitivities to Kocide DF have been found to be acceptable in specific genera and species listed on this label. However, phytotoxicity may occur. Due to the large number of species and varieties of ornamentals and nursery plants, it is impossible to test every one for sensitivity to Kocide DF. Neither the manufacturer nor seller has determined whether or not Kocide DF can be safely used on ornamental or nursery plants not listed on this label. The user should determine if Kocide DF can be used safely prior to commercial use. In a small area, apply the recommended rates to the plants in question, i.e. bedding plants, foliage, etc., and observe for 7-10 days for symptoms of phytotoxicity prior to commercial use.

Use Kocide DF on container, bench or bed-grown ornamentals in greenhouses or outdoor nurseries, for professional use on ornamentals grown for indoor and outdoor landscaping, and for control of bacterial and fungal diseases of foliage, flowers and stems.

One-half tablespoon of Kocide DF per gallon of water is equivalent to 1 pound per 100 gallons.

Apply as a thorough coverage spray using 1 pound Kocide DF per 100 gallons of water. Begin application at first sign of disease and repeat at 7-14 day intervals as needed; use shorter interval during periods of frequent rains or when severe disease conditions persist.

Kocide DF may be used alone or in combination with other fungicides as a maintenance spray. Kocide DF may be used alone or in combination with other fungicides such as the dimethylenamides.

Crop	Diseases	Crop	Diseases
Aralia	Xanthoma & Cercospora Leaf Spot, Alternaria	India Hawthorn (greenhouse)**	Erwiniasporium Leaf Spot
Azalea*	Cercospora Leaf Spot, Botrytis Blight, Phytophthora dieback and Powdery Mildew	Ivy*	Xanthomonas Leaf Spot
Begonia	Xanthomonas Leaf Spot	Pachysandra	Verticillium Leaf Blight
Bellis (Easter Lily, Tulip, Gladiolus)	Anthraxnose, Botrytis Blight	Periwinkle	Pseudomonas Stem Blight
Carnation*	Alternaria Blight, Pseudomonas Leaf Spot and Botrytis Blight	Philodendron	Bacterial Leaf Spot
Chrysanthemum*	Septoria Leaf Spot and Botrytis Blight	Pyracantha	Flourish, Seal
Cotoneaster	Botrytis Blight	Rose*	Powdery Mildew, Black Spot
Euonymus	Botrytis Blight, Anthracnose	Yucca (Adams-Needle)	Cercospora and Septoria Leaf Spot

* Discoloration of foliage and/or blooms have been noted on some varieties. To prevent residue on commercial plants, do not spray just before selling season.

** For India Hawthorn use 2 to 3 lbs. per 100 gallons or 2 to 4 level tablespoons per gallon.

WARRANTY STATEMENT

GRIFFIN warrants that this product conforms to the chemical description on the label thereof and is reasonably fit for the purposes stated on such label only when used in accordance with directions under normal use conditions. It is impossible to eliminate all risks inherently associated with use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as weather conditions, presence of other materials, or the manner of use or application, all of which are beyond the control of GRIFFIN. In no case shall GRIFFIN be liable for consequential, special or indirect damages resulting from the use or handling of this product. All such risks shall be assumed by the Buyer. GRIFFIN MAKES NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE NOR ANY OTHER EXPRESS OR IMPLIED WARRANTY EXCEPT AS STATED ABOVE.

Kocide® is a registered trademark of Griffin Corporation.

Mendax® is a trademark of Griffin Corporation.

Flowel® is a registered trademark of Rheno-Polylene.

Copper Sun® is a registered trademark of A.I. Incorporated.

GCN 012753
CPC 013327

OCT 03 2000

CITRUS

Disease	Rate/Acre	Use Instructions
Melanose, Scab, Pink Pitting	4-12 lbs.	Apply as pre-bloom and post-bloom sprays.
Greasy Spot	2-8 lbs.	Use higher rates when conditions favor disease.
Brown Rot	4-8 lbs.	Begin application in fall and continue as needed. Apply to skirts of trees to a height of at least 4 feet. Apply also to bare ground one foot beyond skirt. Use higher rates when conditions favor disease. NOTE: In California, in areas subject to copper injury, add 1/2 to 1 pound of high quality lime per pound of Kocide DF.
Phytophthora	1 lb.	Mix with 1 gallon of water and paint trunks of trees from the soil surface to the lowest scaffold limbs. Apply in May prior to summer rains and/or in the fall prior to wrapping trees for freeze protection. Treatment serves for protection for up to one year, but does not cure existing infections.
Citrus Canker (Suppression Only)	12 lbs.	Spray flushes 7-14 days after shoots begin to grow. Young fruit may require an additional application. Number and timing of applications will be dependent upon disease pressure. Under heavy pressure, each flush of new growth should be sprayed.

FIELD CROPS

Crop	Disease	Rate/Acre	Use Instructions
Alfalfa	Carcepora & Lep- tophaerulina Leaf Spot	2 lbs.	Apply 10-14 days before each harvest or earlier if disease threatens. NOTE: Spray injury may occur with sensitive varieties such as Lanthoran.
Peas	Carcepora Leaf Spot	1.5-3 lbs.	1-2 quarts of Super Six ³ per acre may be added. Begin spraying at 30-40 days after planting or when disease symptoms first appear and repeat at 10-14 day intervals as needed. Reduce sprays to 7 day intervals during humid weather. Use higher rates when conditions favor disease.
Peas	Early & Late Blight	1-1 1/2 lbs.	Apply 1-1 1/2 lbs. at 7-10 day intervals starting when plants are 6-8 inches high until 4 weeks before harvest in locations where disease is light and up to 3-4 pounds per acre where disease is more severe.
Sugar Beet	Carcepora Leaf Spot	2-5 lbs.	Begin applications when conditions first favor disease development and repeat at 10-14 day intervals as needed. Use the higher rate when disease is severe. Addition of a suitable agricultural spray oil is recommended.
Wheat, Oats and Barley	Saptoria Leaf Blotch, Helmin- thosporium Spot Blotch	1.5-2 lbs.	Make first application at early heading and follow with second spray 10 days later. Use the higher rates when conditions favor disease.

SMALL FRUITS

Crop	Disease	Rate/Acre	Use Instructions
Blackberry (Sanlams, Logans, Boysons, Marions, Aureas, Catwoods, Chehalms and Thornless Evergreens)	Leaf and Cana Spot	4 lbs.	Apply delayed dormant spray after training in the spring. Make fall application after harvest. Add 1 quart crop oil per acre.
Cranberry	Fruit Rot	0 lbs.	Make first application in late bloom. One or two additional applications at 10-14 day intervals may be required, depending upon disease severity.
Current, Gooseberry	Leaf Spot	10 lbs.	Make three applications starting after harvest followed by application before bloom and after petal fall.
Raspberry (Except California)	Leaf and Cana Spot	4 lbs.	Apply delayed dormant spray after training in the spring. Make fall application after harvest. Add 1 quart crop oil per acre.
Strawberry	Leaf Spot & Leaf Blight	2-3 lbs.	Begin application when plants are established and continue on a weekly schedule throughout season. NOTE: Discontinue applications if signs of crop injury appear.

TREE CROPS

Crop	Disease	Rate/Acre	Use Instructions
Almond	Coryneum Blight, Blossom Brown Rot	8-12 lbs.	Dormant application: Apply before foliage buds begin to swell. Use higher rates when rainfall is heavy or disease pressure is high.
		6-8 lbs.	Early bloom (popcorn) application: Apply before full bloom. Use higher rates when rainfall is heavy and disease pressure is high. NOTE: To avoid plant injury, do not use above rate after full bloom.
	Bacterial Blast (Pseudomonas)	12-16 lbs.	Apply at dormant to early pink bud. For control in sprinkler irrigated orchards or where disease is severe, apply 1 pound per acre at 2 week post-bloom intervals or just before sprinkling. NOTE: Injury may occur from post bloom sprays, especially on Heplus varieties.
Apple (Except California)	Anthracoese, European Canker, Pseudomonas	12-16 lbs.	Apply before fall rains. Use higher rates under severe disease conditions. NOTE: Use on yellow varieties may cause discoloration. To avoid, pick before spraying.
	Fireblight	8-16 lbs.	Make application between silver-tip and green-tip. Apply as a full cover spray. NOTE: Crop injury may occur from late application; discontinue use when green-tip reaches 1/2 inch.
	Crown or Collar Rot	4 lbs.	Mix in 100 gallons of water. Apply 4 gallons of suspension as a drench on the lower trunk area of each tree. Apply either in early spring or in late fall after harvest. NOTE: Do not use if soil pH is below 5.5 since copper toxicity may result.
Apricot	Coryneum Blight (Shot Hole), Blossom Brown Rot	8-12 lbs.	Apply at popcorn to full bloom and use higher rates when conditions favor disease. NOTE: Applications applied after bloom will result in crop injury.
Avocado	Scab	8-12 lbs.	Apply when bloom buds begin to swell and continue application at monthly intervals for 5 to 6 applications. Use higher rate when conditions favor disease.
Banana	Sigatoka	2 lbs.	Apply by air in 3 gallons of water combining 0.5 gallons of agricultural oil. Apply on a 14 day schedule throughout the wet season. Apply at 21 day intervals during dry periods.
	Black Pitting	4 lbs.	Mix in 100 gallons of water (4 pounds per acre) directly to the fruit stem and include the basal portion of the leaf crown. Apply during the first and second weeks after fruit emergence.
Cacao	Black Pod	2-8.5 lbs.	Begin applications at the start of the rainy season and continue while infection conditions persist. Apply 2-4 lbs. as often as 14 to 21 days in high rainfall areas at varying rates depending on disease severity. For dry areas, where 2 to 4 applications are recommended during critical infection periods and at long intervals, use 8.5 pounds per acre, according to disease incidence and planting density.
Cherry	Dead Bud (Pseudomonas syri- ngae) and Coryneum Blight	8-12 lbs.	Make first application in fall before heavy rains and a second at late dormant. In orchards where the disease is severe, a spray should also be applied shortly after harvest. Add 1 pint of superior-type oil per 100 gals. of water as a dilute spray.
		8-12 lbs.	Apply a full cover spray at popcorn stage and a second application at full bloom.

**PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
DANGER — PELIGRO**

Corrosive. Causes irreversible eye damage. Wear goggles, face shield or safety glasses. Harmful if swallowed, absorbed through the skin or inhaled. May cause skin sensitization reactions in certain individuals. Avoid contact with skin, eyes, or clothing. Avoid breathing dust. Protective clothing, including goggles, should be worn. Wash thoroughly with soap and water after handling. Remove-contaminated clothing and wash before reuse.

ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish and aquatic organisms. Do not apply directly to water. Drift and runoff from treated areas may be hazardous to fish and aquatic organisms in adjacent aquatic sites. Do not allow rinsate from cleaning of equipment or disposed material to enter surface or ground water.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

RE-ENTRY STATEMENT

Do not enter treated areas without protective clothing until sprays have dried. Because certain states may require more restrictive re-entry intervals for various crops treated with this product, consult your State Department of Agriculture for further information.

Written or oral warnings must be given to workers who are expected to be in a treated area or in an area about to be treated with this product. (Indicate specific oral warnings which inform workers of areas or fields that may not be entered without specific protective clothing, period of time field must be vacated and appropriate actions to take in case of accidental exposure). When oral warnings are given, warnings shall be given in a language customarily understood by workers. Oral warnings must be given if there is reason to believe that written warnings cannot be understood by workers. Written warnings must include the following information: DANGER. Area treated with Kocide DF on (date of application). Do not enter without appropriate protective clothing until spray has dried. In case of accidental exposure see Statement of Practical Treatment.

STORAGE AND DISPOSAL

Store in a cool, dry place.

PESTICIDE DISPOSAL: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER DISPOSAL: Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill, or by incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

GENERAL INSTRUCTIONS

Use Kocide DF as noted below. Kocide DF is adaptable to spraying from aircraft and ground spraying equipment. Depending upon equipment used and the specific crop, the volume applied per acre will differ. Refer to recommended volume table below.

Minimum Recommended Spray Volume (Gallons) Per Acre when Applying Kocide

	Aerial	Ground
Vegetables	3	50
Field Crops	3	50
Small Fruits	5	50
Vines	5	50
Tree Crops	10	100
Citrus	10	100

(50 Florida)

SPECIMEN
OCT 03 2000

GENERAL CHEMIGATION INSTRUCTIONS

Apply this product only through one or more of the following types of systems: sprinkler including center pivot, lateral move, end tow, side (wheel) roll, traveler, big gun, solid set, or hand move irrigation system(s). Do not apply this product through any other type of irrigation system.

Crop injury or lack of effectiveness can result from nonuniform distribution of treated water.

If you have questions about calibration, you should contact State Extension Service specialists, equipment manufacturers or other experts.

Do not connect an irrigation system (including greenhouse systems) used for pesticide application to a public water system unless the pesticide label prescribed safety devices for public water systems are in place.

A person knowledgeable of the chemigation system and responsible for its operation or under the supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise.

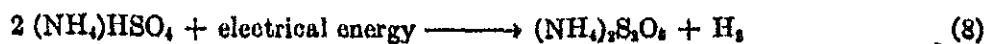
Posting of areas to be chemigated is required when 1) any part of a treated area is within 300 feet of sensitive areas such as residential areas, labor camps, businesses, day care centers, hospitals, in-patient clinic, nursing homes or any public areas such as schools, parks, playgrounds, or other public facilities not including public roads, or 2) when the chemigated area is open to the public such as golf courses or retail greenhouses.

Posting must conform to the following requirements. Treated areas shall be posted with signs at all usual points of entry and along likely routes of approach from the listed sensitive areas. When there are no usual points of entry, signs must be posted in the corners of the treated areas and in any location affording maximum visibility to sensitive areas. The printed side of the sign should face away from the treated area towards the sensitive area. The signs shall be printed in English. Signs must be posted prior to application and must remain until foliage has dried and soil surface water has disappeared. Signs may remain in place indefinitely as long as they are composed of materials to prevent deterioration and maintain legibility for the duration of the posting period.

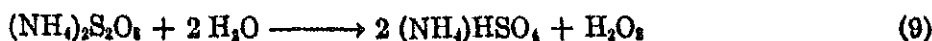
All words shall consist of letters at least 2 1/2 inches tall, and all letters and the symbol shall be a color which sharply contrasts with their immediate background. At the top of the sign shall be the words KEEP OUT, followed by an octagonal stop sign symbol at least 6 inches in diameter containing the word STOP. Below the symbol shall be the words PESTICIDES IN IRRIGATION WATER.

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2. *The Ammonium Persulfate Process.* This process consists essentially of the electrolysis of ammonium sulfate in an excess sulfuric acid solution:

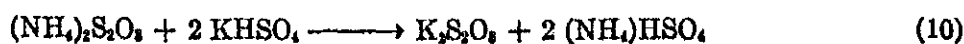


The ammonium persulfate is then concentrated and, as concentration progresses, the ammonium persulfate hydrolyzes to give hydrogen peroxide in accordance with the equation:



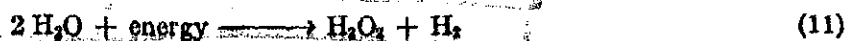
The hydrogen peroxide is recovered in the same manner as in the persulfuric acid process.

3. *The Potassium Persulfate Process.* In this process, an ammonium sulfate solution is electrolyzed in the presence of excess sulfuric acid as in the ammonium persulfate process. After electrolysis, the solution is treated with potassium hydrogen sulfate and cooled:



The potassium persulfate, being of lower solubility, crystallizes out of the solution and is separated from the mother liquor by filtration. The solid potassium persulfate is then added to a strong solution of sulfuric acid, thereby producing a slurry. When this slurry is heated by passing live steam through it, the persulfate hydrolyzes and the hydrogen peroxide formed vaporizes together with steam. The mixed vapors are then passed through rectifying columns as described for the previous processes to produce commercial strengths of hydrogen peroxide.

All three processes resolve into a combined simple reaction in which one molecule of water is oxidized at the expense of another which is reduced:



The chemicals can be recovered and recycled within the process. Side reactions also occur, such as the production of Caro's acid, H_2SO_5 , and the direct decomposition of water to hydrogen and oxygen, but these can be minimized and controlled.

The electrolysis plant consists of large stoneware baths or cells 70 cm. wide and 95 cm. deep, fitted with 6 blocks of electrodes and cooling tubes. Each block contains 14 platinum or tantalum-platinum anodes spaced 44 mm. apart along its center, and 30 graphite cathode rods spaced so that each anode is surrounded by 4 cathodes at an effective minimum distance of about 5 mm. Each block also contains 32 double-walled glass cooling tubes located outside of the cathodes. Hydrogen is swept out of the cell with a current of air, which keeps the hydrogen concentration below 5%.

Electrically, the baths are connected in series and the average voltage for 40 operating baths is about 230 v. and the current 5400 amp., the current efficiency being about 85%. The efficiency of the mercury rectifiers is about 86%, which gives a power input of 14.4 kw.-hr. a.c. per kg. of 100% hydrogen peroxide.

In Great Britain, hydrogen peroxide is manufactured mainly by the ammonium persulfate process (51). The ammonium persulfate and sulfuric acid solution is concentrated after electrolysis, and the concentrated liquor allowed to flow down a heated packed tower in which the persulfate is converted to hydrogen peroxide, which is removed as vapor. This vapor is then fractionated to yield hydrogen peroxide in strengths ranging from 27.5 to 50%.

Although very little has been published about the American practice, some of the

OCT 03 2000

ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY

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VOLUME 7
**FURNACES to
IOLITE**

THE INTERSCIENCE ENCYCLOPEDIA, INC. • NEW YORK

OCT 03 2000

Sodium Chlorate as a defoliant. Our focus on defoliants is outlined below.

- * Sodium Chlorate is a proven product with millions of acres of success stories. For comparative purposes, about 4,000,000 pounds of Sodium Chlorate are used annually versus 800,000 pounds of Def-6, which is the second most used defoliant in California.
- * Sodium Chlorate is manufactured by blending 1.8 pounds of table salt in 1 gallon of water. This blend is then electrocuted. This is the same basic method used to manufacture hydrogen peroxide (an accepted organic product).
- * Sodium Chlorate has two points of concern to the environment:
 1. Sodium Chlorate is a strong oxidizer which needs a fire retardant. Traditionally, urea has served as an accepted fire retardant. Urea is a prohibited organic substance so we would need to substitute another product as an acceptable fire retardant for both the organic industry and the required manufacturers requests. Products such as soda ash and sodium metaborate are strong fire retardants and would not cause organic industry restraints.
 2. There is a salt loading issue. At the rate of 2.5 gallons of Sodium Chlorate per acre we would be applying approximately 5 pounds of salt per acre. Some people may suggest that this type of application will build soil salt loads and cause undo harm to the soil. Research completed at a number of private organizations all over the west do not agree with this position. Studies completed at UC Davis in the 1960's concur with these findings. The 5 pounds of sodium per acre in this application is an insignificant annual application. So the position of increasing salt loads are completely unfounded and literally misunderstood.
- * Reality is as follows: Sodium is an element that is all around us! Sodium is everywhere! Any application of any product that is made to the soil contains Sodium! This includes water, manure and soil amendments.

Examples: Compost: 10 to 30 pounds per ton (applied 4 to 10 tons/AC).
Dairy manure: 20 to 35 pounds per ton (applied rates 3 to 6 tons/AC).
Humic acid: 1 to 2% by volume.
Bonemeal: 1 to 2% @ 1500#/AC = 15#/AC.

- * The point is that sodium is a part of the whole of our everyday environment. The position of salt loading is a very weak argument, or must we remove compost, manure, humic acid, bonemeal and all other products used on the farm if there is a harmful effect in sodium.

OCT 03 2000

GROWER/MILL REQUIREMENTS SUPPORT SODIUM CHLORATE AS AN APPROVED/RESTRICTED ORGANIC COTTON DEFOLIANT

Background on organic cotton production achievements.

- * The organic cotton industry, over the past 12 years, has developed a production program which has enabled the industry to produce respectable yields. This program falls legally within the organic production boundaries.
- * Organic cotton growers have developed production programs that eliminate toxic, synthetic pesticides such as insecticides, herbicides and fungicides.
- * The organic industry has implemented Integrated Pest Management (IPM) strategies, i.e. releasing beneficial insects that control pest insects.
- * Further IPM development includes the use of increased cultivation and hand/hoed weeding crews, eliminating the need for herbicides that contaminate fresh water supplies all over the USA.
- * Fertility of organic cotton is achieved through crop rotation, cover crops, manuring programs and in some areas supplemental applications of chilean nitrate are used when the plants are clearly deficient in nitrogen. (Note: Chilean nitrate is only used when and where it is absolutely needed and always below the "20% rule".)

Defoliation. We are on track with production technology until it comes to defoliation.

Defoliation is a required event in all (be it organic or conventional) cotton production to consistently achieve lint quality that all mills demand. Without defoliation, the organic cotton industry is crippled with regard to market expansion and acreage conversion from conventional production to organic production in many high quality cotton production regions of the western states.

Cotton, being a deciduous plant, loses its leaves after the first hard winter frost. Just like other perennial plants, cotton will cycle with the winter months and "regrow" leaves in the spring if permitted.

In many parts of the USA, the organic cotton growers simply wait until the first hard frost, then once the cotton has defoliated naturally, the fields are picked. However, here in the west (California, Arizona, and parts of Texas) we do not experience hard frosts until late in the year, so growers are forced to defoliate. Why defoliate? California and Arizona cannot wait until the first hard frost because of plowdown requirements mandated by the government.

Plowdown dates are specific dates that growers are required to have all of their cotton, be it organic or conventional cotton fields, destroyed or "plowed under" or the



COTTON DEFOLIANT CONCENTRATE

ACTIVE INGREDIENT BY WT.
Sodium Chlorate 18%
INERT INGREDIENTS 82%
Total 100%

CONTAINS UREA AS A FIRE RETARDANT

KEEP OUT OF REACH OF CHILDREN
CAUTION
FOR AGRICULTURAL USE ONLY OR FOR SALE TO, USE
AND STORAGE BY SERVICE PERSONS ONLY. DO NOT
STORE IN AREAS ACCESSIBLE TO CHILDREN.
SEE SIDE PANEL FOR ADDITIONAL
PRECAUTIONARY STATEMENTS

STATEMENT OF PRACTICAL TREATMENT
If Swallower: Send for physician, induce vomiting immediately by
giving 2 glasses of water and sticking finger down throat. Do not
give anything by mouth to an unconscious person.
If On Skin: Immediately remove all contaminated clothing, includ-
ing shoes. Wash all contaminated areas, including hair, with
soap and plenty of water. Do not reuse contaminated clothing or
shoes until thoroughly cleaned.
If In Eyes: Immediately flush eyes with plenty of water for at least
15 minutes. Send for physician.
If Inhaled: Remove victim to fresh air. If not breathing, immedi-
ately give artificial respiration, preferably mouth-to-mouth, and
maintain until doctor sees victim. If breathing is difficult give oxy-
gen.

STORAGE & DISPOSAL
Do not contaminate water, food or feed by storage or disposal
STORAGE
Keep in original container.
Do not reuse empty container.
Store in cool, dry place.
Protect from excessive heat.
For help with any spill, leak, fire or exposure involving this mate-
rial, call day or night 800-424-9300.
PESTICIDE DISPOSAL
Wastes resulting from the use of this product may be disposed of
at an approved waste disposal facility.
CONTAINER DISPOSAL
Triple rinse (or equivalent). Then offer for recycling or recondi-
tioning, or puncture and dispose of in a sanitary landfill, or by other
procedures approved by State and local authorities.

PRECAUTIONARY STATEMENTS
Hazards to Human & Domestic Animals
CAUTION!
Hunted or swiftnosed May cause skin irritation. Avoid storage
near food and food products. Do not store next to strong acids or
emulsifiable concentrates of Paraquat or Malathion. Wash cloth-
ing and equipment daily after handling. All contaminated clothing
must be removed and washed thoroughly. Do not apply this prod-
uct in such a manner as to directly or through drift expose work-
ers or other persons. The area being treated must be vacated by
unprotected persons.
ENVIRONMENTAL HAZARDS
Spray drift, seepage and drainage will injure or kill all vegetation.
Do not graze treated areas or feed waste to livestock. Keep out of
lakes, ponds or streams. Do not contaminate water when dispos-
ing of equipment washwaters.

CHEMICAL PROHIBITIONS
Do not apply this product through any type of irrigation system.
DIRECTIONS FOR USE
It is a violation of Federal Law to use this product in a manner
inconsistent with its labeling.
**READ ENTIRE LABEL USE STRICTLY IN ACCORDANCE
WITH PRECAUTIONARY STATEMENTS AND DIRECTIONS.**

REENTRY STATEMENTS
Do not enter treated areas without protective clothing until sprays
have dried.
Because certain states may require more restrictive standards for
various crops treated with this product, consult your State Depart-
ment of Agriculture for further information.
Written or oral warnings must be given to workers who are
expected to be in a treated area or in an area about to be treated
with this product. Advise workers to stay out of field during appli-
cation and until sprays have dried. Regular long-sleeved work
clothing should be worn when working in treated fields. When
oral warnings are given, warning shall be given in a language
customarily understood by workers. Oral warnings must be given
if there is reason to believe that written warnings cannot be under-
stood by workers. Written warnings must include the following
information.
CAUTION-Area treated with First Choice Cotton Defoliant Con-
centrate on (Date) . Do not enter without appropriate pro-
tective clothing until sprays have dried. Follow first aid treat-
ment instructions shown on this product label in case of accidental
exposure.

GENERAL USE DIRECTIONS
COTTON: Defoliation--Apply 2 to 3 weeks prior in anticipated
picking date. Do not treat later than 7 to 10 days prior to harvest.
Thorough coverage of the plant is essential. Nozzles should pro-
duce large droplets. Satisfactory defoliation is usually secured
with one application. However, dense or lodged cotton may need
more than one application. Satisfactory defoliation may not be
obtained if cotton is under moisture stress or if plant growth is
retarded by cold weather.

AIRPLANE APPLICATION: Use 1 1/2-2 1/2 gals. per acre in suffi-
cient water to make 4-10 gals. total solution per acre. Use the
lower rate when plants and weather conditions are ideal for de-
foliation. Swath width should not exceed wing spread and nozzles
should produce large droplets. Altitude and speed of aircraft
should be regulated to give good spray coverage. Do not apply
during periods of excess wind so spray may drift and cause injury
to other crops. Do not apply during very high temperatures to
avoid rapid evaporation.

GROUND APPLICATION: Use 1 1/2 to 2 1/2 gals. per acre in suffi-
cient water to make 20 to 30 gals. total solution per acre. If 6
nozzles per row are necessary to obtain good coverage.

Bottom Application: In tall rank cotton, defoliation of the lower
leaves prior to regular defoliation assists in speeding up the
maturity of bolls of lower portions of the plants as well as reduc-
ing boll rot by permitting more air and sunlight to penetrate into
the lower parts of the plant. Spray the lower 1/3 to 1/2 of the plants
only, using a 4 to 6 quarts in 25 to 30 gallons of water per acre
with flat fan or nozzles when the bolls are mature. Spraying
should be done during periods when drift is at a minimum. Appli-
cation should be made during early morning or late evening
hours to avoid rapid evaporation. Application should be made 2
to 3 weeks prior to anticipated picking date.

LIMITATIONS: Preharvest defoliation and cessation. Do not
spray treated areas or feed gin waste to livestock. Do not apply
within 7 days of harvest.

CHILI PEPPERS: (Processing only). Use 2 to 5 gals. in 5 to 15
gals of water by air. Use 20 to 40 gals of water by ground.

**DO NOT APPLY WITHIN 10 DAYS OF HARVEST. CONSULT
YOUR PROCESSOR PRIOR TO APPLICATION.**

MILK: As a harvest aid to reduce excess moisture on milk use 2
to 2 1/2 gals. per acre in 5 to 10 gals. of water by air application. Do
not use plant materials as food for meat animals within 14 days
after harvest.

DO NOT APPLY WITHIN 10 DAYS OF HARVEST.

NOTICE OF WARRANTY

SELLER MAKES NO WARRANTY OF MERCHANTABILITY,
FITNESS FOR ANY PURPOSE, OR OTHERWISE, EX-
PRESSED OR IMPLIED, concerning this product or the uses
which extend beyond the use of the product under normal
conditions in accord with the statements made on this label.

OCT 03 2000

WESTERN FARM SERVICE, INC

P.O. BOX 1163

Fresno, CA. 93715

EPA REG. NO. 11656-90-2A

EPA EST. NO. 11656-CA-28

NET WEIGHT _____ GALLONS

provided by cooling coils, or by a rectangular steel section extending from side to side of the cell as shown in Figure 1. The cooling surfaces and the steel body provide additional cathode surface, part of which is too far from the anodes to carry much current. In the U.S., graphite anodes are employed. These are held in place at the bottom by resting in a "V" notch or by spacers of insulating material, which keep them from contact with the cathode. At the top of the cell they may be brought through the steel cell cover with porcelain inserts, or the cell top may be of insulating material.

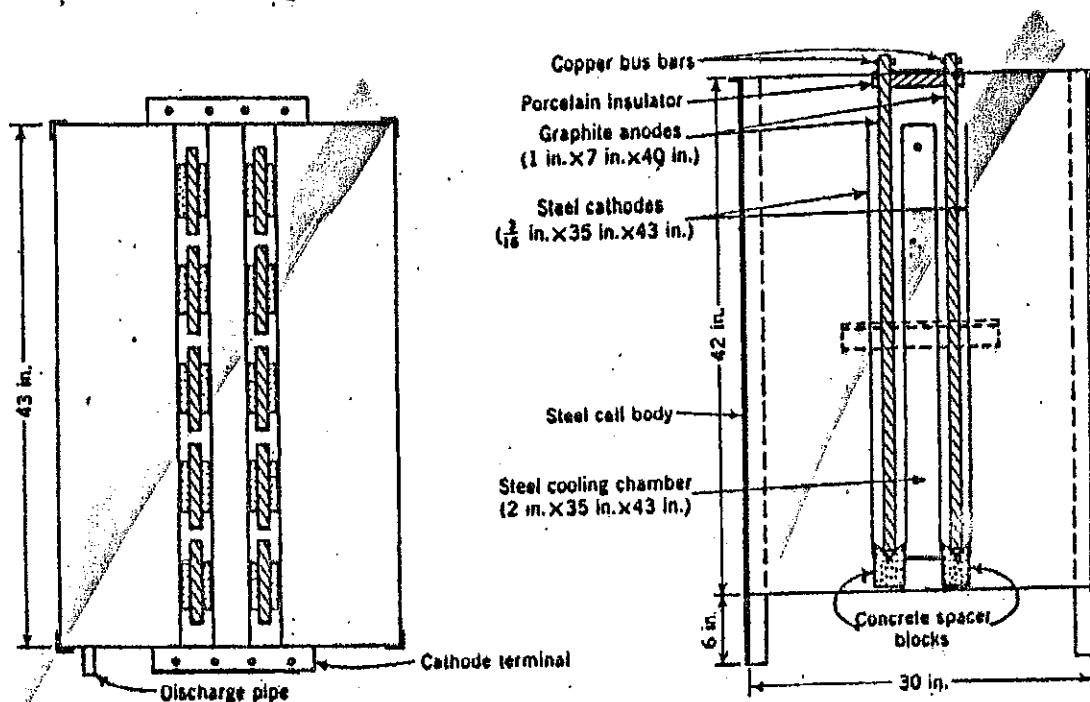
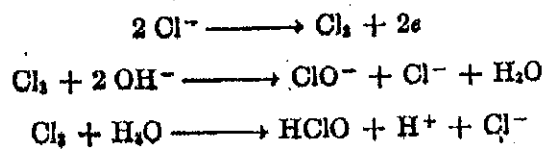


Fig. 1. Cross section of a Cardox chlorate cell (5).

A number of reactions take place at the anode (3,7). Chlorine is liberated and reacts with the hydroxide ion to produce hypochlorite and chloride ions; and with water to form hypochlorous and hydrochloric acid:



By maintaining the electrolyte at pH 6.2-7, favorable conditions for the reaction between hypochlorous acid and hypochlorite ions can be maintained, so that chlorate is formed. This is a slow reaction, and takes place in the body of the cell rather than at or near the anodes. Consequently, in chlorate-cell installations, storage space must be provided in which this reaction can proceed. This may be an integral part of the cell, as in that shown in Figure 1; such cells may be operated batchwise. In continuous-flow installations, the holding time may be provided in a separate tank through which the cell effluent circulates before returning to the cell.

The equations for the electrolyses of sodium chloride, and for the formation of hypochlorous acid and hypochlorite ion from the evolved chlorine, may be combined with the equation for the hypochlorous acid-hypochlorite ion reaction to form chlorate, giving the overall equation:



OCT 03 2000

pure tech Sodium Chlorate is available in drum form.
from many suppliers.

We'd add our own fire retardant. No Urea would be used
as a fire retardant (Using a brine derived Soda Ash.)

ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY

OCT 03 2000

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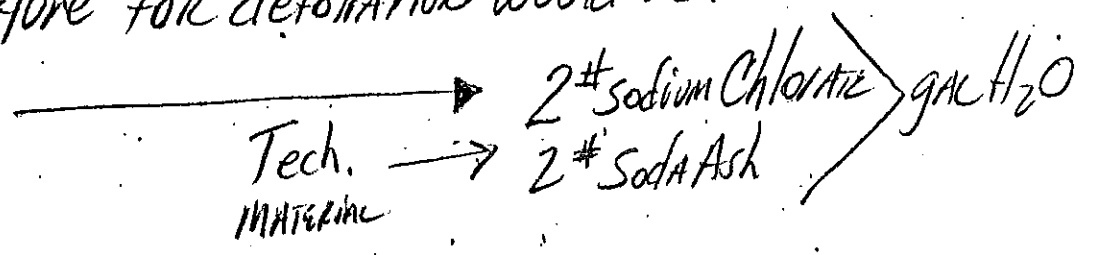
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VOLUME 3
CARBON (contd.) to
CINCHOPHEN

Mixture for defoliation would be: ✓

Preferred

2 1/2 gal
finished product / ac.
recommendation



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We CAN ALSO MAKE an impure version of Sodium Chlorate
by mixing MURATE of Potash and Hydrated Lime. This would
not be NEARLY AS efficient and would require MORE
product / ac