

Storage Limitation Statements: Temperature--Herbicides¹

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This guide provides general temperature effects on storage properties of agricultural herbicides. A table is included that lists many of the common agricultural herbicides registered for use in Florida, with storage limitations statements.

Introduction

The effectiveness and usability of many pesticides is influenced by the temperature at which they were held in storage. Most labels of liquid pesticides that contain specific information on adequate storage temperatures for their products will generally state a temperature in the 40 - 100°F range. For most of Florida, freezing is not a normal concern with pesticide storage, but extreme heat is a factor for the entire state.

Freezing temperatures can render a liquid-formulated pesticide useless by causing the active ingredients to separate from its solvents, emulsifiers, and other inert ingredients. The result may be either crystallization or coagulation of the formulation. Some products may be thawed and reused after adequate agitation; their labels will specifically state if this is the case. Because of the

ingredients in the formulation, the freezing point of many products may be lower than 32°F.

Heat is the major concern in Florida regarding pesticide storage problems. Heat can cause some pesticides to volatilize and drift from their containers, especially if containers are not adequately sealed. Flammability is a problem with some pesticides in the presence of heat and/or open flame. For more on this topic, see EDIS Publication PI-97, *Pesticide Labeling: Physical or Chemical Hazards* (<http://edis.ifas.ufl.edu/PI134>).

Containers may be damaged by either temperature extreme. The integrity of the container may be destroyed by freezing temperatures that cause glass, metal, and plastic materials to break. Alternatively, high temperatures can cause plastic containers to melt and glass to explode. The liquid pesticide contents in metal drums can cause expansion and eventual rupturing (Figure 1).

Generally, dry pesticide formulations are not adversely affected by temperature extremes. Their effectiveness is most often reduced by the presence of moisture in storage. These products have a high

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The use of trade names in this publication is solely for the purpose of providing specific information. UF/IFAS does not guarantee or warranty the products named, and references to them in this publication does not signify our approval to the exclusion of other products of suitable composition. Use herbicides safely. Read and follow directions on the manufacturer's label.

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Figure 1. Pesticide drum bulging from extreme heat.

affinity for water and once absorbed, may solidify into hard masses (tombstone formation). The packaging that surrounds dry products formulated as water-soluble packets can become brittle after taking on moisture; and if freezing occurs, they can break when handled.

To learn of storage temperature limitations for individual products, consult the “Storage and Disposal” section of the pesticides label (e.g., Figure 2). Many products will have specific temperature limitations mentioned in this section; others may be more general. If you have questions regarding these limitations, consult the products manufacturer.

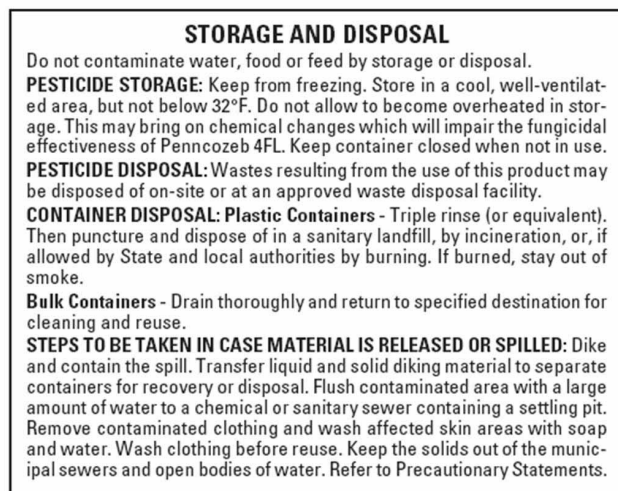


Figure 2. The Storage and Disposal section of the label often contains specific temperature information.

General information on storage and disposal language that is found on pesticide labels is discussed in UF/IFAS EDIS document PI-106, *Pesticide Labeling: Storage and Disposal* (<http://edis.ifas.ufl.edu/PI143>).

Table 1 provides a listing of many commonly-used agricultural herbicides registered for use in Florida. They are listed alphabetically by active ingredient common name (center column) with their trade names and any storage limitation statements that may be listed in their Storage and Disposal directions. Not every herbicide common active ingredient and/or their associated trade products list storage limitations within their storage statements.

Additional Information

Fishel, F.M. 2009. Pesticide Labeling: Physical or Chemical Hazards. EDIS Publication PI-97. <http://edis.ifas.ufl.edu/PI134>. Department of Agronomy, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL.

Fishel, F.M. 2009. Pesticide Labeling: Storage and Disposal. EDIS Publication PI-106. <http://edis.ifas.ufl.edu/PI143>. Department of Agronomy, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL.

Table 1. Storage precaution statements for commonly-used agricultural herbicides.

Trade name*	Common name	Label statements
Hardball® Helena 2010® Unison® Weedar® Weedone 650®	2,4-D	Do not store below temperature of 0F. If frozen, warm to 40F and re-dissolve before using by rolling or shaking container. Store at temperature above 32F. If allowed to freeze, warm to at least 40F and remix before using. Freezing does not alter this product. Do not store near heat or open flame.
2,4-DB 175® 2,4-DB 200® Butoxone® Butyrac®	2,4-DB	Store at temperatures above 32F. If product is allowed to freeze, warm to 50F and agitate thoroughly before using. No storage limitations specified.
Ultra Blazer®	Acifluorfen	Do not store below 32F.
Evik®	Ametryn	Store in a cool, dry place.
Milestone®	Aminopyralid	If this product is exposed to subfreezing temperatures, the active ingredient may crystallize and settle out of solutions. Under these conditions the product should be warmed to at least 40F and agitated well to dissolve any crystallized active ingredient prior to use.
Asulam 3.3® Asulam Herbicide® Asulox®	Asulam	Store at temperatures greater than 20F.
Aatrex Nine-0® Atrazine 90DF® Atrazine 4L® Agri-Star® Atrazine 4F® Atrazine 90WDG®	Atrazine	Store in a dry place. Containers must be stored in a cool, dry, well-ventilated area. Do not store near heat or open flame. Store in cool, dry place.
Balan DF®	Benefin	Do not store in direct sunlight. If stored above 120F, Balan DF could lose some of its dispersing properties, resulting in difficult application, poor weed control, or crop injury.
Londax®	Bensulfuron-methyl	Store in a cool, dry place.
Basagran®	Bentazon	Do not store at less than 32F and do not allow product to freeze.
Hyvar®	Bromacil	Store in a cool, dry place.
Buctril® Moxy 2E®	Bromoxynil	Store at temperatures above 3F. If allowed to freeze, remix before using.
Aim® Quicksilver®	Carfentrazone-ethyl	Store in a cool, dry place and avoid excess heat.
FirstRate®	Chloransulam	No storage limitations specified.
Classic®	Chlorimuron ethyl	Store in a cool, dry place.

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Corsair® Telar®	Chlorsulfuron	No storage limitations specified.
Arrow® Envoy® Section® Select® Trigger® Volunteer®	Clethodim	Store in cool, dry place.
Command®	Clomazone	Store above -4F to keep product from freezing. If frozen, thaw before use.
Lontrel® Transline®	Clopyralid	Combustible. Do not store near heat or open flame. Store above 28F or warm to 40F and agitate before use.
Clincher®	Cyhalofop	Combustible. Do not store near heat or open flame. Store in a cool place.
Dacthal®	DCPA	Store in a dry place.
Banvel®	Dicamba	Avoid cross-contamination with other pesticides.
Casoron®	Dichlobenil	Store in a dry location.
Hoelon® Illoxan®	Diclofop-methyl	Do not use or store near heat or open flame. Do not store below 20F.
Reglone® Reward® Weedtrine®	Diquat dibromide	Store at temperatures above 32F.
Dimension EC® Dimension Ultra 2SC® and 40WP®	Dithiopyr	Store this product above 32F to avoid crystallization. If crystals form or product freezes, move product to area with ambient temperature above 32F and shake well until crystals have dissolved. Store this product above 32F.
Diuron 4L®, 4L® IVM®, 80®, 80 DF IVM®	Diuron	Storage should be in a cool, dry area away from any heat or ignition source. Avoid storage at high temperatures.
Reglone® Reward®	Diquat	Store at temperatures above 32F.
Accelerate® Aquathol Super K Granular® Hydrothol® Aquathol K®	Endothall	Do not store in a manner where cross-contamination with other pesticides, fertilizers, food or feed could occur. Do not store in a manner where cross-contamination with other pesticides, fertilizers, food or feed could occur. Storage at temperature below 32F may result in the product freezing or crystallizing. Should this occur, the product must be warmed to 50F or higher and thoroughly agitated.

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Trade name*	Common name	Label statements
Eptam 20-G®	EPTC	Store in a cool, dry place.
Eptam 7-E®, Eradicane 6.7-E®		Can be stored at temperatures as low as minus 50F.
Curbit® Sonalan HFP®	Ethalfuralin	Avoid freezing. Store above 40F. If frozen, poor weed control may result. Do not use or store near heat or open flame.
Sonalan 10G®		Avoid freezing - store above 40F.
Acclaim Extra®	Fenoxaprop	Do not store over 100F or below 10F.
Resource®	Flumiclorac-pentyl	Store in a cool, dry place.
Broadstar® Chateau® Payload® Sureguard® Valor®	Flumioxazin	Store in a cool, dry, secure place.
Cotoran® Flo-Met®	Fluometuron	No storage limitations specified.
Fluometuron 4L®		Store in a dry location.
Spotlight® Vista®	Fluroxypyr 1-methylheptyl ester	Store above 10F or warm and agitate before use.
Finale® Ignite® Ignite 280 SL® Rely®	Glufosinate- ammonium	Do not use or store near heat or open flame. Do not use or store near heat or open flame. Keep the container tightly closed and dry in a cool, well-ventilated place. Storage temperature should not exceed 125F. If storage temperature for bulk herbicide is below 32F, the material should not be pumped until its temperature exceeds 32F. Protect against direct sunlight.
Extra Credit 5®	Glyphosate	Store above 10F to keep product from crystallizing. Crystals will settle to the bottom. If allowed to crystallize, place in a warm room 68F for several days to redissolve and shake or roll to mix well before using.
Recoil®		Do not store near heat or open flame.
Credit Duo Extra®	Glyphosate, ammonium salt	Store above 10F to keep product from crystallizing. Crystals will settle to the bottom. If allowed to crystallize, place in a warm room 68F for several days to redissolve and shake or roll to mix well before using.

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Trade name*	Common name	Label statements
Accord Concentrate® Glypho® Rodeo®	Glyphosate, isopropylamine salt	Store above 10F to keep product from crystallizing. Crystals will settle to the bottom. If allowed to crystallize, place in a warm room 68F for several days to redissolve and roll or shake container or recirculate in mini-bulk containers to mix well before using.
Aqua Star®		Store above 10F to keep product from crystallizing. Crystals will settle to the bottom. If crystals form, allow product to warm above 50F and mix well or recirculate to redissolve.
Aquamaster®		Store above 5F to keep product from crystallizing. Crystals will settle to the bottom. If allowed to crystallize, place in a warm room 68F for several days to redissolve and roll or shake container or recirculate in mini-bulk containers to mix well before using.
Cornerstone® Cornerstone Plus®		Store above 10F to keep product from crystallizing. Crystals will settle to the bottom. If allowed to crystallize, place in a warm room 68F for several days to redissolve and shake or roll to mix well before using.
Glyfos Aquatic®		Store above 10F to keep product from crystallizing. Crystals will settle to the bottom. If allowed to crystallize, place in a warm room 68F for several days to allow crystals to redissolve, then shake well before using.
Rascal® Rascal Plus®		Store above 10F to keep product from crystallizing. Crystals will settle to the bottom. If allowed to crystallize, place in a warm room 68F for several days to redissolve and roll or shake container or recirculate in mini-bulk or bulk container to mix well before using.
Razor® Razor Pro®		Store above 10F to keep product from crystallizing. Crystals will settle to the bottom. If allowed to crystallize, place in a warm room 68F for several days to redissolve and shake, roll or agitate to mix well before using.
Sandea® Sedgehammer®		Halosulfuron
Velpar®	Hexazinone	Store in a cool, dry place.
Raptor®	Imazamox	Keep from freezing. Do not store below 32F.
Cadre® Plateau® Cadre DF®	Imazapic	Keep from freezing. Do not store below 20F. Store product in a cool, dry place. Do not store this product under wet conditions.
Arsenal® Chopper® Habitat® Polaris® Stalker®	Imazapyr	Do not store below 10F.
Scepter®	Imazaquin	Keep from freezing. Do not store below 32F.
Pursuit®	Imazethapyr	Keep from freezing. Do not store below 32F.
Gallery®	Isoxaben	Do not store in direct sunlight. Do not store at temperatures above 120F.

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Trade name*	Common name	Label statements
Cobra® Phoenix®	Lactofen	Store in a cool, dry place.
Linex® Lorox®	Linuron	Store in a cool, dry place.
Tenkoz MCPA Amine 4® Tenkoz MCPA Ester 4®	MCPA	Store in a dry location. Do not store below 40F or expose to subfreezing temperatures. Store in a dry location.
Callisto®	Mesotrione	Can be stored at temperatures as low as -20F. Keep away from heat and flame.
Me-Too-Lachlor® Paralle® Parrlay® Stalwart®	Metolachlor	No storage limitations specified. This product may be stored at temperatures down to -30F.
Sencor 4F® Sencor 75® Sencor DF®	Metribuzin	Store in a cool, dry place.
Ally XP® Escort XP® Metsulfuron 60EG AG® Metsulfuron 60EG IVM® Purestand®	Metsulfuron-methyl	Store in a cool, dry place.
Drexel MSMA-6 Plus® Prokoz Turf Max MSMA 6+® Prokoz Turf Max MSMA 6.6®	Monosodium acid methanearsonate (MSMA)	Storage should be in a cool, dry area away from any heat or ignition source. High heat may form volatile arsenic compounds.
Devrinol 10-G® Devrinol 2-G Ornamental® Devrinol 50-DF® Devrinol 50-DF Ornamental® Devrinol 2-EC®	Napropamide	Store in a cool dry place. Store in a cool dry place. Do not store below 20F.
Alanap®	Naptalam	Normal storage temperature should be between 60F and 80F. This product should not be stored below 60F, or it may crystallize or precipitate. The crystallized product may be redissolved by gently warming to 95F. ALWAYS ROLL, SHAKE, OR STIR PRODUCT WELL BEFORE USE.
Accent®	Nicosulfuron	Store in a cool, dry place.
Solicam®	Norflurazon	No storage limitations specified.
Oryzalin® Surflan®	Oryzalin	No storage limitations specified.
Ronstar®	Oxadiazon	No storage limitations specified.

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Trade name*	Common name	Label statements
Galigan 2E® Goal 2XL® GoalTender® OxiFlo 2EC®	Oxyfluorfen	Keep from freezing. Store above 32F.
Firestorm® Gramoxone Inteon® Gramoxone Super Tres®	Paraquat dichloride	Store at temperatures above 32F.
Acumen® Helena Pendimethalin® Pendant® Pendimax® Pendulum 3.3® Prowl 3.3 EC® Stealth® Pendulum AquaCap® Pendulum 2G® Pendulum WDG® Prowl H2O®	Pendimethalin	Do not store below 40F. Extended storage at temperatures below 40F can result in the formation of crystals on the bottom of the container. If crystallization does occur, store the container on its side at room temperature (70F) and rock occasionally until crystals re-dissolve. Do not store below 15F. Extended storage at temperatures below 15F can result in the formation of crystals on the bottom of the container. If crystallization does occur, store the container on its side at room temperature (70F) and rock occasionally until crystals re-dissolve. Do not store above 120F. Store in a cool, dry place. Prowl H2O herbicide freezes around 15F and is stable under conditions of freezing and thawing. Product that has been frozen should be thawed and recirculated prior to use.
Spin-Aid®	Phenmedipham	Store in a cool, dry place. Do not use or store near heat or open flame.
Barricade® Endurance® Quali-Pro Prodiamine®	Prodiamine	No storage limitations specified.
Pramitol 25E® Pramitol 4SC® Sonora 4SC®	Prometon	Store at temperatures above 32F.
Caparol 4L® Prometryne 4L® (Agrilliance)	Prometryne	Store in a dry place.
Prometryne 4L® (UAP-Loveland)		Store in a cool, dry place.
Kerb®	Pronamide	Store in a cool, dry place but not below 32F.
Stam 4E® Stam 4SC® Stam M4® Stam 80 EDF® Super Wham!®	Propanil	Ground all metal containers when transferring product. Protect from freezing. If stored below 32F and crystals form, warm to 72F for 24 hours, periodically shaking or rolling container to reconstitute. Do not use, pour, spill, or store near heat or open flame. Store at temperature above 32F. If product is allowed to freeze, warm to 50F and agitate before using.

Table 1. Storage precaution statements for commonly-used agricultural herbicides.

Trade name*	Common name	Label statements
Edict® ET®	Pyraflufen	Store in a cool place.
Staple LX®	Pyrithiobac	Store in a cool, dry place.
Drive®	Quinclorac	Do not store box under dampness or high humidity.
Gowan Targa®	Quizalofop-p-ethyl	Store in a cool, dry place.
Matrix®	Rimsulfuron	Store in a cool, dry place.
Poast® Poast Plus® Sethoxydim G-Pro®	Sethoxydim	Do not store below 32F or above 100F. Store in a dry place away from heat or open flame.
Rezult G®		Do not allow this product to freeze.
Sentry Simazine 90 DF® Agrisolutions Simazine 4L® Princep Caliber 90® Sim-Trol 90DF® Drexel Simazine 4L® Drexel Simazine 90DF® Clean Crop Simazine 4L® Clean Crop Simazine 90 WDG® Agrisolutions Simazine 90 DF® Sim-Trol 4L®	Simazine	Store in a dry place. Store in a cool, dry area away from any heat or ignition source. Store in a cool, dry place.
Dual Magnum® Dual II Magnum®	S-metolachlor	Product may be stored at temperatures down to -30F.
Dual II G Magnum®		Store in a dry place.
Ultra Blazer®	Sodium salt of acifluorfen	Do not store below 32F.
Basagran® Basagran T/O® Rezult B®	Sodium salt of bentazon	Do not store at less than 32F and do not allow product to freeze. Do not allow this product to freeze.
Oust XP®	Sulfometuron methyl	Store in a cool, dry place.
Outrider®	Sulfosulfuron	Store under cool, dry conditions (below 120F). Do not store under moist conditions.
Sinbar®	Terbacil	Store in a cool, dry place.
Mandate®	Thiazopyr	Store this product under dry conditions (between 14F and 104F). If crystals develop, place in a warm area (40F) until crystals redissolve.
Harmony GT XP®	Thifensulfuron-methyl	Store in a cool, dry place.
Bolero®	Thiobencarb	Store in cool, dry place. Protect from excessive heat.
Express XP®	Tribenuron methyl	Store in a cool, dry place.

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Trade name*	Common name	Label statements
Forestry Garlon® Garlon 3A® Tahoe® Turflon II® Grandstand®	Triclopyr	Store above 28F or agitate before use. Store above 28F or agitate before use. Do not store near heat or open flame.
Monument®	Trifloxysulfuron-sodium	Store in a cool, dry place.
Treflan TR-10® Trifluralin 10G® Trust 10G® Treflan 4EC® Treflan 4L® Treflan HFP® Trifluralin 4EC ® (several manufacturers) Trifluralin HF® Combelt Trifluralin® Royster Clark Trifluralin HFP4® Trilin® Trust Herbicide®	Trifluralin	This product may be stored in unheated warehouses. Avoid freezing. Store above 40F. If frozen, poor weed control may result. Do not store near heat or flame.
*Does not include pre-packaged herbicide mixtures.		