

# **Herbicide Reference Guide For Landowners**

The purpose of this guide is to provide information helpful in deciding which herbicide may be most appropriate for a small acreage landowner. There is no intended endorsement of the products listed, nor is discrimination intended towards any product that may have been omitted. This guide is not intended to substitute for a product label. **Always read the label and keep in mind “the label is the law.”** Colorado now requires a permit called the National Pollutant Discharge Elimination System (NPDES) through the Clean Water Act for applications in or near water. Check with Colorado Department of Public Health and Environment (CDPHE ) or the Weed District before making any applications in or near water to insure compliance. This book references instances where aquatic herbicides are recommended, be sure of compliance with NPDES before proceeding with these applications. The user of any pesticide is liable for all aspects of handling the product, including but not limited to mixing, loading, application, spill control and disposal of pesticides or containers.

It is a violation of federal law to use any pesticide in a manner inconsistent with its labeling, with the following four exemptions:

- Application at a rate or frequency less than specified on the label.
- Application on a target species not specified on the label as long as application is to the site or use specified on the label, unless the label specifically prohibits use on that specific pest.
- Employing any method of application not prohibited on the label.
- Mixing with a fertilizer, as long as such a mixture is not prohibited on the labeling.

## **Acronyms and Definitions for Herbicide Reference**

**Surfactants** - Surfactants are additives to a post emergent herbicide spray solution that enhance activity and effectiveness of the herbicide. Surfactants increase spray coverage and penetration on leaf surfaces, and reduce evaporation rate, thereby increasing the amount of an herbicide that translocates into a target plant.

A common question is whether a detergent soap will suffice as a surfactant or not. The best answer is to use the recommended surfactant designed to enhance the activity of a specific herbicide. When a user is investing time and money into a weed management project, why jeopardize success over such a minor cost.

Surfactants recommended for the herbicides listed in this guide:

- **COC** - Crop oil concentrate is a petroleum oil based product, typically applied at a rate of 1 quart/acre, recommended for use with imazapyr and triclopyr on cut-stump treatments.
- **MSO** - Methylated seed oil is a plant oil derivative, typically applied at a rate of 1 quart/acre, for use with imazapic and quinclorac. Often used with other herbicides when applied over weed species with very waxy or hairy leaves such as common mullein or Dalmatian toadflax.
- **NIS** - Nonionic surfactant is an organic compound usually mixed in at 0.25 – 0.50 % volume per volume ratio for example .25% v/v = 1oz per 3 gal, for use with all other herbicides listed in this guide. This surfactant is absolutely essential for chlorsulfuron, metsulfuron methyl, and rimsulfuron to be effective.

**GUP** – General Use Pesticide. Are products which are available to the general public. **All herbicides listed in this guide are general use unless otherwise specified.**

**MSDS** – Material Safety Data Sheet. A technical bulletin that supplements information found on the product label. This bulletin provides detailed descriptions of a product’s physical properties and toxicity, and provides users and emergency personnel with the proper procedures for handling and working with that substance.

**Pesticide Label** – A legal document located on the pesticide container that provides information concerning the safe and effective use of the pesticide. It is a violation of federal pesticide laws to use any pesticide in a manner inconsistent with its labeling.

**PPE** – Personal Protective Equipment (gloves, apron, eye safety glasses, etc.). The required PPE for a specific compound is listed under the “Hazards to Humans” section on the label. Always use protective equipment specified on the label. The most serious risk of exposure from chemicals is during handling and mixing operations with the concentrated product.


**Re-entry interval** - Period of time immediately after a pesticide application when agricultural employees may not enter a pesticide treated area without protective clothing.

**RUP** – Restricted Use Pesticide. The "Restricted Use" classification restricts the purchase of a product, and its uses, to a licensed commercial, private, or public applicator.

**Landowners wishing to purchase and apply restricted use pesticides can obtain a Private Applicator’s License through the Colorado Department of Agriculture. Information is available at 303-239-4186 or at:**

**<http://www.colorado.gov/cs/Satellite/Agriculture-Main/CDAG/1178305424099>**

**Signal Words** – Indicate the toxicity and/or hazards associated with the use of the pesticide. Pre-mix herbicides will always have the highest toxicity level of the mixed active ingredients.

- **Caution** – Category 3 or 4, least toxic. 1 ounce to 1 pint swallowed lethal to an adult.
- **Warning** – Category 2. 1 –3 teaspoons swallowed lethal to an adult.
- **Danger/Poison** –  Category 1, most toxic. 1-3 drops swallowed lethal to an adult.

**Toxicity** – Measured by LD<sub>50</sub> (lethal dose, 50%), describes the dose of a pesticide that will kill ½ of a group of test animals from a single dose. A pesticide with a lower LD<sub>50</sub> is more toxic than one with a higher number because it takes less of the pesticide to kill half of the test animals.

To obtain more comprehensive information regarding Colorado and Federal pesticide laws and regulation, and an overview of the CSU Pesticide Safety Education Program, see:

[www.colostate.edu/Depts/SoilCrop/extension/CEPEP](http://www.colostate.edu/Depts/SoilCrop/extension/CEPEP)

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# Aminocyclopyrachlor

## Brand Name:

*Perspective* with Chlorsulfuron

## Other Pre-mixes:

*Streamline* with metsulfuron methyl

*Viewpoint* with metsulfuron methyl and imazapyr

Signal word (toxicity)	Rainfast period	Re-entry interval	Hay harvest (days)	Grazing interval (days)
Caution	4 hours	NA	NA	NA

### **Dry formulation for use in:**

- Non-cropland sites such as rights-of-way, industrial sites and fence rows.
- **Range & pasture label pending – current label restricts livestock grazing and haying for 1 year following application.**

### **Environmental characteristics:**

- Can be applied to water's edge, do not apply directly to water. Not for use on irrigation ditchbanks.
- Active on target plants through foliar and root uptake.
- **Applications to newly seeded grasses or under desirable trees and shrubs may cause injury.**
- The use of a nonionic surfactant, at a minimum rate of .25% volume/volume (1oz/3 gal), is essential.
- Perspective is a dry formulation that requires vigorous agitation to go into solution. For sprayer tanks that do not provide agitation it is best to fill halfway with water, create slurry in a separate container (mix enough water and granules to agitate until granules are totally dissolved) of the measured herbicide, then add to tank to ensure the product goes into solution.

### **Primary target species:**

- Perspective provides excellent control of the noxious weed species listed in this reference guide, with the exception of any grass species.
- **CSU / Larimer County Weed District field trials have shown Perspective to be the most effective treatment for control of leafy spurge and field bindweed.**

# Aminopyralid

## Brand Name:

*Milestone*

## Pre-mixes:

*Opensight* with metsulfuron methyl

*Forefront* with 2,4-D

*Capstone* with triclopyr

Signal word (toxicity)	Rainfast period	Re-entry interval	Hay harvest (days)	Grazing interval (days)
Caution	2 hours	12 hours	0	0

### **Liquid formulation, used in:**

- Range & pasture, non-cropland sites such as rights-of-way.

### **Environmental characteristics :**

- Can be applied to water's edge; do not apply directly to water.
- Active on target plants through foliar and root uptake.
- Not for use on irrigation ditchbanks.
- Caution under certain tree species. See Label.

### **Primary target species :**

- Canada thistle, biennial thistles, knapweeds, common mullein, common teasel, oxeye daisy, sunflowers, cinquefoil, absinth wormwood, hawkweeds. (Plants of composite, legume, and polygonum families).
- Not effective for controlling grass species, kochia, bindweed, leafy spurge, toadflax, houndstongue, or most mustard species.
- **Milestone is the most frequently recommended product for control of Canada thistle and biennial thistles in range and pasture.**

# Chlorsulfuron

## Brand Name:

*Telar, Glean*

## Pre-mixes:

*Cimarron X-tra* with metsulfuron methyl, **Perspective** with aminocyclopyrachlor, **Landmark** with sulfometuron methyl

Signal word (toxicity)	Rainfast period	Re-entry interval	Hay harvest (days)	Grazing interval (days)
Caution	4 hours	4 hours	0*	0*

### **Dry formulation used in:**

- Range & pasture, non-crop and industrial sites.

### **Environmental characteristics:**

- Can be applied to water's edge; not directly to water.
- Chlorsulfuron has soil residual activity and is active on weeds through foliar and root uptake.
- The use of a nonionic surfactant, at a minimum rate of .25% volume/volume (1oz/3 gal), is essential.
- Chlorsulfuron is a dry formulation that requires vigorous agitation to go into solution. For sprayer tanks that do not provide agitation it is best to fill halfway with water, create slurry in a separate container (mix enough water and granules to agitate until granules are totally dissolved) of the measured herbicide, then add to tank to ensure the product goes into solution.

### **Primary target species:**

- Mustard, biennial thistles, houndstongue, common mullein, common teasel, puncturevine (pre and post emergence), Dalmatian and yellow toadflax.
- Not effective for controlling most grass species, kochia, knapweed species, or bindweed.
- The pre-mix 'Landmark' provides excellent pre and post emergent control of cheatgrass and feral rye. Landmark does not have a range & pasture label, treated areas cannot be grazed or hayed for 1 year after application.
- **Telar, applied at 2.0 oz product/acre with MSO, provides very effective control of Dalmatian toadflax.**

\*Restriction dependant on rate of application



# Clopyralid

## Brand Name:

*Transline, Lontrel, Stinger*

## Pre-mixes:

*Curtail, Cody* with 2,4-D

*Redeem, Confront, Prescott* with triclopyr

Signal word (toxicity)	Rainfast period	Re-entry interval	Hay harvest (days)	Grazing interval (days)
Caution	2 hours	12 hours	0	0

### **Liquid formulation used in:**

- Range & pasture, forest land, and rights-of-way.
- Cropland and turf.

### **Environmental characteristics:**

- Water soluble, should not be applied near water.
- Some soil activity but not as persistent as Tordon.
- Transline can be safely applied near trees and shrubs.
- Active on target plants primarily through foliar uptake, with root uptake to a lesser degree.

### **Primary target species :**

- Canada thistle, biennial thistles, knapweeds, common teasel, oxeye daisy, sunflowers.
- Not effective for controlling grass species, kochia, bindweed, leafy spurge, toadflax, houndstongue, or most mustard species.
- **Safe to use over seedling grasses to control Canada thistle and other listed weed species on re-vegetation sites.**

# Dicamba

## Brand Name:

*Banvel, Clarity, Rifle, Sterling, Vanquish*

## Pre-mixes:

*Brash, Outlaw, Rangestar, Veteran 720, Weedmaster with 2,4-D  
Fallowmaster with glyphosate*

Signal word (toxicity)	Rainfast period	Re-entry interval	Hay harvest (days)	Grazing interval (days)
Caution	4 hours	24 hours	37-70*	0

### **Liquid formulation used in:**

- Range & pasture, crops, rights-of-way, and turf.

### **Environmental characteristics:**

- Water soluble, should not be applied near water.
- Active on target plants primarily through foliar uptake, with root uptake to a lesser degree.
- Do not apply near desirable trees and shrubs.
- Higher rates can cause injury to buffalograss.
- Dicamba is a volatile product that can damage off-target vegetation through vapor drift. Do not use when temperatures are expected to exceed 85 degrees Fahrenheit within 24 hours of application.

### **Primary target species :**

- Kochia and many other annual broadleaf species. At higher rates can be used for suppression of Canada thistle, field bindweed and biennial thistles.
- Not effective for controlling grass species.
- **Dicamba is the most frequently recommended product used to selectively control kochia in established grassland.**

\*Restriction dependant on rate of application

# Diflufenzopyr

## Brand Name:

*Overdrive, Distinct* – premixes with dicamba  
(Diflufenzopyr is not sold alone, available in a premix only)

Signal word (toxicity)	Rainfast period	Re-entry interval	Hay harvest (days)	Grazing interval (days)
Caution	4 hours	12 hours	0	0

### **Dry formulation used in:**

- Range & pasture, rights-of-way, corn and fallow

### **Environmental characteristics:**

- Primarily absorbed through foliar applications, soil uptake to a lesser degree.
- Use of surfactant recommended – nonionic or crop oil concentrate
- Diflufenzopyr is a dry formulation that requires vigorous agitation to go into solution. For sprayer tanks that do not provide agitation it is best to fill halfway with water, create slurry in a separate container (mix enough water and granules to agitate until granules are totally dissolved) of the measured herbicide, then add to tank to ensure the product goes into solution.

### **Primary target species:**

- Kochia and many other annual broadleaf species. At higher rates can be used for suppression of Canada thistle, field bindweed and biennial thistles.
- Not effective for controlling grass species.
- Overdrive is most often used in range and pasture to complement the activity of other herbicides such as aminocyclopyrachlor, clopyralid, picloram, quinclorac and triclopyr.
- **Overdrive + Paramount or Overdrive + Perspective tank mix provides very effective control of leafy spurge.**

# Fluroxypyr

## Brand Name:

*Vista, Starane*

Signal word (toxicity)	Rainfast period	Re-entry interval	Hay harvest (days)	Grazing interval (days)
Warning	1 hour	12 hours	7	0

### **Liquid formulation used in:**

- Non-cropland areas such as non-irrigation ditch banks, rights-of-way, industrial sites including grazed areas within sites, small grains, corn and fallow.

### **Environmental characteristics:**

- Active on target plants through foliar uptake, no soil residual activity.
- Not for use on irrigation ditchbanks.

### **Primary target species :**

- Kochia, prickly lettuce, puncturevine, sunflower and plants of the nightshade family.
- Not effective for controlling grass species, Canada thistle or field bindweed.
- **Safe to use over newly seeded grasses to control kochia and other listed weed species on re-vegetation sites.**

# Glyphosate

## Brand Name:

*Roundup*, current brand names too numerous to list

## Pre-mixes:

Too numerous to list.

Signal word (toxicity)	Rainfast period	Re-entry interval	Hay harvest (days)	Grazing interval (days)
Caution	1-4 hours*	4 hours	NA	NA
<b>Liquid formulation used in:</b> <ul style="list-style-type: none"><li>• Crop, non-crop, fallow.</li></ul>				
<b>Environmental characteristics</b> <ul style="list-style-type: none"><li>• <b>**Non-selective herbicide</b> (active on grasses and broadleaf plants) that controls most annuals and perennials.</li><li>• Active through foliar uptake, has no soil activity.</li><li>• Usually surfactant is part of mix. Do not need to add extra.</li><li>• Labeled for use up to water's edge. At least one formulation, Rodeo, labeled for use in and around water. An aquatic non-ionic surfactant is needed.</li></ul>				
<b>Primary target species:</b> <ul style="list-style-type: none"><li>• Effective for control of most grasses and broadleaf species.</li><li>• Selective control of winter annuals when applied at low rates in the late winter or early spring when desirable perennial grasses are dormant.</li></ul>				

\*Check product label.

\*\* Not approved for the Weed District cost-share program.

# Imazamox

## Brand Name:

*Clearcast*,

*Raptor* – for use in alfalfa, dry bean, soybeans and other legume crops

Signal word (toxicity)	Rainfast period	Re-entry interval	Hay harvest (days)	Grazing interval (days)
Caution	2 hours	4 hours	NA	NA

### **Labeled uses (sites):**

- Clearcast is labeled for control of undesirable emergent and floating aquatic vegetation in and around standing and flowing water. Applications may be made to control undesirable wetland, riparian, and terrestrial vegetation growing in and around surface water including irrigation ditchbanks, though some limitations and restrictions exist – **SEE LABEL.**

### **Environmental characteristics :**

- Can be applied in and around standing and flowing water including irrigation ditchbanks.
- Active on target plants through foliar and root uptake.
- Choose a surfactant that is approved for aquatic use when applying in or near water.
- For terrestrial uses choose a non-ionic surfactant, MSO or crop oil concentrate for best results.

### **Primary target species :**

- Cattails, purple loosestrife, ragweed species, whitetop and other mustard species.
- Perennial grasses and other desirable species such as sedges and rushes may be suppressed. Degree of injury is rate dependant.
- **Clearcast is very effective on cattails.**

# Imazapic

## Brand Name:

*Plateau, Panoramic*

## Pre-mixes:

*Journey with glyphosate*

*Oasis with 2,4-D*

Signal word (toxicity)	Rainfast period	Re-entry interval	Hay harvest (days)	Grazing interval (days)
Caution	1 hour	12 hours	7	0

### **Liquid formulation used in:**

- Range and pasture and rights-of-way.

### **Environmental characteristics :**

- Imazapic has soil residual activity, and is taken up in plants through foliage and roots.
- This product has runoff potential and should not be used on hillsides sloping toward water.
- Do not apply to water or inside irrigation ditches.
- Application timing, use rate and choice of surfactant can be critical, read the label carefully.
- **High rates can be injurious to cool season grasses such as smooth brome.**

### **Primary target species:**

- Leafy spurge, cheatgrass, mustard species, Dalmatian toadflax, field bindweed, common teasel, houndstongue, Russian knapweed, suppression of thistle species at higher rates.
- Not effective on kochia or diffuse and spotted knapweed.
- **Imazapic is the most commonly used herbicide for selective control of cheatgrass in newly seeded and established grass.**

# Imazapyr

## Brand Name:

*Arsenal, Ecomazapyr 2, Habitat, Powerline*

## Pre-mixes:

*Sahara, Topsite* with diuron.

*Chopper* – ready to use pre-mix with adjuvants for cut-stump or basal bark treatments.

*Clearstand* with metsulfuron methyl

Signal word (toxicity)	Rainfast period	Re-entry interval	Hay harvest (days)	Grazing interval (days)
Caution	1 hour	NA	NA	NA

### **Liquid formulation used in:**

- **Arsenal** – Range and pasture (spot treatments), non-crop areas such as industrial sites, and rights-of-way.
- **Habitat** – Aquatic use - for control of undesirable emergent and floating aquatic vegetation in and around standing and flowing water. Applications may be made to control undesirable wetland, riparian, and terrestrial vegetation growing in and around surface water.

### **Environmental characteristics :**

- **\*\*Non-selective herbicide** (controls grasses broadleaf plants and brush).
- Persistent in soil, breaks down rapidly in water, uptake in plants through foliage and roots.
- Arsenal can be applied up to water's edge. Habitat has an aquatic label – can be used in and around water. Not for use on irrigation ditch banks.

### **Primary target species:**

- Often used in mixes for total vegetative control (parking lots, industrial sites, etc.).
- **Imazapyr is very effective for control of tamarisk, Russian olive and other woody species by foliar application or cut-stump treatments.**



# Metsulfuron methyl

## Brand Name:

*Ally, Cimarron, Escort, Pro 60 EG, MSM 60DF*

## Pre-mixes:

*Cimarron Max* with dicamba and 2,4-D

*Cimarron X-tra* with chlorsulfuron

*Opensight* with aminopyralid

*Clearstand* with imazapyr

*Viewpoint* with aminocyclopyrachlor and imazapyr

*Streamline* with aminocyclopyrachlor

Signal word (toxicity)	Rainfast period	Re-entry interval	Hay harvest (days)	Grazing interval (days)
Caution	4 hours	4 hours	0-3*	0-3*

### **Dry formulation used in:**

- Range and pasture, rights-of-way, wheat, barley, and fallow.

### **Environmental characteristics:**

- Can be applied to water's edge; do not apply directly to water or under desirable trees and shrubs.
- The use of a nonionic surfactant, at a minimum rate of .25% vol/vol (1 oz/3 gal), is essential effectiveness.
- Metsulfuron methyl is a dry formulation that requires vigorous agitation to go into solution. For sprayer tanks that do not provide agitation it is best to fill halfway with water, create slurry in a separate container (mix enough water and granules to agitate until granules are totally dissolved) of the measured herbicide, then add to tank to ensure the product goes into solution.

### **Primary target species :**

- **Mustards such as hoary alyssum, hoary cress, perennial pepperweed, blue mustard, flixweed and tumble mustard.**
- Effective for control of houndstongue, common mullein, common teasel, some brush species and assorted annual broadleaf species.
- Not effective for controlling grass species, kochia, knapweed species or Canada thistle.

\*Restriction dependant on rate of application

## Picloram – \*Restricted Use Product

**Brand Name:**

*Tordon, Outpost*

**Pre-mixes:**

*Grazon, Pathway with 2,4-D*

Signal word (toxicity)	Rainfast period	Re-entry interval	Hay harvest (days)	Grazing interval (days)
Caution	2 hours	12 hours	14	0

**Liquid formulation used in:**

- Range and pasture, fallow cropland, and non-cropland areas.

**Environmental characteristics:**

- This product is soluble in water and persistent in soil.
- Do not apply on ditchbanks or bottoms, near water, or under desirable trees and shrubs.
- Tordon is residually active in the soil, and taken into a plant through foliar absorption and/or root uptake.

**Primary target species:**

- Field bindweed, Canada thistle, biennial thistles, knapweeds, toadflax, leafy spurge, houndstongue, woody species.
- Not effective for controlling kochia or most mustard species.
- Not effective for grass control, though will suppress certain established pasture grasses such as smooth brome.

\* Restricted Use Products for retail sale to and use only by Certified Applicators or persons under their direct supervision. See criteria in the preceding 'definitions' section page 59.

# Quinclorac

## Brand Name:

*Paramount, Facet, Drive*

Signal word (toxicity)	Rainfast period	Re-entry interval	Hay harvest (days)	Grazing interval (days)
Caution	6 hrs	12 hours	7	0

### **Dry or liquid formulation used in:**

- Range & pasture, rice, sorghum, fallow and turf.

### **Environmental characteristics:**

- Can be applied to water's edge. Do not apply directly to water or in areas where surface water is present.
- Quinclorac is active on target plants through foliar and root uptake.
- Add methylated seed oil to tank mix at rate of 1 quart/acre
- Do not apply more than 16 oz/acre per calendar year.
- Quinclorac is a dry formulation that requires vigorous agitation to go into solution. For sprayer tanks that do not provide agitation it is best to fill halfway with water, create slurry in a separate container (mix enough water and granules to agitate until granules are totally dissolved) of the measured herbicide, then add to tank to ensure the product goes into solution.

### **Primary target species:**

- Leafy spurge, field bindweed, annual grasses such as barnyardgrass, crabgrass, and green and yellow foxtail.
- **Overdrive + Paramount tankmix is one of the most effective treatments for control of leafy spurge.**

# Rimsulfuron

## Brand Name:

*Matrix, Resolve*

Signal word (toxicity)	Rainfast period	Re-entry interval	Hay harvest (days)	Grazing interval (days)
Caution	4 hours	4 hours	NA	NA

### **Dry formulation used in:**

- Agronomic crops and control of certain invasive species, such as cheatgrass and feral rye, in areas undergoing restoration or re-vegetation.
- **No range & pasture label – no livestock grazing or haying for one year following application on rangeland or pasture.**

### **Environmental characteristics:**

- Rimsulfuron is primarily active through foliar uptake, short soil residual activity for weed control.
- The use of a nonionic surfactant, at a minimum rate of .25% volume/volume (1oz/3 gal), is essential for this product to be effective.
- Rimsulfuron is a dry formulation that requires vigorous agitation to go into solution. For sprayer tanks that do not provide agitation it is best to fill halfway with water, create slurry in a separate container (mix enough water and granules to agitate until granules are totally dissolved) of the measured herbicide, then add to tank to ensure the product goes into solution.

### **Primary target species:**

- Annual grasses such as cheatgrass and feral rye, puncturevine and plants of the mustard family.
- Rimsulfuron may be injurious to certain cool season perennial grasses such as western wheatgrass.

# Triclopyr

## Brand Name:

*Element 4, Element 3A, Garlon 4, Garlon 3A, Weed B Gon, Capstone*

## Pre-mixes:

*Redeem, Prescott* with clopyralid

*Crossbow* with 2,4-D.

*Capstone* with aminopyralid

*Pathfinder II* – ready to use pre-mix with adjuvants necessary for effective cut-stump or basal bark treatments.

Many other pre-mix products are available.

Signal word (toxicity)	Re-entry interval	Hay harvest (days)	Grazing interval (days)
Caution – Danger*	12 hours	14	0

### **Liquid formulation used in:**

- Range and pasture, aquatic use (in and around water), non-cropland, rights-of-way and turf.

### **Environmental characteristics :**

- Ester formulation can be volatile, and is best used when temperature is not expected to exceed 85 degrees.
- Triclopyr has some soil activity but is primarily taken up by plants through foliage and/or vascular tissue (cut-stump or basal bark treatment).
- Restrictions near water vary with formulation – Garlon 4 – up to water's edge. Garlon 3A has an aquatic label, can be used to control target vegetation in standing water.
- Not for use on irrigation ditch banks.

### **Primary target species:**

- Used for controlling broadleaf weeds and woody vegetation. Has little or no effect on grasses.
- **Used as a cut-stump or basal bark treatment for control of Russian olives, tamarisk, and other woody species.**

\*Signal word varies with differing triclopyr formulations

## 2,4-D

### Brand Name:

*Amine 4, Formula 40, Hi-Dep, Weedar, Weedone, Hardball*, and many others too numerous to list.

### Pre-mixes:

Too numerous to list.

Signal word (toxicity)	Rainfast period	Re-entry interval	Hay harvest (days)	Grazing interval (days)
Danger – Caution*	1 hour	48 hours	30	0

### **Liquid formulation used in:**

- A wide range of applications including range and pasture, crops, and non-cropland.

### **Environmental characteristics :**

- 2,4-D is the active ingredient in many compounds, and is available in ester, amine and acid formulations.
- Ester formulations are volatile and may injure non-target plants through vapor drift. Low volatility (LV) esters are less susceptible to vapor drift, but may still volatilize at temperatures above 85 degrees. Amine formulations typically do not volatilize, and should be used during warmer weather.
- Ester formulations penetrate foliage more readily, and are usually used at lower rates than amine formulations.
- An acid formulation, brand name – Hardball, is nonvolatile and labeled for aquatic and rangeland use.
- 2,4-D has little to no soil activity, uptake in plants is through foliage.

### **Primary target species:**

- Used for control of most broadleaf weeds. Higher rates for control or suppression of perennials.
- Not effective for control of grasses, kochia or knapweed species.

\*Signal word varies with differing 2,4-D formulations

# Sprayer Calibration

It is critical to know the output of a sprayer in order to be accurate in adding an herbicide to the tank.

## Handgun

1. Measure a calibration plot that is exactly 18.5 ft X 18.5 ft (128<sup>th</sup> of an acre).
2. Spray the plot uniformly with water, keeping the sprayer pressure constant. Note the number of seconds required.
3. Spray into a bucket for the same number of seconds, again keeping the sprayer pressure constant.
4. Measure the number of ounces of water in the bucket.
5. Number of ounces of water measured from the bucket is equal to the number of gallons per acre (GPA) the sprayer is delivering.

Spray Volume (GPA)	Amount of Herbicide to Add to Each Gallon of Water in Ounces				
	Recommended Herbicide Rate/Acre (from label)				
	1 oz	4 oz	7 oz	1 Pint	1 Quart
15	.067	.268	.469	1	2
20	.05	.2	.35	0.83	1.67
30	.033	.132	.231	0.5	1
40	.025	.1	.175	0.42	0.83
50	.02	.08	.14	0.33	0.63

2 tablespoons = 6 teaspoons = 1 fluid ounce = 29.57 milliliters

8 fluid ounces = 1 cup; 2 cups = 1 pint; 2 pints = 1 quart;

4 quarts = 1 gallon; 1 gallon = 128 fluid ounces

1 ounce (dry) = 28.35 grams; 16 ounces = 1 pound

1 acre = 43,560 square feet; 1 meter = 3.281 feet

1 gallon of water = 8.3453 pounds of water

# Boom or Boomless Sprayer Calibration

## Volume method

1. On level ground, fill sprayer tank to a known level with water and drift agent (if using).
2. Turn on sprayer till all nozzles have output, shut off and refill tank to desired level.
3. Measure off  $\frac{1}{4}$  of an acre, marking the start and end with a flag.

**Width of boom  
swath in feet**

**Linear feet to  
cover  $\frac{1}{4}$  acres**

2	5445
4	2723
6	1815
8	1362
10	1090
20	545
30	363

4. Drive the measured  $\frac{1}{4}$  acre with the speed that you will be using to spray, turning on the sprayer at the starting mark and off at the ending flag.
5. Return to the level ground that you filled the sprayer at and carefully measure the amount of water it takes to refill to the known level from step 1.
6. Multiply the amount from above step by 4. This is GPA (Gallons Per Acre).

## Stationary method

1. On level ground, fill sprayer tank with water and drift agent (if using).
2. Turn on sprayer and measure spray pattern width in feet.
3. Collect liquid from each nozzle for 1 minute. Measure in ounces.
4. Divide ounces by 128 to determine GPM (Gallons Per Minute).
5. Determine speed (MPH) you will be using during spraying.
6. With the below formula calculate GPA (Gallons Per Acre).

$$\text{GPA} = \frac{\text{GPM} \times 495}{\text{MPH} \times \text{swath width (feet)}}$$



## References

### **More extensive information can be obtained from:**

#### *Plant identification and control:*

- Larimer County Weed District - [www.larimer.org/weeds](http://www.larimer.org/weeds)
- Colorado Dept. of Agriculture Noxious Weed Program - [www.colorado.gov/ag/weeds](http://www.colorado.gov/ag/weeds)
- Colorado Weed Management Association - [www.cwma.org](http://www.cwma.org)
- Colorado State University Extension small acreage management- [www.ext.colostate.edu/sam](http://www.ext.colostate.edu/sam)
- Plant identification
  - [www.easterncoloradowildflower](http://www.easterncoloradowildflower)
  - **Weeds of the West**
  - **Aquatic and Riparian Weeds of the West**
  - **Thistles of Colorado**
- Poisonous plants
  - **'A Guide to Plant Poisoning of Animals in North America'**
  - Dr. Knight's website  
[http://southcampus.colostate.edu/poisonous\\_plants](http://southcampus.colostate.edu/poisonous_plants)
  - or e-mail Dr. Knight at [Anthony.Knight@colostate.edu](mailto:Anthony.Knight@colostate.edu)
- Seeding and soil recommendations
  - NRCS office – 970-295-5655

#### *Noxious weed awareness organizations in Larimer County:*

- North Fork Weed Coop - [www.northforkweedcoop.org/](http://www.northforkweedcoop.org/)
- Estes Park Land Stewardship Association - [www.elsainfo.org](http://www.elsainfo.org)

#### *Weed law:*

- The Colorado State Noxious Weed Act - [www.colorado.gov/ag/weeds](http://www.colorado.gov/ag/weeds)
- Applicator education and continuing education information - [www.colostate.edu/Depts/SoilCrop/extension/CEPEP](http://www.colostate.edu/Depts/SoilCrop/extension/CEPEP)

#### *Pesticide labels and safety information:*

- Information on pesticide toxicity, environmental fate, or mode of action 1-800-858-7378
- Rocky Mountain Poison and Drug Center 1-800-222-1222
- Chemtrec 1-800-424-9300 (Use for chemical spills.)
- [www.cdms.net](http://www.cdms.net) (Use for complete labels and MSDS)

## Glossary

**Alien plant** – A plant species not native to the United States.

**Annuals** – A plant which completes its life cycle in one season, spring through fall.

**Biennials** – Plants that require 2 seasons to complete life cycle.

They typically germinate in late summer, over-winter, flower, and set seed by mid-summer of the following year.

**Bolt** – The initial stem arising from rosette leaves as a plant matures. The term ‘bolting’ is often used to describe the growth stage between rosette and flowering.

**Bracts** – A small leaf-like structure below the flower.

**Calibration** - To check, adjust, or determine spray equipment output. (ex. Gallons Per Acre)

**Containment** – Defined in the Colorado Noxious Weed Act, maintaining an intensively managed buffer zone that separates infested regions, where suppression activities prevail, from largely un-infested regions where eradication activities prevail.

**Eradication** - Defined in the Colorado Noxious Weed Act, reducing the reproductive success of a noxious weed species or specified noxious weed population in largely un-infested regions to zero and permanent elimination of the species or population within a specified period of time. Once all specified weed populations are eliminated or prevented from reproducing, intensive efforts continue until the existing seed bank is exhausted.

**Forb** - A broad-leaved herb other than a grass.

**Inflorescence** – The flowering part of the plant.

**Invasive plants** – Plant species that are competitive enough to become dominant in a particular area.

**Lifecycle** – A description of a plant’s duration - annuals, biennials, perennials, simple perennials, winter annuals.

**Lobed** – To cut into shallow segments.

**Native plant** – A plant that is indigenous to Colorado.

**Noxious weed** - Defined in the Colorado Noxious Weed Act, as an alien plant that have been designated by rule as being noxious, and meets one or more of the following criteria:

- (a) Aggressively invades or is detrimental to economic crops or native plant communities;
- (b) Is poisonous to livestock;
- (c) Is a carrier of detrimental insects, diseases, or parasites;
- (d) The direct or indirect effect of the presence of the plant is detrimental to the environmentally sound management of natural or agricultural ecosystems.

**Ornamental** – A plant grown by nurseries with traits desirable for landscaping, such as flower color, drought tolerance, shading, etc.

**Perennials** – Plants that live 3 or more years.

**Raceme** – An arrangement of flowers along a stem on individual stalks about equal in length.

**Restoration** – A management action that results in range or pasture improvement without re-seeding.

**Re-vegetation** – A management action that results in range or pasture improvement including seeding.

**Rhizomes** – An underground stem, usually lateral, sending out shoots above ground and roots below.

**Rosette** – A somewhat round, flattened cluster of leaves typical of the early growth stage of many biennial plant species.

**Seedling** – A newly germinated plant, not yet mature.

**Sessile** – A plant without a stalk.

**Simple perennials** – Perennial plants that reproduce by seed only.

**Spikes** – A usually long inflorescence with sessile flowers.

**Succulent** – Fleshy.

**Suppression** - Defined in the Colorado Noxious Weed Act as reducing the vigor of noxious weed populations within an infested region, decreasing the propensity of noxious weed species to spread to surrounding lands, and mitigation the negative effects of noxious weed populations on infested lands. Suppression efforts may employ a wide variety of integrated management techniques.

**Tiller** - A shoot, often one that sprouts from the base of a grass.

**Winter annuals** – Plants which germinate in late summer or fall, over-winter and complete life cycle by the following spring or summer (ex. cheatgrass, tumble mustard).