VEGETATION MANAGEMENT GUIDE

IVM Experts
The Professional’s Choice for Stewardship, Support and Innovation.

Solutions for the Growing World
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**DOW AGROSCIENCES IVM EXPERTS: TOTAL PORTFOLIO SOLUTIONS**

Whether it’s weeds, brush, trees, or non-selective control you are looking to achieve, Dow AgroSciences IVM Experts have a total portfolio solution to fit your needs.
ClearView™ is the industry standard selective herbicide for the professional vegetation manager, delivering consistent, high-performing, extended broadleaf weed and shrub control with flexible rates.

**WHY USE CLEARVIEW?**
- **The standard.** The industry standard for extended broadleaf weed and shrub control.
- **Flexibility.** ClearView has multiple labelled rates and can be used alone or in combination with other products for bareground control.
- **Low mobility.** Can be safely applied up to the drip line of desirable trees.
- **Excellent health and safety profile.** Industry leading health and safety profile for the environment, wildlife and applicator.
- **Ease of use.** Formulated as a convenient water-dispersible granule, with low use rates, priced and delivered with Gateway™ adjuvant.

**WEEDS CONTROLLED**
- Absinth wormwood
- Baby’s breath
- Ball mustard
- Black henbane
- Bluebur
- Brown knapweed
- Canada fleabane
- Canada goldenrod
- Canada thistle
- Chickweed
- Clover (red, white)
- Common groundsel
- Common ragweed
- Corn spurry
- Cow cockle
- Cudweed
- Curly dock
- Dandelion
- Diffuse knapweed
- Field scabious
- Fireweed
- Flaxweed
- Green smartweed
- Hemp-nettle
- Hoary alyssum
- Horse-nettle
- Japanese knotweed
- Kochia
- Lady’s-thumb
- Lamb’s-quarters
- Musk thistle (nodding thistle)
- Narrow-leaved hawk’s-beard
- Orange hawkweed
- Ox-eye daisy (pre-bud)
- Perennial pepperweed
- Perennial sow thistle
- Plumeless thistle
- Prickly lettuce
- Prostrate pigweed
- Purple loosestrife
- Pussyles
- Russian thistle
- Scentless chamomile
- Shepherd’s purse
- Spotted knapweed
- Stinkweed
- Sterk’s-bill
- Sweet clover
- Tall buttercup
- Tansey
- Tarty buckwheat
- Volunteer alfalfa
- Volunteer canola
- Western ragweed
- Western snowberry (buckbrush)
- Wild buckwheat
- Wild caraway
- Wild carrot
- Wild mustard
- Wild parsnip
- Wild rose
- Wild strawberry
- Yarrow
- Yellow hawkweed
- Yellow star-thistle

**USE GUIDELINE**

**Rates and packaging**
- One case treats 16 ha or 40 ac at the highest labelled rate (2 x 1.84 kg containers per case). For best results, apply ClearView at 230 g/ha.
- ClearView requires the addition of Gateway adjuvant at 0.2% v/v.
- Water volume:
  - Broadcast: Apply in a minimum of 200 L/ha total solution.
  - Individual plant: 2.3 g of ClearView, 20 mL of surfactant, in 10 L of water.
  - Thoroughly wet, but not to the point of runoff.

**When to apply**
- Target weeds and shrubs will be controlled when they are actively growing and present at time of application.
  - **Weeds:** Apply to actively growing weeds, after emergence, prior to flowering.
  - **Shrubs:** Apply to actively growing shrubs, after full leaf expansion, but prior to the development of a waxy cuticle on the leaf of the shrubs.

**Rainfast**
- 2 hours

**Bareground**
- Labelled tank mixes: VP480, glyphosate and Arsenal™
- Other tank mixes, such as OcTTain™ XL, Torpedo™ and EsplAnade™ are supported under the PMRA tank-mix policy. Please contact your Dow AgroSciences representative.

**Mixing instructions**
1. Fill the spray tank ¾ full of clean water.
2. Add the required amount of ClearView herbicide with the agitation running.
   Pre-slurrying with water may be necessary where there is little or no agitation, or an injection system is being used.
3. If tank mixing, add the required amount of tank-mix partner with continued moderate agitation.
4. Add Gateway at 0.2% v/v or 2 L/1,000 L of spray solution.
5. Add antifoaming agent such as Halt™.

**Grazing**
- There is no grazing restriction on livestock or wildlife grazing treated areas.

**Optimizing performance**
- Apply to actively growing weeds and shrubs. Avoid applying to plants under stress.
- Pre-slurrying ClearView is recommended.

**Tree safety**
ClearView should NOT be used over the top of desirable trees. Application may be made up to the drip line (outermost edge of the branches) of desirable trees. Use additional caution around lateral root systems, shallow rooting species and those that propagate vegetatively through root shoots.
Lontrel™ 360 and Lontrel™ XC provide professional vegetation managers with excellent control of Canada thistle and other broadleaf weeds in close proximity to most tree species.

WHY USE LONTREL 360 OR LONTREL XC?
• Performance. Control of tough broadleaf weeds such as Canada thistle.
• Safety. For use in areas requiring lower impact applications.
• Selective. Targeted applications allow for control of undesirable species while being safe to grass and other desirable vegetation.

WEEDS CONTROLLED
• Alsike clover
• Canada thistle
• Common groundsel
• Common ragweed
• Kudzu
• Ox-eye daisy
• Perennial sow thistle
• Scentless chamomile
• Sheep sorrel
• Spotted knapweed
• Vetch
• Volunteer alfalfa
• Wild buckwheat

USE GUIDELINE
Rates and packaging
• Lontrel 360 is packaged in 4 x 4.45 L jugs.
• Lontrel XC is packaged in 4 x 2.67 L jugs.
• Apply Lontrel 360 at 0.42-0.83 L/ha or Lontrel XC at 0.25-0.50 L/ha depending on weeds present and level of Canada thistle control required. Refer to the Weeds Controlled table on the product label for appropriate application rate.
• For best results, apply in 200 L/ha total spray solution.

When to apply
• Apply to target weeds when they are actively growing.
• Only weeds present at the time of application will be controlled.

Rainfast
2 hours

Optimizing performance
• Apply to actively growing weeds. Avoid applying to plants under stress.
• Applications of Lontrel 360 or Lontrel XC should be made when Canada thistle, perennial sow thistle and scentless chamomile are in the rosette to pre-bud stage of growth.
• Best results are obtained when Canada thistle is actively growing and soil moisture is adequate for rapid growth.
• Under dry soil conditions and poor growing conditions, Canada thistle control may be severely reduced.

Grazing
• There is no restriction for livestock grazing treated areas.

WHY USE MILESTONE?
• Invasive weed control. Controls a wide range of invasive plants and broadleaf weeds.
• Selective. Effective control of labelled weeds, while being safe to grass and other desirable species.
• Tank mixability. Excellent tank mix partner with Torpedo, EsplAnade, Arsenal and VP480 for total vegetation control.
• Safe. Favourable environmental and user safety profile. Aminopyralid is the only reduced risk active registered in the Canadian IVM industry.

WEEDS CONTROLLED
• Absinth wormwood
• Canada fleabane
• Canada thistle
• Canadian goldenrod*
• Common ragweed
• Common tansy*
• Common yarrow*
• Cudweed
• Curly dock
• Dandelion*
• Diffuse knapweed*
• Fuller’s teasel
• Hairy buttercup
• Hairy fleabane
• Horsenettle
• Musk or nodding thistle
• Ox-eye daisy*
• Perennial sow thistle
• Plumeless thistle
• Prickly lettuce
• Scentless chamomile
• Spotted knapweed
• Tall buttercup
• Tall ironweed
• Tansy ragwort
• Tropical soda apple1
• Tropic croton
• Western ragweed
• Yellow star-thistle3

*Suppression.
1 Apply to plants in the bolting stage of development.
2 Apply to plants in the pre-bud stages of development.
3 Apply to plants at the rosette through to bolting growth stage.
Rates and packaging
- One case treats 40 ha or 100 ac at the highest labelled rate (2 × 10 L jugs per case).
- For best results, apply Milestone at 0.5 L/ha.
- Water volume:
  - Broadcast applications: Apply in a minimum of 200 L/ha total solution.
  - Individual plant applications: 5 mL of Milestone in 10 L of water. Thoroughly wet, but not to the point of runoff.

When to apply
- Apply to target weeds when they are actively growing.
- Only weeds present at the time of application will be controlled.
- Apply to actively growing weeds, after emergence, prior to flowering.

Rainfast
2 hours

Bareground
- Tank mix Milestone with VP480, Arsenal, or EspiKande for applications where total vegetation control is desired. Refer to product label for rates.
- Other tank mixes, such as OcTain XL and Torpedo, can be supported under the PMRA tank-mix policy. Please contact your Dow AgroSciences representative.

Tank mixes
- Registered tank mix with 2,4-D for enhanced spectrum of control.
- Milestone at 0.5 L/ha tank mixed with 2,4-D Amine will provide activity on the following additional species:
  - Annual sow thistle
  - Bluebur
  - Blue lettuce
  - Burdock (<4 leaf)
  - Bull thistle
  - Buttercup
  - Cocklebur
  - Common plantain
  - Common tansy
  - Curled dock
  - Docks
  - Dog mustard
  - Field bindweed
  - Field horsetail
  - Field pepperggrass
  - Flixweed
  - Goat’s beard
  - Hawkweed
  - Hawry cress
  - Horseradish
  - Pepperggrass
  - Perennial
  - Perennial sow thistle
  - Ragweed
  - Stinging nettle
  - Sweet clover

Optimizing performance
Apply to actively growing weeds. Avoid applying to plants under stress.

Grazing
There is no restriction on livestock and wildlife grazing treated areas.

Tree safety
Milestone should NOT be used over the top of desirable trees. Application may be made up to the drip line (outermost edge of the branches) of desirable trees. Use additional caution around lateral root systems, shallow rooting species and those that propagate vegetatively through layering.

WHY USE OCTTAIN XL?
- Performance. Controls a wide range of broadleaf weeds, including Group 2 and 9 resistant kochia up to 50 cm in height.
- Flexible. Can be used as a stand-alone treatment, or tank mixed with products such as ClearView, Milestone, Torpedo and VP480.

WEEDS CONTROLLED
- Bluebur
- Blue lettuce
- Burdock
- Canola (all varieties)
- Cleavers
- Cocklebur
- Dandelion
- Docks
- Dog mustard
- Field bindweed
- Field horsetail
- Field pepperggrass
- Flixweed
- Goat’s beard
- Gumweed
- Hairy galinsoga
- Hedge bindweed
- Hemp-nettle
- Hoary cress
- Kochia
- Lady’s-thumb
- Lamb’s-quarters
- Leafy spurge
- Mustards (except green & grey tansy)
- Oak-leaved goosefoot
- Plantain
- Prickly lettuce
- Ragweed
- Reddock pigweed
- Round-leaved mallow
- Russian thistle
- Shepherd’s purse
- Smartweed
- Stinkweed
- Stink’s-bill
- Sweet clover
- Tansy mustard
- Tartary buckwheat
- Vetch
- Volunteer flax
- Volunteer sunflower
- Wild buckwheat
- Wild radish

WEEDS SUPPRESSED
- Annual sow thistle
- Canada thistle
- Chickweed
- Perennial sow thistle
- Redroot pigweed
- Redroot pigweed

1 Top growth control only.
2 Spring rosettes.
3 Including Group 2 and 9 resistant biotypes.
4 1- to 6-leaf.
USE GUIDE LINE

Rates and packaging
- 2 x 9 L case (5.8 to 11.25 ha/case).
- 36 cases per pallet.

Broadcast foliar applications
- 1.6 L/ha for control of smaller kochia and other broadleaf weeds in non-crop areas.
- 3.1 L/ha for control of larger kochia (up to 50 cm) and other broadleaf weeds in non-crop areas.

Spot applications with hose and handgun or backpack sprayers
- 16-31 mL in 10 L of spray solution.
- 1600-3100 mL in 1,000 L of spray solution.

When to apply
- When weeds are actively growing, optimally between 12 C and 24 C.
- Control will be reduced if frost occurs three days before or after application.
- When applying to large kochia (20-50 cm) use the 3.1 L/ha rate.

Rainfast
1 hour

Tank mixes
- For bareground control, tank mixes such as VP480, Torpedo, Arsenal and EsplAnade are supported in non-cropland areas under the PMRA tank mix policy. Please contact your Dow AgroSciences representative.

Mixing instructions
1. Fill the spray tank with 1⁄2 to 3⁄4 of the required amount of water.
2. Continue agitation throughout the mixing and spraying procedure.
3. Add any required water conditioners.
4. Add any tank-mix partners that are a dry formulation.
5. Add any tank-mix partners that are liquid formulation.
6. Add the required amount of OcTTain XL.
7. Add any required adjuvant or surfactants.
8. Complete filling the sprayer tank with water.

Note: When tank mixing with Torpedo, the addition of Agral® 90 at 0.25% to 1% or equivalent non-ionic surfactant is required. If mixing issues are experienced, higher rates of 0.5% to 1.0% have been found to be beneficial in keeping multiple products in solution. Note: Gateway or Hasten™ adjuvants are not recommended when mixing Torpedo with OcTTain XL. Agral 90 must be used.

Grazing
- There is no restriction on livestock and wildlife grazing treated areas.

Re-entry intervals for applicators applying in non-crop areas
- Re-entry interval for applicators—Until sprays have dried.

WHY USE SIGHTLINE?
• Broad spectrum. The widest spectrum for extended control of broadleaf weeds, invasive plants and shrubs.
• Kochia control. Exceptional post-emergent control of kochia, including ALS and glyphosate resistant biotypes.
• Bareground. Can be tank mixed with VP480 and Torpedo or other non-selective products to achieve total vegetation control.
• Multiple modes of action. Three different active ingredients and two modes of action in one box.

WEEDS CONTROLLED
- Absinth wormwood
- Baby’s breath
- Ball mustard
- Black henbane
- Bluebur
- Brown knapweed
- Canada fleabane
- Canada goldenrod
- Canada thistle
- Chickweed
- Clover (red, white)
- Common groundsel
- Common ragweed
- Common tansy
- Corn spurry
- Cow cockle
- Cudweed
- Curly dock
- Dandelion
- Diffuse knapweed
- Field scabious
- Flixweed
- Green smartweed
- Hemp-nettle
- Hoary alyssum
- Horse nettle
- Japanese knotweed
- Kokia
- Lady’s-thumb
- Lamb’s-quarters
- Musk thistle (nodding thistle)
- Narrow-leaved hawk’s-beard
- Orange hawkweed
- Ox-eye daisy (pre-bud)
- Pasture sage (fringed sage)
- Perennial pepperweed
- Perennial sow thistle
- Plumeseed thistle
- Prairie wild rose
- Prickly lettuce
- Prostrate pigweed
- Purple loosestrife
- Pussytoes
- Russian thistle
- Scentsless chamomile
- Shepherd’s purse
- Spotted knapweed
- Stinkweed
- Sterk’s-bill
- Sweet clover
- Tall buttercup
- Tarry buckwheat
- Volunteer alfalfa
- Volunteer canola
- Western ragweed
- Western snowberry (buckbrush)
- Wild buckwheat
- Wild caraway
- Wild carrot
- Wild mustard
- Wild parsnip
- Wild rose
- Wild strawberry
- Yarrow
- Yellow hawkweed
- Yellow starthistle
- Scentless chamomile

Sightline™ herbicide for the professional vegetation manager delivers broad-spectrum control of broadleaf weeds, including ALS and glyphosate resistant kochia, in a convenient, all-in-one package.
Mixing instructions

Use 135-230 g/ha Sightline A herbicide tank mixed with 0.42-0.84 L/ha Sightline B herbicide. Note that the highest rate of Sightline B (0.84 L/ha) is required for control of kochia (2- to 8-leaf stage).

1. Fill the spray tank ¾ full of clean water.
2. Add the required amount of Sightline A herbicide with the agitation running. Pre-slurrying with water may be necessary where there is little or no agitation, or an injection system is being used.
3. Add the required amount of Sightline B herbicide with moderate agitation running.
4. Add Gateway at 0.2% v/v or 2 L/1,000 L of spray solution.
5. Add antifoaming agent, such as Halt, if required.

Note: When tank mixing with Torpedo, the addition of Agral 90 at 0.25% to 1% or equivalent non-ionic surfactant is required. If mixing issues are experienced, higher rates of 0.5% to 1.0% have been found to be beneficial in keeping multiple products in solution. Note: Gateway or Hasten adjuvants are not recommended when mixing Torpedo with Sightline. Agral 90 must be used.

Optimizing performance

• Apply to actively growing weeds and shrubs. Avoid applying to plants under stress.
• Kochia: For best results, apply to young plants once the majority of the kochia population has emerged, prior to seed set.

Tree safety

Sightline should NOT be used over the top of desirable trees. Application may be made up to the drip line (outermost edge of the branches) of desirable trees. Use additional caution around lateral root systems, shallow rooting species and those that propagate vegetatively through root shoots.

Please refer to Tree Safety, page 32 for additional information.
**Tordon™ 22K herbicide**

*Provides the longest lasting control of leafy spurge and toadflax.*

**WHY USE TORDON 22K?**
- Extended control. Provides the longest lasting control of leafy spurge and toadflax.
- Easy to use. Liquid formulation packaged in convenient 10 L jugs.

**WEEDS CONTROLLED**
- Canada thistle
- Diffuse knapweed
- Field bindweed
- Leafy spurge
- Poverty weed
- Russian knapweed
- Scentless chamomile
- Perennial sow thistle
- Spotted knapweed
- Toadflax

**USE GUIDELINE**

**Rates and packaging**
- Tordon 22K is packaged in 2 × 10 L jugs.
- Apply Tordon 22K at 1.1-4.5 L/ha. Use enough water to wet the weeds without run-off, 400-800 L of spray per treated hectare is usually required.
- For the control of leafy spurge, field bindweed and toadflax only, a spot treatment rate of 90 mL/100 m² may be used, provided no more than 50% of a hectare is treated.

**When to apply**
- Apply to target weeds when they are actively growing.
- Only weeds present at the time of application will be controlled.

**Rainfast**
- 2 hours

**Optimizing performance**
- Do not apply to soils that are very permeable (textures of sandy loam to sand) throughout the entire profile and that also have an underlying shallow aquifer.
- Do not treat areas intended to be used for cultivated sensitive crops or other desirable plants in sequential years. Clippings from grass or crops that have been treated with Tordon 22K should not be used for composting or mulching, nor should the manure from animals grazing treated areas or fed treated forage be used around susceptible plants.
- Avoid application when heavy rain is forecast.

**Grazing**
- There is no restriction for livestock grazing treated areas.

**Tree safety**
Tordon 22K SHOULDN’T BE USED over the top of desirable trees. Application should remain 1.5X the height of off target trees away. Use additional caution around lateral root systems, shallow rooting species and those that propagate vegetatively through layering.

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**Aspect™ herbicide**

*Provides vegetation managers with extended control of woody species and broadleaf weeds.*

**WHY USE ASPECT HERBICIDE?**
- Trusted results. The industry standard for control of woody species and broadleaf weeds for professional vegetation managers.
- Safe to grass. Selectively controls woody species and weeds.
- Innovative formulation. Two active ingredients co-formulated into an easy to use liquid formulation.

**BRUSH AND BROADLEAF WEED SPECIES CONTROLLED**

**Brush species**
- Alder
- Birch
- Cedar
- Maple
- Pine
- Poplar
- Spruce and other species

**Broadleaf weeds**
- Burdock
- Canada thistle
- Common ragweed
- Common yarrow
- Dandelion
- Dock
- Fleabane
- Goldenrod
- Leafy spurge
- Plantain
- Prickly lettuce
- Sweet and red clover
- Toadflax
- Vetch
- Wild carrot

**USE GUIDELINE**

**Rates and packaging**
- Aspect is packaged in 2 × 10 L jugs.
- For broadleaf weed control, apply 2.47-4.67 L/ha Aspect in a minimum of 200 L total spray solution.
- For woody plant control, apply up to 1.15 L/ha Aspect in a minimum of 200 L total spray solution.
- Directed stem applications: For control of woody plants, use 6.67 L/ha Aspect herbicide in 1,000 L water and apply to woody plants after the foliage is fully developed. Thoroughly and uniformly wet to the point of runoff.
- For increased efficacy and faster plant uptake for tough to control species such as leafy spurge, toadflax and coniferous trees such as spruce, use Gateway adjuvant at a rate of 0.25-0.375% v/v with Aspect.
- Refer to the product label for additional product information.
When to apply

• Apply to target weeds and trees when they are actively growing.
• Only weeds and trees present at the time of application will be controlled.
  - **Weeds**: Apply to actively growing weeds, after emergence, prior to flowering.
  - **Trees**: Apply to actively growing shrubs, after full leaf expansion, but prior to the development of a waxy cuticle on the leaf of the shrubs.

Rainfast

2 hours

Optimizing performance

• Apply to actively growing weeds and shrubs. Avoid applying to plants under stress.
• For faster burndown of coniferous species, use Gateway adjuvant at 0.25% by volume (250 mL/100 L of water). For maximum rainfastness, increase the rate to 0.375% (375 mL/100 L of water). Gateway should be added after the herbicide is thoroughly mixed.
• Do not treat areas intended to be used for cultivated sensitive crops or other desirable plants in sequential years. Clippings from grass or crops that have been treated with Aspect should not be used for composting or mulching, nor should the manure from animals grazing treated areas or fed treated forage be used on susceptible plants.
• For control of leafy spurge and toadflax under less-than-optimum growing conditions, add Gateway adjuvant at the rate of 0.25% by volume.

Tree safety

Aspect should NOT be used over the top of desirable trees. Applications should remain 1.5x the height of off target trees away. Use additional caution around lateral root systems, shallow rooting species and those that propagate vegetatively through layering.

ClearView Brush herbicide for the professional vegetation manager provides elite control of the broadest spectrum of both brush and broadleaf weeds, and can be applied safely up to the drip line of desirable trees.

**WHY USE CLEARVIEW BRUSH?**

• **Performance.** Provides broad-spectrum control of hard-to-control woody species, shrubs, broadleaf and invasive weeds.
• **Flexibility.** Enables applications up to the drip line of non-target woody species for an excellent tool on outside edges of right-of-ways.
• **Safe.** Excellent user safety and safe for wildlife, grass and the environment.

**WEEDS CONTROLLED**

**Broadleaf weed species**

• Absinth wormwood
• Ball mustard
• Bluebur
• Burdock
• Canada fleabane
• Canada goldenrod
• Canada thistle
• Chickweed
• Chicory
• Clover (red, white)
• Common groundsel
• Common ragweed
• Corn spurry
• Cow cockle
• Cudweed
• Curly dock
• Dandelion
• Field bindweed
• Field scabious
• Fireweed
• Flaxweed
• Green smartweed
• Hemp-nettle
• Horsenettle
• Kochia
• Lady's-thumb
• Lamb's-quarters
• Musk thistle (nodding thistle)
• Narrow-leaved hawk's-beard
• Ox-eye daisy (pre-bud)
• Perennial pepperweed
• Perennial sow thistle
• Plumeless thistle
• Prickly lettuce
• Prostrate pigweed
• Pussysoes
• Ragweed
• Russian thistle
• Scentless chamomile
• Shepherd's purse
• Smartweed
• Smooth bedstraw
• Spotted knapweed
• Strikweed
• Stork's-bill
• Sweet clover
• Tall buttercup
• Tarax
• Tatarary buckwheat
• Vetch
• Volunteer alfalfa
• Volunteer canola
• Western ragweed
• Western snowberry (buckbrush)
• Wild buckwheat
• Wild lettuce
• Wild mustard
• Wild strawberry
• Yarrow
• Yellow star-thistle

1. Suppression.
2. Non ALS-resistant biotypes.
3. All varieties except ALS-resistant canola.
**TREES CONTROLLED**

**Woody species**
- Alder
- Ash
- Aspen
- Basswood
- Beech
- Birch
- Blackberry
- Buckthorn
- Cherry
- Chokecherry
- Cottonwood
- Dogwood
- Elderberry
- Elm
- Hawthorn
- Hickory
- Honey locust
- Locust
- Maples
- Mulberry
- Oaks
- Poison oak
- Pines

*These species may need to be re-treated the following year.

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**Rates and packaging**
- This co-package contains:
  - ClearView herbicide: 0.92 kg
  - Garlon™ XRT (2 x 10 L cases)
- One case treats 4 ha or 10 ac at the highest labelled rates.
- Requires the addition of Gateway adjuvant at 0.25%-0.375% v/v.
- Use 135-230 g/ha of ClearView herbicide tank mixed with 2.5-5 L of Garlon XRT herbicide.
- For control of black spruce, use 230 g of ClearView herbicide and 4-5 L of Garlon XRT.
- Water volume:
  - 1,000 L/ha for hose and handgun applications
  - 400 L/ha for broadcast applications

**Application methods**
- Single stem foliar
  - For control of woody plants up to 2.5 m in height, use Garlon XRT herbicide at rates of 2.5-5 L tank mixed with ClearView at 135-230 g/ha in enough water to make 1,000 L of spray solution. Use the higher rate for late summer application when growth rates are reduced or when hard-to-control species are present. Spray brush to the point of runoff. Coverage should be thorough to wet all foliage.

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**When to apply**
- Apply to target weeds, shrubs and trees when they are actively growing.
- Only weeds, shrubs and trees present at the time of application will be controlled.
  - **Weeds**: Apply to actively growing weeds, after emergence, prior to flowering.
  - **Shrubs**: Apply to actively growing shrubs, after full leaf expansion, but prior to the development of a waxy cuticle on the leaf of the shrubs.
  - **Trees**: Apply after full leafout to actively growing trees, prior to autumn colouration.

**Rainfast**
- 2 hours

**Mixing instructions**
1. Fill the spray tank 3⁄4 full of clean water.
2. Add the required amount of ClearView herbicide with the agitation running.
   - Pre-slurrying with water may be necessary where there is little or no agitation, or an injection system is being used, or where herbicide is first added to a tank other than the spray tank.
3. Add the required amount of Garlon XRT with the agitation running.
4. Add the required amount of Gateway adjuvant at 0.25-0.375% by volume.
5. Add antifoaming agent, such as Halt, if required.

**Optimizing performance**
- For best results, apply to actively growing weeds, shrubs and trees. Avoid applying to plants under stress.
- Pre-slurrying ClearView is recommended.
- Use higher rates when hard-to-control species such as ash, chokecherry, elm, maple (other than vine or big leaf), oak or pine are present. If lower rates are used on hard-to-control species, resprouting may occur and re-treatment may be necessary the following year.
- Avoid applications in hot temperatures. If temperatures reach 28 C or higher, cease applications for the day.

**Tree safety**
ClearView Brush should NOT be used over the top of desirable trees. Application may be made up to the drip line (outermost edge of the branches) of desirable trees. Use additional caution around lateral root systems, shallow rooting species and those that propagate vegetatively through root shoots.
Garlon RTU herbicide for the professional vegetation manager is the only ready-to-use basal bark and cut stump treatment product for simple and precise control of deciduous trees, eliminating the need for mixing.

**WHY USE GARLON RTU?**

- **Ready to use.** Requires no mixing for single stem applications.
- **Packaging.** Garlon RTU comes in an innovative jerribox that is easy to pour and eliminates the need for traditional jug disposal.
- **Year-round.** Use anytime throughout the year when plants are dry.
- **Applicator safety.** No mixing required, reducing potential worker exposure.

**TREES CONTROLLED**

- Alder
- Ash
- Aspen
- Basswood
- Beech
- Birch
- Blackberry
- Buckthorn
- Cherry
- Chokecherry
- Cottonwood
- Dogwood
- Elderberry
- Elm
- Hawthorn
- Hickory
- Hop-hornbeam
- Honey locust
- Locust
- Maples
- Mulberry
- Oaks
- Pines
- Poplar
- Red maple
- Sassafras
- Sumac
- Sycamore
- Tamarack
- Wild rose
- Willow
- Witch hazel

*These species may need to be re-treated the following year.

---

**USE GUIDELINE**

**Rates and packaging**

- Garlon RTU is packaged in 13 L jerriboxes and can be added directly to backpack sprayers.
- It is formulated to be used right out of the container. No mixing is required.
- Garlon RTU is designed for selective, direct stem application to woody species.

**Application methods**

**Streamline**

This has proven to be the fastest and most effective method of selective basal bark application. Best results are on young, actively growing stems less than 8 cm in diameter.

- Achieving complete “wrap” of the solution around the entire stem circumference is essential for effectiveness.

- Spray 30–50 cm above ground level:
  - For stems less than 8 cm basal diameter, spray a band 5 cm wide on one side of each stem.
  - For stems 8–15 cm basal diameter, spray a band 5 cm wide on two sides of each stem (two-sided streamline).

- With sufficient volume, the treated zone should widen to encircle the entire stem circumference within 30 minutes.

**Cut Stump Treatment**

This method is excellent for prevention of re-sprouting. It also reduces the need for repeated cutting of large diameter stumps of species that sprout from the base or suck from roots. Applications may be made to both old and freshly cut stumps.

- Thoroughly wet the stump, including:
  - Cut surfaces, especially the cambium layer just inside the bark.
  - The remaining bark to the ground line, including the root collar.

**When to apply**

- Optimal results are achieved when applications are made to young, vigorously growing stems that have not developed the thicker bark characteristic of slower growing older trees.
- For best results, apply when stem and bark are dry.
- Garlon RTU can be applied at any time, including the winter months, except when snow or water prevents spraying at the ground line.
**Optimizing performance**

“Free water” on stems resulting from melting frost, wet snow or rain, causes emulsification and failure to penetrate bark during streamline and stump treatments. Emulsified herbicide can run down the treated stem like water, showing no evidence of “wrap.” If the wetting front formed by the oil in the bark does not wrap, then control is likely to be incomplete. Tips for best results include:

**Frost**

If no emulsification occurs (dry frost), then the solution is working. If the oil solution does not penetrate the frost (ice), shut down the application. Watch for frost as temperature rises above 0 C and moisture appears on stems.

**Potential spray drift**

Keep application pressure low to prevent vapour drift. Small quantities of vapour drift, which may not be visible, can seriously injure susceptible plants and sensitive non-target vegetation.

**Rain**

Basal bark and cut stump applications cannot be made to wet stumps or emulsification may occur and the target trees will not be controlled. However, rain immediately after an application will not affect the efficacy of the product as it will have already entered the bark.

When snow prevents access to ground line at the base of target trees, one-sided application should be stopped. Two-sided streamline application should be used on larger stems to ensure wrap.

**Temperature**

Garlon RTU can be applied at temperatures below –10 C anytime throughout the year. However, if temperature drops too low, and coagulation begins to occur, applicators should stop operations.

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**Garlon XRT herbicide**

Garlon XRT herbicide, in an advanced formulation for the professional vegetation manager, delivers highly selective control of deciduous trees and brush, and can be applied safely up to the drip line of desirable trees.

**WHY USE GARLON XRT?**

- **Industry leading.** Garlon XRT tank mixed with Gateway adjuvant provides superior control of deciduous brush.
- **Broad-spectrum control** of deciduous trees and broadleaf weeds.
- **Application flexibility.** Allows applicators to apply to the drip line of desirable species.
- **Safety.** Garlon XRT has a favourable environmental profile.

**TREES AND BRUSH SPECIES CONTROLLED**

- Alder
- Ash
- Aspen
- Basswood
- Beech
- Birch
- Blackberry
- Buckthorn
- Cherry*
- Chokecherry*
- Cottonwood
- Elderberry
- Elm*
- Hawthorn
- Hickory
- Hop-horbeam
- Honey locust*
- Locust
- Maples
- Mulberry
- Oaks*
- Poison oak
- Pines*
- Poplar
- Red maple*
- Raspberry*
- Sassafras
- Sumac
- Sycamore
- Tamarack
- Wild rose
- Willow
- Witch hazel

*These species may require treatment at the higher rate and may need to be re-treated the following year, particularly if the original treatment was made at the lower rate.

**BROADLEAF WEEDS CONTROLLED**

- Burdock
- Chicory
- Curled docked
- Dandelion
- Field bindweed
- Lamb’s-quarters
- Ragweed
- Smartweed
- Smooth bedstraw
- Vetch
- Wild lettuce

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**Package disposal**

- Garlon RTU containers should not be reused for any purpose. For disposal, return to Univar Environmental Sciences (UES) as per their instructions.
- If the cardboard shows no sign of pesticide contamination, remove the plastic bag inserts and recycle the cardboard box locally. Collect empty plastic bags together and do not triple rinse.
- Return the plastic bag inserts or the whole package to Univar Environmental Services (UES) as per their instructions by contacting a Univar representative at 1-866-572-8240.

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**Grazing**

There is no restriction on livestock grazing treated areas.
**BRUSH CONTROL**

**USE GUIDELINE**

<table>
<thead>
<tr>
<th>Rates and packaging</th>
<th>Garlon XRT is available in 2 x 10 L cases.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broadleaf weed and deciduous tree control</td>
<td>Mix 2.5-5 L of Garlon XRT herbicide in a minimum of 200 L of water per hectare to ensure uniform coverage.</td>
</tr>
<tr>
<td>Application methods</td>
<td>Single stem foliar For control of woody plants up to 2.5 m in height, use Garlon XRT herbicide at rates of 2.5-5 L in enough water to make 1,000 L of spray solution. Use the higher rate for late summer application when growth rates are reduced or when hard-to-control species are present. Spray brush to the point of runoff. Coverage should be thorough to wet all foliage. Low volume foliar For control of woody plants up to 2.5 m in height use this technique with knapsack or backpack sprayers equipped with flat fan or solid cone nozzles. For control of woody plants, mix 0.6-3 L of Garlon XRT herbicide in enough water to make 100 L of spray solution. Direct the spray solution to thoroughly wet the foliage of the target plants, but not to the point of runoff. Apply after full leafout, but before autumn colouration.</td>
</tr>
</tbody>
</table>
| When to apply | For foliar applications, apply to target trees and weeds when they are actively growing.  
Trees: Apply after full leafout to actively growing trees, prior to autumn colouration.  
Weeds: Apply to actively growing weeds, after emergence, prior to flowering. |
| Rainfast | 2 hours |
| Basal bark and stump treatment | For selective control of woody plants, Garlon XRT herbicide can be used in oil mixtures and applied using the streamline or stump treatment technique. Use a diluent such as mineral oil or vegetable oil. Add Garlon XRT herbicide to the required amount of oil in the mixing tank and mix thoroughly.  
If basal bark and stump treatment applications are required, please see Garlon RTU for additional information. |
| Optimizing performance | For best results, apply to actively growing trees and weeds. Avoid applying to plants under stress.  
Use higher rates when hard-to-control species such as ash, chokecherry, elm, maple (other than vine or big leaf), oaks or pine are present. If lower rates are used on hard-to-control species, resprouting may occur and re-treatment may be necessary the following year.  
Avoid applications in hot temperatures. If temperatures reach 28°C or higher, cease applications for the day. |
| Grazing | There is no restriction on livestock grazing treated areas for areas applied with up to 3 L/ha.  
3-5 L/ha: Do not graze or harvest green forage from treated area for 14 days following treatment. Note: No grazing restriction for beef livestock if less than 25% of the grazed area has been treated. |

**BRUSH CONTROL**

**NON-SELECTIVE CONTROL**

Torpedo herbicide is a resistance management rotational tool for the professional vegetation manager providing extended, pre-emergent total vegetation control for bareground applications.

**WHY USE TORPEDO?**

- **Performance.** Provides long lasting, pre-emergent control of grasses and small-seeded broadleaf weeds.  
- **Resistance management tool.** A combination of two active ingredients form two unique modes of action in one granule. Controls a broad spectrum of problem and glyphosate-resistant weeds.  
- **Wide application window.** Pre and early post application timing for bareground and non-crop areas.  
- **Low mobility.** Low risk of off-site movement.

**WEEDS CONTROLLED**

- Canada fleabane*  
- Common lamb's-quarters  
- Common ragweed*  
- Common waterhemp*  
- Dandelion  
- Eastern black nightshade*  
- Green foxtail  
- Green pigweed  
- Hairy nightshade  
- Kochia*  
- Large crabgrass  
- Palmer amaranth  
- Pennsylvania smartweed  
- Redroot pigweed*  
- Velvetleaf  
- Wild buckwheat  
- Wild mustard

*Including Group 2, 5 and/or glyphosate-resistant amaranthus.
**VP480**

**HERBICIDE**

VP480 provides high performance, non-selective control for the professional vegetation manager.

---

**WHY USE VP480?**

- **Reliable.** Trusted non-selective control of grasses and broadleaf weeds
- **Innovative formulation.** Rapidly absorbed by the plant for premium grass and weed control.
- **Tank mix convenience.** Can be used in combination with ClearView, Milestone, Sightline, Torpedo and other IVM registered products for bareground applications.

**WEEDS CONTROLLED**

- Annual broadleaf weeds
- Annual grasses
- Perennial broadleaf weeds
- Perennial grasses and sedges

---

**USE GUIDELINE**

**Rates and packaging**

- One case treats 18 ha at the highest labelled rate (4 x 2.72 kg containers per case).
- Non-crop, bareground and IVM rate 420-580 g/ha.
- Water volume:
  - Broadcast: Apply in a minimum of 100-300 L/ha total spray solution
  - Requires 0.5-1.0 cm moisture for activation.

**When to apply**

- Pre-emergence
  - Apply prior to weeds emerging
- Early post emergence
  - When weeds are emerging (<5 cm)
  - Will require the addition of a non-ionic surfactant (NIS) if glyphosate is not tank mixed
  - NIS at 0.25% v/v, 150-600 L/ha spray volume
- Post emergence
  - If weeds are greater than 5 cm, or very dense, a tank-mix partner should be used in addition to Torpedo herbicide to control emerged weeds

**Tank mixes**

- Labelled tank mixes: 2,4-D Ester, Vanquish™, Banvel™, Tordon 22K, Garlon.
- Other tank mixes, such as ClearView, Milestone, Sightline, OcTTain XL and VP480 can be supported under the PMRA tank-mix policy.

**Mixing instructions**

1. Fill clean spray tank 1/2 to 2/3 of desired level with clean water.
2. To ensure a uniform spray mixture, pre-slurry the required amount of Torpedo herbicide with water prior to addition to the spray tank. Use a minimum of 3.8 L (1 gallon) of water per 283 g (10 oz) of Torpedo herbicide.
3. While agitating, slowly add the pre-slurried Torpedo herbicide to the spray tank. Agitation should create a rippling or rolling action on the water surface.
4. After adding Torpedo, add tank mix partner product(s) in the following order:
   - (1) water soluble granules;
   - (2) wettable powders;
   - (3) aqueous suspensions, flowables and liquids;
   - (4) emulsifiable concentrates; and
   - (5) solutions.

Allow time for complete mixing and dispersion after each addition.
5. Fill spray tank to desired level with water. Agitation should continue until all spray solution has been applied. Aggressive over-agitation may cause precipitate to form on the tank walls.
6. Mix only the amount of spray solution that can be applied the day of mixing. Torpedo herbicide should be applied within six hours of mixing.
7. If product is allowed to settle, thoroughly agitate to re-suspend the mixture before spraying.

---

**Optimizing performance**

- Avoid application to plants under stress, or when prolonged periods without moisture are forecasted.
- Do not incorporate into the soil.

---

**WEEDS CONTROLLED**

- Annual broadleaf weeds
- Annual grasses
- Perennial broadleaf weeds
- Perennial grasses and sedges

---

**Use guideline**

**Rates and packaging**

- VP480 is packaged in 2 x 10 L jugs and 960 L totes.
- Refer to the product label for specific rates.

**When to apply**

- Apply to target weeds when they are actively growing.
- Plants that have not emerged will not be controlled with VP480 alone.

**Rainfast**

- 30 minutes

**Bareground**

- VP480 can be tank mixed with Sightline, ClearView, Milestone or OcTTain XL for applications where total vegetation control is required.

**Optimizing performance**

- Apply to actively growing weeds. Avoid applying to plants under stress.
- Rainfall immediately after application may wash herbicide off.
- Heavy dust on weed leaves will reduce control.
- VP480 is compatible with isopropylamine formulations (IPA Salt) and dimethylamine formulations (DMA Salt). It is not advised to tank mix VP480 with potassium formulations of glyphosate (K + Salt) in the spray tank.
- Use clean water for spray solution, as organic matter binds to the active ingredient, reducing efficacy. Do not use water from open bodies of water.

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**Mixing instructions**

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7. If product is allowed to settle, thoroughly agitate to re-suspend the mixture before spraying.

---

**Optimizing performance**

- Avoid application to plants under stress, or when prolonged periods without moisture are forecasted.
- Do not incorporate into the soil.
Gateway adjuvant is an innovative non-ionic, paraffinic oil blend surfactant developed for use with the IVM portfolio of products from Dow AgroSciences.

WHY USE GATEWAY ADJUVANT?
- **Industry leading technology.** An innovative adjuvant formulation unique to Dow AgroSciences and non-ionic surfactants.
- **Performance.** Gateway improves plant uptake in challenging environmental conditions.
- **Tank mixability.** Labelled for use with the IVM portfolio of products from Dow AgroSciences requiring surfactants.

USE GUIDELINE

Rates and packaging
- Gateway is packaged in 4 x 4 L jugs.
- Use at 0.25-1.0% v/v (2.5 L - 10 L Gateway adjuvant/1,000 L spray mixture).
- Use the higher rate in adverse conditions, such as dense weed populations, late weed growth stages, poor environmental conditions or with certain multiple-product tank mixes.
- Refer to individual herbicide product labels for additional details on rate of use and mixing instructions.

Tank mixes
- Gateway is recommended for use with the following Dow AgroSciences products:
  - ClearView
  - ClearView Brush
  - Sightline
  - Aspect
- For additional products, see the Gateway label.

PRODUCT SOLUTIONS TO FIT YOUR NEEDS

<table>
<thead>
<tr>
<th>BROADLEAF WEEDS, SHRUBS AND GRASS</th>
<th>MEASLY TONE</th>
<th>MEASLY TONE + 2,4-D</th>
<th>CLEARVIEW</th>
<th>CLEARVIEW + 2,4-D</th>
<th>SIGHTLINE</th>
<th>ASPECT</th>
<th>CLEARVIEW + BURDOCK XRT</th>
<th>CLEARVIEW + BURDOCK XRT + 2,4-D</th>
<th>LONTREL 360</th>
<th>LONTREL XC</th>
<th>OCTAIN XL</th>
<th>TORDON 22K</th>
<th>TORPEDO</th>
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This is meant as a reference guide; always read and follow label directions. If there is a species not listed here you are seeking to control, please contact your Dow AgroSciences representative for recommendations.

- **Non ALS resistant biotypes.
- **ALS resistant except ALS resistant canola.
- **ALS. Apply Chlortal at 230 g/ha when plants are actively growing with the optimum time of application occurring from rosette to the bolting stages of development or to the fall. Plants will be controlled by mid summer and fall application even though plants may not show any changes in form or stature development or in the fall. Plants will be controlled by mid summer and fall application occurring from rosette to the bolting stages of development.
- **Diffuse knapweed [suppression]: Apply to plants in the bolting stage of development.
- **Russian knapweed [suppression]: Apply to plants in the bolting stage of development.
- **Japanese knotweed [suppression]: Apply to plants at any growth stage, but application by flowering will reduce seed production.
- **Orange hawkweed: For seasonal and 12 month control, apply to plants in the bolting stage of development.
- **2 Ox-eye daisy: Apply to plants in the pre-bud stages of development.
- **3 Tropical croton: Apply to any growth stage, but applicability by flowering will reduce seed production.
- **4 Sulphur cinquefoil [suppression]: Apply to plants in the bolting stage of development.
- **5 Diffuse knapweed [suppression]: Apply to plants in the bolting stage of development.
- **6 Russian knapweed [suppression]: Apply to plants in the bolting stage of development.
- **7 Japanese knotweed [suppression]: Apply to plants 0.0-1.2 m tall.

*C For control of leafy spurge and tansyflower under less-than- optimum growing conditions, use a recommended surfactant such as Galatey adjacent at the rate of 0.25% by volume (250 ml per 100 L of water).* 

**1 Top growth control. **2 Top growth control. **3 Top growth control. **4 Top growth control. **5 Top growth control. **6 Top growth control. **7 Top growth control.
SUSTAINABLE VEGETATION MANAGEMENT

The safe and effective use of vegetation management herbicides is essential to controlling target weeds and brush, and ensuring environmental, wildlife and human safety. Dow AgroSciences is committed to providing vegetation management professionals with the products and tools to get the job done right and ensuring that the practices used are sustainable in the long term.

**STEWARDSHIP TRAINING AVAILABLE**

All IVM Experts can provide detailed information to answer your questions about products, application procedures and safety. Our IVM Experts are available to train your applicators on a variety of subjects, including: Dow AgroSciences products, product application procedures, human health, safety and professionalism. Contact your Dow AgroSciences representative for details or to book a training session.

**MANAGING INVASIVE PLANTS CROSSES FENCELINES**

Invasive plant control is not only critical in industrial rights of way, roadside and other non-crop area vegetation management. It is also crucial on private permanent grass pastures and rangeland. Controlling invasive plants with a herbicide is an effective way to reduce the spread and infestation of a species that may have the potential to be detrimental to biodiversity and the ecosystem.

Dow AgroSciences offers effective herbicide solutions for invasive plant control on rangeland and permanent pastures. We also provide an educational brochure used by counties and municipalities to promote the control of invasive plants with area residents. To learn more about Dow AgroSciences herbicides designed for range and pasture use, please visit dowagro.ca.

**PROTECTING POLLINATORS**

Bees are one of several types of pollinators that feed from flowers, transferring pollen in the process. Other examples include butterflies and hummingbirds.

Herbicides target a specific pathway in plants. These target sites do not exist in pollinators, including bees. For this reason, herbicides from Dow AgroSciences do not have an adverse effect on pollinators when used according to the label.

Controlling invasive species with herbicides is beneficial for ensuring food stability for pollinators. When invasive plants, such as spotted or diffused knapweed, overtake an area they can choke out a variety of native species. Invasive weeds can flower once annually, while native plants flower throughout the whole growing season, providing a continual food source for pollinators. By eliminating the invasive plant types, the native species will re-establish themselves from seed, providing more sustainable foraging ground and habitat for bees and other pollinators.

**SCIENCE BASED SOLUTIONS**

Dow AgroSciences is committed to investing globally in products specifically designed to meet the needs of the industrial vegetation management market. This investment funds active ingredient discovery for non-crop uses, advancements in formulations that are easier to use, and a continued focus to make sure that our chemistry couples performance together with the highest standards in safety to applicators, the general public, wildlife, pollinators and the environment.
TREE SAFETY

Aspect, ClearView, Milestone, Tordon 22K and Sightline herbicide may have activity on woody species, including trees, when applied to the soil within the root zone. These products should not be used as a spray application under the tree canopy.

ClearView, ClearView Brush, Garlon XRT, Garlon RTU and Milestone should NOT be used over the top of desirable trees. Application may be made up to the drip line (outermost edge of the branches) of desirable trees. Milestone, ClearView and Sightline can be applied up to the drip line of the following species:

- Ash
- Aspen
- Birch
- Black cherry
- Cottonwood
- Dogwood
- Eastern white pine
- Elm
- Fir
- Junipers
- Maple
- Oaks
- Ponderosa and lodgepole pines (may cause transient leaf curling that will disappear)
- Poplar
- Spruce species
- Sweetgum
- Willow

Use caution when using Milestone, ClearView and Sightline around the following species. Greatest caution should be taken around those species with extensive lateral root systems, shallow rooting species and those that propagate vegetatively through layering.

- Black locust
- Caragana
- Cedar
- Honey locust
- Mimosa
- Other locust species
- Redbud
- Rose

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- Caragana
- Cedar
- Honey locust
- Mimosa
- Other locust species
- Redbud
- Rose

APPLICATION TIMING

Herbicide application should be made after the majority of the target weed populations have emerged and are actively growing.

- The ideal timing for application will generally be in June through to mid-July with the exception of Canada thistle, which enters its ideal timing in mid- to late July when the majority of plants have emerged.
- Timing varies from season to season due to environmental conditions that influence growth and plant staging.
- When targeting shrubs such as buckbrush or wolf willow, they must be fully leafed out prior to an application.

HAY, SOIL AND MANURE MANAGEMENT

Treated area:

Vegetation management products.

- Soil from treated areas should never be moved to areas where sensitive plants may be planted within five years.
- Manure from livestock consuming treated grass should never be used for compost or around susceptible plants.
- Clippings from grass that has been treated with Dow AgroSciences vegetation management products should never be used for composting or mulching.
- Please contact your IVM expert with additional questions regarding hay, soil and manure management.

CAUTION: DO NOT use Aspect, ClearView, ClearView Brush, Milestone, Tordon 22K or Sightline over the top of, or directly under, any desirable tree species; injury or death can also result from foliar applications to trees.

* If forage must be removed from treated area.
The use of multiple modes of action on key weeds will provide more effective control and will delay the onset of resistance.

**WATER QUALITY**

Products with multiple modes of action contain two or more active ingredients with different modes of action that:

- Deliver overlapping control on the same target weeds.
- Greatly reduces the opportunity for resistant weeds to escape, survive and reproduce.
- Increases the opportunity for resistant target weeds.
- Overlapping control on different modes of action will delay the onset of resistance.
- No overlapping control on the same target weeds.
- Overlapping control on the same target weeds.
- Greatly reduces the opportunity for resistant weeds to escape, survive and reproduce.
- Soil organic matter, rainfall and temperature all affect the rate of degradation.

**MULTIPLE MODES OF ACTION**

Products with multiple modes of action contain two or more active ingredients with different modes of action that deliver overlapping control on the same target weeds.

The use of multiple modes of action on key weeds will provide more effective control and will delay the onset of resistance.

**HARD WATER AND PH**

Hard water is classified by high concentrations of cations such as Ca
2+, Mg
2+, Mn
2+, Zn
2+, Na
+1, Al
3+ or Fe
3+ (Table 1). Hard water can be problematic because these cations can bind to the herbicide causing a decrease in efficacy of the product. Most research looking at herbicide antagonism with hard water has found Ca
2+, Mg
2+, Mn
2+, Na
+1 and Fe
3+ to be the most problematic. The pH of the water solution can also exaggerate the impact of hard water on the herbicide’s activity. Most post-applied herbicides are weak acids, meaning they have a pKa value less than 7. If the pH of the water is greater than the pKa of the herbicide, the product has a greater chance to dissociate. This results in the separation of the herbicide into negative ions, which can combine with the cations of the hard water, thereby reducing the efficacy of the product. Addition of ammonium sulfate (21-0-0-24) (AMS) can reduce the interaction between hard water and herbicides because the sulfate binds with the positive ions in the hard water and the ammonium binds to the herbicide, which actually helps the product to penetrate the plant cell membrane.

**ALKALINITY**

Soft water can be high in bicarbonates (HCO
3-) or carbonate (CO
3-), which can also interfere with some herbicides, similar to the hard water ions. When testing water for alkalinity, levels should be below 300 ppm.

**TURBID WATER**

Turbid water is a name used to describe a water source with suspended particles which can include soil, organic matter, algae, salt or contamination from runoff. Pesticides have the potential to bind to these particles in the water source, tying up the active ingredient and decreasing the efficacy of the product. How well a chemistry binds to the sediment depends on their Koc ratio, which is the soil organic carbon sorption coefficient. A high Koc number means the product binds strongly to the particles – for example glyphosate.

**Table 1: The World Health Organization’s classification of soft to extremely hard water**

<table>
<thead>
<tr>
<th>Mineral parts per million (ppm) in water</th>
<th>World Health Organization water classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 114</td>
<td>Soft</td>
</tr>
<tr>
<td>114 – 342</td>
<td>Moderately Hard</td>
</tr>
<tr>
<td>342 – 800</td>
<td>Hard</td>
</tr>
<tr>
<td>&gt;800</td>
<td>Extremely Hard</td>
</tr>
</tbody>
</table>

Note: Some hard water test results will be in “grains,” which is the ppm divided by 17.

**Table 2: The pKa values of Aminopyralid, Triclopyr and Picloram**

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>pKa value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aminopyralid</td>
<td>2.6</td>
</tr>
<tr>
<td>Picloram</td>
<td>2.3</td>
</tr>
<tr>
<td>Triclopyr</td>
<td>2.7</td>
</tr>
</tbody>
</table>

Note: pKa (logKa) is an index to express acidity of soils – the smaller the value, the stronger the acid.
WHAT CAN BE DONE?

• Ensure water source is free from sediment — any amount of sediment can be problematic; if you visually see particles, consider a different water source.
• Perform a water analysis to determine suitability for herbicide applications (i.e., hardness, pH, total dissolved solids, etc.).

Some labs that can perform this analysis:
- Environmental Analytical Laboratory, Saskatchewan Research Council, 422 Downey Road, Saskatoon, SK Canada – src.sk.ca/analytical
- ALS Global – alsglobal.com has various labs across Canada that can perform well water testing.
• Some hard water/pH testers can be bought from local pool stores. These testers sometimes read hard water at 300 ppm whereas spraying hard water is considered 1,000 ppm or higher.
• Ideal water pH for these weak acid herbicides is around 5-7.
• If the pH is too high (over 8), consider a different water source.

• Hard water: Studies by Thomas et al. (1996) and Zollinger et al. (2010) found AMS could be added to Picloram and Aminopyralid to mitigate hard water impacts, although there has not been a rate identified specifically for these products.
  - The recommended rates of AMS with glyphosate are 13: 1-2% w/w (i.e., 1-2 kg/100 L of water), or 2.5-5% v/v of a 400 g/L AMS solution
  - If water is over 1,000 ppm and you are applying Aminopyralid or Picloram, consider adding AMS at 20.4 g/L.
  - A jar test can be performed before putting any products in the spray tank to ensure they will not create any problems.
  - Follow all label directions for tank mixes and adjuvants.
  - For best results, Dow AgroSciences recommends using clean fresh water sources for spray solution. Using open bodies of water or poor quality water (sediment, hardness or high pH) as a source increases risk of having water issues.

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SUMMARY

• Picloram and Aminopyralid activity could be affected by hard water ions.
• Picloram and Aminopyralid can both be impacted by pH of water since it can cause them to break down into ions, allowing them to combine with hard water ions decreasing efficacy.
• Triclopyr formulated as an ester has the potential to bind to organic matter or sediment in the water and reduce efficacy.

* Koc (Soil Organic Carbon-Water Partitioning) is a measurement of how well a chemistry binds to the sediment of the soil. The higher the number, the greater potential to bind.

For further information please call your IVM expert or visit ivmexperts.ca