Manitoba Agriculture, Food and Rural Initiatives

Weed Control in Landscape and Turf Areas

2006 Revised Edition

Manitoba

CONTACTS:

Manitoba Agriculture, Food and Rural Initiatives

Manitoba Weed Supervisors Association - For contact information please go to their website at http://www.gov.mb.ca/agriculture/contact/weeddistricts/

CENTRAL PLAINS GO TEAM	
Carberry	834-8815
Gladstone	385-6633
Portage la Prairie	239-3352
Treherne	723-3232
EASTMAN GO TEAM	
Beausejour	268-6094
Dominion City	427-2950
St. Pierre	433-7749
Steinbach	346-6080
Vita	425-5050
NORTH INTERLAKE GO TEAM	
Arborg	376-3300
Ashern	768-2782
Fisher Branch	372-6526
Lundar	762-5649
NORTH PARKLAND GO TEAM	
Dauphin	622-2042
Ethelbert	742-4060
Roblin	937-6460
Ste Rose	447-4032
PEMBINA GO TEAM	
Killarney	523-5260
Pilot Mound	825-3512
Somerset	744-4050
RED RIVER GO TEAM	
Altona	324-2804
Carman	745-5610
Morden	822-5461
Morris	746-2312
Starbuck	735-4080

SOUTH INTERLAKE GO TEAM	
Dugald	853-5170
Selkirk	785-5035
Stonewall	467-4700
Teulon	886-2696
SOUTH PARKLAND GO TEAM	
Birtle	
Hamiota	764-3010
Minnedosa	867-6572
Neepawa	476-7020
Russell	773-5130
Shoal Lake	759-4050
SOUTHWEST GO TEAM	
Boissevain	534-2010
Brandon	726-6482
Melita	522-3256
Souris	483-2153
Virden	748-4770
URBAN GO TEAM	
Winnipeg	945-4521
VALLEYS NORTH GO TEAM	
Swan River	734-3417
The Pas	627-8255
CROPS KNOWLEDGE CENTER	
Pesticide Licensing Coordinator	945-7706
Crop Diagnostic Specialist	945-7707
Plant Pathologist	745-5694
Entomologist	745-5669
Crop Nutrition	745-5644
Weeds	745-5651

Crop Protection Companies

Dow AgroSciences Canada Inc 1-800-667-3852
Interprovincial Co-operative.....1-204-233-3461
Monsanto Canada Inc 1-800-667-4944
Nu-Gro IP Inc 1-519-757-0077
Nufarm.....1-800-868-5444
Syngenta.....1-800-665-9250
True North Specialty Products 1-877-248-3338
United Agri Products 1-800-561-5444

Emergency Numbers

Poison Control Centre
1-204-787-2591

Pesticide Spill Line
1-204-945-4888

Introduction/Disclaimer

This publication is intended to be used as a guide only. Information contained herein is that available at time of printing. While every effort has been made to ensure accuracy, Manitoba Agriculture, Food and Rural Initiatives does not accept responsibility for label changes. When more than one trade name is listed, not all pests may appear on all labels.

This publication is only a guide. Always refer to the product label for application details and precautions.

Certain recommendations in this publication are given in quantity of commercial product per acre (mL, L, g or kg/acre). Product labels are given in quantity of product per hectare (mL, L, g or kg/ha). To avoid application errors be sure to read and understand label recommendations.

The guide *Weed Control in Landscape and Turf Areas* includes the most recent recommendations for ornamental plantings and turf areas.

For non-crop areas refer to the guide *Weed Control in Non-Crop Areas*. For herbicides registered for use in shelterbelts, see the *Guide to Crop Protection.*

These recommendations are based on the uses registered under the federal *Pest Control Products Act* which is administered by the Pest Management Regulatory Agency (PMRA), Health Canada. It is an offence under *The Pest Control Products Act* to apply any chemical in a manner not consistent with the product label. If you have any doubts regarding the instructions in this publication, or on the product label, contact the company representative, the local PMRA office, local weed supervisor or your local Manitoba Agriculture, Food and Rural Initiatives GO office for further advice.

These recommendations are intended for commercial applicators.
Do not use this guide to make recommendations for the home garden.
The recommendations in this guide are for Manitoba conditions only.

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IPM for Weed Control in Landscape and Turf Areas

Integrated Pest Management (IPM) is an approach to controlling pests that use a combination of techniques in an organized program to suppress pests effectively, economically and in an environmentally sound manner. In an IPM program, pest managers use regular inspections, (monitoring), to collect information they need to make treatment decisions. The central idea in IPM is that pesticide application is only used when pest numbers justify it, not as a routine measure. This eliminates unnecessary pesticide use without sacrificing results. Another important idea in IPM is keeping pest populations at manageable levels as opposed to pest elimination. If treatment is needed, pest managers choose a combination of methods that suit the site and local conditions. Developing an IPM program may be result in short-term increased cost for initial program setup. However, in the long-term, an IPM program may be more cost effective as it may prevent future problems, improve the quality of a landscape and reduce pesticide application costs. A good IPM program may include:

- identifying potential pest problems,
- managing sites to prevent a potential pest(s) from becoming major problem(s),
- monitoring populations of pests and beneficial organisms, pest damage and environmental conditions,
- using pest injury thresholds to make treatment decisions,
- using a number of strategies including combinations of biological, physical, cultural, mechanical and chemical controls to reduce pest populations to acceptable levels,
- annual evaluations to assess the effectiveness of the program.

IPM also provides a way to manage pesticide resistant pests and control pests in areas where pesticides cannot be used. It is important to realize that IPM programs change and improve as people gain experience and as new tools and information become available.

Weed Control in Non-Turf Ornamental Plantings

Weeds in ornamental plantings can reduce the esthetic appeal of the planting. Weeds can also harbor insects that can act as pests on the ornamentals or act as pests for people using the area for recreation. Control options for weeds in ornamental plantings are limited and depending on the types of plants involved, cultural methods such as cultivation or manual removal may be the only option available.

Herbicides registered for use in ornamental plantings are listed in Tables 1 and 2. See Table 1 for types of weeds controlled and Table 2 for the types of plantings to which these products can be applied. See the label summaries in this guide for lists of the weeds controlled by these products and lists of plants on which these products are known to be safe for use. For herbicide options in shelterbelts, see the Guide to Crop Protection.

Table 1. Herbicides for Use in Ornamental Plantings and Weed Types Controlled

	Annual Grasses	Quackgrass	Annual Broadleaf weeds
Dacthal 75 W	x		x
Devrinol 10-G	x		x
Simazine 480, Simadex 500	x	x	x
Kerb 50 WSP	x	x	x[1]
Venture L	x	x	
Casoron G-4	x	x	x

[1]Chickweed only

Table 2. Type of Ornamental Planting

	Annual Plantings	Perennial Plantings	Coniferous Trees and Shrubs	Deciduous Trees and Shrubs
Dacthal 75 W[2]	x	x		x
Devrinol 10-G			x	x
Simazine 480, Simadex 500			x	x
Kerb 50 WSP		x[1]	x	
Venture L	x	x	x	x
Casoron G-4			x	x

[1] Iris and peonies and ground covers only.
[2] selected ornamentals – see label

Weed Control in Turf Areas

Most herbicides used for weed control in turf areas are for control of broad leafed weeds and will control a variety of annual and perennial weeds. Few herbicide options are available for control of weed grasses in turf areas.

The herbicides used for broad leafed weed control are group 4 (growth regulator) herbicides. These herbicides must be applied post emergent to the weeds. Best control is achieved when the weeds are young and actively growing. Extreme caution must be used to prevent drift of herbicides onto desirable plants, trees or crops since even minute quantities of herbicides can cause serious injury to sensitive plants and trees.

When applying herbicides for total vegetation control to kill all weeds and grass to allow renovation of turf areas, two herbicide options are available. These products must be applied with care to avoid injury to valuable and desirable plants in and around the turf area. Follow label directions carefully.

Herbicides which can be used for turf areas are listed in Table 3. Summaries of the label information for these herbicides are included in this guide. Consult the label summary for information on weeds controlled, rates and application details. Remember that this publication is only a guide. Always read and follow label directions.

Table 3. Herbicides for Use in Turf Areas

	For Broad leafed Weed Control	For Control of Weed Grasses	Total Vegetation Control for Turf Renovation
2,4-D	x		
Acclaim		x	
Betasan 4.8E		x[1]	
Dacthal W-5	x	x	
Glyphosate			x
Gramoxone			x
K-O-G Granular	x		
MCPA (Amine or Sodium)	x		
Mecoprop, Compitox	x		
Turf-Rite 2+2, Premium 2-Way XP	x		
Par III, Premium 3-Way XP, Tri-Kil	x		
Vanquish	x		

Pesticide Use Permits

Provincial Pesticide Use Permits are required prior to applying pesticides (herbicides, insecticides, fungicides) in the following circumstances:

- Pesticides will be applied to private property to which the public normally use for recreational purposes (ie) lodges and cottage subdivisions, parks, campgrounds, etc.

- Pesticides will be applied to public lands such as crown lands, rights-of-way, school yards, golf courses, cemeteries etc.

- Pesticides will be applied on or in a body of water that is not wholly contained within the person's own property.

Information on permits or permit applications may be obtained from:

Pesticide/Fertilizers Section
Manitoba Conservation
Suite 160
123 Main Street
Winnipeg, Manitoba
R3C 1A5

Contact: Ken Plews (204) 945-7067 or the Manitoba Government website at:
http://www.gov.mb.ca/conservation/envapprovals/pesticide/index.html

Pesticide Safety

The guide *Weed Control in Landscape and Turf Areas* contains information on personal protection when mixing or applying products. It is important to avoid accidental contamination by wearing protective equipment and frequently laundering clothing worn when handling products.

Safe Use of Herbicides

Herbicides are classified according to the use hazard and risk involved.

The categories of hazard are:

- toxicity
- flammability
- explosive potential
- corrosivity

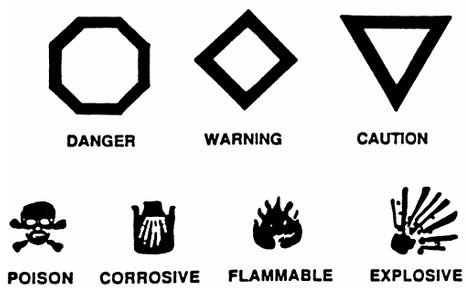
The degree of risk is represented by symbols taken from common traffic sign shapes represented by the stop, caution and yield signs. The signal word for each of the signs is danger (high risk), warning (moderate risk) and caution (low risk). Where the risk is minimal, no designation is required. The label on the container will carry the appropriate signs for the protection of the user. The symbols are illustrated in Figure 1.

LD_{50} values are used to rate the toxicity of pesticides. The LD_{50} refers to the dose of pesticide (in mg per kg of the test animal's body weight) that is lethal to 50 percent of the group of test animals. For example, if a pesticide has a LD_{50} value of 10 mg/kg, and the test animals each weigh 1kg, then 50 percent of the animals would die if they each ate 10 mg of the pesticide.

Oral LD50 Values as they relate to the Risk/Hazard Symbols

Different types of protective equipment are required for pesticides that differ in toxicity. Special equipment requirements are described on the product label, but in general, the following precautions must be taken when using pesticides of different hazard ratings.

Figure 1. Degree of Risk and Hazard Symbols



Danger Poison
LD_{50} less than 500 mg/kg
Indicates high toxicity

Warning Poison
LD_{50} 500-1000 mg/kg
Indicates moderate toxicity

Caution Poison
LD_{50} 1000-2500 mg/kg
Indicates low toxicity

When no symbol
LD_{50} > 2500 mg/kg
Indicates very low toxicity

Danger Poison: requires goggles, respirator, gloves and skin protection, avoid fumes and spray mist.
Warning Poison: requires goggles, gloves and skin protection, avoid fumes and spray mist.
Caution Poison: requires gloves and skin protection, avoid fumes and spray mist.

The absence of a hazard symbol on a pesticide label indicates low toxicity to mammals. Nevertheless, protective clothing should be worn when using pesticides that do not have a hazard symbol.

Protecting Yourself from Exposure

The use of protective equipment and sound safety procedures will help minimize your exposure to herbicides, insecticides and fungicides. Follow the 10 rules for safe application listed, and wear the safety equipment recommended.

10 Rules for Safe Application

1. Never smoke or eat while applying pesticides.

2. Avoid inhaling sprays or dusts. Wear protective clothing and a respirator.

3. Sprayer lines carrying chemicals should not enter the operator's cab.

4. Have soap, water and a towel available. Should concentrated product spill on skin, hands, face or eyes, wash immediately.

5. Wash hands and face when leaving the treated area, before break periods, lunch or urination.

6. Bathe or shower and change to clean clothing after working with pesticides. Wash clothing each day before re-use.

7. Call a physician or get the patient to a hospital immediately if symptoms of illness occur during or shortly after pesticide application. Be sure to take along the product label or container.

8. Store pesticides out of reach of children and where there is no chance of contact with human food or livestock feeds. Do not store herbicides with insecticides and avoid cross-contamination. Storage areas should be locked.

9. Keep chemicals in their original containers, never in unmarked containers or bottles used for food or drink.

10. Follow proper container disposal methods. All containers should be triple rinsed or pressure rinsed, punctured to render the container non-reusable, and delivered to designated disposal sites.

Wash contaminated clothes separately – never with a regular family wash.

Protective Clothing

Wear protective equipment as described in the chart to reduce exposure.

Equipment	Protection	How to wear it
Coveralls	There are two types of coveralls: disposable and reusable. Disposable coveralls are lightweight and comfortable on warm days. They can be worn for mixing and applying pesticides, then discarded at the day's end. If they become contaminated, they should be discarded at once. The second type of coveralls is made of washable fabric and may be reused many times. These fabric coveralls are adequate for use with all but the most highly toxic and concentrated pesticides.	Button (or zip) right up to the neck. Loose coveralls around the neck will suck and blow pesticide in and out of the interior of the coveralls as you bend and move. Wear coveralls over a long-sleeved shirt and pants.
Aprons	When pouring or otherwise handling concentrated pesticides, it makes good sense to wear protection in the form of an apron. The apron protects the front of your body from spills or splashes of the concentrate. The apron should be made of rubber or synthetic liquid-proof material that will resist the solvents used in formulating the pesticide.	Make sure the apron covers your body from your chest to your boots.
Gloves	Protect your hands by wearing chemical-resistant gloves. Neoprene gloves provide the best protection. Natural rubber gloves may be used when handling organo-phosphorus or carbamate pesticides. Be sure that they are designed for use with solvents and pesticides. Never use lined gloves, gloves with wristbands or leather gloves.	Put gloves on and roll up the first inch or two of the cuff. That way when you lift your hands, any liquid on the gloves won't drip down your arm.
Hats	Use a chemical-resistant hat, preferably made of washable plastic. The hat may be a hard hat, or it may be made of flexible plastic. In either case, it should have a plastic sweatband. Wash and dry entire hat after each use and before storing. Ordinary baseball caps with cloth sweatband are dangerous as they absorb the pesticide and recontaminate the forehead each time you wear them. Even small amounts of moderately or slightly toxic pesticides may cause severe skin irritation or other illness if exposure continues for several days.	Ensure hat fits snuggly on head.
Boots	Wear chemical-resistant, unlined boots. These boots are available in a variety of styles and materials. Neoprene boots are the best. Knee-length boots offer greater protection because they extend above the lower end of the apron. Avoid leather or fabric boots and shoes because they will absorb pesticide and cannot be cleaned effectively.	Wear your pant legs outside the top of your boots. This will prevent spills and splashes from running into the boot and on to your leg.

Protecting Your Eyes, Face and Lungs

Wear the following equipment to protect your facial area from exposure.

Equipment	Protection	How to wear it
Goggles	Chemical-resistant goggles keep your eyes safe from both splashing and, if using dry formulations, dust or granules. Don't use goggles with cloth or elastic headbands as these will absorb pesticides.	Wear goggles snugly on your face so that the sides of your head are protected from splashes. If you wear glasses, make sure you purchase goggles which fit snugly over them. Never wear contact lenses when working around pesticides.
Respirators	Only NIOSH-approved respirators should be used. Do not exchange parts of different respirators. (For example, do not use a cartridge produced by Company "A" with a respirator produced by Company "B" as the combination may not provide adequate protection to the user). Dust masks are ineffective in protecting against herbicide vapors. Similarly, the filters on tractor cabs are intended to remove dust and are not designed to protect against pesticide vapors or mists. Chemical cartridge respirators are recommended for outdoor use when mixing and applying pesticides.	When carrying out operations, change filters each day. The cartridge should be replaced when chemical odour becomes apparent or when breathing becomes difficult. New cartridges should always be installed at the beginning of spray season. Prior to commencing work, check the face seal while the respirator is on the wearer's face. Regardless of design, respirators cannot be worn securely by people wearing beards, moustaches or sideburns.
Face Shields	Goggles offer protection, but frequently full-face protection is advised or required according to the pesticide label. It is especially important to protect your eyes and face when pouring or mixing liquid concentrates. Effective face shields are made of clear plastic.	Since the shield attaches to the hard hat, you can raise or lower it as needed.

Laundering Pesticide Soiled Clothing

Skin can absorb chemicals from clothing and equipment that have not been handled and washed properly. Additionally, improper laundering can result in contamination of the washing machine or dryer.

Just as the operator needs to be cautious when handling pesticides, the person doing the laundry needs to be cautious when handling pesticide soiled clothing.

Consult the Manitoba Agriculture factsheet "Protective Clothing for Use with Pesticides" for further information.

Container Disposal

Properly rinsed containers should be delivered to a designated pesticide container disposal site. Contact your Agricultural Representative or your Rural Municipal office for the locations of pesticide container disposal sites in your municipality.

Triple Rinsing

Triple rinsing renders used pesticide containers (metal, plastic, glass) more than 99.9 percent free of residues, in most cases. Recent data shows that over 78 percent of pesticide containers are being rinsed by farmers. Here are the steps that should be followed:

1. Empty contents of the container into the spray tank and drain in a vertical position for 30 seconds.
2. Add a measured amount of rinse water or other dilutent so container is about one-fifth full.
3. Rinse the container thoroughly and pour the rinsate into the spray tank.
4. Repeat the procedure twice (it should only take about 5 minutes in total).
5. Puncture or break triple rinsed containers to render them non-reusable. Paper bags should be rinsed once prior to disposal.

Pressure Rinsing

Also available are pressure rinsers that can rinse all sizes of empty pesticide containers that can be lifted into position over the spray tank. A 30-second rinse with a pressure rinser is convenient and just as effective as triple rinsing. Pressure rinsers are constructed to be thrust into the bottom of a metal can or plastic jug. Holes, situated laterally in the rinser tip, direct water from a pressurized source against the inner sides of the container and effectively wash the residual pesticide into the spray tank.

Some farmers have found it convenient to attach a rinser to the pump on their large water storage tank to minimize container handling. Pressure rinsers have the added advantage of rendering containers useless by automatically puncturing them.

Pesticide Formulations and Compatibilities

Abbreviations associated with product names indicate the type of formulation.

Abbreviations most often used are:

W or WP	= wettable powder
E or EC	= emulsifiable concentrate
SC	= spray concentrate
WDG	= wettable dispersable granules
DF	= dry flowable

When tank mixes are being considered follow any specific label instructions and check label for incompatibilities. Compatibility is usually better if WP is mixed with WP. EC formulations are more likely to cause compatibility problems when mixed with WP formulations.

Compatibility charts only indicate physical mixing properties and do not indicate chemical interactions and for that reason are not included in this guide.

Avoiding Spray Drift

To minimize the risk of drift, follow these guidelines:

1. Do not spray in winds above 15 km/h (9 mph).

2. Do not spray under conditions of dead calm. Dead calm conditions are often associated with temperature inversions, and the combination of these factors can result in long distance spray drift (2 km or more). Fog or dust that seems to hang in the air is a good indicator of inversions, and spraying should be avoided.

3. Avoid using nozzle pressures above 45 psi (310 kPa).

4. Use a minimum of 10 L/acre (45 gallons/acre) water for all herbicides unless otherwise specified for the product.

5. Do not spray when the wind is blowing towards a nearby sensitive crop, shelterbelt, gardens or bodies of water.

6. Use amine formulations of 2,4-D or MCPA where possible. Use special care when applying volatile herbicides (e.g. ester formulations).

7. Ensure that the air flow from air-assist sprayers is properly calibrated to minimize drift for different crop and weed canopies.

8. Operate nozzles at their minimum recommended height. Nozzles which create coarse low-drift sprays should be used where possible.

9. Consider equipping your sprayer with protective drift shrouds. A number of different designs are available that can significantly reduce drift. Note that some drift shrouds are more effective than others at reducing drift.

Spray only in favourable wind conditions.

Handling a Drift Complaint

When spray drift occurs, it is important to take the right steps to resolve the complaint. If you suspect that your crop or property has been damaged because of spray drift, use the following guidelines for resolving the situation.

1. Are you sure that the symptoms or damage you see have been caused by spray drift? Contact your local agricultural office to help determine if the damage is the result of spray drift.

2. Contact the suspected applicator as soon as possible. View the damage with the suspected applicator and determine if that person did, in fact, cause the damage.

3. If the damage was caused by the applicator, determine the extent of the damage and the level of compensation (if any) with the applicator.

4. If the situation cannot be resolved quickly because of disagreements on the extent of damage or level of compensation, contact your local agricultural office to discuss options on how to proceed. Documentation will be required, particularly if insurance companies are involved.

5. The involvement of a private consultant is recommended if documentation is required. Required documentation often includes samples of the damaged plants, photographs, and yield comparisons to determine losses. Your agricultural office can provide you with a list of private consultants in your area.

6. The best approach is to start an open and honest line of communication with the suspected applicator. The majority of drift complaints are resolved quickly and efficiently by communicating with the applicator, without the involvement of outside parties.

How to Identify Weed Leaf Stages

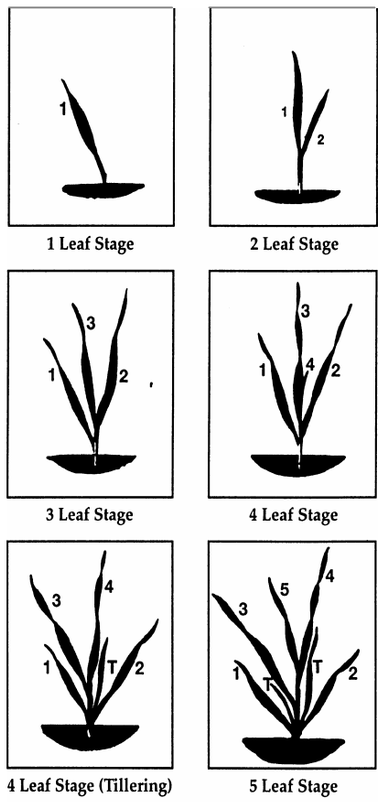
Recognition of plant growth stages is essential for effective weed control. In some cases, weeds are controlled only when they are at certain growth stages. For most post-emergence products, growth stages are described by number of leaves.

Annual Grass Weeds

Leaves are counted, starting at one for the first leaf, and progressing up the primary shoot. Tillers are important but not counted as leaves. A leaf should be counted as soon as it emerges, but may be labelled as early, mid or full leaf. The early leaf stage is when it begins to emerge, the full stage is just before the next leaf emerges. (Figure 2).

Figure 2. Leaf Stages for Annual Grass Weeds

Tillers, or stools, are the secondary shoots of a grass plant. The first tiller emerges from the axil of the first leaf, the second just above the second leaf and so on. Tillers generally appear at the three to four leaf stage. Be sure to identify tillers, and count only leaves on the primary shoot. As well, do not remove any leaves from the main shoot when separating the tillers.



Broadleaf Weeds

Cotyledons: These are the seed leaves which usually emerge above ground. On some plants, such as fababeans, lentils and peas, they stay below the soil surface. Cotyledons are not true leaves and are not counted when determining leaf number. They are a different shape than the true leaves and may dry up and disappear at an early stage.

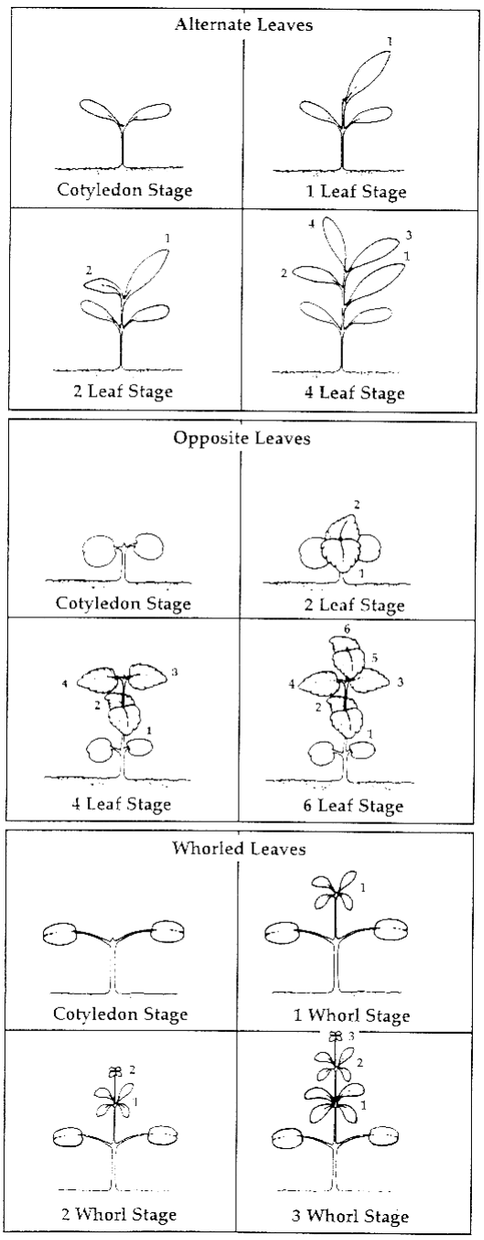
Alternate leaves: Some plants have one leaf at each node on the stem. The next leaf emerges at the next higher node and extends away from the stem in the opposite direction. These plants (lamb's quarters and wild mustard are good examples) are said to have alternate leaves. To determine the leaf stage, simply count the numbers of leaves present (Figure 3).

Opposite leaves: Plants with two leaves at each node, one on each side of the stem, are said to have opposite leaves. The next pair of leaves on the next node are rotated about 45 degrees so that they are not directly over the previous pair. Plants with opposite leaves have even-leaf numbers only. When counting, the leaf number progresses from cotyledons to 2 leaf, 4 leaf, etc. These plants generally appear shorter than plants with alternate leaves at a similar leaf stage. **Be sure to count each pair as two leaves**.

Hemp nettle is a weed which has opposite leaves (Figure 3).

Whorled leaves: More complex plants like cleavers may have whorled leaves. These plants have three or more leaves at each node on the stem. The leaf number in each whorl may vary, so be sure to count each individual leaf unless label recommendation refers to the number of leaf whorls (Figure 3).

Figure 3. Leaf Stages for Broadleaf Weeds



Resistance of Weeds to Herbicides

In recent years, the number of herbicide-resistant weeds and the areas they infest in Manitoba have increased.

Herbicide-resistant weeds arise following repeated use of the same herbicide (or herbicide group) for a number of years on the same area. Where weed resistance has developed, typically a weed, which is normally controlled by a herbicide, escape uncontrolled after a number of years of use of the same product or product group.

Herbicide resistance should be suspected under the following conditions:

- A weed species that the herbicide controlled in previous seasons now escapes the treatment, while other weeds which appear on the label continue to be controlled.
- The escapes cannot be attributed to adverse weather or emergence after application (if a post-emergence product is in question).
- Irregular-shaped patches of a weed develop where the herbicide gives little or no control.
- Records of the past history show repeated use of the same herbicide, or combinations of herbicides, which kill the weed in question in the same way.

Herbicide Resistant Weeds in Manitoba

Current Status of Herbicide Resistance	
Weed	**Description of Resistance**
Wild Oat	Resistant to Group 1 herbicides. Resistant to Group 2 herbicides (At present, confirmed in Manitoba only). Resistant to Group 8 herbicides. Resistant to three different groups of herbicides that includes: Group 1, 2, and 8.
Green Foxtail	Resistant to Group 1 herbicides. Resistant to Group 3 herbicides. Resistant to herbicides in both Groups 1 and 3.
Wild Mustard	Resistant to Group 4 herbicides. Resistant to Group 5 herbicides.
Kochia, wild mustard, chickweed, hemp nettle	Resistant to Group 2 herbicides. Wild mustard, chickweed and hemp nettle confirmed in Manitoba only.

How to Identify Weed Resistance

It is important to avoid confusing herbicide failure due to resistance with herbicide failure due to various other factors (such as weather or application errors). When a herbicide fails to control weeds due to weather or application factors, that herbicide may work in the field the next season. But when herbicides fail due to the development of resistance, they will fail in subsequent years, regardless of weather or application procedures.

Avoiding Weed Resistance

It is far easier to avoid development of resistant weed strains than it is to eradicate or control them after they develop and infest an area.

To avoid the development of resistance on your property, take the following steps:

1. Rather than using the same product on an annual basis, consider using other products with different mechanisms of action if alternative choices are available.

2. Be aware that when resistance to one product develops in a weed population, it can often mean the weed population has developed resistance to other herbicides that act in a similar manner.

3. Keep accurate records of herbicide use. It will be easier to plan your long term weed management strategies if you have good records of your past management practices.

4. Limit the use of herbicides that remain active in the soil for extended periods of time.

If Weed Resistance Develops on your area of Concern

It is important to identify weed resistance before it spreads. Plan on conducting a “patch watch” scouting program this summer to identify suspicious patches before they become difficult to manage. Resistant weed patches have been identified on fields where producers were unaware of their existence.

1. Report suspected cases of resistance to your weed specialist or industry representative.

2. Mow, cultivate or spot spray the patches. Resistant patches should not be allowed to produce seed.

3. Clean equipment before leaving the area to prevent the spread of seeds across the area or to a neighbouring area.

4. Check patches each year to monitor their spread. Keeping your resistant weeds isolated to a manageable patch is easier than dealing with an entire field of resistant weeds.

Resistance Grouping

The following table lists herbicides presented in this guide and places them in groups according to their mechanism of action. New herbicides will not necessarily have a unique mode of action and may fall within the groups listed in the table. Using herbicides from different groups can help to delay or prevent the development of resistant weed populations but for landscape and turf areas, herbicide choices are limited and such rotation is not possible except for control of grasses in ornamental plantings where Group 1 or Group 15 herbicides can be selected for control of some grasses, depending on the ornamentals present. In plantings of deciduous woody ornamentals, Group 15 or Group 20 products can be chosen for broadleaf weed control. See Tables 1 and 2 for help in selecting herbicides for ornamentals.

Important: Herbicides that have the same mechanism of action may not control the same weed spectrum or be safe for use on all target areas. **Always read and follow the label.** Example: Par III and Turfrite 2+2 are both group 4 herbicides which will control clover in turf areas but Turfrite 2+2 is not safe for use on bentgrass.

Herbicide Groups Based on Mechanism of Action

Group 1 (contain ACCase grasskillers)	Acclaim, Venture L
Group 4 (contain growth regulator herbicides)	2,4-D, MCPA, Compitox, K-O-G Granular, Mecoprop, Par III, Premium 3-Way XP, Premium 2-Way XP, Tri-Kil Turf, Turfrite 2+2, Vanquish.
Group 5 (contain Photosynthetic inhibitors – trazines/uracils)	Simazine
Group 9 (contain inhibitors of EPSP synthase)	Glyphosate products
Group 15 (inhibit cell division – benzamides, chloroacetamides)	Betasan, Devrinol, Kerb
Group 20 (inhibit cell wall synthesis Site A)	Casoron G-4
Group 22 (membrane rupture, photosynthetic inhibitors)	Gramoxone

2,4-D

Company

Nufarm (distributed by True North Specialties), IPCO, United Agri Products (UAP)
2,4-D Amine 600, 2,4-D Ester 700– IPCO
2,4-D Amine 600, 2,4-D Ester 700 – Nufarm
2,4-D Amine 500, 2,4-D Amine 600, **2,4-D Ester 600, *2,4-D Ester 700,* Salvo 2,4-D 700 – UAP

Formulations

Application details may differ with different product labels. Consult specific product labels for more information.
470g/L – IPCO 2,4-D Amine 500
564g/L – Nufarm 2,4-D Amine 600
560g/L –IPCO 2,4-D Amine 600
564g/L – UAP 2,4-D Amine 600
**564g/L – UAP 2,4-D Ester 600*
660g/L – Nufarm 2,4-D Ester 700, UAP Salvo 2,4-D 700, IPCO 2,4-D Ester 700
**658 g/L – UAP 2,4-D 700*
**(Formulations of 2,4-D Ester 600 and some 700 formulations may still be available but are being phased out of production in 2006. However, many 700 formulations will still be available after 2006.)*

Use

Lawns, parks, golf courses.

Weeds Controlled

Plantain, dandelion, curled dock, mustard, pigweed, ragweed, shepherd's purse and other weeds susceptible to 2,4-D.

Application Timing

Apply at time of rapid growth (usually May, June and/or September) before grasses are in flag leaf (shot blade) stage.

Rates and Water Volume

700 Ester Formulation: Apply up to 0.76L/acre in 40 – 120 L of water/acre.
500 Amine Formulation: Apply 1.3L/acre in 40-80 L of water/acre.
600 Amine Formulation (IPCO, Nufarm): Apply 0.68-0.76L/acre in 40-80 L of water/acre.
600 Formulation (UAP): Apply 1.08 L/acre in 40-80 L of water/acre.

Restrictions

Aerial Application: Do not apply by air.
Application: Do not use on bentgrass or newly seeded areas.
Maximum Application Frequency: For good lawn/turf management, normally two applications per year per treatment site are adequate. This does not include spot treatments.
Mowing: Avoid mowing for several days before and after treatment.
Rainfall: Do not apply if rainfall is expected, or irrigating, within 24 hours.
Re-entry Interval: Do not allow people (other than applicators) or pets on treatment area during application. Do not enter treated areas until spray has thoroughly dried.
Storage: Store above 0° C.

Use Precautions

Avoid spray drift to any desirable vegetation NOT listed on the label as damage may occur. Avoid contamination of ponds, streams, rivers and other water sources. Do not spray during periods of high winds when spray is likely to drift. Course sprays are less likely to drift.

Environmental Precautions

Applications while plants are under stress, such as during hot, cold or drought conditions, will increase risk of damage to turf and can result in reduced weed control.

How it Works

2,4-D is a systemic herbicide that is absorbed through foliage and roots and is translocated to actively growing areas within the plant. Symptoms include bending and twisting of leaves and stems within 2 to 7 days, followed by browning and plant death 3 to 4 weeks after application.

Hazard Rating

Warning Poison - Amine formulations
Danger Poison, Potential Skin Sensitizer, Warning Skin Irritant – Ester 700 formulations

Acclaim

Company

Bayer Environmental Science Inc., distributed by United Agri Products (UAP).

Formulation

80.5 g/L fenoxaprop-p-ethyl formulated as an emulsifiable concentrate.

Use

For post-emergence control of annual grassy weeds in several turfgrass spp. (all cultivars of seedling and established perennial ryegrass and fine fescue and Kentucky bluegrass established a minimum of nine calendar months.)

Weeds Controlled

Smooth crabgrass, hairy crabgrass, green foxtail, yellow foxtail, barnyard grass, witch grass.

Timing

Apply when weeds are present and actively growing. For best results apply when grass weeds are in the 1-4 leaf plus 3 tiller stage and ensure thorough coverage.

Rate

11.4 mL/100 m². For heavy, mature monostands of grassy weeds a second application may be required after 21 days.

Water Volume

4-8 L of water/100 m².

Restrictions

Application: Licensed applicators only. Do not apply by air.
Tank mix: Do not tank mix with any other herbicide or pesticide.
Storage: Do not freeze.

Precautions

Do not cut grass for 4 days before or after application. Do not apply during periods when weeds are under drought stress as poor control will result. Do not apply if rain is expected within 3 hours of application. Do not water or irrigate for 3 hours after application.

How it Works

The active ingredient, fenoxaprop-p-ethyl is absorbed primarily through the foliage and translocates to the growing points. Visual injury

is evident 5-10 days after treatment (depending on environmental conditions) with complete control taking 14-21 days. Visible effects begin with general chlorosis and purpling of leaves followed by plant death.

Hazard Rating

Caution, Poison.

Betasan 4.8E

Company

Gowan Company, distributed by United Agri Products (UAP).

Formulation

480 g/L bensulide formulated as an emulsifiable concentrate. Container sizes: 10L, 20L.

Use

For pre-emergence control of crabgrass and annual bluegrass in established turf.

Weeds Controlled

For pre-emergence control of annual bluegrass and crabgrass in established turf. Will not control these weeds if they are emerged and established.

Timing

Crabgrass control: Apply any time from fall (September or October) through early spring for spring and summer control. For early spring application, the application must be made prior to crabgrass emergence.
Annual bluegrass control: Apply before weeds emerge from the soil.

Rate and Water Volume

Crabgrass control: Apply 230 mL in 25-50 L of water uniformly on the area of 100 m².

Annual bluegrass: Apply 300 mL in 25-50 L of water on the area of 100 m².

Restrictions

Soil Type: Recommended for use on mineral soils only.
Storage: Do not use, pour or store near heat or open flame. Avoid storage below 6ºC.
Re-entry: Do not allow children or pets on treated lawn until Betasan 4.8E has been watered into the soil and grass is completely dry.
Re-seeding: Do not reseed within one year of application. If reseeding must be done sooner than one year after treatment, remove top 5 cm of soil and replace with clean, untreated soil.

Precautions

Apply when there is little or no wind to avoid drift. Do not get spray on desirable plants.

How it Works

The active ingredient bensulide is I the amide family of herbicides and is a germination inhibitor. It interferes with cell division. It is absorbed onto root surfaces and a small amount is absorbed by the roots.

Hazard Rating

Warning, Poison

Casoron G-4

Company

Crompton Co., distributed by United Agri Products (UAP).

Formulation

4% dichlobenil formulated as a granule.
Container sizes: 15 kg bag and 3 kg jug.

Use

For control of broad leaved and grassy weeds in established plantings of woody ornamentals including: Arbovitae, ash, barberry, birch (cut leaf, weeping), boxwood, caragana, cedar (eastern red, white), crabapple, elm, euonymous, Forsythia sp., heather, honeysuckle, juniper, lilac, linden, maple, mock orange, poplars, rose, spirea, willow, yew (Taxus).

Weeds Controlled

Annual bluegrass, artemisia*, bindweed*, bittercress, blue aster, bracken fern, Canada thistle*, chickweed, crabgrass, quack grass*, dandelion*, foxtail, groundsel, horsetail, grasses (sedges, Juncus spp.), knotweed, kochia, lamb's-quarters, loosestrife, mustard, nutsedge*, pigweed, plantain, purslane, sheep sorrel*, shepherd's-purse, smartweed, sow thistle, spurge, vetch*, wild buckwheat*.
* controlled with the higher rates and late fall application.

Timing

Annual weed control – apply to weed free soil in early spring or late fall before annual weeds have germinated. If annual weeds have started to germinate before application, cultivate to remove them. Apply granules uniformly over the soil surface. Apply when temperatures are below 15ºC.

Rate

Apply 44-70 kg/acre. For small areas apply 11-17 g/m². Use low rate to control annual weeds with repeat applications every year. Use the high rate to control grasses and tough perennial weeds every other year at most.

Control of couch grass and Artemisia in woody ornamentals established at least one year (except boxwood, euonymous, forsythia, heather) – apply 60 kg/acre in late fall (between October 15th and December 15th) and reapply at the same rate in the very early spring (before May1). Do not repeat this application the next year.

Control of quack grass, thistles, bindweed and dandelion – fall treat the areas of weeds from spring plantings of woody ornamentals by applying 90-110 kg/acre in late October or November. Do not transplant into treated soil for one year.

Restrictions

Aerial Application: Do not apply by air.
Application: Do not use in or around greenhouses. Do not apply until 4 weeks after transplanting any crop.
Soil Type: Do not use on light sandy soils.
Storage: Do not store above 35ºC or below 0ºC.

Precautions

Do not use on plantings containing; gladiolas, Ajuga, firs (Abies spp, such as balsam fir), hemlock, herbaceous perennials (plants that die down to the ground in the fall), mugho pine, poplar (established less than 6 months), spruce. Use with caution on shallow rooted ground covers.

How it Works

The active ingredient dichlobenil is a member of the nitrile family of herbicides. It inhibits cell

growth at the growing points of the plant. Weed seed germination and growth initiation is strongly affected.

Environmental Effects

For best results, soil should be moist after application to activate the product. When a dry period is expected after application, incorporate or water in the product. Casoron should not be applied during periods of high soil temperature (above 15ºC). Application at higher temperatures may reduce its herbicidal activity.

Dacthal W-75

Company

AMVAC Chemical Corporation, distributed by United Agri Products (UAP).

Formulation

75% chlorthal formulated as a wettable powder.
Container sizes: 2kg, 10 kg

Use

For use in pre-emergence application for control of crabgrass and other annual grasses and certain broadleaved weeds on mineral soils in turf and established ornamentals including abelia, alyssum, baby's breath, barberry, candytuft, deutzia, feverfew, forsythia, gladiolas, juniper, maple, marigold, peony, petunia, oak, salvia, spirea, weigela, willow.

Weeds Controlled

Susceptible: Common lambsquarters, smooth crabgrass, large crabgrass, lovegrass, witchgrass, purslane, yellow foxtail, green foxtail, common chickweed.
Moderately Susceptible: Redroot pigweed, barnyardgrass, goosegrass, browntop panicum, groundcherry, annual bluegrass, Johnsongrass (from seed).
Tolerant: Velvetleaf, common ragweed, johnsongrass (established from rhizomes), mustards, jimsonweed, galinsoga, smartweed, nutsedge, cocklebur.

Timing

Turf (crabgrass and other weeds): One application made in early spring before weed seed germination usually provides seasonal control. A second application at ½ rate can safely be made 2 months after the first application.
Turf (annual bluegrass and other erratic or late germinating grasses): To supplement early spring application, make a second application in late summer or early fall at least 2 weeks before weed seed germination.
Flower gardens: Apply to the soil following establishment or setting out of flower beds. Delayed or secondary application can be made at any time providing beds have been cultivated and are free of weeds.
Established Ornamental plantings: Apply following proper cultivation to remove existing weeds. Where possible, this should be done in early spring. Late summer applications may be beneficial to control fall germinating weeds, if made following cultivation.

Rate and Water Volume

	Rate(kg)/acre	Water Volume (L) /acre	Rate(g)/100²m	Water Volume (L)/100²m
Turf- crabgrass and other weeds (spring)	6.2	180-440	150	5-10
Turf – annual bluegrass and other erratic or late geminating grasses (fall)	9.0	180-440	225	5-10
Flower gardens and established ornamental plantings	6.8	136	150	5-10

Restrictions

Aerial Application: do not apply by air
Storage: store in dry ventilated place.

Precautions

Do not use on the following plants:
germander, telanthera, bugleweed, mesembryanthemum, button pink, pansy, carnation, phlox, geum, sweet William, celosia, snapdragon, Vinca minor

Recommended for use on mineral soil only.

In turf areas where spring seeding is necessary, there should be a delay of approximately 60 days after the application of most pre-emergence herbicides including Dacthal. This delay increases the survival of desirable grasses. Dacthal is not recommended for use on putting greens.

How it Works

The active ingredient chlorthal is a selective non-systemic group 3 herbicide that is absorbed by the coleoptiles (grasses) and hypocotyls killing germinating seeds.

Equipment Cleaning

Wash out spray tank thoroughly after use.

Devrinol

Company

United Phosphorus, Inc., distributed by United Agri Products (UAP).

Formulations

Devrinol 2-G: 2% napropamide formulated as a granular. Container size: 20 kg
Devrinol 10G: 10% napropamide formulated as a granular. Container size: 22.7 kg

Use

For use on highway, industrial and foundation ornamental plantings including:

Deciduous and Evergreen Trees:			
Acer	Laburnum	Pinus	Populus
Crataegus	Malus	Pittosporum	Prunus
Gleditsia	Picea	Podocarpus	Pyrus

Deciduous and Evergreen Shrubs:			
Asparagus (Sprengeri)	Pittosporum	Ligustrum	Buxus
Hypericum	Podocarpus	Rosa	Euonymus
Juniperus	Pyracantha	Taxus	

Ground covers: Gazania

Weeds Controlled

Annual Grasses: Annual bluegrass, barnyard grass, foxtail, large crabgrass, sandbur, wild oats.
Annual Broadleaf Weeds: Chickweed, small-flowered mallow (from seed), annual sow-thistle, groundsel, pineappleweed, redroot pigweed, prickly lettuce, prostrate knotweed, purslane, storks bill, lamb's quarters.

Timing

Devrinol must be applied pre-emergent to weeds. It does not control established weeds.
Highways, Industrial and Foundation Ornamental Plantings: Apply using broadcast treatment over young ornamentals or as directed application where larger plants are growing. Irrigate soon after application or apply just before expected rain. Fall through spring applications are preferred if irrigation is not available or if application is to be made in low summer rainfall areas.
Ground Covers: Apply as a broadcast treatment over the ground covers. Irrigate immediately with sufficient water to wet soil to a depth of 5-10 cm or apply when rainfall is expected.

Rate

Devrinol 2-G: 90 kg/acre (broadcast)
Devrinol 10-G: 18kg/acre (broadcast)

Restrictions

Aerial Application: Do not apply by air.
Storage: Store in a cool dry place.

How it Works

The active ingredient napropamide is in the amine family of herbicides and is classified as a group 15 herbicide. It is a systemic and is absorbed by the roots and translocated acropetally. It inhibits root development and growth.

Glyphosate

Company and Formulation

Product Name	PCP #	Company	Salt*	Formulation
Roundup Dry Water Soluble	24874	Monsanto	MA	68.5%
Credit	25866	Nufarm	IPA	356 g/L
Vantage	26172	Dow	IPA	356 g/L
Vantage Plus Max	27615	Dow	IPA	480 g/L
Catena	27199	Monsanto	IPA	360 g/L
Roundup Weathermax with Transorb 2	27487	Monsanto	K+	540 g/L
Roundup Ultra	27764	Monsanto	K+	540 g/L

* Salt type: IPA = Isopropylamine, MA = Monoammonium, K+ = Potassium.

Use

To kill off turf and weeds for turfgrass renovation.

Weeds Controlled

Annual Weeds: blue grass, crab grass, downy brome, giant foxtail, green foxtail, Persian darnel, volunteer barley, volunteer corn, volunteer wheat, wild oats, fleabane, flixweed, hempnettle, kochia, lady's thumb, narrow leaved hawk's beard, narrow leaved vetch, prickly lettuce, common ragweed, redroot pigweed, Russian thistle, shepherd's purse, sowthistle, stinkweed, volunteer canola, volunteer flax, wild buckwheat, wild mustard.
Perennial Weeds: Canada blue grass, Kentucky blue grass, smooth brome grass, common cattail, foxtail barley, quackgrass, yellow nutsedge, alfalfa, cotton top, curled dock, dandelion, field bindweed, hemp dogbane, hoary cress, knotweed, milkweed, poison ivy, purple loosestrife, sow thistle, Canada thistle, toad flax,wormwood.

Rates and Water Volume

Product	Boom Application		Hand Held High Volume % Solution	Comments always add 0.5%v/v of an approved surfactant
	Rate/acre	Water vol. (L/acre)		
Vantage Plus Max	0.8 – 3.6	50 -120	0.75 – 1.75	Use higher end of the rate range for perennials.
Roundup Dry	0.5 – 2.5	40 -120	0.5 – 1.0	
Catena	1.2 – 4.8	40 -120	1 - 2	
Roundup Weathermax with Transorb 2, Roundup Ultra	0.7 – 3.2	40 -120	0.67 – 1.34	
Vantage, Credit	1.0 – 4.8	40 -120	1 - 2	

Timing

Do not disturb soil or underground plant parts before treatment. Where existing vegetation is growing in a field or unmowed situation, apply to actively growing weeds at the stages of growth given on the individual labels. Where existing vegetation is growing under mowed turfgrass management, apply after omitting at least one regular mowing to allow sufficient growth for good interception of the spray and proper translocation to underground plant parts. Tillage or renovation techniques such as vertical mowing, coring or slicing should be delayed for 7 days after application to allow proper translocation into underground plant parts. For maximum control of existing vegetation, delay establishment to determine if regrowth from escaped underground plant parts

occurs. When repeat treatments are necessary, sufficient regrowth must be attained prior to application. Desirable turfgrasses may be established following the above procedures.

Restrictions

Application: Do not mix, store or apply this product or spray solutions of this product in galvanized steel or unlined steel (except stainless steel) containers or spray tanks.
Aerial Application: For turf renovation, do not apply by air.

Precautions

Glyphosate is very toxic to non-target plants. Avoid contact with foliage, green stems or fruit of crops, desirable plants and trees since severe injury or destruction may result. Ground Applications- maintain a 15m buffer zone from the downwind edge of the spray boom to non-target areas to minimize drift damage.

How it Works

Glyphosate is a non-selective, systemic herbicide which moves from treated foliage into roots and kills entire plant. Visual effects include gradual wilting and yellowing of the plant which advance to complete browning of the above ground growth and deterioration of underground plant parts. Effects may not be visible for 7 to 10 days after application.

Effects of Growing Conditions

Best results are achieved when temperatures are near 20ºC (28º maximum) and when weeds are actively growing. Frost which kills more than 40% of the above ground tissue will reduce control. Control will also be reduced if foliage is heavily covered with dust.

Hazard Rating

Caution, Eye Irritant (Catena)
Caution, Poison; Danger, Corrosive to Eyes (Roundup Dry)
Danger, Eye and Skin Irritant (Roundup Ultra, Vantage Plus Max)
Caution, Poison; Warning, Eye and Skin Irritant (Roundup Weathermax w/ Transorb 2)
Caution, Irritant (Vantage, Credit)

Gramoxone

Company

Syngenta Crop Protection Canada, Inc.

Formulation

200 g/L paraquat, Container sizes: 1L, 5L, 10L, 55L, 110L, 415L

Use

For turf renovation and prior to turf grass establishment.

Weeds Controlled

Annual grasses and broadleaf weeds.

Timing

Turf to be renovated should be mowed and thoroughly raked to remove all dead and cut vegetation. Apply Gramoxone when green growth is 3-5 cm high. When old turf is dead, cultivate the top 5 cm to cover dead grass, thoroughly rake surface to remove all remaining debris. Level and re-seed or lay sod.

Rates and Water Volume

4.8 L/acre in 400 L of water/acre. For smaller areas apply 125 mL/10 L of water/100m².

Restrictions

Grazing: Do not use treated grass for livestock feed.

Application: Do not apply by air. Do not apply through mist blowers.
Treated Water: Do not use treated water for at least 7 days after treatment for swimming, human or animal consumption. Do not use for at least 5 days after treatment for irrigation.
Storage: Store above 0º C. Store in original container. Do not contaminate foodstuffs, feed or water supply.

Environmental Precautions

Maintain buffer zones of 25 and 55 meters to sensitive terrestrial and aquatic areas, respectively.

Tank Cleaning

Wash equipment thoroughly after spraying. Use a wetting agent (Agral 90 at 60 mL/100 L of water), flush and spray out, then thoroughly rinse with clean water. When possible, the equipment should be filled with clean water and left over night. Spray out before storing equipment or using for other materials.

How it Works

The active ingredient paraquat is a contact herbicide that is absorbed into green leaves and stems where it causes rapid bleaching of green tissue. Plant wilting and desiccation begin within several hours of application, with complete plant death occurring in 1 to 3 days.

Hazard Rating

Danger, Poison
Danger, Corrosive to Eyes

Kerb 50

Company

Dow AgroSciences Canada Inc., distributed by True North Specialties.

Formulation

50% propyzamide formulated as a wettable powder and packaged in water soluble pouches. Container size: 1.36 kg (3 X 454 gm. pouches).

Use

For use in established plantings of iris, peony, ground covers (except Vinca minor) and any coniferous trees and shrubs which are propyzamide tolerant.

Weeds Controlled

Quack grass, and other perennial grasses such as orchard grass and timothy, as well as most annual grasses and chickweed.

Timing

Apply in fall.

Rate

30 grams/100 m² (1500 m² per pouch).

Water Volume

3-5 L of water/100m².

Restrictions

Application: Do not apply by air. Do not apply to plantings that drain onto desirable turf areas.
Soil: Ineffective and not recommended for application re-emergence to weeds on highly organic peat or muck soils.
Handling: Do not allow pouches to become wet or handle with wet hands or gloves prior to adding to spray tank. Oil residues in the tank may make pouches insoluble. Do not add pouches to spray solutions containing boron or that may release free chlorine.

How it Works

The active ingredient propyzamide is a selective systemic herbicide which is absorbed by the roots and translocated. Weeds are killed by root inhibition and abnormal shoot development. Many weeds die before emergence.

Hazard Rating

Caution, Poison

K-O-G Granular Weed Control

Company
Nu-Gro IP Inc.

Formulation
0.70% dicamba formulated as a granular.
Container size: 16.1 kg

Use
Broadleaf weed control on established turf.

Weeds Controlled
Canada thistle, curly dock, ground ivy, yarrow, clover, chickweed (common and mouse-ear), knotweed, sheep sorrel, black medick.

Timing
Bent grass putting greens: For best results apply in spring or fall. Avoid application during extended hot, dry conditions in summer.
Other turf grass areas: Apply any time weeds are actively growing. Delay planting grass seed until after a heavy rain or watering and not sooner than 2 weeks after treatment.
New plantings: Delay treatment until after third or fourth mowing. Do not rake, mow or water within 24 hours after application.

Rate

Turf Type	Weeds Controlled	Rate kg/1000m^2
Bent Grass (putting greens)	Clover, chickweed	3.9
Other Turf Grass Areas	Clover	7.9
	Knotweed, chickweed (common and mouse-ear), sheep sorrel, black medic, Canada thistle*, curly dock*, ground ivy*, yarrow*	15.75 * to control these weeds, repeat applications at 6 month intervals may be required.

Precautions
Application: Do not apply by air. Avoid application on garden plants, flowers and rootzone areas of trees and shrubs. Do not apply to frozen ground.

How it Works
The active ingredient dicamba is a growth regulator type of herbicide that is absorbed primarily by foliage but also by plant roots. It is systemic and translocates throughout the plant causing rapid, undifferentiated growth and bending and twisting of stems and leaves resulting in plant death in 2 to 3 weeks.

MCPA Amine 500

Company

United Agri Products Canada Inc.

Formulation

500 g/L MCPA amine (present as dimethylamine salt) formulated as an emulsifiable concentrate. Container size 10L.

Use

Broadleaf weed control on turf including fairways and lawns.

Weeds Controlled

Susceptible weeds include: stinkweed, lamb's-quarters, common ragweed, vetch, tumbling mustard, ball mustard, bird's-rape, creeping buttercup, false ragweed, field horsetail, flixweed, giant ragweed, hare's-ear mustard, Indian mustard, kochia, mustards, prickly (lobed) lettuce, ragweed, sunflower, wormseed mustard.
Moderately susceptible weeds include: Russian pigweed, wild radish, common plantain, shepherd's purse, dandelion, burdock, cocklebur, thyme-leaved spurge.
Moderately resistant weeds include: curled dock, peppergrass, redroot pigweed, tartary buckwheat,smartweeds, annual sowthistle, American dragonhead, bluebur,buttercup, chickweed, dog mustard, false flax, field peppergrass, goosefoot, hairy galinsoga, lady's thumb, oak-leaved goosefoot, pineappleweed, prairie sunflower, prostrate amaranth, purslane, stinging nettle, sweet clover, sweet gum, tansy mustard, tumble pigweed.
Perennial weeds (and top growth control) include: Leafy spurge, Russian knapweed, Russian thistle, wild buckwheat, Canada thistle, hemp nettle, field bindweed, perennial sowthistle, corn spurry, biennial wormwood, blue lettuce, wild carrot, horsetail, docks, goat's beard, gumweed, hedge bindweed, hoary cress, tall buttercup, toadflax, tumbleweed.

Timing

Apply when weeds are young and actively growing.

Rate and Water Volume

Apply 0.4-1.0 L/acre in 120L of water/acre. Use higher rates for more resistant weeds.
Smaller areas – for 100m², apply 25 mL in 10 L of water.

Tank Mixes

The MCPA Amine 500 label lists tank mixes with mecoprop and mecoprop + dicamba. These mixes may no longer be legal. Check specific product labels prior to use and follow all precautions and restrictions on all labels to be used in the tank mix.

Precautions

Avoid spray drift when using on lawns and turf adjacent to susceptible plants. Vegetables, flowers, fruit trees, special crops and other desirable plants are sensitive to MCPA even in minute quantities. Care should be taken to avoid spraying these types of plants or allowing spray mist to drift onto these plants during both their growing and dormant periods.

Effects of Weather

Applications under hot/dry conditions may result in yellowing of turf.

Restrictions

Application: Do not apply by air.
Re-entry Interval – Do not allow people (other than applicator) or pets on treatment area during application. Do not enter treated areas until spray has thoroughly dried.

How it Works

MCPA is a systemic herbicide that is absorbed through foliage and roots and is trans-located to actively growing areas of the plant. Symptoms include bending and twisting of leaves and stems within 2 to 7 days, followed by browning and plant death 3 to 4 weeks after application. MCPA is persistent in the soil for up to one month in most conditions and up to 6 months in drier climates.

Hazard Rating

Caution, Poison

MCPA Sodium 300

Company

United Agri Products Canada Inc.

Formulation

300 g/L MCPA (present as sodium potassium salts of MCPA) formulated as an emulsifiable concentrate. Container size 10L

Use

Broadleaf weed control on turf including fairways and lawns.

Weeds Controlled

Susceptible weeds include: lamb's-quarters, ball mustard, hare's-ear mustard, tumbling mustard, common ragweed, stinkweed
Moderately susceptible weeds include: blue bur, cocklebur, dandelion, flixweed, goat's beard, Russian pigweed, common plantain, shepherd's purse
Moderately resistant weeds include: field bindweed, wild buckwheat, tartary buckwheat, tall buttercup, common chickweed, hoary cress, curled dock, spear-leafed goosefoot, hemp nettle, horsetail, blue lettuce, tansy mustard, peppergrass, redroot pigweed, quickweed, smartweeds, annual sow thistle, Canada thistle, biennial wormwood
Perennial weeds include: Russian knapweed, perennial sow thistle, leafy spurge

Timing

Apply when weeds are young and actively growing.

Rate and Water Volume

Apply 1.5 L/acre in approximately 440L of water/acre.
Smaller areas: For 100m² apply 50 ml in11 L of water. Wet all foliage thoroughly.

Precautions

Avoid spray drift when using on lawns and turf adjacent to susceptible plants. Vegetables, flowers, fruit trees, special crops and other desirable plants are sensitive to MCPA even in minute quantities. Care should be taken to avoid spraying these types of plants or allowing spray mist to drift onto these plants during both their growing and dormant periods.

Restriction

Re-entry Interval: Do not allow people (other than applicator) or pets on treatment area during application. Do not enter treated areas until spray has thoroughly dried.

How it Works

MCPA is a systemic herbicide that is absorbed through foliage and roots and is trans-located to actively growing areas of the plant. Symptoms include bending and twisting of leaves and stems within 2 to 7 days, followed by browning and

plant death 3 to 4 weeks after application. MCPA is persistent in the soil for up to one month in most conditions and up to 6 months in drier climates.

Hazard Rating

Caution, Poison

Mecoprop, Compitox

Company

Mecoprop: United Agri Products Canada Inc.
Compitox: Nufarm

Formulation

150 g/L mecoprop or mecoprop-p (present as potassium salt) formulated as a liquid.
Container size: 10 L

Use

For broadleaf weed control in turf, golf greens and fairways. Can be used on red fescue, bluegrasses, bent grasses and rye grasses.

Weeds Controlled

Susceptible: common chickweed, plantain, mouse-eared chickweed, clover
Moderately susceptible: buttercup, Canada thistle, creeping Charlie, corn spurry, black medick, stitchwort, dandelion (in tank mix with 2,4-D)

Timing

Apply before flowering in early June or September when weeds are young and growing vigorously. For good lawn/turf management, normally 2 applications per year (not including spot treatments) are adequate.

Rates

Turf stage	Weeds	Rate (L/acre)	Rate (mL/100m²)
Seedling grasses	Susceptible seedling	2.2	60
Established turf	Susceptible established or Moderately susceptible	3.4	90

Water Volume

120-160 L/acre. For small areas use 10 L/100m².

Tank Mixes

Mecoprop: 3 L MCPA Amine + 6.6 L mecoprop for control of mixed weed populations.
Compitox: Where dandelions are present, add 2,4-D to this product.

Check individual MCPA Amine 500 and 2,4-D labels for statements on registered tank mixes. Follow all precautions and restrictions on labels of all products being used in a tank mix.

Precautions

Do not allow drift to come in contact with desirable plants. Some vegetables and ornamentals are very sensitive to mecoprop.

Restrictions

Application: Do not apply by air.

Storage: Do not freeze
Watering: Do not water treated lawn or turf areas for 24 hours after treatment.
Weather: Avoid spraying in very hot weather or in drought conditions.

How it Works

The active ingredient mecoprop is a systemic herbicide that is absorbed through foliage and roots and is translocated to actively growing areas within the plant. Symptoms on susceptible weeds include bending and twisting of leaves and stems within 2-7 days, followed by browning and plant death 3-4 weeks after application.

Tank Cleaning

Rinse all parts including pump, hoses and nozzles several times with water. Then fill complete unit with a solution of water and either detergent or household ammonia (1 part to 100 parts of water) and let stand for 24 hours. Rinse several times with clean water.

Hazard Rating

Caution Poison

Par III, Premium 3-Way XP, Tri-Kil Turf Herbicide

Company

United Agri Products Canada Inc.: Par III
IPCO: Premium 3-Way XP
Nu-Gro IP Inc.: Tri-Kil Turf Herbicide

Formulation

100 g/L mecoprop or mecoprop-p, 190 g/L 2,4-D, 18 g/L dicamba

Use

For broadleaf weed control in established turf areas (ie) parks, lawns, and golf courses including bent grass.

Weeds Controlled

Dandelion, plantain, black medick (yellow clover), buttercup, chickweed, clover, English daisy, ground ivy (creeping Charlie), knotweed (ironweed), poison ivy, ragweed, shepherd's purse, wild white clover, heal-all, devil's paint brush (orange hawkweed), bedstraw.

Timing

Turf (other than bent grass): Apply when weeds are growing actively and temperature is below 30ºC in May or early June or late August and early September. Apply any time to irrigated or watered areas where weeds are not under drought stress and hard to kill. Application during drought or when weeds are under stress will result in poorer control. For good lawn/turf management, 2 applications per year (not including spot treatments) are normally adequate.

Bent grass: Apply in May or mid-August through September. Slight turf yellowing will appear after one week.

Rate and Water Volume

Turf (other than bent grass): 2.2 L/acre in 120 L of water/acre. For smaller areas apply 60 mL/100m² in 10 L of water.

Bent grass: 30 mL/100 m² in 20 L of water. Do not over dose bent grass as damage or kill might occur.

Restrictions

Application: Do not apply by air. Do not spray within 24 hours of rainfall or during hot, dry periods. Do not irrigate within 24 hours of application.
Re-Entry Interval: Do not allow people (other than the applicators) or pets on treatment area during application. Do not enter treated areas until spray has thoroughly dried.
Transfer System: for containers larger than 20 L, use a transfer system that avoids open pouring when transferring liquid concentrate from containers into spray tank.

Precautions
Do not allow spray, mist or vapors to contact field, vegetable, fruit or ornamental crops.

How it Works
The active ingredients 2,4-D, mecoprop and dicamba are systemic herbicides which are absorbed through foliage and roots and translocated throughout the plant causing bending and twisting of leaves and stems. First symptoms should be visible within 7 days and browning and death of plants occurs in 2-3 weeks.

Hazard Rating
Caution, Poison

Premium 2-Way XP, Turf-Rite 2+2 Double Strength Turf Herbicide

Company
IPCO: Premium 2-Way XP
Nu-Gro: Turf-Rite 2+2 Double Strength Turf Herbicide

Formulation
200 g/L 2,4-D + 200 g/L mecoprop formulated as a solution.
Container sizes: (Turf-Rite 2+2) - 4L, 9.5L, 10L, 20L, 205L (Premium 2-Way XP) – 10L

Use
For control of broadleaf weeds in established turf areas (except bent grass). Turf-Rite 2+2 is also registered for use in other established grass areas, vacant lots and along fence rows.

Weeds Controlled
Dandelion, plantain, black medick (yellow clover), buttercup, chickweed, clover, English daisy, ground ivy (creeping Charlie), knotweed (iron weed), poison ivy, ragweed, shepherd's purse, (bedstraw, heal-all, devil's paint brush-not on Turf-Rite 2+2 label).
(Turf-Rite 2+2 is also registered for control of - bindweed*, Canada thistle, corn spurry, curled dock, dock, fall hawkbit, grass-leaved stitchwort, mallow**, mossy stonecrop, narrow-leaved plantain (ribgrass), ox-eye daisy, speedwell, thyme-leaved sandwort. * - temporary control, ** - young stages)

Rate and Water Volume

Product	Rate (L)/acre	Water Volume (L)/acre	Rate (mL)/ 100m^2	Water Volume (L)/100m^2
Premium 2-Way, Premium 2-Way XP	2	120	60	10
Turf-Rite 2+2	1.7-2.2	110-330	40-50	3-8

Timing
Apply when weeds are growing actively and temperature is below 30ºC in May or early June or late August and early September. For knotweed, apply when plants are young, in May or early June only. For creeping Charlie apply in June (spot treatment) and in September. For good lawn/turf management, two (2) applications per year (not including spot treatments) are normally adequate.

Newly seeded areas: *Turf-Rite 2+2* - No treatment recommended within 4 weeks of grass emergence and at half the recommended rate for the first month.

Premium 2-Way (XP) – No treatment recommended until after second mowing.

Restrictions

Application: Do not apply by air.
Re-Entry Interval: Do not allow people (other than the applicators) or pets on treatment area during application. Do not enter treated areas until spray has thoroughly dried.
Transfer System: for containers larger than 20 L, use a transfer system that avoids open pouring when transferring liquid concentrate from containers into spray tank..

Precautions

Do not allow spray, mist or vapors to contact vegetables, fruits or ornamentals.

How it Works

The active ingredients 2,4-D and mecoprop are systemic herbicides that are absorbed through foliage and roots and are translocated to actively growing areas in the plant. Symptoms include bending and twisting of leaves and stems within 2-7 days, followed by browning and plant death.

Tank Cleaning

The manufacturers do not provide enough tank cleaning information on the label to make recommendations. Contact the manufacturer directly for this information.

Hazard Rating

Warning Poison

Simazine 480, Simadex 500

Company

Bayer CropScience: distributed by True North Specialties – Simadex 500*.
**Simadex 500 may not be available after 2006 as it is being phased out of production.*
United Agri Products (UAP): Simazine 480

Formulation

Simazine 480: 474 g/L simazine, 6 g/L related actives formulated as a liquid. Container size: 9.46 L
Simadex: 500 g/L simazine formulated as a liquid. Container size: 10 L

Use

For total weed control in woody ornamentals (cedar, barberry, non-bearing apple, flowering crabapple, boxwood, cotoneaster, dogwood, rose, chamaecyparis, hemlock, juniper, multiflora rose, peony, blue spruce, Norway spruce, red spruce, white spruce, mugho pine, black walnut, white ash) established one year or more.

Weeds Controlled

Broadleaves: lady's-thumb, lamb's-quarters, purslane, ragweed, volunteer clovers, wild buckwheat, smartweed.
Annual grasses: barnyard grass, crabgrass, wild oats, yellow foxtail.
Perennial weeds: Most perennial species starting freshly from seed.

Timing

Apply before buds break in early spring. Apply as directed spray only. Avoid spray contact with desired woody ornamentals.

Rate

Apply 1.8-2.8 L/acre. Use the lower rate for sandy or low organic soils and the higher rate for clay or high organic soils.

Water Volume

120 L of water/acre

Restrictions

Application: Do not apply by air. Do not apply when ground is frozen or snow covered.
Storage: Do not freeze.

Effects of Growing Conditions

Rainfall is required to move the chemical into the root zone of weeds. Effects on weeds may be delayed if soil is dry at time of application.

How it Works

Simazine is a residual systemic herbicide which is absorbed by the roots. Photosynthesis is blocked.

Hazard Rating

Caution, Poison

Vanquish

Company

Syngenta Crop Protection Canada, distributed by True North Specialties.

Use

For weed control in established turf.

Formulation

480 g/L dicamba formulated as a liquid.
Container size: 10L

Weeds Controlled

Broadleaf weeds (see tables below).

Rates and Water Volume

Broadleaf weeds

Species Controlled	**Rate/acre (Apply in at least 44 L/acre of water)**
Clover Sheep sorrel Mouse-eared chickweed Erect knotweed	0.5

Tank Mixes

Species Controlled	Rate/acre (Apply in at least 44 L/acre of water)
Dandelion, plantain and other broadleaf weeds	0.50 L Vanquish + 0.88 L 2,4-D amine (500g/L)
Dandelion, plantain and other broadleaf weeds	0.50L Vanquish + 0.80 L 2,4-D ester (600g/L)

Application Timing

For best results apply to actively growing weeds in early spring or fall, two weeks prior to first frost.

Restrictions

Application: Do not apply by air.
Grazing: Treated areas should not be grazed or cut for hay.

Precautions

General: Do not apply closer than the drip line of trees and shrubs. Apply with caution near trees and shrubs. Do not rake, mow or water lawn within 24 hours after application. **Do not apply to Bent grass turf areas**.
Herbicide Resistance: To delay herbicide resistance rotate the use of Vanquish (or other group 4 herbicides) with different herbicide groups.
Mixing: Do not mix with oils.

How it Works

The active ingredient dicamba is a growth regulator type of herbicide that is absorbed primarily by foliage but also by plant roots. It is systemic and translocates throughout the plant causing rapid, undifferentiated growth and bending and twisting of stems and leaves resulting in plant death in 2 to 3 weeks.

Hazard Rating

Caution Poison

Venture L

Company

Syngenta Crop Protection Canada, Inc.

Formulation

125 g/L fluazifop-p-butyl and s-isomer formulated as an emulsifiable concentrate.
Container sizes: 2L, 5L, 8L

Use

For control of grass weeds in many newly transplanted or established non-grassy ornamentals, trees, shrubs and ground covers.

Over-the-top applications may be made to the following ornamentals in Table 1 and Table 2. Species followed with and asterisk(*) should receive directed applications from bud break to initial growth hardening.

For ornamentals listed in Table 3, apply a directed spray to avoid spray contact with the foliage.

Table 1. Annuals and Perennials

Alyssum	Chrysanthemum	Impatience	Potentilla
Angel's Hair	Delphinium	Iris	Purple coneflower
Anthemis	Dianthus	Lathyrus	Rock cress
Baby's Breath	Doronicum	Lily	Rudbeckia
Barrenwort	Draba	Lilyturf	Salvia
Bergenia	English Ivy	Limonium	Scabious
Bugleflower	Evening Primrose	Linaria	Sempervivum
Catmint	Fleabane	Loosestrife	Silver lace-vine
Centaurea	Fleeceflower	Lupine	Spurge
Cerastium	Forget-me-not	Marigold	Sweet pea
Clarkia Lathyrus	Gaillardis	Moneywort	Verbena
Common Periwinkle	Gazania	Pearlwort	Wild strawberry
Coreopsis	Geum	Petunia	Yucca
Crown Vetch	Hydrangea	Poppy	Zinnia

Table 2. Trees and Shrubs

Apple, crabapple	Escallonia	Linden	Viburnum
Arborvitae (cedars)	Euonymus	Maple	Virginia creeper
Ash	Fir*	Pear	Weigia
Barberry	Firethorn	Pieris	Willow
Boxwood	Forsythia	Pine	Rose
Caragana	Hemlock*	Podocarpus	Scotch heather
Cotoneaster	Honeysuckle	Privet	Smoke tree
Currant	Hornbeam	Quince	Snowberry
Elder	Juniper (except junipers listed in Table 3)	Spiraea	
Elm	Lilac	Spruce*	

Table 3. Plants and Shrubs for Directed Spray Only

Bellfower	Compact Pfitzer Juniper
Sedum	Blue Haven Juniper
	Dogwood
	Mockorange

Weeds Controlled

Johnson grass, Persian darnel, barnyard grass, wild oats, wild proso millet, crabgrass, fall panicum, old witchgrass, green and yellow foxtail, quackgrass, wirestem muhly.

Timing

Annual grasses: Apply to actively growing plants at full 2-leaf to 5-leaf stages (except green and yellow foxtail). For green and yellow foxtail, apply at full 2-leaf to 4-leaf stage. Established grasses beyond the 5-leaf stage will not be controlled. Most effective control is achieved before the grasses produce tillers. Application made to annual grasses that have not tillered and are under moisture and/or temperature stress will not provide acceptable control.

Quack grass (seasonal control): Apply to actively growing plants that have 3 to 5 fully developed leaves. Application to plants greater

than 20 cm in height or which have reached the heading stage will not provide adequate control. For annual plantings, rhizomes of quack grass should be fragmented by tillage prior to application. Tillage can be done in the fall or spring prior to planting. In perennial plantings, effective seasonal control can be achieved providing quack grass is not under moisture or temperature stress and that application is confined to the optimum leaf stage. Competition with desirable plants generally enhances control of quack grass. Do not cultivate for 5 days after application.

Rate

Grass Species Controlled	Rate/acre	Recommended Leaf Stage
Johnson grass, Persian darnel, barnyard grass	0.32	2-5
Wild oats, wild proso millet, crab grass, fall panicum, old witch grass	0.40	2-5
Green and yellow foxtail (W. Canada)	0.56	2-4
Quack grass	0.80	3-5
Wirestem muhly	0.80	3-5

Water Volume

20-80 L of water/acre.

Restrictions

Application: Do not apply by air. Do not apply within 15 m of fish-bearing waters and wildlife habitats.
Storage: May be frozen.

How it Works

The active ingredient fluazifop-p-butyl is a systemic herbicide that is absorbed through foliage and translocated from treated leaves to growing points within the plant. Symptoms include yellowing of newest leaves in 1-3 days, followed by browning and death 21 to 28 days after treatment.

Hazard Rating

Caution, Poison