AGRI-FACTS
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Weed Management in Tree Nurseries

Weed management in tree nurseries should consist of cultural/preventative measures and should be supplemented by the effective use of appropriate herbicides. Since weeds reduce the growth and quality of nursery plants by competing for nutrients, water and light, nursery growers must plan an effective weed control program.

This factsheet will review preventative measures and list registered herbicides for planning a weed control program in tree nurseries. Information about herbicide selectivity, soil versus foliar activity and steps for planning a weed control program with herbicides is also included.

Preventative – sanitation measures

Weeds reduce the growth and quality of nursery plants

- Good sanitation practices are important to prevent the addition of weed seeds to the soil seed bank. Many annual species are prolific seed producers; some produce over one hundred thousand seeds per plant. These seeds can remain dormant and viable for many years. Do not let weeds set seed. Weeds on roadways, paths and nursery headlands should be controlled by mowing or the appropriate use of herbicides.
- Limit the introduction of weed species that currently do not occur in your nursery. Weed seeds or regenerative plant parts (rhizomes, stolons, roots) may be introduced into the nursery with nursery stock from outside sources, compost and manure as well as soil adhering to machinery. New weed species may add an additional cost to your weed control program. Compost manure to kill the majority of weed seeds. Wash nursery equipment, if used in an area containing "new" weed species, with water under high pressure. Scout nursery production areas for new weeds and, if found, pull and destroy them.
- Use cover crops or mulches. Fall rye and barley are excellent cover crops that compete effectively with weeds and prevent erosion. If need be, weeds can be controlled in cover crops with the use of herbicides, or the entire stand can be killed off before seeds can mature (green manure culture). Mulches can also be effective in suppressing weed growth, but they must be at least 8 to 10 cm deep to keep sunlight from penetrating to the soil. The use of mulches must be assessed carefully against the risk of increased damage to trees/shrubs by rodents. Geotextile mulches may be appropriate for certain uses.
- Mechanical cultivating and hand weeding will be required for areas where herbicides cannot be used. These methods should also be used where a herbicide has been ineffective or tolerant weeds have continued growing. The repeated use of one herbicide, or herbicides with a similar mode of action, will gradually produce a shift in the weed population to those that are tolerant, or it could lead to the development of a herbicide resistant biotype. Annual weeds are more readily killed by cultivation when they are small (less than 5 cm tall).
- Make a list of the main weeds present in the nursery, by field and location, and record these in a handy reference. Weeds of special concern, such as patches of Canada thistle for example, should be outlined on a nursery map. A weed species inventory is an important tool in planning strategies for weed control. In addition, accurate weed identification is essential for planning a chemical weed control program.

Planning a weed control program with herbicides

Identify the weed problem, then select the best herbicide

Identify weeds and record their occurrence the year before planting. Eradicate any perennial

weeds before planting. Match your nursery weeds with the weeds listed on the herbicide labels registered for your specific nursery crop (Table 5).

Keep records of your soil characteristics

Keep a record of the soil texture, per cent organic matter, pH and a field map showing the different soil types in the nursery. This information is required for making decisions concerning soil-applied herbicides. Labels for pre-emergence herbicides specify rates that relate to soil texture and organic matter content. For example, linuron and simazine labels specify that these products should not be used on sandy soils. Devrinol is not recommended for use on soils with organic matter greater than 10 per cent.

Understand how the selected herbicide performs

Find out as much as possible about the herbicide's persistence, performance under moist versus dry growing conditions, stage of both the crop and weeds, requirements for irrigation/rain and requirements for soil incorporation.

Apply the herbicide correctly

Calculations and calibration of sprayer output must be accurate. Carefully check nozzles for the spray pattern and spray output (variation between nozzles greater than 5 per cent is not acceptable). Maintain records of the herbicide application, i.e. dates, weather conditions, soil conditions and other application details, such as amount of herbicide applied, litres of water used, area sprayed, pressure and sprayer forward speed (tractor gear and throttle setting). These records will assist in interpreting the results.

Tank mixes

Decide if it is desirable to mix a pre-emergent herbicide with a post-emergence herbicide to destroy emerged weeds and to provide residual control if more weeds are likely to emerge. However, only a few registered tank mixes are available, for example paraquat (Gramoxone) with simazine (Princep). Non-registered tank mixes may decrease herbicide activity and increase the risk of crop injury, or they may be incompatible in the spray tank.

Herbicide selectivity

Herbicide selectivity refers to the ability of a herbicide to control weeds in crops or nursery plantings without damaging the crop. In nursery plantings, including containerized stock, herbicide selectivity is based on some or all of the following conditions:

- the herbicide remains at the soil surface and does not reach the tree roots
- the herbicide dosage is correct
- the herbicide does not come in contact with foliage or green bark or is not absorbed
- the tree/shrub species is able to metabolize or break down the herbicide

The herbicide label provides the required information for optimum application conditions.

Factors affecting herbicide performance

Soil-applied herbicides (pre-emergence)

Soil-applied herbicides include trifluralin, linuron, dichlobenil, napropamide, oxadiazon, simazine and chlorthal. These herbicides, with the exception of linuron products, are applied to a weed-free surface since these products are not taken up by the foliage. Secondly, the soil surface should be free of debris, such as a thick layer of dead leaves, to avoid tie-up of the herbicide (this does not apply to granular herbicides).

Soil-applied herbicides are absorbed either by the roots or shoots of germinating weeds (usually in the top 2 to 3 cm of soil). Herbicides must be moved into the root uptake zone by rainfall or irrigation (about 75 to 125 mm) or by mechanical incorporation (see label for specific information). Susceptible germinating weed seedlings are killed by herbicide uptake from the soil solution or vapour phase, whereas those already emerged are likely to continue growing. Many soil-applied herbicides persist up to a year or more.

The herbicides listed above are selective in trees/shrubs since the chemical remains near the soil surface. The potential, however, for the herbicide to leach into the root zone is much greater in sandy soils. Certain soil-applied herbicides are therefore not recommended for coarse-textured soils. Herbicide solubility in water (Table 6) infers risk for leaching; herbicides with solubility 1 ppm or less have very low leaching potential.

Established nursery plants are more tolerant to herbicides than newly-transplanted stock or seedlings because of a more extensive root system. Soil-applied herbicides need to be applied at the correct dosage to avoid crop injury.

Foliar-applied herbicides (post-emergence)

Foliar-applied herbicides are applied to emerged weeds and can be either systemic or contact in activity. Contact herbicides are not translocated whereas the systemics are taken up via the foliage into the plant's vascular system. Foliar-applied herbicides are most effective when applied to small, actively growing weeds with adequate moisture and warm weather. Sprays of these herbicides must be

carefully directed to avoid hitting the foliage and immature bark of nursery stock. Gramoxone is a contact herbicide that primarily controls top growth of perennial weeds; Roundup (and other glyphosate products) and Amitrol 240 L are systemic herbicides.

Herbicides registered for use in tree nurseries

Pre-emergence herbicides are applied to the soil before weed emergence and, in most instances, require soil incorporation either by water or tillage. Post-emergence herbicides are applied after weed emergence and generally require good spray coverage of the weeds.

The term "non-selective" refers to the herbicide's capacity to kill crop and weeds alike. "Selective" post-emergence herbicides only kill certain weeds and not the crop for which the herbicide is registered.

The list of nursery crops and corresponding registered herbicides are listed in Tables 1, 2 and 3. Weeds controlled by herbicides registered for nursery crops are listed in Table 5. Information on herbicide groups, mode of action (how herbicides work) and herbicide solubility is provided in Table 6.

linuron – This product has been used in Alberta's shelterbelt program and in nurseries for spruce and pine transplants since the 1960's. At this time, linuron is not specifically registered for nursery plantings. It is grouped in with pre-emergence herbicides; however, it has considerable foliar activity as well. Linuron can be applied as an overtop spray without injury to dormant shelterbelt plants; however, this product can cause considerable crop injury if applied directly to the foliage of growing plants. Linuron becomes ineffective if the treated area is cultivated after treatment. It does not control established perennial weeds nor does it control most grasses. It effectively controls annual species in the Brassicaceae (mustard) family. The first symptom of linuron activity in plants is chlorosis of the newest leaves followed by plant death after about two weeks. Soil persistence in the Brown soil zone is generally one full season, but activity in high organic matter soils (>10 per cent) disappears after eight to ten weeks.

glyphosate – This herbicide is used for site preparation and for the control of annual and perennial weeds in nursery crops. In established crops, it is usually applied as a directed spray. Wilting and yellowing of treated annual weeds generally occurs within two to four days, but two weeks may be required to kill the weeds. Glyphosate is adsorbed to soil particles and unavailable for root uptake.

amitrol – This is a non-selective herbicide that translocates within plants. It persists in the soil for several weeks. Typical symptoms of affected plants are whitened foliage, followed by browning and death.

paraquat – This non-selective, contact herbicide is generally considered to lack the capacity to translocate within plants. Thus, it will control the tops of perennial weeds, but not the root system. Symptoms appear within hours of application and desiccation occurs within two days. This product does not control wild buckwheat. Although paraquat is highly soluble in water, it binds with soil particles and is not available to plant roots nor does it leach.

trifluralin – This product is more active on annual grasses than linuron; however, trifluralin does not control weeds in the Brassicaceae family. The use of trifluralin, pre-plant and incorporated into the soil, followed by linuron as a pre-emergence spray provides control of a broad spectrum of weed species. Trifluralin is not generally used for seedbeds (Siberian elm seedbeds are an exception), but rather for transplant stock with a well established root system. Higher application rates are specified on the label for soils with soil organic matter greater than 6 per cent. Herbicide carryover into the following growing season will be greater under dry soil conditions.

napropamide – This herbicide must be applied pre-emergent to weeds and incorporated with irrigation or shallow cultivation. Napropamide can be applied to specific newly-planted container stock after the soil has settled from the first watering and to field-grown nursery stock. If this product is not incorporated, decomposition by sunshine will make it ineffective. Decomposition can also be enhanced by the build-up of certain micro-organisms where this herbicide has been repeatedly used on the same soil. It does not control members of the mustard family.

simazine – This herbicide is registered for use in field stock, shelterbelt and certain species grown in containers. The herbicide is an effective and inexpensive product; however, its lengthy persistence has generally deterred its use in field plantings in prairie soils. Simazine is more persistent under alkaline soil conditions than in acidic soils. Shallow-rooted trees and shrubs, particularly poplar and lilac, often show chlorotic growth on knolls where the topsoil has been eroded.

chlorthal – This herbicide is registered for pre-emergent control of annual grasses and certain broadleaved weeds in mineral soils in established nursery stock only. It will provide control for up to four months.

propyzamide – This herbicide selectively controls some annual and perennial grasses and chickweed in established plantings. Members of the Compositae family are not controlled.

acetic acid – This herbicide is a non-selective post-emergent, foliar active product that gives rapid burndown of annual weeds and top growth reduction of perennial weeds. Best control of young, actively growing weeds.

oxadiazon – This product is registered for a number of species grown in containers only. Oxadiazon does not control common chickweed. Rainfall or overhead irrigation is required after application to activate the herbicide. Do not mechanically incorporate this herbicide. This product is usually applied once per growing season.

sethoxydim and fluazifop-p-butyl – These two products control grasses only and have no effect on most broadleaved plants. For optimum herbicide performance, grassy weeds should be growing under conditions of adequate moisture and fertility, moderate temperatures (15 to 28 degrees C) and without stress. Early application (1 to 6 leaf stage, depending on product) and low water volumes (20 to 40 L/ac) also contribute to successful results. The control of quackgrass can be enhanced by cultivation or rototilling seven days or more after treatment. Quackgrass should be treated when actively growing, up to the 3 to 5 leaf stage (depending on product). Check the Venture L label for plants that can be sprayed over the top and those that require a directed spray.

dichlobenil – This product is registered for the control of grass and broadleaved weeds in established trees and shrubs and for some nursery species grown in containers. Dichlobenil can evaporate rapidly when applied under high temperature and moist soil conditions. It is best to apply the herbicide under cool conditions (late fall, soil not frozen) to a dry soil just before rainfall or snow. Do not use this product in seedbeds, transplant or cutting beds, or in greenhouses. Do not apply to first-year fruit stock or within three months before or following grafting or budding of root stocks or planting of new grafts.

Personal safety for handling and applying herbicides

Ensure your personal safety while handling or applying herbicides by wearing the appropriate protective equipment and clothing. Please refer to the herbicide label and to the guide *Crop Protection*, Agdex 606-1, (the "Blue Book" published by Alberta Agriculture and Food) for specific information on this important topic.

Disclaimer

This publication is intended to be used as a guide only. While every effort has been made to ensure accuracy, Alberta Agriculture and Food does not accept responsibility for label changes, errors in conversion or otherwise. It remains the responsibility of readers to follow product information on the product label or package insert. The publisher, editor and all contributors to this publication cannot be held responsible for publication errors or any consequence resulting from the use of this publication.

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Table 1. Registered herbicides for coniferous trees and shrubs

	Active ingredient	linuron	amitrol	paraquat	trifluralin			napropamide	simazine	oxadiazon	sethoxydim	fluazifop-p-butyl	dichlobenil	chlorthal	propyzamide	glyphosate
	Herbicide trade name	Linuron 400 L/Lorox L/DF	Amitrol 240 L	Gramoxone L	Rival EC	Treflan Granular	Bonanza 400/Bonanza 480 L	Treflan E.C.	Devrinol 10G/50DF/2G	Simadex Simazine/Princep Nine-T/Simazine 480	Ronstar 2G	Poast Ultra	Venture L	Casoron G-4/G-2	Dacthal W-75	Kerb 50 WSP	Glyphosate products
Tree and shrub species																	
Arborvitae – Cedar	*Thuja* spp.		D[1]	D		R[1]			R	F[1]		F	F	F		F[1]	
White Cedar	*T. occidentalis*		D[1]	D		R[1]								R			
Douglas Fir	*Pseudotsuga menziesii*		D[1]	D					R			F	F			F[1]	
Eastern Red Cedar	*J. virginiana*		D[1]	D										F			
Juniper	*Juniperus* spp.		D[1]	D		R			R	F[1]	C	F	F	F	R	F[1]	D[1]
Pfitzer Juniper	*J. chinensis*		D[1]	D		R							F	C			
Compact Pfitzer Juniper	*J. chinensis pfitzeriana compacta*		D[1]	D									D	C			
Spreading Juniper	*J. horizontalis*		D[1]	D		R							F	C			
Savin Juniper	*J. sabina*		D[1]	D		R							F				
Rocky Mountain Juniper 'Blue Haven'	*J. scopulorum*		D[1]	D		R							D				
Fir	*Abies* spp.								R				FD			F[1]	D[1]
Pine	*Pinus* spp.		D[1]	D					R		C		F			F[1]	D[1]
Mugo Pine	*P. mugo*		D[1]	D		R				F[1]	C						
Scots Pine	*P. sylvestris*	S[1]	D[1]	D	S		S	S			C	F					
Spruce	*Picea* spp.		D[1]F	D		R			F	F[1]	C[2]		FD			F[1]	D[1]
White Spruce	*P. glauca*	S[1]	D[1]	D		R				F[1]	C[2]	F					
Colorado Blue Spruce	*P. pungens glauca*	S[1]	D[1]	D		R				F[1]	C	F					

[1] Use only on established plants

[2] Some specific varieties have been found to be sensitive

F field grown

C container grown

S shelterbelts

D directed spray only

R registered for field and container grown nursery plants

Table 2. Registered herbicides for deciduous trees

Active ingredient	linuron	amitrol	paraquat	trifluralin			napropamide	simazine	oxadiazon	sethoxydim	fluazifop-p-butyl	dichlobenil	chlorthal	glyphosate
Herbicide trade name	**Linuron 400 L/Lorox L/DF**	**Amitrol 240 L**	**Gramoxone L**	**Rival EC**	**Bonanza 400/Bonanza 480 L**	**Treflan E.C.**	**Devrinol 10G/50DF/2G**	**Simadex Simazine/Princep Nine-T/Simazine 480**	**Ronstar 2G**	**Poast Ultra**	**Venture L**	**Casoron G-4/G-2**	**Dacthal W-75**	**Glyphosate products**
Tree species														
Apple, Crab Apple	*Malus* spp.		D[1]	D			F	F[1]		N	F	F		
Ash	*Fraxinus* spp.		D[1]	D			F	F[1]			F	F		D[1]
Green Ash	*F. pennsylvanica lanceolata*	S[1]	D[1]	D	S	S	S		S[1]		F			
Cherry, Peach, Plum	*Prunus* spp.		D[1]	D			F			N		F		
Birch	*Betula* spp.						F							
Cutleaf Weeping Birch	*Betula pendula* 'Gracilis'		D[1]	D								F		
Elm	*Ulmus* spp.	S[1]	D[1]	D	S	S	S		S[1]			F	F		D[1]
Linden	*Tilia* spp.		D[1]	D								F	F		
Maple	*Acer* spp.	S[1]	D[1]	D			F		C	F	F	F	F	D[1]
Manitoba Maple	*A. negundo*		D[1]	D				S[1]						
Oak	*Quercus* spp.		D[1]	D			F						F	
Pear	*Pyrus* spp.		D[1]	D			F				F			
Poplar	*Populus* spp.	S[1]	D[1]	D			F				F	F		D[1]
Willow	*Salix* spp.	S[1]	D[1]	D							F	F	F	D[1]

[1] Use only on established plants

F field grown

C container grown

S shelterbelts

D directed spray only

R registered for field and container grown nursery plants

N non-bearing fruit trees

Table 3. Registered herbicides for deciduous shrubs

	Active ingredient	linuron	amitrol	paraquat	trifluralin				napropamide	simazine	oxadiazon	sethoxydim	fluazifop-p-butyl	dichlobenil	chlorthal	glyphosate
	Herbicide trade name	Linuron 400 L/Lorox L/DF	Amitrol 240 L	Gramoxone L	Rival EC	Treflan Granular	Bonanza 400/Bonanza 480 L	Treflan E.C.	Devrinol 10G/50DF/2G	Simadex Simazine/Princip Nine-T/Simazine 480	Ronstar 2G	Poast Ultra	Venture L	Casoron G-4/G-2	Dacthal W-75	Glyphosate products
Shrub species																
Burning Bush	*Euonymous* spp.		D[1]	D		R			R				F	F	F	
	E. fortunei		D[1]	D		R										
Caragana	*Caragana* spp.	S[1]	D[1]	D	S		S	S		S[1]		F	F	F		D[1]
Cotoneaster	*Cotoneaster* spp.		D[1]	D					R	F[1]	C[2]		F			
Peking	*C. dammeri*		D[1]	D		R										
Currant, Gooseberry	*Ribes* spp.		D[1]	D									F			
Alpine Currant	*R. alpinum*		D[1]	D							C					
Dogwood	*Cornus* spp.		D[1]	D		R			R	F[1]	C		D			
Bailey's Dogwood	*C. alba*		D[1]	D		R										
Elder	*Sambucus* spp.		D[1]	D									F			
Golden Elder	*S. canadensis* 'Aurea'		D[1]	D							C					
Forsythia	*Forsythia* spp.		D[1]	D					R				F	F	F	
Hawthorn	*Crataegus* spp.		D[1]	D					F							
Honeysuckle	*Lonicera* spp.		D[1]	D					F				F	F		D[1]
Lilac	*Syringa* spp.		D[1]	D							C	F	F	F		
Mock Orange	*Philadephus* spp.		D[1]	D		R[1]							D	F		
Nanking Cherry	*Prunus tomentosa*		D[1]	D					F		C					
Potentilla	*Potentilla* spp.		D[1]	D							C	F				

(continued)

Table 3. *(continued)*

	Active ingredient	linuron	amitrol	paraquat	trifluralin				napropamide	simazine	oxadiazon	sethoxydim	fluazifop-p-butyl	dichlobenil	chlorthal	glyphosate
	Herbicide trade name	Linuron 400 L/Lorox L/DF	Amitrol 240 L	Gramoxone L	Rival EC	Treflan Granular	Bonanza 400/Bonanza 480 L	Treflan E.C.	Devrinol 10G/50DF/2G	Simadex Simazine/Princip Nine-T/Simazine 480	Ronstar 2G	Poast Ultra	Venture L	Casoron G-4/G-2	Dacthal W-75	Glyphosate products
Shrub species																
Rose	*Rosa* spp.		D[1]	D					R	F[1]			F	F		
Saskatoon Berry	*Amelanchier alnifolia*		D[1]	D								F				
Sea Buckthorn	*Hippophae rhamnoides*		D[1]	D								F				
Spirea	*Spiraea* spp.		D[1]	D		R						F	F	F	F	
	S. arguta		D[1]	D		R										
	S. bumalda		D[1]	D		R										
Snowberry	*Symphoricarpus rivularis*		D[1]	D									F			
Viburnum	*Viburnum* spp.		D[1]	D					F		C[2]		F			
Weigela	*Weigela spp.*		D[1]	D									F		F	

[1] Use only on established plants

[2] Some specific varieties have been found to be sensitive

F field grown

C container grown

S shelterbelts

D directed spray only

R registered for field and container grown nursery plants

Table 4. Herbicides for use in nursery crops, with remarks on application timing and restrictions on use		
Herbicide trade name	**Active ingredient**	**Remarks**
Before planting		
Rival EC Bonanza 400 L Bonanza 480 L Treflan E.C.	trifluralin	Apply in spring before transplanting shelterbelts. Incorporate according to label directions. Do not apply if soil is crusted, lumpy or too wet for good mixing action.
New plantings or established stock – pre-emergence to weeds		
Treflan Granular	trifluralin	May be used on established field or container stock or on woody ornamental beds. Apply early in the spring. Smooth soil surface should be present to ensure even distribution. Irrigation or precipitation should follow application.
Linuron 400 L Lorox L Lorox DF	linuron	Shelterbelt plants must be established at least 1 year. Make only a single application. Apply before buds open in the spring and before weeds are 10 cm high. Do not use on sandy soils.
Devrinol 10G Devrinol 50DF Devrinol 2G	napropamide	Use on a range of field-grown and container nursery stock. Use only on transplanted or established stock. Apply as a band or broadcast depending on plant size. Adequate moisture is necessary for good weed control. Mechanical incorporation may be necessary. Does not control emerged weeds or perennials.
Simadex Simazine Princep Nine-T Simazine 480	simazine	Use only on nursery stock or shelterbelts established 1 year or more. Apply in fall or spring. Rainfall is required to move chemical into root zone. Apply before buds break in the spring. Do not apply to trees grown on saline soils. Adjust rate based on soil type.
Ronstar 2G	oxadiazon	For use on ornamentals grown in containers only. Ensure uniform distribution in the container. Rainfall or overhead irrigation will improve control activity. Do not apply to wet foliage or when granules will collect on leaves. Suggestion: For a more uniform application, apply half the product in one direction and the other half in the opposite direction.
Casoron G-4 Casoron G-2	dichlobenil	Established planting only. Apply when temperature is less than 15°C. Water is required to move chemical into the soil. Apply in early spring or fall. Use high rate every other year or low rate every year. Do not use on plants that die down to ground in fall, and use with caution on shallow-rooted ground covers. Can be used for some container-grown species; must be watered in after application. Consult label for directions for use on fruit tree nursery applications.
Dacthal W-75	chlorthal	Apply at lining out, late fall or early spring. Apply to recently cultivated, uniform texture soil. Can be applied immediately after lining out stock. For established plantings, apply after cultivation to remove existing weeds. Apply in early spring. Can also be applied in late summer, if following cultivation.

(continued)

Table 4. *(continued)*		
Herbicide trade name	**Active ingredient**	**Remarks**
Post-emergence – after weed emergence, directed spray only		
Glyphosate Products	glyphosate	Different formulations and concentrations are available. Rate depends on the weeds to be controlled. Glyphosate products are non-selective and must be applied as a carefully directed spray to avoid contact with tree or shrub foliage and immature bark.
Amitrol 240 L	amitrol	Established shelterbelts only. Spray carefully to avoid contact with trunks or foliage of shelterbelt plants. Restricted application on spruce nursery barefoot stock. Consult product label for detailed application instructions.
Gramoxone	paraquat	Established shelterbelts/nurseries only. Apply carefully to avoid contact with green foliage or other green plant parts. Adjust rate based on size of weeds. Directed spray only.
Poast Ultra	sethoxydim	Treat annual grasses when at 1 - 6 leaf stage or quackgrass when actively growing, up to 3 leaf stage (8-12 cm high). Merge surfactant must be added.
Venture L	fluazifop-p-butyl	Rate depends on grass species to be controlled. Can be used in either newly planted or established ornamental plantings. Treat annual grasses at 2 - 5 leaf stage (green/yellow foxtail at 2-4 leaf stage). Quackgrass should have 3 - 5 fully developed leaves. Check label for more details. Over the top applications are acceptable for most plant species; however directed sprays are recommended for some species.
Kerb 50 WSP	propyzamide	Use on plants that are established 1 year or more. Apply in the fall when soil temperatures are low but not frozen. Kerb is taken up by weeds in the spring. Product starts to break down in warm soils. Do not allow treated areas to drain onto turf grasses.
EcoClear	acetic acid	Best results with spring and early summer applications to actively growing weeds. Contact, non-selective. Adequate coverage necessary for control. Rainfall within one hour of application will reduce degree of control. Avoid contact with desirable plants.

Table 5. Weeds controlled by herbicides for use in nursery/shelterbelts

Active ingredient	linuron			amitrol	paraquat	trifluralin				napropamide	simazine	oxadiazon	sethoxydim	fluazifop-p-butyl	dichlobenil	chlorthal	propyzamide	glyphosate	acetic acid
Herbicide trade name	**Linuron 400 L**	**Lorox L**	**Lorox DF**	**Amitrol 240 L**	**Gramoxone**	**Rival EC**	**Treflan Granular**	**Bonanza 400 L/480 L**	**Treflan E.C.**	**Devrinol 10G/50DF/2G**	**Simadex Simazine/Princep Nine-T/Simazine 480**	**Ronstar 2G**	**Poast Ultra**	**Venture L**	**Casoron G-4/G-2**	**Dacthal W-75**	**Kerb 50 WSP**	**Glyphosate products**	**EcoClear**
Broadleaved weeds																			
Chickweed	R	R	R	z	R	R	P	P	R	R					R	R	R	R	R
Buckwheat, wild		R	R	z	R	R		R	R		R				R*			R	
Dandelion	S*			R											R*			R	ST
Groundsel, common	R			z	R					R		R			R				
Kochia	R			z	R										R			R	
Knotweed	R	R	R	z	R	R	R	R	R	R					R			R	
Lamb's-quarters	R	R	R	z	R	R	R	R	R	R	R	R			R	R		R	R
Mustards	R	R	R	z	R						C				R			R	
Pigweed, redroot	R	R	R	z	R	R	R	R	R	R	C	R			R	R*		R	
Purslane, common	R		R	z	R	R	R	R	R	R	R	R			R	R			
Shepherd's purse			R	z	R							R			R			R	
Smartweed (lady's-thumb)	R	R	R	z	R						R				R			R	
Stinkweed		R	R	z	R						C	R			C			R	
Thistle, Russian					R	R												R	
Thistle, Canada				R	T										R*			R	
Thistle, sow (perennial)	S*			R	T										R*			R	

(continued)

Table 5. *(continued)*

Active ingredient	linuron			amitrol	paraquat	trifluralin				napropamide	simazine	oxadiazon	sethoxydim	fluazifop-p-butyl	dichlobenil	chlorthal	propyzamide	glyphosate	acetic acid
Herbicide trade name	**Linuron 400 L**	**Lorox L**	**Lorox DF**	**Amitrol 240 L**	**Gramoxone**	**Rival EC**	**Treflan Granular**	**Bonanza 400 L/480 L**	**Treflan E.C.**	**Devrinol 10G/50DF/2G**	**Simadex Simazine/Princep Nine-T/Simazine 480**	**Ronstar 2G**	**Poast Ultra**	**Venture L**	**Casoron G-4/G-2**	**Dacthal W-75**	**Kerb 50 WSP**	**Glyphosate products**	**EcoClear**
Grass weeds																			
Cereals, volunteer	G			z	R	C	C	C			C		R	R	C		R	R	
Foxtail, green	G	R	P	z	R	R	R	R	R	R		R	R	R	R	R	R	R	
Grass, barnyard	G	P	P	z	R	R	R	R	R	R	R	R	R	R		R	R	R	
Oats, wild	G			z	R	R	P	P	S	R	R		R	R			R	R	
Quackgrass				R	T								R	R	R*		R	R	ST

z controls most annual weeds

R registered for control of weed

R* controlled with higher rates and/or late fall applications

C control can be expected, but weed not on label

S suppression

T top growth only

P partial control

S* control of seedlings only

G most annual grasses

Table 6. Nursery/shelterbelt herbicides – herbicide groups, herbicide solubility and how they work			
Herbicide	**Herbicide group**	**Solubility in water**	**How the herbicide works**
amitrol	11	28g/100ml	Inhibits chlorophyll formulation and regrowth from the buds. Moves primarily with water to the leaf tissue. Non-selective.
chlorthal	3	0.5 mg/L	Interferes with cell division in roots. Kills seedlings after they germinate.
dichlobenil	20	25 ppm	Acts primarily on growing points and root tips. Inhibits growth and the synthesis of cellulose. Seedlings fail to germinate.
fluazifop-p-butyl	1	1 ppm	Systemic. Translocated to growing point. Interferes with the synthesis of an enzyme required for synthesis of lipids.
glyphosate	9	1.57 per cent	Inhibits the production of plant amino acids required for plant growth. Translocated to growing points and in fall, to roots and rhizomes of perennial weeds; non-selective.
linuron	7	75 ppm	Inhibits photosynthesis. Moves primarily with water to leaf tissue.
napropamide	15	73 ppm	Blocks cell division. Inhibits root growth. Seedlings fail to emerge.
oxadiazon	14	0.7 ppm	Contact action as young plant grows through the treated soil. Oxadiazon forms a chemical barrier on the soil surface.
paraquat	22	Completely soluble	Disrupts photosynthesis and cell structure. Contact action only. Non-selective.
sethoxydim	1	48 ppm	Systemic. Translocated to growing point. Interferes with the synthesis of an enzyme required for synthesis of lipids.
simazine	5	3.5 ppm	Inhibits photosynthesis. Moves primarily with water to the leaf tissue.
trifluralin	3	0.3 ppm	Interferes with cell division in roots. Kills seedlings after they germinate.
propyzamide	15	15 ppm	Blocks cell division. Inhibits root growth. Seedlings fail to emerge.
acetic acid			Contact action only. Non-selective.

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