POTATO CROP WEED AND PEST CONTROL

2006

New Nouveau Brunswick CANADA

Agriculture, Fisheries and Aquaculture | Agriculture, Pêches et Aquaculture

For NEW BRUNSWICK

For additional information regarding potato production,
refer to Publication 1300, Atlantic Canada Potato Guide or
our web site at http://www.gnb.ca/0029/0029index-e.asp

POTATO EXTENSION SPECIALISTS

New Brunswick Department of Agriculture, Fisheries and Aquaculture

Potato Development Centre	**Bon Accord Elite Seed Potato Centre**	**Plant Propagation centre**
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Web address:
http://www.gnb.ca/0029/0029index-e.asp

ACUTE TOXICITY TABLE

Hazard Symbol	**Hazard Rating**	**MAMMALS**			**FISH**
		ORAL LD50 (mg/kg body wt)	**INHALATION LD50** (mg/L of air)	**DEMERAL LD50** (mg/kg body wt)	**RELATIVE RISK RANKING SCORE**
VLH	Very Low Hazard	Above 500	Above 2	Above 2000	Above 8
LH	Low Hazard	101-500	0.41-2	401-2000	6-7.99
MH	Moderate Hazard	21-100	0.21-0.4	201-400	4-5.99
VHH	Very High Hazard	11-20	0.081-0.2	81-200	2-3.99
EH	Extremely Hazardous	10 and less	0.08 and less	80 and less	1.99 and less

PESTICIDES ABBREVIATIONS

SU suspension		SC spray concentrate		DP dispersable powder
WP wettable powder		SN solution		EC emulsifiable concentrate
DU dust		SP soluble powder		GR granular
FC flowable concentrate		DF dry flowable		SURF surfactant
kg kilogram		g gram		FLOW flowable liquid
ha hectare		L litre		EW water base
mL milliliter				

KEEP IT SAFE!
KEEP GOOD RECORDS WHEN YOU USE PESTICIDES

INSECT CONTROL

The management of insect pests on potatoes continues to rely on synthetic insecticides but their continued usefulness can only be insured by the concurrent use of cultural and alternative control methods.

Scouting

Monitor each field on a regular and recurring basis to identify the insect pests present and determine the relative abundance of their different life stages. Note the growth stage of the crop. Keep in mind that the previous crop, cropping practices and the type of vegetation surrounding the field affect the presence and the development of insect populations. Information on the changes in the abundance of insect pests in your region can be obtained from a variety of pest forecasting and monitoring services offered by government extension specialists and private consultants.

Use all the information gathered to develop an insect control program for the season or to respond to a specific pest outbreak.

Alternative Control Methods

A number of non-insecticidal control methods are now available. These methods are environmentally friendly and help prolong the effective life of insecticides if they are used consistently, year after year. These methods are most effective against the Colorado potato beetle but many will help reduce the abundance of other insects.

Field rotation. Rotate fields frequently and isolate potato fields whenever possible. It delays field colonization by overwintered adults and reduces their abundance in the crop. Increasing the distance between old and new fields of potatoes will increase the level of beetle control.

Plastic-lined trenches. Install trenches around new potato fields adjacent to Colorado potato beetle overwintering sites or fields planted to potatoes the previous year. On the average, trenches reduce the abundance of overwintered adult beetles on the crop by 50%. They also reduce the number of egg masses.

Propane burner. This method is very effective at reducing the abundance of overwintered adult Colorado potato beetles on short plants up to 4" in height. It also reduces the viability of egg masses. More than one pass per season may reduce yield.

Insecticidal Control

Insecticide resistance is present in many populations of Colorado potato beetles in the Atlantic region. It is recommended that a few simple steps be followed to manage the problem with the Colorado potato beetle and prevent its development with other insects.

1. Reduce the number of insecticide applications by using alternative control methods.
2. Apply an insecticide only if the abundance of an insect pest has reached a level where it can cause an economic yield loss.
3. Rotate to an insecticide of a different chemical class after each application of a particular insecticide. In the case of the Colorado potato beetle, use an insecticide resistance test kit if one is available in your region, to help determine if your beetles are resistant to a particular insecticide.
4. Use the right nozzles on a recently calibrated sprayer to insure that the insecticide is applied to the target pest on the crop with minimal drift to the environment. Consider banding rather than treating the whole area.
5. Apply only at the recommended rate for the pest.
6. All insecticides listed in this guide will control some potato insect pests however, differences in their respective modes of action, persistence, sensitivity to temperature and pest specificacy must be considered when choosing a chemical.

INSECTICIDES

Please see insecticide notes and /or your Extension Specialist.

S - Spray **I - In Furrow** **PL - Apply at Planting**
B - Band **BR - Broadcast** *** - Registered**
ST-Seed Treatment **- Information not available**

Chemical or Biological	Product	Formulation	Product/ha	Days to Harvest	GREEN PEACH APHID	COMMON POTATO AHPID	BUCKTHORN APHID	COLORADO POTATO BEETLE	FLEA BEETLE	WIREWORMS	EUROPEAN CORN BORER	TARNISHED PLANT BUG	LEAFHOPPERS	Application method	ACUTE HAZARD RATING MAMMALS				Re-entry time
															Oral	Inhalation	Dermal	Fish	
Carbamates																			
carbaryl	CO-OP SEVIN 50WP	WP	1.1-4.5 kg	7				*	*		*	*	*	S	LH		VLH	VHH	24 h
	CO-OP SEVIN 80WP	WP	0.75-2.75 kg	7				*	*		*	*	*	S					
	SEVIN BRAND 50W	WP	1.1-4.5 kg	7				*	*		*	*	*	S					
	SEVIN 85S	SP	0.675-2.75 kg	0				*	*		*	*	*	S					
	SEVIN XLR PLUS	SU	1.25-5.25 L	7				*	*		*	*	*	S					
carbofuran	FURADAN 480F	SU	0.55-1.1 L	7				*	*			*	*	S	EH		VLH	MH	48 h
methomyl	LANNATE SP	SP	0.54 kg	3	*	*	*		*				*	S	VHH	MH	VLH	MH	24 h
	LANNATE L	EC	2.25 L	3	*	*	*		*				*	S					
oxamyl	VYDATE L	EC	2.3-3.0 L	7	*	*		*	*			*	*	S	EH	EH	LH	MH	24 h
pirimicarb	PIRIMOR 50DF	DF	0.425-0.55 kg	7	*	*	*							S	LH		LH	LH	24 h
Chlorinated hydrocarbons																			
endosulfan	THIODAN 4EC	EC	1.4 L	1	*	*	*	*	*				*	S	MH	VLH	VHH	EH	48 h
	THIODAN 50WP	WP	1.1 kg	1	*	*	*	*	*			*	*	S					
	THIONEX 50WP	WP	1.1 kg	1	*	*	*	*	*			*	*	S					
	THIONEX EC	EC	1.5 L	1	*	*	*	*	*			*	*	S					
	ENDOSULFAN 50W	WP	1.1 kg	1	*	*	*	*	*			*	*	S					
methoxychlor	MARLATE 50WP	WP	2.5 kg	7				*	*					S	VLH		VLH	EH	24 h
	MINTOX	EC	22-63 L	7	*	*	*	*	*				*	S					
	METHOXYCHLOR 50W	WP	1.7-5.0 kg	7				*	*				*	S					
	METHOXYCHLOR 240	EC	3.5-9.5 L	7				*	*				*	S					
Organophosphates																			
azinphos-methyl # #	GUTHION 240SC	SC	1.25-3.5 L	7				*	*		*	*	*	S	VHH		MH	EH	48 h
	GUTHION SOLUPAK 50WP	WP	0.55-1.75 kg	7				*	*		*	*	*	S					
	AZINPHOS METHYL 240 EC	EC	1.8-3.6 L	7	*	*	*	*	*		*	*	*	S					
	AZINPHOS METHYL 50W	WP	0.55-1.75 kg	7	*	*	*	*	*		*	*	*	S					
	AZINPHOS METHYL 35W	WP	0.8-2.5 kg	7	*	*	*	*	*		*		*	S					
	SNIPER 50W	WP	0.55-1.75 kg	7	*	*	*	*	*		*	*	*	S					
	APM 50W INSTAPAK	WP	0.55-1.75 kg	7	*	*	*	*	*		*	*	*	S					
chlorpyrifos	LORSBAN 4E	EC	1.0 L	7				*	*			*		S	LH		LH	EH	24 h
	LORSBAN 50W	WP	1.125-2.25 kg	7					*			*		S					
	PYRINEX 480EC	EC	1.0 L	7				*	*			*		S					
dimethoate	BARTLETT CYGON 480	EC	0.55-1.1 L	7	*	*	*						*	S	LH		LH	MH	24 h
	CYGON 480E	EC	0.55-1 L	7	*	*	*						*	S					
	IPCO CYGON 4E	EC	0.55-1.1 L	7	*	*	*						*	S					
	DIMETHOATE PLUS	EC	0.7 L	7	*	*	*						*	S					
	SANEX DIMETHOATE 480EC	EC	0.55-1.1 L	7	*	*	*						*	S					
	LAGON 480	EC	0.55-1.1 L	7	*	*	*					*	*	S					

INSECTICIDES

Please see insecticide notes and /or your Extension Specialist.

S - Spray I - In Furrow PL - Apply at Planting
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Chemical or Biological	Product	Formulation	Product/ha	Days to Harvest	GREEN PEACH APHID	COMMON POTATO AHPID	BUCKTHORN APHID	COLORADO POTATO BEETLE	FLEA BEETLE	WIREWORMS	EUROPEAN CORN BORER	TARNISHED PLANT BUG	LEAFHOPPERS	Application method	ACUTE HAZARD RATING MAMMALS				Re-entry time
															Oral	Inhalation	Dermal	Fish	
malathion	CYTHION WP	WP	2.75-4.25 kg	3	*	*	*	*					-	S	VLH		LH	VHH	24 h
	CYTHION EC	EC	1.5-2.25 L	3	*	*	*	*					-	S					
	DISPAR MALATHION 50EC	EC	1.5 L	3	*	*	*							S					
	MALATHION 50	EC	1.5 L	3	*	*	*						*	S					
	IPCO MALATHION 500	EC	1.4-2.0 L	3	*	*	*	*					*	S					
	RIDDEX MALATHION 500EC	EC	1.5-2.25 L	3	*	*	*	*					*	S					
	MALATHION 25W	WP	2.75-4.25 kg	3	*	*	*	*					*	S					
	SANEX MALATHION 50EC	EC	1.5-2.25 L	3	*	*	*						-	S					
	MALATHION 500E	EC	1.25-1.8 L	3	*	*	*	*					*	S					
	MALATHION 85E	EC	1.0 L	3	*	*	*	*					*	S					
	MALATHION 25W	WP	2.75-4.25 kg	3	*	*	*	*					*	S					
	GUARDSMAN CYTHION 1000 L	EC	1.0 L	3	*	*	*						-	S					
	GUARDSMAN MALATHION 500EC	EC	1.5-2.0 L	3	*	*	*	*					*	S					
	MALATHION 500E	EC	1.5-2.0 L	3	*	*	*	*					-	S					
methamidophos	MONITOR 480 L	SN	1.75-2.25 L	14	*	*	*	*	*			*	*	S	MH	VLH	VHH	MH	48 h
	ORTHO MONITOR 480 L	SN	1.85-2.3 L	14	*	*	*	*	*			*	*	S					
naled	DIBROM	EC	1.1 L	4				*	*				*	S	LH	VLH	LH	VHH	24 h
phorate	THIMET 15G	GR	15.4-23.6 kg	PL	*	*	*	*	*	*			*	B/I	VHH		LH	EH	24h
phosmet	IMIDAN 50WP	WP	2.25 kg	7		*		*	*				*	S	LH		VLH	VHH	24 h
Synthetic pyrethroids																			
cypermethrin	RIPCORD 400	EC	0.0625-0.125 L	7				*	*			*	*	S	LH	VLH	VLH	VHH	24 h
	CYMBUSH 250	EC	0.14 L	7				*	*			*	*	S					
deltamethrin	DECIS 5.0EC	EC	0.1-0.25 L	1		*	*	*	*			*	*	S	LH	LH	VLH	VHH	24 h
cyhalothrin-lamda	MATADOR 120EC	EC	0.083-0.125 L	7				*	*			*	*	S	MH	VLH	LH	VHH	24 h
permethrin	POUNCE	EC	0.19-0.28 L	1				*	*			*	*	S	LH	VLH	VLH	VHH	24 h
	BIO-ENVIRONMENTAL PERMETHRIN	SC	0.185 L	1				*	*			*	*	S					
Bacteria																			
Bacillus thuringiensis ten.	NOVODOR	FC	4-8 L	0				*						S	VLH	VLH	VLH	VLH	when dry
Choronicotinyls																			
imidacloprid	ADMIRE 240F	FLOW	0.85-1.3 L	PL	*	*	*	*	*				*	I	VLH	VLH	VLH	LH	24 h
	ADMIRE 240F	FLOW	0.2 L	7	*	*	*	*					*	S					
	GENESIS 240	FLOW	26-39 mL/kg of seed	ST	*	*	*	*					*	ST	VLH	VLH	VLH	LH	
Pyridine azomethine																			
pymetrozine	FULFILL	WG	0.193 kg	14	*	*	*							S	VLH	VLH	VLH	VLH	12 h
Botanical																			
Rotenone	ROTENONE DUST	DU	-	-	*	*	*	*	*	*		*	-	D	LH		LH	VHH	24h
	LIQUID ROTENONE ORGANIC INSECTICIDE	SC	-	1	*	*	*	*	*	*		*	-	S					
	ORGANIC INSECTICIDE WP	WP	-	1	*	*	*	*	*	*		*	-	S					

Because of Colorado Potato Beetle resistance to insecticides and to prevent the development of resistance in other pests, AVOID REPEAT APPLICATIONS OF INSECTICIDES FROM THE SAME CHEMICAL GROUP.

#: This product will not be sold beyond 31 August, 2007

NOTES ON INSECTIDIDES

Many of the insecticides used on potatoes are highly poisonous to man, animals, fish, and beneficial insects. Poisoning of the applicator can occur by swallowing, inhaling or by skin contact. FOLLOW ALL PRECAUTIONS STATED ON THE PRODUCT LABEL. It is against the law not to comply with the label instructions of a pesticide under Pest Control Products Act of Canada. Contamination of fisheries waters by pesticides is also against the law under the Fisheries Act of Canada.

Carbamates

Non systemic carbamates generally remain effective for 7 -10 days.

Carbaryl has low toxicity to man and animals but is highly toxic to bees. It is effective against beetles for 3-4 days under favourable conditions (the XLR formulation may be wash-off resistant for as much as 7 -10 days). It does not control aphids. Repeated applications usually cause an increase in aphid populations, since it kills aphid predators.

Carbofuran is highly toxic to humans. Foliar applications are effective against beetles through contact action. Carbofuran does not control aphids. Applications of Furadan usually result in an increase in aphid populations, since it kills aphid predators.

Methomyl has low toxicity to man and animals but is highly toxic to bees. Foliar applications are effective against aphids and flea beetles through contact and some systemic action. Effective insect control lasts less than 7 days.

Oxamyl has moderate toxicity to humans. It is effective against the beetles and the aphids through contact and systemic action.

Pirimicarb has low toxicity to humans. It is very effective any time against aphids, acting through contact and vapour action.

Chlorinated hydrocarbons

Endosulfan is moderately toxic to humans. It is effective against beetles and the buckthorn aphid. Low temperatures decrease its effectiveness, especially against the buckthorn aphid.

Methoxychlor has low toxicity to man and animals but is highly toxic to fish and bees. It is effective against aphids, Colorado potato beetles and potato flea beetles through contact action.

Organophosphates

Non-systemic organophosphates remain effective for 7-14 days.

Azinphos-methyl is highly toxic to humans. The lower rate is effective against the beetles but the higher rate is necessary to control the buckthorn aphid. It acts as a contact and stomach poison. It offers quick knockdown and has a residual action significantly longer than other non-systemic organophosphates.

Chlorpyrifos has low toxicity to humans. It works through contact, ingestion and vapour action against the beetles. It does not control aphids.

Diazinon has low toxicity to man and animals but is highly toxic to bees. It works through contact, systemic and ingestion action against aphids, Colorado potato beetles, and potato flea beetles.

Dimethoate has low toxicity to humans. It is effective against the potato and the buckthorn aphids by contact and systemic action.

Malathion has low toxicity to man and animals but is highly toxic to bees. It is registered for use against aphids and, most formulations, the Colorado potato beetle.

Methamidophos is highly toxic to humans. It is effective against both species of beetles and all three species of aphids by contact and local systemic action. It will control large populations of aphids late in the season. It provides a quick, initial knockdown as well as residual control.

Naled is moderately toxic to humans. It is a fast acting insecticide that gives good control of the beetle. Do not apply above 32°C.

Phorate is highly toxic to humans. It is effective against all pests. It does not persist long enough to control the second peak of flea beetles and its control of aphids is variable.

Phosmet has low toxicity to humans. It is a contact and stomach poison that is effective against beetles.

Synthetic Pyrethroids

In contrast to carbamates and organophosphates the toxicity of pyrethroids decreases as temperature rises. Whenever possible synthetic pyrethroids should be applied at temperatures below 24 °C. They are generally toxic to bees and other beneficial insects but not most are low mammalian toxicity. These insecticides are extremely toxic to fish, shellfish and aquatic organisms which are food for fish, and waterfowl. Careless use can seriously harm sport and commercial fisheries and wildlife. Although the pyrethroids are generally poor potato aphicides, they may reduce probing by colonizing aphids which may protect the plants from infestation and virus spread as long as the residual dose is sufficient, even if it is no longer lethal. Being virtually insoluble in water, they offer excellent resistance to leaching out during rain. They should not be used on muck soils. Allow a minimum of 24 hours before evaluating the efficacy of a pyrethroid spray to permit enough time for the insects to return to the plant and feed some more after the knockdown effect.

Cypermethrin is effective against the beetles by contact and stomach action.

Deltamethrin is effective against the beetles as a contact and stomach poison. May be effective against the common potato aphid and the buckthorn aphid at higher rates.

Cyhalothrin-lambda is effective against Colorado potato beetles by contact and stomach action.

Permethrin is effective against the beetles. Thorough coverage of plants is important and the higher rate is required for heavy infestations. It is a contact and stomach poison.

Bacteria

Some varieties of the bacterium Bacillus thuringiensis are active against the larvae of the Colorado potato beetle. For optimum results, apply early in the season against small actively feeding larvae. Repeat the application twice at intervals of 5-7 days or after heavy rainfall. The bacteria are not fast acting. Larval death occurs only 1-5 days later but the larvae stop feeding after eating foliage sprayed with the bacteria. These products are not very effective against large larvae and will not kill adults and other insect species.

Bacillus thuringiensis is effective against the Colorado potato beetle larvae by stomach action. The higher the rate is required for heavy infestations.

Chloronicotinyls

Nicotinyls affect the nervous system of insects by blocking a specific type of receptor on the postsynapse.

Imidacloprid is effective against the Colorado Potato beetle, the flea beetle and aphids. It has low toxicity to humans and animals but is highly toxic to bees.

Pyridine azomethine

Pyridine azomethine compounds have selective activity against sap sucking insects such as aphids. The chemicals interfere in the nervous regulation of feeding behavior which leads to death due to starvation after a few days.

Pymetrozine is effective for the control of aphids on potato plants. Thorough spray coverage of plant foliage is essential for optimum control. Maximum of two applications per season.

Botanicals

Rotenone is prepared as ground up roots or extracts of the roots of plants from the genera Derris and Lonchocarpus. It is highly toxic to fish. It has moderate toxicity to mammals, except highly toxic to pigs. It is moderately effective against some species of aphids. Breaks down rapidly when exposed to light and air, thus it is good for use on crops close to harvest.

HERBICIDES

SEE NOTES AND PRODUCT LABELS FOR DETAILS ON HERBICIDES

WEED CONTROL RATING
E - Excellent F - Fair
G - Good P - Poor

	Chemical Name	Product Name (s)	Formulation	Rate of Product/ha	WEED CONTROL RATING: ANNUAL BROAD LEAVES: chickweed	hempnettle	lambs quarters	mustard family	pigweeds	ragweeds	smartweed family	wild buckwheat	wild radish	ANNUAL GRASSES: barnyard grass	foxtail	crabgrass	PERENNIALS: quackgrass	Canada thistle	sow thistle	goldenrod	field mint	Potato tolerance	Acute Hazard rating Mammals	Reentry Time (hrs)
BEFORE PLANTING	EPTC	Eptam 8E (800 g/L)	EC	4.2 - 5.6L/ha	F	-	F	P	F	F	F	P	P	G	G	G	F	P	P	-	-	E	VLH	12
		Eptam 8E	EC	6.2 - 8.4L/ha	F	-	F	P	E	G	F	P	P	E	G	G	G	P	P	-	-	E	VLH	12
	glyphosate	Roundup,Glyfos or Touchdown	SN	2.5 L/ha in 50 -100 L/ha wat	+	+	+	+	+	+	+	+	+	+	+	+	G	P	E	+	+	P	VLH	12
		Roundup,Glyfos or Touchdown	SN	4.7 - 7.0L/ha	+	+	+	+	+	+	+	+	+	+	+	+	E	E	E	+	+	P	VLH	12
	glyphosate + Frigate	Roundup + Frigate	SN SURF	2.5L/ha + 1L/200L water	+	+	+	+	+	+	+	+	+	+	+	+	E	P	E	+	+	P	-	-
	glyphosate + Enhance	Roundup + Enhance	SN SURF	2.5L/ha + 0.5L/ha 100 - 200L water	+	+	+	+	+	+	+	+	+	+	+	+	E	-	-	+	+	P	-	-
	s-metolachlor	Dual II Magnum (915g/L)	EC	1.25 -1.75L/ha	P	P	-	-	-	-	-	P	-	G	G	G	P	-	P	P	P	G	VLH	24
PLANTING TO EMERGENCE	linuron	Afolan F (480g/L) or Lorox L (480g/L) or Linuron 480 FL (480g/L)	SU SU SU	2.3 - 4.6L/ha	G	G	E	E	G	G	E	E	F	F	F	F	P	-	P	P	P	F	VLH	24
		Lorox DF(50%)	DF	2.2 - 4.3 kg/ha																				
		Linuron 400FL(400g/L)	SU	2.5 - 5.2 L/ha																				
	linuron + s-metolachlor	Afolan F or Lorox L or Lorox DF(50%) + Dual II Magnum	SU SU DF EC	1.6 - 2.5L/ha or 1.9 - 2.3 L/ha or 1.75 - 2.25 kg/ha +1.25 - 1.75 L/ha	G	G	E	E	E	G	E	G	G	E	E	E	P	P	P	P	P	E	LH	-
	metribuzin	Sencor 75 DF	DF	0.55 - 1.5 kg/ha	G	E	E	E	E	E	E	G	E	G	G	G	P	-	P	-	P	G	VLH	12
		Sencor Solupak 75 DF	DF	0.55 - 1.5 kg/ha																				
		Sencor 480F	SU	0.85 - 2.25 L/ha																				
	metribuzin + s-metolachlor	Sencor 75 DF or Sencor 480 F + Dual II Magnum	DF SU EC	0.75 - 1.5 kg/ha or 1.1 - 2.25 L/ha +1.25 - 1.75 L/ha	G	E	E	E	E	E	E	G	G	E	G	G	P	-	P	-	P	G	LH	-
	metribuzin + linuron	Sencor 75 DF or Sencor Solupak 75 DF or Sencor 480 F + linuron 480	DF DF SU SU	0.55 - 1.1 kg/ha or 0.55 - 1.1 kg/ha or 0.85 - 1.75 L/ha 1.6 - 3.75 L/ha	G	E	E	E	E	E	E	E	E	G	G	G	P	-	P	-	P	G	VLH	-
	monolinuron	Afesin (200g/L)	EC	5.5 - 11.0 L/ha	-	-	E	E	E	G	E	E	G	F	F	P	P	P	P	-	-	F	VLH	-
	monolinuron + s-metolachlor	Afesin + Dual II Magnum	EC EC	5.5 - 8.5 L/ha +1.25 - 1.75 L/ha	-	-	E	G	G	F	G	E	G	G	G	G	P	-	P	-	-	G	-	-
BEFORE EMERGENCE (GROUND CRACK)	metribuzin	Sencor 75DF	DF	0.55 - 1.5 kg/ha	G	E	E	E	E	E	E	G	G	G	-	-	F	-	P	-	-	G	VLH	12
		Sencor Solupak 75DF	DF	0.55 - 1.5 kg/ha																				
		Sencor 480F	SU	0.85 - 2.25 L/ha																				
	paraquat	Gramoxone (200 g/L)	SN	2.8 - 4.25 L/ha	+	F	G	G	G	-	F	F	F	P	-	-	G	P	F	-	F	G	LH	24
	metribuzin + paraquat	Sencor 75DF or Sencor Solupak 75 DF or Sencor 480F + Gramoxone	DF DF SU SN	0.75 - 1.1 kg/ha or 0.75 - 1.1 kg/ha or 1.1 - 1.75 L/ha +2.75 L/ha	G	E	E	E	E	E	E	E	G	G	G	G	G	-	F	-	F	G	VLH	-
	glufosinate ammonium	Ignite 15SN	SN	2.7 - 5.0 L/ha	+	E	E	E	E	E	E	G	F	E	E	E	-	-	-	-	F	G	VLH	12
	metribuzin + glufosinate ammonium	Lexone DF or Sencor 480F Ignite 15 SN	DF SU SN	750g/ha or 1.1L/ha 2.7 - 5.0 L/ha	+	E	E	E	E	E	E	G	G	E	E	E	F	-	P	-	F	G	VLH	12
	glyphosate	Roundup *****	SN	2.5 L/ha	G	E	E	E	E	E	E	E	E	E	E	E	G	-	-	+	+	F	VLH	12

HERBICIDES

SEE NOTES AND PRODUCT LABELS FOR DETAILS ON HERBICIDES

WEED CONTROL RATING
E - Excellent F - Fair
G - Good P - Poor

	Chemical Name	Product Name (s)	Formulation	Rate of Product/ha	WEED CONTROL RATING: ANNUAL BROAD LEAVES: chickweed	hempnettle	lambs quarters	mustard family	pigweeds	ragweeds	smartweed family	wild buckwheat	wild radish	ANNUAL GRASSES: barnyard grass	foxtail	crabgrass	PERENNIALS: quackgrass	Canada thistle	sow thistle	goldenrod	field mint	Potato tolerance	Acute Hazard rating Mammals	Reentry Time (hrs)
SOON AFTER EMERGENCE (CHECK NOTES)	metribuzin	Sencor 75DF	DF	0.55 - 1.5 kg/ha	G	E	E	E	E	E	E	G	E	G	-	-	F	-	P			F	VLH	12
		Sencor Solupak 75DF	DF	0.55 - 1.5 kg/ha																				
		Sencor 480F	SU	0.85 - 2.25 L/ha																				
	paraquat	Gramoxone (200g/L)	SN	3.0 L/ha	+	F	G	G	G	-	F	F	F	F	-	-	G	-	F	-	F	F	LH	24
POST EMERGENCE	clethodim (annual grass)	Select/Amigo***	EC + Surf	0.19 L/ha + 0.5% v/v	P	P	P	P	P	P	P	P	P	E	E	E	F	P	P	P	P	E	VLH	24
	clethodim (quackgrass)	Select/Amigo***	EC + Surf	0.375 L/ha + 1.0% v/v	P	P	P	P	P	P	P	P	P	E	E	E	E	P	P	P	P	E	VLH	24
	diclofop-methyl	Hoe-Grass (284g/L)**	EC	3.5 L/ha	P	P	P	P	P	P	P	P	P	E	E	P	P	P	P	P	P	E	VLH	24
	fenoxaprop-p-ethyl	Excel Super**,***	EC	0.67 L/ha	P	P	P	P	P	P	P	P	P	E	E	E	P	P	P	P	P	E	VLH	24
	fluazifop-p-butyl Annual Grass (2-5 leaves)	Venture L***	EC	1.0L/ha	P	P	P	P	P	P	P	P	P	E	E	G	F	P	P	P	P	E	VLH	12
	fluazifop-p-butyl Quackgrass(3-5 leaf)	Venture L***	EC	2.0 L/ha	P	P	P	P	P	P	P	P	P	E	E	G	E	P	P	P	P	E	VLH	12
	rimsulfuron + Surf	Prism*** + Surf	DF + surf	60 g/ha +0.2 %V/V	G	-	F	G	G	-	-	-	E	E	E	E	G	-	-	E	-	G	LH	4
	sethoxydim + Merge or Assist (Annual Grasses 2-5 leaf)	Poast Ultra***+ Merge or Assist	EC Surf Surf	0.32 L/ha + 1 L/ha or 1 L/ha	P	P	P	P	P	P	P	P	P	E	E	E	P	P	P	P	P	E	VLH	12
	sethoxydim + Merge or Assist (wild oats and volunteer cereals)	Poast Ultra***+ Merge or Assist	EC Surf Surf	0.47 L/ha+ 1 L/ha or 1 L/ha	P	P	P	P	P	P	P	P	P	E	E	E	F	P	P	P	P	E	VLH	12
	sethoxydim + Merge or Assist (Quackgrass 1-3 leaf)	Poast Ultra***+ Merge or Assist	EC Surf Surf	1.1 L/ha + 1 - 2 L/ha or 1 - 2 L/ha	P	P	P	P	P	P	P	P	P	E	E	E	E	P	P	P	P	E	VLH	12

* A dash (-) in the weed control rating indicates lack of information. Do not use a herbicide more than once or apply an additional herbicide during the growing season unless split or combination treatments are registered. A plus (+) in the weed control rating indicates weeds will be controlled if emerged.

** Do not tank mix with other herbicides

*** Do not use Poast within 80 days of harvest

*** Do not use Select within 60 days of harvest.

*** Do not use Venture L within 90 days of harvest.

*** Do not use Excel within 35 days of harvest

***** Apply after weeds emerged but before potatoes emerge

*** Do not use Prism within 30 days of harvest

NOTE: FOR ADDITIONAL INFORMATION AND CAUTIONS ON HERBICIDE USE, REFER TO “Ontario Ministry of Agriculture and Food " Guide to Weed Control

NOTES ON HERBICIDES

All herbicides are known by a chemical name. Agricultural chemical companies use trade names for their products, but, by law, they must include on the label the accepted chemical name for the herbicide and the actual amount of that herbicide in the product.

Supply companies sell products with different concentrations for the same herbicide and over the years some have changed the concentration of active herbicide in a product. The concentrations of metribuzin, EPTC, prometryne and several other herbicides have been changed. Thus, suggested rates in these notes specify the amount of herbicide product required per hectare.

CLETHODIM sold as SELECT contains 240 g/L of clethodim. It should be used at all times in a tank-mix with the adjuvant AMIGO. Clethodim is a systemic postemergence herbicide with uptake primarily through the leaves. Potatoes are tolerant to clethodim at all growth stages. Thorough coverage of the leaf foliage is necessary for consistent grass control. Do not apply if rainfall is expected within 1 hour of application. The time for complete control is normally 7 to 21 days depending on growing conditions and crop competition. Apply Select when the annual grasses are in the 2 to 5 leaf stage, and when quackgrass is in the 2 to 5 leaf stage.

DICLOFOP-METHYL, sold as Hoe-Grass contains 284 g diclofop-methyl per litre of Hoe-Grass. Diclofop-methyl is applied post-emergence to the potatoes for control of annual grasses in the 1 to 4 leaf stage. It will effectively control barnyard grass, green and yellow foxtail, wild oats, old witchgrass, fall panicum and volunteer corn. Quackgrass will not be controlled. Apply in 100 to 300 litres of water per hectare. Do not apply if rain is expected within one hour after application. Tank mixture of diclofop-methyl with other chemicals must not be used. As diclofop-methyl controls only grass weeds, it is important to control broadleaf weeds by using an appropriate pre-emergence herbicide.

EPTC, sold as Eptam 8E, contains 800 g emulsifiable concentrate (EC) of EPTC per litre. It is applied under low pressure 200 kPa in 110-340 litres of water per hectare. It is also available in granular formulations. **It can be used before planting as long as it is incorporated, at drag-off with incorporation by spike tooth harrows or cultivation equipment or post emergence at the next to the last or at time of the last cultivation with incorporation.** It controls many weeds, including annual grasses, quackgrass and nutsedge. A few broadleaf weeds, such as wild radish and wild mustard are not controlled. For control of annual grasses apply and incorporate EPTC either preplanting or at lay-by. For control of dense stands of nutsedge and quackgrass apply and incorporate EPTC preplanting. The underground quackgrass rhizomes must be cut up thoroughly so that four or less nodes remain on a stem. This is best done with discs set to cut 15 to 20 cm deep.

EPTC must be incorporated into the soil immediately to prevent loss of the herbicide. Once trapped into the soil, the vapour which forms when EPTC comes into contact with moisture acts to destroy germinating weed seeds and quackgrass rhizomes if the rhizomes are cut into short lengths of 7.5 cm or less. The soil must be in good tilth and have a dry surface. EPTC sprayed on wet soils vaporizes quickly into the air and is lost. Avoid wet soil conditions or control will be poor. It is less active in cold soils than in warm soils. It is difficult to incorporate into stoney soil. Whenever possible, application and incorporation should be done in the same operation.

EPTC is incorporated using power driven cultivation equipment set to cut to a depth of 5 to 8 cm, or tandem discs set to cut to a depth of 10 to 15 cm, operated at 6.5 to 9.5 kilometres per hour, or a Danish type cultivator, with tines set on 15 to 20 cm centers, set 10 cm deep, operated at 10 to 13 km/hr and followed by a spike tooth harrow or some other levelling device which extends beyond the ends of the discs or cultivator.

An overspray with a pre-emergence or postemergence herbicide to control germinating annual broadleaf weeds is usually required to control some weeds tolerant to EPTC. Eptam can also be tank mixed with metribuzin (Lexone, Sencor) and applied pre-plant incorporated (see label for precautions).

FENOXAPROP-P-ETHYL, sold as Excel Super contains 80.5 g of fenoxaprop-p-ethyl per litre of Excel Super. Fenoxaprop-p-ethyl is applied post-emergence to the potatoes for control of annual grasses in the 1 to 6 leaf stage. It will control green and yellow foxtail, barnyard grass, crabgrass, old witch grass, fall panicum and volunteer corn. Fenoxaprop-p-ethyl does not control broadleaf weeds, sedges, quackgrass or other perennial grasses. Second flushes of annual grasses will not be controlled since fenoxaprop-p-ethyl is not residual.
Apply Excel Super in at least 100 litres of water per hectare. Thorough coverage of the foliage is essential for effective grass control. Application through flat fan nozzles at a 45 degree angle forward will result in the best spray coverage. Do not apply if rain is expected within 1 hour of application.
As fenoxaprop-p-ethyl controls only annual grass weeds, it is important to control broadleaf weeds with another herbicide. A time interval of four days before or after fenaxaprop-p-ethyl application is required before any other pesticide is applied.

FLUAZIFOP-P-BUTYL, sold as Venture L contains 125 g fluazifop-p-butyl per litre.
It is applied post-emergence to the potatoes and weeds and will give control of many annual grasses and also quackgrass. It does not control broadleaf weeds or sedges such as nutsedge. Growth of grasses stops soon after application but destruction of the whole plant may take several weeks. For annual grass control, apply when the annual grasses have 2-5 leaves. For quackgrass control, apply when the quackgrass has 3 to 5 leaves on each shoot. Pre-plant tillage to fragment quackgrass rhizomes improves control. Do not apply if rainfall is expected within 2 hours of application. May also be tank mixed with metribuzin (Lexone, Sencor) formulations for early post emergent applications (see labels for precautions). Apply a maximum volume of 300 L/ha. Do not cultivate until 5 days after application. Do not apply within 90 days of harvest.

GLUFOSINATE AMMONIUM is the active chemical in IGNITE. DO NOT USE ON POTATOES GROWN FOR SEED. Apply glufosinate ammonium in at least 110 litres of water per hectare. Application of the spray at a 45° angle forward will result in better coverage. Leave a 15 m buffer between edge of field and environmentally sensitive areas. DO NOT spray when winds exceed 16 km/hr. when using open boom sprayers. Apply IGNITE at no later than ground crack. Only emerged weeds will be controlled with IGNITE. For residual control of annual weeds, IGNITE may be tank mixed with SENCOR 480F or Lexone DF. Do not apply if rainfall is expected within 4 hours of application.

GLYPHOSATE, sold as Roundup containing 356 g of glyphosate per litre as isopropylamine salt, or GLYFOS containing 360 g of glyphosate per litre as isopropylamine salt, or TOUCHDOWN containing 330 g of glyphosate per litre as trimethylsulfonium salt, for perennial weed control prior to planting potatoes. Apply glyphosate in the spring or fall for quack (couch) grass control. The quackgrass must be at least 20 cm in height (3 to 4 leaf stage). Tillage prior to application will reduce control of quackgrass. Weed control with glyphosate is reduced if dirty or hard water is used for application. **The addition of ammonium sulfate to the spray mix is recommended if glyphosate must be applied in hard water.**
Where tillage is desired, delay for 5 to 7 days after application. Glyphosate has no soil activity. Therefore, it will not injure crops planted in the treated area. Roundup, when used after weed emergence but before ground crack and potato emergence will control emerged weeds. Emerged potato plants will be injured and reduced yield may result.

LlNURON sold as Afolan F or Lorox L or Linuron 480 FL containing 480 g Linuron per litre or Linuron 400 FL with 400 g/L linuron, or Lorox DF containing 50% linuron. Apply linuron before potato sprouts emerge, never on the sprouts. Potato tops must be covered to avoid injury. Abnormally heavy rainfall following application may cause crop injury. However, moisture is needed for good weed control action. Potato sets should be 5 cm below the treated soil.
The high rate usually controls annual grasses such as barnyard grass. Do not use on sand or coarse textured soils low in organic matter. Use the higher rate on clay soils and the lower rate on sandy soils. Linuron formulated as soluble granular (DF) requires constant agitation to keep it in suspension.

METRIBUZIN sold as Sencor Solupak 75DF, and Sencor DF (dry flowable) contain 75% metribuzin, Sencor 480F, a liquid, contains 480 g/L. Metribuzin is used pre-emergence to potatoes. The higher rate is usually required to control annual grasses and dense weed infestations. Also, the higher rate will retard the growth of quackgrass (use the lower rate for broadleaf weed control only). Moisture is needed shortly after a pre-emergence application for better weed control.

Do not use on Belleisle, Tobique, Sante, Tolaas or red-skinned cultivars. Use only pre-emergence on Shepody cultivars. Do not use on muck soil. Fall-seeded cover crops and certain vegetables such as cole crops, seeded the following spring are likely to be injured. Avoid overlaps that will increase dosages above those recommended. Read the manufacturer's label.

PRE-EMERGENCE APPLICATION (PLANTING TO GROUND CRACK) OF METRIBUZIN IS PREFERRED. However, where it is not possible to spray before crop emergence, metribuzin can be applied early postemergence before weeds are 4 cm high and before first emerged potato tops are 7.5 cm high. This treatment may cause temporary yellowing and/or leaf burn, especially when the crop is under the stress of poor growing conditions such as cool, wet, cloudy weather. Under Atlantic Canada conditions, a few early postemergence applications have occasionally reduced vine growth sufficiently to retard bulking and possibly to reduce yield. However, under these situations, the use of metribuzin early postemergence to potatoes could be better than abandoning the crop to weeds such as barnyard grass which are difficult to control by cultivation.

Some of the limitations on early postemergence applications are as follows:

a) Do not use when plants are under stress, such as cool, wet, cloudy weather or very dry soil conditions.

b) If insufficient metribuzin was used pre-emergence, it may be necessary to apply an additional early post-emergence treatment to control annual grass. In one season, do not apply more than a total of 1.1 kg active metribuzin per hectare.

c) Weed control with early postemergence application is most effective when spray is applied before weeds are 4 cm high.

d) Do not apply metribuzin early postemergence on Shepody, Tobique, Belleisle, Sante, Tolaas, red-skinned varieties or potatoes grown for early market.

e) Superior and Norchip are mid-season varieties which appear to be sensitive to metribuzin applied postemergence.

MONOLINURON, sold as Afesin is an emulsifiable concentrate (E.C.) containing 200 g of monolinuron per litre.

Monolinuron is applied in 225 to 450 litres of water per hectare between planting and emergence of potatoes; never on potato shoots. Use the lower rate on soils with low organic matter and the higher rate on clay or soils high in organic matter.

PARAQUAT, sold as Gramoxone containing 200 g paraquat per litre kills weeds on contact with the foliage. Apply in 280 to 560 litres of water per hectare to emerged weeds including quackgrass. It can be used in N.B. and P.E.I., postemergence on potatoes until 25-30% of the crop has emerged, but none of the tops exceed 5-8 cm in height (one week after ground crack), except Russet Burbank. Do not apply postemergence to potatoes in the evening, or on cloudy days, or when the plants are under moisture shortage. Temporary chlorosis (loss of leaf colour) of potato leaves will occur.

Application of paraquat for emergency control of quackgrass and emerged annual grass may be made when shoots are up to 10 cm high (not to Russet Burbank) but potato leaf chlorosis may be more severe and

yield could be reduced. Late application should only be considered when quackgrass or annual grasses threaten the crop.

Use clear water for applying paraquat as it is deactivated by clay or organic particles. Paraquat is inactivated on contact with the soil so there is no residual action in the soil. If new weed growth appears, it will be necessary to cultivate or use a postemergence herbicide. Usually, the lay-by cultivation (hilling) will be sufficient. For residual control of annual broadleaf weeds and annual grasses, tank mix paraquat and metribuzin or tank mix paraquat and linuron or monolinuron. Use the lower rate of linuron, or monolinuron on lighter soils and the higher rate on heavier soils with high organic matter. Apply the tank mix before the potatoes emerge.

RIMSULFURON sold as PRISM containing 25% rimsulfuron, is a dry flowable formulation in water soluble bags. It is applied in a minimum of 100 L/ha of water and must be used within 24 hours as the herbicide will degrade in acidic or highly alkaline water. It must be applied with a non-ionic surfactant as recommended on the label. Mix the Prism with at least one quarter of the water first and add the surfactant after the herbicide is thoroughly mixed. Prism is applied as a post-emergence treatment to control annual grasses in the 1 to 6 leaf stage and quackgrass in the 3 to 6 leaf stage, when less than 10 cm tall. Control of some broadleaf weeds is also obtained. Do not apply if rainfall is expected within two hours of application. Apply before potatoes have initiated flowering. Do not apply within 30 days of harvest.

SETHOXYDIM, sold as Poast Ultra contains 450 g of sethoxydim per litre. Sethoxydim is a postemergence, contact and systemic herbicide for control of certain grasses and uptake is primarily through leaves. Apply to actively growing grasses. Thorough coverage of the foliage is necessary for consistent grass control. Complete annual grass destruction takes 7 to 21 days depending on growing conditions and crop competition. Destruction of quackgrass may take 6 to 8 weeks.

Application is made at the 1 to 6 leaf stage of annual grasses and at the 1- 3 leaf stage of quackgrass. A cultivation no sooner than 7 days after application of sethoxydim will improve grass control. Best results are obtained in water volumes of 100 to 200 litres per hectare. Do not use flood jet or hollow cone nozzles with this herbicide as level of grass control will be reduced. Surfactants are required to be used with Poast Ultra. See product label of Poast Ultra for information on rate of application and mixes with surfactants Merge and Assist. This herbicide does not control broadleaf weeds. Use an appropriate pre-emergence herbicide to control broadleaf weeds. Do not apply if rainfall is expected within one hour of application. Do not apply within 80 days of harvest.

S-METOLACHLOR, sold as Dual Magnum and Dual II Magnum containing 915g/L emulsified concentrate (EC). It controls large and smooth crabgrass, witch grass, barnyard grass, fall panicum, green and yellow foxtail, yellow nutsedge, American nightshade and eastern black nightshade. For control of yellow nutsedge apply preplant incorporated (ppi) (see label) only or for annual grasses either ppi or pre-emergence. Use the higher rate wherever annual grasses or yellow nutsedge predominates or densities of weeds are expected to be high. Do not apply to potatoes at ground crack or if potatoes have emerged. Rainfall within 10 hours is required for maximum activity of the pre-emergence application. Residual activity will normally be retained for 10-14 weeks. Winter cereals may be planted 4-5 months after s-metolachlor application. See the product label for registered tank mix combinations. Do not use s-metolachlor on muck soils or coarse textured soils low in organic matter. Do not use on the variety Superior.

DISINFECTION

Cleaning and disinfection of storages and potato handling equipment each year are essential elements of a potato disease management program to eliminate carryover of disease-causing bacterium. Warehouse and equipment disinfection programs are primarily to control bacterial ring rot (BRR) of potatoes, but can also reduce the potential for soft rot, silver scurf, and fusarium problems.

An effective disinfection program is a three-step process that includes:

1. Removal of all loose debris, dirt, and trash from equipment and the warehouse.

2. A thorough cleaning of all surfaces! Cleaning is best accomplished using water, a pressure washer, and a detergent. The detergent helps to prepare a surface for subsequent disinfection.

3. A registered disinfectant, applied after cleaning and in a way that ensures the surface remains wet for a minimum of ten minutes.

Disinfection of set-cutters and planters between seed lots is important in reducing the potential for pathogen transfer between different seed lots. Sponge rollers on set-cutters should be removed, cleaned then soaked in a container of disinfectant. Used or borrowed equipment should be cleaned and disinfected; preferably before the equipment arrives on the farm.

Transport trucks arriving on farms for loads of potatoes should be disinfected, before arrival on the farm. The possibility exists for such vehicles to carry potato debris from one location to another with the risk of disease spread.

The choice of disinfectant will depend on availability of a product, its efficacy, registration, the type of surface being disinfected, and specific safety considerations. Some disinfectants work well on metal and wood but can corrode rubber and plastics on conveyor belts or other machine parts. Quaternary ammonium compounds (registered for BRR control) are effective on porous surfaces like wood and only slightly corrosive to metal. Equipment that is being disinfected outside, on warm sunny days, must be given special attention to ensure the ten minute exposure time is maintained.

DISINFECTANTS FOR THE CONTROL OF BACTERIAL RING ROT

CHEMICAL	PRODUCT	CONCENTRATION	HAZARD RATING	CAUTIONS
Didecyl dimethyl ammonium chloride	**DMR-23 DISINFECTANT**	6.7 mL/L water	VLH	avoid skin or eye contact and inhalation of mist
n-alkyl dimethyl benzyl ammonium	**AG-SERVICES INC. GENERAL STORAGE**	6-12 mL/L water	VLH	avoid skin or eye contact and inhalation of mist

VINE DESSICATION - TOPKILLERS

Chemical Name	Product Name	Formulation	Product/ha	Acute Hazard Rating Mammals	Reentry Times (hrs)
Copper Hydroxide	**Coppercide**		3.4 Kg/ha	VLH	24
Diquat	**REGLONE 240** (240g/L)	SN	-Heavy green vines-3.5L/H -Medium vines, maturing-1.7-2.3 L/ha -Split application-1.25-2.3L/ha +1.25L/ha, 4-6 days later	MH	24
* Use the higher rate on green immature, dense or rapidly growing tops			* Use a lower rate on tops showing some maturity yellowing or senescence		
Glufosinate Ammonium	**IGNITE**	SN	3.0 L/ha	LH	12
Endothall	**DES-I-CATE** (62g/L)	SN	17-22L/ha	LH	48

NOTES ON TOPKILLERS

Diquat is the active chemical in REGLONE 240. Applications should be made after growth has passed its peak, rather than when plants are growing actively.

Apply diquat in 560-1100 litres of water per hectare (label Direction). Do not apply diquat during drought conditions, wait for at least three days after the soil has been thoroughly moistened by rain or irrigation. Use clear water with diquat as it is deactivated by clay or organic particles.

Laboratory tests show that diquat (Reglone 240) is stable and compatible with the following fungicides: Dithane DG, Polygram DF, Bravo Flowable, Manzate 200DF and copper sulphate.

Do not use any wetters (Agral 90) or stickers in Eastern Canada.

Glufosinate ammonium is the active chemical in IGNITE. DO NOT USE ON POTATOES GROWN FOR SEED. Apply glufosinate ammonium in at least 110 litres of water per hectare. When canopy is dense or weed growth is heavy, use 170 to 220 litres of water per hectare. Do not harvest the treated crop within 9 days of application. Uniform, thorough spray coverage is important to consistent cop desiccation. Better desiccation will be achieved if the potato vines are past peak growth, rather than actively growing.

Endothall is the active ingredient in DES-I-CATE. For light vine growth apply 17-22 L/ha of DES-I-CATE using the higher rate in cloudy cool, weather. For heavy vine growth use the full rate of 22 L/ha and spray to thoroughly wet the lower stems. For best results, use a sprayer pressure of 700-1050 kPa using 500-800 L of water/ha. Applications should be made 10-14 days prior to harvest. Add DES-I-CATE to the spray tank after adding water to reduce foaming.

In situations involving very heavy vine growth, double spraying, first up and then down the field on the same day, applying 11L/ha per application, will maximize coverage and top desiccation. No wetting agent or emulsifier is needed with DES-I-CATE. Under conditions favorable for rapid vine growth, such as low soil moisture or high temperature, do not use the high rate as stem end discoloration may occur.

SPROUT INHIBITORS

Sprout inhibitors provide a rather inexpensive means of keeping potatoes in good condition for the late fresh and processing markets. Sprouts increase water loss from tubers and reduce the volume of saleable potatoes. Sprouting will also cause color loss in processing potatoes. Removal of sprouts is not necessary when sprout inhibitors have been used.

When sprout inhibitors are used as directed, tuber residues are below tolerance levels and there are no harmful effects on humans.

CHEMICAL NAME	PRODUCT NAME	METHOD OF APPLICATION	COMMENTS
Maleic Hydrazide	**Royal MH 60SG**	Applied at 3.39 kg active (5.65 kg product) per hectare in a minimum of 300 L/ha water with ground equipment or a minimum of 100 L/ha with aerial equipment.	Time of application is critical**. Follow label instructions carefully**.
Chlorpropham (CIPC) Fog Application	**Ag-Services Potato Sprout Inhibitor** **Ag-Services 750A Potato Sprout Inhibitor** **Ag-Services 98A Potato Sprout Inhibitor** **Sprout Nip 840** **Sprout Nip 980** **DECCO 271**	Applied in storage after curing and suberization are complete. Cannot be used in storage containing seed potatoes. Seed cannot be safely stored in a treated storage within 3 years of treatment. Depending upon storage conditions, a repeat application may be necessary to achieve desired results.	**In-storage application is available only from a manufacturer's representative**. Effectiveness can be reduced by dirty potatoes, poor air distribution and advanced physiological age. Consult your applicator.
If treated potatoes are to be exported to the U.S. and you need information on acceptable residue levels in the U.S., contact 1-866-375-4648 or www.cropro.org/			
Chlorpropham (CIPC) Emulsifiable Concentrate	**Sprout Nip E.C.** **DECCO 276 E.C.**	An emusifiable formulation of choropropham that is applied after storage. Mixed with water it is sprayed on potatoes during the grading operation. Apply a 1% active ingredient emulsion to clean, washed potatoes using 1.0 liter of solution per tonne.	Used to control sprouting during retailing and home storage by the consumer. **Potatoes must be clean and all bruises and cuts healed**. Dirt may prevent chemical from reaching the buds. **Follow label instructions carefully** in regards to application equipment, mixing directions and application rates.

Never use sprout inhibitors in a seed storage
Never store treated potatoes in a seed storage.
Never use treated potatoes for seed.

FOLIAR FUNGICIDES

FUNGICIDES	PRODUCT (RATE/HA)			DAYS TO HARVEST	HAZARD RATING	
	LATE BLIGHT	EARLY BLIGHT	BOTRYTIS (GRAY MOLD)		HUMANS	FISH
Anilids						
Lance WDG [2]	-	0.175-0.315 Kg	-	30	VLH	VHH
Chlorothalonils						
Bravo 500	1.2-2.4 L	1.6-2.4 L	1.6-2.4 L	1	VLH	VHH
Coppers						
Parasol WP [3]	1.1-2.5 kg +1.75-2.25 kg mancozeb	1.1-2.5 kg +1.75-2.25 kg mancozeb	-	1	VLH	VHH
Parasol flowable [4]	0.80-1.80 L +1.75-2.25 kg mancozeb	-	-	1	VLH	VHH
Coppercide	1.1-2.25 kg +1.75-2.25 kg mancozeb	1.1-2.25 kg +1.75-2.25 kg mancozeb	-	1	VLH	VHH
Copper Spray	4.0 kg	4.0 kg	-	1	VLH	VHH
Copper Spray 53W	5.5 kg	5.5 kg	-	1	VLH	VHH
Kocide 101[3]	1.1-2.25 kg +1.75-2.25 kg mancozeb	1.1-2.25 kg +1.75-2.25 kg mancozeb	-	1	VLH	VHH
Kocide DF[3]	1.1-1.7 kg +1.75-2.25 kg mancozeb	1.1-1.7 kg +1.75-2.25 kg mancozeb	-	1	VLH	VHH
Cymoxanils						
Curzate 60 DF	225 gms+1.6kg mancozeb	-	-	8	VLH	LH
Dimethomorhps						
Acrobat MZ	2.5 kg	2.5 kg	-	14	VLH	MH
Acrobar 50 WP [5]	0.45 kg	-	-	4	VLH	VHH
Fenamidones						
Reason 500 SC [6]	200 ml	200 ml	-	14	VLH	VHH
Mancozebs						
Dithane DG Rainshield NT	1.1-2.25 kg	1.1-2.25 kg	-	1	VLH	MH
Dithane M-45	1.1-2.25 kg	1.1-2.25 kg	-	1	VLH	MH
Manzate DF	1.1-2.24 kg	1.1-2.24 kg	-	1	VLH	MH
Penncozeb 80 WP	1.1-2.25 kg	1.1-2.25 kg	-	1	VLH	MH
Penncozeb 75 DF	1.1-2.25 kg	1.1-2.25 kg	-	1	VLH	MH
Metalaxyls						
Ridomil Gold MZ 68WP	2.5 kg	2.5 kg	-		VLH	MH
Ridomil Gold/Bravo Twin Pak	8.83 L/4ha	8.83L/4ha	8.83L/4ha		VLH	VHH
Metirams						
Polygram DF	1.1-2.25 kg	1.1-2.25 kg	-	1	VLH	VHH
Propamocarbs						
Tattoo C	2.7 L	-	-	7	VLH	VHH
Pyridinamine						
Allegro 500 F	0.4 L	-	-	14	VLH	HH
Strobilurins						
Quadris F	0.8 L	0.5-0.8 L	-	1	LH	VHH
Headline EC [8]	0.45-0.67 L	0.45-0.67 L	-	3	VLH	VHH
Zinebs						
Zineb 80 W	1.7-3.3 kg	1.7-3.3 kg	-	1	VLH	MH
Zoxamides						
Gavel 75 DF	1.7-2.25 kg	1.7-2.25 kg	-	3	VLH	MH

[1] Product not registered for use against the particular disease.

[2] Begin applications prior to disease development and continue at 14 day intervals if conditions continue to be favorable for disease development. Do not apply more than 4 applications per season. Do not apply more than 2 consecutive applications before rotating to another mode of action for at least 1 spray. Lance should be kept 5 meters downwind from Estuarine/marine habitats and it should not be applied where runoff is likely to occur.

[3] These products may be applied without a mancozeb product at 3.4 kg/ha at topkill with a topkiller or after topkill prior to harvest.

[4] These products may be applied without a mancozeb product at 2.40 L at topkill with a topkiller or after topkill prior to harvest.

[5] Must be tank-mixed with Polyram® DF, Dithane DG Rainsheild or Bravo® when late blight threatens and before symptoms appear. Acrobat reduces incidence of tuber blight. Do not apply more than 3 applications per season. See label for details.

[6] Do not apply by air. Application rate of 200 ml/ha mixed with 1.25 L/ha of Bravo 500 or 1.25 kg/ha of Dithane DG (or 935 g ai/ha equivalent mancozeb). Begin application when plants are 15-20 cm high or when disease threatens, whichever comes first. Apply a fungicide of a different mode of action within 7-10 days after each application of Reason 500 SC. Use the shorter spray interval when conditions favor disease development. Follow the recommended spray interval for each fungicide application before proceeding with the next application. Ensure that the area to be treated is covered uniformly. Do not apply Reason 500 SC, alone or in a tank mix, more than 6 times in a year. Do not mix Reason 500 SC with pesticides, fertilizers or any other chemical additives unless recommended on the label. Rotational crop restriction: Potatoes and all other crops may be rotated following a minimum plant back interval of 30 days.

[7] Metalaxyl products also have label recommendations for suppression of Pink Rot and Pythium Leak. Experience has shown that metalaxyl-insensitive strains of *Phytophthora* may develop. Metalaxyl products should not be used when late blight is present in fields.

[8] Begin applications prior to row closure, or when conditions become favorable for disease development. For early blight apply on a 7-14 day interval. For late blight apply on a 5-7 day interval. Use higher rates under heavy late blight pressure. Do not apply more than 6 applications per season. To reduce the potential of late blight resistance, no more than 1 application of Headline may be made before alternating to a fungicide with a different mode of action for at least 1 application.

IN-FURROW FUNGICIDES

FUNGICIDE	PRODUCT RATE			DAYS TO HARVEST	HAZARD RATING	
	PINK ROT	SOFT ROT	RHIZOCTONIA		HUMANS	FISH
Metalaxyls						
Ridomil Gold 480 EC	4 ml/ ha	-	-	80	VLH	MH
Strobilurins						
Quadris F***	-	-	4-6 ml/ 100 m row	0	LH	VHH

[9] Apply as an in furrow spray in 50-140 L of water per hectare at planting. Mount the spray nozzle so the spray is directed into the furrow as a 15-20 cm band just before the seed is covered.

POTATO SEED PIECE TREATMENT

PRODUCTS		FORMULATIONS	PRODUCT/100 KG OF SEED	HAZARD RATING MAMMALS
Trade Name	**Active Ingredient**			
Maxim MZ PSP	Fludioxonil (0.5%) + Mancozeb (5.7%)	DU	0.5 kg	VLH
Maxim PSP	Fludioxonil 0.5%	DU	0.5 kg	VLH
MancoPlus	Mancozeb 16%	DU	0.5 kg	VLH
Potato ST 16	Mancozeb 16%	DU	0.5 kg	VLH
Tuberseal	Mancozeb 16%+ Douglas Fir Bark	DU	0.5 kg	VLH
Polyram 16 D	Metiram 16%	DU	0.45-0.65 kg	LH
Senator PSPT	Thiophosphanate-methyl 10%	DU	0.5 kg	LH
Penncozeb 80 WP	Mancozeb 80%	WP	0.1 kg	VLH

POST HARVEST FUNGICIDES

These fungicides are effective only when the **TOTAL SURFACE** of each tuber is covered and recommended rates are used.

Dithane F-45

Dithane F-45 is reregistered for the control of Fusarium dry rot on **SEED POTATOES**. Apply 1.58 litres of water post harvest per 1000 kg of seed potatoes. Apply as a spray on a conveyer belt prior to storage.

Mertect SC

Apply Mertect (thiobendazole) as a mist spray on the **WHOLE** potatoes going into storage to control Fusarium, Phoma, Rhizoctonia and the fungal diseases, Silver Scurf and Skin Spot. Add 7.5 litres of Merctect to 170 litres of water. Apply this suspension at the rate of 2 litres per 1000 kg of potatoes. This treatment is effective only when the recommended rate is used. Improper use can result in development of resistant strains of fungal pathogens of potatoes.

Mertect SC can also be applied at the same application rate when potatoes are being moved, as fungal pathogens are present on grading equipment and mechanical injuries will create an entry point for fungal diseases.

CAUTION: DO NOT combine Mertect SC with chlorinated compounds. DO NOT use after sprout initiation. Some resistant strains of Fusarium rot and Silver scurf pathogens are now present in the region, reinforcing the need to use recommended rates and application methods.

GUIDELINES
FOR CHEMICAL PESTICIDE SAFETY

Treat all pesticides (insecticides, herbicides, fungicides, etc.) as poisonous substances and handle them with great caution. They can kill.

1. Read each pesticide label carefully and follow the instructions. The instructions on a pesticide label serve to safeguard the health of the user as well as to ensure the pesticide is employed as efficiently and economically as possible. When in doubt, read the label.
2. Except where product labels read otherwise, nitrile gloves are recommended. Always refer to product label.
3. Always wear the recommended protective clothing and safety equipment. Pesticides may enter the user's body through the skin, mouth or by inhalation. The protective equipment worn by the conscientious applier includes a respirator or gas mask, a wide-brimmed hat, goggles, a shirt with long sleeves over gloves, overalls with rubber bands around the cuff, and neoprene or rubber boots. Because fumigants are readily absorbed by neoprene, be sure to follow label instructions. Don't follow someone else's bad example. Wear the equipment. It's for your own good.
4. Open, pour, weigh, and mix pesticides in a safe manner and according to label instructions. Use the proper tools to open a container. Stand upwind of all opening, pouring and mixing operations, and in a well-ventilated area. Avoid splashing and spilling.
5. Learn to recognize the typical signs of poisoning and the correct first aid procedures. Keep a first aid kit handy. Some symptoms of acute poisoning are nausea, diarrhea, loss of muscle coordination, stomach cramps, mental confusion etc.
6. If you feel ill during pesticide application, stop work and seek medical attention at once. Do not carry on because of the work schedule. Always save the pesticide container or the label to assist the medical aid person.
7. Do not permit anyone including yourself, to work alone when handling or applying pesticides.
8. Never use your mouth to siphon liquid materials to blow out a clogged spray nozzle.
9. Keep people and animals away from the contaminated equipment and areas until decontamination procedures are complete.
10. Be sure a good supply of lime, sawdust, or other absorbent is available on site to soak up a spilled pesticide.
11. Do not permit anyone unfamiliar with chemical safety practices to carry out cleaning or maintenance procedures. Appropriate protective equipment is necessary for cleaning and maintenance personnel.
12. Always dispose of irreparable faulty protective equipment and contaminated clothing.
13. Do no store pesticides near any food or drink. Store them in a locked, well-marked area and out of the reach of children.
14. Do not keep any food, drink, tobacco, cups or cutlery anywhere in the work areas or work clothes. Refrain from smoking, eating, or drinking while mixing or applying pesticides.
15. Dispose of empty containers by crushing and puncturing and burying in at least 50 cm of soil at a recommended site or on your own property away from watercourses, crops, animals, or human habitation. Recycle 200 L drums if possible. Small pesticide containers should be thoroughly rinsed at least three times with the rinsing being added to the spray mix.
16. After handling pesticides, wash hands carefully before eating, drinking, smoking, or using the toilet.
17. Shower thoroughly, with special attention to hair and fingernails, after each pesticide application is complete. Change clothes daily or more often if any contamination occurs. Wash contaminated clothing separately from normal laundry.
18. Before mixing and applying pesticides, clear all livestock, pets and people from the area to be treated. Apply pesticides only at the correct time and under acceptable water conditions.
19. Check the application equipment. Look for leaking hoses, or connections, plugged or worn nozzles, and examine the seals on the filter openings to make sure they will prevent pesticide spillage.

20. Mix the pesticide application equipment at the recommended rate, and apply at the specific dosage on the label. Carry only a sufficient quantity of the pesticide for the job at hand.

POISON INFORMATION CENTRES

The hospitals and telephone numbers listed below provide emergency information on potentially toxic substances 24 hours a day. If you suspect poisoning from exposure to pesticides consult the label for immediate first aid instructions. Transport the person to the nearest hospital and take the label information with you.

POISON INFORMATION CENTRES

New Brunswick
911 Ask for poison information

ENVIRONMENTAL EMERGENCIES

New Brunswick
1-800-565-1633

THINK SAFETY

WARNING

Please note that we make no warranty or guarantee of any kind, expressed on implied, concerning the use of products listed in this publication. The user assumes all risk, whether recommendations are followed or not.
This publication is intended as a guide only.

For specific product information ALWAYS REFER TO AND FOLLOW DIRECTIONS ON THE LABEL.

METRIC CONVERSION FACTORS FOR ENGLISH SYSTEM

Metric units ÷ Approximate conversion factor = Results in:

LINEAR		
Millimetre (mm)	÷25	inch
Centimetre (cm)	÷ 30	foot
Metre (m)	÷ 0.9	yard
Kilometre (km)	÷ 1.6	mile
AREA		
Sq. centimetre (cm2)	÷ 6.5	square inch
Sq. metre (m2)	÷ 0.09	square inch
Hectare (ha)	÷ 0.40	acre
VOLUME		
Cubic centimetre (cm3)	÷ 16	cubic inch
Cubic decimetre (dm3)	÷ 29	cubic foot
Cubic metre (m3)	÷ 0.8	cubic yard
Millilitre (mL)	÷ 28	fluid ounce
Litre (L)	÷ 0.57	pint
Litre (L)	÷ 1.1	quart
Litre (L)	÷ 4.5	gallon
Hectolitre (hL)	÷ 0.36	bushel
Litres/sec./tonne	÷ 10.4	cubic feet/min./cwt.
WEIGHT		
Gram (g)	÷ 28	ounce
Kilogram (kg)	÷ 0.45	pound
Tonne (t)	÷ 0.9	ton
Tonne (t)	÷ 0.0454	hundredweight (cwt)
TEMPERATURE		
Degrees Celsius	(9/5x°C)+32	degrees Fahrenheit
PRESSURE		
Kilopascal (kPa)	÷6.9	pounds per square in inch
POWER		
Watt (W)	÷746	horsepower
Kilowatt (kW)	÷0.75	horsepower
SPEED		
Metres per second (m/s)	÷0.30	feet per second
Kilometres per hr. (km/h)	÷1.6	miles per hour
AGRICULTURE		
Hectolitres/hec. (hl/ha)	÷.90	bushels per acre
Litres per hec. (L/ha)	÷11.23	gallons per acre
Litres per hec. (L/ha)	÷2.8	quarts per acre
Litres per hec. (L/ha)	÷1.4	pints per acre
Millilitres/hec. (L/ha)	÷70	fluid ounces per acre
Tonnes per hec. (t/ha)	÷2.24	tons per acre
Kilograms per hec (kg/ha)	÷1.12	pounds per acre
Grams per hec. (g./ha)	÷70	ounces per acre
Plants per hec. (plants/ha)	÷2.47	plants per acre

Examples

3 km ÷ 1.6 = 1.9 miles

4 ha ÷0.4 = 10 acres

13.5 hl/ha ÷ 0.90 = 15 bushels per acre

Forward revisions for the 2005 Potato Crop Variety, Weed and Pest Control Guide to the following section editors before November 15, 2004:

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