INSECT MANAGEMENT IN

OILSEED CROPS

(Canola, flax, mustard, sunflowers)

Ian Wise; Agriculture and Agri-Food Canada, and
John Gavloski; Manitoba Agriculture, Food and Rural Initiatives

Last Updated: June 2009

Note: For pesticide toxicity to bees see the chapter in this guide on: "Hazards and Safeguards in Applying Insecticides to Crops in Bloom"; the link for this reads “Bee Poisoning”.

ALFALFA LOOPER

Alfalfa Looper (canola)

Economic threshold - No thresholds have been determined for the alfalfa looper in canola but check threshold levels for the Bertha armyworm as a guideline.

Chemical Control -

Insecticide	Rate (vol/acre)	Rate (vol/ha)	Preharvest Interval (days)	References
Chlorpyrifos Lorsban 4E /Pyrinex /Nufos /Citadel	0.3 - 0.4 L	0.75-1.0 L	21	1-3
Methomyl Lannate Toss-N-Go	87 - 206 g	216-510 g	8	1-3

References -

1. Dolinski *et al*., Pest. Res. Rep. 1973:136.
2. Jacobson *et al*., Pest. Res. Rep. 1973:137.
3. McDonald, Pest. Res. Rep. 1973:252.

APHIDS

Aphids (canola and flax)

Economic Threshold -

Canola - Control aphids in canola if densities exceed 25 aphids/10 cm shoot tip after flowering (1). To estimate aphid densities, randomly collect a minimum of 20 shoot tips.

Flax - Do not control aphids in flax unless populations exceed 3 aphids/stem at full flowering or 8/stem at early green boll growth stages (3).To estimate aphid densities in flax, sample 25 plants at full bloom or 20 plants at early green boll growth stage (4).

Chemical Control -

Apply to canola only if aphids are found in clusters on the shoot tips.

Insecticide	Crop	Rate (ml/acre)	Rate (ml/ha)	Preharvest Interval (days)	References
Dimethoate Lagon /Cygon	canola flax	344 - 364 177	850-900 437	21	2

References -

1. Sekon and Bakhetia, GCIRC Int. Rapeseed Congress, 1991.
2. Wise, Pest Mgmt. Res. Rep. 1991: 48, 49.
3. Wise and Lamb, Can. Entomol. 127:967-976.

BEET WEBWORM

Beet webworm (canola, mustard and flax)

Economic threshold -

No thresholds have been determined.

Chemical Control -

Insecticide	Crop	Rate (vol/acre)	Rate (vol/ha)	Preharvest Interval (days)	References
Methomyl Lannate Toss-N-Go	canola	87 - 206 g	216-510 g	8	1
Deltamethrin Decis 5EC	canola, mustard	40 - 60 ml	100-150 ml	7	1
	flax	40 - 60 ml	100-150 ml	40	

References -

1. Harris, Pest. Mgmt. Res. Rep. 1990:36.

BERTHA ARMYWORM

Bertha Armyworm (canola, mustard and flax)

Cultural control -

Flax is less attractive as an egg-laying site to female moths than canola or mustard. Controlling broadleaf weeds such as lamb's quarters will greatly prevent the build-up of larval populations in flax.

Economic Thresholds -

Consult the table below to determine if the economic injury level in canola or mustard is exceeded.

ECONOMIC INJURY LEVELS* FOR BERTHA ARMYWORM

Insecticide Application Cost - $/ac	Expected seed value - $/bushel										
	6	7	8	9	10	11	12	13	14	15	16
	# Larvae/metre^2										
7	20	17	15	13	12	11	10	9	9	8	8
8	23	20	17	15	14	13	11	11	10	9	9
9	26	22	19	17	16	14	13	12	11	10	10
10	29	25	22	19	17	16	14	13	12	11	11
11	32	27	24	21	19	17	16	15	14	13	12
12	34	30	26	23	21	19	17	16	15	14	13
13	37	32	28	25	22	20	19	17	16	15	14
14	40	35	31	27	24	22	20	19	17	16	15
15	43	37	32	29	26	23	22	20	19	17	16

* Based on an average of 20 larvae/m² consuming the equivalent of 65 kg canola seed/ha (1.16 bushels/acre) (7, 8). Thresholds apply to both Argentine and Polish type canola and not to mustards, which are higher because they are a less preferred host (15) and have a greater ability to compensate for feeding damage (16).

Drought stress on canola may result in early dropping of leaves. Lack of leaves may cause more pod feeding by the larvae and affect yield more directly. Also, canola may not compensate as well for tissue loss under stressed conditions. Thus, under moisture stress, economic thresholds for bertha armyworm may be lower than indicated in the above table. Under severe drought stress, dividing the economic thresholds above by 1.5 may give more appropriate economic thresholds.

Chemical Control -

Insecticide	Crop	Rate (vol/acre)	Rate (vol/ha)	Preharvest Interval (days)	References
Chlorpyrifos Lorsban 4E /Pyrinex /Nufos /Citadel	canola, flax	304-405 ml	750 ml – 1L	21	1,4-6
Cypermethrin Ripcord 400EC UP-Cyde	canola	28 - 36 ml 81-113 ml	70 - 90 ml 200-280 ml	30	-
Deltamethrin	canola,	40 - 60 ml	100-150 ml	7	9-14

Decis 5EC	mustard				
Lambda-cyhalothrin Matador /Silencer	canola, mustard	34 ml	83 ml	7	-
Methomyl Lannate Toss-N-Go	Canola, flax	87 - 206 g	216-510 g	8	1-6
Methamidophos Monitor	canola	230 – 500 ml	575 ml – 1.25 L	10	

Restrictions -

Apply only once per year by air.
Do not apply at water volumes less than 10 L/ha.
Cymbush, Decis, Matador: Apply when temperatures are below 25°C.

References -

1. Putnam, Pest. Res. Rep. 1970:126.
2. McDonald *et al*., Pest. Res. Rep. 1971:177.
3. Peterson *et al*., Pest. Rep. Rep. 1971:143.
4. Lee *et al*., Can. Entomol. 104:1745, 1972.
5. Stewart, Pest. Res. Rep. 1972:166.
6. Harris and Turnbull, Can. Entomol. 107:865, 1975.
7. Bracken and Bucher, J. Econ. Entomol. 70:701, 1971.
8. Bracken and Bucher, Rep. Canola Council of Canada,1981.
9. Derksen and Blouw, Pest. Res. Rep. 1980:121, 122, 123.
10. McVicar and MacKenzie, Pest. Res. Rep. 1980:124.
11. McVicar and Makowski, Pest. Res. Rep. 1980:125.
12. Wise and Kitson, Pest. Res. Rep. 1980:128.
13. Wise and McVicar, Pest. Res. Rep. 1980:129, 130.
14. Wise, McVicar and Kitson, Pest Res. Rep. 1980:131.
15. Ulmer *et al.* Can. Entomol.133: 509-20, 2001.
16. Gavloski and Lamb. Env. Entomol. 1258-67, 2000.

CABBAGE SEEDPOD WEEVIL

Cabbage seedpod weevil (canola and mustard)

Economic threshold -

Control is required at densities of 3 to 4 adult weevils per one 180° sweep net sample (1). Apply by air or ground when crops are in 10 to 20% flowering stage to prevent egg-laying into newly formed pods (1,2). This is the stage when 70% of plants in the field have at least 3 to 10 open flowers.

Cultural Control –

Plant Resistance: Yellow mustard (*Sinapis alba*) is resistant to cabbage seedpod weevil; oriental and brown mustards (*Brassica juncea*) are susceptible to feeding damage by cabbage seedpod weevil (3).

Trap crops: If a trap crop of Polish canola (*Brassica rapa*) is planted at the same time as the main crop of Argentine canola (*Brassica napus), B. rapa* should flower several days earlier and effectively concentrate the weevils, which then can be sprayed with an insecticide if needed (4).

Chemical control -

Insecticide	Crop	Rate (ml/acre)	Rate (ml/ha)	Preharvest Interval (days)	References
Lambda-cyhalothrin Matador /Silencer	Canola, mustard	34	83	7	5
Deltamethrin Decis 5EC	Canola, mustard	80	200	7	5

Restrictions -

Spray late in the day to minimize harmful effects to bees and other beneficial insects.
Do not make more than 1 application per year by air.

References -

1. Dosdall, 2000 AAFRD Tech. Rep. 98M301, 65 pp.
2. Dosdall *et al.* 2001. Alta. Agr. Agdex 622-21, 4 pp.
3. Cárcamo *et al* 2007. Can. Entomol. 139 : 658-669.
4. Cárcamo *et al* 2007, Crop Protection 26: 1325-1334
5. Cárcamo *et al* 2005, Can. Entomol. 137: 476-87

CLOVER CUTWORM

Clover cutworm (canola, mustard, and flax)

Economic thresholds - Check threshold levels for the Bertha armyworm as a guideline to determine if control measures are needed in canola.

Chemical Control -

Insecticide	Crop	Rate (vol/acre)	Rate (vol/ha)	Preharvest Interval (days)	References
Methomyl Lannate Toss-N-Go	canola	87 - 206 g	216-510 g	8	1
Deltamethrin Decis 5EC	canola, mustard	40 - 60 ml	100-150 ml	7	2-5
	flax	40 - 60 ml	100-150 ml	40	

References -

1. Dixon, Pest. Res. Rep. 1971:176.
2. Catellier and Wise, Pest. Res. Rep. 1982:99.
3. Catellier and Wise, Pest. Res. Rep. 1982:100.
4. McDonald, Pest. Res. Rep. 1975:260.
5. McDonald, Pest. Res. Rep. 1979:354.

CUTWORMS

Cutworms (canola, flax and sunflower): Army, Dingy, Pale Western and Redbacked cutworms

Economic threshold -

Pale western or redbacked cutworm - Apply an insecticide if densities exceed 4-5 larvae/m² in flax (8) or 10/m² in sunflowers (9). No thresholds have been established in canola but threshold levels in flax can serve as a guideline.

Army cutworm - No thresholds have been determined but larval densities of 5/m destroyed a mustard crop (10).

Dingy cutworm – Crops can withstand higher populations than other cutworms because larvae are more apt to feed on foliage and less likely to damage crops by severing the stem (11).

Cultural Control -

To prevent egg laying by pale western cutworm adults in summerfallow fields, destroy all plant growth in July and allow soil surface to crust until September 15. In areas where redbacked adults are present, avoid weedy growth in August and weedy patches in crops. Starve young cutworm larvae before spring seeding by allowing volunteer growth to reach 2-5 cm before cultivation, then delay seeding 10-14 days.

Chemical Control -

Insecticide	Crop	Rate (ml/acre)	Rate (ml/ha)	Preharvest Interval (days)	References
Chlorpyrifos Lorsban 4EC /Pyrinex /Nufos /Citadel	canola, flax sunflowers	354 - 486 486	875-1200 1200	21 42	1-5
Permethrin Pounce /Perm-UP	canola, flax sunflowers	73 - 158	180-390	<6 leaf stage	-
Deltamethrin Decis 5EC	flax	80	200	40	6,7

Restrictions -

Pounce, Decis: Do not apply at temperatures above 25°C.

References -

1. McDonald, J. Econ. Entomol. 62:30, 1968;65:533, 1972.
2. Askew *et al*., Pest. Res. Rep. 1973:151.
3. McDonald, Pest. Res. Rep. 1974:251.
4. Askew *et al*., Pest Res. Rep. 1974:244.
5. Philip and Dolinski, Pest. Res. Rep.1977:215.
6. McVicar and Wise, Pest. Res. Rep. 1982:113.
7. Wise and Long, Pest. Res. Rep. 1985:95.
8. Ayre, Can. Entomol. 122: 21-28, 1990.
9. NDSU Extension Service #E-1143
10. Jacobsen, J. Econ. Entomol. 55: 408, 1962.
11. Cullen, Wisconsin Crop Manager, May 2005

DIAMONDBACK MOTH

Diamondback moth (canola and mustard)

Economic Thresholds -

Control is required in canola if larvae exceed 100-150/m² in immature to flowering plants and 200-300/m^2 (2-3 larvae/plant) in plants with flowers and pods (2). Sample individual plants by removing plants from field and dislodge larvae by striking plant on a clean surface. A nominal threshold of 25-33% defoliation, with larvae still present on plants, can be applied for canola at seedling stage (5). Threshold at all crop stages may be lower for Polish type canolas than for Argentine type canolas (3) and higher for mustard (5).

Chemical Control -

Insecticide	Crop	Rate (ml/acre)	Rate (ml/ha)	Preharvest Interval (days)	References
Chlorpyrifos Lorsban 4E /Pyrinex /Nufos /Citadel	canola	400	1000	21	
Deltamethrin Decis 5EC	canola, mustard	40-60	100-150	7	4
Lamba-cyhalothrin Matador /Silencer	canola, mustard	34	83	7	
Malathion Malathion 500 Malathion 500E	canola, mustard	220- 345	550-850	7	1

Restrictions -

deltamethrin: Do not make more than three applications/yr. (Only one application/yr. by air). Do not apply at temperatures above 25°C. Apply in minimum of 11 L water/ha by air.

malathion: Do not apply at air temperatures below 20°C.

References -

1. Putnam, Pest. Res. Rep. 1962:126.
2. Putnam, unpublished, 1976.
3. Harris, Sask. Agric., Regina, Sask. 1990.
4. Wise and Leader, Res. Rep. 1985:84,85.
5. Gavloski and Lamb, Env. Entomol. 1258-67, 2000

FLAX BOLLWORM

Flax bollworm (flax)

Economic threshold - Apply an insecticide if 3% or more of bolls are infested. Infestations on flax are generally very rare.

Chemical Control - No insecticides presently are registered.

FLEA BEETLES

Flea beetles (canola and mustard)

Cultural control - Damage to canola and mustard (oriental, brown) is greater under conventional tillage than with zero tillage (7,8). In conventional tillage flea beetle damage to seedlings may be reduced by increasing seeding rates to 10 kg/ha and widening row spacings to 25 cm. (8). In zero tillage optimal seeding rates to reduce flea beetle damage are about 8 kg/ha.

Chemical Control - Rotate the use of all pre-emergent and foliar insecticides to delay possible onset of insecticide resistance.

Seed Treatments

Trade Name	Active Ingredient	Rate (vol/kg seed)	References
Helix Helix Xtra	thiamethoxam (seed dressing**)	15 ml 15 ml	-
Prosper	clothianidin (seed dressing**)		-
Gaucho Canola System Gaucho Platinum	imidacloprid (seed coating**)	8.3 ml 16.7 ml	5

* Use 2.5 ml rate for low to moderate flea beetle populations only.
**For use by commercial seed treaters only.

Foliar Sprays

Insecticide	Rate (ml/acre)	Rate (ml/ha)	Preharvest Interval (days)	References
Deltamethrin Decis 5EC	40 - 60	100 - 150	8	4
Lambda- cyhalothrin Matador /Silencer	34	83	50	-
Cypermethrin			30	3
Ripcord	20	50		
UP-Cyde	56.6	140		
Permethrin Pounce	36 - 73	90 – 180		
Malathion Malathion 500 Malathion 500E	450	1120	7	1
Carbaryl Sevin XLR	200	500	-	2,3
Carbofuran Furadan	60	150	60	

Restrictions -

Sevin XLR:	Apply only up to 4 weeks after seedling emergence.
Matador:	Apply only one application per year by air.
Ripcord:	Avoid application at temperatures above 25°C.
Decis:	Do not feed treated crop to livestock. Do not apply at temperatures above 25°C. Do not make more than 3 applications/yr. (Only one application/yr. by air).
Malathion:	Do not apply at air temperatures below 20°C. Do not apply when bees are foraging.

Note -

Yellow mustard seedlings are tolerant to flea beetle attack (6) and should not require any insecticide treatments at seeding.

References -

1. Askew *et al*., Pest Res. Rep. 1974:226,228; 1976:127,129,131; 1977:144.
2. Westdal *et al*., Pest. Res. Rep. 1976:134,136; 1980:115.
3. Romanow *et al*., Pest. Res. Rep. 1977:151; 1982:84; 1983:83.
4. Wise, Pest. Res. Rep. 1983: 95.
5. Wise, Pest. Man. Res. Rep. 1993:26, 1995:32.
6. Brandt and Lamb, Can. J. Plant Sci. 74: 169-76, 1994

7. Milbraith *et al.*, Can. Entomol. 127: 289-93, 1995.
8. Dosdall *et al.*, Crop Protection 18: 217-224, 1999.

GRASSHOPPERS

Grasshoppers (canola, flax, mustard, safflowers)

Cultural Control -

· Fall stubble cultivation may reduce egg pod survival.
· Destroying green growth on stubble in the spring at hatching may help to starve young grasshoppers.
· Barrier strips of a non-preferred crop like oats next to an infested area at the margin of fields may delay young grasshoppers from feeding on susceptible crops (2).
· Trap crops or weeds in an adjacent summerfallow field can attract grasshoppers where they can be controlled with an insecticide (3).

Chemical Control -

Trade Name	Crop	Rate (vol/acre)	Rate (vol/ha)	Preharvest Interval (days)	References
Carbaryl Eco Bran Bait	Canola	0.8 – 1.6 kg	2 - 4 kg	Seedlings only	-
Deltamethrin Decis 5EC	canola, Flax	40 - 60 ml	100-150 ml	7 40	
Lambda-cyhalothrin Matador /Silencer	canola, flax & mustard	25 - 34 ml (Ground) 34 ml (Air)	63-83 ml	7	-
Cypermethrin Ripcord	Canola	20 – 28 ml	50 – 70 ml	30	
Malathion Malathion 500 Malathion 500E	canola, flax & mustard	450 - 680 ml	1100-1680 ml	7	1
Chlorpyrifos Lorsban 4E /Pyrinex /Nufos /Citadel	Canola	235 - 354	580-875 ml	21	1
Dimethoate Cygon Lagon 480	canola safflowers	340 - 364 ml 222 - 450 ml	850-900 ml 550-1100 ml	21	-
Methamidophos Monitor	Canola	500 ml	1.25 L	10	

Restrictions -

Do not apply when bees are present (with the exception of Eco Bran, which can be applied when bees are foraging).

Apply higher rates when foliage is dense or if grasshopper nymphs are past the third instar stage.

Do not apply Malathion at air temperatures below 20°C or Matador and Decis above 25°C.

References -

1. Charnetski, Pest. Res. Rep. 1975: 210.
2. Olfert, Grasslands and Grassland Health, 2000: 61-70.
3. Olfert, Can. Entomol. 1986: 133-140.

LYGUS BUGS

Lygus bugs (canola, mustard, confectionary sunflowers)

Economic thresholds -

Canola - Thresholds are based on the number of lygus bugs sampled per 10 net sweeps (2). Canola should be sampled as flowering ends (stage 4.4), particularly if precipitation is low. If densities are near but less than the threshold at stage 4.4, canola should be resampled at stage 5.1 (when seeds in the lower pods are full size, translucent). If densities are sufficiently high, control is still warranted at stage 5.2 (seeds in lower pods green).

Lygus bug densities should be determined from a minimum of 15 samples of 10 sweeps or 10 samples of 20 sweeps per field (3). Samples can be collected from along the edge or at right angles from the edge of the field. Research has shown that samples taken along the edge of commercial fields and at various distances into the field all gave similar estimates of plant bug density (3). Sampling along the edge reduces effort during years when thick crop growth impedes access to the field. For edge sampling, the area selected for sampling should be at a crop stage similar to that in the main part of the field.

Application Cost		**End of Flowering (Canola Crop Stages 4.4 - 5.1)[1]**					
$ / ha	**$/ ac**	**Economic Injury Level**					
22	8.00	11	8	7	5	5	4
25	10.00	13	10	8	7	6	5
27	12.00	16	12	10	8	7	6
30	14.00	19	14	11	9	8	7
32	16.00	22	16	13	11	9	8
35	18.00	24	18	15	12	10	9
Canola Price ($/bu)		6.00	8.00	10.00	12.00	14.00	16.00

At crop stages prior to end of flowering, feeding by lygus bugs on canola does not generally result in economic damage

Application Cost	**Pod Ripening (Canola Crop Stage 5.2)[1]**

$ / ha	**$/ ac**	**Economic Injury Level**					
22	8.00	15	12	9	8	7	6
25	10.00	19	14	11	10	8	7
27	12.00	23	17	14	11	10	9
30	14.00	27	20	16	13	11	10
32	16.00	30	23	18	15	13	11
35	18.00	34	26	20	17	15	13
Canola Price ($/bu)		6.00	8.00	10.00	12.00	14.00	16.00

[1]Crop stages of Harper and Berkencamp (1975):
4.4 is flowering complete, seeds enlarging in lower pods;
5.1 is when seeds in the lower pods are full size, translucent;
5.2 is when seeds in the lower pods are green.

When precipitation is greater than 100 mm from the onset of bud formation to the end of flowering, the plant may partially compensate for damage by lygus bugs (2).

Confectionary sunflowers – Research in North Dakota found that feeding by adult lygus bugs can result in approximately 5% of seeds in a head being damaged per adult (4). One adult lygus bug per 9 heads can result in economic loss through the reduction of seed quality.
Damage to sunflower heads was approximately twice as severe when infestations occurred at growth stages R4 and R5 compared with stages R6 and R7. Lygus bug management should be initiated between the R4 to R5.1 stage if adult densities approach the economic injury level (4).

No control needed in oilseed sunflowers.

Chemical Control -

Insecticide	**Crop**	**Rate (ml/acre)**	**Rate (ml/ha)**	**Preharvest Interval (days)**	**References**
Chlorpyrifos Lorsban 4E /Citadel Pyrinex /Nufos	canola	 200 - 400 400	 500-1000 1000	21	1
Lambda- cyhalothrin Matador /Silencer	canola	34	83	7	-
Deltamethrin Decis 5EC	canola, mustard	60	150	7	1

References -

1. Wise, Pest. Res. Rep. 1988: 65, 66.
2. Wise and Lamb, Can. Entomol. 130: 825-36, 1998.
3. Wise and Lamb, Can. Entomol. 130: 837-51, 1998.
4. Charlet. Helia. 26: 83-92, 2003.

RED TURNIP BEETLE

Red turnip beetle (canola, mustard)

Cultural Control -

The eggs are layed on the soil late in the summer beneath canola or related plants. They hatch in the spring and the grubs feed on volunteer canola or winter annual weeds such as flixweed and mustards. Destruction of these food plants while the pest is still in the early grub stage may starve larvae. Adults are very mobile and will migrate to canola in summer to feed.

Chemical Control –

Insecticide	Crop	Rate (ml/acre)	Rate (ml/ha)	Preharvest Interval (days)	References
Carbofuran Furadan	canola, mustard	110	275	60	

ROOT MAGGOTS

Root Maggots (canola)

Cultural Control -

· Varieties of *Brassica napus* (Argentine canola) are less susceptible to infestation than are *B. rapa* (Polish) varieties (1,2).
· Cultivating prior to seeding reduces adult emergence from overwintered pupae (3).
· Seeding at approximately twice the recommended rate (10 kg/ha) (4), and at a row spacing of 20 or 30 cm (5) reduces damage from root maggots and results in improved yields.
· Root maggot infestations are greater under zero-till systems than under conventional tillage, but yields under zero tillage usually still exceed those with conventional tillage (5).

Chemical Control - No insecticides are registered for control of roots maggots in canola.

References -

1.Griffiths, Proc. GCIRC Congress, 1991:528-535.
2. Dosdall *et al.*, Can. Ent. 126: 251-260, 1994.
3. Dosdall *et al.*, Can. Ent. 128:1157-1165, 1996.
4. Dosdall *et al.*, Can. J. Plant Sci. 76: 169-177.
5. Dosdall and Dolinski. AARI Tech. Rep. 95M723, 1997: 40pp.

SUNFLOWER BEETLE

Sunflower beetle

Economic Thresholds -

Control is required in sunflowers with 1 - 2 adults/seedling or 10 - 15 larvae/plant (9). Count larvae in the plant tops where they rest during the day. Sample a minimum of 20 plants to estimate larval densities.

Biological Control-

The tachinid fly *Myiopharus macellus* is an important natural enemy of sunflower beetle larvae (11).

Cultural Control –

Research in North Dakota found that sunflower beetle adult and larval populations decreased as planting date was delayed (10). Delaying planting did not reduce the effectiveness of the parasitic fly *Myiopharus macellus* which attacks the sunflower beetle larvae. Growers are advised to not delay seeding if it results in seeding being done after recommended seeding dates.

Chemical Control -

Insecticide	Rate (ml/acre)	Rate (ml/ha)	Preharvest Interval (days)	References
Lambda-cyhalothrin Matador / Silencer	17 – 25 (ground) 34 (air)	42 - 63 83	7	-
Cypermethrin Ripcord UP-Cyde	 28 40	 70 100	70	7, 8
Deltamethrin Decis 5EC	40	100	70	6, 7
Endosulfan Thidoan 4EC Thionex EC	600	1500	60	1-5
Carbofuran Furadan	110	275	60	

Restrictions -

Do not apply insecticides after plants are 60 cm high or after heads begin to form.

cyhalothrin-lambda: Only one application by air per year.

cypermethrin: Avoid application at temperatures above 27°C. Only one application by air.

endosulfan: Do not apply more than once per season. Do not feed treated foliage to livestock.

deltamethrin: Do not make more than three applications/yr. (Only one application by air.) Do not apply at temperatures above 25°C.

References -

1. Kolach, Pest. Res. Rep. 1970:147.
2. Kolach *et al*., Pest. Res. Rep. 1972:141.
3. Palmer and Todd, Pest. Res. Rep. 1973:157.

4. Zirk and Donaghy, Pest. Res. Rep. 1973:158, 1974:247.
5. Askew *et al*., Pest. Res. Rep. 1974:245.
6. Westdal *et al*., Pest. Res. Rep. 1980:130.
7. Romanow and Askew, Pest. Res. Rep. 1983:144.
8. Emilson, Pest. Res. Rep. 1983:141,142,143; 1984:160,161,162,163.
9. Deedat, Ph.D. Thesis, Univ. of Manitoba. 1987:92.
10. Charlet and Knodel. 2003. J. Econ. Entomol. 96: 706-713.
11. Charlet. 1992. J. Econ. Entomol. 85: 766-771.

SUNFLOWER MAGGOTS

Economic Threshold - Larvae of *Strauzia longipennis* burrow inside the stem and can reach densities high enough to cause stem breakage to individual plants. Yield losses have not been found to be high enough to warrant chemical control.

Chemical Control – Foliar insecticides are ineffective against larvae in the stem.

SUNFLOWER MIDGE

Sunflower Midge

Economic Threshold -

Destruction of seeds and distortion of heads can cause serious losses in fields in the Red River Valley of Manitoba. Losses are more severe around field edges. Losses can be estimated by sampling heads and classifying them by the degree of head cupping and the relative area of seed destroyed (1).

Cultural Control -

Where significant losses occur, growers should rotate to other crops and plant resistant varieties in subsequent years. Among currently registered varieties, some are resistant and many are highly susceptible. Consult provincial guides for the varieties suited for your area.

Chemical Control -

No chemical control is feasible because the larvae feed within the head.

Reference -

1. Bracken, Can. J. Plant Sci. 71: 81-85.

SUNFLOWER MOTHS

Sunflower moth (SM) and Banded sunflower moth (BSM)

Economic threshold - The sunflower moths are found mainly in the field margins. Only apply an insecticide in areas where 2-4 SM are found at dusk for every 10 plants (1). Pheromone traps can be used to determine when adults of the sunflower moth and banded sunflower moth are present.

Cultural Control – Research in North Dakota has shown that delaying the planting of sunflowers until late May or early June can reduce levels of damage by banded sunflower moth (2). Check seeding date recommendations in your area to determine if late seeding is an option.

Chemical Control - Do not apply an insecticide if insects are not found within 2 weeks of flowering. Apply when 20-50% of the heads are in bloom.

Insecticide	Rate (g/acre)	Rate (g/ha)	Preharvest Interval (days)	References
Bacillus thuringiensis kurstaki Dipel 2X DF (sunflower moth)	127 - 253	315-625	None	-

Restrictions - By air, apply in minimum of 20 L of water per ha.

References -

1. NDSU Extension Service, Pub. # E-1143.
2. Oseto et al. 1989. J. Econ. Entomol. 82: 910-912.

SUNFLOWER SEED WEEVILS

Red and grey Sunflower seed weevils

Economic Threshold -

Apply an insecticide if there are one to two adults/head in confectionery sunflower and 12-14 adults/head in oilseed sunflowers for plant densities of 45 000 - 55 000/ha (1). Count the number of weevils found on a minimum of 25 plants when the yellow ray petals are beginning to show (2).

Cultural Controls-

Research in North Dakota showed that planting sunflowers in early to mid May will help reduce damage by red sunflower seed weevil (3). However, early planting may increase the risk of damage by other insects.

Chemical Control -

Optimal Spray Timing: Early anthesis, when 30 - 70% of sunflower heads are in early pollen formation, i.e. R-5.1 stage (for example, when 3 - 7/10 plants show ray petals and at least one row of disc flowers). Re-infestation of the field may occur in areas with a high weevil population. Fields at

70% pollen shed stage are no longer susceptible to economic damage (2).

Insecticide	Rate (ml/acre)	Rate (ml/ha)	Preharvest Interval (days)	References
Chlorpyrifos Lorsban 4E /Pyrinex /Nufos /Citadel	485	1200	42	-
Cypermethrin			70	-
Ripcord	28	70		
UP-Cyde	40	100		

Note: Apply in minimum 20 L water/ha either by ground or air.

Reference -

1. Peng and Brewer. 1995. Can. Entomol. 127: 561-568.
2. N. Dakota State Univ. Coop. Ext. Serv. Publ. #E-817.
3. Oseto et al. 1987. J. Econ. Entomol. 80 : 190-192.