COOPERATIVE EXTENSION SERVICE

UNIVERSITY OF KENTUCKY • COLLEGE OF AGRICULTURE

ENT - 16

INSECTICIDE RECOMMENDATIONS FOR CONVENTIONAL AND NO-TILLAGE FIELD CORN - 1999

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This publication was prepared as a guide for use in the selection of agricultural insecticides. It is not as inclusive as the manufacturer's label. Products listed in bold italics are ***Restricted Use*** pesticides. **Read and understand the label** before purchasing and using any insecticide. Information on corn insects and their management is available at your county extension office. Several formulations of carbaryl (Sevin) are registered for use on corn. Only the Sevin 80 S is listed, however, Sevin XLR Plus, Sevin 4F, or Sevin 4-Oil may be used if appropriate.

Seed treatments are recommended for fields that do not receive a soil insecticide at planting time. Seedcorn maggots can be damaging to fields planted early, especially under reduced tillage practices.

Treatments for Seed Corn Maggots

Product	Contents	Use Rate
Agrox D-L Plus	captan, diazinon, lindane	2 oz/bu
Diazinon 50% WP	diazinon	½ oz/bu
Germate	Vitavax, maneb, lindane	2.7 oz/50 lbs
Isotox Seed Treater	lindane + captan	8 oz/100 lbs
Kernel Guard	captan, diazinon, lindane	2 oz/bu
KickStart	Vitavax, diazinon, lindane	2 oz/bu
Lindane 25 EC-LF	lindane	4 fl oz/100 lbs
Lorsban 50 SL	chlorpyrifos	2 oz/100 lbs

Corn Rootworm

These are potential pests in fields where corn is grown year after year. If densities of adult western and/or northern corn rootworm beetles exceeded an average of one per plant at any time from July through August and the field is to be planted to corn the following year, an "at-planting" soil insecticide is advisable. See **ENT-45**, Corn Rootworm Beetles, for more information.

Pounds of granular insecticide needed per acre

% active ingredient	Row width					
	30"	32"	34"	36"	38"	40"
1.5	8.7	8.2	7.7	7.3	6.9	6.5
15	8.7	8.2	7.7	7.3	6.9	6.5
20	6.5	6.1	5.8	5.4	5.2	4.9

Rootworm Insecticides- Granular Formulations

Insecticide	Application	Ounces/1,000' row
Aztec 2.1% G	Band, T-Band, or furrow	6.7
Counter 15% G	Band or furrow	8
Counter 20 CR	Band or furrow	6
Dyfonate II 20% G	Band	6
Force 1.5% G	Band, T Band or furrow	8-10
Force 3% G	Band, T Band or furrow	4-5
Fortress 2.5% G	T-band or furrow	6
Fortress 5% G	T-band or furrow	3
Holdem 20% G	Band	6
Lorsban 15% G	Band or T band	8
Mocap 10% G	Band	12
Thimet 20% G	Band	6

NOTE: If you anticipate the use of ACCENT or BEACON herbicides, read the labels of these products carefully before selecting a soil insecticide, especially note the comments regarding ***Counter***. Also, learn the precautions concerning FOLIAR APPLICATIONS of organophosphate insecticides in conjunction with use of these herbicides.

Rootworm Insecticides- Liquid Formulations

Insecticide	Application	Rate
Dyfonate 4 EC	Broadcast PPI	3 qts per acre
Dyfonate 4 EC	7" Band	3/4 to 1 qt per acre
Furadan 4 F	7" Band, Broadcast or Injected	2.5 fl/1,000' row
Lorsban 4 E	Broadcast PPI	3 qts per acre
Mocap 6 EC	7" Band	1.6 fl oz/1000' row
Regent 80 WG	Microtube injection or infurrow band	0.149 oz/1000' row

Liquid insecticides must be compatible with liquid fertilizer when applied as tank mixes. *Mocap* is labeled only as a spray with water. Follow label directions carefully. Follow all recommended precautions when using these products. Liquid formulations are **more toxic** than granular formulations. Do not plant small grains or other rotational crops within 12 months following a **Regent** application**. Note: *Dyfonate II, Mocap*** and ***Thimet*** may cause injury if placed in contact with the seed.

Cultivation Applications for Rootworms

A cultivation application may be made if no soil insecticide was applied at planting. Any of the granular insecticides listed above may be used at the indicated rates. ***Furadan 4F*** at the rate above or Lorsban 4E at 2 pts per acre may be used as basal sprays. These treatments should be applied no later than the last half of May. Moisture following

any cultivation is necessary for activation. Treatments will be slow to work or ineffective under very dry conditions. Cultivation treatments should be regarded as delayed applications, **not rescue** treatments. If significant rootworm damage has already occurred, these delayed applications will not provide effective control.

Wireworms

These can be a potential problem where corn follows grass or legume-grass sod. Several species can cause economic damage. Wireworms reduce plant populations by attacking the seed or boring into the young plant. The plant will die if the growing point is destroyed. There are no effective rescue treatments once damage is found in the field. Preplant incorporated applications of liquid formulations of Diazinon, ***Dyfonate***, Lorsban or ***Mocap*** are registered for wireworm control in corn. This is economically impractical in most cases. Use of a soil insecticide at planting when destructive wireworm populations exist or are anticipated provides the best means of reducing stand loss.

Wireworm Insecticides

Insecticide	Application	Ounces/1,000' row
Aztec 2.1% G	Band, T-Band, or furrow	6.7 oz
Counter 15% G	Band or furrow	8 oz
Counter 20% CR	Band or furrow	6 oz
Dyfonate II 20% G	Band	8 oz
Force 1.5% G	Furrow	8-10 oz
Force 3% G	Furrow	4-5 oz
Fortress 2.5%G	T-band or furrow	6 oz
Fortress 5%G	T-band or furrow	3 oz
Lorsban 15% G	Band, T-Band, or furrow	8 oz
Lorsban 4 E	Broadcast PPI	2 qts/acre
Mocap 10% G	Band	12 oz
Regent 80 WG	Microtube injection or infurrow band	0.149 oz/1000' row
Thimet 20% G	Band	6 oz

White Grubs

These may be abundant in fields following sod or severe grassy weeds in row crops, or where manure has been spread extensively. Several species of white grubs occur in Kentucky and occasionally may damage corn roots. A banded application of either ***Counter 15%*** *G* at 8 oz per 1,000 ft of row or ***Counter 20 CR*** is registered for control of white grubs. Lorsban 15G can be used at 8 to 16 oz per 1,000 ft in furrow. Aztec 2.1 G and ***Mocap 15% G*** are labeled for suppression of white grubs. ***Force 3% G*** is labeled at 5 oz per 1,000 ft and *Force 1.5% G* at 10 oz per 1,000 ft for white grubs. ***Fortress 2.5% G*** is labeled at 6 oz per 1000 ft and ***Fortress 5%*** *G* at 3 oz per 1,000 ft for white grubs. ***Regent 80 WG*** is labeled at 0.149 oz per 1,000 ft for white grub control (Microtube injection or infurrow band). There are no rescue treatments.

Soil insect pressure can be high in **no-till** corn planted directly into ESTABLISHED SOD. Wireworms, white grubs and corn root aphids may be encountered. Use of a soil insecticide is recommended when planting corn directly into sod because of the high probability of damaging populations of soil insects. Best results can be expected when the insecticide is placed directly in the seed furrow. Both the seed and granular insecticide should be covered with soil

immediately after application.

Foliar Insect Pests

Populations of aboveground corn insect pests vary from year to year. Weekly field inspections, at least during critical periods of corn development, will allow detection of damage and timely application of an insecticide treatment. In general, infestations of these pests can be detected and evaluated by weekly examinations of groups of 20 consecutive plants at random locations within the field. One site for each 10 acres of field size should be adequate. Recording the number of infested plants per location and numbers and size of pests provides invaluable information on which to base control decisions.

Cutworms

Late planting, moderate to heavy infestations of broadleaf weeds prior to planting, poor field drainage, or an abundance of crop residue, especially soybean straw, are factors that contribute to cutworm problems. Fields with one or more of the risk factors listed above and a history of cutworm problems need to be monitored closely and rescue treatments applied according to economic thresholds or receive a preventive cutworm treatment. Cutworm monitoring and the use of rescue treatments is recommended as the primary cutworm management strategy, but in the absence of monitoring in fields that are at risk, producers should not leave cutworm management to chance. Rescue treatments can be applied when field inspection indicates that an economic infestation is present. This is the most cost efficient strategy to follow. Frequent field scouting and early detection of the problem is essential. Treat when 3% of the stand is cut and 2 or more larvae (1" or smaller) are found per 100 plants. In fields with a history of serious cutworm problems or in years when cutworm activity is high, fields that have received preventive treatments may need to be scouted and rescue treatments applied. Control may be unsatisfactory if the soil is dry and crusted and the cutworms are feeding well below the soil surface. Under hot, dry conditions control with some products may be enhanced by cultivation or use of rotary hoe after application. See **ENT-59**, Cutworm Management in Corn, for more information.

Cutworm Preventive Treatments

Insecticide	Rate	Notes
Ambush 2 E	6.4 to 12.8 fl.oz. per acre	Apply no more than 5 days prior to emergence.
Asana XL	5.8 to 9.6 fl. oz. per acre	
Aztec 2.1% G	6.7 oz. per 1000' of row	Apply as a T-band
Force 1.5 % G	8 to 10 oz per 1000' of row	May use 6 oz with T-band or banded applications in 1st year corn only
Force 3 % G	4 to 5 oz per 1000' of row	May use 3 to 4 oz with T-band or banded applications in 1st year corn only
Lorsban 15 % G	8 oz per 1000' or row	Apply as T-band or band
Lorsban 4 E	2 to 4 pints per acre	Preplant incorporation
Lorsban 4 E	2.4 fl. oz. per 1000' of row	Apply as T-band in front of press wheel
Pounce 1.5 % G	8 ounces per 1000' of row	Apply as T-band or band
Pounce 3.2 EC	4 to 8 fl. oz. per acre	Broadcast or banded sprays
Warrior 1 E	1.92 to 3.20 fl. oz. per acre	

Cutworm Rescue Treatments

Insecticide	Rate per Acre	Notes
Ambush 2 E	6.4 to 12.8 fl oz	
Asana XL	5.8 to 9.6 fl oz	
Lorsban 4 E	1 to 2 pts	35 day fodder interval

Penncap-M 2FM	4 pts	Ground equipment only
Pounce 3.2 EC	4 to 8 fl oz	30 days
Sevin 80 S	2-1/2 lbs	12" band
Warrior 1 EC	1.92 to 3.20 fl oz	21 day harvest

Armyworm

Armyworm damage may occur in corn shortly after planting into killed sod or small grains. Usually, these insects are present at planting and move to small corn as the cover crop dies. Infestations may be spotty and intense. Control is justified if an average of 2 or more larvae are found on 25-30% of the plants or 1 larva is found per plant on 75% of the stand. See **ENTFACT-109**, Armyworms in Corn, for more information.

Fall Armyworm

Fall armyworm can appear in early July and are most likely to attack late-planted corn. Late corn should be watched closely for signs of infestation. Insecticide application by ground rig using at least 30 gallons of water per acre and high pressure will give the best results. Treat whorl stage corn if egg masses are present on 5% or more of the plants or if live larvae are found on 25% or more of the plants. See **ENTFACT-110**, Fall Armyworm in Corn, for more information.

Foliar Sprays for Armyworm and Fall Armyworm

Ambush 2 E	6.4 to 12.8 fl oz	Apply prior to brown silk
Asana XL	5.8 to 9.6 fl oz	True armyworm
Lannate 90 WSP	1/4 to ½ lb	
Lorsban 4 E	1 to 2 pts	See cutworm notes
Malathion 57% EC	1-1/2 to 2 pts	
Penncap-M 2 FM	4 pts	Ground equipment only
Pounce 3.2 EC	4 to 8 fl oz	30 days
Sevin 80 S	1-1/4 to 2-1/2 lbs	12" band
Warrior 1 EC	2.56 to 3.84 fl oz	

European Corn Borer and Southwestern Corn Borer

Treatment for FIRST GENERATION European corn borers may be recommended if 50% of the plants show fresh "window pane" feeding damage and live larvae are present. Infestations are generally higher in early planted corn. A computer model accurately predicts when to look for damage. Contact your county extension agent for this information and a copy of **ENT-49**, European Corn Borers in Corn. This publication will allow a more accurate estimate of potential yield loss and will aid in making control decisions.

Regent 80 WG when applied for rootworm control at planting will also control first generation European corn borer.

The SECOND GENERATION of European corn borers is usually only a problem for late-planted corn. Control with insecticides is difficult and rarely justified. Early harvest is a way to reduce losses due to stalk breakage in fields that are heavily infested.

Controls should be considered for first generation southwestern corn borer if 35% of the plants show damage and Southwestern corn borer larvae are still present in the whorls. Corn planted after May 1 has a greater potential for Southwestern corn borer infestation.

European corn borer resistant corn hybrids genetically engineered to produce the *Bacillus thuringiensis* (Bt) delta endotoxin are now available. In effect, these hybrids produce their own insecticide. Some of these also provide effective control of southwestern corn borer. In effect, these hybrids produce their own insecticide.

Types of Bt-corn Technology Available for Commercial Use

Event	***Company***	***Bt gene***	***Trade name***	***ECB control 1st/2nd Generation***
176	Ciba (Novarits), Mycogen	CryIA(b)	Knockout, NautreGard	Excellent/fair
Bt 11	Northrup King (Novartis)	CryIA(b)	YieldGard	Excellent/excellent
MON 810	Monsanto[1]	CryIA(b)	YieldGard	Excellent/excellent
DBT 418	DeKalb[2]	CryIA(c)	Bt-Xtra	Excellent/good
CBH 351	AgrEvo[3]	Cry9C	StarLink	Excellent/excellent

[1] Monsanto has licensed the use of their YieldGard technology to several seed corn companies including, but not limited to Cargill, Pioneer, Golden Harvest, ICI-Garst, and DeKalb.

[2] DeKalb's Bt hybrids either use the YieldGard (BtY) or Bt-Xtra (BtX).

[3] Agrevo has licensed the use of their StarLink technology to ICI Garst.

Growers using these hybrids still need to monitor their fields regularly for non-lepidopteran pests (such as corn leaf aphids, and western and northern corn rootworms) and some lepidopteran pests including armyworm, cutworms, and fall armyworm that are not controlled by these new hybrids. One concern with the use of these new hybrids is the development of Bt-resistance. The potential for European corn borer populations developing tolerance or becoming resistant to Bt increases as Bt-corn acreage increases. Growers need to prevent resistance rather than try and fight it once it becomes a problem. The primary method to prevent or delay insect resistant is to always plant a portion (at least 25%) of your corn acreage to non-Bt hybrids. This will provide a place for the Bt-susceptible corn borers to develop. Preventing resistance will be the responsibility of the corn producer.

Foliar Treatments for European Corn Borer

Insecticide	Rate/acre	Notes
Ambush 2 E	6.4 to 12.8 fl oz	Apply prior to brown silk
Asana XL	7.8 to 9.6 fl oz	21 day harvest
Bt products	See Biobit, Condor, Dipel, Javelin, M-Peril, and MVP labels for specific use rates	
Dyfonate 20% G	5 lbs	30 day forage
Furadan 4 F	1-1/2 to 2 pts	30 days
Lorsban 15% G	5 to 6.5 lbs	35 day grain; 14 day fodder
Lorsban 4 E	1.5 to 2 pts	35 day grain; 14 day fodder
Penncap-M 2 FM	2 to 4 pts	Ground only
Pounce 3.2 EC	4 to 8 fl oz	30 days

Pounce 1.5% G	6.7 to 13.3 lbs	
Sevin 80 S	1-7/8 to 2-1/2 lbs	
Thimet 20% G	5 lbs	
Warrior 1 EC	2.56 to 3.84 fl oz	

Foliar Treatments For Southwestern Corn Borer

Insecticide	Rate/acre	Notes
Ambush 2 E	6.4 to 12.8 fl oz	Apply prior to brown silk
Asana XL	5.8 to 9.6 fl oz	21 day harvest
Bt products	See Biobit, Dipel, Javelin, and Javelin labels for specific use rates	
Furadan 4 F	1 to 2 pts	30 days
Lorsban 15% G	5 to 6.5 lbs	35 day grain; 14 day fodder
Lorsban 4 E	1.5 to 2 pts	35 day grain; 14 day fodder
Penncap-M 2 FM	2 to 4 pts	Ground only
Pounce 3.2 EC	4 to 8 fl oz	30 days
Pounce 1.5% G	6.7 to 13.3 lbs	
Sevin 80 S	1-1/2 to 2-1/2 lbs	
Warrior 1 EC	2.56 to 3.84 fl oz	21 day harvest

Occasional pests

Chinch bugs are small insects with sucking mouthparts that can move from small grain fields or grassy areas into corn fields. The small red and white or black and white bugs congregate under the lower leaf sheaths near the base of the stalk. ***Asana XL***, Lorsban, or Sevin may be used for control. Application of a high gallonage (30 gpa) spray directed at the base of the plants is needed for control. See the product label for rates. From seedling through the 4-leaf stage, an average of 10 bugs per plant can cause wilting or stunting; an average of 20 or more can kill plants.

Common stalk borers can be damaging in notill or reduced tillage corn. Control is difficult once the larvae have become established in corn plants. Treatment is most successful when applied just prior to the borers entering the plants. Most insecticides labeled for cutworm control are labeled for stalk borer. See **ENTFACT-100**, The Common Stalk Borer in Corn.

Corn earworms may be found feeding on ear tips of field corn. Repeated insecticide applications are needed to significantly reduce infestations because moths lay eggs over an extended period of time. Control attempts cannot be economically justified. Corn earworms can be found feeding in the whorl but will not cause significant injury.

Corn flea beetles overwinter as adults and populations are generally highest following mild winters. Early feeding often occurs during cool weather when corn growth is retarded. ***Counter* or *Furadan*** at planting will reduce flea beetle injury. ***Ambush, Asana XL, Lannate***, Lorsban, ***Penncap-M, Pounce***, Sevin or ***Warrior*** can be used as foliar sprays if feeding damage becomes severe. Corn flea beetles can carry the pathogen that causes bacterial leaf blight. Selection of corn varieties resistant to this disease should be considered.

Corn root aphids are small (1/16" long) bluegreen to graygreen sucking insects that feed on corn roots. Leaves of infested plants will wilt and may turn brown and die. These aphids are tended by ants and ant mounds and activity may be visible on the soil surface. Plants are rarely killed but may be stunted for a time. Damage is most severe under dry soil conditions. There are no rescue treatments. Soil insecticides will provide some control.

Grasshoppers may become a problem in field corn late in the growing season. Damage is often confined to border rows. No suitable economic thresholds are available. ***Asana XL***, Lorsban, malathion, ***Penncap M,*** or Sevin may be used as foliar sprays if treatment is needed. See product label for rate. ***Furadan 4F*** may be used at 1/4 to ½ pt/acre. Do not harvest within 30 days. Do not enter field without protective clothing within 14 days.

Silk clipping insects may present a problem if damage occurs prior to pollination. Consider treatment if less than 75% of the plants in the field have silked, there are 5 or more rootworm beetles or 2 or more Japanese beetles per ear and silk clipping is occurring. See **ID-48**, Silk Clipping Insects on Corn. ***Ambush, Asana XL***, Imidan, ***Lannate***, Lorsban, Malathion, ***Penncap-M***, ***Pounce***, Sevin or ***Warrior*** can be used to control silk clipping insects.

Stink bugs may be a problem in corn planted under reduced tillage practices following soybeans or small grains. These brown, shield-shaped insects with piercing-sucking mouthparts, feed at the base of corn plants and may cause stunting, tillering or death. Corn is most susceptible to damage from seedling through the 4-leaf stage. Stunted plants usually recover, but yields from stunted plants are reduced by about 60%. Lorsban or ***Penncap-M*** applied at cutworm rates, or ***Warrior*** at 3.2 to 3.84 fl oz per acre should provide adequate control. See **ENTFACT-305**.

Webworms can attack corn following sod. These light-gray, spotted caterpillars insects feed in the same manner as cutworms. They may be found surrounded by a loose silken sack covered with soil particles. The added protection of the sack makes control by contact insecticides more difficult. Lorsban and ***Warrior*** are specifically labeled for this pest, however, products registered for cutworm control on corn should be effective, also. A basal spray should enhance control.

Summary of Insecticide Performance Against Corn Rootworm Larvae, 1988-1996

Treatment	Rate per 1000' row	Application Method	Average Root Rating*	Consistency**
Aztec 2.1 G	6.7 oz	T-Band	2.1	5/6
Counter 15G	8 oz.	Furrow	1.7	7/8
Counter 15G	8 oz.	Band	1.9	6/6
Counter 20CR	6 oz.	Band	1.8	6/6
Dyfonate 20G	6 oz.	Band	2.3	7/8
Force 1.5G	8 oz.	Furrow	2.0	4/4
Force 1.5G	8 oz.	Band	2.5	6/7
Fortress 2.5G	6 oz	T-band	2.5	3/3
Furadan 4F	1 qt./acre	Broadcast	2.8	5/7
Holdem 20G	6 oz.	Band	2.5	2/3
Lorsban 15G	8 oz.	Band	2.5	5/8
Thimet 20G	6 oz	Band	2.3	3/4
Untreated	-	-	4.2	0/9

***** Rated on a scale of 1 to 6, with 1 being the least damaged, and 6 being most heavily damaged. Ratings of 3.0 or less provide adequate root protection. ****** Consistency indicates the number of years in our field trials that the respective treatments provided satisfactory root protection.

Products for Control of Insect Pests in Stored Corn

Information in these tables is subject to change at any time. Always check the label of the product to insure that you use it correctly. There are other brand names and formulations of the products listed below. These are only the most common forms. If you wish to use a similar product check the label to insure it is registered for the intended use.

NOTE: The "stored grain" label for Liquid formulations of malathion is being withdrawn. Current stocks, with the correct label may be used until the stock is exhausted. Unlabeled product may not be used on stored grain.

Bin Surface Applications -- dilute with water to make enough spray to treat 1,000 sq ft of bin surface. Use only in empty bins.

Malathion 57EC	½ pt
Methoxychlor 2EC	1 gal
Tempo 2	0.27 fl oz (8 milliliters)

Grain Protectants -- applied to stored corn.

	Amount per 1,000 bushels
Actellic 5E	9.2 - 12.3 fl oz
Malathion 57E	1 pt

Grain Surface Treatments -- for Indian Meal Moth in stored corn.

Actellic 5E	3 fl. oz. in 2 gal water / 1,000 ft sq
Dipel 2X	1 lb / 1,000 ft sq (mixed to 4 inch deep)
Malathion 57E	½ pt / 1,000 ft sq (mixed to 4 inch deep)
Javelin WG	14 oz / 1,000 ft sq (mixed to 4 inch deep)

Amount of Fumigant -- to be applied/1,000 bu stored corn.

Aluminum phosphide	tablets	25 - 180 / 1,000 bu
	pellets	120 - 900 / 1,000 bu