

INSECTICIDE RECOMMENDATIONS FOR FIELD CORN – 2019

ENT-16

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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 in Kentucky; however, only Sevin XLR PLUS or Sevin 4F are registered to be used for field corn following the manufacturer's label.

Seed treatments are recommended for fields that do not receive a soil insecticide at planting time. Several commercially applied seed treatments may be ordered on the seed to protect against wireworms, seed corn maggot, and other pests. These include Poncho (clothianidin), and Cruiser (thiamethoxam). Seedcorn maggots can be damaging to fields planted early, especially under reduced tillage practices.

Selecting Which Insecticide to Use

Using the same insecticide over and over is never a good idea. This may lead to resistance within the targeted pest population. The tables below are set up to allow you to select among products. While products may have different trade names they may have the same active ingredient or a different active ingredient but the same mode of action. Note that the Trade name (above) and active ingredient name (below) are listed in the left most column. In addition the second column will list the active ingredient's **Mode of Action (MOA)**. The mode of action is an indication of how the insecticide kills the pest. Choosing products with different modes of action will aid in avoiding resistance.

Treatments for Seed Corn Maggots

Product	MOA	Contents	Use Rate
Dyna-shield	4A	imidacloprid	13.5 oz. / 100 lbs
Kernel Guard Supreme	3A	vitavax, permethrin	1.5 oz./42 lbs
Latitude	4A	imidacloprid, carboxin, metalaxyl	1.5 oz. / 42 lbs

Pretreatments for Corn Seed (Ordered on the seed)

Commercially Applied Pretreatment	MOA	Contents	Target Pests*
Cruiser 5FS (Thiamethoxam)	4A	0.165 lb/A (74.8 grams ai/A)/season	CLA, WW, SCM, FB, WG, CRW
Poncho 600 (clothianidin)	4A	1.13 to 2.26 fl oz/ 80,000 seeds	CLA, CW, WW, SCM, WG, FB, CRW
Poncho Votivo (clothianidin)	4A	1.35 to 2.7 fl oz/ 80,000 seeds	All the above plus nematodes

*CLA= corn leaf aphid, CRW= corn rootworm, CW= cutworm, FB= flea beetle, GC= grape colaspis, SCM= seedcorn maggot, WG= white grub, WW = wireworm.

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	80.7	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 Applications

Insecticide	MOA	Application	Ounces/1,000' row
Aztec 4.67% G (tebupirimphos + cyfluthrin)	1B + 3A	Band, T-Band, or furrow	3
Counter 15% G (terbufos)	1B	Band or furrow	8
Force 3% G (tefluthrin)	3A	Band, T Band or furrow	4-5
Lorsban 15% G (chlorpyrifos)	1B	Band or T band	8
Mocap 15% G (ethoprophos)	1B	Band	8
Thimet 20% G (phorate)	1B	Band	6

NOTE: If you plan to use sulfonylurea herbicides, such as ACCENT or BEACON, 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 Applications

Insecticide	MOA	Application	Rate
Brigade 2 EC (bifenthrin)	3A	5 to 7" T-band over open furrow	0.3 fl. oz./1000' of row
Capture LFR (bifenthrin)	3A	5 to 7" T-band over open furrow	0.39 to 0.49 fl. oz./1000' of row
Force CS (tefluthrin)	3A	T-banded or in furrow	0.46 to 0.57 fl. oz./1,000' of row
Lorsban75 WG (chlorpyrifos)	1A	Broadcast	0.67 to 1.33 lb/ac

Liquid insecticides must be compatible with liquid fertilizer if 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 similar granular formulations. **Note: 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. *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. This is economically impractical in most cases. Use of a soil insecticide at planting when high wireworm populations exist or are anticipated or seed treatments with moderate populations provide the best means of reducing stand loss.

Wireworm Insecticides

Insecticides	MOA	Application	Ounces/1,000' row
<i>Aztec 4.67% G</i> (tebupirimphos + cyfluthrin)	1B +3A	Band, T-Band, or furrow	3 oz.
<i>Brigade 2 EC</i> (bifenthrin)	3A	5 to 7" T-Band over open furrow	0.3 fl. oz.
<i>Capture LFR</i> (bifenthrin)	3A	5 to 7" T-Band over open furrow	0.20 to 0.39 fl. oz.
<i>Counter 15%G</i> (terbufos)	1B	Band or furrow	8 oz.
<i>Force CS</i> (tefluthrin)	3A	T-banded or in furrow	0.46 to 0.57 fl. oz./1,000' of row
<i>Force 3G</i> (tefluthrin)	3A	Furrow	4-5 oz.
<i>Fortress 5%G</i> (chlorothoxyfos)	1B	T-band or furrow	3 oz.
<i>Lorsban 15G</i> (chlorpyrifos)	1B	Band, T-Band, or furrow	8 oz.
<i>Mocap 15% G</i> (ethoprophos)	1B	Band	8 oz.
<i>Thimet 20% G</i> (phorate)	1B	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 **Counter 15 G** 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, **Force CS** at 0.46 to 0.59 fl. oz./1,000 ft, and Force 1.5% G at 10 oz. per 1,000 ft for white grubs. **Fortress 5% G** at 3 oz. per 1,000 ft for white grubs. **Brigade 2EC** is labeled for white grub control at 0.3 fl. oz. per 1000 row feet. **Capture 1.15G** is labeled for white grub control at 3.2 to 8 oz. per 1000 ft as a T-band or 3.2 to 8 oz. as an in-furrow application. 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	MOA	Rate	Notes
Asana XL (esfenvalerate)	3A	5.8 to 9.6 fl. oz. per acre	21 day PHI
Aztec 4.67% G (tebupirimphos + cyfluthrin)	1B +3A	3 oz. per 1000' of row	Apply as a T-band
Baythroid XL (beta cyfluthrin)	3A	0.8 to 1.6 fl. oz.	grain/fodder 21 days, green 0 day
Brigade 2 EC (bifenthrin)	3A	0.3 fl. oz. per 1000' of row	Apply as a T-band
Capture LFR (bifenthrin)	3A	0.20 to 0.78 fl. oz. per 1000' of row	Apply as a T-band
Force 3 % G (tefluthrin)	3A	4 to 5 oz. per 1000' of row	May use 3 to 4 oz. with T-band or banded applications in 1st y. corn only
Fortress 5G (chlorothoxyfos)	1B	3.0 to 3.75	Apply as a T-band
Lorsban 15 % G (chlorpyrifos)	1B	8 oz. per 1000' or row	Apply as T-band or band
Lorsban 4 E (chlorpyrifos)	1B	1 to 2 pints per acre	
Lorsban 75 WG (chlorpyrifos)	1B	0.67 to 1.33 lb. per acre	Broadcast
Mustang Maxx (zeta cypermethrin)	3A	1.6 oz. per 1000' of row	Apply as T-band
Permethrin 3.2 (permethrin)	3A	4 to 6 fl. oz. per acre	Broadcast or banded
Pounce 1.5 % (permethrin)	3A	8 ounces per 1000' of row	Apply as T-band or band
Proaxis 0.5 EC (gamma cyhalothrin)	3A	0.66 fl. oz. per 1,000' of row	
Warrior II (lambda cyhalothrin)	3A	0.33 fl. oz. per 1,000' of row	

Cutworm Rescue Treatments

Insecticide	MOA	Rate per Acre	Notes
Asana XL (esfenvalerate)	3A	5.8 to 9.6 fl. oz.	21 day PHI
Baythroid XL (beta cyfluthrin)	3A	0.8 to 1.6 fl. oz.	Grain/fodder 21 days, green 0 days
Belt (♦ read below) (flubendiamide)	28	2 to 3 fl. oz. per acre	28 day PHI
Brigade 2 EC (bifenthrin)	3A	2.1 to 6.4 fl. oz.	30 day PHI
Lorsban 4 E (chlorpyrifos)	1B	1 to 2 pts.	35 day fodder interval
Lorsban 75 WG (chlorpyrifos)	1B	0.67 to 1.33 lb.	21 day PHI
Mustang Maxx (zeta cypermethrin)	3A	1.28 to 2.8 fl. oz.	30 day grain, 60 day silage PHI
Permethrin 3.2 EC (permethrin)	3A	4 to 6 fl. oz.	30 day PHI
Proaxis 0.5 EC (gamma cyhalothrin)	3A	1.92 to 3.2 fl. oz.	21 day PHI
Sevin XLR PLUS (carbaryl)	1A	2 qrts.	12" band
Warrior II (lambda cyhalothrin)	3A	0.96 to 1.60 fl. oz.	21 day PHI

♦ As EPA has issued a notice to cancel all flubendiamide registrations in 2016, growers can still use existing flubendiamide stocks following directions specified on its label

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 **ENFACT-109**, Armyworms in Corn, for more information.

Fall Armyworm

Fall armyworm can appear in early July and are more 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 Applications for Armyworm and Fall Armyworm

Insecticide	MOA	Rate per Acre	Notes
Asana XL (esfenvalerate)	3A	5.8 to 9.6 fl. oz.	True armyworm, 21 day PHI
Baythroid XL (beta cyfluthrin)	3A	1.6 to 2.8 fl. oz.	grain/fodder 21 days PHI
Belt (♦ read note below) (flubendiamide)	28	2 to 3 fl. oz. per acre	28 day PHI
Brigade 2 EC (bifenthrin)	3A	2.1 to 6.4 fl. oz.	30 day PHI
Coragen 1.67 SC	28	3.5 to 5 fl. oz.	Fall armyworm, 14 day PHI

(chlorantraniliprole)			
Intrepid 2F (methoxyfenozide)	18	4 to 8 fl. oz.	True armyworm, 21 day PHI
Lannate SP (methomyl)	1A	1/4 to 1/2 lb.	21 day PHI
Lorsban 4 E (chlorpyrifos)	1B	1 to 2 pts.	21 day PHI
Lorsban 75 WG (chlorpyrifos)	1B	0.67 to 1.33 lb.	21 day PHI
Mustang Maxx (zeta cypermethrin)	3A	3.2 to 4 fl. oz.	30 day grain, 60 day silage PHI
Permethrin 3.2 EC (permethrin)	3A	4 to 68 fl. oz.	30 day PHI
Proaxis 0.5 EC (gamma cyhalothrin)	3A	2.56 to 3.84 fl. oz.	21 day PHI
Radiant SC (spinetoram)	5	3 to 6 fl. oz.	28 day PHI
Sevin XLR PLUS (carbaryl)	1A	1 to 2 qrts.	12" band, 14 day PHI
Tracer 4 SC (spinosad)	5	2 to 3 fl. oz.	28 day PHI
Warrior II (lambda cyhalothrin)	3A	0.96 to 1.6 fl. oz.	21 day PHI

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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.

The SECOND GENERATION of European corn borer is usually only a problem for late-planted corn. Control with insecticides can be difficult because the second generation is poorly synchronized. 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.

Resistance Management and Bt Corn

A major concern with the use of these new hybrids is the development of Bt-resistance. The potential for corn borer and rootworm populations developing tolerance or becoming resistant is real and can be managed with the use of refuges. Growers need to prevent resistance rather than try to fight it once it becomes a problem. The EPA, Land Grant Universities, and industry have developed an effective resistance management plan that must be followed by all growers using Bt corn. The primary method to prevent or delay insect resistant is to always plant a corn borer/rootworm refuge depending on the type of Bt corn used. Each farm using Bt corn must have a form of refuge on that farm.

Foliar Treatments for European Corn Borer

Insecticide	MOA	Rate/acre	Notes
Asana XL (esfenvalerate)	3A	7.8 to 9.6 fl. oz.	21 day PHI

Baythroid XL (beta cyfluthrin)	3A	1.6 to 2.8 fl. oz.	grain/fodder 21 days, green 0 day
Bt products	11A	See labels for specific use rates	
Belt SC (♦ read note below) (flubendiamide)	28	2 to 3 fl. oz. per acre	28 day PHI
Brigade 2 EC (bifenthrin)	3A	2.1 to 6.4 fl. oz.	30 day PHI
Coragen 1.67 SC (chlorantraniliprole)	28	3.5 to 5 fl. oz.	14 day PHI
Intrepid 2 F (methoxyfenozide)	18	4 to 8 fl. oz.	21 day PHI
Lorsban 15% G (chlorpyrifos)	1B	5 to 6.5 lbs.	35 day PHI; 14 day fodder
Lorsban 4 E (chlorpyrifos)	1B	1 to 2 pts	21 day PHI
Lorsban 75 WG (chlorpyrifos)	1B	0.67 to 1.33 lb.	21 day PHI
Mustang Maxx (zeta cypermethrin)	3A	2.72 to 4 fl. oz.	30 day grain, 60 day silage PHI
Permethrin 3.2 EC (permethrin)	3A	4 to 6 fl. oz.	30 day PHI
Pounce 1.5% G (permethrin)	3A	6.7 to 13.3 lbs.	30 day PHI
Proaxis 0.5 EC (gamma cyhalothrin)	3A	2.56 to 3.84 fl. oz.	21 day PHI
Radiant SC (spinetoram)	5	3 to 6 fl. oz.	28 day PHI
Sevin XLR PLUS (carbaryl)	1A	1 to 2 qrts.	14 day PHI
Tracer 4 SC Spinosad	5	1 to 3 fl. oz.	28 day PHI
Warrior II (lambda cyhalothrin)	3A	1.28 to 1.92 fl. oz.	21 day PHI

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Relative Efficacy of Single and Stacked Corn Traits for use Against Insect Pests in Kentucky (2016).

The table below is meant to provide you information on the B.t. trait containing corn products. This information is not meant as a recommendation but rather to help you make a decision on what product will work best in your situation. Some of these products have never been or may no longer be available in Kentucky. Additionally, this information is not meant to be used in cotton growing areas, as cotton growing areas have different refuge requirements. This table is **NOT** a substitute for the corn product label. Always read and follow the label instructions.

Corn rootworm Control: All three species of corn rootworm occur in Kentucky. Nevertheless, this pest is highly controlled by our common three crops in two years, corn-wheat-Soybean rotation. Consider the following recommendations for control of corn rootworm in Kentucky.

- Rotate corn with a non-corn crop annually.
- Do not use a corn product containing rootworm trait(s) if the field is in an annual rotation with a non-corn crop.
- If corn must be grown over multiple years in a given field, do not use a corn product containing a single rootworm trait. Use a multiple rootworm trait product.
- If corn must be grown over multiple years in a given field, do not use the same corn rootworm trait in succession; rotate to different traits each year.

Credit for some information and formatting used in these tables is gratefully given to: DiFonzo, Chris. 2018: Handy Bt Trait Table, Michigan State University.
(https://www.canr.msu.edu/news/handy_bt_trait_table)

Trade names and Event names for insect proteins expressed in <i>Bt</i> for Field corn				
Trade name	Event name	Proteins(s) expressed	Insect Target	Herbicide tolerance
Agrisure CB/LL	Bt11	Cry1Ab + <i>PAT</i>	corn borer	<i>glufosinate</i>
Agrisure Duracade	5307	eCry3.1Ab	rootworm	
Agrisure GT	GA211	EPSPS		<i>glyphosate</i>
Agrisure RW	MIR604	mCry3A	rootworm	
Agrisure Viptera	MIR162	Vip3Aa	broad lepidopteran control except corn borer	
Herculex I (HXI) or CB	TC1507	Cry1F	corn borer	<i>glufosinate</i>
Herculex Rootworm (RW)	DAS-59122-7	Cry34Ab1/Cry35Ab1	rootworm	<i>glufosinate</i>
Yieldgard Corn Borer (CB)	MON810	Cry1Ab	corn borer	
Yieldgard Rootworm	MON863	Cry3Bb	rootworm	
Yieldgard VT Pro	MON89034	Cry1A.105 + Cry2Ab2	broad lepidopteran control	
Yieldgard VT rootworm (RW)	MON88017	Cry3Bb1 + <i>EPSPS</i>	rootworm	<i>glyphosate</i>

INSECT TARGETS

ECB = European corn borer

BCW = black cutworm

FAW = fall armyworm

TAW true armyworm

WBC western bean cutworm

SWCB = southwestern corn borer

CEW = corn earworm

WCRW = Western corn rootworm

CRW = corn rootworm

SB = stalk borer

Table organized alphabetically

Trait packages (acronym)	Bt protein(s) in trait package	Marketed for control of											Insects resistant to the combination of Bt proteins in the trait package	Herbicide trait		Non-Bt Refuge % (cornbelt)
		CW	EW	CB	FAW	SB	SCB	SWCB	TAW	WBC	CRW	GT RR2		LL		
AcreMax (AM)	Cry1Ab Cry1F	x		x	x	x	x	x					FAW WBC	x	x	5% in bag
AcreMax CRW (AMRW)	Cry34/35Ab1											x	CRW	x	x	10% in bag
AcreMax1 (AM1)	Cry1F Cry34/35Ab1	x		x	x	x	x	x				x	FAW SWCB WBC CRW	x	x	10% in bag 20% ECB
AcreMax Leptra (AML)	Cry1Ab Cry1F Vip3A	x		x	x	x	x	x	x	x				x	x	5% in bag
AcreMax TRIsect (AMT)	Cry1Ab Cry1F mCry3A	x		x	x	x	x	x				x	FAW WBC CRW	x	x	10% in bag
AcreMax Xtra (AMX)	Cry1Ab Cry1F Cry34/35Ab1	x		x	x	x	x	x				x	FAW WBC CRW	x	x	10% in bag
AcreMax Xtreme (AMXT)	Cry1Ab Cry1F mCry3A Cry34/35Ab1	x		x	x	x	x	x				x	FAW WBC CRW	x	x	5% in bag
Agrisure 3010 and 3010A	Cry1Ab			x			x	x						x	x	20%
Agrisure 3000GT and 3011A	Cry1Ab mCry3A			x			x	x				x	CRW	x	x	20%
Agrisure Viptera 3110	Cry1Ab Vip3A	x	x	x	x	x	x	x	x	x				x	x	20%
Agrisure Viptera 3111	Cry1Ab Vip3A mCry3A	x	x	x	x	x	x	x	x	x	x		CRW	x	x	20%
Agrisure 3120 E-Z Refuge	Cry1Ab Cry1F	x		x	x	x	x	x					FAW WBC	x	See bag tag for code	5% in bag
Agrisure 3122 EZ Refuge	Cry1Ab Cry1F mCry3A Cry34/35Ab1	x	x	x	x	x	x	x	x	x	x		FAW WBC CRW	x		5% in bag
Agrisure Viptera 3220 EZ Refuge	Cry1Ab Cry1F Vip3A	x		x		x		x		x				x		5% in bag
Agrisure Viptera 3330 E-Z Refuge	Cry1Ab Vip3A Cry1A.105 + Cry2Ab2	x	x	x	x	x	x	x	x	x				x	EZO NO	5% in bag
Agrisure Duracade 5122 E-Z Refuge	Cry1Ab Cry1F mCry3A eCry3.1Ab	x		x	x	x	x	x				x	FAW WBC CRW	x	EZ1 YES	5% in bag
Agrisure Duracade 5222 E-Z Refuge	Cry1Ab Cry1F Vip3A mCry3A eCry3.1Ab	x	x	x	x	x	x	x	x	x	x		CRW	x		5% in bag

Herculex I (HXI)	Cry1F	x		x	x	x	x	x					FAW SWCB WBC	x	x	20%
Herculex RW (HXRW)	Cry34/35Ab1											x	CRW	x	x	20%
Herculex XTRA (HXX)	Cry1F Cry34/35Ab1	x		x	x	x	x	x				x	FAW SWCB WBC CRW	x	x	20%
Intrasect (YHR)	Cry1Ab Cry1F	x		x	x	x	x	x					FAW WBC	x	x	5%
Intrasect TRIsect (CYHR)	Cry1Ab Cry1F mCry3A	x		x	x	x	x	x				x	FAW WBC CRW	x	x	20%
Intrasect Xtra (YXR)	Cry1Ab Cry1F Cry34/35Ab1	x		x	x	x	x	x				x	FAW WBC CRW	x	x	20%
Intrasect Xtreme (CYXR)	Cry1Ab Cry1F mCry3A Cry34/35Ab1	x		x	x	x	x	x				x	FAW WBC CRW	x	x	5%
Leptra (VYHR)	Cry1Ab Cry1F Vip3A	x	x	x	x	x	x	x	x	x				x	x	5%
Powercore ^a Powercore Refuge Advanced ^b	Cry1A.105 Cry2Ab2 Cry1F	x	x	x	x	x	x	x					CEW WBC	x	x	^a 5% ^b 5% in bag
QROME (Q)	Cry1Ab Cry1F mCry3A Cry34/35Ab1	x		x	x	x	x	x				x	FAW WBC CRW	x	x	5% in bag
SmartStax ^a Smartstax Refuge Advanced ^b SmartStax RIB Complete ^b	Cry1A.105 Cry2Ab2 Cry1F Cry3Bb1 Cry34/35Ab1	x	x	x	x	x	x	x				x	CEW WBC CRW	x	x	^a 5% ^b 5% in bag
Trecepta ^a Trecepta RIB Complete ^b	Cry1A.105 Cry2Ab2 Vip3A	x	x	x	x	x	x	x	x	x				x		^a 5% ^b 5% in bag
TRIsect (CHR)	Cry1F mCry3A	x		x	x	x	x	x				x	FAW SWCB WBC CRW	x	x	20%
VT Double PRO ^a VT Double PRO RIB Complete ^b	Cry1A.105 Cry2Ab2		x	x	x	x	x	x					CEW	x		^a 5% ^b 5% in bag
VT Triple PRO ^c VT Triple PRO RIB Complete ^d	Cry1A.105 Cry2Ab2 Cry3Bb1		x	x	x	x	x	x				x	CEW CRW	x		^c 20% ^d 10% in bag
Yieldgard Corn Borer (YGCB)	Cry1Ab			x				x	x					x		20%
Yieldgard Rootworm (YGRW)	Cry3Bb1											x	CRW	x		20%
Yieldgard VT Triple	Cry1Ab Cry3Bb1			x				x	x			x	CRW	x		20%

Table organized based on trait Family

Bt trade name	Insect toxins	Dual modes of Action	ECB	SWCB	BCW	CEW	FAW	WCRW	Min. Refuge Requirement
Agrisure Trait Family									
Agrisure CB	Cry1Ab		++++	++++		++	++		20% block
Agrisure 3000GT	Cry1Ab, mCry3A		C			S	S	C	20% block
Agrisure Artesian 4011	Cry 1Ab, mCry3A		C			S	S	C	20% block
Agrisure RW	mCry3A	Associated with rootworm resistance in north central states						C	20% block
Agrisure CB/RW	Cry1Ab, mCry3A		++++	++++		++	++	++	20% block
Agrisure Viptera 3110	Vip3Aa20, Cry1Ab		++++	++++	+++	++++	++++		20% block
Agrisure Viptera 3111	Vip3Aa20, Cry1Ab, mCry3A		++++	++++	+++	++++	++++	++	20% block
Agrisure Viptera 3122	Cry1Ab, Cry1F, mCry3A, Cry34Ab1/Cry35Ab1	✓	++++	++++	++	+++	++	+++	95/5% RIB
Agrisure Viptera 3220	Vip3Aa20, Cry1Ab, Cry1F	✓	++++	++++	+++	++++	++++		95/5% RIB
Agrisure Duracade 5122 E-Z Refuge	Cry1Ab, Cry1F, mCry3A, eCry3.1Ab	✓	C		C	C	C	C	95/5% RIB
Agrisure Duracade 5222 E-Z Refuge	Cry1Ab, Cry1F, Vip3a, mCry3A, eCry3.1Ab	✓	C		C	C	C	C	95/5% RIB expected
Herculex Trait Family									
Herculex 1	Cry1F		++++	++++	++	+	++		20% block
Herculex RW	Cry34Ab1/Cry35Ab1	Associated with rootworm resistance in north central states						C	20% block
Herculex Xtra	Cry1F, Cry34Ab1/Cry35Ab1		++++	++++	++	+	+++	++	20% block
Optimum Trait Family									
Optimum Intrasect	Cry1Ab, Cry1F	✓	++++	++++	++	+++	++		5% block
Optimum Intrasect Leptra	Cry1F, Cry2Ab, Vip3A	✓	C		C		C		5% block
Optimum AcreMax 1	90% Cry1F, Cry34Ab1/ Cry35Ab1 + 10% Cry1F		++++	++++	++	++	++	++	10% RIB + 20% Ext. block
Optimum AcreMax RW	Cry34Ab1/Cry35Ab1	Associated with rootworm resistance in north central states						++	10% RIB
Optimum AcreMax	Cry1F, Cry1Ab	✓	++++	++++	++	+++	++		5% RIB
Optimum AcreMax Xtra	Cry1Ab, Cry1F, Cry34Ab1/Cry35Ab1		++++	++++	++	++	++	++	10% RIB
Genuity SmartStax RIB Complete	Cry1A.105, Cry2Ab2, Cry3Bb1, Cry1F, Cry34Ab1/Cry35Ab1	✓	++++	++++	+++	+++	++++	+++	5% RIB

Optimum AcreMax Xstream	mCry3A, Cry1Ab, Cry1F, Cry34Ab1/Cry35Ab1	✓	++++	++++	++	+++	++	+++	5% RIB
Optimum Intrasect Xtra	Cry1Ab, Cry1F, Cry34Ab1/Cry35Ab1	✓	++++	++++	++	+++	++	++	20% block
Optimum Intrsect Xstream	mCry3A, Cry1Ab, Cry1F, Cry34Ab1/Cry35Ab1	✓	++++	++++	++	+++	++	+++	5% block
Optimum TRIssect	mCry3A, Cry1F	✓	++++	++++	++	+	+++	++	20% block
YieldGard / Genuity Trait Family									
YieldGard CB	Cry1Ab		++++	++++		++	++		20% block
YieldGard VT RW	Cry3Bb1	Associated with rootworm resistance in north central states						C	20% block
YieldGard VT Triple	Cry1Ab, Cry3Bb1		++++	++++		++	++	+++	20% block
Genuity VT Double Pro or as RIB complete	Cry1A.105, Cry2Ab2	✓	++++	++++	++	+++	++++		5% block(VT2) or 5% RIB(com)
Genuity VT Trirple Pro or as RIB complete	Cry1A.105, Cry2Ab2, Cry3Bb1		++++	++++	++	+++	++++	+++	20% block(VT3) or 10% RIB (com)
Genuity SmartSTax RIB Complete	Cry1A.105, Cry2Ab2, Cry1F, Cry3Bb1, Cry34/35Ab1	✓	C		C	C	C	C	5% RIB
Other									
Smartstax (Micogen) or as Refuge Advanced	Cry1A.105, Cry2Ab2, Cry1F, Cry3Bb1, Cry34/35Ab1	✓	C		C	C	C	C	5% block (SS) or 5% RIB (RA)
Powercore	CryiA.105, Cry2Ab2, Cry1F	✓	This product pending approvals.						

ECB = European corn borer; SWCB = Southwestern corn borer

BCW = Black cutworm; CEW = Corn earworm

FAW = Fall armyworm; WCRW = Western corn rootworm

‘ ‘ = Little or no activity; ‘ + ‘ = Poor to fair control;

‘++’ = Good control; ‘+++’ = Very good control; ‘++++’ = Excellent control

‘C’ = Labeled for Control of indicated insect but has not been evaluated in Kentucky.

‘S’ = Labeled for Suppression of indicated insect but has not been evaluated in Kentucky.

Foliar Treatments for Southwestern Corn Borer

Insecticide	MOA	Rate/acre	Notes
Asana XL (esfenvalerate)	3A	5.8 to 9.6 fl. oz.	21 day PHI
Baythroid XL (beta cyfluthrin)	3A	1.6 to 2.8 fl. oz.	grain/fodder 21 days, green 0 day
Bt products	11A	See labels for specific use rates	
Belt SC (♦ read note below) (flubendiamide)	28	2 to 3 fl. oz. per acre	28 day PHI
Brigade 2 EC (bifenthrin)	3A	2.1 to 6.4 fl. oz.	30 day PHI
Intrepid 2 F (methoxyfenozide)	18	4 to 8 fl. oz.	21 day PHI
Lorsban 15% G (chlorpyrifos)	1B	5 to 6.5 lbs	21 day PHI; 14 day fodder
Lorsban 4 E (chlorpyrifos)	1B	1.5 to 2 pts	21 day PHI; 14 day fodder
Lorsban 75 WG (chlorpyrifos)	1B	1 to 1.33 lb	35 day PHI
Mustang Maxx (zeta cypermethrin)	3A	2.72 to 4 fl. oz.	30 day grain, 60 day silage PHI
Permethrin 3.2 EC (permethrin)	3A	4 to 6 fl. oz.	30 day PHI
Pounce 1.5% G (permethrin)	3A	6.7 to 13.3 lbs	30 day PHI
Proaxis 0.5 EC (gamma cyhalothrin)	3A	2.56 to 3.84 fl. oz.	21 day PHI
Radiant SC (spinetoram)	5	3 to 6 fl. oz.	28 day PHI
Sevin 80 S (carbaryl)	1A	1-1/4 to 2-1/2 lbs	14 day PHI
Tracer 4SC (spinosad)	5	2 to 3 fl. oz.	28 day PHI
Warrior II (lambda cyhalothrin)	3A	1.28 to 1.92 fl. oz.	21day PHI

♦ As EPA has issued a notice to cancel all flubendiamide registrations in 2016, growers can still use existing flubendiamide stocks following directions specified on its label

Occasional pests

Brown marmorated stink bug has become a problem late in the season for corn grown in the Mid Atlantic states and has recently moved into Kentucky. It feeds through the husk to shrivel the developing kernels. Although only labeled for generic stink bug control, **Baythroid, Brigade, Capture, , Decis, Lorsban, Mustang, or PennCap-M, , or Warrior** should help to control this pest.

Corn leaf aphids should be monitored prior to tassel emergence and again one week later. Consider treating for corn leaf aphids if an average of 100 or more per plant on 50 percent or more of the plants. On tasseled corn, aphids usually have done their damage and killing them often provides little savings. If less than 50% of pollination has occurred, aphids and honeydew are covering tassels and plants are stressed, an insecticide may be necessary to ensure adequate pollination, but treatments need to be made within 48 hours of tassel emergence. **Asana XL, Brigade, Capture, Dimethoate, Lannate, Lorsban, or Malathion** may be used for control.

Common stalk borers can be damaging in no-till 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*** for more information.

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** at planting will reduce flea beetle injury. **Asana XL, Baythroid, Capture, Decis, Lorsban, Mustang, 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. Ant mounds and ant activity may be visible on the soil surface. Plants can be killed or stunted. Damage is most severe under dry soil conditions. There are no rescue treatments. Tillage or soil insecticides will provide some control, seed treatments do not appear to provide sufficient 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, Baythroid, Brigade, Capture, Decis, Lorsban, Mustang, Malathion, Penncap M, or Sevin** may be used as foliar sprays if treatment is needed. See product labels for rates.

Early-Season 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%. **Baythroid, Brigade, Capture, Decis, Lorsban, Mustang, 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 *Stink Bug Damage to Corn*, for more information.

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**. **Asana XL, Baythroid, Brigade, Capture, Lannate, Lorsban, Mustang, Malathion, Penncap-M, Pounce, Sevin, or Warrior** can be used to control silk clipping insects.

Southern corn leaf beetle can be a problem by cutting off newly emerging seedlings. Their color allows them to blend in with the soil and the damage is often attributed to cutworms. Use thresholds for cutworms to help decide if treatment is needed. **Baythroid XL, Brigade, Lorsban, Mustang Max, and Warrior** can be used to control southern corn leaf beetle.

Products for Control of Insect Pests in Stored Field 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.

Empty Bin "Clean Out"

This is an "empty" space fumigation targeted at the space beneath the perforated floor in a metal grain bin. See the **WARNING** below.

per 1000 cubic feet

Phostoxin, Fumitoxin, etc. (aluminum phosphide):..... tablets 30-140.
NOTE: applied to a volume not bushels. pellets 150-700

Aluminum phosphide is not significantly heavier than air. Because of its light and penetrating nature very close attention must be paid to sealing the area to be treated.

Interior Bin Surface Applications

Use only in empty bins.

per 1,000 sq. ft.

Centynal (deltamethrin).....	0.25 – 1.5 fl. oz. in 1 gal.
Diacon-D IGR (s-methoprene).....	1.5 oz.
Pyronyl (pyrethrin).....	1-1/3 pint in 9.6 gal. water
<u>Tempo SC Ultra</u> (cyfluthrin).....	0.27 fl. oz.
<u>Insecto, etc.</u>	1 lb.
(silicon dioxide, from diatomaceous earth)	

Grain Protectants

Applied to stored corn. Do not use the same compound to treat both the empty bin and the bulk grain.

per 1,000 bu

Actellic 5E (pirimiphos-methyl).....	9.2 - 12.3 fl. oz.
Centynal (deltamethrin).....	8.53 fl. oz. in 5.0 gal.
Diacon-D IGR (s-methoprene).....	8 – 10 lb
Sensat (spinosad).....	9.8 fl. oz. in 5.0 gal.
Insecto.....	1-2 lb per TON (Note: change in standard)
(silicon dioxide from diatomaceous earth)	
Pyronyl (pyrethrin)	1 pint in 3-5/8 gal water. Apply 4 to 5 gal. of
..... this mixture per 1,000 bu. of grain	

Grain Surface Treatments

For Indian Meal Moth in stored corn.

/ 1,000 sq. ft.

Actellic 5E (pirimiphos-methyl).....	3 fl. oz. in 2 gal. water
<u>Dipel DF</u> (Bacillus thuringiensis, kurstaki).....	1 lb (mixed to 4 inch deep)
<u>Biobit HP</u> (Bacillus thuringiensis, kurstaki).....	1 lb (mixed to 4 inch deep)
Diacon-D IGR (s-methoprene).....	8 lb (mixed to 12 inch deep)
Pyronyl (pyrethrin)	1 pint in 2-3/8 gal. water. Apply 1 to 2 gal.
.....of mixture and rake in to a depth of 4 in.	
Sensat (spinosad).....	2.6 fl. oz. in 2.0 gal.

Note: Indian meal moth adults (IMM) may be controlled by hanging DDVP Resin strips (Vapona) in the head space over the grain mass. Use 1 strip for each 1,000 cubic feet of air space over the grain. One treatment will last about 3 months. Many products with the active ingredient *Bacillus thuringiensis* (B.t.), may be used to control IMM. Dipel and Javelin are just two examples.

Bulk Grain Fumigation

Phostoxin, Fumtoxin etc. (aluminum phosphide) tablets 40 to 180 / 1,000 bu.
pellets 200 to 900 / 1,000 bu.

Economic thresholds are hard to determine for stored grain but these numbers should provide a guide to when fumigation will be profitable. Rice weevil or lesser grain borer 1 insect / qt of grain. Red flour beetle, rusty grain beetle and other bran bugs 5 insects / qt of grain. Successful fumigation includes consideration of many variables, use these fumigant amounts as a guide and consult the label of the product you choose.

WARNING: Fumigation is a complicated and dangerous technique. If at all possible hire a commercial fumigator. If a commercial fumigation is not possible consult the label of the product you have chosen to use and follow it to the letter.

Warning: Diacon-D IGR and Insecto are dust formulations. Wear dust mask and protective gloves when handling or applying.