INSECTICIDE RECOMMENDATIONS FOR POPCORN - 2018 ENT-62

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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 popcorn following the manufacturer's label.

Multiple Active Ingredient Insecticides

There are a number of products on the market which contain multiple insecticide active ingredients (AIs). Examples are: Cobalt (chlorpyrifos and gamma-cyhalothrin), Besiege (lambda-cyhalothrin and chlorantraniliprole), Brigadier (bifenthrin and imidacloprid), Hero (zeta-cypermethrin and bifenthrin), Endigo (lambda-cyhalothrin and thiamethoxam), Leverage (imidacloprid and cyfluthrin), Swagger (bifenthrin and imidacloprid), Voliam Xpress (lambda-cyhalothrin and chlorantraniliprole), and Voliam Flexi (thiamethoxam and chlorantraniliprole). These products are not recommended for use when products containing a single insecticide AI, provides comparable control unless there is a specific need to use multiple AIs for resistance management of specific, difficult to manage pests. The use of multiple insecticide AIs when a single AI will suffice may expose sub-economic pest populations to selection pressure and increases the likelihood of non-target effects on pollinators and natural enemies of arthropod pests.

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.

Seed Treatments

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

Treatments for Seed Corn Maggots

Product	MOA	Contents	Use Rate
Dyna-shield	4A	imidacloprid	6.4 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	Rate	Target Pests*
CruiserMaxx Corn 250 (thiamethoxam)	4A	0.25 to 1.25 mg/kernel	WW, SCM, FB, WG, CRW
Poncho 600 (clothianidin)	4A	1.3 to 2.26 FL. OZ. / 80,000 seeds	CW, WW, SCM, WG, FB, CRW
Poncho/Votivo (clothianidin/*Bacillus firmus*)	4A	1.35 to 2.7 FL. OZ. / 80,000 seeds	Nematodes, CW, WW, SCM, WG, FB, CRW

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

Soil Insecticides

Corn Rootworms

Corn rootworm larvae are potential pests in fields where field corn, sweet corn or popcorn 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 with any type of corn the following year, an "at-planting" oil insecticide is advisable. See **ENT-45**, Corn Rootworm Beetles for more information.

Rootworm Insecticides- Liquid Formulations

Insecticide	MOA	Application	Rate/1,000' row
Brigade 2 EC (bifenthrin)	3A	5 to 7" T-band over open furrow	0.3 fl. oz.
Capture LFR (bifenthrin)	3A	5 to 7" T-band over open furrow	0.39 to 0.98 fl. oz.
Force CS (tefluthrin)	3A	T-band or in furrow	0.46 to 0.57 fl. oz.

Liquid insecticides must be compatible with liquid fertilizer when used as tank mixes. Follow label all directions. Follow all precautions when using these products. Liquid formulations are more toxic than granular formulations.

Rootworm Insecticides- Granular Formulations

Insecticide	MOA	Applications	Ounces/1000' 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
Fortress 5% G (chlorethoxyfos)	1B	T-band or furrow	3

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.

White Grubs

White grubs 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 popcorn roots. A banded application of ***Counter 15 G*** at 8 oz per 1000 ft of row is registered for control of white grubs. ***Force 1.5% G, Force CS*** and ***Force 3% G*** are labeled for suppression of white grubs. ***Fortress 5% G*** at 3 oz per 1000 ft for white grubs. ***Capture 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 6.4 to 8 oz per 1000 ft as a T-Band or 3.2 to 8 oz per 1000 feet as a furrow treatment. There are no rescue treatments.

Soil insect pressure can be high in **no-till** popcorn planted directly into ESTABLISHED SOD. ***Aztec 2.1 G*** is labeled for control of white grubs. 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.

Wireworms

Wireworms are a potential problem where popcorn 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. Use of a soil insecticide

at planting when high wireworm populations exist or a seed treatment with moderate populations are anticipated provide the best means of reducing stand loss.

Wireworm Insecticides

Insecticide	MOA	Application	Ounces/1000' row
Aztec 4.67% G (tebupirimphos + cyfluthrin)	1B+3A	Band, T-Band, or furrow	3 oz.
Capture LFR (Bifenthrin)	3A	5 to 7" T-band over open furrow	0.20 to 0.78 fl. oz.
Capture 1.15% G (bifenthrin)	3A	T-band or furrow	3.2 to 8 oz.
Force CS (tefluthrin)	3A	T-band or in furrow	0.46 to 0.57 fl. oz.
Force 3% G (tefluthrin)	3A	Band	4 to 5 oz.
Fortress 5%G (chlorethoxyfos)	1B	T-band or furrow	3 to 3.75 oz.

Foliar Insect Pests

Populations of aboveground popcorn insect pests vary from year to year. Weekly field inspections, at least during critical periods of popcorn 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	Broadcast
Aztec 4.67% G tebupirimphos + cyfluthrin	1B+3A	3 oz. per 1000' of row	Apply as a T-band
Belt SC (♦read note below) (flubendiamide)	28	2 to 3 fl. oz.	
Capture LFR (bifenthrin)	3A	0.2 to 0.39 fl. oz./1000' of row	5 to 7" T-band over open furrow
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 year corn only
Fortress 5G (chlorethoxyfos)	1B	3.0 to 3.75 oz./1000’ of row	Apply as a T-band
Hero 1.24 EC (zeta-cypermethrin + bifenthrin)	3A	4.0 to 10.3 fl. oz.	

Mustang Max (zeta-cypermethrin)	3A	0.16 fl. oz./1000' row	Apply as band or T-Band
Pounce 1.5 % G (Permethrin)	3A	8 ounces per 1000' of row	Apply as T-band or band
Pounce 25WP (permethrin)	3A	0.5 oz. per 1000' of row	In furrow or T- banded sprays
Proaxis 0.5 EC (gamma cyhalothrin)	3A	0.66 fl. oz. per 1,000' of row	
Warrior II (lambda cyhalothrin)	3A	0.33 to 3.2 fl. oz. per acre	

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.	21 day PHI
Belt SC (♦read note below) (flubendiamide)	28	2 to 3 fl. oz.	28 day PHI
Decis 1.5 EC (deltamethrin)	3A	1 to 1.5 fl. oz.	21 day PHI
Hero 1.24 EC (zeta-cypermethrin + bifenthrin)	3A	2.6 to 6.1 fl. oz.	30 day PHI
Mustang Maxx (zeta-cypermethrin)	3A	1.28 to 2.8 fl. oz.	PHI 30 day grain & stover, 60 day forage
Pounce 25WP (Permethrin)	3A	6.4 t0 9.6 fl. oz.	30 day PHI
Proaxis 0.5 (gamma chyalothrin)	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 1.6 fl. oz.	21 day PHI

♦ As EPA has issued a notice to cancel all flubendiamide registrations in 2016, growers can still use existing stocks following directions specified on its label until December 31, 2019.

Armyworm / Fall Armyworm

Armyworm damage may occur in popcorn 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 in a field. Control is justified if an average of 2 or more larvae are found on 20% of the plants or 1 larva is found per plant on 50% of the stand. See **ENTFACT-109**, Armyworm in Corn, for more information.

Fall armyworm can appear in early July and are most likely to attack late-planted popcorn. 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.

Foliar Sprays for Armyworm and Fall Armyworm

Insecticide	MOA	Rate per Acre	Notes
Asana XL (esfenvalerate)	3A	5.8 to 9.6 fl. oz.	1 day PHI. "True" armyworm
Baythroid XL (beta cyfluthrin)	3A	1.6 to 2.8 fl. oz.	1st and 2nd instar only, 21 day PHI
Belt SC (♦read note below) (flubendiamide)	28	2 to 3 fl. oz.	28 day PHI
Hero 1.24 EC (zeta-cypermethrin + bifenthrin)	3A	4 to 10.3 fl. oz.	30 day PHI
Lannate 90 SP (methomyl)	1A	1/4 to ½ lb	21 day PHI

Mustang Maxx (zeta-cypermethrin)	3A	3.2 to 4 fl. oz.	PHI 30 day grain & stover, 60 day forage
Pounce 25WP (Permethrin)	3A	6.4 to 9,6 fl. oz.	30 day PHI
Proaxis 0.5 (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 "True" armyworm
Sevin XLR PLUS (carbaryl)	1A	1 to qrts	12" band, 14 day PHI
Tracer 4 SC (spinosad)	5	2 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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European Corn Borer

Treatment for FIRST GENERATION European corn bores may be recommended if 25% of the plants show fresh "window pane" feeding damage and live larvae are present. Infestations are generally higher in early-planted popcorn. A computer model accurately predicts when to look for damage. Contact your county extension agent for this information and a copy of **ENTFACT-106**, 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 more of a problem for late-planted popcorn. Control with insecticides is difficult because eggs are laid over an extended period. Early harvest is a way to reduce losses due to stalk breakage in fields that are heavily infested.

Foliar Treatments for European Corn Borer

Insecticide	MOA	Rate/acre	Notes
Asana XL (esfenvalerate)	3A	5.8 to 9.6 fl. oz.	1 day PHI
Baythroid XL Beta cyfluthrin	3A	1.6 to 2.8 fl. oz.	21 day PHI
Belt SC (♦read note below) (flubendiamide)	28	2 to 3 fl. oz.	28 day PHI
Bt products (Bacillus thuringiensis)	11A	See Biobit, Dipel, Javelin,or Lepinox labels for use rates	
Decis 1.5 EC (deltamethrin)	3A	1.5 to 1.9 fl. oz.	21 day PHI
Hero 1.24 EC (zeta-cypermethrin + bifenthrin)	3A	4 to 10.3 fl. oz.	30 day PHI
Mustang Maxx (zeta-cypermethrin)	3A	2.72 to 4 fl. oz.	PHI 30 day grain & stover, 60 day forage
Pounce 3.2 EC (Permethrin)	3A	4 to 8 fl. oz.	Apply prior to brown silk
Pounce 1.5% G (Permethrin)	3A	6.7 to 13.3 lbs	30 day PHI
Proaxis 0.5 CS (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	1.5 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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Foliar Treatments for Southwestern Corn Borer

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

Insecticide	MOA	Rate/acre	Notes
Asana XL esfenvalerate)	3A	5.8 to 9.6 fl. oz.	1 day PHI
Baythroid XL (beta cyfluthrin)	3A	1.6 to 2.8 fl. oz.	21 day PHI
Belt SC (♦read note below) (flubendiamide)	28	2 to 3 fl. oz.	28 day PHI
Bt products	11A	See Biobit, Dipel, Lepinox and Javelin labels for specific use rates	
Hero 1.24 EC (zeta-cypermethrin + bifenthrin)	3A	4 to 10.3 fl. oz.	30 day PHI
Mustang Maxx (zeta-cypermethrin)	3A	2.72 to 4 fl. oz.	PHI 30 day grain & stover, 60 day forage
Pounce 25WP (Permethrin)	3A	6.4 to 9.6 oz	30 days
Pounce 1.5% G (Permethrin)	3A	6.7 to 10 lbs	30 days
Proaxis 0.5 (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	2 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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Corn Earworm

Corn earworm can be a very serious popcorn pest by eating or damaging kernels at the ear tip. Corn earworm damage to kernels can bring a lower selling price. Earworms only lay eggs on fresh silks. If insecticides are used for earworm control, they should only be applied after tassel emergence and before the silks dry. Pheromone traps can be used to monitor earworm moth activity and predict severity of egg laying.

Corn Earworm Treatments

Insecticide	MOA	Rate per acre	Notes
Asana XL (esfenvalerate)	3A	5.8 to 9.6 fl. oz.	Rootworm adults, 1 day harvest
Baythroid XL (beta cyfluthrin)	3A	1.6 to 2.8 fl. oz.	21 day PHI
Belt SC (♦read note below) (flubendiamide)	28	2 to 3 fl. oz.	28 day PHI
Bt Products	11A	See labels for rates	
Hero 1.24 EC (zeta-cypermethrin + bifenthrin)	3A	4 to 10.3 fl. oz.	30 day PHI
Lannate 90 SP (methomyl)	1A	1/4 to ½ lbs	21 day harvest
Mustang Maxx (zeta-cypermethrin)	3A	1.76 to 4 fl. oz.	30 day grain, stover 60 day forage PHI
Pounce 25WP (permethrin)	3A	6.4 to 9.6 oz	Apply prior to brown silk
Proaxis 0.5 (gamma cyhalothrin)	3A	1.92 to 3.2 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	2 to 3 fl. oz.	28 day PHI

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 stocks following directions specified on its label until December 31, 2019.

Silk clipping insects may present a problem if damage occurs prior to pollination. Consider treatment if less than 5% 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, for information on damage and control.

Foliar Applications to Control Silk Clipping Insects

Insecticide	MOA	Rate per acre	Notes
Asana XL (esfenvalerate)	3A	5.8 to 9.6 fl. oz.	Rootworm adults, 1 day harvest
Baythroid XL (beta cyfluthrin)	3A	0.8 to 1.6 fl. oz.	21 day PHI
Hero 1.24 EC (zeta cypermethrin + bifenthrin)	3A	4 to 10.3 fl. oz.	30 day PHI
Lannate 90 SP (methomyl)	1A	1/4 to ½ lbs	21 day harvest, rootworm adults
Mustang Maxx (zeta-cypermethrin)	3A	2.72 to 4 fl. oz.	PHI 30 day grain & stover, 60 day forage
Pounce 25WP (Permethrin)	3A	6.4 to 9.6 oz	Apply prior to brown silk, 30 day PHI
Proaxis 0.5 (gamma cyhalothrin)	3A	2.56 to 3.84 fl. oz.	21 day PHI
Sevin XLR Plus (carbaryl)	1A	1-1/4 to 2-1/2 lbs	14 day PHI
Warrior II (lambda cyhalothrin)	3A	1.28 to 1.92 fl. oz.	21 day PHI

Occasional Pests

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 15 or more (10 with stressed plants) per whorl are found 3 weeks before tassel emergence or 30 or more (15 with stressed plants) per whorl 1 week later. In 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, Capture, Dimethoate,*** or ***Lannate*** may be used for control.

Common stalk borers can be damaging in no-till or reduced tillage popcorn. Control is difficult once the larvae have become established in corn plants. Treatment is most successful when applied just prior to the cutworm rates are labeled for common stalk borer. See **ENTFACT-100**, *Common Stalk Borer in Corn*, for more information.

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, Capture, Decis, Hero, Mustang, Penncap-M, Pounce*** Sevin, or ***Voliam Xpress*** at rates for silk clipping insects (see above) can be used as foliar sprays if feeding damage becomes severe. Corn flea beetles an 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) blue-green to gray-green sucking insects that feed on corn roots. Leaves of infested plants will wilt and may turn brown and die. Corn leaf aphids are tended by ants, so 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 provide some control when applied at planting.

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, Capture, Decis, Mustang, Penncap-***M, Sevin or ***Voliam Xpress*** 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%. ***Capture, Decis, Hero***, or ***Mustang*** applied at cutworm rates, ***Voliam Xpress*** 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.

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, Hero, Mustang Max, Penncap-M***, ***Voliam Xpress*** or ***Warrior*** should help to control this pest.

Products for Control of Insect Pests in Stored Popcorn

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.

Phostoxin, Fumitoxin, etc. (aluminum phosphide):	tablets 30-140 / 1000 cubic feet.
NOTE: applied to a volume not bushels.	pellets 150-700 / 1000 cubic feet

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 Empty Bin Surface Applications — Enough to treat / 1,000 sq. ft.

Centynal (deltamethrin)	0.25 – 1.5 fl. oz.
Diacon-D IGR (s-methoprene)	1.5 oz.
Insecto, etc. (silicon dioxide, from diatomaceous earth)	1.0 lb.
Pyronyl (pyrethrin)	1-1/3 pint in 9.6 gal. water
Tempo SC Ultra (cyfluthrin)	0.27 fl. oz. (Do NOT apply to grain.)

Grain Protectants

Applied to stored popcorn. If at all possible do not use the same compound to treat both the empty bin and the bulk grain.

Enough to treat 1,000 bu.

Actellic 5E (cyfluthrin)	9.2 - 12.3 fl. oz.
Centynal (deltamethrin)	8.53 fl. oz. in 5.0 gal.
Diacon-D IGR (s-methoprene)	8-10 lb.
Insecto, etc. (silicon dioxide, from diatomaceous earth)	1-2 lb. per Ton **(Note change in standard)**
Pyronyl (pyrethrin)	1 pint in 3-5/8 gal. water
Sensat (spinosad)	9.8 fl. oz. in 5.0 gal.

Grain Surface Treatments

For Indian Meal Moth in stored corn.

Actellic 5E (cyfluthrin)..... 3 fl. oz. in 2 gal water / 1,000 sq. ft.
Dipel DF (Bacillus thuringiensis, kurstaki) ..... 1 lb. / 1,000 sq. ft. (mixed to 4 inch deep)
Biobit HP (Bacillus thuringiensis, kurstaki)..... 1 lb. / 1,000 sq. ft. (mixed to 4 inch deep)
Diacon-D IGR (s-methoprene)..... 8 lb. / 1,000 sq. ft.(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. / 1,000 ft.sq. ft.

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, Fumitoxin, etc. (aluminum phosphide)	tablets	40-180 / 1,000 bu.
	pellets	200-900 / 1,000 bu.

Economic thresholds are hard to determine for stored grain but these numbers have been suggested as a guide for FIELD corn. Thought Popcorn is more valuable, they should provide a general 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 / fumigation manual of the product that you have chosen and follow it to the letter.

Note that the Aluminum phosphide label underwent major revision in recent years and now contains significant requirements for pre-planning and documentation of the fumigation and access to considerable safety equipment. In addition, this product in currently undergoing another review and may have additional changes in the near future.

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