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Texas Agricultural Extension Service

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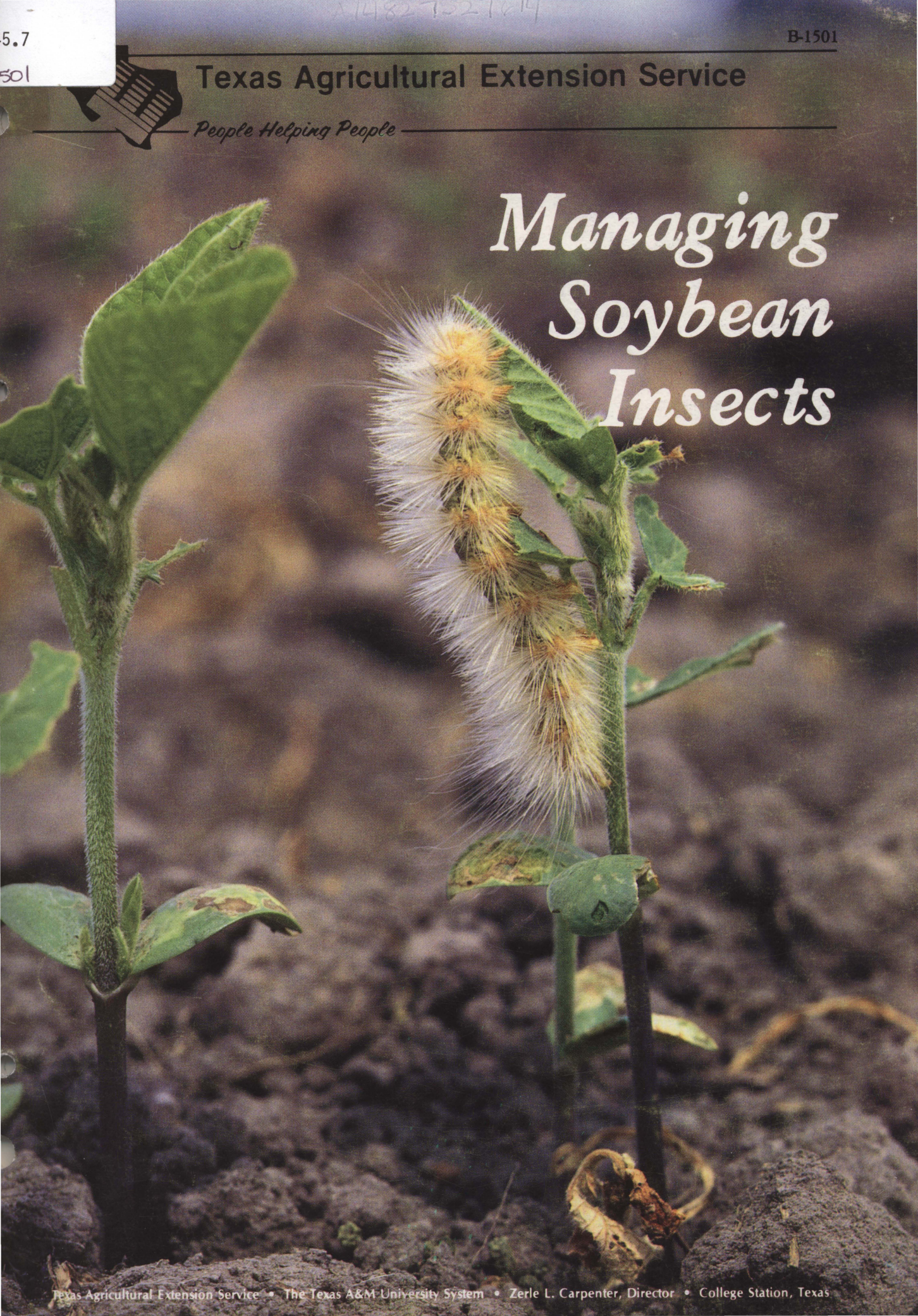
Managing Soybean Insects



Texas Agricultural Extension Service • The Texas A&M University System • Zerle L. Carpenter, Director • College Station, Texas

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Cover photo: *Saltmarsh caterpillar*

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Managing Soybean Insects

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and
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Insects that feed on soybeans are numerous and each year they pose a threat of yield or quality loss. The frequency of pest damage and, thus, the need for chemical control, differs in the various production areas and from season to season. In Texas, the greatest potential for economic pest loss exists in Gulf Coast and Lower Rio Grande Valley counties. The inconsistency in damaging pest populations clearly underlines the importance of regular field inspections and the use of established economic thresholds or action levels.

PEST MANAGEMENT PRINCIPLES

The term "integrated pest management" applies to a philosophy used in the design of insect, mite, disease and weed pest control programs. It encourages the use of the most compatible and ecologically sound combination of effective available pest suppression techniques. The pest management concept rests on the assumption that pests will be present to some degree in a production system. The first line of defense against them is prevention through the use of good agronomic practices or cultural methods which discourage pest development. Furthermore, properly selected control measures are implemented only when pest populations reach levels at which crop damage suffered could result in losses greater than the cost of the treatment. This potentially injurious population or plant damage level, determined through regular field scouting activities, is called an *economic threshold level* or *action level.* Precise timing and execution of each production operation is essential. In short, pest management strives to optimize rather than maximize pest control efforts.

Economic thresholds or action levels presented in this publication are intended to be used only as rules of thumb. Several factors affect the level of damage soybean plants can tolerate before the cost of implementing a pest suppression tactic, such as the use of an insecticide, becomes profitable. These factors include the anticipated market value of the crop, anticipated yield and the cost of the treatment. In general, when the market value of soybeans is high and/or the cost of control is low, economic threshold levels may actually decrease (fewer pests or pest damage can be tolerated). Threshold levels presented here may also change with the growing season, the presence of different pests, the type of damage, plant growth stage and general plant vigor.

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Variety Selection

Some soybean varieties, such as Centennial, are known to suffer more damage from certain pests (particularly caterpillar feeding damage) than others. A new variety called Crockett has been shown to be resistant or tolerant to several of the major pests in the Texas soybean arthropod complex. However, availability of this variety will be somewhat limited for the 1988 and 1989 seasons. Data on the yield potential for soybean varieties adapted to various areas of the state are available from your local county Extension agent. Selection of varietal maturity group also influences the potential for arthropod pest damage and the need to treat. Group IV varieties mature early and may escape potentially heavy damage from many of the late-season soybean pests. Late-maturing soybean varieties (Group IX) are most vulnerable to caterpillar and stink bug damage and may require more insecticide applications than earlier-maturing varieties.

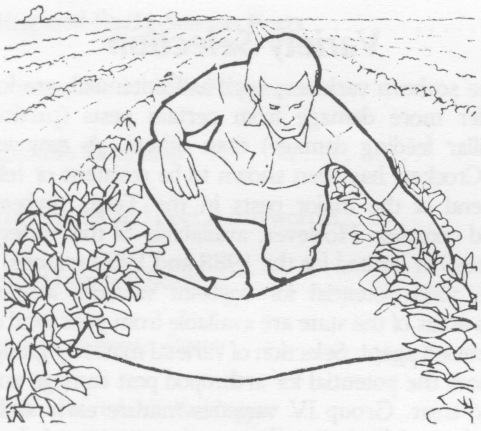
Inspecting Soybean Fields for Insects and Damage

Insect populations in soybean fields can change rapidly. Growers should check fields at least once and preferably twice a week to determine the species present, pest density and amount of damage.

Populations of most insects can be estimated by the ground cloth method or with a sweep net. The ground cloth method is more accurate and works well for sampling stink bugs and caterpillars in row beans when the soil is dry. In broadcast beans, or when the soil is wet, the sweep net is more convenient. The sweep net method requires less time but is less accurate, especially when plants are small or wet, or when the canopy is dense. Plant damage estimates also are useful in making management decisions.

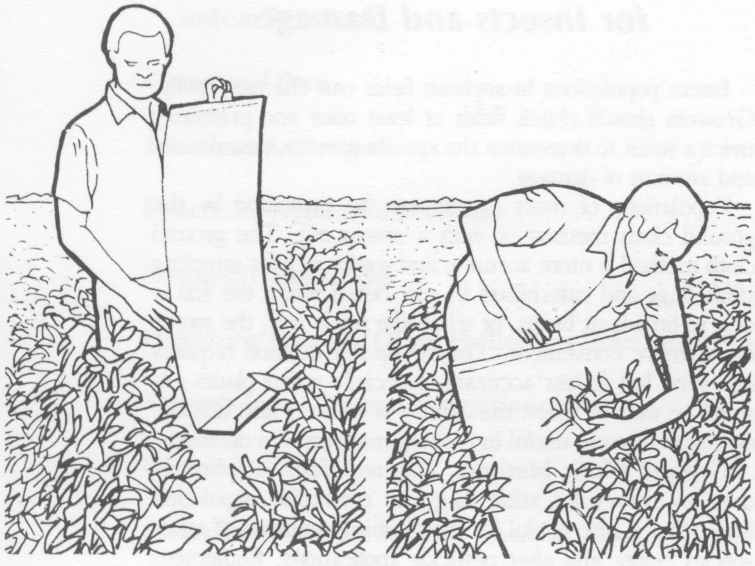
Ground Cloth Method: This technique is primarily used to survey for stink bug and caterpillar population levels, but is also useful for determining numbers of other species before and after pesticide applications. Equipment consists of an off-white cloth measuring 36 x 42 inches.

Staple a thin strip of wood, approximately ½ x 1 inch wide, to each short side of the cloth. Select a random site in the field and unroll the cloth from one row over to the next row. Vigorously shake the plants from both rows bordering the cloth, using both hands and fore arms. In this way, two 3-row-foot sections (6 feet total) can be sampled simultaneously for insects. Count the number of insects that fall on the cloth. Repeat the process in at least five locations in the field (30 feet of row sampled) and sum the counts to get the number of each species per 30 row feet. If the resulting populations are close to threshold levels or if the field is very large, increase the number of samples to increase confidence in the results. This method is not useful in drill or broadcast planted soybean fields.



Ground cloth sampling method

Vertical Beat Sheet Method: The vertical beat sheet (VBS) is another method for sampling insect populations. This device is contructed of galvanized metal flashing or similarly stiff material, 36 inches wide and crimped to provide a beating surface 34 inches tall and a collecting trough 4 inches wide. For sampling, the trough is positioned at the base of row-planted soybean plants and arthropods are removed along 36 inches of row by shaking and beating the foliage against the vertically positioned surface. Dislodged arthropods slide into the trough where they can be counted in the field or poured into a container to be counted elsewhere. The entire sampling process can be accomplished without kneeling down between the rows, and can be used to sample weedy fields, fields with standing water in the rows, and fields planted on narrow rows or drill-planted soybean fields (although threshold levels may need to be adjusted).



Vertical beat sheet sampling method

Sweep Net Method: A standard 15-inch diameter sweep net is commonly used for sampling insects on soybeans. A sampling unit of 10 consecutive (180-degree) sweeps, made while walking through the field, has proved to be effective. The net is swung from side to side with each step. After 10 successive sweeps the insects are identified and counted as they are removed from the net. Repeat the sampling procedure at a minimum of 10 random sites and sum the counts of each species per 10 sweeps to determine the number of insects per 100 sweeps. Increasing the number of samples taken from a field increases the accuracy and reliability of the population estimates. If the population estimates are close to threshold levels, or if the field is large, increase the number of samples to increase the accuracy of the results obtained. Economic threshold levels developed for this sampling method are for row-planted soybeans only and should not be used if row spacings are less than 30 inches. Use of a sweep net, however, is one of the few methods capable of sampling arthopods in drill- or broadcast-planted soybean fields.

Sweep net sampling method

Plant Damage: Insects damage soybean plants in four ways. Underground, chewing insects can feed on germinating seedlings or roots, causing the plants to lose vigor, wilt or die. Above ground, stems can be damaged by tunneling larvae or girdled by the threecornered alfalfa hopper. Foliage can be damaged by chewing caterpillars and beetles, or by the feeding of mites, aphids and thrips. Finally, pods can be hollowed out by corn earworms and seed malformed

and discolored by stink bug sucking damage. Estimating the level of insect related plant damage is essential in determining the need for control measures.

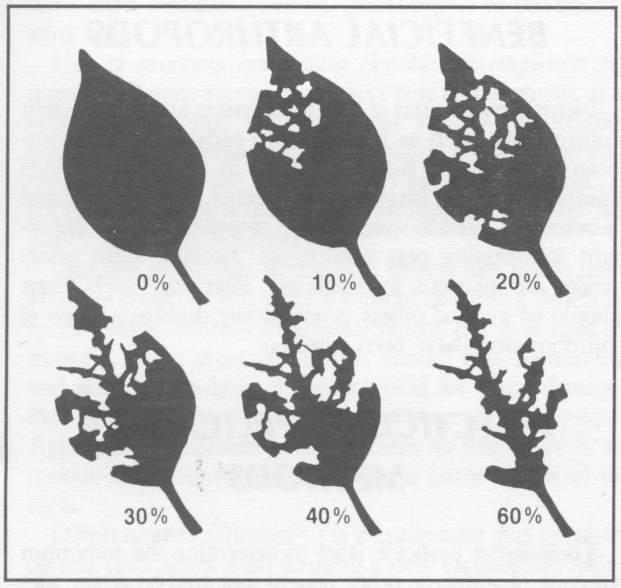
Insects that feed on seedling soybeans are important only if stands are damaged to the extent that yields are reduced. *Four to eight seedlings per row foot are sufficient to make optimum yields.* Uniform removal of seedlings is not as detrimental as the removal of all seedlings in portions of a row. To determine stand loss from early-season pests, count the numbers of healthy and damaged seedlings in 3 row feet at randomly selected locations in the field.

Threecornered alfalfa hoppers girdle the main stems of soybean plants prior to bloom. These girdles first appear as slight indentations and later as swellings encircling the entire main stem. Randomly selected row-foot sections should be examined for fresh damage early in the season (3- to 10-inch plants) at several locations in the field.

Estimation of foliage loss from the feeding of caterpillars and beetles is made by visual observation. Examine randomly picked individual leaflets and estimate the percent leaf surface missing in each (see guide for estimating percent defoliation). Be sure to sample all levels of the canopy evenly. Add these estimates together and divide by the total number of leaves examined to determine the percent of defoliation for the different areas of the sampled field. Research has shown that slight leaf-feeding injury may actually increase yield somewhat. However, for more severe damage (10 to 50 percent defoliation), every 10 percent loss of soybean leaf surface area results in a 2 bushel decrease in yield.

Pod damage is not sampled directly. Insect populations which cause pod damage are estimated using sweep net or ground cloth techniques.

If the damage estimates are close to threshold levels, increase the number of samples to determine the level of plant damage. Larger sample units generally increase the accuracy of the results obtained.



Guide for Estimating Percent Defoliation

SEEDLING AND EARLY-SEASON PESTS

Threecornered Alfalfa Hopper: The threecornered alfalfa hopper is present in soybean fields from the seedling stage through maturity. Feeding activity during the seedling stage results in girdled main stems; in later growth stages petioles are girdled. Plants damaged in early growth stages may not be noticed until they are much older and heavier. Because of damaged stems, plants may lodge when stressed by winds, rain or cultivation equipment. The restricted flow of nutrients in girdled plants can reduce the number of pods produced. However, this type of damage rarely reduces field yield because healthy plants adjacent to damaged lower-yielding plants compensate by producing higher yields. This is a phenomenon known as "plant stand compensation." Main stem girdling is difficult to prevent with insecticide applications. A better management strategy for this type of damage is to manipulate seeding rates in order to obtain at least six undamaged plants per foot of row.

Saltmarsh Caterpillars: These large, hairy, yellow caterpillars migrate into the field from weed hosts early in the production season. When numerous, damage may be sufficient to cause some loss in plant stand near field margins. This insect is one of the major defoliators of Group IV soybean varieties. Spot or perimeter treatment may be required if infestations threaten plant stands. Woolly bear caterpillars are hairy black and red caterpillars which cause damage similar to the saltmarsh caterpillar.

Armyworms and Beet Armyworms: Armyworms are conspicuously striped caterpillars that may occur locally in high numbers. Often they develop in pastures or roadside vegetation and march en masse into fields, eating as they go. They also can develop where moths lay eggs in the field. Young caterpillars feed close together, resulting in localized skeletonization and defoliation damage.

Beet armyworms are green to brown with pale stripes along their sides, and with a conspicuous black mark on each side of the second body (thoracic) segment. They prefer broad-leaved plants, including soybeans, and are generally more difficult to kill than armyworms because they are tolerant to carbaryl, methyl parathion and parathion.

Armyworm and beet armyworm populations in the Gulf Coast region of Texas rarely cause sufficient damage to warrant treatment. However, in the northwestern portions of the state beet armyworm outbreaks do occasionally occur.

Lesser Cornstalk Borers: Soybeans in the seedling stage may be damaged by the lesser cornstalk borer. Larvae tunnel into the stem at the soil line, restricting the flow of nutrients to the upper portion of the plant and causing it to wilt and eventually die. The very active, bluish green caterpillars have brown stripes and are found inside the stem or in a silken tube just below the soil surface adjacent to the stem. These pests usually are found only in soybeans growing in well drained, sandy soils; they thrive under dry conditions. Chlorpyrifos (Lorsban®) and diazinon (D•Z•N®)

are labeled for their control. However, these treatments may not be economical, particularly for broadcast-planted or drill-planted soybean fields.

MID- TO LATE-SEASON PESTS

Threecornered Alfalfa Hopper: Petiole girdling by adult and nymphal threecornered alfalfa hoppers during the blooming and pod-filling stages of soybean development has been shown to reduce yields. In Louisiana, control of this pest is recommended from pod set to maturity when there are three nymphs per foot or one adult per sweep. Fenvalerate (Pydrin®) at 0.075 to 0.1 lb. active ingredient per acre is suggested for control.

Foliage Feeding Pests: Various caterpillars, beetles and grasshoppers feed on soybean foliage. Since all cause defoliation, they are grouped together for damage estimation purposes. These pests can occur throughout the year, but are most significant from blooming to pod fill when defoliation can cause yield reductions (see ''Plant Damage,'' p. 4). Control of these pests is complicated when several species are involved. Insecticide applications made early in the season may cause resurgent populations, necessitating additional control. Infestations of one or a combination of these species usually become important from August through September along the Upper Gulf Coast. Infestations may develop very rapidly and completely defoliate soybean fields.

Soybean loopers, velvetbean caterpillars and **green cloverworms** are the most common and severe defoliators of Texas' soybeans. Soybean loopers are green caterpillars with two pairs of abdominal prolegs in addition to a proleg at the end of the body; they may or may not be marked with black. This species is difficult to control with carbaryl, methyl parathion or parathion. This species occasionally becomes abundant earlier in the season than the others, and populations are often composed of caterpillars of all sizes. Velvetbean caterpillar moths migrate into Texas each year in large numbers. Caterpillar populations can build up rapidly as a result. The larvae are green to brown with stripes along their sides, and have four pairs of abdominal prolegs. Because of their migratory nature, populations can build up very rapidly. Although they are relatively easy to control with insecticides, populations often go undetected until significant damage has occurred. Green cloverworms have three pairs of abdominal prolegs. This species usually is not numerous, and low level populations are considered beneficial since they provide hosts for beneficial arthropods which may control other defoliators. However, occasional outbreaks of green cloverworms do require control.

Stink Bugs: Several species of stink bugs feed on soybeans. The **southern green stink bug** and **brown stink bug** are the most common species along the Gulf Coast of Texas, although occasionally other species such as the **green stink bug** are found. Adult stink bugs commonly move into fields when pods are beginning to fill. Stink bugs feed by inserting their mouthparts into the beans inside the pods. This feeding may reduce yield and quality of the soybeans, and increase the incidence of yeast spot seedling disease. During the pod-filling period of soybean development, high populations of stink bug nymphs can develop in the field. Since adult females deposit eggs in clusters, nymphal populations are extremely aggregated. Accurate sampling methods are required to estimate average field populations.

Corn Earworm: This pest is also known as the **bollworm** and **soybean podworm.** Female moths lay eggs on the terminal leaves of soybean plants. The young larvae feed for a few days and then move down the plant to feed on developing soybeans. Occasionally, corn earworms are detected during vegetative growth stages, but this species is not considered to be a serious defoliator. However, large populations during pod-filling stages can produce yield losses by feeding on pods. Infestations are most common where alternate hosts such as corn, sorghum and cotton are grown.

Soybean Stem Borer: These long-horned beetles are occasional pests of soybeans in the Texas High Plains. Adults are 3/8-inch-long, charcoal grey beetles with long antennae. The larvae are cream-colored, legless grubs. Larvae tunnel in soybean stems in July and August, eventually cutting off plants at the base. These plants may lodge and become difficult to harvest. Peak girdling activity occurs during September and October. Soybeans should be harvested as soon as possible to minimize losses to the stem borer.

OCCASIONAL PESTS

Occasional early-season defoliators include **cutworms, garden webworms, southern corn rootworm** and **banded cucumber beetles.** However, their feeding rarely becomes serious enough to warrant treatment. Several **grasshopper** species occasionally move into the margins of fields bordered by weedy areas, and at times they require spot treatments. Also, populations of **thrips, whiteflies** and **spider mites** can produce noticeable damage to the foliage, but they rarely require treatment (See footnote 1 in the ''Soybean Insect Control Suggestions'' table, page 8).

BENEFICIAL ARTHROPODS

Natural populations of beneficial insects and spiders often control pests such as loopers, corn earworms and velvetbean caterpillars. Key predators in soybeans include **spiders, big-eyed bugs, assassin bugs, damsel bugs** and **lacewings.** Certain wasp and fly parasites are also important in reducing pest populations. Because most insecticides are injurious to beneficials, insecticide applications should be avoided unless economically damaging levels of injurious pests have been detected.

INSECTICIDE APPLICATION METHODS

Consult the pesticide label to determine the minimum amount of water or other diluent required to attain adequate coverage. One product containing malathion (Cythion® Malathion ULV™ Concentrate), registered for control of grasshoppers or green cloverworms, is applied undiluted. Several products, including permethrin (Ambush® , Pounce®), fenvalerate (Pydrin®), es-fenvalerate

(Asana®), methomyl (Lannate® LV) and tralomethrin (Scout®), are registered for application in refined, non-volatile vegetable oils such as cottonseed or soybean oil; in water; or in water plus an emulsifiable oil (See ''Restrictions'' portion of ''Soybean Insect Control Suggestions,'' p. 11). Application in vegetable oil, approved for aerial application, may provide some advantages such as a longer period of residual activity, increased coverage, less drift and more acreage treated with each tankful. However, special modifications of application equipment are required and proper calibration is extremely important.

Spray applications are most effective and hazards minimized when wind velocity does not exceed 15 miles per hour. Nozzle size and number, ground speed and pump pressure influence the rate of output per acre; therefore, calibrate the sprayer carefully to insure application of the recommended rate. For ground applications, one nozzle per row usually is adequate for young plants, but two to three nozzles per row may be desirable on larger plants to obtain thorough coverage. For best results with aerial applications, flag swaths so they meet or overlap. Do not fly higher than 15 feet above the plant canopy to insure less drift and maximum coverage. When making any insecticide application, follow label directions. For calibration and safety information refer to MP-1289, ''Using Pesticides-Private Applicator Manual.'' The section on ''Protecting Bees and other Pollinators from Insecticides'' in this bulletin contains information on preventing bee losses.

BIOLOGICAL INSECTICIDES

Bacillus thuringiensis (Dipel® , Thuricide® and others) is presently labeled for use on soybeans. This biological insecticide will control foliage-feeding larvae before bloom, or moderate populations after bloom initiation and during pod formation. It is not recommended where heavy populations develop during the pod-filling period. This insecticide will not control defoliating beetles, grasshoppers or pod-feeding stink bugs.

Use of products containing *Bacillus thuringiensis* requires a different approach to insect pest management. It is rather slow acting, is much more effective on smaller worms, and performs much better when applied in greater volumes of water per acre (10 to 15 gallons by ground application and 5 to 8 gallons by air). Application rates are related to thorough coverage.

The real advantage of biological insecticides lies in their ability to suppress pest species without disrupting beneficial species that contribute to natural control. But to be used effectively, there must be regular, careful field monitoring and accurate analysis of the potential for plant damage. Precise application (timing, rate and coverage) is required. Application equipment must be clean so that there is no residue of conventional insecticide to harm beneficial insects.

Diflubenzuron (Dimilin®) is a compound that prevents certain caterpillars from forming a new exoskeleton (skin) after molting. It is referred to as a ''chitin synthesis inhibitor.'' Because of its mode of action, this product has been recommended for use in Florida when velvetbean caterpillar population levels are lower than the thresholds mentioned in this publication (four rather than eight small larvae per foot of row). If populations are extremely high (2 to 3 times higher than the threshold) and/or when other pests are present (stink bugs, other caterpillar species, etc.) diflubenzuron may need to be augmented with low rates of conventional insecticides, or omitted altogether.

PROTECTING BEES AND OTHER POLLINATORS FROM INSECTICIDES

Pollination is extremely important in producing many seed crops. Follow these guidelines to protect bees and other pollinating insects in the vicinity of soybeans to be treated:

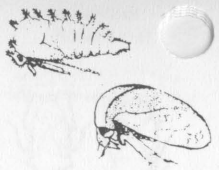
1. Where insecticides are needed, use materials least toxic to bees. If it is necessary to use an insecticide from groups 1 or 2 in the following list, notify beekeepers so they can make necessary arrangements to protect their bees.
2. Make all applications when bees are away from the field, usually during the evening or early morning, between the hours of 7 p.m. and 6 a.m. Evening applications, after bees have left the field, are less hazardous than early morning applications.
3. To prevent heavy losses of bees, do not spray colonies directly and avoid insecticide drift onto colonies. Bees often cluster on the fronts of their hives on hot evenings. Pesticide drift or direct spray at this time generally results in high mortality.

Insecticides Grouped According to Their Relative Hazards to Honey Bees

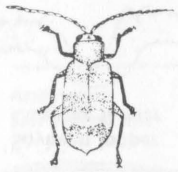
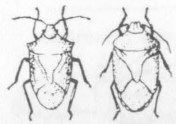
Insecticides	Remarks
Group 1 - Highly Toxic acephate (Orthene®) carbaryl (Sevin®) diazinon (D•Z•N® , Diazinon®) dimethoate (Cygon® , Defend®) methyl parathion parathion (ethyl) permethrin (Ambush® , Pounce®) tralomethrin (Scout®)	This group includes materials that kill bees on contact during application or for several days following application. Remove bees from the area if these insecticides are used on plants visited by the bees. Pyrethroids (permethrin and tralomethrin) are highly toxic to bees if sprayed directly on foraging workers or drifted onto colonies. Once these materials dry, however, they are only moderately toxic to bees.
Group 2 - Moderately Toxic es-fenvalerate (Asana®) fenvalerate (Pydrin®) methomyl (Lannate® , Nudrin®) thiodicarb (Larvin®)	Do not apply when bees are working in field. Apply in late evening.
Group 3 - Relatively NonToxic *Bacillus thuringiensis* (Dipel® , Thuricide® , and others) diflubenzuron (Dimilin®)	Make applications in late evening or early morning when bees are not foraging.

Soybean Insect Control Suggestions

Pests[1]	Economic threshold	Insecticide	Rate[2] (active ingredient/acre)	Days from last application to: harvest	Days from last application to: livestock grazing or feeding[3]	Remarks
Cutworms 	When stands are threatened. Six healthy seedlings per foot of row are sufficient to make optimum yields.	carbaryl (Sevin®)	1 to 1.5 lbs.	0	0	Direct spray to base of plants and to soil several inches on each side of rows. See restrictions.
		es-fenvalerate (Asana®)	0.025 to 0.05 lb.	21	X	
		fenvalerate (Pydrin®)	0.1 to 0.2 lb.	21	X	
		methyl parathion (climbing cutworms only)		20	20	
		(Methyl Parathion 4E)	0.38 to 1.0 lb.			
		(MP-4EC)	0.38 to 0.5 lb.			
		(Methyl Parathion 7.5)	0.25 lb.			
		permethrin (Pounce®)	0.05 to 0.1 lb.	60	X	
		thiodicarb (Larvin®)	0.5 to 0.75 lb.	28	X	
		tralomethrin (Scout®)	0.015 to 0.019 lb.	21	X	
Armyworm **Fall armyworm** 	When stands are threatened. Six healthy seedlings per foot of row are sufficient to make optimum yields.	acephate (Orthene®)	0.75 to 1.0 lb.	14	X	See restrictions.
		carbaryl (Sevin®)		0	0	
		(armyworm, fall armyworm)	(0.5) 1.0 to 1.5 lbs.			
		(yellowstriped armyworm)	1.5 to 2.0 lbs.			
		methomyl (Lannate® or Nudrin®)		14	3 forage, 7 hay	
		(light to moderate populations)	0.27 to 0.42 lb.			
		(light to severe populations)	0.42 to 0.56 lb.			
		methyl parathion	1.0 lb.	20	20	
		(Methyl Parathion 4E- fall armyworm only)				
		(MP-4EC - armyworm and fall armyworm to third instar)				
		(Methyl Parathion 7.5 - armyworm and fall armyworm)				
		parathion (ethyl)		15	15	
		(fall armyworm only)	0.5 to 0.8 lb.			
		thiodicarb (Larvin®)		28	X	
		(fall, southern, yellow striped, etc.)	0.25 to 0.4 lb.			
		tralomethrin (Scout®)		21	X	
		(fall armyworm)	0.015 to 0.019 lb.			
Beet armyworm 	When stands are threatened. Six healthy seedlings per foot of row are sufficient to make optimum yields.	es-fenvalerate (Asana®)	0.025 to 0.05 lb.	21	X	See restrictions
		fenvalerate (Pydrin®)	0.1 to 0.2 lb.	21	X	
		methomyl (Nudrin®)	0.25 to 0.45 lb.	14	3 forage, 7 hay	
		permethrin (Ambush® or Pounce®)	0.1 to 0.2 lb.	60	X	
		thiodicarb (Larvin®)	0.25 to 0.4 lb.	28	X	
		tralomethrin (Scout®)	0.015 to 0.019 lb.	21	X	
Saltmarsh caterpillar 	Spot treat for eight worms per foot of row.	carbaryl (Sevin®)	1.5 to 2.0 lbs.	0	0	See restrictions.
		es-fenvalerate (Asana®)	0.0125 to 0.025 lb.	21	X	
		fenvalerate (Pydrin®)	0.05 to 0.1 lb.	21	X	
		permethrin (Ambush®)	0.05 to 0.1 lb.	60	X	
		methomyl (Lannate® or Nudrin®)		14	3 forage, 7 hay	
		(light to moderate infestations)	0.27 to 0.42 lb.			
		(moderate to severe infestations)	0.42 to 0.56 lb.			

Threecornered alfalfa hopper 	Before bloom, when the infestation has reduced the number of girdled plants to six or fewer per foot of row and nymphs are still present. For mid- to late-season damage, see discussion in text (p. 6)	(0.5) 0.75 to 1.0 lb.	14	X	Thorough coverage of plants and stems is needed for early-season control. See restrictions.
		carbaryl (Sevin®)	1.0 lb.	0	0	
		es-fenvalerate (Asana®)	0.025 to 0.05 lb.	21	X	
		fenvalerate (Pydrin®)	(0.075) 0.1 to 0.2 lb.	21	X	
		methyl parathion		20	0	
		(Methyl Parathion 4E)	0.38 to 1.0 lb.			
		(MP-4EC)	0.38 to 0.5 lb.			
		(Methyl Parathion 7.5)	0.25 to 0.5 lb.			
		(Penncap-M)	0.5 to 0.75			
		thiodicarb (Larvin®)		28	X	
		(supression only)	0.45 to 0.75 lb.			
Velvetbean caterpillar 	When defoliation exceeds 40 percent prebloom, 20 percent during blooming and pod fill, and 35 percent from pod fill to harvest or when ½-inch or larger worms number eight or more per foot of row or 300 per 100 sweeps (see "Biological Insecticides," p. 7, for threshold level for diflubenzuron)	acephate (Orthene®)	0.5 to 1.0 lb.	14	X	Check infestations at weekly intervals to determine damage level. Applications may need to be repeated at 5-day intervals to achieve control. See restrictions.
		Bacillus thuringiensis (Dipel® , Thuricide® and others) (see remarks in text)	see labels for rates	0	0	
		carbaryl (Sevin®)	(0.25) 0.5 to 1 lb.	0	0	
		diflubenzuron (Dimilin®)	0.03 to 0.06 lb.	21	X	
		es-fenvalerate (Asana®)	0.0125 to 0.025 lb.	21	X	
		fenvalerate (Pydrin®)	0.05 to 0.10 lb.	21	X	
Green cloverworm 		methomyl (Lannate® or Nudrin®)		14	3 forage, 7 hay	
		(light to moderate populations)	0.14 to 0.28 lb.			
		(moderate to severe populations)	0.28 to 0.56 lb.			
		methyl parathion		20	20	
		(Methyl Parathion 4E)				
		(velvetbean caterpillar)	0.38 to 1.0 lb.			
		(green cloverworm)	1.0 lb.			
		(MP-4EC)	0.38 to 0.5 lb.			
		(Methyl Parathion 7.5)				
		(velvetbean caterpillar)	0.38 lb.			
		(green cloverworm)	0.5 to 1.0 lb.			
		(Penncap-M)	0.5 to 0.75 lb.			
		parathion (ethyl)	0.5 lb.	15	15	
		permethrin (Ambush® or Pounce®)	0.05 to 0.1 lb.	60	X	
		thiodicarb (Larvin®)	0.25 to 0.4 lb.	28	X	
		tralomethrin (Scout®)	0.014 to 0.016 lb.	21	X	
Soybean looper Cabbage looper 	When defoliation exceeds 40 percent prebloom, 20 percent during blooming and pod fill, and 35 percent from pod fill to harvest or when ½-inch or larger worms number eight or more per foot of row or 150 per 100 sweeps.	acephate (Orthene®)	0.5 to 1.0 lb.	14	X	See remarks.
		Bacillus thuringiensis (Dipel® , Thuricide® and others) (see remarks in text)	see labels for rates	0	0	
		es-fenvalerate (Asana®)		21	X	
		(cabbage looper only)	0.025 to 0.05 lb.			
		fenvalerate (Pydrin®)		21	X	
		(cabbage looper only)	0.1 to 0.2 lb.			
		methomyl (Lannate® or Nudrin®)		24	10 forage, 12 hay	
		(worms up to ½ in. long, higher rate for severe infestations)	0.56 to 1.1 lbs.			
		permethrin (Ambush® or Pounce®)	0.05 to 0.1 lb.	60	X	
		thiodicarb (Larvin®)	0.45 to 0.75 lb.	28	X	
		tralomethrin (Scout®)	0.015 to 0.019 lb.	21	X	

Soybean Insect Control Suggestions (continued)

Pests[1]	Economic threshold	Insecticide	Rate[2] (active ingredient/acre)	Days from last application to: harvest	Days from last application to: livestock grazing or feeding[3]	Remarks
Bean leaf beetle **Blister beetles** 	When defoliation exceeds 40 percent prebloom, 20 percent during blooming to pod fill, and 35 percent from pod fill to harvest. Banded cucumber beetle (illustrated) is often present but rarely causes economic damage.	acephate (Orthene®) (grasshoppers and bean leaf beetle)	0.25 to 1.0 lb.	14	X	See restrictions.
		carbaryl (Sevin®)	0.5 to 1.5 lbs.	0	0	
		es-fenvalerate (Asana®) (bean leaf beetle and grasshoppers)	0.025 to 0.05 lb.	21	X	
		fenvalerate (Pydrin®) (bean leaf beetle and grasshoppers)	0.1 to 0.2 lb.	21	X	
		methomyl (Lannate® or Nudrin®) (light to moderate infestations of bean leaf beetle)	0.28 to 0.42 lb.	14	3 forage, 7 hay	
		(moderate to severe infestations of bean leaf beetle)	0.42 to 0.56 lb.			
		methyl parathion (Methyl Parathion 4E) (blister beetles)	0.38 to 1.0 lb.	20	20	
		(MP-4EC) (blister beetles)	0.5 lb.			
		(bean leaf beetles and grasshoppers)	1.0 lb.			
		(Methyl Parathion 7.5) (blister beetles)	0.5 lb.			
		(bean leaf beetles)	1.0 lb.			
		(Penncap-M) (grasshoppers)	0.25 to 0.75 lb.			
		(bean leaf beetles)	0.5 to 1.0 lb.			
		permethrin (Ambush® or Pounce®) (bean leaf beetle)	0.05 to 0.1 lb.	60	X	
		thiodicarb (Larvin®) (bean leaf beetle)	0.45 to 0.75 lb.	28	X	
		tralomethrin (Scout®) (grasshoppers)	0.015 to 0.019 lb.	21	X	
Stink bugs 	Pod formation to bean maturity — when one bug per foot of row or 36 or more per 100 sweeps occur. Stink bugs should be ¼ inch or larger.	acephate (Orthene®)	0.75 to 1.0 lb.	14	X	Check infestations weekly and repeat applications as necessary to maintain populations below economic levels. See restrictions.
		carbaryl (Sevin®)	0.75 to 1.5 lbs.	0	0	
		es-fenvalerate (Asana®) (southern green stink bug)	0.025 to 0.05 lb.	21	X	
		fenvalerate (Pydrin®)	0.1 to 0.2 lb.	21	X	
		methyl parathion (Methyl Parathion 4E)	0.38 to 0.75 lb.	20	20	
		(Penncap-M)	0.5 to 0.75 lb.			
		parathion (ethyl)	0.5 lb.	15	15	
		thiodicarb (Larvin®) (supression only)	0.45 to 0.75 lb.	28	X	
		tralomethrin (Scout®)	0.014 to 0.016 lb.	21	X	

Corn earworm (podworm or cotton bollworm) 	After blooms appear when three or more worms per foot of row or 38 or more in 100 sweeps are found. Seldom causes economic injury after solid canopy has formed.	acephate (Orthene®)	0.75 to 1.0 lb.	14	X	It is often difficult to control large worms. When treatment becomes necessary, repeat applications at less than 7-day intervals until the infestation is reduced below economic levels. If worms are large and emergency or salvage treatments are necessary, apply at 3-day intervals until the outbreak is under control, or use methomyl at 5-day intervals. See restrictions.
		carbaryl (Sevin®)	0.5 to 1.5 lbs.	0	0	
		es-fenvalerate (Asana®)	0.025 to 0.05 lb.	21	X	
		fenvalerate (Pydrin®)	(0.075) 0.1 to 0.2 lb.	21	X	
		methomyl (Lannate® or Nudrin®)		14	3 forage, 7 hay	
		(worms up to ¼-in. long, light to moderate infestations)	0.14 to 0.28 lb.			
		(worms up to ½-in. long, moderate to severe infestations)	0.28 to 0.56 lb.			
		methyl parathion		20	20	
		(Methyl Parathion 7.5 or Methyl Parathion 4E)	1.0 lb.			
		(Penncap-M)	0.75 to 1.0 lb.			
		parathion (ethyl)	0.5 to 0.8 lb.	15	15	
		permethrin (Ambush® or Pounce®)	0.1 to 0.2 lb.	60	X	
		thiodicarb (Larvin®)	0.25 to 0.4 lb.	28	X	
		tralomethrin (Scout®)	0.015 to 0.019 lb.	21	X	

1 Mexican bean beetle, Japanese beetle, thrips, lygus bug, seedcorn maggot, white grub, wireworm, aphid, leafhopper, cucumber beetle, alfalfa caterpillar, woolly bear caterpillar, painted lady (thistle caterpillar), (garden) webworm, silver-spotted skipper and (two-spotted spider) mite are not included in this guide as they have not been found to be pests of Texas soybeans. The Mexican bean beetle and Japanese beetle have not been found in the state.

2 Rates in parentheses are below those found on product labels, but have been shown to be effective under certain conditions by research entomologists. When using rates that differ from those listed on a product's label, the user assumes the responsibility for the effectiveness of the treatment.

3 An "X" in this column indicates that livestock grazing or feeding IS NOT permitted on soybeans treated with this insecticide.

RESTRICTIONS

Refer to product labels for endangered species restrictions.

acephate — Apply in 10 to 50 gals. of water with ground equipment or in 2 to 10 gals. of water with aerial equipment.

carbaryl — Do not apply a combination of carbaryl and 2,4 DB herbicides to soybeans. Use lower rates for light to moderate populations and smaller instars and to provide maximum survival of beneficial insects and spiders. Use higher rates for heavy populations and larger instars. For grasshopper control, use the lower rate for nymphs on small plants or sparse vegetation in wasteland, rangeland, ditchbanks, rights-of-way, pastures, hedgerows and roadsides. Use the higher (1.5 lbs. AI/acre) rate for adult grasshoppers or applications to dense vegetation. Also labeled for cucumber beetles, alfalfa caterpillar, leafhoppers, thrips, webworms and painted ladies (thistle caterpillars).

chlorpyrifos — Do not apply more than 3 lbs. AI per acre per season. Do not apply last two treatments closer than 4 days apart.

diflubenzuron — See discussion in "Biological Insecticides," p. 7. For aerial application, apply when larvae are small (less than ½ inch). Apply in sufficient (1 to 3 gals. per acre) water to achieve uniform coverage of foliage. For ground application, apply recommended rate in 9 to 35 gals. of water per acre to achieve uniform coverage. Do not make more than two applications per season. From 3 to 5 days may be required before populations are reduced. Do not rotate crops other than soybeans or cotton until 6 months following last application. Do not apply to lakes, streams, ponds or other bodies of water.

es-fenvalerate — Do not feed or graze livestock on treated plants. Do not exceed 0.2 lb. AI per acre per season. When applying in nonvolatile vegetable oils use a total spray volume of 1 or more qts.

fenvalerate — Do not exceed 0.8 lb. AI per acre per season. When applying in nonvolatile vegetable oils use a total spray volume of 1 or more qts.

methomyl — Also labeled for thrips. For aerial application of Lannate® LV as a low-volume spray, ensure that equipment is capable of delivering small spray droplets for thorough coverage, and that equipment is adjusted to distribute spray uniformly over the spray swath. Apply when wind, temperature and humidity will allow spray to be delivered to the target area. Make sure local regulations do not prohibit low-volume aerial sprays. Apply in a minimum total spray volume of 0.53 gal. per acre. Water or once-refined vegetable oil may be used as the spray carrier. Continue to apply at 5- to 7-day intervals or as needed to maintain control.

methyl parathion — Do not apply more than twice per growing season. Products containing methyl parathion are also registered for use on thrips, (garden) webworms, (two-spotted) spider mites, leafhoppers and silver-spotted skippers.

parathion — Do not apply more than twice per season. Also labeled for webworms, two-spotted spider mites, white grubs and wireworms.

permethrin — Apply by air or ground. Do not apply more than 0.4 lbs. AI per acre per season. Apply Pounce® 25 WP in a minimum of 1 gal. finished spray per acre by air or 5 gals. with ground equipment. When appling Pounce® 3.2EC in nonvolatile vegetable oil, apply in a minimum of 1 qt. total volume per acre using equipment calibrated to give adequate coverage. When applying in water by aircraft, 1 qt. of oil may be substituted for 1 qt. water per gallon of finished spray.

thiodicarb — Apply in a minimum finished spray volume of 2 gals. per acre by air or 5 gals. per acre by ground. Use lower rates for low to moderate populations and maximum protection of beneficials. Refer to product label for special instructions for cutworm applications.

tralomethrin — For aerial applications, use a minimum of 1 gal. of water per acre or 1 qt. of at least once-refined crop oil per acre. For ground applications, use a minimum of 5 gals. of water per acre for thorough coverage of the foliage. Not for sale or distribution after December 31, 1989; not for use after December 31, 1990.

Conversion table: Pounds of active ingredients (AI) per acre to amount of formulation per acre.

For additional conversions use these formulas:
lb. AI per acre/lb. formulation per gal. = gal. formulation per acre
lb. AI formulation per acre/% AI formulation per acre/100 = lb. formulation per acre
Note: 1 gal. = 4 qts. = 8 pts. = 128 fl. oz.

Insecticide and formulation	Pounds of active ingredients (AI) per acre converted to amount of actual product per acre
acephate	
Orthene® 75S	0.25 lb. AI = 0.33 lb./acre; 0.5 lb. AI = 0.67 lb./acre; 0.75 to 1.0 lb. AI = 1.0 to 1.33 lbs./acre
carbaryl	
Sevin® 80S	0.5 lb. AI = 0.63 lb./acre; 1.0 lb. AI = 1.25 lbs./acre; 1.5 lbs. AI = 1.87 lbs./acre; 2.0 lbs. AI = 2.5 lbs./acre
Sevin® 50WP	0.5 lb. AI = 1.0 lb./acre; 1.0 lb. AI = 2.0 lbs./acre; 1.5 lbs. AI = 3.0 lbs./acre; 2.0 lbs. AI = 4.0 lbs./acre
Sevimol ® 4F and Sevin ® XLR Plus	0.5 lb. AI = 0.5 pt./acre; 1.0 lb. AI = 1.0 qt./acre; 1.5 lbs. AI = 1.5 qts./acre; 2.0 lbs. AI = 2.0 qts./acre
chlorpyrifos	
Lorsban® 4E	0.75 lb. AI = 1.5 lbs./acre; 1.0 lb. AI = 2.0 lbs./acre; 2.0 lbs. AI = 4.0 lbs./acre
Lorsban® 15G	5.7 lbs. AI = 38.0 lbs./acre
diazinon	
D•Z•N Diazinon® 50W	2.0 lbs. AI = 4.0 lbs./acre; 4.0 lbs. AI = 8.0 lbs./acre
D•Z•N Diazinon® 14G	2.0 lbs. AI = 14.3 lbs./acre; 4.0 lbs. AI = 28.6 lbs./acre
diflubenzuron	
Dimilin® 25W	0.03125 lb. AI = 2.0 oz./acre; 0.0625 lb. AI = 4.0 oz./acre
es-fenvalerate	
Asana® 1.9EC	0.0125-0.025 lb. AI = 0.85-1.7 fl. oz./acre; 0.025-0.05 lb. AI= 1.7-3.4 fl. oz./acre
fenvalerate	
Pydrin® 2.4EC	0.05 lb. AI = 2.67 fl. oz./acre; 0.1 lb. AI = 5.33 fl. oz./acre; 0.2 lb. AI = 10.7 fl. oz./acre
methomyl	
Lannate® L and Nudrin® 1.8	0.13 to 0.25 lb. AI = 0.58 to 1.2 pts./acre; 0.38 lb. AI = 1.7 pts./acre; 0.5 lb. AI = 2.2 pts./acre; 1.0 lb./acre = 4.4 pts./acre
Lannate® WSP and Nudrin® 90	0.13 to 0.25 lb. AI = 0.14 to 0.28 lb./acre; 0.38 lb. AI = 0.42 lb./acre; 0.5 lb. AI = 0.56 lb./acre; 1.0 lb. AI = 1.1 lbs./acre
Lannate® LV	0.13 to 0.25 lb. AI = 0.43 to 0.83 pt./acre; 0.38 lb. AI = 1.27 pts./acre; 0.5 lb. AI = 1.67 pts./acre; 1.0 lb. AI = 3.3 pts./acre
methyl parathion	
Methyl Parathion 4E and MP 4 EC	0.25 lb. AI = 0.5 pt./acre; 0.38 lb. AI = 0.76 pt./acre; 0.5 lb. AI = 1.0 pt./acre; 1.0 lb. AI = 2.0 pts./acre
Methyl Parathion 7.5	0.25 lb. AI = 0.27 pt./acre; 0.38 lb. AI = 0.41 pt./acre; 0.5 lb. AI = 0.53 pt./acre; 1.0 lb. AI = 1.1 pts./acre
Penncap-M	0.25 lb. AI = 1.0 pt./acre; 0.5 lb. AI = 2.0 pts./acre; 0.75 lb. AI = 3.0 pts./acre; 1.0 lb. AI = 4.0 pts./acre
parathion	
Clean Crop Parathion 4-EC	0.5 lb. AI = 1.0 pt./acre; 0.8 lb. AI = 1.6 pts./acre
Riverside Parathion 8, Clean Crop Parathion 8-F and Parathion 8-E	0.5 lb. AI = 8.0 fl. oz./acre; 0.8 lb. AI = 12.8 fl. oz./acre
permethrin	
Ambush® 25W and Pounce® 25WP	0.05 lb. AI = 3.2 oz./acre; 0.1 lb. AI = 6.4 oz./acre; 0.2 lb. AI = 12.8 oz./acre
Ambush ® and Pounce® 3.2EC	0.05 lb. AI = 2.0 fl. oz./acre; 0.1 lb. AI = 4.0 fl. oz./acre; 0.2 lb. AI = 8.0 fl. oz./acre
thiodicarb	
Larvin® 3.2	0.25-0.4 lb. AI = 10.0-16.0 fl. oz./acre; 0.45-0.75 lb. AI = 18.0-30.0 fl. oz./acre; 0.5-0.75 lb. AI = 20.0-30.0 fl. oz./acre
tralomethrin	
Scout®	0.014-0.016 lb. AI = 6.0-7.0 fl. oz./acre; 0.015-0.019 lb. AI = 6.4-8.0 fl. oz./acre

Additional Insecticide Products Registered For Use on Soybeans (Note: the information below is presented for completeness of available product information only. This listing does not constitute a recommendation for use of these products in Texas soybean production.)

aldicarb (Temik® 15G) — Labeled for thrips control and for threecornered alfalfa hopper suppression as an at-plant application by drilling granules 2 to 3 inches below seed line OR 2 to 3 inches to the side of the seed row, 2 to 3 inches deep, at a rate of 5.5 to 11 oz. per 1000 feet of row or 5 to 10 lbs. per acre (based on 36- inch row spacing). Granules can be applied in seed furrow if rate does not exceed 5 lbs. per acre.

azinphosmethyl (Guthion ®) — Labeled for bean leaf beetle, green cloverworm, leafminers, leaf rollers, stink bugs and velvetbean caterpillars. As a foliar application use Guthion 50WP at a rate of 3/4 to 1 lb. per acre or Guthion 2S or 2L at a rate of 1 1/2 to 2 pts. per acre in a minimum of 1 gal. water to give complete coverage. Do not apply within 45 days of harvest. For Guthion 2L, one or two applications of rates up to 2 pts. per acre may be made up to 14 days before harvest. Do not graze or feed treated vines to livestock.

carbofuran (Furadan® 4F) — Labeled for grasshopper control as a foliar application using ¼ to ½ pt. in 20 or more gals. of water per acre. Do not apply within 21 days of harvest and do not graze or feed foliar-treated forage to livestock or cut for silage or hay.

carbophenothion (Trithion ® 8-E) — Labeled for green cloverworm, green stink bug, serpentine leafminer and spider mites as a foliar application using 1/2 to 3/4 pt. (use 3/4 pt. for stink bug). Do not apply within 7 days of harvest. Do not feed treated forage to livestock.

chlorpyrifos (Lorsban® 15G) — Labeled for the control of cutworms and lesser cornstalk borers as an at-plant or postemergence band application at a rate of 4 to 8 oz. per 1000 linear row feet.

diazinon — D•Z•N® Diazinon 50W is labeled for cutworm (surface and subterranean) control as a broadcast application of 4 to 8 lbs. per acre or 1.5 to 3 oz. per 1000 square feet just prior to planting. D•Z•N Diazinon 14G is labeled for cutworm control as a broadcast application of 14 to 28 lbs. per acre just prior to planting, and for lesser cornstalk borers when applied at a rate of 7 to 14 lbs. per acre in a 10-inch band over the row at planting time or as crop emerges. D•Z•N Diazinon AG500 is labeled for cutworms as a broadcast application of 2 to 4 qts. per acre just prior to planting. Applications must be incorporated into the soil following application.

dimethoate (Cygon® 400) — Labeled for spider mites, bean leaf beetle, threecornered alfalfa hoppers and grasshoppers as a foliar application of 1 pt. per acre. Do not feed or graze within 5 days of last application.

malathion (Cythion® Malathion ULV Concentrate) — Labeled for grasshopper and green cloverworm control at a rate of 8 fl. oz. per acre, undiluted. Do not harvest or graze for 7 days following application.

permethrin plus methyl parathion (Pounce® Plus Methyl Parathion 2-5EC) — Labeled for control of cabbage looper, corn earworm, soybean looper, velvetbean caterpillar, bean leaf beetle, alfalfa looper and garden webworm at 6.4 to 12.8 fl. oz. per acre and for stink bug and threecornered alfalfa hopper at a rate of 12.8 fl. oz. per acre. This product is convenient when a complex of pests occurs that does not respond to the ingredients in this product applied separately. Application may be made with air or ground equipment. Use a minimum of 1 gal. of water per acre with aircraft or 5 gals. of water per acre with ground equipment. Do not make more than two applications per season. Do not apply within 40 days of harvest. Do not feed or graze soybean forage. Do not plant rotational crops within 60 days of last application.

phorate (Thimet® 15G and 20G) — Labeled for the early season control of thrips, mites and other insects as an at-plant application at a rate of 12 oz. (Thimet 15G) and 9.0 oz. (Thimet 20G) per 1000 feet of row.

POLICY STATEMENT FOR MAKING CHEMICAL CONTROL SUGGESTIONS

The information and suggestions included in this publication reflect the opinions of Extension entomologists based on field tests and use experience. Our management suggestions are a product of research and are believed to be reliable. However, it is impossible to eliminate all risk. Conditions or circumstances which are unforeseen or unexpected may result in less than satisfactory results even when these suggestions are used. The Texas Agricultural Extension Service will not assume responsibility for risks. Such risks shall be assumed by the user of this publication.

Suggested pesticides must be registered and labeled for use by the Environmental Protection Agency and the Texas Department of Agriculture. The status of pesticide label clearances is subject to change and may have changed since this publication was printed. County Extension agents and appropriate specialists are advised of changes as they occur.

The USER is always responsible for the effects of pesticide residues on his livestock and crops, as well as for problems that could arise from drift or movement of the pesticides from his property to that of others. **Always read and follow carefully the instructions on the product label.**

The information given herein is for educational purposes only. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the Cooperative Extension Service is implied.

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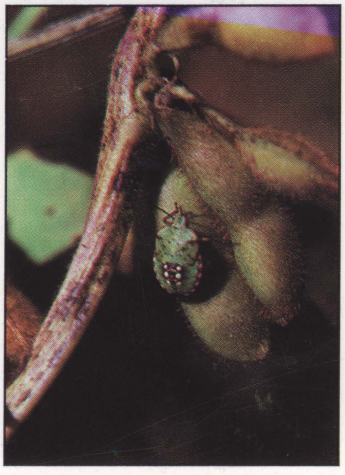


Top to bottom:

Soybean looper
Beet armyworm
Banded cucumber beetle

Green cloverworm
Threecornered alfalfa hopper—nymph
Southern green stink bug—nymph

Velvetbean caterpillar
Soybean stem borer
Southern green stink bug—adult

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