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EC92-1509-D Insect Management Guide for Nebraska Corn and Sorghum

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INSECT MANAGEMENT GUIDE

for Nebraska Corn and Sorghum

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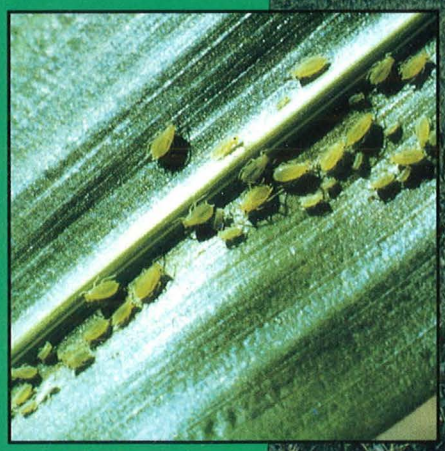

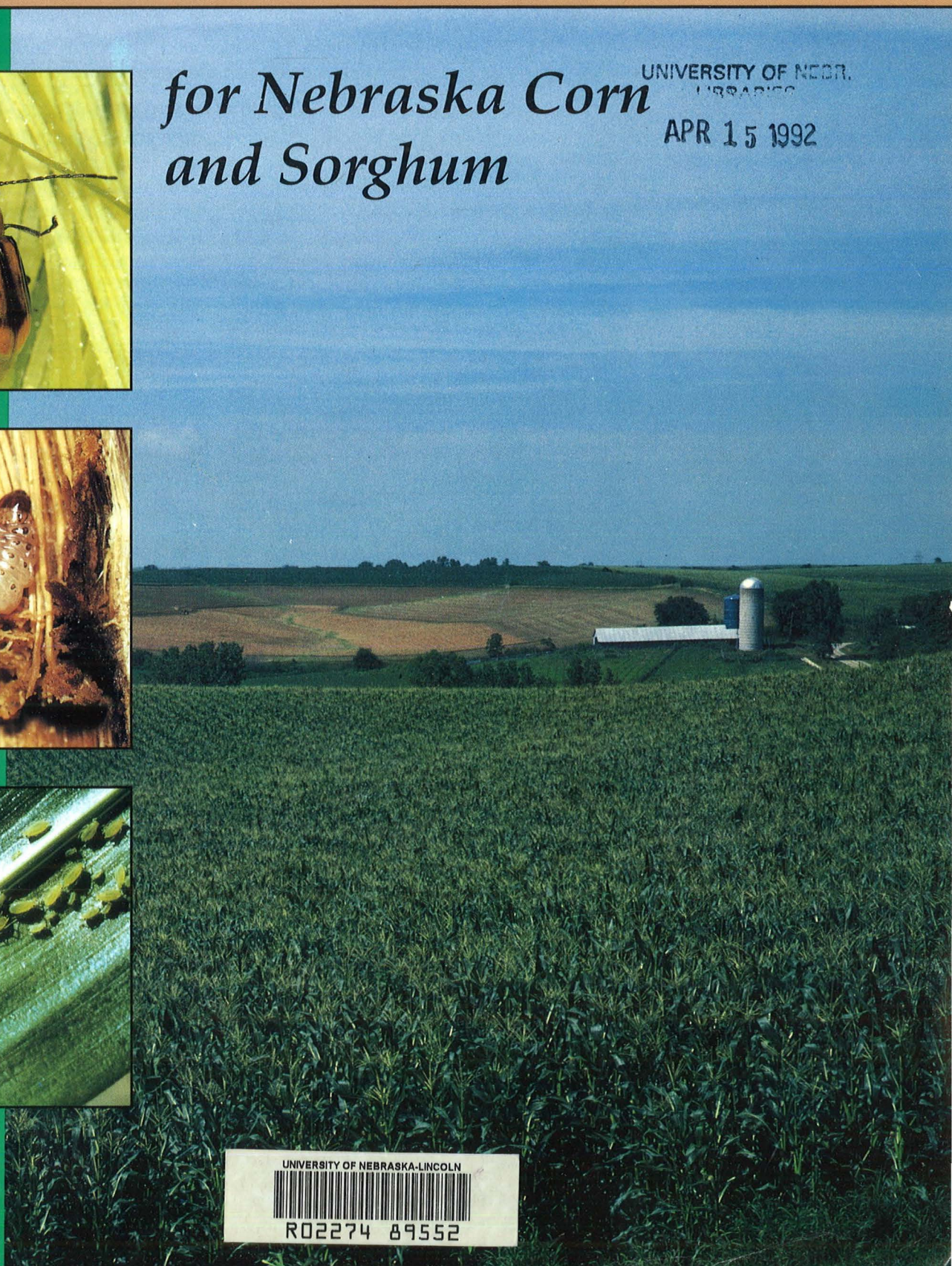

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Insect Management Guide for Nebraska Corn and Sorghum

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On the cover

Corn and sorghum insects pictured, from the top down: European corn borer larva in corn, greenbugs in sorghum and the western corn rootworm beetle.

General guidelines

Insect management suggestions in this circular are based on University of Nebraska research, data from surrounding states, USDA recommendations, previous experience, and label registrations. These suggestions are designed to guide Nebraska farmers when they select an insect management program. Extension NebGuides and other publications containing additional information on insect identification, damage, and life cycles are referenced under insect headings and are available by mail order or from local Cooperative Extension Offices. (For more information write: Bulletins, 104 ACB, P.O. Box 830918, University of Nebraska, Lincoln, NE 68583-0918.)

There are several approaches to managing insect pests in Nebraska. These include the use of cultural practices, resistant varieties, biological control, and/or insecticides. Before choosing a treatment, consider all appropriate management strategies. If insecticide use is indicated, consider the efficacy against the target pest or pest combination, label restrictions, pesticide formulation, cost, safety to non-target species (including humans), environmental conditions at the time of application, and other factors.

The user is responsible for the effects of pesticide residues on crops and livestock, as well as pesticide drift and contamination.

This publication does not supersede label information. Always read and carefully follow the instructions on the container label. For current information, contact your local Cooperative Extension Office.

The use of trade names in this circular is not an endorsement by Nebraska Cooperative Extension.

Toxicity of insecticides

All insecticides are poisonous and must be used with caution. Always store them in their original containers out of the reach of children, unauthorized personnel, and livestock. A skull and crossbones and the words *Danger/Poison* appear in red on the label of highly toxic materials and require special handling. Liquid formulations of these products are recommended only for use by commercial applicators. Granular formulations of these chemicals can be applied safely and effectively when proper precautions are followed as indicated on the label. Moderate and low toxicity pesticides are marked with the signal words *Warning* and *Caution,* respectively.

For more information on this subject, refer to Extension NebGuides G85-758, G84-715, G79-460, G79-472, G79-473, and G79-479.

(R) Restricted Use (R)

Several insecticides listed in this circular are classified ***Restricted Use*** by the Environmental Protection Agency. These compounds are marked with the symbol **(R)**. Pesticides may be classified as ***Restricted Use*** based on their persistence, toxicity, or potential environmental hazards. To use these products, EPA certification is required. A valid certification card must be presented to your dealer when buying these chemicals.

Your local Cooperative Extension office will have a list of the dates and locations of certification training. Remember that the status of a formulation can change at any time. When buying a pesticide, ask the dealer if the attached label is current.

Important

Subscribe to the University of Nebraska-Lincoln ***Insect Science, Plant Disease, and Weed Science News*** for the latest pest management information, changes in pesticide registrations, and updates on the current status of insect pests. An order blank is on page 23.

Management decision guidelines/ economic thresholds

Economic thresholds are flexible guidelines. They indicate the level of insect abundance or damage that can be tolerated before taking action. **They are not hard rules that apply to every situation.** Used conscientiously, they should be helpful in making management decisions. Many variables can affect your decision including insect abundance, anticipated value, relative effectiveness of controls, and pesticide plus application costs.

Timing and accuracy of application, as well as the effects of weather, also determine the ultimate degree of control.

Seed treatments

Damage to corn and sorghum seed by soil-dwelling, seed-feeding insects is often intensified by prolonged periods of cool, moist weather after planting or other conditions which delay germination. In Nebraska, the major seed-feeding insects are wireworms, seedcorn maggots and seedcorn beetles. Once planted, little can be done to protect seed from these insects. Probably the most effective way of reducing injury by seed-feeding insects is with an approved planter-box seed treatment containing diazinon (corn only) and/or lindane prior to planting. **These treatments are suggested for all corn and sorghum in Nebraska.** In fields with a history of serious seed-feeding insect problems or in situations where stands have been seriously reduced and replanting is the only feasible recourse, consider a seed treatment plus an in-furrow application with an approved soil insecticide. *(For more information on this subject, refer to Extension NebGuide G91-1023.)*

NOTE: Agricultural seed is often treated with an insecticide such as malathion to protect against damage from stored grain pests. These treatments will **not** provide protection against seed-feeding soil insects.

Insecticide performance

When pest problems exist or are anticipated, select an appropriate management strategy. If pesticides are indicated:

1) Select the proper insecticide/miticide.
2) Read, understand, and follow label directions.
3) Calibrate application equipment for each use.
4) Document application rates and keep accurate records.
5) Leave untreated check strips.
6) Continue scouting on a regular basis to determine pest abundance and also to evaluate product performance.

Insecticides can provide less than satisfactory control for a variety of reasons, including: 1) unusually high insect infestations, 2) inaccurate calibration, 3) improper placement and incorporation, 4) poor timing, 5) inappropriate product selection (low toxicity to target pest), 6) high soil or water pH, 7) pest resistance to insecticide, 8) enhanced microbial breakdown, 9) weather factors (excess rain, wind, drought, temperature), and 10) other environmental conditions.

If you suspect a problem with insecticide performance:

1) Compare treated areas of field to untreated check strips.
2) Reread product label for warranties, guarantees, and claims.
3) Consult an Extension agent or other pest management specialist and, if appropriate, contact your pesticide dealer and/or pesticide company representative as soon as possible.
4) Be prepared to document suspected loss.

When one product fails in a field while another product provides control, the manufacturer may have a responsibility to the grower. This could include replacement of the product, and/or compensation for lost yield.

Protect honeybees

Honeybees collect nectar and/or pollen wherever they can, including field crops such as corn, sorghum, soybeans and alfalfa. If bee colonies are nearby or bees are foraging in fields sprayed during flowering (pollen-shed stage for corn and sorghum), they may be killed in substantial numbers.

To avoid injury to important pollinators observe the following precautions: 1) treat only if insect pests reach economic levels; 2) if possible, do not treat crops that are in bloom; 3) never directly spray honeybee colonies; 4) check the crop for heavy concentrations of flowering weeds and avoid spraying these areas; 5) treat only those parts of fields that have significant pest infestations; 6) when possible, select an insecticide that has a lower toxicity to bees; 7) make applications very early in the morning or later in the evening when bees are not actively foraging; and 8) properly dispose of unused pesticides.

Beekeepers often will relocate bees from areas to be treated if given sufficient prior notice.

Sprayed by mistake?

Gardens, particularly plantings of sweet corn, often are placed in or adjacent to crop fields that may be sprayed with an insecticide. The produce is safe to eat if the insecticide is registered for use on the vegetable or fruit and the specified waiting period has elapsed.

We do not suggest using vegetables or fruit that have been treated with a pesticide which is not labeled for that commodity. The table on page 4 shows some selected preharvest intervals (waiting periods). Check appropriate labels for any others.

If you have questions regarding accidental applications, determine the specific pesticide formulation used, the application rate, and time of spraying. Then, by checking the pesticide label, an informed decision can be made concerning use of the crop.

Container disposal

Proper disposal of insecticide containers is important. Serious accidents have occurred when "empty" containers have not been disposed of safely. Following are suggested disposal methods:

Paper bags: Be certain all contents have been emptied into applicators or tanks. Burn paper containers in open fields where: 1) regard is given to wind direction in relation to people, domestic animals, and water supplies; 2) such burning does not violate federal, state or local ordinances; and 3) provisions are made to avoid contamination of surface water.

Metal, glass, or plastic containers: Thoroughly rinse containers at least three times with water and dump rinse material into tanks to be used with regular applications. Where possible, recycle five-gallon or larger metal drums after completely rinsing. Containers that cannot be recycled should be punctured, crushed, and buried in a landfill or 24 inches below the soil surface where they will not contaminate water, crops, man, or animals.

Abbreviations

AI/A — Active ingredient per acre
E — Emulsifiable
EC — Emulsifiable concentrate
ES — Emulsifiable suspension
F — Flowable
Form — Formulation
G — Granular
GPA — Gallons per acre
lb — Pound
L — Liquid
LC — Liquid concentrate
LS — Liquid solution
oz — Ounce
(R) — Restricted Use
S — Soluble
SC — Spray concentrate
SP— Soluble powder
WP — Wettable powder

Who to call

Use the following telephone numbers in case of emergency:

Poison Control Center — Children's Memorial Hospital (Omaha) ..... **(800) 955-9119**

CHEMTREC — Pesticide Emergency Network ..... **(800) 424-9300**

EPA — Environmental Protection Agency
- Lincoln ..... **(402) 471-5080**
- Kansas City, KS ..... **(913) 236-2800**

Nebraska Department of Environmental Control (DEC) ..... **(402) 471-2186**

Nebraska State Patrol ..... **(800) 525-5555**

Nebraska Department of Agriculture — Bureau of Plant Industry ..... **(402) 471-2341**

Nebraska Natural Resources Commission ..... **(402) 471-2081**

Minimum number of days between application and harvest for some selected crops

	Apple	Cabbage	Cucumbers	Green Beans	Leaf Lettuce	Peppers	Sweet Corn	Tomatoes
(R) *Ambush 2E, 25W*	***	1	0	NR	1	3	1	NR
(R) *Asana XL*	21	3	3	3	NR	7	1	1
Comite 6.5 EC	NR	NR	NR	NR	NR	NR	NR	NR
Cygon 400	28	3	NR	0	14	0	NR	7
Dipel 2X, ES, 10G	0	0	0	0	0	0	0	0
(R) *Di-Syston 8EC*	NR	42	NR	60	*	NR	NR	30
(R) *Di-Syston 15G*	NR	42	NR	60	*	*	NR	NR
(R) *Dyfonate 4EC*	NR	*	NR	*	NR	*	*	NR
(R) *Dyfonate II 20G*	NR	*	NR	NR	NR	NR	30	NR
(R) *Dylox 80SP*	NR	NR	NR	NR	NR	NR	0	21
(R) *Furadan 4F*	NR	NR	NR	NR	NR	NR	14	NR
(R) *Guthion 3F*	7	NR	NR	NR	NR	NR	NR	NR
Imidan 50WP	7	NR	NR	NR	NR	NR	14	NR
(R) *Lannate 1.8L*	8	1	1-3	1-3	NR	3	0	1
Lorsban 4E	NR	*	NR	NR	NR	NR	35	NR
Malathion EC, Cythion 57EC	3	7	1	1	14	3	5	1
(R) *Metaxystox-R 2SC*	NR	7	**	21	NR	**	7-21	NR
(R) *Parathion 8E (ethyl)*	NR	NR	NR	NR	NR	NR	12	NR
Penncap-M	14	21	NR	3	NR	NR	3	15
(R) *Pounce 3.2EC*	***	1	0	NR	1	3	1	NR
Sevin 80S, XLR Plus	1	3	0	0	14	0	0	0

NR = Not Registered
* = At or prior to planting time application only
** = Registered, preharvest interval not indicated on label
*** = Do not apply after petal fall

Some field re-entry periods

Most labels indicate the re-entry period as a minimum time period that must elapse before entering the treated area, unless the worker wears protective clothing. Follow label directions and do not enter fields after treatment until the re-entry period has passed.

(R) *Ambush 2E, 25W* — When spray is dry
(R) *Asana XL* — When spray is dry
Comite 6.5EC — When spray is dry
(R) *Counter 15G* — After treatment completed
Cygon 400 — 4 days
Dipel 2X ES, 10G — When dust settles or spray is dry
(R) *Di-Syston 8EC, 15G* — 24 hrs
(R) *Dyfonate 4EC* — 24 hrs, 48 hrs (sorghum)
(R) *Dyfonate II 20G* — 96 hrs (foliar)
— 24 hrs (soil)
4 EC — 24 hrs
Dylox 80SP — 24 hrs
(R) *Force 1.5G* — None stated on label
(R) *Furadan 15G, 4F* — 24 hrs (limited activity in fields)
— 14 days (prolonged activity in fields)
(R) *Guthion 3F* — 24 hrs
Imidan 50WP — 24 hrs
(R) *Lannate 1.8L* — When spray is dry
Larvin 3.2F — When spray is dry
Lorsban 4E — 24 hrs
15G — None stated on label
Malathion EC — When spray is dry
(R) *Metasystox-R 2E* — 48 hrs
(R) *Parathion (ethyl and methyl)* — 48 hrs
(R) *Penncap-M* — 48 hrs
(R) *Pounce 3.2EC* — When spray is dry
(R) *Pydrin 2.4EC* — When spray is dry
Sevin, all formulations — When spray is dry
(R) *Thimet 20G* — 48 hrs

Corn insects below ground

Corn rootworm larvae

Damage by corn rootworm larvae is most likely to occur in continuous corn fields. However, it has been estimated that more than 60 percent of Nebraska's continuous corn fields do not have economic corn rootworm infestations in a given year. Data from regular field scouting are essential to determine the potential for damage the next year.

For more information on this subject, refer to Extension NebGuides G87-839, G82-597, G76-283, and G86-774, and North Central Regional Publication (RP) 98.

Corn should be scouted weekly from July through early September or until the threshold is exceeded. If on any scouting date during the egg-laying period, counts indicate more than 18,000 beetles per acre (this is an average of 0.75 beetles per plant, based on a plant population of 24,000 plants per acre), consider rotation or use of a soil insecticide as a precautionary measure the next spring. Beetle thresholds (expressed as number per plant) will vary with plant population (*see NebGuide G86-774*).

It is not possible to make an informed decision regarding management of corn rootworm larvae in continuous corn if you do not have scouting data from the previous season for the full beetle activity period.

First year corn is unlikely to benefit from soil insecticide applications in most situations. Crop rotation is at least 98 percent effective in protecting fields from economic levels of corn rootworms. Treatment of first year corn should be considered only if corn follows oat stubble, or soybean fields heavily infested with volunteer corn or weeds. In a very small percentage of fields following soybeans or other rotations, northern corn rootworm larvae may damage first year corn. This is because a certain percentage of the eggs may hatch two years after being laid — a phenomenon referred to as *extended diapause*. These fields cannot be identified with certainty, but tend to occur in localized areas. Growers in areas where extended diapause has been a problem must base their treatment decision on the presence of past rootworm problems in their fields and their neighbors' fields. In this regard, extended rotations (i.e. more than two years) are encouraged if practical.

The effectiveness of soil insecticides can be reduced if the soil remains dry after application, if excessive rainfall occurs, if soils are highly alkaline, or if insecticides are applied at planting time on early planted corn. Insecticide performance is more reliable if an insecticide is applied at cultivation time in late May or early June, especially if corn was planted before May 15. Cultivation treatment is particularly desirable if soil is alkaline (high pH accelerates decomposition of some insecticides) or if the field has developed a history of poor root protection when insecticides have been applied at planting.

Corn rootworm larva

Many insecticide performance failures can be traced to poor calibration of granular applicators. In many cases, amounts used are below those recommended on the label. Remember that label recommendations for pounds/acre are based on 40-inch row spacings. If corn is planted in rows narrower than 40 inches, there are more linear feet of row per acre, which requires more insecticide per acre to obtain the proper rate. By calibrating applicators to deliver the suggested amount of granules per 1,000 feet of row, the amount will be correct regardless of row spacing. Refer to the table in NebGuide G76-283, *Rootworm Insecticide Rate Conversion*, when planning insecticide purchases and calibrating sprayers.

Soil conditions and type of planting equipment can greatly affect the placement of soil insecticides, which is an important factor in rootworm management. Soil insecticides are more effective if lightly covered with soil during application. Granules or liquids remaining on the surface may rapidly volatilize or break down, which can result in poor performance. Also, leaving insecticide on the soil surface may increase the chances of environmental contamination and the poisoning of nontarget organisms.

Fertilizer combined with a soil insecticide should be applied in bands on both sides of the seed furrow at seed level. Certain insecticides (e.g. Thimet 20G, Dyfonate 20G, Mocap

10G, Broot 15GX, and all liquid formulations) should not be allowed to enter the seed furrow, or stand reduction may occur. If soil is moist, rough, or cloddy and the furrow fails to close properly, the possibility of phytotoxicity is increased. In-furrow applications of Counter 15G, Furadan 15G and Force 1.5G and T-band applications of Lorsban 15G can be used without stand reduction.

Regardless of material or placement, some feeding on roots will occur, and some larvae will survive to adulthood. Extensive adult emergence does not necessarily indicate that the insecticide did not perform adequately.

Reducing damage from corn rootworm larvae

A. Rotating corn with other crops is the best control method.

B. If corn is planted before May 15 (this date will vary depending on rootworm egg hatch), apply one of the granular insecticides as early as possible at cultivation time, but usually no later than June 10. Lightly cover with soil at the base of plants. If planting time application is used on early-planted corn, Counter 15G, Dyfonate 20G, Force 1.5G, Furadan 15G (if not on Furadan history fields) and Lorsban 15G are more likely to provide longer lasting protection than other products.

NOTE: Soil insecticide performance should be evaluated annually by comparing corn root ratings in treated and untreated areas. Use of the same corn rootworm soil insecticide in continuous corn over several consecutive years in the same field has generally been successful in Nebraska. In a few fields, however, poor and/or erratic performance has occurred. While many of these failures can be attributed to application problems, planting dates, calibration errors, or environmental factors, some may have resulted from continuous use of the same soil insecticide.

If problems have occurred with planting time applications, consider using a cultivation application or rotating to another crop. When there is no alternative to planting time application in continuous corn, consider the following suggestions:

1. If rootworm protection has been poor after use of a carbamate insecticide (Furadan and Broot), switch to an organophosphate (Counter, Dyfonate, Lorsban, Mocap or Thimet) or pyrethroid (Force) the following season.

2. If poor performance has resulted after use of an organophosphate insecticide, consider switching to a carbamate, a pyrethroid, or another organophosphate insecticide.

These two suggestions are offered as precautionary measures. The extent of the problem associated with continuous use of the same insecticide remains unclear. Just how many years it takes a soil to develop a problem or to "recover" is unknown.

For results of annual rootworm insecticide evaluations conducted by entomologists at the University of Nebraska-Lincoln, refer to the UNL *Insect Science, Plant Disease and Weed Science News* (see order form on page 23) or contact your local Nebraska Cooperative Extension office.

C. When planting after May 15, apply a granular insecticide at planting and cover with soil. If corn is listed, apply at cultivation time regardless of planting date.

D. Rescue or "Last Resort" Treatment. After about June 10 (or earlier depending on timing of egg hatch), rescue treatment at lay-by time can be made by applying any of the recommended cultivation-time materials to the soil at the base of plants. Cover the insecticide with 1-2 inches of soil. This treatment will not guarantee root protection because the insecticide will not thoroughly penetrate the soil. It may help reduce further root damage by establishing a barrier between the rootworms and developing roots. If applications are made by aircraft, use granules, cultivate into rows immediately, and irrigate if possible. Considerable variation in insecticide performance has occurred where broadcast applications have not been incorporated into the soil.

Suggested treatments for protecting corn roots from corn rootworm larvae

	Insecticide	Amount formulation per 1,000 row feet	Restrictions and comments
	carbofuran (Furadan 15G)	8.0 oz	Field and popcorn. Planting (banded or in-furrow), cultivation — over plants or basal.
(R)	*(Furadan 4F)*	2.5 fl. oz	Field and popcorn. Suggest application over plants or basal at cultivation.
	chlorpyrifos (Lorsban 15G)	8.0 oz	Field and popcorn. Planting, cultivation over plants or basal.
	(Lorsban 4E)	2.45 fl. oz	Field corn and popcorn. Cultivation. Basal only.
	(Lorsban 4E)	2.0 - 3.0 pt**	Apply through sprinkler irrigation systems with enough water to wet the root zone to depth that root protection is needed. Timing should coincide with appearance of second instar larvae.
(R)	*ethoprop (Mocap 15G)*	12.0 oz	Field and sweet corn. Planting, cultivation basal only.*
(R)	*fonofos (Dyfonate II 20G)*	6.0 oz	Field corn and popcorn. Planting, cultivation — over plants or basal. Refer to label for application instructions. T-band — Do not apply in-furrow.*
(R)	*phorate (Thimet 20G)*	6.0 oz	Field corn. Planting, cultivation — over plants or basal.*
(R)	*terbufos (Counter 15G)*	8.0 oz	Field corn and popcorn. Planting (banded or in-furrow), cultivation — basal or over plants.
(R)	*(Counter 20CR)*	6.0 oz	Same as Counter 15G.
(R)	*tefluthrin (Force 1.5G)*	8.0 - 10.0 oz	Field, popcorn and seedcorn. At planting, in-furrow, banded or T-band. Apply in-furrow only on no-till corn. Do not rotate to crops other than corn or soybean. Soybeans may be planted 12 months after Force application.
	trimethacarb (Broot 15GX)	8.0 oz	Field corn and popcorn. Planting*, cultivation. Do not harvest within 90 days of application.

* Do not allow insecticide to enter the seed furrow, as stand reduction may occur. Dyfonate 20G can be applied as a T-band, thus, some granules may fall into seed furrow without injury.

** Rate is formulation per acre.

Cutworms

Black cutworm larva

Soil cutworms are most likely to damage corn following sod, pasture, alfalfa, soybeans or small grains. Fields with heavy crop or weed residues or with heavy, early season weed growth also are more susceptible to cutworm infestations. Early detection is essential. Treatment is suggested when one plant out of 20 (5 percent) is damaged by cutworms.

If the soil surface is dry or crusted, rotary hoeing immediately before or after application may improve control. Pyrethroids (Ambush, Asana, Pounce, Pydrin) should not be incorporated. Generally, cutworms are best controlled by rescue treatments applied after the plants are up and early damage signs are detected. Preventive treatments applied at or before planting have generally given erratic control, especially where cutworm numbers have been high.

For more information on this subject, refer to Extension NebGuide G80-501 and RP 98.

Controlling soil cutworms in corn

Rates are active ingredient per acre.

	*chlorpyrifos (Lorsban 4E)**	1.0-1.5 lb
(R)	*esfenvalerate (Asana 1.9EC) (Asana XL) **	0.025-0.05 lb
(R)	*fenvalerate (Pydrin 2.4EC)**	0.1-0.2 lb
(R)	*permethrin (Ambush 2E)* (Pounce 3.2EC*, 1.5G)*	0.1-0.2 lb

*May be applied through overhead sprinkler irrigation system.

White grubs

White grub larva

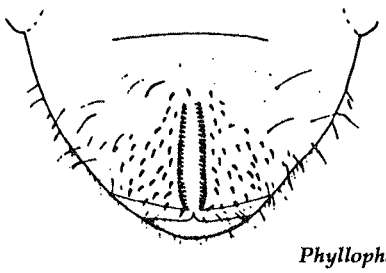
First year corn following small grains, pasture or sod, as well as eco-fallow or early-planted fields are most likely to be damaged by white grubs.

Two white grubs (*Phyllophaga* and *Cyclocephala* spp.) are commonly found in Nebraska. *Cyclocephala* (or annual white grubs) have one generation per year and rarely damage field crops. Grubs stop feeding and pupate in mid to late May. *Phyllophaga* (or three-year grubs) may damage field crops if abundant. They commonly complete their life cycle over a three-year period, and thus will feed over the summer following egg hatch and through the next growing season.

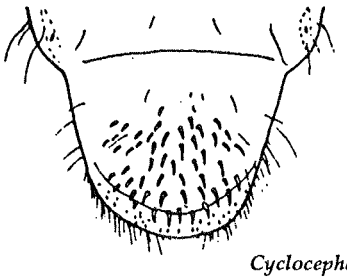
You must examine the underside of the last segment to identify white grubs. The pattern of hairs and spines is different for the two white grubs *(see illustration).*

There is no effective way to control white grubs after fields have been planted. Soil insecticides may be useful in fields that need to be replanted because of *Phyllophaga* grubs, or if large numbers of *Phyllophaga* grubs are observed while preparing fields for planting corn.

For more information on this subject, refer to Extension NebGuide G91-1023.



Phyllophaga



Cyclocephala

Examine the underside of the last segment of the white grub to correctly identify it.

Suggestions for controlling white grubs in corn

	Insecticide	Amount formulation per 1,000 row feet	Restrictions and comments
	chlorpyrifos (Lorsban 15G)	8.0-16.0 oz	In-furrow or T-Band, 8 oz rate, in furrow only.
		13.5 lb*	Preplant broadcast incorporated.
	(Lorsban 4E)	4.0 pt*	Preplant broadcast incorporated.
(R)	*fonofos* (Dyfonate II 20G)	6.0 oz	For suppression of white grubs, T-band.
(R)	*phorate* (Thimet 20G)	6.0 oz	7-inch band over row in front of or behind press wheel.
(R)	*phorate + flucythrinate* (Aastar 15G)	8.0 oz	6-8 inch band over the row behind or in front of press wheel.
(R)	*terbufos* (Counter 15G)	8.0 oz	Apply in a 7-inch band at either rate, or in-furrow at planting time at lower rate ony.
(R)	(Counter 20CR)	6.0 oz	Apply in a 7-inch band, or in-furrow at planting time.
(R)	*tefluthrin* (Force 1.5G)	8-10 oz	Apply banded or in-furrow at planting, for suppression only.

*Rate is formulation per acre.

Wireworms and seed-destroying insects

First year corn following small grains, pasture or sod, as well as eco-fallow and early-planted fields are most likely to be damaged by seed-feeding insects. Seed-destroying insects also are sometimes a problem where seeds do not germinate rapidly (e.g., cold, damp, or dry soils).

Wireworm beetles are attracted to grasses to deposit eggs. Wireworms have long life cycles, therefore fields damaged one year are likely to be damaged in subsequent seasons.

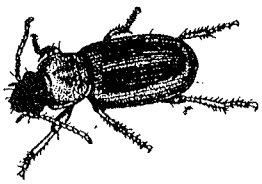
Planter box seed treatments of lindane and/or diazinon (see labels for rates and restrictions) are suggested for all corn fields in Nebraska. Where serious wireworm problems are anticipated (e.g. in fields with history of damage, or if wireworms are seen during field preparation), use an in-furrow application of soil insecticide plus a planter box seed treatment.

For more information on this subject, refer to Extension NebGuide G91-1023 and RP 98.

Wireworm

Suggestions for controlling heavy infestations of wireworms, seedcorn maggots, and seedcorn beetles in field corn

	Insecticide	Rates, restrictions and comments
(R)	*carbofuran* (Furadan 15G)	8.0-16.0 oz form per 1,000 feet of row in seed furrow for wireworms and seed corn maggots
(R)	*terbufos* (Counter 15G)	8.0 oz form per 1,000 feet of row in seed furrow for maggots, wireworms, seed corn beetles.
(R)	(Counter 20CR)	6.0 oz form per 1,000 feet of row in seed furrow for maggots, wireworms, and seed corn beetles.



Seed corn beetle

Corn insects above ground

Armyworms

Armyworm

Control when migration from adjacent grassy areas, pastures or fields is sufficient to damage margin rows of corn, or when infestations are causing the loss of two lower leaves before full dent stage. Armyworms hide under dirt clods or surface debris by day and feed by night. Applications are likely to be most effective when applied in evening or early morning.

For more information on this subject, refer to Extension NebGuides G82-613 and G82-615 and RP 98.

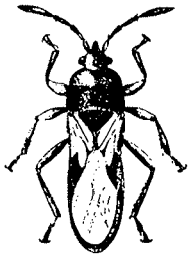
Suggested treatments for controlling armyworms in corn

Rates are active ingredient per acre.

	carbaryl (Sevin 80S, XLR Plus)	1.5 lb
	chlorpyrifos (Lorsban 4E)	0.5-1.0 lb
(R)	*ethyl parathion*	0.5 lb
(R)	*esfenvalerate (Asana 1.9EC)*	0.025-0.05 lb
(R)	*fenvalerate (Pydrin 2.4EC)*	0.1-0.2 lb
	malathion 57EC	1.25 lb
(R)	*methomyl (Lannate 1.8L)*	0.45 lb
(R)	*methyl parathion (Penncap-M)*	0.5-0.75 lb
(R)	*permethrin (Ambush 2E, 25W, Pounce 25WP, 3.2EC)**	0.1-0.2 lb

* Use prior to brown silk stage

Chinch Bugs



Chinch bug

Preventing chinch bug damage by cultural practices is more reliable than chemical controls. If chinch bugs were a problem the previous year, do not plant corn into wheat stubble or adjacent to wheat fields. Use drop pipes from sprayer booms so spray is directed onto the lower stalks and soil around the plants. Broadcast sprays over plants are not effective.

Insecticides generally will not be effective more than four to seven days. If migrations of first generation chinch bugs from adjacent wheat fields are heavy, multiple applications will be necessary. When heavy infestations are present, chemical control may not be satisfactory.

For more information on this subject, refer to Extension NebGuide G86-806, and RP 98.

Suggested treatments for controlling chinch bugs in corn

Rates are active ingredient per acre unless otherwise noted.

	Insecticide	Rate	Restrictions and comments
	carbaryl (Sevin 80S, XLR Plus, 4-Oil)	2.0 lb	Apply as a directed spray with at least 40 gallons of water per acre.
(R)	*carbofuran (Furadan 15G)*	8.0 oz form*	Apply granules in-furrow at planting.
(R)	*phorate (Thimet 20G)*	6.0 oz form*	Apply granules at time of cultivation in a band over or at the base of plants just ahead of cultivator shovels so granules are covered with soil as for corn rootworm control. One application per season. Do not graze or cut for forage within 30 days of treatment.

* Amount of formulation per 1,000 row feet.

Corn rootworm adults

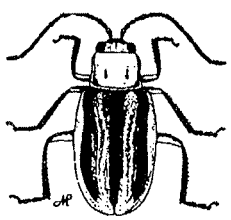
Control to reduce larvae the next year

Controlling rootworm adults (beetles) to reduce the number of larvae the next season may not be as reliable as soil insecticides because precise timing of control is essential. If this method is used, it should be under the supervision of trained pest management personnel. To have a reasonable chance of success, weekly scouting should begin in early July. Control should be applied when there are 18,000 beetles per acre (0.75 beetles per plant, based on a plant population of 24,000 plants per acre) and 10 percent of the females have mature eggs.

Note that strict use of calendar dates in timing of treatment is not suggested since there may be as much as three weeks variation in optimum treatment timing from year to year. When beetle numbers first reach or exceed the above threshold, apply a longer-lasting, residual insecticide such as Sevin 4-Oil. Residual activity is reduced by overhead irrigation or rainfall after application. If beetles reinfest the field, make a second application when population levels reach 0.5 beetle per plant. The cost of two or more treatments may exceed that of a single soil treatment applied at planting or first cultivation the following spring.

It is not possible to make an informed decision regarding management of corn rootworm larvae in continuous corn, if you do not have scouting data from the previous season for the full beetle activity period. It should be noted that many fields never develop a rootworm problem during a given year.

For more information on this subject, refer to Extension NebGuides G82-613 and G87-839, and North Central Regional publication (RP) 98.



Western corn rootworm beetle

Control to reduce silk clipping

Corn rootworm beetles occasionally interfere with pollination if there are sufficient numbers to keep silks severely clipped during the pollen-shedding period. Controls are indicated only when severe silk clipping (silks chewed to within 1/2 inch of husks) is occurring at 25-50 percent pollen-shed. In an average year, few fields will need to be sprayed to prevent severe silk clipping. Beetles are most likely to cause a problem in late-planted or late-silking fields and where water stress delays or reduces silking. Silk clipping after pollination causes no problems.

For more information on this subject, refer to Extension NebGuides G86-774 and G87-839, and North Central Regional publication (RP) 98.

Spraying pollinating corn can be extremely hazardous to bees. Coordinate activities with local beekeepers before applying insecticides.

Registered products to control corn rootworm adults in corn

Rates are active ingredient per acre.

	carbaryl (Sevin 80S, XLR Plus; Sevin 4-Oil)	1.0 lb
(R)	*carbofuran (Furadan 4F)*	0.125-0.25 lb
	chlorpyrifos (Lorsban 4E)	0.5-1.0 lb
	dimethoate (Cygon 400)	0.5 lb
(R)	*disulfoton (Di-Syston 8EC)*	0.25 lb
(R)	*EPN (4EC, 5EC)*	0.5 lb
(R)	*esfenvalerate (Asana 1.9EC)*	0.025-0.05 lb
(R)	*fenvalerate (Pydrin 2.4EC)*	0.15-0.2 lb
	malathion (57EC)	1.0 lb
	malathion (ULV 9.33)	0.3 lb
(R)	*methyl parathion (Penncap-M)*	0.25-0.50 lb
(R)	*parathion (ethyl or methyl)*	0.25 lb
(R)	*permethrin (Ambush 2E, Pounce 3.2EC)**	0.1-0.2 lb
	phosmet (Imidan 50WP)	0.25-0.5 lb

*Use prior to brown silk stage. Consult the label for details.

European corn borer larva

European corn borers

The decision to treat for European corn borer is a complex one affected by many variables, such as weather, plant maturity, borer survival and development, anticipated corn prices, insecticide efficacy, and costs versus anticipated returns. However, enough is known about these variables to help growers make intelligent assessments as to the need for control of each of our two annual generations.

First generation

European corn borer moths prefer the tallest plants for egg laying. Therefore, expect initial concentrations of egg-laying moths in those fields where the corn plants are taller than those in surrounding fields. If most fields are about the same height, moths may disperse evenly throughout them. Even late-planted corn can become infested if rapid growth makes fields attractive late in the borer moth flight period. Therefore, plan to scout all corn fields for at least three to four weeks after peak moth flight, usually between early June and early July. Also, some varieties of corn are more susceptible than others. Consider locally adapted varieties that produce well and have some resistance to the borer.

Begin routine scouting during the moth flight, egg-laying and early hatching period. To determine the need to treat for first generation borer, examine at least 25 corn whorls at each of four locations in each field. Record the percent of total plant whorls infested. To calculate the average number of borers per infested whorl, unroll several whorls at each site and record the number of live worms present. Enter these numbers into the following worksheet. This will give you an estimate of the **maximum** number of borers that might survive to produce tunnels in the plant. Remember that mortality of young borers is normally high, therefore, if you make a treatment decision when most borers are small, your scouting figures may overestimate the final borer population. It may be better to delay your treatment decision until just before borers leave whorls and enter stalks.

Caution: Borers which have left the whorl and entered the stalk cannot be controlled. If most have left the whorl, it is too late to attempt control. Be certain to sample enough plants at enough locations to ensure that estimates are typical of the field. Twenty-five plants in four locations in each field is a **minimum sample.**

To make a decision on first generation European corn borer treatment you need the following information:

1. Average percent infested whorls in the field and average number of worms per infested plant. These numbers help provide an estimate of possible maximum number of cavities per plant at the end of the first generation.
2. Cost per acre of the insecticide application.
3. Anticipated value of the grain per bushel.

4. Estimated percent control given by a particular insecticide.

Example: An average of one borer cavity per plant is capable of causing an approximate 5 percent yield loss. In the example shown, from scouting you know that 50 percent of the plant whorls are infested with an average of four live worms per infested plant. Therefore, 50 percent x 4.0 = 2.0 worms per plant, if all worms survive. Assume 75 percent control and $2.00 price per bushel of corn with a yield expectation of 125 bushels per acre.

For more information on this subject, refer to Extension NebGuides G75-217 and G82-613 and RP 98 and RP 22.

Management worksheet for first generation corn borer

	Example field	Your estimates
1. Yield potential for this field	125 bu/a	_____ bu/a
2. Number of larvae/plant = average live larvae/plant x average percent infestation (4 larvae X 50% infestation = 2 larvae/plant)*	2 larvae/plant	_____ larvae/plant
3. Potential yield loss (2 larvae/plant X 5% loss/larva = 10% loss in yield, 10% X 125 Bu = 12.5 Bu loss/A).	12.5 bu/a	_____ bu/a
4. Dollar loss/A (12.5 Bu/A X $2.00 per Bu = $25.00 Loss/A).	$ 25.00	$ _____
5. Preventable loss (if chemical is 75%** effective $25.00 X 75% = $18.75/A).	$ 18.75	$ _____
6. Chemical (8.00/A) and application costs ($4.00/A). (Estimate your own cost or call dealer/applicator.) TOTAL = $12/A	$ 12.00	$ _____
7. Compare preventable loss ($18.75/A) with treatment cost ($12.00):$18.75/A - $12.00/A = $6.75/A (dollars saved by treatment/A).	$ 6.75	$ _____

8. If preventable loss (No. 5) exceeds total cost of treatment (No. 6), you may benefit from an insecticide application for first generation corn borer.

*To determine the need for treatment, it is essential to obtain an estimate of the final population of borers in each field. Ideally, you should make this final population estimate and the treatment decision after egg-laying stops, the oldest borers are approaching the third stage (about half-grown), and before the oldest worms have left the whorl. Remember that natural insect mortality caused by weather (low temperatures, low relative humidity, wind, or driving rain), other insects, diseases and resistance factors in the corn plant is often high, especially in the very earliest borer stages. Occasionally, such mortality may be as high as 90 percent. However, warm, wet and humid, mild conditions can increase survival considerably. Therefore, due to these variables, it is nearly impossible to support the use of an "average percentage of surviving borers" and plug it into the formula. As it is, the above formula tells you what would happen if all the borers you observed survived to invade the stalk and complete a tunnel. The later you can make your treatment decision without compromising on control, the more natural mortality will occur and the greater your likelihood of making a correct treatment decision.

**A reasonable expectation for insecticidal control of first generation European corn borer under typical field conditions is approximately 75 percent. Percent control can vary considerably, depending on several factors, including timing of application, product choice and application method. Research has shown that granules generally work better than liquids for first generation European corn borers, with the exception of center pivot applications.

Suggested treatments for controlling first generation European corn borers in corn

Insecticide	Rate (form/acre)	Restrictions and comments
Bacillus thuringiensis *(Dipel 10G)*	10.0 lb	Field, pop and seed corn.
	5.0-10.0 lb (banded)	Apply over the row so granules fall into the whorl for banded rates.
(Dipel ES)	1.5-2.0 pt	May be applied through sprinkler irrigation system.*
(R) *carbofuran* *(Furadan 15G)***	6.7 lb	Do not make a foliar application if Furadan 15G was applied at more than 8 ounces per 1,000 linear feet of row at planting (6.7 lbs/acre with 40 inch row spacing). No more than two foliar applications per season. Field corn only.
chlorpyrifos *(Lorsban 15G)*	6.5 lb	No more than 16 oz per 1,000 feet of row or 13 lbs per acre (two post-plant applications) per season. Field and popcorn.
(Lorsban 4E)	1.0-2.0 pt	May be applied through an overhead sprinkler irrigation system.* Field and popcorn.
(R) *fonofos* *(Dyfonate II 20G)*	5.0 lb	Field and popcorn.
(R) *methyl parathion* *(Penncap-M)*	2.0 qt	May be applied through an overhead sprinkler irrigation system.* Note bee hazard statement. Field corn. Use low rate for whorl application; high rate for broadcast application.
(R) *permethrin* *(Pounce 3.2EC)*	4.0-8.0 oz	May be applied through an overhead irrigation system.* Field, seed, and popcorn. Apply prior to the brown silk stage.
(R) *(Ambush 2E)*	6.2-12.4 oz	May be applied through an overhead irrigation system.* Field and popcorn. Apply prior to the brown silk stage.
(R) *(Ambush 25W)* *(Pounce 25WP)*	6.4-12.8 oz	May be applied through an overhead irrigation system.* Field and popcorn. Apply prior to the brown silk stage.
(R) *(Pounce 1.5G)*	6.7-13.3 lb	Field, sweet and popcorn. Do not apply more than 0.4 lb active ingredient after brown silk stage.

*This application method dictates the use of specific equipment, specific application conditions, accurate calibration, and critical safety precautions. Consult the label for complete directions before use.
**Furadan 15G is no longer labelled for foliar European corn borer control. Existing supplies of Furadan 15G labelled for this use may be applied according to label directions.

Second generation

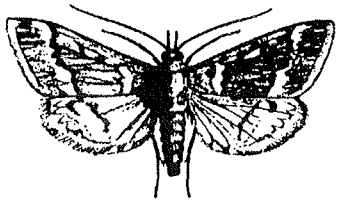
Fields that have green silks and are shedding pollen during the peak period of moth flight are most susceptible to second generation infestation. To determine the need for controlling second generation European corn borers, begin scouting when the second flight of moths appears, usually in mid-July. Scout fields regularly, at least once every three to five days, especially during the early half of the moth flight period. Refer to the UNL *Insect Science, Plant Disease and Weed Science News* (see page 23) for information on the moth flight period. Select a minimum of 50 plants per field, choosing plants from several different parts of the field. Examine the underside of leaves for white borer egg masses. These masses, usually found on leaves in the middle third of the plant (frequently near the midrib), normally hatch in about five days. Each egg develops a black spot just before hatching.

Timing of application is critical if reasonable control is to be achieved. Best control (approximately 50-70 percent, depending on timing, application method and product choice) is realized when application is timed at first significant egg hatch and young larvae are still located in the leaf axils. Larvae which have bored behind the leaf axil, into the sheath or are in or on the ear are not likely to be controlled. As the plant approaches blister stage and beyond, potential economic benefits of an insecticide application rapidly decline.

A worksheet has been developed to help determine whether treatment of second generation European corn borers in corn is economical. This worksheet is similar in concept to those used for first generation European corn borer treatment decisions *(see page 13)*.

For this worksheet you need to know:

- Average number of egg masses per plant in field
- Crop stage
- Expected yield
- Expected value of corn
- Expected percent control with insecticide
- Cost of control (chemical plus application costs)



European corn borer adult

This worksheet may be useful in closely evaluating the many factors influencing the cost/benefit relationships involved in treating second generation European corn borers. Average values are suggested in the worksheet and may need to be modified in certain situations.

1. Borer survival is suggested to be three borers per egg mass. On average, European corn borer egg masses contain 20 eggs, although this may vary from 10 to 40. Three borers per 20 eggs equals a 15 percent survival rate. Larval survival will vary with

Management worksheet for second generation European corn borers

_____Number of egg masses per plant x 3 borers per egg mass* = _____ borers per plant

_____Borers per plant x 4 percent yield loss per borer** =_____ percent yield loss

_____Percent yield loss x _____expected yield (bushels per acre) =_____ bushels per acre loss

_____Bushels per acre loss x $_____sale price per bushel = $_____ loss per acre

$____Loss per acre x 70 percent control = $_____ preventable loss per acre

$_____preventable loss per acre
_ $_____cost of control (chemical + application costs)
= $_____ profit (+) or loss (-) per acre if treatment is applied

If preventable loss exceeds cost of control, insecticide treatment is likely to result in economic benefit.

* Assumes survival rate of three borers per egg mass; may vary with weather and egg mass size.
** Use 3 percent loss per borer per plant if infestation occurs after silks are brown. The potential economic benefits of treatments decline rapidly if infestations occur after corn reaches the blister stage.

weather conditions and field type (dry land versus irrigated). In irrigated corn, larval survival is more likely to be 20 percent or more, but in dryland corn it's likely to be 10 percent or less. Exposure to hot, dry weather greatly decreases egg survival.

2. Yield loss per borer is suggested to be 4 percent per borer for infestations before silks turn brown, and 3 percent per borer after silks turn brown, but before blister stage. These values only account for physiological yield loss (reduced yield from corn borer damage to water and nutrient uptake through the stalk) and do not consider the potential for yield loss due to stalk breakage or ear drop.

3. Percent control with insecticides is suggested to be equal to 70 percent. This is a good average value for second generation European corn borer control, although if you have data to suggest higher or lower levels of control under your conditions, change this value.

The best control that can be achieved will usually prevent much of the stalk and leaf sheath tunneling, but will not necessarily prevent invasion of the ear tip. This is especially true if the borer flight period is extended or a partial third generation occurs. Stalk protection is critical for the plant to fully develop the ear. While late worms that attack the ear tip do reduce grain quality, they do not reduce yields as seriously as borers that tunnel in stalks. Early harvest and selection of a corn variety that has good ear retention qualities should minimize ear drop.

Generally, liquid and granular formulations of the same insecticide are equally effective against second generation European corn borer larvae. However, if other insects (except spider mites) are present and/or European corn borer moth numbers are high, liquid formulations are preferred over granules because of their broader spectrum of activity and the added advantage of obtaining some moth control. If spider mites are present, select an insecticide that is least likely to contribute to rapid increases in mite numbers (see *Spider Mite* section, page 19).

Suggested treatments for controlling second generation European corn borers in corn

	Insecticide	Rate (form/acre)	Restrictions and comments
(R)	*carbofuran (Furadan 15G)***	6.7 lb	Do not make a foliar application if Furadan 15G was applied at more than 8 ounces per 1,000 linear feet of row at planting (6.7 pounds per acre, 40 inch row spacing). No more than two foliar applications per season. In field corn only.
(R)	*(Furadan 4F)*	1.5-2.0 pt	Do not make a foliar application if more than 6.7 pounds of Furadan 15G or 1 quart of Furadan 4F were used per 13,000 linear feet (one acre with 40 inch rows) at planting. No more than two applications per season. Do not apply within 30 days of harvest. Do not apply on seed corn prior to tasseling or rogueing. See label for field reentry information. In field corn only.
(R)	*chlorpyrifos (Lorsban 4E)*	1.0-2.0 pt	Aerial or ground application; may be applied through an overhead sprinkler irrigation system.* Do not apply within 35 days before harvest. Do not apply more than a total of 15 pints of Lorsban 4E per acre per season. Do not allow livestock to graze in treated areas. Do not harvest treated corn silage as feed for meat or dairy animals within 14 days after last treatment. Do not feed treated corn fodder to meat or dairy animals within 14 days after last treatment. Do not feed treated corn fodder to meat or dairy animals within 35 days after last treatment. In field corn and popcorn.

Suggested treatments for controlling second generation European corn borers in corn *(continued)*

	Insecticide	Rate (form/acre)	Restrictions and comments
	chlorpyrifos (Lorsban 15G)	6.5 lb	No more than 16 ounces per 1,000 feet of row or 13 pounds per acre (two post-plant applications) per season. Do not apply within 35 days before harvest of grain. Do not allow livestock to graze in treated areas nor harvest treated corn silage as feed for meat or dairy animals within 14 days after last treatment. Do not feed treated corn fodder to meat or dairy animals within 35 days after last treatment. Use in field and popcorn.
(R)	*esfenvalerate (Asana 1.9EC)*	2.7-3.4 oz	21 days to harvest for field corn, one day for sweet corn and popcorn.
(R)	*(Asana XL)*	7.8-9.6 oz	May be applied through overhead sprinkler irrigation system.*
(R)	*fenvalerate (Pydrin 2.4EC)*	8.0-10.6 oz	21 days to harvest. Do not exceed 1.0 lb active ingredient per acre per season. Field corn. May be applied through overhead sprinkler system.*
(R)	*fonofos (Dyfonate II 20G)*	5.0 lb	Do not apply within 30 days of harvest or feed or graze livestock within 30 days of treatment. Use in field corn.
(R)	*methyl parathion (Penncap-M)*	2.0 qt	Aerial or ground application; may be applied through overhead sprinkler irrigation system.* Read label relative to bee hazards prior to application.
(R)	*permethrin (Pounce 3.2EC)*	4-8 oz	May be applied through overhead sprinkler irrigation system.* Apply prior to brown silk stage. Use in field, seed corn, and popcorn.
(R)	*(Pounce 1.5G)*	6.7-13.3 lb	Use in field, seed corn, and popcorn. Do not apply more than 0.4 lb active ingredient per acre after brown silk stage.
(R)	*(Ambush 2E)*	6.4-12.8 oz	May be applied through overhead sprinkler irrigation system.* Apply prior to brown silk stage. Use in field and seed corn and popcorn.
(R) (R)	*(Ambush 25W)* *(Pounce 25WP)*	6.4-12.8 oz	May be applied through overhead sprinkler irrigation system.* Same restrictions as Ambush 2E or Pounce 3.2EC.

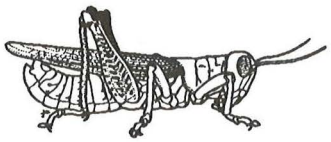
Be alert for possible build-up of spider mites after insecticide applications.

*This method of application dictates the use of specific equipment, specific application conditions, accurate calibration, and critical safety precautions. Consult the label for complete directions prior to use.
**Furadan 15G is no longer labelled for foliar European corn borer control. Existing supplies of Furadan 15G labelled for this use may be applied according to label directions.

Grasshoppers

Grasshopper control is best accomplished when hoppers are small and confined to grassy or weedy margins. For infestations within corn fields, the following table can be used to evaluate the need for treatment. It is based on the estimated number of young grasshoppers per square yard. If spider mites are present, select an insecticide that is least likely to contribute to increases in mite numbers (see *Spider Mite* section, page 19).

For more information on this subject, refer to Extension NebGuide G86-791.



Grasshopper

Number of nymphs or adult grasshoppers per square yard of cropland

Classification	Field	Field border	Treatment
Non-economic	0 to 2	5 to 10	Usually not
Light	3 to 7	11 to 20	Questionable
Moderate	8 to 14	21 to 40	Probably
Abundant	15 or more	41 or more	Yes

Be alert for possible build-up of spider mites after insecticide applications.

Suggested treatments for controlling grasshoppers in corn

Rates are active ingredient per acre.

(R) *carbofuran (Furadan 4F)*	0.25 lb
chlorpyrifos (Lorsban 4E)	0.25-0.5 lb
dimethoate (Cygon 400)	0.5 lb
(R) *esfenvalerate (Asana 1.9EC)*	0.025-0.05 lb
(R) *fenvalerate (Pydrin 2.4EC)*	0.1-0.2 lb
(R) *methyl parathion (Penncap-M)*	0.5 lb

Registered treatments for controlling grasshoppers in non-crop and waste areas

Rates are active ingredient per acre, unless otherwise noted.

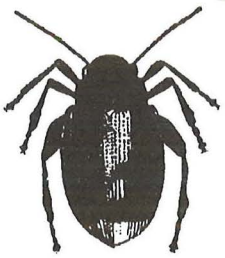
acephate (Orthene 75S)	0.125-0.5 lb
carbaryl (Sevin 80S, XLR Plus, 4-Oil)	0.5-1.5 lb
diazinon AG500, 50W	0.375-0.5 lb
(R) *esfenvalerate (Asana 1.9EC)*	0.025-0.05 lb
(R) *fenvalerate (Pydrin 2.4EC)*	0.05-0.1 lb
malathion ULV 9.33	8-12 fl oz form

Spraying pollinating corn can be extremely hazardous to bees. Coordinate activities with local beekeepers before applying insecticides.

Flea beetles

These small (about 1/16 inch long), shiny black beetles are excellent jumpers. Injury is first noted as a silvery-white appearance on seedlings where beetles have gouged leaf tissues, producing a "window-pane" effect. If injury is present and there are five or more beetles per plant (4-6 inches tall), treatment is probably justified. Fewer beetles can injure smaller plants. Corn taller than 6 inches can probably tolerate five beetles per plant without economic loss.

For more information on this subject, refer to Extension publication RP 98.



Flea beetle

Registered treatments for controlling flea beetles in corn

Rates are active ingredient per acre unless otherwise noted.

carbaryl (Sevin 80S, XLR Plus)	1.0 lb
carbofuran (Furadan 15G)	8.0 oz form per 1,000 row feet, banded or in furrow in planting
chlorpyrifos (Lorsban 4E)	1.0-1.5 lb
(R) *esfenvalerate (Asana 1.9EC)*	0.025-0.05 lb
(R) *fenvalerate (Pydrin 2.4EC)*	0.1-0.2 lb
(R) *methyl parathion (Penncap-M)*	0.50-0.75 lb
(R) *permethrin (Ambush 2E, 25W, Pounce 25WP, 3.2EC)*	0.1-0.2 lb
(R) *phorate (Thimet 20G)*	6.0 oz form/1,000 row feet banded at planting*
(R) *phorate + flucythrinate (Aastar 15G)*	8.0 oz form/1,000 row feet, banded at planting
(R) *terbufos (Counter 15G)*	8.0 oz form per 1,000 row feet, banded or in furrow at planting

*Apply by ground only, one application per season

Spider mites

Two species of spider mites, the twospotted spider mite and the Banks grass mite, damage corn in Nebraska. They are somewhat similar in appearance but differ in the amount of damage they cause and their susceptibility to chemical controls. Weather and natural enemies appear to be important determining factors in spider mite abundance. Spider mites are most likely to develop economically damaging populations in fields that are moisture stressed during June and July, particularly if weather is hot, windy, and dry. Mite build-up can occur even in irrigated fields, especially if irrigation problems exist or if irrigation is delayed during stress periods prior to the blister stage of corn. Other fields likely to develop mite problems are those that have received foliar applications of certain insecticides for European corn borers, western bean cutworms or other pests and fields situated next to grasses, ripening wheat or alfalfa. Watch these situations closely for a rapid mite increase.

Proper mite identification is important since the two-spotted spider mite is much more difficult to control. The most useful characteristic for differentiating between these two species is the pattern of pigmentation. Generally, in older twospotted spider mite females, pigmentation appears as a well-defined spot on each side of the body, ending abruptly just beyond half the length of the body (see drawing). Banks grass mite females tend to have blackish-green pigmentation extending the full length of the body. Banks grass mites appear earlier in the season and are more likely to remain on lower leaves. Twospotted spider mites appear later in the season and may spread rapidly over the entire plant.

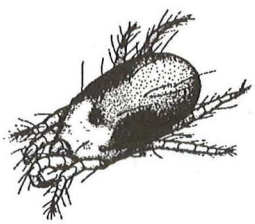
Before deciding to treat for spider mites, consider the benefits of that application. Most insecticides have a detrimental effect on spider mite natural enemies. These same chemicals, however, often vary considerably in their effects on Banks grass mites and twospotted spider mites. Some products cause little mortality to either species, while others are somewhat toxic to Banks grass mites. Fewer insecticides/miticides are toxic to twospotted spider mites.

Since products differ in their effects on the two species, it is important to determine the mite species present in the field before making an application. Products that have sometimes been associated with both Banks grass mite and twospotted spider mite problems after their use include permethrin (Pounce, Ambush) and to a lesser extent, carbaryl (Sevin), and fenvalerate (Pydrin), which under some circumstances may even reduce Banks grass mites. Other products, including parathion, are most likely to be associated with mite population increases only when twospotted spider mites are present. Parathion seems to suppress Banks grass mites but not twospotted spider mites. Still other chemicals have only a slight effect on spider mites or tend to suppress them to some extent. These include Furadan, Counter and Lorsban.

For more information on this subject, refer to Extension NebGuide G75-50.

Reducing spider mites

Spider mite control decisions are based on many factors including the mite species present, level of infestation, growth stage of the crop, cost of application, and market price of the crop.



Twospotted spider mite

For Banks grass mites only: Treatment is usually justified if one lower leaf is yellowing from mite damage and colonies are present up to the ear zone. In Nebraska, dimethoate (Cygon) has generally provided acceptable control of Banks grass mites.

For twospotted spider mites only; or twospotted spider mites plus Banks grass mites: Except for Comite, no registered miticide/insecticide product or combination of products has provided consistent, effective control of twospotted spider mites. Although the Comite 6.55 EC product label suggests that best results are expected when it is applied early in the season, post tassel applications have provided satisfactory reductions in twospotted spider mite infestations when applied with 5 gallons of water per acre. In many cases, treatments with some registered pesticides have actually aggravated twospotted spider mite problems. However, a pesticide treatment to suppress an infestation may be justified when 15-20 percent of the total leaf area is covered with active twospotted spider mite colonies and moderate damage is apparent. Early spot treatments with Comite may be helpful, particularly in fields that have a history of spider mite problems.

When managing infestations of either twospotted spider mites or Banks grass mites, consider the following approaches:

1. Reduce moisture stress through timely irrigation.
2. Treat only the heavily infested areas of the field to allow for recolonization by predators.
3. Increased gallonage (5 gallon minimum) and multiple insecticide applications may improve the degree of mite suppression.
4. In areas where water pH is high (7-9), a buffer such as LI700 may help to extend the residual action of some pesticide products.
5. Corn that has reached the full dent stage is unlikely to benefit from treatment for mites.

Be alert for possible build-up of spider mites after insecticide applications.

Registered treatments for controlling spider mites in corn

Rates are active ingredient per acre.

(R)	*carbofuran (Furadan 4F)*	1.0 lb
	dimethoate (Cygon 400)	0.5 lb
(R)	*disulfoton (Di-Syston 8EC)*	1.0 lb
(R)	*oxydemeton methyl (Metasystox-R 2SC)*	0.5 lb
(R)	*phorate (Thimet 20G)**	1.0 lb
	*propargite (Comite 6.55EC)***	1.6 lb

* Ground application only; single application per season
**Up to two applications per season; second application may be applied up to 30 days preharvest; 24 (C) registration in Nebraska

Western bean cutworms

Western bean cutworm

Several factors influence the decision to control this insect, including weather, corn maturity, and time of cutworm infestation. Corn is most attractive to egg-laying moths during the late whorl or early tassel stages and less attractive when the corn is small or has already pollinated. Apply an insecticide if 8 percent of the plants are infested with newly hatched larvae in tassels and/or eggs on leaves, and corn is at least 95 percent tasseled. Poor control is likely if worms have already reached the ear tips. If corn is developing late (i.e. not yet in susceptible stage) in relation to the western bean cutworm infestation, the treatment threshold should be raised, since fewer worms are likely to survive.

Many products used to control western bean cutworms have been shown to increase the risk of spider mite infestations. If spider mites are present, even in very small numbers, select an insecticide that is least likely to stimulate increases in mite reproduction (see Spider mite section, page 19-20).

For more information on this subject, refer to Extension NebGuides G76-290 and G82-613.

Registered treatments for controlling western bean cutworms in corn

Rates are active ingredient per acre.

	*carbaryl (Sevin 80S, XLR Plus, Sevin 4-Oil)**	2.0 lb
(R)	*carbofuran (Furadan 4F)*	1.0 lb
	*chlorpyrifos (Lorsban 4E)**	0.5-1.0 lb
(R)	*esfenvalerate (Asana 1.9EC, XL)**	0.0125-0.025 lb
(R)	*fenvalerate (Pydrin 2.4EC)**	0.05-0.1 lb
(R)	*methyl parathion (Penncap-M)**	0.5-1.0 lb
(R)	*methyl parathion + EPN*	0.5 lb
(R)	*permethrin (Ambush 2E, 25W,Pounce 25WP, 3.2EC)**	0.1-0.2 lb

* May be applied through an overhead sprinkler system. Follow label directions carefully

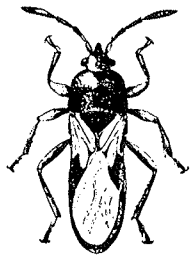
Sorghum insects

Chinch bugs

Preventing chinch bug damage to sorghum by cultural practices is more reliable than chemical controls. Do not plant sorghum into wheat stubble, or adjacent to winter wheat. Chinch bugs do not feed on legumes, so soybeans are an ideal alternative to sorghum in fields with a high probability of chinch bug infestation.

Research in Nebraska and Kansas indicates that Furadan 15G applied in the seed furrow at planting provides the longest lasting control of chinch bugs moving into sorghum from adjacent wheat. Under high infestations, soil insecticides are not highly effective and may need to be supplemented with foliar sprays. Also, these sprays may need to be repeated during migration.

For more information on this subject, refer to Extension NebGuide G86-806 and RP 98.



Chinch bug

Suggestions for chinch bug control in sorghum

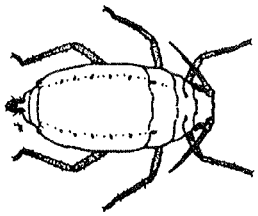
Rates are active ingredient per acre unless otherwise noted.

Insecticide	Rate	Restrictions and comments
At planting		
carbofuran (R) *(Furadan 15G)*	8.0 oz form*	Place in-furrow with seed. Should give three to four weeks protection.
Post-emergence		
carbaryl (Sevin 80S, 50W, XLR Plus)	2.0 lb	Apply as directed; spray with at least 40 gallons of water per acre.
carbofuran (R) *(Furadan 4F)*	0.5 lb	Apply as a basal directed spray in 20-30 gallons of water. Do not make more than two foliar applications per season. Do not apply after heads emerge from the boot. Do not graze treated fields or cut for silage or forage within 30 days of treatment.
phorate (R) *(Thimet 20G)*	6.0 oz form*	Apply by ground only over or at base of plants at cultivation and cover with soil. One application per season. Do not feed foliage before grain harvest.

*Rate is formulation per 1,000 row feet.

Corn leaf aphids and greenbugs

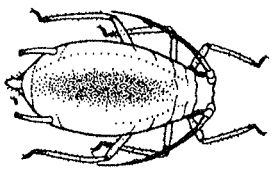
Corn leaf aphids rarely cause economic damage to grain sorghum in Nebraska. This bluish-green aphid is narrow-bodied with solid black legs, antennae and cornicles ("tail pipes"). Treatments seldom result in a yield increase that would pay for the cost of treatment — **except** in times of severe drought stress after heading.



Corn leaf aphid

Greenbugs are frequent pests in Nebraska sorghum. These small insects are light green, with a darker green stripe down the back. The tips of the legs, cornicles, and most of the antennae are black. Typically they feed on the underside of leaves on larger plants; however, greenbugs may be found in the whorls of seedling sorghum. Resistant varieties provide some reduction in greenbug damage, but sometimes even these varieties will require insecticide treatment.

Although seedling sorghum can be treated at planting time with soil systemic insecticides, these applications are not suggested. These treatments do not usually prevent mid-to-late season buildup, which normally peaks in late July or early August. Seedling sorghum occasionally is infested with greenbugs in late May or early June. Unless plants are threatened in the seedling stage, it may be best to withhold treatment until greenbug colonies are better established but still small. Foliar treatments have given good control and often have prevented mid-season damage.



Greenbug

The following table summarizes greenbug treatment guidelines at various sorghum growth stages:

Growth stage	Treatment guidelines
Seedling (0-5 leaves)	Greenbug colonies present on 10-20 percent of plants; visible yellowing or spotting on leaves.
Plants 6 inches tall to boot	Greenbug colonies beginning to cause red or yellow leaf spotting on lower leaves of most plants.
Boot to soft dough	Treat if greenbug colonies are present on most plants, before one lower leaf has been killed, and if parasite numbers are low (less than 20 percent of greenbugs parasitized).

These guidelines are based more on damage than on greenbug numbers, therefore, they apply to both greenbug resistant and greenbug susceptible grain sorghum varieties. They are not hard and fast rules. Resistant lines should tolerate greenbug damage better than susceptible lines. Older plants will tolerate more greenbugs, while small or stressed plants will generally tolerate fewer greenbugs.

Forage sorghum. This is typically planted in early July following harvest of small grains, and should be treated with an approved soil-applied systemic insecticide at planting, since forage sorghum runs greater risk of serious greenbug infestation in the seedling stage. For infestations on larger plants, treatment may be justified when 25 percent of the lower leaves have greenbug colonies and are showing signs of feeding damage.

For more information on this subject, refer to Extension NebGuide G87-838.

Suggested treatments for controlling greenbugs in sorghum

Rates are active ingredient per acre.

(R) *carbofuran (Furadan 4F)*	0.25-0.5 lb
chlorpyrifos (Lorsban 4E)	0.25-0.5 lb
dimethoate (Cygon 400)	0.5 lb
(R) *disulfoton (Di-Syston 15G)*	1.0 lb
(Di-Syston 8EC)	0.5 lb
(R) *fonofos (Dyfonate 4EC)*	1.0 lb
malathion 57EC	1.0 lb
(R) *oxydemeton methyl (Metasystox-R 2SC)*	0.5 lb
(R) *parathion (ethyl only)*	0.5 lb
(R) *phorate (Thimet 20G)**	1.0 lb

* Ground application only; single application per season

Registered treatments for planting time application in sorghum

Rates are formulation per 1,000 feet of row.

(R) *carbofuran (Furadan 15G)*	8.0 oz banded or in-furrow
(R) *disulfoton (Di-Syston 15G)*	8.0 oz banded only
(R) *phorate (Thimet 20G)*	6.0 oz banded (or knifed in)
(R) *terbufos (Counter 15G)**	8.0 oz banded (or knifed in)
(R) *(Counter 20CR)**	6.0 oz banded (or knifed in)

*Registered for use only on grain sorghum. Modified in-furrow rate, 6.0 oz, see label (may adversely affect germination).

CAUTION: Since certain grain and forage sorghum varieties may be sensitive to organophosphate insecticides, ethyl parathion and Metasystox-R should be applied to a small area and observed for a few days prior to treatment of an entire field to determine if any crop injury will occur.

Soil cutworms

Black cutworm larva

Soil cutworms are occasional pests of seedling sorghum. The most common species involved is the black cutworm. This pest is a greasy black or gray worm with a brown head. The cutworm may be over 1 inch long when feeding is completed. Black cutworms feed primarily at night and will hide under debris or in the soil during the day. Young black cutworms feed on above ground portions of plants while older cutworms cut plants at or below the soil surface.

For more information on this subject, refer to Extension NebGuide G80-501.

Recommendations for soil cutworm control in sorghum

Insecticide	Rate	Restrictions and comments
chlorpyrifos *(Lorsban 4E)*	0.5-1.0 pounds AI/A	Apply with sufficient water for thorough coverage. Do not apply more than three pints of Lorsban 4E per acre per acre per season. The treated crop is not to be used for forage, fodder, hay, or silage within 30 days after application of one pint per acre or within 60 days after application of more than one pint per acre. Do not treat sweet varieties of sorghum.

Wireworms, seedcorn maggot and seedcorn beetle

Planter box seed treatment with lindane. Follow label directions for amounts and restrictions.

For more information on this subject, refer to Extension NebGuide G91-1023.

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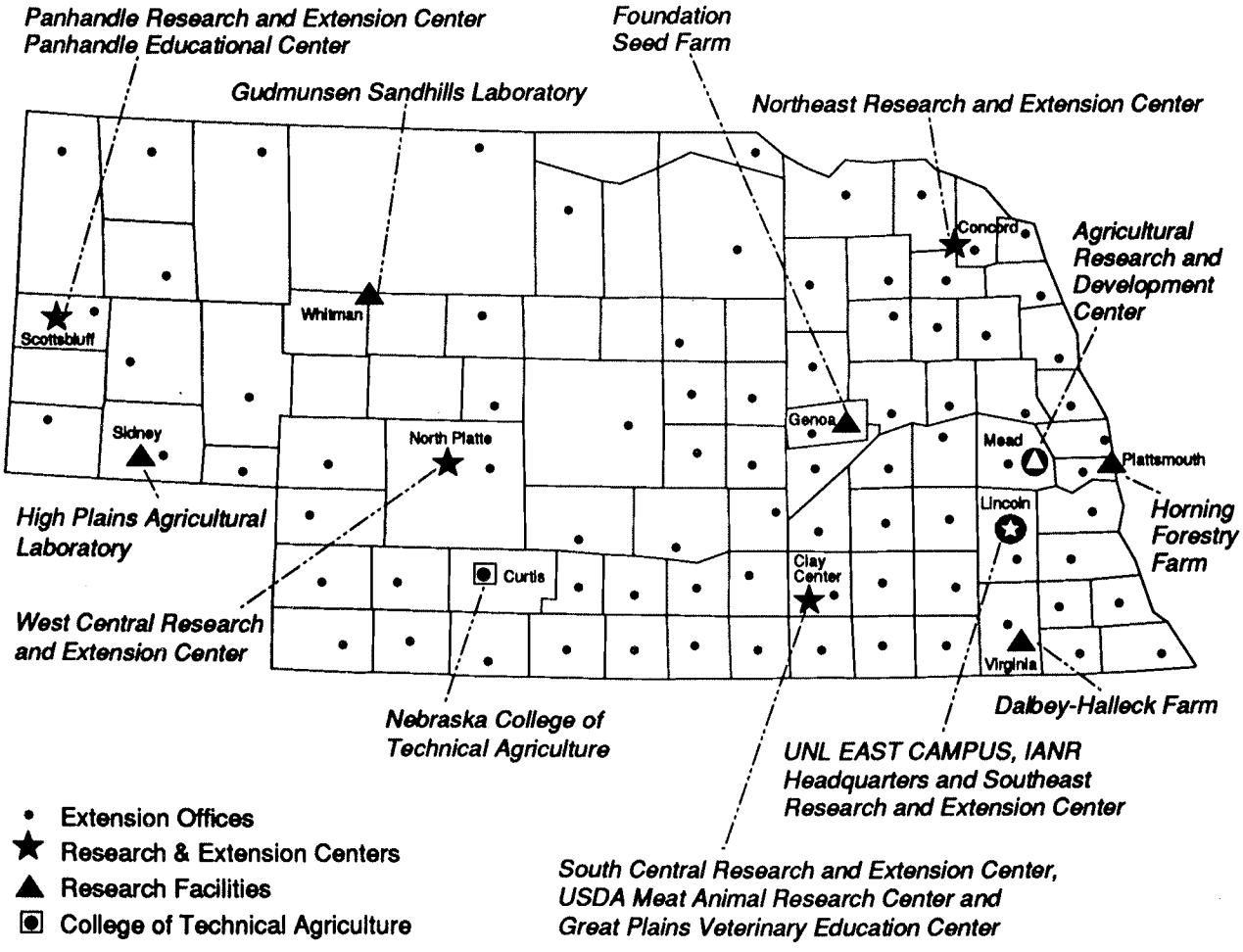

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