Crop Profile for Corn in Texas

Prepared: October, 2003

General Production Information

- State Rank: Eleventh
- Percent of U. S. Production: 2%
- Acres Planted: (Average)
  - Total: 2,050,000
  - Irrigated: about 50% of total
- Acres Harvested: (Average)
  - Total: 1,820,000
  - Yield 113 bushels/Avg/A
- Yearly Production Costs
  - Irrigated: $510 per acre
  - Non-irrigated: $210 per acre

Data on corn grown for grain in Texas show that harvested acres, production, and yield have fluctuated but trended upward from 1978 to the present while price has trended downward. Production for that time period was at a low in 1983 of 104.8 million bushels and a high in 1994 at 238.7 million bushels. In 1980 and 1990 yield was down to 90 bushels per acre but up to 138 bushels per acre in 1997. It was 129 bushels per acre in 1999. Price was $2.45 per bushel in 1978 but only $2.25 per bushel 21 years later in 1999. Price was at a high at $3.39 per bushel in 1983 and a low at $1.78 per bushel in 1986. The trend has been slightly increasing for the percent of total acres harvested and total production from irrigated corn. The percent of acres harvested from irrigated corn has bounced around from between 48% and 54% and the percent of production from between 63% and 85%. Acres harvested, production, and yield of corn for silage in Texas, like shell corn, has shown an increasing trend from 1987 to the present. Yield was at its lowest for the period in 1988 and 1990 at 13 tons per acre and its highest at 23.5 tons per acre in 1997. Yield in 1999 was 21 tons per acre.

Commodity Destination:

The great majority of Texas corn production goes to livestock feed with some for silage. A small portion is food grade. Nearly all the feed corn produced on the High Plains goes to local feed yards. Low Plains and Cross Timbers feed corn is sold to elevators for merchandising or fed locally to livestock. Elevators handle most of the feed corn produced in the Texas Blacklands and the Edwards Plateau. East Texas and South Central feed corn is marketed through grain elevators but some is used by local livestock and poultry feeders. Local and port elevators are the primary destinations of the feed corn produced in the
Upper Coast, Coastal Bend, Winter Garden, and the Lower Valley.

**Production Regions:**

The Northern High Plains accounts for almost two thirds of total Texas corn production. Other production regions with significant corn production are the Blacklands 12%, the Upper Coast 6%, and South Central Texas 4%.

**Cultural Practices**

**Irrigation:**

Except for the High Plains, most of Texas corn production is non-irrigated. In the High Plains and the irrigated fields of the Winter Garden, South Texas, and the Lower Valley, fields are first irrigated just prior to planting.

**Land preparation:**

Most growers throughout the state prepare the land for planting by discing and/or using a field cultivator. In the Edwards Plateau, Upper Coast, Coastal Bend, Winter Garden, South Texas, and the Lower Valley corn fields are bedded. Conservation tillage practices are used on a small acreage of the corn grown in the High Plains with an increasing acreage in the rest of the state.

**Planting:**

Corn planting dates range from late January to early May. Growers in the Lower Valley, the Winter Garden, and South Texas will plant between late January and late February while in the Northern parts of the state, the Plains and Cross Timbers, planting is from mid April to early May. Planting dates in other parts of the state are between these two extremes. Double-disc open planters equipped with precision metering systems are common. Corn is planted on beds where furrow or furrow dike irrigation is used or where the field is poorly drained, the rest is planted flat. Most irrigated corn is planted in 30 inch rows but a small, growing number of acres are more narrow rows, some 15 inches apart. Most non-irrigated corn is planted in 38 inch to 40 inch rows but 30 inches is becoming popular. Seeding rate is 28,000 to 34,000 seeds per acre in irrigated corn depending on the amount of water available for irrigation and the intended use of the crop. Non-irrigated seeding rates range from 18,000 to 26,000 seeds per acre.

**Varieties:**

Typical corn varieties planted in Texas include Pioneer 31B13, DeKalb 687, Asgrow RX913, Texas Seed TS 8811, and Triumph 1866Bt.
Fertility/Fertilization:

Growers rely on experience, soil tests, and recommendations from crop consultants to determine their fertilizer needs. With the exception of nitrogen, most nutrients are applied prior to planting.

Pre-harvest Activities:

Most all corn growers throughout the state apply soil insecticides, pre-emergence herbicides, and starter fertilizer at planting. Fertilizer is applied in side dressing applications after corn emergence and postemergence herbicides are applied as needed during the growing season. In irrigated corn, several irrigations are applied throughout the season, mostly with center pivot sprinkler systems; some lepa and some furrow dikes are also used. Furrow dikes will be found in some non-irrigated corn.

Harvest:

In the Lower Valley, South Texas, and the Winter Garden, corn is harvested between late June and mid July. The harvest window is between late June and mid August in the Upper Coast and the Coastal Bend, between late July and mid August in South Central Texas, late July and late August in the Blacklands, late July and early September in East Texas, late August and late September in the Edwards Plateau, and early September and mid October in the Plains and Cross Timbers. Silage is cut when the grain is at about the 50% milk-line maturity stage then delivered to a feed-lot. Corn for grain is harvested after reaching physiological maturity. In the Northern High Plains grain is allowed to dry to below 25% to 30% moisture before harvest, for wet grain and to below 20% moisture, for grain that is to be dried for farm storage. Corn grain is also harvested at below 20% moisture in the Southern High Plains where most goes to farm storage and in the Low Plains and the Cross Timbers where most goes to feedlots or local grain elevators. In the rest of the state it is harvested below 14% moisture and delivered to local elevators.

Worker Related Activities
(activity followed by no. per season)

- Furrow irrigated - shredding, discing (2), chiseling, bedding, apply fertilizer (2), apply herbicide (2), irrigation (4), rod weeding, planting, cultivating, apply insecticide, drying, harvest & haul.
- Sprinkler irrigated - shredding, discing (2), chiseling, irrigation (6), apply herbicide (2), apply fertilizer (2), planting, cultivating, apply insecticide, drying, harvest & haul.
- Corn silage sprinkler irrigated - shredding, discing (2), chiseling, apply herbicide, rod weeding, apply fertilizer, planting, irrigation (6), cultivating, apply insecticide, harvest & haul.
- Non-irrigated Central Texas - discing (1 offset, 3 tandem), apply liquid fertilizer, apply herbicide (2), apply dry fertilizer, shaping beds, planting, apply insecticide, rolling, cultivating, custom combing, custom hauling.
- Non-irrigated Gulf Coast - discing, bedding (3), apply fertilizer, apply herbicide, planting, apply insecticide, apply iron (2), cultivate (2), harvest & haul, drying.
Non-irrigated Coastal Upland - discing, bedding (3), apply fertilizer, apply herbicide, planting, apply insecticide, apply iron (2), cultivate (2), harvest & haul, drying.

Seed treatments are applied by seed suppliers and not by workers at the farm level.

Pest Information


2. Above ground insects [corn ear worm (*Heliothis zea*), European corn borer (*Ostrinia nubilalis*), Southwestern corn borer (*Diatraea grandiosella*), Mexican rice borer (*Eoreuma loftini*), sugarcane borer (*Diatraea saccharalis*), fall armyworm (*Spodoptera frugiperda*), chinch bugs (*Blissus Leucopterus leucopterus*), grasshoppers, true armyworms (*Pseudoletia unipuncta* howardi), two spotted spider mite (*Tetranychus urticae*), banks grass mite (*Oligonychus pratensis*), western bean cutworm, and stink bugs].

3. Diseases [common rust (*Puccinia sorghi*), common smut (*Ustilago maydis*), seed rots and seedling blight (fungi - several species), charcoal rot, Northern corn leaf blight (*Exserohilum turcicum*), Southern corn leaf blight (*Bipolaris maydis*), Southern corn rust (fungus - *Puccinia polysora*), ear and kernel rots (fungi - several species), and viruses]


Soil Insect Pests

[Mexican corn root worm (*Diabrotica virgifera zeae*), Southern corn root worm (*Diabrotica undecimpunctata howardi*), Western corn root worm (*Diabrotica virgifera*), white grubs (*Phyllophaga* spp.), {*Elasmopalpus lignosellus* (Zeller)}, cutworms, wireworms, seed feeding ants.]

Frequency of Occurrence:

*Mexican corn root worms* are present in some corn fields annually in the Blacklands, South Texas, the Upper Coast, South Central Texas, the Coastal Bend, and the Winter Garden. *Southern corn root worms* are found annually in South and South Central Texas corn fields, every two years in the Blacklands and
West ern corn root worms occur annually in South Central Texas, sporadically in the Winter Garden, the Upper Coast, and the Coastal Bend, and seldom to sporadically in the Blacklands, and seldom in South Texas. The lesser cornstalk borer is sporadic and cutworms occur annually in South Texas, the Upper Coast, South Central Texas, the Coastal Bend, and the Winter Garden. Occurrence is seldom to sporadic in the Blacklands and seldom in the High Plains. Wireworm occurrence is annual in the central area of the Blacklands, seldom to sporadic in other parts of the Blacklands, sporadic in the Upper Coast, and seldom in the Winter Garden, South Texas, South Central Texas, and the Coastal Bend. Seed feeding ants occur annually in South Texas, the Upper Coast, South Central Texas, and the Coastal Bend and sporadically in the Blacklands. They are more prominent in dry weather.

**Damage Caused:**

*Mexican and western corn root worms* feed on the corn roots which can cause extensive damage to the brace roots and fibrous roots which in turn may cause the corn plants to lodge, resulting in a "goose necking" appearance and stand loss. *Southern corn root worm* larvae feed on plant roots and bore into germinating seed, large roots and underground stems. Damage may result in wilting and stunting of plants or a loss of stand. The adults are general foliage feeders and can occur in large enough numbers to cause considerable leaf damage. Damage appears as irregular holes in leaves, damaged growing tips and occasionally the girdling of seedling at or near ground level. *White grubs* feed on the corn plant roots, often killing small plants and stunting large plants and/or causing them to lodge prior to harvest. One *white grub* per square foot is enough to cause significant stand loss. The *lesser cornstalk borer* larva is found in the soil in a silken tube just below the surface where it will injure a plant by boring and tunneling inside the stem. *Cutworms* damage seedling corn by cutting the stalk just above ground level. *Wireworms* attack planted seeds and plant roots causing poor stands or complete stand loss. *Seed feeding ants* chew the germ out of the seed and damage seedlings.

**Percent Acres Affected:**

An estimated 50% of statewide corn acreage is economically infested (sufficient infestation to cause economic loss) with *Southern corn root worm*, 1% with *Western corn root worm*, 7% with *Mexican corn root worm*, 2% with the *lesser cornstalk borer*, 1% with *cutworms*, 4% with *seed feeding ants*, 5% with *wireworms*, and 4% with *white grubs*.

**Pest Life Cycles:**

*Mexican and western corn rootworm beetles* lay eggs in the top 2 to 8 inches of the soil during the summer and fall. The eggs hatch the following year beginning about mid-April in South Texas and about mid-May in the High Plains. They continue to hatch for several weeks. They require corn roots for survival and only one generation is produced each year. More than one generation of *Southern corn rootworms* may occur each year. They deposit their eggs after the corn is in the seedling stage and
therefore, crop rotation does not provide adequate control. *White grubs* are the larval stage of May and June beetles. Their life cycle is from 1 to 3 years depending on the species. Adults deposit their eggs in the soil and after hatch, larvae migrate up and down through the soil profile, coinciding with seasonal temperature changes. In the spring adults emerge, followed by mating and egg laying.

*Wireworms* may be found practically any time of the year. Eggs are laid in the soil with a generation taking from 1 to 6 years to complete, depending upon the species. The *fire ant*, a social insect, lives in colonies evident by mounds of dirt that may be more than 18 inches high. Single queen (monogyn) and multiple queen (polygyne) colonies can be found in one area producing as many as 800 mounds per acre. The *lesser cornstalk borer* over winters as a larva or pupa and emerges as an adult in early spring. The larva spin silken tube habitats and will remain close to this shelter to mature, while feeding on host plant material. There are generally two to three generations per season.

*Black cutworms* deposit eggs singly or in small batches on lower leaves or stems and produce four or more generations a year. They overwinter as larvae or pupae. *Variegated cutworms* deposit eggs in batches on lower stems and leaves, may produce three or four generations in a year and overwinter as pupae. The larvae are often found on the soil surface, beneath leaves and other debris. *Granulate cutworms* are subterranean in habit, complete up to four generations per year and overwinter as larvae.

**Timing of Control:**

When soil insects are a problem, most growers apply pesticides pre-plant or at planting. When the target insects are *wireworms, southern corn rootworms*, and/or *ants* growers may treat the seed prior to planting. Control for *cutworms* is applied pre-plant, at planting, or during the seedling to tassel stage. The lesser cornstalk borer is managed best with early season, soil-applied, directed spray insecticides. Insecticide treatment for *cutworms* is most effective when applied in the late afternoon on moist soil. Some growers treat for *western corn rootworms* during the early silking period.

**Yield Losses:**

If present in the corn field and not controlled *Mexican corn rootworms* can cause an estimated 8% yield loss, *southern corn rootworms* .5%, *western corn rootworms* 10%, *white grubs* 3%, *lesser cornstalk borer* 2%, *cutworms* 5%, *wireworms* 1%, and *ants* 9%.

**Regional Differences:**

*Mexican corn rootworms* are not a problem in the High Plains; a minimal problem in the Coastal Bend; a moderate problem in the Blacklands, the Upper Coast, and the Winter Garden and a major problem in South Central Texas and South Texas. *Southern corn rootworms* are not a problem in the High Plains; a minimal problem in the Winter Garden; a moderate problem in the Blacklands, South Texas and a major problem in the Upper Coast and in South Central Texas. *Western corn rootworms* are a moderate problem in the High Plains, minimum in the Blacklands, and non-existent in all other Texas corn...
production areas. White grubs are not a problem in the High Plains but a minimum problem in the other corn producing areas. The lesser cornstalk borer can be a minor pest in south central Texas and Cut worms are a small problem in all corn producing areas of the state. Wireworms are a small problem in all corn growing areas except the Blacklands where they are a minimal problem and the High Plains where they are not a problem. Ants are not a problem in the High Plains; minimal problem in the Blacklands; a minor problem in South Texas; a moderate problem in South Central Texas and the Coastal Bend and a major problem in the Upper Coast.

**Cultural Control Practices:**

Rotating corn with any other crop is a good control method for Mexican corn rootworm and Western corn rootworms, since they only produce one generation per year and they cannot survive without corn roots to feed on. Crop rotation is not as effective for control of Southern corn rootworms since they may produce more than one generation a year and they deposit their eggs after the corn is in the seedling stage. Not planting the corn next to small grains and fields where grass weed control was poor the previous year will help prevent southern corn rootworm problems. Planting early will help sometimes. Not planting corn after turf, pasture, or small grains will help minimize problems with white grubs, cutworms, and wireworms. The lesser cornstalk borer damage is often less under minimum tillage systems or with moist conditions such as rain or irrigation. Control of winter annual vegetation (grass and weeds) two weeks prior to planting and planting early and is important for preventing the build up of cutworms.

**Biological Control Practices:**

Nematodes have been evaluated for control of corn root worm larvae but they are not commercially used. Most soil insects will have natural enemies and broad spectrum control measures may disrupt this balance.

**Chemical Control-Soil Insects:**

<table>
<thead>
<tr>
<th>Chemical</th>
<th>% A. Trt.</th>
<th>Type of Appl./ A</th>
<th>Typical Rates</th>
<th>Timing</th>
<th># of Appl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terbufos</td>
<td>49</td>
<td>soil in furrow</td>
<td>3-6 oz./1000 ft. 20CR, 4-8 oz./1000 ft. 15G</td>
<td>Applied at planting.</td>
<td>1</td>
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<tr>
<td>(Counter®)</td>
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<tr>
<td>Target insects</td>
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</tbody>
</table>

corn rootworms, chinch bugs, white grubs, wireworms, cutworms, ants, and corn borers.
<table>
<thead>
<tr>
<th>Insecticide</th>
<th>ASTM</th>
<th>Application</th>
<th>Rate</th>
<th>Application Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chlorpyrifos (Lorsban®)</strong></td>
<td>6</td>
<td>soil in furrow, foliar &amp; some chemigation</td>
<td>4-8 oz/1000 ft, 15G, 1-2 pt/ac 4E</td>
<td>Applied at planting and from seedling stage through season.</td>
</tr>
<tr>
<td><strong>Target insects</strong></td>
<td></td>
<td>corn rootworms, white grubs, wireworms, cutworms, ants, chinch bugs, fall armyworms, lesser cornstalk borers and southwestern corn borers.</td>
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<td></td>
</tr>
<tr>
<td><strong>Cyfluthrin (Baythroid®)</strong></td>
<td>5</td>
<td>soil &amp; foliar (some foliar by air)</td>
<td>.8-2.8 fl oz per acre depending on target pest</td>
<td>Applied at planting or as needed in the season.</td>
</tr>
<tr>
<td><strong>Target insects</strong></td>
<td></td>
<td>corn root worms, white grubs, cutworms, wireworms, chinch bugs, corn ear worms, grasshoppers, banks brass mites, two spotted spider mites, fall armyworms, and corn borers.</td>
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<td></td>
</tr>
<tr>
<td><strong>Tebupirimphos + cyfluthrin (Aztec® 2.1G)</strong></td>
<td>15</td>
<td>soil</td>
<td>3.4-6.7 oz/1000 ft.</td>
<td>Applied at planting.</td>
</tr>
<tr>
<td><strong>Target insects</strong></td>
<td></td>
<td>corn rootworms, white grubs, wireworms, cutworms, and chinch bugs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tefluthrin (Force®)</strong></td>
<td>5</td>
<td>soil &amp; foliar (some foliar by air)</td>
<td>5 oz/1000 ft 3G, 8-10 oz/1000 ft 1.5G</td>
<td>Applied at planting.</td>
</tr>
<tr>
<td><strong>Target insects</strong></td>
<td></td>
<td>corn rootworms, white grubs, wireworms, cutworms, ants, and chinch bugs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fipronil (Regent® 80WG)</strong></td>
<td>2</td>
<td>soil (requires special equipment)</td>
<td>1.95 oz/ac (40&quot; rows)</td>
<td>Applied at planting.</td>
</tr>
<tr>
<td><strong>Target insects</strong></td>
<td></td>
<td>corn rootworms, white grubs, wireworms, cutworms, ants, chinch bugs, and mites.</td>
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</tr>
<tr>
<td><strong>Captan + Lindane + Diazinon (Kernel Guard®)</strong></td>
<td>5</td>
<td>planter box</td>
<td>3.6 oz/cwt seed</td>
<td>Applied at planting.</td>
</tr>
<tr>
<td><strong>Target insects</strong></td>
<td></td>
<td>cut worms</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chloretospyfos (Fortress 2.5G)</strong></td>
<td>2</td>
<td>soil</td>
<td>6 oz/1000 rf (3 oz of 5G)</td>
<td>Applied at planting.</td>
</tr>
<tr>
<td><strong>Target insects</strong></td>
<td></td>
<td>rootworms, cutworms, lesser cornstalk borer, grubs, wireworms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insecticides</td>
<td>Rate</td>
<td>Application</td>
<td>Target insects</td>
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<tr>
<td><strong>bifentrin (Capture 2E)</strong></td>
<td>2 oz/A</td>
<td>soil</td>
<td>2.1-6.4 oz/A Applied at planting.</td>
<td></td>
</tr>
<tr>
<td><strong>Target insects</strong></td>
<td></td>
<td></td>
<td>corn rootworms, white grubs, wireworms, cutworms, ants, chinch bugs, and mites.</td>
<td></td>
</tr>
<tr>
<td><strong>Permethrin (Ambush®/Pounce®)</strong></td>
<td></td>
<td>foliar</td>
<td>6.4-12.8 oz/A Applied at plant or late July and early August in the Northern High Plains.</td>
<td></td>
</tr>
<tr>
<td><strong>Target insects</strong></td>
<td></td>
<td></td>
<td>cutworms, armyworms, chinch bugs, and corn ear worms.</td>
<td></td>
</tr>
<tr>
<td><strong>Carbofuran (Furadan® 4F)</strong></td>
<td>1 oz/A</td>
<td>foliar</td>
<td>2.5 oz/1000 ft pre-plant, 1-2 pt/A post-plant Applied at planting and postemergence.</td>
<td></td>
</tr>
<tr>
<td><strong>Target insects</strong></td>
<td></td>
<td></td>
<td>corn rootworms, white grubs, wireworms, cutworms, chinch bugs, southwestern corn borers, and banks brass mites.</td>
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</tr>
<tr>
<td><strong>Carbaryl (Sevin XLR)</strong></td>
<td>2 quarts</td>
<td>foliar</td>
<td>Foliar application.</td>
<td></td>
</tr>
<tr>
<td><strong>Target insects</strong></td>
<td></td>
<td></td>
<td>chinch bugs (treat when 2 bugs or more on 20% of 6&quot; or shorter plants)</td>
<td></td>
</tr>
<tr>
<td><strong>imidacloprid (Gaucho/Prescribe)</strong></td>
<td></td>
<td>soil</td>
<td>1-2 quarts Seed treatment.</td>
<td></td>
</tr>
<tr>
<td><strong>Target insects</strong></td>
<td></td>
<td></td>
<td>Wireworms, white grubs, flea beetles</td>
<td></td>
</tr>
<tr>
<td><strong>thiamethoxam (Cruiser, Actara and others)</strong></td>
<td></td>
<td>soil</td>
<td>.125 mg/seed Seed treatment.</td>
<td></td>
</tr>
<tr>
<td><strong>Target insects</strong></td>
<td></td>
<td></td>
<td>Wireworms, white grubs, chinch bugs, European corn borer</td>
<td></td>
</tr>
</tbody>
</table>

1Cyfluthrin controls mites when mixed with dimethoate.

**Pest Management:**

Crop rotation and destruction of stalks are two important IPM practices. However, for many growers in the Northern High Plains, crop rotation is not an economical option. In South Texas an estimated 60% of growers practice crop rotation, 85% in the Upper Coast, 50% in South Central Texas and 97% in the Coastal Bend. In areas where cotton does not grow well, crop rotation is less of an option. Growers
could rotate with sorghum but yields are poor due to the difficulty in controlling weedy grasses. There are more grass herbicides available for corn than sorghum and corn shades out weeds better than sorghum. Also, sorghum is more likely to suffer from iron chlorosis. An estimated 45% of South Central, Upper Coast, Coastal Bend, and South Texas growers control winter weeds which is helpful for keeping cutworm populations in check. Although some growers apply preventative soil insecticides, most only use soil treatments at planting when there is evidence a problem may develop. The decision is generally based on root worm adult beetle populations the previous fall. When growers intend to follow the corn crop with another corn crop, they check the root worm adult population during the green silk stage (June and early July in the Northern High Plains). If there is an average of one adult beetle per corn plant, growers will apply soil insecticides at planting the next year, otherwise, they will monitor the fields and make a post-emergence foliar application if a problem develops.

Use in Resistance Management:

Growers can rotate soil applied insecticides of different chemical groups from year to year to avoid corn root worm resistance. Terbufos (Counter®) is the most heavily used. Some growers switch alternate with tefluthrin (Force®), tebpirimphos (Aztec®) and others. An estimated 50% of growers rotate soil insecticides among chemical groups to avoid resistance. Using reduced rates is also a resistance management practice.

Above Ground Insect Pests

(Foliar insects) [corn ear worm (Heliothis zea), European corn borer (Ostrinia nubilalis), Southwestern corn borer (Diatraea grandiosella), Mexican rice borer (Eoreuma loftini), sugarcane borer (Diatraea saccharalis), fall armyworm (Spodoptera frugiperda), chinch bugs (Blissus Leucopterus leucopterus), grasshoppers, true armyworms (Pseudaletia unipuncta), banks grass mite (Oligonychus pratensis), two spotted spider mite (Tetranychus urticae), western bean cutworm, and stink bugs].

Frequency of Occurrence:

Corn ear worms are found annually in corn fields throughout Texas. European corn borers are present annually in most corn fields in the High Plains but are economically damaging in only a few years in a few fields. Southwestern corn borers infest corn fields in the High Plains annually. Mexican rice borers occur sporadically in the Winter Garden. Occurrence of Sugarcane borers is sporadic in the Coastal Bend. In the northern part of the Northern High Plains fall armyworms occur about every 2 to 3 years and about every 5 years in the southern part. Occurrence is annual in the Winter Garden, sporadic in the Blacklands, about every two years in South Texas and the Coastal Bend, and about every three years in South Central Texas and the Upper Coast. Chinch bugs occur annually (but not in all fields) in South Texas, the Upper Coast, South Central Texas, and the Coastal Bend, sporadically in the Northern High Plains and seldom (every 3 to 4 years) to sporadically in the Blacklands. Economic infestations of
Grasshoppers occur infrequently. Many corn fields have some grasshoppers but only along field edges. True armyworms are not present very often in the Northern High Plains but when they are, a high infestation can be devastating. True armyworms are usually more prevalent in fields with watergrass and johnsongrass in the furrows, or in fields that have hail damaged leaves. On the High Plains, 5% to 50% of fields often are infested with banks grass mites which are seldom found in the Blacklands and the Winter Garden. Twospotted spider mites are found annually in the Northern High Plains, sporadically in the Southern High Plains, the Winter Garden and not often in the Blacklands. Mite populations (banks grass mites and twospotted spider mites) increase with periods of hot dry weather. Also, mite numbers may increase when excessive amounts of fertilizer are used and/or when beneficial insects are killed by applications directed at other pests.

Western bean cutworms occur annually in the Northern High Plains. Some years 100% of the fields are infested and in some years almost none. Stink bugs appear about every two years in corn fields on the Upper Coast.

Damage Caused:

Corn earworm larvae feed in the whorl and on the tip of an ear causing the leaves to appear ragged with some cracked kernels. Damage is usually minor to feed corn. Corn ear worms cause quality problems in food corn and the buyer may reject or discount corn that has its damage. First generation European corn borers feed in the whorl and later will enter stalks. Approximately 75% of second generation European corn borer larvae feed on leaf axils and 25% on the ear sheath and collar tissue. They cause physiological damage to the corn plant by direct kernel feeding and tunneling. Feeding can cause ears to drop off the plant. First generation Southwestern corn borer larvae feed on the whorl and then they crawl down the plant and bore into the stalk. The damage caused while feeding in the whorl is minimal unless there is bud destruction which ultimately can lead to complete loss of yield by the infested plant. The second generation causes the most damage. After hatching they feed behind leaf collars and beneath the shucks of the primary ear then later bore into the stalk. As plant maturity is reached, larvae prepare for overwintering by girdling the plant (chewing a complete or partial internal groove around the stalk) near the base about one to six inches above the ground. The wind can easily blow these plants over and these ‘lodged’ plants cannot always be harvested. Mexican rice borers and sugarcane borers attack corn in the pre-tassel stage. After a brief period of feeding on the leaves they borer into the stalks which can lead to lodging. The weakened stalks may fall during ear filling or ear maturation or in a high wind. The stalks may break at any point but seldom near the soil level as with Southwestern corn borer infestations. If stalk lodging does not occur, there is little effect on yield. When fall armyworm activity occurs prior to the tassel stage, larvae rag the leaves but damage is minimal. When infestations occur from tassel to dough stage, damage can be severe resulting in significant yield reductions. There may be additional yield losses due to dropping ears and lodging caused by feeding on shanks and nodes. Adult and immature chinch bugs suck plant juices and normally damage corn from the seedling through 18 inch tall plants. Grasshoppers occasionally cause damage by feeding on the corn plants. They are mostly found around the edges of the field. True armyworms feed on corn leaves where the larger larvae can defoliate corn plants very quickly causing the stalk to die prematurely and leading to lodging problems. Heavy infestations of mites (banks grass mites and/or twospotted spider mites) cause extensive webbing
on the leaves and may be associated with stalk rot and lodging. *Mites* infest the corn plants after the tassels appear. They begin feeding on the lower leaves and move upward until all the leaves are killed. In extreme cases the entire plant can be killed.

*Western bean cutworms* that hatch before the corn has tasseled feed in the whorl of the developing tassel. Larvae hatching after the corn has tasseled feed on the silk and then as they mature begin feeding on developing grain. They feed similarly to corn ear worms but there are often more cutworms in an ear. This feeding can result in the loss of all the grain in an ear or provide for mold development. Damage from *stink bugs* is caused by nymphs and adults sucking sap from the developing corn kernels causing them to become flattened and shriveled.

**Percent Acres Affected:**

*Corn ear worms* are present in an estimated 98% of Texas corn fields. An estimated 50% of the acres are affected by *Southwestern corn borers*, 40% by *fall armyworms*, 37% by *European corn borers*, 29% by *banks grass mites*, 10% by *twospotted spider mites*, 10% by *Western bean cutworms*, 8% by *sugarcane borers*, 7% by *grasshoppers*, 5% by *chinch bugs*, 3% by *true armyworms*, 1% by *stink bugs*, and less than 1% by *Mexican rice borers*.

**Pest Life Cycles:**

*Corn earworm* moths deposit eggs on leaves before and after the tassel stage and newly hatched larvae begin to feed in the whorl. Soon after tasseling eggs will be deposited on the silks. Hatched larvae tunnel into the silk channel to feed. Pollination usually occurs before the larvae begin feeding on the silks and therefore, it is seldom hampered by *corn earworm* activity. Later instar larvae feed on kernels at the tip of the corn ear.

*European corn borers* overwinter in corn field debris such as corn stalks, corn cobs and weed stems. Pupation is in May and moths emerge in late spring. Newly emerged moths live in dense vegetation near corn for a few days where they mate. Following mating, the females return to corn to lay 15 to 30 eggs on the undersides of leaves near the midribs, preferring taller plants. Eggs hatch in 3 to 7 days and after feeding in the whorl the first generation larvae move into the stalk. After pupation moths emerge in midsummer and move to dense vegetation around the field for mating. The mated females lay most of their eggs in masses on the undersides of recently tasseled corn leaves nearest to and including the ear leaf. In about 3 to 5 days the eggs hatch and about 75% of the small second generation larvae travel to the leaf axils and the rest to the ear sheath and collar tissue where they tunnel and feed. *Southwestern corn borer* moths emerge in the spring and lay eggs on the upper and lower surfaces of expanded leaves in the corn plant whorl. In about five days, small first generation larvae hatch from the eggs and begin feeding in the whorl. After feeding in the whorl the larvae crawl down the plant and bore into the stalk. They pupate in the stalk in July (High Plains) and moths begin emerging about mid-July and lay eggs for the second generation. About 75% of these second generation eggs are usually laid after tasseling on the upper surfaces of the middle seven leaves (the ear leaf, two leaves above and four leaves below the ear
Eggs are laid singly or in masses of two or more overlapping like fish scales or shingles. After about 5 days the eggs hatch, then the small larvae begin to feed behind leaf collars, ears and beneath shucks of the primary ear. Next they bore into the stalk to continue the feeding cycle. The pest will prepare for overwintering by girdling the plant near the stalk base. They overwinter in the stalk base or root crown, insulated by a frass plug and by surrounding soil.

**Mexican rice borers** produce four to six generations annually. Adults lay eggs between layers of dry leaf tissue near the plant base. The eggs hatch in six to seven days and the larvae undergo five or six molts. Young larvae feed on and in the leaf sheaths then will enter the stalks, tunneling in a girdling pattern, which may damage enough to lead to stalk breakage. Tunnels become packed with frass (feeding debris and excrement) which protects the larvae from chemical and biological control agents. Mature larvae construct pupation cells near the stalk surface that is protected by one or two layers of transparent leaf tissue (emergence window). The larva to pupa phase takes about 29 days which is followed by a 9 to 10 pupal period. The adults live for about 7 days.

**Sugarcane borers** attack corn in the pre-tassel stage. They bore into the stalks shortly after feeding on the leaves. The sugarcane borers lay flat, oval eggs on green leaf blades in flat clusters of about 25. In 4 to 9 days, the eggs hatch into larvae, which grow to about 1 inch long. The larvae undergo six or seven instars and tunnel vertically within stalks, producing a hollow cavity that may be invaded by red rot fungus. After 20 to 30 days of feeding, the larvae pupate then adults emerge after about another 9 days. The life cycle of **sugar cane borers** is completed in 30 to 45 days during the summer and four to five generations are produced per year.

**Fall armyworm** moths deposit eggs in masses of 50 to 100 on corn leaves and grasses in the furrow. Hatched larvae feed in the whorl, on ears and ear shanks, and behind leaf collars. **Chinch bugs** overwinter as adults in tufts of bunch and clump-forming grasses. In the spring they migrate to small grain fields. However if cool weather delays migration, they may fly directly to corn or sorghum where they mate and the females begin laying eggs. The eggs are laid behind the lower leaf sheaths, on roots, or in the ground close to the host plant. The females deposit eggs at the rate of 15 to 20 per day over a period of two to three weeks. In one to two weeks nymphs hatch from the eggs and begin feeding on the grain crop. They pass through five nymphal instars in about 30 to 40 days. When mature, large numbers of **Chinch bugs** can crawl or fly from wild bunch grasses or small grains into corn or sorghum fields where they lay the second generation eggs. After hatch feeding is behind the leaf sheaths of the corn plants. Following pupation, adults fly to wintering quarters.

**Grasshoppers** overwinter as eggs and hatch in the spring over a period of four to six weeks. Grasshopper nymphs feed on green vegetation, preferring small grains. They can go through five to six nymphal instars in 35 to 50 days prior to becoming adults and there is one generation annually. **True armyworms** overwinter as partially grown larvae. They resume feeding in the spring and at the final larval instar stop feeding a few days before entering the 15-20 day pupal period. Mating and subsequent egg laying is at night. Females have a life span of about 17 days, often laying up to 2,000 eggs. These eggs hatch into small caterpillars in six to ten days that move to feed on plant leaves, generally at night. They pupate in flimsy cocoons and emerge as full adults in August and September. They mate and lay eggs and the
second or overwintering generation larvae hatch and partially develop before winter begins. *Banks grass mites* and *Two spotted spider mites* overwinter as adult females and nymphs. Activity resumes as temperatures begin to warm in the spring. Female adults produce eggs throughout their three to four week life span laying from 3 to 14 eggs per day with an average of 70 eggs for a life time. The eggs hatch in 2 to 15 days, depending on the temperature. Temperature also determines the length of the larval stage which ranges from 1½ to 4¼ days. Following a quiescent period the larvae, which have six legs, shed their skin and emerge as 8 legged protonymphs. After 1½ to 3¼ days a quiescent period occurs again, the skin is cast off and the second nymphal stage appears. Depending again on temperature, this stage lasts one to sixteen days. The adult female that emerges after the quiescent period has a preoviposition period of about 1½ days. *Banks grass mites* and *twospotted spider mites* reproduce very rapidly under hot, dry conditions and can reach extremely high population levels especially late in the summer. All life stages of the mites may be present at any given time, and there can be 7 to 10 generations during the growing season.

In July *western bean cutworm* moths lay eggs in masses of 5 to 200 on the upper surfaces of corn leaves. After hatching the young worms feed on the egg shell before moving to feed in the whorl or the silk of the developing ear. The larvae drop to the ground to spend the winter and it is unlikely that any can still be found in the ears in mid-September, but their damage will be evident until harvest. Only one generation develops per year.

*Stink bugs* overwinter as adults and become active in spring when temperatures rise above 70 degrees F. Females deposit up to several hundred eggs each, usually in mid- or late June. They lay the eggs on leaves in clusters (averaging 36 eggs). After hatching nymphs pass through five instars before becoming adults. Approximately 5 weeks elapse between hatching and adult emergence.

**Timing of Control:**

Damage from *corn ear worms* is usually not cost effective and seldom severe enough to merit insecticide applications in feed corn. Treatment may be recommended in food corn at the green silk stage during moth laying activity, since food corn processors will reject corn with worms. Insecticide applications for control of *European corn borers* are justified when 50% of the plants are infested with at least one live larva. Insecticide applications for *Southwestern corn borers* should be made before the borers leave the whorl and enter the stalk. Most damage from *European* and *Southwestern corn borers* is from second generation borers and therefore, insecticide applications are generally applied later in the season to target the second generation borers.

Generally, infestation level and damage from *sugarcane borers* and *Mexican rice borers* is not severe enough to merit treatment. If scouting reveals a severe problem exists, however, treatment should be made before the larvae bore into the corn stalks.

Insecticide applications for *fall armyworm* control should not be made unless scouting reveals that infestations are severe enough to merit it since treatment can be detrimental to beneficial insects.
Treatment is most effective when the larvae are small and before they enter the primary ear, therefore, insecticides are generally applied at the whorl stage. If a field has a history of early season, economically damaging *chinch bugs*, an at-plant soil incorporated insecticide application will suppress *chinch bug* populations. Growers should monitor for *chinch bug* activity after germination, particularly during dry periods. Insecticide applications are recommenced when two or more adult *chinch bugs* are found on 20% of less than 6 inch high seedlings or when immature and adult bugs are found on 75% of taller plants. Most growers do not treat for grasshoppers. Treatment is justified, however, when there are 14 to 15 hoppers per square yard on the edges of the field. Treating field borders and turn-rows is an option. Although infestations of *true armyworms* are infrequent, insecticide applications can be made when an infestation occurs, usually from mid June to early July. Insecticide applications for control of *banks grass mites* and *two spotted spider mites* should be made at the economic damage level which is when mite feeding has caused the death of two functional leaves. Applications can be made from planting until three weeks before harvest but usually threshold is not reached until later in the season after tasseling. If infestations are sufficient to justify treatment, treatments for *western bean cutworms* are made in early July. When stink bugs are a problem, insecticide applications are made at the corn milk stage.

**Yield Losses:**

When *southwestern corn borers* are present in corn fields and not controlled, they can cause a 18% estimated yield loss. Estimated yield loss from *banks grass mites* is 12%, *western bean cutworms* 11%, *sugarcane borers* 9%, *twospotted spider mites* 9%, *chinch bugs* 8%, *European corn borers* 6%, *Mexican rice borers* 5%, stink bugs 5%, *corn ear worms* 4%, *fall armyworms* 2%, grasshoppers 2%, and *true armyworms* 0.5%.

**Regional Differences:**

*Corn ear worms* are present in most corn fields in all the corn growing regions of the state. *European corn borers* and *southwestern corn borers* infest most corn fields in the High Plains and a few corn fields in the Blacklands. *Mexican rice borers* are found in a few fields in the Winter Garden. *Sugarcane borers* are abundant in the Upper Coast and quite common in the Lower Valley. A few are found in South Central fields and a very few in the Blacklands and Coastal Bend corn fields.

*Fall armyworms* infest over half the corn acres on the High Plains, the Upper Coast, South Central Texas, the Costal Bend and just under half in South Texas. They infest a moderate number of acres in the Winter Garden and a small number of acres in the Blacklands. In the Upper Coast and South Central Texas *chinch bugs* infest around 20% of the corn acres. They infest around 10% in the Coastal Bend and South Texas and 5% in the Blacklands. *Grasshoppers* are somewhat prominent in South Central and South Texas. A few are found in Upper Coast and Blacklands corn fields and a very few in the High Plains. A small percentage of corn acres in the High Plains have *true army worms*. More than half of the corn acres in the High Plains and about one-tenth in the Blacklands, South Texas, and the Winter Garden get infested with *banks grass mites*. *Twospotted spider mites* are found in 10% to 15% of the corn acres in the Blacklands and the High Plains and about 5% of the acres in South Texas and the Winter Garden.
Almost one quarter of the corn acres in the High Plains are infested by western bean cutworms. Stink bugs infest about 10% of the Upper Coast corn acres.

### Cultural Control Practices:

Early planting and weed control are helpful in fall armyworm and mite control. Keeping the corn healthy and well watered is also important for mite control. Unnecessary insecticide sprays and spray drift from other fields can cause mite populations to increase and should be avoided. Corn borers overwinter in corn stubble and weeds so destroying stubble and weeds via plowing, double discing, knifing, or burning in the fall helps prevent borer problems. If European corn borers are expected to be a problem late planting is recommended. Early planting is recommended to reduce potential southwestern corn borer problems. Good weed control, especially control of grassy weeds helps keep Mexican rice borer and true armyworm populations down. Crop rotation will also help reduce insect problems.

### Biological Control Practices:

Planting Bt corn is the primary biological control practice utilized. An estimated 40% of Texas corn acreage is currently planted with Bt corn seed. Bt corn gives excellent control of first and sometimes second generation European corn borers, southwestern corn borers, and sugarcane borers. Some Bt varieties may also be effective in controlling or suppressing corn ear worm.

### Chemical Control (Foliar Insects):

<table>
<thead>
<tr>
<th>Chemical</th>
<th>% A. Trt.</th>
<th>Type of Appl./A</th>
<th>Typical Rates</th>
<th>Timing</th>
<th># of Appl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bifenthrin (Capture® 2EC)</td>
<td>28</td>
<td>foliar</td>
<td>5.1 - 6.4 oz</td>
<td>As needed - usually late season for mite control.</td>
<td>1</td>
</tr>
<tr>
<td><strong>Target insects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>As needed - usually late season for mite control.</td>
<td></td>
</tr>
<tr>
<td>Dimethoate1 4E</td>
<td>27</td>
<td>foliar</td>
<td>0.66 - 1 pt</td>
<td>As needed</td>
<td>1</td>
</tr>
<tr>
<td><strong>Target insects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>As needed - usually late season for mite control.</td>
<td></td>
</tr>
<tr>
<td>Lambda-chyalothrin (Warrior T® 1CS)</td>
<td>12</td>
<td>foliar</td>
<td>1.92 - 3.84 fl oz.</td>
<td>As needed from seedling stage through the season.</td>
<td>1</td>
</tr>
<tr>
<td><strong>Target insects</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>As needed - usually late season for mite control.</td>
<td></td>
</tr>
</tbody>
</table>

### Additional Information:

- Bifenthrin (Capture® 2EC) targets southwestern corn borer, European corn borer, mites, western bean cutworm, fall armyworm, and grasshoppers.
- Dimethoate1 4E targets mites, chinch bugs, and cutworms.
- Lambda-chyalothrin (Warrior T® 1CS) targets corn borers, mites, armyworms, and grasshoppers.
### Esfenvalerate (Asana® XL)

<table>
<thead>
<tr>
<th>Target insects</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>corn borers, mites, armyworms, corn ear worms, cutworms, and grasshoppers.</td>
<td>4</td>
<td>foliar</td>
<td>SCB - 0.66 - 5.8 oz; ECB - 7.8 - 9.6 oz</td>
<td>Late July to early August (maybe earlier with food corn).</td>
</tr>
</tbody>
</table>

1Dimethoate is rarely applied by itself. In many cases dimethoate is mixed and applied with Capture, Baythroid, Karate, Asana, or Furadan for southwestern corn borer and mite control. Dimethoate by itself is not a good mite control but when mixed with one of these other products synergism takes place and good mite control results.

### Alternative Chemicals:

Bt corn is the number one insect control alternative. Spinosad (Tracer®), which may become available for use on corn, has been tested with mixed results for control of southwestern corn borers. It is fairly good at controlling fall armyworms.

### IPM Management:

The Pyrethroids, (Capture®, Baythroid®, Karate®, and Asana®) are the best corn IPM insecticides and then Furadan® in terms of causing minimal damage to beneficial insects. Tracer® is even less harmful to beneficial insects. Two corn IPM practices are crop rotation, and destruction of stalks. Most growers limit their foliar applied insecticide applications to the minimum needed, only treating when the infestation meets or exceeds economic thresholds. Growers are careful to time insecticide applications for corn borer control for optimum benefit. In South Central Texas, the Upper Coast, the Coastal Bend, and South Texas an estimated 70% of growers scout their fields, 80% use thresholds, and 85% practice conservation of natural enemies.

### Use in Resistance Management:

While corn growers can rotate soil applied insecticides of different types to avoid corn root worm resistance, all products for corn borer control are of the same type, pyrethroids, so rotation for resistance avoidance is not effective. Foliar applied insecticides are not applied every year but only in the years when a severe enough problem develops and this helps keep resistance down. A national research project is underway for southwestern corn borer resistance management. Waiting until economic threshold is reached and making only one application can help prevent resistance in the banks grass mite. The best control for banks grass mites is to put on extra irrigation water to relieve pressure on the plant. To prevent corn borer and corn ear worm resistance to Bt corn, Bt corn is restricted to no more than 80% of the corn acreage in the Northern part of the Northern High Plains and no more than 50% in...
the Southern part (cotton is planted in the Southern part and crops are rotated so borers and ear worms are not as prevalent).

Diseases

[common rust (*Puccinia sorghi*), common smut (*Ustilago maydis*), seed rots and seedling blight (fungi - several species), charcoal rot, Northern corn leaf blight (*Exserohilum turcicum*), Southern corn leaf blight (*Bipolaris maydis*), Southern corn rust (fungus - *Puccinia polysora*), ear and kernel rots (fungi - several species), and viruses]

Frequency of Occurrence:

*Common rust* occurrence is generally sporadic and rare, but it does occur annually in some fields and it can be severe in some years if resistant varieties are not planted. *Common smut* is a sporadic problem but gets more serious in dry years. *Seed rot and seedling blight* occurs sporadically, mostly in cool wet seasons. *Charcoal rot* is more likely to occur during drought years. Occurrence is generally infrequent but can be annual in pockets or individual fields where the corn is stressed by drought. *Northern corn leaf blight* and *Southern leaf blight* are sporadic problems in corn. *Northern leaf blight* has been a problem one out of the last 14 years on the Southern High Plains. *Southern corn rust* is somewhat common but it is rarely a problem. *Ear and kernel rots* occur infrequently, however, they are more likely to occur in wet years near harvest. *Viruses* are sporadic or infrequent problems in most of the state but occur annually in some parts of South Texas and the Coastal Bend.

Damage Caused:

Corn plants with *common rust* develop round to oval areas called pustules, with cinnamon brown spores on the corn leaf tissue. These eventually turn black and weaken the plant. *Common smut* can affect all parts of the corn plant. It is rare but early infection may kill small plants. Galls develop that are covered with a white membrane with a mass of powdery black spores inside. A gall on the lower part of the stalk can make the ears small or non-existent. *Seed rots and seedling blight* symptoms include yellowing and wilt of leaves, seed rot, damping-off of seedlings, seedling wilt, and root rot. *Seed Rot* causes the seed to rot before germination; damping off and seedling blight cause rotting of the stem tissues near the ground level; seedling wilt, a gray coloration starting at the leaf tips and extending rapidly to the whole leaf, can cause complete collapse of seedlings in 27-48 hours; and root rot causes water soaking, browning and sloughing (dead tissue separating from living tissue) of rootlet and may advance into main roots and crown tissues. *Charcoal rot* begins as a rot rot and moves up the stalk causing a ashy-gray appearance. The *Northern corn leaf blight* organism causes long, elliptical, grayish green or tan lesions, often with a yellow halo in the early stages, to develop on the lower leaves. The disease progresses up the plant causing premature death, resembling frost or drought injury. If it is established before silking, losses will be high but if delayed until six weeks after silking, yield losses will be minimal. Seedlings from
southern corn leaf blight infected kernels may wilt and die within three to four weeks after planting. Also, southern corn leaf blight can cause cob rot with substantial losses in harvesting and shelling. Early shank invasion can cause premature kill of the ear and possible ear drop. Southern corn rust is destructive to leaf tissue, causing the leaves to turn yellow and die. Heavy infection while ears are filling can cause drastic yield reductions. Corn ears affected with ear and kernel rots are smaller and yields, quality, and feed value are reduced. Maize dwarf mosaic virus is the most common and damaging virus disease of corn in Texas. Infected plants are sometimes stunted with excessive tillering, multiple ear shoots and poor seed set. Early infection may predispose corn to root and stalk rots and premature death.

Percent Acres Affected:

An estimated 7% of Texas corn acreage is affected by common rust, 7% by common smut, 4% by seed rots and seedling blight, 6% by charcoal rot (when drought stressed), 3% by Northern corn leaf blight, 3% by Southern corn rust, 3% by viruses, 2% by Southern leaf blight, and 2% by ear and kernel rots.

Pest Life Cycles:

The Common rust fungus has numerous physiologic races. It develops under conditions of cool temperatures, and high relative humidity and high summer temperatures will usually reduce it. Older tissue is generally resistant. Conditions favorable to common smut development include dry weather (780 F - 950 F) and high soil nitrogen content or heavy manure applications. Also, injuries from blowing sand, hail damage, or cultivation will increase smut. Seed rots and seedling blight are seed-borne fungi that attack corn seed. These fungi are favored by cold, wet, poorly drained soils. Genetic resistance, seed quality, planting depth, and soil type affect the severity of the disease. Charcoal rot (Northern corn leaf blight) overwinters in infected leaves, husks and other plant parts. Spores travel by wind over long distances to the leaves of corn plants. Secondary spread occurs within and between fields from spores produced abundantly on leaf lesions. Disease development is favored by moderate temperatures, heavy dews, and frequent showers during the growing season. Southern corn leaf blight fungus overwinters as mycelium and spores in corn debris in the field and on kernels in cribs, bins and elevators. Conidia are carried by wind or splashing water to growing plants where primary infections occur. Sporulation on diseased plants leads to a rapid spread in the field. The disease cycle can be completed in about 60-72 hours under ideal conditions. Southern corn rust develops most quickly when high temperature and high relative humidity occur in a field planted to a susceptible hybrid. Southern corn rust is favored by temperatures around 800 F. Corn ear and kernel rots are more likely to develop in areas where rain fall is high between the silking stage and harvest. Bird and insect damage to ear will increase ear and kernel rots. Maize dwarf mosaic virus symptoms can appear in the field within 30 days after seedling emergence. The virus is transmitted mechanically and by at least 12 aphid species, including the green bug. It has a wide host range among wild and cultivated grasses. Johnsongrass is believed to be a major overwintering reservoir host.

Timing of Control:
Aside from planting fungicide treated seed, field corn growers in Texas do not apply fungicides. This is impacted by the availability and use of disease resistance varieties.

**Yield Losses:**

*Common smut* and *charcoal rot* cost corn growers an estimated 8% in yield loss when either is present in the crop. Yield loss is estimated at 5% when *seed rots and seedling blight* or *ear and kernel rots* are present. Estimated yield loss from the presence of *common rust, Northern leaf blight, Southern leaf blight, Southern rust,* or *viruses* is 1%.

**Regional Differences:**

*Common smut* and *common rust* are more prominent in the High Plains than other corn growing areas of Texas. *Charcoal rot* and *viruses* are seen more often in the southern than the northern part of the state. *Seed rots and seedling blight, Northern corn leaf blight, Southern corn leaf blight,* and *ear and kernel rots* may occur with equal likelihood in any of the corn growing areas of the state.

**Cultural Control Practices:**

Crop rotation, removal of stubble or mixing it into the soil and keeping the fields clean of weeds help prevent *common rust* problems. Growers can reduce the threat of *common smut* occurrence by being careful not to cause mechanical injury to the corn plants and by keeping the crop fertility balanced. *Seed rots and seedling blight* controls include planting high quality damage-free seed that has been treated with a fungicide; planting in warm, moist soil, in a field with good drainage; and correct placement of in furrow fertilizer. *Charcoal rot* problems are reduced by planting early and irrigation management practices that minimize drought stress. Crop rotation will reduce the threat of *Northern corn leaf blight* and *Southern corn leaf blight* problems. There are no cultural control practices for *Southern corn rust.* Early harvest and proper storage below 15% moisture help reduce incidences of *ear and kernel rots.* Johnsongrass control will eliminate habitats for aphids that transmit *viruses* to corn and lower the chances of *virus* infections.

**Biological Control Practices:**

Planting resistant varieties is the only biological control practice available. Resistant varieties are available for *common rust, common smut, Northern corn leaf blight, Southern corn leaf blight, Southern corn rust, ear and kernel rots,* and *viruses.* Drought-tolerant varieties are available for *charcoal rot.* There are no resistant varieties available for *seed rot and seedling blight.* Researchers and breeders continue to seek for improved varieties. They plant test plots and screen for the different diseases and eliminate the hybrids that are not resistant.

**Seed Treatments:**
<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Brand Name &amp; Formulation</th>
<th>Typical Rates (per cwt seed)</th>
<th>Target Diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metalaxyl</td>
<td>Allegiance-FL (28%)</td>
<td>3-10 oz</td>
<td>pythium seed rot and seedling blight</td>
</tr>
<tr>
<td>Metalaxyl</td>
<td>Apron XL LS (32%)</td>
<td>0.32-0.64 fl. oz.; 0.0425 fl. oz.</td>
<td>pythium seed rot and seedling blight</td>
</tr>
<tr>
<td>Fludioxonil</td>
<td>Maxim 4FS (40%)</td>
<td>0.08-0.16 fl. oz.</td>
<td>seed rot and seedling blight, pythium and other pathogens</td>
</tr>
<tr>
<td>Fludioxonil</td>
<td>MaximXL (21%)</td>
<td>0.167-0.334 fl. oz.</td>
<td>seed rot and seedling blight, pythium and other pathogens</td>
</tr>
<tr>
<td>Captan</td>
<td>Captan 75D (75%)</td>
<td>1.25 fl. oz.</td>
<td>seed rot and seedling blight, pythium and other pathogens</td>
</tr>
<tr>
<td>Captan</td>
<td>Captan 400 (39%)</td>
<td>1.25-2.375 fl. oz.</td>
<td>seed rot and seedling blight, pythium and other pathogens</td>
</tr>
<tr>
<td>Captan</td>
<td>Captan 30-DD (29%)</td>
<td>1.5 fl. oz.</td>
<td>seed rot and seedling blight, pythium and other pathogens</td>
</tr>
<tr>
<td>Thiram</td>
<td>Thiram 50WP (50%)</td>
<td>3 oz.</td>
<td>seed rot and seedling blight, pythium and other pathogens</td>
</tr>
<tr>
<td>Thiram</td>
<td>Vitaflo-280 (13%)²</td>
<td>4.5 fl. oz.</td>
<td>seed rot and seedling blight, pythium and other pathogens</td>
</tr>
<tr>
<td>Carboxin</td>
<td>Vitaflo-280 (13%)³</td>
<td>8.5-11.5 fl. oz.</td>
<td>seed-borne head smut, seed rot and seedling blight, pythium and other pathogens.</td>
</tr>
</tbody>
</table>

**Note:** All of the Texas corn acreage is planted with treated seed for disease prevention. Use rates are low usually 1.5 oz per acre. Disease resistant corn varieties have a big impact on reducing disease problems in Texas corn.

1When used with fludioxonil or captan.
2Also contains carboxin.
3Also contains thrim.
4Will not control soil-born spores.

All the seed treatments given in the table above provide good control of the target diseases and 95 percent to 100 percent of the acres planted are planted with seed treated with one or two of these chemicals.

**Alternative Chemicals:**
Bacillus subtilis (28%) [Kodiak concentrate Biological Fungicide], a bacterium, is an alternative seed treatment. It is applied as a biological control of seed and seedling pathogens. Efficacy is generally poor.

Weeds

**Broadleaf Weeds**

- pigweed, *Anaranthus spp.*
- sunflower, *Helianthus annuus*
- kochia, *Kochia scoparia*
- cocklebur, *Xanthium strumarium*
- morning glory, *Ipomoea spp.*
- silver leaf nightshade, *Solanum elaeagnifolium*
- water hemp, *Amaranthus rudis*
- field bindweed, *Convolvulus arvensis*
- velvetleaf, *Abutilon theophrasti*
- smell melon, *Cucumis melo*
- yellow top *Verbesina encelioides*

**Grasses**

- common bermuda, *Cynodon dactylon*
- johnson grass, *Sorghum halepense* L.
- Texas panicum, *Panicum texanum*
- sorghum alnum, *Sorghum X alnum*

**Frequency of Occurrence:**
All weeds can occur annually in Texas corn at varying infestation levels.

**Damage Caused:**
Weeds reduce yields by competing with the corn plants for space, sun light, water, and nutrients. Unwanted plants interfere with harvest and act as alternate hosts for diseases, and insects.

**Percent Acres Affected:**
Estimated percent of Texas corn acreage potentially economically infested or that would warrant management efforts for each weed are pigweed 96%, sunflower 28%, kochia 13%, cocklebur 11%, morning glory 11%, silver leaf nightshade 4%, water hemp 3%, field bindweed 2%, velvetleaf 2%, smell melon 1%, and yellow top 1%.
Pest Life Cycles:

*Pigweed, sunflower, cocklebur, and yellow top* are native annual warm season weeds; *kochia, velvetleaf*, and *smell melon* are introduced annual warm season weeds; *water hemp* is a native annual cool season weed; *silver nightshade* is a native perennial warm season weed; *field bindweed* is an introduced perennial warm season weed; and *morning glory* is a native (imported) annual (perennial) warm season weed.

Timing of Control:

Most growers apply preplant herbicides and follow up with post plant whole field applications or spot treatments as needed. Post plant treatments are most effective when the weeds are small. Pre and post plant broadleaf target weeds include *pigweed* and *water hemp*. *Sunflower, cocklebur, morning glory, silver night shade, smell melon*, and *yellow top* usually require post plant treatments.

Yield Losses:

Corn fields infested with *velvetleaf* may suffer an estimated 20% yield loss even with the use of herbicides and other currently practiced control efforts and an estimated 40% yield loss without herbicides. Estimated yield loss from other weeds if present in the field with and without herbicides, respectively is as follows: *field bindweed* 15% and 25%, *smell melon* 15% and 50%, *yellow top* 15% and 50%, *morning glory* 14% and 49%, *sunflower* 12% and 17%, *silver leaf nightshade* 8% and 12%, *water hemp* 7% and 68%, *pigweed* 5% and 51% and *cocklebur* 2% and 28%. No estimate is available for yield loss from *kochia* with herbicide use but without herbicide use the estimated loss is 90% where *kochia* is present.

Regional Differences:

*Pigweed* is a potential major problem in Texas corn fields throughout the state. *Sunflowers* are abundant in the Blacklands, moderate in the South Central, Coastal, and Southern areas, and minimal in the High Plains. *Kochia* is very abundant in the High Plains but almost nonexistent elsewhere. *Cocklebur* affects an estimated 25% of corn acreage in the South Central, Coastal, and Southern areas, 15% in the Blacklands, and 10% in the High Plains. *Morning glory* infests a moderate number of corn fields in the Blacklands, a small number of fields in the South Central, Coastal, and Southern areas, and even a smaller number in the High Plains. *Silverleaf nightshade* affects an estimated 15% of corn acreage in the South Central, Coastal, and Southern areas but is seldom seen in other areas. A small amount of corn acreage in the South Central, Coastal, and Southern areas is infested with *water hemp* and a minimal amount in the Blacklands. *Field bindweed* and *velvetleaf* are mainly found in the High Plains but only in a few fields. *Smell melon* and *yellow top* infest a few corn fields in the South Central, Coastal, and Southern areas.
Cultural Control Practices:

Cultivation and crop rotation are the primary cultural weed control practices employed. Some growers practice no till and avoid bringing new weed seed up to the soil surface. Most growers only cultivate one time in the season but some cultivate two times. Growers can cultivate until the corn is about knee high.

### Chemical Control:

<table>
<thead>
<tr>
<th>Chemical</th>
<th>% A. Trt.</th>
<th>Type of Appl/A</th>
<th>Typical Rates</th>
<th>Timing</th>
<th># of Appl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrazine (Aatrex)</td>
<td>70</td>
<td>soil &amp; foliar</td>
<td>4L - 1.5 qt.</td>
<td>Up to 45 days pre-plant or postemergence before corn 12&quot; high and weeds 1.5&quot; high.</td>
<td>1</td>
</tr>
<tr>
<td><strong>Target weeds</strong></td>
<td></td>
<td></td>
<td>90DF - 1.5 lb.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-4D amine 4 lb. LVE 616</td>
<td>15</td>
<td>foliar</td>
<td>0.33 pt.</td>
<td>Post-plant.</td>
<td>1</td>
</tr>
<tr>
<td><strong>Target weeds</strong></td>
<td></td>
<td></td>
<td></td>
<td>broadleaf weeds including: pigweed, sunflower, cocklebur, morning glory, woolly croton, water hemp, yellow top, smell melon, and silverleaf nightshade.</td>
<td></td>
</tr>
<tr>
<td>Dicamba (Banvel 4L)</td>
<td>13</td>
<td>foliar</td>
<td>0.5 pt.</td>
<td>Post-plant.</td>
<td>1</td>
</tr>
<tr>
<td><strong>Target weeds</strong></td>
<td></td>
<td></td>
<td></td>
<td>morning glory, cocklebur, pigweed, sunflower, velvetleaf, woolly croton, water hemp, yellop top, smell melon, silverleaf nightshade and field bindweed.</td>
<td></td>
</tr>
<tr>
<td>Bromoxynil (Buctril 2EC)</td>
<td>6</td>
<td>foliar</td>
<td>1 - 1.5 pt.</td>
<td>Pre-emergence and postemergence.</td>
<td>1</td>
</tr>
<tr>
<td><strong>Target weeds</strong></td>
<td></td>
<td></td>
<td></td>
<td>sunflower, cocklebur, yellow top, and nutsedge.</td>
<td></td>
</tr>
<tr>
<td>Primisulfuron +methyl (Beacan 75WG)</td>
<td>6</td>
<td>foliar</td>
<td>0.76 oz.</td>
<td>Post-plant.</td>
<td>1</td>
</tr>
<tr>
<td><strong>Target weeds</strong></td>
<td></td>
<td></td>
<td></td>
<td>pigweed, sunflower, cocklebur, water hemp, yellow top, Texas panicum, shattercane, barnyard grass, johnsongrass, broadleaf signal grass, and brown top panicum.</td>
<td></td>
</tr>
<tr>
<td>Glyphosate (Roundup Ultra)</td>
<td>35</td>
<td>foliar</td>
<td>0.5-5 qt.</td>
<td>Pre or Post-plant depending on type of corn</td>
<td>1</td>
</tr>
<tr>
<td>Target weeds</td>
<td>All weeds including broadleaf weeds, grasses, and sedges.</td>
<td></td>
<td></td>
<td></td>
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<td>----------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dimethenamid</strong> + atrazine (Guardsman)</td>
<td>4</td>
<td>soil &amp; foliar</td>
<td>4 pt.</td>
<td>Pre-plant.</td>
<td>1</td>
</tr>
<tr>
<td>Target weeds</td>
<td>morning glory, cocklebur, water hemp, kochia, pigweed, velvetleaf, barnyard grass, johnsongrass (seedling) and yellow nutsedge.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Imazethapyr</strong> (Pursuit)</td>
<td>3</td>
<td>foliar</td>
<td>DG -1.4 oz., 2AS - 4 oz.</td>
<td>Post-plant.</td>
<td>1</td>
</tr>
<tr>
<td>Target weeds</td>
<td>pigweed, sunflower, morning glory, barnyard grass, water hemp, yellow top, and smell melon.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Imazethapyr+ imazapyr</strong> (Lightning WSB)</td>
<td>3</td>
<td>foliar</td>
<td>1.28 oz</td>
<td>Post-plant.</td>
<td>1</td>
</tr>
<tr>
<td>Target weeds</td>
<td>cocklebur, field bindweed, morning glory, kochia, pigweed, sunflower, velvetleaf, barnyardgrass, johnsongrass, shattercane, Texas panicum, foxtail, and yellow nutsedge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Isoxaflutole</strong> (Balance WDG)</td>
<td>2</td>
<td>soil</td>
<td>1.5 - 3 oz.</td>
<td>Pre-plant.</td>
<td>1</td>
</tr>
<tr>
<td>Target weeds</td>
<td>water hemp, kochia, pigweed, velvetleaf, barnyardgrass, broadleaf signalgrass, foxtail, and johnsongrass (seedlings).</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dicamba+ diflufenzopyr</strong> (Distinct WG)</td>
<td>1</td>
<td>foliar</td>
<td>4 oz.</td>
<td>Post-plant.</td>
<td>1</td>
</tr>
<tr>
<td>Target weeds</td>
<td>cocklebur, sunflower, waterhemp, kochia, morning glory, pigweed, smell melon, velvetleaf, silverleaf nightshade, barnyardgrass, johnsongrass (seedlings), foxtail and shattercane.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>prosulfuron+ primisulfuron+methyl</strong> (Exceed WDG)</td>
<td>1</td>
<td>foliar</td>
<td>1 oz.</td>
<td>Post-plant.</td>
<td>1</td>
</tr>
<tr>
<td>Target weeds</td>
<td>cocklebur, sunflower, water hemp, field bindweed, morning glory, kochia, pigweed, shattercane, velvetleaf, and johnsongrass.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rimsulfuron+ thifensulfuron</strong> (Basis WDG)</td>
<td>1</td>
<td>foliar</td>
<td>0.33 oz.</td>
<td>Post-emergence.</td>
<td>1</td>
</tr>
<tr>
<td>Target weeds</td>
<td>pigweed, velvetleaf, barnyardgrass, and foxtail.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1Low volatility ester.
2Only for IMI-corn otherwise severe damage will occur.
3Diflufenzopyr makes dicamba more active.

References


