Common Concerns in West Texas Sunflower Production and Ways to Solve Them

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Extension's goal in West Texas is to provide information to help producers make management decisions about their crop. This guide summarized some key issues that producers best understand to help them increase their success, that when he or she—particularly a first-time grower—steps away from their crop at the end of the season that they have had a good experience.

Our observations are that too many new growers fall short in educating themselves about sunflower production, managing the crop, or having the patience to see the crop through. In the early years of our cropping experience in West Texas we observed too often a low-input attitude toward a significant number of acres. That has decreased considerably. We probably still hear a higher percentage of frustration among first-time sunflower growers than any other crop in West Texas. But this summary reflects some of what we have learned and know about sunflower and how to address common concerns that often arise in sunflower cropping.

Sunflower production in West Texas, both confectionary and oilseed, has been the subject of several recurring concerns from growers. These primary concerns are:

1) Crop losses due to sunflower (head) moth, *Homoeosoma electellum* (Hulst),
2) "Sunflowers were hard on my ground," as many growers feel their subsequent crop performs poorly,
3) Volunteer sunflowers the year after sunflower production.

These are legitimate concerns. The lack of answers or understanding of these three issues has soured many Texas sunflower growers after only one or two years. Our objective is to help both prospective and current growers anticipate potential problems (or equipment needs) before they occur and offer some options to compensate for and overcome these and other secondary concerns in Texas sunflower production. Comprehensive production and insect guides for sunflowers offer more detail, but for now we want to highlight these issues in advance of increased acreage and new sunflower growers before the next crop is planted.

General information on sunflower production in West Texas is available from Texas AgriLife Extension Service (http://lubbock.tamu.edu/sunflower, http://varietytesting.tamu.edu), sunflower contractors, sunflower seedsmen, and others. Kansas State Univ. publishes an excellent resource for sunflower production useful for Texas growers, "High Plains Sunflower Production Handbook," publication MF-2384 (2009). It is available via the Internet at http://www.ksre.ksu.edu/library Also, Ed Bynum, Texas AgriLife Extension Service, Amarillo, has revised "Insect Pests of Texas Sunflowers" (E-579) which is available at http://lubbock.tamu.edu/ipm/AgWeb or http://agrilifebookstore.org

Primary Concerns

Sunflower (head) moth.

We call this insect "the Boll Weevil of Sunflowers" to help communicate how important and devastating it can be. No, it is not a season-long pest like the boll weevil of cotton, but is quite a different insect altogether. This insect left unchecked when sunflowers are entering full bloom, however, can be a disaster on par with any heavy loss uncontrolled boll weevil ever inflicted on cotton.

Sunflower moth is a tan or gray adult up to 3/4 inch long. The moths are attracted to sunflowers beginning to bloom. Their regional population is often influenced by the many alternate hosts, especially wild sunflowers. Sunflower moths are only fertile when pollen is available. Egg laying occurs on the head. After hatching, young larvae are relatively exposed for the first 4 to 6 days as they feed on pollen and floral parts. However, older larvae tunnel into seeds and seed heads and are fairly well protected from insecticides. These older larvae may destroy up to fifteen seeds per larva. Often *Rhizopus* head rot, a fungus, follows the tunneling sunflower moth larvae. If the insects don't do the major damage *Rhizopus* can, turning sunflower heads black and mushy. The incidence of this fungal disease, to which there is little chemical control available, is closely tied to sunflower moth infestations, and sometimes other physical damage like hail.

For sunflower moth control, timing is everything, both in scouting and in treatment. Sprays control moths and young larvae, but not larvae that have tunneled into the seed. The presence of moths triggers insecticide applications. Scouting is best in the early morning or evening, even after dark with a flashlight, and needs to begin before any ray petals are visible while laying flat on the head. Also, if you walk into a blooming sunflower field during the heat of the day and see more than 1 moth in the field (on any blooming head), chances are you may have significant sunflower head moth pressure because otherwise the moths tend to be down in the canopy during the heat of the day.

Two facts have caught some growers unprepared to move on sunflower moth treatments: 1) buds of newer hybrids often open faster than older hybrids, and fields often go from 5% to near 75% bloom in as little as 2 days (one example from Hale Co.: Day 1-6%, day 2-19%, day 3-43%, day 4-67%), and 2) a sprayer may not be available at the critical time you need it. When a field of sunflowers is at 1-5% bloom, i.e. 1 to 5% of the plants are in bloom (which essentially means that though yellow ray flower petals are visible, usually physiological flowering, i.e. the disc flowers, are now shedding pollen), that is the time to make a spraying decision. If conditions are warm at 1-5% then you will meet just about any threshold for spraying in 1 and at most 2 days. If there is a delay of a couple days in scheduling a spray, then we still might be near 20%. In the past, too often spraying decisions were more likely to be made at 50% bloom, but in today's quicker-opening hybrids this leaves too little room for error. OK, so you sprayed for sunflower moth. Now what? Keep scouting! For one, you need to know for sure that your spray worked, and you won't know if you don't check. Particularly for early plantings many experienced sunflower growers budget a second spraying about five days later to avoid the possibility of any egg laying. In years of the most severe pressure, even a third spraying may be justified.

More northern states suggest that 1 to 2 sunflower moth adults per 5 plants is an economic threshold, especially for confectionary sunflowers. Current Texas guidelines said to spray when any moth—presence—are found in a field at 20-25% bloom. Many farmers, however, rightly feel more secure scheduling a spray even if only a few scattered sunflower moths are present. If you are a new grower and don't have experience with this insect we would advise that you consider hiring a consultant or working with your local Extension IPM agent until you have learned how to respond appropriately—which means timeliness—to this insect. He or she can assist your scouting, spray decision-making, and offer suggestions on the several products that control this insect and how to apply them.

One agronomic practice that can affect our efforts to control sunflower moth is obtaining a uniform emergence of plants at once rather than spread out over several days or whenever the next rain occurs to germinate remaining seed. This is not always easily accomplished when planting in soils with poor moisture for good germination. But every effort should be made reach deeper to moisture if you have to, to get a uniform stand; it is OK to plant sunflower in the hole. (If irrigated, experienced growers suggest it is preferable to plant into moisture rather than water up after planting.) Else sunflower moths will be actively laying eggs in a field over a longer period of time than you have the patience or money to make additional sprayings.

Also, sunflower moth pressure is usually highest early in the season and declines with time. Early season sunflowers are more likely to require two sprayings whereas a planting after mid June might require only one spray or maybe none. This might steer growers to planting later, but keep in mind that sunflower yield potential tends to decline with later planting dates.

Sunflower producers in the Dakotas have the nasty *Sclerotinia* disease. West Texas has the sunflower moth. We have practical treatment options, but they don't. As conditions allow we encourage growers to plant early and reach for the higher yield potential, provided they understand and are committed to staying on top of potential sunflower moth infestations.

While not useful for sunflower moth, crop rotation will help prevent some of the other potentially major insect pest problems, especially stem weevils (see Secondary Concerns section) and girdlers. However, sunflowers should not be planted in last year's soybean fields because girdler (caused by soybean stem borer) problems are usually worse in this rotation.

"Sunflowers were hard on my ground."

We believe there are two main contributing factors to the poor performance of crops following sunflower in West Texas. These factors are deep-water extraction and inadequate fertility programs for sunflower. Don't blame sunflower for what it does quite well—scavenge for water and nutrients.

First, sunflowers are deeply rooted. It is common for sunflowers to extract soil moisture from a depth of six feet or more. Thus most of the time subsequent crops do not have as much stored soil moisture to draw from, and there has been insufficient time for rainfall to recharge soils. Sunflower is a crop that can succeed in droughty conditions, but given the opportunity it will use amounts of water comparable to cotton, corn, and soybean. Sunflower is not a good candidate for the first crop in a double cropping system, as minimal moisture may be available for the next crop, particularly fall-planted small grains. On the other hand, the rainfall patterns in West Texas provide on average about 2.0 to 2.5 inches in September and 1.5 to 2.0 inches in October. Full-season sunflowers planted by May 1 coincides with higher yield potential relative to the same hybrid planted in June or early July, even full season hybrids, will mature before the end of August. Thus these two months of fall rains will help to replenish soil moisture in most years. This is a simple, cost-free means to alleviate soil moisture deficits after sunflower.

Secondly, sunflower soil fertility programs for much of West Texas are minimal or nonexistent. As a rule of thumb, each hundred pounds of sunflower production requires about 5 pounds of N, 1.5 pounds of P_2O_5, and 3.6 pounds of K_2O. As for micronutrients, for the same reason that deep moisture removal occurs due to deep rooting, we don't usually see micronutrient deficiencies in West Texas sunflowers. Kansas data suggest that a 2000-pound crop of sunflowers has about the same nutrient requirements as a 40-bushel per acre wheat crop. Our Panhandle wheat information suggests this level of wheat production

would require about 60 pounds of N (soil and fertilizer). Using the above rule of thumb for sunflower would establish a requirement of 100 lbs. N per acre for a 2000-pound sunflower crop. This suggests that the fertility requirement for sunflower is higher than that of a 40 bu./A wheat crop.

The nitrogen requirement for sunflower is a balance between ensuring that enough is present to reach yield potential, but don't add too much. Excess levels of N in sunflower are detrimental due to lodging and/or greater susceptibility to disease.

P and especially K are not normally a limitation in for West Texas sunflower unless soil test information warns that these nutrients might be short. In general, sunflowers will require some supplemental P if soil test is Very Low and Low. Fertilizing with some P if soil test P is Medium might ensure better residual fertility for the subsequent crop.

Sunflowers are often seen as a low input crop fertility-wise, and this sets up your subsequent crop for a potential disappointment. For sunflower, if a certain nutrient is not readily available it will take all it can from the top two feet or so and go deep to get the rest. Other crops can't do this. In West Texas if you choose a minimal fertility program for sunflower then we strongly encourage you to soil test after sunflower in advance of growing cotton, corn, or other crops the next year. In lieu of a soil test one might assume that a typical irrigated cotton crop the next year after unfertilized sunflower may require up to 30 to 40 additional pounds of N per acre above your normal application and up to 20 more pounds of P_2O_5 per acre. For dryland cotton, consider an additional 20 pounds of N per acre.

For further information on fertility, refer to the Kansas sunflower guide mentioned on the first page.

Volunteer sunflowers the next year.

This concern is less than it used to be with the advent of Round-Up ready crops. Nevertheless, volunteer sunflower the following year can be a big nuisance. Significant amounts of sunflower seed may end up on the ground from shattering (particularly if harvested late), feeding birds, improper harvesting equipment, and not setting the harvester adjustments correctly. Roundup is effective in controlling volunteer sunflower the next year, provided the plants don't get too big. Because Roundup spraying on other crops could come several weeks after initial sunflower germination, we may need mechanical control in spite of Roundup. Planting a Roundyup ready crop the next year is not a requirement, but if you anticipate a volunteer sunflower problem it certainly is an option.

Research reports note several other herbicides may also be satisfactory for volunteer sunflower control. For further information please consult "Control of Volunteer Annual Sunflower" and "2010 Texas Sunflower Weed Control Guide" *both at http://amarillo.tamu.edu) by Extension's Brent Bean, Amarillo, and Calvin Trostle, Lubbock.

There are other actions we can take, however, to reduce the problem besides chemical treatments. Leaving the stubble and residues of harvested sunflowers on the surface in the late fall and over the winter allow ample time for birds to find the field and clean up a much of the seed. Given time, this can eliminate more than 80% of the seed remaining in heads or on the ground. Fields closer to town, bodies of water, or wooded areas are more likely to experience clean up.

Sunflowers will germinate near 50° F (similar to corn). For many crops such as cotton or sorghum, which will be planted after these temperatures are reached, an early flush of volunteer sunflower can be controlled with tillage operations during field preparation.

Not having the proper harvesting equipment can contribute to volunteer sunflower, and we will discuss harvesting equipment tips below.

In rare cases fall volunteer sunflower after early planted crops can be sufficient to require termination lest soil moisture be depleted.

Secondary Concerns

Here are some lesser concerns we hear about sunflower production in West Texas. Some of these involve equipment, and it is not too soon to get the right planter plates, drums, etc. on hand to plant sunflowers the best you can. Also, experience in sunflower harvesting is a definite plus, and lest we get too busy and don't follow through we might leave too many dollars per acre of harvestable sunflowers in the field.

Achieving desired stand (plant population) and the right planter equipment.

These two issues go hand in hand. The best intention and understanding of why seeding rate is important is moot if you don't have the right planter equipment with any degree of seeding rate control. Achieving a targeted plant population is ESSENTIAL for sunflower production in West Texas. We need to limit overseeding. Any type of planter, even an air/vacuum planter, needs to be calibrated. From my own experience it is a real headache trying to calibrate a plate planter; don't use one as you probably won't or can't take the time to reliably and accurately calibrate it.

Seeding Rate Targets for West Texas

We encourage growers to think in terms of seed drop per acre rather than just plant population. This emphasizes our part in controlling the amount of seed we put out (and perhaps limiting the higher costs with too high seeding rates). Most sunflower guides talk about plant population and that is OK, but you have to understand how many seeds it takes to get that. Too many seed, hence plants per acre, is a potential economic pitfall for confectionary sunflowers due the lower value, usually by one-third to one , of small seeds that don't pass a 20/64" screen.

Similar to sorghum in West Texas, we assert that we can manage drought risk with modest per acre sunflower seed drop rates. Particularly for dryland, growers should adjust typical seed drop down to poor moisture conditions, but don't increase the seeding rate above a targeted maximum just because you may have excellent soil moisture. A case in point: who would have thought with all the moisture Lubbock Co. had in June, 2000, that so much dryland cotton would fail? We face this risk more than sunflower growers in Kansas and Colorado, and that is the primary reason that the sunflower seeding rates and resulting plant populations we suggest for West Texas are lower than you'll find in their recommendations.

Also, West Texas soils, especially as you move into the South Plains (Lubbock region), are sandier and have lower water holding capacity. We have higher evapotranspiration and irregular rainfall. Conditions are even more droughty. Although research suggests that sunflower seeding rates should not be adjusted for row width, the 40" row spacing is another reason to ensure that we don't go too high with seeding rates.

With that said here are some assumptions underlying West Texas seeding rate targets. Assume 85% of seeds planted become productive plants (combination of germination and establishment). Adjust as needed for soil and moisture conditions (down but not up) and seed quality. The savior of many mistakes

in sunflower production when rates were too low, and something we can take advantage of to manage risk, is that sunflower has great ability to flex upward (more seed, larger seed) at lower plant populations as conditions are favorable.

For West Texas confectionary (85% stand establishment), remembering that LESS (seed) is MORE ($) due to the approximate 2X yield value of larger seeds, we suggest 16,000-18,000 seeds per acre irrigated, and 12,000-14,000 seeds per acre dryland.

For West Texas oilseed (85% stand establishment), we suggest 20,000-23,000 seeds per acre irrigated and 14,000-18,000 seeds per acre dryland. For reasons given above note that these oilseed rates are lower than often suggested by seed companies and even universities to the north. We have seeded dryland sunflower at the low end of this range when soil moisture was low. Early in the season one would have thought we were too low in numbers of plants, but what was the goal? The goal was to make a crop, not a mistake (too many plants)!

Optimizing Your Sunflower Planting Equipment

Foremost, your sunflower seedsman should have the necessary technical information to plant sunflowers at a targeted seed drop. In a nutshell, here is the planter equipment information for oilseed sunflower that a seedsman will probably hand you. For air/vacuum planters, medium corn plates work well for the large Size 2 oilseed, and OK with Size 3. Small corn plates help with plantability of the small Size 4 and perhaps Size 3.

For cyclo/drum planters always move the brush in the down position. In a normal corn seed drum, Size 2 works well and Size 3 is fair (but expect some unwanted doubles). A popcorn seed drum works OK with Sizes 3 and 4. Special sunflower drums work best with Size 4 rather than the larger seeds. Also, soybean drums can work fairly well if every other hole is plugged.

For finger pickup units, normal corn fingers work well with Size 2, OK with Size 3, but poor with Size 4. Special sunflower finger units are available and recommended for Size 4 and may also help with Size 3.

Alas, here is the plate planter information—just keep in mind you don't have that layer of metering protection you have for air/vacuum or drum units. Plate planters require a filler ring, and this ring varies with seed size (larger seed, thinner filler plate). For oilseed Size 2, use a yellow-colored BO-20 plate and a BFR-2 filler ring. For Size 3, use a BO-30 plate (red) and BFR-2 ring. For Size 4 use a BO-40 plate (blue) and BFR-40 ring.

Similar information for confectionary sunflowers may be obtained from your seed supplier.

Because we believe that achieving a targeted seed drop is so critical, we strongly suggest that if you can't get the right equipment together for sunflower planting we advise you to lease an air/vacuum planter or hire someone to plant your sunflowers. This is particularly so for confectionary sunflowers where too many seeds hence plants per acre will yield more smaller seed which is only worth half as much.

The importance of irrigation timing.

Sunflower can do about as much with the first 5 inches or so of timely irrigation water as any crop grown in West Texas. Data from Kansas and Colorado suggest that after the first seven inches of water, each additional inch to sunflower can yield about 150 pounds of seed per acre. One or two timely rains or

irrigations can sometimes double yields as well as increase oil content for oilseeds (which increases your chance for a premium for oil content above 40%).

In general, the critical time for irrigation in sunflower is an approximately 40-day period from about 20 days (bud stage) before flowering to about 20 days after flowering, which roughly coincides with petal drop. High water use begins at bud stage and peaks at flowering, which for most hybrids is about six weeks after emergence. Irrigation of confectionary sunflowers may be of slightly more value to ensure good seed size and quality.

Preplant irrigation for sunflower can have longer benefit than for other crops. Data from Kansas suggest that the yield return from one single large irrigation at either bud stage or full bloom (ray flowers fully extended outward) produced similar yields. In that scenario, if you could only water once (and there is enough soil moisture available during bud stage) then wait to water at full bloom. On the other hand excess irrigation during the vegetative stage can produce rank sunflowers (tall), which actually yield less.

In a limited irrigation scenario where you may apply two mid-season irrigations, apply the first irrigation at bud swelling, 0.75-1.0" in diameter (R-3) and the second watering at full bloom.

Sunflowers favor larger irrigations over frequent irrigation as deep percolation of water is still taken up by the deep-rooted sunflower. This also reduces the opportunity for disease development with fewer waterings and less humidity, particularly with sprinkler irrigation. Sandier soils of the Texas South Plains may not store all of the water in large irrigations, though if any crop can chase the water downward sunflower is it. Due to the limits of some pivot irrigations permitting more limited water per pass, the first watering may occur at bud with two subsequent irrigations 7 to 10 days apart (before early flower and full bloom).

Full irrigation of sunflower may be considered from early bud to petal drop. Research data suggests, however, that in many years optimal timely irrigation can perform just as well as full irrigation for sunflower.

Sunflower stem weevil.

Sunflower stem weevil is an occasional pest, but can reach high numbers in early planted fields that have not been rotated. The small (3/16 inch) brown and white mottled adults emerge in early May and begin laying eggs 2 to 5 weeks later. The stem weevil is very difficult to detect. Larvae burrow into the stalk, feed, and eventually form a chamber near the base of the plant where they overwinter. This is not to be confused with soybean stem borer in sunflower, which is a larger insect (Longhorn beetle; the larvae has similar action on the plant but will also girdle the stalk from the inside near the soil line. This causes the plant to be highly susceptible to lodging, particularly when harvest is delayed. Many growers do not realize they have had damaging levels of stem weevil (or soybean stem borer in sunflower) until plants actually lodge. The larvae also seem to predispose the plant to charcoal rot. Crop rotation and delayed planting can be used to help avoid the problem. For reasons unknown, Castro County usually has a greater problem with stem weevils than other counties in the Texas South Plains.

Bird damage.

Most sunflower growers deal with bird problems at one time or another. Just know that this nuisance can occur, but learn to recognize when it is truly an economic threat. A few turtledoves are not going to harm

you, and you might even get some good hunting. But large numbers of birds such as crows and blackbirds have to be dealt with.

Being ready to harvest at maturity is probably the best thing we can do to keep bird damage in check. But left unchecked they will clean a field given enough time. In 2000 we had to hand harvest some of the early maturity hybrids at the Halfway, TX plots while waiting about three weeks for the small plot combine to come.

Some of the following cultural practices may also help minimize potential for bird damage (from Kansas sunflower guide noted in introduction). Consider hybrid plant types with heads that turn down after flowering (note that the efficacy of any over-the-top insecticide may be reduced); plant early hybrids at early planting dates with early harvest (good for near town?); avoid planting near streams, playas, etc. where there are large numbers of birds and a late-summer water supply; leave a 100-yard buffer strip of crop not attractive to birds (small grains, cotton) adjacent to shelter belts or other wooded areas. On the other hand, after harvest don't be in a rush to plow harvested sunflower fields. Birds will help clean up shattered seed thus reducing volunteer sunflower potential.

Several mechanical noisemakers are possible to deter birds or drive them away, but this is difficult over large areas. Avitrol (4-aminopyridine) has been registered as a bait control, but may be only somewhat effective in the face of heavy bird pressure. This bait is really a last resort, and it may also kill game and other non-pest birds.

Harvesting and proper equipment.

Due to limited acreage the most advanced sunflower harvesting equipment may not be readily available in West Texas. All-crop headers (soybean headers, low-profile crop headers) are often the best choice if available. There is little need for modification, but this equipment can pose minor and solvable problems as it runs more stalk through the combine. Small grain platform headers work satisfactorily only if Acatch pans@ are installed to cut losses due to seed shattering on the ground. In contrast to most equipment, the catch pans should be relatively inexpensive and worth the investment.

West Texas has more of the platform headers available and that would appear to be a favorable option as compared to an all-crop header. How many sunflower acres you may harvest over time will dictate whether you decide to purchase an additional combine attachment. Corn headers have also been used, and can work satisfactorily if you install stationary knives to cut the stalks. This, however, is not the best choice relative to the suitability of an all-crop header or a platform header with catch pans. Regardless what equipment you use, check your losses at the header.

If you have not harvested sunflowers before, we advise you to consult someone who has the experience. Talk to them beforehand and maybe have them check with you in the field at the beginning of harvest. Poor harvesting is the major reason why volunteer sunflower was cited earlier as a major concern.

Over-threshing is the most common problem with combine thresher settings. Preferably the sunflower head will get to the straw walker and pass on through the combine in one two piece, but broken heads can overload the cleaning shoe with small pieces of head and trash. Experienced harvesters have learned to keep the cylinder speed slow (e.g. 250-450 rpm), but keep the concaves well open. Harvest at a reasonable ground speed (1.5-2.0 mph) when seed moisture is low (e.g. <15%), and use a minimum amount of air, but don't dump a bunch of confectionary pops in your seed bin either—that will hurt when you get socked for trash cleanout grading. As needed it is better to decrease concave clearance than increase cylinder speed to improve threshing. Harvesters also caution about fire hazards on your

combine, especially if the crop is dry. Finally, to reduce gum problems arising from green heads, harvesters advise that and desiccant be sprayed east-west against the row pattern (sunflowers should be planted north-south because of the heads bending over after bloom).

All the right harvesting equipment won't stop significant harvest losses in a sunflower crop well past maturity. Eventual bird damage, the manifestation of lodging due to stem weevil, potential storm damage, etc. are good reasons to be ready to harvest once sunflowers are mature.

Additional harvest tips are available at from Kansas State University at http://www.ksre.ksu.edu/library

Disease potential.

We do not yet have much experience with diseases of sunflower in West Texas. We see downy mildew in the Lubbock region from time to time, but because this disease thrives more under wet or humid conditions there are limits in how much economic damage it can do. Foremost among sunflower diseases in the U.S. is *Sclerotinia* (white mold) which, like downy mildew, is much more common in wet, humid conditions. It is a major problem in the Dakotas, and there is no in-season treatment. It can be managed by rotating sunflower at most one year out of four. Industry sources say they have rarely seen *Sclerotinia* in the Texas South Plains. Also, phoma black stem and the rusts can appear on West Texas sunflower, but we have not yet learned much about them. *Rhizopus* head rot was mentioned earlier in conjunction with sunflower moth larvae activity in the head. The mushy appearance of a head so infected is not unlike the result of *Sclerotinia*.

According to Charlie Rush, plant pathologist, AgriLife Research, Amarillo, the big increase of sunflower acreage in the northern Panhandle in the early 1980s crashed in part because of disease problems. Unfortunately, we do not have a record of which diseases were present.

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