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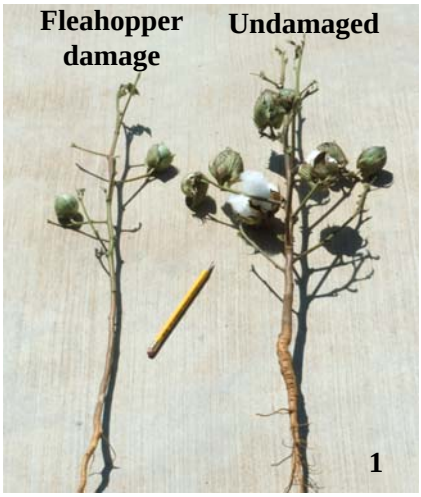
COTTON INSECTS

Some early-planted cotton should be blooming now but the vast majority of fields range from cotyledons to squaring. It has taken awhile for weather and thrips damaged cotton to recover and respond to the hot dry conditions that have prevailed across the region. Now plants are beginning to grow more normally. The **thrips** problems we have experienced should be pretty much an ugly memory but two square thieves (**fleahoppers** and **Lygus bugs**) are beginning to make a run on our early squares. Emergence of overwintering **pink bollworms** continues with 95% emergence on track for Lubbock but running late in the Midland and San Angelo areas. **Boll weevil** eradication has restarted in the Lower Rio Grande Valley and some spraying has been necessary in Crosby, Garza, and Dawson counties. As more hostable fields develop, there will be considerably more acreage sprayed in the Permian Basin and St. Lawrence zones. **Beet armyworms** and **aphids** are in some fields but hot; dry conditions and natural enemies are keeping them in check.

Square retention has been generally high across the area, ranging from 80-100% with most fields in the 90-95% range. There are some situations where square set has dropped to levels unacceptable to either the producer or consultant and these fields are often being treated. Sometimes without



finding the requisite numbers of bugs to justify the treatment. However, one can not be too harsh in criticism of this approach as both cotton fleahoppers (FLH) and western tarnished plant bugs (WTPB) are fairly secretive and WTPB are highly mobile, frequently moving in and out of fields as winged adults.

There are four points I think are worth mentioning as far as management of these two pests are concerned: **1) plant bug problems are often associated with weedy areas** and one would expect to find higher numbers in field margins adjacent to these weedy areas. Our hot, dry weather should accelerate "dry down" of weed hosts, encouraging these bugs to move into nearby cotton. Recent mowing, herbicide use and disking of weedy areas will also encourage movement. Click on survey for an update on the Lygus bug weekly sampling of wild and cotton hosts conducted by Lubbock Experiment Station entomologist, Dr. Megha Parajulee.

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2) Pre-flower water stress will increase yield losses due to pre-bloom insect-induced square loss according to studies conducted by entomologist, Dr. Tina Teague, from the University of Arkansas. Delaying irrigation initiation until after flowering occurred decreased the plant's ability to compensate for early square loss, resulting in an average yield loss of 23% over the 3-year study. We have seen a similar situation develop in dryland cotton when July rains fail to materialize.

3) Irrigated cotton has tremendous yield potential following three weeks of squaring. There can be as many as 8 first position squares, 7 second and 3 third position squares after 24 days of squaring. This would represent over 5 bales (45,741 plants/acre)! An 80% retention rate would result in 4.2 bales and a 60% retention rate in 3.2 bales. More than enough for most folks. Now here is the rub. If you rely on too much later compensation to fill early loss voids, your mid to late season crop management must be impeccable and we must not experience a cool fall or early plant killing freeze. Also keep in mind that the square carrying capacity of a cotton plant can be severely compromised by earlier environmental damage and thrips damage.

4) Low numbers of Lygus bugs are often overlooked in scouting for pre-flower FLH. I believe that one WTPB is equal to three FLH in damage potential. Remember that FLH can only damage pinhead sized squares while WTPB can damage any size square. I like to think in terms of "damage units". If I check 40 plants and find 6 fleahoppers, then my "units" add up to 15%, well below the suggested threshold of 25-30 FLH per 100 terminal/plants. But what if I find 2 Lygus bugs as well? Now I have a 30% infestation based on 12 "damage units".

There are several insecticides that work well for both FLH and WTPB control. But rates differ. For fleahopper control I would recommend:

Insecticide	Rate of formulated per acre	Performance rating
Address 75S	5.0 oz	Excellent
Address or Orthene 90S	3.75 oz	Excellent
Bidrin 8E	2.4 oz	Excellent
Trimax 4F	1.5 oz	Very Good
Centric 40WG	2.0 oz*	Excellent
Intruder 70WP	0.6 oz**	Very Good

*Expensive rate.
**Addition of crop oil improves performance.

For western tarnished plant bug control I would recommend:

Insecticide	Rate of formulated per acre	Performance rating
Address 75S	14.4 oz	Very Good
Address or Orthene 90S	12 oz	Very Good
Bidrin 8E	8 oz	Very Good
Trimax 4F	1.5 oz	Good
Pyrethroids	Varies	Very Good
Vydate 2L	16 oz	Good
Vydate 3.77C-LV	30 oz	Good

Other products also appear as recommendations in our cotton guide, but the above are the ones I have the most confidence in. I also avoid pyrethroid use until after bloom and as long as possible after that. No sense disturbing the lurking aphids. Natural enemies are helping keep Lygus bugs and fleahoppers down but the presence of wingless fleahopper nymphs in several fields indicates they have not been entirely successful.

Spider attacking fleahopper

While there have been more pink bollworms caught this year in Gaines County than last year and more areas of the High Plains appear to be catching moths, very little acreage has been sprayed to this point. There are still a lot of fields that are yet to be hostable (matchhead to full size square) and many fewer fields in the 20% sprayed refuge option used for resistance management for Bollgard cotton. Since overwintering emergence of pink bollworms will continue into the flowering and boll formation period (see Plains Cotton Growers "Pink Bollworm Information"), consultants and producers should know that infested boll counts and not trap catches should be used to make control decisions after flower. This period could represent anywhere from 2-4 weeks. Then there should be a breather before the next generation of moths start laying eggs.

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There are fewer traps being run by consultants and producers this year because there are fewer acres that are planted to non-Bollgard varieties and/or are in the 20% sprayed option. But traps they are running in historically infested areas are catching a lot of moths. Our updated trap catches are presented in the linked table. Emergence from our Lubbock study is a measly 2.4%. This could represent the level of survival that occurred this last winter. It also appears that baring a late flush of activity, emergence is winding down.

Boll weevils trap catches are increasing, with more acreage sprayed in the St. Lawrence, Permian Basin and Southern High Plains zones. Hopefully high temperatures and dry conditions coupled with an aggressive spray program will bring the situation under control this year. After all, the entire state of Texas is now under eradication and sources of weevils should soon dry up. The Valley started their program last week with 4,721 sprayed acres. More fields will quickly come into play as bolls crack.


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Average number of boll weevils caught per trap inspection and sprayed acreage through June 26. Number of boll weevils caught for the week ending June 26, 2005.

High Plains Zone	2005	2004	Sprayed acres	Total weevils caught this week
Permian Basin	0.0587	0.0096	34,990	3,216
Western High Plains	0	0.00003	0	0
Southern High Plains	0.0001	0.00002	2,627	4
Northern High Plains	0	0.00002	0	0
Northwest Plains	0	0	0	0
Panhandle	0	NA	0	0
St. Lawrence	1.0995	NA	7,884	11,807

Beet armyworms continue to lurk in some cotton fields. Egg masses can be found and sometimes a few larvae but our small cotton and hot, dry weather are limiting infestations to levels way below threshold. And now that the thrips problems are all but over and fleahopper and Lygus bug problem fields are limited, the lack of spraying is encouraging more natural enemies to appear. Hot weather will limit their increase however until cotton gets some size. Natural enemies are critical to stabilizing beet armyworm infestations at below treatment levels. There is no doubt a potential for beet armyworm problems this year. Keep a watch on pigweeds, a preferred host.

Beet armyworm egg mass

Some square loss could be attributed to the cotton square borer, the larva of a butterfly called the gray hairstreak. The caterpillar stage is "slug like" in appearance, covered with very fine hairs and pale green in color. Damage to squares is much neater than that of either bollworms or beet armyworms. Their feeding holes resemble perfectly drilled holes. There is no frass present. This pest also feeds on legumes such as black-eye pea. While a curiosity, there are rarely enough to justify treatment.

Cotton square borer

For more management information on west Texas cotton insects, including a list of recommended insecticides, go to: Managing Cotton Insects in the High Plains, Rolling Plains and Trans Pecos Areas of Texas 2005 (E-6) and Suggested Insecticides for Managing Cotton Insects in the High Plains, Rolling Plains and Trans Pecos Areas of Texas 2005 (E-6A). **JFL**

COTTON AGRONOMY

Over the last week, we have experienced hot, dry, and sometimes windy conditions across the High Plains. Our temperatures have been somewhat above normal for highs and near normal for lows. Overall, we are still running about 10% above normal for cotton heat unit accumulation for the month of June.

Many growers are completing over-the-top (OT) glyphosate applications on Roundup Ready fields. Even some of the later planted dryland cotton is beginning to hit the OT window closure. Many fields are on track for blooms in early July, and many of the late-planted fields are making good progress due to good growing conditions.

Overall we have a good crop out there in many places. Based on my observations when traveling across the area, many fields are somewhat later than we are used to seeing by now. I think this is due to the lost week of

planting in early May. The dryland crop is situated pretty nicely and if we get some timely rainfall we should end up making a good crop.

Some producers are beginning to crank up irrigation on dry fields. With high temperatures nearing the century mark and virtually no rainfall in the forecast, coupled with cotton reaching near-bloom stage, crop water requirements will quickly reduce soil moisture to critical levels. Don't get lulled into thinking this year is anything like 2004 as far as rainfall events. I suggest that producers watch their fields and not get behind on irrigation – especially if it remains hot and dry as forecasted.

Plant growth regulators. Questions concerning mepiquat-based plant growth regulators (PGRs) (Pix, Pix Plus, Mepex, Mepichlor, Mepiquat Chloride, Mepex GinOut and others) are being asked. Pricing of these materials varies greatly. Our results have shown that we usually do not get statistically significant increases in yields, but do get excellent growth control. Many times we don't see a lot of differences between higher priced materials and lower priced ones when it comes to growth control. Monti Vandiver, Parmer/Bailey Extension IPM Agent, had an excellent project at Muleshoe last year that included several of these type products.

I think growers should be on point on this issue with some of the newer cotton varieties. My suggestions are that these materials should be targeted to high input ("high" irrigation capacity) pivots, furrow-irrigated, and drip irrigated fields planted to high-growth potential varieties. I also suggest you visit with your seed company representatives concerning the amount of growth potential you might expect with the specific varieties you have planted in these high-input fields. We noted last year that many fields did get very growthy due to variety and the considerable rainfall. Remember that last year we had well above normal rainfall during June, July, and August over most of the region. 2004 was not typical, and we usually see hot and dry July weather, which limits growth in many fields (even with "good" irrigation capacity). The bottom line here is to manage each field that may have high growth potential. Hopefully high fruit retention at the late square and early bloom stage will "tie the plants down" and we won't have to spend a lot of money for growth control.

We participated in a **statewide Chaperone testing** protocol last year. Chaperone PGR is marketed as a yield-enhancing product. We were not able to document any significant yield increases from this product in Texas. A summary of High Plains Chaperone projects is available for viewing.

For some good information concerning PGR type materials, go to the new FOCUS Crop Production Guide Series document on plant growth regulators. **RB**

DISEASES AND NEMATODES

The worst year for root-knot nematode damage in over a decade!!! The root-knot nematode is causing tremendous damage to cotton this year. The damage is due to a combination of events including: buildup last fall of nematode eggs on large root systems, good winter survival, lots of heat units so that it completed its lifecycle a little quicker than usual this spring, rough growing weather for cotton initially so roots were still relatively small at 30 days after planting and finally --- PEOPLE DID NOT USE TEMIK 15G AT PLANTING!!!

The nematode starts the growing season as eggs that hatch out as second-stage juveniles. This stage is mobile and quickly infests the emerging roots. Once the nematode is inside the root, it is safe from chemical control, so using a nematicide like TEMIK 15G at planting is critical for effective control. This nematicide will paralyze or even kill the young nematodes when they encounter Temik 15G in a film of water found in soil pores. The paralyzed nematodes can recover if the Temik 15G is washed away, but the delay in nematode infection is often all the plant needs to get it's roots growing faster than the nematode can damage them.

Once the nematode enters the root and starts feeding, it will become large (about 100 times bigger), and eventually start producing hundreds of eggs. This year, around 30 days after planting, I began finding some eggs. We are now seeing hatch of eggs into the second generation nematodes. Relatively small roots are now facing not 10 or 100 nematodes, but 10,000 or more nematodes in bad situations. Of course that much pressure stops root growth, and the plants appear stunted. In the last few weeks many fields have begun showing the characteristic root-knot galling and above ground stunting. In some cases the plants have died.

What to do? In cases where the taproot has been destroyed, you don't have any decent options. If there is a lot of galling, but the taproot is still able to grow, minimize all other stresses (i.e. water, nitrogen, insects). You may also benefit from an application of either Temik 15G as a sidedress at 5 lbs/acre (see you Bayer representatives to borrow sidedress rigs), or applications of Vydate C-LV at 8.5 oz/acre at the pinhead size square stage, and a second application 7-10 days later. If you miss the beginning of the second generation (i.e. around pinhead size square), then I would not recommend any chemical control--just minimize other stresses.

If you used Temik 15G at planting at 3.5 lbs/acre or higher rates, then sit back and enjoy the knowledge that you saved yourself as much as a bale of cotton for that relatively small investment.

Control methods for root-knot nematode include:

1) Crop rotation for one year with peanut.
2) Use a tolerant variety such as Stoneville 5599 BR.
3) Temik 15G at 3.5 to 5 lbs/acre at planting.
4) Syngenta will offer a nematicide seed treatment in 2006 called Avicta that can be applied as an over-treatment on top of the regular seed treatment. See your Syngenta representative for details. Remember that rescue treatments after planting rarely are effective! **TW**

CORN INSECTS

Mite numbers are currently low, but scouting should intensify as fields approach tassel. We have had relatively little insect activity so far this season, but continued hot, dry weather has us a bit concerned about the potential for spider mites. I have included a "pre-release" spider mite chapter from the upcoming Texas Corn IPM Manual that will be published this fall. This chapter covers spider mite biology,

Twospotted spider mite

identification, scouting, threshold, and miticide selection.

The Environmental Protection Agency has approved Oberon (spiromesifen) for use on corn for control of spider mites. Oberon performed very well in tests we conducted jointly with New Mexico State University at Clovis, and in Kansas trials. Oberon is in a new insecticide class called tetronic acids, and it is a lipid biosynthesis inhibitor. Oberon can be applied by air (5.0 gallons per acre minimum) or ground (10.0 gallons per acre minimum) or through chemigation. The labeled rate for Banks grass mite and twospotted spider mite is 5.7 – 8.5 ounces per acre. The maximum amount of Oberon that can be used per 14-day interval is 8.5 ounces, and only 17.0 ounces can be used in any one season. There can be only two applications per season. The pre-harvest interval for green forage is 5 days, and it is 30 days for grain or stover.

We now have three good miticides: Oberon (Bayer CropScience), Onager (hexythiazox, Section 18, Gowan Co.), and Comite II (propargite, Uniroyal). All of these products should be used when mite populations begin to build, and before damaging populations become established. They are not intended to be used as "rescue" treatments. They will generally be used prior to tasseling, but this depends on mite populations. I will discuss rescue treatments at a later date.

Spider mite resistance: let us avoid the pain this time. We all remember a few years ago when Capture failed to control many infestations of spider mites north of I-40. We don't have to go through the resistance nightmare again if these three fine miticides are used wisely. The worst thing to do is to use the cheapest miticide on all your corn acres, make multiple applications, and use the same product year after year. This scenario provides heavy selection for resistance. The best thing to do is to use each of the three miticides on different fields, and if a repeat application is necessary in a field, use a different miticide from the one that was used in the first application. The guiding principle is to avoid exposing mite populations to the same active ingredient and mode of action over a wide geographic area and/or for multiple generations. Overuse of the cheapest product is a bad idea in the long run. Spread the risk and enjoy the benefits for a longer period of time. **PP**

PEANUT & GRAIN SORGHUM IRON DEFICIENCY

In the past two weeks, several callers have inquired about yellowing in peanut and also grain sorghum. These questions surface routinely in June. For a detailed discussion of Fe deficiency, pictures, and management strategies, review the Iron section of the July 2, 2004 issue of the FOCUS on Entomology newsletter.

In West Texas and eastern New Mexico iron typically becomes limiting in crop production when soil pH is very high, e.g. caliche soils, or when soils become temporarily water logged. For all crops---peanut, grain sorghum, etc.---Fe deficiency symptoms are on the younger leaves with green veins in the leaf and yellow in between. Iron is not mobile within the plant. Most crops here in the High Plains tend to grow out of the condition to some extent as the rooting volume expands and conditions dry out. Crops on highly caliche soils, however, will remain chlorotic throughout the season, and growth restriction can be severe for both peanut and grain sorghum. In contrast to iron deficiency, nitrogen deficiency shows up more on older leaves, as nitrogen is mobile within the plant.

My preference for correcting iron deficiency when merited is a foliar application of iron (ferrous) sulfate or ferrous ammonium sulfate and a sticking agent rather than expensive iron chelates. Spray coverage is important. However, on several fields I have seen, I was never convinced that spraying iron actually helped. With warm weather and expanding

root volume, mild iron deficiency gradually disappears. **CT**

DRYLAND SORGHUM PLANTING

Numerous producers, particularly south of Lubbock will be seeding sorghum/sudan or haygrazer once another rain is received. Seeding can occur well into July with satisfactory forage yields. The nice advantage of these late-planted forage crops planted late is the lack of risk associated with having to have maturity in the crop in the fall. Grazing or baling can occur at any time once the crop reaches ~24" in height.

But what about stand establishment? For dryland fields I have seen many poor drilled stands where producers just didn't get good emergence. Although ideally we agree that a drilled stand would be best for forage production, if we have difficulty getting a stand due to limited moisture, a rough seedbed, or an old drill that doesn't have good seed placement, then a planter would be better. Two-year study results at AGCARES, Lamesa, have demonstrated that good yields (2-4 dry tons/A) could be achieved using a planter, in spite of dry conditions at planting. The key, in my opinion, is not necessarily the forage yield, but the ability to get the crop established in the first place.

By using a planter, we have the ability to move dry soil to get the individual seeds placed in good soil moisture contact, unlike with a drill. For this dryland forage crop, the day of planting is probably the most important day in the life of the crop. Producers can also reduce their seeding rate by about 1/3 using a planter vs. a drill. A further advantage of planted sorghum/sudan vs. drilled is the reduced grazing losses from cattle tromping forage in drill rows. Usually, when row spacing exceeds 20" cattle will walk between the rows resulting in less damage and continued good tiller production.

For further information on sorghum/sudan forage types in West Texas, including brown midrib (BMR) sorghum/sudans, consult "Annual Summer Forages for West Texas".

Summer annual forage seeding rates, both dryland and irrigated, for the Texas High Plains are outlined in "Suggested Summer Forage Seeding Rate Targets for West Texas" . **CT**

IRRIGATION ISSUES

Considerations for New Irrigation systems. Start with a good design. Work with a qualified designer (CID, PE, or similar). Shortcuts at this stage can be very costly later in terms of efficiency, fuel costs, etc. Design for realistic well capacities, as this is key to sizing pumps, pipelines, subsurface drip irrigation zones and center pivot nozzle packages.

Compare "apples to apples" on designs and equipment. Cheaper may not be better. Make sure the system design includes adequate pressure/vacuum relief, flexibility to accommodate crop rotations and well capacity fluctuations, and ease of maintenance. Do not underestimate the importance of appropriately sized underground pipelines; consider friction losses, especially in longer pipeline runs. For center pivots, consider whether pressure regulators are needed to improve distribution uniformity, especially in fields with appreciable slopes or rolling topography. For subsurface drip irrigation, make sure the design adequately addresses filtration and other maintenance, including acid injection, fertigation, etc. as needed. Install the system correctly, and follow design specifications.

Considerations for older systems. Or making the most of what you've got already in the field. Consider whether the system is performing according to its specifications. If it is not, some relatively simple adjustments may significantly improve system performance.

Does the center pivot / linear system need to be re-nozzled? Check the package on the system against your nozzle printout. It is not uncommon to replace broken or missing nozzles with whatever is available and convenient at the moment, but over time, these quick fixes can cause a nozzle package to drift appreciably from the specifications. Replace broken or worn out pressure regulators and applicators as needed. If there has been a significant decline in well capacity and/or system pressure, a new nozzle package may be warranted. Keep in mind that the outside spans of a center pivot irrigation system cover the largest field acreage. A drop off in water volume and pressure affects the outside spans first and most.

If you have a subsurface drip irrigation system, make sure you have an adequate filtration system and maintenance program to protect your investment. Keep an eye on pressure gauges and flow meters to detect problems early and simplify trouble-shooting.

Irrigation management. Advanced irrigation technologies provide us with great tools to irrigate efficiently. However, in order to realize the benefits of these technologies, we have to manage them well. Some items to consider in irrigation management are root zone depth, soil moisture storage characteristics and crop water requirements.

Root zone depth: Roots are generally developed early in the season, and will grow in moist, not saturated or extremely dry, soil. Soil compaction, caliche layers, perched water tables, and other impeding conditions will limit the effective rooting depth. Most crops will extract most (70% - 85%) of their water requirement from the top one to two feet of soil, and almost all of their water from the top 3 feet of soil, if water is available. Deep soil moisture is beneficial primarily when the shallow moisture is depleted to a water stress level.

Soil moisture storage capacity: A soil's capacity for storing moisture is affected by soil structure and organic matter content, but it is primarily determined by soil texture. Generally speaking, fine sandy soils can store 0.6 to 1.25 inches of water per foot of soil depth; loam soils can store 1.2 to 1.9 inches of water per foot of soil depth, and clay loam soils can store 1.5 to 2.3 inches of water per foot of soil depth. Water applications exceeding the soil's moisture storage will likely be lost through deep percolation and/or runoff.

Crop water requirements: There are a variety of irrigation scheduling tools and methods available, including soil moisture monitoring, plant indicators, and evapotranspiration-based models. Evapotranspiration-based models take into account air temperature, humidity, wind, solar radiation, and crop type and growth stage to estimate maximum expected water demand under the local conditions. Crop water demand estimates for additional crops and locations are available from the South Plains ET Network.

Crop water use estimates for the week of June 22 - June 28, 2005. Average Daily Crop Water Demand (Inches per day).

Location	Reference Crop ET (in/day)	Corn	Cotton	Peanut	Sorghum
		10-leaf-blister	Emerged-squaring	Flower - begin peg	Emerge-5-leaf
Halfway	0.34	0.33-0.43	0.17- 0.22	0.15-0.34	0.14-0.24
Lamesa	0.33	0.35-0.42	0.16- 0.32	0.23-0.33	0.13-0.23
Lubbock	0.35	0.36-0.45	0.18- 0.23	0.16-0.35	0.14-0.25

Irrigation system capacity **(**Well capacity): The rate at which water can be supplied to the irrigation system is often the most important limiting factor to irrigation design and management in the South Plains. Limited capacity of some systems will mean that more time is needed to provide the desired quantity of water to the root zone. Some useful conversions are provided in the last table. **DP**

Conversions of water flow rates to depths over time.

Gallons per minute to acre-inches per day			**Gallons per minute per acre to inches per day or inches per week**		
GPM	**Ac-in/day**		**GPM/Ac**	**In/Day**	**In/Week**
100	5.3		1	0.053	0.37
200	10.6		2	0.11	0.74
300	15.9		3	0.16	1.11
400	21.2		4	0.21	1.48
500	26.5		5	0.27	1.86
600	31.8		6	0.32	2.23
700	37.1		7	0.37	2.60
800	42.4		8	0.42	2.97

COTTON INSECT PHOTO CREDITS

1. Leser, Jim. Texas Cooperative Extension
2. Dotray, Peter. Texas Cooperative Extension
3. Sterling, Winfield. TAMU Retired
4. University California Management Guidelines. Cotton Pink Bollworm
5. Clemson University. Image 1233021. http://www.ipmimages.org
6. Sparks, Alton. University of Georgia. Image UGA1327055. http://www.ipmimages.org
7. Ruberson, John. University of Georgia. Image UGA1857050. http://www.ipmimages.org
8. Boman, Randy. Texas Cooperative Extension
9. Wheeler, Terry. Texas Agricultural Experiment Station
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