California Cotton Review

September 1998, Volume 49

DEFOLIATING THE 1998 CROP

Steve Wright, Ron Vargas and Bruce Roberts

The 1998 growing season has been difficult to say the least. The prolonged cool wet spring resulted in late plantings with many fields being planted the end of May. As a result, there is a big difference between the best crops and those that were planted late or had a slow start. Many of the best fields are 10-14 days behind while some of the late-planted fields are 4 to 5 weeks behind. A longer and warmer fall than normal will be needed to compensate for the early poor season growth. Due to the lateness of the crop many growers will extend the last irrigation in hopes of maturing some of the latest set bolls.

The best approach to insure a successful defoliation is timely applications to prevent losses in quality and yield. Defoliation decisions will have to be made on a field-by-field basis due to the wide range of maturities. Some fields experienced good cutout and have a uniform boll load with little vegetative growth, while many of the late planted fields are still growing vegetatively with a small boll load. Fields that evenly cutout and have a good boll load will be much easier to defoliate. Whatever the situation, time defoliation applications on the crop maturity. Cotton fields with good retention will be easier to defoliate similar to 1997 whereas late fields with low retention (similar to 1995) or fields that dropped a good part of the upper crop (similar to 1996) will be more costly and difficult to defoliate.

Timing Defoliation: Nodes Above Cracked Boll

The standard recommendation is to apply treatments when 95% of the green bolls are mature or when 65% of the expected harvestable bolls are open. A mature green boll can not be cut with a sharp knife. The seed coat of mature bolls also have a tan color as opposed to the milky white color of immature bolls.

Nodes above cracked boll is the recommended technique to determine proper timing of defoliants. The recommended time that applications can be made on Acala is 4 NACB and for Pima 3 NACB. Timing defoliants at these stages will not affect fiber quality or yield. Determine the last first position boll on the main stem that is going to be harvested and begin counting down the stem to the first cracked boll. When there are 4 nodes separating these bolls in Acala and 3 nodes in Pima, defoliants can be applied without affecting fiber quality or yield. With fields that are very late, these “targets” for defoliation can be moved to 5 to 6 NACB (Acala) or 4 or 5 NACB (Pima) with relatively limited impact on micronaire or yield.

When you can advance the start of defoliation the risk of damage from late season whitefly or aphids is reduced. Other advantages of an earlier harvest include: Defoliants are much more effective when temperatures are warm –> 80°F. Harvest in October with longer, warmer days is much more effective and time efficient that during shorter, cooler, and possibly wet days of November. Fiber quality is preserved an earlier finish results in the completion of full seedbed preparations before winter rain.

Factors to Consider When Selecting a Defoliation Strategy
Defoliation often is as much an art as a science with results varying considerably from field to field, due to variation in crop maturity and weather. For the 1998 crop, basically two crop scenarios exist.

<u>Condition 1. Fields with uniform boll load, abrupt cutout, and little vegetative growth.</u>

- Under this condition, lower labeled rates of most defoliants are effective, efficacy of defoliants improve and harvest can usually begin 14 days after defoliant applications.

- There is less potential for regrowth, less need for early glyphosate applications unless preharvest weed control is needed.

- Ginstar treatments should give effective single shot defoliation. Def and Folex will be effective.

- Ethephon treatments for boll opening may be less critical however, ethephon tank mixes, will be useful in areas with aphids or whiteflys for faster leaf drop.

- If a second treatment is needed, Chlorate/Starfire/cacodylic acid applied alone or in combination will be effective.

<u>Condition 2. Late plantings, low boll retention, rank growth in Upland and Pima cotton.</u>

- Under these conditions defoliant performance is reduced. Regrowth and boll opening are a concern, therefore pretreatments with Ginstar, Dropp, Prep and Roundup will enhance defoliation.

- Sequential applications will usually be required. Higher rates are usually required on the second application to defoliate or desiccate remaining leaves.

Acala Maxxa Studies: Table 1 summarizes 12 trials conducted at the West Side Research and Extension Center (WSREC) between 1993-1997, ranking the overall performance at 14-21 days after treatment. Percent defoliation is a range from low to high. Table 2 summarizes the 1993 to 1997 results of the Acala defoliation screening study for regrowth control.

Table 1. WSREC Acala Defoliation Summary, 1993-1997	Percent Defoliation
Ginstar (10 oz) or Ginstar combinations	65-86
Def or Folex (2 pt) + Prep 2 pt, Def or Folex + Accelerate 1.5 pt or Dropp .3 lb	65-77
Def or Folex (2 pt)	50-65
Sodium Chlorate (1 Gal. Defol 5) + Starfire (21 oz) or Cotton Aid (2 pt)	45-65

Table 2. Acala Regrowth Control 1993-1997	Percent Regrowth Co
Treatments with glyphosate (1-2 qt)	80-92
Def or Folex (2 pt) + Dropp (.3 lb) + Agridex (1 pt)	65-87
Ginstar >9 oz, Ginstar 9 oz + Accelerate (1.5 pt) or Cotton Aid (2 pt)	55-80

Table 3 list some of the treatment results for 1996 and 1997. This table reemphasizes the difference that each season has on performance of harvest aids. The field conditions that produced the results in 1997 are more representative of <u>condition 1</u> whereas the conditions that produced the results in 1996 are more representative of <u>condition 2</u>. In 1996 the pretreatments combine provided the most effective defoliation.

Table 3. Acala Screening Summary 96 & 97 **Percent Defoliation (14 DAT)**

Treatment	1996	1997
Folex (2 pt) + Prep (2 pt) B. $NaClO_3$ (1 Gal. Defol 5) + Starfire (21 oz)	86	83
Folex (2 pt) + Pre (2 pt) + Agridex (1 pt)	82	55
Ginstar (6 oz) B. Ginstar (8 oz)	74	98
Prep (2 pt) B. Ginstar (8 oz)	60	--
Def (2 pt), or Def (2pt) + Accelerate (1 pt), Def + Dropp (.3lb), or + Def + Rdup (1 qt)	55	60
Ginstar (8 oz)	36	70
$NaClO_3$ (1 Gal) + Starfire (11 oz) B. $NaClO_3$ (1 Gal) + Starfire (21 oz)	21	65

B. Sequential - 2nd application 7 days after initial treatment.

Table 4 gives some general costs for Upland defoliation options. A grower must select a treatment that will perform the best under his field conditions. Material cost, efficacy, local and plant back restrictions will determine which treatment to use.

Table 4. Upland Defoliation Costs

Treatment	Rate /A	Material Cost /A
Chlorate B. Chlorate + Starfire	3 gal 2.5 gal + 16 oz	$10.06
Ginstar	10 oz	$17.17
Prep B. Chlorate	2 pt + 2.5 gal	$17.80
Prep B. Chlorate + Starfire	2 pt + 2.5 gal + 16 oz	$22.80
Prep + Folex	2 pt + 2 pt	$28.05
Roundup + Ginstar	2 qt + 10 oz	$30.50
Prepp + Dropp + Agridex B. Chlorate + Starfire	2 pt + .3 lb + 1 pt 2.5 gal + 16 oz	$44.63

Pima Studies

Because of its more indeterminate growth characteristics, Pima is more difficult and costly to defoliate than upland varieties. Higher rates and sequential applications are usually needed to thoroughly desiccate remaining leaves (Condition 2). Several treatments were evaluated at the WSR&ES on Pima S-7. Table 5 lists the treatments that provided the most consistent defoliation performance at 14 to 21 days after treatment and includes material costs.

Some European mills have reported the presence of arsenic in Pima samples from the San Joaquin Valley due to excessive rates of cacodylic acid. A single application of cacodylic acid at label rates should avoid this problem. Select an alternative to cacodylic acid if additional treatments for desiccation are needed.

Table 5. Most Effective Pima Defoliation Treatments and costs. WSR&EC 95-97.									
Treatment	**DEF %**				**DES %**				
	19	1996	1997	**AVE**	1995	1996	1997	**AVE**	**Cost/A**
Prep (2 pt) + Dropp (.3 lb) B. Ginstar (10 oz) or $NaCLO_3$ + Harvade (8 oz), or Starfire (21 oz), or $NaCLO_3$ + Folex, or $NaCLO_3$ + Cot.Aid (1.3 p)	63	38	63	**55**	75	70-82	30	**60**	**$47 - 52**
Ginstar (13 oz) + Prep (2 pt) B. $NaCLO_3$ (1 gal DeFol 5) + Starfire (21 oz)	70	34	75	**60**	80	75	53	**69**	**$48**
Ginstar (6 oz) B. Ginstar (10 oz)	61	39	73	**58**	93	83	58	**78**	**$30**
Dropp (.3 lb) + Agridex (1 pt) B. Ginstar (13 oz)	65	38	--	**49**	75	65	9	**50**	**$45**
Cotton Quik (3.5 qt) + Ginstar (13 oz)	--	85	72	**67**	--	85	72	**79**	**$41**
Ginstar (13 oz)	58	38	77	**58**	71	57	65	**64**	**$20**

Defoliation is the last operation in the production cycle where harvest management can influence profit. These final decisions will effect the overall harvest efficiency, fiber quality, and lint value. Recognizing 1998 as a difficult production season, hopefully this information will be helpful in making your defoliation decisions.

MANAGING SILVERLEAF WHITEFLY TO PROTECT LINT QUALITY IN 1998

James Brazzle, Peter B. Goodell, Larry Godfrey, Nick Toscano, and Beth Grafton-Cardwell, University of CA Cooperative Extension

Silverleaf whitefly populations are slowly building as a result of cool spring conditions in some ways reminiscent of 1995. At this time, whitefly levels are much lower than those observed in 1997, however, we need to carefully monitor fields. Populations are not likely to reach the wide distribution observed last year, but areas near overwintering sites will observe treatable levels. In addition, the potential of late harvested cotton could expose lint to heavy adult migration later in the season. Fields with low retention and subsequent vigorous growth later in the season are likely to be harder to defoliate, thus providing regrowth for continued whitefly development.

To date a few fields have reached threshold levels of silverleaf whitefly in the southern portion of Kern County and the eastern region of Tulare County. Populations in these areas are slowly building to threshold levels as a result of adjacent overwintering sites and other host crops such as vegetables and melons. An occasional whitefly adult can be observed in most cotton fields at this time.

Whitefly dynamics in the San Joaquin Valley result in different management scenarios often related to local cropping patterns. The decision to manage whitefly and what products to use will depend upon time to defoliation, quality of defoliation, percent of crop at risk of honeydew contamination, stages of whitefly present in the field, potential for future adult migration, level of resistance observed by UC monitoring efforts and the absence or presence of aphid populations. At this late time in the season we will likely see two situations. The first situation exists in fields adjacent to overwintering whitefly populations and sources of spring development. The insect growth regulators (IGRs) are best used when adults (5 per 5th mainstem leaf from the terminal) and nymphs (1 per leaf disk) are present. This situation is commonly observed after the initial period of invasion and internal buildup of low numbers of silverleaf whitefly. IGRs will provide longer control of a building population, which is important if you’re in need of four or greater than four weeks of control and/or future migration is likely. In addition, the IGRs will provide control of the nymphs, which is needed if high nymph populations are present throughout the plant.

The second situation occurs at the end of the season when silverleaf whitefly is migrating heavily, the bolls are opening, lint is at risk, and quick knockdown is required. Pyrethroids in combination with organochlorine, endosulfan, or organophosphates can best be used in this situation. The economic threshold is 10 adults per leaf on the fifth main stem leaf from the terminal. Resistance monitoring confirms the need for a tank mix to provide adequate control verses one of these products alone. To determine the best tank mix partners refer to the 1998 resistance monitoring data via the internet www.ipm.ucdavis.edu or contact your local Farm Advisor. The tank mix combinations have limited control of nymphs relative to the IGRs and will have limited impact on post treatment migrations. Field observations suggest a maximum of 3-4 weeks control with these combinations if populations consist mostly of adults and nymphs are limited to the upper four nodes of the plant. These observations are based upon optimum coverage. Other products may need to be added under both scenarios if control of aphids (10 aphids per leaf at open boll) or worms are needed. Refer to the sampling plan outline below for monitoring guidelines.

The final piece in the puzzle to protect the quality of your cotton lint is crop management. Cotton should be managed for earliness to reduce susceptibility to late season whitefly migrations. Terminate as early as possible, using nodes above cracked boll guidelines. Utilizing plan mapping and a soil auger will ensure accurate final irrigation dates, good cutout and limited regrowth. Good defoliation with limited regrowth is very important in regions of heavy whitefly migrations.

Silverleaf Whitefly Sampling Plans

Adult sampling plan for decision making:

- Identify species (do not treat for green house or banded wing whiteflies).
- 60 plants per 80 acre field (15 leaves from each quadrant).
- Sampling unit: 5th main stem leaf from the terminal.
- Leaves should be turned to count the number of whitefly adults per leaf (keep shadow off the plant).
- Count only silverleaf whitefly, *Bemisia argentifolii* 3 adults per leaf equals an infested leaf.
- After sampling 60 leaves the percentage of infested leaves will be calculated % infested = number of infested leaves X 100 / 60 (number of leaves sampled).
- Thresholds: 57% infested leaves equals 5 adults per leaf, 82% infested leaves equals 10 adults per leaf.
- Field edges and centers may be treated as separate sampling units.

Threshold (adults/leaf)	Infested Leaves*
1	14%
2	28%
3	39%
4	49%
5	**57%**
6	64%
7	70%
8	75%
9	79%
10	82%

***** From: Arizona Guidelines (IPM Series No. 2) Naranjo, Ellsworth, Diehl, Dennehy.

Nymph sampling plan* for decision making:

- Necessary for the proper use of IGRs.
- 60 plants per 80 acre field (15 leaves from each quadrant).
- Sampling unit: 5th main stem leaf from the terminal.
- Count visible nymphs (3rd and 4th instars) within the leaf disk.
- Note yellow spots & red eyes.
- Leaf disk = size of quarter, or sight of a large hand lens.
- Calculate average number of nymphs / leaf.
  Number of red eyed nymphs predict subsequent adult levels.

***** From: Arizona Guidelines (IPM Series No. 6) Naranjo, Ellsworth, Diehl.

General sampling rules:

1. Sample greater than 50 feet from the field edge.
2. Zig zag through the field randomly selecting plants.
3. Avoid sampling plants being sweep sampled.
4. Sampling in the morning before adults move down in the canopy is suggested particularly in mid-summer.

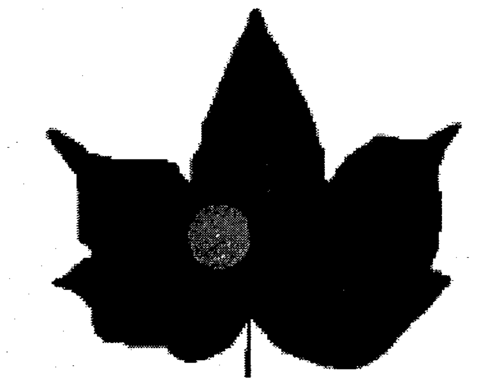


Table 1. Insecticide resistance management guidelines. These guidelines are based on best experience for consistent control results during the past few years. Local conditions may vary and may affect control. Check with qualified experts for control conditions in your area.

Silver Whitefly Situations			
Chemical Class	**Initial Buildup**	**Gradual Invasion**	**Heavy Migration***
Insect growth regulator	Applaud[+]		
Chitin synthesis inhibitor			
Insect growth regulator	Knack[+]		
Juvenile hormone mimic			
Chloronicotinyl		Provado	
Organochlorines		Endosulfan[3]	Endosulfan[3]
Pyrethroid			Capture®
Pyrethroid + organochlorine			Pyrethroid[+]
			Endosulfan
Pyrethroid + organophosphate			Danitol®[+] Orthene®/Curcron®

Notes:

[+] Section 18 has been requested. Check with Agricultural Commissioner for Status of request. Read and follow the label when using any insecticide. See text for special concerns on any of these situations.

[3] There are several products available and restrictions may be different between them. Check the label and contact Agricultural Commissioner if uncertain about any local restrictions.

* Late season heavy migrations options depend upon the length of control desired and previous insecticide use. Tank mixes may be required in many areas to adequately protect lint.

CONSIDERING SOIL QUALITY IMPROVEMENTS FOR COTTON?

Dan Munk and Blake Sanden

In the course of farming the rich alluvial soils of the San Joaquin Valley, the soil and water management practices we use have significantly modified soil quality characteristics since the introduction of irrigation water to valley soils. The time course of changes in soils quality characteristics depend largely on the quality component of interest and the intensity of farming practices. For example, impacts on soil water infiltration can occur very quickly when poor quality water (various mixes of chemical constituents) is used to irrigate crops. By comparison, years or even decades may pass before soil organic matter content declines to the point where soil aggregates break down, affecting soil properties such as pore volume, pore size, distribution, carbon:nitrogen ratios, and some other factors. There is a need to develop soils amendment strategies that are most beneficial in both the short- and long-term. Some specific reasons to improve or maintain soil quality include:

1. Provide optimum seed germination.
2. Provide adequate water and nutrient transfer within the root zone.
3. Provide optimum water and nutrient storage.
4. Allow for leaching of salts.
5. Reduce the incidence of diseases related to “problem” soil conditions.

Since so many agricultural practices can impact soil quality, the real challenge for land managers is to provide soil and water treatments that are economically-feasible <u>and</u> effective in making significant improvements in soil conditions.

Inorganic Amendments

Frequently, surface soil structure is degraded as a result of unfavorable soluble salt balances. Sodium is notorious for its ability to disperse soils, and often plays a significant role in degraded surface soil quality. Under many conditions, the soil management goal is to reduce the dominance of sodium of the soil exchange sites by enhancing the availability of soluble calcium. Key chemical equations that help to understand sodium/calcium balances on soils are as follows:

The creation of lime in soils

$\Uparrow$

$$CO_2 + H_20 \Leftrightarrow H^+ + HCO_3 \Leftrightarrow HCO_3^- + Ca^{2+} \Rightarrow CaC0_3 + 2H^+$$

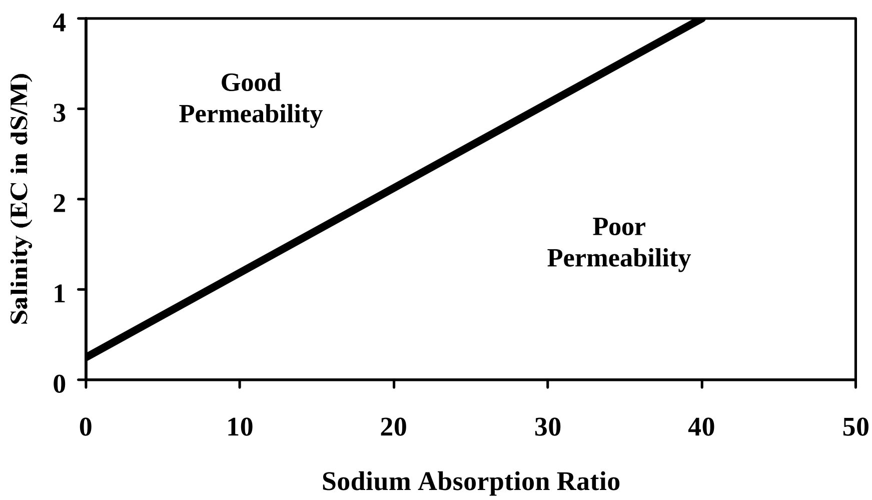
$\Downarrow$ $\Downarrow$

root respiration bicarbonate

Carbon dioxide from root respiration or bicarbonate/carbonate ions dissolved in well water often work to render soil solution calcium inactive by forming lime. Soluble calcium can be increased directly by adding a source of readily available calcium, such as $CASO_4$ (gypsum) or indirectly by adding compounds that make calcium more available in the soil solution. Calcium that is bound in soils as $CaCO_3$ is dissolved and soluble calcium is increased.

A measure of the balance between sodium and calcium is the sodium absorption ratio (SAR), a solution property. This is an important soil parameter since high sodium content on soil exchange sites can result in a breakdown of soil structure and hence water penetration properties. It can be measured from a soil extract (soil solution). The SAR's capacity to destabilize soil aggregates and disperse the surface soil is related to the total salt concentration of the soil water solution. Exchangeable sodium percentage is another available measure of this balance and strictly refers to a soil property.

As the total salt concentration (described in soil tests as electrical conductivity (EC)) of a soil solution increases, so does the stability of the soil system. Therefore, even at low SAR values, conditions promoting unstable soil aggregates can occur with very low salinity irrigation waters (low EC). Such conditions are often present in surface water delivered from sources such as the Central Valley Project and other low salinity surface waters. It is important to know the irrigation water quality being used in order to evaluate its potential impact on soil structure. Modification of some soil physical and chemical properties under these conditions can produce increases in water penetration rates of 50 percent or more. Neglecting impacts of water quality, on the other hand, can increase water application costs, increase crop water stress, and reduce yields. The soil water salt balance is just one of several factors to consider in stabilizing soil aggregates.



Organic Soil Amendments

Many organic matter decomposition by-products work to bind soil aggregates. Current models suggest that polysaccharides are one key by-product helpful in developing and maintaining structural units in soils. Therefore, additions of organic residues are often beneficial in soil stabilization. The problem often becomes a question of the quantity of organic residue needed to produce a desired outcome. At very high application rates (10 tons/acre), organic soil amendments have been shown to significantly increase soil water retention, water stable aggregates, and water infiltration rates.

There is a continued need to develop more information that specifically predicts the impact of organic amendment additions on soil properties. Since organic amendments differ widely in physical size of particles and chemical composition, it is very important to have information regarding the general composition and consistency of composition of materials you use from different sources and at different times of the year. Continued work in this area is being pursued by projects like BIFS (Biologically Integrated Farming Systems). Another question being asked regarding the addition of organic amendments to soils is the nutrient value of these products.

Table 1 describes common nutrient quantities of common amendments used in cotton production systems. The variability between classes is just one concern when evaluating amendment value. Within each of these categories, a significant amount of variation exists depending largely on the original source material and how it is handled prior to application. Table 2 shows the variability of composts that have been made largely using combinations of gin trash and dairy manure. Each of these products were marketed and applied as composts and yet each has a markedly different level of maturity, as evidenced by the wide range of carbon to nitrogen ratios (C:N). There is a four-fold difference in nitrogen content for this small sample, while a 20 and two-fold difference is cited for the phosphorus and potassium respectively.

Table 1. Nutrient Concentrations Found in Organic Amendments

Amendment	Nutrient	Nutrients content per ton of dry material
Gin Trash	N P_2O_5 K_2O	Moderate (20-30 lb) Low (5 lb) High (45 lb)
Poultry Manure	N P_2O_5 K_2O	High (100 lb) High (60 lb) High (45 lb)

Table 2. Composts - Fall, 1995

Sample	Total N %	Total P %	Total K	C:N
1	2.74	1.35	2.95	9.1
2	3.83	2.27	2.87	18.9
3	1.19	0.22	1.36	9.3
4	3.11	2.59	2.90	9.1
5	4.71	5.21	2.57	4.5

Growers purchasing products must be aware of the water content of compost being applied. Often, the materials are sold on a mass basis. Ranges in water content are generally between 25 and 60 percent water by weight. Comparing products and evaluating their value should be linked to a dry weight application basis.

Gaining Perspective: In establishing soil management goals for agricultural lands, we need to recognize and establish our objectives and recognize the costs associated with achieving each objective. If our goal is to improve soil tilth and soil quality, we must identify the limitations of the system by understanding more about water and soil salinity composition as well as the organic matter maintenance issues. For example, if we determine that our water quality has been adjusted adequately through appropriate amendment applications, or we determine no need exists for modifications of water quality, we may determine that an increase in soil organic matter contributions may best service our need for enhancing soil quality. Exploring ways to build soil organic matter economically will be essential. Cover crops can produce 40 tons or more of organic matter per season but require resources like water, a management commitment and a time commitment. Composts and manures can build organic matter, but can be more expensive per volume to increase organic matter.

Organic amendments can be evaluated strictly upon their nutrient content and value. These amendments can be a valuable source of essential nutrients for maintaining high crop productivity. There are increased risks, however, and synthetic/processed fertilizers continue to have a market niche. The timing of nutrient availability for organic amendment is not fully understood. This goal should be consistent with nutrient management objectives.

WELCOME TO BRIAN MARSH

On September 1, 1998, Dr. Brian Marsh began a split appointment as a Farm Advisor in Kern County and also as the Superintendent for the Shafter Research and Extension Center. Brian is a native Californian, growing up in Patterson in the northern San Joaquin Valley. College took him to Utah State University for a Bachelor’s degree (Plant Science) and Master’s degree (Soil Science) and then to the University of Kentucky for a Ph.D. in Agronomy. He also gained experience as a farm manager in Washington and Idaho working with crops ranging from small grains and alfalfa to potatoes and corn. Most recently, he was the Agronomist-In-Charge at the Kansas State University Cornbelt Experiment Station. While in that position, he did work in varietal evaluations, herbicides, water quality, tillage, fertility, and growth regulators.

Brian’s Farm Advisor responsibilities include serving farmer and industry needs in cotton, alfalfa and small grains. In cotton, his work will be complementary to that of James Brazzle, who will still be involved in cotton entomology concerns in Kern County. As Shafter Superintendent, he will oversee day-to-day administrative operations and deal with field research management and industry relations at the Center. Brian is anxious to become acquainted with individuals in the cotton industry and with other commodities in the Kern County area. Hopefully, we’ll give him a little time to get “settled in.” He can be reached at the UC Kern County Cooperative Extension Office at (661) 868-6210. We are glad to welcome Brian to the University of California Cooperative Extension and look forward to many years of collaborative work with him in research and education.

IN MEMORIAM

Those of us who have worked on the California Cotton Review in recent years which to express our sorrow for the loss of a co-worker, Nancy Shaw, who passed away during August. Nancy, a long-time secretary at the UCCE office in Fresno, worked “behind the scenes” on the Cotton Review (and many other projects over the years), but her careful work was very evident since she typed and did page-layout on the newsletter. She always put extra effort into this newsletter as well as other projects, and somehow was able to keep a smile and professional attitude even when dealing with “fussy” authors. We offer our condolences to her family and co-workers.