

DEFOLIATION TIMING FOR ARIZONA COTTON

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Proper timing of a defoliation event is not an easily made decision and must take into account many factors related to the maturity status of the crop. The application of harvest aid chemicals is only the last step in maximizing economic returns with an efficient defoliation. Many late and end of season practices should need to be properly managed before selecting and timing harvest aid chemical applications. These practices include proper water and N management, insect control, and others. Timely irrigation termination will set the stage for efficient crop preparation for harvest. Once the final irrigation has been applied it is time to begin selecting the proper harvest aid materials and scheduling an appropriate application timing to prepare the crop for harvest. Harvest preparation includes removal of mature foliage (defoliation), arresting juvenile growth and stimulating the opening of mature bolls.

Leaf senescence and defoliation is a natural process that occurs as the plant reaches physiological maturity. However, this natural process is not typically synchronized with a well-timed harvest that achieves optimum yield and fiber quality. Therefore the application of chemicals to induce defoliation and enhance boll opening are often used.

Chemical defolianters are designed to alter the hormonal balance in the crop to enhance the natural process of defoliation and boll opening (Ayala and Silvertooth, 2001). The manipulation of these hormonal balances comes about through the application of a chemical defoliant or desiccant. Many of the chemical defolianters and boll openers in use today (Wang and Norton, 2012) retard the production of auxin class hormones while stimulating the production of ethylene and abscisic acid (ABA) in the plant. This in turn results in the production of enzymes necessary for the degradation of cellular components and to the formation of the abscission layer and eventual leaf drop (Ayala and Silvertooth, 2001). Since the process of defoliation and boll opening is the enhancement of a natural process, the crop must still be physiologically active for effective defoliation to occur. The crop should also be heading towards senescence and all harvestable bolls mature.

Proper Timing of Application

Several techniques or ‘rules of thumb’ have been developed to assist in properly timing a harvest aid application. Each of the following techniques has proven to be helpful in planning and timing an effective defoliation application in Arizona cotton production systems. There are, however, advantages and disadvantages with each. So the use of more than one will help fine tune the correct timing of defoliant application and enhance the efficiency with which the crop is defoliated and

prepared for harvest. **For any approach, the most important point is that harvestable bolls should be mature at time of defoliant application.** The maturity of bolls can be determined by cutting the boll in a cross-section. If the boll is difficult to cut in cross-section, the seed coats within are tan or brown, and small leaves (and no jelly) are present within the seed walls, the boll is considered mature (Fig. 1A).

Irrigation Interval

Two times the late season irrigation interval is usually a good indicator of a crop’s readiness for defoliation (Silvertooth, 2001). For a late season irrigation interval of 12 days, for example, the crop should be ready for a defoliant application within 24 days (or 2 x 12 days) after the final irrigation. This approach can be significantly impacted by weather conditions during that interval as well as by soil texture. Hot and dry conditions will shorten the interval while cooler conditions may lengthen it. Cotton grown on coarser textured soils will dry-down more rapidly than those on finer textured soils thus reducing the interval. This basic approach works best when combined with one of the techniques that follow.

Percent Open Boll

Percent open boll is simply the ratio of fully opened and/or cracked bolls to the total number of harvestable bolls in a given area. The most common recommendation for defoliation application is at 60% open bolls, which gauges the maturity status of the crop and helps avoid damage to immature bolls. This estimate can be made by measuring a length of row and counting the total number of mature harvestable bolls and the total number of cracked or open bolls in that same area. The percent open boll for that area of the field is:

$$\text{Percent open bolls (\%)} = \frac{\text{Cracked and open bolls}}{\text{Total number of bolls}} * 100$$

Obtain several estimates when significant variation exists across the field. When using desiccant-type chemicals such as sodium chlorate, a higher percentage of open bolls (>85%) should be present prior to application to reduce damage to unopened bolls.

Nodes Above Cracked Boll (NACB)

NACB is determined by counting the total number of mainstem nodes (branches) between the uppermost, first position open or cracked boll and the uppermost first position harvestable (mature) boll (Fig. 1B). This measurement is a good predictor of percent open bolls and is much easier to estimate.

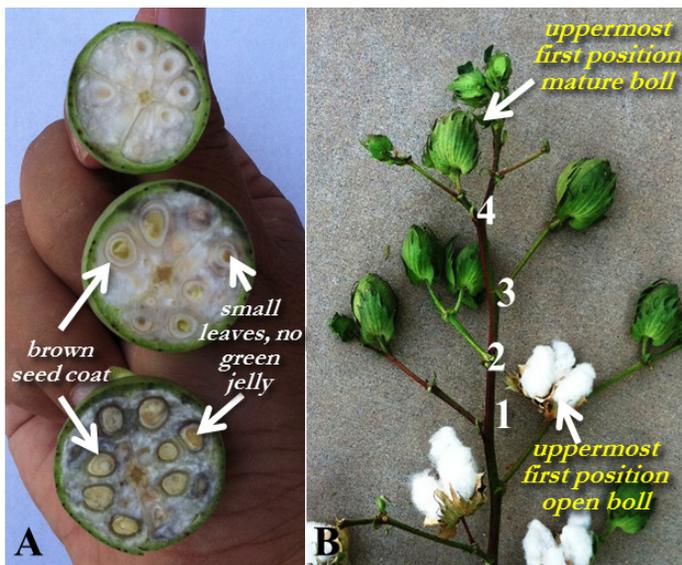


Fig. 1. A, Non-mature bolls (top) and mature bolls (middle and bottom), and B, Nodes above cracked boll (NACB) is 4 or less and the crop is ready for defoliation.

A crop with approximately 60% open bolls is equivalent to a NACB value of 4.

Heat Unit Accumulation / Boll Maturity Estimates

Heat units are a measure of time over a temperature scale and specific to daily maximum and minimum temperatures. Heat unit accumulations have been well correlated to cotton development and are based on an 86° maximum and 55°F minimum daily temperature in Arizona. Approximately 600 HUs are required for a fresh bloom to develop into a mature, harvestable boll (Fig. 2). Based on long-term temperature trends for central Arizona, a fresh bloom that is set on 10 September will require approximately 26 days to mature into a harvestable boll (6 October). The predicted dates to mature into harvestable bolls based on long-term HU trends in each cotton production area of Arizona are available through University of Arizona Cooperative Extension (Brown and Silvertooth 2011). Any defoliant application made after the last intended, harvestable boll is mature (600 HU after fresh bloom) will not negatively impact yield or quality.

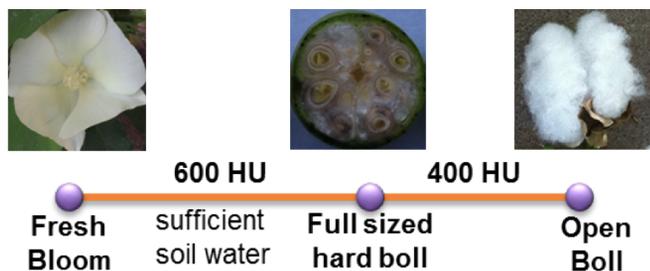


Fig. 2. Heat units (86/55°F) required for fresh blooms to reach mature bolls and open bolls.

Following the techniques described above will increase the probability of an efficient and thorough defoliation resulting in a crop that can be harvested in a timely fashion for the highest possible fiber quality and lint yield.

References

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