



# TECH Tips

Brad Ruden  
Manager - Agronomy Tech Service



Vol. 7 No. 14, Part I

## 2018 Soybean Production- What Soybean Leaves Are Saying!

Soybean production and the growing environment in 2018 can be summarized in one word- VARIABILITY! Soybeans were planted into soils ranging from good extremely dry soils...then came spotty rains and high heat, not to mention weather events that caused replanting. With recent rainfall events coming through much of the area and the R1 stage either here or happening soon, soybeans are actively and rapidly growing. Unfortunately, with my over 30 years in agronomy, I seem to get calls every year about cupped leaves, or damaged leaves in soybean, usually right around the R1 growth stage. It is a nemesis that never goes away- just changes face year to year. Soybeans will show every stress event in the leaves, and this year is no different.



**Figure 1a and 1b.** Soybean with significant leaf spotting from a PPO herbicide application. Image 1a is typical of FlexStar, Reflex, Cobra or Cadet type herbicides. Figure 1b is the leaf bronzing more typical of Ultra Blazer. Leaf cupping is not common with these herbicides, but leaves can wrinkle from the damaged areas.

The easy ones: PPO injury. Burned leaves and leaf spotting from an injury such as a PPO-class herbicide like Flexstar or Cobra are fairly straight forward (Figure 1a). Ultra Blazer injury looks a little different (Figure 1b), but is still more of a classic pattern, being more of a leaf bronzing type injury.

Beyond PPO: Diagnosing what causes damaged leaves in soybeans takes a little detective work, and really some patience and a systematic look. Here are a few thoughts. Remember first that overall, SOYBEANS ARE RESILIENT, and most leaf cupping does not have as large of an effect on final yield as the visual symptoms appear to show. Be PATIENT! The crop is very likely not going to have long term damage, and waiting an extra week can really tell us more than a quick view.

### Cupped Soybean Leaves

Cupped leaves in soybeans make you think immediately of herbicide damage. It certainly is true that growth regulator herbicides like dicamba, Stinger, Tordon and Milestone (with the last two being pasture products) can indeed cause significant upward leaf cupping. See Figures 2, 3a and 3b. Status Herbicide contains a second ingredient that keeps the dicamba at the active site in the plants, and causes significantly more severe cupping and injury symptoms vs dicamba alone. Remember, though that 2,4-D generally looks different, with leaves folding back more into what is often called an "alligator head".

**Figure 2.** Soybean from a field with damage from Status Herbicide. This is similar to severe dicamba injury, and is not likely to be outgrown. Notice the lack of flowers at the top growing points and the stacked upper nodes.





**Figures 3a and 3b.** Soybean plants from a field with significant leaf injury from 2,4-D. The first image is from soybeans shortly after emergence, and is from 2,4-D applied pre-emergence without a preplant interval. The second image is from 2,4-D drift. Notice the “strapping” of the soybean leaves and the (generally) backward cupping of the leaves.



**Figure 4.** Dicamba injury symptoms to soybean. Notice the distinct “upward” cupping of the leaves, with cupping going all around the leaf margin.

## Acetamide Herbicide Response

The acetamide herbicides- namely Dual, Warrant, Outlook and Zidua, are very good herbicides to extend residual control in soybeans. These products can be applied pre-emergence or post-emergence in soybeans. Pre-emergence applications to dry soil, followed with rainfall in-season, especially if rainfall and post-emergence herbicide applications were timed together, can lead to a crop response. This is simply from the plant trying to metabolize all the herbicide it is exposed to. The classic symptom of acetamide class herbicides is the “drawstring” leaves- pinched at the tip and sometimes even heart-shaped. Damaged leaves are also often “bumpy” on the leaf surface. Injury from post-emergence application is often temporary, affecting only a couple trifoliates.



**Figure 5.** Acetamide response in soybean leaves. Note the pinched leaf tips and the “drawstring” tip to the center leaf, as well as the bumpy leaf surfaces.



**Figure 6.** Environmental response. Soybean with significant leaf cupping from a non-herbicide source. Notice the flowers at the top growing points and the extension of the upper nodes, rather than stacking, like is seen with Status Herbicide. This would indicate a plant hormone issue rather than herbicide injury.

## Cautions on Leaf Cupping Symptoms

Not everything that “cups” a soybean leaf is a growth regulator herbicide. This is especially true if cupping is widespread in a field. If classic drift patterns can be ruled out, and tank contamination is also ruled out, what do we do then? Spray contamination is very unlikely in this case. More likely the cause is something physiologic within the plant. Explaining this can be a little bit difficult. Plants, like animals, produce hormones in response to changing environments. If these hormones get “out of

balance” in the plant, the soybean plant response is often to cup or wrinkle up the leaves. The key is to look at the stems. If internodes are extending normally and are not shortened, yield-robbing damage is unlikely (Figure 6).



*Brad Ruden*  
Manager - Agronomy Tech Service

# TECH Tips



Vol. 7 No. 14, Part II

## Diagnosing Cupped or Wrinkled Soybean Leaves- A Systematic Approach

Diagnosing what is happening in a soybean field with cupped or wrinkled leaves is difficult. Laboratory analysis for pesticide residues is a definitive test, but even then, diagnosis can be somewhat difficult. However, a systematic approach to looking at a damaged field is helpful.

### First of course, eliminate the obvious.

- Look across the field and see if you see a drift pattern- does the pattern follow sprayer turns, or is there possible drift following lower areas of the field or other geography, etc. Sprayer drift patterns coming from adjacent fields look very distinct - with irregular streaks across the field. Patterns often taper to a point.
- Look for a boom contamination pattern. Boom contamination from larger sprayers generally has a very distinct pattern to it. Damage starts out uniform across the spray boom and transitions down the field to V-shaped "healthy streaks" behind the various boom sections and then to fully healthy areas as the sprayer moves down the length of the field. This type of symptom will also clearly follow a sprayer pass in width.
- Look at previous spray records. Previous cropping records can be used to determine if we have a carryover issue from previous years. We were dry last Fall, and I have seen Stinger and HPPD herbicides carry over.
- Look at FieldReveal or other precision ag maps. With variable moisture and heat events, damage often follows soil type and/or zone maps closely. If zones are clearly seen, I think environment immediately.

**Secondly, look at the plants.** What part is affected- is it only the newest leaves, or are all plant parts/stems affected? What does the top of the plant look like? Are the nodes continuing to extend? Are there flowers at the upper nodes? If nodes are extending and flowers are occurring at the upper soybean nodes, I would be much less likely to think about herbicide issues and more likely to look to plant physiology issues happening, even if new leaves are cupped. The non-extension of nodes is a KEY that I use to determine if a chemical drift, like dicamba, has the potential to limit yield. Remember, green leaves that are simply cupped are still photosynthesizing normally, and if nodes are normal and have normal flowers, yield is not likely impacted.

**OK so drift patterns are fairly easy to see- but often the call is for leaf cupping that is occurring across an entire field, or at least in the most stressed zones. What do we do then?** Spray contamination is very unlikely in this case, unless an incorrect product has gotten put into the tank or we have carryover. More likely the cause is something physiologic within the plant. Here are a couple causes that I have determined are quite accurate over my years of looking at plants and as a plant diagnostician.

1. **First- a rapid burst of growth.** We have been extremely dry at times this season. We recently have had rain in many areas. This shot of rain made soybean growth "explode" for a few days. Plant hormones accumulate in higher amounts in certain areas of plants during stress periods. Now add a shot of rain in the mix, and

everything in the plant is moving upwards toward the growing points. This includes plant hormones. These hormones accumulate at the tip of the plant. If the plant cannot metabolize these hormones fast enough and reduce the concentration, the result is that leaf growth gets affected- often as leaf cupping in the new leaves.

2. **Secondly- add in herbicides.** Because of increased growth after a rainfall, growers often consider that this is a great time to apply herbicides. The soybean plant must metabolize the herbicides, whether a PPO, ALS or acetamide chemistry. All of this takes energy. Applying herbicides, by nature, results in a certain stress to the plant. This stress can cause a slight, temporary imbalance in hormone levels at the tip of the plant, and we get leaf cupping.
3. **“Bushy” plants** are possible. With wide environmental swings, the plant hormone levels in soybean are riding a roller coaster of growth. This may cause lower growing points to shoot out a new leaf (Figure 7). This is simply due to the imbalance in hormones in the apical meristems (top growing points), making these upper growing points lose dominance for a short time. The lower shoots grow and continue to elongate, making these plants a little “bushier”. These plants are normal and productive.



**Figure 7.** Branching in soybeans. Note the branching right above the unifoliate leaves (at my fingers). This is likely a response to environmental stress.

### **So, WHY do Dicamba Tolerant soybeans look BETTER?**

Dicamba Tolerant soybeans are a tremendous herbicide system.

The genetic tolerance to dicamba- in other words the ability of the soybeans with the trait to detoxify dicamba- is incredible. There is nearly ZERO STRESS to these crop varieties when dicamba is applied, just like we expect from Roundup. Therefore, when we are applying dicamba and Roundup mixes to DT soybeans, these plants are not experiencing really any stress from metabolizing the herbicides. Roundup-based systems- with PPO or ALS herbicides in the mix, take more energy for the soybeans to metabolize. If leaves burn, even more stress is seen. These stresses create conditions that favor cupped leaves. Dicamba tolerant soybeans are not immune to stresses, and these varieties can show cupped leaves as well from environmental stress or herbicides like PPO's or acetamides (Figure 8).



**Figure 8.** Dicamba Tolerant soybean showing cupping of new leaves. This is a clear indication of environmental stress causing the cupping.

### **Keeping Soybeans Healthy and on the Right Track**

The good news is that soybeans very often easily outgrow physiological cupping. You may see a permanent “layer” in the soybean canopy that has a few leaves cupped, but normal growth usually resumes in a short amount of time, and yield is often not affected. Cupped soybeans can often be a sign of acceptable to excellent growing conditions, and cupped leaves are generally not a concern, once we eliminate the obvious causes of damage. Keeping soybeans healthy throughout the year is critical to maximizing yield. Remember to take care of crop nutrition, fungicides, insecticides and even PGR products. Using these can all reduce stress and maximize yields.