

# GUIDANCE

**TORO**

## Aftercut Appearance, Part 2:

### Demystifying Cutting Unit Mismatch

**In Part One of this series**, we laid the groundwork behind how the cutting unit interacts with the turf and how various agronomic conditions can affect the aftercut appearance across the season(s). The intent of Part Two is to address the physical differences in the turf that create a visual aftercut-appearance (ACA) variation and provide guidance on how to diagnose and improve upon one specific ACA issue: cutting unit (C/U) mismatch.

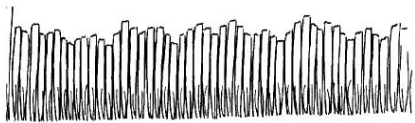
Let's start by addressing the physical differences that create a color variation in the ACA. As most people know, reel mowers create a striping effect (light/dark variation) by rolling the leaf blade over in alternating directions. The degree of striping is determined by the variations in the leaf blade angle which reflect more sunlight in one direction (creating a brighter or lighter appearance) and less sunlight in the opposite angle (creating a dimmer or darker appearance). This visual appearance varies to the observer's eye throughout the day for one or a combination of three main reasons;

- The change in sunlight angle (which alters the angle and amount of sunlight reflected toward the observer's eye),
- The evaporation of moisture on the leaf blade (which reduces the leaf blade's reflectivity), and
- The natural tendency of the turf to spring back into position (thus reducing the variation in leaf blade angle).

These are just a few of the reasons why ACA issues may be highly visible in the early morning or late evening (when the

sunlight angle is low and reflecting directly into the observers eye) and not as apparent or disappears throughout the day as the sunlight angle changes and the moisture evaporates from the leaf blade.

To build off of this concept, let's discuss the effect "straggler count" and "HOC uniformity" have on the visual appearance of the turf. Reel mowers are not 100% efficient during the mowing process which means not every blade of grass gets cut, nor does every blade get cut at the same HOC.



This variation in leaf blade height along with the presence of stragglers tends to diffuse the amount of light reflected back toward the observer's eye, which ultimately reduces the color varia-

**This variation in leaf blade height along with the presence of stragglers tends to diffuse the amount of light reflected back toward the observer's eye, which ultimately reduces the color variation between passes...**

tion between passes. Any differences, be it an increase or decrease in stragglers or HOC, will show up as a color variation.

For example, when a course is experiencing lighter strips between cutting units (typically the result of double cut marks), the lighter appearance is generally the result of a decrease in straggler count or essentially an increase in uniformity of cut in the overlap

area. The lighter color in relation to the rest of the C/U path is the effect of a more uniform leaf canopy which diffuses less light and appears brighter when standing behind the mowing pass. Understanding how these variations influence the visual appearance of the turf is essential to creating a solid knowledge base in which to build on and diagnose potential ACA issues.

Now that we've reviewed some of the primary building blocks needed to fully understand the cause and effect relationships of ACA issues, let's focus on one of the most common issues, C/U mismatch.

**C/U mismatch** is the pronounced appearance of a single or multiple cutting units within a single pass of a reel mower. The mismatched appearance or strip will be consistent across your entire course or turf area. (If the appearance is intermittent, or specific to a location, this would generally indicate a

turf or agronomic condition, in which case you should refer back to Part 1 of this series).

In the following sections, we will define the four main types of mismatch, identify diagnostic techniques, and provide directional recommendations to help optimize the ACA on your course. There are many things that can affect ACA; the following guidance is to be used as a reference for directional ad-

**Aftercut appearance** (Continued from pg 6) justments, not an exact solution guide. If you need further assistance, please contact your local distributor service professional.

### Diagnosing your ACA issue:

Let's start by identifying a few diagnostic techniques which can be used to better understand what is creating the visual ACA variation (Although we will focus on cutting unit mismatch, these techniques can be applied to resolving a wide range of ACA issues).

#### Technique 1: Identify where the ACA variation is coming from

1. While standing behind the reel mower, have the operator mow a pass and stop the unit in the middle of the pass. Turn off the reels and the traction unit, but leave the reels down. From behind the mower, identify the exact turf location of the variation. Follow this variation up to the traction unit and mark the location on the turf just behind the reel mower (You may need to walk backward a few steps after you have marked the location to ensure your marker is in the correct location).
2. Correlate the location of the ACA variation with the components that interact with the turf in this area. If you are seeing a line then you should search for what is unique in that area or line of travel that could cause the variation. If you are seeing a variation across a C/U or set of cutting units, then you should search for why that C/U is unique compared to the others. For example, if the variation leads up to a single tire path or specific cutting unit and appears to be the same width, that component should be investigated for its consistency across the rest of the traction unit.
3. Utilize a TurfEvaluator™ or similar angled mirror diagnostic tool to analyze turf variations in and around the identified areas. For example, if the variation leads up to an area where the cutting units overlap, the 45 degree mirror on the turf evaluator will help you identify differences such as increased

or decreased straggler count, HOC variation, and even potential turf variations.

#### Technique 2: Identify whether the ACA variation is cutting or contact related

If the location and cause of the ACA variation is not obvious, an alternative method is to make a second pass using the same steps discussed in Technique 1 with the exception of not turning the reels on while making the initial pass. This technique will remove cutting related issues to help isolate the suspect area and identify whether the variation is being created from a cutting variation (ex. inconsistent HOC or double cut marks) or from a contact variation (ex. roller brackets, tires, double roll marks, etc.).

- If the variation is still visible in this pass, it is most likely created from a contact interaction and one should investigate inconsistencies between components such as roller brackets, tires, hose, rollers and/or debris buildup.
- If the variations disappear in this pass, the variation is most likely created from a cutting interaction. Settings such as HOC, C/U aggressiveness, bedknife angle and or C/U sharpness should be investigated.

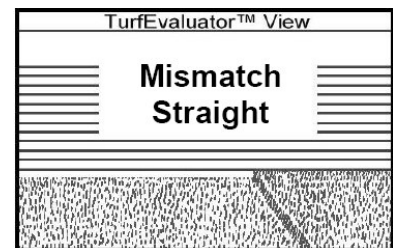
### ACA Directional Recommendations

Once the location and associated components have been narrowed down, you will need to identify the type of ACA mismatch. There are many variations and reasons for C/U mismatch, but most can be categorized into the following mismatch categories:

- **Straight** – shows up as adjacent cutting units mowing evenly and parallel to the ground, but at different HOC.
- **Overlap Marks** – shows up as a visible difference in the turf between cutting units in a multiple cutting unit machine or between adjacent cutting unit passes of one or more machines.

- **Angled or Ridge** – shows up as though one cutting unit has cut lower on one side while other points appear to have the same effective HOC
- **Color Variation** (cutting related) – Shows up as a visible difference in the shade or color of grass across all or a portion of the swath of cut on a single mower. A true color variation differs from other mismatch ACA issues because there is no measurable HOC difference or tire marking in the area in question.

**Straight C/U Mismatch**, recognized by a full width HOC and/or color variations between adjacent C/U's.



*Single C/U HOC variation* generally indicates a setup or suspension difference.

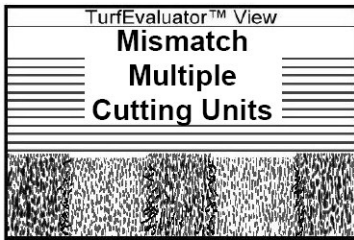
Adjustments that should be investigated for consistency include:

- HOC (bench set and effective) vs those of adjacent C/U's,
- spring and/or suspension counterbalance settings (these adjustments affect the C/U engagement with the turf),
- reel speed and/or bedknife contact compared to adjacent C/U's.
- roller alignment or parallelism to the reel, and
- reel diameter or bedknife differences which can affect bedknife angle and potentially the behind center distance of the bedknife (these variations affect aggressiveness of cut from reel to reel).

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Other settings should be investigated, but the primary focus should be to identify inconsistencies and make directional adjustments to improve the setup consistency across all C/U's.



Pattern Repeats



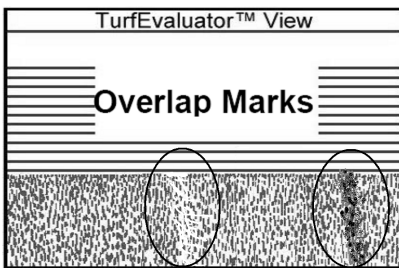
Front to back HOC variation generally indicates a suspension or effective HOC difference.

Adjustments that should be investigated include C/U net down pressure (ex. spring counter balance or other downpressure systems) to increase or decrease the down pressure on the C/U resulting in a directional effective HOC shift.

Other possible variations include tire pressure differences from front to rear which tends to shift the frame up or down, potentially altering the suspension geometry and/or down pressure, thus affecting the C/U turf engagement and effective HOC.

**C/U Overlap Variation**, recognized by darker or lighter stripes in the cutting unit overlap area.

*Increased straggler count* and darker visible stripes (in at least one



Exaggerated View



direction) in the overlap area indicate **double roll** marks. To offset this variation you will need to focus on adjustments that either reduce the rolling effect or increase the cut effect/efficiency in the overlap area.

Adjustments that *reduce roll effect* include:

- using shorter rear rollers,
- removing collars or shoulder rollers, and/or
- reducing the weight on the rear roller (ex. adjustment of the turf compensation spring).

Many other options are available depending on the C/U, but the primary goal of the adjustment(s) should be focused on reducing the roll effect.

Adjustments that *increase the efficiency of cut* include:

- sharpening the reel and bedknife,
- reducing clearance up to light contact, and
- increasing the aggressiveness of cut.

Many other options are available, but the primary goal of these changes is to increase the efficiency of cut across the area which ultimately reduces overall straggler count and color variation.

*Decreased straggler count* (sometimes appears to be a lower effective HOC) and lighter visible stripes in the overlap area indicate **double cut** marks. To offset this variation you will need to focus on adjustments that either reduce the cut effect/efficiency or increase the rolling effect in the overlap area.

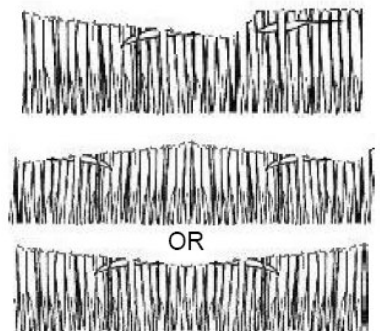
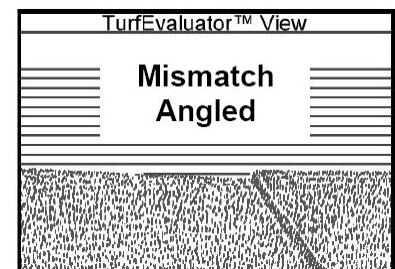
Adjustments that *reduce the efficiency of cut* include reducing the aggressiveness of cut by flattening the bedknife angle. This type of adjustment will move the cutting point forward and closer to the bottom dead centerline of the reel — which will help diffuse the efficiency of cut across the cutting unit. This results in a more uniform straggler count and color across the swath of the reel mower.

Many other options are available but the primary goal of these changes is to reduce the efficiency of cut across

the areas which will ultimately diffuse the variation/straggler count and color variation.

Adjustments that *increase the roll effect* include using longer rear rollers, full front rollers, collars or shoulder rollers, and/or adjusting the turf compensation spring to increase the weight on the roller that is going to affect the area. Keep in mind that this is not always the same roller from front to rear C/Us. It may end up being the rear roller on the front cutting units and the front roller on the rear C/Us. Many other options are available depending on the C/U, but the primary goal of the adjustment should be focused on increasing the roll effect.

**Angled or Ridged Mismatch**, recognized by a visible HOC difference on one side of the C/U which creates a ridge or peak between two C/Us.



*Single C/U variation from side to side* or from adjacent C/U's generally indicates an inconsistent side to side HOC setting, a non-parallel roller, or an external uneven force acting on the C/U suspension.

Adjustments that should be investigated include:

- the side to side HOC setting (bench set and effective HOC),
- the suspension and cutting unit

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pivot points (stiff or sticking pivot points can affect the C/U engagement over undulations),

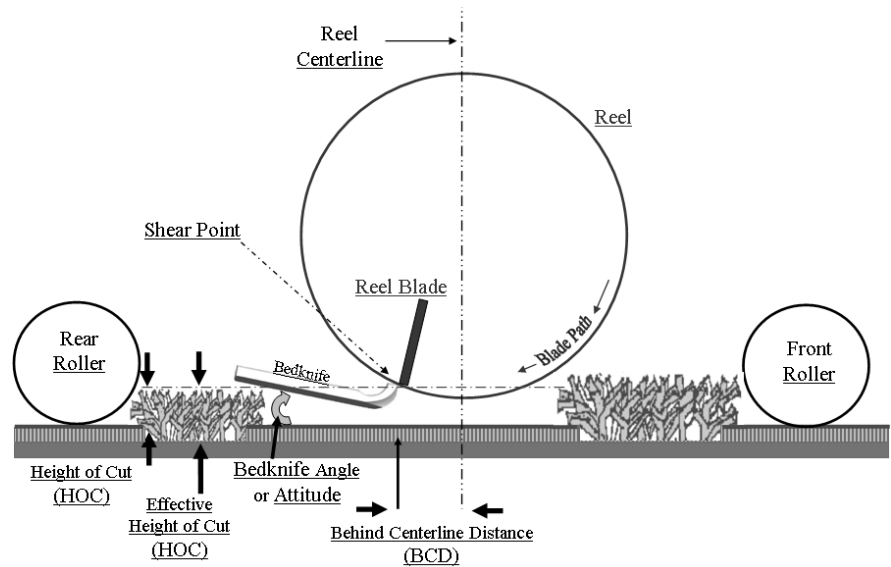
- the routing of hoses should be checked for binding, twisting, etc... (hoses can influence and/or limit the C/U suspension if not connected properly or overly constrained).
- the consistency of counterbalance weights (most C/U's have counter weights to offset the reel motor weight and balance the C/U from side to side),
- the roller alignment and parallelism of front and rear rollers to the reel (non-parallel rollers may shift the HOC from side to side), and
- the reel diameter uniformity from side to side (cone or barrel shaped reels can affect the bedknife angle and C/U aggressiveness across the cutting path).

Other side to side settings should be investigated for uniformity, but the primary goal should be to identify inconsistencies and make directional adjustments to improve the setup consistency across the C/U.

**Tech Tip:** HOC should be set up and checked from both sides of the cutting unit before and after tightening the adjustment bolts to ensure HOC uniformity across the C/U. On worn reels, checking HOC setting in the center of the reel in addition to the sides should be done periodically to ensure the reel is cylindrical and consistent.

**Color Variation (cutting related)**, recognized by a visible difference in the shade or color of the turf across all or a portion of the swath of cut of a single mower. A true color variation differs from other mismatch ACA issues because there is no measurable HOC difference or tire marking in the area in question.

*Single or multiple C/U variation, but no HOC difference* generally indicates variations in C/U aggressiveness or potentially a clipping dispersion issue.



- To diagnose this issue, brush over the marked variation during the diagnostic techniques explained earlier. If the variation disappears, the issue is generally a clipping dispersion issue and related components such as rear roller brush/scrapers should be considered (if already installed, they should be checked for proper contact and consistency).
- If the variation does not disappear, the issue generally tends to be tied to an efficiency of cut variation. To resolve this type of ACA issue, components which affect how clean or efficient the C/U cuts should be investigated for inconsistencies. Examples of these components are C/U aggressiveness, bedknife attitude, roller type or configuration, C/U down pressure and potentially inconsistent sharpness and/or wear pattern of the reel vs. other C/U's in the group.

In conclusion, the information above and the topics discussed in Part 1 of this series are intended to increase your team's understanding of the physical cause and effect relationships that influence ACA — and ultimately provide the knowledge and tools needed to help resolve current or future issues specific to your individual environment and course.

These adjustments are not specific to any one model, and as such, the ad-

justments highlighted throughout this series should be utilized as directional guidelines only. They work well for most ACA issues, but additional adjustments may be necessary for specific designs and/or circumstances.

**Tech Tip:** On traditional or legacy style C/U's (non-DPA), the aggressiveness of the C/U tends to increase as the reel and bedknife wears. Because of this design geometry, it is important that all reels remain relatively equal in diameter to improve ACA consistency across the reel mowers swath. If possible, reels or bedknives should be replaced as a group to minimize this inconsistency.

If further assistance is needed, please contact your local distributor service professional.

Thank you to everyone who provided feedback on the first article. We hope this information will prove helpful in your goal of providing exceptional course conditions.

