Wandering Hybrid Syndrome: Yield Monitor Errors

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"It's like déjà vu all over again." -- Yogi Berra

Recently I shared an example of a type of yield monitor error that can inadvertently influence yield estimates, unrelated to the calibration process, when using yield monitors enabled with less than precise DGPS (Nielsen, 2014). The error occurs when the yield monitor is set to automatically change the estimated swath width value based on the harvested "coverage map" and the estimated current geo-position of the combine in the field. Header or swath width, of course, is used by the yield monitor to estimate the harvested area which is subsequently used in the calculation of yield per acre for individual data points and thus accurate widths are important to ensure accurate yield estimates.

Another type of yield monitor error, similarly related to imprecise DGPS signal sources, is one associated with the automatic hybrid labeling of yield data points during the harvest operation. Some planter displays allow you to "track" what hybrids or varieties are being planted and record this information in a planting log for the field. If you are planting different hybrids in the two halves of the planter, the display can also log this spatial information in a coverage file (Fig. 1).

During harvest, the same display uses the logged planting information to automatically label yield data points with the appropriate hybrid identification by matching the combine's geo-position in the field during harvest with the logged geo-position of the planted hybrids. This capability to automatically associate yield data points with the planted hybrids enables you to easily summarize average yields by hybrid either on the display itself or later in your mapping software.

The Wandering Hybrid Syndrome

Similar to the underlying cause of the auto swath width errors (Nielsen, 2014), inaccuracies in perceived geo-position can result in inaccurate hybrid labeling of yield data points during harvest. Figure 2 illustrates several harvest passes in a field that was planted with a 16-row planter with different hybrids in the two 8-row halves of the planter and harvested with an 8-row combine. Sections of three harvest passes of 8 rows of Hybrid B (blue) were mislabeled as being Hybrid A (red).

The DGPS signal source for the planting operation was RTK (1-inch accuracy) and that used for the harvest operation was WAAS (5 to 15-ft accuracy), which resulted in occasional imprecise overlapping of "perceived" planting and harvest paths in the field. In some areas of the field, the degree of imprecise overlapping of the two paths resulted in inaccurately labeled harvest data points.

Figure 3 illustrates an area of the field where the geo-positions of the two field operations overlap precisely. The black data points represent the logged geo-position of the center of the 16-row planter (aka the planting coverage file). The red (Hybrid A) and blue (Hybrid B) yield data points represent the logged center of the 8-row combine, but also correspond to the center of each half of the planter when positioned correctly relative to the logged data points of the planting coverage file.

Figure 4 illustrates an area of the field where the geo-positions of the two field operations do not overlap precisely. The yield monitor occasionally senses (incorrectly) that the path of the combine has drifted far enough into the other hybrid's logged geo-position that it incorrectly labels those yield data points as being the other hybrid.

In contrast to auto swath width errors where the cause is only related to pass-to-pass geo-position inaccuracies during the harvest operation itself, errors in automatic hybrid labeling may be compounded if geo-position inaccuracies occur during both planting and harvesting. The most likely scenario for this would be if WAAS (5 to 15-ft accuracy) were used as the DGPS signal source for both planting and harvesting.

Consequences of Wandering Hybrid Syndrome?
Recognize that the consequence of inadvertently erroneous hybrid labels on yield estimates per se is... nothing. That is because, contrary to incorrect swath widths, hybrid labels have nothing to do with the yield monitor's estimation of yield for each data point.

The primary consequence of inadvertently erroneous hybrid labeling of yield data points is that it leads to mistakes later if those hybrid labels are then used to filter and analyze the yield data. Several scenarios can be considered and the probability of each is unpredictable.

Let's consider two hybrids, A and B, with different yields. The actual average yield for Hybrid A is 200 bu/ac and that of Hybrid B is 180 bu/ac.

1. If some proportion of Hybrid A's data points (200 bu potential) are mislabeled as Hybrid B, but none of Hybrid B's data points (180 bu potential) are mislabeled, then the apparent yield of Hybrid B will be inflated.
2. Vice versa if some percentage of Hybrid B's are mislabeled as Hybrid A.
3. If equal proportions of Hybrid A's and Hybrid B's data point are mislabeled, then there may be no consequence later summaries of the yield data by hybrid.

So, how can you tell whether your yield data is afflicted with Wandering Hybrid Syndrome?

- If you use auto-steer on your combine, I suppose you could keep your eyes glued to the display monitor and watch the hybrid names change as you harvest the field :-).
- Some, but not all, mapping software programs allow you to map the logged data by their assigned hybrid names. That allows you to visualize the hybrid name changes throughout the field as illustrated in Fig. 2.
  - Unfortunately, this diagnostic occurs after the "cows have broken through the fence" and only points you in the right direction for future harvesting.

So, what can be done to prevent or minimize the occurrence of Wandering Hybrid Syndrome?

- Equip both your planter tractor and combine with more precise DGPS signal sources, such as RTK, so that the both field operations log geo-position more precisely (within inches) and repeatably.

So, what can be done once the problem has occurred and you are stuck with a bunch of yield files containing incorrect hybrid attributes?

- Some mapping software programs allow you to highlight / select groups of data points and then edit their "properties" or "attributes". For small areas of fields where the data mapped by "hybrid" indicates mistakes in hybrid assignment, you could then edit and correct the hybrid names. For large and/or numerous areas of fields with incorrect hybrid name assignments to the yield data, you may simply choose to "live" with the mistakes.

"We made too many wrong mistakes." -- Yogi Berra

Related reading


Fig. 1. Example of logged planter data (black = planter center) and planter coverage file for a field planted with different hybrids in each half of the planter (red = Hybrid A, blue = Hybrid B).

Fig. 2. Example of errors in labeling yield data points with previously logged hybrid information (red = Hybrid A, blue = Hybrid B).
Fig. 3. Precisely overlapped geo-positions of logged 16-row planting data (black = planter center) and 8-row harvest data (combine center), resulting in accurate assignment of hybrids to yield data points (red = Hybrid A, blue = Hybrid B).

Fig. 4. Less than precise overlapping of logged 16-row planting data geo-positions (black = planter center) and 8-row harvest data (combine center), resulting in inaccurate assignment of hybrids to yield data points (red = Hybrid A, blue = Hybrid B).