

Corn Silage and Grain Yield Monitor Data Cleaning

By Tulsi Kharel, Sheryl Swink, Karl Czymmek and Quirine Ketterings



Calibration of yield monitors during the harvest season is essential to obtain accurate yield data, but even if calibrated properly, the data obtained from the yield monitors still needs to be cleaned.

Yield monitor values recorded are estimated based on:

- 1** Distance (inches or feet) that a combine or chopper travels during the data logging time period
- 2** Width (inches or feet) harvested during each logging time period
- 3** Silage or grain flow (mass) measured by the equipment's flow sensor per logging time period (lbs/second)
- 4** Moisture content (MC in percent) of the harvested mass as measured by a moisture sensor per time period
- 5** Logging interval of the yield monitoring system (seconds)

Errors that impact the accuracy of the yield data occur in multiple ways. The distance the combine travels during a time period and its width give the area required for yield

calculation. If a combine is not equipped with a harvest swath width sensor, the default will be the chopper or combine width, and that can cause errors when fewer rows are harvested than the width of the chopper or combine. Another source of error is the delay time of grain or silage moving from the chopper or combine head to the flow rate sensor. Flow rate sensors, moisture sensors, and Global Positioning System (GPS) units are located in different places on harvest equipment and since it takes some time for harvested silage or grain to travel to the sensors, adjustments need to be made. This is called delay time correction. Each harvest pass will be affected by this delay correction, independent of whether a new pass starts from one end of the field or from somewhere within the field, in situations where the harvester is paused during harvest. The delay time itself is related to the speed of the combine or chopper as well, which may introduce another source of error.

Combines and forage choppers are calibrated for a certain velocity range. If the velocities that are recorded fall outside the calibrated range,

flow rate and yield values associated with those points are no longer trustworthy and should be removed from the data. Similarly, abrupt changes in velocity affect the flow rate, resulting in erroneous yield calculations for logged data points. Other easily trackable errors are logged data points with zero grain or silage moisture. This may occur as the chopper or combine enters the field or pauses mid-field while the silage or grain flow has not yet reached the moisture sensor.

Last, but not least, if the operator does not raise the combine/chopper head after completion of a pass, the pass number will not be updated in the logged dataset. Cleaning of data that are obtained this way will take additional effort, so lifting of the combine/chopper head while turning in the field is recommended.

Especially for corn silage yield data, use of raw data without proper cleaning can lead to substantial over and underprediction of actual yield, depending on the field and harvest conditions. Figure 1 shows this in more detail for a number of fields. Look at a

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20 ton/acre corn silage yield (cleaned yield) for the fields in this figure, and you will see that the raw data corresponding to this cleaned yield can range from 15 to 37 tons/acre! The raw data for many of the fields in this figure overpredicted yield, while for some fields it actually underpredicted. Thus, data cleaning is absolutely necessary.

In the past months the Cornell Nutrient Management Spear Program, in collaboration with colleagues at the University of Missouri and the Iowa Soybean Association, evaluated cleaning protocols to develop a standardized and semi-automated procedure that allows cleaning of datasets for whole farm yield data recording. The protocol developed for whole farm data cleaning calls for unfiltered or “raw” harvest data files that are downloaded from the yield monitor with corresponding field boundary files. These files are read into the Ag Leader Technology Spatial Management System (SMS) software to preview the yield map and reassign any harvest data that might show up in the wrong field. Next, the individual field harvest

data are exported as an Ag Leader Advanced file format. The yield map files are then imported into Yield Editor (ars.usda.gov/research/software/download/?softwareid=370) for cleaning. Yield Editor is a software developed by the United States Department of Agricultural Research Service (USDA-ARS). The software allows for use of different filters to remove the errors mentioned above. After cleaning of the data in Yield Editor, the cleaned datasets are exported to MS Excel and data points with zero moisture (for grain) and 45 percent moisture or less (for forage) are deleted. This final step is particularly important to obtain accurate corn silage yield data.

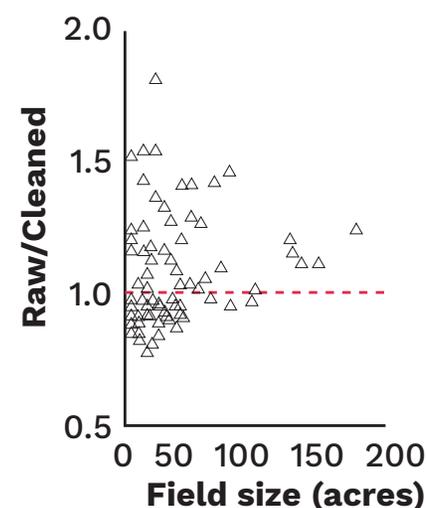
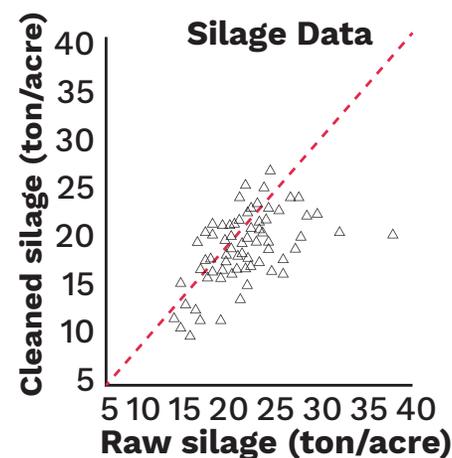
A step-by-step protocol for cleaning individual field datasets and batch processing of harvest data from growers with large numbers of corn silage or grain fields will be described in a manual that will be available to download from the Cornell Nutrient Management Spear Program website (nmssp.cals.cornell.edu). For a training session in New York on the cleaning protocol, contact Quirine M. Ketterings at qmk2@cornell.edu. ■

Quirine Ketterings, Tulsi Kharel and **Sheryl Swink** are with the



FIGURE 1

Not cleaning yield monitor data can result in larger over or underpredictions of actual corn silage yield



Cornell Nutrient Management Spear Program. **Karl Czymmek** is with the Cornell Nutrient Management Spear Program and Cornell CALS PRO-DAIRY.