FIELD TESTS OF A JOHN DEERE HARVESTER FOR THE PURPOSE OF PRODUCTION MAPS ACHIEVEMENT

Vlad Nicolae ARSENOAIA[1], Roxana RAȚU[1], Ionut VELEȘCU[1], Ioan ȚENU[1]

e-mail: vnarsenoaia@uaiasi.ro

Abstract

Errors in the generation of production maps can arise from many causes and are practically inevitable. Even though errors will occur, production data can be improved by following a few best practices. The primary methods for improving harvest data should always be the calibration and proper operation of the combine. In cases where this is not possible or where errors occur, the John Deere Operations Center offers data analysis tools through filtering, post-calibration, and improving the visualization of production maps. These practices will result in obtaining accurate data on which agronomic decisions can be made for subsequent farming years. Mapping productions using the John Deere S780i harvester combine and its associated systems provides the farmer with valuable information about their farm, which can be used to make informed and calculated decisions to increase overall productivity, sustainability, and profitability of the agricultural farm.

Key words: production maps, harvest, profitability

Production maps on harvesters are valuable tools in modern agriculture. These maps provide a detailed visual representation of the crop yields and other relevant data as the harvester operates in the field.

Production maps offer a clear and intuitive way to visualize the performance of the harvester in real-time. They show variations in crop yield, moisture levels, and other important parameters across the field.

One of the primary functions of production maps is to monitor and record crop yields. This data can be used to assess the effectiveness of different farming practices and identify areas of the field that may require specific attention.

Production maps are an integral part of precision farming. They enable farmers to make data-driven decisions regarding seeding rates, fertilizer application, and irrigation. This precision can lead to improved resource utilization and reduced waste (Cazacu D., 2021).

Over time, production maps generate a wealth of historical data. Analyzing this data can help farmers identify long-term trends, make predictions, and optimize their farming strategies for maximum efficiency and yield.

If the harvester experiences issues during operation, production maps can help pinpoint the problem areas. This aids in rapid troubleshooting and reduces downtime, ensuring that the harvester remains productive.

Many modern harvesters come equipped with technology that integrates production maps with farm management software. This allows farmers to manage and analyze data from all their equipment in one place.

With accurate and up-to-date production maps, farmers can make informed decisions about post-harvest processing, storage, and sales. They can identify high-performing areas and potentially plan for future crop rotations.

By monitoring crop yields and variations, production maps can also support environmentally responsible farming practices. Farmers can reduce the use of fertilizers and pesticides in areas where they are not needed, minimizing environmental impact (Cazacu D., Roșca R., 2020).

Ultimately, production maps are a valuable tool for optimizing farm profitability. By fine-tuning operations based on the data they provide, farmers can aim for higher yields and better financial outcomes.

Production maps on harvesters have revolutionized modern agriculture by providing real-time data and insights that help farmers make informed decisions, increase efficiency, and optimize their farming practices for greater productivity and sustainability.

[1] Iasi University of Life Sciences, Romania

Interpreting data from production maps on agricultural combines is a crucial part of the agricultural analysis process. It involves understanding and extracting useful information from the data collected and graphically represented on production maps (Karampoiki, 2021).

One of the central aspects of data interpretation is analyzing crop yield. Farmers can determine high and low-yield areas, thus identifying the reasons for production variations. For example, low yield may be caused by water stress, poor soils, or plant diseases.

Production maps reveal spatial variations in production. Interpretations can uncover patterns of variation and help farmers understand which geospatial factors, such as topography, soil type, and moisture levels, influence production.

Production maps can help identify potential issues in the field, such as pest infestations or nutrient deficiencies. By identifying these issues, farmers can take more effective corrective measures (Lobachevsky YP, 2016).

Data from production maps can be used to plan agricultural resources such as irrigation, fertilization, and pesticides. This precise planning can reduce resource waste and costs.

Farmers can use data from production maps over multiple agricultural seasons to analyze trends over time. This can help assess the impact of changes in agricultural practices or weather conditions on production.

Based on data interpretation from production maps, farmers can plan future crops and crop rotations to maximize yield and prevent soil depletion (Li, 2022).

Properly interpreting data from production maps can serve as a basis for agronomic decision-making regarding land management. This may include adjusting fertilizer dosages, scheduling irrigation, and implementing crop protection measures (Zhalnin E.V., 2013).

Interpreted data from production maps can be documented and reported, providing farmers with a historical record of their performance and supplying valuable information for agricultural reports or audits.

Properly interpreting data from production maps is essential for modern farmers, as it allows them to make more informed decisions, optimize resources, and increase the efficiency and profitability of their agricultural operations.

MATERIAL AND METHOD

To achieve the research objectives, we have created production maps for some plots of winter wheat established within a company.

Within the conducted experiments, the following objectives were considered:

- studying the reliability of the software component of the John Deere combine;
- examining the impact of using new technologies on the work process;
- investigating potential ways to utilize the generated production maps.

Based on the harvest maps generated by the combine, we were able to make decisions for the technology to be applied in the next agricultural campaign. Even though we did not have variable-rate seeding or fertilizing equipment at that time, we used the generated map to apply chemical fertilizers differentially in specific zones. Relying on the harvest maps and understanding the reasons for production variations in certain areas of the field, we made decisions to improve soil fertility by applying manure and amendments, initiating the technique of incorporating all plant residues, and reducing the working depth in areas with high organic matter in the upper horizon.

Furthermore, production maps for the following years can be tracked and compared to assess improvements in productivity resulting from the measures taken. This approach allows for a more data-driven and targeted approach to farming practices and can lead to increased agricultural efficiency and yield.

We used a S780i harvester. The John Deere S780i is a high-performance harvester designed for quality harvesting operations across a wide range of agricultural crops. It features advanced technology, such as "Automatic Crop Flow," which utilizes sensors to optimize the harvester's performance and increase efficiency, and the "Command Center" display, providing real-time information to operators about the machine's performance. In addition, the S780i is equipped with a large-capacity grain bin and a powerful engine to handle demanding tasks and provide continuous power in any conditions. It is designed for medium to large farms where advanced farming practices result in high yields and the desire for high-quality, high-yield grain harvesting.

The systems and structural elements that define the combines in the S series, and especially the John Deere S780i, include the following:

- The S780i is powered by a 13.5-liter John Deere PowerTech PSS engine, providing high power and torque for efficient harvesting;
- The S780i is equipped with a 2.75-square-meter threshing drum and a concave or counter-rotating separator system designed to efficiently separate grain from straw;
- The combine features a cleaning system with a surface area of 5.20 square meters and an air volume fan of 740 m^3/min, ensuring effective separation of impurities from the harvested crop;
- The Intelligent Power Management (IPM) System allows the combine to automatically adjust the engine power and travel speed based on crop conditions, optimizing efficiency;

- The S780i comes with a CommandCenter Gen 4 display, enabling operators to manage all machine functions, settings, and data from a single location;

- The combine is equipped with John Deere's automated guidance system, allowing the operator to automatically control the combine's path, maintain a consistent speed, and avoid overlap, increasing operational efficiency.

These advanced features and systems contribute to the S780i's ability to provide efficient and effective harvesting for medium to large farms, making it a valuable tool for modern agriculture.

The research was conducted using a harvester speed of 5 to 7 km/h.

RESULTS AND DISCUSSIONS

Havesting maps generated by John Deere combines are a precision agriculture tool that allows farmers to monitor and analyze crop yields. This tool utilizes GPS technology to create detailed maps of harvested fields and can be used in conjunction with other precision farming equipment, such as liquid or solid fertilizer applicators and precision seeders.

One of the key features of John Deere Harvest maps is their ability to create detailed production maps. These maps can be used to identify areas within a field where yields are low or where there are variations in crop growth. This information can be used to adjust planting or fertilization practices to improve crop yields. Additionally, farmers can use the maps to identify areas where there may be soil or drainage issues affecting crop growth.

Another advantage of harvesting maps is that they allow farmers to easily share data with other team members. Moreover, they can be integrated with other precision farming tools and software, such as precision seeders, to provide detailed and accurate information about crop yields at every point in the field.

Overall, harvesting maps are a valuable tool for modern agriculture, enabling farmers to make data-driven decisions, optimize farming practices, and maximize crop yields.

The dedicated agricultural solution called "Yield Data" allows the analysis of production data and converts it into maps for variable rate application. As mentioned earlier, the system has an integrated feature that provides accurate information. Supported by powerful processing capabilities, Yield Data enables multi-layer analysis and visualization of various production data features, such as moisture content, weight, volume, fuel consumption, speed, and more. A cloud-based platform ensures data storage and transmission across multiple devices, which is vital for multi-year mapping of farm field productions. This facilitates data access and sharing among various stakeholders and supports the long-term analysis and planning of agricultural activities.

The issue arises when combines harvesting the same unit of land or when harvesting the same field using a single combine at different times have not been calibrated and correlated in the ActiveYield system. This can result in significant production differences between the combines. One of the best ways to avoid this problem is to perform calibration before starting work and ensuring data calibration parameters are consistent between the two machines or across different harvest times.

Calibration is a crucial step in ensuring accurate yield data collection. It involves setting up the equipment to precisely measure and record crop yields. When multiple combines are used or harvesting occurs at different times, it's essential to calibrate and correlate their systems to maintain data accuracy and consistency. Proper calibration and data synchronization can help avoid discrepancies and provide reliable production data for better decision-making in agriculture.

We must follow the operating instructions and requirements for the combine and any associated equipment. We must ensure that all equipment is properly calibrated and in optimal working condition before harvesting.

During harvesting, we should make sure the focus is on the operation. Any interferences or deviations from procedures can affect data quality. Monitor the combine and other equipment closely.

We must ensure that all necessary data is recorded correctly during harvesting.

This includes information about the area, crop type, soil type, and more. Accurate and complete data is essential for subsequent interpretation. After harvesting, ensure that the data is transferred and correlated correctly in the Operation Center or the software platform used. Verify that data from combines, GPS, and other equipment is correctly synchronized.

When interpreting data from production maps, we must pay attention to details. Identify variations, patterns, and trends that can provide valuable insights for optimizing farming practices. Recognize that there are potential error factors, such as GPS inaccuracies or terrain variations, that can affect data. Try to quantify and understand these factors in data interpretation.

We must ensure that data is stored in a secure environment and can be accessed for future analyses. Regular backups are essential.

The problems caused by differences in the header's height relative to the ground during operation can be due to Header Height Switch Issues. Problems with the header height switch, which may fail to detect when the header is raised or lowered, resulting in no production data being recorded. This can lead to missing data or gaps in production data if the issue persists. Commonly, operator error may result from leaving the header in the harvesting position between fields or not raising and lowering the header correctly at field edges or unsown areas. This can lead to missing or inaccurate data. To obtain high-quality harvest maps, the operator should monitor the operating parameters during the harvesting process, and the map generated in the Operation Center. Even if the field does not have a regular shape, the AutoPath system maintains the same working width of the combine, reducing idle pass areas. When the combine harvests an area that doesn't cover the full width of the header with vegetation material, the production yield is reduced, and the obtained data becomes inaccurate. At the end or beginning of a pass, when the combine accelerates or decelerates, the production map is altered, overestimating or underestimating the production. The generated production map on a 7.83 ha area by John Deere S780i harvester is shown in *figure 1*.

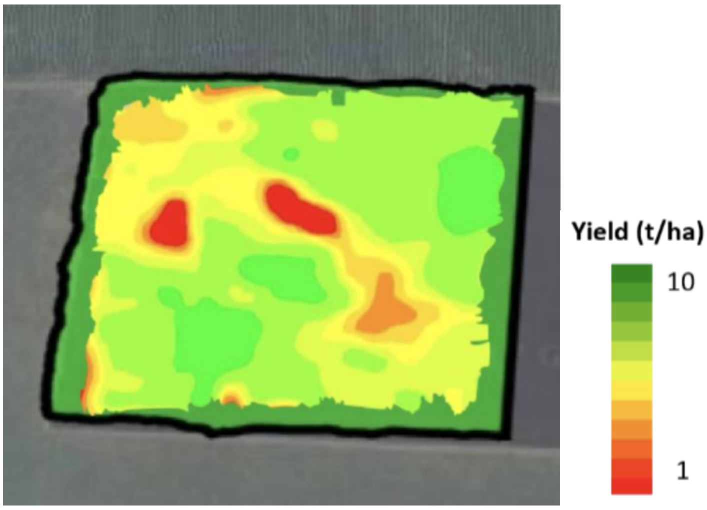

Figure 1 **Production map generated by John Deere S780i harvester for winter wheat**

CONCLUSIONS

These types of errors can also occur in the middle of a pass if the combine accelerates or decelerates suddenly.

These types of production data issues can be avoided by making gradual adjustments to the combine's speed. In cases where this is not possible, the John Deere Operation Center will eliminate erroneous data during data processing.

In conclusion, mapping productions using the John Deere S780i harvester and its associated systems provides farmers with valuable insights about their farm.

These insights can be used to make well-informed and calculated decisions aimed at enhancing overall productivity, sustainability, and profitability of the agricultural operation. By using production maps and variable rate for sowing, for spreading fertilizers and for phytosanitary treatments, we can reduce very much the costs for each crop.

REFERENCES

Cazacu D., 2021 – *The research method to determine the work quality, energy and exploitation indices of grain harvesters, Iași.*

Cazacu D., Roșca R., 2020, – *Exploitation of agricultural aggregates, Iași.*

Karampoiki M., Heiss A., Sharipov G. M., 2021 – *Producing grain yield maps by merging combine harvester and remote sensing data,Precision agriculture, Page645-651.*

Li W., Huicuan B., Duncan W. Yun, L., 2022 – *Estimation and Spatial Mapping of Residue Biomass following CTL Harvesting in Pinus radiata Plantations: An Application of Harvester Data Analytics, Forests, volume 13, Issue 3.*

Lobachevsky YP, 2016 - *Methodical recommendations on the implementation of monitoring systems and management of harvest-transport complexes /* co-authors: FSBI FNATS VIM. M., 2016.107 p.

Zhalnin E.V., **2013** - *Optimization of the machine use of a powerful reserve for increasing the efficiency of agricultural production // Science in Central Russia. No. 1. P. 4-15.*

https://www.deere.com/en/harvesting/wts-series-combines/

https://www.deere.com/en/harvesting/s-series-combines/