

THE USE OF GPS SYSTEM DURING FIELD DEWEEDING

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Abstract

Agriculture is an industry that focuses on the production of food, feed, building materials, and agricultural products by growing plants and raising animals. This sector is crucial for providing food for people and animals and sustaining the world economy. Agriculture involves modern techniques and technologies to maximize production as well as traditional methods of cultivation, which can be used depending on the crop and availability of resources. Digital agriculture refers to the use of digital technology in all aspects of farming, from planning and cultivation to harvesting and marketing. This can include using sensors, IoT devices, automation, data analytics and blockchain technologies to collect, store and use valuable information about crops, terrain and weather conditions. The purpose of digital agriculture is to improve the efficiency, productivity and profitability of agricultural activity, as well as to protect the environment and provide food for people and animals.

Key words: GPS, field clearing

Digitization of agriculture refers to the use of digital technology in all aspects of agricultural activity, from planning and cultivation to harvesting and marketing. Some of the beneficiaries of digital technology used in agriculture include:

- IoT (Internet of Things): Using internet-connected devices such as sensors, GPS devices and drones to collect and transmit data about cropland, plants, animals and weather conditions.

- Data Analytics: Using algorithms and data analytics techniques to create predictive models and predict the performance of crops and farmland.

- Automation: The use of robot and automation technologies to improve the efficiency and productivity of agricultural activity, such as the precise distribution of fertilizers and pesticides.

- Blockchain: Using blockchain technology to create traceability systems and guarantee the integrity of agricultural production information, from the field to the store shelf.

- Agro-technology: Use of technology to improve plant performance and increase production through methods such as plant and hybrid selection, seeding and irrigation technology.

In monitoring the machinery fleet, the ultimate goal is to maximize farm efficiency and profitability. To achieve this goal, farm owners can use different monitoring technologies, such as GPS systems, sensors, fleet management software, etc.

These technologies collect information such as machinery position, fuel consumption, performance, operating time, etc (Huzum N., 2013).

This data can then be analyzed to identify ways to improve efficiency and profitability. For example, farm owners can identify machinery that is consuming too much fuel or operating inefficiently and take steps to optimize its use.

In addition, monitoring can provide farm owners with up-to-date information on machinery activity in real time, which can enable them to quickly intervene in the event of problems and avoid disruptions to farm activity. It can also enable farm owners to allocate resources efficiently and plan machinery activity based on work needs (Leontescu M., 2016).

Monitoring the fleet of agricultural machinery within a holding can include the following beneficial information for the farmer:

- Location: Use of GPS to stay aware of the position of each machine on the field.

- Use: Monitoring of operating time, distance traveled and activities performed (such as cultivation, furrowing or spraying).

- Efficiency: Analysis of fuel consumption and machine performance to identify ways to optimize efficiency.

- Maintenance: Following the maintenance schedule and the operating status of the machines

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to prevent possible problems and ensure optimal operation.

- Reporting: Generating reports to assess fleet performance and make informed decisions on equipment spending and investment.

- Allocation of resources: Efficient allocation of machines according to work needs and their operating status.

- Security: Monitoring of machinery activities to identify potential risks and ensure the safety of employees and equipment.

- Integration with farm management systems: Integration with farm management systems such as land and crop management systems to get a complete picture of farm activities.

- Real-time monitoring: The ability to monitor the fleet of machines in real-time to quickly respond to unforeseen situations.

- Data Analysis: Analysis of data collected through monitoring to improve business decisions and strategies.

So, monitoring the farm equipment fleet can provide farm owners with valuable information to maximize their efficiency and profitability, as well as improve productivity, safety and informed decision-making.

A study examined the impact of fleet monitoring systems on the efficiency and effectiveness of agricultural machinery fleet management. The study involved the use of a system to monitor a fleet of agricultural machinery during a harvest season. The system was used to track machinery performance and condition, including fuel consumption, operating hours and idle time (Zhalnin E.V., 2013).

It was found that the use of this system led to a significant reduction in machine maintenance costs and machine downtime. They also found that the system enabled more efficient management of preventive maintenance programs and more accurate scheduling of farm work.

In addition, the authors identified several additional benefits of using fleet monitoring systems, such as:

- Improving the energy efficiency of machines, by identifying and eliminating behaviors that lead to excessive fuel consumption.

- Reduce the risk of unplanned failures and outages by identifying and fixing problems before they become critical.

- Improving employee safety by monitoring and managing risks associated with the use of agricultural machinery.

One looked at the use of navigation and fleet monitoring systems in precision agriculture.

The study was conducted in Australia and involved the use of a navigation and monitoring

system for a fleet of agricultural machinery during a harvest season. The system enabled precise tracking and monitoring of machinery movement and performance, as well as the application of agricultural inputs.

It was found that the use of the system led to a significant improvement in the precision of the application of agricultural inputs, by eliminating human errors and by optimizing the routes and the speed of movement of the machines. They also found that the system enabled more accurate resource and cost management by monitoring the use of agricultural inputs and fuel consumption.

In addition, the authors identified other benefits of using fleet navigation and monitoring systems, such as:

- Improving agricultural profitability, by optimizing the use of agricultural inputs and resources.

- Reducing the impact on the environment, by using agricultural inputs in quantities and at precise times.

- Improving working conditions, by reducing the time spent by employees in agricultural machinery.

In conclusion, the studies highlighted that the use of navigation and fleet monitoring systems can significantly improve the accuracy of agricultural input application, reduce costs and environmental impact, as well as improve the working conditions of employees.

MATERIAL AND METHOD

An agricultural activity, more and more used to obtain good results, is field clearing. In the following lines, you will find information about its role, its benefits, and how it is implemented.

The harvesting campaign is still in full swing, and after this process will end, the lands must be prepared for the future crops.

Every owner of a culture seeks to obtain optimal results, therefore, it is necessary that the works intended for this objective be carried out in time. In this way, the harvest will be rich, and the work will be rewarded.

The process by which the soil is worked with the disc harrow, to maintain the soil moisture and to prepare the soil for the next crop, is de-weeding.

The main aspects that must be taken into account when this work is carried out are:

- Working depth;
- Adjusting the parallelism of the harrow frame;
- Adjusting the distance between the scrapers and the harrow discs.

Due to the fact that most of the soil in our country has a high clay content, it requires loosening. Also, weeds appear very often, which is

why works are needed to maintain the soil in the desired parameters.

The USV Iasi research team generated reports from the WayQuest application. The application records data based on the GPS modules mounted on the agricultural machinery and aggregates within the farm.

The purpose of the analysis of the reports was to establish the influence of the machinery fleet within the S.C. AGROMECA DRAGALINA S.A. on the management of the agricultural farm.

The efficiency of labor in agriculture depends primarily on the degree of mechanization. The use of machines has the effect of increasing productivity, carrying out the execution of agricultural works in an optimal time, which contributes to obtaining high productions.

The use of GPS systems contributes to increasing efficiency and productivity by monitoring agricultural activity in the field and by optimizing the use of resources.

A report related to the field clearing process with a Pöttinger aggregate (*figure 1*) was generated. For the months of November and January, the Kr coefficient has a value of 0.91. Normal values for this work are between 0.70 – 0.90.

The farmer carried out the weeding work on an area of approximately 200 hectares.

The total consumption of diesel for these 200 hectares was 2,347 liters, which results in a consumption of 32.4 liters/hour.

Comparing the results of this report with the report generated in previous months, an increase in fuel consumption/hour of approximately 3 liters is observed.

The increase is due to the difficulties encountered in the execution of the work: the increase in the forward resistance of the machines and aggregates, the increase in the operating time of the machines.



Figure 1 Pöttinger deweeding aggregate used to perform the work

In addition to the performance of the machines and agricultural aggregates found on the farm, the farm administrator is also interested in the efficiency of its employees, namely the technical operators. With the help of the new system for monitoring the fleet of machinery and agricultural equipment, the farmer has a clear record of the working time of each employee.

RESULTS AND DISCUSSIONS

For accurate monitoring, each technical operator received a key named: iButton, being required to insert it into the special device in the cabin of the agricultural machine each time an agricultural machine is used.

It was observed that the human resource registered decreases in the period of activity, as a result of reduced agricultural activity in the analyzed period.

Thus, the employees worked in shifts to complete the two activities: harvesting and weeding and carried out maintenance work on agricultural machinery and equipment.

With the help of this report issued by the management application, the farmer can observe the evolution of the yield of each employee.

Thus, he can make major decisions in the management of the farm and introduce measures to motivate the human resource: bonuses, promotion, social motivation.

The farmer worked with the help of his fleet of machines, an area of approximately 580 hectares. The total diesel consumption recorded by the tractors was 7,881 liters, which leads to a consumption of 9.8 liters/hectare.

GPS systems used to guide them provided this data (*figure 2*) and have several major advantages:

- You can work with precision at night;
- It is possible to work in conditions of fog/reduced visibility due to dust clouds;

- Reduces the risk of physical overwork of operators.

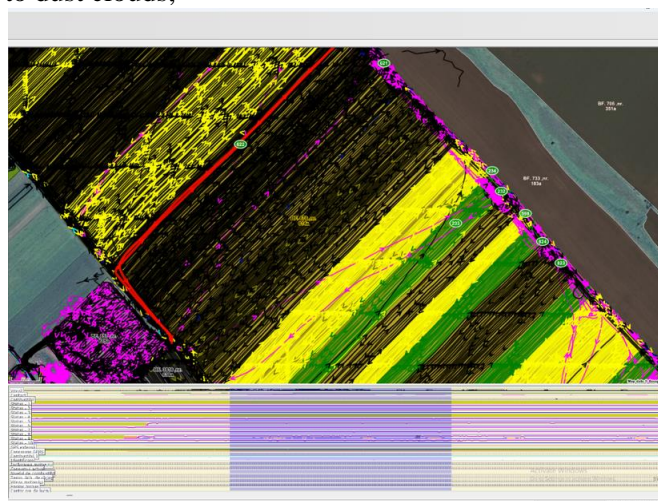


Figure 2 Images provided by the application following the completion of the work

In addition to eliminating pests, weeding also helps with plowing, because everything will take place much more easily, with a higher yield, the traction effort being reduced to 10-14%, the productivity of the plow being increased by 15-20%, and the consumption of fuel will be reduced by 8-12%.

CONCLUSIONS

Thanks to the application used by S.C. AGROMECA DRAGALINA S.A., it can optimize its production factors, improving the use of resources to achieve maximum production at minimum costs.

The use of GPS technology in the study allows automatic monitoring, without manual interventions, of agricultural activity. The return on investment of an agromonitoring system can be increased by increasing operational efficiency, by regulating procedures using real data, as well as by optimizing and saving resources.

Agricultural fleet tracking systems allow real-time tracking or history of farm equipment and operators from any internet-connected laptop or phone.

In order to more clearly illustrate the data collected in this time frame, the following findings were reached:

- Providing the location, speed and activity of each unit, allows a more efficient planning of activities and resources;
- Monitoring the excessive use or abuse of machines and equipment, prevented possible damages, improving durability;

- Being monitored fuel consumption allowed the farmer to optimize it and reduce fuel costs in the future, moreover, the technical operators became more responsible knowing that they are being monitored, some of them even asking about the areas worked by them during a day;

- Given that agronomic engineers have permanent access to the history of the activities of machines and mechanizers, the monitoring of the areas where work has become much easier to analyze;

- The generated reports provided information on the efficiency and productivity of each unit, thus allowing their improvement and increasing the profitability of the farm.

ACKNOWLEDGMENTS

The realization of the study is part of the project *The constitution and implementation of partnerships for knowledge transfer between the Research Institute for agriculture and the environment of Iași and the agricultural economic environment* with SC Agromec Dragalina SA – Contract POC-A1-A1.2.3-G-2015, ID P_40_385, nr. 4/05.06.2018.

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