Digital agriculture: the experience of Ukraine

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Abstract: *For example of the implementation of an educational project to train students in the field of digital agriculture technologies is given. The project was implemented at the Dnipro State Agrarian and Economic University. The equipment was provided by LLC "Agro KMR" for information. An overview of software of Ukrainian and foreign production working in the field of digital agriculture is given. The advantages of using digital agriculture are shown. As an example, the implementation of the functions of differentiated sowing of sunflower by the unit Case IH Magnum 380 + Horsch Maestro 36.50SW, for which sowing maps were developed by students, is given. Sowing was performed in real conditions*

It is shown that farmers and owners of agricultural holdings should be more interested in the functioning of such a project than universities - because it significantly optimizes and automates production. Without such technologies in the coming years, agricultural enterprises will begin to lose competitiveness.

Keywords: DIGITAL FARMING, AGRICULTURAL, EQUIPMENT, STUDING

1. Introduction

The development of the agricultural sector of Ukraine will be constantly accompanied by modern agricultural machines [1-2] and technologies, which will provide: intensive introduction of energy-saving technologies for agricultural, reducing the cost of using machinery, total control and accounting of soils, crops, resources, production, etc. Today, Ukraine is a leader in the pace of implementation of modern technologies in agriculture in the world. However, Digital Farming is not being implemented so rapidly. Large agricultural holdings and medium-sized farmers have high-tech foreign equipment from the world's leading manufacturers.

It should be noted that in general, there are no problems with the provision of agriculture with machinery today. All technological operations are performed, as a rule, in due time. The struggle and competition for the cost of work began. At the same time, the coefficient of use of machinery is still at a non-high (and sometimes low) level, which reaches 65… 80%. Although the tractors and harvesters is equipped with advanced means of diagnostics and automatic control. And few farmers know that they already have many free options in the purchased equipment, but due to ignorance of how to use them, unreasonably overpay dealers.

Why is this happening? There are several reasons, but one of them is the lack of understanding of the owner of the agricultural enterprise about the algorithm of introduction of Digital Farming technologies and qualified machinery operators.

However, today we can conclude that the first to master the technology of the Digital Farming, he will ensure the colossal competitiveness of his enterprise.

2. Analysis of the state of the issue

So, what are the bonuses that the introduction of Digital Farming technologies will bring to the agribusiness owner? Where and when to start?

Figure 1 *- A fragment of the use of machinery in the field with digital farming.*

Who and how will support the functionality? Are there enough qualified specialists in this sector?

The bonuses are obvious: the practice of farmers in the US, Canada, Australia, innovative agricultural enterprises of Ukraine (Fig. 1) shows, that the introduction of Digital Farming technologies not only provides a high level of planning, control, cost reduction, but also increases profits by 10% . At the same time, a significant problem faced by Ukrainian farmers is the lack of a flexible algorithm for managing the Digital Farming. Dealers who sell equipment and software are not ready to fully provide qualified support to the company, to organize the necessary and sufficient training of consumers of the product. On the contrary, they charge for consultations, thus increasing the cost of implementing and maintaining Digital Farming, and thus, the latter becomes cumbersome and incomprehensible to the farmer. We also found that today agricultural universities do not train full-fledged specialists in Precision Farming or Digital Farming (even if it is advertised on university websites). Thus, a large proportion of graduates, for example, specialty 208 "Agroengineering" are not competitive and do not fully meet the modern requirements of the agricultural labor market. The fact that it is necessary to thoroughly and immediately update the quality of education, to rejuvenate the scientific and pedagogical staff in agricultural education is evidenced, for example, by the fact that the Center for Distance Testing and Education "Agroosvita" [1] offers in tests the knowledge of agricultural machines, which are obsolete and are not used today. Who prepares these tests? Do the questions correspond to the level of the modern fleet of machines and technologies of their use?

It is obvious that students who study new modifications of combine harvesters, for example, John Deere - series W, T, S, telematic systems like JD Link, control and management of them - do not know the structure of combines ККП-3 "Херсонець-9" and similar combines! Because, they are obsolete and are no longer used today. Thus, there is an imbalance in the assessment of students' knowledge: the student has knowledge and skills in relation to modern technology, but does not have them in relation to outdated technology and "Agroosvita" assesses his knowledge as "unsatisfactory". Does this correspond to the objective reality?

The purpose of the work is to bring the quality of training of engineering and technical workers to the real needs of production, taking into account the introduction of Digital Farming!

Today, there are definitions of "precision farming" and "smart farming" (they can be found in free access on the Internet), the implementation of which allows you to collect a significant amount of various production data in real time and store them. Digital Farming integrates both concepts of Precision and Smart Farming. It can be defined as "the consistent application of methods of Precision and Smart Farming, internal and external interconnections of the economy, as well as the use of both web platforms containing

data and big data analysis" - according to the definition of DLG (Deutsche Landwirtschafts-Gessellschaft).

Thus, at the Dnipro State Agrarian and Economic University, the implementation of an experimental project to train specialists in the field of Digital Farming technologies has been launched.

It should be noted that we have already started a similar project before with one of the John Deere dealers, but this project has not been developed. The analysis showed that for the full and, most importantly, the actual functioning of such a project requires the following:

- systematic interest of the dealer and the university in the implementation of such a project through continuous operation without interruption of the production process and training;
- motivation of students and teachers-participants of the project;
- constant and stable access of project participants to the digital data of the enterprise, which is already working with the technologies of the Digital Farming or is at the stage of their implementation.

Taking note of the reasons for the failures, we launched a new project on Digital Farming, which should solve the following tasks:

- to give a clear explanation to the Project participants of the essence, purpose and tasks of Digital Farming, advantages and problems on the way of their implementation;
- to teach practical skills of students in the use of equipment, software, obtaining accurate data of production activities;
- to study the algorithm of introduction of Digital Farming in the enterprise;
- learn to make the right decisions based on the data obtained;
- be able to make forecasts, identify risks and implement flexibility of decisions in production activities;
- to exchange students between DSAEU and Olds College (Canada).
- to get full-fledged ready specialists in the field of Digital Farming.

Eleven AFS (Advanced Farming System) licensed programs provided by My Agro Canada were installed for the implementation of the Project at the Department of Machine and Tractor Operations (DSAEU). The management of LLC "Agro KMR", represented by the director Clement Coussens, provided access to the databases of the headed enterprise. Thus, students worked online, designing production tasks for the company.

Most farmers and dealers today make the same mistake: they try to buy equipment without delving into the software, violating the sequential algorithm. In addition, not everyone understands the need to introduce an additional staffing unit for a person who would be directly involved in Digital Farming in the enterprise. As a rule, it is an IT specialist.

In the first lectures, students were able to get a detailed analysis of the digital platform Cropio, which is widely used in Ukraine (Fig. 3): what are its functions, how to start working, what to look for and much more. For example, on these maps we see that you can simultaneously observe on some relief what is the state of vegetation of crops on specific dates. And hundreds of such data can be collected. Ukraine (Fig. 2): what are its functions, how to start working, what to look for and much more. For example, on these maps we see that you can simultaneously observe on some relief what is the state of vegetation of crops on specific dates. And hundreds of such data can be collected.

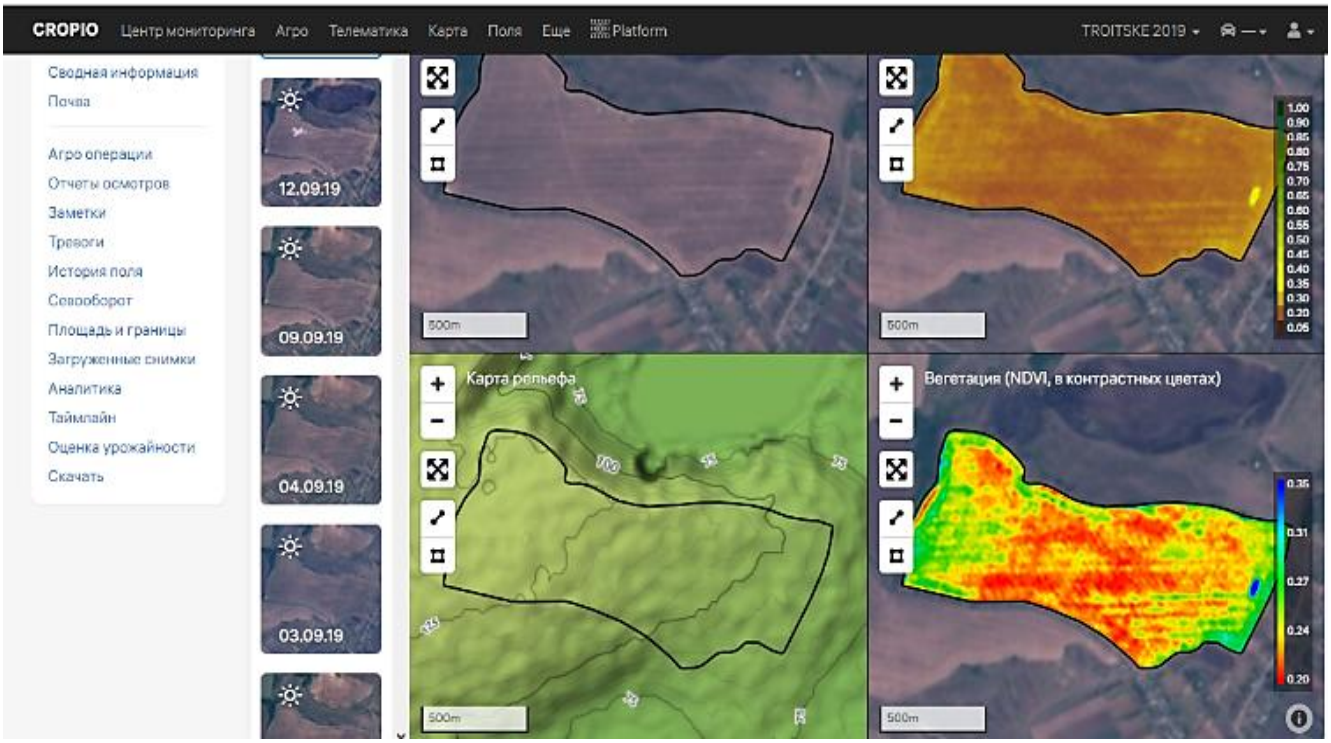

Figure 2 - *Characteristics of one of the fields of the enterprise on the Cropio platform.*

In fact, only in one figure 3 you can see a lot of collected data, showing a complete picture of the current state of production and on the basis of which you can make the right and effective decisions.

A comparative analysis of different platforms, their similarities and differences was conducted. For many it was a surprise that there are similar platforms of domestic manufacturers, such as the platform from AgroOnline (Fig. 4), which has a similar platform to Cropio functionality.

The digital penetrometer developed by domestic manufacturers is shown, which transmits soil hardness data to the SkokAgro platform (Fig. 5) – another Ukrainian product of digital technologies, online.

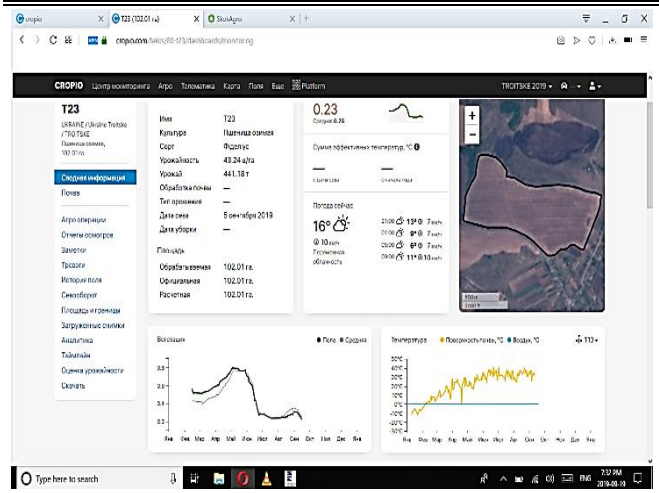

Figure 3 *- Characteristics of one of the fields of the enterprise on the Cropio platform.*

Figure 4 *- AgroOnline software interface*

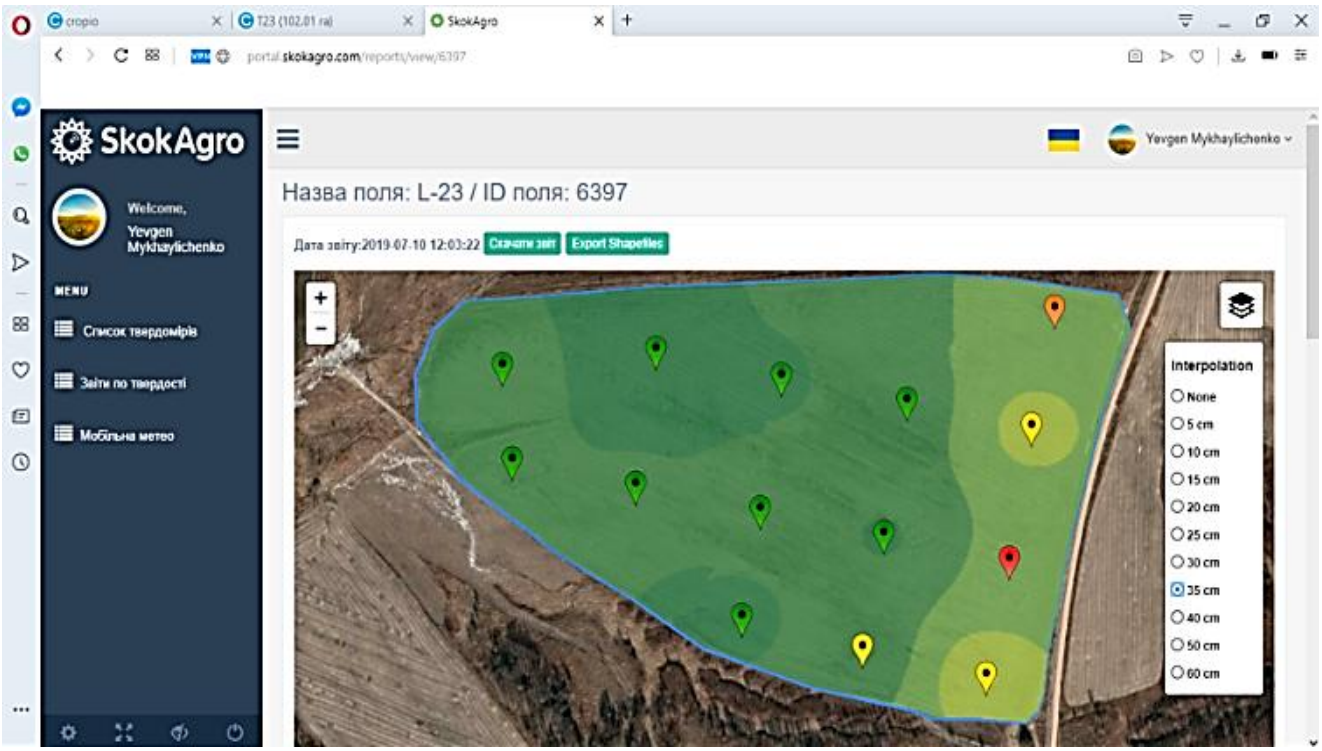

Figure 5 *- Fragment of the map of soil hardness measurement digital penetrometer S 600*

After finishing the first block of classes, 12 students who participated in the project for 2 years were selected into a separate group. They have gone step by step all the way that ensured the full start and functioning of Digital Farming. The next classes took place in a computer classroom, where students with the help of AFS software learned to operate data obtained from LLC "Agro KMR". And the next step was practical training in the selected fields of this enterprise: from hardness measurement to the technology of soil analysis and much more.

In general, after two years of intensive and systematic classes, we should exchange between students of one of Canada's colleges and show the ability of students (at that time already specialists in Digital Farming) to resist the change of situational production activities and the ability to perform tasks in other conditions, in this case - in another country.

After receiving positive results of this project, it should be implemented in other agricultural universities of Ukraine, in order to train competitive specialists who would not only meet the requirements of time and level of agricultural production, but also were generators of ideas and innovations of the agro-industrial complex.

3. Example

Here is one example of how and what you can save, increase the productivity of the unit. So, in one of the enterprises by means of a drone the operative control of a condition of a field is carried out and it is found out that long rains promoted formation on the field of a certain number of small lakes that completely destroyed crops. The dimensions and coordinates of these lakes were entered into a digital map, which was uploaded to the sprayer map. The agronomist decided: to carry out treatment with chemicals with a rate of 150 l / ha (blue color) and to stop processing (red color) in case of passage of the sprayer over the sites destroyed by water (fig 6).

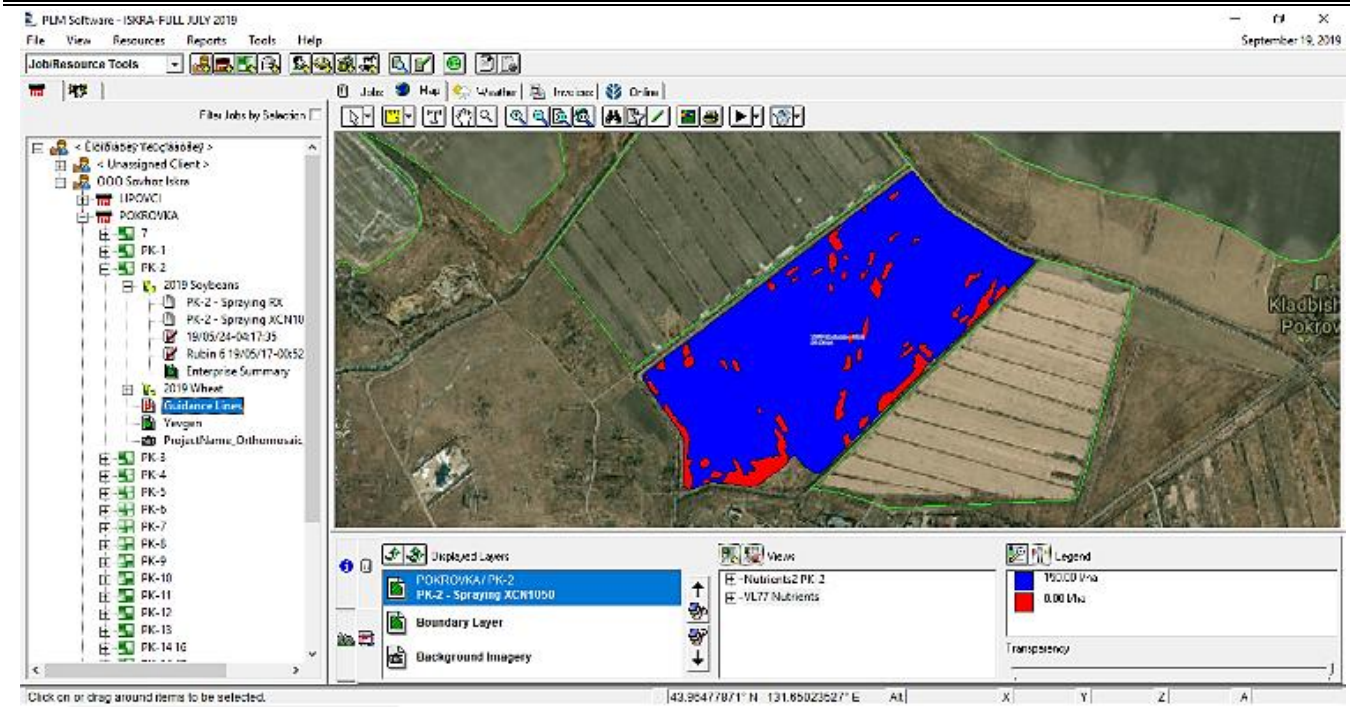

Figure 6 *- Operational map for differential application of chemicals*

What did this give the company? Disabling sprayers on the machine in the case of passage over the area of the field, where crops are destroyed by water, provided a reduction in the cost of chemicals by 9.5%. The volume of the working solution and the cost of transporting and preparing the working solution of chemicals were saved. That is, reduced energy consumption, and hence the cost of this technological operation. Similarly, adjustments are made at all stages of production: in the main and ancillary operations, in the process of production coordination (for example, coordination of the multiplicity of the width of the units, their productivity and more).

As a result of the block of studies, students based on a map of differentiated sunflower sowing. The task provided for differential sowing of sunflower seeds in three zones of the field with a sowing rate of 65, 70 and 75 thousand seeds per 1 ha.

The unit was part of a Case IH Magnum 380 tractor with a Horsch Maestro 36.50SW sowing complex. The unit is equipped with the Trimble TMX-2050 monitor. The process of uploading the task took place directly in the field and was completely filmed on video (Fig. 7, a), which readers can view by using the QR-code and following the link.

Figure 7 *- a) Video formation of the task. It starts from the moment after downloading the file from the flash drive. The duration of the operation is 6 minutes.*
b) start of sowing

The map of tasks (Fig. 8) with three seeding zones looked like this.

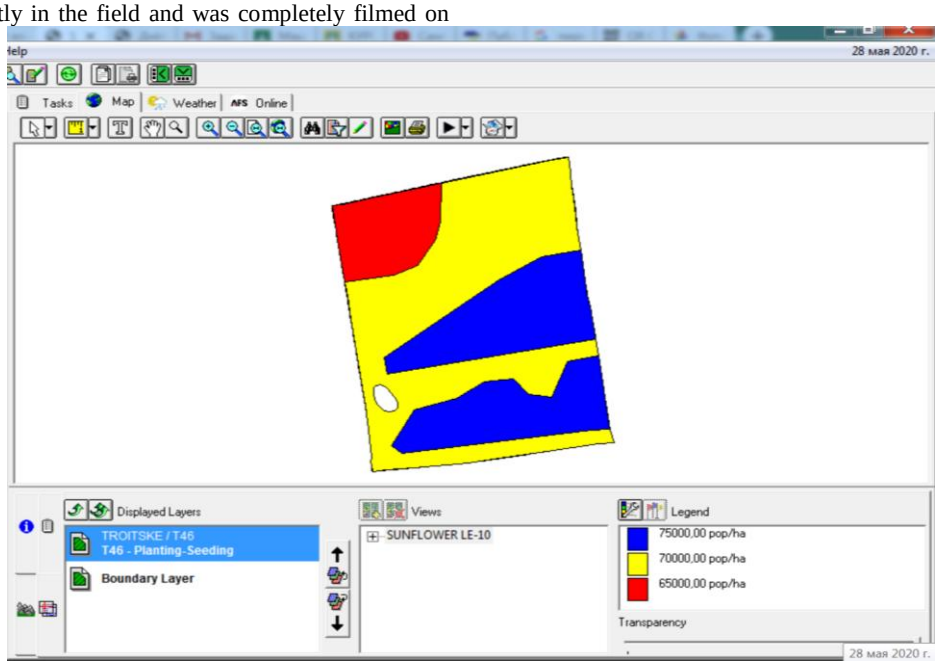

Figure 8 *- General view of the task map, built in AFS software, with three seeding zones.*

The map of the performed differentiated sowing is shown in Fig.9.

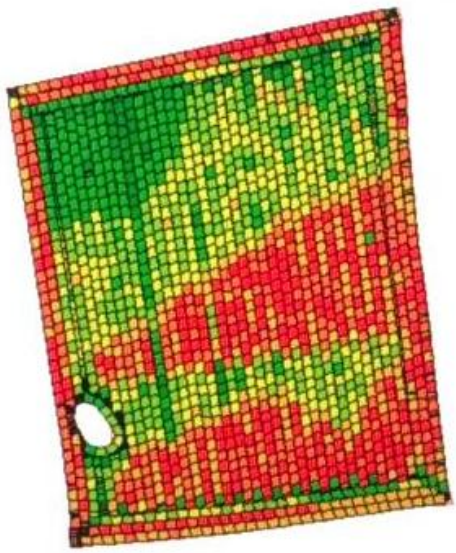

Figure 9 *- Map of differentiated sowing.*

Conclusion

The creation of the Project on Digital Farming at the Dnipro State Agrarian and Economic University is due to the lack of training of specialists in this field on the market of educational services.

Such a project is currently the first and only in Ukraine and its graduates must solve the problem of stable implementation of Digital Farming in agricultural companies of Ukraine.

In our opinion, farmers and owners of agricultural holdings should be even more interested in the functioning of such a project than universities - because it significantly optimizes and automates production. Without such technologies in the coming years, agricultural enterprises will begin to lose competitiveness.

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