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APPLICATION OF PLANO RS SOFTWARE IN A FARM

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ABSTRACT

The paper presents evaluation of Plano RS software used in a farm that is covered with agri-environmental scheme. The objective of the research was to check to what extent Plano RS software influences the process of defining quantity of fertilizers necessary in a farm. Wide spectrum of the program, its common availability, and the fact it is user-friendly, allows even people with basic knowledge of computers to use Plano RS software as an effective tool supporting their decisions. Using Plano RS software, a farmer is able to define quantities of fertilizers that should be applied in a farm, crosscheck manual calculations.

Introduction

Profitability of production in a farm requires a farmer nowadays to have not only agricultural knowledge, but also the one concerning agricultural engineering, law, finances, and management. Collecting all data related to a farm and production, and then analyzing and obtaining information, may turn out a difficult and time consuming process. Computer or internet decision support systems for agriculture may undoubtedly bring necessary assistance.

First Decision Support Systems (*DSS)* were developed at the turn of 60s and 70s, and they were used for business management (Bojar, 2010). Since the beginning of 80s and the development of information technology, which was accompanied by appearing of computers that were available almost for all people, decision support systems have been used in agriculture as well. A decision support system is in different words a set of rules recorded in a form of a mathematical formula or logical questions, the answer for which should be found in computer software (Grudziński, 2006). Apart from obvious economic advantages observable for a farmer who uses decision support systems, there are also advantages for environment. Taking the advantage of agri-environmental schemes means the reduction in production process of e.g. fertilization, or using plant protection products, which should be followed by a farmer in return for some financial instruments such as subsidies that compensate them (Kuszewska and Fenyk, 2010, Brodzińska, 2009). Quantity of used pesticides gets reduced and processes are performed in the so called optimum conditions, which

means, that these products are in full consumed by plants, and they do not pose a threat to functioning of ecosystems. Reduction of a number of performed processes and farm works limits the usage of machines in a farm, which means the decrease in carbon dioxide emission from fuels used in farm machines. Consultancy concerning fertilizers requires exact analysis of soil and filling in data form about a farm, but it assures rational, sustainable fertilization of plants, and safe application of natural and mineral fertilizers (Fotyma (Ed.), 2009). In principle, all these requirements and factors that are sometimes too difficult to be analyzed by an individual, are taken into account by an appropriate software of decision support in the scope of making a fertilization plan (Jadczyszyn, 2009).

Objective, scope and methodology of research

The objective of the research was to evaluate application of Plano RS software used in particular for making fertilization plans in farms covered with agri-environmental schemes within the framework of Rural Areas Development Plan 2007-2013.

The research has been conducted based on an experimental method – there has been simulation run of Plano RS software application in relation to data and indicators of a particular farm. In the experiment there have been used: data put in the agri-environmental scheme adopted for a farm, as well as statistical data of a farm, current soil analysis and field work. The research was run in the business year 2011/2012. It was run in a farm located in Jaświły commune (in north-eastern part of Mońki County, Podlaskie Voivodeship). The northern part of the commune is Biebrza National Park, and the eastern border is marked by Brzozówka River, which is one of the biggest tributaries of Biebrza River.

Research results

Application of Plano RS software allowed to make fertilization plan not only for one business year, but also for some next years (e.g. a period of fulfilling an agri-environmental scheme), although it turned out that it was necessary to introduce unexpected modifications that depended e.g. on weather conditions or applied agro-technical procedures, e.g. soil drying, fertilization, introducing a new form of crop and livestock production.

The software allowed not only planning quantities of necessary fertilizers, but it also verified certain routine mistakes made by farmers in the process of defining quantities. Comparison of fertilizers demand calculated by a farmer for permanent pastures: 102 kg $N \cdot ha^{-1}$, 34 kg $P_2O_5 \cdot ha^{-1}$, 70 kg $K_2O \cdot ha^{-1}$, 21 kg $MgO \cdot ha^{-1}$and 10 kg $CaO \cdot ha^{-1.}$ In the process of calculation, Plano RS software changed quantities of fertilizers 41 kg $N \cdot ha^{-1}$, 11 kg $P_2O_5 \cdot ha^{-1}$, 35 kg $K_2O \cdot ha^{-1}$, 6 kg $MgO \cdot ha^{-1}$and 3800 kg $CaO \cdot ha^{-1}$.

The discussed software allowed in a very precise manner to calculate a necessary fertilizers dose, which influenced economically the farm. It was defined that the farmer should spread agricultural lime more often on pastures because acidity of the soils is within the range 5.1-5.5 pH. The advantage of the software is calculating nitrogen doses that should be delivered for a particular plant together with giving the dates of application. No matter if it is a pasture (e.g. A field: dose I – before sowing, dose II – after the first windrow, dose III –

after the windrow), or triticale (e.g. dose I – before the beginning of spring vegetation, dose II – stem extension stage), the software will conduct a necessary calculation.

Table 1
Nutrition demands of a field with permanent pastures (printout)

	Field No.(name): O					Field area (ha): 5.74				
Crops	Recommended portions kg per 1 ha					Recommended portions for field				
	N	P_2O_5	K_3O	MgO	CaO(t)	N	P2O5	K3O	MgO	CaO(t)
Crop: grass	41	11	35	6	3,8	235	63	201	34	22
Nitrogen fertilization (kg N/ha/ year): 54				incl. Natural and organic fertilizers:13					N balance:14	
Organic fertilizer for a plant: liquid manure-fermented and unfermented 48 tons/field										
Distribustion of nitrogen doses:($kg \cdot ha^{-1}$)										
Dose I:16 before sewing										
Dose II:12 after the first windrwow										
Dose III:12 after the second windrow										
Half of calculated CaO dose is recommended to apply in a form of magnesium lime										

It was observed on the basis of fertilization analysis that the reason for incorrect growth of plants was shortage of phosphorus and potassium macroelements in the soil. The research pointed out that the farmer calculating manually doses of applied fertilizers, even when applying very high amount of nitrogen (143 kg $N \cdot ha^{-1}$, 34 kg $P_2O_5 \cdot ha^{-1}$, 40 kg $K_2O \cdot ha^{-1}$) was not able to achieve satisfactory crops of triticale, because in order to obtain on average 5 tons of triticale, we need 67 kg $N \cdot ha^{-1}$, 50 kg $P_2O_5 \cdot ha^{-1}$, and 71 kg $K_2O \cdot ha^{-1}$ (Jadczyszyn, Kowalczyk, Lipiński, 2008).

Table 2
A farm balance (printout)

Balance indicators of a farm			
Area	ha	Consumption of natural fertilizers	
Agricultural area	44.12	NIG (statistical farm number):024136041	Year:2012
Arable area	37.91	Farm:	Farm tested
Fallows incl.	0		
Pastures	6.21		
Grain crops	4.04	11% share in crops structure	
Permanent	0		
Green fields	13.78	36% share in arable area	
Fields with ploughed straw	0	0% share in arable area	
Main feed area	40.08		
Crop in grain units	dt		
For 1ha of agricultural area	37.5		

Balance indicators of a farm			
Area	ha	Consumption of natural fertilizers	
For 1 ha of crop area	43.6		
LSU/1ha of agricultural area	0.96		
LSU/ 1 ha of main feed area	1.06		
indicators	N	P	K
NPK quantity in applied natural fertilizers (kg)	356	179	564
NPK consumption in natural fertilizers in kg·ha^{-1} of agricultural area	8	4	13
NPK consumption in mineral fertilizers in kg·ha^{-1} of agricultural area	91	34	89
Intake of components from all sources in kg·ha^{-1} of agricultural area	133	22	99
Intake of components from all sources in kg·ha^{-1} of arable area	144	25	108
Intake of components from all sources in kg·ha^{-1} of pastures	62	6	45
NPK balance for 1ha of agricultural area	12	3	-9
Fertilization of arable area with nitrogen (N kg/ha/year)	113		
Fertilization of agricultural area with nitrogen (N kg·ha^{-1}/year)	45		
Recommended value of balance indicator		1.08	1.92
Current value of balance indicator		1.15	0.92
Straw management:			
Demand for straw for litter (tons)	15.7		
Amount of straw for litter to be used by farm (tons)	33.3		Print
Ratio of using straw for litter	2.13		Close

Another advantage of the software is the fact that it contains a lot of important information necessary for a farmer, e.g. such as: crop rotation on a particular field, NPK ratio·ha^{-1} of agricultural land, quantity of straw in a farm and demand for litter, shortage of nutrition components kg·ha^{-1} of agricultural land, livestock of adult animals LSU·ha^{-1}. It is required that a farmer puts in a very exact and correct manner all data from his farm, and then it will be possible to use such an analysis in the farming production process.

An element of the software that requires further improvement is calculating the natural fertilizers quantity, which can be used by a farm. It depends on the number of livestock in a farm, type of breeding, age and number of days spent on pasture. From the practical point of view, in a farm there are quite frequent changes to a number of livestock and their age, as well as number of days spend on pasture. One may notice when trying to compare calculations of the software and realistic usage of liquid and stable manure from the barn on deep litter, that they are quite different, which results from averaging the number of animals by

the software. It does not include either the possibility of combining production of a particular farm with others, whereas in farm production, there are frequent cases of e.g exchanging products by neighbours, which may not be included in the data input (no such function).

Table 3
SWOT analysis of Plano RS program application

Advantages:	Disadvantages:
- Common and free access to the software. - User-friendly, even for people with basic knowledge of computers. - High number of variables, which allows matching to a particular farm. - A possibility to plan for many years. - Low hardware requirements. - Commonly used by agri-environmental experts in the process of preparing fertilization plan. - Recommended by Farming assistance center and farming chambers.	- Incomplete data. - Takes into account only standard situations, no possibility to modify in extraordinary situations. - High number of commands to be done in order to make calculations. - Reading is possible only at the computers where Plano RS is installed, no possibility of exporting data. - A necessity of putting fertilization data twice in different periods of a business year. - Limited possibility of manual changes in order to match with the specificity of a particular farm.
Chances:	**Threats:**
- A modern software for making fertilization plans. - Well-tried in scientific research and in practice, which proves its usefulness. - Allows a better planning and usage of natural and mineral fertilizers.	- It requires monitoring of its correctness with a realistic farm production process since too high level of trust into the software calculations may result in negative effects. -

Summary and discussion

In Polish conditions computer decision support programs in farming undoubtedly still remain a certain novelty, and they are too seldom used. As field works prove, only ca. 17% of farm producers who have a computer with the Internet access, use a program for defining the quantity of necessary fertilizer (Borusiewicz, 2009). A significantly higher percentage of farmers use computers to select the goods, make a purchase, fill in subsidiary applications correctly, or for plain entertainment. It is worth mentioning that numerous "traditional" farmers do not have necessary knowledge to use computers and the Internet, and main users of their computers are their children or grandchildren (Lorencowicz and Figurski, 2008), which gets confirmed by the research carried out by Kapela and Borusiewicz (2012).

However, taking into account western practices and experience, this thinking is incorrect, since a computer is extremely useful, and more importantly it is an effective tool for fertilization planning. Grudziński (2006) quotes most important reasons of certain objections of farmers against modern programs of decision support, i.e.:

– worries of farmers concerning high purchase costs of hardware and software that might not get compensated by savings obtained thanks to their application,
– too much complicated hardware and software service,
– low reliability of solutions suggested by a software, which results from accepted simplified models,
– difficulties to modify software according to individual farm properties,
– being up to the date with information stored in the data base memory,
– knowledge level of a user may be a factor that discourages from using a software.

Despite all indicated reasons, when getting better acquainted with the practical aspect of using a farming computer software such as Plano RS, they are not obstacles that may not be overcome, the more that majority of farms is assisted by different forms of farming assistance experts, farming assistance centers, farming chambers or other entities.

The research of Kapela and Borusiewicz (2013) point out that the average age of farmers got lower, but education level, scope of competences and awareness of modern solutions increased, and these factors mean greater interest into modern technologies, including the programs of decision support in farming.

Plano RS program includes all these factors: soil properties, e.g. acidity, content of basic elements; forecrop and fertilization that was performed specially for a plant, issue of an aftercrop and the aim of crop, managing the side crop, application of natural fertilizers. Using Plano RS software allowed reduction of quantity of applied mineral fertilizers, which meant the cost reduction of farm costs.

Each farm producer, even the one having specialist education and practical knowledge, when using the computer software may obtain a lot of valuable information that may bring about visible economic results. Wide spectrum of the program, its common availability and the fact it is user-friendly, allows even people with basic knowledge of computers to use Plano Rs software as an effective tool supporting their decisions. One may expect in the future that – as in western countries – a computer equipped with decision support systems – will be one of the most basic tools used in a modern farm.

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ZASTOSOWANIE PROGRAMU PLANO RS W GOSPODARSTWIE ROLNYM

Streszczenie. W pracy przedstawiono ocenę działania programu Plano RS wykorzystywanego w gospodarstwie rolnym objętym programem rolnośrodowiskowym. Badanie miało na celu sprawdzenie, w jakim stopniu program Plano RS wypływa na określenie ilości stosowania niezbędnych nawozów w gospodarstwie. Wszechstronność programu, jego powszechna dostępność oraz łatwość obsługi, pozwala nawet dla osób z podstawową znajomością obsługi komputera wykorzystać program Plano RS, jako skuteczne narzędzie wspomagania decyzji. Stosując program Plano RS, rolnik może ustalić ilości nawozów jakie powinny być zastosowane w gospodarstwie, zweryfikować wyliczenia ręczne.

Słowa kluczowe: Plano RS, nawożenie, komputerowa aplikacja rolnicza, programy rolnośrodowiskowe