Облік і оподаткування

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MAKING MANAGERIAL DECISIONS IN THE PROCESS OF ORGANIC FARMING
ПРИНЯТИЕ УПРАВЛЕНЧЕСКИХ РЕШЕНИЙ В ОРГАНИЧЕСКОМ ЗЕМЛЕДЕЛИИ

Summary. *The technique of marginal calculations is based on the principle of marginal costs. It definitely considers the yield (Output), and use of production resources (Input). Its main aim is the definition of on-farm competitive index for the production processes in making decisions in planning. Depending on the applied planning methodology, there are three methods of keeping marginal calculation: methodically valid marginal revenue, marginal calculation by practical method and standard marginal profit.*

To ensure the efficient management of the market of products of organic farming we need information and its detailing, which helps the formation of decisions adequate to the situation and management tasks. As evidenced by the analysis, the over-saturation of information, as well as its lack, complicates the processing of information flows about the state and prospects of development of the market of products of organic agriculture for the preparation, adoption and implementation of appropriate management decisions.

Optimization calculations (program planning, linear programming) require that the marginal revenue is calculated accurately in accordance with economic theory. Methodically actual margin income is the difference between marginal value and marginal expenses.

In relation to the individual production process the following questions arise:

a) *that an amount of additional produce the process brings with the expansion of production by one unit;*
b) *that an expense arises from the expansion of production by one unit.*

The marginal cost as a rule is easily measurable, because the volume of production increases in proportion to the expansion of production. Basically, when you define a methodically valid marginal income, only the commercial products (revenue from sales) are estimated.

Organization of the system of crop rotation in the farms is inextricably linked to the definition of a rational structure of sown areas. Thus, it is necessary to ensure the production of goods in such quantity to fulfill contractual obligations for the sale of products and to provide on-farm needs (seed fund, natural wages fund, forage fund, catering fund, insurance fund, the marketing, repayment of loans to other farms etc.).

Key words: *organic farming; making managerial decisions; accounting and analytical support; modeling; marginal calculation; input output analysis.*

Аннотация. *Построенная нами программа за основу берет расчеты маржинальных доходов по всем культурам. Методика маржинальной калькуляции базируется на принципе предельных стоимостей. Она однозначно учитывает выход продукции (Output), и использование производственных средств (Input). Основной ее целью является определение внутрихозяйственного конкурентного показателя для производственных процессов при принятии решений в планировании. В*

зависимости от применяемой методики планирования, различают три метода проведения маржинальной калькуляции: методично действительный маржинальный доход, маржинальная калькуляция по практическому методу и стандартный маржинальный доход.

Для обеспечения эффективного процесса управления рынком продукции органического сельского хозяйства нужна та информация, ее детализация, которая помогает формированию решение, адекватного ситуации и задачам управления. Как показывает проведенный анализ, перенасыщенность информации, как и ее недостаток, усложняет процесс обработки информационных потоков о состоянии и перспективах развития рынка продукции органического сельского хозяйства для подготовки, принятия и реализации соответствующих управленческих решений.

Оптимизационные расчёты (программное планирование, линейное планирование) требуют, что бы маржинальный доход был рассчитан точно в соответствии с экономической теорией. Методически, маржинальная прибыль является разницей между маржинальным доходом и маржинальными затратами.

По сути, когда вы определяете методически обоснованный предельный доход, оцениваются только коммерческие продукты (выручка от продаж).

Организация системы севооборота в хозяйствах неразрывно связана с определением рациональной структуры посевных площадей. Таким образом, необходимо обеспечить производство товаров в таком количестве, чтобы выполнить договорные обязательства по продаже продукции и обеспечить внутрихозяйственные нужды (посевной фонд, фонд естественной заработной платы, кормовой фонд, фонд общественного питания, страховой фонд, маркетинг, погашение кредитов другим хозяйствам и т. д.).

Ключевые слова: *органическое земледелие; принятия управленческих решений; учетно-аналитическое обеспечение; моделирование; маржинальный расчет; анализ входящих и исходящих данных.*

Statement of the problem. Every agrarian enterprise in making management decisions regarding the further development of the economic activity is faced with the problem of basic calculations, which can be used to make high-quality and long-term planning. We have developed a model that enables managers of an enterprise to obtain basic calculations for management decision making on the development of the economy. When planning (according to the situation) from a variety of methods appropriate combination is choosing. While planning the development of agricultural enterprises it is recommended to carry out static calculation for the entire enterprise on the basis of calculation of marginal income. Thus, a multilateral relationship between the separate business parts of the enterprise is considered; the most important economic relations are represented in a plan easily accessible for inspection (with relatively little cost in time). Both aspects are important while applying in practice.

A thorough analysis of the actual situation is always a prerequisite for the right decisions. If the result indicates the potential for improvement, in the future we are talking about the analysis of problems.

Analysis of recent research and publications. The topic of organic farming has raised many times during last decade within the Ukrainian researchers. Meanwhile, general overview of organic market is dominated within the papers dedicated to organic farming, for example the following authors: B.V. Dukhnytskyi[1], V.I. Artysh[2], O.T. Dudar, O.S. Kilnytska [3], A.O.Sokolova [4] and many other researchers. However, there are quite a few scientific papers examining the economic efficiency of organic farming at the level of an individual farm (O.V. Kruglyak [5]).

Formulation purposes of article (problem). The proposed model of the

analysis of the actual situation and future development of an enterprise is developed based on the platform Wolfram Mathematic. The input data for the model is a data flow charts growing crops and nutritional needs of animals. The objective of the model is to optimize the use of animal products and plant for the implementation of organic agriculture.

The main material. First, the influence of the Wolfram Mathematic was felt in physics, mathematics and engineering disciplines. But over the years, Wolfram Mathematic has been actively used in a much broader range of areas of knowledge beyond the technical. Wolfram Mathematic is used today in a variety of disciplines – physics, biology, social and agricultural Sciences. It has played a crucial role in many important discoveries and has become the basis for thousands of technical documents. In the commercial activities the Wolfram Mathematic plays an important role in the development of complex financial modeling and is currently widely used in many kinds of general planning and analysis of various spheres of activity. For many years, the common basic design of the system Wolfram Mathematic has steadily allowed it to expand the scope of its area of influence. Gradually, Wolfram Mathematic has gone from a program that is used primarily for mathematical and technical calculations to the tool, which is widely used in various other fields of computing disciplines, including agricultural areas [6].

The program that we have built takes as a basis the calculations of marginal gains across cultures.

The technique of marginal calculations is based on the principle of marginal costs. It definitely considers the yield (Output), and use of production resources (Input). Its main aim is the definition of on-farm competitive index for the production processes in making decisions in planning. Depending on the applied planning methodology, there are three methods of keeping marginal calculation: methodically valid marginal revenue, marginal calculation by practical method and standard marginal profit.

Optimization calculations (program planning, linear programming) require that the marginal revenue is calculated accurately in accordance with economic theory. Methodically actual margin income is the difference between marginal value and marginal expenses.

In relation to the individual production process the following questions arise:

a) that an amount of additional produce the process brings with the expansion of production by one unit;
b) that an expense arises from the expansion of production by one unit.

The marginal cost as a rule is easily measurable, because the volume of production increases in proportion to the expansion of production. Basically, when you define a methodically valid marginal income, only the commercial products (revenue from sales) are estimated.

Produce for domestic needs is considered in physical terms, and it is not assessed by the replacement value or value of the crop and is not added to the revenue from sales. This implies that the needs of other production processes are also to consider in physical terms. Revenue from the sale of certain process is derived ultimately from the cost of the main and side commodity products.

It is impossible to identify, which items of expenditure in the expansion of production refer to variable costs and which remain constant.

Of course, there are expenses that as a rule are always variables (e.g. seeds, plant protection products, variable costs of machinery, concentrated feed and repair of main livestock), however, a number of the costs may be, depending on the decision-making situation, constant or variable. It depends on the situation of planning (planning period, the availability of permanent resources, the level of production expansion), and of that in what way arise costs (depreciation, maintenance, costs of capital, rents) for further necessary agricultural land, houses, buildings, machinery, etc. Marginal costs of permanent and thus limited

resources are only counted in the optimization of the production area (opportunity cost) [7].

Marginal income is calculated in such a way:

$$\text{Marginal income} = Sales\ revenue / Variable\ costs\ (both\ proportionate\ and\ disproportionate) \quad (1)$$

Thus, marginal revenue is the contribution

- to cover the expenses of the resources considered in agriculture as permanent:

Land: The rent for the use of agricultural land.

Labor: Salaries of permanent / all employees.

Capital: Depreciation, maintenance, interest, rental of buildings, equipment, rights to supply.

- to form a profit and pay 'the unpaid' own production resources:

Equity: Accrual of interest on equity.

Labor: The rate of wages of unpaid (family) labor.

Management: Payment for business activities of head of the farm.

Thus, the marginal income shows which contribution certain manufacturing process brings in recoupment of permanent resources and thus is a real indicator to determine, in the calculation of optimization, relative economic advantages of production processes. Here, the best process is one in which the highest payback of limited resources is achieved.

As an indicator for inter-farm comparisons the marginal income can't be used because:

- every farm has its own provision of production resources;
- an expense that are considered cannot be established similarly.

Marginal revenue is an internal indicator of efficiency. The farm does not need to wait for the calculation of profit in order to compare between the two production processes. The difference in margin income from 1 hectare of different cash crops is identical to the difference in income, which will be calculated at the

end of the year. From the value of marginal income for various crops the same fixed and overhead costs will be deducted and distributed at the end of the year on the entire area proportionally [8].

Initial data for the developed model, based on applying the farm's own organic fertilizer, using several scenarios of norm of application.

The ratio of organic fertilizer is at the maximum scenario - 130 tons / ha, the minimum - 100 tons / ha.

The share of replacement of green manure by biomass in obtaining equal amount of organic matter in the soil is 40%.

Accordingly, if on the minimal scenario you need to apply 100 tons / ha of organic fertilizers, then green manure will occupy 40 t / ha and at the maximum scenario (130 t / ha) - 52 t / ha. Accordingly at the maximum scenario the humus needed to apply is 78 tons / ha, and at the minimum - 60 t / ha.

Application of organic fertilizers is expected once every three years for certain cash crops.

Description of the proposed by the enterprise crop rotation:

1. Sunflower for seeds
2. Steam or green manure (Viko + buckwheat, once every three years)
3. Winter wheat
4. Corn for silage
5. Barley + perennial grasses
6. Perennial grasses
7. Perennial grasses
8. Perennial grasses
9. Winter wheat

Where the sales price is not specified, it is assumed that this production is for on-farm use.

The main feed is required for ruminants and is provided by the processes of forage production. Its assessment is in many cases possible, for example, by the

relative purchase price. The definition of replacement cost is possible only in a very limited way, because its replacement does not always have the same effect for ruminants (the feeds structure, etc.).

In practice, most often, the main feeds are produced for own use. Even where sale and purchase are possible, they exist in very small quantities. If within the economic planning it is necessary to decide how the total demand for main feed can be covered with at the cheapest (in terms of expenses, working time, of capital availability), a crucial role is played by the cost of feed production. Therefore, the evaluation of products supplied is excessive.

Composing of the animal feed balance sheets is based on nutrient content. This means that not the demand for hay, haulage is balanced, but the energy, protein and other nutrients. Often it is enough to stop on limited nutrients.

Negative income that we receive on the feed production shows, which total costs for using the feeds are additionally transferred on each hectare of forage production (in addition to the general expenses for the livestock) [9].

Table 1

The element of the model "Initial data"

Indicators			Sunflower	Steam	Wheat	Silage	Barley	Grass	Grass	Grass	Wheat
Yield	100 tons/ha	c/ha	25	0	45	150	40	200	200	200	45
	130 tons/ha	c/ha	30	0	50	225	45	350	350	350	50
Price		UAH/ t	19000	0	8600	2500	7000	2000	2000	2000	8600
Seeds	norm.	kg/ha	20	0	250	50	200	160	15	15	250
	price	UAH/ kg	120	0	9.2	24	6	7.5	7.5	7.5	9.2
Fertilizers		t/ha	100	0	0	100	0	0	0	0	0
	price	UAH	100	0	0	100	0	0	0	0	0
Charges		UAH	3600	0	3600	3000	3300	1500	1500	1500	3600
Oil and gas	disking	l/ha	40	0	40	40	40	40	40	40	40
	occupied	l/ha	20	0	20	20	20	20	20	20	20
	harvesting	l/ha	20	0	20	20	20	20	20	20	20
	price	UA/l	18	0	18	18	18	18	18	18	18

Source: developed by the author

The first element of the model shown on Fig. 1 contains all the original information on the productivity of crops of the proposed crop rotation, depending on the amount of fertilizers, prices for commodity products, variable production costs of each crop: the price of commodity products, the number and value of seeds, the number and value (substitutional value) of fertilizers, variable costs of mechanization (which includes repair costs) and the cost of fuel.

The element of the model "Annual balance" shown in Table 2 allows us to construct a visual map of the fields of the enterprise, taking into account the crop rotation for 10 years. The calculation itself is based on the method of accounting margin calculation for crops.

Table 2

The element of the model "Annual balance", initial model

Crops	**Area(ha)**	**Crop capacity (centner/ha)**	**Harvest (ton)**	**Cost (th. UAH)**
Sunflower	529.255	25	13231.4	251396
Fallow	320.285	0	0	0
Wheat 1	404.725	45	18212.6	156629
Silage	432.085	150	64812.7	162032
Barley	401.475	40	16059	112413
Grasses 1	422.525	200	84505	169010
Grasses 2	396.995	200	79399	158798
Grasses 3	617.295	200	123459	246918
Wheat 2	336.74	45	15153.3	130318
Total	3861.38		414832	$1.38751*10^5$

Source: developed by the author

An important part of the model is the introduced by us pictogram "Fertilizer". It allows us to change the scenario of applying fertilizers from minimum to maximum, which affects the rate of productivity, yields and ultimately profitable indicators of activity of the company.

Also, the model allows you to adjust in the calculations, changing crop rotation by years. The model shows crop rotations for 10 years.

We have chosen the index "Marginal Income" which is defined in the model as "Total balance", which allows the entrepreneur to take management decision

on the use of certain crops in the rotation, and the extension of certain areas up to the most profitable crops at any time (Figure1).

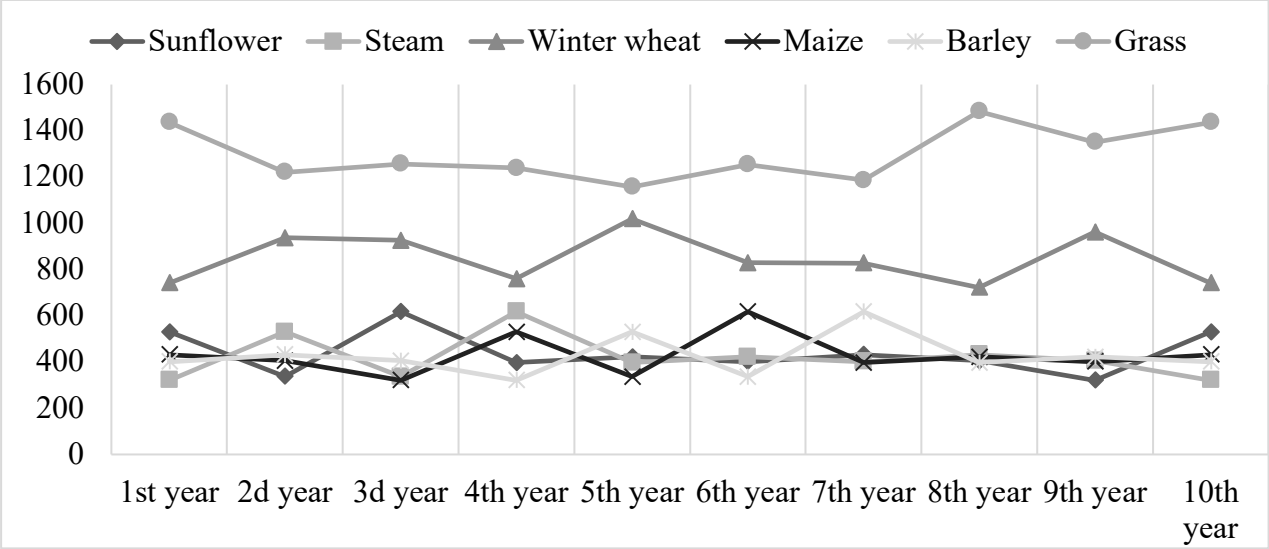

Fig. 1. The element of the model "Area by crops"

Source: developed by the author

The element of the model Area by crop" shown on Figure 1, gives us the opportunity to see the planned area under a particular crop for the past ten years. This visibility allows you to optimize space by years and crops.

Organization of the system of crop rotation in the farms is inextricably linked to the definition of a rational structure of sown areas. Thus, it is necessary to ensure the production of goods in such quantity to fulfill contractual obligations for the sale of products and to provide on-farm needs (seed fund, natural wages fund, forage fund, catering fund, insurance fund, the marketing, repayment of loans to other farms etc.).

The main measure to stop and prevent the development of negative processes and the crisis in agriculture is scientifically justified placing of crops in crop rotation. With their use the land and fertilizers are used more productively, the potential of plant varieties is implemented better, weed infestation is reduced, the impact of pests and diseases on crops is reduced with the minimal use of chemicals [10].

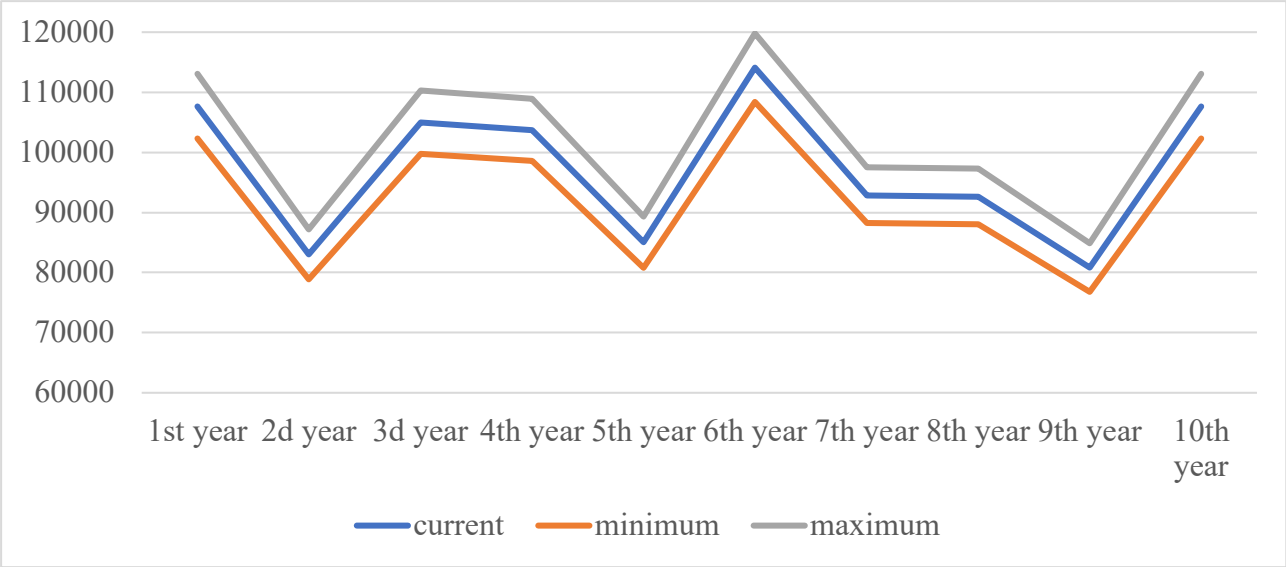

Fig. 2. The element of the model «Needed fertilizers»

Source: developed by the author

The element of the model «Needed fertilizers», shown in Figure 2, allows you to make changes in the rates of application of fertilizers according to the chosen scenario.

While applying fertilizers they differentiate the need of plants in fertilizers and economic-valid application of fertilizers. When calculating according to plant needs in fertilizers they rely on takeaway and needs of plants of active substances in view of their reserves in the ground (residual effect of application of fertilizers under the crop-predecessor is also considered). In calculating the economic-valid applying of need for fertilizers they determine the amount of active ingredients required to compensate the damage caused to the balance of active substances in the soil when growing certain crops. In business and economic calculations it is always advantageous to reflect separately the removal of active ingredients by the by-products (straw) so that in the calculation practice it could be possible to cover different processes (plowing or harvesting straw). Removal of the active ingredients through parts of plants that remain in the field to facilitate is not considered and thus is equivalent to their return.

Properties and composition of local fertilizers of animal origin, i.e. manure, pus and liquid manure, adds to the complexity of their application through losses of nutrients. So, to apply this type of fertilizers there are certain rules:

- liquid manure. Pus, bird droppings cannot be applied into the arable land from November 15 to January 15, and into the pastures from December 5 to February 5;
- the direct plowing-in of the liquid manure, pus, poultry litter on rough fields helps to avoid losses of nitrogen. After harvesting of the main crop these fertilizers can be applied only under the field grasses, additional sowings, winter crops and only in an amount which shall not exceed 40 kg NH4/ha or 80 kg of total nitrogen per hectare.

In our model the pictogram "fertilizer" allows to regulate the rate of application.

- close to the soil surface application of fertilizers into the moisture. Cool and windless weather helps to avoid weathering ammonia;
- areas with a high content of phosphate and potassium allow the application of local fertilizers of animal origin in the amount equal to the takeaway of nutrients by plants;
- on average on the farm the figure should not exceed 210 kg N / ha / year for grassland and 170 kg N / ha / year for arable land. Liquid manure during storage loses 10%, manure - 25% of the amount of nitrogen which was contained in organic matter. While applying up to 20% of the calculated total content of nitrogen is lost [11].

Example of calculation

Liquid manure obtained from 100 dairy cows (annual yield - 6000 kg milk) with youngsters:

100 x 166 kg of nitrogen = 16600 kg of nitrogen

- 10% losses during storing = 1660 kg of nitrogen
- 20% losses during application = 3320 kg of nitrogen

Amount of nitrogen after application = 11620 kg

For application of such amount we need the area, at list, 11620 kg: 170 kg/ha = 68.4 ha of arable land.

Due to the purposeful selection and breeding work the Poltava Region ranks 3rd among the regions of Ukraine by milk productivity of cows. Milk yield per cow (by the average number of cows) is 6154 kg (5426 kg in Ukraine). So, our farm should have about 5,650 dairy cows with a plume to provide 3,861 hectares with own organic fertilizers.

In the table 1 groups of animals and their maximum population per 1 hectare in the pasture farms are presented.

Table 3

The maximum possible location of animals in calculation per 1 hectare of pastures

Groups of animals	**Type of organic fertilizer**		
	Liquid manure	**Manure + liquid manure**	**Manure of deep bedding**
Dairy cows without calves (6000 kg milk)	2,5	2,8	3
Dairy cows with calves (6000 kg milk)	1,8	1,9	2,1
Cow separated from its calf	3,6	3,9	4,3
Calves up to 3 months	20,8	22,7	22,0
Heifer	6,2	6,8	7,4
Horses, 500 - 600 kg of live weight	6,0	6,5	7,1
Sheep + litter	11,3	14,5	15,9

Source: [6]

According to the above-mentioned examples of calculations and tables, the can do recalculation of the maximum and minimum possible population of various groups of animals for retention.

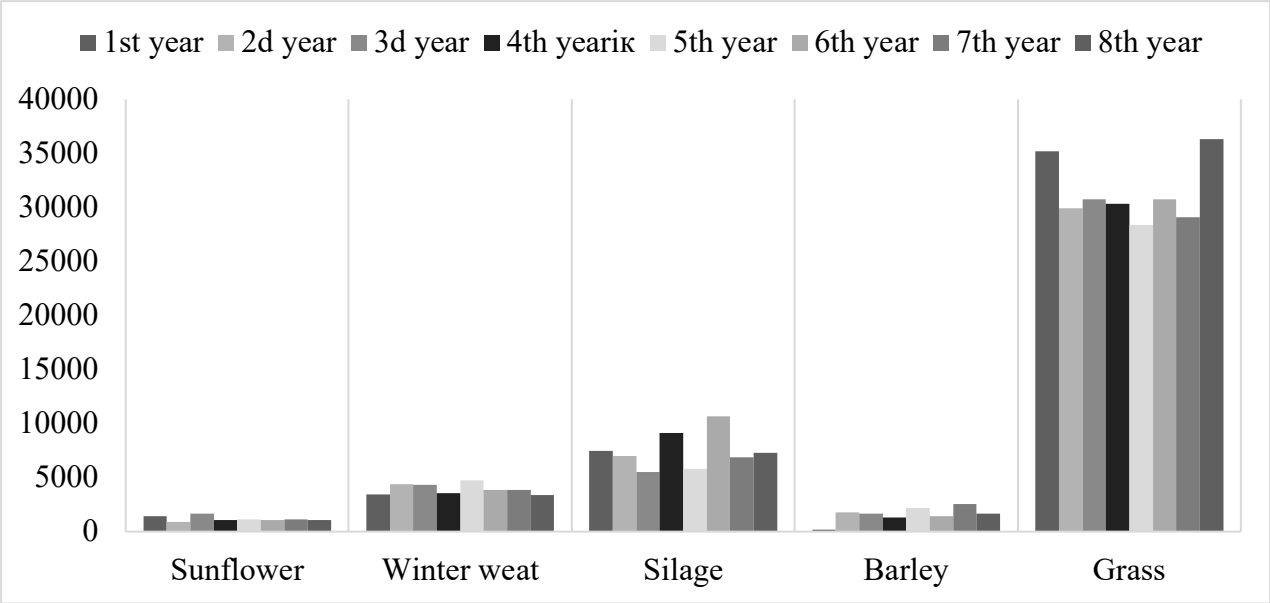

Fig. 3. The element of the model «Yield»

Source: developed by the author

The element of the model «Yield», displayed in Figure 3 represents the planned total yield for each crop in years. As in previous sheets, using the pictogram "Fertilizer" we have the opportunity to choose any scenario for fertilization from the minimum to the maximum and thus to obtain the gross yield - the minimum possible, optimum and maximum – for this or that crop of crop rotation. Also, this sheet allows you to quickly calculate the yield for each of the grown crops.

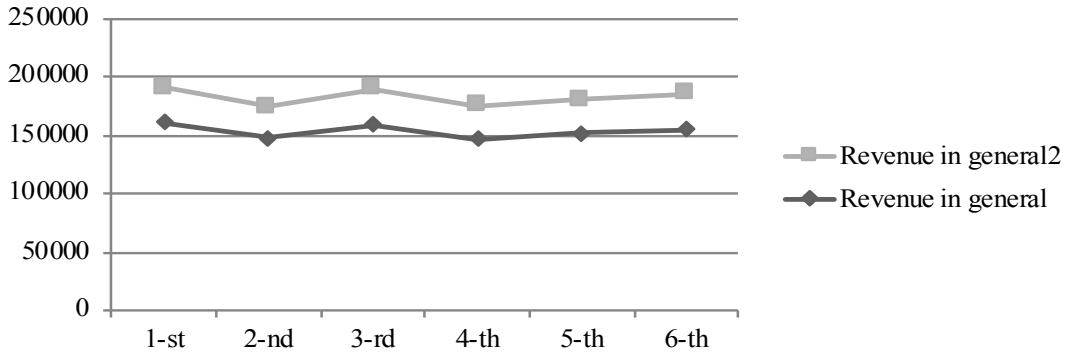

Fig. 4. The element of the model «Revenue and expenses»

Source: developed by the author

The element of the model "Revenue and expenses" shown in Figure 4, enables on the basis of rates of return and expenses carefully review them and evaluate from the point of view of the suitability of possible alternative ways of development of the enterprise. At the same time, the integrity and objectivity of facts, the responsibility during consequence analysis, creativity and a certain persistence in the implementation of decisions are important requirements.

Insights from this study and perspectives for further research in this direction. To ensure the efficient management of the market of products of organic farming we need information and its detailing, which helps the formation of decisions adequate to the situation and management tasks. As evidenced by the analysis, the over-saturation of information, as well as its lack, complicates the processing of information flows about the state and prospects of development of the market of products of organic agriculture for the preparation, adoption and implementation of appropriate management decisions. Therefore, our proposed model is easy to use and easy to understand for practitioners involved in organic farming.

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