

UDC 631 / 631.8 / 631.521.54

© 2015

Yu. Halep,
candidate of economic sciences

V. Volkogon,

Corresponding Member of NAAS, Doctor of Agricultural Sciences A. Moskalenko, candidate of economic sciences

Institute of Agricultural Microbiology and Agro-Industrial Production of NAAS

Forecasting fertilizing potential in models of organic production

Goal. To develop a method for forecasting the fertilizer potential in crop rotations of organic agriculture. **Methods.** Balance, calculation-constructive, abstract-logical. **Results** The algorithm for forecasting the size of fertilizer potential and the results of its approbation on the example of developed models of organic crop rotation is presented. **Conclusions** The method allows to predict levels of fertilizer potential in crop rotation of organic production. In compliance with the conditions for the construction of crop rotation with the ecological criteria, with time, a relatively closed ecologically stable agocenosis with corresponding fertilizing potential is formed, which makes it possible to achieve a fully acceptable level of productivity.

Key words: organic production, forecasting, fertilizing potential, nutrition elements, crop rotation.

One of the deterrent factors for the widespread introduction of organic production in Ukraine is the low productivity of organic crop rotation due to insufficient fertilizer levels, especially given the small number of animals and, as a result, a small amount of organic fertilizer such as manure. Therefore, it is relevant to carry out research and develop methods for forecasting the development potential of organic crop rotation.

Analysis of recent research and publications. Domestic researchers pay considerable attention to the productivity of organic production [6, 10]. However, the authors preferentially rely on the results of experiments conducted under certain specific schemes, which limits the possibility of combining different options and forecasting their endpoints. The aspect of the production process of agricultural crops under traditional agricultural practices has been extensively investigated and processed in the methodological and normative plans [2, 11]. They are mainly aimed at determining the amount of mineral fertilizers that must be made to achieve the planned level of yield or its optimal level [13]. At the same time, in organic farming yields are primarily limited by the limited possibilities of organic fertilization, therefore, it is necessary to forecast its potential potential. At the same time, considering the prolongability of the action and after-action of organic fertilizers in time, it is necessary to develop dynamic models in crop rotation.

The purpose of the research is the development of methods for forecasting the fertilizer potential (on the supply of agricultural crops with the compounds of the main elements of nutrition) in crop rotations of organic agriculture and its testing on the example of the developed models.

Research methodology. In the methodological plan, in the model calculations used, the adaptation of existing techniques to the conditions of organic production and their combination with the results of studies on the effectiveness of biological factors for increasing the productivity of agro-crops were used. The given method of forecasting the fertilizer potential is based on the determination of its possible size, taking into account the availability and receipt in an accessible form of the connections of the main power elements (NPK). In addition, it is foreseen to calculate the balance (on the indicators of losses and extraction) of nutrients for monitoring the state of the soil reserves and to determine the potential for the formation of the fertilizing potential of the next crop. We used a dynamic model (in crop rotation over the years of development and rotation), which includes an annual correction of the size of the fertilizer potential on the NPK balance sheet.

Appropriate methodological, reference and normative information was used for calculations [2, 9, 13]. For the basis of prediction of incomes and losses (expenditures) of nutrients a method [9] with specification of separate general norms is taken into account, taking into account the results of relevant researches. In

particular, the volume of the flow of symbiotic nitrogen is taken from data [5], the incoming part is supplemented by the addition of nitrogen from the associative (non-symmetric) nitrogen fixation according to [1], etc. In addition, for the total number of by-products, it is foreseen to determine the volumes of removal and repopulation of nutrients, which is important for forecasting the fertilizing potential of crop rotation crops at the state level, as opposed to calculating the NPK balance at the regional level [9], which takes into account the by-products of only 5 crops that are distinguished for the needs of livestock.

As a compulsory component of organic farming technologies, we are foreseeing the use of biological preparations for pre-sowing bacteria of sowing material of all major and intermediate crops. The impact of this measure on the size of the fertilizer potential is based on the averaged multi-year data from the ISMAV NANN research [6]. It is also foreseen to grow siderates after all major crops (with the exception of shellfish and winter predecessors), and not only after the early cereals, as is now the case. According to the author, this is quite possible for the climatic conditions of Polissya, but requires additional administrative, technical and financial efforts from business entities regarding the timely and qualitative conducting of relevant technological operations and is worth the given results.

Research results. In general, the algorithm for forecasting the size of the abdominal potential is one of the models of organic fertilizer Polissya (1 - a clover for seeds, 2 - rye winter, lupine sederal, 3 - millet, sederal radish, 4 - potatoes, rye sederal; 5 - wheat with a clover under a clover) is given in the table. 1.

It should be noted that the individual components of the investigated fertilizer potential are calculated according to the methods available or developed by us. Thus, the presence of nutrients in the soil is taken by averaged data and taken into account as the starting size in the first year of development of crop rotation. In subsequent years, the nitrogen content (due to its dynamism and instability) was predicted in soil as a result of humus mineralization under a certain culture (calculated for [3]). The content of phosphorus and potassium, taking into account the low parameters, is considered to be stable, ie it is completely renewed each year, and its insignificant deficit in some models of crop rotation due to the cultivation of crops is quite permissible to maintain the ecological balance of agrocenosis [8]. Acceptance of nitrogen from the symbiotic nitrogen fixation for legume crops was not taken into account in the sources of income, but by the reduction of withdrawal with the yield, which is the result of a certain self-sufficiency in the standards [4].

Since the crop yields of the main agricultural crops are calculated on the basis of a critical factor in the presence of certain nutrition elements in the fertilizer systems and methods, then the other two are left in surplus. In this case, the excess (residue from the predecessor) is included in the fertilization potential of the next culture only in the absence of a time gap between it and the precursor (clover, winter). In all other cases, this residue is lost (flushing, etc.) or consumed by an intermediate culture.

The coefficients of the absorption of nutrients from the soil by agricultural crops are based on data [2], from atmospheric precipitation - at the level of mineral fertilizers and classified according to data [1], from seeds - to the level of averaged manure data, availability of nitrogen from According to [1], after years of exposure to manure (4 years), lateral products (4 years), siderates (3 years) and legumes of legume nitrogen (3 years), according to our previous studies [12], according to data [1]. The availability of batteries from the remainder of the predecessor is averaged over other sources.

As regards the structure of the fertilizing potential of this crop rotation (Table 1), it should be noted that, based on the existing content of the elements, it is formed predominantly at the expense of natural soil reserves, in the 2nd place - by-product, on the 3rd - with a slight delay on nitrogen and phosphorus and on potassium essential - siderates. Regarding the structure of available content, taking into account the factors of assimilation, the proportion of natural soil reserves decreases, with leading role being played by phosphorus and potassium. At the same time, the share of by-products and siderates increases by the majority of indicators, and siderates outnumber side products by the amount of available nitrogen and phosphorus. The notable role (4th place by all indicators) in the formation of available fertilizer potential is played by biological preparations, the use of which in crop growing technologies contributes to the increase of the degree of assimilation of power supplies from all sources.

Data in tab. 1 is given on the example of the 5th year and the rotation of the crop rotation, when the size of the fertilizer potential has already stabilized. In this case, it is advisable to consider the dynamics of the size of the fertilizer potential (Table 2). Here the numerical data is given by the productive content, that is, that part of the nutrition elements that can be assimilated by the plant and mathematically calculated as the

difference between the available content and losses from rinsing and immobilization of nitrogen by by-products of the precursor.

For several years, the fertilization potential of the crop rotation with fluctuations in quantitative parameters is underway.

The sizes of the fertilizing potential (after stabilization) in relation to the 3 studied forms (available, available and productive) on the example of Model No. 1 and other developed models of crop rotation are given in Table. 3. Model No. 2: 1 - clover for seeds; 2 - winter wheat, radish radish; 3 - soybean, rye, winter; 4 - buckwheat, radical radel; 5 - barley with sowing clover. Model number 3: 1 - seed of spinach; 2 - winter rye, radel radish; 3 - corn for grain, rye for winter cedar; 4 - peas; 5 - winter wheat, sideral radish; 6 - oats with sowings of the clover. Models are considered crop rotation of crop husbandry enterprises in order to eliminate the regulatory impact of animal husbandry. All models are designed according to the ecological criterion - providing a positive balance of humus.

In the studied models of organic fertilizers, in the presence of certain differences, there are certain regularities regarding the quantitative parameters of their fertilizing potential (Table 3).

Consequently, in the conditions of organic production and construction of crop rotation, according to environmental criteria, the formation of a relatively closed ecologically stable agrocoenosis with a corresponding fertilizing potential is achievable over time, which makes it possible to achieve a fully acceptable level of productivity. This becomes possible due to the activation of natural processes, which, according to [14], take place in all agroecosystems, but the degree of their manifestation depends on anthropogenic loading.

Conclusions

The given method allows theoretically to predict the levels of fertilizer potential of agricultural crops in organic crop rotations. The results of approbation of the methodology on the example of the developed models of crop rotation for the Polissya conditions indicate that in conditions of organic production and construction of crop rotation, according to ecological criteria, occasionally a relatively environmentally stable agrocoenose can be formed with an appropriate fertilizing potential, which makes it possible to achieve completely an acceptable level of performance.

Bibliography

1. *Біологічний азот*/В.П. Патики, С.Я. Коць, В.В. Волкогон та ін.; за ред. В.П. Патики. — К.: Світ, 2003. — 424 с.
2. *Довідник по удобренню сільськогосподарських культур*; за ред. П.О. Дмитренка, М.К. Крупського, І.Г. Демиденка. — 3-е вид., перероб. і доп. — К.: Урожай, 1975. — 344 с.
3. *Забезпечення бездефіцитного балансу гумусу в ґрунті*/О.О. Бацула, Є.А. Головачов, Р.Г. Дерев'янка та ін.; за ред. О.О. Бацули. — К.: Урожай, 1987. — 128 с.
4. *Завалин А.А.* Роль бобового предшественника в питании зерновых культур и повышении плодородия Предкавказского выщелоченного чернозема/А.А. Завалин, М.В. Кашукоев//Агрохимия. — 1998. — № 12. — С. 20 – 23.
5. *Кожемяков А.П.* Продуктивность азотфиксации в агроценозах/А.П. Кожемяков//Мікробіолог. журн. — 1997. — 59, № 4. — С. 22 – 26.
6. *Методологія і практика використання мікробних препаратів у технологіях вирощування сільськогосподарських культур*/В.В. Волкогон, А.С. Заришняк, І.В. Гриник та ін. — К.: Аграр. наука, 2011. — 156 с.
7. *Модель системи екологічного землеробства в Лісостепу України (Методичні рекомендації для впровадження у виробництво)*. — К.: Аграр. освіта, 2008. — 37 с.
8. *Прянишников Д.Н.* Избранные сочинения/Д.Н. Прянишников. — М.: Изд-во с.-х. лит-ры, 1963. — Т. 1. Агрохимия. — 692 с.
9. *Розрахунок балансу гумусу і поживних речовин у землеробстві України на різних рівнях управління*/С.А. Балюк, В.О. Греков, М.В. Лісовий, А.В. Комариста. — Х.: КП «Міська друкарня», 2011. — 30 с.

10. *Танчик С.П.* Розвиток органічного землеробства в Україні/С.П. Танчик, О.А. Цюк, С.О. В'ялий//Вісн. аграр. науки. — 2009. — № 1. — С. 11 – 15.
11. *Шувар І.А.* Наукові основи інтенсивно-екологічного землеробства/І.А. Шувар. — Львів: Каменяр, 1998. — 224 с.
12. *Халеп Ю.М.* Коефіцієнти використання та собівартість удобрювального потенціалу органічних добрив на дерново-підзолистих ґрунтах Полісся/Ю.М. Халеп, Н.І. Горбаченко//Аграр. вісн. Півдня. Сільськогосподарські науки. — Одеса: Ін-т с.-г. Причорномор'я НААН, 2014. — Вип. 1. — С. 50 – 55.
13. *Sims J.T.* Soil fertility evaluation/J.T. Sims//Handbook of soil science; ed. M.E. Summer. — CRC PRESS, 2000. — P. 113 – 153.
14. *Stinner B.R.* The role of ecology in low input, sustainable agriculture/B.R. Stinner, G.J. House//American Journal of Alternative Agriculture. — 1988. — № 2. — P. 145 – 147.