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APPLICATION EXPERIENCE OF AGRICULTURAL LANDS PRODUCTIVITY IMPROVEMENT METHODS

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K e y w o r d s: agricultural lands, bioactive substances, soil chemical characteristics, cropping capacity, soil-protective technologies.

A b s t r a c t

In a present article the results of land fund investigation of Vasylivka Rural Counsil in Onufriivka region of Kirovohrada oblast in Ukraine and agricultural lands productivity monitoring of land use entity Limited Liability Company "Maryivske" are given. It was established that lands are low-yielding (2.5 Mg ha^{-1} of crops and leguminous plants) and ploughed up to 71%. The implementation of measures of agricultural chemicals rational use showed that their productivity reached 100%. It is reasonable to calculate the rates of local fertilizer distribution, taking into account soil chemical characteristics, provided by plants protection products adding and bioactive substances.

BADANIE ZASTOSOWANIA METOD ZWIĘKSZENIA PRODUKCJI ROLNEJ ZIEMI

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S ł o w a k l u c z o w e: grunty rolne, substancje biologicznie czynne, właściwości chemiczne gruntu, plony, technologia ochrony gruntu.

A b s t r a k t

W artykule przedstawiono wyniki badań zasobów ziemi obszaru Vasylivka w powiecie Onufriskim (województwo kirovohradskie) na Ukrainie i wydajność monitorowanych gruntów rolnych użytkownika Ltd. „Maryivske". Ustalono, że grunty orne stanowią 71% i są niskowydajne (2,5 Mg ha^{-1} upraw zbożowych i roślin strączkowych) Wykazano, że po uwzględnieniu racjonalnego wykorzystania nawozów nastąpił 2-krotny wzrost plonów. Uzasadniona jest więc taka dystrybucja i rozdysponowanie nawozów, która uwzględni właściwości chemiczne gleby, odpowiednie środki ochrony roślin i substancje biologicznie czynne.

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Introduction

In the modern period of state evolution the most important is the guard of land reserves. The problems of large-scale ploughing and low-yield of agricultural lands demand a great attention. It is of great importance to work-out the economic instruments that have to guarantee reliable and effective land maintenance. The soil actual price, effective system of operational monitoring and state ecological policy are required. To work out precise and clear methods of assessment of damages from soil erosion in monetary terms is very essential. In conditions of law-based state, the land-user has to provide obvious evidences of adequate assessment of damages caused by his activities or, on the contrary, he has to be sure that improving the soil condition one will offset the expenditures on soil-protective technologies. The state has to conduct scientifically-based policy orientated on soil guard and regeneration for land-users (SHYKULA 2006).

Materials and Methods

The soil of Vasylivka village soviet Rural Council in Onufriivskyi region of Kirovohrada oblast is the main research object. From 2005 till 2009 the researches of the land stock of the country and monitoring of the soil productivity of the limited liability company "Maryivske" using a complex approach to fertilizers applying have been held. The standards of mineral fertilizers regarding the level of nutrients have been established, taking the planned harvest scope into account. In order to establish more exact standards, the indices of the actual content of feed elements, agrochemical cartograms, ecological and agrochemical certificate and formulae were used (DEMYDENKO 2006, ZHUCHENKO 2006):

– winter wheat and maize, grain:
– nitrogen = $(4.0 - 0.16 \cdot N) \cdot Y - Ncor$; (1)
– phosphorus = $(3.2 - 0.213 \cdot P) \cdot Y$; (2)
– potassium = $(3.1 - 0.155 \cdot K) \cdot Y$. (3)

Sunflower: nitrogen = $(5.8 - 0.193 \cdot N) \cdot Y - Ncor$;
phosphorus = $(6.6 - 0.44 \cdot P) \cdot Y$;
potassium = $(5.6 - 0.233 \cdot K) \cdot Y$,

where:
N – the nitrogen content, mg/100 gr,
P – the phosphorus content in the soil,
K – the potassium content in the soil,
Y – the crops height,
Ncor – the forerunner correction.

Results and Discussion

The total area of Vasylivka Rural Council soviet is 6168.00 ha, including agricultural lands, among them: 4360.88 ha of arable lands (70.7%), 880.87 ha of pastures (14.28%), 59.7 ha of hayfields (0.97%), 62.0 ha of gardens (1.0%), 84.76 ha (1.37%) of built-up lands, 627.2 ha of forests and forest-plantations (10.16%), 26.7 ha of underwater territories (0.43%) and other lands – 65.89 ha (1.06%) – Figure 1.

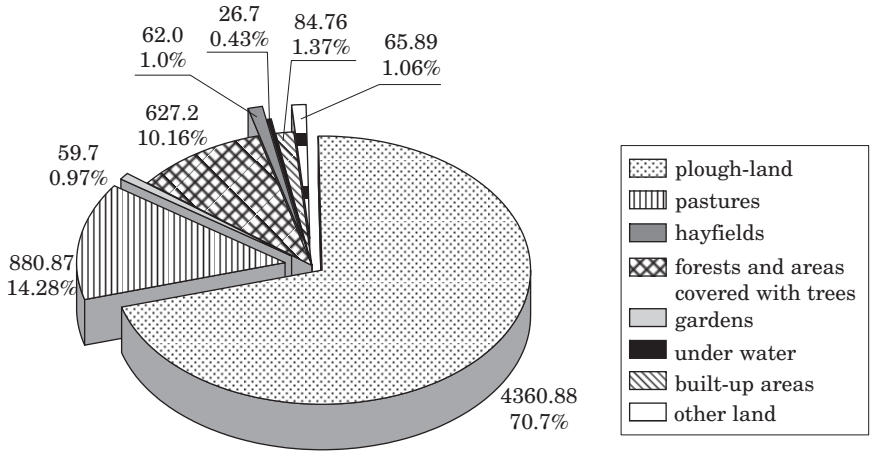

Fig. 1. Structure of agricultural lands on the having a special purpose setting

During denationalization and privatization of agricultural lands 2244.76 ha of lands (36%) have been attached to the State property and 3923.24 ha (64%) of lands – to the private property (Figure 2). Some lands have been transferred to the temporary use, including 2663.12 ha (43.2%) on lease terms, 429.93 ha (7%) on long-use terms, 2233.19 ha (36.2%) on short-use terms.

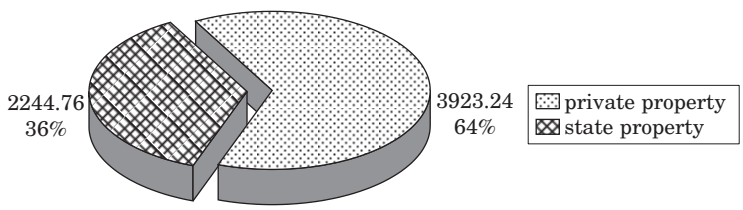

Fig. 2. Distributing of the landed fund is on the patterns of ownership

The land area within a settlement makes up 481 ha. Agricultural enterprises take up 6.07 ha (1%), personal peasant households take up 254.70 ha (53%), civil lands comprise 4.40 ha (1%), commercial lands take up 0.40 ha, lands of technical infrastructure – 0.21 ha, motor transport lands comprise 7.00 ha (2%), lands for general use take up 208.22 ha (43%). Agricultural (arable) lands are used on tenant rights and also by the citizens who own land shares (Figure 3).

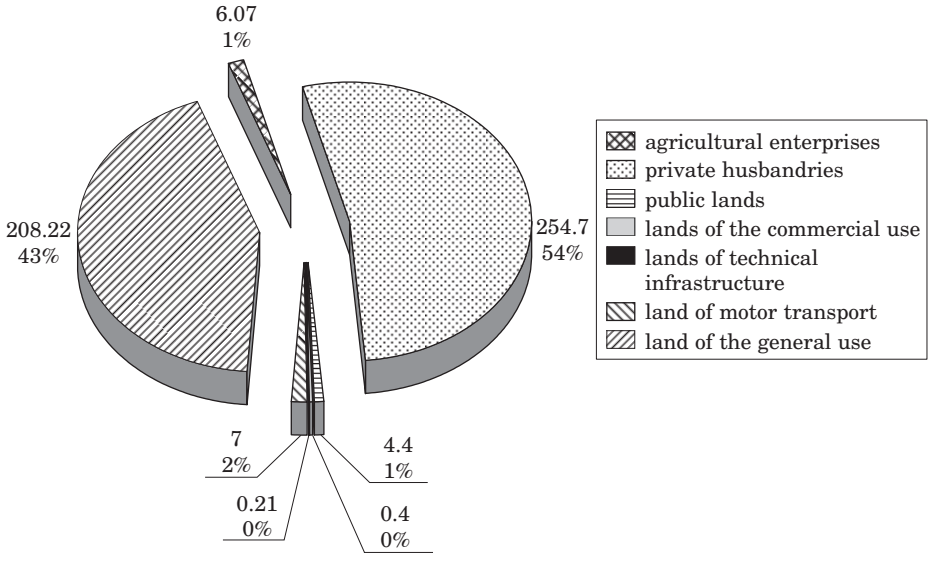

Fig. 3. The functional use of earths is within the limits of vill

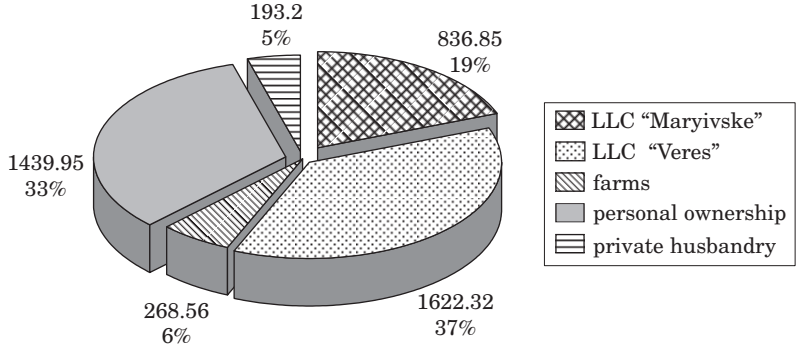

Fig. 4. Structure of the use of plough-land by Lands-users

The main land-users on the territory Vasylkivka Rural Council are the following juridical entities: Limited Liability Company "Maryivske", which possesses the plot of land (arable land) with the total area 836.85 ha (19%),

Limited Liability Company "Veres" with the total area of 1622.32 ha (37%). The usage of individuals: farms – 268.56 ha (6%); private usage of land plots (Shares) which were transferred into ownership – 1439.95 ha (33%), and the lands for private husbandry – 193.2 (5%) ha (Figure 4).

The main reasons, which determine the modern conditions of erosional danger of the solid are: the high rate of the cultivated agricultural holdings, the total area of the cultivated lands on the territory oh the Vasylkivka Rural Council reaches more than 71% (Figure 5), the rapid formation of new types of the land-tenures, the absence of the state, regional and local solid-protection programs and the law level of financial implementation of politics directed to the protection of solid from erosion (KANASH 2005).

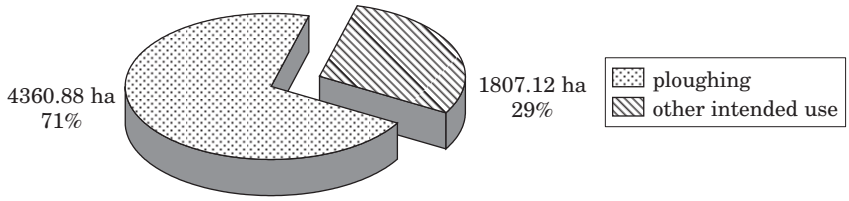

Fig. 5. Thrown of agricultural lands open

Most of the land-users do not abide the solid-protection technologies of the crop growing. The drawback in the providing of such technologies is the absence of the direct financial concernment of the land-users in the maintenance of the solid both with the absence of the system of the antierosion equipment for the work at inclination more than 3°. The land users are not responsible for the damage they inflict to the soil. Their work is estimated by the profitability rate of the manufactured products (KIRSANOV 2007, MEDVEDIEV 2007).

During the years 2005–2009 on the territory of Limited Liability Company "Maryivske" the system the efficient usage of the agricultural holdings was provided: the calculation of the norm of fertilizers in each case, their local adding with bioactive substance and for plants protection products.

In order to get 2.6 Mg ha^{-1} (Figure 6) of the winter wheat grain and 1.5 Mg ha^{-1} sunflower, the norm of fertilizers under the actual provision of the fields with nitrogen – 9.4, phosphorous – 6.0 and potassium – 9.3 mg per 100 g of the soil (Figure 7) is: by nitrogen – 95 kg ha^{-1}, by phosphorus – 50 kg ha^{-1}, by potassium – 45 kg ha^{-1} (winter wheat); by nitrogen – 75 kg ha^{-1}, by phosphorus – 50 kg ha^{-1}, by potassium – 50 kg ha^{-1} (sunflower).

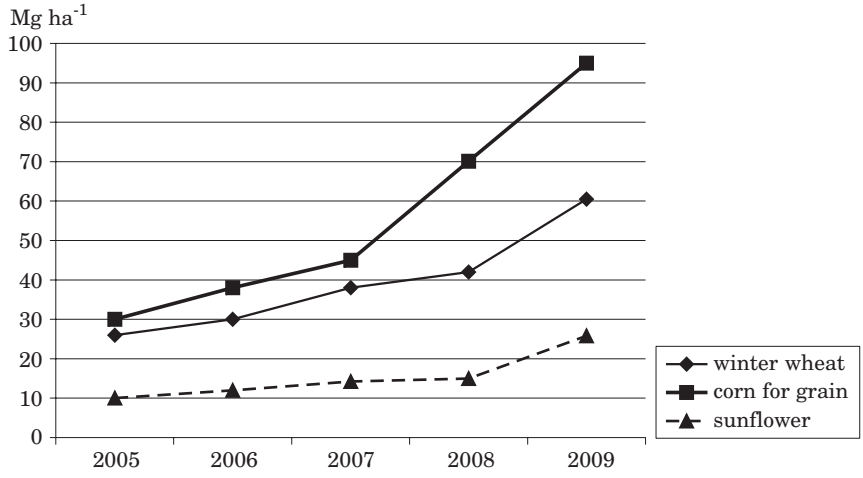

Fig. 6. Productivity of agricultural cultures [Mg ha^{-1}]

The formula (1–3) evaluation resulted in the more accurate norm of the fertilizers, 2005 year:
at nitrogen = $(4.0 - 0.16 \cdot 9.4) \cdot 26 - 12 = 52.89$ kg ha^{-1}, (Figure 8);
at phosphorus = $(3.2 - 0.213 \cdot 6.0) \cdot 26 = 49.97$ kg ha^{-1};
at potassium = $(3.1 - 0.155 \cdot 9.3) \cdot 26 = 43.12$ kg ha^{-1}.

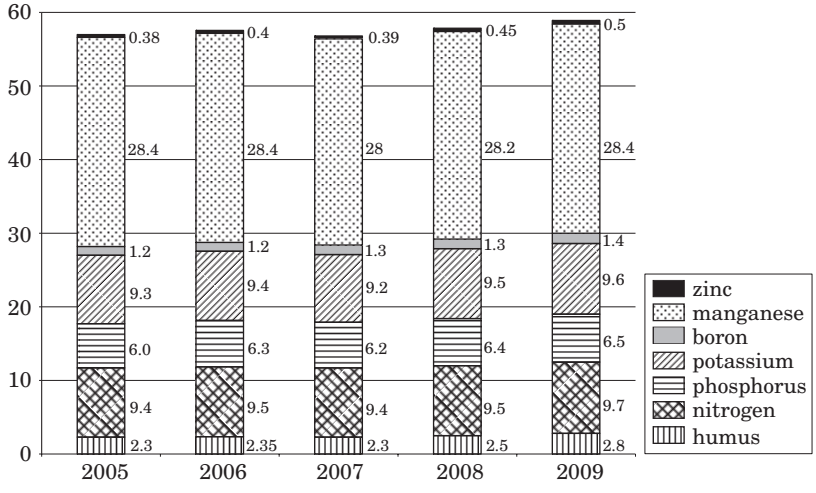

Fig. 7. Feeding elements content the soil layer per

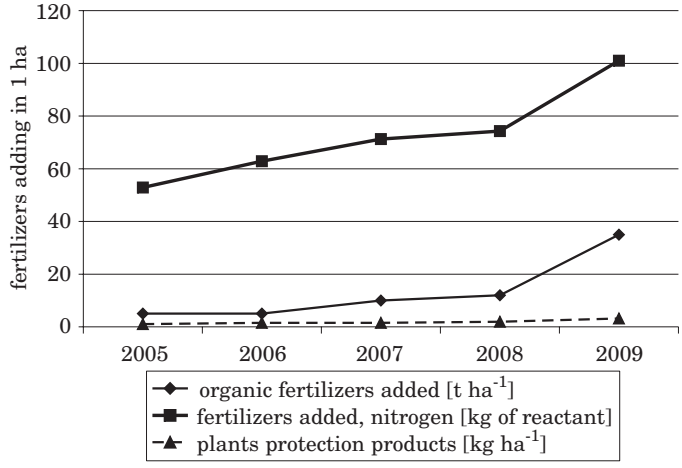

Fig. 8. Agricultural lands fertilizers adding

For sunflower (2.1–2.3), 2008 year:
– at nitrogen = $(5.8 - 0.193 \cdot 9.4) \cdot 15 - 3 = 56.79$ kg ha^{-1};
– at phosphorus = $(6.6 - 0.44 \cdot 6.0) \cdot 15 = 59.4$ kg ha^{-1};
– at potassium = $(5.6 - 0.233 \cdot 9.3) \cdot 15 = 51.4$ kg ha^{-1}.

The findings showed that such an approach of adding the fertilizers has a perspective of soil quality improvement and productivity increasing more than 100%.

The above mentioned norms are calculated for the spreaded adding, which by the local appliance can be decreased by 30–40%. During the period of the plants vegetation the mineral fertilizers were used according to the plants diagnostics. Such approach permits to apply fertilizers only when the plants need, to decrease their consumption to 10–15%, to secure the stability of the environment and to obtain output without surplus of nitrates (SOZINOV 2004, SYNYTSKYI 2007).

Fertilizers are the elements of the whole system of agrochemical programs (the regulation of the soil acidity, abatement with the weedages, diseases and plant pests, the selection of the best sorts, the confining of the optimal seed time).

Use of fertilization in crop rotation is an important part of high-yielding agriculture. However increasing volumes of its use (especially in the time of low output yield) results in environmental pollution (TARARIKO 2004, TOPOLNYI 2007).

Conclusions

1. Main reasons of soil agrochemical properties decreasing is a repeated cultivation by means of different tools with the help of powerful and heavy wheel-tire tractors and high level of ploughed of agricultural lands.

2. The analysis of present condition of Vasylivka Rural Council agricultural land shows their deep degradation which is manifested in large increasing of erosion lands areas, areas of medium and high eroded soil. It happens because lands are situated on the surface with inclination 1–15° that is why because of soil erosion the areas of arable land and meadows are getting lost.

Experience of rational use of fertilizers by the Limited Liability Company "Maryivske" showed the perspective of land quality improvement and, as a result, decreasing of areas of ploughed land.

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