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Economic efficiency of fertilazer application systems in crop rotation under different systems of soil tillage *

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Aim. To examine the economic efficiency of application of organic and mineral fertilization systems of the 4-field rotations under different soil tillage systems. **Methods.** Field, laboratory and statistical. **Results.** It was investigated the costs for the application of organic and mineral crop fertilization systems of short crop rotation under moldboard and minimum tillage systems and levels of profitability were calculated. It was defined that the use of mineral fertilizers under such parity of prices that currently prevailing in the agricultural market of Ukraine on some variants of the experiment was unprofitable. **Conclusions.** It was established that the highest level of profitability of fertilizer application was by mineral and organic fertilizing systems respectively by minimum and moldboard tillage systems - 25.2 and 15.2%.

Keywords: *system of fertilization, tillage system, economic efficiency, profitability level.*

Under market economy conditions the use of mineral and organic fertilizers is a key tool for improving the profitability of growing crops, but high prices for fertilizers and high cost of the use of organic fertilizers require comprehensive economic justification for their use [1, 8-9].

However, to achieve the fullest impact of fertilizer use one must fully comply with scientifically proven correlation between nutrients and optimal timing of application [10].

The average rates of fertilizers, according to many scientists, provide them with the highest efficiency and return [2-4].

Tillage system also affects the economic efficiency of growing crops. Minimum soil tillage has benefit from significant energy savings [5-7].

Influence of ways of organic matter application in soil on fertilization efficiency are highlighted in the literature not enough [12].

Aim of research – to study the economic efficiency of organic and mineral fertilization systems of 4-field crop rotations under different tillage systems.

Research Methodology. The research was carried out on the experimental field of Sumy Institute of Agricultural Production (now the Institute of Agriculture of North East of NAASU) during 2007-2010.

Soil was chernozem typical large-silty medium loamy on the loess rocks. Sown area was 100 m^2, the discount - 50 m^2, repetition of the experiment - three times, method of variant placement and repetitions - systematic.

In the experiment there was studied 4-field seed-beet crop rotation, followed by alternating crops: barley sowing of sainfoin - sainfoin - winter wheat - sugar beet.

For control it was accepted the variant where fertilizers were not used. The second variant was an organic fertilizer system, which involved the use of green manure for fertilizer (sidereal sainfoin steam under winter wheat) and non- tradable crop production (straw of winter wheat + N10/t under sugar beet, turnip of beet under barley sowing sainfoin). The third variant was mineral fertilizer system with the use of minimal doses of mineral fertilizers (presowing and fertilizing).

Different systems of crop fertilization of rotation were studied by 2 soil tillage systems: 1) plowing to a depth of 22-27 cm; 2) surface tillage with disk tools - 6-8 cm.

Research results.

The use of different fertilization systems helped increase yields of crop rotation. The cost of increase in yield was higher by the mineral system of fertilization (1694 - 2159 UAH/ha). By organic systems, these figures were much lower (166 - 584 UAH/ha).

Economic efficiency of systems of crop fertilization by different soil tillage in field crop rotation in average during 2007-2010

System of fertilization	Cost of crop increase, UAH/ha	Costs associated with the use of fertilizers, UAH/ha	Additional conventionally net income (loss), UAH/ha	Level of profitability (loss) by conditional net income, %
By moldboard system of soil tillage				
Organic	584	507,1	76,9	15,2
Mineral	1694	1736,7	-42,7	-2,5
By minimum system of soil tillage				
Organic	166	373,5	-207,5	-61,0
Mineral	2159	1723,9	435,1	25,2

The results of our research showed that the average for the period 2007-2010 the economic efficiency of system of fertilizer use varied greatly and depended on the systems of soil tillage in crop rotation. Thus, by moldboard tillage system organic fertilizer system was more effective, and by the minimum one - mineral system was more effective, despite the fact that the cost of yield increase was higher by mineral fertilizer system. However, the cost of applying fertilizers by mineral fertilizer system was 1723,9-1736,7 UAH/ha and by organic one - only 375,3-507,1 UAH/ha.

The use of mineral fertilizers by such price parity that now prevailing in the agricultural market of Ukraine was unprofitable - 42.7 and -207.5 UAH/ha respectively by the mineral system of fertilization on the background of moldboard soil tillage and organic system on minimum soil tillage system.

Level of profitability of fertilizer use was higher on mineral fertilization system by minimum soil tillage system - 25.2 and 15.2% - on organic fertilizing system by moldboard tillage system.

The highest level of unprofitability of fertilizer application by conditional net profit (-61.0%) was by organic fertilization system by minimum soil tillage system in field crop rotation. It can be explained by the fact that green fertilizer, tops of sugar beet and straw of winter wheat are made in soil layer of 0-10 cm and are mineralized faster compared with the conditions that created by moldboard soil tillage.

However, over time, in our opinion, it should be improved, as the biological system of soil will transfer to equilibrium state and under these conditions the supply and mineralization of organic matter will be equilibrium and plants will get more nutrients.

Conclusions.

It was found by research that the profitability of fertilizer use was the highest by mineral and organic fertilizing systems respectively by minimum and moldboard soil tillage systems - 25.2 and 15.2%.

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