

Effectiveness of agricultural land use in the lower Danube Euroregion

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Abstract:

The article conducts a comparative analysis of land productivity by major agricultural crop types of the bordering territories in the Lower Danube Euroregion which comprise 196.3 thousand hectares of Romania, 105.1 thousand hectares of Ukraine, 142.2 thousand hectares of Moldova on average within the years of 2004-2007. It computes the level of use of land fertility potential by major types of crops, based on which the average index of land productivity use in the territories of the Lower Danube Euroregion (the Tulcea District of Romania, four districts of Ukraine, and five districts of Moldova) is designed.

Key words: effectiveness of land use, land fertility potential, land productivity, level of use of land fertility potential, average index of land productivity use.

Introduction. The Lower Danube Euroregion comprises the districts of the Odessa Region of Ukraine, the lands of the Galati and Braila Regions of Romania and of the Southern districts of Republic of Moldova. The goal of the Euroregion is to mobilize the efforts of the afore-mentioned administrative territories for mutual enrichment of economic mechanisms of their agricultural management. The Lower Danube Euroregion has a diverse agriculture with crop-farming as a predominant sector. Due to this fact, the efficiency of agricultural land use has a crucial effect on the economic development of the region.

Defining the Problem. Despite an over 10-year period of the Lower Danube Euroregion's functioning, the goal of its creation has not been attained. Moreover, no precise steps toward a more efficient cooperation have been taken so far. Considering a dominant role of agriculture in the economic development of the region, the problem of efficient use of land as the main factor of production in agriculture remains a major challenge for land users.

Relevance of the Problem and Its Practical Meaning. As the research analysis shows, land fertility in the region is not being used to its full capacity. Moreover, the structure of planted lands does not correspond to scientifically proven norms. That is why the comparative analysis of land use efficiency in the region has not only an informative purpose. It also has an important mobilizing role in the identification and wide use of reserves of crop production based on the growth of the crop yield.

Analogous research of land use efficiency in the agriculture of the Lower Danube Euroregion has never been conducted before.

The purpose of this article is the identification of weaknesses in the structure of planted lands and the determination of reserves for a fuller use of land fertility potential in the crop cultivation of the region.

Results. For the purpose of determining the level of use of agricultural lands in the Lower Danube Euroregion, the districts of Tulcea (Romania), Bolgrad, Ismail, Kilia, Reni (Ukraine), and Cahul,

Ceadir-Lunga, Comrat, Taraclia, Vulcanesti (Republic of Moldova) were selected as primary areas of research. The Lower Danube Euroregion has a diverse agriculture with crop farming as a predominant sector. The research of the use of soil fertility has been conducted in Romania (the District of Tulcea) – on the area of 196.3 thousand hectares, in Republic of Moldova – on the area of 142.2 thousand hectares (the District of Cahul – 36.7 thousand hectares, Ceadir-Lunga – 28.8 thousand hectares, Comrat – 34.2 thousand hectares, Taraclia – 29.5 thousand hectares, Vulcanesti – 13 thousand hectares), and in Ukraine – on the area of 105.1 thousand hectares (Reni – 15.4 thousand hectares, Ismail – 28.0 thousand hectares, Kilia – 18.1 thousand hectares, and Bolgrad – 43.6 thousand hectares).

Based on the occupied area, the region has the following predominant crops (in descending order):

- wheat (134.38 thousand ha, 30.3% of total area)
- sunflower (101.56 thousand ha, 22.9% of total area)
- corn (95.87 thousand ha, 21.7%)
- barley (58.66 thousand ha, 13.2% of total area)
- grape/vineyards (30.13 thousand ha, 6.8% of total area)
- pea (17.04 thousand ha, 3.8% of total area)
- fruit (5.59 thousand ha, 1.3% of total area)

This article contains indicators of the use of soil fertility within the last 4 years – 2004, 2005, 2006, and 2007. Let us consider the yields of types of crops that have the largest weight in the structure of agricultural lands in the Lower Danube Euroregion, i.e. wheat, corn, sunflower, and grapes. According to the research, the highest grain crops yield in 2004-2007 has been achieved in the District of Tulcea (Romania) – 31 centner per hectare, then (in descending order) – in the agricultural entities of the District of Ismail (Ukraine) – 26.2 centner per hectare, Taraclia (Republic of Moldova) – 25.8 centner per hectare, Bolgrad (Ukraine) – 25.7 centner per hectare, Reni (Ukraine) – 24.6 centner per hectare, Ceadir-Lunga (Republic of Moldova) – 24.0 centner per hectare, Kilia (Ukraine) – 22.3 centner per hectare, Cahul (Republic of Moldova) – 22.1 centner per hectare, Comrat (Republic of Moldova) – 20.2 centner per hectare. The average fertility per region was equal to 27.3 centner per hectare. Let us further consider the yield of the two major types of crops in the region: wheat and corn (Table 1).

Table 1. Crop Yields of Wheat and Corn in the Lower Danube Euroregion in 2004-2007

Administrative District Area	Wheat		Corn	
	Area, ha	Yield centner/ha	Area, ha	Yield centner/ha
Reni	5,728	26.3	1,376	27.7
Bolgrad	14,382	28.7	5,623	28.1
Ismail	9,027	29.6	3,170	23.8
Kilia	7,268	29.5	895	37.3
Total on the lands of the Odessa Region of Ukraine	36,405	28.7	11,065	27.6
Vulcanesti	4,282	20.5	1,804	24.2
Ceadir-Lunga	9,571	26.8	4,174	23.1
Comrat	11,786	24.0	4,134	18.0
Cahul	11,556	24.1	6,062	22.6
Taraclia	8,916	26.6	6,465	25.7
Total on the lands of Moldova	46,111	24.8	22,639	22.9
Tulcea (Romania)	51,861	24.0	62,263	40.7
Total for the Lower Danube Euroregion	134,377	25.5	95,967	35.0

Based on the data provided by the Departments of Agriculture of Tulcha (Romania) and district areas of Moldova and Ukraine

Having excluded of the unfavorable year of 2007, we will obtain the region's average yield in 2004-2006 equal to 29.3 centner/ha which is 14.9% higher than the 4-year average.

Productivity of the wheat fields in 2007 was twice lower compared to the previous 3-year level and barely reached 14.2 centner/ha. The year of 2004 provided the highest productivity of the leading type of crops - 34 centner/ha. The highest results have been achieved by the grain growers of the District of Taraclia - 37.3 centner/ha, the lowest results - in the District of Vulcanesti (29.5 centner/ha which is 20.9% lower).

The year of 2007 was particularly unfavorable for the corn crops when the average yield per district had not achieved even 1 ton per hectare, which is 4.4 times below the average level of the preceding three years (2004-2006) with the average yield at 39.3 centner/ha. The year of 2004 turned out to be the most productive. The fields of the District of Tulcea attained then the yield of 61.7 centner/ha which corresponds to the level of the highly developed countries of Europe. The corn yield in the Districts of Ismail and Vulcanesti were 2.6 and 2.5 times lower than in Tulcea accordingly.

Let us also consider the crop yields of sunflower and grapes (Table 2).

Table 2
The Crop Yields of Sunflower and Grapes in the Lower Danube Euroregion in 2004-2007

Administrative District Area	Sunflower		Grapes	
	Area, ha	Yield centner/ha	Area, ha	Yield, centner/ha
Reni	2,529	11.6	799	15.8
Bolgrad	6,866	10.5	3,791	27.9
Ismail	4,492	11.7	623	19.8
Kilia	2,399	14.1	407	28.7
<i>Total on the lands of the Odessa Region of Ukraine</i>	<i>16,286</i>	<i>11.5</i>	<i>5,620</i>	<i>25.3</i>
Vulcanesti	2,217	8.2	1,651	22.7
Ceadir-Lunga	5,760	10.0	3,857	28.2
Comrat	6,016	8.4	4,184	37.9
Cahul	7,736	10.5	3,738	33.2
Taraclia	5,608	1.2	4,173	39.8
<i>Total on the lands of Moldova</i>	<i>27,337</i>	<i>9.7</i>	<i>17,603</i>	<i>33.8</i>
Tulcea (Romania)	57,932	12.1	6,907	38.6
<i>Total for the Lower Danube Euroregion</i>	<i>101,555</i>	<i>11.3</i>	<i>30,130</i>	<i>33.3</i>

Based on the data provided by the Departments of Agriculture of Tulcha (Romania) and district areas of Moldova and Ukraine

The highest yield of sunflower has been attained in the District of Kilia in 2004 - 17.1 centner/ha, the lowest - in the District of Comrat of the same year - 8.8 centner/ha, i.e. the amplitude of the crop yield reached 1.94 (17.1/8.8). On average, in 2004-2007 the sunflower crops have been occupying 101,560 ha or 22.9% of lands of the leading crop types of the region. In the field-crop growing, the share of sunflower among the five major types of crops is 24.9% which is above the scientifically proven norms. For instance, in the District of Tulcea in 2004-2007 on average the area of sunflower was equal to 57,932 ha, and the total area of cultivated land without multiannual plants equaled 239,292 ha, i.e. the percentage weight of this type of crops reached 24.2% at scientifically proven norms of 14.2%.

The share of sunflower in the agricultural lands of Ukraine attained 15.1% which is close to the recommended norms. The highest crop yields of grapes were achieved in 2004 (41 centner/ha), the worst ones - in 2007 (26.8 centner/ha). The 3-year crops yield average of fruit-bearing cultures

within 2004-2006 reached 35.5 centner/ha. The highest average yield of grape plantations within the four years of research was registered in the districts of Taraclia and Comrat - 39.8 centner/ha and 37.9 centner/ha, the lowest yield - in the districts of Reni and Ismail (15.8 centner/ha and 19.8 centner/ha accordingly). In 2004 the grape growers of the Comrat District received 60.4 centner from each hectare of plantations, the grape growers of the Taraclia District - 52.7 centner/ha accordingly, which tells about potential opportunities for a more productive use of the grape plantations. Analyzing the dynamics of productivity of major agricultural crops in the Lower Danube Euroregion in 2004-2007, it is important to identify the degree of stability of their crop yields. As the analysis shows in 2004-2006 (excluding 2007 due to its non-typical weather conditions), the amplitude of crop yields in the Lower Danube Euroregion equaled for sunflower - 1.09, for fruit - 1.24, pea - 1.27, wheat - 1.28, grapes - 1.42, barley - 1.50, corn - 2.17.

The crop culture most stable to weather fluctuations is the sunflower. The highest yield - the region average of 13.6 centner/ha - was achieved in 2004, the lowest yield was registered in 2006 - 12.5 centner/ha. Therefore, the amplitude of its crop yields reached only 1.09 (13.6/12.5). In other words, the limit of changes in the productivity of sunflower did not exceed 9%. The crop yields were even more stable on the lands of Ukraine: within these years the changes in the productivity of this crops culture did not exceed 3%. When researching the use of agricultural lands in the Lower Danube Euroregion it is important to conduct a comparative analysis of the achieved crop yields of major crop cultures based on the administrative territories. Our computations will be based on the following assumptions:

- ✧ the achieved maximal yield of a particular crop culture in one region or district is attainable for all other administrative territories;
- ✧ equality of soil fertility;
- ✧ similarity of weather and climate conditions for cultivating crop cultures.

We collect all of our computations on the level of use of land productivity in 2004-2007 in Table 3. Thus, the highest productivity for the grain-based crop cultures was achieved in the district of Tulcea - 31.1 centner/ha. If we assume this yield to be equal to 100%, the level of use of agricultural lands in the Reni District then attained 79.1% $\left(\frac{24,6}{31,1} \cdot 100\right)$ at the productivity level of 24.6 centner/ha. Computations on the other seven crop cultures are conducted in an analogous way.

Table 3

Average Level of Land Productivity Use by Crop Culture (%) in the Lower Danube Euroregion in 2004-2007

Administrative Territory (District)	Grain and pulse/ leguminous crops	Wheat	Barley	Pea	Corn	Sunflower	Fruit	Grapes
Reni	79,1	88,9	82,2	93,6	68,1	82,3	30,6	39,7
Bolgrad	82,6	97,0	84,4	81,8	69,0	74,5	44,0	70,1
Ismail	84,2	100,0	93,3	100,0	58,5	83,0	73,5	49,7
Kilia	71,7	99,7	100,0	94,5	91,6	100,0	78,7	72,1
<i>Districts of Ukraine, Average</i>	83,9	97,0	90,0	91,4	67,8	81,6	57,4	63,6
Vulcanesti	65,0	69,3	66,2	70,0	59,5	58,2	6,9	57,0
Ceadir-Lunga	77,2	90,5	71,0	85,0	56,8	70,9	29,6	70,8
Comrat	69,8	81,1	72,9	92,7	44,2	59,6	100,0	95,2
Cahul	71,1	81,4	69,1	82,7	55,5	74,5	74,2	83,4
Taraclia	83,0	89,9	96,7	84,5	63,1	72,3	64,6	100,0
<i>Districts of Moldova,</i>	66,2	83,8	73,6	84,5	56,3	68,8	72,5	84,9

Administrative Territory (District)	Grain and pulse/ leguminous crops	Wheat	Barley	Pea	Corn	Sunflower	Fruit	Grapes
<i>Average</i>								
Tulcea (Romania)	100,0	81,1	61,7	95,9	100,0	85,8	77,0	97,0
<i>Lower Danube Euroregion, Average</i>	87,8	86,1	77,3	89,1	86,0	80,1	74,9	83,7

Computed by author based on the data provided by Departments of Agriculture of Tulcha (Romania) and district areas of Moldova and Ukraine

Based on the grain crop cultures, the order of districts by the efficiency of use of agricultural lands in 2004-2007 is the following (descending):

1. Tulcea District;
2. Ismail District;
3. Taraclia District;
4. Bolgrad District;
5. Reni District;
6. Ceadir-Lunga District;
7. Kilia District;
8. Cahul District;
9. Comrat District;
10. Vulcanesti District.

Let us conduct computations on the average index of the level of use of land productivity in the Lower Danube Euroregion in 2004-2007. In order to do this, we will multiply the index of land use in a particular administrative territory by its weight coefficient. We conduct our computations for each crop culture. For instance, the index of use of land productivity for wheat production in the Reni District equaled 0.889 on average in 2004-2007. The share of wheat in the structure of agricultural lands is equal to 37.3%, i.e. the wheat weight index is 0.373. We conduct analogous computations for each crop culture in all districts of the region. Results are presented in Table 4.

Table 4. Average Index of Land Productivity Use in the Lower Danube Euroregion, 2004-2007 average

	<i>In Economic Entities of Ukraine:</i>				
	<i>Reni</i>	<i>Bolgrad</i>	<i>Ismail</i>	<i>Kilia</i>	<i>Average</i>
<i>Wheat</i>	0.332	0.320	0.322	0.401	0.336
<i>Barley</i>	0.191	0.163	0.227	0.302	0.208
<i>Pea</i>	0.077	0.079	0.132	0.079	0.093
<i>Corn</i>	0.061	0.089	0.066	0.046	0.071
<i>Sunflower</i>	0.136	0.117	0.133	0.133	0.126
<i>Fruit</i>	0.002	0.003	0.006	0.005	0.004
<i>Grape</i>	0.021	0.061	0.011	0.016	0.034
<i>Average</i>	0.820	0.832	0.897	0.982	0.872

Table 4 (continued)

	<i>In Economic Entities of Moldova:</i>					
	<i>Vulcanesti</i>	<i>Ceadir-Lunga</i>	<i>Comrat</i>	<i>Cahul</i>	<i>Taraclia</i>	<i>Average</i>
<i>Wheat</i>	0.228	0.300	0.280	0.256	0.271	0.272
<i>Barley</i>	0.127	0.079	0.113	0.096	0.081	0.096
<i>Pea</i>	0.024	0.043	0.032	0.036	0.030	0.034

	In Economic Entities of Moldova:					
	Vulcanesti	Ceadir-Lunga	Comrat	Cahul	Taraclia	Average
Corn	0.082	0.082	0.053	0.092	0.138	0.090
Sunflower	0.099	0.142	0.105	0.157	0.137	0.133
Fruit	0.001	0.008	0.050	0.018	0.017	0.020
Grape	0.072	0.095	0.116	0.085	0.142	0.105
Average	0.633	0.821	0.749	0.740	0.816	0.750

Table 4 (continued)

	In Economic Entities of:	
	Romania (the Tulcea District)	Lower Danube Euroregion
Wheat	0.214	0.261
Barley	0.050	0.102
Pea	0.004	0.034
Corn	0.317	0.187
Sunflower	0.253	0.183
Fruit	0.003	0.010
Grape	0.034	0.057
Average	0.875	0.834

Computed by author based on the data provided by Departments of Agriculture of Tulcha (Romania) and district areas of Moldova and Ukraine

The average indices of the land productivity use - based on seven major types of crops - in the administrative territories of the Lower Danube Euroregion are the following (ascending): Vulcanesti - 0.633, Cahul - 0.740, Comrat - 0.749, Taraclia - 0.816, Reni - 0.820, Ceadir-Lunga - 0.831, Bolgrad - 0.832, Tulcea - 0.875, Ismail - 0.897, Kilia - 0.982.

Conclusion. As we notice, the most productively used agricultural lands are in the Kilia District - 98.2% of potential level. The level of use of land productivity is quite low in the Vulcanesti District - only 63.3% of its potential.

The lands of the four districts of Ukraine were used in 2004-2007 on average by 87.2% of their potential level, the lands of the Romanian District Tulcha - by 83.4%, the lands of the five districts of the Republic of Moldova - by 75.0% accordingly.

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