

## AGRICULTURE AND SUSTAINABLE SOIL USE IN TIMIȘ COUNTY, ROMANIA

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### Abstract

*The main purpose of this study was to analyse the main development resources of Timiș County, Romania, and to find opportunities for sustainable development of agriculture on the basis of available resources. Thus, the main objective of this study was to assess the resources regarding the development of sustainable agriculture that do not affect the environment in Timiș County. From the analyses carried out, it was found that, from the point of view of natural resources, Timiș County can be considered a rich county, both in terms of natural resources (fertile soils favourable to cereals, vegetables, fruit trees or vines, natural deposits of lignite, basalt, crude oil, natural gas, mineral waters or geothermal water), as well as economically, socially or culturally.*

**Key words:** natural resource, soils, sustainable agriculture

### INTRODUCTION

Timiș County is located in Western Romania, in one of the most prosperous areas of our country, namely the Western Plain. It is also the largest county of our country, ranking first, with a total area of 8,697 km<sup>2</sup>, i.e. 3.6% of our country's total area [11].

From the point of view of the administrative organization, Timiș County has two municipalities – Timișoara and Lugoj; eight cities – Sânnicolau-Mare, Jimbolia, Buziaș, Făget, Deta, Ciacova, Recaș and Gătaia; and 87 communes. The relief is particularly varied, so in the central and western part of Timiș County there are plains, and in the eastern area, there is a hilly and mountainous relief. The plain is the predominant form of relief in the county: Timișului Plain, which has altitudes of 80-90 m, Arancăi Plain (Mureș-Aranca), which includes the Mureș meadow and the Arancăi Meadow, Vinga Plain and Gătaia Plain [12].

Since the past centuries, the special fertility of the soils of Banat Region has been acknowledged, which has been supported by

famous historiographers of the time, such as Francesco Grisellini (1777), author of a well-known history of Banat in which he pointed out that the lands of this region are so good that even in the absence of natural fertilisers they have high productivity that goes far beyond the productivity of the land in any other country in Europe

Agriculture is a priority of our country's economy; its main purpose is to meet human needs and the overall progress of the national economy. The main functions of our agriculture are: food function, socio-economic function, environmental protection and sustainable development of agriculture function. [9, 10].

At present, Romania's Food Agenda is characterized by the inconsistency of the supply of agricultural products, by a deficient structure in terms of quality of food consumption, by the high share of expenditure sourcing in the budget of a middle-income family, and by increased dependence on the import of basic foods needed for daily consumption [5, 6]. This food imbalance in our country is given by the relatively low

consumption of animal protein and the relative low fruit consumption, but also by an increased degree of biological and chemical pollution of food [3, 7].

Agriculture makes an important contribution to the overall economic growth process, being an important source of income and jobs, both in this economic sector and in related sectors such as industry, infrastructure, or tourism [1]. At national level, agriculture is an export source, with an important role in the balance of payments. This sector of the economy is also a defining element of rural space progress, ensuring the development of many small- and medium-size businesses in various fields, thus fostering a wide distribution of revenues [4].

Agriculture also performs the function of preserving, protecting and beautifying the environment, ensuring the maintenance of ecological balance on Earth. However, it has dual effects on the environment: on the one hand, it performs the function of environmental protection through agricultural landscaping systems that ensure the value of premises and landscapes to protect them and, on the other hand, it can destroy the ecological balance by misuse of chemicals, irrational irrigation, water and air pollution, soil compaction, etc. [4, 10].

Ensuring the purity of food products and promoting the quality and compatibility of environmental requirements are increasingly important features of competitiveness in agriculture nowadays. Areas that will produce food with higher ecological characteristics will receive financial support through various programmes promoted by the European Union, thus organic farming can become a growth factor for Romania rural areas [2, 8].

In addition to these three vast agricultural functions, the following can also be listed: agriculture is an active participant in foreign trade; it constitutes a market for other sectors; it is a permanent generator of raw materials needed for the food and light industry

## MATERIALS AND METHODS

The material used here is mostly the result of studies and research carried out by the authors

of the article, carried out over several years at the Centre of Excellence "Sustainable Rural Development of Romania" at the Banat University of Agricultural Science and Veterinary Medicine "King Michael I of Romania" from Timisoara, Romania. Many references come from the literature in the field. The methods used are specific to economic research: collection and selection of material, processing, comparing, observing and drawing conclusions.

## RESULTS AND DISCUSSIONS

Agriculture is a particularly important economic branch in Western Romania, which owns 13.2% of the country's agricultural area and has a very high production potential due to the high fertility of soils in the Western Plain Romania.

In Timiș County, the agricultural sector is of particular importance, due to the fruitfulness of the land and the high productions over the years in the field. At the level of Timiș County, the structure of the land and the categories of use is presented according to Table 1.

Table 1. Land distribution by use categories in Timiș County, 2017

Use category	Area (ha)	%
Agricultural lands, of which:	693,094	
• Arable land	530,808	76.59
• Meadows	121,741	17.56
• Haymaking fields and natural meadows	28,106	4.06
• Vineyards and viticultural nurseries	8,334	1.20
• Orchards ad fruit nurseries	4,105	0.59
Agro-zootechnical buildings	2,058	
Degraded and non-productive land	4,190	
Forest fund administered by the Timiș Forestry Directorate	84,370	
Forest fund administered by the R.P.L. Ocolul Silvic Stejarul R.A.	8,812	

Source: Statistical yearbook of Timiș County, 2017.

According to Table 1, the largest share of Timiș County's area (530,808 ha, i.e. 76.59%)

is represented by arable land which has a high but not properly exploited fertility.

Following the study, in Timiș County there is a gradual increase in the total area cultivated in recent years in most crops (Table 2, Figure 1).

Table 2. Area cultivated with main crops (ha)

Crop	2014	2015	2016	2017
Total cultivated area	453,569	445,738	434,850	501,424
Grain cereals	363,054	345,406	342,970	327,388
Wheat and rye	146,673	138,961	142,909	127,280
Barley and two-row barley	24,978	20,072	16,552	18,048
Maize	179,064	175,000	174,787	167,519
Legumes	766	728	392	646
Sunflower	37,387	46,000	46,785	73,451
Soybean	4,665	7,591	3,451	25,047
Potato	5,591	5,469	3,309	3,010
Vegetables	12,579	12,670	11,228	11,282
Others	29,527	29,527	26,715	60,600

Source: Statistical yearbook of Timiș County per year 2017.

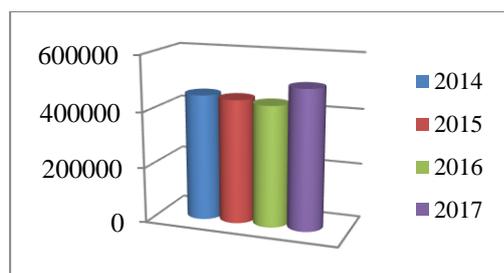


Fig. 1. Evolution of total cultivated area (ha) in Timiș County

Source: Our own construction based using the data of the Statistical Yearbook of Timiș County for the year 2017.

The most significant increase in terms of areas were in sunflower and soybean, as illustrated in Table 2, as well as in fodder crops. It is noted that, in the cultivated area, the largest share is held by grains (wheat and rye, barley, two-row barley, maize and other cereals). Timiș County has the largest share in grain production in the Western region, with an average of around 50% of all production at region level. This activity contributes more than 50% to the formation of total turnover in the primary sector of the economy. At present, the land is not capitalized at its true value, because the productions recorded are below the fertilising potential of the soils of Banat.

With regard to crop production obtained, the largest productions were in cereals, but significant increases were also recorded in 2017 in sunflower and soybean.

The highest average productions (kg/ha) were recorded in sugar beet, which increased in 2017 compared to 2014, and substantially in 2015.

With regard to the valorisation of productions, it should be noted that, from the data obtained, it was found that, on small- and medium-size farms in Timiș County, much of the production made is intended for family consumption.

Sustainable agriculture, agriculture of the future.

Sustainable agriculture is a complex system through which very high productivity is achieved, the food needs of the population are ensured, and large and secure profits are achieved, all in the context of environmental protection and conservation.

Sustainable agriculture involves the scientific and balanced use of modern technologies regarding soil works, crop rotations, fertilization, sowing, care work (weed, disease and pest control, including through biological methods), irrigation, animal husbandry, storage, processing and use of residues from agricultural activities, for the production of high and stable productions, without adverse effects on the environment.

Sustainable soil use involves maintaining its three ecological functions: providing habitat for organisms; biomass production; and filtration, buffering, processing of matter and soil water in order to ensure their circuit in nature. The situation of the environment and the efficient and rational use of natural resources visibly impact the conditions of economic growth, as well as the level and quality of life of the population.

In Romania, the interest in sustainable development in agriculture was based on long-term research on crop productivity factors, on biodiversity, environmental protection, and bioresources, and have been important objectives over the past decades, correlated at European and global level.

Soil is a vital component of the biosphere, resulting from the action of climatic and biotic factors on the rocks on the surface of the earth. It also contributes, together with vegetation and climate, to regulating the hydrological regime and the quality of the environment. At the same time, this is a complex and dynamic environment, comprising characteristic fauna and flora, a set of mineral and organic elements, and its own air and water circulation.

Soil quality depends on the suitability and favourability of land for use for various purposes and for different crops. The area covered by the soil is limited. The total area of land globally is estimated at 13.395 billion ha, of which 11% represent arable land, 22% meadows and 30% forests, i.e., on average an area of 0.35 ha arable per inhabitant around the globe. In Romania, this value is estimated to be 0.495 ha arable land/inhabitant. Demographic growth and increased food needs have revealed the need to expand agricultural land. Worldwide, around 460 million people are believed to suffer from malnutrition.

In recent decades, agricultural ecosystems have been overburdened as a result of increased food demand, and this has significantly decreased soil stability and increased soil degradation.

Soil degradation is achieved by erosion of the humus layer, which produces serious negative effects on soil fertility. Soil pollution and degradation are strongly correlated phenomena. The following are considered the main causes of soil degradation and pollution: excessive tree cutting and uncontrolled deforestation; expansion of housing districts and of communication systems; expansion of industrial platforms, of waste materials (excavation materials) and dump sites (sterile deposits derived from mining works); expansion of agricultural crops; irrational application of irrigation; salting of swamps and soils; introduction into soil of heavy metals, residues, pesticides, industrial emissions, etc. Agricultural crops, apart from their role in providing food for humans and

animals, play an increasingly important role in ensuring environmental balance.

Excessive chemisation induces involution processes: microorganisms in the soil disappear and structural destabilisation of the soil occurs. In order to maintain soil fertility, they continue the application of chemical fertilizers, thus leading to soil intoxication, in which case degradation can no longer be avoided. Deforesting and drying swamps and puddles cause irreversible imbalances within ecosystems. The use of excess chemicals (pesticides, herbicides, fertilizers) is an important source of pollution and soil degradation because they introduce chemicals affecting its qualities and fertility. Soil damage can also occur because of the exploitation of surface and underground deposits, by continuing this process at a high pace. At the same time, massive deforestation leads to soil erosion, climate aridity and increased wind speed, and intensive grazing contributes to soil erosion, to natural habitat modification, to vegetation removal, and induce other negative effects on the soil and ecosystem in general.

The irrational application of irrigation can also contribute to soil erosion and is the main cause of sediment water pollution, the clogging of the soils in flooding meadows, and contributes to the stopping of reservoirs and water tank functioning. Household waste and waste from industrial activities, from agriculture or other activities also contribute to the poor state of soils and, if discharged into the environment, thus altering the geochemical abundance of soil elements. Agricultural practice taking place under various conditions, under the influence of a complex of environmental factors and conditions, modified in time and space by human intervention, requires the deepest knowledge of all ecological and soil determinants. The qualitative evaluation of the soil and the choice of the most suitable way of using the land based on science in relation to the degree of suitability contribute to the increase and conservation of productivity and, thus, increase the resilience

capacity of the most sensitive and fragile soils.

The crediting of agricultural land is the complex operation of in-depth knowledge of the conditions for the growth and development of crops and to determine the degree of favourability of these conditions for different uses and crops through a system of technical indicators and creditworthiness notes (MADR Order no. 278/2011). Credit worthiness in the research area studied revealed a number of limiting factors acting on the production capacity of agricultural land within Timiș County, including excess stagnant and phreatic moisture, compactness and moisture deficiency, salting and

acidification. Their analysis results in a number of requirements and measures of improved and/or mandatory use, as well as requirements and measures to prevent soil degradation and preserve soil fertility. In the analysed western area, i.e. in the Aranca-Galațca Inter-River Plain, it was found that 36.21% of the territory, i.e. 65,494 ha, is affected by excess surface moisture and 35.38% is affected by excess ground moisture, according to the data in Table 3. When determining excess moisture, the essential factors that determine humidity conditions are groundwater depth, hydric balance, microrelief, soil permeability and soil texture.

Table 3. Land with excess surface and ground water from the inter-river Aranca-Galațca Plain

Locality	Agricultural land (ha)	Of which land with:					
		Surface water excess			Ground water excess		
		low	medium	strong	low	medium	strong
Gotlob	4,114	650	0	0	350	116	43
<b>Lovrin</b>	<b>3,807</b>	<b>780</b>	<b>0</b>	<b>0</b>	<b>816</b>	<b>180</b>	<b>170</b>
Periam	5,886	0	0	0	840	416	138
Pesac	3,147	0	0	0	550	400	186
Saravale	9,620	3,510	495	158	1,680	298	418
Sânpetru Mare	9,176	3,508	488	176	2,094	339	401
Sânnicolau Mare	12,689	9,068	142	0	1,960	1,820	650
Teremia Mare	7,748	450	31	852	452	1,083	283
Tomnatic	3,547	620	0	0	580	128	30
Valcani	5,760	230	750	1,810	2,660	2,560	1,560
Total (ha)	65,494	18,816	1,906	2,996	11,982	7,340	3,879
Total (%)	100	28.73	2.91	4.57	18.29	11.21	5.88

Source: OSPA Timisoara archive.

Depending on the phreatic level, lands without limitations are lands where groundwater is deeper than 2 m, with moderate limitations, those with groundwater between 1-2 m, and unfavorable (strong and excessive limitations) land, where the depth of groundwater is 1 m (i.e. in the first 50 cm). In view of these restrictive factors, soil and hydroameliorative measures (depleting, drainage, deep-watering, etc.) and the development of a balanced aero-hydraic regime and measures to promote the processes of concentration of nutrients and organic matter in soil are mandatory. It is also noted from the analysis that a significant area

of the land of the localities analysed is affected by compactness, i.e. 70.12%, while another area of 44.28% is affected by moisture deficit. The situation is presented in Table 4. Compaction is a particularly important restrictive factor of increasing the root system, reducing water infiltration into the soil and increasing the risk of excess moisture on the surface, but also on the soil profile. It reduces soil fertility and accessibility of nutrients to plants in particular. The use of agricultural machinery or any machines on too wet land leads to severe compaction of the soil and significant reduction of the root system. When using

agricultural machinery, for any kind of work, it is always absolutely necessary to know the degree of humidity. Moreover, agricultural machinery systems, as well as the moment of "entry" into the land must be in line with the specifics of the soil.

Measures should be taken to improve the physical state of soils on land affected by

physical processes of surface degradation (crustification, dusting, clogging of porous space, etc.) by reducing the number of soil works, by introducing long-term crop rotations with protective and improving plants, alternation of deep soil work for annual weeding crops with superficial works.

Table 4. Land affected by compactness and moisture deficiency in the Aranca-Galața Plain

Locality	Agricultural land (ha)	Of which land with:					
		compactness			moisture deficit		
		low	medium	strong	low	medium	strong
Gotlob	4,114	2,134	560	258	2,560	730	350
<b>Lovrin</b>	<b>3,807</b>	<b>1,081</b>	<b>685</b>	<b>242</b>	<b>1,384</b>	<b>813</b>	<b>315</b>
Periam	5,886	2,264	959	680	787	3,798	0
Pesac	3,147	1,268	860	188	680	2,560	0
Saravale	9,620	3,680	1,970	350	1,260	2,950	1,360
Sânpetru Mare	9,176	3,023	1,797	420	986	1,865	1,290
Sânnicolau Mare	12,689	6,516	1,291	1,410	2,560	3,980	1,460
Teremia Mare	7,748	2,071	1,470	526	31	2,856	3,106
Tomnatic	3,547	1,850	695	280	2,360	790	378
Valcani	5,760	1,260	1,350	960	1,120	3,369	230
Total (ha)	65,494	25,147	11,637	5,314	13,728	23,711	8,489
Total (%)	100	38.40	17.77	8.11	20.96	36.20	12.96

Source: OSPA Timisoara archive.

Table 5 shows the land in the ten analysed localities affected by salting and acidification. It was found that 51.58% of the area are affected by salting, but a share of 38.84% is affected by medium salting, 6.78% suffer

moderate salting, and only 5.96% experience strong, excessive salting. Of the 65,494 ha in the Aranca-Galața Plain, 19.47% are affected by low and medium acidification.

Table 5. Land affected by salting and acidification in the Aranca-Galața Plain

Locality	Agricultural land (ha)	Of which land with:				
		salting			acidification	
		low	medium	strong	low	medium
Gotlob	4,114	960	46	0	560	150
<b>Lovrin</b>	<b>3,807</b>	<b>1,446</b>	<b>70</b>	<b>56</b>	<b>890</b>	<b>194</b>
Periam	5,886	2,556	110	43	1,960	350
Pesac	3,147	2,180	85	25	510	130
Saravale	9,620	4,160	695	1,160	1,110	230
Sânpetru Mare	9,176	3,960	615	960	1,280	193
Sânnicolau Mare	12,689	3,476	1,623	738	1,571	218
Teremia Mare	7,748	3,339	213	201	1,927	0
Tomnatic	3,547	1,202	57	3	620	180
Valcani	5,760	2,158	928	719	680	0
Total (ha)	65,494	25,437	4,443	3,905	11,108	1,645
Total (%)	100	38.84	6.78	5.96	16.96	2.51

Source: OSPA Timisoara archive.

In this context, actions are required to correct pH (soil acidity) and proper fertilisation of the soil, on the basis of authorised agrochemical mappings, as well as the application of agricultural and soil improving measures aimed at achieving a balanced air and water regime with optimal operating parameters. The quantity of mineral and organic fertilisers applied on the surface unit shall not exceed 170-210 kg N/ha/year.

## CONCLUSIONS

On the basis of the research and analysis carried out, it is possible to say that the agricultural potential of Timiș county is considerable due to large agricultural areas and favorable soil and climate conditions in many localities that have soils with high fertility and need to be properly exploited.

The main objectives pursued in order to practice sustainable agriculture are: maintaining soil quality and ensuring proper correlation between food quantity and quality, human health and maintaining the quality of the environment.

Under the current economic conditions, it is necessary to find an optimal ratio between agricultural technologies, productions and ecology, ensuring a balanced economic-social development of the rural area by satisfying food and social requirements, improving the quality of the environment and the sustainable exploitation of natural resources, optimal and sustainable use of limited and non-renewable resources, and improving the quality of rural life.

It is important to note that degraded soil is regenerated due to the beneficial influence of sun energy and of atmosphere. The process of ecological reconstruction of the soil is very long-lasting, with specialists considering that even ten centuries are needed, to restore only a few cm of soil thickness. Since the conditions and history of soil formation cannot be replicated, it is absolutely necessary to use this vital natural resource, which has the ability to increase its fertility provided it is used properly.

For economic reasons and for environmental protection, at the level of each agricultural holding of more than 10 ha, it is necessary to properly manage fertilizers at farm level. In order to achieve this objective, good management based on a nitrogen and other nutrients fertilization plan is required for each soil or plot cultivated with a particular crop.

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