PRACTICE OF ENVIRONMENTALLY FRIENDLY AGRICULTURE. CASE STUDY

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Abstract. *The paper presents a case study carried out on a farm in the town of Șag, Timiș county, where cereals (wheat, barley, corn), sunflower and alfalfa are cultivated. The total area of the farm is 149 ha, of which, as of 2018, 28 ha are cultivated in an ecological system, the study being carried out on 20 ha out of the 28, namely: 10 ha are cultivated with corn, 5 ha with sunflowers, 2 ha with wheat, 1 ha with barley and 2 ha with alfalfa. The objectives considered were: the description of the geographical, pedological and climatic conditions; identification and presentation of the main soil types; culture technology practiced; the range of crops and the areas occupied by the three basic crops. The soil is of cambic chernozem type. In this farming system, crop rotation is very important, this being one of the factors that determined an expansion of areas and crops. The introduction of legumes and the future use of green manures in addition to the practice of direct sowing are desired. In the fall of 2022, along with the sowing of wheat, red clover was sown in a mixture with wheat on an area of 3 ha, to be used as fertilizer. The purpose of the work is to obtain a fund of pedological and agrochemical information regarding the soil cover in the perimeter of the town of Șag, Timiș county, in order to make a correct and rational use of the edaphic resource in conjunction with a sustainable development of the entire agricultural activity in the studied area.*

Keywords*: Sag, cambic chernozem, ecological system, environmentally friendly agriculture*

INTRODUCTION

The commune of Şag is located 14 km south of Timişoara, on the right bank of the Timiş River. It is crossed by the national road DN59 Timişoara - Moraviţa (or the European road E70). The Timişoara - Stamora Moraviţa railway also passes through Şag. It also borders Pădureni to the south (10 km on DN59), the village of Parţa to the southeast (3 km), Sânmihaiu Român to the northwest (9 km). (BLAGA GH., FILIPOV F., RUSU I., UDRESCU S., VASILE D., 2005).

Located in the southwestern part of Timiș county, the town of Șag, the seat of the commune with the same name, is at a distance of 14 km from the municipality of Timișoara and 3 km from the town of Parţa. The commune of Șag covers an area of 8664 ha, of which 8419 ha is agricultural land (URUIOC STELA, 2001; OSPA Timișoarra)

The researched territory is part of the river basin of the Timiș river with the presence in the southern part of the Timișului Mort (the former course of the Timişului) (FLOREA N.,MUNTEANU I., 2012).

In order to characterize from a climatic point of view the area taken in the study, we used the "Agroclimatic Resources of Timiș County", some climatological elements from the Climatological Atlas of Romania and some climatological data from the Timișoara Meteorological Station contained in the work "Timișoara - Monograph" - (BUCUR N., LIXANDRU GH., 1997; IANOȘ GH., PUȘCĂ I., GOIAN M., 1997; POSEA GH., 2009).

Both for economic reasons and environmental protection requirements, a correct management and use of fertilizers (fertilizers) is required at the level of each agricultural or agro-zootechnical holding. Every agricultural producer must be aware that the use of fertilizers to achieve profitable production must be based on realistic forecasts, which take into account

the local pedoclimatic conditions, the productive potential of the crops and the technological level of the agricultural unit (Brady N.C., Weil R.R., 2003; GOIAN M., IANOȘ GH., RUSU I., 1993; LIXANDRU GH., PETRESCU S. ȘI COLAB., 1984; MIHUȚ CASIANA, EL AT., 2022; RADULOV ISIDORA, 2007).

A particular emphasis, especially in areas with high vulnerability to water pollution with nitrates of agricultural origin, must be placed on the management of organic and mineral fertilizers with nitrogen, given the particularly complex behavior of this nutrient in the soil and the ease with which it can be lost in the form of nitrates by entrainment with infiltration waters and surface runoff (Code of good agricultural practices, 2003; CRISTA F., GOIAN M., 2008).

As practiced for decades, agriculture has had a significant negative impact on the environment through the irrational use of fertilizers and pesticides to increase yields to meet the demands of a growing population (MĂRGHITAȘ MARILENA, RUSU M., MIHĂIESCU TANIA, 2005; . Consequences have included deforestation and soil degradation, as well as biodiversity loss, irrigation and pollution problems, among others (BORLAN Z., HERA C., 2003; LIXANDRU GH., PETRESCU S. ȘI COLAB., 1984; MIHUȚ CASIANA, EL AT., 2022). This led to the development of a new type of agriculture known as sustainable agriculture to remedy the current situation. Specifically, the goal is to "meet the food needs of society today without compromising the ability of future generations to meet their own needs." Using appropriate agricultural practices to implement sustainable agriculture is the most effective method to achieve this goal. According to research, farmers' decisions to effectively adopt sustainable agricultural practices are influenced by a variety of factors (CRESSER J., KILLHAM N., EDWARDS J., 1993; HAVLIN J.L., BEATON J.D., TISDALE S.L., NELSON W.L., 1999; NIȚĂ L., ET AL., 2004).

In the paper I described the situation of a farm in the town of Șag, Timiș county, thus providing an overview of sustainable agricultural practices.

MATERIAL AND METHODS

The paper is a case study carried out on a farm in the town of Șag, Timiș county, where cereals (wheat, barley, corn), sunflower and alfalfa are cultivated. The farm has 253 ha, of which in the study we took an area of 20 ha, 10 ha with corn, 5 ha with sunflower, 2 ha with wheat, 1 ha with barley and 2 ha with alfalfa.

The purpose of the work is to obtain a fund of pedological and agrochemical information regarding the soil cover in the perimeter of the town of Șag, Timiș county, in order to make a correct and rational use of the edaphic resource in conjunction with a sustainable development of the entire agricultural activity in the studied area.

The most effective way to enrich humanity's food resources is to increase the agricultural production per hectare on the current arable land surfaces, by introducing new varieties and productive hybrids and by improving the culture technology.

The activities necessary to carry out the proposed theme refer to extensive information and documentation from specialized literature, carrying out soil analyses, carrying out the work of preparing the germinal bed, sowing, applying chemical and organic fertilizers, carrying out phytosanitary treatments when necessary, harvesting , data interpretation and development of fertilization plans.

RESULTS AND DISCUSSIONS

The following types of soils appear on the territory of the town of Șag (FLOREA N.,MUNTEANU I., 2012) (figure 1):

- Alluvial soils (eutric, gleyc, dystric, molic, mollic-salic);

- Enthyanthrosols (mixed);
- Chernozems (typical, cambic, cambic-alkalized, salty vertices);
- Phaeosiums (cambic, cambic-gleyc);
- Eutricambosols (typical, mollic, loam, gleyc, mollic-loam, pelic, loam-gleyc, mollic-alkalized, moliic-gleyc, gleyc-alkalized, pelyc-gleyc);
- Pelosols (gleyc, alkalized gleyc);
- Solonetz (salted gleyc),
- Associations of soils.

The specific soil types found in the area of the plan, typical of the low plain, are: chernozems, leached chernozems, alluvial soils, cernic gleiosols, solonetz and solonchak, etc. Also in the plains, but on smaller surfaces, psammosols and colluvial soils are present.

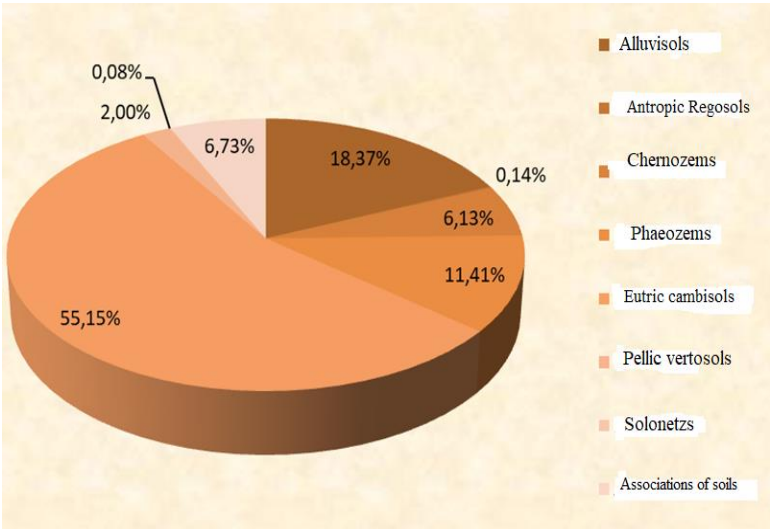

Figure 1. Soil types and occupied surfaces in the outskirts of the town of Șag

The soils of the Protisols class are found on an area of 1511 ha (18.51%) of the total investigated area, and the most representative of this class is the alluvium with 4 subtypes.

The Cambisols class is found on an area of 4625 ha (55.15 %) of the identified area, with the eutricambosol soil type having 7 subtypes.

The Cernisols class occupies an area of 1469 ha (17.54%) of the area under study with the most important soil types Cernoziom (513 ha; 6.13 %) and Faeoziom (956 ha; 11.41 %).

The Vertisols class occupies an area of 167.44 ha (2.00%) of the researched area, and the most representative soil type from this class is the Vertisols.

Soils from the Salsodisols Class occupy an area of 6.60 ha (0.08%) of the researched area, and from this class the most representative type of soil is the solonc with two subtypes (gleyc and salinic).

The farm has an area of 149 ha, in the work I described the area of 28 ha, divided into 3 crops, wheat, corn and alfalfa.

The administrative territory of Sag commune contains areas that may be affected if environmental protection measures are not respected. In this context, by changing the morphology of the land through the works carried out, accidental spills of petroleum products, improper management of household, urban and industrial waste, or improper collection and

evacuation of generated domestic wastewater, the conditions for contamination of the soil and subsoil and the water table can be created.

As a result, the soil and the basement in the area of the plan are vulnerable if the environmental protection norms are not respected.

The General Urban Plan provides for the measures required to avoid the pollution of environmental factors.

The specific soil types found in the area of the plan, typical of the low plain, are: chernozems, leached chernozems, alluvial soils, cernic gleiosols, solonets and soloncacs, etc. Also in the plains, but on smaller surfaces, psammosols and colluvial soils are present

Representative soils from the commune of Șag, Timiș County, are represented in the following tables and graphs:

Table 1.

The main subtypes of Alluviosol

Soil class	Soil type	Subtype Area (ha)	Area (ha)	Area (%)
Protisols	**Alluviosols**	Eutric	1,551	18.51
		Gleyc		
		Mollic		
		Enthic		
		Vertic		

Table 2.

The main types and subtypes of Inksols

Soil class	Soil type	Subtype Area (ha)	Area (ha)	Area (%)
Cernisols	**Chernozioms**	Typic	513	6.13
		Gleyc		
		Cambic		
		Aluvic		
		Cambic-gleyc		
		Gleic salinic		
	Phaeozems	Typic	956	11.41
		Cambic		
		Gleyc		
		Aluvic		

Table 3.

The main types and subtypes of Cambisols

Soil class	Soil type	Subtype Area (ha)	Area (ha)	Area (%)
Cambisols	**Eutrica Cambisols**	Mollic	4,625	55.15
		Stagnic		
		Mollic-gleyc		
		Gleyc		
		Typic		
		Gleyc-saline		

Table 4.

The main types and subtypes of Vertisols

Soil class	Soil type	Subtype Area (ha)	Area (ha)	Area (%)
Vertisols	**Pellic vertosols**	Typic	167.44	2.00
		Gleyc		
		Argic		
		Entyc		

Table 5.

The main types and subtypes of Salsodisols

Soil class	Soil type	Subtype Area (ha)	Area (ha)	Area (%)
Salsodisols	**Solonetz**	Gleyc	6.60	0.08
		Saline		

The total area of the town is 8382.86 ha. In addition to the soils listed above, on the territory of this area there are also soil associations totaling 563.82 ha, i.e. representing 6.73% of the locality's territory and which are represented by psamosols, solonceacs, solonets, gleosols and stagnosols.

Of the farm's total surface of 149 ha, 28 ha was cultivated in an ecological system. Thus, mineral fertilizers and herbicides were not used and phytosanitary treatments were those accepted in ecological culture

Of the 28 ha, 10 ha were cultivated with corn, 8 with wheat and 10 with alfalfa in 2021, then in 2022, 10 ha were cultivated with wheat, 10 with corn and 8 with alfalfa. Alfalfa was sown gradually, 3 ha in 2018, 3 in 2019, 4 in 2020. Where at least 3 scythes were not obtained per year, alfalfa was shown and corn was grown instead (table 6.).

Table 6.

Organic crops and occupied areas within the farm,
from the period 2021-2022

Culture	Wheat		Maize		Alfalfa	
Anii	2021	2022	2021	2022	2021	2022
Area (ha)	8	10	10	10	10	8
Area (%)	5.34	14.9	14.9	14.9	14.9	5.34
Total, ha	13.34	24.9	24.9	24.9	24.9	13.34

The agricultural works are those practiced in the classic system and for corn, 2 mechanized harrows are made each to remove weeds, destroy the crust and aerate the soil.

The soil on which ecological agriculture is practiced is of cambic chernoziom type.

The productions obtained in the two years of study are close to those obtained in the conventional system and the maintenance of crops is carried out with lower expenses.

In the future, an extension of this ecological system to other crops is desired by increasing the cultivated areas. On soils with a lighter texture (psamosols, alluvial soils) it is desirable to cultivate autumn cereals (wheat, barley), without plowing, sowing to be done directly in the stubble.

Among the factors that led to the practice of ecological agriculture, with reduced negative impact on the environment (soil, water, microorganisms), are the following:

Farmers' age and agricultural education. Age (between 25-45 years) is one of the most important characteristics of farmers, young farmers being able and willing to apply everything they have learned, reduce pollution, ensure high quality products, without pesticides or other treatments and chemicals ;

On the other hand, the expertise and resources that old farmers benefit from could offer more opportunities to the young ones, to experiment with new technologies, varieties and hybrids that adapt more easily to current needs.

On the other hand, younger farmers are more inclined to accept new technologies compared to older farmers because they have benefited from more outside information and experience.

It was thus established that during the two years of studies carried out on the farm, there were a number of economic benefits following the practice of this type of agriculture (environmentally friendly - ecological agriculture), among which:

- lower expenses with precision agriculture techniques;
- food security due to the improvement of crop productivity in sustainable agriculture;
- saved energy by withholding fossil fuels whenever possible.

CONCLUSIONS

The commune of Șag is located at a distance of only 14 km south from the municipality of Timișoara and 3 km from the town of Parța, with an area of 8664 ha, of which 8419 ha are represented by agricultural land. The town is located on the right bank of the Timis river.

The studies were carried out on a farm that has an area of 149 ha, of which, starting from 2018, the area of 28 ha is cultivated in an ecological system. The farm is managed by a 34-year-old agricultural engineer. The transition period from traditional to ecological (conservative) agriculture is 7 years until the latter system balances out and production begins to increase.

To begin with, wheat, corn and alfalfa are cultivated, and in the future both the cultivated area and the range of crops will be expanded.

The soil cultivated in this system is of cambic chernoziom type.

In this farming system, crop rotation is very important, this being one of the factors that determined an expansion of areas and crops. The introduction of legumes and the future use of green manures in addition to the practice of direct sowing are desired. In the fall of 2022, along with the sowing of wheat, red clover was sown in a mixture with wheat on an area of 3 ha, to be used as fertilizer.

Crop rotation involves planting different types of crops in a certain sequence, ensuring crop diversity in sustainable agriculture and being a more rational approach to farming than monoculture.

Crop rotation practices contribute to soil and environmental sustainability, in particular, crop rotation minimizes compaction due to different root systems; supply nitrogen with nitrogen-fixing plants (biological nitrogen fixation for sustainable agriculture); helps in pest control as certain pest species attack their host crop types; reduces soil depletion; mitigate agricultural risks; avoiding unjustified chemical inputs; adds organic matter and stimulates the activity of soil biota.

Sustainable use of water in agriculture is achieved by planting crop species that use less water and implementing smart irrigation techniques. In particular, drip versus furrow (flood) irrigation requires 20-40% less water while getting 20-50% more crops.

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