

INFLUENCE OF PEDOCLIMATIC CONDITIONS ON AUTUMN CROP YIELDS

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Abstract. The paper presents the pedoclimatic conditions specific to a plateau area (Lipova Plateau) and their influence on the productions of three autumn crops, namely wheat, barley and triticale. This is a case study carried out over a period of three years in the area of Chesinț locality in Arad County. The paper addresses a topical issue, the recent climate changes (through the increase in temperatures, lack of rainfall, increased evapotranspiration, etc.), are increasingly leaving their mark both on the evolution of soils and especially on the growth and development of plants. The studied area is located at the intersection of the Arad-Lipova and Timisoara – Lipova county roads, on the border with Timiș County. A part of the territory of the locality is part of the Mureș river basin. In the period studied (2021, 2022 and 2023), the yields obtained varied from year to year for the three crops, the average yields obtained being 4100 kg/ha for winter wheat; 5200 kg/ha, for triticale and 3400 kg/ha for barley. The lowest productions were obtained in 2021 and the highest in 2023. This was largely due to a poor rainfall regime, especially during the period of grain formation and filling. Among the cultivated species, the largest differences were found in the barley crop. In conclusion, climate change is becoming more and more evident, the lack of snow, the increasingly high temperatures in winter, determine the taking of measures, such as: sowing to take place later (October 10-20), cultivation of varieties resistant to drought, diseases and pests, avoiding monoculture and introducing legumes into rotation.

Keywords: pedoclimatic conditions, straw cereals, productions, Chesinț

INTRODUCTION

In Romania, pedoclimatic conditions are favorable to agriculture, offering opportunities for the development of the agricultural sector, as intensive methods and industrialization have not yet reached the level of the West (MIRCOV V.D., ET AL., 2023). Compared to developed countries, Romanian farmers still do not take advantage of the untapped soil potential, which has led to the degradation of soil fertility. Thus, agriculture has a significant share in the region's economy and has favorable development prospects at European level (MIRCOV VLAD DRAGOSLAV ET AL., 2024).

The increasingly present pedo-climate changes will have an increasingly strong impact on food security at European level. At the level of the European Union, global warming is expected to generate undesirable effects, through the uneven distribution of precipitation and the increase in temperature. Europe is expected to benefit overall from small productivity gains in the crop sector, in parallel with regional variations. Northern Europe and the highlands (especially the Alpine regions) will initially see an increase in productivity and an expansion of crops and agricultural land, but the southern regions will be negatively affected by global warming and water scarcity. However, it is expected that these initial benefits will be outweighed by more frequent flooding and soil instability in the aforementioned areas (POSEA, GR., 2006).

In the medium and long term, Romania will be increasingly affected by climate change, which will have a major impact on the agricultural sector. Romania needs to prepare for the steady increase in annual average temperatures, according to forecasts for Europe, with possible variants between 0.5 °C and 1.5 °C by 2029 and between 2.0 °C and 5.0 °C by 2099, depending on the global scenario (BERZOVAN, ALEXANDRU 2017; MIRCOV, V.D., ET AL., 2022).

Rainfall patterns are expected to undergo significant changes and affect the territory of Romania differently. The northern part of the country will likely see an increase in crop productivity in the medium term, but will suffer from greater flooding in winter and water shortages in summer. The southern and southeastern regions of our country will suffer more severe consequences, and high temperatures and lack of rainfall will cause a general decrease in agricultural yield and production (BAN CORINA MONICA, 2000; PUȘCĂ I., 1998; MIHUȚ, CASIANA & NIȚĂ L. 2018).

Romania is among the countries in Europe that benefit from favorable pedo-climatic conditions to produce significant quantities of quality agricultural products, thus satisfying an important part of the domestic demand for agri-food products. Although it has a significant potential, the productivity in Romanian agriculture is low, signaling an underutilization of production factors compared to ideal levels (MIHUȚ, CASIANA ET AL., 2024). Used correctly, the current potential can lead to a more efficient use of agricultural labour, helping to reduce poverty and eliminate income gaps between urban and rural areas. Therefore, the foundations are laid for economic growth, efficient management of financial resources and the achievement of a positive trade balance (ALINCĂI C ET AL., 1994). The competitiveness of agri-food products must go hand in hand with the sustainability of the process of obtaining them. The losses suffered by the agricultural sector, especially by rural communities and the national economy as a whole due to extreme weather events, have been the main reason for increasing efforts in recent years in terms of active atmospheric interventions (IANOȘ GH., GOIAN M., 1992; IANOȘ GH., ET AL., 1994).

Compared to the EU average, Romania has a higher climate risk, which exposes agricultural crops to several extreme weather events, leading to significant production losses in almost all regions of the country. The most affected areas are: South-East, South-Muntenia, Bucharest-Ilfov and South-West Oltenia. Drought is the main extreme climatic phenomenon that affects agricultural crops in most regions of our country (FLOREA N., 1985).

Unlike the other areas of Romania, in the western part of our country, there are more pronounced influences of low pressure systems, generated over the Atlantic, which determines more moderate temperatures and richer precipitations (EREMI O., ET AL., 2024).

The purpose of the paper is to present the pedoclimatic conditions in Chesinț, Arad county and their influence on the productions of three of the autumn cereal crops, namely: winter wheat, barley and triticale.

MATERIAL AND METHODS

In the paper, the productions obtained from three autumn crops are presented, namely wheat, barley and triticale in the pedo-climatic conditions specific to Chesinț (Zăbrani commune) in Arad County over a period of three years: 2021, 2022 and 2023.

Both laboratory and field methods were used. We have carried out a series of individual studies using data from the OSPA Arad archive, from the Zăbrani City Hall, together with the specialized literature, including the monograph of the Zăbrani locality and the National Meteorological Agency.

To describe the locality, a series of data and information from the Zăbrani and Lipova City Hall, from the locals, were used, along with the information obtained in the field (TODUȚA GHEORGHE, ET AL., 2014; BORONEANȚ VASILE, BORONEANȚ ADINA, 2002).

The current methodology of qualitative evaluation of agricultural land uses the thermal resource as a multiannual average, which it corrects according to the slope of the land and the permeability of the soil, a method which, for scales equal to or less than 1:10 000, seems to be considered good for the time being.

For the specific conditions of the Banat Plain, numerous attempts have been made to correlate the production of different crop plants with the average annual rainfall, obtaining positive correlations, especially between the amount of rainfall and the corn harvest. For the researched area, the water resource, of approx. 600 – 650 mm, is optimal for soils with phreatic input and deficient for automorphic soils. Synthesizing the research on the manifestation of the influence of the thermal resource on the growth and production of different crop plants, D. Teaci and the team for the elaboration of the methodologies of crediting agricultural land within ASAS – ICPA Bucharest, have developed a series of nomograms of the conditions. As a matter of fact, it is important to note that the Creator of the Universe, the Creator of the Universe, is the Creator of the Universe.

RESULTS AND DISCUSSIONS

Chesinț is part of the Zăbrani commune, it is located in the Lipova plateau, in the south-eastern part of Arad county, on the border with Timiș county (figure 1).



Fig. 1. Geographical location of Chesinț locality at the level of Arad county on DJ 691

In the eastern part of the village of Chesinț there is a ditch bordered by a, which has a northeast-southwest direction, almost five kilometers long. Along the pier, from place to place, mounds appear, the highest being "Hunca". Since ancient times, the dam has been called "Trajan's Wave".

The studies were carried out over a period of 3 years, respectively the years 2021-2023.

Given the fact that the village of Chesinț is located at an altitude between 181 and 217 m, the soil cover was mostly represented by eutricambosols, luvisols and preluvisols, predominantly the preluvisols, which occupy over 70% of the studied area, followed by luvisols, with 26% and whose spread is at altitudes of over 200 m.

The climatic conditions recorded in the period 2021-2023 were different from one year to another, as well as during the vegetation period, as can be seen from the data presented in Table 1.

Table 1.

Climatic conditions in the Chesinț area, Arad county in the period 2021-2023

Years/ Phenophase	Sowing - sprouting period (IX-X)	Autumn - winter period (XI-III)	Period of intense growth - flowering (IV-V)	Grain filling period (VI)
2021	120.2	131.0	65.2	58,8
2022	127.4	137.2	68.3	72.6
2023	173.2	253.4	110.8	75.4
Multi-year average	140.3	173.9	81.4	68.9

The studied area is 24 ha.

The main crops are: wheat, barley and triticale.

In Table 2. The main crops and cultivated areas (in ha and %) taken in the study are shown.

Table 2.

Crop range and area occupied

Culture	Occupied area		Total area, in ha
	Ha	%	
Wheat	10	41.7	24
Barley	6	25	
Triticale	8	33,3	
TOTAL	24	100	

During the period under study (2021-2023), the situation is as follows:

In wheat, the Anapurna – C1 variety was cultivated, using a seed quantity between 220 and 250 kg/ha. Larger quantities (240-250 kg/ha) were applied on the luvosol and smaller (220-230 kg/ha) on the preluvosol.

In 2020, 20t/ha of manure was applied and in the vegetation, mineral fertilizers were applied fractionally.

The preparation of the seedbed was done through several passes using the disc and applying 250 kg/ha of complex fertilizers of the type: NPK 15-15-15.

At the start of vegetation (mid-February) an additional fertilization with Nitrolimestone was also applied at a dose of 150 kg/ha.

The last fertilization was done before the bellows phase, when we applied 150 kg/ha (NP 27:13,5).

For barley, the Andreea variety was grown. The land preparation was carried out in the same way as for the wheat crop, and the yields obtained were between 1860 and 3900 kg/ha, as can be seen from the data presented in table 3.

Two varieties were cultivated in triticale, Negoiu and Haiduc, each variety was cultivated on 4 ha of the 8 ha cultivated with triticale.

In 2021, before ploughing, immediately after the land was freed from the previous crop, manure in the amount of 30 t/ha was applied, then ploughing was carried out at 22 cm.

During the 3 years taken in the study, in September, the seedbed was prepared and starting with 2022, 200 kg/ha of complex fertilizers of the 15:15:15 type was applied to the triticale crop, and in 2023, 250 kg/ha. Mineral fertilizers were also applied in winter, respectively towards the end of February, when the amount of fertilizers was supplemented with 150 kg/ha of Nitrolimestone in 2021 and 2022 and 200 kg/ha in 2023.

As for the productions obtained for wheat, barley, triticale crops, they are presented in table 3.

Table 3.

The productions obtained from the main crops on the farm in Chesinț

Culture	Yields in kg/ha			Average of the 3 years
	2021	2022	2023	
Wheat	4100	3900	4300	4100
Barley	3000	3500	3800	3433
Triticale	5000	5100	5500	5200

As can be seen from the data presented both in Table 3. and Figure 2., the highest productions were obtained in 2023, in all three crops, while 2022 was the year with the lowest productions.

The situation each year is different depending on the crop, namely: In 2021, high productions were obtained for straw cereals, respectively wheat and triticale.

In 2021, the highest productions of 4300 kg/ha were obtained for the winter wheat crop and the lowest for barley, where 3000 kg/ha was obtained.

In 2022, the productions were between 3500 for barley and 5100 for triticale while 2023 was the year with the highest productions of all three cultivated species. The average production during the three years was 3433 kg/ha for barley, 4100 kg/ha for wheat and 5200 kg/ha for triticale, respectively.

CONCLUSIONS

The studies were carried out over a period of 3 years, respectively 2021, 2022 and 2023, in Chesinț, Zăbrani commune in Arad County.

Chesinț is part of the Lipova Plateau and is located in the southern part of DJ691, 4 km from Zăbrani commune, 5 km from Neudorf and 12 km from Lipova city.

In the study, the area of 24 ha was taken. The type of soil identified was represented by preluvosol and luvosol and the main crops studied are: wheat, barley and triticale.

The average yields obtained in the studied period were different from one year to another depending on the climatic conditions and the amount of precipitation that fell during the vegetation period. Higher yields were obtained in 2023 and lower yields in 2021. The average over the studied period was 3400 kg/ha for barley, 4100 kg/ha for wheat and 5200 kg/ha for triticale.

Considering the fact that pedoclimatic conditions have a great influence on crop plants and especially on the productions obtained, it is desired that in the future these studies and research will continue and other types of soil and crops will be taken into study.

Among the main measures recommended to increase the productive potential we list:

- expansion of the areas occupied with legumes (alfalfa, clover, soybeans);
- carrying out on time and according to the pedoclimatic conditions specific to each year specific agrotechnical works that place a higher emphasis on the accumulation and maintenance of water in the soil;
- application of organic fertilizers in larger quantities and fractionation of mineral fertilizers over a longer period;
- avoiding monoculture as much as possible;
- the application of a rational rotation.

Application of irrigation systems or modernization of existing ones;

Cultivation of varieties and hybrids that adapt as best as possible to the pedoclimatic conditions specific to this area.

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