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THE INFLUENCE OF THE WESTERN PLAIN TOPOCLIMATE ON CEREAL AND CEREAL DERIVATIVE PRODUCTION QUALITY AND QUANTITY

A., OKROS[1], Georgeta POP[2]
[1,2]Banat's University Of Agricultural Sciences And Veterinary Medicine„King Michael I Of Romania"From Timisoara
Aradului Boulevard,Nr.119
adalbertokros@yahoo.com

Abstract. *By ecologic factors we understand the total abiotic and biotic factors with which an organism comes in contact, interconditioning each other. Ecologic factors are classified according to various criteria: where they pertaining to, physiological-chemical structure, way in which they act a. o., a fact demonstrated by numerous presentation coming in speciality literature. The simplest classification divides ecologic factors in abiotic (pertaining to the physical-chemical environment) and biotic (pertaining to living organisms) factors, based on the classical criteria of presence or absence of life. This classification is considered to be divided due to the dialectic influence and determination of most factors. For example, climate is influenced by the vegetal carpet, while the vegetal carpet is influenced by the climate. According to B. STUGREN (1975) abiotic factors remain only sun radiated energy, gravitation, tides, geotectonic factors. Environmental factors are only biogenic and abiogenic, that is depending on biotic or abiotic components (B. STUGREN 1975). One of the widest spread ecologic factor presentation schemata is based on their pertaining to the great subsystems of Terra: climatic factors (temperature, light, precipitation, etc.), orographic (relief forms, exposure, sloping), edaphic (soil characteristics), biotic (living organism activity), anthropic (Human actions). According to MENDEHASKY (1958,1962), R. DAJOZ (1985) and F. RAMADE (1991) there are: primary periodic factors determined by the succession of night and day and seasons succession (the day-night alternation determined the circadian rhythms and the winter – summer alternation season rhythms in plants and animals), secondary periodic factors whose cyclic variation depends on primary periodic factor variation (atmospheric humidity depends on temperature) and non-periodic factors which does not normally exist in the habitat of living beings but occur randomly and suddenly change life conditions (volcanic eruptions, violent storms, fires, human actions) and for which living organisms are not equipped. Finally, the simplest ecologic factor classification is that of natural and anthropic factors.*

INTRODUCTION

The study of the climatic and pedological vegetation and relief ensemble in our country, as well as of the vegetation factors, allows people to acquire knowledge about their relationship with crop plants, their needs regarding the environmental conditions. Based on these findings ecologic crop zoning was initiated and perfected, which means establishing favourable zones for plants, based on the confrontation of natural area conditions with the biologic plant requirements.

Zoning actually means crop distribution in those biogeographical territories where they benefit from conditions favourable for a high and constant annual crop. Ecologic zoning respects the basic principle of ecologic optimum that is the optimal relation between agricultural crops and ecologic factors. Zoning also depends on other elements: general geomophological frame, hydrographic frame.

When referring to agricultural crop zoning works, climatic factors represent a priority, and only after delimiting the so called "topo-climatic" zones or topo-climatic maps the soil factor is taken into account. Of course, temperature and humidity play a fundamental role in zoning, by highly influencing the distribution of crop vegetation.

Ecologic zoning insures: production growth, capitalization of the biologic and productive cop potential in a certain area, harvest stability, capitalization of climate and soil resources, identifying the ecologic potential of a region, territory or locality; establishing priorities for an eventual ecologic reconstruction of polluted and degraded areas.

Zoning makes data available for the foundation of the decision act referring to the ecosystem, biotope and biocenosis management.

MATERIALS AND METHODS

For the topoclimatic description of the area we used data supplied by the Western Plain Meteorologic Stations, data supplied by OSPA Timisoara, field observations and measurements.

RESULTS AND DISCUSSIONS

Temperature as a vegetation factor. Temperature influences directly, or in correlation with other vegetation factors, the development of fundamental processes in plants and soil.

The plant requirements for warmth oscillate depending on crop species, variety or hybrid, in close correlation to the vegetation stage and various plant organs.

According to requirements for temperature, plants are divided in three groups:

- microthermal plants, with thermal requirements ranging between 0-15°C;
- mesothermal plants, with requirements between 16-40°;
- megathermal plants, with thermal requirements higher than 40°C.

Plants cultivated in our country belong to the mesothermal group.

The main soil warmth source is solar energy with a value of 1.94 cal/cm2/min.

Of the normal warm quantity produced by the sun, only 0.6-0.8% warms the soil. That is because over 40% of the solar energy is lost in inferior atmospheric layers, rich in dust, clouds and fog, and 10% is reflected off the soil surface into the lower atmosphere.

Soil temperature is very different from one place to another, given the influence of numerous factors: relief (altitude, slope, exposure, position in relief), land nature (covered in vegetation or not, smooth or rolling, aired or compacted, covered in snow or not, colour), soil components (humidity, aeration, texture, organic matter content).

Light as a vegetation factor. Light is essential for the photosynthesis process, solar light energy being transformed in biochemical energy during the process. In the presence of light and chlorophyll, carbon dioxide absorbed by the leaves from the air and water absorbed by the roots form more and more complex organic substances (initially monosaccharide, ulterior polysaccharide).

The vastness of the photosynthesis process is amazing. It is estimated that approximately 1300 billion tone carbon dioxide, resulting in 80 billion tone carbohydrates. A simple example shows that in the case of a hectare corn with a 5000 kg grain production, the photosynthetic activity results in the accumulation of 3400 kg starch, 500 kg protein and 200 kg fats, whose energetic value exceeds 75 million kj (Burzo I. et al, 1999).

The energy necessary for the photosynthesis comes from the sun, which practically represents a free, inexhaustible source. Solar energy has accumulated during geologic eras in immense quantities, resulting in organic deposits; the humus also comprises a large quantity of solar energy.

Light influences plants through intensity, duration and quality.

Water as a vegetation factor. For the life of plants water equals other factors in importance, but occupies a special place under the pedoclimatic conditions in our country.

Water represents a plant internal environment, participating in their metabolism. Oxygen and hydrogen – the two water components – largely constitute the structure of organic matter synthesised by the plant. As an environmental element, water participates in the dissolution and resolution of soil compounds, the transport of nutritive substances in the soil and the plant as solutions and mediates the nutritive substance assimilation in the plant.

Participating in plant metabolism, water is directly involved in fundamental processes of the vegetal world: photosynthesis, respiration and transpiration (SALISBURY AND ROSS, 1991; SEBQANECK, 1992).

Plants assimilate a larger water quantity than needed for the nutrition functions, the water excess being eliminated through the transpiration process.

The transpiration factor values vary from one species to the other, from one area to the other, and inside the species from one variety or hybrid to the other

From the point of view of plant adaptation to the water factor, they can be classified as follows:

- xerophileous plants which are adapted to grow in extreme drought conditions, like cacti;
- hydrophilic plants which prefer to vegetate in excessive humidity, like rice;
- mesophilic plants, adapted to moderate water quantities, like all annual plants grown in our country, except for rice.

Edaphic factors and the ecologic role. One must remember the fact that, unlike old theories, which claimed that the soil is the plant support, today everybody accepts the view point according to which the soil is an environment where one can find living organisms (microflora and flora, microfauna and fauna). Specific processes take place in the soil, namely: assimilation and dissimilation, synthesis and organic substance breakdown, energy concentration and emission.

Soils, in the course of their formation and evolution have acquired specific characteristics, which influence differently the biocenoses structure.

A first essential characteristic is the soil reaction (pH). It can oscillate from highly acid to highly alkaline (pH = 3-10.0). Depending on the soil pH:

- on acid soils humification is facilitated, as well as microbe and enzyme activity, N, S, P, B, K mobility is reduced;
- on alkaline soils Fe, Mo, PO4 assimilation is reduced.

Another important soil characteristic is the salt content. According to the plants behaviour when facing an increase of the salt content (NaCl), they are classified in three groups:

- plants which do not like large salt quantities (green peas, peach tree, apple tree, cherry tree, lemon tree, orange tree);
- plants with average salt tolerance level (< 0.35% NaCl) (barley, wheat, oat, lucerne, sun flower, corn, tomatoes, spinach);
- plants with high salt tolerance level (> 0.65% NaCl) (oat, sugar beet, mangel-wurzel, sorghum, sudan grass, bird seed).

Soil enrichment with (harmful) salts takes place:

- in areas with arid climate, where salt occurs as a natural consequence of lack of precipitations which facilitates evaporation and their being raised on the soil surface;
- In areas with humid climate, salts occur only in salt water springs which solubilize salt deposits or at the seaside where the sea water sprays.

One should remember CTS (total salt content) represents an ecologic factor limitative for plants.

Another soil characteristic is texture (granulometric composition, relation between clay, dust, sand). this characteristics links to physical characteristics (structure) and hydrophysical ones (soil water capacity).

Soil water comes in several shapes:

- hygroscopic water – strongly linked to soil particles;

- capillary water – occupies soil pores;
- gravitation water – slow free discharge.

Soil water supply from the surface underground water layer receives a special significance, being able to influence the biocenosis (hydrophilic, mesophilic and xerophilous plants).

The presence of humus and accessible nutritive plants, are essential for plants. These characteristics keep the soil apart from the parental rock from which the soil was formed. Humus formation, one knows, originates in dead organic substances in the soil, transformed in a complex by animals, fungi and microorganisms from the soil.

In the soil, a permanent humus forming process (humification) develops, as well as its breakdown (mineralization or dihumification) with useful nutritive substance release. Nutritive substances are represented by salts: ammonium, nitrates, phosphates, sulphates, bicarbonates etc.

In relation to the soil humus and nutritive substance content, specific biocenosis was created, with a special structure. For example, on nitrogen rich soils, there grow mostly great nitrogen consuming plants (*Datura stramonium, Amaranthus retroflexus, Urtica dioica*).

Soils stand out through a certain heavy metal content. The heavy metal group includes all metals with a density higher than 5 (Fe, Mn, Cu, Zn, Mo, Co, Hg, Pb, Cd). Some of these are necessary for plants as microelements.

Heavy metals are found naturally, in places where, in the surface layers, occur geological layers with a rich heavy metal content.

But soils can be enriched (loaded) with heavy metals due to human activity (in area limitrophe with extraction, industrial and metal processing activities) due to deposits in the soil.

The Western Plain represents a consequence of the Panonic lake retreat, which left a wide an insalubrious marsh area behind (GRISELINI, 1779 in ŢĂRĂU & LUCA, 2002), which exist since the end of the 18th century. (ROGOBETE G., 1985). The lake colmation was produced by sediment depositing (marl, clay, sands and pebbles deposited alternatively and covered in a loess layers, alluvial and delluvial deposits) brought by rivers since the Neogene era until recent times. The plain became dry land, tiering successively during the Pleistocene (high plains, situated in the vicinity of hills and made up, at the surface, from sands, pebbles and loess) and Holocene (low divagation plains, and grasslands, made up at the surface from recent alluvia) (MÂNDRUŢ, 1993).

Due to the great relief diversity and its influence on the climate of the Timiş county, a topoclimatic zoning of the territory was undertaken, which should express as well as possible pedogeographic and geobotanic conditions of the respective area.

In the lower plain one can find 5 topoclimatic types:

- Sânnicolau Mare topoclimatic type;
- Biled-Banloc topoclimatic type;
- Cenei topoclimatic type;
- Timişoara topoclimatic type;
- Lugoj topoclimatic type (Timiş-Bega golf Plain).

In the higher plains there are 3 topoclimatic types:

- Maşloc topoclimatic type;
- Orţişoara topoclimatic type;
- Gătaia topoclimatic type.

The hill area presensă two topoclimatic types:

- the low mountain and high hill undertier (between 500 and 800 m altitude);

- the low mountain and low hill undertier (under 500 m altitude) (GHIBEDEA, 1973).

The Sânnicolau Mare topoclimatic type is found in the north-western of the county, with a climate resembling the steppe one, with a multiannual average temperature of 10.5 °C and many tropical days (40). During the last years, the average annual temperature has exceeded this value, reaching 11.1 °C in 2006.

The Biled - Banloc topoclimatic type overlaps the Torontalului Plain. The thermal regime relatively resembles that of the Sânnicolau Mare topoclimate. During the last years, although the months January and February have been colder (-5.2 °C in February 2005, as compared to the multiannual average of 1.3 °C), December registered a raise of average temperatures (2.6 °C in 2004, as compared to the multiannual average of 0.9 °C).

The topoclimatic particularity is given by the varied precipitation distribution on reference intervals: 80 - 90 mm in September and October, 210 – 220 mm in the interval November - March and under 200 mm in the interval Mai - July. The months which registered the least rain were March (in 2003 and 2004 – like the multiannual average) and October – November (in 2005 and 2006).

The Cenei topoclimatic type presents a thermal regime similar to the Biled – Banloc topoclimatic type, being characterized by a much more uniform precipitation distribution, especially during the periods of agricultural interest.

The Timişoara topoclimatic type is specific for the silvosteppe area. The annual average temperature is high (10.6 °C), and during the last years it was exceeded, showing 11°C (2003) and 11.s1 °C (2004, 2006).

Average precipitation quantities exceed the 600 mm limit (600.9 mm), being very close to the multiannual county average, and their distribution on characteristic periods is superior to the former topoclimates (IX - X = 80 – 90 mm, X – III = 210 – 220 mm, V – VII = 200 – 210 mm). The only period with a humidity deficit is autumn (PUŞCĂ, 2001).

Topoclimates of high plains

The topoclimates of high plains are situated in the transit area between silvosteppe and forest, sharing many common elements with the Lugoj topoclimatic type. There are also some differences owing to the higher relief and conjunctural atmospheric circulation.

Most topoclimatic types identified in the high plains present similar thermal characteristics, with annual average temperatures ranging between 10 and 11°C and close seasonal and monthly oscillations. Differentiations generated by a varied pluviometric regime divide them into:

The Maşloc topoclimatic type is specific for the eastern Vinga High Plain area, with annual pluviometric averages of 627.3 mm (at Maşloc) and pluvial water quantities, usually sufficient in the characteristic periods: IX - X = 90 – 100 mm, XI - III = 220 - 230 mm and V - VIII = 210 – 220 mm.

The Orţişoara topoclimatic type area of the Vinga High Plain and is characterized by a much lower annual precipitation average (500.7 mm), it could be considered the drought pole of the county. Regarding the precipitation quantity distribution on characteristic periods, lower values are registered, especially during the intervals V - VII (200 – 210 mm) and IX - X (80 – 90 mm).

The Gătaia topoclimatic type overlaps the Gătaia High Plain. The annual average precipitation quantity and its distribution on characteristic periods does not differ from the Maşloc topoclimate. Still, the specific area soils present a more reduced permeability and a high capillary porosity, a fact that facilitates the accumulation of a larger water quantity, water which can prevent, for a time interval, the drought phenomenon (GHIBEDEA et al., 1972).

Hill topoclimates

Hilly areals are characterized by a more moderate climate, with temperatures ranging between 9.3 – 10.3 0C, soft winters, frequent thermal inversions in depression areas, and long, warm summers. The relative air humidity is higher, due to the cold air which comes down from higher surrounding areas. Atmospheric precipitations are more abundant as compared to the western peripheral areas due to humid air masses blocked by the mountain heights (734 mm at Făget). During characteristic intervals they exceed 100 mm during the IX - X period and 220 - 230 mm during the XI - III and V – VII intervals.

CONCLUSIONS

By knowing the Western Plain topoclimates we can achieve a much more optimal crop zoning.

Zoning represents the distribution or positioning of crops in those regions where they can have ecologic conditions favourable for forming a stable harvest, in order to highlight their natural production potential. Zoning harmonizes crop plant requirements and their biologic particularities with their environment, it respects the ecologic optimum, by that we mean th relation between crop requirement and environmental factors.

Agricultural areas (territories, regions). They have been established according to the ecologic principles stated above, to the convergence between crops and their biographic frame, the analysis of areal and local resources. The areas are characterized by ecologic factor structure and dynamics, the biodiversity and the surfaces destined for crop plants.

Zoning is conditioned by the identification of a cultivated region's biologic and ecologic potential, the capitalization of soil resources, the geomorphologic, hydrographic and climatic frame. Similarly, one has to bear in mind the foundation of the decision act regarding ecosystem and crop management.

Romania is part of the temperate climatic belt of the northern hemisphere, where productive horticultural areas formed, comprising a great diversity of species and crop systems. That is why, the pedo-climatic resources must be used with a maximum efficiency, in the sense that a permanent monitoring is required.

Ecologic theories are a part of the zoning activity and are established on the basis of a study of ecologic conditions, the convergence of crop and biogeographic frame, and the soil and climatic resource analysis. The theories are characterized by ecologic factor structure and dynamics, species and variety diversity and the surface they are grown on.

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