THE EFFECT OF AGROMETEOROLOGICAL CONDITIONS ON APRICOT GROWTH AND FRUIT BEARING

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Abstract *The current study will present the effect of the main weather conditions on the growth and fruit bearing in apricot tree. Within this framework, an analysis is made into the geographical distribution of the main characteristics of the temperatures, precipitation as well as insolation during the spring season with the respect to the flower-cladding and the effect of low April temperatures upon fruit bearing. Considering the fact that the study of the peculiarities of each variety of apricot is a complex process and due to the bioclimatic conditions, that must be met in order to have both a qualitative as well as a quantitative culture, the meteorological characteristics play an important role in the growth and fruiting of the apricot. The purpose of this article is to analyse the agrometeorological characteristics of the fruit bearing seasons for the western part of Romania. By analysing both the synoptic and the agrometeorological indices, a framework can be established in order to present a pertinent study in the field of agrometeorology with high regard on apricot growth and fruit bearing. The analysis of severe weather events associated with early to late spring solar radiation is also presented in this paper because of the negative effects of hail and it is included in the final framework of this study.*

Keywords: *agrometeorology, climatology, agriculture, fruit bearing, western Romania*.

INTRODUCTION

Considering the wide range of apricot varieties with different prices and which ensure the supply of the market with fresh fruit for a long period of time, the study of their bioclimatic features is of interest at the level of the national economy. Also, for the works of zoning and microzoning of varieties and in establishing the most effective methods of preventing and combating negative meteorological elements, this study is of particular importance (BERBECEL & NEACŞA, 1979).

In this paper, the main areas of economic apricot cultivation in western Romania will be presented, as well as the particularities of the main meteorological factors with a decisive influence on the productive potential of this culture. The commercial apricot cultivation centres are located both in the south and in the west of the country. For this study, only the cultivation centres from the western part of Romania will be presented.

In the west of the country, the main basins are found in the Oravita and Crasna-Jer Depressions, the Ciacova and Arad Depressions, the High Plain of Oradia, the Secuieni-Carei Plain, the Timiş Plateau, Sînpetru-Pecica, Peregru-Curtici. The most important apricot cultivation centres are in Ciacova, Giarmata, Timisoara, Arad, Oradea, Valea lui Mihai, Carei (TOPOR & STOICA, 1965; ŞERBAN, 2010).

During the winter, under the influence of the intense activity from the Mediterranean Sea, there are frequent intrusions of warm air from the southwest, especially in the Banat sector of the Western Plain, which causes intense heating, accompanied by thawing, overcast weather and precipitation in liquid form. For this reason, the winter phenomena have a reduced duration and frequency (BLUESTEIN, 1993; SANDU ET AL., 2010).

MATERIALS AND METHODS

The relatively mild winter and earlier spring favour the resumption of vegetation in these orchard basins, much earlier than the other areas of the country. That is why the frosts and especially frosts of spring and autumn, although not very often, are more dangerous for apricots (BERBECEL & STANCU, 1970; POPA & TEODORESCU, 1990).

The thermal and pluviometric anomalies are less pronounced compared to the other lowland areas, which shows a stability of crop yields from one year to the next. As negative phenomena, we can mention the excess of moisture on the soil surface, on the low and poorly drained lands in the first half of spring, which causes slow and abnormal apricot vegetation. Thus, the fruits remain small, ripen late or not at all, and the trees weaken, easily falling prey to parasites. In these areas, apricots represent approximately 9.8% of the total of apricots in the country, meeting frequently and sub spontaneously. The most widespread varieties are Louisette in the Banat area and Ambrosia in Crisana (TEODORESCU ET AL., 2021; IRIMIA & PATRICHE, 2012).

The altitude, the exposure of the land and the location on the slopes are equally important factors for the success of the apricot tree. Regarding the location on the slope, in the area of the subcarpathian hills, the most favourable situation is the middle third, that is, especially the area in the south of Moldova, Dobrogea and in the entire steppe area, on the banks of the Danube, in the first and second terraces (MĂNESCU ET AL., 1977; POPA ET AL., 2015).

By highlighting the evolution of the meteorological conditions with the biological requirements of the apricot in different phases and the stage of development, a series of indices characterizing the duration of the different phases of vegetation, the formation of the vegetative mass and of production. Thus, the year 2020 was studied for the apricot plantations in the south and west of the country, analysing how the special agrometeorological conditions of this year's spring influenced the processes of debudding, flowering and finally fruit production.

RESULTS AND DISCUSSIONS

The spring of 2020 started in significantly different agrometeorological conditions compared to previous years. Thus, the drought installed since the fall of the previous year continued in the spring. The high temperatures, recorded during the month of February, as well as the partial restoration of soil moisture, generally stimulated the biological processes of the fruit trees.

Given these conditions, the resumption of vegetation was uneven, depending on the area and soil. In the plantations in the west of the country, as a result of the long drought, when spring came, it was noticed that a fairly large percentage of flower buds were affected (approximately 50%), locally, even some of them withered. Plantations from Moldova and Bărăgan performed better, where the resumption of vegetation took place with some delay compared to the rest of the areas.

The meteorological conditions characterized by the lack of humidity and low temperatures from the first part of March continued with a noticeable warming, the maximum air temperatures reaching 20-25°C, so that at the end of March the thermal regime was in a considerable advance compared to multiannual average values. The biggest thermal advance, for about two weeks, was registered in the western areas, followed by the southern areas, being less in Moldova (POPA ET AL., 2007; TEODORESCU ET AL., 2021).

As a result, apricot budding occurred earlier throughout the country, which determined a lower resistance to the low temperatures that followed in April. The negative effect of this cooling was felt especially on the plantations in the valleys and depressions, on the slopes with eastern and south eastern exposure (MĂRĂZAN ET AL., 2020).

In the plantations in these areas, the flower buds of the trees more advanced in the vegetation suffered, so the flowering rate was slowed down, and some disturbances in the pollination process were noted. From the observations made in a series of apricot plantations on the territory of Romania, it appears that the flowering rhythm took place in a longer interval compared to the average duration of this phase (table 1).

The highest rate was recorded in the interval without precipitation and with high temperatures, with the decrease of temperatures below the multiannual average value and the presence of rains. Thus, flowering suddenly stagnated, extending by an average of 5 days depending on the area.

Table 1

The duration of the period from the swelling of the buds to the flowering of the apricot - Ambrosia variety

Station	Flower buds swelling (date)	Debudding of flower buds (date)	Bloom		
			Beginning	End	Duration (days)
Craiova	28 III	30 III	6 IV	12 IV	7
Marculesti	28 III	2 IV	8 IV	12 IV	5
Bucuresti	25 III	3 IV	8 IV	15 IV	8
Valul lui Traian	24 III	26 IV	8 IV	24 IV	13

In the case of the Louisette variety, whose flowering was recorded before the change of weather, it lasted 6 days, the rhythm evolving quite close to optimal. The precipitation that fell in the second part was both in the form of rain and snow. Thus, around April 15, when the apricots were in full bloom, there was snow and sleet accompanied by strong wind, which caused a massive fall of the flowers, approximately 40-60%. Also, another effect of this cold and wet weather was the appearance of the Monilia attack on shoots, leaves and fruits, an attack reported in the great majority of apricot plantations in the west and south of the country. The incidence of hail was due to the western circulation and the advection of cold northern continental air. The instability of the air masses produces air mass thunderstorm and, if conditions are good enough, hail might form and fall from the convective cloud (COOMBE, 1987; REX, 1950).

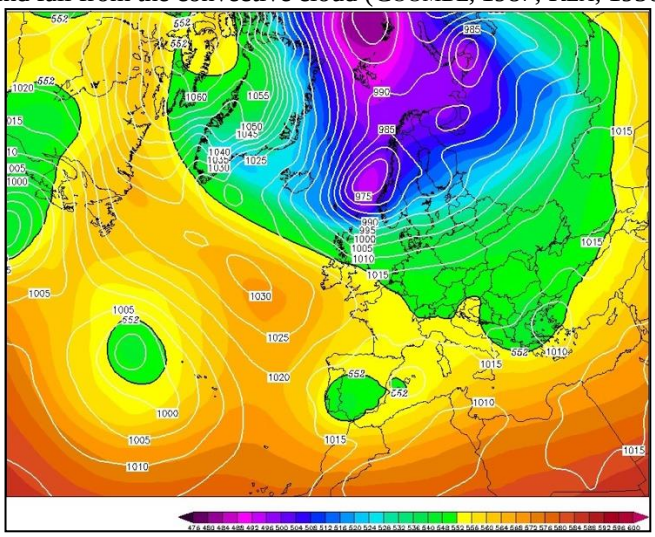

Figure 1. The geopotential field at the level of 500 hPa from April 2, 2020, 06.00

During the period of shoot growth and fruit setting, the weather was 3-4°C colder than the multiannual average values and with abundant precipitation in most of the country. Thus, shoot growth and fruit setting did not have favourable conditions. The growth of shoots was achieved at a fairly low daily rate, over a different period, depending on the age of the plantation, namely approximately three months for plantations younger than ten years and two months for those over 16 years old.

From the research in the literature, it emerged that the thermal index specific to this period varies depending on the age of the plantation between 30 and 50°C as a sum of degrees necessary for the growth of one centimetre of shoot. For the plantations studied, the average shoot length recorded this year was lower, i.e., 8-24 cm, compared to the optimal length of 30-40 cm. It follows that the growth rate of shoots reached a maximum during May, after which the rate dropped suddenly and then became stagnant.

The evolution of the meteorological conditions during the summer, in some orchard basins in the south and west of the country, did not allow the growth of the second wave, the weather being sunny and dry. Also, in some plantations in Oltenia, due to the high temperatures, the lack of humidity and the strong wind, the leaves reduced their turgidity and twisted during the day. Locally, several cases of drying of trees were also encountered. The fruits ripened in the second decade of July. The sizes of the fruits were different depending on the area, the current agrometeorological conditions as well as those of the previous year.

Although the weather conditions were favourable during the growth and ripening of the fruits, the production per tree was generally below the potential of the areas, as a reflection of the unfavourable weather during the period of flowering and fruit set.

CONCLUSIONS

From the analysis of the influence of agro-meteorological conditions on the apricot, several conclusions emerged that must be analysed over a longer period. Thus, the warm air advections in February weaken the resistance of flower buds and represent difficulties regarding the resistance process of flowers to temperature variations. Also, good productions can be obtained when the April-June interval is less humid, and the summers are warm and dry.

It is also recommended the zonal delimitation of the production prospects since the budding periods. An important aspect in the case of 2020, i.e., the early resumption of vegetation determined a weakening of the resistance of flower buds. Although the flowering period of the year 2020 was extended compared to the average values as a result of the meteorological conditions of that year, i.e., due to the alteration of dry periods with cold and wet periods, it is also considered that an increase in shoots took place at a slower pace, and their growth in length was reduced.

It is mentioned that this work represents only the beginning of a wider study in the field of agrometeorology with special attention on apricots, but they will continue in the next period to try to determine specific indices of the different phenological stages and the influence of meteorological conditions on the processes of fruit binding.

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