THE WATER REQUIREMENT OF THE SUNFLOWER CROP IN ARAD COUNTY

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Abstract. *The sunflower (Helianthus annus) is a plant native to North America spread all over the globe especially for obtaining oil. The oil extracted from the seeds is significant and is characterized by a pleasant color, taste and smell, they have a high content of vitamins (A, D, E, K) and the oil preserves very well for a long period. The sunflower is a plant with high water requirements during certain periods of vegetation with a transpiration coefficient of 480-580. At the same time, it is also a plant with a high resistance to drought. As for the plant's high water requirements, that starts from the second half of June to the first part of August. During these two months the requirements are very high, water consumption represents approximately 65% of the total. During this period the sunflower goes through three critical stages for moisture. In the analyzed period 2019-2021, we can see that the warmest year of the three years was 2019, with an annual average of 12°C. All three years under study exceeded the multiannual average of the normal temperature, they were warmer years. The driest year was the year 2021. It is recommended to use irrigation systems to obtain a fairly balanced and high-quality harvest for years with a deficit in precipitation during the growing season, for example 2021, when the amount of precipitation during the growing season it was very small.*

Keywords*: sunflower, oil, water consumption, drought, irrigation*

INTRODUCTION

The sunflower (Helianthus annus) is a plant native to North America spread all over the globe especially for obtaining oil. The oil extracted from the seeds is semi-drying and is characterized by a pleasant color, taste and smell, they have a high content of vitamins (A, D, E, K) and the oil preserves very well for a long period.

The largest sunflower growing countries worldwide are: Argentina with a cultivated area of approximately 3.75 million hectares, India with a cultivated area of 2.2 million hectares, the U.S. with an area of 1.4 million hectares. These areas are currently increasing year by year for its demand.

From domestic production, the entire requirement of edible oil is achieved, with the country also having availability for export. Romania is one of the largest producers of sunflower oil in Europe.

The plant's high water requirements start from the second half of June until the first part of August.

In the period from rise to the appearance of the inflorescence, sunflower calathids consume around 20-25% of the total. To be able to determine the normal vegetative growth of plants, soil moisture must be moderate.

During these two months the requirements are very high, water consumption represents approximately 65% of the total. During this period, the sunflower goes through three critical stages for moisture. The first critical stage is the emergence and formation of calathids, the second critical stage is at flowering and the third is at the formation and filling of seeds.

Lack of water in critical periods leads to loss of seed quality and quantity. In the first critical stage, in the absence of water, calathids will have a much smaller diameter with fewer flowers. The formation of carbon hydrates is hampered, leading to a decrease in oil content.

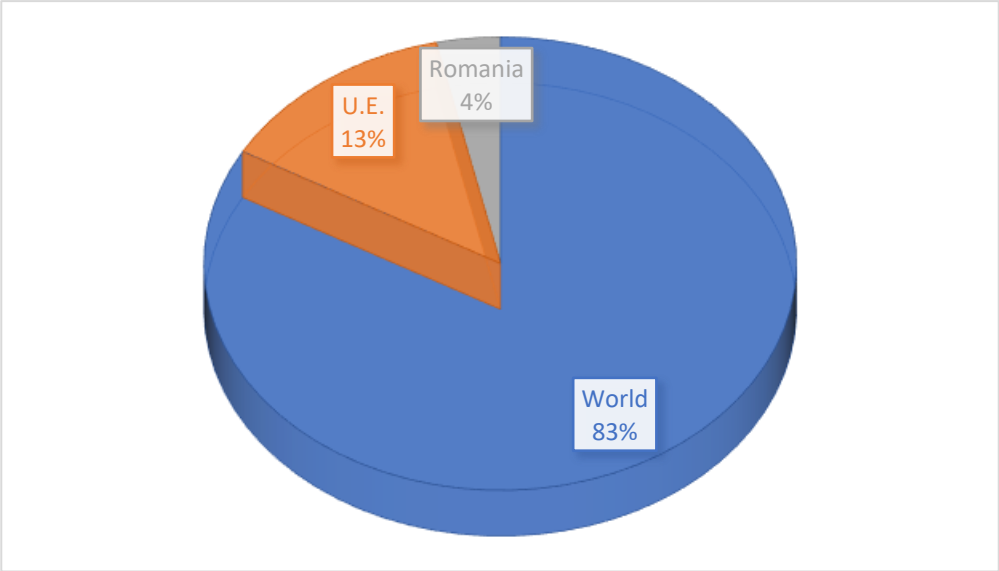

Figure 1. Cultivated areas

AT sunflower, water consumption varies throughout the vegetation period depending on the critical phases of the plant. During April-May, water consumption is much lower than in the months of June-July. The critical period begins with the formation of calathides when the plant has almost double the consumption compared to the first part of the vegetation.

MATERIAL AND METHODS

Determining the amount of water to be administered to agricultural crops can only be done based on prior knowledge of the total water consumption for each individual crop, through indirect methods. [1]

Knowing the water consumption of sunflowers helps us to determine the stability and the irrigation regime, more precisely to determine the irrigation rate, the number of waterings and the interval between waterings.

The total water consumption of an agricultural crop represents the amount of water extracted from the soil through plant transpiration, to which is added the direct evapotranspiration of water from the soil surface. In addition to the amount of water consumed by agricultural crops through transpiration and lost through evaporation, there is also the loss through infiltration in the deep layers of the soil, as well as the water consumed by weeds. [2] Total water consumption refers to the amount of water consumed during the entire vegetation period, measured in mm water column or m^3 water/ha.

In this paper, the climatic elements of the studied years 2019-2021 in Arad county, the water consumption of sunflowers (ETRO) were analyzed through two indirect methods during this period.

The water consumption of the sunflower crop (ETRO) in Arad was determined by indirect methods, namely the Thornthwaite method, the most used method for the conditions in our country, the Lawry-Jonson method, an extremely fast method.

RESULTS AND DISCUSSIONS

In the analyzed period 2019-2021, we can see that the warmest year of the three years was 2019, with an annual average of 12.°C. All three years under study exceeded the multiannual average of the normal temperature, they were warmer years.

The driest year was 2021, below the multi-year average by 39.5 mm and below the average during the vegetation period by 100 mm. The driest year being the most affected plant during its vegetation period.

Following the analysis of figure 1 we see that in the year 2019 in eight months there is a moisture deficit, and in the rest of the months there is a moisture surplus.

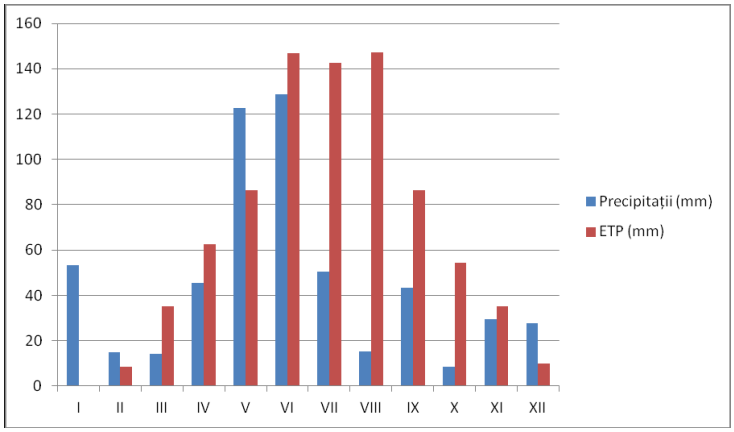

Figure 2. Monthly hydroclimatic balance, ARAD 2019

In the year 2020 from the hydroclimatic balance we notice that this year we have a moisture deficit in only 6 months. We encounter these deficits during the vegetation period of the sunflower.

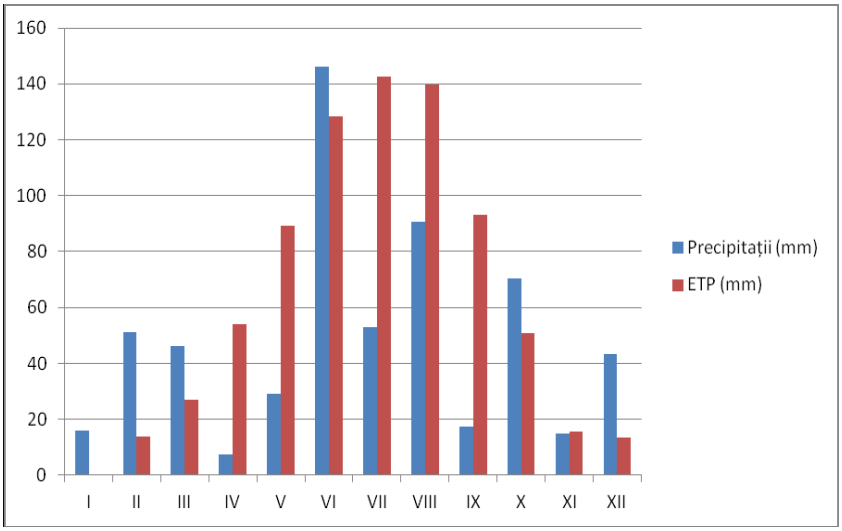

Figure 3. Monthly hydroclimatic balance, ARAD 2020

In the year 2021, we can observe that throughout the vegetation period of the sunflower we have a moisture deficit. The month with the greatest deficit is June, at the beginning of the critical sunflower period.

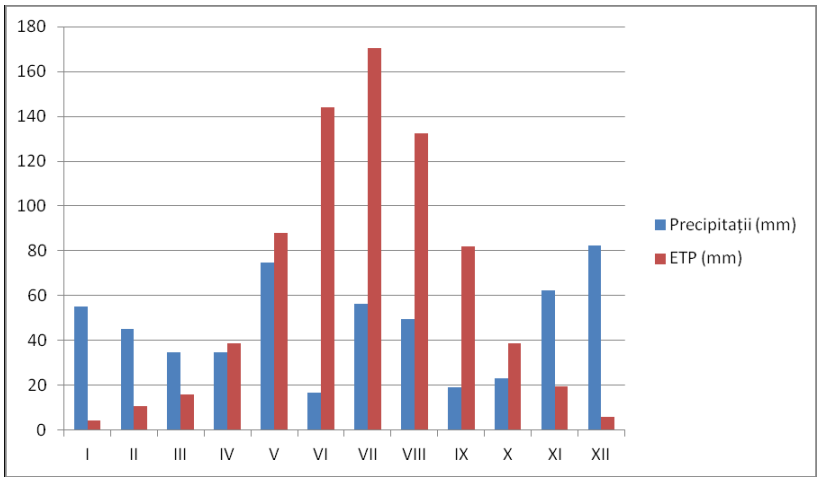

Figure 4. Monthly hydroclimatic balance, ARAD 2021

The highest daily water consumption was obtained in July, an average of 56.5 mc/ha.

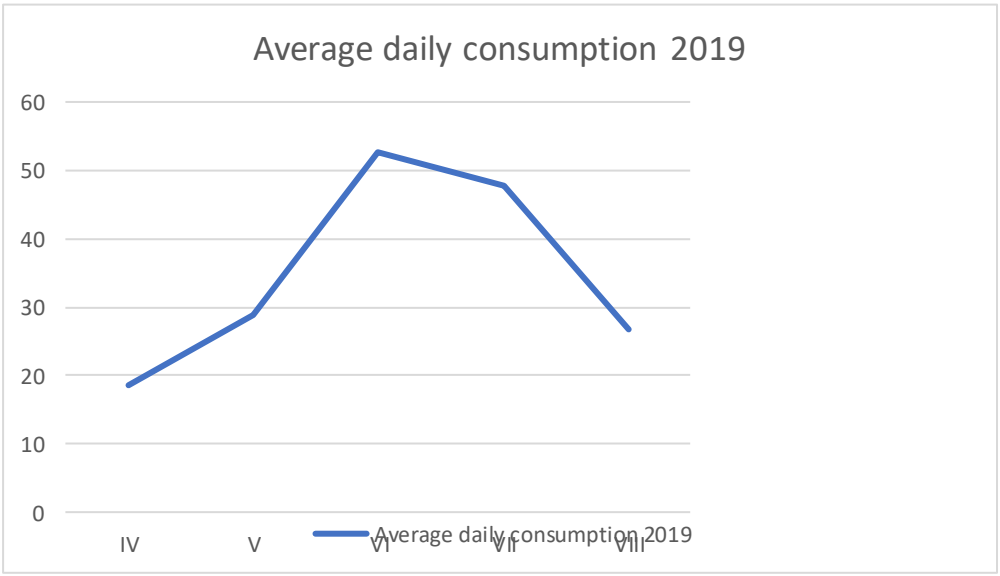

Figure 5. Average daily consumption in 2019 (m^3/ha/day)

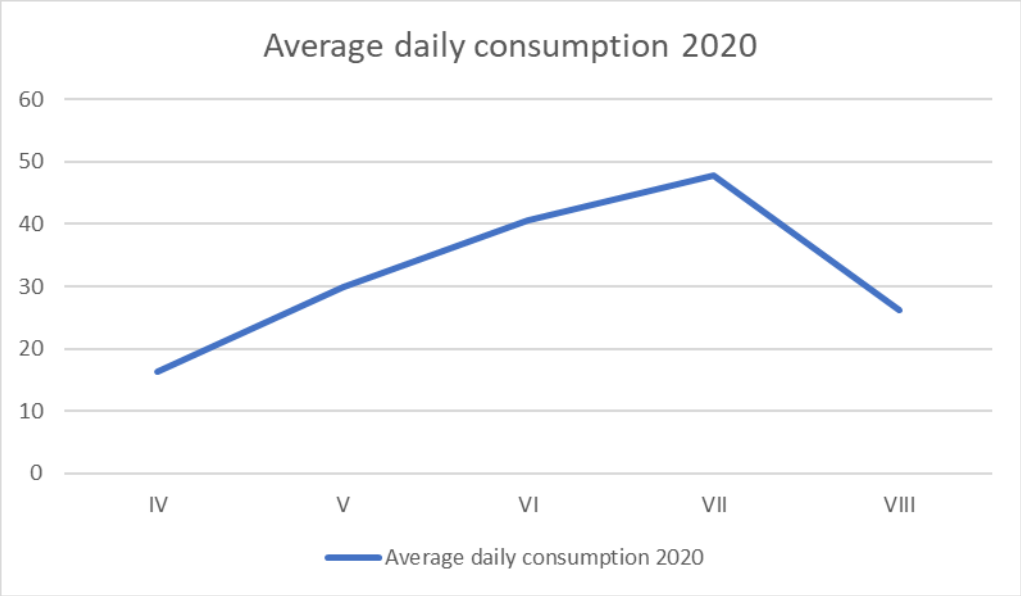

Figure 6. Average daily consumption in 2020 (m^3/ha/day)

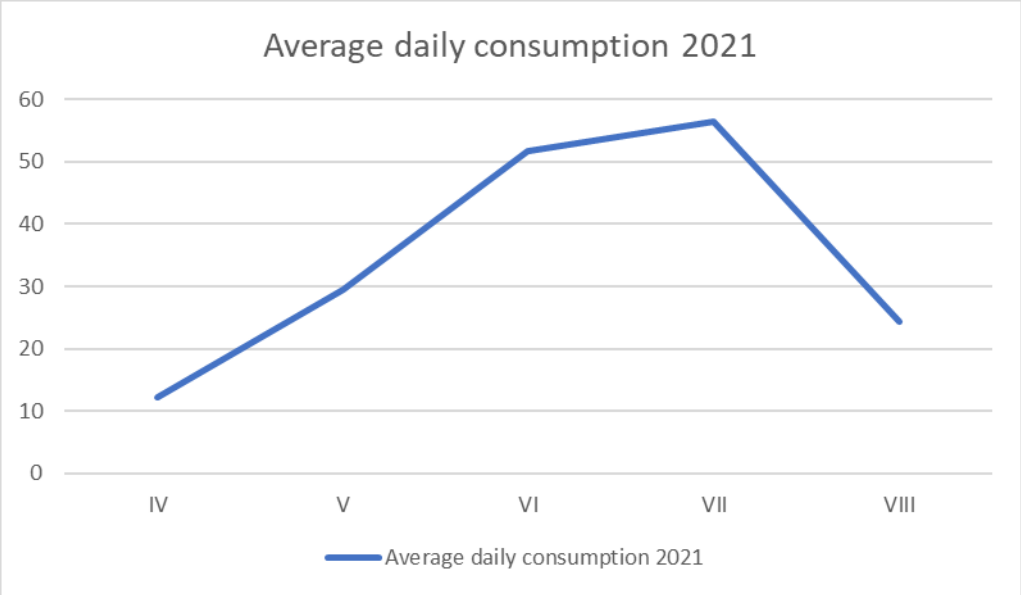

Figure 7. Average daily water consumption in 2021 (m^3/ha/day)

The highest total water consumptions were obtained in 2019 and 2021, being almost equal, and the lowest total consumption was recorded in 2020, as can be seen from the figure below.

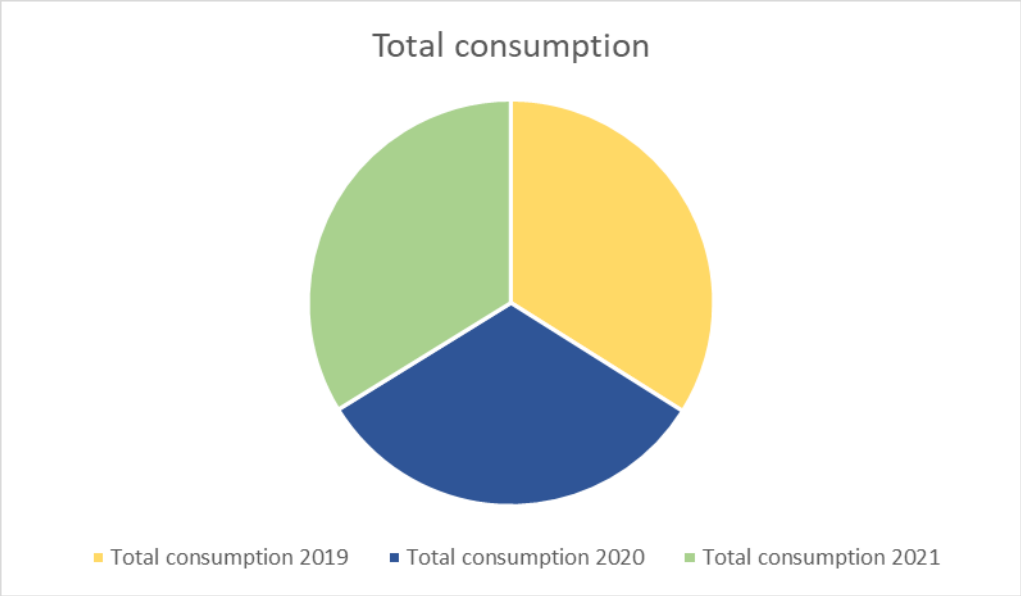

Figure 8. The total water consumption of the sunflower crop during the analyzed period

The year 2019 was the best covered with atmospheric precipitation in the years studied.

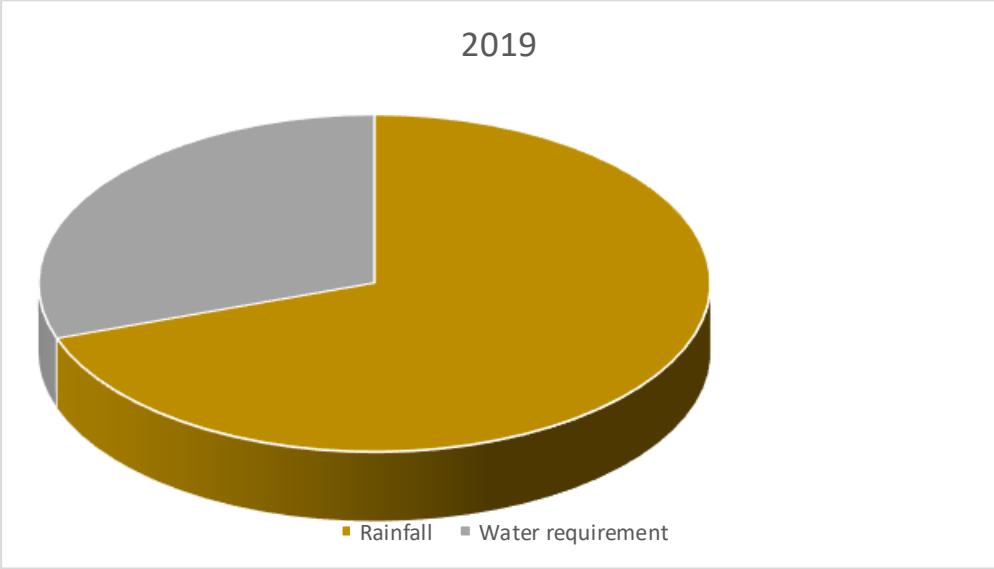

Figure 9. The water requirement covered by precipitation in 2019

In 2020, the water requirement increased throughout the vegetation period. It can be seen from the graph above that rainfall mostly covers the water requirement.

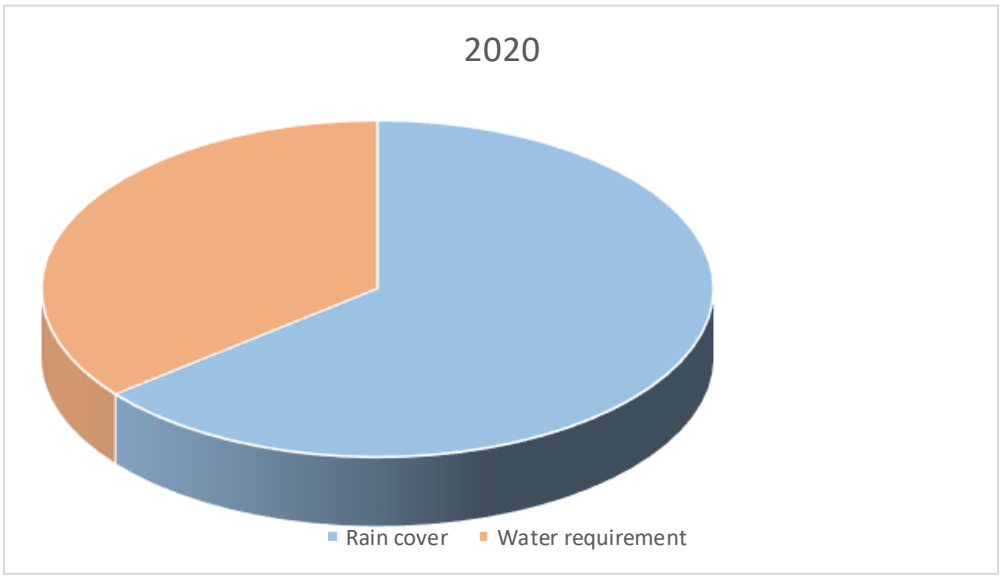

Figure 10. The water requirement covered by precipitation in 2020

The water requirement during the vegetation period in 2021 is 2976 mc/ha, this being the highest requirement in the years under study.

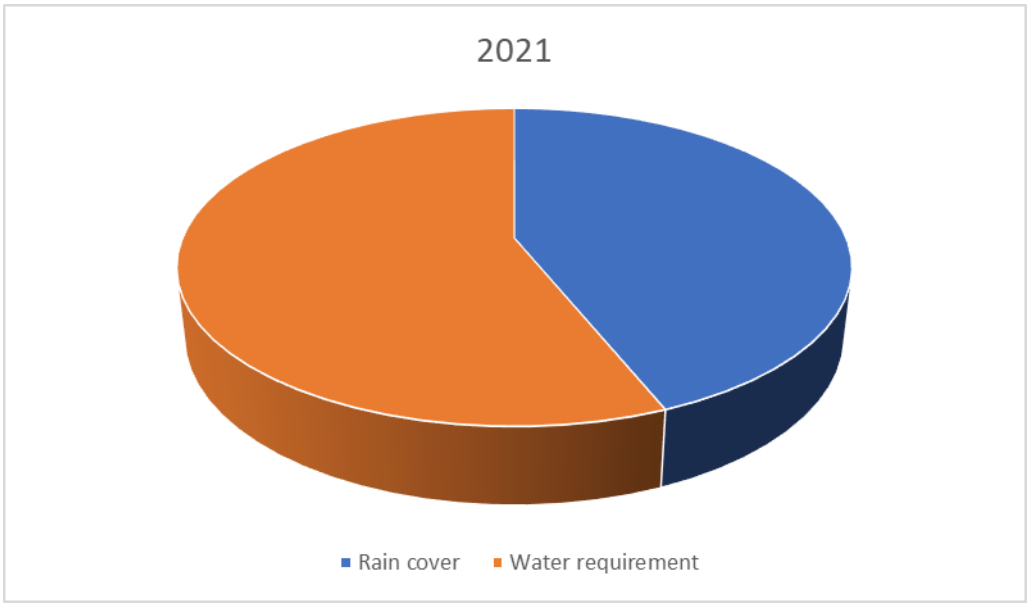

Figure 11. The water requirement covered by precipitation in 2021

CONCLUSIONS

All the three years studied, 2019, 2020 and 2021 respectively, were warm, with the annual average temperature exceeding the area's normal.

Atmospheric precipitation was lower in all 3 years, being below normal for the area.

Monthly and total water consumption values were influenced by environmental factors, the year 2019 with a very high consumption of 5353 mc/ha, and the lowest consumption was in 2020,

The year 2019 was the best covered with precipitation, they being covered on a proportion of 69.7%, while the year 2021 with only 43.8%. This proves how dry 2021 was during the sunflower growing season.

It is recommended to use irrigation systems to obtain a fairly balanced but also high-quality harvest for years with a deficit in precipitation during the vegetation period, for example 2021, when the amount of precipitation during the vegetation period was very low.

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