



## **Economic Development, Technological Change, and Growth**

### **Economic Assessment of Damage Caused by Drought**

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**Abstract:** High temperatures and prolonged drought have caused farmers, households and agricultural production across Europe to face unprecedented damage in 2019-2021. Drought is a natural feature of climate variability and the water cycle and can occur in all climate areas. It results from a temporary reduction in the normal precipitation regime over an extensive area, but other climatic factors, such as high temperatures and winds or low relative humidity can significantly aggravate the severity of the event. Weather-induced losses and damage in the agricultural sector will lead to lower global agricultural production, causing food insecurity having consequences on the export of food and agricultural products.

**Keywords:** assessment; loss; drought; agriculture; damage; decisions

**JEL Classification:** F02

Food and agricultural systems are essential to human well-being, when food security is considered, these systems are needed not only to provide safe and healthy food, but also livelihoods and incomes for large numbers of farmers, the same systems do integral part of rural and economic development.

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The main objective of food security is the production of grains around the globe to meet the growing demands for food, animal feed and biofuels. The EU cereals sector faces not only structural but also financial and climate challenges. The developments in the policy framework, as reflected in the proposals of the new Common Agricultural Policy (CAP), as well as advances in scientific and technological spheres such as plant breeding and digitalisation, point the way to a more efficient sector. However, the sectoral challenges are many. The post-2020 CAP reform process that promises a new delivery model and strategic plans is a departure from what is known. Global agricultural markets face new uncertainties that, on the supply side, include regulatory responses to new plant breeding techniques and responses to the increasing likelihood of extreme climate events. Climate change is causing an increase in the frequency of extreme events, whether they are unusual rainfall, temperature or winds. For agriculture, this usually results in lower yields and greater yield variability. Cereals, especially wheat and barley, are particularly subject to the phenomenon of vernalization, which causes a loss of yield, a decrease in grain quality and an extension of the harvest time. On the other hand, yields are also affected by drought, especially in areas where shallow soils predominate.

### **Research Method**

The goal of the research is the assessment of damage in agriculture by studying the causes, effects and damage caused by drought in the agricultural sector in the North-East region and Iași county in the period 2019-2021.

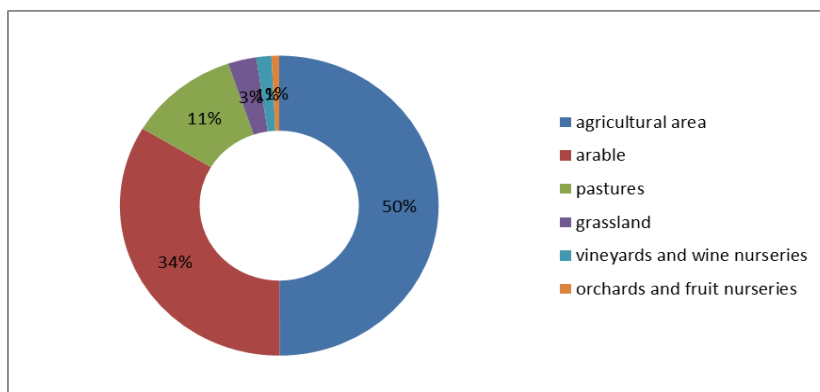
### **Results**

The general situation of agricultural land in the Northeast region and risk management is a key issue, and price volatility is only one side, other aspects include risk related to production, climate and income. How these three types of risk should be addressed depends on the frequency of the risk and its impact on farm income.

Risks can be classified as:

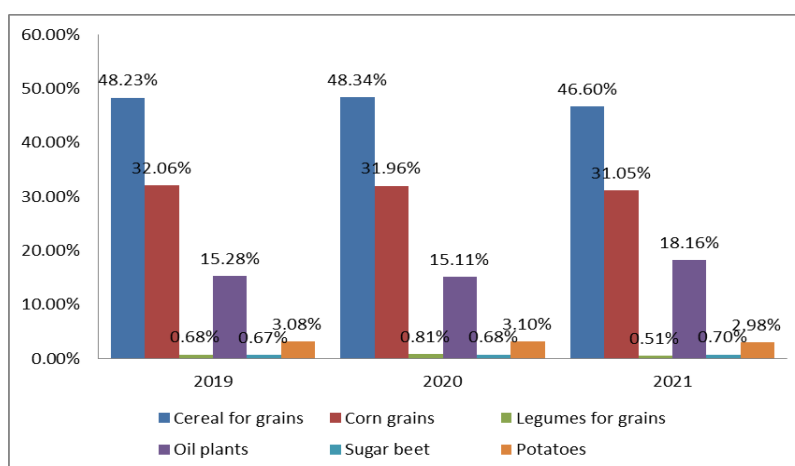
- Normal: include small changes (in prices or yields caused by a weather event) that can be managed on the farm;
- Marketable: occurs less frequently and leads to larger losses that are more difficult to manage and require market intervention. An example of tradable risk would be a major drop in price that can lead to a significant drop in farm income.
- Catastrophic or systemic occur rarely but cause great damage to many farmers. Leading to very high costs, private companies are not best placed to cope; consequently, public aid is granted to cover the losses of agricultural producers.

As can be seen in the North-East region, the share of agricultural areas is quite high: in 2019, there was an agricultural area of 2121801 ha in the region, in 2020 of 2121157 ha and in 2021 - 2124775 ha. Regarding the other categories of land use, in the North-East region, vineyards and wine nurseries represent approx. 30640 ha in the period 2019-2021, and orchards and fruit nurseries approx. 18300 ha.



**Figure 1. The share of the area in Iași county according to the land use mode**

Analyzing the share of the area in Iași county according to the land use mode, we can observe the following: the agricultural area holds 50% of the total area, followed by the arable category of 33.63%, pastures 11.23%. During the analyzed period, at least 5.5 million ha were cultivated with cereals, which demonstrates the specialization of Romanian agriculture in cereals. Among cereals, the areas cultivated with corn were predominant (at least 44.8% of the area cultivated with cereals in Romania in 2020), then those with wheat, with at least 31.3% in 2020.



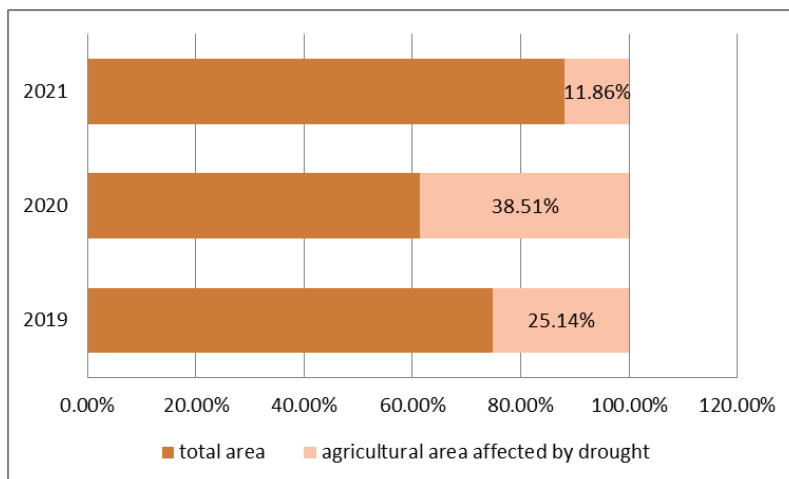
**Figure 2. Share of the area cultivated with the main crops in the North-East region in the period 2019-2021**

Analyzing the share of the area cultivated with the main crops in the North-East region and in Iași county in the period 2019-2021, it can be seen that the largest share is grain for grains (about 48%), followed by grain corn (about 32%) , oily plants (about 15%).

### **Assessment of the Damage caused by Drought in the North-East Region and in Iași County**

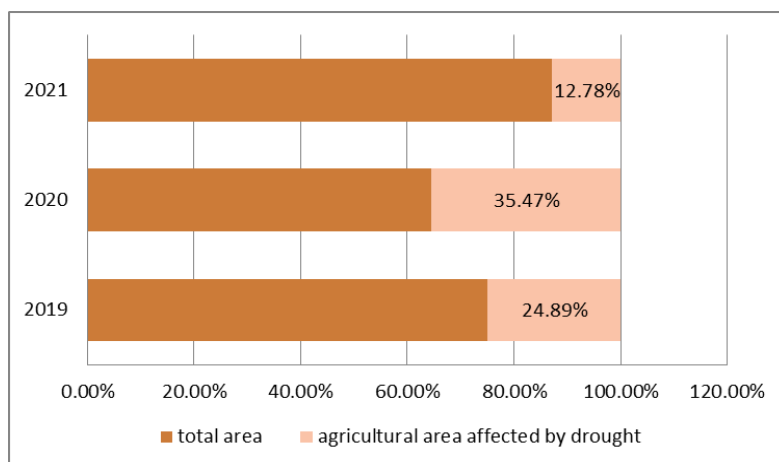
With global warming, droughts will occur more frequently, last longer and become more intense in Southern and Western Europe, while drought conditions will become less extreme in northern and northeastern Europe. With a global warming of 3°C in 2100, drought losses could be 5 times higher than today, with the strongest increase in drought losses projected in the Mediterranean and Atlantic regions of Europe. When expressed in terms of the total size of the economy, the effects are relatively muted, as drought-sensitive sectors such as agriculture are expected to become relatively less economically widespread in future EU economies than they are in present. Ecosystem consequences are usually not monetized and therefore not reflected in loss estimates. As can be seen from the data presented, the total agricultural area affected by drought in the North-East region was 344775.8 ha in 2019, 537384.2 ha in 2020 and 164407 ha in 2021. In Iași County, according to the data provided by the INS, the agricultural area affected by drought was 70091.25 ha in 2019, 106147.3 ha in 2020 and 32957.98 ha in 2021.

Figure 3 shows the share of the agricultural area affected by drought in the North-East Region compared to the total area, thus in 2019 the share was 25.14%, in 2020 38.51%, and in 2021 11, 86% Regarding the share of the agricultural area affected by drought in Iași county, it is represented in figure 4. According to it, at the level of Iași county in 2019, about 24.89% of the total area was affected by drought, in 2020 the share reached to around 35.47%, and in 2021 to 12.78%. Comparatively analyzing the share recorded at the level of the North-East region and Iași county of the area affected by drought in 2019, the share in the North-East region is higher than that of Iași county by approximately 1.01%, in 2020 it will increase to 7, 89% and in 2021 the share in Iași County exceeds the share from the region by 7.75%.

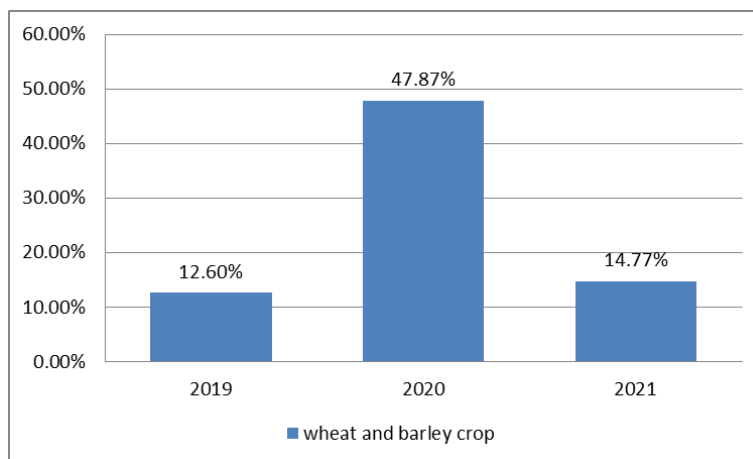


**Figure 3. Share of the agricultural area affected by drought in the North-East Region**

Regarding the average yields obtained, we note that they fluctuated from year to year for all cereals. The lowest averages were in 2020 for wheat, rye and barley and in 2019 for maize. 2021 was also an agricultural year with poor yields, especially for maize and rye. In only one situation (2021) did yields approach those of western EU countries for both wheat and maize. Overall, the variations in total grain production were very large.

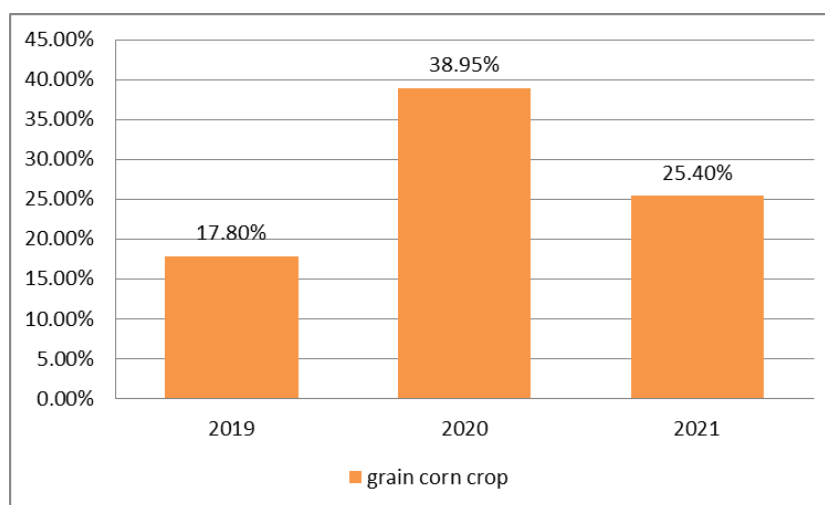


**Figure 4. Share of the agricultural area affected by drought in Iași county**



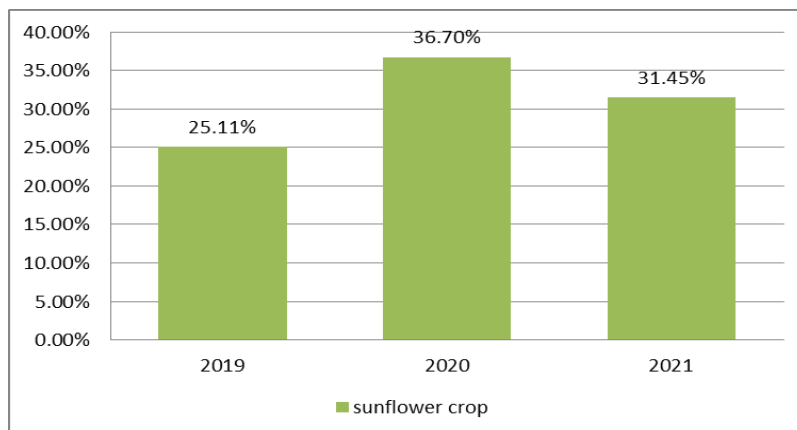
**Figure 5. Share of the area affected by drought in wheat and barley crops**

Regarding the share of areas affected by drought in the wheat and barley crop, it can be seen that the most affected is the year 2020 with a share of 47.87% compared to the total cultivated area, followed by the year 2021 with 14.77% of the area and from 2019 with a weight of 12.60%.



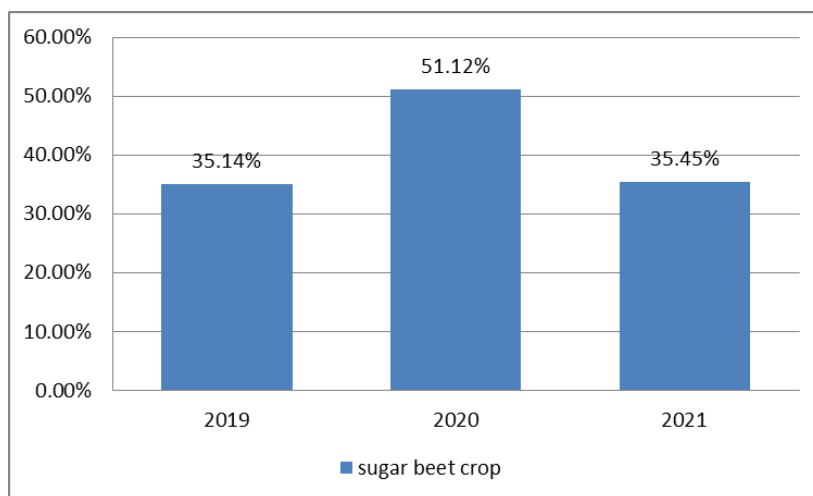
**Figure 6. Share of the area affected by drought in the grain corn crop**

The share of areas affected by drought in grain corn culture is as follows: in 2019 it was 17.80% of the total area, in 2020 it was 38.95%, and in the last analyzed year it reached a share of 25.40% of the total cultivated area.



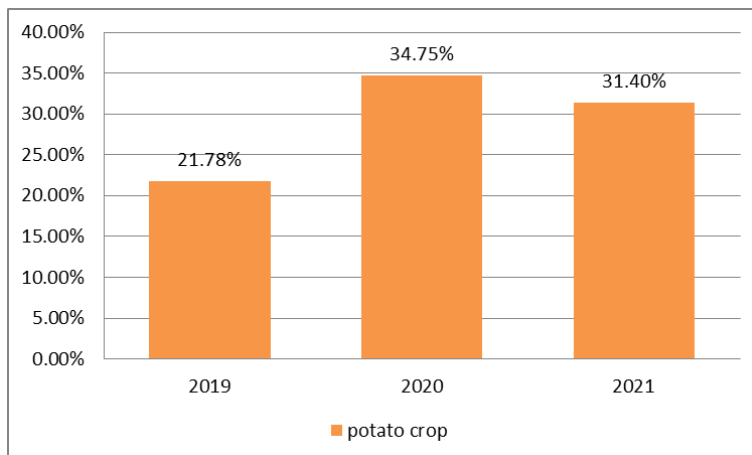
**Figure 7. Share of the area affected by drought in the sunflower crop**

For the sunflower crop, the share of the surface affected by drought is presented as follows: the most affected year remains 2020 with a share of 36.70%, followed by 2021 with a share of 31.45%, and in 2019 with 25, 11% of the total area.



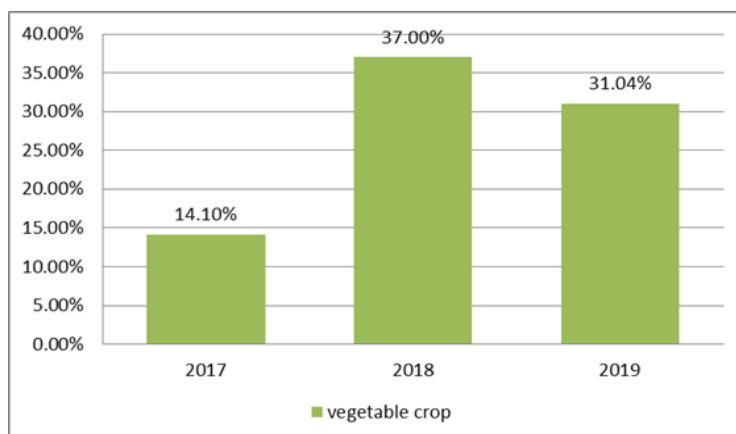
**Figure 8. Share of areas affected by drought in the sugar beet crop**

The data provided by the INS for the sugar beet crop are presented as follows: the most affected is the year 2020 with a weight of 51.12% compared to the total cultivated area, followed by the year 2021 with 35.45% of the area and the year 2019 with a weight of 35.14%.



**Figure 9. Share of areas affected by drought in the potato crop**

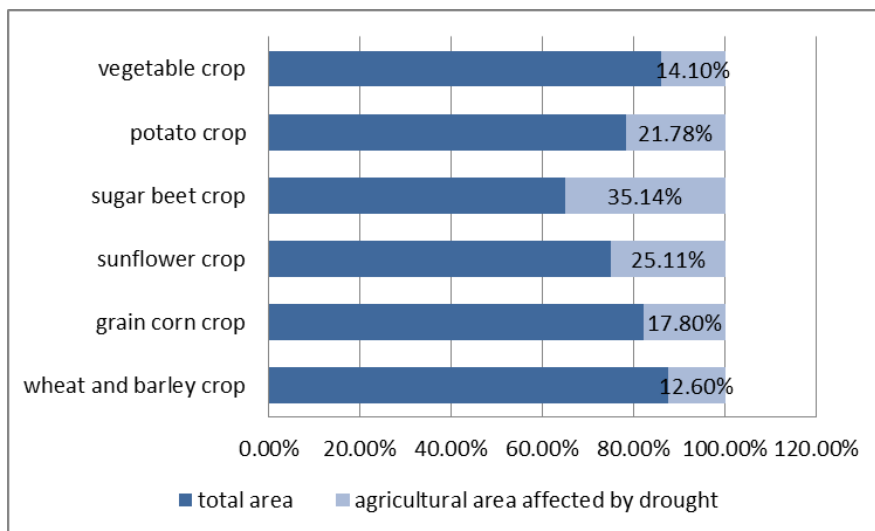
For the potato crop, the share of the area affected by drought is as follows: the most affected year remains 2020 with a share of 34.75%, followed by 2021 with a share of 31.40%, and in 2019 with 21.78% of the total area.



**Figure 10. Share of areas affected by drought in the vegetable crop**

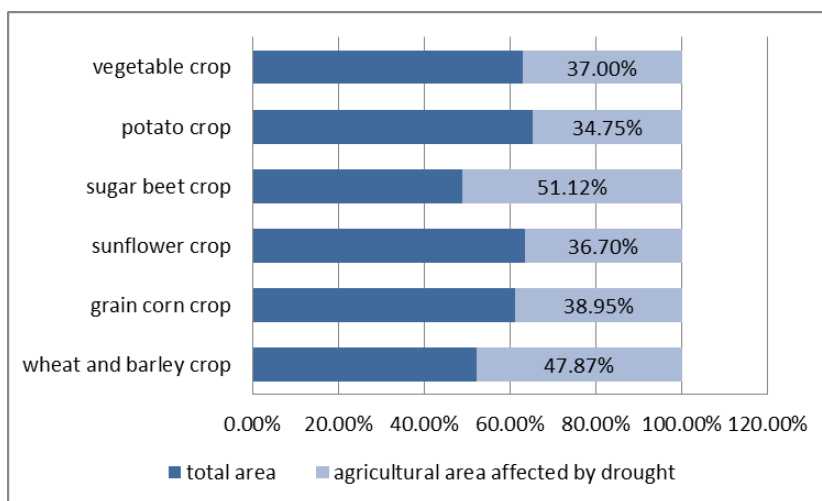
In the vegetable crop category, the situation is similar to that of agricultural crops, i.e. the year most affected by drought is the year 2020 with a weight of 37%, followed by the year 2021 with a weight of 31.04%, and the year 2019 has a weight of 14.10% of the total area cultivated with various vegetables in Iași county.





**Figure 11. Share of the total area and that affected by drought for the main crops in 2019**

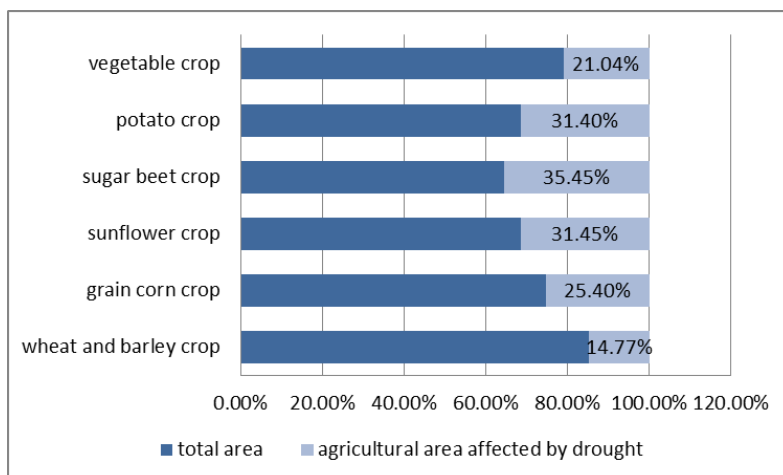
Analyzing as a whole the share of the total area and that affected by drought in the main crops in 2019, it can be seen that the most affected crop is sugar beet (35.14%), followed by the sunflower crop (25.11), potato (21.78%), grain maize (17.80%), vegetables (14.10%) and wheat and barley (12.60%).



**Figure 12. Share of the total area and that affected by drought for the main crops in 2020**

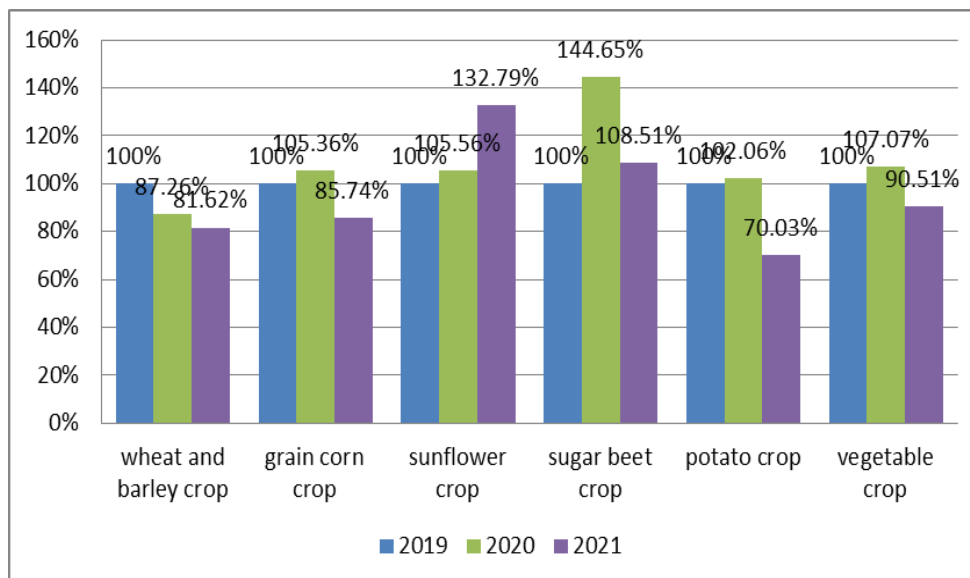
In 2020, the year most affected by drought, at the level of all crops the share of the total area affected by drought is as follows: sugar beet (51.12%), wheat and barley

(47.87%), grain corn (38, 95%), vegetables (37%), sunflower (36.70%) and potato (34.75%).



**Figure 13. Share of the total area and that affected by drought for the main crops in 2021**

Regarding the evolution of the area affected by drought in 2021, it is as follows: sugar beet (35.45%), sunflower (31.45%), potato (31.40%), grain corn (25.40%), vegetables (21.04%) and wheat and barley (14.77%). According to the data provided by the INS, production values fluctuate from year to year and from one crop to another, the main cause being the weather conditions, followed by the soil conditions, the applied technology and the equipment of each farm in Iași County.



**Figure 14. Production dynamics in the period 2019 – 2021 for the main crops**

Analyzing the dynamics of the production obtained in the period 2019-2021 for the main agricultural crops in Iași County, it is presented as follows:

- in the wheat and barley crop in 2020, production decreases by 12.74%, and in 2021 by 18.38% compared to 2019;
- in the grain corn crop, production increases in 2020 compared to 2019 by 5.35%, but in 2021 it decreases by 14.36% due to the drought that affected the crop that year;
- in the sunflower crop in 2020 production increases by 5.56%, and in 2021 by 32.79% compared to 2019;
- in the sugar beet crop, production in 2020 increases the most by 44.65% compared to 2019, and in 2021 by 8.51% compared to the first analyzed year;
- in the potato crop, production increases by 2.06% in 2020 compared to 2019 and in 2021 it increases by 29.97% compared to 2019;
- in the vegetable crop, production in 2020 is 7.07% higher compared to 2019, and in 2021 production decreases by 9.49% compared to 2019.

## Conclusions

In Romania, the largest crop is that of cereals; the average of the last 25 years shows that more than 65% of the total arable area is cultivated with cereals. Cereal production is relatively strongly influenced by climatic factors, mainly drought, which leads to the conclusion that we need to find new efficient ways to stimulate the irrigation of larger land areas, taking advantage of the growth of large farms. By accessing the projects within the PNDR, it was desired both to attract young farmers - in the rural area, as well as to modernize agricultural farms together with the establishment of farmers' groups. Economic agents also benefited from these projects, which followed the increase in the added value of agricultural and forestry products, but also of subsistence farms. A common problem identified is the lack of functional irrigation systems, to make up for the lack of rainfall in certain years or in certain periods of the year, or finding solutions so that Romania no longer exports raw materials without added value and imports finished products with added value, which affects the trade balance. The price of oil, as well as the refugee crisis, can indirectly affect the analyzed sector and especially international trade to some extent. In this general context, we must not omit the increasingly perceptible climate changes of recent years, but also the legislation, policies and strategies adopted by governments that have encouraged the development of bipolar agriculture. On the other hand, factors with a positive effect on the grain sector have been identified. Here we include the accession to the EU, which forced the increase in the competitiveness of agri-food products, even if in the short and medium term it had a negative impact on the trade balance, precisely because of the lack of competitiveness of Romanian products.

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