HEALTH STATUS OF SOME SUNFLOWER HYBRIDS DURING 2019-2021 IN CLUJ COUNTY

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Abstract

Climate change is occurring in Romania and interacts with agroecological factors to increase biotic stress in sunflowers. Furthermore, the uneven distribution of precipitation has increased the chances of infection with necrotrophic pathogens. Therefore, the main objective of this paper was to study the dynamics of pathogens in the sunflower culture influenced by both the use of fertilizers and the genetic characteristics of the hybrids, correlated with the economic potential offered by pedo-climatic condition found in the Transylvania Plains area. The main objective of this paper was to monitor the health of some sunflower hybrids in different climatic conditions given by the experimental years (2019, 2020, 2021), but also differentiated fertilization (DAP, unfertilized). Thus, under the conditions of the experimental years, the pathogens identified were: *Plasmopara halstedii, Sclerotinia sclerotiorum, Alternaria zinniae, Puccinia helianthi, Septoria helianthi, Botrytis cinerea, Plenodomus lindquistii, Diaporthe helianthi, Verticillium spp., Pseudomonas tagetis*. Of these, only the following pathogens presented quantifiable degrees of attack each year: *Diaporthe helianthi, Plenodomus lindquistii, and Alternaria zinniae.* During the experiment, six hybrids were tested each year. The choice of Klarika and Neoma hybrids to be presented was due to the observed genetic tolerance, which differed considerably from the other variants of the year.

Keywords: sunflower, disease, *Diaporthe helianthi, Plenodomus lindquistii, Alteranaria zinniae*

Introduction. Sunflower (*Helianthus annuus* L.) is among the essential oilseeds plants in the world. Since sunflower seed oil is one of the healthiest vegetable oils available for cooking, there is a growing demand due to a health-conscious diet. (Ban R. *et al*, 2021). Oilseed hybrids are bred to have an oil content of 40 to 50%, and the oil is now predominantly composed of oleic acid (Harveson R.M. *et al,* 2016; Mathew F. *et al*, 2018).

Sunflower is a major source of vegetable oil in Europe (Jørgensen L., 2008). Therefore, the diseases that affect the sunflower culture represent a crucial factor in the decrease in production. For this reason, the dynamics of the factors that influence the development of pathogens have been studied for their early identification and diagnosis (Sara U. *et al*, 2022).

It is essential to determine the relationships between the occurrence and severity of the disease, as well as pedo-climatic factors. For example, some destructive diseases in one area may be tolerant in another due to differences in environment or technology (Gulya T. *et al*, 2019).

Climate change is occurring in Romania and interacts with agroecological factors to increase biotic stress in sunflowers. In addition, the observed uneven precipitation distribution has increased the chances of outbreaks of necrotrophic pathogens like *Diaporthe* (Hulke B. *et al*, 2019).

Numerous diseases produced by phytopathogenic fungi, such as Phoma stem black spot, white blister rust, and Phomopsis stem break, adversely affect the cultivation technology and production of sunflower. For example, the black stem, caused by the fungus *Phoma macdonaldii,* is one of the most important sunflower diseases regardless of region. It is present in many European countries but also China, Iran, Pakistan, Kazakhstan, Australia, and the USA. (Qian Y. *et al*, 2022).

Sunflower diseases are a limiting factor for sunflowers' qualitative and quantitative production. This fact is observed not only in Romania but also concerns all countries that cultivate this technical plant. More than thirty pathogens causing economically important damage have been mentioned (Encheva V. *et al*, 2014). *Diaporthe helianthi* can survive in the remains of diseased plants for up to 5 years (Maric, A., Masirevic S., 1980). Therefore it is recommended to work the soil or bury the plant remains at depth. Crop rotation with plants that do not share common pathogens

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with sunflower (cereals and corn) is recommended to reduce transmission levels of the pathogen. Weeds can host *D. helianthi* and other *Diaporthe* species (Thompson S.M. *et al*, 2011). Therefore is vital to manage weed control in a sunflower field.

Yield losses above 40% have been reported in Europe, South America, and North America, and the disease also occurs in Asia and Australia (Harveson R.M *et al*, 2016). Recently, the disease reemerged in the United States (Mathew F. *et al*, 2018).

Alternaria helianthi is recorded for the first time on sunflower in Italy. The disease characterizes by irregular necrotic surrounded by a chlorotic halo on the leaves, stems, and heads. (Tosi, L., Zazzerini A., 1991)

The main objective of this paper was to study the dynamics of pathogens in the sunflower culture influenced by both the use of fertilizers and the genetic characteristics of the hybrids, correlated with the economic potential offered by pedo-climatic condition found in the Transylvania Plains area.

MATERIAL AND METHOD

The main purpose of this work was to study the dynamics of pathogens in the sunflower crop influenced by both the use of fertilizers and the genetic characteristics of the hybrids in the geographical conditions of Cătina, Cluj County. Thus, six sunflower hybrids were studied (only two are presented in the current paper), which were treated with two doses of fertilizer while monitoring the attack of the main pathogens.

During the vegetation period, three observations were made to check the crop condition regarding phytosanitary protection. The first observation was carried out in the phenophase before flowering to identify the main foliar diseases, the second observation was carried out two weeks before harvesting to analyze the pathogens of the stems and calathids, and the last observation took place the day before harvesting necessary to note the evolution of the diseases which affects the calathidium. The observations were carried out separately for each variant; in three repetitions, each area was highlighted, and an intermediate portion was chosen, respectively, rows 3 and 4, where the surface of two rows was marked (the row width was 0.7 m) over a length of 5 m, which determined an area of 7 sqm.

After performing these examinations, calculations were made to determine the degree of pathogen attack. This was determined using the formula AD% = (I% X F%)/100, where I% represents the attack intensity, and F% is the attack frequency. The intensity shows us the percentage affected at the level of the plant, and the frequency is calculated using the formula F= (number of diseased plants X 100) / total number of plants.

RESULTS AND DISCUSSIONS

Below are presented the data on the state of health of the two hybrids, chosen by the fact that they have the most productive potential, considering them to be relevant both in terms of the stability of the production quantity and the phytosanitary state recorded every year starting in 2019 and ending in 2021.

Analyzing the graph in *figure 1*, it can be seen that the *Plenodomus linquistii* fungus shows a relatively constant degree of attack in the 3 experimental years, being on average between 13 and 19%. However, the conditions of 2021 led to increases in the degree of attack by more than 3% compared to the other two years, this difference being statistically covered.

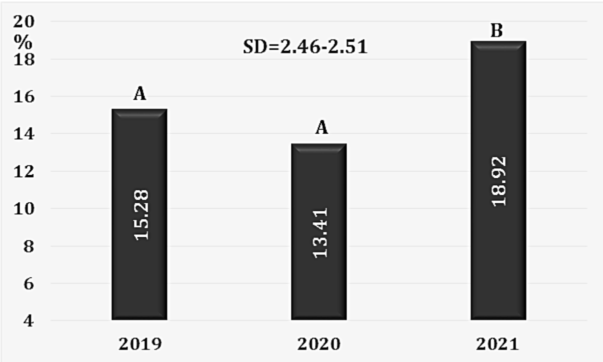

Figure 1 **Attack degree of the pathogen *Plenodomus linquistii* in sunflower**

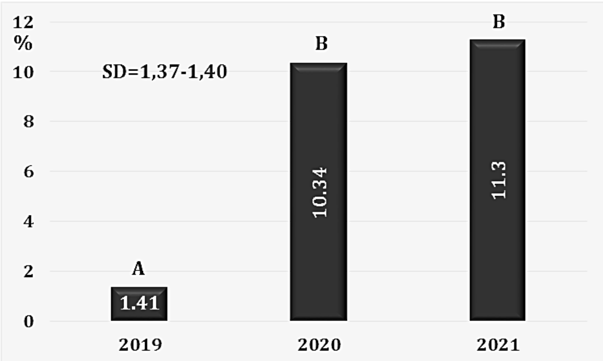

Figure 2 **Attack degree of the pathogen *Diaporthe helianthi* in sunflower**

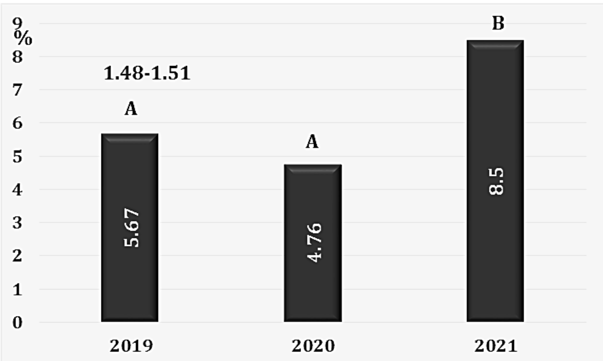

Figure 3**. Attack degree of the pathogen *Alternaria zinniae* in sunflower**

If we take into account the behavior of the *Diaporthe helianthi* fungus (*figure 2*), it can be seen that practically the year 2019 did not record favorable conditions for its manifestation. In 2020 and 2021 the attack rate exceeded 10%.

Also the third pathogen monitored (*figure 3*) showed constant levels of attack during the three years of monitoring in the experiment, however the conditions of 2021, led to significant increases in the attack of *Alternaria* spp., by about 4% compared to the previous year. However, the *Alternaria* fungus did not exceed the 10% total attack rate reported in the experimental field.

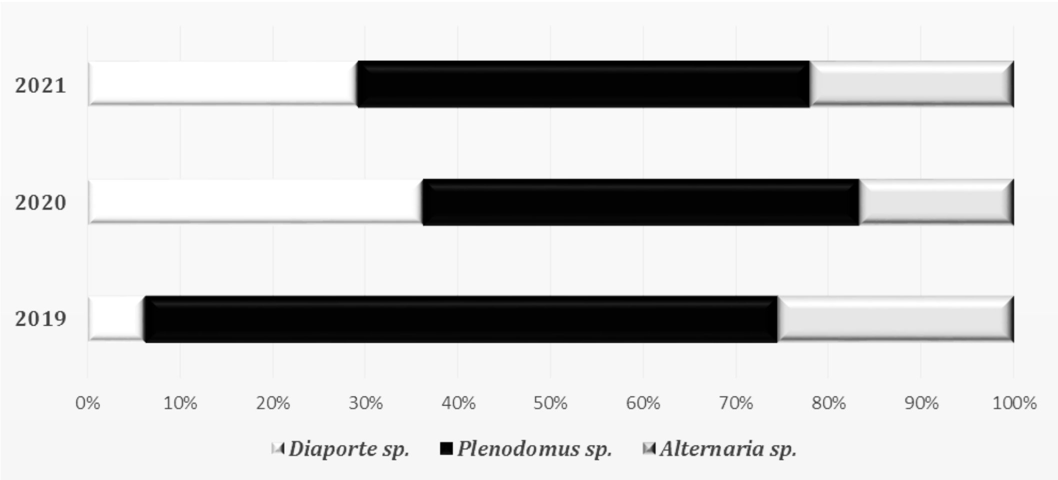

Figure 4 **Representation of the degree of attack of the three pathogens over the years of study**

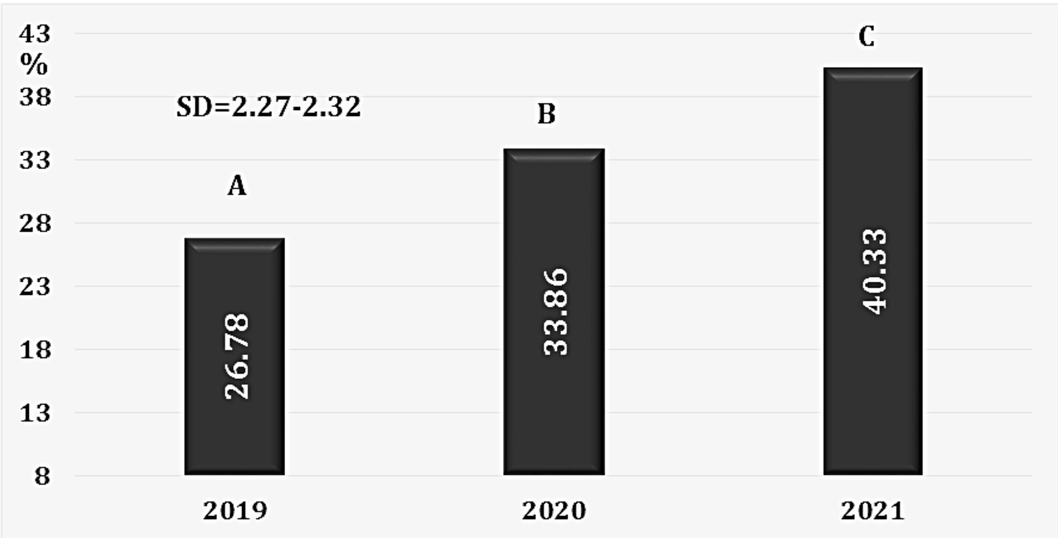

Figure. 5 **The total degree of attack in the interval 2019-2021**

If we analyze the graph in *figure 4*, it is found that, in general, the share of participation in the total degree of attack of each pathogen is constant, regardless of the monitoring year. However, the year 2019 deviates from this rule, especially because it did not favor the attack of the *Diaporthe* spp. fungus. Also this year, it can be noted the increase in the above-average attack of the *Plenodomus* spp. pathogen, which meant that a considerable percentage of the analyzed plants showed characteristic symptoms of infection with diseases that affect the stem, as a result an early maturation of the analyzed plants was observed due to blockages caused by severe infection.

The total degree of attack was determined by summing the averages calculated for the three monitored pathogens, thus the levels of the total degree of attack were significantly different from one year to another, increasing significantly from 2019 to 2021 (*figure 5*). Practically, we can talk about almost a doubling of the level of attack in 2021 compared to 2019. This fact can be justified both by the climatic conditions favorable to the development of pathogens in 2021, but also by the increase in the biological reserve of pathogens from one year to another.

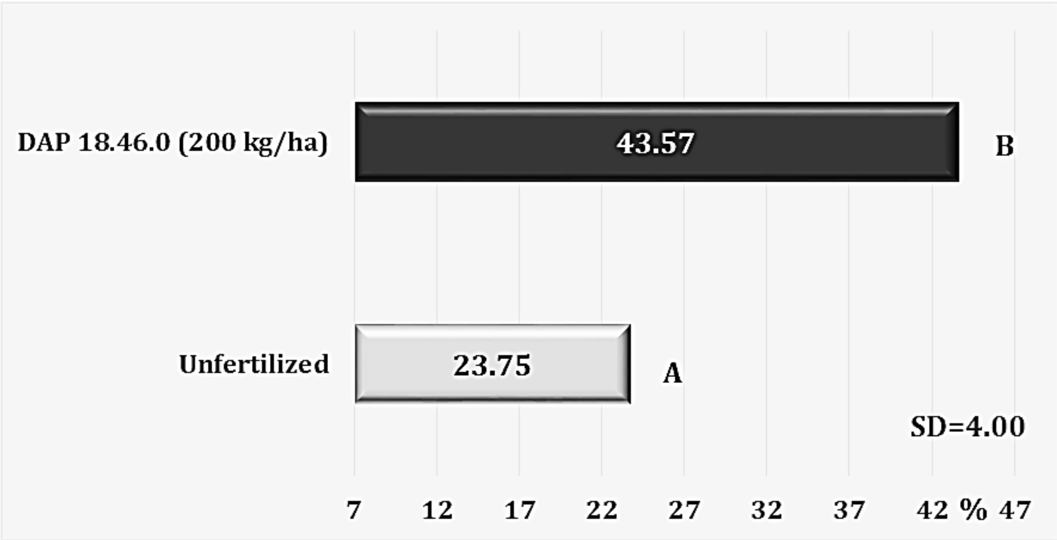

Figure 6 **The influence of fertilization on the degree of attack**

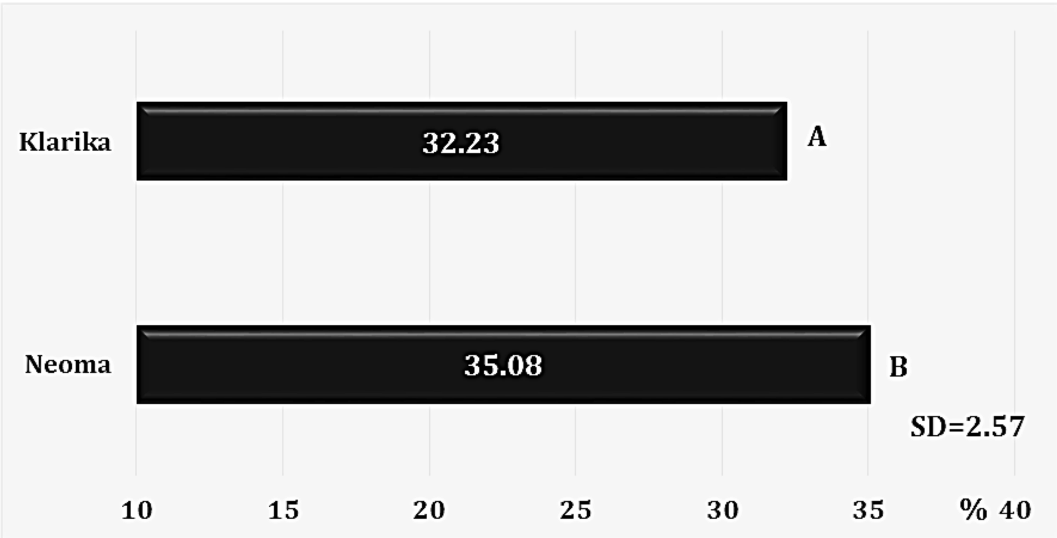

Figure 7 **The degree of attack according to the hybrid**

As expected, fertilization led to an increase in the degree of attack (*figure 6*) which reached a value of 43%, but this increase did not materialize in production losses at the level of the experimental field.

As I mentioned before, two sunflower hybrids were tested in the experimental field. Among them, Klarika proved to be the least attacked, with significant differences compared to the Neoma hybrid studied (*figure 7*).

Another indicator monitored in the experimental field was sunflower production (*figure 8*), which was influenced by both climatic conditions and the level of pathogen attack.

Thus, the highest productions are found, of approximately 3300 Kg/ha noted in 2020, and in 2021 productions decreased by 250 Kg/ha, this fact is consistent with the pathogen attack level of over 40% recorded in this year.

Analyzing the relationship between production and the total degree of attack (*figure 9*), it is found that the tested hybrids tolerate the attack of pathogens, under fertilization conditions. Which outlines the need for intervention with additional fertilization for a significant increase in production.

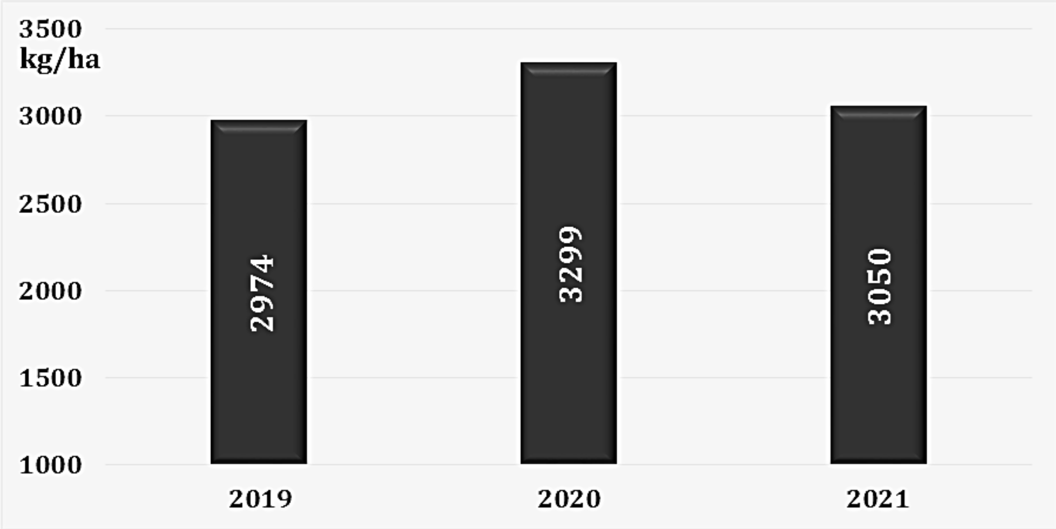

Figure 8 **Differences in total production of the experimental field**

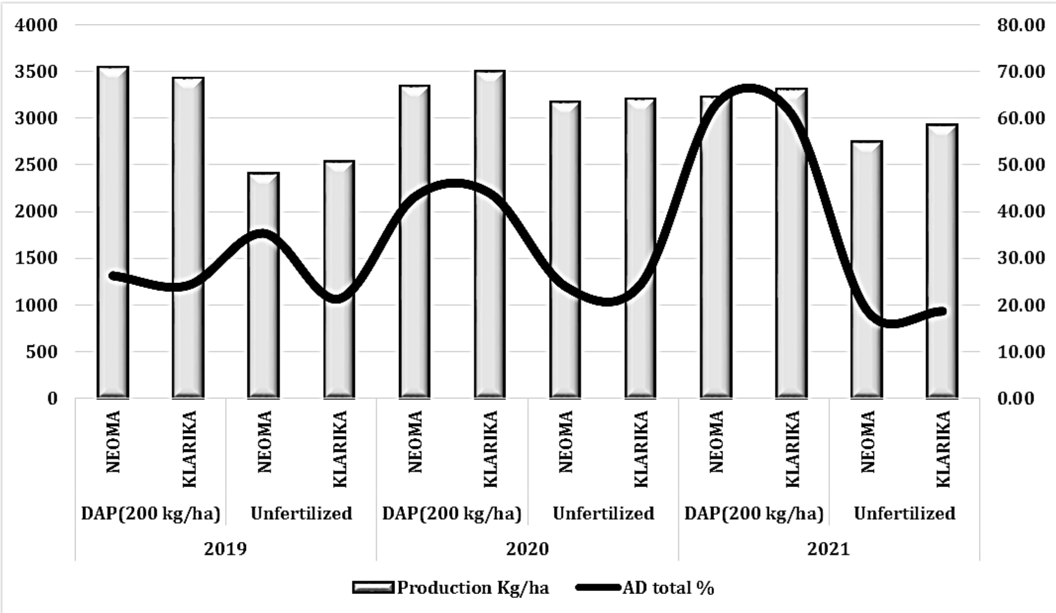

Figure 9 **The relationship between production and the total degree of attack**

CONCLUSIONS

Following the determinations made in the experimental field regarding the attack level, we identified three main pathogens (*Diaporthe helianthi, Alteranaria zinniae, and Plenodomus linquistii*, respectively).

Fertilization increased the attack rate of pathogens identified in the experimental field.

Even if the attack of the diseases mentioned above was constant, the cultivation of the hybrids taken in the test could be recommended precisely because of their characteristics, which they managed to keep regardless of the climatic conditions recorded annually.

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