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THE CURRENT SITUATION OF THE DEGREE OF WEED INFESTATION IN THE MAIZE CROP

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Abstract. *Maize (Zea mays L.), one of the most important forage crops in Romania, is highly sensitive to early weed competition, especially during the first 6–8 weeks of vegetation. In corn, there is a high level of infestation with annual and perennial weed species, associated with a high diversity of them, which determines a pronounced competition for the development of the crop plant, negatively influencing the production and quality obtained per hectare in the absence of the application of adequate control measures. In the pedoclimatic conditions specific to the Fundulea area — characterized by fertile chernozem soils, springs with variable water regime and hot summers — the degree of weed infestation remains high and represents a major limiting factor of production, and the experiments were located on the cambic chernozem soil type. Weed management in European agriculture is subject to divergent trends generated, on the one hand, by the access to innovative technological proposals and on the other hand by the negative impact of already observable climate change and legislative restrictions. Integrated Weed Management (IWM) represents a modern and sustainable weed control strategy, based on the combination of methods, so that weed infestation is effectively reduced and the environmental impact is minimal.*

Keywords: *crop, density, degree of infestation, weeds.*

INTRODUCTION

Maize (Zea mays) is one of the most important agricultural crops in Romania, making a major contribution to food security, the livestock sector and numerous food and non-food industries. Due to its high nutritional value, technological versatility and ability to adapt to different pedoclimatic conditions, corn constantly occupies large areas in national agriculture. In addition, Romania is frequently among the main corn producers in the European Union, which gives this crop a strategic role in the agricultural economy. Corn is a strategic species both for plant production and for studies on modern plant protection technologies.

The maize crops weed flora is very diverse and numerous, through the numerical ratio of weed species present, and especially the numerous combinations between the various biological groups. This variety is explained by the diversity of pedoclimatic conditions existing in the areas where this crop is grown (ANGHEL *et al*., 1972; POPESCU *et al*., 2007).

One of the biggest challenges of this crop remains the degree of infestation, prevalence and dominance of weeds, a phenomenon that significantly affects plant development in the early stages of vegetation and can lead to production losses of up to 80% in unfavorable conditions.

In Romania, corn cultivated areas have an extremely high degree of weed infestation, over 80%, with a wide range of annual and perennial monocotyledonous and dicotyledonous weeds, depending on the zonal pedoclimatic conditions. The most significant weed species are: mocotyledonates - *Setaria sp., Echinochloa crus-galli, Sorghum halepense* (from seed and rhizomes), *Digitaria sanguinalis, Elymus repens, Eriochloa villosa* and dicotyledonates - *Amaranthus retroflexus, Chenopodium album, Solanum nigrum, Xanthium strumarium, Polygonum sp., Sinapis arvensis, Raphanus raphanistrum, Stellaria media, Thlaspi arvensisHibiscus trionum, Datura stramonium, Abutilon theophrasti, Cirsium arvense*,

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*Convolvulus arvensis, Sonchus arvensis, Lepidium draba, Galinsoga parviflora, Capsella bursa - pastoris, Erigeron canadensis (*POPESCU et al., 2009).

In the field of weed control, the main objective was to permanently eliminate weed competition throughout the vegetation period, by reducing infestations below the damage threshold, reducing water and nutrient consumption by weeds, ultimately contributing to obtaining high and quality production, corresponding to the biological potential of corn hybrids (BÂRLEA and SEGĂRCEANU, 1987; ȘARPE, 1987; GUȘ et al., 2004)

The number and spectrum of weeds depends on various factors such as soil type, crop rotation, tillage, crop density, fertilization level, etc. (*Hanzlik and Gerowitt, 2011; Partal et al., 2023*). There is a large body of literature data proving the harmful consequences caused by weeds and also the importance of mechanical and chemical weed control (FETVADZIEVA et al. 1991; SPASOV, 1995; PETCU et al., 2022)

The Fundulea area, characterized by pedoclimatic conditions specific to the Romanian Plain, the degree of weed infestation in the corn crop remains high and represents a major limiting factor for production. The local climatic conditions — warm summers, periods of drought alternating with episodes of humidity — favor successive waves of emergence and maintain a constant weed pressure.

During the research period, the corn crop presented a diversified degree of weed infestation, with annual and perennial weed species, depending on the location area, the applied technological links and the preceding plant. The emergence of different weed species is correlated with aspects of climatic conditions, with the reserve of weed seeds in the soil and the reduced power of the corn plant to compete with them. (SERBAN, 2021)

Weeds in the maize crop need a thorough study of their lifestyle and behavior in the pedoclimatic conditions of Fundulea, especially due to the fact that they have different biological properties compared to the crop plant.

MATERIAL AND METHODS

The research on the study of the degree of infestation, dominance and predominance of weed species present in the corn crop was carried out at the National Institute for Agricultural Research and Development – FUNDULEA, in the experimental field- the Agrotechnics laboratory. The experiments were located on the cambic chernozem soil type (3.2% OM, 37% clay, 6.5 Ph).

Climate change represents one of the greatest threats to agriculture. Over the past few decades, phenomena such as increasing global temperatures, changing precipitation amounts and the frequency of extreme events have begun to make their presence felt, having significant consequences on production both quantitatively and qualitatively. The increase in temperatures during the summer months can influence crop development and weed dynamics, an important aspect in studies on infestation and the impact of climate change.

The differences between years highlight a moderate climatic variability, characteristic of the continental climate in the area, with possible influences on the development of corn crops and existing weeds in the experimental field at NARDI Fundulea.

The graph highlights the average monthly temperature regime for the period 2019-2023 at NARDI Fundulea, characterized by a seasonal variability specific to the temperate-continental climate:-the minimum temperatures are recorded in the winter months (January, February), with average values close to or below 0 ºC (Figure 1).

- a progressive increase in temperature occurs in the spring season (March-May), marking the transition to a warm regime.

- the annual maximums are reached in the summer months (June-August), indicating high temperatures.

- starting with the month September, a gradual decrease in temperatures is noted, contributing to the autumn season.

From an interannual point of view, fluctuations in the average monthly values between the 5 years analyzed are observed, suggesting moderate climate variability.

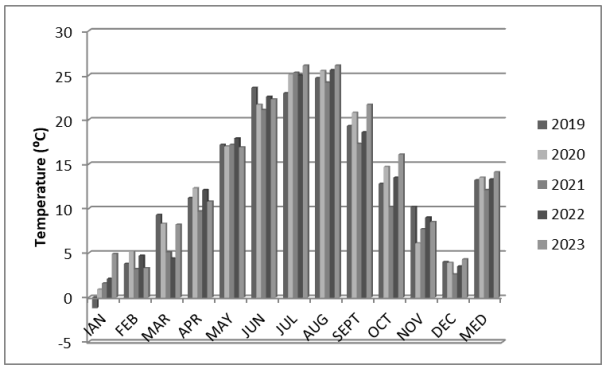

Figure1. Climatic condition (temperature) from NARDI FUNDULEA

The precipitations (Figure 2) recorded at NARDI - FUNDULEA during 2019-2023 was variable and generally below average, with higher values in spring (May-June) and sometimes in winter. Drier years are observed (2020-423.2 mm, 2022-258,4 mm, 2023-423.4 mm) and a more favorable one – the year 2021-553.2 mm. Overall, the rainfall regime indicates water deficit and increased risk of drought, especially in the summer season.

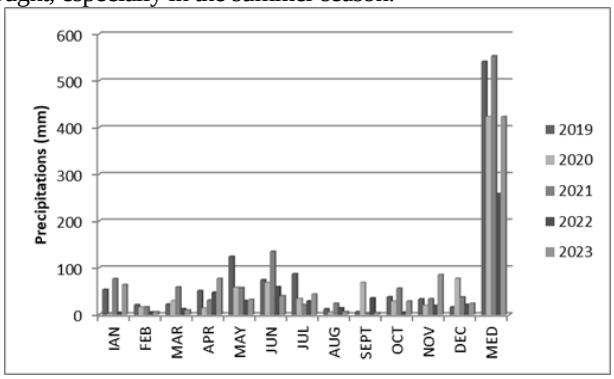

Figure 2. Climatic condition (precipitations) from NARDI FUNDULEA

RESULTS AND DISCUSSIONS

Weed infestation of maize crops is becoming an increasingly problematic factor in the context of climate change, as changes in temperature, precipitation and extreme events create ideal conditions for weed proliferation and reduce crop competitiveness.

In many agricultural regions, including Romania, climate change is already affecting productivity through droughts, torrential rains and sudden temperature variations, which amplifies weed pressure on crops.

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At the national and international level, weeds represent one of the greatest challenges of modern agriculture. Climate change and legislative restrictions require the transition to integrated weed management, in which mechanical work, crop rotation and modern technologies play an essential role. Weeds compromise the crop to a much higher degree, they compete with crop plants for water, light, heat and nutrients, affecting the level of production and quality of the harvest.

Most weeds demonstrate better adaptation to climate and soil conditions, compared to cultivated plants. Their roots develop at a much faster rate, penetrate deeper and have a high capacity for absorbing nutrients - (nitrogen, phosphorus, potassium).

In the maize experiment carried out in the Fundulea experimental field, the crop showed a high degree of infestation with annual and perennial monocotyledonous and dicotyledonous weeds, 65-90%, extremely diversified, depending on local pedoclimatic conditions. The evolution of weeds during the period 2019-2023 shows a general trend of increasing density for most of the species analyzed.

In the experimental field (untreated plot), the most significant weed species (Figure 3.) are: the monocotyledonous: *Setaria viridis., Echinochloa crus-galli, Sorghum halepense (from seed and rhizomes) and the dicotyledonous: Polygonum convolvulus, Anthemis arvense, Amaranthus retroflexus Solanum nigrum Xanthium strumarium, Galium aparine, Chenopodium album, Sinapis arvensis, Ambrozia sp., Cirsium arvense and Convolvulus arvensis.*

Monocotyledonous weeds

Setaria viridis is a very common annual weed that grows rapidly and easily invades agricultural land. Based on information from the sources consulted, is an annual grass known as green foxtail, found mainly in cultivated areas, on roadsides and in disturbed soils.

Echinochloa crus-galli is a very aggressive annual weed, commonly found in corn, sunflower, vegetable crops and even on uncultivated land. It is an annual plant of the *Poaceae* family, with fast growth and high twinning capacity. It prefers moist and warm soils and can reach heights of over 1.5 meters. It strongly competes with crops for water, light and nutrients, significantly reducing production. It produces a very large number of seeds, which remain viable in the soil for several years, which makes it difficult to control.

Sorghum halepense is a perennial plant of the *Poaceae* family, extremely invasive, which spreads both by seeds and by very vigorous rhizomes. It forms dense bushes, with stems that can exceed 2 meters in height, suffocating crops through intense competition for light, water and nutrients. It produces numerous seeds that are easily dispersed by the wind, contributing to rapid infestations over large areas and is particularly problematic in corn, sunflower, soybean and cereal crops, where it can drastically reduce production.

Annual dicotyledons

Polygonum convolvulus is an annual plant with thin, wiry stems that climb crop plants, causing them to fall and making harvesting difficult. It prefers well-aerated soils and temperate areas, germinating in early spring. It produces numerous hard seeds, which can remain viable in the soil for many years, contributing to persistent infestations.

Anthemis arvense -prefers light and well-aerated soils, being frequent in straw cereal crops.It competes with crop plants for light and nutrients, and in large infestations it can reduce production. Its seeds are numerous and resistant, remaining viable in the soil for several years, which favors the reappearance of the weed.

Amaranthus retroflexus - known in Romanian as red ragweed or American ragweed, is one of the most widespread and competitive annual weeds in agricultural crops. It produces

an impressive number of seeds (tens of thousands per plant), which remain viable in the soil for many years. It prefers nitrogen-rich soils and sunny areas, developing strongly in high temperature conditions.

Solanum nigrum - known as black nightshade or field nightshade, is an annual weed commonly found in crops and ruderal areas. Annual plant of the Solanaceae family, with ovate leaves and small, white flowers. Prefers nitrogen-rich soils and sunny areas. Spreads rapidly through numerous and resistant seeds.

Xanthium strumarium **-** known in Romanian as cornuti or field burdock, is a robust and very competitive annual weed. It is an annual plant in the Asteraceae family, with thick stems and large, trilobed leaves. It prefers nitrogen-rich soils and sunny areas, being frequent in weedy crops and on ruderal lands. It strongly competes with crop plants for resources and can significantly reduce production.

Galium aparine is a very common annual weed in crops and on ruderal lands. It is an annual plant with thin, hairy and clinging stems, which cling to other plants and knock them to the ground. It prefers nitrogen-rich soils and humid areas, being frequent in strawy cereals and rapeseed. It competes strongly with crops for light and space, causing problems at harvest and produces numerous seeds that remain viable in the soil for several years, favoring recurrent infestations.

Chenopodium album known in Romanian as white fescue or white fescue, is one of the most widespread annual weeds in European agriculture. It is a very competitive annual weed, present in almost all types of crops, especially in legumes. It prefers nitrogen-rich soils and sunny areas, having a rapid growth. It produces a large number of seeds, which can remain viable in the soil for a long time.

Sinapis arvensis known in Romanian as wild mustard or field mustard, is an annual weed widely distributed in agricultural crops. It prefers nitrogen-rich soils and sunny areas, being frequent in cereal, rapeseed and legume crops. It strongly competes with crop plants for light and nutrients, reducing production in large infestations. The seeds are numerous and can remain viable in the soil for many years, which favors the reappearance of the weed.

Ambrozia sp.,- known in Romanian as ambrozie or iarba părloagelor, is a genus of invasive plants, of which the most problematic species is Ambrosia artemisiifolia. It is an extremely invasive annual weed, present especially on uncultivated lands, roadsides and weedy crops. It has a high capacity for spreading through seeds, which can remain viable in the soil for many years. It competes with crops for resources and can significantly reduce production, especially in sunflower, corn and soybean.

Perennial dicotyledons

Cirsium **arvense** is one of the most persistent and difficult to control perennial weeds in European agriculture. It is a perennial weed with a very extensive root system, capable of regenerating from small root fragments. It is particularly problematic in perennial and sedge crops, where it can significantly reduce production.

Convolvulus arvensis is a very invasive perennial weed and difficult to control. It spreads both by seeds and vegetatively, which makes it persistent and difficult to eliminate.

The study on the dynamics of weed species density (plants/m^2) in the pedoclimatic conditions of Fundulea, during the period 2019-2023, shows a significant interannual variability of the degree of infestation determined by climatic conditions and the applied cultivation technology. The highest densities were recorded in the years 2019-2021, especially for *Setaria viridis., Sorghum halepens*e and *Amaranthus retroflexus* which frequently deposited 30 plants per square meter. In the years 2022-2023, a general trend of reducing weed density is

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observed in most species due to climatic conditions and control measures. Annual and perennial dicotyledonous species showed more pronounced fluctuations compared to the others, indicating a greater sensitivity to environmental variations. Weed structure and density are strongly influenced by the interaction between climatic factors and agricultural practices, and multiannual monitoring is essential for optimizing weed management strategies.

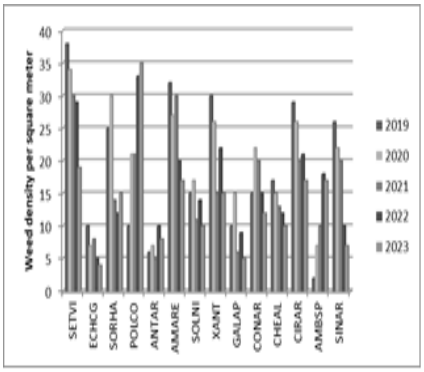

Figure 3. The evolution of weeds from maize crop during the period 2019-2023

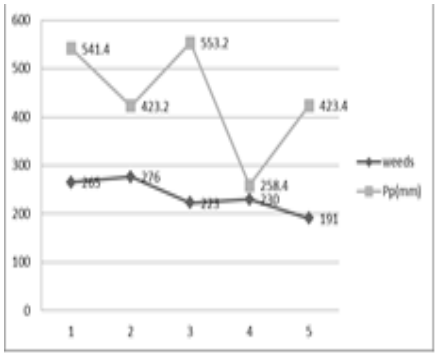

Figure 4 Weed density and precipitations

During the period 2019-2023, variations in the total weed density in relation to the amount of precipitation recorded at Fundulea are highlighted.(Fig.4) It is observed that the precipitation values fluctuate significantly from one year to another, with a maximum in 2021 (553.2 mm) and a pronounced minimum in 2022 (258.4 mm). On the other hand, the weed density has a generally decreasing trend during the analyzed period. According to the graph, the amount of precipitation recorded at Fundulea partially influences the density of weed species present in the corn crop, and other factors, such as crop technology or pedoclimatic conditions, may have an important role in their dynamics.

The study of the degree of weed infestation is not an end in itself, but in fact a possibility of knowing the infestations and the floristic composition of weed species.

Integrated weed management is a system of combined measures that aims to maintain the degree of weed infestation of crops below the damage threshold, while minimizing the negative impact on the environment. (CERGAN, 2025)

The agricultural damage caused by them manifests itself at a quantitative and qualitative level. Weeds compromise the crop to a much higher degree, they compete with crop plants for water, light, heat and nutrients, affecting the level of production and the quality of the harvest. In agriculture, the damage caused by weeds is irrecoverable and quantified in several ways: - quantitatively (by reducing the level of production); - qualitatively (by depreciating the quality of the harvests); - increasing production costs (technological links are affected in value).

Integrated Weed Management (IWM) is a modern and sustainable weed control strategy, based on a combination of methods (preventive, mechanical, biological and chemical) so that weeding is effectively reduced and the impact on the environment is minimal. In the current context, legislative restrictions on active substances and climate change, Integrated Weed. Management (IWM) becomes essential for maintaining agricultural productivity. Through crop rotation, weed monitoring, the use of agricultural work, Integrated Weed

Management contributes to soil protection, cost reduction and increased sustainability of agroecosystems.

CONCLUSIONS

The maize crop presents a high degree of infestation annually, with characteristic species. The causes of the appearance of different weed species are correlated with: - zonal climatic conditions; - seed reserve in the soil ;- plant-weed competition.

Weed infestation of corn crops in the Fundulea area is amplified by climate change by extending the vegetation period of weeds, favoring invasive species and increasing competition for resources. Adapting agricultural technologies becomes essential to maintain productivity in current and future climatic conditions.

Integrated Weed Management (IWM) is a modern and sustainable weed control strategy, based on the combination of methods (preventive, mechanical, biological, and chemical) to effectively reduce weed infestation and environmental impact.

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