

RESEARCH ON CORN TOLERANCE TO DROUGHT AND HEAT IN THE CONTEXT OF CHANGING PLANT-SOIL-WATER-AIR RELATIONSHIPS CAUSED BY CLIMATE CHANGE

Spinu Angela

*National Center Research and Seed Production,
s. Pascani, Republic of Moldova*

**e-mail: angelapatlatii@yahoo.com*

Summary. The study in this thesis evaluated a set of maize genotypes (simple hybrids) in field and laboratory conditions with different hydric stresses in different localities using a well-defined drought index to identify higher resistance/tolerance traits to drought and heat with a direct impact on final production.

Keywords: corn, germoplasm, resistance/tolerance, drought, heat, corn breeding, field conditions, HWS, LWS, production, experimental network, water stress, PEG, production stability index, drought sensitivity index.

Introduction

Recent climatic changes have significantly increased the interest of breeders to improve germplasm in all crop plants, including maize, on their tolerance to drought and heat. Drought and heat are two distinct phenomena but have a devastating synergistic effect on crop plants, causing major damage to all agricultural species. The genetic conditioning of tolerance to these two phenomena is different and difficult in the absence of exact quantification methods.

The identification and use of more accurate quantification of drought and heat tolerance in the selection process has become one of the primary objectives of the greatest importance in maize breeding programs from our country and worldwide. Epstein et al., 1980, found that physiologically, the ability of plants to adapt to different types of abiotic stress (drought, salinity, radiation, high or low temperatures, floods, etc.) and biotic (pathogens, competition with other organisms) that alter the plant-environment balance, can reduce the biosynthetic capacity of the plant and cause injuries that can destroy the plant.

Maize (*Zea mays* L.) is a major crop in the world. Corn production and stability are significantly affected by water scarcity and excessively high temperatures in critical development phases, Ciocăzanu I. et al., 1996. As a result, improved tolerance to drought and heat has become a priority in public and private sector improvement programs, and the identification of corn germplasm with high traits of drought and heat resistance has become an important target for breeders.

Creating and enhancing hybrids for drought and heat is a long-term strategy for maintaining and increasing production in future climatic events. The identification and characterization of germplasm with superior traits of drought and heat is an important step in corn breeding.

The methodology and maize germplasm used in this study are means of identifying the stability, variability, and performance level of maize production in the context of changing current climate conditions.

Material and methods

The biological material used consisted of the most advanced perspective corn hybrids created at NSRPC (National Seed Research and Production Center) Porumbeni, belonging to FAO groups 300-400, and 400-500. Hybrids were experimented during the period 2020 -2023 in competitive comparative microcultures.

Each year/location was classified into two water stress classes as follows: LWS (low water stress, normal production under normal climatic conditions) and HWS (high water stress, lower

production under drought conditions (below 6-7 t/ha). This classification was based on the climatic characterization, but especially based on the general production level obtained in the year and the respective location. The comparative microcultures were seeded according to the fully randomized block method, using a density of about 50000 plants/ha in all test sites, regardless of the degree of water stress. Each microculture was seeded in 2 to 3 repetitions, in 2-row plots, 7 m long, and 0,7 m row spacing.

Results and discussions

Based on the results of this study, it was proposed to improve the testing strategy, by using the production stability index, in the selection of the most adapted corn hybrids to different conditions, starting with the earlier test stages where there were enough data for an estimate as possible correctness of the index.

For this, it is necessary to expand and improve the experimentation network, as well as to introduce early testing links into this network.

As a result of this strategy, the selection index for production stability was also calculated for the orientation crops (CO), an important link in the test scheme, the orientation crops being the source, through selection and advancement, of valuable hybrids of hybrids for the competition, the last test link before promotion, to be registered in the State Register and production.

The data obtained in this study highlight the correlation coefficients between the real productions, obtained in the NSRPC Porumbeni test network, both under water stress conditions and under normal conditions, without stress, in the period 2020-2023, as well as the stability and drought indices calculated on production base and selection indices obtained for physiological indices.

Correlations of physiological indices are weak with grain yield obtained in normal conditions (LWS) localities and stronger with grain yield obtained in water-stressed localities (HWS).

Except for the average grain production obtained under favorable conditions, without water stress, where the lowest correlation coefficients were obtained and even insignificant in the case of some physiological indices, the values of the correlation coefficients are high enough to be significant.

It can be stated that there is a real correlation between the primary data and predictions, justifying their use to forecast drought and heat tolerance in modern breeding works. There is a need to continue these studies on a larger scale in such a way as to increase the safety and efficiency of predictions by identifying some physiological indicators that are easy to determine and well correlated with production data.

Conclusions

It is necessary to develop some researches that identify simple physiological indices, easy to determine and that correlate reasonably with tolerance to drought and heat in the growth and development phases of corn critical for drought and heat (flowering-silking, formation, and filling grains).

An important advantage of estimating drought and heat tolerance based on physiological indices determined in maize plants is that the determination of these indices is quite simple, it can be done in the off-season (during the winter) and allows promotion at sowing for field studies of a selected number of hybrids.

References

1. Ciocăzanu I., Sarca T., Cosmin O. and Bâgiu C. 1996. Drought Tolerance of Recently Registered Romanian Maize Hybrids. Maize and Sorghum Eucarpia XVII the Conference, Thessaloniki – Greece, Programme and Abstracts.
2. Epstein, E.J.D. Rush, RW Kingsbury, D.B. Kelly, G.A. Cinnigham and A.F. Wrono 1980. Saline culture of crops: A genetic approach. Science 210.