BEHAVIOR OF ACTUAL CORN HYBRIDS (*ZEA MAYS L.*) IN DROUGHT AND HEAT CONDITIONS

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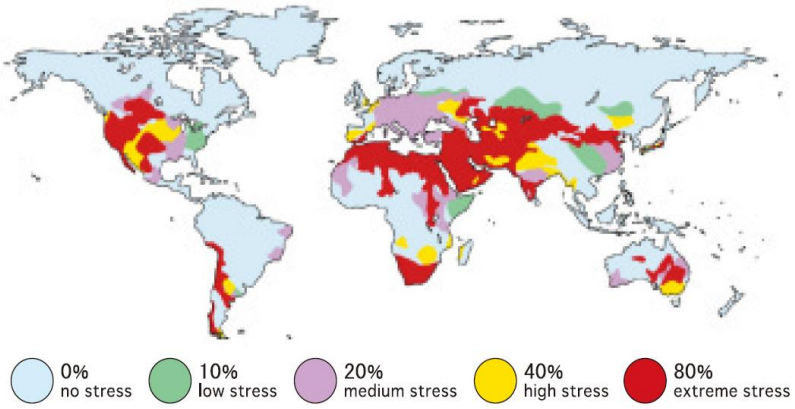
Abstract

Although Romania is not an area with a extreme water stress, drought manifested from the end of July 2011 until September 2012 caused pedological drought. The winter snow from 2011-2012 was not sufficient to recover the water deficit. The south-east part of Romania was one the most affected area. First negative effect of the drought shown in corn was uneven emergence in the spring. The explanation of the phenomena is that the autumn plowing was done in though conditions resulting earth boulders which retained the water that in spring help only a part of the seeds to germinate and emerge. The other seeds germinated approximately after two weeks with the first rain. The objective of this study is to evaluate the effects of water and heat stress during different growth stages in actual corn hybrids (*Zea mays L.*). The research methodology involves observations in vegetation in six locations to determine the effects of water stress, during vegetation. The water stress influence on different corn hybrids yield was determined in a polyfactorial field experiment (Siretel, Iasi County). The studied factors were: the hybrid (3 maturity groups) and planting dates (4 periods). During flowering and silking time, drought caused different abnormalities in corn husks and ears resulting in decreasing the yield. The hybrids behavior according to planting time was not significantly different in the field experiment, because the water and heat stress did not allowed the genetic potential to be maximum exploited.

Key words: **corn, actual hybrids, drought, heat stress**

Global population tripled in the 20th Century and water usage increased six times.

Under water stress are key region in China, India, the Midle East, Europe, Australia and Nord America [RSBS, 2006] (*fig. 1*).



Source: RSBS, 2006

Figure 1 **2025 World "water stress" status quo scenario (World Water Council)**

Drought is one of the most important a-biotic stress factor in corn which affects almost every aspect of plant growth [Rahman Mujeeb Ur *et al.*, 2004]. Water stress associated with high temperature decrease kernel set and is considered to be a limiting factor in corn production [Ramadoss Madhiyazhagan et al., 2004]. Water stress in corn can significantly affected the yield and yield components [Dagdelen Necdet *et al.*, 2008; Lamm, F. R., A. A. Abou Kheira, 2008]. In vegetative development, water stress reduces stem and leaf cell expansion resulting in reduced plant height and less leaf area. Ear size may be smaller and kernel number is reduced. During flowering and pollination water stress delays silking, reduces silk elongation, inhibits embryo development after

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pollination and reduces corn grain yield 3-8% for each day of stress.

This stage is are critical because the yield components of ear and kernel number can no longer be increased by the plant and the potential size of the kernel is being determined.

Water stress during grainfilling reduces yield 2.5 to 5.8% with each day of stress because increases leaf dying, shortens the grain-filling period, increases lodging and lowers kernel weight.

Once kernels have reached the dough stage of development, further yield losses will occur mainly from reductions in kernel dry weight accumulation.

Severe drought stress that continues into the early stages of kernel development (blister and milk stages) can easily abort developing kernels. Severe stress during dough and dent stages of grain fill decreases grain yield primarily due to decreased kernel weights and is often caused by premature black layer formation in the kernels.

Once grain has reached physiological maturity, stress will have no further physiological effect on final yield. Stalk and ear rots, can continue to develop and indirectly reduce grain yield through plant lodging [Lauer J., 2007].

The objective of this study is to evaluate the effects of water and heat stress during different growth stages in actual corn hybrids (*Zea mays L.*).

MATERIAL AND METHOD

The research methodology involves observations in vegetation in six locations to determine the effects of water stress, during vegetation, in actual corn hybrids in the eastern part of Romania, in 2012, targeting in particular the counties: Neamt, Iasi, Vaslui, Bacau and Galati.

The water stress influence on different corn hybrids yield was determined in a polyfactorial field experiment (Siretel, Iasi County). The studied factors were: the hybrid (3 maturity groups) and planting dates (4 periods).The experience has been located by randomized block method.

A.The hybrid (three maturity groups): H1 – DKC 3511 (RM 85)**;** H2 – DKC 4590 (RM 95); H3 – DKC 4795 (RM 97).

RM = relative maturity and express the number of days from emergence to black point appearance on kernel. The black point is usually installed when the corn kernels reach about 35% humidity, when the exchange of substances between plant and kernels are decreasing then interrupt.

In the experience it was used three control hybrids, one for each of the three analyzed hybrids. Were chosen as control hybrids, each corresponding market leaders from the same maturity groups (hybrids recorded the highest sales).

B. Planting time (4 periods):

- ✓ Planting time 1 - 12 April 2011
- ✓ Planting time 2 – 21 April 2011
- ✓ Planting time 3 – 30 April 2012
- ✓ Planting time 4 – 9 May 2012

The corn technology was the conventional one.

RESULTS AND DISCUSSIONS

Drought manifested in autumn 2011 and spring of 2012 caused water deficiency in soil.

In June 2012, with the installation of high temperature, soil water reserve decreased and in the same time the water consumption of the plant.

The atmospheric and soil drought, depreciated the crop vegetation in almost all areas of the country, especially in the south-east of Romania.

In Iasi County, during 01.04.2012-15.09.2012 the total amount of precipitation was 238.1 mm, of which 101 mm just in May.

In the rest of vegetation period most rains were below 5 mm, causing water stress for the corn.

In the same time, high temperature were recorded, in Iasi County, during July-August which increase the stress for the corn plants (the maximum daily temperature were frequently over 40 °C) *(fig. 2).*

The yield obtained in the field experiment from Siretel, Iasi County were between 2.3 tones/hectare and 6.23 tones/hectare, a good production considering the water and heat stress.

On average, the best productions were recorded in the planting time 2 (21 April 2011).

The hybrids behavior according to planting time was not significantly different.

DKC 3511 recorded the highest production when was planted in 1 and 2 planting time, having a decrease in production in the 3 and 4 planting time. DKC 4590 behaved best in the first planting time, yield decreasing from 1-4 planting time.

DKC 4795 recorded the highest production in the second planting time, drastically decreasing in the 3 and 4 planting time.

Control variant 1 and 2 registered almost constant production depending on planting time.

Control variant 3 recorded the best production in the second planting time, yield decreasing in the 3 and 4 planting time. Comparing the analyzed hybrids with the control variants, it was found that they behave better in the first two planting times, while in the 3 and 4 planting time there were no notable differences *(fig. 3).*

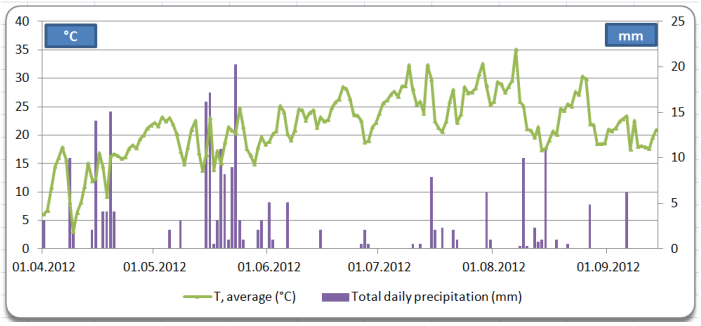

Figure 2 **Climate data recorded at Iasi Weather Station – 2012**
(Source: www.freemeteo.com)

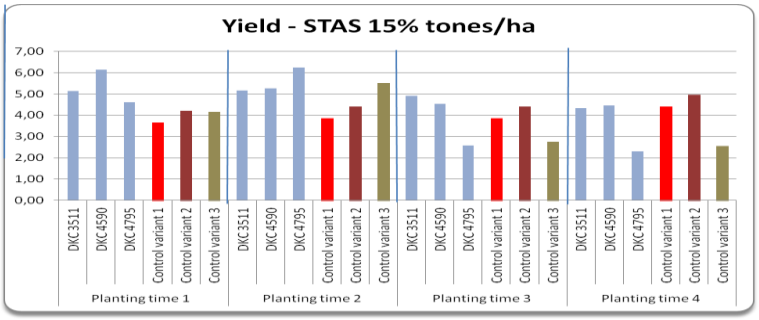

Figure 3 **Production results in Siretel, Iasi County**

In Andrieseni and Trifesti (Iasi County) the water and heat stress was very pronounced during vegetation time, causing pedological drought (the water reserve in the soil was very low) *(fig. 4, fig. 5).*

Figure 4 **Corn affected by drought - Andrieseni, Iasi County**

Figure 5 **Corn affected by drought - Trifesti, Iasi County**

The water and heat stress during flowering and silking time caused different abnormalities in corn husks and ears.

For instances there were observed incomplete developed corn husks and common smut in Trifesti, Iasi County (*fig. 6, fig. 7*), poor pollination on the basis of ear in Trifesti, Iasi *(fig. 8)*, County, banana-shaped corn in Andrieseni, Iasi County *(fig. 9)*, poor pollination in Strunga, Iasi County *(fig. 10)*, or *Aspergillus spp.* in Munteni, Galati County *(fig. 11)*.

Figure 6 **Incomplete developed corn husks - Trifesti, Iasi County**

Figure 7 **Incomplete developed corn husks, common smut - Trifesti, Iasi County**

Figure 8 **Poor pollination on the basis of ear - Trifesti, Iasi County**

Figure 9 **Banana-shaped Corn - Andrieseni, Iasi County**

Figure 11 **Aspergillus spp. - Munteni, Galati County**

CONCLUSIONS

Water and heat stress can affect almost every aspect of plant growth and is considered to be a limiting factor in corn production because it can affect the yield and yield components.

The hybrids behavior according to planting time was not significantly different in the field experiment, because the water and heat stress did not allowed the genetic potential to be maximum exploited.

During flowering and silking time drought caused different abnormalities in corn husks and ears resulting in decreasing the yield.

ACKNOWLEDGEMENTS

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