MAGYAR AGRÁR- ÉS ÉLETTUDOMÁNYI EGYETEM

Columella

Volume 9, Number 2, 2022

Columella
Journal of Agricultural and Environmental Sciences

Examination of water and salt stress for five different maize hybrids

Ádám KOMLÓSI[1] – Gábor BENCZE[1] – Zoltán FUTÓ[1]

1: Hungarian University of Agriculture and Life Sciences, Department of Irrigation and Land Improvement, Hungary, e-mail: adamkomlosi24@gmail.com

Abstract: In today's climatic conditions, the yield-reducing effects of drought are increasingly being felt. Irrigation is the easiest and most effective way to eliminate the damage caused by drought. The production of drought-tolerant hybrids is a new trend that can easily affect the amount and quality of crops to be harvested in a drought year. In the course of the research, we investigate the drought responses of five different hybrids, in three different water doses, in an environment closed from external precipitation in three replicates. We set up our experiment at the Department of Irrigation and Land Improvement of the Hungarian University of Agriculture and Life Sciences in Szarvas. The test was performed in pots. In addition to different water doses, the salt tolerance reactions of maize hybrids on saline soils were also investigated. The highest SPAD values were achieved with a water supply of SWS80%. Relative chlorophyll content results decreased by the end of the growing season, but the decrease was lowest with SWS80% water doses. The biomass weight of maize hybrids improved in all cases with increasing water supply (from 0.307 ± 0.04 to $0,440 \pm 0.07$) . The biomass weight of the drought-tolerant hybrids decreased the least under drought stress, while the decrease in biomass weight of the sensitive hybrids was much stronger during the experiment. The root mass of maize hybrids decreased significantly due to drought stress (from 0.555 ± 0.08 g to 0.328 ± 0.06 g). The smallest decrease was achieved by the roots of drought-tolerant hybrids. The maize hybrids were able to achieve the best LAI values at the SWS80% (good water supply) level. LAI values decreased by 19.5–21.7% due to drought stress. As a result of the drought stress, the decreased LAI values of the hybrids as well as the reduced root mass resulted in smaller cob weight. A significant mean positive correlation was found between LAI values and cob weight values of maize hybrids at $r = 0.493$. Hybrids showed more significant drought stress on saline soils, which worsened the yields achieved (from 11.2% to 18.7%). The production of maize hybrids under saline conditions was significantly decreased, but significant differences were found between the hybrids.

Keywords: SPAD, LAI, drought-stress, corn

Received 27 June 2022, Revised 8 December 2022, Accepted 13 December 2022

Introduction

One of the cornerstones of high maize yields is high-quality soil preparation, which consists of autumn tillage, spring seedbed preparation and fertilization. We must take care of a deep summer / autumn deep cultivation, because maize prefers airy soils (Birkás & Szieberth, 1998; Hegedűs, 1984; Radics, 2003).

Corn has tufted roots. Tasseled root is formed from a primary germ root, auxiliary root, and an auxiliary root emerging from the stem nodules. At the beginning of germination, maize develops only a single germ root that penetrates rapidly down into the soil, up to a depth of 30–40 cm. The side roots branch off from the main root in a fan-like manner in the soil. It is 60% below the surface of the earth to a depth of 10 cm and 90% to a depth of 50 cm. The main task of the side roots is to penetrate the soil into the deeper layers so that the plant can absorb water from as many places as possible. In addition to the secondary roots, we can also talk about additional roots. Additional roots can be called in several ways: air, support or dew roots. Their development can be traced to the second half of the vegetative developmental phase, and the stem nodules from which they originate are often found above ground. These play a role in protection against tipping over, water uptake and nutrient uptake (mainly phosphorus). The size of the root system of maize is influenced by the aeration and water supply of the soil, but it is determined by the varieties. The root development of maize is strongly influenced by the chemical and physical properties of the soil (Kovács, 1981). Adequate seeding density should be used, although there is no relationship between the length of the season and the seeding density (Pepó, 2011).There are also correlations between the size of the leaf area and the size of the grain yield achieved. Corn usually has 8–14 leaves, but rare forms can have 14–38. In addition to the leaf size of the maize, the leaf position is also important due to the purposeful, purposeful breeding work of the leaves, which is an advantageous property in terms of stem compaction (Antal, 2005). According to Nyíri (1997), a balanced supply of potassium and phosphorus is very important in the supply of nutrients to maize, which is incorporated into the soil in the autumn, and a precise supply of nitrogen is also important. The specific nutrient requirement of maize from macro nutrients is 28 kg N / t, 11 kg P_2O_5 / t, 30 kg K_2O / t. After fertilizing the corn with phosphorus and potassium in the fall, the nitrogen must be introduced into the soil in the spring (Füleky, 1999).

Corn has a medium water requirement of 450–550 mm. Its water consumption can reach up to 5.5–6.5 mm / day. From a depth of up to 150–200 cm, corn can absorb water. The lack of water during the period of tasseling can reduce our yield by up to 53%, while the drought at grain saturation can reduce our yield by 30% (Futó & Sárvári, 2015; Menyhért, 1979). According to Gyulai and Sebestyén (2011), the amount of precipitation is not necessarily decisive for the development of maize in terms of water supply, but its distribution during the growing season may be decisive. The water supply of corn consists of three main components. Precipitation retained during autumn and winter, the amount of water stored in the soil by appropriate agrotechnics during the growing season, and water applied by irrigation in addition to precipitation (Petrasovits & Balogh, 1969). Based on the drought index, Szász and Tőkei (1997) found that between 1860 and 1900 the incidence of dry and wet seasons was equal (22.5%), with average vintages accounting for only more than half of the years (55%) were typical, while in the period between 1980 and 2000 the proportion of drought vintages increased significantly (52.6%) at the expense of average vintages (26.3%). The occurrence of drought years is becoming more and more important and the role of drought control in agriculture is becoming increasingly important.

According to Pepó (2011), we can only perform successful selection in genetically diverse populations, so new directions in plant breeding include maintaining biodiversity through different methods. According to Basal (2020), it is not the SPAD results for soybeans but the much more closely correlated leaf area index (LAI) results that will provide reliable data to assess the resulting drought damage. In the maize stock that does not suffer from drought damage, the grain yield per hectare increases linearly up to the value of 5–5.5 LAI and then to 6–7 LAI. There is also a correlation between the size of the leaf area (LAI) of maize and grain yield (Futó, 2003; Antal, 2005).

Many research confirm that drought and salt stress are similar physiological and biological processes and result in similar reactions in plants (Chaves et al., 2003; Chen

DOI: https://doi.org/10.18380/SZIE.COLUM.2022.9.2.155

et al., 2003; Jiang & Zhang, 2004; Liu & Vance Baird, 2004; Shao et al., 2005; Zhu et al., 2004). The concept of water stress includes both salt stress and drought stress too (Kaur & Zhawar, 2015), and it has been observed that salt stress combined with drought stress can cause even greater yield loss (Cong, Pang, Xu, & Wang, 2021).

Materials and Methods

In the course of the research, we examined the responses of different maize hybrids to drought and salt stress in an environment excluded from external precipitation. If we can reduce the negative effects of climate change with a properly chosen hybrid, we can also have a major impact on crop loss and production economy. During the experiment, 5 different maize hybrids were tested, with drought-sensitive and drought-tolerant hybrids among them. The experiment was performed in pot experiments isolated from external precipitation. The first step was to determine the field water capacity of the soil (SWS) that the soil could hold back against gravity and set up 3 different water doses (SWS 40%, SWS 60%, SWS 80%). Secondarily, we also measured salt stress in the experiment, so we also performed treatments where the same water doses are set on moderately saline soils.

Our crop results are greatly affected by the effect of drought stress, so we set up a water supply experiment to study the irrigation response and drought tolerance of different maize hybrids. If, in this world burdened by climate change, we can make the yield of maize more stable in a drier season with a well-chosen hybrid, it could increase the yield and production safety.

In this experiment, the irrigation response and drought tolerance of maize hybrids recognized or pending recognition were investigated. Alternatively, salt tolerance was also tested in the experiment. Drought-tolerant and drought-sensitive hybrids were also included in the research.

In the experiment, the drought and salt tolerance reactions of different maize hybrids were investigated in a pot experiment closed from external precipitation. 11 kg of arable soil was weighed into the culture pots at the time of setting up the experiment and the main physical and soil chemical properties of the arable soil were determined. These parameters are as follows:

- Physical type of soil: clay soil
- Arany's soil plasticity: 46 KA
- Field water capacity: 47 V/V%
- Dead water content: 31 V/V%
- Water content available for plants: 16 V/V%
- pH: 7.07

The following hybrids were included in the experiment: GKT 372 (drought tolerant), GKT 376 (drought tolerant), GKT 3385 (drought tolerant), GKT 4486 (drought sensitive), GK SILOSTAR (drought sensitive). The corn hybrids were sown on April 29, 2020, which emerged on May 8-9. The plants were watered uniformly until the 10-leaf stage, according to the water requirement. From June 9, 2020, we started the treatments with different water doses. The experiment was harvested on September 3, 2020.

Only the changes of the temperature values as monitored from the meteorological data, as the pots were in greenhouse, where the plants closed from external precipitation. Temperature had the greatest effect on evapotranspiration and thus on the daily amount of water discharged. The increasing temperature increased the daily evaporation, which required the use of higher water doses to achieve the planned water supply level.

3 water supply levels were set in the experiment. The first step was to determine the natural water capacity (TAC) of the soil, which was the amount of water that the soil could retain against gravity. For this, we took a soil sample that was saturated with water. The

soil was then placed on dry sand and allowed to drain and weighed. The soil was then dried at a temperature of 105 °C and weighed again. From the difference in weight, we calculated the value of the soil field water capacity. The following treatments were set up experimentally: SWS 40%, SWS 60%, SWS 80% (SWS = Soil Water Storage Capacity).

In the experiment, we measured and calculated the amount of daily evaporation based on the daily temperatures with which we were able to maintain different levels of water supply in the treatments. In the lowest treatment (SWS40%), 361.1 mm less water was released during the growing season than would have been justified for us by plant transpiration. During the experiment, the plants were exposed to significant drought stress. In the highest dose treatment (SWS 80%), the amount of water applied (100% of the evapotranspirated water was replaced) this covered the amount of evaporation, so it was optimal for corn..

In the salt tolerance experiments, different water supply levels (SWS40%, SWS 60% and SWS 80%) were also set. The salt tolerance of hybrids was monitored by applying different Na salts added to irrigation water. This salt mixture contained NaCl, NaSO4 and NaCO3. During the treatments we applied to model the water management properties of a medium quality saline soil (salt% = 0.1–0.25, EC=2–4 mS/cm).

During the research, the following phenological parameters were measured: relative chlorophyll content (SPAD) with Konica SPAD 501 instrument, leaf area (based on Montgomery formula), leaf area index (LAI m^2/m^2), cob weight, biomass weight, root weight.

Data were measured several times during the growing season. Final biomass (leaf and stem weight, root weight, etc.) was measured at harvest, relative chlorophyll content (SPAD) and leaf area were measured every two weeks. The data were processed with Microsoft Excel, while the statistical evaluation of the data was performed with SPSS for Windows 25.0. program, using the method of variance analysis and correlation.

Results

The highest relative chlorophyll content (SPAD) in corn plants was measured during the 2nd measurement, after which the chlorophyll content began to decrease, the process of drying and ripening began (Figure 1). This indicated that the decrease in chlorophyll content was large under dry conditions, but plant aging reduced the relative chlorophyll content to a greater extent.

There were significant differences in SPAD values due to different water doses. At the lowest water dose (SWS 40%), the SPAD value decreased to 41.47 due to drought stress, while it was 45.94 for medium water supply and 46.05 for good water supply (Table 1.).

In drought conditions (SWS 40%), the decrease in the SPAD value of the treatments was significant. The lowest relative chlorophyll content values were at the time of the last measurement, for all corn hybrids. The smallest SPAD depreciation was under excellent water supply conditions, is maize was able to further photosynthesize with adequate water supply. Figure 2. shows that the SPAD values of different maize hybrids are different for different water doses. Maize hybrids do not show us clear changes in SPAD results, as some hybrids (GKT4486 and GK SILOSTAR) achieved the highest SPAD (40.73 and 42.97) in the good water supply (SWS 80%) and others (GKT372, GKT376 and GKT3385) in the medium water dose (SWS 60%) treatment (48.73, 41.72 and 40.1) so we assume that the SPAD is not considered an appropriate consideration in all cases when examining drought stress.

The mass of the above-ground biomass (leaf, stem) of the hybrids was also measured in the

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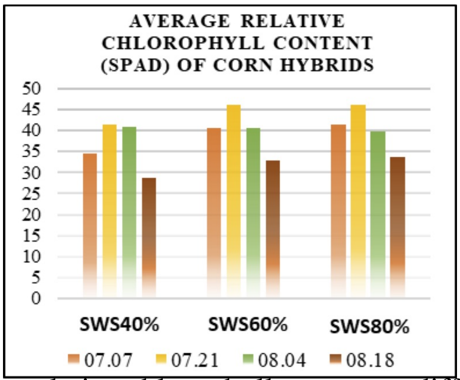

Figure 1: Average relative chlorophyll content at different water doses

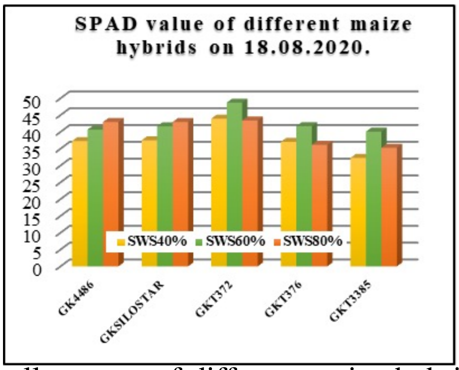

Figure 2: Relative chlorophyll content of different maize hybrids at different water supply levels

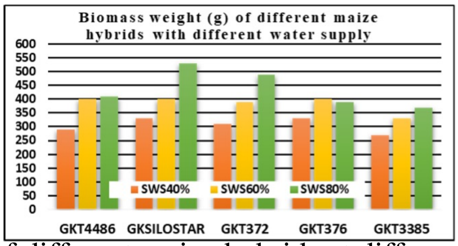

Figure 3: Biomass of different maize hybrids at different water supply levels

Table 1: Variance analysis of SPAD value

SPAD Value	SS	df	MS	F	p	$Fcrit.$
Between groups	143.5903	2	71.79513	22.43241	0.0000883	3.885294
Within a group	38.40611	12	3.200509			
Total	181.9964	14				

experiment (Figure 3). At all water supply levels, the lowest plant weight was achieved by a hybrid called GKT 3385 (Table 2).

The hybrid named GKT 376 has the smallest difference between the hybrids for different water doses, suggesting that this hybrid has

Table 2: Value of biomass of different corn hibrids and different water supply

	Biomass (kg)					
	GKT4486	GKSILOSTAR	GKT372	GKT376	GKT3385	Mean
SWS 40%	$0.293^{a} \pm 0.09$	$0.333^{a} \pm 0.02$	$0.307^{a} \pm 0.05$	$0.333^{a} \pm 0.02$	$0.267^{ac} \pm 0.02$	0.307^{A}
SWS 60%	$0.400^{ad} \pm 0.00$	$0.400^{ad} \pm 0.04$	$0.387^{a} \pm 0.36$	$0.400^{ad} \pm 0.04$	$0.333^{a} \pm 0.02$	0.384^{B}
SWS 80%	$0.413^{ad} \pm 0.12$	$0.533^{b} \pm 0.08$	$0.493^{b}d \pm 0.40$	$0.387^{a} \pm 0.02$	$0.373^{a} \pm 0.06$	0.440^{B}
Mean	0.369^{C}	0.422^{D}	0.396^{C}	0.373^{C}	0.324^{C}	

(a,b,c,d Different significant groups between hybrid × SWS values;
A,B Different significant groups between SWS average values;
C, D Different significant groups between hybrid average values)

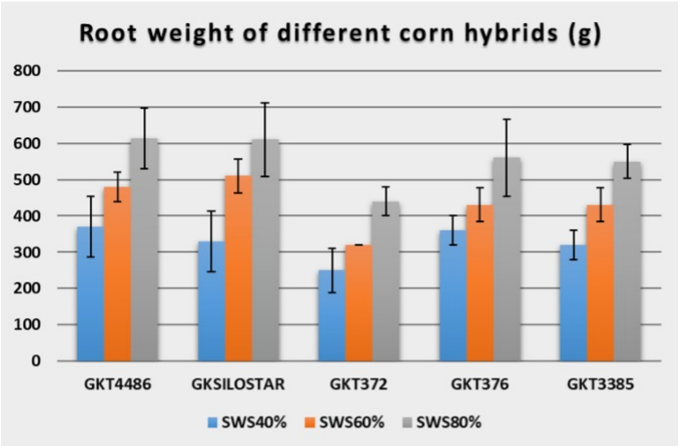

Figure 4: Root mass of different corn hybrids at different water supply levels

Table 3: Analysis of variance of root weight (g)

Tests of Between-Subjects Effects					
Source	*TSS*	*df*	*MS*	*F*	*Sig.*
Intercept	8.642	1	8.642	2431.770	.000
Hybrid	.135	4	.034	9.470	.000
Irrigation	.386	2	.193	54.339	.000
Error	.135	38	.004		
Total	9.298	45			

a. R Squared = .794 (Adjusted R Squared = .762)

Table 4: Means and confidence intervals of root weight (g) under different irrigations

Root weigth (g)				
Irrigation	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
SWS 40%	0.328^{a}	0.015	0.297	0.359
SWS 60%	0.432^{b}	0.015	0.401	0.463
SWS 80%	0.555^{c}	0.015	0.524	0.586

a-c Values with different letters within treatments (irrigation) differ statistically ($P < 0.05$)

the worst irrigation response. This hybrid did not achieve the highest biomass mass with a good water supply, but with a medium water dose (SWS 60%). GK SILOSTAR achieved

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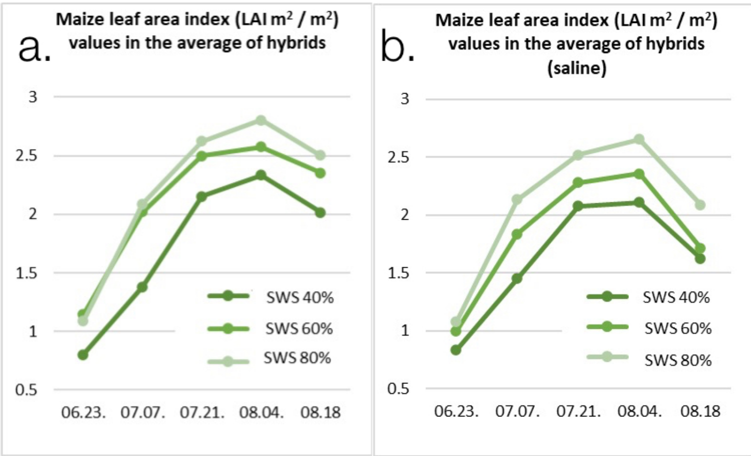

Figure 5: Development of leaf area index (LAI) values in different water supply treatments (a.) and on saline soils (b.)

Table 5: Analysis of variance of LAI (m^2/m^2)

Tests of Between-Subjects Effects					
Source	*TSS*	*df*	*MS*	*F*	*Sig.*
Intercept	1658.650	1	1658.650	4458.801	.000
Hybrid	7.839	4	1.960	5.268	.000
Irrigation	16.877	2	8.439	22.685	.000
Salt	2.452	1	2.452	6.593	.011
Error	164.422	442	.372		
Total	1850.239	450			

the highest biomass mass (530 g), which is understandable due to its genetic background (silage corn), but the difference between the results of different water dose treatments is quite large, which indicates that this hybrid has a good reaction to irrigation.

One of the most important parameters for us is the development of root masses in addition to the leaf area index and cob mass. Research is currently underway to demonstrate that hybrids with higher root mass / root area are much better able to tolerate drought thus being able to achieve higher yields. There may also be significant differences in the root mass of hybrids that affect the water and nutrient uptake of a given hybrid. For all maize hybrids, increasing water doses resulted in increasing root masses. During the experiment, the hybrid named GKT 372 reached the lowest root mass in all irrigation treatments. GK SILOSTAR achieved the highest root weight (610 g) at the SWS 80% water dose, had only 3 g less root weight than the GKT4486 maize hybrid (613 g) in the treatment, which is really good results (Figure 4, Table 3, 4).

The hybrid GK 4486 was able to achieve the highest root weight (370 g) in dry conditions (SWS 40%), which could be an advantage over other hybrids in a drier season. At medium (SWS 60%) water dose, GK SILOSTAR showed that it can achieve significant root mass when medium amount of water is available, as it reached the highest root mass, indicating good water utilization and irrigation response. The GKT 4486 hybrid achieved the highest root mass under good water supply conditions (80% water

Table 6: Means and confidence intervals of LAI (m^2/m^2) under different treatments

		LAI (m^2/m^2)		
Hybrid	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
GKT 4486	2.060^a	.064	1.933	2.186
GK Silostar	2.027^a	.064	1.900	2.153
GKT 3724	1.873^{ab}	.064	1.747	2.000
GKT 376	1.950^a	.064	1.823	2.076
GKT 3385	1.690^b	.064	1.563	1.816
		LAI (m^2/m^2)		
Irrigation	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
SWS 40%	1.675^c	.050	1.577	1.773
SWS 60%	1.935^{cd}	.050	1.838	2.033
SWS 80%	2.149^d	.050	2.051	2.247
		LAI (m^2/m^2)		
Salt	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
without salt	1.994^e	.041	1.914	2.074
with salt	1.846^e	.041	1.766	1.926

a-e Values with different letters within treatments (hybrid. irrigation and salt) differ statistically ($P < 0.05$

dose of SWS). The size of the water doses in the hybrids had a great influence on the root mass of the hybrids. As a result of the improved water supply, the increase in root masses was significant for all hybrids, increasing between 35.7% and 45.9% in the experiment.

The average leaf area index (LAI) values of the hybrids in the treatment of different water doses are shown in Figure 5. They show that at the lowest SWS water dose of 40%, significantly smaller leaf area was formed in maize hybrids, and their leaf area results remained lower than the SWS 60% (medium water supply) during the growing season. SWS in 80% (good water supply) treatment.The significant leaf area increased due to the 60% water dose of SWS and the 80% water dose of SWS, the values of these water doses increased the leaf area evenly until the measurement on 07.07, but after that the 80% water dose of SWS was able to increase the leaf area of hybrids.

The irrigation results of the salt-treated culture vessels are shown in Figure 5b. On saline soils, after the 40% water dose of SWS, the other two treatments (SWS 60% and SWS 80%) could not increase the leaf area of maize hybrids as much as in the treatments without salt treatment, so salt stress can also suppress the positive effect of increasing water doses. The increase in water supply in saline soils resulted in much weaker leaf area growth than in non-saline treatments. Salt in the soil significantly impairs the nutrient and water uptake of maize, thereby significantly affecting the water management of the medium. In addition to the medium water supply (SWS 60%), we measured only the same leaf area results (2.36 m^2/m^2) as in the experiment without salt treatment under drought stress (SWS 40%) (2.33 m^2/m^2) (Tables 5 and 6).

At the beginning of the vegetation, the treat-

 DOI: https://doi.org/10.18380/SZIE.COLUM.2022.9.2.155

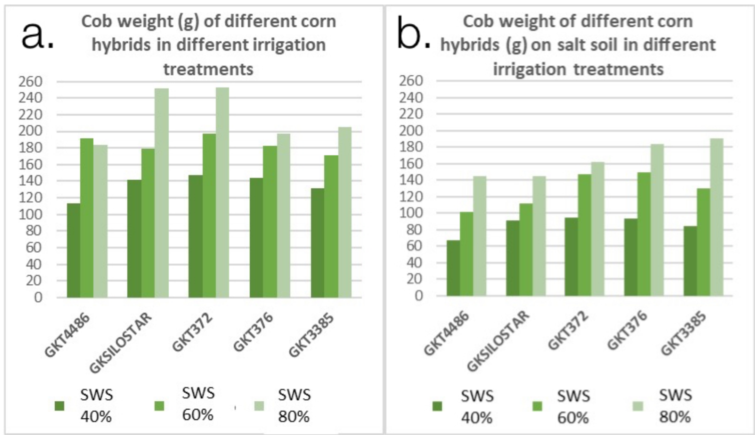

Figure 6: Cob mass of maize hybrids at different water supply levels (a.) and on saline soils (b.)

Table 7: Value of cob weight of different corn hibrids and different water supply

	Cob Weight (g)					
	GKT4486	GKSILOSTAR	GKT372	GKT376	GKT3385	Mean
SWS 40%	$113,123^{a} \pm 52,15$	$141,537^{ad} \pm 8,42$	$146,573^{ae} \pm 20,67$	$143,597^{a} \pm 12,61$	$130,510^{a} \pm 6,54$	$135,068^{A}$
SWS 60%	$192,367^{be} \pm 6,63$	$178,807^{bd} \pm 8,39$	$196,933^{be} \pm 4,86$	$181,633^{bd} \pm 11,91$	$171,247^{bd} \pm 16,40$	$184,191^{B}$
SWS 80%	$184,633^{b} \pm 34,04$	$252,02^{c} \pm 28,38$	$253,380^{c} \pm 28,41$	$196,667^{be} \pm 6,88$	$204,747^{b} \pm 13,15$	$218,291^{C}$
Mean	$163,378^{D}$	$190,788^{D}$	$198,961^{E}$	$173,954^{D}$	$168,834^{D}$	

(a,b,c,d Different significant groups between hybrid × SWS values;
A,B,C Different significant groups between SWS average values;
D,E Different significant groups between hybrid average values)

Table 8: Pearson correlation between LAI and maize cob weight

		LAI	Cob weight
LAI	Pearson Correlation	1	0.478 ∗∗
	Sig. (2-tailed)		0.001
Cob weight	Pearson Correlation	0.478 ∗∗	1
	Sig. (2-tailed)	0.001	

∗∗ Correlation is significant at the 0.01 level (2-tailed).

ments do not show significant differences in the development of the leaf area index, but as the vegetation progresses, they are better able to explain the negative effects of salt stress, which cause drastic leaf area index declines (between 14.9% and 26.8%). Under these conditions, the plants are able to photosynthesize for a shorter time and with a significantly smaller leaf area, which reduces the plant's organic matter production on a large scale. During the experiment, the salt stress caused on the salty soil resulted in faster aging, dehydration and drying of the corn plants. Comparing Figures 6a and 6b, it becomes clear that salt stress significantly reduced the cob weight of each hybrid, but the extent varied from hybrid to hybrid (Table 7).

The greatest yield-reducing effect was on the tube weight of GKT 4486 and GK SILOSTAR. Drought-sensitive hybrids were able to achieve high tube masses in non-saline treatments with a good irrigation reaction, but stress-tolerant hybrids prevailed due to the negative effects of salt stress. In Figure 6a, GK SILOSTAR was able to reach the second highest tube weight (252 g) at the 80%

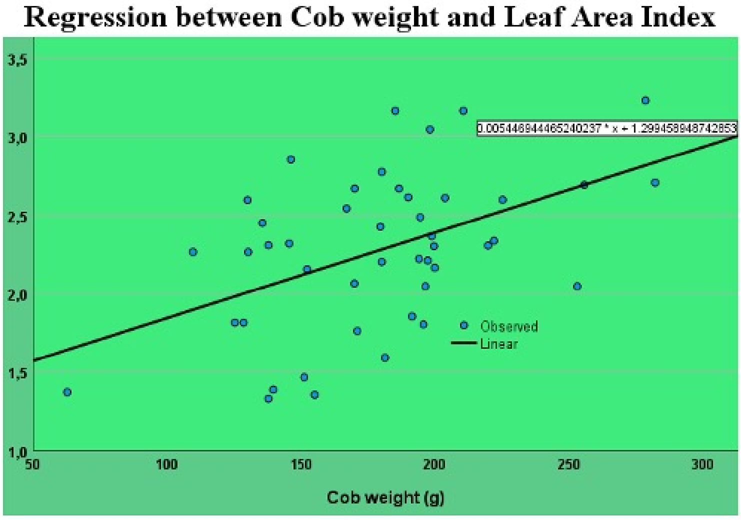

Figure 7: Regression between LAI and maize cob weight

water dose of SWS, but was forced to the penultimate position in the treatments (145 g) due to salt stress.

The effect of salt stress on drought-sensitive hybrids was more pronounced in terms of yield loss. In contrast to salt stress, however, drought-tolerant hybrids showed less decline compared to themselves. The hybrid GKT 372 achieved the highest tube weights in non-saline treatments (253 g) and performed quite well in saline treatments (162 g), from which it can be concluded that it tolerates the yield-reducing effects of salt stress and drought well.

The GKT 3385 hybrid performed best in terms of pipe weights (190 g), so it can be said to have good resistance to drought stress as well as salt stress (only 15 g). Under the effect of salt stress, significant yield loss can be realized, but the experiment shows that a good hybrid selection can reduce yield loss. The degree of correlation between leaf area index (LAI) and tube weight was examined during the statistical evaluation. A correlation study was performed first. It can be stated that the correlation showed a significant correlation, the correlation value was 0.478, the correlation was positive(Table 8). The regression study also clearly confirmed that an increase in leaf area leads to an increase in tube mass, so the negative effects of water scarcity on leaf area (LAI) are strongly correlated with a decrease in subsequent tube mass results (Figure 7).

Conclusions

Based on the experiment, it can be concluded that the hybrids with the best irrigation reaction were GKT 4486 and GK SILOSTAR. These two drought-sensitive hybrids were helped by their good irrigation reaction to achieve high biomass mass. With a good water supply, they were able to achieve a high tube mass, and in non-saline treatments, the two hybrids were able to achieve the highest root mass. These two hybrids were at the forefront of SPAD and LAI results throughout the non-saline treatments, but only at the highest water supply level were they able to achieve good results in tube mass development.

The GKT 372 hybrid was able to achieve good results in non-saline treatments. He had the lowest root weight in the non-saline treatments, but nevertheless had the highest tube weight and the second best result in terms of biomass.

DOI: https://doi.org/10.18380/SZIE.COLUM.2022.9.2.155

In the saline treatments, the two drought-sensitive hybrids reached the lowest tube weight, and their biomass and root weight loss were also the largest for these hybrids. The GKT 3385 hybrid was able to reach the highest tube weight during the salt treatments, but the GKT 376 and GKT 372 hybrids did not lag far behind. Their stem, tube, and root mass development did not decrease much in the saline treatments, which shows us that these hybrids have good salt tolerance.

The results of the experiment show that the GKT 372 is a great choice in a rainy and in a normal year, but the GKT 372 can be a good choice for us even in a droughty year, but the other drought-tolerant hybrids GKT 376 and GKT can be mentioned here. 3385. GK SILOSTAR has a good irrigation reaction and can achieve a high biomass mass in a normal vintage, which is a particularly important feature because it is a silage corn. GKT 4486 did not give us good results in either the saline or smooth treatments.

Thanks to the experiment, it has been found that a drought-tolerant hybrid can achieve good crop safety in a drier vintage, and if this property is combined with a good irrigation reaction, hybrids can be grown that produce higher yields in both a drier and a normal vintage. The experiment has shown that a good irrigation response can be a key property for a drought-sensitive maize hybrid, but it cannot even compete with the crop safety provided by drought-tolerant hybrids.

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