

THE RESPONSE OF SOME SUNFLOWER HYBRIDS IN LOW WATER-SUPPLY CONDITIONS IN THE CENTRAL DOBROGEA PLATEAU

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Abstract

Aim of the study: The response of some sunflower hybrids in low water-supply conditions. The central part of Dobrogea is chiefly characterized by a warm and droughty climate, with the medium annual temperature of 11°C and medium annual rainfall of 432.2 mm, which are irregularly distributed during the whole year and therefore for the sunflower crop there isn't ensured a comfortable humidity regime for a normal development of plants. A decreased sunflower yield is drastic if there is an intervening of the hidric shortage. Taking into consideration the importance of the usage of some drought and torridity resistant genotypes, the work aims to find the most adequate germoplasm for obtaining some profitable crops in low water-supply conditions in the central Dobrogea Plateau. The method used: The sunflower trial was located at S.C.D.A Valu lui Traian, Constanta County in 2011; bifactorial type it was used the randomized blocks method, with the following factors and graduations: A Factor: Water-supply level (A₁ unirrigated; A₂ – irrigated with pedological norm of 700 m³/ha; A₃- irrigated with 50% reduced pedological norm = 350 m³/ha; B Factor: The hybrid (FAVORIT, SINGI, DELFI, PR64A89, TEKNY, KONDI). Results: 2011 proved to be a favourable one for the sunflower crop. The obtained yield while using the sunflower hybrids was influenced by the water-supply level, the average being 42.0 q /ha in unirrigated conditions, 50.4 q/ha taking into account the pedological norm of 700 m³/ha and 45.7 q /ha, with 50% reduced the pedological norm. Conclusions: The classification of hybrids after the obtained yield in different water-supply conditions is: Singi, Kondi, Tekny, Favorit, Delfi and PR 64A89. The average seed- weight per head, 1000 –seed weight and the hectolitic mass varied in terms of the hybrid and the water-supply level.

Key words: crop, genotype, pedological norm, tolerance, yield.

INTRODUCTION

The pluviometric and termic rate in Romania, irregularly distributed on the territory and the drought periods in South, South-East and South-West in July and August, made necessary the introduction of irrigation in these ecological areas as well as the use of some drought and arid tolerant genotypes. There is a high reduction of sunflower yield when the hidric shortage appears and the sunflower leaves growth and development is significantly affected by the moderate hidric shortage. The appearing of the hidric stress before blooming leads to a decreased weight of sunflower plants, the reduction of stem and head diameters. There is a much reduced quantity of seeds/plant when the stress turns up in the blooming period. The hidric stress in the maturity stage leads to a

low crop coefficient and there is a decreasing in what concern the oil-seed percent [3, 6]. The losses of dry substance yield can be 22-50% and the yield reduction is between 20% and 51% when there is a severe and moderate coefficient, the water consumption in the case of sunflower being with 20% or 47% less than the crop with an optimal water-supply level [1]. There is a negative correlation statistically ensured by the correlation coefficient $r=-0,586^{**}$ between the yield and rainfall in the period of bead grain formation, a period corresponding to July and August. If there is an increasing of rainfall over the limit of 130 mm in this period, then the yield decreases from an average potential of 29.8 q/ ha with 4.6 q/ha for each mm of excedentary rainfall [4]. Dobrogea region is characterized by an irregular distribution in time and space of rainfall, and

that is why for the sunflower crop there is not provided a comfortable humidity rate corresponding to the normal development of plants. Taking into account the important use of some drought and torridity genotypes with tolerance to drought and torridity, the work aims to find the most adequate germoplasma for obtaining a profitable crop in low-water supply conditions in the central part of Dobrogea plateau.

MATERIAL AND METHOD

The research was developed and it was executed a sunflower trial, bifactorial type, located after randomized blocks method with the following factors and graduations: A factor – water insurance level: A₁ unirrigated (drought-tolerance), A₂ irrigated with pedological norm of 700 m³/ha, A₃ irrigated with reduced pedological norm 50%=350 m³/ha. The B factor: Hybrid- B₁ Favorit, B₂ Singi, B₃ Delfi, B₄ PR64A89, B₅ Tekny, B₆ Kondi. Before sowing there was fertilization with complex fertilizers 28:28:0. The fertilizers were incorporated into soil with disc harrow. The field preparation for sowing was executed before the actual sowing day with the cultivator. In the sowing day, the rows were delimited with the seeding machine and the trial was marked with sticks according to the trial plan. The necessary seeds were treated with insecto-fungicide. The sowing was executed with the dibble distributing 3-4 seeds together, the depth of 4 cm and distance of 30 cm between the plants on the row. The sowing date was 27th of April 2011. After emergence the plants were spaced leaving, only a planting hole. The plot doesn't have holes. There were made observations and determination in the plot such as: the emergence date; number of days from sowing till emergence; blooming date; harvesting date; plant height; head diameter. The yield was established through the seed weighting on the field after the lateral and frontal eliminations were made. The seed yield was calculated on hectare, at STAS humidity parameters (11%). The 1000 - seed weight was determined by the counting of 500 seeds in two repetitions at each hybrid, their weighting and the reporting of the 1000 - seed medium weight. The hectolitic mass was determined

taking into account the average of three executed weightings from the yield of each hybrid. The results were developed through statistical calculations, using the analysis of the variation for bifactorial field trials placed after the randomized blocks method and the correlation between different characters and water supply [5].

RESULTS AND DISCUSSIONS

The year 2011 was a favourable one for the sunflower crop, and this is reflected in the obtained yield. The influence of the different water-supply conditions over the sunflower hybrids' yield is presented in table 1. In comparison to the Favorit hybrid (Mt 1), cultivated under low-water supply conditions, which obtained a yield of 44.1 q/ha, the highest yield was obtained by Kondi 54.0 q/ha and Singi 53.5 q/ha hybrids under irrigation conditions with pedological norm of 700 m³/ha, with significant differences in relation to the witness. Under the same water-supply conditions, Tekny and Delfi hybrids obtain significant yield differences of 6.7 q/ha and respectively 6.4 q/ha in comparison to Favorit hybrid which is unirrigated. In comparison to Favorit hybrid, irrigated with pedological norm of 700 m³/ha (Mt 2), only Kondi hybrid cultivated under the same water-supply conditions obtains a higher yield with 5.7 q/ha, significant. Under unirrigation conditions, the yield differences in relation to Favorit hybrid (Mt₂) were negative, and those of Kondi, Delfi and PR64A89, significant distinct, demonstrating the drought sensibility. By reducing with 50% the pedological norm, the yield decreased and the most affected were PR64A89 hybrid with 6.7 q/ha and Delfi with 6.6 q/ha, the differences being significant; in this way these hybrids prove their sensibility to the absence or water deficit. There was established a significant distinct relation between the water-supply and the sunflower hybrids yield, but this occurs only in case the crop is not irrigated (Fig. 1). The sunflower hybrids behaviour cultivated under different water supply conditions shows that 2011, was favourable for crop, the medium obtained yield was between 42.10 q /ha (PR64A89) and 49.20 q/ha (Singi). In comparison to the field trial

average (Mt1) only PR64A89 hybrid obtained a lower yield with 3.9q/ha, significant difference. And in relation to Favorit hybrid (Mt2), PR64A89, had a lower yield with 3.6q/ha, significant difference (Table 2). The irrigation with pedological norm of 700 m³/ha proved to be the most efficient for a high yield. This was with 4.4 q/ha higher comparatively to the field trial average, and with 8.4 q/ha comparatively to the unirrigated variant, very significant differences. There was also a yield increasing obtained of 3.7 q/ha under irrigation with pedological norm of 350 m³/ha in comparison to unirrigated variant, significant distinct (Table 3). The climatic conditions in 2011 as well as the water-supply conditions marked the medium seed weight per head. Under irrigation with pedological norm of 700 m³/ha, the seed-weight was the biggest (highest), between 90 g at Tekny hybrid and 103 g at Kondi hybrid (Fig. 2) By reducing the water pedological norm with 50% led to the decreasing of the medium seed weight per head at range between 88 g at Tekny hybrid and 98 g at Kondi hybrid. In what concern the unirrigated variant, the seed weight decreasing per head was the the highest, its range being of 86 g at Tekny hybrid and 97 g at Kondi hybrid.

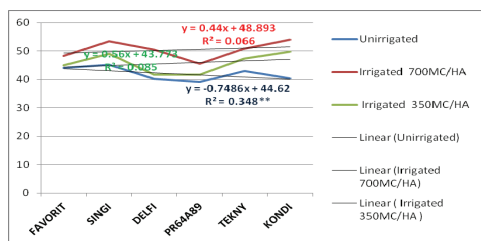


Fig. 1. The relationship between the sunflower hybrids yield and water supply

Table 1. The influence of water supply conditions different over the production of sunflower (2011)

Variant	Yield (q/ha)	Dif A1b1 (q/ha)	Significant Dif. A1b1	Dif. A2b1 (q/ha)	Significant Dif. A2b1
A1b1 unirrigate-Favorit	44.1	Mt1		-4.2	
A1b2 unirrigate-Singi	45.1	1.0		-3.2	
A1b3 unirrigate-Delfi	40.3	-3.8		-8.0	00
A1b4 unirrigate-PR64A89	39.2	-4.9		-9.1	00
A1b5 unirrigate-Tekny	42.9	-2.2		-5.4	
A1b6 unirrigate-Kondi	40.4	-3.7		-7.9	00

A2b1 irrigated with pedological norm 700m ³ /ha-Favorit	48.3	4.2		Mt2	
A2b2 irrigated with pedological norm 700m ³ /ha-Singi	53.5	9.4	**	5.2	
A2b3 irrigated with pedological norm 700m ³ /ha-Delfi	50.5	6.4	*	2.2	
A2b4 irrigated with pedological norm 700m ³ /ha-PR64A89	45.5	1.4		-2.8	
A2b5 irrigated with pedological norm 700m ³ /ha-Tekny	50.8	6.7	*	2.5	
A2b6 irrigated with pedological norm 700m ³ /ha-Kondi	54.0	9.9	**	5.7	*
A3b1 irrigated with reduced pedological norm 50%:350m ³ /ha-Favorit	44.9	0.8		-3.4	
A3b2 irrigated with reduced pedological norm 50%:350m ³ /ha-50%:350m ³ /ha-Singi	49.0	4.90		0.7	
A3b3 irrigated with reduced pedological norm 50%:350m ³ /ha-Delfi	41.7	-2.4		-6.6	0
A3b4 irrigated with reduced pedological norm 50%:350m ³ /ha-PR64A89	41.6	-2.5		-6.7	0
A3b5 irrigated with reduced pedological norm 50%:350m ³ /ha-Tekny	47.4	3.3		-0.9	
A3b6 irrigated with reduced pedological norm 50%:350m ³ /ha-Kondi	49.8	5.7	*	1.5	

DL5% = 5.7 q/ha
DL1% = 7.6 q/ha
DL 0.1% = 10.1 q/ha

Table 2. The influence of the sunflower hybrid over the yield under different water supply conditions

Nr crt	Hybrid	Yield (q/ha)	Dif Mt ₁ (q/ha)	Significant Dif. Mt ₁	Dif. Mt ₂ (q/ha)	Significant Dif.Mt ₂
1	FAVORIT	45.7	-0.3		Mt ₂	
2	SINGI	49.2	3.2		3.5	
3	DELFI	44.2	-1.8		-1.5	
4	PR64A89	42.1	-3.9	0	-3.6	0
5	TEKNY	47.0	1.0		1.3	
6	KONDI	48.0	2.0		2.3	
7	Average	46.0	Mt ₁			

DL 5% = 3.3 q/ha
DL 1% = 4.4 q/ha
DL 0.1% = 5.9 q/ha

Table 3. The influence of water supply conditions over the production of sunflower

Nr crt	Water supply	Yield (q/ha)	Dif. Mt ₁ (q/ha)	Significant Dif. Mt ₁	Dif. Mt ₂ (q/ha)	Significant Dif. Mt ₂
1	Unirrigated	42.0	-4.0	0 0	Mt ₂	
2	Irrigation with pedological norm of 700 m ³ /ha	50.4	4.4	***	8.4	***
3	Irrigation with pedological norm 50%= 350 m ³ /ha	45.7	-0.3		3.7	**
4	Average	46.0	Mt ₁			

DL5% = 2.3 q/ha
DL1% = 3.1 q/ha
DL0.1% = 4.1 q/ha

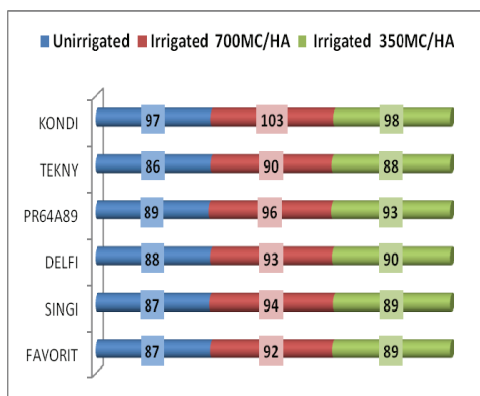


Fig. 2. The medium seed weight (g) per head of sunflower hybrids in terms of water supply level

There was established a significant correlation between the medium seed weight of the sunflower hybrids and the water-supply level, in conditions of irrigation with pedological norm of 700 m³/ha and distinct significant in the case in which there is a 50% reduction of the pedological norm, as well as there is not any irrigation (Fig. 3).

The influence of the climatic and water-supply conditions was noticed in the 1000-seed weight range of the tested sunflower hybrids in 2011. The influence of irrigation with pedological norm of 700 m³/ha was remarked while obtaining the highest 1000-seed weight range:

73 g at Kondi hybrid in contrast with 64 g for unirrigation conditions.

Significant differences were also obtained for the 1000- seed weight at the other hybrids comparatively to the irrigated variant with 50% reduced pedological norm or unirrigated variant (Fig. 4).

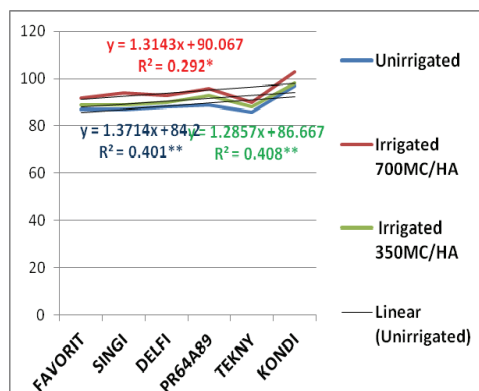


Fig. 3. The relation between the medium seed weight per head of the sunflower hybrids and the water supply level

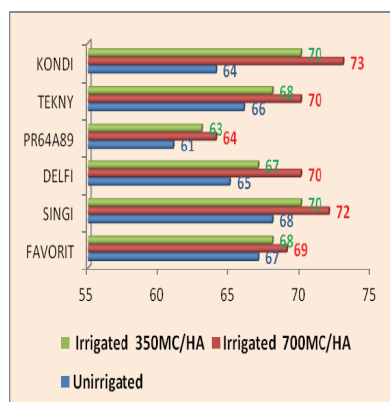


Fig. 4. The 1000-seed weight of sunflower hybrids in terms of water supply level

The crop irrigation determined the getting of a higher hectolitic mass in comparison with the situation in which the field was not irrigated. The hectolitic mass values were between 38 kg/hl (PR64A89 hybrid) and 40 kg/hl (Singi hybrid) for the irrigated variants with pedological norm of 700 m³/ha, between 37.5 kg/hl (PR64A89 hybrid) and 38.6k g/hl (Kondi hybrid) for the irrigated variants with pedological norm of 350 m³/ ha and between 36 kg/hl (PR64A89and Favorit hybrids) and 37.9

kg/hl (Tekny hybrid) for the unirrigated variant (Fig. 5).

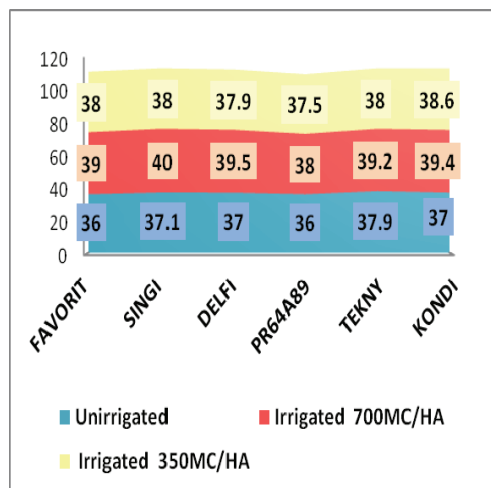


Figure 5. Hectolitic mass (kg/hl) of sunflower hybrids in terms of the water supply level

CONCLUSIONS

The central part of Dobrogea is characterized by warm and droughty climate with the medium annual temperature of 11°C and medium annual rainfall of 432.2 mm which are irregularly distributed.

2011 proved to be a favourable year for the sunflower crop.

The obtained yield by the sunflower hybrids was influenced by the water-supply level, the values were between 39.20-44.10 q/ha for unirrigated conditions, 48.30-54.00 q/ha when the pedological norm was of 700 m³/ha and 41.60-49.80 q/ha when the pedological norm was reduced with 50%.

There was established a distinct significant relation between the water-supply level and the obtained yield only if the crop was not irrigated.

The classification of hybrids taking into account the obtained yield under different water-supply conditions is: Singi, Kondi, Tekny, Favorit, Delfi and PR64A89.

There was established a significant correlation between the medium seed weight of the sunflower hybrids and the water-supply level, in conditions of irrigation with pedological norm of 700 m³/ ha and distinct significant in the case in which there is a 50% reduction of the pedological norm as well as there is not any irrigation.

The average seed weight per head the 1000–seed weight and the hectolitic mass varied in terms of the hybrid and the water-supply level.

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