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ORIGINAL ARTICLE

Effect of Irrigation Cycle on Morphological Characteristics of Maize Hybrids

Hadi Jaberi[1], Babak Lotfi[*2], Jafar Bakhtiari[3], Ebrahim Souri[4], Mostafa Hossein Abadi[5], Sadegh Bahamin[6]

[1] Lecturer of PNU unit of Dehloran , Iran
[2]Expert of Jahad University, Unit of Ilam province, and Lecturer of Islamic Azad University, Dareshahr Branch, Iran
[3] Department of Physiology, University of Malayer, Iran
[4] Department Plant Breeding, Ferdowsi university of Mashhad. Mashhad, Iran
[5] Department of Plant Breeding, Islamic Azad University, Kermanshah Branch, Iran
[6]Young Researchers and Elite Group, Ilam Branch, Islamic Azad University, Ilam, Iran.
*Corresponding Author E-mail: babaklotfi59yahoo.com

ABSTRACT

The implementation of research programs for the planning and management of irrigation in agricultural fields, as one of the options to crop, it is necessary. Therefore, in order to test plot in a randomized complete block design with 3 replications. Treatments include: 4 level of irrigation as the main factor, and three corn hybrids were subplot. Traits, such as yield and yield components were measured. The results showed that drought, root diameter in the upper third of the stem elongation and flowering stage (at the level of one percent) and harvest index, root dry weight of stem elongation, flowering and maturity, root volume in the stem go, flowering and maturity, root diameter at the stem and root penetration depth at flowering stage (at five per cent) and the volume root elongation step at a percentage and root dry weight of stem elongation in significant impact on the level of five percent. According to the results, the highest yield of 10,450 kg per hectare, for the treatment of 75 mm evaporation and the figure is Caron.

Keywords; *Irrigation, Maize Varieties, Hybrid, Root Volume*

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INTRODUCTION

Water scarcity is one of the limiting factors in the production of agricultural crops, such as corn worldwide. Iran, with a variety of weather, including corn production is prone areas. Approximately two-thirds of agricultural land in semi-arid areas is faced with drought [1]. Drought stress at vegetative stage, because determining the potential size of the ear and of the ovaries during this period of growth, a decrease in the number of grains per ear. The occurrence of drought stress during the vegetative period, resulting in shrinkage of leaves and leaf area index and the amount of light absorbed by plants reduced [2].

Sinclair [3] reported that the final number of grains per ear, determined at the time of pollination. Assimilates inadequate for the growing embryo cells, has a negative effect on the number of grains per ear. Also, he reported that water stress by reducing the number of grains per ear and grain weight, grain yield was reduced. Drought stress during vegetative and reproductive stages, seed, grain filling stage, and grain weight decreases. Shortage of water, the reduction of photosynthesis per unit leaf area index and a decrease in leaf area provides. Resulted in a reduction of assimilate supply and a negative effect on the production of grains per ear and a decrease in the yield. Researchers reported that poor diet, water, reduce the leaves, it will accelerate aging. Whereas, the production rate is much higher than that due to the effects of low intensity reduced net photosynthesis [4].

Malakoti and Homaee [5] in this regard, stated that adequate soil moisture and nutrients such as nitrogen and root spread, the higher the level of the soil is received. However, the flow of water in the soil carries nutrients to the root cause.

Flowering, drought is the most critical stage of plant growth sesame. Effects of water stress on various parameters Rshdgyah sesame is intensified with increasing stress [6]. In general, the concentration of dry matter represents the ability of the canopy in the use of environmental factors such as light and food industry, for the production of dry matter. Increased biological function may be caused by the increase in leaf area index and crop growth rate is thereby increased. Higher water levels by improving the physiological indices, increased dry matter accumulation in vegetative organs and the biological function [7].

Grain yield under drought stress, water stress depends on the severity and duration. In corn, grain yield stress can directly and indirectly affect. Most research has shown that the most sensitive life stages of corn, the stress can cause a serious decrease in performance, and in particular the reproductive stage pollination, the pollen shedding and silking. By applying stress in the early stages of maize, found that water loss at this stage will reduce dry matter. Shortage of water in the arid and semiarid regions of the main problems that affect the growth of plants. Reduce the amount of water available to plants leads to stress and inappropriate morphological and physiological changes in the plant [8].

Khalily [9], according to the results of the stress, as one of the constraints expressed in maize seed production in dry conditions, the distance between the flag of the Silk Overall, the number of days to silk emergence, green cover percentage and number seeds in a row, the properties for the selected hybrids are resistant to drought stress in maize.

Although reduced seed weight between treatments was significant stress and tension, but this reduction was not significantly different in mild and severe stress.

Angadi [10] reported that grain yield loss due to drought stress at flowering stage and shoot growth, mainly due to a decrease in the number of pods per plant. However, the occurrence of drought stress in grain filling stage and yield reduction was mainly through a reduction in grain weight. Gan [11] reported that, between the root and drought tolerance in sorghum and millet there is stress. Stress the importance of the end of the season, usually in March and April and coincides with the period of flowering and grain filling occurs, identify genotypes with yield stability as well as the study of physiological traits related to drought tolerance Asian is especially important.

The purpose of this study was to evaluate and how to grow corn is under drought stress in Dezful. Based on that, the optimal amount of water to produce water with maximum efficiency improvements and the introduction of hybrid maize in the area is drought tolerant.

MATERIALS AND METHODS

The trial, in the summer of 2013 in the field of agricultural research was conducted Safiabad. The center of the longitude 48 degrees 32 minutes east and latitude 32 degrees 22 minutes north and 82 meters above sea level at a distance of 120 km from the provincial capital, is located in the North West province.

In general, Khuzestan subtropical climate, with warm dry summers and rainy winters are long and humid. Khuzestan heating season begins in May and continues until October. Of rainfall between the months of November to April is usually the most rainfall in the northern plains of Khuzestan and southern and East is lower and narrower. Climatic conditions, in particular the characteristics of the soil and water, fertile for growing most crops (sugarcane, maize and sorghum) and physiological adaptation to climate plants province has caused the plant dry matter accumulation, highly significant and close to its genetic potential is.

Pilot projects on land that has been cultivated wheat, respectively. Therefore, prior to the project and to determine the nutrient status of the soil, the six-point bottom 30-0 cm soil sampling and laboratory Safiabad Agricultural Research Center, was analyzed. The results of the soil analysis are shown in Table 1.

To investigate the effect of water stress on morphological characteristics, yield and yield components of three maize hybrids Safiabad climate, cultivation experiment in the 2013 summer season Safiabad Agricultural Research Center, located in the South West of the country, was conducted.

The experimental design was a randomized complete block, in a 3 × 4 × 3 was implemented. Four irrigation S1: irrigation after 75 mm evaporation, S2: irrigation after 110 mm evaporation, S3: irrigation after 145 mm evaporation and S4: irrigation after 180 mm evaporation as the main factor and three corn hybrids (Bc678, Sc704 and Karun) as subplot. Thus, taking into account the margins and spacing treatments iterations of the experiment was about 1300 square meters. It should be noted that the numbers will be randomly assigned to each block. Landing stage on the 20th of July, and then take care of the farm-based standards were applied.

Table 1. Test results of chemical soil test piece

Potassium acidity saturation mg/Kg	Phosphorus acidity saturation mg/Kg	Soluble nitrogen mg/Kg	Total acidity saturation pH	Conductivity $ds.m^{-1}$
158	7.1	37	7.95	1.2

Table 2. Test results of soil physical test piece

Sand	Silt	Clay	
27	35	38	Percent

Number of kernels per row, the number of kernel rows per ear, grain weight, grain yield, biological yield, harvest index, leaf area, plant height, ear diameter, ear length, hair length, root dry weight, root volume, root diameter the upper one-third of the number of aerial roots, the largest part of the root, rooting depth, root fresh weight.

The study of software to analyze the data to help MSTATC Duncan test at 5% level is used to draw graphs and Excel software was used for data analysis.

RESULTS AND DISCUSSION

SEED YIELD

Analysis of variance showed that water stress on yield data and the interaction of water stress and the level of one percent, five percent significance level (Table 3).

The results of the comparison showed that water stress, the maximum yield of 8474 kg ha belonged to the group of 75 mm evaporation. Less with 3113 kg per hectare to 180 mm of evaporation, which was treated with 145 mm evaporation from the difference in a group (c) was used (Fig. 1). Figures treatments, the highest yield of 6767 kg per hectare, the figure was owned Caron. Less with 4434 kg per hectare, the figure of 678, which is statistically in a group with the 704 (b) was used (Fig. 2).

Hugh [12] concluded, mild and severe drought hybrid maize grain yields were reduced by 63 and 85 percent. Sherbaf Khojaste and Ahmad [13] reported that maize grain yield under drought stress during the period of growth; by reducing the number of grains per ear was performed. Researchers the performance of grain corn in grain yield, stress, mild and severe drought (respectively irrigation after 30, 40 and 50% of field capacity of the soil) have been studied and reported, drought, severe yield compared with favourable conditions, a reduction of 40 percent.

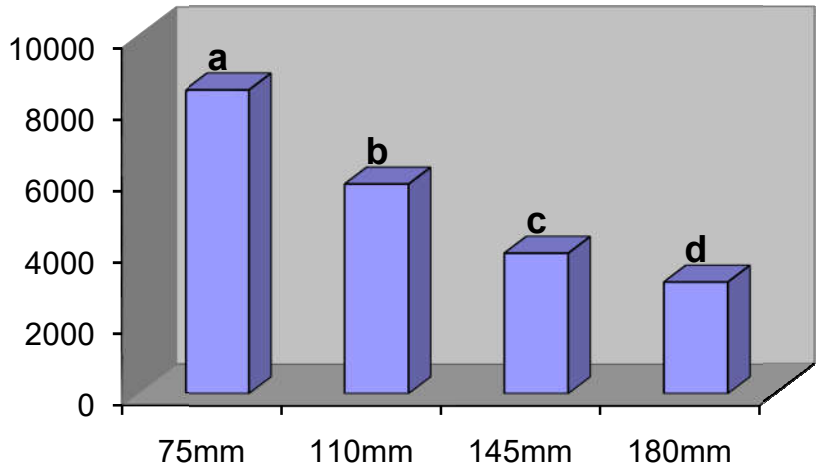

Figure 1. Comparison of stress on seed yield (kg/ha)

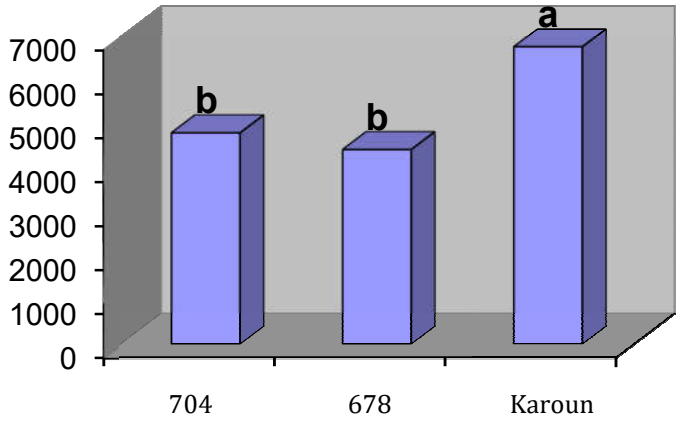

Figure2.Comparison of hybrid treatment son seed yield (kg/ha)

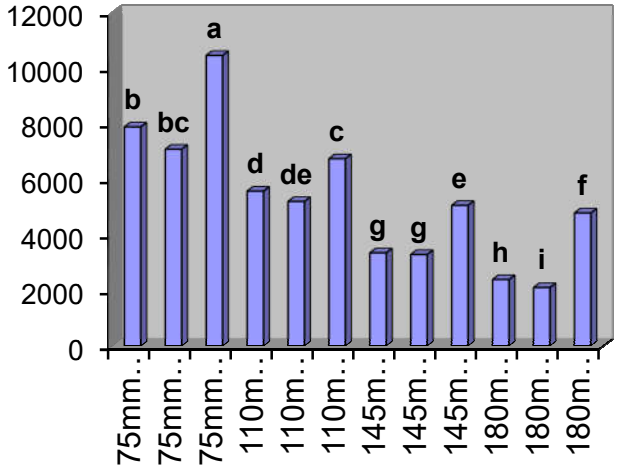

Figure3.Comparison of the interaction of the stress on seed yield (kg/ha)

ROOT DRY WEIGHT - STEM ELONGATION

Analysis of variance showed that the drought and root dry weight (at five per cent) were significant, but the interaction of water stress and showed no significant effect on this trait (Table 1).

The results of the comparison showed the highest root dry weight of 2.17 grams of water stress treatments least 180 mm evaporation and treated with 3.7 g in 75 mm belonging evaporation (Figure 3). In treatments with the highest root dry weight was 10.7 g and 7.7 g in Caron and minimum number of 678 (Fig. 5).

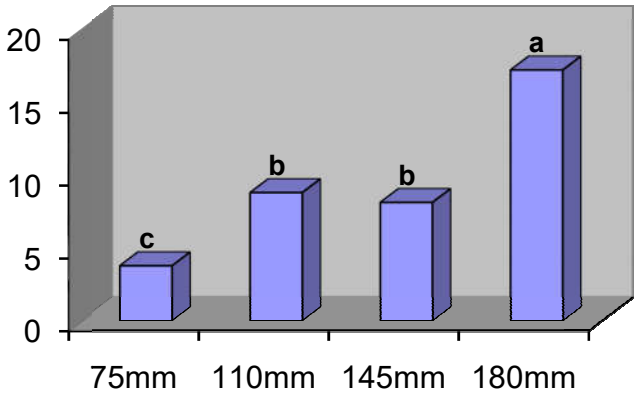

Figure 4. Comparison of stress on root dry weight (g) in stage of steming

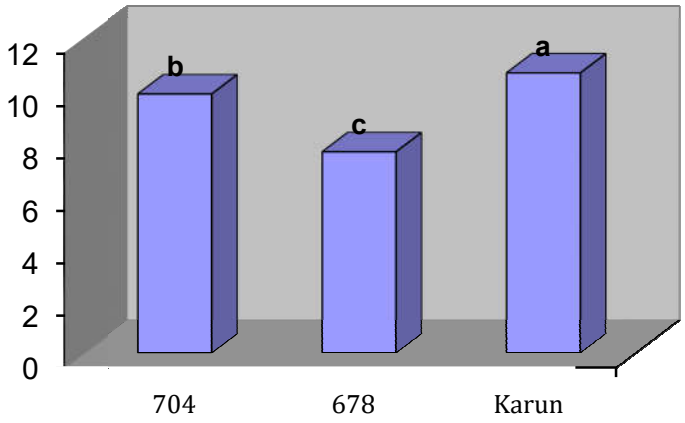

Figure5.Comparison of hybrid treatments on root dry weight

VOLUME ROOT - STEM ELONGATION

Analysis of variance showed that drought stress on the root volume (at the level of one percent) and figure (at five per cent) were significant, but the interaction of water stress and showed no significant effect on this trait (Table 1).

The results of the comparison showed that drought stress treatments, most of the roots treated with 69 cc to 180 mm, 145 mm evaporation belonged to different treatments in a group (a) was used. Least 75 mm evaporation treated with 36 cc of belonging (Figure 6). In the treatment, most of the roots of 60.9 to 46.9 cc to the Karun and the lowest figure of 678 (Fig. 7).

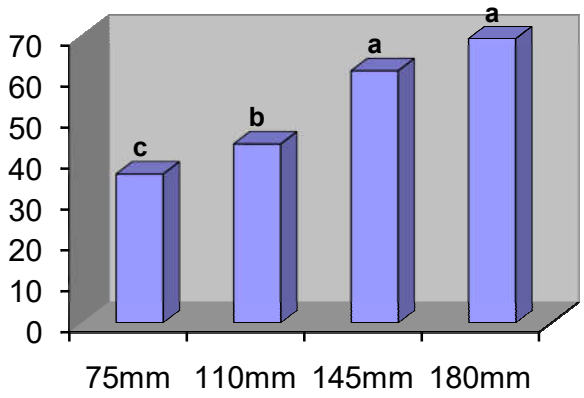

Figure6.Comparison of mean stress on the root volume (cm3)

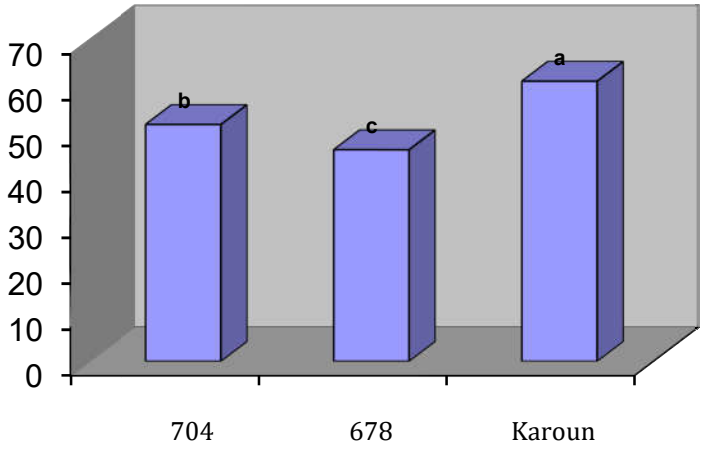

Figure7.Comparison of treatments on root volume (cm3) in stage of stemming

DIAMETER OF ROOT-STEM ELONGATION

Analysis of variance indicated that the effects of water stress on root diameter (at five per cent) were significant, but the interaction of water stress and the number of treatments showed no significant effect on this trait (Table 1).

The results of the comparison showed that drought stress, the maximum diameter of 5.1 mm to 180 mm evaporation roots belonged to a group treated with 75 mm evaporation from the difference in (a) was used. Lowest with 1.1 ml of 75 and 110 mm evaporation belonged to treatment (Figure 8).

Most research has shown that the most sensitive life stages of corn, the stress can cause a serious decrease in performance, and in particular the reproductive stage pollination, the pollen shedding and silking. By applying stress in the early stages of maize, found that water loss at this stage will reduce dry matter. Reduce the amount of water available to plants leads to stress and inappropriate morphological and physiological changes in the plant [8].

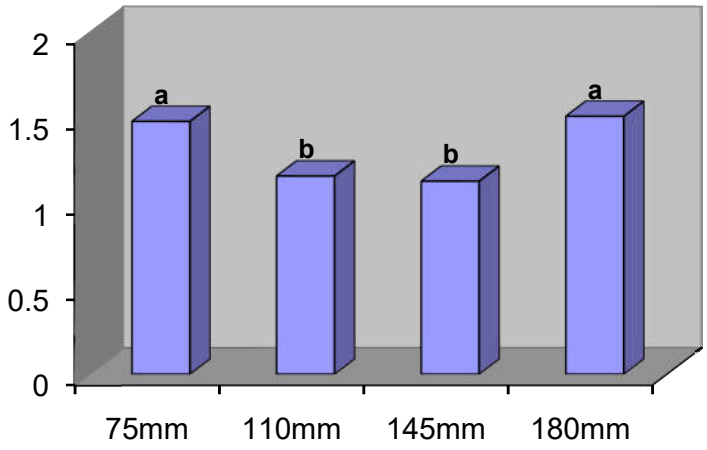

Figure 8. Comparison of stress on root diameter (cm) in stage of stemming

THE NUMBER OF AERIAL ROOTS - STEM ELONGATION STAGE

Analysis of variance showed that drought stress, and the interaction of water stress and the number of aerial roots showed no significant effect (Table 1).

THE ROOT AERIAL - STEM ELONGATION STAGE

Analysis of variance showed that drought stress, and the interaction of water stress on the root and the effect was not significant (Table 1).

THE DEPTH OF THE ROOT - STEM ELONGATION STAGE

Analysis of variance showed that drought stress, water stress and the number and depth of root penetration interaction effect was not significant (Table 1).

ROOT PENETRATION DEPTH - THE FLOWERING STAGE

Analysis of variance indicated that the effects of water stress on root penetration depth (at five per cent) were significant, but the interaction of water stress and the number of treatments showed no significant effect on this trait (Table 2).

The results of the comparison showed that drought stress treatments, root penetration depth of 33 cm to 180 mm by 145 mm evaporation evaporation belonged statistically in a group (a) was used. Minimum of 28.6 cm, 75 mm evaporation belonged to treatment (Figure 9).

THE ROOTS WIDTH- THE FLOWERING STAGE

Analysis of variance showed that water stress, water stress and the number of interactions on the root, the effect was not significant (Table 2).

THE NUMBER OF AERIAL ROOTS - THE FLOWERING STAGE

Analysis of variance showed that the effects of drought, and the interaction of water stress and the number of aerial roots, showed no significant effect (Table 2).

THE ROOT DIAMETER - THE FLOWERING STAGE

Analysis of variance indicated that the effects of water stress on root diameter (at a percentage) were significant, but the interaction of water stress treatments and varieties and cultivars did not show a significant effect on this trait (Table 2).

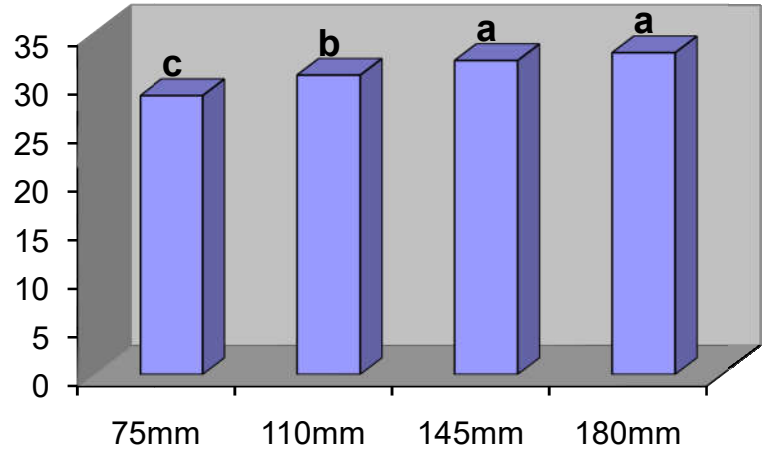

Figure 9. Comparison of stress on root depth (cm) in stage of flowering

The results of the comparison showed that drought stress, the maximum root diameter of 1.48 mm to 180 mm was evaporated. Minimum of 0.84 mm, 75 mm evaporation treatment, belonged (Figure 10).

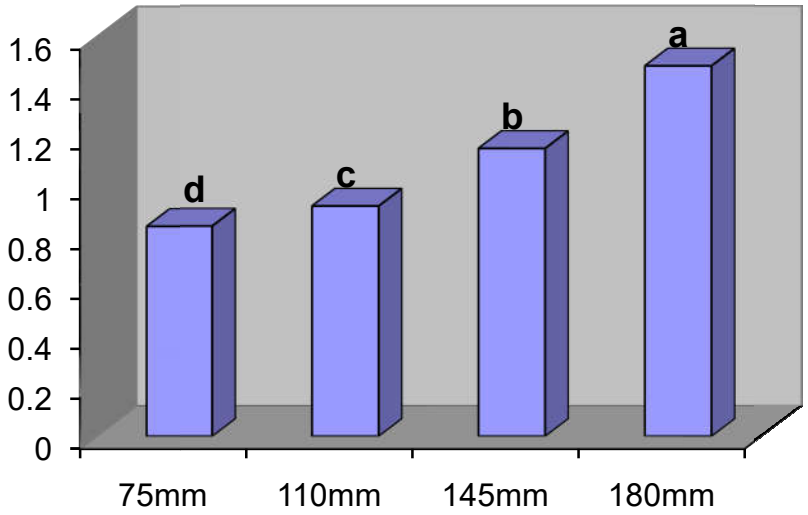

Figure 10. Comparison of stress on root diameter (cm) at one-third the depth of soil in stage of flowering

ROOT VOLUME – THE FLOWERING STAGE.

Analysis of variance indicated that the effects of water stress on root volume (at five per cent) were significant, but the interaction of water stress and the number of treatments, no significant effect on this trait (Table 2).

The results of the comparison showed that the root of most of the drought treatment with 228 cc to 162 cc with a minimum of 180 mm evaporation and evaporation belonged to the group of 75 mm (Figure 11).

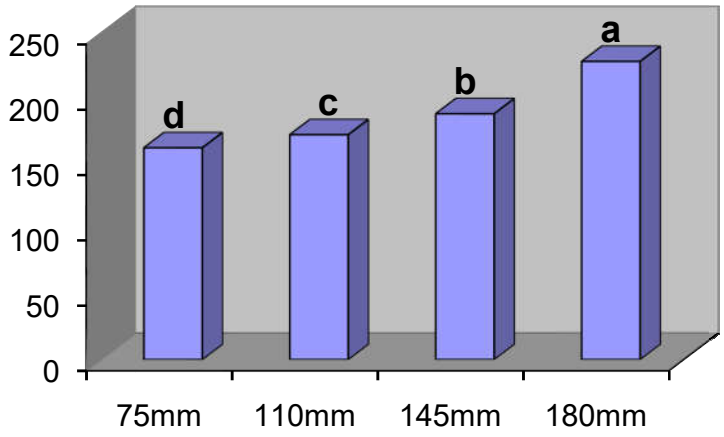

Figure 11. Comparison of stress on the root volume (cm3) in stage of flowering

ROOT DRY WEIGHT – THE FLOWERING STAGE

Analysis of variance indicated that the effects of water stress on root dry weight (at five per cent) were significant, but the interaction of water stress and the number of treatments and cultivars showed no significant effect on this trait (Table 2).

The results of the comparison showed that drought stress treatments, root dry weight by 66 grams to 180 grams treated with 27 mm minimum 75 mm evaporation and evaporation belonged (Figure 12).

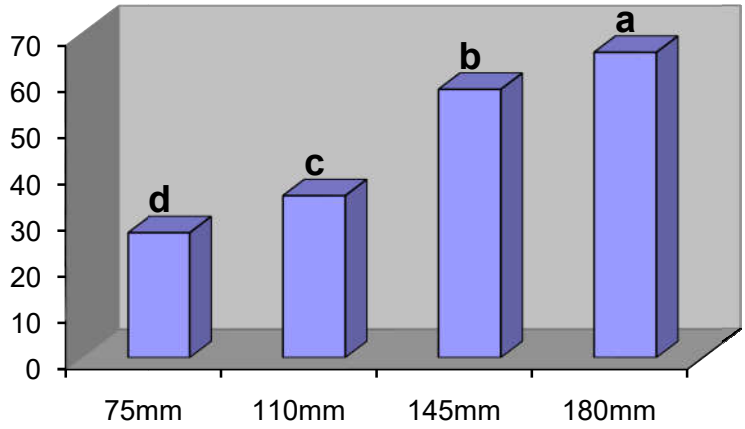

Figure 12. Comparison of stress on root dry weight (g) in stage of flowering

THE PENETRATION OF ROOTS - A MATURATION STAGE

Analysis of variance showed that drought stress, water stress and the number and depth of root penetration interaction effect was not significant (Table 3).

THE NUMBER AERIAL ROOTS - A MATURATION STAGE

Analysis of variance showed that drought stress, and the interaction of water stress on the root and the effect was not significant (Table 3).

THE NUMBER OF AERIAL ROOTS - A MATURATION STAGE

Analysis of variance showed that the number of aerial roots (at the level of five percent) was significant, but the interaction of water stress and water stress treatments and cultivars showed no significant effect on this trait (Table 3).

The results of the comparison showed that the treatments figures, the highest number with 42 roots to the aerial roots Karun least 34 belonged to the figures 704 and 678 (Figure 12).

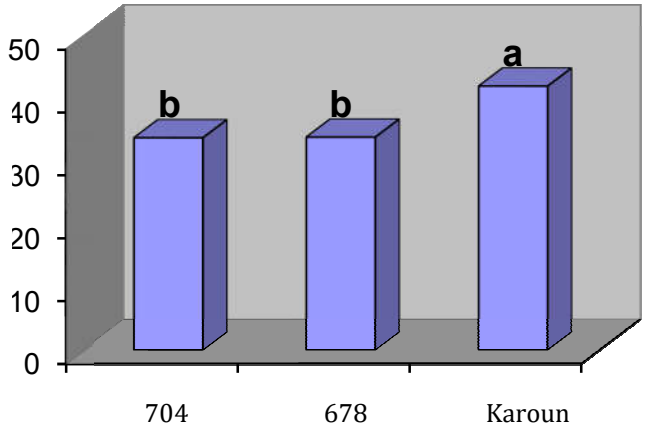

figure12.Comparison of hybrid treatments on number of aerial roots in stage of maturity

ROOT DIAMETER- MATURATION STAGE

Analysis of variance indicated that the effects of water stress on root diameter (at five per cent) were significant, but the interaction of water stress and the number of treatments, no significant effect on this trait (Table 3).

The comparison results show that the root diameter of 1.5 mm maximum stress treatments least 145 mm evaporation and treated with 0.94 mm to 75 mm belong evaporation (Figure 14).

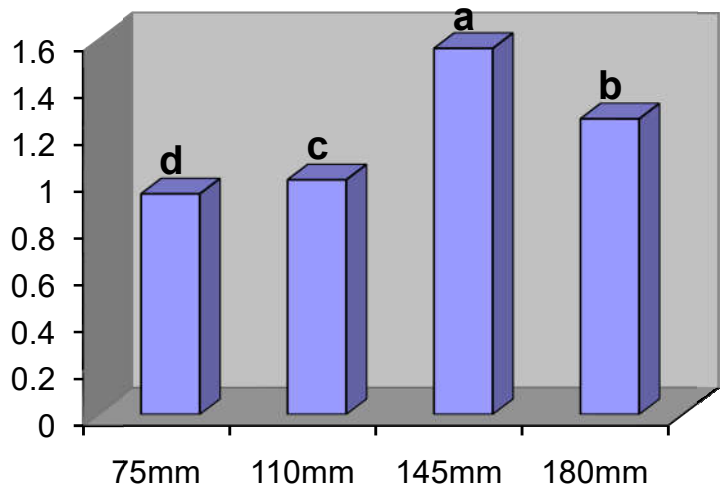

Figure 13. Comparison of stress on root diameter (cm) in stage of maturity

ROOT VOLUME - MATURATION STAGE

Analysis of variance indicated that the effects of water stress on root volume (at five per cent) were significant, but the interaction of water stress and the number of treatments showed no significant effect on this trait (Table 3).

The results of the comparison showed that drought stress treatments, most of the roots to the 233 cc in 180 mm belonged evaporated. Least 172 cc, in 75 mm evaporation belonged to treatment (Figure 14).

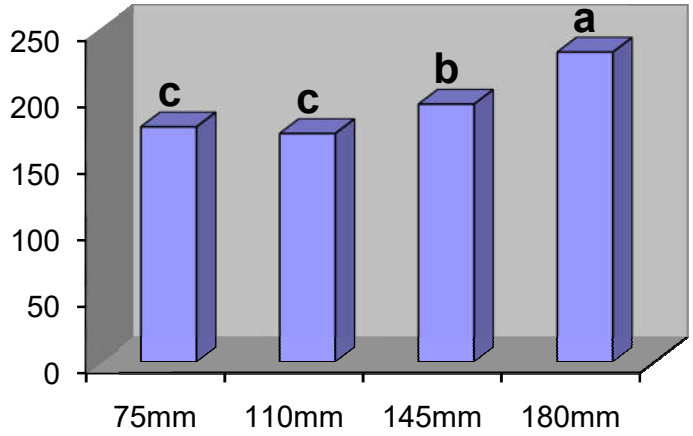

Figure 14. Comparison of stress on the root volume (cm3) in stage of maturity

ROOT DRY WEIGHT - MATURATION STAGE

Analysis of variance indicated that the effects of water stress on root dry weight (at five per cent) were significant, but the interaction of water stress and the number of treatments, no significant effect on this trait (Table 3).

The results of the comparison showed that drought stress treatments, root dry weight to 180 mm evaporation 66.8 gram and 30 gram minimum in 75 mm evaporation belonged to treatment (Figure 15).

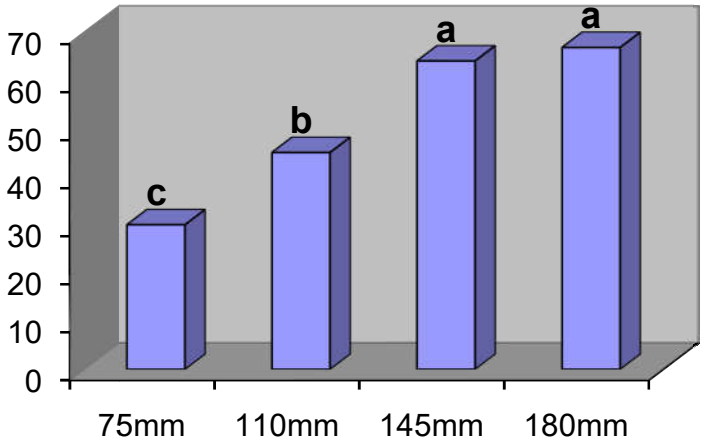

Figure 15. Comparison of stress on root dry weight (g) in stage of maturity

The results of this study showed that the number and drought had a significant effect on grain yield. In the case of the treatment, the best treatment and drought Caron best treatment, treatment was seventy mm evaporation. The results showed that drought, root diameter in the upper third of the stem elongation and flowering stage at a percentage of the harvest index, root dry weight of stem elongation, flowering and maturity, size of the root elongation flowering and maturity, root diameter of the stem and root penetration depth at the flowering stage (at five per cent) and the volume root elongation step (at the level of one percent) and root dry weight of stem elongation stage (at five percent) were significant. According to the results, the highest yield of 10450 kg ha plots in the Karun is 75 mm evaporation. It should be noted that the appropriate and beneficial for the climate and soil water regime and amount of food in different skins.

Table 1. Analysis of variance root in elongation stage

MS						DF	SOV
Depth of root penetration	Root Width	number of aerial roots	Root diameter	Root volume	Root dry weight		
11 ns	20.3 ns	0.86 ns	0.006 ns	19.1 ns	10.5 ns	2	Rep
22.4 ns	24.4 ns	38.4 ns	0.37 *	2096 *	284 *	3	Drought
28.9	27.1	11.5	0.076	265	58.3	6	Error
13 ns	2.58 ns	8.36 ns	0.053 ns	668 **	28.9 *	2	hybrid
21.6 ns	31.5 ns	12.3 ns	0.14 ns	839 ns	27.4 ns	6	Drought * hybrid
23.4	31.1	8.19	0.15	565	42.8	16	Error
5.8	8.4	5.2	9.2	8.4	6.8	-	CV%

Table 2. Analysis of variance root in flowering stage

MS						*DF*	*SOV*
Root dry weight	Root volume	Root diameter	number of aerial roots	Root Width	Depth of root penetration		
418 ns	1814 ns	0.009 ns	52.5 ns	10.3 ns	21.5 ns	2	Rep
3102 **	7569 **	0.72 **	53.2 ns	54 ns	32.6 *	3	Drought
788	2308	0.053	81.8	11.2	18.7	6	Error
2178 ns	4314 ns	0.023 ns	102 ns	13 ns	90.8 ns	2	hybrid
1085 ns	4935 ns	0.75 ns	30.9 ns	18.3 ns	14.8 ns	6	Drought * hybrid
722	6905	0.044	64.4	40.8	6.1	16	Error
5.7	4.4	8.9	9.3	8.3	7.9	-	CV%

Table 3. Analysis of variance root in flowering stage

MS						*DF*	*SOV*
Root dry weight	Root volume	Root diameter	number of aerial roots	Root Width	Depth of root penetration		
154 ns	1824 ns	0.002 ns	5.4 ns	71.8 ns	50.7 ns	2	Rep
2670 *	6851 *	0.71 **	36.3 ns	7.7 ns	15.4 ns/4 ns	3	Drought
1345	2313	0.06	36.2	14.8	15.5	6	Error
1341 ns	4349 ns	0.25 ns	269 *	7.6 ns	6.6 ns	2	hybrid
686 ns	4961 ns	0.074 ns	54.3 ns	5.9 ns	13.6 ns	6	Drought * hybrid
920	6900	0.038	64.1	12.5	13.7	16	Error
5.8	7.2	6.3	7.5	7.6	7.6	-	CV%

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