(JZS)Journal of Zankoy Sulaimani , Dec. 2005,vol 8(1) part A(85-97)
گۆڤاری زانکۆی سلێمانی کانوونی یەکەم ٢٠٠٥بەرگ ٨(١) بەشی A (٨٥-٩٧)

Responses of Various Wheat (Triticum spp.) Cultivars to Water Status

Faisal-Abdulkadir Sakri
College of Science, University of Salahaddin, Erbil, Kurdistan Region/Iraq.
Norri –Hassan Ghafour and
College of Science, University of Sulaimani, Sulaimani, Kurdistan Region/Iraq.
Shireen-Abdulkarim Amin
College of Science, University of Salahaddin, Erbil, Kurdistan Region/Iraq.

Abstract

This research was conducted to study the response of various wheat cultivars to water status through plant length, flag leaf length, number of tillers per plant, number of leaves per plant, number of spike per plant, number of seed per spike, number of seed per plant, weight of loosed, plant dry weight, protein content in kernel%, and total carbohydrates. Results indicate that the drought periods significantly decreased the plant length for all cultivars. Flag leaf length increased significantly at drought period 7 days for Sham-3-hard(durum)cultivars and significantly decreased for Maxipak and Abu-Greb cultivars at drought period 21 days and Bakrajow at drought period of 7, 14, and 21 days. The number of leaves per plant significantly decreased at 7, 21 days period for Abu-Greb and 21 days period for Aras.

Water stress periods significantly decreased number of spike per plant, number of seed per spike, number of seed per plant for all cultivars except Bakrajow for number of seed per spike, and also it significantly decreased weight of loosed especially of the two water stress periods 14, and 21 days and plant dry weight for all cultivars except Sham-3-Soft (aestivum). Drought period significantly decreased protein content in kernel% of Sham-3-hard in all drought periods and Sham-6-soft at 21 days period.

Keywords:-Various wheat (***Triticum aestivum***) cultivars[Maxipak, Abu-Greb, and Sham-3-hard (durum) also Aras,Bakrajow and Sham-6-soft(aestivum),water drought periods.

Introduction

Water is a major limiting factor in world agriculture. In general most plants are highly sensitive to even a mild dehydration stress.[1]

Water is a fundamentally important component of the metabolism of all living organisms, facilitating many vital biological reactions being solvent, transport medium, and evaporative coolant. [2]It is already being documented that the greatest fear of the global climate changes is the drought which influences crops growth and plays an important role in maintaining food production in the world. Wheat plants respond to drought through morphological,anatomical, physiological, and metabolic modifications occurring in all plant organs. Some of these effects are related to the decrease in turgor and water potential. Wheat (***Triticum aestivum*** L.) is an annual grass of the gramineae family and considered as the world's largest cereal grass crop and the most staple crop in the middle east and north African regions. It is considered as a major food source for human kind. Wheat kernel in general contains 12% water, 70% carbohydrates, 12% proteins, 2% fat, 1.8% minerals, and 2.2 crude fibers, thiamin, riboflavin, niacin, and small amount of vitamin (A) are also present,

Email:noorihg@yahoo.com

wheat popularity as high cultivated crops is due to its content of high amount of gluten protein.[3]Wheat plants grow well over a wide range of moderate temperature is relatively easy to cultivate and consistently produces high crop yields [4]. In fact water stress is reducing the yield
production of wheat through the reduction of spike number.[5,6], while others showed that spike fertility, number of tillers, and the weight of 1000 kernels increased under water stress condition in wheat plants[7]. It is clarified recently that water stress has reduced number of kernels per head, kernel weight, and also affected the floret sterility [8].Water stress leads to the development of more heads in wheat plant than usual but many fail to produce grain that finally reducing the yield [9]. Scores of terminal spiklet, style primordium, green anther, and ear emergence development were markedly affected by water stress in all treatments used in this experiment(6).Water stress reduced the number of spiklet per plant during vegetative growth and spiklet initiation phase and this study was performed to reveal the effects of water stress on growth and development of the inflorescence of two Iranian spring wheat cultivars (*Triticum aestivum* L.) during different stages of development [10]. Further more, drought has reduced and delayed wheat germination, nitrogen-uptake, and increased tiller numbers as grain size and resulted in the death of young florets [11]. The effect of water stress could also be extended to the vegetative and reproductive growth of wheat plants [12]; Some experiment on the effect of water stress on four wheat cultivars during three successive years showed that both the time of sowing and weather conditions have a major impact on the proportion of small grain screening, the level of screenings was greater in 2000, which experienced terminal drought [13,14]. Recently there have been some intense research on phenotypic responses of barley to water stress in green house experiment, water was withheld from plants for two periods (10d and 14d) after flag leaf emergence .Ten of the morphological, developmental, and fertility were significantly affected by water stress. High degree of phenotypic variation was found in the population with significant genotype treatment and soil type treatment [15]. The lack of rain in early summer late of autumn and relatively low annual rainfall frequently results in drought which is most sever in soils with low-holding capacity compared to soil possesses a greater water-holding capacity . The tolerancy towards water stress is due to the genetic diversity of wild barely and wheat as well as this have been study intensively with and between population. Water stress studies have extended to evaluate the content of some variable compounds in wheat after drought and watering has compared to control values the content of ά-Tocopherol in wheat leaves was increase 2.4 – fold and β-Carotene content was increased by 2.6 – fold after drought [16]. The controlled green house experiment described have were designed to mimic the insitue drought to measure phenotypic variation with in the population , to compare the performance in well-watered and water –with held conditions , and to identify individual with contrasting responses to water stress.

This study has been conducted to investigate the effect of drought resistance on the yield of six wheat cultivars as well as on the protein and carbohydrate contents. Also, we did not plan in this study to distinguish between desiccation postponement and desiccation tolerance

among these limited number of cultivars included in this study.

Materials and Methods

The present study was performed on January, 2003, at the green house station, college of science-University of Salahaddin – Erbil – Iraq . Six wheat cultivars were chosen to be used in this investigation to evaluate their status and responses to water stress. The varieties tested in this study were : Mexipak, Abu-Greb, Sham-6-hard (durum), Aras, Sham-3-, and Bakrajow soft (aestivum) with four drought treatment periods. These treatment periods included : the control in which they were irrigated as need, 7-day periods, 14-day, and 21-day periods irrigations. To ensure germination, four seeds were sown in each plastic pot with 22cm in diameter and height. The pots were filled with sandy loam soil supplemented with 20 kg / donum area contain 45% nitrogen and 46%phosphorus elements as P_2O_5.

After seed germination the number of seedling were reduced to one per pot. In order to allow for more distribution of root mass in to the soil and eliminating the competition factor. Pots were distributed in the green house according to the factorial completely randomized design with four replications for each treatment . The means were compared using the Least Significant test (L.S.D) at the level of 5% as the degree of freedom [17, 18].Vegetative characteristics for each treatment were studied such as the plant length, number of leaves, flag leaf length and width, number of tillers, number of seeds per spike, number of spikes perplant, weight of 100 kernels, and finally number of seeds per plant. Total carbohydrates for treatments were determined [19], also Measurement of protein and nitrogen content were performed [20]. Since most proteins have a nitrogen content of about 16% ;

Table (1) shows the soil characteristics:

Characters	
Sand%	76
Slit%	14
Clay%	10
Soil texture % (hydrometer method)	Sandy loam
Moisture % (oven methods)	2.82
Organic matter	0.95
Calcium carbonate (titration with NaOH)	27.5
Available phosphorus (ppm)-(Olsen method)	1.93
PH	8.54
Electrical conductivity (decimeter 25C)	0.65

therefore the migration content has been converted in to weight of protein by multiplying a factor of 6.25 .And also the soil was analyzed [21] as shown in table (1).

Results and Discussion

Vegetative Growth

Plant length

Table (2) indicates that the maximum mean value for plant length among the cultivars was recorded with Mexipak in spite of drought periods. It is also shown that the drought period zero gave the highest mean value of plant length in spite of cultivars and decreased successively with prolonging the drought period. In facts, the drought periods significantly decreased the plant length for all cultivars *stress*and the high reduction was recorded for Bakrajow at 21 day period.

Flag leaf length

As shown from table (3) that the maximum mean value for flag length among the cultivars was recorded with Mexipak in spite of drought periods. And

Table (2) Variation in plant length of wheat cultivars under different periods of water

Wheat cultivars	Plant length at different drought period (cm)				mean
	0	7	14	21	
Mexipak (Hard)	80 20	67.75	55.00	42.87	61.45
Abu-Greb (Hard)	71.87	58.50	42.87	39.37	53.15
Sham-3-hard	67.75	41.87	44.62	38.25	48.12
Aras (Soft)	84.75	54.37	54.00	48.25	60.34
Sham-6-soft	66.75	47.50	38.75	39.62	48.15
Bakrajow (Soft)	76.30	46.62	43.50	34.00	50.10
CP LSD = 10.29					C LSD=5.14
Mean	74.60	52.76	46.46	40.39	
P ≤ 0.05	P LSD = 4.20				

the drought period zero gave the highest mean value of flag length in spite of cultivars. Flag leaf length increasedsignificantly at drought period 7 for sham- 3-hard cultivars, and significantly decreased for Mexipak, Abu-Greb cultivars at drought period 21 and causes reduction in cell elongation, which in turn decreases shoot, root, and leaf elongation [22] sun flower leaf enlargement ceased when the leaf water potential felled below-3.8 bars and the turgor pressure below 6.8 bars. As water Bakrajow at drought period 7, 14, 21 d and insignificantly decreased at drought period 7 for Mexipak, Abu-Greb and Aras. The reduction in plant and leaf length might, due to cell turgor which causes reduction in cell elougation , which in turn decreases shoot ,root,and leaf elougation (22). Sun flower leaf enlargement ceased when the leaf water potential felled below -3.8 bars and the turger below 6.8 bars.As water becomes limiting in the environment, cellular volume in plant tissues is reduced. In desiccation sensitive plants, once turgor is lost, the mechanical strain in the cellular membranes and cell walls usually results in cell walls collapse and membranedamage, which is irreparable [23] . It is believed that water stress might also affectcell wall metabolism, possibly . Through cellulose synthesis. It is also believed that the ability of young xylem tissue to incorporate C^{14} labeled glucose is greatly decreased by decreasing water potential [24]. During the measurement of flag leaf length we also measured its width at the middle; it has been observed that decrease in the width was associated with the decreasing in length of the leaf as was shown in table (4).

Number of tillers per plant

Table (5) shows that the maximum mean value for the number of tiller per plant was recorded with Sham-6-soft cultivars in spite of the drought periods , while the low mean value was recorded at drought periods 21d in spite of cultivars, It is also shown that water stress periods insignificantly decreased the number of tiller per plant for all cultivars as compared to control except for Abu-Greb which is increased significantly at all drought periods while the other varieties were responded differently.

Number of leaves per plant

It is obvious that Sham-6-soft cultivars has distinguished itself as one of the most important wheat variety it has given,

Abu-Greb , 21d period for Aras, a significantly increased at 7d period for Sham-3-hard (Table (6)) .Increasing tiller and leaf numbers might refer to that some plant are naturally more resistance to drought than other and after this resistance is achieved of production specific proteins or small molecules which help resist the osmotic damage from heat [25].

And the reduction of tiller and leaf numbers is refer to that water stress reduced synthesis of growth regulators such as cytokinins and gibberellins in the roots. The possibility that water deficit reduced the supply of growth regulating substances supplied to the shoot by the roots. When only apart of the root system of a wheat plant was subjected to a mild water deficit -1 bar , growth and metabolism were materially affected [26]. There is significantly less cytokinins activity in the xylem exudates from roots of sun flowers subjected to water stress Than in exudates from unstressed control plants.

Yield Characteristics

Number of spike per plant

The maximum value for number of spike per plant was recorded for Aras cultivars inspite of drought periods and inspite of cultivars the highly reduction was found at the drought period 21, as shown in table (7). Also it seems that water stress periods significantly decreased number of seed per plant for most of the cultivars while insignificantly decreased at water stress periods (7, 14, 21) for Sham-3-hard cultivar and at drought period 7 for Abu-Greb cultivar and drought period 14 for Mexipak and Aras cultivar, as compare to control. It refers to that the drought period increase the Abscisic acid (ABA) in wheat plant that decreases the growth [11].

Number of seed per spike.

It has been shown from table (8) that maximum number of seed per spike was found in Aras cultivar inspite of drought period, while high value was recorded at drought period 21 inspite of cultivars. It has also notice from the table that water stress periods significantly decrease number of seed per spike for all the cultivars except Bkrajow that insignificantly decreased at the drought period 14. Also it was shown from the table that number of seed per spike significantly decreased for all the cultivars except Sham-3-hard and Bakrajow as compare to control, It may refer to that water stress induces large alteration in source - sink relations with source limitations resulting in a decreased export of assimilates and, therefore, in a decreased crop load [27], or it may refers to induction of male sterility in wheat by meiotic stage.Water dificity was preceded by decline in a vacuolar invertase activity(28).

Table (3) Variation in flag leaf length of wheat cultivars under different periods of water stress

Wheat cultivars	Flag leaf length at different drought period (cm)				mean
	0	7	14	21	
Mexipak (Hard)	16.50	14.57	10.82	9.90	12.94
Abu-Greb (Hard)	13.30	11.35	9.22	9.27	10.78
Sham-3-hard	9.57	9.90	9.02	7.07	8.89
Aras (Soft)	14.17	13.87	12.97	10.20	12.80
Sham-6-soft	11.22	13.95	14.67	9.02	12.21
Bakrajow (soft)	14.75	9.82	9.62	9.00	10.80
CP LSD = 3.77					C LSD=1.88
Mean	13.25	12.24	11.05	9.07	
P ≤ 0.05	P LSD = 1.54				

Table (4) Variation in flag leaf width of wheat cultivars under different periods of water stress

Wheat Cultivars	Flag leaf width at different drought period (cm)				mean
	0	7	14	21	
Mexipak (Hard)	1.20	1.27	1.12	0.52	1.03
Abu-Greb (Hard)	1.12	1.17	0.95	0.60	0.96
Sham-3-hard	1.00	1.17	0.80	0.57	0.88
Aras (Soft)	1.30	1.57	1.05	0.77	1.17
Sham-6-soft	0.97	1.00	1.02	0.77	0.94
Bakrajow (Soft)	1.32	1.15	1.10	0.65	1.05
CP LSD = 0.30					C LSD=0.15
Mean					
P ≤ 0.05	P LSD = 0.12				

Table (5) Variation in number of tillers of wheat cultivars under different periods of water strse

Wheat cultivars	Number of tillers at different drought period (cm)				mean
	0	7	14	21	
Mexipak-hard	3.50	3.00	3.50	2.25	3.06
Abu-Greb –hard	4.50	1.75	2.75	1.25	2.56
Sham-3-hard	2.50	3 25	2.50	2.50	2.69
Aras- soft	3.50	1.25	2.75	1.00	2.12
Sham-6-soft	4.75	4.25	5.75	2.75	4.37
Bakrajow -soft	4.50	4.5	4.75	3.5	4.31
CP LSD = 1.59					C LSD=0.79
Mean	3.87	3.00	3.67	2.21	
P ≤ 0.05	P LSD = 0.65				

Table (6) Variation in number of leaves of wheat cultivars under different periods of water stress

Wheat cultivars	Number of leaves at different drought period (cm)				mean
	0	7	14	21	
Mexipak-hard	24.50	21.50	17.50	15.00	19.62
Abu-Greb –hard	26.75	15.25	16.50	12.75	17.81
Sham-3-hard	16.75	18.25	15.25	13.25	15.87
Aras- soft	21.50	11.75	12.25	9.25	13.69
Sham-6-soft	31.00	30.00	23.50	20.25	26.19
Bakrajow -soft	30.50	21.75	22.50	24.50	24.81
CP LSD = 11.44					C LSD=5.70
Mean	25.17	19.75	17.92	15.83	
P ≤ 0.05	P LSD = 4.65				

Table (7) Variation in number of spike / plant of wheat cultivars under different periods of water stress.

Wheat cultivars	Number of spike / plant at different drought period (cm)				mean
	0	7	14	21	
Mexipak-hard	2.50	1.50	1.75	1.25	1.75
Abu-Greb –hard	2.50	1.75	1.25	1.50	1.75
Sham-3-hard	1.75	1.75	1.25	1.00	1.43
Aras- soft	3.25	2.25	2.50	1.00	2.25
Sham-6-soft	3.25	1.25	1.00	1.25	1.68
Bakrajow -soft	2.50	1.25	1.25	1.00	1.50
CP LSD = 0.92					C LSD=0.46
Mean	2.62	1.62	1.50	1.16	
P ≤ 0 05	P LSD = 0.37				

Table (8) Variation in number of seed / spike of wheat cultivars under different periods of water stress

Wheat cultivars	Number 0f seed / spike at different drought period (cm)				mean
	0	7	14	21	
Mexipak-hard	46.00	36.00	22.50	10.00	28.75
Abu-Greb –hard	35.25	29.75	19.50	9.25	23.44
Sham-3-hard	38.25	26.75	14.75	10.00	22.44
Aras- soft	55.00	40.75	27.25	14.50	34.37
Sham-6-soft	35.50	26.00	12.00	9.25	20.69
Bakrajow -soft	32.00	28.75	34.50	14.50	27.44
CP LSD = 9.92					C LSD=4.96
Mean	40.33	31.42	21.75	11.25	
P ≤ 0.05	P LSD = 4.05				

Table (9) Variation in number of seed / plant of wheat cultivars under different periods of water stress

Wheat cultivars	Number of seed / plant at different drought period (cm)				mean
	0	7	14	21	
Mexipak-hard	113.50	56.50	39.50	12.00	55.37
Abu-Greb –hard	97.00	52.50	22.25	13.75	46.37
Sham-3-hard	67.50	48.25	24.00	10.00	37.44
Aras- soft	178.00	91.50	70.50	14.50	88.62
Sham-6-soft	118.25	31.00	9.50	8.75	41.48
Bakrajow -soft	79.25	35.00	43	14.50	42.94
CP LSD = 36.72					C LSD=18.36
Mean	108.92	52.46	34.79	12.25	
P ≤ 0.05	P LSD = 14.99				

Table (10):variation in loosed weight(gm) of wheat cultivars under different periods of

Wheat cultivars	100 seed weight (gm)				mean
	0	7	14	21	
Mexipak-hard	2.56	2.41	2.12	1.40	2.12
Abu-Greb –hard	2.33	2.21	2.23	1.38	2.04
Sham-3-hard	3.56	3.31	2.99	1.45	2.83
Aras- soft	3.42	3.31	4.27	2.57	3.3925
Sham-6-soft	2.96	2.00	2.22	1.46	2.16
Bakrajow -soft	2.27	1.63	1.39	1.29	1.645
CP LSD = 0.56					
Mean	2.85	2.48	2.54	1.59	C LSD=0.28
P ≤ 0.05	P LSD = 0.23				

Table (5) shows that the maximum mean value for the number of tiller per plant was recorded with Sham-6-soft cultivars in spite of the drought periods , while the low mean value was recorded at drought periods 21d in spite of cultivars, It is also shown that water stress periods insignificantly decreased the number of tiller per plant for all cultivars as compared to control except for Abu-Greb which is increased significantly at all drought periods while the other varieties were responded differently.

Number of seed per plant

The high value of number of seed per plant was recorded for Aras cultivar inspite of drought period and low value recorded at drought period 21 inspite of cultivars, as shown in table (9), also it seems that water stress periods significantly decreased number of seed per plant for all cultivars but significant decreased at water stress period
7 for Sham-3-hard, as compare to control and high reduction was recorded at drought period 21 for Sham-6-soft.The lower soil moisture content might be attributed to the decrease in the nutrient mobility because of the absence of the thicker moisture film through which the ions could diffuse[29].

Weight of loosed (gm)

As shown in table (10) high value of loosed weight was found in Araz cultivar inspite of drought periods and the drought period 21 gives low value of loosed weight inspite of cultivars. And also it shown from the table that water stress periods significantly decreased weight of loosed specially of the two weter stress period (14,21d) for all cultivars except the two cultivars Mexipak and Abu-Greb at water stress 14, and it increased significantly at water stress period 14 for Aras cultivar and high reduction recorded at drought period 21 for Bakrajow as compare to control.

Plant dry weight (gm)

In spite of drought periods the Aras cultivar gives high value of plant dry weight and the drought period 21 gives the low value inspite of cultivar as shown in table (11). And the water stress periodssignificantly decreased plant dry weight for all cultivars except sham-3-hard cultivar which insignificantly decreased plant dry weight at water stress period 7

Protein content in kernels %

As shown in the table (12) high value of protein was recorded for Mexipak in spite of drought periods and low value in spite

of cultivars was recorded at 21d period. Italso clarified that drought periods significantly decreased in all drought periods, and Sham-6-soft at 21 d period.
The reduction in proteins occurs in width plants and is accompanied by increase in amino acids [30]. One of the major consequences of drought stress is the loose protoplasmic water leading to the concentration of ions such as Cl and NO3. At high concentration, these ions effectively inhibit metabolic functions [31]. Additionally concentration of protoplasmic constituents and the loose of water from the cell lead to the formation of what is termed a glassy state, in this state whatever liquid is left in the cell has a very high viscosity, increasing the chance molecular interaction that can cause protein denaturation and protein fusion water deficit in plants leads also to physiological modification ,such as photosynthesis reduction ,transcriptional and post transcriptional regulation of various genes, protein turnover and osmolyt biosynthesis [2].

Total Carbohydrates

Table (13) indicates that the maximum mean value was recorded for carbohydrates content in Sham-3-hard cultivar in spite of drought periods and the drought period 21d gave

Table(11).variations in dry weights(gm) of wheat cultivars under different periods of water drought

Wheat cultivars	Dry weight (mg) at different drought			
	0	7	14	21
Mexipak-hard	6.06	2.52	2.30	1.01
Abu-Greb –hard	4.29	2.15	1.72	1.42
Sham-3-hard	5.71	2.66	2.89	1.43
Aras- soft	7.50	3.32	4.69	1.84
Sham-6-soft	3.16	2.14	1.35	1.27
Bakrajow -soft	5.12	2.87	2.43	1.32
CP LSD = 1.64				
Mean	5.31	2.19	2.55	1.38
P ≤ 0.05	P LSD = 0.67			

Table (13) variation in total carbohydrate content %of different wheat cultivars under different periods of water

Wheat cultivars	Carbohydrate % drought				Mean
	0	7	14	21	
Mexipak-hard	68.59	60.87	60.53	58.46	62.11
Abu-Greb –hard	70.01	64.14	62.26	60.07	64.12
Sham-3-hard	69.77	67.16	64.89	60.24	65.51
Aras- soft	70.74	63.06	64.83	62.93	65.39
Sham-6-soft	67.18	66.96	61.02	61	64.04
Bakrajow -soft	67.47	64.46	64.98	62.80	64.93
	CP L S D = 11.6				4.76 LSD
Mean	68.96	64.44	63.08	60.92	
P≤0.05	L S D 5.81				

low value in spite of cultivars. Also show that water stress periods insignificantly decreased total carbohydrates percentage in wheat kernel for all cultivar and the lower reduction was recorded at 21d period for all cultivars .The reduction in carbohydrate content due to that respiration often decreased more slowly than photosynthesis .Causing depletion of food reserves and change in the proportion of various carbohydrates [32].

Refrences

1. Mundree, S. G. , Bienyameen B. , Shaheen, M., Sham P., Sabri M. , Clare V. W. , Kershini G., Ali M. , Samson M., Jill, M. F. and Jennifer A. T. Physiological and molecular insights in to drought tolerance. *African journal of biotechnology*. **2002** (2). 28-38.
2. Bohnert, H. J.; Nelson D. E., and Jensen R. G. Adaptations to environmental stresses. *Plant cell* **1995**. 7: 1099-1111.
3. Cigiar Priorities and Strategies for Resource Allocation During April. 29. **1997.**
4. Wheat and grain flours **2002**. Wheat out look (WHS). Products of the Economic Research service US. Department of Agriculture.
5. Nizameddin, M. Marshall, D. R. Effects of dwarfing genes on yield and yield components under irrigated and rain-fed conditions in wheat (Triticum aestivum L.). *Euphytica* **1989**.42: 127-134.
6. Waddington, S. R.; Cartwright, P. M., and Wall P. C. A quantitative scale of spike initial and pistil development in barely and wheat. Annuals of Botany. . **1983**,51: 119-130.
7. Alexandrov, V. A. and Hoogenboom, G. The impact of climate variability and change on crop yield in Bulgaria. Agricultural and Forest Meterology **2000**,104: 315-327.
8. Li, A.-G., Hou,Y. S. Wall, G.W. Trent, A., Kimball, B. A. and Printer J. R., P. J. Free-air CO2 enrichment and drought stress effects on grain filling rate and duration in spring wheat. Crop science **2000**, 40: 1263-1270.
9. Bauder, Jim. **1998** When necessary "Just in time" irrigating can saw water. Montana state university U.S.A. Extension soil and water quality.
10. Bakhshandeh, A. **2001.** Effects of water stress on the development of the inflorescence in two spring wheat. Proceedings of the 10th Australian Agronomy Conference, Hobart.
11. Xiping, D.; Shan L., and Inanaga S. **2002**. Assessments on the water conservation practices and wheat adaptations to the semi-arid and eroded environments. 12th ISCO Conference.
12. Baalabaki, R. and A. Abdel-Rahim, **2002**. Effect of Osmotic stress on vegetative growth and yield of drought tolerant susceptible wheat cultivars and protection. Crop production. AUB research Agricultural crop project.
13. Sharma, D. L. and Anderson W. K. **2001**. Agronomic responses of new wheat cultivars in the northern wheat belt. In crop updates **2001**: Cereal updates (Eds. Roslyn. Jetner and Jessica Johns) pp. 41-42. Agriculture westrn.
14. Sharma, D. L. and Anderson W. K. **2003**. Time of sowing affects small grain screening in wheat in a dry season proceedings of the 11th Australian Agronomy Conference. Geelong "Victoria-Australian Society of Agronomy.
15. Ivandic, V; C. A. Hackett; Z. J. Zhang, J. E. Stabub, E. Nevo; W. T. B. Thomas and B. P. Forster, Phenotypic responses of wild barley to experimentally imposed water stress . *Journal of Experimental Botany* **2000**.51(353): 2021-2029.
16. Bartoli, G. M. Simontacchi, E. Tambussi, J. Beltrano, E. Montaldi, and S. Puntarulo. Drought and watering- dependent oxidative stress: effect on antioxidant content in (Triticum

aestivum L.) leaves. *Journal of experimental Botany***1999** , 50, 373-381, Copy right oxford university press.

17. Cochran, W. G. and Cox, G. M. **1957**. Experimental Design. Wiley publication in statistics. 2nd edition. John Wiley and sons Inc. USA.
18. McClare, J. T. and Sincich,T. **2000**. A first course in statistics. 7th edition. Printed Hall Inc. USA .
19. Shalfer, P. A. and Hartman, A. F. **1921**. The iodometric determination of cupper and its use in sugar analysis (Modified by Noakell E. J. and El-Gawadi , A., Barnell: New phytol 35: 229-266.
20. Coombs, J., G. Hind, R. C. Leegood , L. L. Tieszen and A. Vonshak **1985**. Analytical techniques. From techniques in bioproductivity and photosynthesis. 2nd edition .Pergamon press. Newwork.
21. Black, C. A.; D. D. Evans; L. E. Ensminger and F. E. Clark. **1982**. Methods.
22. Kramer J. K. **1969**. Plant and soil water relation ships; Amodern synthesis. McGraw-Hill Book Company.
23. Vander, W. C.; Pammenter N. W., Mundree S. G., Farrant J. M. Physiological comparisons between the resurrection grass. Ergannindeasis and the related desiccation-sensitive species, Eragrostis plant growth Regul. **2001**.35: 121-129.
24. Whitmore, F. W. and R. Zahnor Evidence for direct effect of water stress on traechid wall metabolism in pine forest Sci. **1967**.13: 397-400.
25. Stuchburg, **2000**. Making crop plants which have increased resistance to stress. Plant cell biotechnology. Lecture synopsis for BI 1505.
26. Meyer, R. E. and J. R. Gigrich, Osmotic stress: effects of its application to a portion of wheat root systems. *Science* **1964**. 144:1463-1464.
27. Itai, C., and Y. Vaadia, Kinetin- like activity in root exudates of water stressed sunflower *plants. Physiol. Plant.* **1965**.18: 941-944.
28. Berman, M. E.; Dejong T. M. Water stress and crop load effects on fruit fresh and dry weights in peach (Prunus persica) . *Tree physiology.* **1996**. 16; 859-864.
29. Dorion ,S., Lalonde S, Saini H. SInduction of male sterility in wheat by meiotic- stage water deficit is preceded by a decline in invertase activity and changes in carbohydrate metabolism in culture. *Plant physiology.* **1996**. 111, 137-145.
30. AL-Niemi, S. N. **1980**. Early growth response of grain sorphum, Corn and soybean to salt and water stress. Ph.D. Thesis . Missouri University-Columbia in physiology.
31. Bernett, W. E., D.H. Brown and J. L. Epler, Mitochondria specific, chloroplast; *plant physiol.* **1967**.41: 764-770.
32. Hartung, W. ;Schiller Pikar Josef D., Physiology of poikilohydric Prog. Bot. **1998**. 59: 299-327.

بۆباری ئاو (Triticum spp.) وەڵام دانەوەی چەند چەشنێکی جیاوازی گەنم

فەیسەڵ عبدالقادر سەکری
بەشی بایۆلۆجی/ کۆلێجی زانست / زانکۆی سەلاحەدین / هەرێمی کوردستان _ عێراق
نوری حسن غفور
بەشی بایۆلۆجی/ کۆلێجی زانست / زانکۆی سلێمانی / هەرێمی کوردستان _ عێراق
و شیرین عبدالکریم ئەمین
بەشی بایۆلۆجی/ کۆلێجی زانست / زانکۆی سەلاحەدین / هەرێمی کوردستان _ عێراق

پوختە

وەڵام دانەوەی ڕەگەزی گەنمی جیاواز بۆ باری ئاوییان خرایە ژێر لێکۆڵینەوە لەڕێگەی درێژی ڕووەك ، درێژی گەڵای ئاڵا ، ژمارەی لق لێبونەوە / ڕووەکێك ، ژمارەی گەڵا / ڕووەکێك ، ژمارەی گوڵە گەنم / ڕووەکێك ، ژمارەی تۆو / گوڵە گەنمێك، ژمارەی تۆو / ڕووەکێك ، کێشی وون بوو ، وشکە کێش / ڕووەکێك ، ڕێژەی سەدی پێکهاتەی پڕوتین / دەنکێك و بڕی کاربۆهیدراتی گشتی .

لە ئجامی لێکۆڵینەوە دەرێخست کە ماوەی وشکی دەبێتە کەمبونی بەرجەستەیی درێژی ڕووك لە هەموو ڕەگەزەکانـدا ، درێژی گەڵای ئاڵا زیاد بوو بە بەرجەستەیی لە ماوەی وشکی ٧ ڕۆژیدا وە بەتایبەت بۆ ڕەگـەزی شـامی ٣ ، بـەڵام گـەمبوونی بەرجەستەیی ڕویدا بۆ هەردوو ڕەگەزی مکسیباك و ئەبوغریب لە ماوەی وشکی ٢١ ڕۆژیـدا ، هـەروەها بۆزەگـەزی بـەکرەجۆ لـە ماوەی وشکی ٧، ١٤، ٢١ ڕۆژیدا. ژمارەی گەڵاکانی / ڕووەکێك بە بەرجەستەیی کەمی کرد لە ماوەی وشکی ٧، ١٤ ڕۆژیدا تایبەت بە ڕەگەزی ئەبو غریب وە ماوەی وشکی ٢١ ڕۆژی تایبەت بە ڕەگەزی ئارام .

ماوەی وشکی کاریگەری کەمبونەوەی بەرجەستەیی هەبوو لەسەر ژمارەی گوڵە گـەنم/ ڕووەکێـك ، ژمـارەی تـۆو / گوڵـە گەنمێك ، ژمارەی تۆو / ڕووەکێك لەسەر ئاستی هەموو ڕەگەزەکان جگە لە بەکرەجۆ بۆژمارەی تۆو / گوڵە گەنمێك هەروەها کـەم بونەوەی بەرجەستەیی ڕووی‌دا لە وون بونی کێشدا لەسەر ئاستی هەردوو ماوەی وشکی ١٤، ٢١ ڕۆژیدا . سەرەڕای کەمبونی وشکە کێش لەسەر ئاستی هەموو ڕەگەزەکان جگە لە شامی ٣. ماوەی وشکی بووە هـۆی کـەمبوونی بەرجەسـتەیی‌لە ڕێـژەی سـەدی پێکهاتەی پڕوتین / دەنکێك لە ڕەگەزی شامی ٣ لە هەموو ئاستە وشکی‌یەکاندا وە بۆڕەگەزی شامی ٦ لە ماوەی وشکی ٢١ ڕۆژی‌دا .

استجابة اصناف الحنطة المختلفة (Triticum spp.) للحالات المائية

فيصل عبدالقادر سكرى
قسم البايولوجى / كلية العلوم / جامعة صلاح الدين / اقليم كردستان _ العراق
نورى حسن غفور
قسم البايولوجى / كلية العلوم / جامعة السليمانية / اقليم كردستان _ العراق
شيرين عبدالكريم امين
قسم البايولوجى / كلية العلوم / جامعة صلاح الدين / اقليم كردستان _ العراق

الخلاصة

تم دراسة استجابة اصناف زراعية مختلفة من الحنطة للحالات المائية متنوعة من خلال طول النبات ، طول ورقة العلم ، عدد التفرعات / نبات ، عدد الأوراق / نبات ، عدد السنابل / نبات ، عدد الحبوب / سنبلة ، عدد الحبوب / نبات ، فقدان الورق، الورق الجاف / نبات ، النسبة المئوية للبروتين و المحتوى الكاربوهيدراتى.

دلت النتائج بان مدة الجفاف أدت إلى الانخفاض المعنوي في طول النبات لكافة الاصناف ، طول ورقة العلم زادت معنويا في مدة الجفاف ٧ يوما وخاصة لصنف شام ٣ ولكن سبب انخفاضا معنويا لصنف مكسيباك و ابوغريب في مدة الجفاف ٢١ يوما وكذلك لصنف بكرجو في مدة الجفاف ٧، ١٤، ٢١ يوما . عدد الأوراق / نبات انخفض معنويا في مدة ٧، ٢١ يوما لصنف ابوغريب و ٢١ يوما لصنف اراس .

مدة الجفاف سبب الانخفاضا معنويا في عدد السنابل / نبات ، عدد الحبوب / سنبلة ، عدد الحبوب / نبات لكل الاصناف عدا صنف بكرجو و لعدد الحبوب /سنبلة ، كذلك سبب الانخفاض المعنوي فى فقدان الوزن وبلاخص مدتى الجفاف ١٤، ٢١ يوما. مدة الجفاف سبب الهبوط المعنوي لوزن الجاف للنباتات ولكل الاصناف عدا صنف شام ٣. مدة الجفاف أدت إلى الهبوط المعنوي في النسبة المئوية للبروتين ولصنف شام ٣ ولكافة مستويات مدد الجفاف وكذلك بالنسبة لشام ٦ في مدة الجفاف ٢١ يوما .

Received on15 /10/2004 Accepted on 15/3/2005 .
وەرگیرا لە ٩/ ١٠/ ٢٠٠٤ پەسەند کرا لە ١٥/ ٣/ ٢٠٠٥ .