DROUGHT TOLERANCE OF SOME SOYBEAN VARIETIES IN NEWLY LAND

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ABSTRACT

Soybean is the most important pulse crop in the world and especially Egypt. It's import a lot of soybean. Water is one of the major limiting factors of soybean production in semiarid regions as Egypt. Therefore, choosing the appropriate irrigation system and quantity are very important for obtaining high crop production and overcoming the lack of water and not affect yield. Experiments ware conducted carried out during summer season at years 2017 and 2018, in privet Farm in north Delta, in Qalbsho area, Belqas Center, Dakahlia Government, Egypt, to investigate production of five varieties of soybean (Giza 22, Giza 21, Crawford, Giza 111 and Giza 35), affected by three irrigation intervals (4 and 6 days) and treatment (potassium k 2%, proline 3%, and K + proline) were arranged in split split plot design with three replications in sandy soil under drip irrigation system. Results showed that the drip irrigation lead to increase of all growth yield characters all varieties. Variety of Crawford had a significant effect on plant height; number of pods/plant, hundred seed weight, and seed yield compare other treatments. The variety Giza 21 had low readings compare with other varieties.

Key words: Drought, irrigation interval, sandy soil, varieties of Soybean.

مجلة العلوم الزراعية العراقية -2019 :50(3):741-752 خطاب وآخرون

تحمل بعض أصناف فول الصويا للجفاف في الأراضي الحديثة الاستزراع

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المستخلص

فول الصويا هو من أهم محاصيل البقول في العالم وخاصة فى مصر. حيث إنها تستورد كميات كبيرة ر من فول الصويا. وحيث أن المياه هي واحدة من أهم العوامل الرئيسية التي تحد من إنتاج فول الصويا في المناطق شبه الجافة ومنها مصر. لذلك، يعد اختيار نظام الري المناسب والكمية أمرًا مهمًا للغاية للحصول على إنتاجية عالية من محصول البذور. وللتغلب على نقص المياه وعدم التأثير على المحصول تم إجراء تجارب حقلية خلال موسمين صيفين خلال عامي 2017 و 2018 ، في مزرعة خاصة بشمال الدلتا، في منطقة قلبشو، مركز بلقاس، محافظة الدقهلية، مصر، للتحقيق في إنتاج خمسة أصناف من فول الصويا (جيزة 22 ، جيزة 21 ، كروفورد ، جيزة 111 و الجيزة 35) تحت تأثير فترتين ري (4 و 6 أيام) والمعاملة بكل من (البوتاسيوم 2 ٪ ، البرولين 3 ٪ ، والبرولين) وصممت التجربة بنظام القطع المنشقة مرتين ووزعت في ثلاث مكررات في التربة الرملية تحت نظام الري بالتنقيط. أوضحت النتائج أن الري بالتنقيط يؤدي إلى زيادة جميع صفات النمو لجميع الاصناف. كان لصنف Crawford تفوق على جميع الاصناف الاخرى فى صفات ارتفاع النبات؛ وعدد القرون/النبات، ووزن المائة بذرة، ومحصول البذور مقارنة بالمعاملات الأخرى. الصنف جيزة 21 سجل قراءات منخفضة مقارنة مع الأصناف الأخرى.

كلمات مفتاحية: فترات الري، التربة الرملية، أصناف فول الصويا, البوتاسيوم, البرولين.

***Received:21/12/2018, Accepted:19/3/2019**

INTRODUCTION

Soybean (*Glycine max* L Merrill) is a legume that grows in tropical, subtropical and temperate climates. Soybean is a multipurpose crop used for human food, animal feed and industrial uses (33). Soybean is a major source of protein and it contains significant amounts of all the essential amino acids for the human body and oil contains linolenic acid (omega-3 fatty acid), which has been shown to reduce the risk of heart disease, (39) used as a source of cooking oil, and for many other purposes. It has an average protein content of 40% and oil content of 20%, which is cholesterol-free making it a good alternative to meat, poultry and sea food. The productivity of soybeans in Egypt and Africa is still low compared to global varieties (FAO, 14). Soybean varieties play a strategic role in increasing seed yield plant (27); (12 and (2) showed that some soybean had the best seed and oil yields. Additionally, Hamakareem *et al*., (17) classified soybean plant as oilseed rather than pulse crop as approximately 85% of the world's soybean crop processed into soybean meal and vegetable oil. The oil yield, physicochemical properties and attributes of the oils can vary among different varieties of oil seeds with respect to their genetic make-up, (29). Accordingly, it is important to address our efforts to this fundamental issue by improving some cultural practices for soybean growth and development (40). Drought stress is the most stressful effect on plants in arid and semi-arid lands, followed by salt stress, which affects the components of the crop negatively impacted on grain yield and oil yield (15). Irrigation led to increase the productivity of soybean plants as well as the use of irrigation systems, and modern methods to increase yield. while, drought stress led to a changes in molecular, biochemistry, physiology and morphology of plants, (43). Proteins which are synthesized in response to drought stress are called dehydrin, that is a functional protein to facilitating water retention, membrane stability and ions flow and also play a role in the protection of cytoplasms components during drought stress (6). Dehydrin and Dehydrin-like also increase the accumulation of ions in the cell and control the concentration of cytoplasm, which increases the drought resistance. Plants that are exposed to stress form ROS which led to damage of leaves and, ultimately, decreases crop yield. The change in the global climate has led to increased drought in arid regions, causing a shortage of soybean crop, so soybean breeding have to be for drought tolerance, (18). Potassium is a major nutrient of the plant and plays an important role in the synthesis of enzymes, protein, photosynthesis, energy transfer, ionic balance and stress resistance. Therefore, it was found high concentrations in the cytoplasm and apoplastic, this explane the role of K on plant resistance to abiotic (drought) stresses (47); (31) and (42). Potassium sufficient plant, leads to the synthesis of high molecular weight compounds such as proteins, starches, cellulose and phenols, thus playing an important role in plant resistance for stresses (23). Drought works on the lack of growth and the rate of root spread, which limits the absorption of potassium, so the potassium concentration in the plant should be increased to further depress the plant resistance to drought stress (25). Adequate amounts of K, can enhance the total dry mass accumulation of crop plants under drought stress, might be attributable to stomata regulation by K^+, increase photosynthesis, root growth and leaf area; and cells membrane integrity and stability (41); (37) and (25). Drought stress leads to aquaporin gene expression regulated, which helps the plant maintain the water balance and regulate the ability of the roots to absorb water and ions by modifying plasma membrane intrinsic proteins, as well as inhibiting the production of ethylene (28); (21); (7) and (22). Proline is the most amino acid compatible with osmolytes, and works to protect the cytoplasmic enzymes and storage of nitrogen and carbon necessary for growth after the stress post works on the synthesis of protein and stability of membranes and scavenger of free radicals and energy sink to regulate the processes of oxidation and reduction. So, the function of proline is an osmo-protectant under drought and salinity stress (23). Drought stress led to increase the level of proline and activity of γ-glutamyl kinase and reduces proline oxidase activities (9). Treatment with proline before the occurrence of dehydration has a significant protective effect for nitrate reductase activity, and cell membranes in the leaves (4). The objective of the present investigation was to determine role of proline and potassium and the relationship between them to the adaptation of five varieties of soybean plant to drought stress.

MATERIALS AND METHODS

Experimental Site Characteristics

Field Experiments ware conducted carried out during summer season at years 2017 and 2018, in privet Farm in north Delta, in Qalbsho area, Belqas Center, Dakahlia Governorate, Egypt. Representative soil samples (0 to 30 cm) were taken at sowing and analyzed for some parameters. The soil samples were air dried ground and analyzed for physical and chemical characteristics according to (Jackson, 20) (Table 1). The experimental area has an arid climate with hot dry summers and cool winters.

Table 1a. Soil physico-chemical properties of the experimental sites before sowing

Texture	O.M (%)	E.C (dsm^{-1})	pH	Total N (%)	P ($mg\ kg^{-1}$)	K $mg\ kg^{-1}$	SO_4-N ($mg\ kg^{-1}$)
Sandy	0.93	0.49	7.90	1.16	4.32	5.2	2.12

Experimental material

The experimental material used in the present study comprised of 5 soybean cultivars Giza 22, Giza 21, Crawford, Giza 111 and Giza 35 are characterized for improved quality, and are insect-resistance and need low amount of nitrogenous fertilizer. The seed of cultivars was obtained from Food Legumes Research Section, Agricultural Research Center, Giza, Egypt.

Table 1b. The descriptions of soybean cultivars used in this study

Cultivar	Country origin	Maturity group	Growth habit	Days to maturity	Pedigree
Giza 22	Egypt	IV	Indeterminate	120-125	Crawford × Celest
Giza 21	Egypt	IV	Indeterminate	120-125	Crawford × Celest
Crawford	USA	IV	Indeterminate	120-125	Williams × Columbus
Giza 111	Egypt	IV	Indeterminate	120-125	Crawford × Celest
Giza 35	Egypt	III	Indeterminate	115- 120	Crawford × Celest

Experimental Designs and Treatments

The experiment was conducted as split split-plot design based on randomized complete block design with three replications. Drought stress treatments control treatment (4 days and drought stress at 6 days) were arranged in main plots and soybean cultivars (Giza 22, Giza 21, Crawford, Giza 111 and Giza 35) were allocated in sub plots while, treatments including (potassium, proline and interaction between them) in sub subplot. The experimental plots consisted of five rows; each was 3.5 m long and 0.6 m width occupying an area of 10.23 m^2.The research field and treatment plot was irrigated with drip irrigation system. Water regime treatments were started after 25 days from planting.

Agronomic Management: Soybean seeds were inoculated prior to sowing with the specific strain of *Rhizobium japonicum* leguminous arum. Soybean were sown in May 21st in the 2017 and 2018 and harvested 124 days after planting (DAP). Soybean seeds were planted in hill spaced 20 cm on the two sides of the ridge. Each hill received 4 seeds and was thinned to two plants per hill 21 days after sowing. Before planting operations of land preparation were conducted a week before planting through plowing, disc, leveler and implementing experiment plant calcium super phosphate (200 Kg/ha, 15.5% P_2O_5) per hectare was applied during seed bed preparation. Potassium sulfate (75 kg/ha, 48% K_2O) was applied at 21 days after planting. Nitrogen fertilizer in the form of Urea (46% N) was added at the rate of 90 kg N/ha was divided into two equal doses prior to the first and second irrigations. All cultural operations were kept normal and uniform except water regime levels. Regular pest and disease control were undertaken as needed. Potassium fertilizer and proline were applied to treatments in both years after 35 days from sown then repeat every fifteen days three time (in spray form) foliar application on plants.

Data Collection: After 85 days from sown, various parameters of some growth traits and morphological and physiological characteristics of plant were measured to avoid marginal effects, two rows (one row from each side) and 1 m from the top and bottom ends of each plot were discarded. Ten guarded plants were randomly sampled from each plot and the following traits were measured at harvest (124 days after sowing) five shrubs were randomly picked from the second half of each plot and were used to measure measurements were recorded: plant height (cm), number of pods/plant, number of seed/plant, 100 seed weight (g), yield/plant (g), grain yield (t/ha), biomass yield (t/ha) and biological yield (t/ha). Finally, samples from each experimental plot were transported to the laboratory to determine Potassium %, Chlorophyll mg/g fresh weight, Leaf proline content (µmol/g) was extracted and assayed according to Bates *et al*., (5), leaf Carbohydrate content (mg/g), seed oil content was determined using Soxhlet apparatus and diethyl ether as a solvent and protein percentage of seeds was measured using Kjeldahl method according to AOAC (1). Chlorophylls were extracted and assayed according to (Witham *et al*., (48).

Statically analysis

The experiment was conducted as split split-plot design having irrigation interval in main plot varieties in sub plot and potassium and proline in sub subplot. Data were subjected to statistical analysis of variance according to (Gomez and Gomez, 16) and L.S.D value for comparison. All statistical calculations were performed using the computer statistical package program, MSTAT-C Version 2.1 (Russell, 38).

RESULTS AND DISCUSSION

3-1- Growth characters: Data in table 2 indicated that the effect of drought stress on some varieties under treatments of potassium and proline on growth. Irrigation every 6 days has the lowest value of growth characters compare irrigation every 4 days. There was a remarkable significant difference in respect of characters among all the soybean varieties. The highest reading was found in soybean variety Giza 22. While soybean variety Giza 111 was the lowest variety as compared with others.

Table 2. Effect of interactions between irrigation intervals, varieties of soybean plants and treatments on some growth characters

Treatments			Plant Height (cm)	Dry matter plant^{-1}(g)	No. of nodules	No. of branches plant-1	No. of nodes plant^{-1}	No. of filled pods plant^{-1}	No. of empty pods plant^{-1}
4 days	Giza 22	K	36.88	20.81	27.40	3.71	11.07	58.28	1.152
		Pro.	35.48	19.55	22.06	3.70	10.83	52.34	1.164
		K + pro.	35.55	19.69	20.26	3.68	10.07	44.33	1.201
	Giza 21	K	34.36	19.18	25.40	3.55	10.47	51.05	2.002
		Pro.	34.13	19.66	21.06	3.43	10.17	47.01	2.373
		K + pro.	33.68	19.02	19.26	3.34	9.93	44.14	2.072
	Crawford	K	35.40	19.98	26.30	3.562	10.63	55.95	2.561
		Pro.	34.06	18.77	21.18	3.552	10.40	50.25	2.458
		K + pro.	34.13	18.90	19.45	3.533	9.67	42.56	2.275
	Giza 111	K	32.99	18.41	24.38	3.408	10.05	49.01	1.633
		Pro.	32.76	18.87	20.22	3.293	9.76	45.13	1.920
		K + pro.	32.33	18.26	18.49	3.206	9.53	42.37	1.565
	Giza 35	K	35.77	20.19	26.58	3.599	10.74	56.53	1.987
		Pro.	34.42	18.96	21.40	3.589	10.51	50.77	1.940
		K + pro.	34.48	19.10	19.65	3.570	9.77	43.00	1.581
6 days	Giza 22	K	32.53	16.69	19.53	2.87	10.40	52.14	2.235
		Pro.	32.02	16.79	18.33	2.43	10.00	46.48	2.258
		K + pro.	32.77	16.28	17.13	2.73	9.87	39.86	2.330
	Giza 21	K	31.36	16.18	18.53	2.55	9.47	46.05	3.884
		Pro.	31.13	16.26	17.33	2.43	9.87	45.01	4.604
		K + pro.	31.68	16.02	16.13	2.34	9.93	42.14	4.020
	Crawford	K	31.23	16.02	18.75	2.755	9.98	50.05	4.968
		Pro.	30.74	16.12	17.60	2.333	9.60	44.62	4.769
		K + pro.	31.46	15.63	16.44	2.621	9.48	38.27	4.414
	Giza 111	K	30.11	15.53	17.79	2.448	9.09	44.21	3.725
		Pro.	29.88	15.61	16.64	2.333	9.48	43.21	3.036
		K + pro.	30.41	15.38	15.48	2.246	9.53	40.45	3.855
	Giza 35	K	31.55	16.19	18.94	2.784	10.09	50.58	3.764
		Pro.	31.06	16.29	17.78	2.357	9.70	45.09	3.067
		K + pro.	31.78	15.79	16.61	2.648	9.573	38.66	4.336
LSD Drought			8.695632	4.552032	5.533584	0.15415	2.11462	9.433443	0.111989
LSD Varieties			8.065596	4.222217	5.132652	0.142981	1.961406	8.74995	0.103875
LSD Treatments			8.037216	4.207361	5.114592	0.142478	1.954505	8.719162	0.10351
LSD D X V			6.61254	3.461565	4.20798	0.117222	1.60805	7.173604	0.085162
LSD DX T			6.04494	3.164435	3.84678	0.10716	1.47002	6.557844	0.077852
LSD V X T			4.279704	2.24036	2.723448	0.075867	1.040746	4.64283	0.055117
LSD D X V X T			3.836976	2.008599	2.441712	0.068019	0.933083	4.162538	0.049416

Data indicated that the effect of potassium and/or proline on all characters led to increase values. Effect of drought on varieties of soybean plants were application of drought with irrigation every 4 days interaction with variety Giza 22 was recorded highest values with all these characteristics, while application of drought with irrigation every 4 days interaction with potassium and/or proline was recorded highest values with all these characteristics. Interaction between irrigation every 4 days with variety Giza 22 under treatment of potassium were recorded highest values with all characteristics, while the effect of drought and varieties of soybean plants treated with potassium. Application of drought with irrigation every 4 days interaction with variety Giza 111 under treatment of potassium were recorded lowest values with all these characteristics. It is worth mentioning that, the effect of drought and varieties of soybean plants treated with proline surprise verity Giza 22, followed Giza 35, Crawford, Giza 21 and Giza 111. Application of drought with irrigation every 4 days interaction with variety Giza 22 under treatment of proline were recorded highest values with all characteristics. Application of drought with irrigation every 6 days interaction with variety Giza 111 under treatment of potassium were recorded lowest values with all these characteristics. Data in table 2 indicated that the effect of drought and varieties of soybean plants treated with potassium and proline. Application of drought with irrigation every 4 days interaction with variety Giza 22 under treatment of potassium were recorded highest values with all these characteristics. But, number of empty pods plant-1 was recorded highest value 1.201 followed with variety Giza 35 under treatment of potassium and proline were recorded highest values with all these characteristics. While the effect of drought and varieties of soybean plants treated with potassium and proline. Application of drought with irrigation every 4 days interaction with variety Giza 111 under treatment of potassium were recorded lowest values with all these characteristics. Application of drought with irrigation every 6 days interaction with variety Giza 22 under treatment of potassium were recorded highest values with all these characteristics, followed with variety Giza 35 under treatment of potassium were recorded highest values with all these characteristics. But, number of empty pods plant-1 was recorded highest value 3.764. Application of drought with irrigation every 6 days interaction with variety Giza 111 under treatment of potassium were recorded lowest values with all these characteristics. It is worth mentioning that the effect of drought and varieties cv. of soybean plants treated with proline surprise verity Giza 22, Giza 35, Crawford, Giza 21 and Giza 111. Application of drought with irrigation every 6 days interaction with variety Giza 22 under treatment of proline were recorded highest values with all these characteristics. But, number of empty pods plant-1 was recorded highest value 2.258, followed with variety Giza 35 under treatment of proline were recorded highest values with all these characteristics. But, number of empty pods plant-1 was recorded highest value 3.067. Application of drought with irrigation every 6 days interaction with variety Giza 111 under treatment of potassium were recorded lowest values with all these characteristics. But, number of empty pods plant-1 was recorded highest value. Application of drought with irrigation every 6 days interaction with variety Giza 22 under treatment of potassium were recorded highest values with all these characteristics. But, number of empty pods plant-1 was recorded highest value 2.33 followed with variety Giza 35 under treatment of potassium and proline were recorded highest values with all these characteristics. But, number of empty pods plant-1 was recorded highest value 4.336. Application of drought with irrigation every 6 days interaction with variety Giza 111 under treatment of potassium were recorded lowest values with all these characteristics. But, number of empty pods plant-1 was recorded highest value.

3-2- Yield characters

Analysis of variance indicated that the effect of drought stress on growth was significant probability level. Mean comparisons showed that drought stress in 6 days reduced yield characters more than 4 days treatment. The effect of varieties on yield characters was significant. But between Giza 111 and Giza 35 there was no significant difference, while the difference was significant as compared with the Giza 22. The lowest number of filled pods plant-1 was observed from 6 days. Whereas the lowest dry weight of plant (53.43) was obtained from the 6 days. The greatest reduction in seed numbers per plant due to drought stress was observed at flowering stage. Data in table 3 indicated that the effect of potassium on all yield characters led to increase values. Potassium application to leguminous crops is necessary especially at the flowering and pod setting stages. Data in table 3 showed that the effect of proline on all characters lead to increase values. Spraying with proline increased all these characteristics. Application of potassium and proline increased all these characteristics as data in table 3 show that effect of drought on varieties of soybean plants.

Table 3. Effect of interactions between irrigation intervals, varieties of soybean plants and treatments on yield and its component

Treatments			Plant Height(cm)	Number of pods/plant	Number of seed/plant	100 seed Weigh (gm)	Seed yield/plant (gm)	Grain yield (t/ha)	Biomass yield (t/ha)	Biological yield (t/ha)
4 days	Giza 22	K	79.26	36.88	124.42	16.15	60.2525	3.1519	4.2784	7.4303
		Pro.	76.82	35.48	124.15	16.11	59.43	3.0579	4.1509	7.2088
		K + pro.	75.64	36.36	123.35	16.16	62.5625	3.1213	4.2369	7.3582
	Giza 21	K	68.90	35.40	119.46	15.83	59.01	2.8940	3.9283	6.8223
		Pro.	68.36	34.06	119.19	15.79	57.3475	2.7638	3.7516	6.5153
		K + pro.	74.58	34.91	118.39	15.84	58.6775	2.9102	3.9504	6.8606
	Crawford	K	67.45	35.40	110.08	15.67	57.2425	3.0258	4.1073	7.1331
		Pro.	66.29	34.06	109.81	15.63	56.455	2.9356	3.9848	6.9204
		K + pro.	69.08	34.91	109.14	15.68	59.43	2.9964	4.0674	7.0638
	Giza 111	K	73.05	33.99	111.09	15.35	56.0525	2.7782	3.7712	6.5494
		Pro.	70.80	32.70	110.89	15.31	54.4775	2.6532	3.6015	6.2547
		K + pro.	69.71	33.51	110.15	15.36	55.7375	2.7938	3.7924	6.5862
	Giza 35	K	72.32	33.99	106.66	15.20	58.45	2.9048	3.9430	6.8478
		Pro.	70.09	32.70	106.46	15.16	57.645	3.0573	4.1501	7.2074
		K + pro.	69.01	33.51	105.73	15.21	60.69	2.9662	4.0263	6.9925
6 days	Giza 22	K	70.26	32.86	118.19	15.14	55.9475	2.6227	3.5601	6.1828
		Pro.	69.05	31.61	117.92	15.03	55.5975	2.6383	3.5813	6.2196
		K + pro.	71.96	32.40	117.18	15.14	55.72	2.6444	3.5895	6.2339
	Giza 21	K	76.09	31.55	113.50	14.84	53.7075	2.4653	3.3465	5.8118
		Pro.	73.75	30.35	113.23	14.73	53.375	2.4800	3.3664	5.8465
		K + pro.	72.61	31.10	112.49	14.84	53.4975	2.4857	3.3742	5.8599
	Crawford	K	66.14	31.55	116.98	14.69	53.1475	2.5178	3.4177	5.9355
		Pro.	65.63	30.35	116.71	14.58	52.815	2.5328	3.4381	5.9709
		K + pro.	71.60	31.10	115.98	14.69	52.9375	2.5386	3.4459	5.9846
	Giza 111	K	64.75	30.28	112.29	14.39	51.0125	2.3667	3.2126	5.5794
		Pro.	63.64	29.13	112.02	14.29	50.6975	2.3808	3.2318	5.6126
		K + pro.	66.32	29.86	111.29	14.39	50.82	2.3863	3.2392	5.6255
	Giza 35	K	64.10	30.28	103.45	14.25	54.2675	3.0276	4.1098	7.1374
		Pro.	63.00	29.13	103.25	14.14	53.935	2.5440	3.4533	5.9973
		K + pro.	65.66	29.86	102.58	14.25	54.0575	2.5592	3.4739	6.0331
LSD Drought			15.328	6.5876	32.2832	3.5236	3.5236	0.200692	0.188436	0.49024
LSD Varieties			14.217	6.1103	29.2196	3.2683	3.2683	0.186151	0.174783	0.45472
LSD Treatments			14.163	6.0888	29.0816	3.2568	3.2568	0.185496	0.174168	0.45312
LSD D X V			11.657	5.0095	22.154	2.6795	2.6795	0.152615	0.143295	0.3728
LSD DX T			10.653	4.5795	29.394	2.4495	2.4495	0.139515	0.130995	0.3408
LSD V X T			7.546	3.2422	11.8104	1.7342	1.7342	0.098774	0.092742	0.24128
LSD D X V X T			6.764	2.9068	8.6576	1.5548	1.5548	0.088556	0.083148	0.21632

Application of drought with irrigation every 4 days interaction with variety Giza 22 under treatment of potassium were recorded highest values were variety Crawford recorded lowest values with all characteristics. It is worth mentioning that the effect of drought and varieties of soybean plants treated with proline surprise verity Giza 22 then Giza 35, Giza 111, Giza 21 and Crawford. Application of drought with irrigation every 4 days interaction with variety Giza 22 under treatment of proline were recorded highest values with all characteristics. Followed with variety Giza 111 under treatment of proline were recorded highest values with all these characteristics. Application of drought with irrigation every 4 days interaction with variety Giza 22 under treatment of potassium were recorded highest values with all these characteristics, followed with variety Giza 111 under treatment of potassium and proline were recorded highest values with all these characteristics.

Data in table 3 indicated that the effect of drought and varieties of soybean plants treated with potassium. Application of drought with irrigation every 6 days interaction with variety Giza 22 under treatment of potassium were recorded highest values with all these characteristics, followed with variety Giza 111 under treatment of potassium were recorded highest values with all these characteristics. While the effect of drought and varieties of soybean plants treated with potassium. Application of drought with irrigation every 6 days interaction with variety Crawford under treatment of potassium was recorded lowest values with all these characteristics. It is worth mentioning that the effect of drought and varieties of soybean plants treated with potassium and/or proline surprise verity Giza 22, Giza 35, Giza 111, Giza 21 and Crawford. Application of drought with irrigation every 6 days interaction with variety Giza 22 under treatment of proline were recorded highest values with all these characteristics, followed with variety Giza 111 under treatment of proline were recorded highest values with all these characteristics. But the effect of drought and varieties of soybean plants treated with proline. Application of drought with irrigation every 6 days interaction with variety Crawford under treatment of potassium was recorded lowest values with all these characteristics.

3-3- Chemical contents

Analysis of variance indicated that the effect of drought stress on potassium % was significant probability level. Mean comparisons showed that drought stress in 6 days reduced the potassium % more than 4 days treatment. Proline content was significantly affected by drought 4 day compere with 6 day as table 4. Soybean plants result to drought 6 days decreased proline content (35.353067 µmol gr^{-1}). The maximum mean proline content (37.779867µmol gr^{-1}) was obtained from irrigation interval 4 day.

Table 4. Effect of interactions between irrigation intervals, varieties of soybean plants and treatments on some chemical content

Treatments			Potassium %	Chlorophyll mg/g fresh weight			Leaf proline content (µmol gr^{-1})	Leaf Carbohydrate content (mg gr^{-1})	Oil %	Protein %
				Chlo. A	Chlo. B	Carot.				
4 days	Giza 22	K	27.322	3.5932	1.1335	0.8635	2.310	94.00	21.694	39.039
		Pro.	24.541	4.0382	1.3229	0.9075	3.740	112.00	21.536	38.943
		K + pro.	26.944	4.2818	1.4078	0.9504	3.460	121.00	21.694	39.064
	Giza 21	K	26.883	3.4761	1.0966	0.8354	2.171	86.48	21.913	38.258
		Pro.	24.147	3.9066	1.2797	0.8779	3.516	103.04	21.755	38.163
		K + pro.	26.509	4.1422	1.3619	0.9194	3.252	111.32	21.913	38.283
	Crawford	K	25.134	3.4725	1.0955	0.8345	2.125	89.30	22.360	37.868
		Pro.	22.577	3.9027	1.2784	0.8770	3.441	106.40	22.198	37.775
		K + pro.	24.785	4.1381	1.3605	0.9186	3.183	114.95	22.360	37.891
	Giza 111	K	24.732	3.4656	1.0933	0.8328	1.998	82.16	22.591	37.110
		Pro.	22.216	3.8949	1.2759	0.8752	3.234	97.89	22.427	37.019
		K + pro.	24.388	4.1174	1.3578	0.9167	2.992	105.75	22.591	37.134
	Giza 35	K	24.485	3.4483	1.0879	0.8287	1.938	90.24	23.052	36.740
		Pro.	21.993	3.8754	1.2695	0.8708	3.137	107.52	22.884	36.649
		K + pro.	24.144	4.1803	5.1803	6.1803	2.902	116.16	23.052	36.762
6 days	Giza 22	K	25.652	3.4828	1.0988	0.8370	3.308	124.08	23.142	36.597
		Pro.	23.435	3.9142	1.2822	0.8795	5.356	147.84	23.084	36.332
		K + pro.	24.215	4.2221	5.2321	6.2421	4.955	159.72	23.155	36.597
	Giza 21	K	25.240	3.2698	1.0315	0.7858	3.109	114.15	23.375	35.866
		Pro.	23.055	3.6748	1.2038	0.8258	5.034	136.01	23.317	35.605
		K + pro.	23.823	3.8964	1.2811	0.8649	4.657	146.94	23.389	35.866
	Crawford	K	23.598	3.1632	0.9979	0.7602	3.043	117.88	23.852	35.500
		Pro.	21.556	3.5550	1.1645	0.7989	4.927	140.45	23.792	35.242
		K + pro.	22.273	3.7694	1.2393	0.8367	4.558	151.73	23.867	35.500
	Giza 111	K	23.220	3.1600	0.9969	0.7594	2.861	108.45	24.098	34.789
		Pro.	21.211	3.5514	1.1634	0.7981	4.632	129.21	24.038	34.537
		K + pro.	21.917	3.7656	1.2381	0.8359	4.285	139.60	24.112	34.789
	Giza 35	K	22.988	3.1537	0.9949	0.7579	2.775	119.12	24.590	34.442
		Pro.	20.999	3.5444	1.1610	0.7965	4.493	141.93	24.529	34.192
		K + pro.	21.698	3.7468	1.2356	0.8342	4.156	153.33	24.606	34.442
LSD Drought			6.25822	1.51515	0.69170	0.03294	0.93742	23.057	5.73121	7.37811
LSD Varieties			5.80479	1.40537	0.64158	0.03055	0.86950	21.386	5.31596	6.84354
LSD Treatments			5.78436	1.40042	0.63932	0.03044	0.86644	21.311	5.29726	6.81946
LSD D X V			4.75903	1.15219	0.52600	0.02505	0.71285	17.533	4.35827	5.61064
LSD DX T			4.35053	1.05329	0.48085	0.02290	0.65166	16.028	3.98417	5.12904
LSD V X T			3.08009	0.74571	0.34043	0.01621	0.46137	11.348	2.82071	3.63126
LSD D X V X T			2.76146	0.66856	0.30521	0.01453	0.41364	10.174	2.52892	3.25562

There was a remarkable significant difference in respect of potassium content among all the soybean varieties in (Table 4). The highest potassium 29.91 % was found in soybean variety Giza 22. Cultivar Giza 111 (22.95) was statistically similar to soybean variety Giza 35 (22.95). Chlorophyll (chlorophyll a, chlorophyll b and carotene) differed significantly among the soybean varieties. Table 4 showed the recorded data on seed oil content of the soybean varieties, which indicated that significant differences among the soybean varieties for this trait. Soybean variety Giza 22 among the studied varieties was superior to the other varieties. Data in table 4 showed that soybean variety Giza 22 among the studied varieties was superior to the other varieties. Soybean variety Giza 22 produced the highest protein content (44.27µmol gr^{-1}) followed by soybean variety Giza 21 (3.6232 µmol gr^{-1}), while the lowest protein content (3.2335 µmol gr^{-1}) was obtained in soybean variety Giza 35 as compared with others. Data in table 4 indicated that the effect of potassium and/or proline on all characters led to increase values. Some chemical contents, potassium %, chlorophyll (chlorophyll a, chlorophyll b and carotene mg/g fresh weight), seed oil %, protein %, proline content (µmol gr-1) and total carbohydrate content (mg gr-1). Some chemical contents, potassium %, chlorophyll (chlorophyll a, chlorophyll b and carotene mg/g fresh weight), seed oil %, protein %, proline content (µmol gr-1) and total carbohydrate content (mg gr-1) affected by drought and varieties has significant difference. Application of drought with irrigation every 4 days interaction with variety Giza 22 was recorded highest values with all characteristics. These results may be attributed to the fact that interaction between drought and soybean variety Giza 111 was recorded lowest values with all these characteristics. Plant exposure to drought in the vegetative growth stage, led to reduce cell swelling and cell wall and enzyme synthesis, decrease of elongation of the cell, interruption of water flow from wood tissue, lack of mitosis, leaf area, and rate of photosynthesis, consequently result in reduced vegetative growth. drought stress, reduce flowering period, the time required for the pollination and the period of grain filling increased the number of unfilled pods (24); (19); (13); (8) and (34) Variance in the data of the values of the morphological and yield characteristics of soybeans can be due to differences in the genetic characteristics of the studied species. Giza 22 was found to be superior to other varieties. These results are in parallel with those observed with those obtained by (27); (11); (36); (12); (35) and (3). Drought stress causes changes in the shape of the cells. Therefore, the processes play an important role in maintaining the shape and components of the cells by increasing the active accumulation of solvents in the cells and the solvents of the proline than other amino acids in drought stressed plants and accumulates in large quantities (46) and (26). Proline accumulates in flowers to help metabolic activities and plays a role in the elongation of the pollen tube because it represents the source of nitrogen and carbon in the petunia, tomato berry and corn elongation, according to (45). The ability of the plant to resist drought stress depends on the plant species as well as the varieties. It is found that the mesophyll layer in the paper controls the rate of light absorption and thus the amount of photovoltaic process products, which affects the vegetative growth of the plant (30). The roles of K in physiological and molecular mechanisms of plant drought resistance have been explored. Adequate amounts of K can enhance the total dry mass accumulation of crop plants under drought stress in comparison to lower K concentrations. This finding might be attributable to stomatal regulation by K+ and corresponding higher rates of photosynthesis. Proline is one amongst the most important cytosolutes and its free accumulation is a widespread response of higher plants to low water potential (Wahid and (10). Exogenously applied proline enhanced the endogenous accumulation of free proline and improved the drought tolerance in petunia (49).Potassium plays an important role in drought resistance for its role in many physiological processes, protein synthesis, sugary enzymes and photosynthesis, which reduces the harmful effect of drought according to role for proline in flowering and reproduction came from the measurements of proline content, which revealed strong accumulation of this amino acid in floral organs and siliques of different plant species under (unstressed) physiological conditions because function of proline in development is protecting developing cells from osmotic damage, especially in those developmental processes, such as pollen development and embryogenesis, in which tissues undergo spontaneous dehydratation. The osmotic adjustment in leaves was due to K^+ but proline did not start to accumulate in leaves until the concentration of total monovalent cations in leaves reached a threshold of approximately 200 μmol/g fresh weight. Above this threshold, the contents of proline and monovalent cations in leaves increased with increasing salinity of the medium. The ratio of proline to monovalent cation was 5% of that amount of monovalent cation in excess of the threshold concentration. Therefore, if the cations are located in the vacuoles and proline accumulates in the cytoplasm, then the amount of accumulated proline is sufficient to act as a balancing osmoticum across the tonoplast evaluated the effect of moisture and K fertilization on the physiology of two common bean cultivars and observed that the addition of K to the system via a nutrient solution promoted an increased photosynthetic rate under conditions of water stress in both cultivars. These responses indicate that K may promote greater recovery of photosynthesis in soybean after a period of water restriction. These values were only achieved in plants that were supplemented with K. (44). Based on our data, it may be suggested that the potassium and/or proline content in plants should be increased by applying their foliar spray to the soybean plant to increase yields under water stress conditions. The highest productivity was Giza 22 variety, followed by variety Giza 35 and other varieties, especially when the plants were exposed to drought stress. Irrigation every 4 days in the sandy soil led to highest reading from irrigation every 6-days period on all readings. We express our appreciation to all those who have provided partial support for this work, either as seeds or supervise, as well as laboratory analyzes, useful comments and suggestions for improving this manuscript.

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