Effect of Water Salinity and Different Irrigation Systems on Technological Properties of Soybean (Glycine m *axL.*) in El-Noubaria Area.

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ABSTRACT :

The present research aimed to studied the effect of different low quality water such as different levels of salinity water (1200ppm, 2000ppm, traditional water) and different irrigation systems such as sprinkler and drip irrigation systems on the yield and technological quality properties of soybean (Glycine Max L.). The field experiments were conducted at National Research Center Research Station, El-Noubaria, El-Behaira Governorate, during the two successive seasons of 2014/2015 and 2015/2016

The obtained results could be summarized as follows:

Technological properties:

- Amino acids (%),
- Protein in seeds (%),
- Carbohydrates in seeds (%).

Key words: Saline Water - Amino Acids Protein- Carbohydrates-Oil - soybean

Introduction

Soybean (*Glycine max* L *Merrill*) is the main source of supplying protein and oil plant , which can provide complete protein , containing essential amino acids for human health . in order to reduce the gap between oil production and its consumption which reach 10% from our production only .

The total harvested area in the world in 2016 season was 123 million hectare with total of seed yield116 million ton with an average 2.5 ton / ha , the total area harvested in Egypt was about , 8000 ha with total of seed yield 24000 ton with an average 2.67 ton / ha of seed yield (**FAO 2016)** .

The quality of soybean seed, particularly in tropical and The quality of soybean seed, particularly in tropical and occurring before and during harvesting and at the other production stages. Such factors include drought periods, insect damage, temperature extremes during maturation and severe fluctuations in environmental moisture conditions, which accelerate the seed deterioration process **FrançaNeto *et al.*(2000).**

found that with increasing salinity , rate and percentage of protein accumulation , duration of oil and protein accumulation in soybean grains and oil and protein content per grain decreased , but oil percentage increased . Oil and protein yields per plant decreased as salinity increased . These reductions were mainly attributed to the short duration of protein and oil accumulation and grain yield per plant under saline conditions . Williams had the highest rate and duration of protein accumulation and rate of oil accumulation , but L17 had the highest grain yield per plant , Consequently ,, differences in protein and oil yields per plant between these two cultivars were not statistically significant . However , Zan had the lowest protein and oil yields , due to the lowest grain yield per plant . **Ghassemi – Golezani *et al* (2010**)

USDA, (2010) studied that the isoflavones content in some foods and found that soy beans , green, cooked, boild and drained without salt contain daidzein , genisten glycitein 7.41, 7.6 and 4.60 mg/100g, edible protein while raw soybeans were 20.34, 22.57 and 7.57mg/100g.

Soybeans foods are rich source of dietary protein ,Soybeans based foods are rich a class of compounds called isoflavones. isoflavones have chemical structure that is similar to the hormone estrogen receptors commonly called phytoestrogens . the consumption of soy isoflavones appears to result in health benefits for cancer, heart disease, menopausal symptoms and osteoporosis. So as a result soy protein have become major components of food **(Bolla , 2015)**

The objectives of current research work is to studying the effect of different low quality water such as different levels of salinity water

(1200ppm, 2000ppm, traditional water) and different irrigation systems such as sprinkler and drip irrigation systems on the yield and technological quality properties of soybean (Glycine Max L.).

Material & methods

Soil and water analysis and monitoring soil moisture:

Soil physical and chemical analysis of suggested field of current studying. Monitoring of soil moisture content provides a good assessment of the crop's water needs. A wide range of methods offering varying accuracy levels is available for monitoring soil moisture, each having its respective strengths and shortcomings.

Irrigation water treatments:

Irrigation water analysis of:

Saline water will prepare by mixing salt with normal water and measuring by EC meter of three treatments under study:

- Saline water 2000 ppm (SW-2000 ppm)
- Saline water 1200 ppm (SW-1200 ppm)
- Available irrigation water (SW-400 ppm)

Technological properties:

Amino acids % (according to Official method of Analysis of AOAC 2012) Protein in seeds (%),(according to (A.O.A.C Carbohydrates in seeds (%).(according to Dubois *et al*.1956)

The purpose of current research work is to study the effect of different low quality water such as different levels of salinity water (4000ppm, 2000ppm, traditional water) and different irrigation systems such as sprinkler and drip irrigation systems on the yield and technological quality properties of soybean (Glycine Max L.).

Soybean parameters growth and yield component in conclude the following Technological properties of soybean including: Engineering parameters ofsoybean seeds, Amino acids %, Protein in seeds (%), Carbohydrates in seeds (%).

Chemical constituents:

1-Amino acids %

Applicable to determination of amino acid (including methionine and cysteine) I foods, not Applicable to determination of tyrosine and tryptophan.

Performic acid oxidation is performed prior to hydrolysis to oxidize cystine and methionine to cysteic acid and methionine sulfone.

Hydrolysis were carried out in closed conical flask for determining all amino acids other than tryptophan . Sample equal to 10 mg of protein was weighed in the conical flask and 5ml. of per formic acid was added . the flask was closed and placed in ice bath for 16 h.

sodium disulfite was added , 25 ml HCL 6N was added to the oxidized mixture.

the flask was placed in an oven at 110 C for 24 h . The flask was then opened using Rotary evaporator to reduce the volume 5-10 ml under vacuum at 60 c. Adjust the PH to 2.20 with sodium hydroxide solution. Suitable volume of sodium citrate buffer (PH2.20) was added to hydrolyzed sample. After all soluble material completely, dissolved, the sample is ready for analysis.

The system used for the analysis was high performance Amino Acid analyzer (Biochrom 30) . A.O.A.C. (2012).

2- Protein Percentage

Nitrogen Percentage in the seeds was determined using the micro Kjeldahl method as described by **A.O.A.C (1975).** The micro Kjeldahl method can be broken down into three basic as followed:

- Digestion of milled sample: This is designed to break down the bonds that hold the polypeptides together and covert them to simpler chemicals such as water, carbon dioxide and ammonium 0.2 g weight of oven –dried (70c), finely ground sample into a flask and adding 10 ml of concentrated sulphuric acid (98%) followed by 1 ml of perchloric acid (70%) or hdrogen peroxide as a catalyst then heating the mixture to about 400c for 90 minutes approximately to oxidizes the organic materials and releases ammonium ions. Switch off the heating when the digest become clear. The digest was transferred to a 100 ml measuring flask and complete the volume using distilled water (digestion solution).
- Distillation: This separates the ammonia from the digestion solution (5ml) by raising the PH with (10ml) sodium hydroxide (40%), which changes the ammonium ions into ammonia gas. The ammonium is collected through boiling and distillation of gas into a trapping solution of 5 ml of saturated boric acid (4%) in presence of mixed indicator (20 mg methyl red and 100 mg bromocresol green dissolved in 100 ml of ethyl alcohol) for 10 minutes.
- Titration: As the ammonia dissolves into trapping solution , it is back- titrated by hydrochloric acid (N/70) until the reaction mixture changes its colure from green to pink. The standard acid used in the titration was measured , so that the quantity of distilled- off ammonia can be calculated and amount of nitrogen determined.
- Protein percentage in the dry seeds was calculated by multiplying nitrogen percentage by the factor of 6.25.

Total carbohydrate percentage

Total carbohydrate percentage in the seeds was estimated as follows:

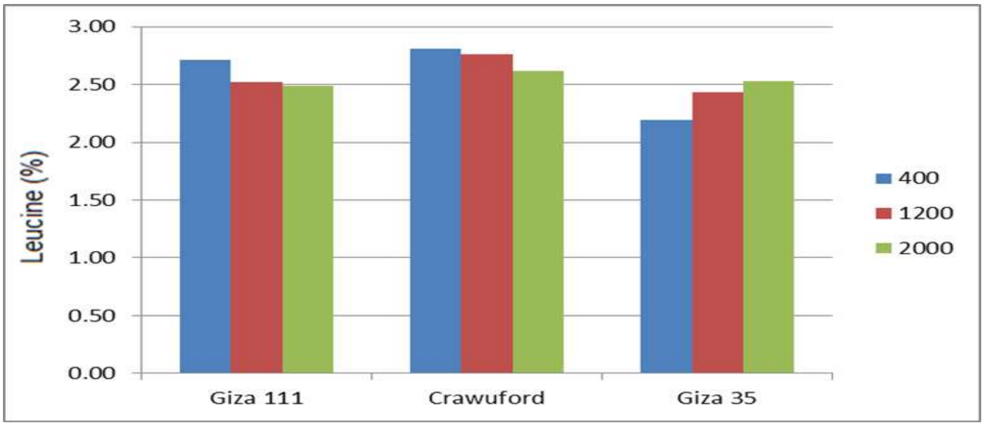
- 0.2 g weigh of milled seeds was completely hydrolyzed for 6 hours with 50.ml hydrochloric acid (6N) on boiling water bath (70c) under reflux condenser. The solution was clarified by leading and deleading method in presence of phenolphthalein indicator (1%) using sodium hydroxide (6N) and the excess of alkaline was equalized with hydrochloric acid. This solution was then filtrated and the filtrate was completed with distilled water to mark of measuring flask (250ml) . The sugars were determined according to the methods described by Dubois et al.(1956) as follows:
- An aliquot of 0.2 ml sugars solution was quantitatively transferred into a test tube and treated with 1 ml aqueous phenol solution (5%) followed by 5 ml of concentrated sulphuric acid (Analar) added by a fast delivery pipette. The blank experiment was carried out using 0.2 ml of distilled water instead of the sugar solution . The absorbance of yellow-orange cooler was measured in spectrophotometer at wavelength 490 nm . A standard curve was prepared using known concentration of glucose. The established curve was used to convert the colorimeter optical density (O.D) into mailgrams of glucose.

Results and Disscusion

Table(1): Effect of saline water and irrigation systems treatments on Leucine amino acid .

Saline water	Irrigation system	Giza 111	Crawuford	Giza 35
400	SSD SD Sp	2.75 2.73 2.66	2.84 2.82 2.77	2.25 2.19 2.13
1200	SSD SD Sp	2.56 2.51 2.48	2.8 2.77 2.72	2.46 2.43 2.41
2000	SSD SD Sp	2.52 2.49 2.45	2.66 2.62 2.57	2.58 2.52 2.49
LSD 0.05				
SW	400 1200 2000	2.71 2.52 2.49	2.81 2.76 2.62	2.19 2.43 2.53
LSD 0.05				
IS	SSD SD SP	2.61 2.58 2.53	2.77 2.74 2.69	2.43 2.38 2.34
LSD 0.05				

Fig.(1) Effect of saline water and irrigation systems treatments on Leucine amino acid.



Fig(2) Effect of saline water treatments on Leucine amino acid.

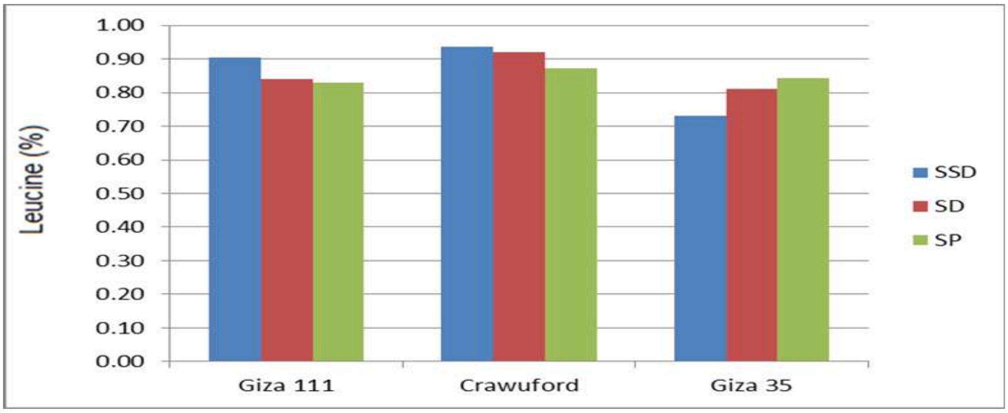


Fig. (3) Effect of irrigation systems treatments on Leucine amino acid.

Table(2): Effect of saline water and irrigation systems treatments on Argnine amino acid .

Saline water	Irrigation system	Giza 111	Crawuford	Giza 35
400	SSD SD Sp	2.64 2.44 2.39	2.82 2.97 2.83	2.31 2.27 2.22
1200	SSD SD Sp	2.58 2.48 2.42	2.77 2.71 2.67	2.52 2.48 2.43
2000	SSD SD Sp	2.56 2.52 2.49	2.69 2.64 2.58	2.5 2.47 2.44
LSD 0.05				
SW	400 1200 2000	2.49 2.49 2.52	2.87 2.72 2.64	2.27 2.48 2.47
LSD 0.05				
IS	SSD SD SP	2.59 2.48 2.43	2.76 2.77 2.69	2.44 2.41 2.36
LSD 0.05				

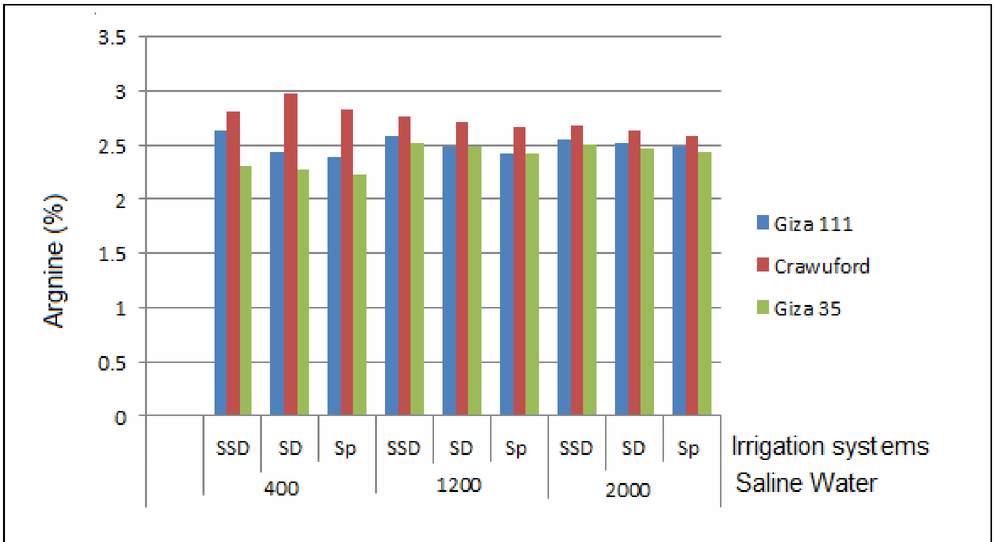
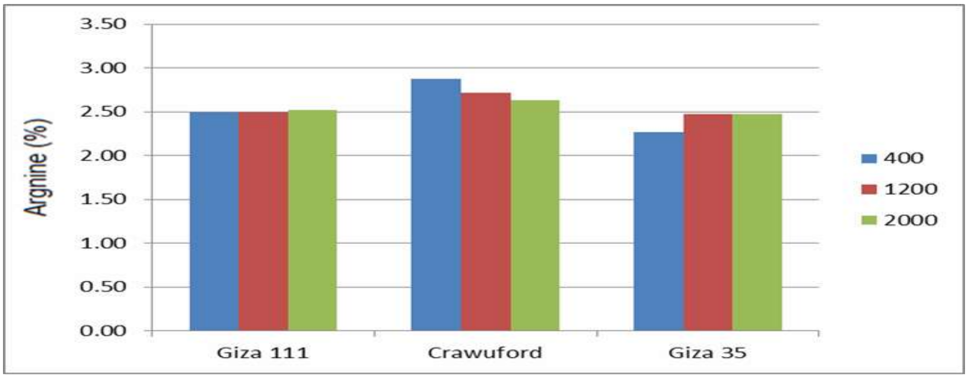


Fig.(4) Effect of saline water and irrigation systems treatments on Argnine amino acid.



Fig(5), **Effect of saline water treatments on Argnine amino acid**

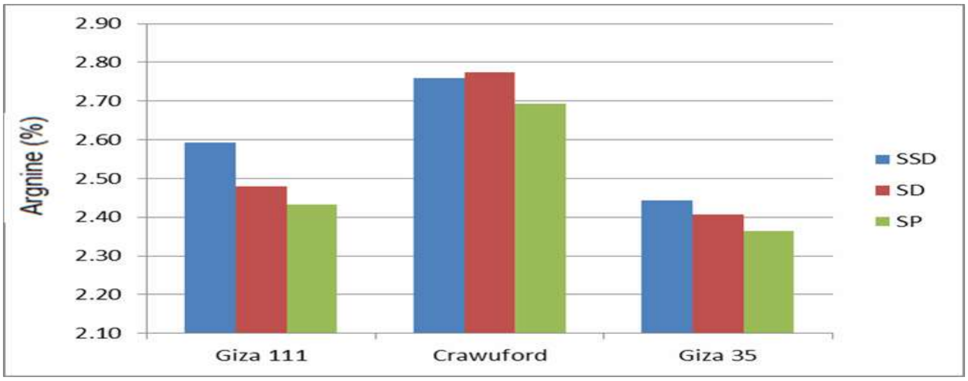


Fig. (6) Effect of irrigation systems treatments on Argnine amino acid.

Table(3): Effect of saline water and irrigation systems treatments on Lysine amino acid.

Saline water	Irrigation system	Giza 111	Crawuford	Giza 35
400	SSD SD Sp	2.4 2.33 2.13	2.37 2.31 2.26	1.99 1.93 1.88
1200	SSD SD Sp	2.21 2.17 2.14	2.35 2.31 2.28	2.04 2.01 1.97
2000	SSD SD Sp	2.17 2.14 2.11	2.27 2.21 2.18	2.15 2.1 2.05
LSD 0.05				
SW	400 1200 2000	2.29 2.17 2.14	2.31 2.31 2.22	1.93 2.01 2.10
LSD 0.05				
IS	SSD SD SP	2.26 2.21 2.13	2.33 2.28 2.24	2.06 2.01 1.97
LSD 0.05				

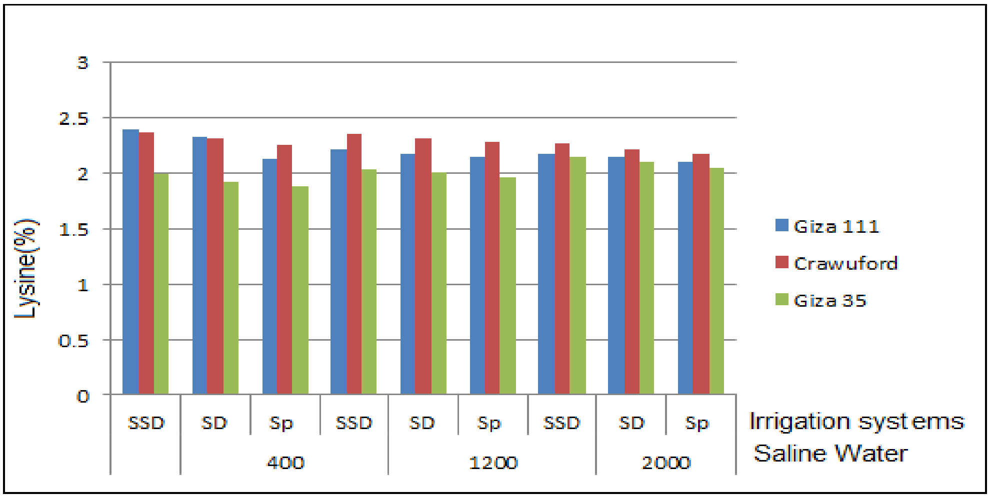
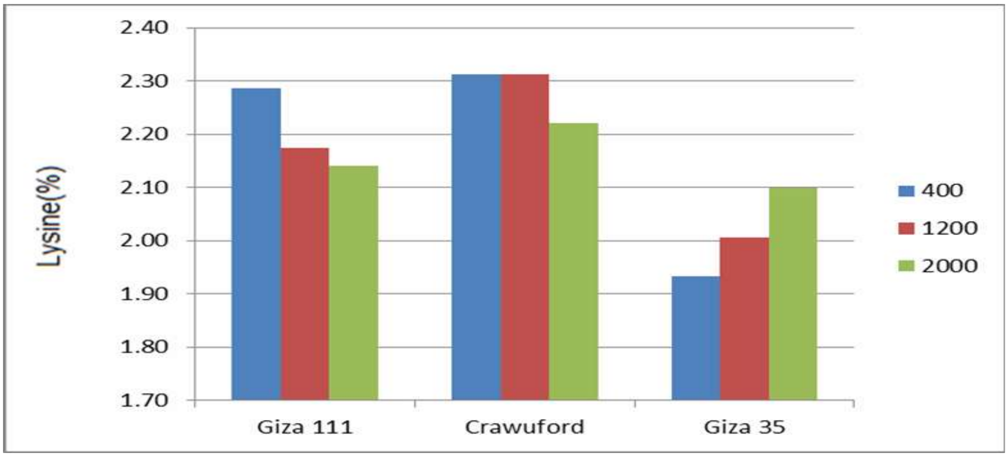


Fig.(7) Effect of saline water and irrigation systems treatments on Lysine amino acid.



Fig(8), Effect of saline water treatments on Lysine amino acid

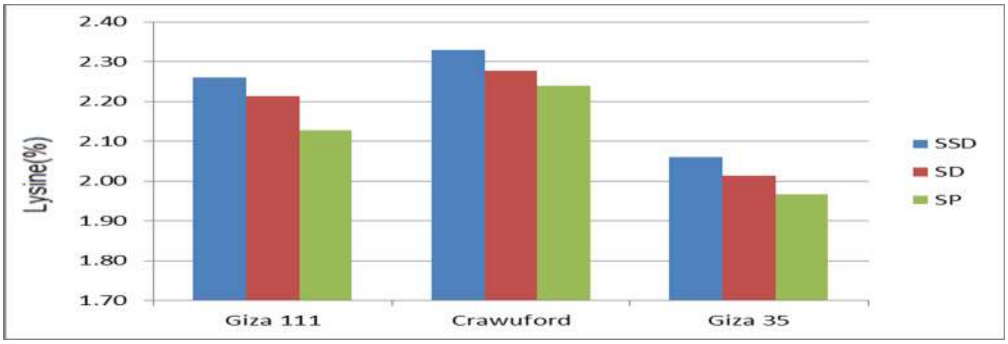


Fig. (9) Effect of irrigation systems treatments on Lysine amino acid.

Table(4): Effect of saline water and irrigation systems treatments on Phenylalanine amino acid .

Saline water	Irrigation system	Giza 111	Crawuford	Giza 35
400	SSD	2.16	1.99	1.62
	SD	2.09	1.94	1.57
	SP	2.02	1.91	1.52
1200	SSD	1.81	1.96	1.62
	SD	1.77	1.91	1.56
	Sp	1.72	1.85	1.51
2000	SSD	1.82	1.81	1.85
	SD	1.77	1.77	1.82
	Sp	1.73	1.73	1.75
LSD 0.05				
SW	400	2.09	1.95	1.57
	1200	1.77	1.91	1.56
	2000	1.77	1.77	1.81
LSD 0.05				
IS	SSD	1.93	1.92	1.70
	SD	1.88	1.87	1.65
	SP	1.82	1.83	1.59
LSD 0.05				

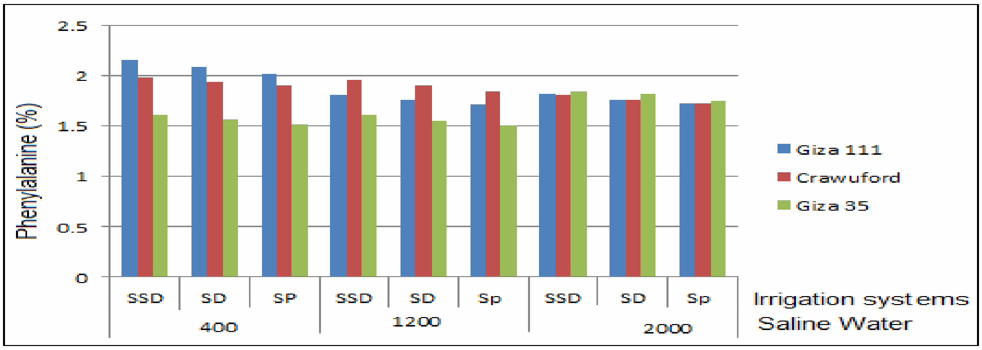
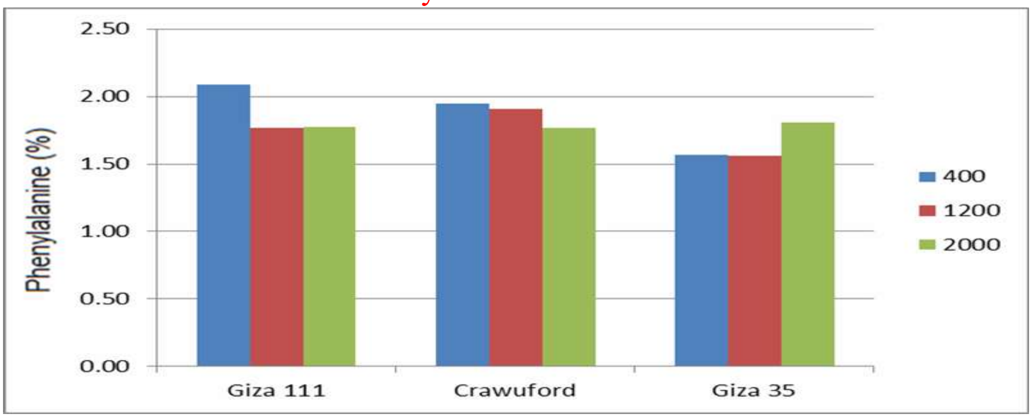


Fig.(10) Effect of saline water and irrigation systems treatments on Phenylalanine amino acid.



Fig(11), Effect of saline water treatments on Phenylalanine amino acid

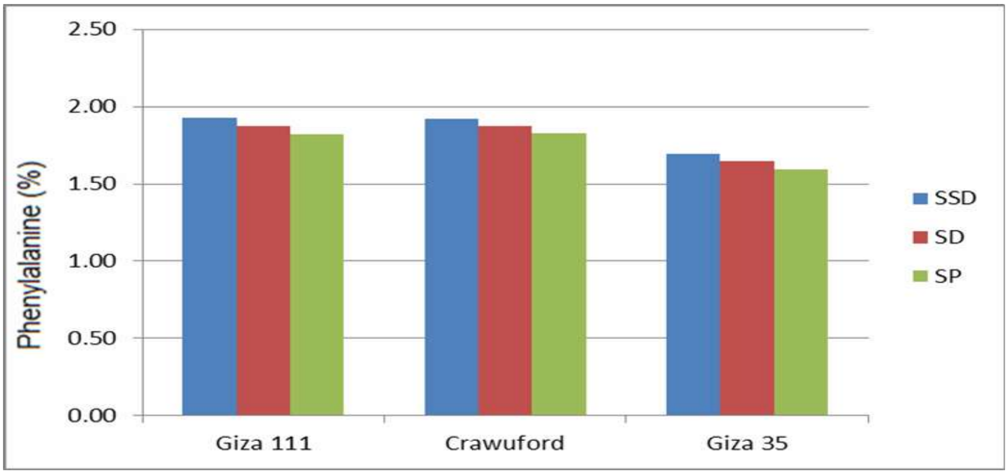


Fig. (12) Effect of irrigation systems treatments on Phenylalanine amino acid.

Table(5): Effect of saline water and irrigation systems treatments on Glycine amino acid .

Saline water	Irrigation system	Giza 111	Crawuford	Giza 35
400	SSD SD Sp	1.6 1.53 1.49	1.69 1.63 1.58	1.35 1.29 1.24
1200	SSD SD Sp	1.43 1.41 1.37	1.56 1.51 1.48	1.38 1.35 1.31
2000	SSD SD Sp	1.5 1.46 1.42	1.49 1.47 1.44	1.46 1.4 1.36
LSD 0.05				
SW	400 1200 2000	1.54 1.40 1.46	1.63 1.52 1.47	1.29 1.35 1.41
	LSD 0.05			
IS	SSD SD SP	1.51 1.47 1.43	1.58 1.54 1.50	1.40 1.35 1.30
	LSD 0.05			

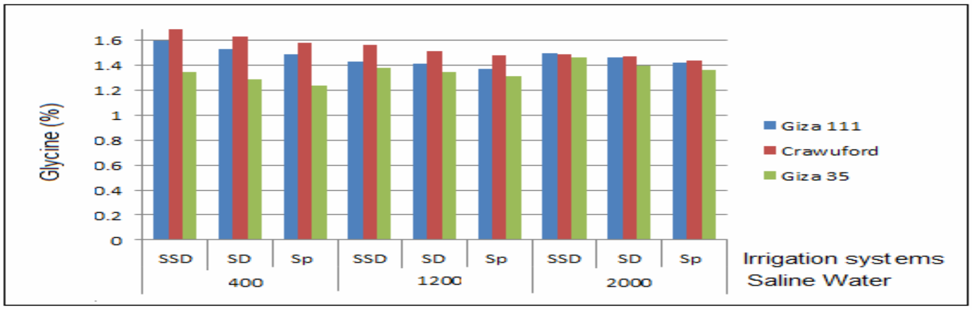
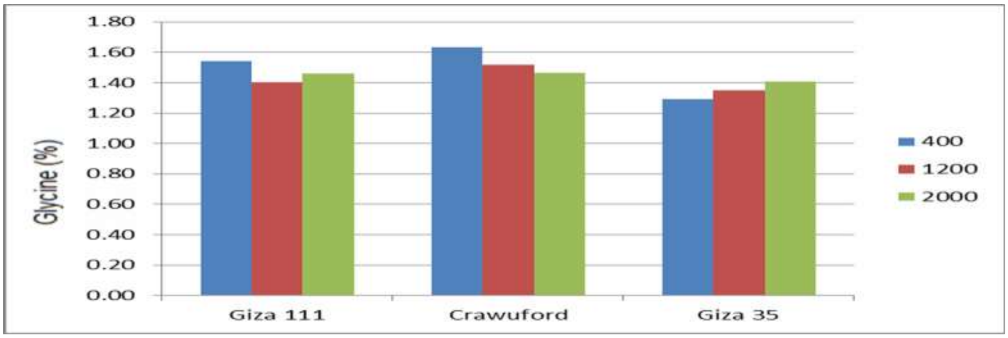


Fig.(13) Effect of saline water and irrigation systems treatments on Glycine amino acid.



Saline water	Irrigation system	Giza 111	Crawuford	Giza 35
400	SSD SD Sp	41.06 39.15 38.55	46.69 42.15 41.33	43.19 42.55 41.18
1200	SSD SD Sp	37.62 37.1 36.22	40.85 40.35 40.2	33.69 33.13 32.77
2000	SSD SD Sp	36.13 35.17 34.45	40.13 39.55 39.1	31.25 30.85 30.12
LSD 0.05				
SW	400 1200 2000	39.59 36.98 35.25	43.39 40.47 39.59	42.31 33.20 30.74
LSD 0.05				
IS	SSD SD SP	38.27 37.14 36.41	42.56 40.68 40.21	36.04 35.51 34.69
LSD 0.05				

Fig. (14) Effect of saline water treatments on Glycine amino acid

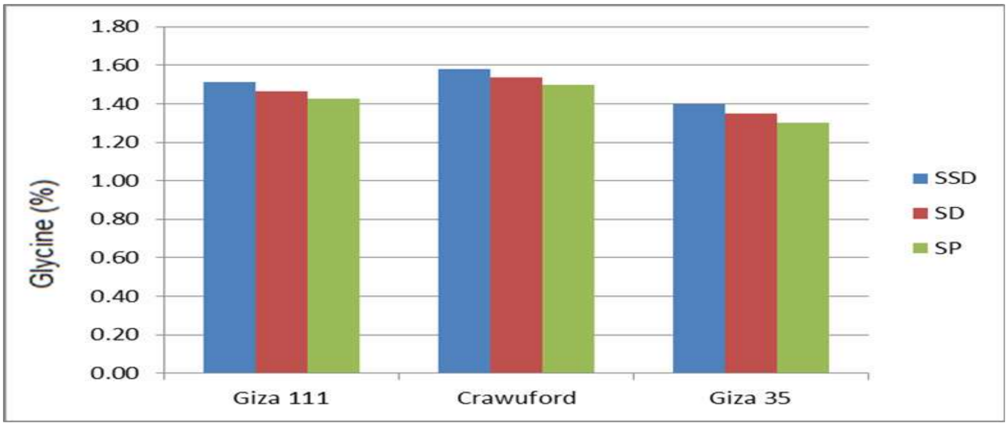


Fig. (15) Effect of irrigation systems treatments on Protein in seeds (%).

Table(6): Effect of saline water and irrigation systems treatments on Protein in seeds (%)

Fig.(16) Effect of saline water and irrigation systems treatments on Protein in seeds (%).

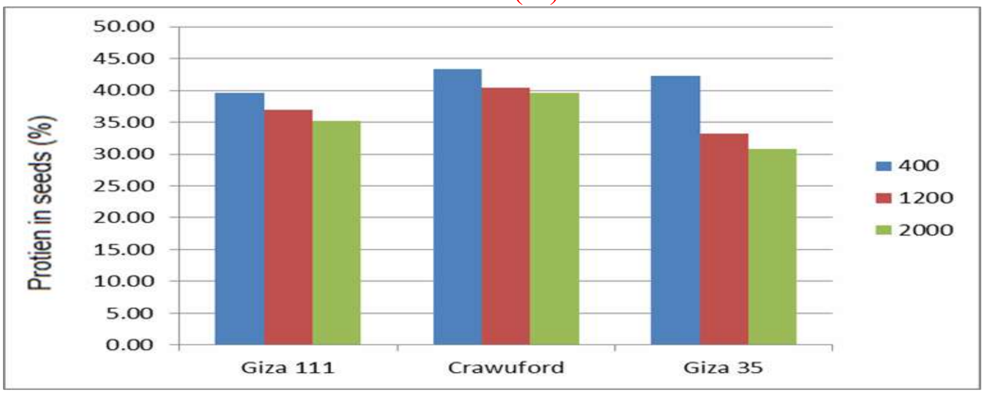


Fig. (17) Effect of saline water treatments on Protein in seeds (%).

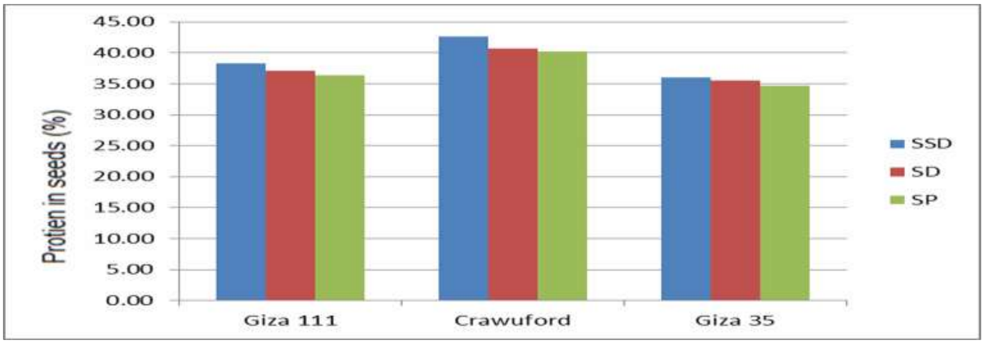


Fig. (18) Effect of irrigation systems treatments on Protein in seeds (%)

Table(7): Effect of saline water and irrigation systems treatments on Carbohydrates %.

Saline water	Irrigation system	Giza 111	Crawuford	Giza 35
400	SSD SD Sp	19.6 19.5 19.3	19.1 19.01 18.9	19.5 19.4 19.2
1200	SSD SD Sp	19.2 19.1 18.9	18.7 18.6 18.55	19.3 19.25 19.15
2000	SSD SD Sp	18.8 18.7 18.6	18.5 18.4 18.45	19.1 19.05 18.9
LSD 0.05				
SW	400 1200 2000	19.47 19.07 18.70	19.00 18.62 18.45	19.37 19.23 19.02
LSD 0.05				
IS	SSD SD SP	19.20 19.10 18.93	18.77 18.67 18.63	19.30 19.23 19.08
LSD 0.05				

Fig.(19) Effect of saline water and irrigation systems treatments on Carbohydrates %.

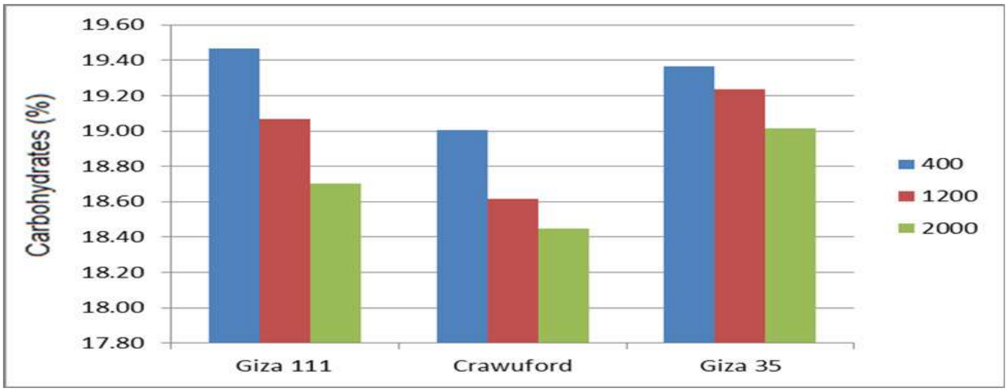


Fig. (20) Effect of saline water treatments on Carbohydrates %

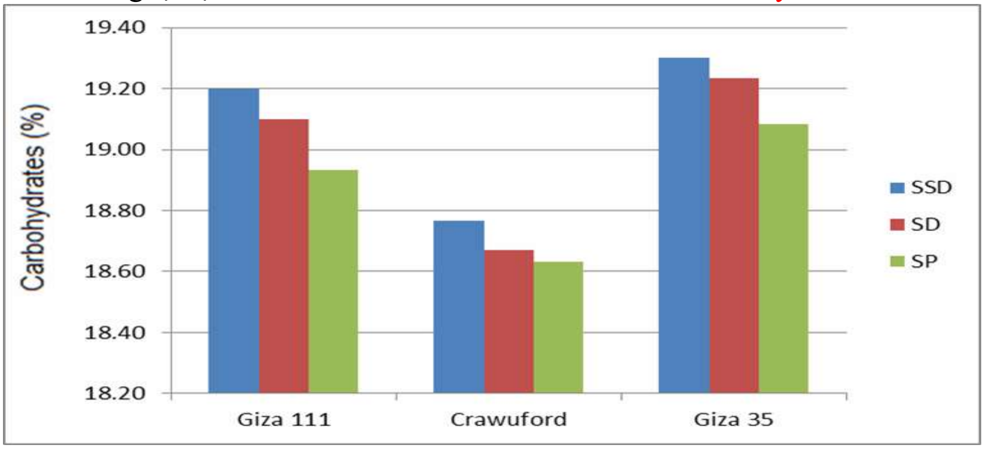


Fig. (21) Effect of irrigation systems treatments on Carbohydrates % .

CONCLUSION

The objectives of current research work is to studying the effect of different low quality water such as different levels of salinity water (1200ppm, 2000ppm, traditional water 400 ppm) and different irrigation systems such as sprinkler and drip irrigation systems on the yield and technological quality properties of soybean (*Glycine Max L.).*

The effect of three saline water treatments (400, 1200 and 2000 ppm) and three irrigation systems Subsurface drip (SSD), Surface drip (SD) and Sprinkler system (SP) on Leucine amino acid, Argnine amino acid percentage of protein and Carbohydrates in seed for three Egyptian soybean varieties. One can notice that for Crawuford, Giza 111 and Giza 35 varieties, Data could be summarizing as following:

1- For Leucine and Argnine amino acids, percentage of protein and Carbohydrates, it could be arrange the Saline water and Irrigation systems factors as following descending orders: 400 > 1200 > 2000 and SSD > SD > SP, respectively.
2- Effect of interaction of Leucine and Argnine amino acids, percentage of protein and Carbohydrates, minimum and maximum values

recorded for Crawuford, Giza 111 and Giza 35 varieties: 2000 X SP and 400 X SSD, respectively.

3- Effect of interaction, minimum and maximum values of Leucine amino acid recorded for Crawuford and Giza 111 varieties and Giza 35: 2000 X SP and 400 X SSD, respectively. While for Giza 35 variety, minimum and maximum values of Leucine recorded at 400 X SP and 2000 X SSD, respectively

Finally, it could be recommend to use saline water of 1200 and 400 ppm and SSD irrigation system in order to getting high quality of soybean Crawuford and Giza 111 varieties and Giza 35varieties

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Dubois

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تأثير ملوحة مياه الري ونظم ري مختلفة على خصائص الجودة التكنولوجية لمحصول فول الصويا فى منطقة النوبارية

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رمضان كمال سليمان ابوسته
ماجستير العلوم البيئية – معهد الدراسات والبحوث البيئية – جامعة مدينة السادات 2014

الملخص العربى

الهدف من البحث الحالي هو دراسة تأثير مياه ذات جودة منخفضة (مستويات مختلفة من ملوحة المياه 1200ppm– 2000ppm ، ومياه الري العادية 400 ppm للمقارنة)، ونظم ري متطورة مختلفة وهى نظام الري بالرش والري بالتنقيط السطحي والري بالتنقيط التحت سطحي والأصناف جيزة 35، جيزة 111، وكراوفورد على خصائص الجودة التكنولوجية لمحصول فول الصويا(Glycine Max L.)

أجريت هذه الدراسة البحثية الحالية في محطة التجارب للمركز القومي للبحوث ، بمنطقة النوبارية ، محافظة البحيرة ، خلال الموسمين 2015/2014 و 2016/2015 على التوالي وكان ملخص اهم النتائج التي تم الحصول عليها ما يلى :

بالنسبة للحمض الأمينية ليوسين، ارجنين، نسبة البروتين والكربوهيدرات، أمكن ترتيب المياه المالحة ونظم الري تنازليا كما يلي: 400> 1200> 2000 والرى بالتنقيط تحت السطحى > الرى بالتنقيط السطحى > الرى بالرش، على التوالي.، تأثير التفاعل من حمض أميني ليوسين، ارجنين، نسبة البروتينات والكربوهيدرات، والقيم الدنيا والقصوى المسجلة في أصناف كروفورد والجيزة 111 والجيزة 35: 2000 X الرى بالرش و 400 X الرى بالتنقيط تحت السطحى الرى بالتنقيط تحت السطحى على التوالي. تأثير التفاعل والقيم الدنيا والقصوى للأحماض الأمينية ليوسين المسجلة لأصناف كروفورد والجيزة 111 والجيزة 35: 2000 X الرى الرش و 400 X الرى بالتنقيط تحت السطحى على التوالي. في حين أن مجموعة 35 متنوعة، والقيم الدنيا والقصوى ليوسين سجلت في 400 X الرى بالرش و 2000 X الرى بالتنقيط تحت السطحى ، على التوالي. ويمكن التوصية باستخدام المياه المالحة من 1200 و 400 جزء في المليون و نظام الرى بالتنقيط تحت السطحى من أجل الحصول على جودة عالية من أصناف فول الصويا كروفورد والجيزة 111 أصناف وجيزة 35.