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RESEARCH ARTICLE

RESPONSE OF GERMINATION AND SEEDLING GROWTH OF WHEAT TO SEAWATER IRRIGATION UNDER ALGAL EXTRACT EFFECT.

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Abstract

Water shortage in Egypt for new reclaimed areas is the most important problem to meet the rapid increase in population and crop production. This investigation was conducted in the laboratory and green house of Fayoum Regional Research Station, Fayoum governorate, Egypt to study the effect of seawater irrigation and algal extract concentrations on germination percentage, seedling growth and biochemical properties of seedling. In this study, the germination, growth and enzymatic activities of wheat seedlings subjected to two seawater levels (10% and 20%) combined with different algal concentrations (5, 10, 15, 20, 25 and 50%) for two marine algae *Ulva lactuca* and *Cystoseira sp*. were investigated. Irrigation with fresh water gave the highest germination percentage, shoot height, root length, chlorophyll a, chlorophyll b and carotenoids, but catalase, peroxidase, superoxide dismutase and proline of seedlings were significantly decreased to the low values. Irrigation with 10, 20, 30, 40 or 50% seawater without algal presoaking caused gradual decreases in germination percentage. Germination percentage, seedling growth, photosynthetic pigments, seedling enzymes and proline content of irrigation with10% seawater for presoaked grains were superior to those obtained from 20% seawater of presoaked grains. The optimum algal concentration for presoaking was 25% for the two algae species and *Cystoseira sp*. was more efficient in reducing water salinity adverse effect than *Ulva lactuca*.

Introduction:-

Improvement of agricultural system for high production should reduce the negative environmental impact of agriculture and enhance the system sustainability. Many new methods were used to reduce the hazard effect of saline water on plants, i.e. water magnitation, atomic distillation, and using marine algae.

Using the biocontrol agents is one of the new methods which are used to enhance the yield and quality of stressed plants. Wheat (*Triticum sp.*) is one of the most important crops in the world. Therefore, it is necessary to increase wheat production to satisfy the needs of the rapid population growth (**Fred *et al.*, 2006**). The total area cultivated with wheat in Egypt has grown to reach 1.04 - 1.12 million ha, producing about 7.0 million tons per year, whereas overall consumption exceeds this ratio reaching 13- 14 million tons per year as a result of high population increase

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(**Pervaiz *et al.*, 2002**), So Egypt imports about 6-7 million tons every year to compensate this different. Nowadays, increase the production of wheat crop occupies the main aim of agriculture policy of the Egyptian government. This increment of wheat production can achieved by improving wheat varieties, improving agricultural practices or by increasing the wheat planted area to reach 1.5 million ha per year, especially in the new reclaimed area, but this increase in the area must be accompanied by increasing in the water demands.

Water is considered as one of the main factor limiting development of agriculture and other sectors. It's an important national source that can be utilized by people in developing his prosperity, as well as their essential needs (**Hillel, 2000**). In a survey of world freshwater, it has been reported that Egypt is one of countries will suffer from water scarcity by the year 2025 as a result of the rapid increase in population (**Engelman and Le Roy, 1993**). Egypt's main source of fresh water is the River Nile which represents about 97% of the renewable supplies in Egypt and Egypt's annual share of its water is 55.5 billion m^3 of water/ year supplying 85% from them to the agricultural sector (**Abdel- Shafy and Aly, 2002**). However, by the year 2025 the gap between the needs and availability of water is about 75.6- 80.0 billion m^3/ year (**Abdel- Dayem, 1994 and El- Kassas, 1998**). The reclamation of new areas needs to search for new water resources to satisfy the increasing water demands. One of these sources is using seawater in plants irrigation (**Oster and Grattan, 2002**) however, seawater salinity have negative effects on plant growth and productivity (**Hassan *et al.*, 2005**). Obviously, the most adequacy way to enhance wheat production in Egypt is to elevate wheat tolerance to seawater salinity (**Pervaiz *et al.*, 2002**). The utilization of seawater in irrigation of wheat by its dilution with fresh water, or magnitation of saline water, or application of seaweed extract to alleviate the negative effect of salinity on seed germination and seedling growth and treat the stressed plants with some certain chemicals during vegetative growth (**Abd El-Baky *et al.*, 2008; Abd El-Baky, 2009 and Abd El-Baky *et al*., 2014**).

Salinity is one of the main problems that can severely limits the germination, growth and productivity of plants (**Munns & Tester, 2008 and Ibrahim *et al.*, 2014**) and this attributed to the combined effect of the ions toxicity and osmotic stress which caused inhibition of seed water uptake (**Wakeel *et al.*, 2001**). Reduction in germination, seedling growth and biochemical processes like photosynthesis by increasing salinity levels were reported in wheat (**Brini *et al.*, 2009; Abd El- Baky *et al.*, 2008 and Hussain *et al.*, 2013)**, while proline accumulation and the activities of the antioxidative enzymes such as catalase, peroxidase and superoxide dismutase were increased under salt stress (**Barakat, 2011 and Abd El Baky *et al*., 2014**). Thus, the idea to find an alternative from natural sources such as algae is very important aspects to develop the plant tolerance under certain environmental stress (**Thajuddin & Subramanin, 2005 and Abd El-Baky & Baroty, 2012)**. The seaweeds extract are advantageous because they are biodegradable, safe, non-polluting and non-hazardous to humaneness, animals and birds (**Dhargalkar and Pereira, 2005**). The beneficial influence of seaweed attributable to its constituents of bioactive substances that can be used as biostimulants, exhibit growth stimulating activities and enhance plant performance (**Vernieri *et al*., 2006 and Gupta & Abu-Ghannam, 2011)**. Therefore, seaweeds extract demonstrated an improvement in the percentage of seed germination and seedling growth **(Kumar and Sahoo, 2011).** The present study was intended to investigate the efficiency of various marine algal extracts to stimulate the growth and metabolic activities of wheat seedlings grown under different seawater levels.

Material and Method:-

Preparation of algal material, sample preparation and extraction:-

The green seaweed *Ulva lactuca* was collected from Mediterranean Sea at Abo Keer coast (Alexandria) during summer season 2015. The brown seaweed *cystoseira sp was* collected from the Red Sea at Hurghada coast during summer season 2015. The collected algal sp. were brought to the laboratory and washed thoroughly in tap water for several times to remove all the unwanted impurities, sand, salt and epiphytes. The fresh seaweed sample was homogenized in distilled water (1: 1 w/v) at ambient temperature, and the extracts were filtered through a filter paper. The liquid extract was taken as 100% concentration. Different concentrations (5%, 10%, 15%, 20%, 25% and 50%) of *U. lactuca and cystoseira sp.* were prepared by mixing appropriate level of extracts with distilled water.

Plant material:-

Wheat crop of Sakha 95 cv. was obtained from wheat Res. Dept., A. R. C., Giza, Egypt.

Experimental Design:-

The germination and seedling experiments were conducted at the laboratory and green house of Fayoum Regional Res. Station, A.R.C., Egypt. Before experimentation, all the grains samples were surface sterilized with 10% sodium hypochlorite solution for 5 min and washed three times with sterilized distilled water.

Five seawater concentrations (10, 20, 30, 40 and 50%) were combined with eight algal extract concentrations (0, 5, 10, 15, 20, 25, 50 and 100%) for each algal sp. in split- plot design with three replications for each treatment. The sterilized grains were presoaked in different algal extract for 12 h. Thereafter, the grains were allowed to drain for one hour. The grains were transferred to sterile petri dishes containing two sheets of Whitman number 1 filter paper moistened with 15 mL of different seawater concentrations. Each petri dish contained 10 grains. The grains were allowed to germinate at 25◦C in the darkness and 2 mL of seawater concentrations was added to each petri dish. The papers were altered once after every 2 days to prevent salt accumulation (**Rehman *et al.*, 1996**). Germination percentages were recorded at the 7th day.

Seedling Experiment:-
The presoaked grains in algal extracts for two algal sp. were planted in small plastic pots contain soil and sand mixture (1:1v/v). Each treatment was replicated three times and the presoaked grains were irrigated with seawater concentrations (10 and 20 %) for three weeks until the plant have three leaves, after that the seedlings were taken for the following observations:

Growth Measurement:-
Shoot height and root length were measured using a centimeter scale.

Biochemical compounds Determination:-
Extraction and determination of photosynthetic pigments:-
The photosynthetic pigments (chlorophyll a, b and carotenoids) were determined using the spectrophotometric method recommended by **Metzner *et al*. (1965)** and applied for higher plants by **Ahmed *et al*. (1977, 1979 and 1980).**

Enzyme Activity Assay:-
Samples of plant tissues (0.5 g) were homogenized in ice cold 0.1M phosphate buffer (pH = 7.5) containing 0.5mM EDTA. Each homogenate was centrifuged at 4◦C for 15min at 15000 g. The supernatant was used for enzyme activity assay (**Esfandiari *et al*., 2007**). SOD activity was estimated according to **Gupta *et al*. (1993)**, CAT activity was measured according to **Aebi (1984)** and POD activity was measured according to **Polle *et al.* (1994).**

Determination of proline.:-
Free proline was determined according to **Bates *et al*. (1973).**

Statistical Analysis:-
All the measurement collected for wheat plant was subjected to statistical analysis described by Snedecor and Cochran, 1980. And the means were compared according the LSD test at 0.05 and 0.01 probability.

Results:-
Germination percentage:-
The results presented in Figure 1 and 2 show that irrigation with fresh water without presoaking grains in algal extracts gave the highest germination percentage. The germination percentage significantly decreased by 6.7, 13.4, 43.4, 56.7 and 70.0 when grains were irrigated with 10, 20, 30, 40 and 50%, respectively, comparing to fresh water irrigation. Germination percentage under 10% seawater irrigation increased constantly by increasing the algal extract of presoaking grains from 5% to 25% for *Ulva* or *Cystoseira* algae, then redecreased again when *Cystoseira* extract increased to 50% and 100% by 16.7 and 36.7, respectively, where for *Ulva lactuca* the reductions were 33.4 and 60.0, respectively. Under 20% seawater irrigation and presoaking grains have the same trend of 10% seawater irrigation, i.e. increasing the germination percentage as algal extracts increased from 5 to 25% for *cystoseira* or *Ulva* sp., but the reductions in germination percentages at 50% and 100% algal extracts was more than those under 10% seawater irrigation level. Also, for 30%, 40% and 50% seawater irrigation levels the same trend of 10% and 20% seawater levels were detected, but the increases in germination percentages by increasing algal extracts from 5% to 25% were less than those under 10% or 20% seawater levels for the two algal species. On the other hand, increasing seawater levels to 30, 40 and 50% and presoaking grains in 50% or 100% algal extract gave pronounced decreases

in germination percentage than the same concentrations under 10% or 20% seawater levels. It could be concluded that increasing seawater irrigation levels from 10% to 20% or 30% or 40% or 50% or 100% without presoaking grains in algal extract gave significant reductions in germination percentage, comparing with fresh water irrigation. Also, increasing algal extract concentration under any seawater level from 5% to 25% enhanced the germination percentage to increase to the maximum value, but increasing algal extract more than 25% gave pronounced depressions in germination percentage. *Cystoseira* extracts were more efficient in enhancing germination percentage more than *Ulva* extracts.

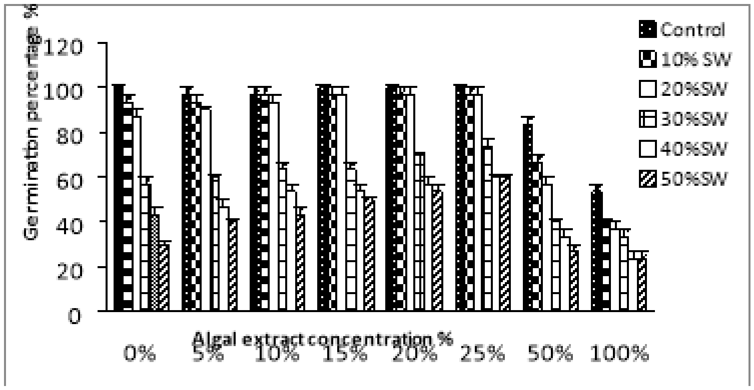

Figure 1:- Effect of *Ulva lactuca* extracts on germination percentage of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW, 20%SW, 30%SW, 40%SW and 50%SW).

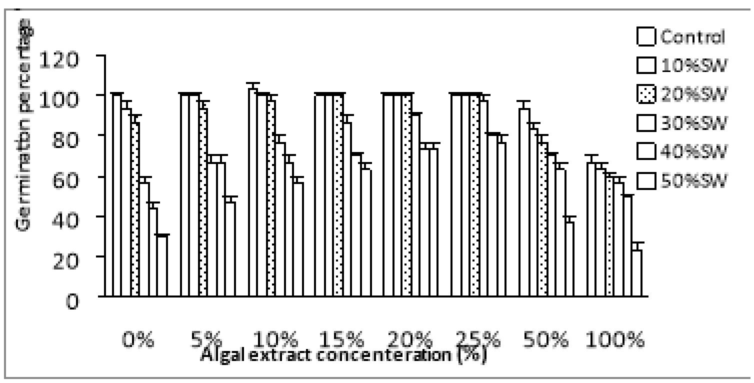

Figure 2:- Effect of *Cystoseira sp.* extracts on germination percentage of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW, 20%SW, 30%SW, 40%SW and 50%SW).

Seedlings:-

According to the obtained results of final germination percentages by using seawater levels and different algal extract concentrations, the seawater 10% and 20% beside fresh water (control) and 5, 10, 15, 20, 25 and 50% algal extracts were chosen for determining seedling characters.

Seedling shoot height:-

The means of seedling shoot height recorded in Figure 3 and 4 indicate that irrigation with fresh water produced the highest shoot height, whereas irrigation with 10 % or 20% seawater without presoaking in algal extract significantly decreased shoot height by 36.5 and 46.6%, respectively. Irrigation with 10% seawater and presoaking in *ulva* extract significantly increased shoot height by increasing the extract concentration from 5% to reach its maximum value (11.2 cm) at 25% concentration, then redecreased to 9.9 cm at 50% concentration. Irrigation with seawater 10% and grain presoaked in 25% *cystoseira* extract significantly increased seedling shoot height than those resulted from grains presoaked in 5, 10, 15, 20, 25 and 50% algal extract by 8.7, 5.9, 5.9, 4.2 and 16.8%, respectively. Concerning to irrigation with 20% seawater, the seedling shoot height significantly increased by increasing *ulva* or *cystoseira* extract from 5 to 10 or 15 or 20 and 25%, then redecreased at 50% algal extract concentration.

Seedling root length:-

The data recorded in Figure 5 and 6 revealed that root length was significantly affected by seawater levels and algal extract concentrations. Irrigation with seawater 10% or 20% significantly decreased main root length by 10.3 and 20.5%, respectively**,** comparing with fresh water irrigation. On the other hand irrigation with seawater 10% or 20% for grains presoaked in 25% *Ulva* or *Cystoseira* extract resulted in the longest main root length of wheat seedlings, whereas the shortest root length was observed when the grains presoaked in 5% algal extract and irrigated with 10% or 20% seawater under the two algal used. It can be noticed that increasing algal extract concentration from 5% to 25% for *Ulva lactuca* or *Cystoseira* sp. significantly increased seedling root length under seawater 10% and 20%.

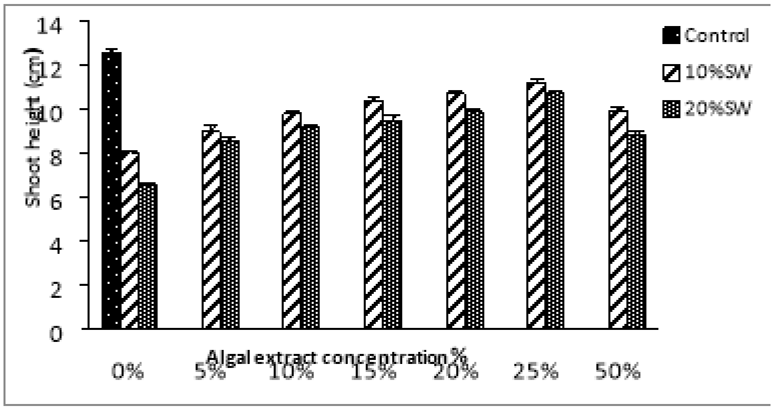

Figure 3:- Effect of *Ulva lactuca* extracts on shoot height of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW and 20%SW).

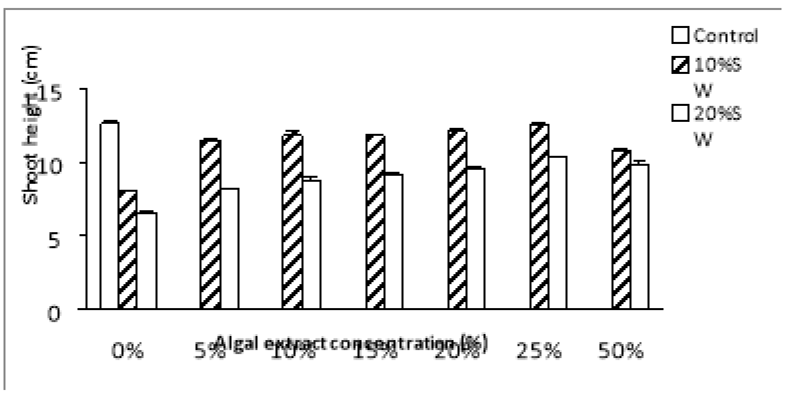

Figure 4:- Effect of *Cystoseira sp.* extracts on shoot height of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW and 20%SW).

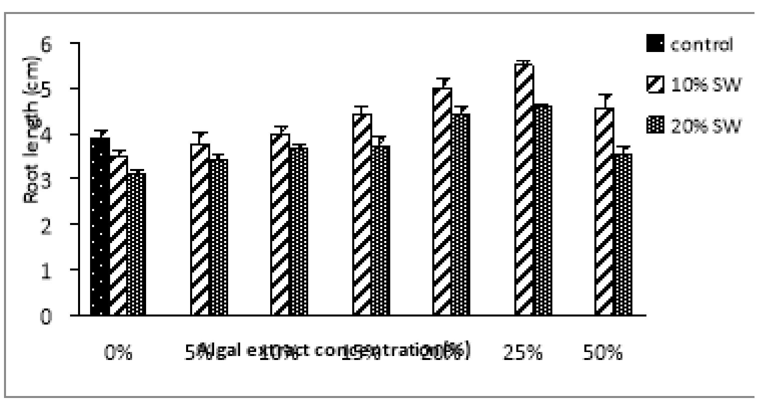

Figure 5:- Effect of *Ulva lactuca* extracts on root length of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW and 20%SW).

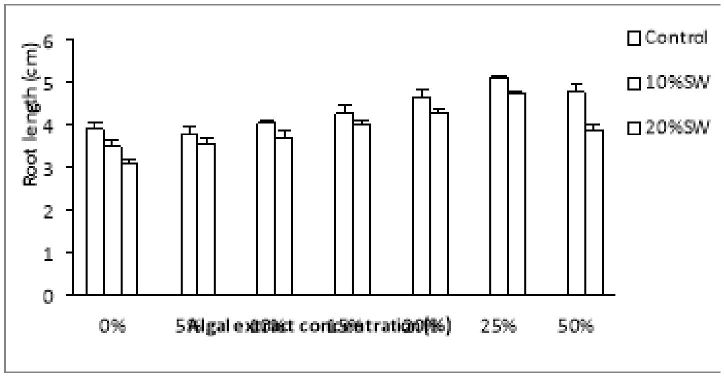

Figure 6:- Effect of *Cystoseira sp.* extracts on root length of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW and 20%SW).

Leaf pigments:-

Chlorophyll a:-

The data of Figure 7 and 8 clarified that irrigating wheat seedlings with fresh water gave the highest value of chlorophyll a (1.820 mg/g F.W.). Irrigation with 10% and 20% seawater without algal extract presoaking resulted in high significant decrease in chlorophyll a by 0.28% and 0.40%, respectively, compared with fresh water. Whereas, the algal treatment of wheat grains before the irrigation with seawater induced high significant increase in chlorophyll a by increasing the concentration of algal extract from 5% to 25% reaching the maximum value 2.854 mg/g F.W. for *Ulva lactuca* and 2.718 mg/g F.W for *Cystoseira sp.* after the irrigation with 10% seawater. Then there is decrease in chlorophyll a with the increase in algal concentration more than 25%, for the two algal sp..

Chlorophyll b:-

The results shown in Figure 9 and 10 revealed that increasing the salinity of irrigation water to 10% and 20% seawater caused highly significant reduction in chlorophyll b in wheat seedlings. Irrigation with 10% seawater and presoaking in *Ulva* extract significantly increased chlorophyll b content. Increasing the extract concentration from 5% to reach its maximum value (0.811 mg/g F.W.) at 25%, then redecreased to 0.766 mg/g F.W. at 50% algal concentration. Irrigation with seawater 20% of presoaked grains in different concentrations of both algae induced highly significant increase in chlorophyll b from 5% reaching to 0.683 mg/g F.W in case of 25% *Cystoseira* extract which increased chlorophyll b more than those resulted from grains presoaked in 5%, 10%, 15%, 20%, and 50% algal extract by 26%, 18%, 12%, 6% and 10%, respectively.

Carotenoids:-

The data illustrated in Figure 13 and 14 indicated that carotenoids content was significantly affected by seawater irrigation and presoaking with algal extract. Irrigation with seawater 10% or 20% caused highly significant decrease in carotenoids content by 12% and 24%, respectively than that obtained from fresh water. Whereas, increasing the algal extract concentration increased the carotenoids content especially at 25% extract concentration for both algae and irrigated with 10% seawater inducing a remarkable increase in carotenoids, but the lowest value was observed when grains presoaked in 5% and irrigated with 10% or 20% seawater, then redecreased with increasing the algal extract concentration to 50%.

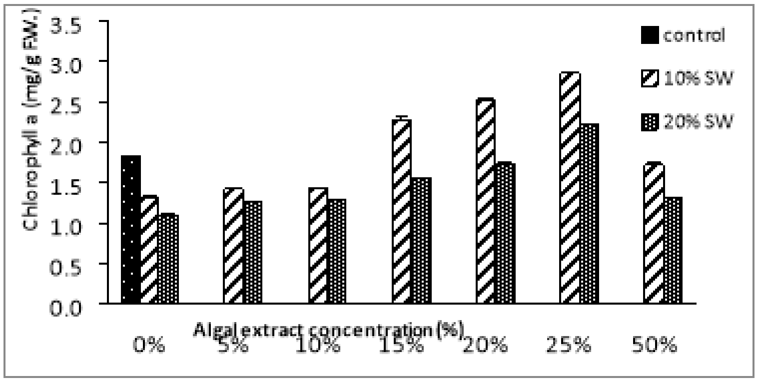

Figure 7:- Effect of *Ulva lactuca* extracts on chlorophyll a of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW and 20%SW).

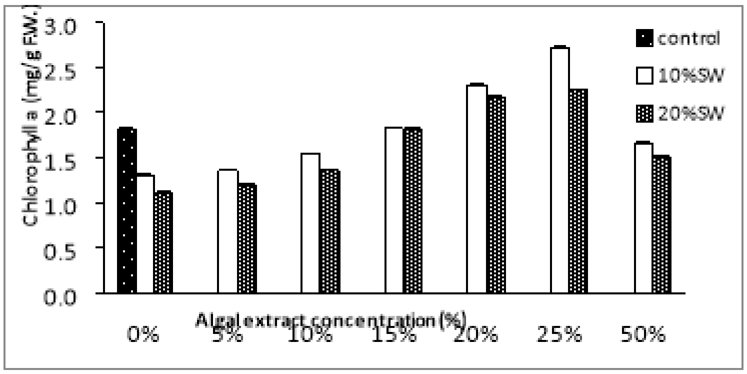

Figure 8:- Effect of *Cystoseira sp.* extracts on chlorophyll a of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW and 20%SW).

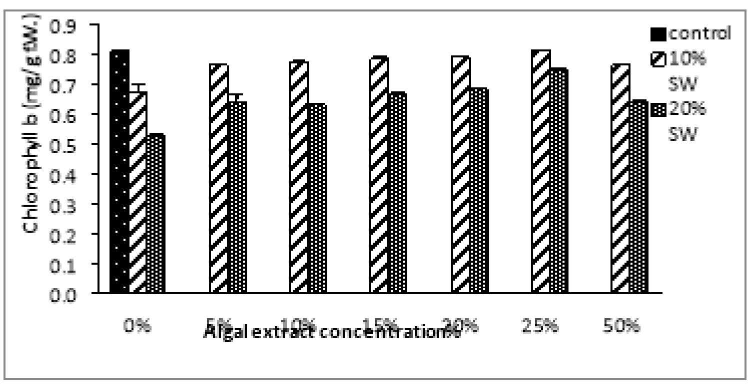

Figure 9:- Effect of *Ulva lactuca* extracts on chlorophyll b of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW and 20%SW).

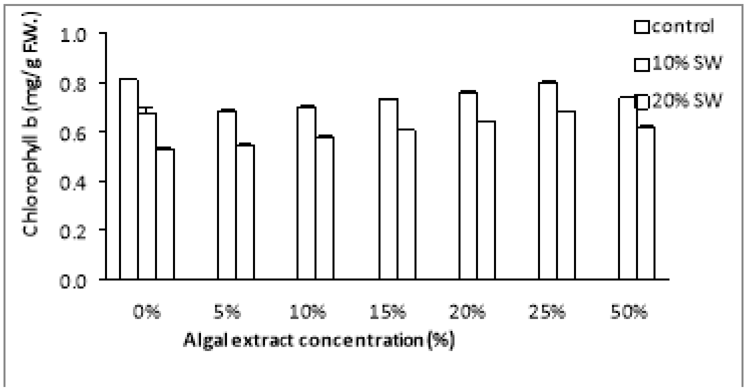

Figure 10:- Effect of *Cystoseira sp.* extracts on chlorophyll b of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW and 20%SW).

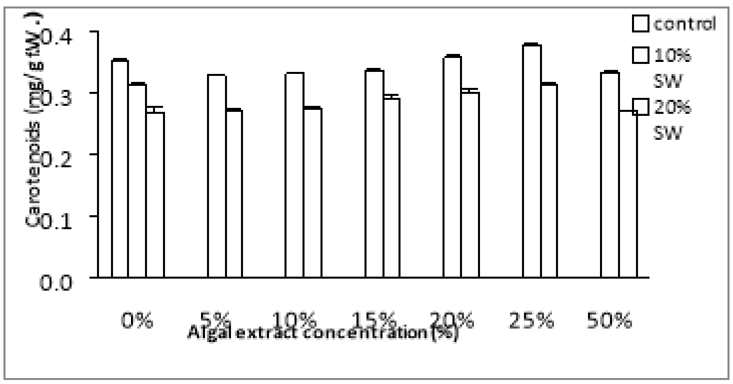

Figure 11:- Effect of *Ulva lactuca* extracts on carotenoids of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW and 20%SW).

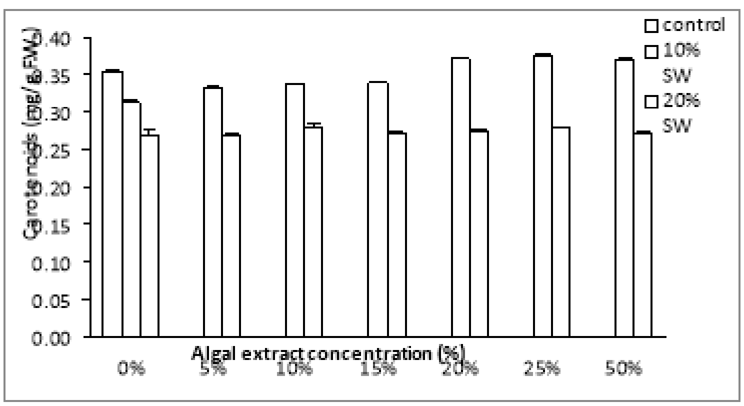

Figure 12:- Effect of *Cystoseira sp.* extracts on carotenoids of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW and 20%SW).

Seedling enzyme activities:-

Catalase:-

It is clear from the data recorded in Figure 15 and 16 that irrigation with fresh water had the minimum value of catalase activity. Irrigation with 10% and 20% seawater produced an increase in catalase activity by 8% and 19%, respectively, compared with the control. Irrigation with 20% seawater for grains presoaked gave pronounced increase in catalase activity than irrigation with 10% seawater. The maximum catalase activity was observed when the grains presoaked in 25% alga extract and irrigation with 20% seawater, i.e. 36.6 µ mol/min g F.W. for *Ulva* and 33.2 µ mol/min g F.W. for *Cystoseira.*

Peroxidase (µ mol/min g F.W.):-

Regarding the peroxidase activity in wheat seedlings, Figure 17 and 18 showed that algal presoaking grains gave highly significant increase in peroxidase activity than non- presoaked ones when the irrigated with 10% and 20% seawater. The highest activity value 84.8 µ mol/min g F.W. for 25% *Ulva* extract and 33.2 µ mol/min g F.W. for 25% *Cystoseira* extract was detected from irrigation with 20% seawater, then the activity redecrease again with increasing the algal extract concentration to 50%.

Superoxide Dismutase:-

The results show in Figure 19 and 20 that 10% and 20% seawater irrigation of wheat seedlings without algal presoaking caused highly significant increase in superoxide dismutase activity than the control by 88% and 212 %, respectively. However, presoaking of wheat grains and irrigation with 10% and 20% seawater caused further increase in the activity by increasing the algal extract concentration from 5% to 25% seawater which gave the maximum value of superoxide dismutase and this was noticeable when the grain was presoaked in *Ulva* extract and irrigated with 20% seawater giving 27.9 µ mol/min g F.W..

Seedling proline Content:-

The data illustrated in Figure 21 and 22 indicate that irrigating wheat seedling with fresh water gave the lowest value of proline content (0.37 mg/g D.W.), whereas and increased with increasing the salinity level to 10% and 20% seawater. While the increasing of algal extract concentration decreased the proline content constantly until reach the lowest value at 25% algal extract concentration and irrigation with 10% seawater i.e.0.37 mg/g D.W. for *Ulva lactuca* and 0.47 mg/g D.W. for *Cystoseira* sp.. Increasing *Cystoseira* extract concentration over 25% decreased the proline content when irrigated with 10% and 20% by 6.6% and 4.9 %, respectively, than those irrigated with seawater only.

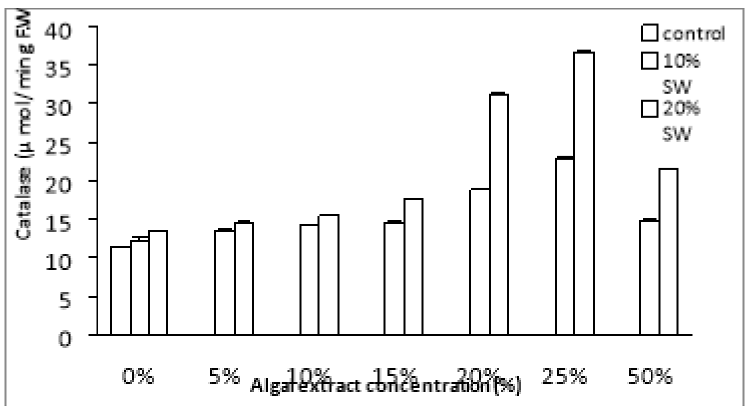

Figure 13:- Effect of *Ulva lactuca* extracts on catalase of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW and 20%SW).

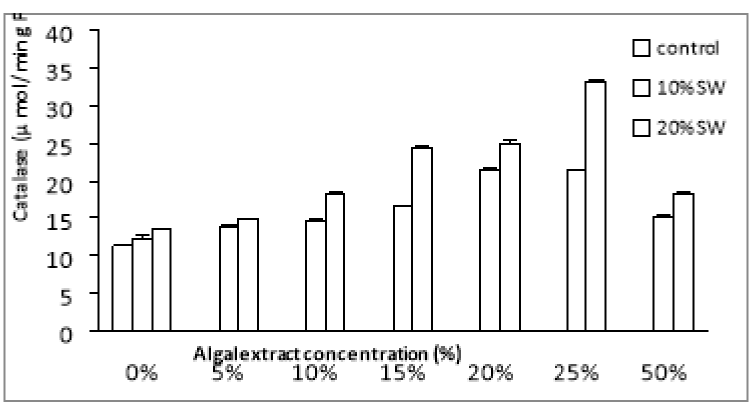

Figure 14:- Effect of *Cystoseira sp.* extracts on catalase of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW and 20%SW).

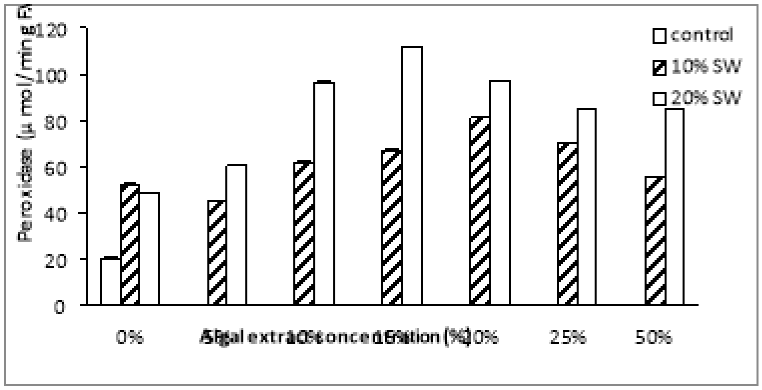

Figure 15:- Effect of *Ulva lactuca* extracts on peroxidase of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW and 20%SW).

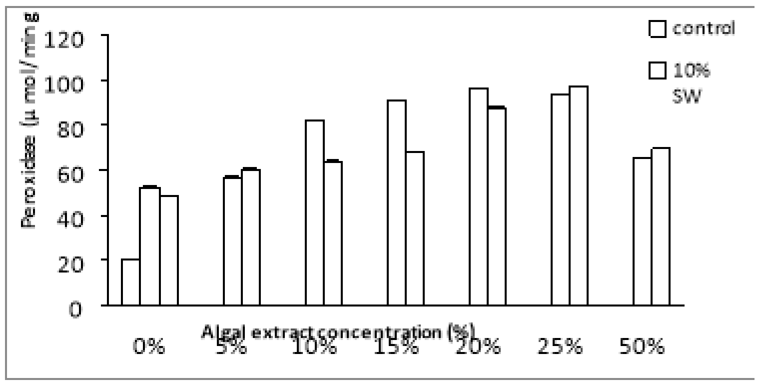

Figure 16:- Effect of *Cystoseira sp.* extracts on peroxidase of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW and 20%SW).

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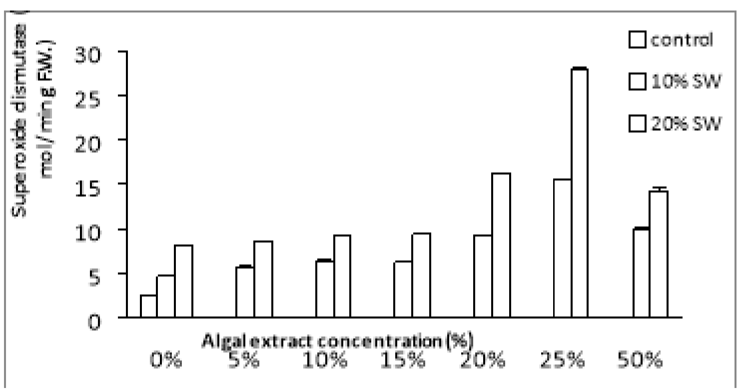

Figure 17:- Effect of *Ulva lactuca* extracts on superoxide dismutase of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW and 20%SW).

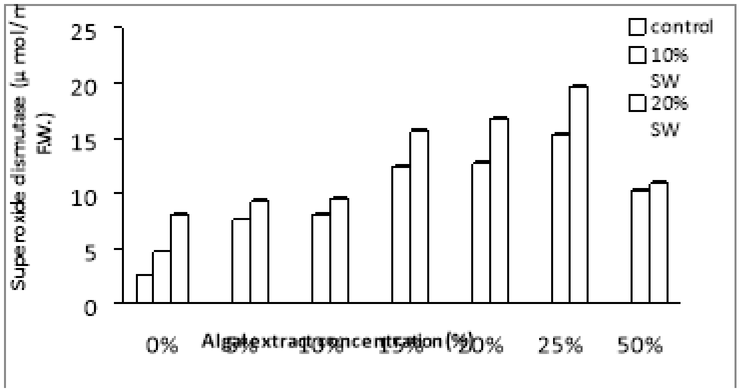

Figure 18:- Effect of *Cystoseira sp.* extracts on superoxide dismutase of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW and 20%SW).

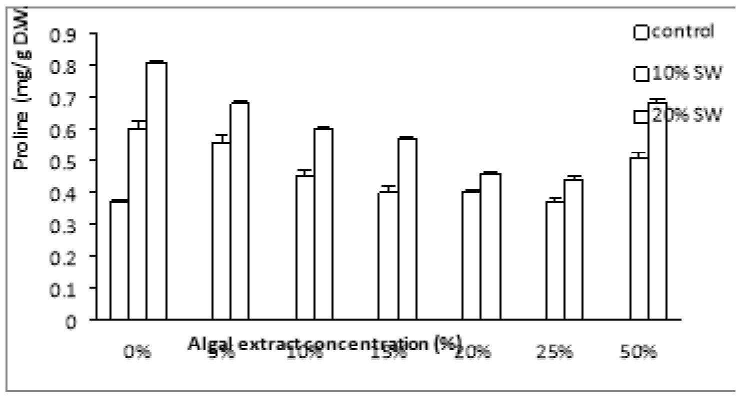

Figure 19:- Effect of *Ulva lactuca* extracts on proline content of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW and 20%SW).

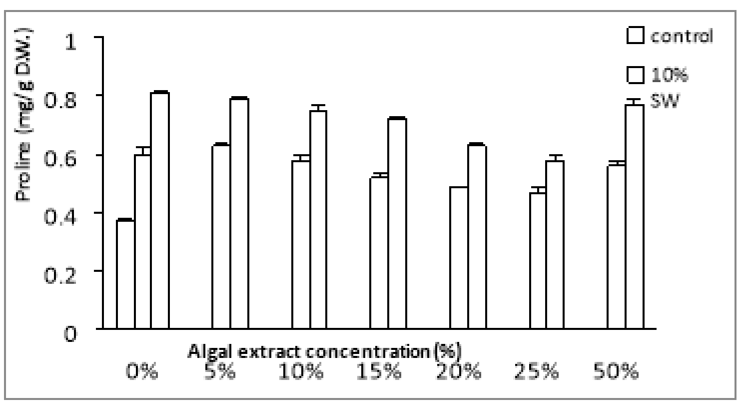

Figure 20:- Effect of *Cystoseira sp.* extracts on proline content of wheat seedlings irrigated with different concentrations of seawater (Control, 10%SW and 20%SW).

Discussion:-

Abiotic stress such as salinity stress induces an oxidative stress due to generation of reactive oxygen species (ROS) which overcome the scavenging system and caused severe deterioration to cellular structures and ultimately cell death **(Sharma *et al*., 2012).**

This research was carried out to observe the effects of seawater salinity and extract concentrations of two algal species *Ulva lactuca* and *cystoseira sp.* on germination and wheat seedlings. Germination and seedling stages are the most important and sensitive stages of plant life for screening the salt tolerance of wheat plants and reflects its response under salinity condition **(Munnus, 2002 and Cuartero *et al* 2006).** From the results it can be concluded that reduction in germination under salinity has been attributed to combined effect of osmotic potential which caused the retardation of water uptake **(Moud and Maghsoudi, 2008)** and salt toxicity **(Saboora and Kiarostami, 2006)** or due to chlorine ion which caused osmotic stress. **(Almodares *et al.,* 2007**) The inhibitory effect of salinity on germination of different plants is in accordance with **Farooq *et al.* (2011); Elouaer and Hannachi, (2012) and Afzal *et al.* (2012).**

Salinity stress is a major adverse factor that can reduce the seedling growth (root and shoot length) in salt stressed grains of wheat. Shoot height and root length are considered important parameters show the response of plant to salt stress due to the direct contact between the soil and plant roots which absorb water and nutrient from the soil, then shoot supply it to all plant parts. (**Jamil and Rha, 2004)**. The deleterious effect of salinity on seedling growth was more pronounced with increasing seawater concentration. Salt intensity depressed shoot height more than root length which indicated that the shoot showed more sensitivity to salinity than the root. This results are in accordance with those obtained by **Kaya *et al*. (2008)**; **Moud &Maghsoudi (2008) and Ibrahim *et al.* (2014).** This mainly due to the occurrence of rapidly osmotic regulator inside the root in spite of its losing to turgidity is more slowly than the shoot. (**Studer *et al*., 2007 and Ferdose *et al.,* 2009**). However, these were in disagreement with **Rahman *et al.* (2001), Jamil *et al*. (2006) and Ogawa *et al*. (2006),** who reported that growth of root was more negatively influenced by oxidative stress than that of the shoot. Presoaked wheat grains with the extract of *Ulva lactuca* or *Cystoseira sp.* showed better performance than non- presoaked ones and ameliorate the adverse effect of seawater salinity and enhanced the seedling growth of wheat, and this may be attributable to the promoting growth substances and hormones found in algal extract (**Thorsen *et al,* 2010; Prasad *et al,* 2010 and Blunden *et al,* 2010).** Moreover, the presence of some cytokines, gibberellins, auxins, auxin-like compounds (**Stirk *et al,* 2003; Yokoya *et al,* 2010 and Ibrahim *et al.*, 2014).** Extracts from Chlorophyta and Phaeophyta are proved to be rich in various cytokines (**Zhang and Ervin, 2004, 2008**). The inhibitory effect of seawater irrigation on pigments biosynthesis in wheat seedlings may be related to an increase in the activity of chlorophyllase enzyme (**Santos, 2004)**, chloroplast destruction and the instability of pigment protein complexes (**Jamil *et al*., 2012).** Furthermore, the deleterious effect of chloride in inhibition of chlorophyll synthesis or acceleration of chlorophyll destruction. (**Musyimi *et al*., 2007**). Promising application of algal extracts is attributable to its constituents of various beneficial compounds as betaines that showed an enhancement in photosynthetic pigments due to its role in declining chlorophyll degradation (**Whapham *et al.,* 1993**), or magnesium which is important for the synthesis of chlorophyll (**Erulan *et al*., 2009; Sangeetha and Thevenathan *et al*., 2009).** The oxidative stress in stressed wheat seedlings after irrigation with two different seawater concentrations resulting in the production of excess reactive oxygen species (ROS), such as superoxide ($O_2^{\bullet-}$), hydrogen peroxide (H_2O_2) and hydroxyl radicals ($OH^{\bullet}$), that are very cytotoxic and react seriously with vital cellular molecules such as lipids, proteins, nucleic acid, etc., causing lipid peroxidation, protein denaturing and ultimately DNA mutation (**Apel and Hirt, 2004; Tunc-Ozdemir *et al.*, 2009).** Wherefore wheat seedlings developed many protective mechanisms including antioxidant enzymes such as CAT and SOD to eliminate and scavenge them. (**Hernandez *et al*., 2000)**. The enzymatic antioxidant such as CAT and POD are very important in protecting the plant against salt stress by counteracting the production of H_2O_2 in many cell organelles in the plant. (**Asada, 2006**). Whereas, the amount of ROS is modulated by the activity of CAT enzyme (**Jiang and Huang, 2001).** Moreover, in different concentrations of algal extract from 5 to 25%, antioxidative compounds in algae such as ascorbic acid, proline, betaine, and glutathione have an enhancement effect and improve the protection defense in stressed wheat. (**Hemida *et al*., 2014, Deivanai *et al*., 2011 and Tuna *et al* 2013)**. The observed accumulation of proline content in wheat seedlings exposed to osmotic stress might have been caused by the fact that plants undergo metabolic adjustments and accumulate suitable organic solutes to improve its resistance to salinity. **(Nabti et al., 2010).** Similar increases in proline content have been reported in other plants under a salt stress (**Misra and Gupta, 2005).** Pretreatment of wheat grains in different concentrations of *Ulva lactuca* and *Cystoseira sp*. decreased the level of proline in response to various betaines and other compatible solutes which are used by wheat seedlings for osmotic adjustment. Therefore, Salt-induced proline accumulation in seedlings is reversed, giving various amino acids substantial for growth and development **(Brenda *et al.,* 2005).** It should be noted that two algal extracts in concentration higher than 25% redecreased the germination and development of seedlings. This result is concordant to finding of other researchers who reported that dilute extracts of algae are efficacious than the concentrated ones **(Bai *et al,* 2011; Kumar *et al,* 2012).**

Conclusions:-

Our results show that presoaking of wheat grains in different concentrations of algal extracts and irrigated seawater showed a positive effects on wheat seedlings by stimulation the plants salt tolerance through an improvement of growth, antioxidant enzymes, enhancement of photosynthetic pigments and decreasing the proline level. This can be explained by the nutritive value of the extract which is considered as essential growth promoting Constituents and played a key role in the enhancement of growth and physiology of wheat. However, optimum concentration of algal liquid extracts is necessary as the present study exhibited that 25 % had better influence on wheat growth.

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