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THE IMPACT OF SALINITY WATER ON GROWTH AND YIELD OF TWO OATS CULTIVARS (*AVENA SATIVA L.*)

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Abstract

A field experiment was conducted in one of the farms in Babylon governorate during winter season. (2015-16) and (2016-2017) to know the effect of salinity water in growth and yield of three varieties of oats. were used. RCBD distribution with (split-plot design) with three replication. The result showed a significant effect of salt water irrigation all studied qualities. Where decreased values of studied characteristics by increasing salinity water more than 3ds.m^{-1} and showed no significant differences with comparative coefficient (irrigation by river water) in all studied characteristics. While salinity level 9ds.m^{-1} give the least average number of Tillers (457,422) per/m^{-2} and number of panicles (376, 355) per/m$^{-2,}$ and number of grain in panicle (28.54 and25.97) per/m^{-2},waght of 1000 grain (26.77, 26.48) gm, grain yield (3.96, 3.71) ton/h^{-1}, biological yield (17.53, 16.43) ton/h^{-1}, average of plant growth (12.30, 11.55) gm.m^{-2}, harvest Index (22.52, 23.08)% both of season. The result of statistical analysis showed a significant differences between genotypes, where plant gave varieties ALshafa and Hamel high average for number of tillers, biological yield, plant growth yield and grin yield both of season .thus we conclude salt stress is a negative effect on the stage of plant growth which is reflected negatively on grin and its components.

***Keywords* :** Oats Components, NaCl, *Avena sativa* L., Salinity, salt stress

Introduction

Many factors hereditary and environments, Irrigation water management of factors that important, affected the qualities of any economic crops (Riaz *et al.*, 2010). Iraq is suffering today As in the rest of more country in world from the fall of rain and low water resources As well as misuse of water Resources in Agriculture for follow random method in watering plantation during the growing season, this problem will increase over the coming years (STAT, 2000) in particular that the water does not exceed 1% per cent (Mavi and Tupper, 2004) and to this challenge and then made a great effort in the world to use the most saline water sources such us eyes and elbows and agriculture drainage water even wastewater after making the treatment on them (Miyamota *et al.*, 1986) the phenomenon of salinization and diminishing water suitable for agriculture in the world is one of the most important challenges to agricultural expansion and increased productivity, as the spaces that affected in salinity are taken by the increased today it is between 20-50% of the agricultural lands, Higher salinity levels caused significant reduction in growth parameters like leaf area, leaf length and root and shoot dry weight (Al-Taey, 2018). Salinity caused osmotic stress and ionic toxicity cause changes in plant physiological processes, mineral distribution (Al-Taey and Majid, 2018), Characteristics of the yield and stability of quantitative qualities many gene pairs control them opinions on the impact of salt stress on yield witch is exposed to the plant continuously or intermittently (Yokoi, S., Bressan and Hasegawa. 2002). The yield components of the different crops are also significantly affected by high salinity (Nahar, and. Hasanuzzaman, 2009). This decrease in yield and it is component under saline stress can be attributed to decreases in the expansion of the biologic yield and physiological acceleration in older cells (Ahid and Rasul, 1997). (Al-Taey *et al.*, 2018) mentioned to reduction of lettuce yield with elevation of salinity stress by different water qualities, (Wang and Song 2006) mention to that oats crops has a high amount to assemble sodium and slave in the biomass oatmeal cultivation is a good biologic scale to improve salt land, (Zhao and Ren, 2009) mention to the studying of the effect of salt stress on the growth and yield of oats using five concentration of sodium chloride (3.42, 6.74, 9.66, 12.4, 15.04) ds.m^{-1} the saline stress affected the number of maturity day, number of panicle , number of grin in panicle ,weight of 1000 grain and it is number of panicle , number of grin panicle more components yield sensitive to stress salt As a reduce of oat grin yield due to the decrease in the number of plant grins and weight of the grin. (Zhao and Xu, 2013) explained that decreased grain yield and dray matter yield of oats much when the percentage salinity 6% and more. the comparison of the yield of wheat grin between treatment found (Maas and Grieve, 1990) that the salt stress negatively affected the outcome as a result of its effect on vegetative growth and decrease in the number of grin –bearing strain. The aim of this experiment is to know the effect of irrigation salt water in some of growth characters, grin yield of oats, and know resistance range of varieties to water irrigation.

Material and Methods

A field experiment was conducted in one of the farms in Babylon governorate during winter season. (2015-16) and (2016-2017) to know the effect of salinity water in growth and yield of three varieties of oats were used RCBD distribution with (split-plot design) with three replication. With tow Factor, First Factor of three varieties of oats shafa varieties Certified by Ministry of agriculture and tow varieties imported from Italy (Hamel and Pimula), second Factor included three level of salt water (3, 6, 9) ds.m^{-1} in addition to the control treatment (river water 1.164 ds.m^{-1}) with three replication. Were used seed rates 100 kg/h^{-1}, distance of experiment unit 9m^{2}. The seed planted in a line distance between them 20cm. the fertilize of NPK (Diamonio phosphate) composite 0:46:18. then add 160 kg/ h^{-1} with prepare the soil to planting, urea fertilizer add (46%) in range 40kg/h^{-1} in two date, first with in planting, second after 40 day from emergence. Water salt was prepared by using sodium chloride (NaCl) using the following approximate relationship to convert the electrical connecting plug to the sum of dissolved food at a temperature of 25ºC. TDS (mg.L^{-1}) = 640 ×EC (ds.m^{-1}) and calculated sodium chloride amount that needs each liter of distilled water for an electrical connection by (3, 6, 9) ds.m^{-1} using the equation of the pandemic. The results were.

3ds.m^{-1} =1.920 mg.L^{-1}

6ds.m^{-1} =3.840 mg.L^{-}

9ds.m^{-1} =5.760 mg.L^{-1}

The electrical plump was water from the river 1.164 ds.m^{-1}was the calculated amount of salt available for complex (0.744) mg.L^{-1} and the substance of existing salt in the water river from the total need of sodium chloride to need to reach the electronic plug in to illuminate irrigation , it has been added (1.176, 3.096, 5.016) kg from NaCl each.1 m^{-3} from water river to get electrical connection by deposit (3, 6,9) ds.m^{-1} .

The following qualities were studied :

Number of tillers, number of panicles number of grain in panicles weight of 1000 grain (gm), and extraction of grain yield (ton/ h^{-1}) after the process of operation in /m^{2} who take from each experiment unit, then the grain was isolate from straw with in moisture percentage 14%, extract the biological yield (kg.m^{-2}) we have been weight (straw +grain)the unit convert from (gm.m^{-2}) to(ton.h^{-1}). Calculate mean of plant growth by dividing yield of dray matter upon number of day to arrive the maturity and harvest index (%) by use the equation developed by donald (Donald. 1962) and which provides.

$$\text{Harvest index (\%)} = \frac{grain\ yield}{biological\ yield} \times 100$$

Results and Discussion

(1) Number of Tillers

The ability of the cultivar to give the largest number of tillers carries a positive status in increasing the productivity of the variety, especially under the conditions of tensile stress such as salinity, but increasing the number of tillers from the optimal limits may increase the volume of biomass at the expense of the harvest index due to competition growth Proliferative and low grain yield. Table 1 shows significant differences between the cultivars in the number of tillers, where the superiority of Shifaa and Hamel cultivars by giving them the highest average number of tillers per square meter was 740, 733 for the first season, 707 and 698 for the second season respectively, while Pimula recorded the lowest average number of tillers per square meter was 607 and 591 during the first and second seasons in succession. The difference between species in the number of tillers may be due to their genetic differences.

The salinity of irrigation water was also effected on the number of tillers per unit of area. The salinity level was 9 dS.m^{-1}. The average mean of the number of tillers per square meter was 457 and 422 during the first and second seasons respectively and thus differed significantly from all saline concentrations used in the experiment Comparative treatment (river water) showed the highest number of slugs per square meter (828 and 798) for the first and second seasons respectively. The salinity level 3 dS.m^{-1} did not differ significantly, with 808 and 792 cm per square meter for the first and second seasons respectively. These results were consistent with what. (Hasanuzzaman *et al*., 2009) found. The reason is that salt concentrations are high in small tillers that exceed their ability to divide salt into gaps, leading to salt concentration in the cytoplasm to toxic concentrations, early time. The data did not indicate a significant overlap between the varieties and salinity levels of irrigation water in this category. These findings were agreed upon by Zhao et al. (Zhao *et al*., 2009) and Zhao *et al*.,

(2) Number of Racemes

The salinity of irrigation water was also effected on the number of tillers per unit of area. The salinity level was 9 $dS.m^{-1}$. The average mean of the number of tillers per square meter was 457 and 422 during the first and second seasons respectively and thus differed significantly from all saline concentrations used in the experiment Comparative treatment (river water) showed the highest number of slugs per square meter (828 and 798) for the first and second seasons respectively. The salinity level 3 $dS.m^{-1}$ did not differ significantly, with 808 and 792 cm per square meter for the first and second seasons respectively. These results were consistent with what (Hasanuzzaman *et al*., 2009) found. The reason is that salt concentrations are high in small tillers that exceed their ability to divide salt into gaps, leading to salt concentration in the cytoplasm to toxic concentrations, early time. The data did not indicate a significant overlap between the varieties and salinity levels of irrigation water in this category. These findings were agreed upon by (Zhao *et al*., 2009) and Zhao *et al.*

(3) Number of grains in racemes

The number of raceme grains is the final result of the number of flowers produced in Raceme and the percentage of fertilization. If the cultivars of the growing cultivars are under saline conditions, the number of raceme grains will be higher than that of the non-tolerant strain of salinity. From the data in Table 3, the studied oats showed insignificant differences in the number of racemes grains and both seasons. The results also indicate significant differences between the effect of salinity levels of irrigation water and both seasons. The highest mean number of racemes grains was (42.92 and 42.36), while the salinity of irrigation water was 9 $dS.m^{-1}$. The mean number of grains in the daily was 28.54 and 25.97, followed by salinity $DS.m^{-1}$ with mean number of grains of (34.19 and 31.46). The ratio of salinity of irrigation water 3 $dS.m^{-1}$ was not significantly different with the comparison treatment. The average number of grains per dial was 41.09 and 40.96 and the first and second seasons Sequentially. The decrease in the number of varicose grains may be due to the effect of salinity on the number and activity of pollen, as salinity caused a decrease in pollen activity, which led to the failure of a large proportion of eggs in fertilization and the formation of grain and this is consistent with what Khan and Abdullah (Khan, and Abdullah. 2003). Salinity also has negative effects on organ growth and development during vegetative growth. Maas and Grieve (Maas and Grieve. 1990) in wheat noted that the number of spike grains decreased due to the decrease in the number of spikes in the spike. These results were consistent with the findings of (Zhao *et al*., 2009) and. (Elsahookie *et al*., 2013.), who indicated to differences in the number of grain in racemes due to saline water irrigation, which attributed the effect of salinity to fertilization rate.

(4) Weight of 1000 grain (g)

It is known that the weight of the grain of the attributes associated with the category and the least qualities effected by the environmental stresses surrounding the mother plant, including salt stress. It is also the last of the components of the main yield. The results of Table 4 indicate that there were no significant differences in the weight of 1000 grain for different varieties. Pimula gave the lowest mean weight of 1000 grain (27.62 and 27.95 g) for the first and second seasons respectively, with no significant difference between the other two varieties (Shifaa and Hamel) There was no significant overlap between cultivars and salinity levels of irrigation water, indicating the similarity of varieties in their response to salinity levels of irrigation water. The results showed that there were significant differences between the salinity of irrigation water. The weight of 1000 grains decreased by increasing salinity of irrigation water. And gave irrigation by river water (comparison treatment) the highest weight of 1000 grain(29.62 and 29.36) g for the first and second seasons sequentially. While irrigation treatment with salinity water of 9 $dS.m^{-1}$ was the lowest weight (26.77 and 26.48 g) for the first and second seasons respectively. The differences were not significant between irrigation treatment with salinity water 3 $dS.m^{-1}$ and the comparative treatment (irrigation by river water). Irrigation treatment with salinity water 6 $dS.m^{-1}$ and salinity water 3 $dS.m^{-1}$ did not differ significantly from each other and both seasons. The reason for the low weight of 1000 grain may be due to the same reasons that led to the decline of the average plant growth and decrease in the biological yield in the unit area (Table 6 and 7). The decrease in the area of vegetative expansion as well as the scarcity of key elements due to the substitution and competition of soya and chlorine ions, the high acidic pressure of the soil solution and the low absorption of water due to the low level of water available in the root zone (Hasegawa *et al*., 2000) may lead to low photosynthesis, Dry matter inside the bean. (Hasanuzzaman *et al*., 2009) attributed this to the intense competition between vegetative growth and reproductive growth on carbs produced in photosynthesis.

(5) Number of grains

The number of raceme grains is the result of the number of flowers produced in racemes and the percentage of fertilization. If the cultivars of the growing cultivars are under saline conditions, the number of racemes grains will be higher than that of the non-tolerant strain of salinity. From the data in Table 3, the studied oats showed insignificant differences in the number of racemes grains and both seasons. The results also indicate significant differences between the effect of salinity levels of irrigation water and both seasons. The highest mean number of racemes grains was (42.92 and 42.36), while the salinity of irrigation water was 9 $dS.m^{-1}$. The mean number of grains in the daily was 28.54 and 25.97, followed by salinity $DS.m^{-1}$ with mean mean number of grains of (34.19 and 31.46). The ratio of salinity of irrigation water 3 $dS.m^{-1}$ was not significantly different with the comparison treatment. The average number of grains per dial was 41.09 and 40.96 and the first and second seasons Sequentially. The decrease in the number of varicose grains may be due to the effect of salinity on the number and activity of pollen, as salinity caused a decrease in pollen activity, which led to the failure of a large proportion of eggs in fertilization and the formation of grain and this is consistent with what (Khan and Abdullah, 2003). Salinity also has negative effects on organ growth and development during vegetative growth (Al-Taey *et al*., 2017). (Maas and Grieve, 1990) in wheat noted that the number of spike grains decreased due to the decrease in the number of spikes in the spike. These results were consistent with the findings of (Zhao *et al*., 2009) and (Elsahookie *et al*., 2013), who indicated differences in the number of grain in racemes due to saline water irrigation, which attributed the effect of salinity to fertilization rate.

(6) The biological yield

Table 6 data indicated to significant differences between cultivars. Pimula gave the lowest mean of the biological yield of 19.60 ton h^{-1} and 20.80 $tons^{-1}$ for the first and second consecutive agricultural seasons, compared to the category of Shifaa and Hamel, which were not significantly different from each other in this capacity. The decrease in the Pimula crop is due to lower average growth compared to other varieties (Table 7). The results showed that there were significant differences between the effect of irrigation water salinity levels in the biological yield where the rate of salinity of irrigation water decreased gradually from 3 $dS.m^{-1}$ which did not differ significantly from the comparison treatment (river water) and both seasons. The lowest mean of the biological yield was 17.53 and 16.43 tons. The total number of dewormes (Table 1) and the decrease in the number of chicks (Table 2, 3). These results were consistent with(Rogers *et al*., 2003) and Hu and (Schmidhalter, 2005), who attributed the reason that salt stress causes food imbalance due to poor nutrient availability, competitive absorption, transport and distribution within the plant, which adversely affects photosynthesis and its output. The results showed that there was a significant overlap between the varieties and their response to salinity levels. Hamel gave the highest value of interference when irrigated with river water and water level of salinity 3 dS.m-1 reached 29.13 and 28.97 $^{-}$sequentially for the first season, 30.20 and 29.57 tons. 1. Sequentially for the second season. While Pimula gave the lowest, mean of the biological yield when irrigated with saline water 9 $dS.m^{-1}$ at 17.00 and 15.97-ton h^{-1} in the first and second seasons in succession. The difference is due to different species in their average growth as well as their different response to salt stress. These findings have been agreed upon by (Zhao *et al*., 2013).

(7) Average plant growth

The average plant growth is the average daily increase in the biogeographic unit of the area, which is the result of the average daily photosynthesis after subtracting the lost by the process of light breathing. Table 7 shows significant differences between the varieties in their daily growth. Hamel gave the highest daily growth rate of 16.57 and 17.24 gm^{-2} for the first and second seasons respectively. While Pimula gave the lowest average daily growth of the plant was 13.48 and 13.99 gm^{-2} for the first and second seasons sequentially. This may be due to different species' response to growth factors and their optical representation. The results showed significant differences between the effect of salinity levels of irrigation water and both seasons. The irrigation of the river water (comparison treatment) gave the highest daily growth rate of 17.23 and 17.70 gm^{-2} for the first and second seasons respectively, which did not differ significantly from the average daily plant growth When irrigated with saline water 3 $dS.m^{-1}$. The salinity level of 9 $dS.m^{-1}$ showed the highest decrease in the average plant growth per unit area. It gave an average daily growth of 12.30 and 11.55 gm^{-2} for the first and second seasons respectively. This is due to the low number of tillers, number of dillions, (Table 1, 2, 3 and 4). These results were consistent with what (Sudhir and Murthy.2004) found that there was an inverse relationship between the ammonia pressure produced by sodium chloride and photosynthesis and yield of different crops. (Fisarakis *et al*., 2001) also showed a positive relationship between inhibition of salinity growth and inhibition of photosynthesis. It may be due to the formation of chlorophyllase responsible for the destruction of chlorophyll or changes in the composition of green plastids of plant leaves at high salinity levels, leading to the breakdown of plastids and chlorophyll reduction and inhibition of transport. Potassium deficiency and its role in photosynthesis due to increased sodium content lead to loss of green color and yellowing of leaves. The results showed no significant overlap in the first season. On the other hand, the overlap in the second season was significant, as the cultivar gave less average daily growth when treated with salinity water with a salinity level of 9 dS.m^{-1} at 11.10 gm^{-2}, while Hamel was superior with irrigation by river water and gave The highest daily growth was 20.05 gm^{-2}. The reason for the overlap is due to the difference of varieties in their response to saline stress. The data from Table 5 indicate that the Shifaa category has increased its average daily growth (although the increase is insignificant) has a salinity with salinity of 3 dS.m^{-1} of 18.13 and 17.74 g. m^{-2} compared to Re-treatment of river water, where the average daily plant growth was 17.58 and 17.48 gm^{-2} for the first and second seasons respectively. These findings were agreed upon by (Zan *et al.*, 2011).

(8) Harvest index (%)

The harvest index is a measure that gives an idea of the efficiency of grain production versus the production of total dry matter (grain + straw) and a criterion for the efficient conversion of photosynthetic or dry matter products to an economic product. The results of Table 8 indicate that the three varieties (Hefa, Pimula, and Hamel) were similar in the harvest guide ratios without any significant differences in this status and for the first and second seasons, indicating that all varieties were similar in the conversion of dry matter from sources to estuaries.

The results showed that there were significant differences between salinity of irrigation water and both seasons. The irrigation of river water gave the highest harvest index (33.03 and 33.01%) for the first and second seasons in succession. While irrigation with salinity water of 9 dS.m^{-1} gave the lowest percentage of harvest index (22.52 and 23.08%) for the first and second seasons respectively. The treatment of irrigation with water level 3 dS.m^{-1} did not differ from the comparison treatment (irrigation by river water). The reduction of the harvest index at the high levels of salinity of irrigation water (6 and 9 dS.m^{-1}) was due to the decrease in grain yield due to the effect of irrigation water salinity on the number of pods per unit area (Table 2, 4). According to (Nahar and Hasanuzzaman, 2009), the decrease in yield and its components and the guide to harvest under the influence of salt stress is due to the decline in the expansion of the polygenesis and the acceleration in the aging of cells and tissues and thus the reduction of the average photosynthesis and the transfer of its products from sources of representation to estuaries. There was no significant overlap between cultivars and irrigation water salinity due to the similar response of the varieties of irrigation water salinity. These findings were agreed upon with the findings of (Elsahookie *et al.*, 2013).

Table 1: The number of tillers per square meter of oats by the salinity levels of irrigation water.

(2017 – 2016)**seasons**				(2016 – 2015) **seasons**				**salinity levels (dS.m^{-1})**
Average	**varieties** Hamel	**Pimula**	**Shifaa**	**Average**	**varieties** Hamel	**Pimula**	**Shifaa**	
798	**859**	**702**	**835**	**828**	**884**	**722**	**879**	**river water**
792	**853**	**696**	**828**	**808**	**887**	**702**	**846**	3
649	**679**	**582**	**686**	**680**	**703**	**620**	**716**	6
422	**405**	**383**	**479**	**457**	**467**	**386**	**519**	9
79.1			**n.s**	**76.4**			**n.s**	**Lsd 0.05**
	698	**591**	**707**		**733**	**607**	**740**	**Average**
			46.1				**38.2**	**Lsd 0.05**

Table 2 : Number of pesos per square meter of oats due to salinity of irrigation water

seasons2017 – 2016				**seasons**2016 – 2015				**salinity levels (dS.m^{-1})**
Average	**varieties** Hamel	**Pimula**	**Shifaa**	**Average**	**varieties** Hamel	**Pimula**	**Shifaa**	
676	**684**	**621**	**723**	**672**	**695**	**628**	**693**	**river water**
666	**678**	**609**	**712**	**663**	**688**	**623**	**677**	3
535	**513**	**502**	**589**	**564**	**572**	**531**	**589**	6
355	**341**	**336**	**390**	**376**	**358**	**436**	**423**	9
66.2			**n.s**	60.2			**n.s**	**Lsd0.05**
	554	**517**	**604**		**578**	**532**	**596**	**Average**
			n.s				**n.s**	**Lsd 0.05**

Table 3 : Number of raceme's grain of oat by irrigation water levels.

seasons2017 – 2016				seasons2016 – 2015				Salinity levels ($dS.m^{-1}$)
Average	varieties			Average	varieties			
	Hamel	Pimula	Shifaa		Hamel	Pimula	Shifaa	
42.36	44.58	38.22	44.29	42.92	44.23	41.66	42.87	river water
40.96	41.78	39.32	41.78	41.09	42.10	39.87	41.31	3
31.46	31.04	31.04	32.29	34.19	36.58	33.42	32.56	6
25.97	26.30	26.59	25.03	28.54	30.21	28.10	27.31	9
3.646			n.s	3.451			n.s	Lsd0.05
	35.92	33.79	35.85		38.28	35.77	36.01	Average
			n.s				n.s	Lsd 0.05

Table 4: Weight of 1000 grain (gm) of oats due to salinity of irrigation water.

seasons2017 – 2016				seasons2016 – 2015				Salinity levels ($dS.m^{-1}$)
Average	Varieties			Average	Varieties			
	Hamel	Pimula	Shifaa		Hamel	Pimula	Shifaa	
29.36	30.07	28.70	29.30	29.62	29.77	29.33	29.77	river water
29.02	29.37	28.63	29.07	29.06	28.90	28.60	29.67	3
27.66	27.97	27.34	27.57	27.14	27.03	26.23	28.17	6
26.48	26.33	27.03	26.07	26.77	27.08	26.30	26.20	9
1.04			n.s	0.87			n.s	Lsd0.05
	28.43	27.95	28.00		28.37	27.62	28.45	Average
	n.s						n.s	Lsd 0.05

Table 5 : Grain yield (tons h^{-1}) for oats by irrigation salinity levels.

(2017 – 2016) Seasons				(2016 – 2015) Seasons				Salinity levels ($dS.m^{-1}$)
Average	varieties			Average	varieties			
	Hamel	Pimula	Shifaa		Hamel	Pimula	Shifaa	
8.94	9.77	7.83	9.23	8.61	9.53	7.20	9.10	river water
8.71	9.27	7.83	9.03	8.26	9.00	6.97	8.80	3
6.16	6.33	5.37	6.77	5.86	6.10	5.20	6.27	6
3.71	4.07	3.50	3.97	3.96	3.97	3.20	4.70	9
0.46			n.s	0.45			n.s	Lsd0.05
	7.36	5.98	7.25		7.15	5.64	7.22	Average
			0.57				0.66	Lsd 0.05

Table 6: Biogeographic yield ($ton.h^{-1}$) for oats by the salinity of irrigation water.

seasons2017 – 2016				seasons2016 – 2015				salinity levels ($dS.m^{-1}$)
Average	Varieties			Average	Varieties			
	Hamel	Pimula	Shifaa		Hamel	Pimula	Shifaa	
27.17	30.20	23.33	27.97	26.13	29.13	21.57	27.70	River water
26.94	29.57	23.13	28.13	26.08	28.97	20.53	28.73	3
23.44	24.87	20.77	24.70	21.77	22.03	19.30	23.97	6
16.43	17.17	15.97	16.17	17.53	17.37	17.00	18.23	9
0.764			1.312	1.736			2.917	Lsd0.05
	25.45	20.80	24.24		24.38	19.60	24.66	Average
			0.881				1.841	Lsd 0.05

Table 7 : Average plant growth (gm $^{-2}$, day $^{-1}$) for oats by irrigation salinity levels.

seasons2017 – 2016				**Seasons**2016 – 2015				**Salinity levels ($dS.m^{-1}$)**
Average	**Varieties**			**Average**	**varieties**			
	Hamel	**Pimula**	**Shifaa**		**Hamel**	**Pimula**	**Shifaa**	
17.70	**20.05**	**15.57**	**17.48**	**17.23**	**19.64**	**14.48**	**17.58**	**River water**
17.43	**19.82**	**14.74**	**17.74**	**17.16**	**19.41**	**13.94**	**18.13**	3
15.82	**16.90**	**14.29**	**16.29**	**14.62**	**15.02**	**13.37**	**15.46**	6
11.55	**12.21**	**11.35**	**11.10**	**12.30**	**12.22**	**12.13**	**12.55**	9
0.65			1.19	1.23			**n.s**	**Lsd0.05**
	17.24	**13.99**	**15.66**		**16.57**	**13.48**	**15.93**	**Average**
			0.91				1.47	**Lsd 0.05**

Table 8 : Harvest index (%) for oats by irrigation salinity levels.

seasons2017 – 2016				**seasons**2016 – 2015				**Salinity levels ($dS.m^{-1}$)**
Average	**varieties**			**Average**	**varieties**			
	Hamel	**Pimula**	**Shifaa**		**Hamel**	**Pimula**	**Shifaa**	
33.01	**32.34**	**33.68**	**33.01**	**33.03**	**32.75**	**33.49**	**32.85**	**river water**
32.44	**31.33**	**33.86**	**32.13**	**32.13**	**31.06**	**33.97**	**31.36**	3
26.22	**25.46**	**25.82**	**27.38**	**26.97**	**27.74**	**26.99**	**26.17**	6
23.08	**23.65**	**32.19**	**24.57**	**22.52**	**22.97**	**18.81**	**25.77**	9
1.90			**n.s**	2.83			**n.s**	**Lsd0.05**
	28.19	**29.14**	**29.27**		**28.63**	**28.31**	**29.04**	**Average**
			n.s				**n.s**	**Lsd0. 05**

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