EFFECT OF SALINITY OF IRRIGATION WATER , LEVEL AND TYPE OF PHOSPHATE FERTILIZER ON GROWTH AND YIELD OF SORGHUM

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ABSTRACT

Field experiment was carried out to study the effect of type and level of phosphate fertilizer with different levels of saline water on growth and yield of sorghum. Triple super phosphate (TSP)and diammonium phosphate (DAP) were used with four levels (0,80,120,160 kgP.ha^{-1}) for each type. Four levels(1.0,4.0,7.0,10.0 ds.m^{-1})of saline water were used for irrigation. Results indicated that increasing salinity levels significantly decreased shoot dry weight , phosphorus uptake and grains yield .Using Tsp fertilizer decreased the effect of salinity by 20% on dry weights compared with DAP fertilizer . Increasing phosphate fertilizers levels increased growth parameters and grain yield in spite of high level of available soil phosphate , while the effect of TSP fertilizer was higher than DAP fertilizer . Each unit increase in salinity of irrigation water above 4.0ds-m^{-1} reduced grains yield by 8%. Yield reduction was due mainly to the lower weight of 1000 grains and secondly to the number of grains. head^{-1} .Vegetative growth was affected less by increasing salinity levels of irrigation water than was grains yield.

INTRODUCTION

Water resources is one of the most important factors in development and expanding of agriculture system specially in arid and semiarid regions. Shortage in water was drastically increased due to the drought condition in these regions . To compete these problems farmers tend to use saline water for corps irrigation .However many researchers study the possibility of using saline water for irrigation of many crops . The benefit of that is to reduce the use of fresh water through the good soil management (Aljelani etal, 1996). Alzubadi (1989) mentioned that saline water were used for irrigation in different regions in Iraq. Saline water with 12000 ppm were used in irrigation of tomato crop production in Alzubiar region Basra. Rahi and Shukri (2001) used saline water with 7.0ds.m^{-1} in irrigation wheat grown in sandy soil, using 20% leaching requirement compared with fresh water. Rhoads etal(1992) indicated that sorghum can be

classified as moderately tolerant to salinity and will give grain yield 100% when soil salinity was 6.8ds.m^{-1} and irrigation water salinity 4.5 ds.m^{-1} .

On the other hand Igartua etal(1995) in their studies on sorghum irrigated with different levels of saline water found that the most affected parameters are grain yield and dry weight. In other field experiment Fakira (1996) used three levels of saline water (4 , 8 and 12 ds.m^{-1}) in irrigation of sorghum and he concluded that salinity between 4.0 and 8.0 ds.m^{-1} are significantly decreased plant height and dry weight , but salinity level of 12.0 ds.m^{-1} was the most effected level on sorghum productivity. Almagrabi(2004) mentioned that application of phosphate fertilizer (TSP) significantly increased grain yield of Sorghum irrigated with different levels of Saline water.

Production of sorghum is receives special attention in south and central iraq , and due to the shortage in water supplies , an agriculture strategy in these areas, is to using a saline water and fertilizers to improve and expanding sorghum production. The purpose of this work is to study the effect of type and levels of phosphate fertilizers on the growth , yield and yield components of sorghum irrigated with different levels of saline water.

MATERIALS AND METHODS

Field experiment was conducted at Alwhda station -Baghdad- , during the autumn growing season 2002 .Factorial experiment 2*4*4 with three replications was used in randomized split block design. Two types of phosphate fertilizers (PF) were used including triple super phosphate (TSP) and diammonium phosphate (DAP) with four levels (0,80,120,160,kgP.ha^{-1}) for each type. Four levels of saline water were used of EC ,1.0,4.0, 7.0 and 10.0ds.m^{-1}. These represent , S_0, S_1,S_2 and S_3 treatments respectively , The S_0 represented water from Tigris river and the others were prepared by blending drainage water with water from Tigris to obtain S_1,S_2,S_3 levels.

Grain sorghum (C.V.Ankath) was planted on 20 July in rows 75cm apart and 10cm within rows leaving one plant per hole. The experiment unit area of each treatment (polt) was (2*3m) with 4 rows . Phosphate fertilizers TSP and DAP were added befor planting using banding application method . All plots received nitrogen as urea

(280 kg N.ha^{-1}) divided in two doses , the first dose was added with phosphate fertilizers while the second dose added after 45 days from planting .

Soil sample was collected from the field before planting and analyzed with saline irrigation water for chemical and physical properties (Table 1) according to page et al (1982). Five plants from each plots were taken randomly at flowering stage , washed with distilled water, dried in oven at 70C° and dry weights were recorded. A 0.5g of ground plant material was digested in Conc. Sulfuric and Perochloric acids. Phosphorus was determined in digested samples using spectrophotometer , according to the method of Matt (1970). At maturity stage , two middle rows were harvested from all treatments then grain yield and yield components were recorded. Data were subjected to statistical analysis using Duncan test for mean comparisons .

Table (1) Some physical and chemical properties of the studied soil and saline water

Property	Value	Property	Value
Clay g.kg-1	528	$NaHCo_3$-P mg.kg^{-1}	13.75
Silt g.kg-1	430	CH_3COONH_4-K mg.kg^{-1}	165
Sand g.kg-1	40.0	Soluble Ions Cmol.kg^{-1}	
Texture	Si.C	Ca^{++}	20.60
O.M g.kg-1	13.8	Mg^{++}	17.25
Ca Co_3 g.kg-1	320	Na^{+}	69.10
PH	7.6	K^{+}	0.03
EC ds.m^{-1}	10.2	Cl^{-}	122.40
CEC Cmol.kg^{-1}	26.7	HCO_3^{-}	2.43
KCl -N mg.kg^{-1}	110	$SO_4^{=}$	12.36

Property	S_0	S_1	S_2	S_3
EC ds.m^{-1}	1.0	4.0	7.0	10.0
Soluble ions mM.L^{-1}				
Ca^{++}	2.20	4.16	6.70	9.8
Mg^{++}	1.50	8.10	13.80	19.9
Na^{+}	3.39	12.86	28.10	41.2
K^{+}	0.10	0.16	0.33	0.48
Cl^{-}	6.95	27.25	46.30	66.7
HCO_3^{-}	1.18	2.73	3.10	4.50
$SO_4^{=}$	1.30	4.52	10.30	15.20
SAR	2.40	5.19	8.78	10.69
Water Sal. Class. (Rhoads etal ,1992)	Low	Medium	Medium	Medium

RESULTS AND DISCUSSION

Results indicated that salinity had a significant effect on sorghum dry weights (Table2). It was found that in creasing salinity levels caused a significant reduction in shoot dry weights at S_2 and S_3 salinity levels, however no signification effect between S_0 and S_1 was found .The reduction percentage in dry weight were 1.73, 12.38 and 22.92% at salinity levels S_1,S_2 and S_3 respectively .The maximum dry weight was 209.55 at S_0 salinity level while the minimum value was 161.52g at S_3 salinity level. The reduction in dry weights is mainly due to the negative effect of salinity on nutrients uptake and growth of sorghum .These results agreed with Almakrebi (2004)for sorghum grown under different salinity treatments.

Irrespective of type of fertilizers and salinity levels it was found that increasing fertilizer levels was significantly increased the dry weights.The increasing dry weight percentage were 7.82 , 17.47 and 23.31% at fertilizer levels(80.0,120.0,160.0 kgP.ha^{-1}) respectively .which reflected the positive effects of phosphate fertilizers addition and reducing the negative effect of some anions (specially Cl^- ion) on plant growth , in spite of high level of available soil phosphate (13.75 mg.kg^{-1}).

On the other hand , it was found that the type of phosphate fertilizer has a significant effect on dry weight . The addition of TSP was increased dry weight by 5.8% more than DAP fertilizer irrespective of salinity and fertilizer levels . These results reflect the difference in the behavior of phosphate fertilizers added to the soil. TSP fertilizer have an acidic effect while DAP is alkaline .Acidity of TSP liberate some nutrients (such as K^+ ,Fe^{+2},$Mn^{+2}$and Zn^{+2}) which increases the availability and uptake of nutrients and reducing the negative effect of some ions (such as Cl^+ and Na^+).

Table (2) Effect of Salinity Levels type and level of Phosphate Fertilizers interaction on shoot dry weights (g.plant^{-1})

Salinity Level ds.m^{-1}	Fert. Type	Phosphate Fertilizer Levels (Kg P . ha $^{-1}$)				Sal*Fert. Type	Mean of Sal	Mean of Fert.Type
		0.0	80.0	120.0	160.0			
S_0	DAP	193.70	204.05	211.20	219.55	207.13ab		
	TSP	193.05	202.30	218.95	233.60	211.97a		
S_1	DAP	187.75	203.45	213.60	219.05	205.96ab		
	TSP	186.30	196.30	218.55	222.30	205.86ab		
S_2	DAP	165.07	168.50	180.15	200.85	178.80c		
	TSP	167.10	175.15	201.90	209.60	188.44c		
S_3	DAP	131.45	135.05	153.90	169.15	147.39d		
	TSP	131.35	177.70	195.10	198.50	175.66c		
Inter. Salinity Level	S_0	193.37c-f	203.17b-e	215.08a-c	226.57a		209.55a	
	S_1	187.03 e-h	199.87c-f	216.07a-c	220.67ab		205.91a	
Fert. Level	S_2	166.40 ij	171.82h-j	191.03cd	205.22b-d		183.62b	
	S_3	131.40k	156.37j	174.50ji	183.82f-h		161.52c	
inter. Fert. Type	DAP	169.65c	177.76c	189.71bc	202.15ab			184.82b
Fert. Level	TSP	169.45c	187.86bc	208.62ab	216.00a			195.48a
Fert. Level		169.55d	182.81c	169.17b	209.07a			

Values of mean group compare with each other

Values of the same Symbol at each group showed no Significant Differences using Duncan Test at 5%

Fig (1) shows that the effect of both salinity and fertilizer levels on dry weights was 88% sig=0.0001 irrespective of fertilizer type. The effect of salinity was 58.3% while DAP effect was 29.70% on dry weights however the effect of TSP fertilizer was 49.27%. this means that using TSP reduce the salinity effect by 20% which reflect a positive effect on dry weights.

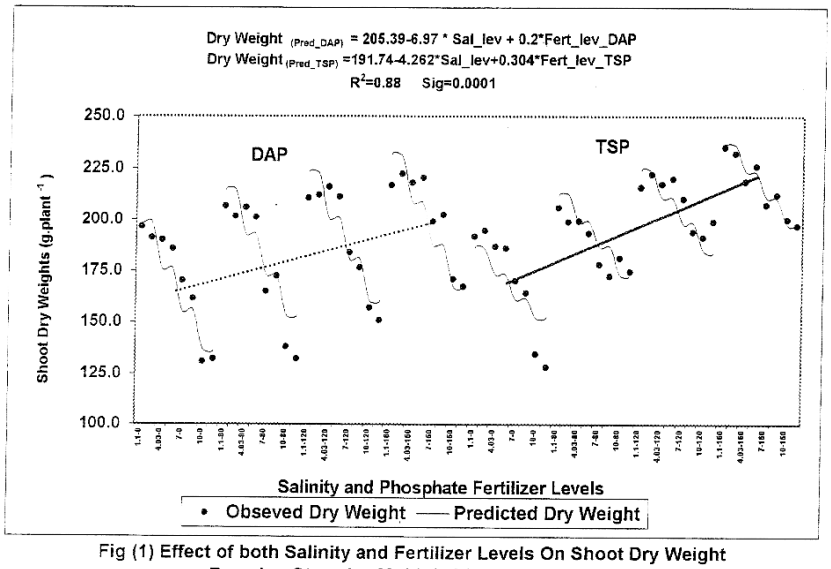


Fig (1) Effect of both Salinity and Fertilizer Levels On Shoot Dry Weight
By using Stepwise Multiple Linear Regression
Salanity Lev Effect=58.3% Fertilizer DAP Effect=29.7 %
Salanity Lev Effect=38.71% Fertilizer TSP Effect=49.27 %

Phosphorus uptake was significantly reduced as salinity levels increased (Table.3) .The reduction percentage of P-uptake was 5.6,20.33 and 38.25% at salinity levels S_1,S_2 and S_3 respectively .This may be attributed to the ions competition between soluble anions specially chloride and phosphate ions on uptake sites under these conditions.
The highest value of P-uptake was found at salinity level S_0 (650.50 mg.plant^{-1}).

Increasing phosphate fertilizer levels was significantly increased P-uptake which show the maximum P-uptake was 731.79 mg.plant^{-1} at 160.0 kg P.ha^{-1} level. Increasing percentage of P-uptake were 23.39, 61.16 and 93-52% at salinity levels S_1,S_2 and S_3 respectively. Results

Table (3) Effect of Salinity Levels type and level of Phosphate Fertilizers interaction on phosphorus uptake (mg.plant^{-1})

Salinity Level ds.m^{-1}	Fert. Type	Phosphate Fertilizer Levels (Kg P . ha $^{-1}$)				Sal*Fert. Type	Mean of Sal	Mean of Fert.Type
		0.0	80.0	120.0	160.0			
S_0	DAP	474.18	551.19	686.43	834.29	636.52a		
	TSP	482.65	556.50	722.53	899.44	665.28a		
S_1	DAP	450.60	539.02	672.72	777.69	610.01a		
	TSP	447.12	530.01	699.36	800.28	619.19a		
S_2	DAP	347.97	421.25	549.27	684.59	500.77abc		
	TSP	347.91	437.87	625.89	733.60	536.32ab		
S_3	DAP	236.61	297.011	392.60	499.08	356.35c		
	TSP	238.18	399.99	526.77	625.35	447.57bc		
Inter. Salinity Level	S_0	478.41e	553.84d	704.48c	866.86a		650.90a	
	S_1	448.86e	534.51d	686.04c	788.98b		614.60b	
Fert. Level	S_2	347.94f	429.56e	587.58d	709.09c		518.54c	
	S_3	237.39g	348.55f	459.68e	562.22d		401.96d	
inter. Fert. Type	DAP	377.34e	452.14e	575.26cd	698.91ab			525.91b
Fert. Level	TSP	378.96e	481.09de	643.64bc	764.67a			567.09a
Fert. Level		378.15d	466.62c	609.45b	731.79a			

Values of mean group compare with each other

Values of the same Symbol at each group showed no Significant Differences using Duncan Test at 5%

were in agreement with those obtained by Khalil(1967)and Almakrebi (2004).

Salinity retard root growth due to the effect of osmotic pressure and nutritional unbalance as well as specific ion toxicities –Addition of phosphate fertilizers boosting root growth and development , which also increasing P-uptake and others nutrients , and plant growth under this condition. From (Table.1) we can find that soil and saline water contains high quantity of soluble magnesium. which means that dicalcium phosphate dihydrate (DCPD) and or dimagnesium phosphate trihydrate (DMPT) formed in soil which having soluble Ca to Mg ratio less than 1.5 when phosphate fertilizer added to calcareous soil(Raz & Soper ,1967).

Bell and Black (1970b) reported that the conversion of DCPD to Octa-Calcium phosphate (less soluble form) was decreased in the presence of access amount of Mg. As mentioned above the availability of phosphorus was increased and positive response of P-fertilizers by sorghum under these condition of hight water soluble Mg .The effect of TSP was resulted in a significant increase in P-uptake(7.8%) compared with DAP fertilizer.

The data of sorghum yield is given in table (4) .it was found that increasing salinity levels resulted in significant decreased in grains yield . The maximum grains yield was 2598 kg.ha^{-1} at S_0 while the lowest yield was 1106 kg.ha^{-1} at S_3 level .The reduction percentage in grains yield was 9.2,33.1 and 57.4% at salinity levels S_1,S_2 and S_3 respectively. Increasing salinity levels from S_1 to S_2 and from S_2 to S_3 , give a reduction value equal to 24% .This results indicate that in each unit increase in salinity of irrigation water above 4.0 ds.m^{-1} caused a reduction in yield by 8% . Froncois etal (1984) mentioned that soil salinity above 6.8 ds.m^{-1} reduced yield by 16% for each unit increase .

Increasing phosphate fertilizer levels in creases significantly grain yield. The increasing in grains yield percentage was 17.7 ,38.4 and 50.2% at level 80.0, 120.0 and 160.0 kg P.ha^{-1} respectively .

Results also showed no significant effect between TSP and DAP on grains yield . Fig(2) shows the effect of both salinity and fertilizer level on grains yield irrespective of fertilizer type was 94% sig=0.0001, and the effect of salinity level was 63.65% while DAP effect was 30.4%.Using TSP fertilizer the effect was 33.96% .These results reflect that using TSP fertilizer decreased the salinity effect by 3.92% on grains yield.

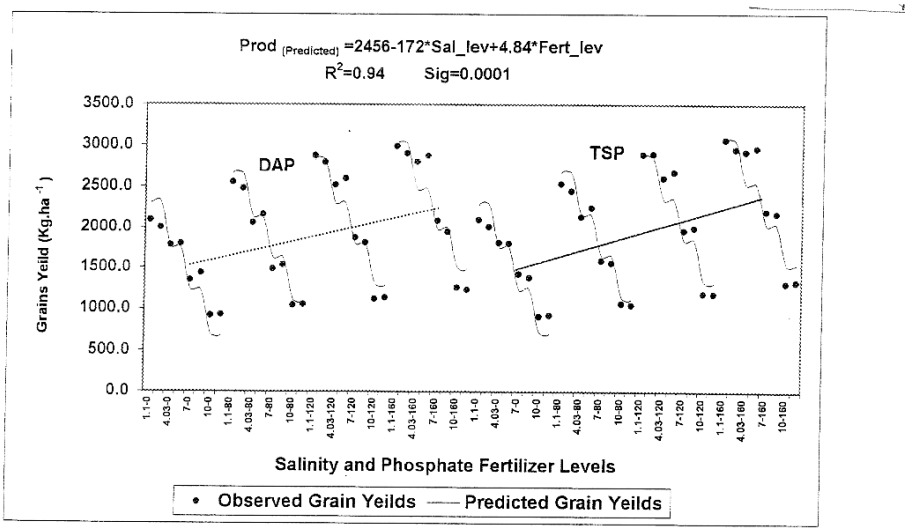


Fig (2) Effect of both Salinity and Fertilizer Levels On Grain Yeilds
By using Stepwise Multiple Linear Regression
Salan Lev Effect=63.65% Fertilizer DAP Effect=30.4 %
Salan Lev Effect=60.04 Fertilizer TSP Effect=33.96 %

Table (4) Effect of Salinity Levels type and level of Phosphate Fertilizers interaction on grain yield(kg.ha^{-1})

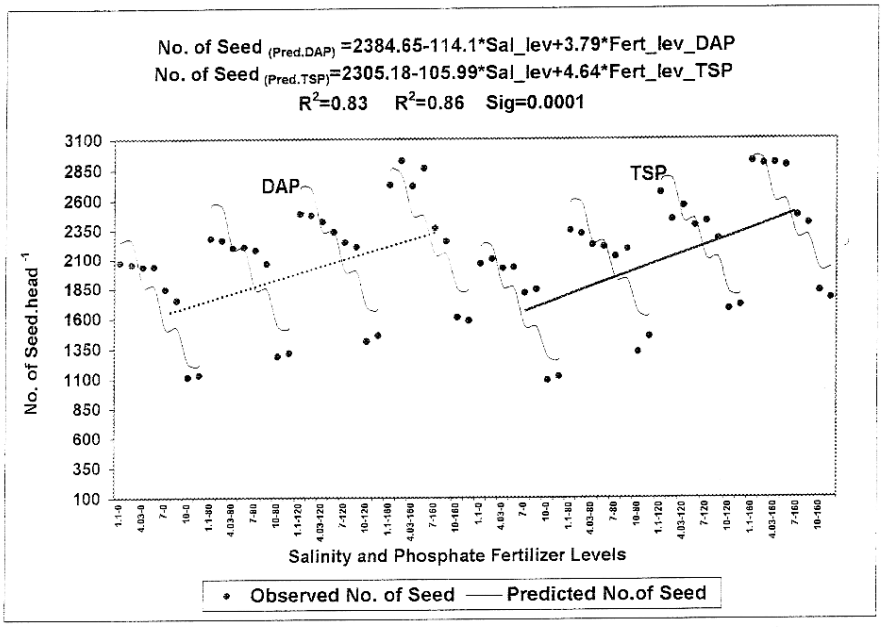
Salinity Level ds.m^{-1}	Fert. Type	Phosphate Fertilizer Levels (Kg P . ha $^{-1}$)				Sal*Fert. Type	Mean of Sal	Mean of Fert.Type
		0.0	80.0	120.0	160.0			
S_0	DAP	2043.0	2513.0	2831.0	2945.0	2583.0a		
	TSP	2033.0	2493.0	2892.0	3021.0	2612.0a		
S_1	DAP	1787.0	2110.0	2558.0	28835.0	2322.0a		
	TSP	1805.0	2191.0	2643.0	2947.0	2396.0a		
S_2	DAP	1392.0	1510.0	1841.6	2017.0	1690.0b		
	TSP	1405.0	1576.0	1982.0	2190.0	1788.0b		
S_3	DAP	924.0	1052.0	1128.0	1250.0	1088.0c		
	TSP	918.0	1060.0	1189.0	1326.0	1123.0c		
Inter. Salinity Level	S_0	2048.0f	2503.0d	2862.0b	2979.0a		2598.0a	
	S_1	1796.0h	2150.0e	2600.0c	2891.0b		2359.0b	
	S_2	1399.0j	1543.0i	1912.0g	2104.0ef		1739.0c	
Fert. Level	S_3	921.0n	1056.0m	1159.0l	1288.0k		1106.0d	
inter. Fert. Type	DAP	1537.0b	1796.0ab	2089.0ab	2262.0ab			1921.0a
Fert. Level	TSP	1545.0b	1830.0ab	2177.0ab	2369.0a			1980.0a
Fert. Level		1541.0d	1813.0c	2133.0b	2315.0a			

Values of mean group compare with each other

Values of the same Symbol at each group showed no Significant Differences using Duncan Test at 5%

Increasing salinity levels were reduced the number of grains head^{-1} (Table 5). The number of grains.head^{-1} parameter exhibited significant decrease at high salinity level ($S_2$and S_3) as compared to S_0 level . This results indicated that increasing salinity level above 4.0 ds.m^{-1} had a negative effect on number of grains.head^{-1} . Maximum number of grains.head^{-1} obtained at salinity level S_0 (2438.0), while the minimum grains.head^{-1} was S_3 level (1426.0). Increasing fertilizer levels caused a significant increase in number of grains.head^{-1}. The percentage of increasing values were 17.70 , 38.4 and 56.2 % at 80.0 ,120.0 and 160.0 kgP.ha^{-1} respectively .TSP was significantly increases the number of grains.head^{-1} compared with DAP fertilizer .This may be due to the acidic behavior of TSP on solubility of some micronutrients such as Fe and Zn which play a major role in flowering and fertilization stages (Mengel & Krikby , 1982) .

The effect of both salinity and DAP fertilizer on the number of grains.head^{-1} was 83% and with TSP was 86% sig=0.0001(Fig3). The effect of salinity was 52.12% while DAP effect was 30.88% .This effect was decreased to 47.1% at using TSP , causing an increasing in number of grains.head^{-1}.



Fig(3) Effect of both Salinity and Fertilizer Levels on No. of Seed .head $^{-1}$
By using Stepwise Multiple Linear Regression
Salanity Lev Effect=52.12% Fertilizer DAP Effect=30.88 %
Salanity Lev Effect=47.1% Fertilizer TSP Effect=38.90 %

Table (5) Effect of Salinity Levels type and level of Phosphate Fertilizers interaction on number of (grains.head^{-1})

Salinity Level ds.m^{-1}	Fert. Type	Phosphate Fertilizer Levels (Kg P . ha $^{-1}$)				Sal*Fert. Type	Mean of Sal	Mean of Fert.Type
		0.0	80.0	120.0	160.0			
S_0	DAP	2060.0	2270.0	2480.0	2825.0	2409.0ab		
	TSP	2080.0	2332.0	2550.0	2905.0	2467.0a		
S_1	DAP	2034.0	2201.0	2378.0	2790.0	2351.0ab		
	TSP	2023.0	2212.0	2469.0	2889.0	2398.0ab		
S_2	DAP	1795.0	2117.0	2225.0	2310.0	2112.0b		
	TSP	1824.0	2152.0	2346.0	2435.0	2189.0ab		
S_3	DAP	1120.0	1300.0	1435.0	1595.0	1362.0c		
	TSP	1100.0	1383.0	1688.0	1791.0	1490.0c		
Inter. Salinity Level	S_0	2070.0g	2301.0ed	2515.0b	2860.0a		2438.0a	
	S_1	2028.0g	2207.0ef	2423.0bc	2840.0a		2375.0a	
	S_2	1809.0h	2135.0fg	2286.0cd	2372.0cd		2151.0b	
Fert. Level	S_3	1110.0l	1341.0k	1562.0j	1693.0i		1426.0c	
inter. Fert. Type	DAP	1752.0c	1972.0bc	2130.0abc	2380.0ab			2058.0b
Fert. Level	TSP	1757.0c	2020.0abc	2263.0ab	2505.0a			2137.0a
Fert. Level		1755.0a	1996.0c	2197.0b	2442.0a			

Values of mean group compare with each other

Values of the same Symbol at each group showed no Significant Differences using Duncan Test at 5%

Increasing salinity levels resulted in a significant decrease on the mean weight of 1000 grain character (Table 6) .The reduction percentage was 5.2 ,21.2 and 41.2% at salinity S_1,S_2 and S_3 respectively. Highest weight of 1000 grains was 24.56 g at salinity S_1, While the minimum was 14.49g at S_3 level . This can be attributed to the negative effect of salinity on nutrients uptake and plant growth .Similar results were obtained by Hummadi (2000).The effect of increasing fertilizer levels was a significant increase in mean weight of 1000grains at 80.0 and

120.0 kgP.ha^{-1} as compared with control ,but there is no significant effect of phosphate fertilizer type on 1000 grains weight.

From above results ,it can be concluded that increasing salinity levels was significantly reduced grain yield. The reduction in the grains yield was mainly due to the decrease in the mean weight of 1000 grains and secondly in the number of grains.head^{-1}. Highest values of plant growth parameter and yield components were obtained by TSP fertilizer in comparison to DAP fertilizer .The effect of salinity also result in a greater reduction in grain yield than in the shoot dry weight and phosphorus uptake .Consequently it is important to recommend to use TSP fertilizer under irrigation with saline water for sorghum production.

Table (6) Effect of Salinity Levels type and level of Phosphate Fertilizers interaction on mean weights of 1000 grain (g)

Salinity Level ds.m^{-1}	Fert. Type	Phosphate Fertilizer Levels (Kg P . ha $^{-1}$)				Sal*Fert. Type	Mean of Sal	Mean of Fert.Type
		0.0	80.0	120.0	160.0			
S_0	DAP	20.80	24.40	26.50	26.51	24.55a		
	TSP	21.10	24.35	26.19	26.63	24.57a		
S_1	DAP	20.24	22.92	25.03	24.46	23.16a		
	TSP	20.68	22.94	25.13	24.95	23.43a		
S_2	DAP	15.32	17.91	21.70	21.86	19.20b		
	TSP	15.47	19.05	21.18	22.66	19.59b		
S_3	DAP	12.56	13.64	14.63	15.40	14.06c		
	TSP	12.49	14.24	15.72	16.90	14.84c		
Inter. Salinity Level	S_0	20.95e	24.37b	26.35a	26.57a		24.56a	
	S_1	20.46e	22.93c	25.08b	24.70b		23.29b	
Fert. Level	S_2	15.39g	14.48f	21.44de	22.26cd		19.39c	
	S_3	12.33i	13.94h	15.17g	16.15g		14.45d	
inter. Fert. Type	DAP	17.23b	19.72ab	21.96ab	22.06ab			20.24a
Fert. Level	TSP	17.43b	20.14ab	22.06ab	22.78a			20.60a
Fert. Level		17.33c	19.93c	22.01a	22.42a			

Values of mean group compare with each other

Values of the same Symbol at each group showed no Significant Differences using Duncan Test at 5%

الخلاصة

تاثير ملوحة مياه الري ومستوى ونوع السماد الفوسفاتي على النمو وحاصل الذرة البيضاء

عبد المجيد تركي المعيني
كلية الزراعة – جامعة تكريت

الخلاصة

نفذت تجربة حقلية للموسم الزراعي 2002م في محطة ابحاث الوحدة –بغداد لدراسة تاثير ملوحة مياه الري ونوع ومستوى السماد الفوسفاتي في النمو وحاصل الذرة البيضاء ، استخدم نوعين من السماد الفوسفاتي هما السوبر فوسفات الثلاثي وفوسفات ثنائي الامونيوم (الداب) وباربعة مستويات لكل منهما (صفر ،80 ،120، 160 كغمP /هكتار) واستعمال المياه المالحة باربعة مستويات هي (1.01 ، 4.0 ، 7.0 ، 10.0 ديسيمينز/م) لتمثل S_3,S_2,S_1,S_0 على التوالي اشارت النتائج الى ان زيادة مستويات ملوحة ماء الري ادت الى انخفاض معنوي في حاصل المادة الجافة والكمية المحتصة من الفسفور وحاصل الحبوب ادى استخدام سماد السوبر فوسفات الى خفض تاثير الملوحة على حاصل المادة الجافة بمقدار 20% مقارنة بسماد الداب وان زيادة مستويات التسميد الفوسفاتي ادت الى زيادة في صفات النمو والحاصل على الرغم من المحتوى العالي من الفسفور الجاهز ، وكان تاثير سماد السوبر فوسفات اكبر من سماد الداب على الصفات المدروسة ، اظهرت النتائج الى ان زيادة مستويات ملوحة ماء الري اكثر من $4.0ds-m^{-1}$ ادت الى خفض حاصل الحبوب بنسبة 8% عند زيادة الملوحة وحدة واحدة ، كان تاثير الملوحة اكبر على حاصل الحبوب مقارنة بحاصل المادة الجافة والكمية الممتصة من الفسفور ، وان انخفاض حاصل الحبوب كان يعود بالدرجة الاساسية الى انخفاض وزن 1000حبة والى عدد البذور / راس بالدرجة الثانية.

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