

تأثير الملوحة ونسبة ادمصاص الصود يوم في مياه
الرى على محصول اصناف مختلفه من القطن
المصري

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درس تأثير الملوحة الكلية بتركيزات ٢٠٠٠، ٤٢٠٠٠، ٤٦٠٠٠، ٨٠٠٠ جزء في المليون \times ٣ مستويات من نسبة ادمصاص الصود يوم المعدله على ٧ اصناف من القطن المصري في تجريبه اصص اجريت في الفيوم وعلى صنفين في تجربة ليسيمترات اجريت في الاسكندريه. وشملت التجربه الاخيره نوعين من الاراضى مختلفه القوام. وقد ر محمول القطن الزهر والحطب ونسبة الشعر الناتج من كل معامله .

ويستدل من النتائج ان محصول القطن الزهر كان يتناقص الى ٦٠٪ بزياده ملوحة مياه الرى من ٢٠٠ الى ٨٠٠٠ جزء في المليون كما كان يتناقص الى ٨٠٪ بزياده نسبة ادمصاص الصود يوم المعدله من ١٠ الى ٣٠ وكان التناقص في المحصول بتأثير الملوحة يتزايد بزيادة نسبة ادمصاص الصود يوم المعدله . وكان اغلب الاصناف (ويصفه خاصه جيژه ٨٠) لا تتأثر سلبيا بالملوحة حتى ٤٠٠٠ جزء في المليون . وكانت قوة النمو الخضري لا تمثل دليلا على تحمل محصول القطن للملوحة . وكانت نسبة تصافي الحليج تزداد قليلا جدا بزيادة الملوحة ونسبة ادمصاص الصود يوم في مياه الرى .

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EFFECT OF SALINITY AND SODIUM ADSORPTION RATIO OF
IRRIGATION WATER ON DIFFERENT VARIETIES OF EGYPTIAN
COTTON.

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Total salinity of irrigation water i.e. 200, 2000, 4000, 6000 and 8000 ppm X3 levels of adjusted SAR were tried on 7 varieties of Egyptian cotton in spot experiment at El Fayoum and on 2 varieties in a lysimeter experiment at Alexandria. The latter experiment comprised 2 soils of different texture. Seed cotton yield, stalks and lint percentage were taken as criteria.

Statistical analysis revealed moderate depression of yield as salinity and SAR increased depending on variety and soil. Vegetative growth was more sensitive to treatments than seed cotton yield than lint percentage.

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SUMMARY

Total salinity of irrigation water i.e. 200, 2000, 4000, 6000 and 8000 ppm X3 levels of adjusted SAR were tried on 7 varieties of Egyptian cotton in a pot experiment at El Fayoum and on 2 varieties in a lysimeter experiment at Alexandria. The latter experiment comprised 2 soils of different texture. Seed cotton yield, stalks and lint percentage were taken as criteria.

Seed cotton yield was reduced to 60% by raising the salinity of irrigation water from 200 to 8000 ppm and to 80% by raising adjusted SAR from 10 to 30. Reduction due to salinity was increased as adj. SAR increased. Most varieties, especially Giza 80, were not negatively affected by salinities up to 4000 ppm. Vegetative vigour was found not always indicative of yield tolerance. Lint percent was improved very slightly by increasing both salinity and adj. SAR in irrigation water.

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INTRODUCTION

Good quality resources of water for irrigation, reclamation and development of new areas are usually lacking in arid and semi-arid regions. Low quality water supplies such as drainage or ground waters need adequate evaluation to obtain economic crop production (Allison 1954, Barakat et al 1973 and Ayers 1975). Suitability for irrigation purposes is based mainly on its contents of soluble salts, the ratio of sodium to the sum of both calcium and magnesium, its content of soluble carbonate relative to calcium plus magnesium and occurrence of boron in toxic concentrations (Richards 1954, Wilcox 1955, Kelly 1962; Rhoades 1972 and Ayers and Westcot 1976).

In Egypt, drainage waters are considered second resource for irrigation on conditions involving soil texture, quantity of water used, drainage system and salt tolerance of crops. Large deviations of these conditions had been reported to affect the safety of water use (Kaddah 1954, Kaddah and Barakat 1963 and Ismail et al 1978).

Tolerance of crops to salinity differ according to species, variety and the environmental conditions (Hayward and Wadleigh 1949, Balba 1962 and Ayers and Westcot 1976). El Sheik (1961), Barakat et al (1971) and Mohamed et al (1978) studied the tolerance of some Egyptian cotton varieties to salinity and rate them as moderately high tolerant but they differ in this respect.

One million feddans is annually cultivated to Egyptian cotton varieties. Of these varieties Giza 45, Giza 69, Giza

70, Giza 75, Giza 76, Giza 77 and Giza 80 that occupied 17239, 100906, 222551, 529941, 3362, 26096 and 7468 feddans respectively during the season of 1982 (The Egyptian cotton Gazette 1983).

The present work aims to study the interaction effect of salinity and adjusted sodium adsorption ratio on these varieties.

MATERIALS AND METHODS

Two experiments were carried out to find out the effect of total salinity and adjusted sodium adsorption ratio in irrigation water on the yield of several local varieties of cotton (*Gossypium barbadense*). One experiment was at El Fayoum Faculty of Agriculture and the other at the soil Salinity and Alkalinity Laboratory of Alexandria.

The El Fayoum experiment was in pots 33 cm. height X 27 cm. diameter containing a surface clay soil taken from the faculty farm and that of Alexandria in lysimeters of area, 150X75 cm² X50 cm. height containing a surface sandy loam soil taken from Abis and a surface clay soil taken from nearby Kafr El Dawar. Characteristics of the soils as determined according to Black et al (1965) were as follows:

Soil characteristics	Soil site		
	El Fayoum	Abis	Kāfr El Dawar
Coarse sand, %	3.4	55.7	23.1
Fine sand, %	21.6	20.0	10.2
Silt, %	33.6	10.5	24.5
Clay, %	41.4	13.6	42.2
Field capacity, %	47.6	23.4	43.2
EC _e mmhos/cm at 25 C	1.37	1.9	2.4
pH _e	7.9	7.9	7.8
Organic matter, %	1.45	1.15	1.68
Cation exchange capacity, me./100 g. soil	36.5	18.4	37.7
Exchangeable sodium, %	6.4	6.9	11.2

The experimental design in pots was 7 cotton varieties (Giza 45, 69, 70, 75, 76, 77 and 80) X 5 total salinity levels in irrigation water (≠ 200 (control), 2000, 4000, 6000 and 8000 ppm) X 3 adjusted sodium adsorption ratios in irrigation water (10, 20 and 30) X 4 replicates. That in lysimeters was 2 cotton varieties (Giza 69 and 70) X 2 soils X the same total salinity and adj. SAR treatments of irrigation water as above X 4 replicates.

Sowing took place on 4/3/1983 at a rate of 3 pairs of plants/pot and that of lysimeters on 14/3/1982 at a rate of 10 pairs of plants/lysimeter (5/ each of the two varieties). Plants of both experiments received superphosphate, potassium sulphate and urea fertilizers at a rate of 150, 100 and 150 Kg./feddan.

The calculated pH values (pH_c) of the irrigation water treatments were adjusted at a value of 8.4 to maintain calcium ions of the soil system without dissolving or precipitating throughout irrigations (Ayers and Westcot, 1976). The amount of irrigation included leaching requirement in order to avoid salt accumulation during growth season.

Harvest took place on 15/9/1983 for the pots and on 29/9/1982 for lysimeters. At harvest, weight of seed cotton and stalks were reported and lint percentage determined.

RESULTS AND DISCUSSIONS

Effect of main variables:

This is shown in table 1 for the pot experiment of El Fayoum and in Table 2 for the Alexandria lysimeter experiment.

Salinity:

On average of the 7 varieties X 3 adj. SAR for the pot experiment and average of 2 varieties X 3 adj. SAR X 2 soils for the lysimeter experiment, seed cotton yield was depressed nearly to the same extent (60 and 56% respectively of the control yield) by a salinity of 8000 ppm in irrigation water. Vegetative vigour represented by stalks weight was depressed likewise. At a salinity of 4000 ppm in irrigation water which is above the mean salinity of most drainage waters in Egypt (Kaddah and Barakat 1963 and Ismail et al 1978), the reduction in yield proved nonsignificant. For lint percentage, it improved very slightly but consistently with increasing salinity in irrigation water in confirmation of previous works (Barakat et al 1971 and Mohamed et al 1978).

Adjusted sodium adsorption ratio:

On average variety and salinity for the pot experiment and average variety, salinity and soil for the lysimeter experiment; increase in adj. SAR resulted in about 20% reduction in both vegetative vigour and seed cotton yield for both experiments. This may be attributed to subsequent deterioration in physical properties of the soil upon irrigation with such waters (Ayers and Westcot 1976). Lint percent improved also slightly as with increasing salinity.

Table 1: Mean value of stalks, seed cotton and lint percent of cotton plant as affected by salinity and adjusted SAR of irrigation water and variety. "Pot experiment".

Variable	Stalks g./plant	Seed cotton g./plant	Lint %
<u>Salinity (ppm) in⁽¹⁾ irrigation water:</u>			
200	37.4	15.4	35.1
2000	35.2	14.9	35.4
4000	32.6	14.3	35.7
6000	27.5	12.0	35.9
8000	22.4	9.3	36.5
L.S.D 0.05	1.32	1.04	0.96
<u>Adjusted SAR in⁽²⁾ irrigation water:</u>			
10	33.2	14.2	35.5
20	29.2	12.5	35.8
30	26.2	11.1	36.4
L.S.D 0.05	1.12	0.95	0.80
<u>Variety:⁽³⁾</u>			
Giza 45	25.6	11.5	35.9
Giza 69	32.2	13.6	35.7
Giza 70	27.7	11.8	35.7
Giza 75	33.4	13.8	35.8
Giza 76	30.5	13.1	35.9
Giza 77	33.4	14.4	36.1
Giza 80	27.3	11.6	35.8
L.S.D 0.05	1.85	1.08	n.s

(1) Each value is a mean of 7 varieties X 3 SAR X 4 replicates X 6 plants.

(2) Each value is a mean of 7 varieties X 5 salinity X 4 replicates X 6 plants.

(3) Each value is a mean of 5 salinity X 3 SAR X 4 replicates X 6 plants.

Table 2: Mean value of stalks, seed cotton and lint percent of cotton plant as affected by soil, variety and irrigation water salinity and adjusted SAR. "Lysimeter experiment".

Variable	Stalks g./plant	Seed cotton g./plant	Lint %
<u>Salinity (ppm) in⁽¹⁾ irrigation water:</u>			
200	49.8	21.4	35.2
2000	46.3	21.0	35.6
4000	45.6	21.7	35.7
6000	39.4	16.4	36.3
8000	29.7	12.0	36.7
L.S.D 0.05	2.4	1.35	0.88
<u>Adjusted SAR in⁽²⁾ irrigation water:</u>			
10	45.3	20.3	35.5
20	40.2	17.8	36.0
30	36.3	15.5	36.6
L.S.D 0.05	2.1	1.08	0.88
<u>Soil:⁽³⁾</u>			
Sandy loam	35.7	16.6	36.0
Clay	46.2	19.6	36.1
L.S.D 0.05	1.8	1.00	n.d
<u>Variety:⁽⁴⁾</u>			
Giza 69	44.1	19.2	36.0
Giza 70	37.8	16.9	36.0
L.S.D 0.05	1.8	1.0	n.d

- (1) Each value is a mean of 3 SAR X 2 soils X 2 varieties X 4 replicates X 10 plants.
- (2) Each value is a mean of 5 salinity X 2 soils X 2 varieties X 4 replicates X 10 plants.
- (3) Each value is a mean of 5 salinity X 3 SAR X 2 varieties X 4 replicates X 10 plants.
- (4) Each value is a mean of 5 salinity X 3 SAR X 2 soils X 4 replicates X 10 plants.

Variety:

On average salinity and adj. SAR treatments for the pot experiment and average salinity, adj. SAR and soil for the lysimeter experiment; different varieties gave different yields, being for the pot experiment Giza 75 = Giza 77 > Giza 69 = Giza 76 > Giza 80 = Giza 70 > Giza 45 and for the lysimeters Giza 69 > Giza 70. Lint percentage, however, was almost equal for all experimental varieties.

Soil:

On average salinity, adjusted SAR and varieties for the lysimeter experiment, the clay soil showed higher yields of stalks and seed cotton being 129 and 118% of that of the sandy loam respectively.

Interaction effects:

Only significant effects of appreciable magnitude are considered here and graphically represented:

Variety X Salinity:

This interaction effect on both seed cotton yield and stalks proved to be significant. Figure 1a and b show their relative values respectively at different salinity of irrigation water for the pot experiment. For the lysimeter experiment, this effect was not significant and therefore not shown. The two varieties Giza 69 and Giza 70 used in the lysimeter showed the same trend in the pot experiment as appears from the figures. With respect to seed cotton yield it is quite obvious from figure 1a that Giza 80 outyielded all other varieties, which

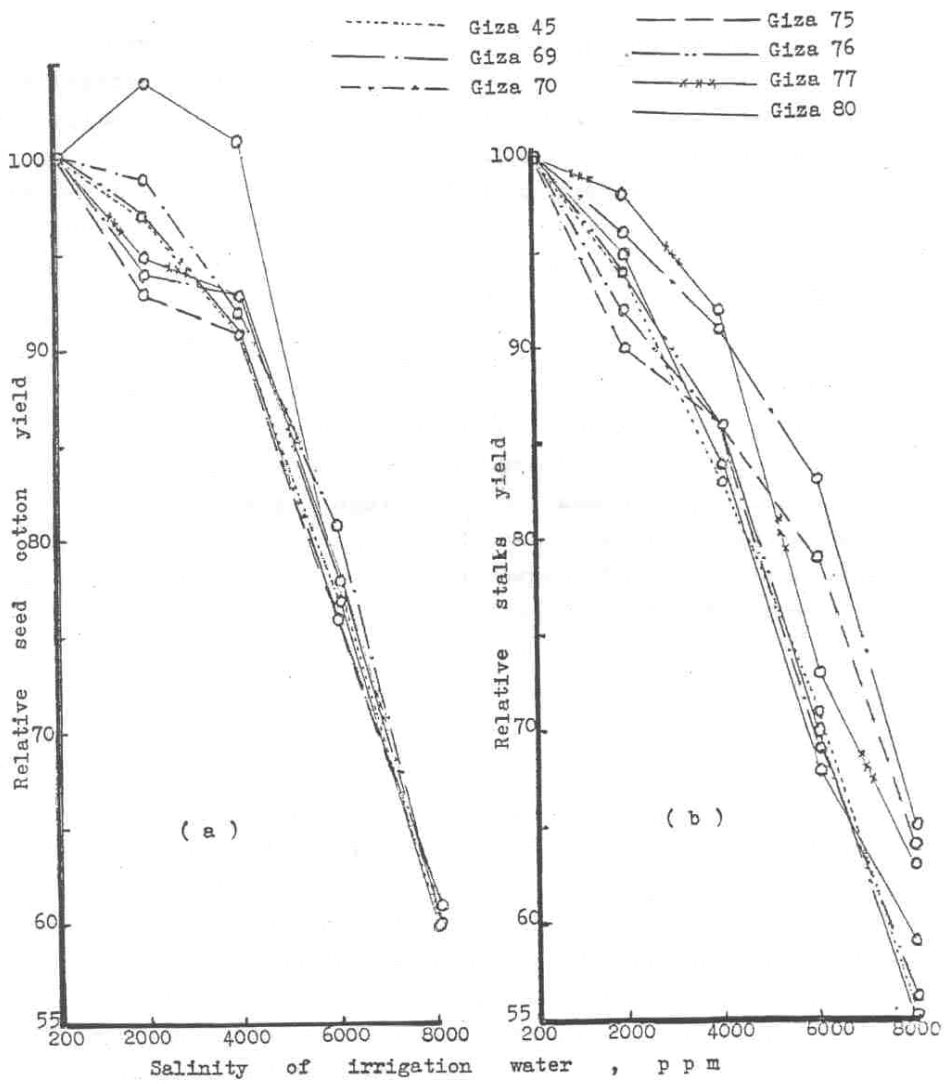


Figure 1 : Relative seed cotton and stalks yield of cotton plant as affected by salinity of irrigation water and cotton variety. "Pot experiment".

behaved more or less the same at salinities up to 4000 ppm in irrigation water but even exceeded that of the control. This situation was not the same with stalks. As shown in Figure 1a, Giza 69 shared Giza 80 in this respect for salinity up to 4000 ppm but exceeded it at higher salinities. This would lead to the conclusion that vegetative vigour is not always indicative of productivity as salinity effect is concerned (Barakat et al, 1970).

Variety X adj. SAR:

This interaction also proved to produce significant effect on both seed cotton yield and stalks as shown in figures 2a and b respectively. Again Giza 80, and perhaps also Giza 70, showed higher tolerance to adjusted SAR in irrigation water than the other varieties with respect to seed cotton yield (Fig. 2a). With stalks, Giza 69 and Giza 80 showed the higher tolerance, the same phenomenon reported for salinity.

Salinity X adj. SAR:

This interaction effect on both seed cotton yield and stalks for both pot and lysimeter experiment was highly significant. Results of only the pot experiment are represented here in figures 3a and b respectively as those of the lysimeter experiment is very nearly the same. From figure 3a and b, it is clear that as salinity increased adj. SAR had more depressive effect on both seed cotton yield and stalks almost equally. This agree with previous investigations of Richards (1954) and Ayers and Westcot (1976).

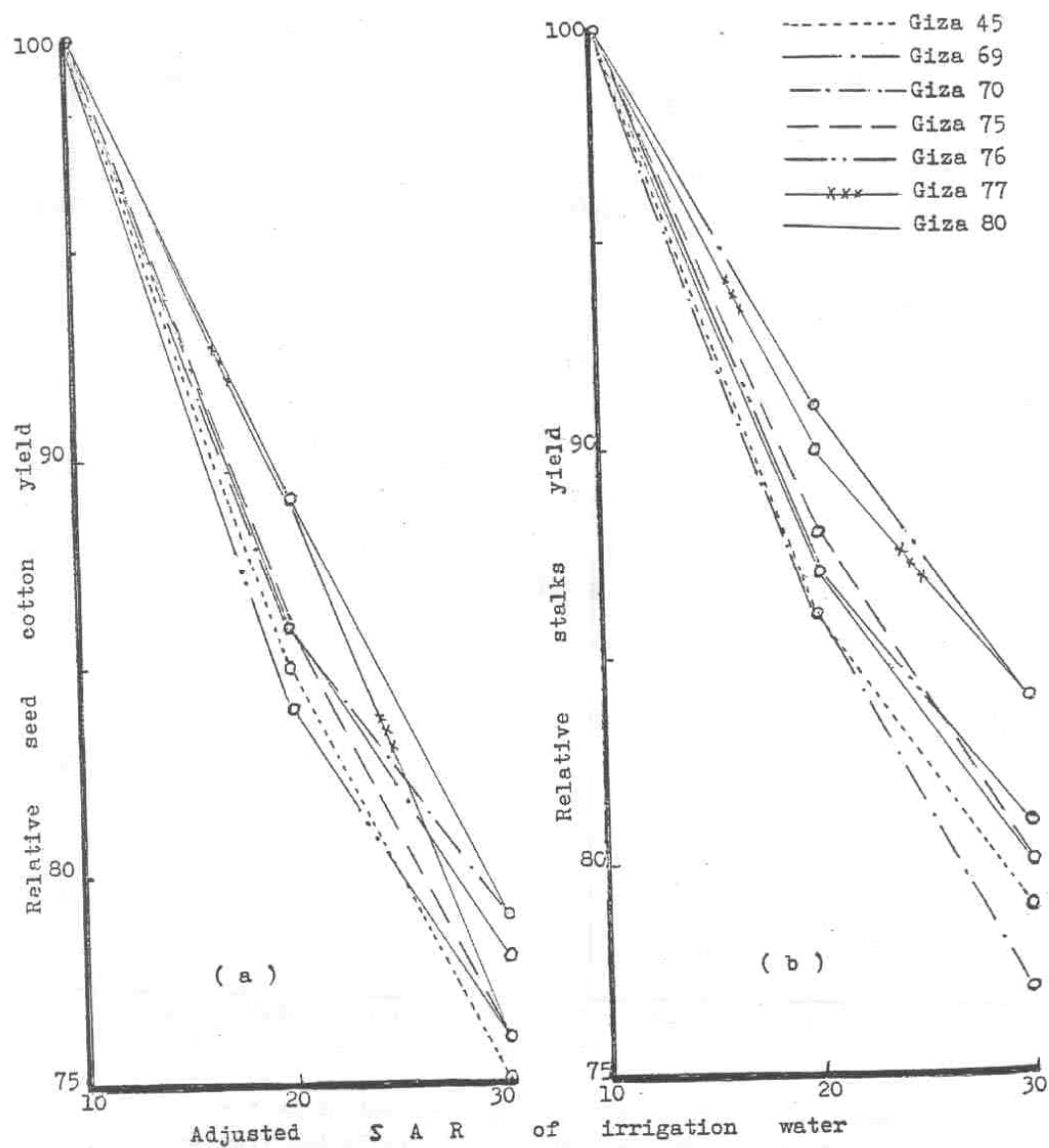


Figure 2 : Relative seed cotton and stalks yield of cotton plant as affected by adj. SAR of irrigation water and cotton variety. "Pot experiment"

تثبيت الازوت والامتصاص الكلي للفوسفور والبوتاسيوم والماء
في الغول البلدى تحت تأثير صفيوط ملحية

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زرع الغول البلدى صنف جيزة ٢ فى تجربة اصص على مزرعة رملية باستخدام محلول مغذى خالى من الازوت ومذاب فيه كميات مختلفة من الاملاح حتى + ٦٠٠٠ جزء فى المليون . وقد قدر عدد العقد الجذرية ونشاط انزيم النيتروجينيز ومحتويات النبات من النيتروجين والفوسفور والبوتاسيوم مرتين خلال موسم النمو وعند النضج . وقد ر المحصول وحسب ماء النتج .

وقد دلت النتائج على أنه بزيادة الملوحة فى الوسط الغذائى انخفضت جميع هذه الخواص المختبرة بالنسبة للنبات ولكن بالنسبة للعقدة الجذرية الواحدة زاد وزنها الجاف ونشاط انزيم النيتروجينيز فى تثبيت الازوت مع تقدم العمر . كما ان النسبة المئوية للفوسفور والبوتاسيوم لم تتأثر كثيرا بزيادة الملوحة . وكان ٢٥ ٤٥٠ ٧٥ ٪ من المحصول القياسى ينقص بازد ياد ملوحة الوسط الى ١٨٠٠ ٣٨٠٠ ٧٠٠٠ جزء فى المليون . وكانت كمية المياه المستعملة لانتاج وحده جافة من النبات تتناقص بازد ياد الملوحة .

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