Response of Growth and Yield of Tall-Straw Wheat (*Triticum aestivum* L.) to Salinized Water Irrigation and Cycocel (CCC)

F. A. SOROUR, M. ASSEED, AND Y. M. GAJEM[1]

ABSTRACT

The effect of irrigation with salinized water and cycocel application on seedling emergence, growth, yield, and yield components of the tall-straw wheat cultivar 'Florence Aurora' was studied under the greenhouse conditions (at the Faculty of Agriculture, Alfateh University, Tripoli, Libya in 1974–1975).

Seedling emergence was delayed by increasing the salinity level one week after sowing. However, after ten days from sowing the seedling emergence percentages were comparable for the different treatments. The low and medium salinity levels (3,000 and 6,000 ppm) exerted a supressing effect on seedling emergence for the rest of germination period. On the other hand, the highest salinity level (9,000 ppm) resulted in a stimulating effect, since it gave the maximum seedling emergence percentage. This stimulating effect might be caused by the positive effect of high salinity which increased the seed viability and/or controlled the soil microorganisms that attack the germinating seeds and occasionally cause their failure to emerge above the soil surface. At harvest, plant height, spike length, tillering and grain weight per spike were decreased by both increasing the salinity level and spraying the plants with cycocel. On the other hand, while the total yield, grain yield, number of spikes and number of grains per plant were decreased by increasing salinity, they were not significantly affected by the cycocel treatment.

Straw yield per plant was increased by increasing the salinity level. However, it was unaffected by the cycocel treatment.

INTRODUCTION

Cereal crops were reported to be responsive to treatment with the growth regulant cycocel (CCC) under various conditions (5,6,7,8,9). The tall-straw wheat cultivar, Florence Aurora, was significantly shortened by cycocel treatment (5). In a previous study carried on the semi-dwarf wheat cultivar 'Sidi Misri 1', Asseed *et al.* (1) indicated that cycocel application significantly reduced plant height without any obvious effect on grain yield and yield components.

High resistance of wheat plants to drought and soil salinity due to cycocel treatment

[1] *Faculty of Agriculture, University of Alfateh, Tripoli, Libya.*

has been reported (2,3,8). However, El Kobbia *et al.* (4) claimed that growth and yield of wheat plants were not affected by salinity level up to 20,000 ppm.

Seedling emergence was delayed by increasing salinity, whereas the grain yield per plant and the other yield components were increased with the increase of salt concentration in irrigation water up to 6,000 ppm in case of Sidi Misri 1 wheat cultivar (1).

The present investigation was conducted to study the combined effect of different salinity levels of irrigation water and cycocel spray on the tall-straw wheat cultivar, Florence Aurora, under the greenhouse conditions.

MATERIALS AND METHODS

A pot experiment was conducted in the greenhouse at the Faculty of Agriculture Farm, Alfateh University, in 1974–1975, to study the effect of three salinity levels of irrigation water and two levels of cycocel on the growth and yield of the tall-straw wheat cultivar, Florence Aurora (*Triticum aestivum* L.).

Ten grains of wheat were planted per pot on November 16, 1974. Standard pots 28 cm deep and 25 cm wide with drainage facilities were filled with dried and sieved soil from the surface horizon of the Faculty Farm. The soil was found to contain 69.1% sand, 19.2% silt, 10.1% clay and 7.44% calcium carbonate. The initial salt content of soil amounted to 0.41 mmhos/cm for 1:1 soil extract.

The experiment consisted of two levels of cycocel; namely, 0.0 and 1.5 kg a.i. CCC/ha and four salinity treatments in the form of pure tap water, 3,000 ppm, 6,000 ppm and 9,000 ppm of 1:1 NaCl and $CaCl_2$. A randomized complete design with four replicates was followed. Plants were thinned to four per pot. Ten grams per pot of a compound fertilizer (12N-24P-12K) was added in two splits at 45 and 100 days after planting. Cycocel was sprayed when the plants were six weeks old.

The pots were irrigated to the field capacity with pure tap water or artificially salinized water whenever the tensiometer placed in the rootzone reached 25–30 centibars tension.

Seedling emergence percentage was determined at three-day intervals seven days after planting until constant count was reached at the end of the germination period.

RESULTS AND DISCUSSION

I. Plant growth

In general, it was noticed that the seedling emergence percentage, as indicated in Table 1 and Figure 1, was delayed at the first count (one week following sowing) due to

Table 1 Effect of salinity level on seedling emergence percentage of wheat.

	Days after sowing				
Salinity level	7	10	13	16	19
Control	46	54	56	58	60
3000 ppm	41	49	53	55	55
6000 ppm	45	53	55	56	56
9000 ppm	36	54	61	64	65

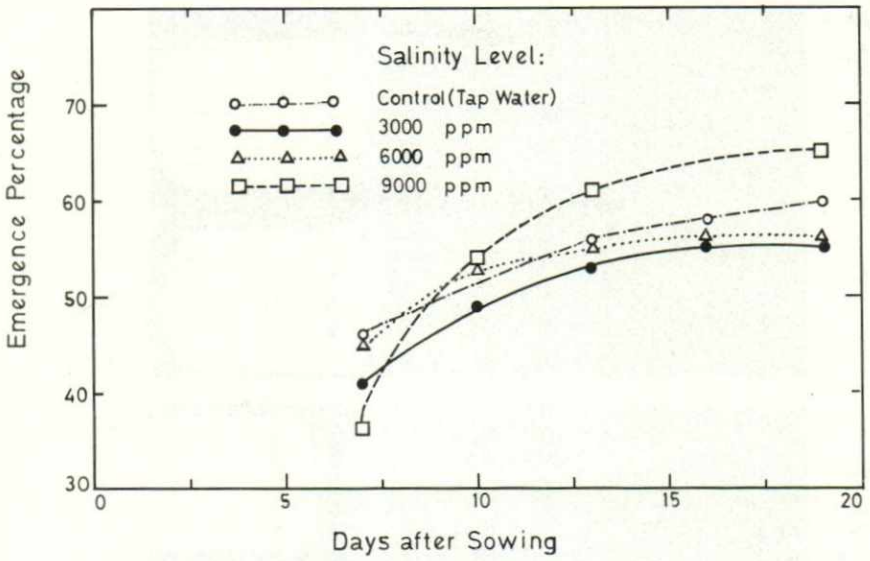

Fig. 1. Effect of salinity level on seedling emergence percentage.

the increase in salinity level. However, the seedling percentages were comparable for the different treatments ten days after sowing. For the rest of the emergence period, the low and medium salinity levels (3,000 and 6,000 ppm) gave lower emergence percentages than the control. It is interesting to note that the highest salinity level (9,000 ppm) gave the highest emergence percentage (65% after nineteen days from sowing), indicating a stimulating effect on seedling emergence. This might be attributed to either a seed disinfecting action caused by high salinity in the medium against soil microorganisms attacking the germinating seeds, or an improvement in seed viability causing better germination and high seedling emergence percentage.

The effect of salinity level and cycocel treatment on plant height is shown in Table 2 and Figure 2. This height, at harvest time, was highly significantly reduced due to the increase in salinity level and cycocel treatment.

Table 2 Effect of salinity level and cycocel spray on plant height at harvest (cm).

	Salinity level				
Cycocel	Control	3000 ppm	6000 ppm	9000 ppm	Mean[a]
Treated	94.6	82.5	65.1	54.1	74.1
Untreated	127.6	119.5	80.3	65.6	98.3
Mean[b]	111.1	101.0	72.7	59.9	—

[a] L.S.D. for cycocel spray: (0.05) = 2.3 & (0.01) = 3.1 cm.
[b] L.S.D. for salinity level: (0.05) = 3.3 & (0.01) = 4.4 cm.

Spike length was similarly reduced by both the increase in salinity level and cycocel spray. The differences were highly significant (Table 3). The results obtained with the effect of salinity level and cycocel treatment on plant height and spike length were in close agreement with the previous reports (1,6).

Fig. 2. Response of tall-straw wheat to salinity level with and without CCC treatment: (a) control: (b) 3,000 ppm; (c) 6,000 ppm and (d) 9,000 ppm.

Table 3 Effect of salinity level and cycocel spray on spike length (cm).

	Salinity level				
Cycocel	Control	3000 ppm	6000 ppm	9000 ppm	Mean[a]
Treated	10.40	8.25	6.90	6.00	7.88
Untreated	11.25	9.25	8.25	6.40	8.72
Mean[b]	10.81	8.75	7.56	6.06	—

[a] L.S.D. for cycocel spray: (0.05) = 0.38 & (0.01) = 0.52 cm.
[b] L.S.D. for salinity level: (0.05) = 0.54 & (0.01) = 0.73 cm.

The data of Table 4 indicated that tillering was significantly decreased by increasing the salinity level and spraying the plants with cycocel.

Table 4 Effect of salinity level and cycocel spray on number of tillers per plant.

	Salinity level				
Cycocel	Control	3000 ppm	6000 ppm	9000 ppm	Mean[a]
Treated	5.00	3.75	3.00	1.75	3.38
Untreated	3.75	3.00	2.75	1.00	2.63
Mean[b]	4.38	3.38	2.88	1.38	—

[a] L.S.D. for cycocel spray: (0.05) = 0.53 & (0.01) = 0.72 tiller/plant.
[b] L.S.D. for salinity level: (0.05) = 0.75 & (0.01) = 1.02 tiller/plant.

While the number of spikes per plant was highly significantly decreased by increasing the salinity level, it was not significantly affected by the cycocel treatment (Table 5).

Table 5 Effect of salinity level and cycocel spray on number of spikes per plant.

	Salinity level				
Cycocel	Control	3000 ppm	6000 ppm	9000 ppm	Mean
Treated	3.75	3.00	2.25	1.25	2.56
Untreated	3.25	2.75	2.75	1.00	2.44
Mean[a]	3.50	2.88	2.50	1.13	—

[a] L.S.D. for salinity level: (0.05) = 0.88 & (0.01) = 1.19 spike/plant.

Table 6 Effect of salinity level and cycocel spray on total yield (grain plus straw) per plant (g).

	Salinity level				
Cycocel	Control	3000 ppm	6000 ppm	9000 ppm	Mean
Treated	14.42	7.31	5.25	2.24	7.31
Untreated	10.68	9.92	7.71	1.50	7.46
Mean[a]	12.56	8.62	6.48	1.87	—

[a] L.S.D. for salinity level: (0.05) = 3.26 & (0.01) = 4.43 g.

Table 7 Effect of salinity level and cycocel spray on grain yield per plant (g).

	Salinity level				
Cycocel	Control	3000 ppm	6000 ppm	9000 ppm	Mean
Treated	5.90	3.42	2.50	0.75	3.16
Untreated	4.25	3.20	2.55	0.50	2.63
Mean[a]	5.08	3.31	2.53	0.66	—

[a] L.S.D. for salinity level: (0.05) = 1.33 & (0.01) = 1.81 g.

II. Yield and yield components

Results presented in Tables 6 and 7 show that both the total yield (grain plus straw) and grain yield per plant were similarly affected by the salinity level and cycocel treatment. They were highly significantly decreased by increasing the salinity level and were not significantly affected by the cycocel treatment. Comparing these results with those reported on the short-straw wheat cultivar 'Sidi Misri 1' under the same conditions (1), it can be stated that although cycocel had the same effect on both short and tall-straw wheat cultivars, they were affected differently with salinity. So, in the case of the short-straw cultivar, the increase in salinity increased the grain yield per plant and reduced the total yield per plant. However, in the case of the tall-straw cultivar, both the total and grain yield per plant were significantly decreased by increasing the salinity level.

Straw yield per plant was highly significantly increased by increasing the salinity level. On the other hand, it was not affected by the cycocel treatment (Table 8).

Table 8 Effect of salinity level and cycocel spray on straw yield per plant (g).

	Salinity level				
Cycocel	Control	3000 ppm	6000 ppm	9000 ppm	Mean
Treated	8.52	3.89	2.75	1.41	4.14
Untreated	6.44	6.72	5.16	1.00	4.83
Mean[a]	7.48	5.31	3.96	1.21	—

[a] L.S.D. for salinity level: (0.05) = 2.29 & (0.01) = 3.11 g.

Table 9 Effect of salinity level and cycocel spray on number of grains per plant.

	Salinity level				
Cycocel	Control	3000 ppm	6000 ppm	9000 ppm	Mean
Treated	138.00	90.25	59.75	24.00	78.06
Untreated	92.50	71.00	58.25	16.25	59.50
Mean[a]	112.88	80.63	59.00	20.13	—

[a] L.S.D. for salinity level: (0.05) = 28.88 & (0.01) = 39.3 grains//plant.

The number of grains per plant, as indicated in Table 9, was not significantly affected by the cycocel treatment. However, it was decreased by increasing the salinity level. The highest and lowest mean numbers of grains per plant were those of the control (112.88) and the 9,000 ppm level (20.13), respectively.

The grain weight per spike was significantly decreased by the increase in salinity level and by the cycocel spray (Table 10).

Table 10 Effect of salinity level and cycocel spray on spike weight (g).

	Salinity level				
Cycocel	Control	3000 ppm	6000 ppm	9000 ppm	Mean[a]
Treated	1.60	1.15	1.10	0.67	1.13
Untreated	1.30	1.15	0.93	0.50	0.96
Mean[b]	1.44	1.15	1.01	0.59	—

[a] L.S.D. for cycocel spray: (0.05) = 0.14 g.
[b] L.S.D. for salinity level: (0.05) = 0.21 & (0.01) = 0.28 g.

The results in Table 11 indicate that the number of grains per spike was significantly affected by both the salinity level and the cycocel treatment. Significant reduction in this number was obtained with the cycocel treatment. On the other hand, the number of grains per spike was not significantly affected by the increase in salinity level up to 3,000 ppm, but it was highly significantly decreased by further increase in salinity up to 9,000 ppm.

Table 11 Effect of salinity level and cycocel spray on number of grains per spike.

	Salinity level				
Cycocel	Control	3000 ppm	6000 ppm	9000 ppm	Mean[a]
Treated	37.50	30.25	17.25	19.75	26.69
Untreated	28.75	26.50	21.75	16.25	23.31
Mean[b]	33.13	28.38	24.50	18.00	—

[a] L.S.D. for cycocel spray: (0.05) = 3.63 grains/spike.
[b] L.S.D. for salinity level: (0.05) = 5.13 & (0.01) = 6.92 grains/spike.

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