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INFLUENCE OF (2–CHLOROETHYL)–TRIMETHYL AMMONIUM CHLORIDE (CCC) ON THE GROWTH AND DEVELOPMENT OF WHEAT

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The effects of (2–Chloroethyl)–trimethyl ammonium chloride on growth, development and yield aspects were investigated at the University of Agriculture, Faisalabad.

The seeds of wheat variety C–591 were soaked in 0, 600, 1000 and 1400 parts per million solution of cycocel for 24 hr. Cyeocel trratment decreased plant height, shoot dry weight and shoot per root ratio. Increase in the concentration of cycocel increased the dry weight of shoot, while shoot/root ratio decreased significantly in 1000 and 1400 ppm as compared to control. Cycocel increased the root length significantly. The root dry weight was increased significantly only in 1000 ppm cycocel treated plants as compared to control. The leaf area was uneffected by the treatment. The number of tillers, length of spikes, number of spikelets and number of kernels were increased significantly by the application of 1000 ppm cycocel. The grain yield was significantly increased by all the three concentrations of cycocel used as compared to control. There was 45.4 % increase in grain yield in 1000 ppm treated plants whereas the increase recorded in 600 and 1400 ppm treated plants was 28.9 and 23.4 % respectively. The grain yield of 932.01 g was observed in control.

INTRODUCTION

Wheat *(Triticum aestivum)* is a temperate region crop, but is now under cultivation in all climatic zones except the tropics. It is grown for direct human consumption. The use of plant growth regulators develop a new population of economic merit. These substances are becoming increasingly important in the field of agriculture. Cycocel, chemically known as (2–Chloroethyl)–trimethyl ammonium chloride and abbreviated as CCC was first introduced by Tolbert[1]. Cycocel treatment induces dwarfness and drought and salt resistance to some extent. However, the physiological function of various plant growth regulators may be entirely different. Cycocel is usually applied to crop plants as foliar spray but has also been used as seed dressing[2]. Cycocel decreases the plant height[3,4,5]. Increases root length[6]; decreases shoot dry weight[7,8] and increases the number of tillers, length of spikes, number of spikelets, number of kernels and total grain yeild[5,6,9,10].

MATERIALS AND METHODS

The seeds of wheat *(Triticum aestivum* L. Var. C–591) were soaked in 600, 1000 and 1400 ppm cycocel solution of 24 hr. The control seeds were soaked in the distilled water for the same period. 165 g seeds were soaked in each concentration and control in 250 ml solution or distilled water. The seeds were then sown in the field. The design of the experiment was completely randomized with 3 replications. The size of the individual plot was 10'x8'. In each individual plot 55 g seeds were sown in 6 rows (at the rate of 30 kg per acre).

Five harvests were carried out at fortnightly intervals. At each harvest, three plants were harvested at randam from each treatment and data on growth parameters were recorded. Ten plants per treatment were earmarked to record the number of tillers per plant, length of spikes per plant, number of spikelets per spike, number of kernels per spike and grain yield of treated and control plants. Data for different characters were analysed statistically by analysis of variance[11], and the treatments and harvest effects were compared by the Duncan's New Multiple Range Test[12].

RESULTS

Cucocel application (seed soaking) to wheat resulted in significant decrease in the plant height and shoot dry weight as compared to control (Table 1). The difference among 600, 1000 and 1400 ppm treated plants was not significant. The maximum decrease in plant height and shoot dry weight was observed in plants treated with 1000 and 600 ppm cycocel respectively. Shoot dry weight decreased significantly in all the harvests except the first where the decrease was not significant. Plant height was not influenced by the cycocel application until the

Table 1. Influence of cycocel on vegetative characteristics of *Triticum aestivum.*

Characters	Treatment	Harvest I	II	III	IV	V
Height of plant	Control	4.69 a	4.44 a	7.77 a	37.65 a	85.69 a
	600 ppm	4.71 a	3.60 a	5.79 a	31.27 b	69.78 b
	1000 ppm	3.98 a	4.06 a	6.89 a	28.15 b	63.77 b
	1400 ppm	3.77 a	4.23 a	6.00 a	29.22 b	63.80 b
Root length (cms)	0	7.07 a	9.08 a	10.81 a	11.99 a	14.31 a
	600	8.02 a	10.56 ab	17.33 c	21.95 b	24.93 b
	1000	8.00 a	11.16 b	15.90 o	20.63 b	23.28 b
	1400	7.63 a	11.36 b	14.06 b	20.80 b	23.33 b
Dry weight of shoot (g)	0	0.1104 a	0.7033 a	1.1836 a	1.5447 a	1.7363 a
	600	0.0505 a	0.0507 b	0.2717 b	0.4963 b	1.1123 b
	1000	0.0398 a	0.0650 c	0.2940 b	0.5073 b	1.2913 ab
	1400	0.0352 a	0.0820 d	0.4103 b	0.5510 b	1.5207 ab
Dry weight of root (g)	0	0.0204 a	0.0346 a	0.4157 a	0.4101 a	0.6580 a
	600	0.0475 a	0.493 a	0.0616 a	0.6265 ab	1.1436 b
	1000	0.0250 a	0.0340 a	0.0700 a	0.9567 b	1.4747 b
	1400	0.0250 a	0.0384 a	0.2073 a	0.5763 ab	1.0500 ab

Means with same letter are not significantly differrent at P 0.05.

Treatment means

CCC concentration ppm	Plant height cm	Root length cm	Shoot dry weight g	Root dry weight g
0	28.45 a	10.65 c	1.0557 a	0.3078 b
600	23.03 b	16.56 a	0.3963 b	0.3857 b
1000	21.37 b	15.79 ab	0.4395 b	0.5121 a
1400	21.40 b	15.44 b	0.5198 b	0.3794 b

Means with same letter are not significantly different at P 0.05

third harvest and it decreased significantly at the fourth and fifth harvest. Root length was increased significantly by the application in all the harvests except the first where the increase in root length was not significant as compared to control. The maximum increase was observed in 600 ppm cycocel treated plants with the mean value of 16.56 cm followed by 1000 and 1400 ppm. However, the difference between 600 and 1000 ppm and 1000 and 1400 ppm treatments was not significant. The root dry weight increased significantly in 1000 ppm cycocel treated plants at harvest four and five. Maximum root dry weight was observed in 1000 ppm treated plants with a value of 0.51 g as compared to 0.31 g in control. The difference among 600, 1400 ppm and control plants was not significant.

Cycocel of 1000 ppm level significantly increased the number of tillers per plant, length of spikes per plant, number of spikelets per spike and number of kernels per spile (Table 2). 1000 ppm cycocel revealed mean values of 14.73 tillers per plant, 11.23 cm length of spikes per plant, 20.80 number of spikelets per spike 42.39 number of kernels per spike as compared to control with means of 9.20, 7.75 cm, 14.95 and 35.28 respectively. However, the difference in the number of tillers per plant between 1000 and 1400 ppm, control and 600 ppm treatments was not significant. Whereas, the difference in number of spikes per plant, number spikelets and kernels per spike among 600,

Table 2. Influence of CCC on yield components of *Triticum aestivum.*

CCC concentration ppm	Number of tillers/plant	Length of spikes/plant cm	Number of spikelets per spike	Number of kernels per spike	Total yield per plot g
0	9.20 b	7.75 b	14.95 b	35.28 b	932.01 c
600	8.87 b	8.62 b	17.43 b	34.91 b	1191.49 b
1000	14.73 a	11.23 a	20.80 a	42.39 a	1351.81 a
1400	12.50 ab	7.98 b	15.38 b	35.74 b	1150.80 b

Means with same letter are not significantly different at P 0.05.

1400 ppm and control treatments was not significant. Total grain yield of plot was recorded. Cycocel application increased the grain yield significantly at all three concentrations used. The difference in the total yield between 600 and 1400 ppm cycocel was not significant. A maximum yield of 1351.81 g was recorded in 1000 ppm cycocel treated plants followed by 600 and 1400 ppm with an increase of 28.9 and 23.4 % respectively. The yield recorded by control plants was 932.08 g.

DISCUSSIONS

In the present investigation plant height and shoot dry weight were decreased by the application of cycocel. These findings are in agreement with the results of Appleby *et al.*,[7] , Melzer *et al*[3] , Kosturskii and Atanasova[4] and Zeidan and El-Faily[5] . The results of present investigation revealed that the cycocel application at the three concentrations used in the experiment induced an increase in the root length. Similar results were reported by Ibrahim and El–Hattab[6] who recorded an increase in the root length. Consequently root dry weight was increased by the treatment of cycocel. These results agree with the findings of Appleby *et al*[7] and Domanska[8] .

Cycocel treatment has shown pronounced and significant effects on the yield components of wheat. The number of tillers per plant, length of spikes, number of spikelets per spike and number of kernels per spike were increased significantly by the application of cycocel at the 1000 ppm level. Similar results were also achieved by Varenitsa and Sudakova[9] ,Melzer *et al*[3] and Ibrahim and El-Hattab[6] . In this investigation cycocel application increased the grain yield significantly. This finding is in accordance with that of Melzer *et al*[3] Ibrahim and El–hattab[6] , Primost[10] , Zeidan and El–Failly[5] and Varenitsa and Sudakova[9] who also recorded an increase in the grain yield. The yield increase was attributed to cincrease in the number of spikes produced per unit area, kernel number and kernel weight per spike. It was concluded that cycocel could increase grain yield directly under certain conditions and not only by prevention of lodging. The results of the percent investigation do not agree with the findings of Appleby *et al.*[7] , who recorded decrease in the grain yield of semi dwarf wheat by the application of cycocel.

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