

Study of fluoride toxicity on the growth and yield of wheat (*Triticum aestivum* L.)

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The effect of fluoride toxicity has been studied on growth and yield characters *viz.* plant height, tillers number, leaves, leaf area, number of ears/ plant, dry wt./m², Test wt. of 1000 seeds and yield/m² of wheat (*Triticum aestivum* L.) of two varieties, WL75 and UP2003. The experiments were conducted at C.C.R. (P.G.) College Muzaffarnagar in the year 2002 and 2003. Simple Randomized Blocks Design was followed with five conc. of Sodium fluoride such as 10, 25, 50, 100 and 200 ppm along with control for four replications. The results were found significant. 100-200 ppm doses of sodium fluoride were found toxic for both the varieties of wheat.

Key words : Fluoride toxicity, Wheat, *Triticum aestivum*, Growth, Yield

INTRODUCTION

Wheat (*Triticum aestivum* L.) ranks second in area and production in India. The yield of wheat varies from 20-32 q/ha in India which is very low. In National demonstration yield trials an average on whole India basis varies from 35-54 q/ha. Thus, with the help of advanced cultural practices and improved methods, farmer can increase yield to the great extent. The production of wheat at Shahjahanpur was recorded 50 q/ha, which is approximately 2.5 times more than the average yield in Uttar Pradesh, Bihar, M.P., Punjab, Haryana and Rajasthan.

The rapid progress in industries has certain disadvantages arising from injury to plant and animal life in industrial area caused by release of noxious gases from industrial plants in to the air. Industrial pollution of air is becoming an important agricultural hazard. Many investigators have shown that certain air pollutants can cause injury to vegetation (Zimmerman and Hitchcock 1956; Darley *et al.*, 1958, Daines *et al.*, 1967). It causes damages including growth suppression, hidden injury effects, genetic differences, necrotic lesions and chlorosis of foliage (Gillette, 1969).

Odum (1971) has given the review of fundamental concepts related to energy. In the ecosystem the ratio of total community respiration to the total community biomass (R/B) can be considered as the maintenance to structure ratio or as a thermodynamic order function. Ethirington (1975) discussed "energy exchange and productivity".

Soam and Agrawal (1990) reported the reduction of nodulation in *Vicia faba* due to application of NaF. The decrease in nodules was associated with gradual increase

in NaF concentration. The simultaneous reduction in biomass and productivity was the direct result of continuous increase of NaF. The similar observations have been made by Sunita Kumari and Agrawal (1980) and Rthore and Agrawal (1989). Brennan and Rhoads (1976) observed the loss due to air pollution on growth of woody vegetation. Treshow and Harmer (1968) reported the growth response of pinto bean and alfalafa to fluoride concentration. Zimmerman (1952) has observed the similar response of HF and NaF in soil and on plants.

Yamazoe (1962) studied the response of HF on growth and yield of various crops. According to him 25 ppm HF is enough to cause significant reduction in paddy and barley while 50 ppm HF is enough for wheat production cut. Rice (1974) and Mc Cune *et al.* (1976) also supported the theory of reduction of yield of crop plants due to fluoride application. Reduction in growth and yield was reported by Malik (1997), Arya (1997) and Kumar (2000) in various crops.

MATERIALS AND METHODS

The experiment was conducted at the research farm of C.C.R. (P.G.) College Muzaffarnagar during the years 2002-03. Simple randomized block design was followed with four replications. The seeds of wheat varieties were obtained from IARI, New Delhi. The row to row distance was kept 30 cm and plant to plant 10 cm. After sowing wheat varieties WL 75 and UP 2003, all agronomic practices and spraying of pesticides were done properly at required time. Five concentrations of sodium fluoride *viz.* 10 ppm, 25 ppm, 50 ppm, 100 ppm and 200 ppm were

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Table 1 : Showing the effect of different concentrations of NaF on the growth and yield characters of wheat (*Triticum aestivum* L.)

Treatments (NaF)	Height (cm) per plant		No. of tillers per plant		No. of leaves per plant		Leaf area sq. cm per plant		No. of ears per plant		Dry wt./m ² (g)		Test weight of 1000 seeds (g)		Yield per plant (g)	
	WL 75	UP 2004	WL 75	UP 2004	WL 75	UP 2004	WL 75	UP 2004	WL 75	UP 2004	WL 75	UP 2004	WL 75	UP 2004	WL 75	UP 2004
Control	98.8	98.7	20.5	20.1	86.7	86.5	2318	2327	20.9	20.8	1074	1071	61.2	60.9	1477	1485
10 ppm	95.5	95.4	20.2	20.0	83.4	85.5	2079	2037	20.1	20.1	1021	879	59.3	59.9	1384	1318
25 ppm	94.6	94.5	18.4	18.6	77.6	81.8	1805	1776	18.4	18.3	847	825	59.2	59.3	1244	1240
50 ppm	93.6	93.5	16.9	16.2	70.6	72.1	1575	1665	17.5	17.4	753	722	58.5	58.3	942	948
100 ppm	91.0	90.2	13.4	13.5	63.4	63.2	1524	1579	14.5	14.2	721	609	56.2	56.8	777	779
200 ppm	79.6	79.5	11.4	11.3	58.2	57.7	1375	1374	12.9	12.8	506	503	54.5	54.9	563	660

taken along with control. After 30 days of sowing the plants were treated with different concentrations of NaF. Subsequent sprayings were done at 15 days interval. The solutions were sprayed on plants with the help of Knap sac. sprayer.

The growth and yield characters which were studied are given below :

- Plant height (cm)
- Number of tillers per plant
- Number of leaves per plant
- Leaf area (Sq.cm) per plant
- Dry weight/m² (g)
- Test weight of 1000 seeds (g)
- Yield/m² (g)

The first observation was recorded after 30 days of sowing and subsequently at 15 days interval till maturity. The data was recorded from 3 randomly selected plants from each treatment.

RESULTS AND DISCUSSION

The effect of different concentrations of NaF on the growth and yield characters of wheat is given in Table 1. The maximum values were recorded in control plant and minimum was found in highest conc. (200 ppm) in all the characters in both the years. The maximum height (cm.) per plant was recorded 98.8 cm. and only 79.6 cm. in 200 ppm in WL75 variety. Similar results were found in UP 2004. As regards the case of tillers per plant, leaf per plant, leaf area (Sq. cm/plant), number of ears/plant, dry wt/m² were found maximum in control and minimum in 200 ppm treatment. Similar effect of NaF was observed on test weight and yield/m².

Similar to present results many scientist reported reduction in growth and yield of many crops due to flouride (Yamazoe, 1962; Rice, 1974; McCune *et al.*, 1976; Middleton *et al.*, 1965; Brandt, 1967; Arya, 1997; Malik *et al.*, 2008; Dameja, 2007; Agarwal and Sangal, 2008; Malik and Arya, 2008; Kaushik and Kaushik, 2008).

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