

# Effect of fluoride toxicity on germination of seeds of wheat (*Triticum aestivum* L.)

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**ABSTRACT :** The effect of sodium fluoride toxicity was found on germination of seeds of wheat cv. WH-711, HD-2932, PBW-502 and DBW-17. The seed of each variety was tested for its viability with the help of tetrazolium salt. The presoaked seeds in water were also treated with NaF solutions (10, 25, 50, 100 and 200 ppm). The seeds were sown in petri dishes and their germination was recorded. Generally seeds begin to germinate from 3rd day of sowing. Complete germination percentage was noted on 7th day of sowing. Toxicity was seen in higher concentrations of NaF solution *i.e.* 100-200 ppm dose. Lethal effect was seen above 200 ppm *i.e.* 500 ppm dose. Seeds did not show germination at this 500 ppm dose.

**Key Words :** Seed viability, Tetrazolium salt, Petri dishes, Germination, Lethal effect, Threshold value

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Atmospheric fluoride reaches the plant in the form of a gas, particulate matter, or gaseous fluoride observed to particles. The most phytotoxic form of an atmospheric fluoride is gaseous hydrogen fluoride (E.P.A., 1978).

Fluoride inhibits the germination of seeds and causes necrotic lesions and chlorosis of germinating seedlings. The seeds showed threshold response of sodium fluoride upto 10 ppm concentration. Dwarfism, reduced growth, low biomass and productivity, low chlorophyll, nitrogen, protein, phosphorus and caloric values were recorded in 100-250 ppm concentrations of NaF in wheat, barley, pea, maize, tomato and brinjal (Arya, 1971, Arya and Sunita Kumari, 1978, Arya *et al.*, 1978, 1979, Agrawal 1979 and Beniwal, 1979). Kumari Sunita and Agrawal (1980) reported that toxic effect of NaF may be minimized by adding more NPK fertilizers than normal dose *viz.*, N<sub>2</sub>P<sub>2</sub>K<sub>2</sub> and N<sub>3</sub>P<sub>3</sub>K<sub>3</sub> in broad bean (*Vicia faba*) and onion (*Allium cepa*).

Watson (1952) discussed the physiological basis of variation in yield. Germination percentage was studied in various crop plants by Singh (1992), Malik (1997), Arya (1997), Kumar (2000) and Nimesh (2001).

The seeds of wheat (*Triticum aestivum* L.) var. WH-711, HD-2932, PBW-502 and DBW-17 were obtained from I.A.R.I., New Delhi. These seeds were tested for seed viability from 0.25 % to 1 % solution of tetrazolium salt (2, 3-5 triphenyl tetrazolium chloride). All the seeds showed above 99 % seed

viability.

Stock solution of Sodium fluoride (NaF) salt was prepared. When 1 g. salt is dissolved in 1000 ml distilled water, this gives 1000 ppm stock solution. Now this solution is dissolved in water and it gives 10, 25, 50, 100 and 200 ppm NaF solution. The seeds were presoaked in water for 24 hours and then they were dipped in various NaF solutions for 6 hours. After washing these seeds, they were sown in petri dishes. Cotton pads were used in all the petri dishes. After 3 days observations were recorded and the germination of seeds was noted. 100-200 ppm delayed germination of seeds. If the treatment of 500 ppm was given to seeds, they did not germinate and showed lethal effect.

Table 1 indicates the data of germination percentage of four varieties of wheat. Control treatment showed the best performance and maximum germination percentage was observed. WH-711 variety showed 98.25 % germination of seed, HD-2932 showed 98.15 % while other two varieties showed 98 % germination. As the concentrations of NaF increased they showed poor germination. 200 ppm showed 48.12 % in WH-711, 46.85 % in HD-2932, 45.36 % in PBW-502 and 44.00 % in DBW-17. Thus reduction percentage of seeds was observed in 100-200 ppm doses of sodium fluoride. Thus toxic effect of fluoride was recorded in Table 1.

It is observed that the accumulation of 'F' ions was more in presoaked NaF treated seeds due to inhibition of

**Table 1 : Effect of NaF on seed germination percentage of wheat (*Triticum aestivum* L.)**

NaF Concentrations	Seed germination % of wheat varieties			
	WH-711	HD-2932	PBW-502	DBW-17
Control	98.25	98.15	98.00	98.00
10 ppm	96.00	95.00	95.00	94.15
25 ppm	90.23	88.00	86.25	84.13
50 ppm	81.00	75.60	73.00	70.15
100 ppm	60.45	58.50	57.00	55.16
200 ppm	48.12	46.85	45.36	44.00

sodium fluoride solution. 100 to 200 ppm NaF solution showed maximum fluoride concentrations in germinating seed. The germination percentage reduced as the

concentration of NaF solution increased upto 200 ppm. There was non-significant difference between control and 10 ppm concentration of solution. This was due to threshold limit. 500 ppm concentration showed lethal effect and all seeds decayed and died due to high accumulation of 'F' ions inside the seeds. Similar findings were seen in the work of Arya (1971) in pea (*Pisum sativum* L.) var. T-163 and Bonneville and barley (*Hordeum vulgare* L.) DL-69 and K-24. Singh (1992) conducted experiments on wheat (*Triticum aestivum* L.), barley (*Hordeum vulgare* L.) and triticale. Chaudhry (2004) also obtained similar results in two varieties of wheat and two varieties of Chickpea. Malik (2008) in Mung bean and urd bean, Neeru (2011) also obtained similar results in cowpea (*Vigna sinensis* L.) and Singh (2013) in two varieties of wheat and two varieties of barley.

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