

STUDIES ON THE IMPACT OF FLUORIDE TOXICITY ON GROWTH PARAMETERS OF *Raphanus sativus* L.

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ABSTRACT

A study was concluded during 2011-2013 on the effect of various concentrations 50, 100, 200 and 400 mg NaF/kg soil on different growth parameters in *Raphanus sativus* L. Different concentrations of sodium fluoride inhibited seedling germination percentage, length of root, length of shoot, plant height, number of leaves, size of leaf, number of flowers per plant, fruit-set percentage and seed-set percentage. The plants growth in soil supplemented with 400 mg NaF/kg soil shows maximum reduction in their growth parameters as compared to control plants.

KEYWORDS: Growth Parameter, Fluoride, *Raphanus sativus* L.

Fluoride a toxic substance is present in air, water and soil. Industrial growth as well as human activities are responsible for increasing environmental pollution. Several workers have reported adverse effect of fluoride on root, shoot and leaf elongation (Wang et al., 1995 and Nagoor, 1997). Even at lower ambient fluoride concentrations, a number of physiological changes may be initiated in plant without the appearance of visible injury symptoms. Some of these changes may have important consequences such as reduction in growth or yield. Thus, the effect of fluoride on growth may be complex, varying from positive to negative effects (Davison, 1982).

Moreover, Gupta et al., (1999) have reported the high fluoride concentration in ground water at Agra district, Hence a study was conducted on the effect of fluoride on the growth parameters of *Raphanus sativus* L. at Agra.

MATERIALS AND METHODS

A field experiment was conducted during 2011-2013 with *Raphanus sativus* L. seeds (collected from the Division of genetics, I.A.R.I., New Delhi) at Botanical garden, Agra College, Agra in microplots of 1.5m x 1.5m containing loam soil (pH 7.8, ECF 1.5 ds/m, available N 150 kg/ha, P 15 kg/ha, K 225 kg/ha, organic carbon 0.15%, soluble cations 15.01 me/l, soluble anions 15.01 me/l, CaCO₃ 0.8%). Each microplots was separated by polythene line upto 60 cm depth. Between two microplots a bund of 0.5 m was left. The treatments were replicated thrice. The seeds were sterilized and then soaked for a period of 24

hours in distilled water. Sodium fluoride (NaF) was added @ 50, 100, 200 and 400 mg/kg soil (dry wt) in different microplots. For control, NaF was not added in alternate microplots between the ones supplemented with NaF. The seeds were sown in these microplots in respective years. The crop was raised to maturity by irrigation with distilled water. Observations of different growth parameters were recorded and statistically analysed.

RESULTS AND DISCUSSION

Data of the table 1 clearly indicate that *Raphanus sativus* L. plants grown in soil supplemented with various levels of Sodium Fluoride (NaF) exhibited a marked reduction in growth parameters i.e. seedling germination percentage, length of root, length of shoot, plant height, number of leaves, size of leaf, number of flower per plant, fruit-set percentage and seed-set percentage as compared to control plants. Also, the reduction in above growth parameters increased with the increase in the level of NaF in soil. In addition to this, the plants grown in soil supplemented with 400 mg NaF/kg soil showed maximum reduction in their growth parameters as compared to control plants.

Several workers have reported adverse effects of fluoride on plants (Yang and Miller, 1963; Posthumus, 1983; Rathore and Agarwal, 1989; Fornasiero, 2001, 2003; Elloumi et al., 2005; Reddy and Kaur, 2008). Our findings are in conformity with those of Wang et al., (1995) and Nagoor, (1997). They have reported the inhibition of root,

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Table 1 : Morphological Parameters in *Raphanus sativus* L. Plants Treated With Different Concentration of NaF

S. No.	Parameters	NaF (Mg/Kg) soil				
		Control	50	100	200	400
1	Seedling germination %	95.1 ± 2.48	92.0 ± 1.02	90.16 ± 1.68	88.54 ± 1.60	85.32 ± 0.82
2	Length of root after 45 days (cm)	21.52±2.35	18.06±1.60	15.36±1.85	11.42±1.24	9.12±1.63
3	Length of shoot after 45 days (cm)	27.18±2.25	25.02±1.70	19.26±1.72	15.47±2.32	10.26±1.09
4	Plant height after 45 days of germination	48.70±3.14	45.16±2.30	39.58±1.15	34.60±1.18	28.02±1.35
5	Number of leaves	16.20±0.84	15.10±1.72	14.07±1.24	12.19±1.68	8.96±1.20
6	Size of the leaf (cm)	18.20 ± 1.62	21.54 ± 1.72	20.78 ± 1.85	19.35 ± 1.91	15.95 ± 1.99
7	Number of flower/plant	685	660	560	530	412
8	Fruit set %	85.1±1.94	78.3±1.78	65.5±2.18	60.2±1.84	40.8±1.44
9	Seed set %	92.2±1.52	84.26±1.77	73.6±1.68	64.37±1.14	51.50±2.12

Mean value ± SD

shoot and leaf elongation by sodium fluoride treatments.

Present findings are also supported by Singh et al. (1978a and b), Pant (1997), Reddy and Kaur (2008), Gupta et al., (2009). Chang, (1966) has observed fluoride prevented the dephosphorylation of phylin compound in the plant tissue and retarded the rate of seedling root growth during germination. Shaddad et al., (1989) have also supported adverse effect of NaF supplied in various concentrations on seed germination, seedling growth, transpiration rate and growth criteria of *Zea mays* L., *Helianthus annuus* and *Vicia faba* L. According to them, the germination of the treated seeds significantly dropped as the concentration of NaF increased. However, low doses of the applied inhibitors stimulated the germination of maize grains. The results are also supported by the view that fluoride induce alternations in metabolism resulting in the reduction in crop field (Weinsten, 1977). The reduction in yield of plants grown in soil with higher concentration of Sodium Fluoride can also be attributed to the fact that fluoride causes pollen sterility (Schulzbach and Pack, 1972).

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