Chapter 8
Phytotoxicity of Oxidised and Reduced Nitrogen Aerosols on Potato (*Solanum Tuberosum L.*) Crop

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ABSTRACT

In a field trial (2012), simulated aerosols: NH_4Cl (reduced) and $NaNO_2$ (oxidised) @ 10 & 20 kg $ha^{-1}y^{-1}$ (≈ 100 ppm & ≈ 200 ppm respectively), 1000 cm^3m^{-2} of each along with a control were misted to population of Kufri Jyoti at different growth stages viz., vegetative (10-60 DAS), tuber initiation (60-90 DAS) and tuber bulking >90DAS). The higher dose of aerosols lowered nitrate reductase activity, nitrogen use efficiency, cell membrane stability, tuber yield, but increased photosynthesis, peroxidise activity significantly. The mechanisms of injury in terms of higher peroxidase activity and lower membrane stability of leaf cells have been elucidated. Foliar feeding of nitrogenous pollutant in the form of aerosols to plants at juvenile stage is important in addition to basal use of recommended fertilizers.

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INTRODUCTION

Potato (*Solanum tuberosum* L.) is one of the finest sources of starch, vitamins, minerals and dietary fiber. 100 g of it provides 70 calories, however, they contain very little fat (just 0.1 g per100 g) and no cholesterol. Potatos are very good natural sources of both soluble and insoluble fiber. The dietary fiber in them increases the bulk of the stool, thus, it helps prevent constipation, decreases absorption of dietary cholesterol and thereby, lowers plasma LDL cholesterol. Additionally, its rich fiber content also helps protect from colon polyps and cancer. The tubers are one of the richest sources of B-complex group of vitamins such as pyridoxine (vitamin B6), thiamin, niacin, pantothenic acid and folates. Fresh potato along with its skin is one of a good source of antioxidant vitamin, vitamin-C. 100 g of fresh tuber provides 11.4 mg or 20% of daily required levels of this vitamin. They also contain adequate amounts of many essential minerals like iron, manganese, magnesium, phosphorous, copper and potassium. Red potato contains good amount vitamin A, and antioxidant flavonoids like carotenes and zeaxanthins (USDA, National Nutrient Database revised May, 2016).

On the other hand, global warming and climate change are the facts relating the observed century-scale rise in the average temperature of the Earth's climate system, and its impacts on environments. The rate of global warming in last 50 years is double than that for the last century. As many as 11 of the past 12 years were warmest since 1850, when records began. The threshold value of temperature rise is 2^0C for devastating, dangerous and irreversible consequences of warming to manifest world over. Global warming is witnessing shifting pattern of rainfall and increasing incidents of extreme weather events like floods, droughts and frosting along with increasing soil salinity and impaired quality of irrigation water. The current level of CO_2 (369 ppm) in the atmosphere, the main GHG is 35.4% more than the pre-industrial level, and is rising unabatedly. The CO_2 level is predicted to be 393, 543 and 789 ppm in year 2020, 2050 and 2080 respectively. In potato crop, a C_3 group of plant, yields are presumed to benefit from increased carbon dioxide concentrations in the atmosphere by an increase in their photosynthetic rates, and more starch to the edible tubers under elevated carbon dioxide levels (Haverkort & Verhagen, 2008). Potatoes grow best under temperate conditions (Hijmans, 2003). For instance, the corresponding rise in temperature would be 1, 3 and 5 ^{0}C approximately during main potato growing winter season in India. The climate change and global warming will have a profound effect on potato growth story in India affecting not only production and profitability, but seed multiplication, storage, marketing and processing of this perishable vegetatively propagated crop (Singh *et al.,* 2009). India produces about 24 million tonnes of potato from 1.32 million hectares under the crop. The Northern plains contribute about 84% of the total produce. Under the impact of future scenarios of climate change and global