

Sulphurdioxide

Title	Leaf demography and growth analysis to assess the impact of air pollution on plants: A case study on alfalfa exposed to a gradient of sulphur dioxide concentrations
Author Name	Lorenzo Cotrozzi
Journal Name	Atmospheric Pollution Research
Year	2019
Volume and Issue	---
Pages	---
Abstracts	<p>Although air pollution usually leads to a reduction in the overall growth and development of plants, its effects on leaf demography have not been well examined so far. The present study was designed to highlight the capability of the demographic approach, together with traditional growth and other leaf trait analyses, to assess the impact of air pollution on vegetation by exposing plants of <i>Medicago sativa</i> L. (alfalfa) to a long-term gradient of sulphur dioxide (SO₂) concentrations (0, 30, 60 and 90 ppb, for 45 consecutive days). This study shows that (i) alfalfa plants tolerated only the lower SO₂ concentration, while detrimental effects on leaf demography and growth were imposed by higher SO₂ levels, with a less efficient strategy in carbon gain and allocation found in plants under 60 ppb; (ii) leaf demography and traditional growth analysis led to agreeing outcomes, but the demographic approach detected the stress induced by SO₂ sooner; and more generally (iii) demography can be a powerful and non-destructive tool for monitoring plant responses to air pollution, especially considering that the feasibility of this approach will likely increase with the reduction of its operational time related to the rapid expansion of several automated phenotyping techniques.</p>
Keywords	Growth and death rates; Leaf and inflorescence productions; <i>Medicago sativa</i> ; Net assimilation rate; Relative growth rate; Survivorship curves

Title	Response of gas-exchange characteristics and chlorophyll fluorescence to acute sulfur dioxide exposure in landscape plants
Author Name	Jiuju Duan, Baochun Fu, Hongmei Kang, Zhuoqin Song, Minlong Jia, Dongmei Cao, Aili Wei
Journal Name	Ecotoxicology and Environmental Safety
Year	2019
Volume and Issue	171
Pages	Pages 122-129
Abstracts	<p>To explore the toxicity and action mechanism of acute sulfur dioxide (SO₂) on urban landscape plants, a simulated SO₂ stress environment by using fumigation chamber involving increasing SO₂ concentration (0, 25, 50, 100, 200 mg m⁻³) was carried out among three species. After 72 h of exposure, SO₂-induced oxidative damage indicated by electrolyte leakage increased with higher dose of SO₂. Meanwhile, SO₂ decreased the contents of chlorophyll a, chlorophyll b and carotenoid and increased the contents of sulfur. Net photosynthetic rate (Pn) decreased as a result of stomatal closure when SO₂ dose was lower than 50 mg m⁻³, out of this range, nonstomatal limitation play a dominant role in the decline of Pn. Simultaneous measurements of chlorophyll fluorescence imaging (CFI) also revealed that the maximal quantum efficiency of PSII photochemistry in darkadapted state (Fv/Fm) and the realized operating efficiency of PSII photochemistry (Fq'/Fm') was reduced by SO₂ in a dose-dependent manner. In addition, the maximum quantum efficiency of PSII photochemistry in lightadapted state (Fv'/Fm') and the PSII efficiency factor (Fq'/Fv') decreased when exposure to SO₂. These results implied that acute SO₂ exposure induced photoinhibition of PSII reaction centers in landscape plants. Our study also indicated that different urban landscape plant species resist differently to SO₂: <i>Euonymus kiautschovicus</i> > <i>Ligustrum vicaryi</i> > <i>Syringa oblata</i> according to gas-exchange characteristics and chlorophyll fluorescence responses.</p>
Keywords	Sulfur dioxide exposure; Urban landscape plants; Gas-exchange characteristics; Chlorophyll fluorescence imaging; Sulfur content

Title	Assessment of air pollution impact on micromorphological and biochemical properties of <i>Pentas lanceolata</i> Forssk. and <i>Cassia siamea</i> Lam.
Author Name	Lohith Kumar, Hemanth kumar N. K. and Shobha Jagannath
Journal Name	TROPICAL PLANT RESEARCH
Year	2018
Volume and Issue	5(2)
Pages	141-151
Abstracts	<p>In the present study an attempt was been made to assess the air pollution effect on micro smorphological and biochemical parameters of <i>Pentas lanceolata</i> and <i>Cassia siamea</i>. There was a decrease in number of stomata in <i>P. lanceolata</i> of the polluted site compared to control but in <i>C. siamea</i> numbers of stomata were increased in the polluted area when compared to control. The number of clogged stomata was less in control area samples when compared to polluted sample. A number of epidermal cells in <i>C. siamea</i> of polluted and control sites showed a significant difference. Stomatal index of both species was found to be reduced in polluted site when compared to control. Leaf surface area in both the plant species decreased from control to polluted area and leaf colour changes from green to pale yellow/dark in a polluted area of both the plant species. Chlorophyll a, b and total chlorophyll content in both the plants were found to be significantly different in control and polluted plants. Ascorbic acid, relative water content, pH and Air Pollution Tolerance index was found to be significantly different between control and polluted plants. Based on the present study results two plant species i.e., <i>P. lanceolata</i> and <i>C. siamea</i> are categorized in to intermediate and sensitive respectively. Thus they can be considered as bio indicators of air pollution.</p>
Keywords	Air pollution; APTI; Chlorophyll; Ascorbic acid

Title	Examining the utility of hyperspectral remote sensing and partial least squares to predict plant stress responses to sulphur dioxide pollution: a case study of TrichiliadregeanaSond.
Author Name	MinoliAppalasamy, Bobby Varghese, Sershen & Riyad Ismail
Journal Name	South African Geographical Journal
Year	2018
Volume and Issue	100, 1
Pages	22-40
Abstracts	<p>The use of air quality monitoring stations is expensive, with pollution data being either unavailable or inaccessible. Hence, effects of atmospheric sulphur dioxide (SO₂) levels on biomarkers related to environmental stress were investigated for Trichiliadregeana tree leaves, in order to assess their bioindicator potential. Leaves were sampled randomly from trees at three industrial sites within the South Durban Basin, and an ex situ control, across two seasons (n = 28, per season). Ground-level SO₂ concentrations were measured daily and ranged between 1 and 25 ppb. There were significant (p < 0.001) differences across sites and seasons for leaf area and leaf chlorophyll content. Partial least squares regression (PLSR) was used to quantify the relationship between biomarkers and hyperspectral data. For leaf chlorophyll content and leaf area, r² values ranged from 0.325–0.475 to 0.429–0.586, with root mean square error of prediction (RMSEP) ranging between 8.75–8.98 and 9.20–12.52. The variable importance in projection (VIP) method was utilized and significant hyperspectral wavebands were identified, within the red-edge region, at 552 and 704 nm for spring and at 552 and 708 nm for summer. Notably, PLSR was able to relate hyperspectral data-sets to both biomarkers, showing promise in identifying stress in T. dregeana leaves. However, the interaction between leaf chlorophyll content and leaf area suggests that a simultaneous prediction of these biomarkers may be more suitable.</p>
Keywords	Air pollution; biomarker; hyperspectral; partial least square regression; reflectance; variable importance in projection

Title	The relationship between SO₂ exposure and plant physiology: A mini review
Author Name	Hyun Kyung Lee, InkyinKhaine, Myeong-JaKwak & Jihwi Jang
Journal Name	Horticulture, Environment and Biotechnology
Volume and Issue	58, 6
Year	2017
Pages	523-529
Abstracts	<p>Air pollutants are emitted from various sources into the atmosphere. During winter, greenhouses are heated by the burning of fuel in heating systems, which creates sulfur dioxide (SO₂) that can be detrimental to plant growth and human health. However, there is a poor understanding of the comprehensive effects of SO₂ on crops in a greenhouse environment. Therefore, this review aimed to summarize the impacts of greenhouse heating system-derived SO₂ on the physiological, morphological, and biochemical responses of plants. In general, plant SO₂ exposure has a negative effect on these processes. An initial decline in physiological activities appears several days following SO₂ exposure. Morphological and biochemical activities are also negatively affected by extensive SO₂ exposure. However, since sulfur is an essential nutrient for plant growth, low-level SO₂ exposure has a positive impact on plants. Atmospheric SO₂ is taken up by the plant via the stomata, after which it is assimilated and used to synthesize sulfur-containing amino acids, such as methionine and cysteine. Sulfur-containing compounds are crucial for plant growth, and various physiological and biochemical processes. It was concluded that SO₂ is a significant greenhouse pollutant, especially for crops.</p>
Keywords	air pollutant; cysteine; greenhouse; heating system; reactive oxygen species (ROS); sulfur dioxide (SO ₂)

Title	SO₂ Stress: Its effect on Plants, Plant Defence Responses and Strategies for Developing Enduring Resistance
Author Name	Subhadip Brahmachari & Surekha Kundu
Journal Name	International Advanced Research Journal in Science, Engineering and Technology
Year	2017
Volume and Issue	4, 7
Pages	303-309
Abstracts	<p>In the present scenario of rising SO₂ in the atmosphere, the negative impact of this obnoxious gas on the plants is among major concerns in the field of agriculture and crop protection. From the scientific research conducted so far, it has been established that the main toxic effect of SO₂ on plant system is exerted by the resulting oxidative stress and generation of sulphite ions. Prominent adverse effect is observed on the overall plant growth and health, Photosynthetic efficiency and produce turn over. On the other hand, plant defence mechanism tries to counter the stress either by inhibiting the entry of the gas by or by detoxifying the excess sulphur and scavenging the resulted reactive oxygen species. Enzymes like superoxide dismutase, peroxidase, polyphenol oxidase, play a key role in the detoxifying process and a considerable amount of toxic sulphur is detoxified by forming S-containing sulphur compounds. This phenomenon is being utilized for the development of SO₂ resistant plant lines by over-expression of Cysteine synthase like genes. This review presents literature study of SO₂ induced effects on plants as well as plant resistance against it and approaches toward developing enduring resistance in plants.</p>
Keywords	Sulphur dioxide stress; Sulphite toxicity; Abiotic stress; Oxidative stress response; Plant defence.

Title	Nitrogen fertilization and conservation tillage: a review on growth, yield, and greenhouse gas emissions in cotton
Author Name	Shah AN, Iqbal J, Tanveer M, Yang G, Hassan W, Fahad S, Yousaf M & Wu Y
Journal Name	Environmental Science and Pollution Research
Year	2017
Volume and Issue	24, 3
Pages	2261–2272
Abstracts	<p>Cotton is planted worldwide as a “cash crop” providing us fiber, edible oil, and animal feed as well. In this review, we presented a contemporary synthesis of the existing data regarding the importance of nitrogen application and tillage system on cotton growth and greenhouse gas (GHG) emission. Cotton growth and development are greatly influenced by nitrogen (N); therefore, proper N application is important in this context. Tillage system also influences cottonseed yield. Conservation tillage shows more promising results as compared to the conventional tillage in the context of cotton growth and GHG emission. Moreover, the research and knowledge gap relating to nitrogen application, tillage and cotton growth and yield, and GHG emission was also highlighted in order to guide the further studies in the future. Although limited data were available regarding N application, tillage and their interactive effects on cotton performance, and GHG emission, we also tried to highlight some key factors which influence them significantly.</p>
Keywords	Cotton Greenhouse gases; Nitrogen management; Tillage; Sustainable agriculture