Sulphurdioxide

Title	**Assessment of air pollution impact on micromorphological and biochemical properties of Pentas lanceolata Forssk. and Cassia siamea 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	In the present study an attempt was been made to assess the air pollution effect on micro smorphological and biochemical parameters of Pentas lanceolata and Cassia siamea. There was a decrease in number of stomata in P. lanceolata of the polluted site compared to control but in C. siamea 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 C. siamea 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., P. lanceolata and C. siamea are categorized in to intermediate and sensitive respectively. Thus they can be considered as bio indicators of air pollution.
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, Boby Varghese, Sershen & Riyad Ismail
Journal Name	South African Geographical Journal
Year	2018
Volume and Issue	100, 1
Pages	22-40
Abstracts	The use of air quality monitoring stations is expensive, with pollution data being either unavailable or inaccessible. Hence, effects of atmospheric sulphur dioxide (SO_2) 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 SO_2 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.
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	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 (SO_2) that can be detrimental to plant growth and human health. However, there is a poor understanding of the comprehensive effects of SO_2 on crops in a greenhouse environment. Therefore, this review aimed to summarize the impacts of greenhouse heating system-derived SO_2 on the physiological, morphological, and biochemical responses of plants. In general, plant SO_2 exposure has a negative effect on these processes. An initial decline in physiological activities appears several days following SO_2 exposure. Morphological and biochemical activities are also negatively affected by extensive SO_2 exposure. However, since sulfur is an essential nutrient for plant growth, low-level SO_2 exposure has a positive impact on plants. Atmospheric SO_2 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 SO_2 is a significant greenhouse pollutant, especially for crops.
Keywords	air pollutant; cysteine; greenhouse; heating system; reactive oxygen species (ROS); sulfur dioxide (SO_2)

Title	**SO_2 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	In the present scenario of rising SO_2 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 SO_2 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 SO_2 resistant plant lines by over-expression of Cysteine synthase like genes. This review presents literature study of SO_2 induced effects on plants as well as plant resistance against it and approaches toward developing enduring resistance in plants.
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
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Pages	2261–2272
Abstracts	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.
Keywords	Cotton Greenhouse gases; Nitrogen management; Tillage; Sustainable agriculture