

# Malé Declaration

on Control and Prevention of Air Pollution  
and its Likely Transboundary Effect for South Asia



## Report of the Workshop on Crop Impacts

11 March 2008  
Pathumthani, Thailand

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## LIST OF ACRONYMS

APINA	Air Pollution Information Network Africa
EDU	Ethylenediurea
OTC	Open Top Chamber
RAPIDC	Regional Air Pollution in Developing Countries
RUA	Rapid Urban Assessment
SEI	Stockholm Environment Institute
UNEP RRC.AP	United Nations Environment Programme Regional Resource Centre for Asia and the Pacific

## **R E P O R T**

### **I. INTRODUCTION**

1. The Malé Declaration: Workshop on Crop Impacts was held in Pathumtani, Thailand on 11 March 2008. The workshop was organized by the United Nations Environment Programme (UNEP) Regional Resource Centre for Asia and the Pacific (RRC.AP) and the Stockholm Environment Institute (SEI). The workshop was attended by participants from the Malé Declaration member countries including Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan and Sri-Lanka. Regional experts and participants from Japan, Kenya, South Africa, Sweden, United Kingdom, Thailand, and Zimbabwe also joined the workshop. The list of participants is enclosed in Annex 1

### **II. OPENING SESSION**

2. The workshop was started with opening addresses from UNEP and SEI. Mr. Mylvakanam Iyngararasan, Senior Programme Officer of UNEP RRC.AP, indicated in his opening address the importance of agriculture and food security, with emphasis of technology innovation. He provided a brief introduction on UNEP's initiatives for air pollution and crops and emphasized the need of cooperation between countries and stakeholders. The workshop agenda is attached in Annex 2.
3. In her opening address, Dr. Lisa Emberson from SEI gave an overview of the results from the experiment of the impact of air pollutants on crops in Malé Declaration (Malé) countries. Dr. Emberson highlighted the importance of communicating the experiment results to policy makers and the concern of addressing air pollution issues in connection with climate change.

### **III. OVERVIEW ON AIR POLLUTION AND ITS IMPACTS ON CROPS**

4. Mr. Mylvakanam Iyngararasan from UNEP delivered a presentation on Malé and Its Projects. Mr. Mylvakanam started his presentation with the history and the implementation phases of Malé. The cooperation framework of Malé Phase III (2006-2008) and its focuses were introduced. Monitoring was indicated as the essential activity of Malé Phase III. Mr. Mylvakanam then briefed that the data collection work has been accomplished and also identified the gaps to be filled. Overview on the future plan of Phase VI (2009-2011) and its emphasis on health, crop, corrosion and rapid urban assessment (RUA) impact assessments were also presented. Mr. Mylvakanam's presentation is attached in Annex 3.
5. Dr. Patrick Büker from SEI delivered a presentation on the Progress of Crop Impact Studies Performed in Malé Declaration countries during the current funding phase of the Regional Air Pollution in Developing Countries (RAPIDC) project. Dr. Büker mentioned the overview and aims of RAPIDC crop activities and status quo of the bio-monitoring experiment using two white clover genotypes with differing sensitivity to ozone and the chemical protectant study using ethylenediurea (EDU) in Malé countries. The problems encountered, such as transportation of plant cuttings, EDU supply and data transfer were discussed. Changes in experimental protocols on the establishment of clover plants and the preparation of the soil for the experiment were announced. Dr. Büker concluded the presentation by giving an outlook on the RAPIDC project. Dr. Büker's presentation is attached in Annex 4.
6. Mr. Pieter Smit from the North-West University of South Africa gave a presentation on Air Pollution Impact Studies on Crops in Southern Africa. Calling upon the importance of food security, Dr. Smit explained the ongoing and new ozone bio-monitoring activities organized by the Air Pollution Information Network Africa (APINA) in six southern African countries, namely, Botswana, Mozambique, South Africa, Tanzania, Zambia and

Zimbabwe. Mr. Smit presented results from the research and concluded that 1) the Open Top Chamber (OTC) experiment shows that sulfur dioxide does make crops more sensitive to drought and 2) the standard in UK might not be applicable to other regions such as southern Africa and South Asia. The future activities under APINA were presented. Mr. Smit's presentation is attached in Annex 5.

#### **IV. PRESENTATION OF RESULTS OF BIO-MONITORING AND EDU STUDY IN VARIOUS MALÉ DECLARATION COUNTRIES**

7. Mr. Md. Towhid Islam, Ph.D student from the Agricultural University of Bangladesh, gave a presentation entitled "The Impacts of Tropospheric Ozone on Agricultural Crops in Bangladesh". Bangladesh's social-economic profile, the sources of formation of tropospheric ozone, ozone's negative impacts on crops and its economic cost were briefed as background. Mr. Towhid then presented the results of a local bio-monitoring experiment on the comparison of two genotypes of white clover, one ozone-resistant and one ozone-sensitive. His research shows that ozone did cause foliar injury on the ozone-sensitive clover genotype and reduced its biomass in comparison to the ozone-resistant clover genotype. Mr. Towhid's presentation is attached in Annex 6.
8. Prof. Madhoolika Agrawal from Banaras Hindu University in Varanasi, India delivered a presentation on Use of EDU as a Research Tool in Assessing the Impact of Ambient Ozone on Plants. Prof. Agrawal introduced the formation of tropospheric ozone from sources such as nitrogen oxides, carbon monoxide, methane and methane hydrocarbons, and the impact of ozone on plants. EDU was introduced as one of the methods to assess the impact of ozone on plants. The effects of EDU treatment on leaf number, leaf area and total plant length of mung bean plants were presented. The results show that the number and weight of pods and seeds of mung bean plants exposed to ambient air in Varanasi increased significantly for EDU treated as compared to non-EDU treated plants. The harvesting index of EDU treated plants was higher as compared to non-EDU treated plants. Research results on the effect of EDU treatment on root and shoot lengths of potato plants were as well introduced. Prof. Agrawal concluded that EDU does have a positive impact on preventing plants from ozone injury. It was noted that some toxicity has been found for high concentrations of EDU, as well as some changes in nutrition effects. However on a general level, the experiments show that EDU has no direct negative effect on plants, rather it prevents plants from ozone effects during episodes of high ozone concentrations. Prof. Agrawal's presentation is attached in Annex 7.
9. Mr. L.P Amgain from Nepal presented a talk on Bio-monitoring Experimentation for the Assessment of Tropospheric Ozone at Rampur Chitwan, Nepal. Geographical and meteorological data of Nepal and Chitwan were presented. After initial problems with the clover bio-monitoring study in Chitwan, it was decided to swap this study for the EDU chemical protectant study with mung bean plants. The various preparation processes of the white clover bio-monitoring and the chemical protectant study, including soil preparation, transplanting saplings, surface preparation, fertilizer selection and passive sampler for ozone measurement were introduced in detail. The EDU study is currently running in Chitwan and results are expected for July 2008. Mr. Amgain's presentation is attached in Annex 8.
10. Prof. S. Razi Abbas Shamsi from Pakistan gave a presentation on growth requirements for monitoring the impact of Tropospheric Ozone on White Clover and Mungbean in Lahore, Pakistan. Prof Shamsi reported that tropospheric ozone concentration in Lahore during early summer is relatively much higher as compared to concentrations reported in the literature. His research showed that such high concentration can have adverse impact on the sensitive white clover genotype as well as on commercially used local spinach and mungbean varieties. His study also showed that EDU application has got great potential

in protecting spinach and mungbean from ozone injury. Prof. Shamsi's presentation is attached in Annex 9.

11. Dr. G.A.D Perera from Sri Lanka delivered a presentation on the Investigation of the Impacts of Tropospheric Ozone on Mung Bean in Peradeniya. The experiment was conducted on two varieties, one relatively ozone-tolerant and the other relatively ozone-sensitive. The passive sampler results suggest that the average ozone concentrations at the study site are not at a risk level, but sporadic high ozone concentration peak values during the day-time might well have a negative impact on mung bean grown in Peradeniya. The study showed that statistically significant differences between EDU treated and non-EDU treated plants were not observed. However, this result might have been influenced by the suggested harvesting procedure of the experimental protocol, or some unexpected pest attack at the latter stage of the experiment. Heavy rainfall, high humidity and low night temperatures during the study period may also have affected the ozone impacts in Mung bean plants. The experiment will hence be repeated from May 2008 on. Dr. Perera's presentation is attached in Annex 10.
12. Mr. Abdul Muhusin Ramiz of the Department of Meteorology, Ministry of Environment, Energy and Water of Maldives briefed the local condition in Maldives with emphasis on the emerging threats by climate change and tsunami. It is suggested that it is important for a country like Maldives to conduct air pollution impact on crops. Despite the fact that sources for primary and secondary air pollutants are limited on the Maldives, concentration levels of air pollutants, especially particulate matter, are often high during the monsoon season due to the long-range transport of air pollutants. It is suggested to conduct a crop impact study in the northern part of the country, where agricultural fields are available. The political support from the government will ensure the success of the project.

## **V. DISCUSSION**

13. The workshop discussed the future direction on crop impact assessment under the Malé Declaration. Major discussion points included:
  - Future studies, especially chemical protectant studies using EDU, should consider local varieties of economically important crop species;
  - Experiments should be carried out according to previously defined ideal crop-specific growing season in the region;
  - The co-benefits of addressing air pollution and climate change should be considered in future crop impact studies;
  - The workshop agreed to develop a Malé Declaration report, compiling all the results. Therefore, the report will be presented to the Malé Declaration member during the third quarter of 2008.