

Introduction to RAPIDC Malé Crops Project



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RAPIDC

Regional air pollution in developing countries

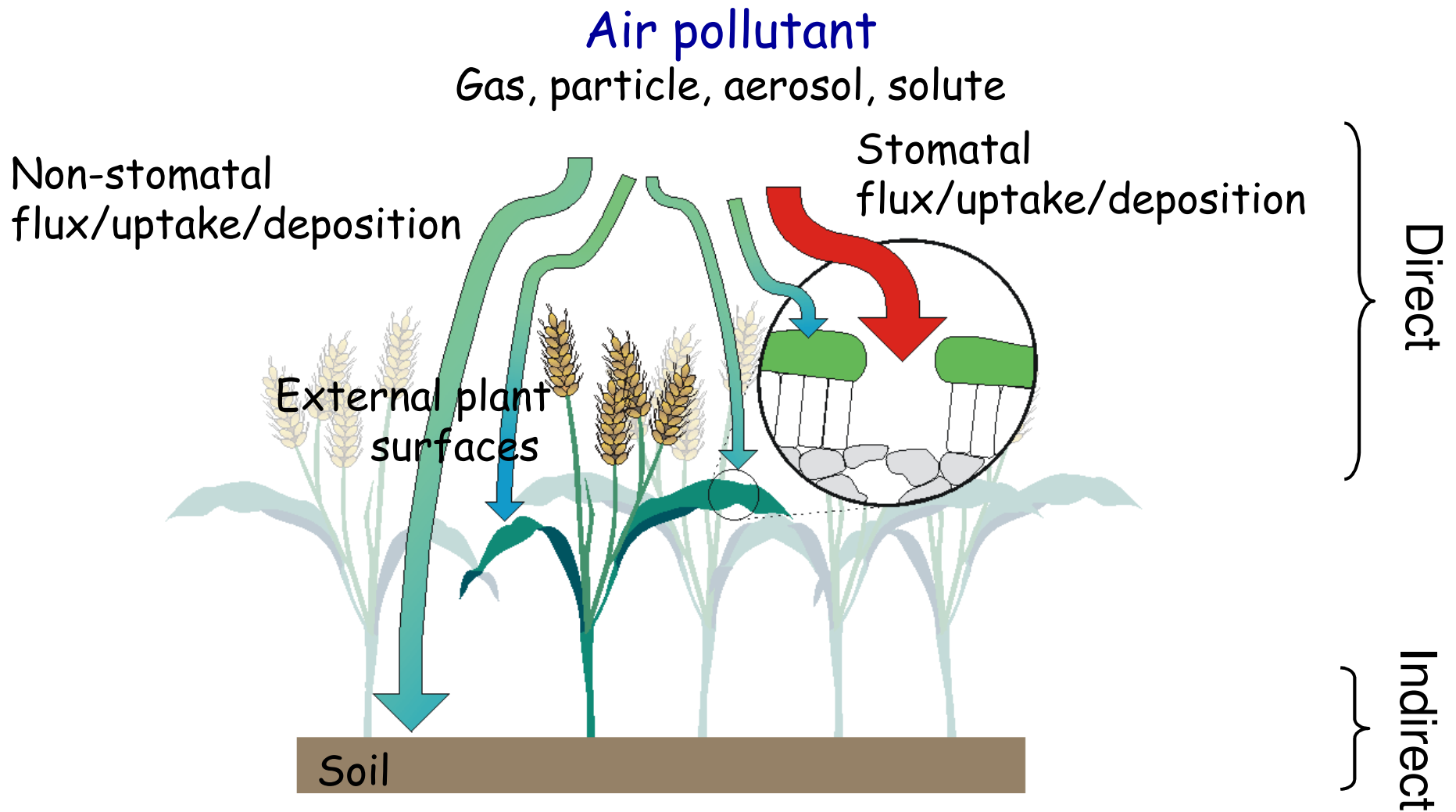


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How do air pollutants affect agricultural productivity?



What damage do these pollutants cause?

Pollutant	Impact mode	Impact	Scale
Ozone (O ₃)	Direct (stomates)		
Sulphur dioxide (SO ₂)	Direct (stomates & cuticle)		
	Indirect		
Nitrogen oxides (NO _x)	Direct (stomates)		
	Indirect		
Hydrogen Fluorides (HF)	Direct (stomates & cuticle)		
Suspended Particulate Matter (SPM)	Direct		

* At low concentrations can stimulate growth via fertilization effect

** Dependant upon chemical composition of particles

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Sulphur dioxide (SO ₂)	Direct (stomates & cuticle)	* Visible injury, growth & yield reductions	
	Indirect	Soil acidification (growth & yield reductions)	
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Hydrogen Fluorides (HF)	Direct (stomates & cuticle)	Visible injury, growth & yield reductions. Fluorosis in grazing animals	
Suspended Particulate Matter (SPM)	Direct	**Phytotoxicity, abrasive action, reduced light transmission, occlusion of stomates	

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atmospheric chemistry with emissions and meteorology

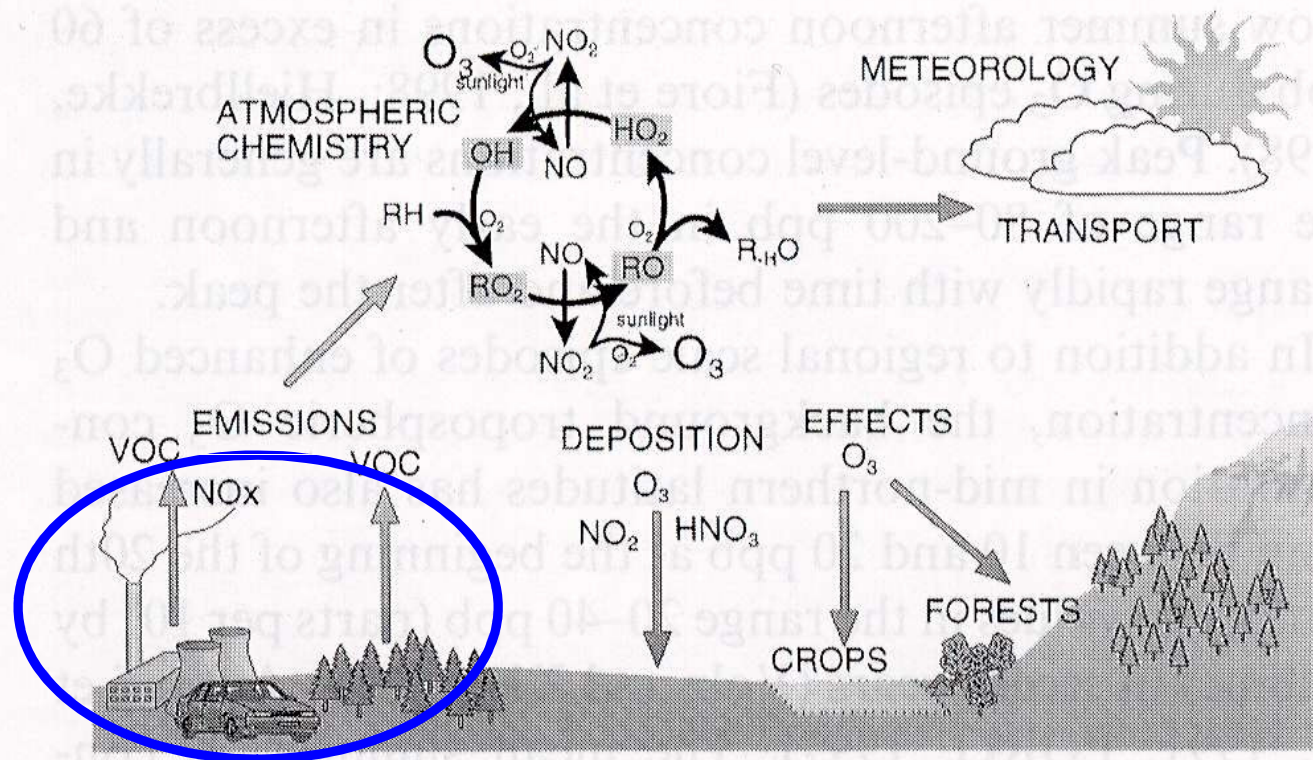


Fig. 1. Processes in photochemical oxidant formation and deposition.

Ozone is a rural pollutant reaching high concentrations in rural / agricultural areas

Evidence of Air Pollution Impacts: south Asia

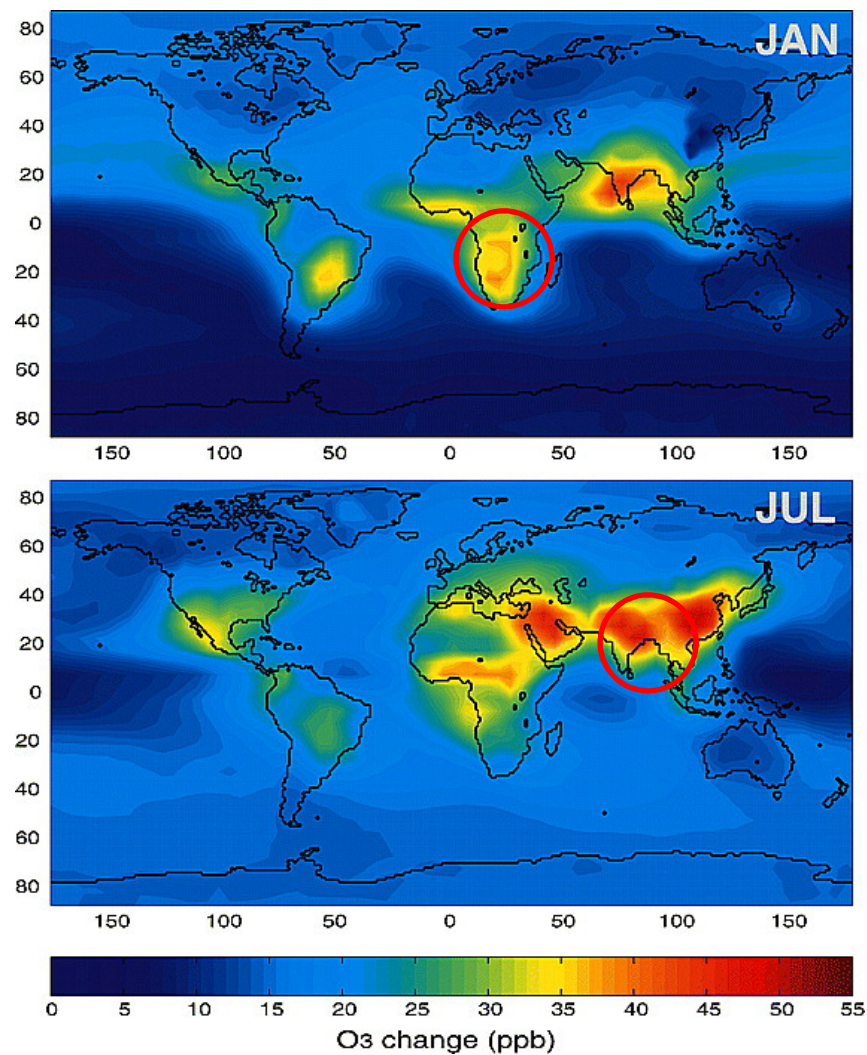
Damage occurred in rural areas outside of Lahore, Pakistan



*O₃ impacts on wheat growth, Pakistan
(courtesy of A. Wahid)*

Provisional Risk Assessment

Difference in Ozone Concentration (ppb)
Between current day and 2100



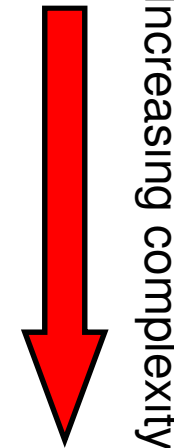
Prather et al. (2003)

Risk assessments at the global scale?

Issues relating to transferability

Observational / Experimental methods :-

Bio-monitoring
Transect studies
Chemical protectant studies e.g. EDU
Filtration / fumigation studies



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Conclusions

To concentrate on ground level ozone as a pollutant

- * High in rural / agricultural regions
- * Transboundary pollutant

To use simple bio-monitoring and chemical protectant methods to assess ozone damage

Clover Protocol Amendments

Agreed in Dhaka, Bangladesh, 15th Aug

Establishment of clones

Specify by some physical characteristic (rather than time) when the clover plants are well enough established and ready for exposure

Allow the use of a local soil mixture for establishment of cuttings:

local sandy loam soil + peat (humus)

Clover Protocol Amendments

Agreed in Dhaka, Bangladesh, 15th Aug

Soil for exposure experiment

Suggest to “sterilize” the soil e.g. by spreading on a clean surface and exposing to high temperatures / direct sunlight

Slow Release Fertilizer

N13: P13: K13 ratio suggested, but at least make sure all major nutrients are included

May also be beneficial to add minor nutrients (e.g. Fe, Mg, S)

Should last for a minimum of 4 months otherwise will have to re-apply during experiment

Clover Protocol Amendments Cont....

Agreed in Dhaka, Bangladesh, 15th Aug

Growing season (exposure period)

Identify appropriate local growing season for clover based on min & max T°C

The growth period should be extended (i.e. past 4 harvests, max of 6 harvests) wherever possible to give greatest chance of “capturing” high ozone periods during the year

Wicks

Tie 2 up round pot until needed (i.e. when soil is drying out too quickly)- this should avoid over-watering when plants are still rather immature

Amount of water provided to pot can be controlled to some extent by level of water in reservoir pot, this can help to reduce over-watering.

Clover & EDU Protocol Amendments

Agreed in Dhaka, Bangladesh, 15th Aug

Passive Samplers

Send to IVL at least every 8 weeks (2 batches). Inform Patrick Bueker when experiment will finish.

Where possible use continuous electrical ozone monitoring in combination with passive samplers (e.g. in India) to provide information on diurnal profiles and ozone peak concentrations

Clover & EDU Protocol Amendments

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Visible injury assessments

Add additional injury classes as “jump” from 5 to 25% injury to great; suggested:

< 5 %

5 to 15%

15 to 30 %

30 to 50 %

> 50 %

EDU Protocol Amendments

Agreed in Dhaka, Bangladesh, 15th Aug

EDU timing of application

Protocol should state application to start once the cotyledon leaves are fully mature which will coincide with emergence of the first new leaves