Use of ethylenediurea (EDU) as a research tool in assessing the impact of ambient ozone on plants

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Impact of ozone on plants

Higher levels of ozone cause

Foliar injury

Accelerate senescence

Decrease plant growth

Alter plant metabolism

Reduce crop yield

Assessment of O₃ injury on plants using EDU

- Ethylenediurea (N-[2-(2-oxo-1-imidazolidinyl) ethyl]- N' phenylurea; EDU)
- Synthetic chemical
- Provides protection to wide range of plants from O₃ injury without confounding effects of its own
- Allows assessment of yield losses

EDU as a tool to assess ozone injury on mungbean plants

- EDU solution (400 ppm) @ 100 ml plant⁻¹ as soil drench, one week after seedling emergence, at interval of 10 days up to 70 days
- Mean ozone concentration 60 ppb
- From March to June 2006

O₃ Concentration Exceeding 50, 60, 70 And 80 ppb During The Experimental Period (April To June 2006)



Effect of EDU treatment on weight and number of seeds and pods of mungbean plants







EDU as a tool to assess ozone injury on wheat plants

EDU (150, 300 and 450 ppm) at 10 days interval after germination up to 100 days age

Mean ozone concentration 43 ppb

From December 2002 to April 2003

O₃ CONCENTRATIONS EXCEEDING 40, 50 AND 60 ppb DURING THE EXPERIMENTAL PERIOD



Date of observation

Variations in the seed weight of two wheat varieties at different EDU concentrations



Relationship between concentrations of EDU and yields of wheat cultivars



EDU as a tool to assess ozone injury on palak plants

EDU (200, 300 and 400 ppm) at 10 days interval after germination up to 60 days age (100 ml)

Mean ozone concentration 64 ppb

From 15th April to 15th June 2007



Effect of EDU treatment on fresh leaf weight of palak plants





Effect of EDU treatment on shoot biomass of palak plants

Comparison of yield of palak grown in filtered and non-filtered chambers and at different EDU treatments



EDU as a tool to assess ozone injury on potato plants

EDU (400 ppm) at 10 days interval after germination up to 110 days age (100, 150 and 200 ml)

Mean ozone concentration 42 ppb

From 30th October 2007 to 15th February 2008





Effect of EDU treatment on fresh weight of tuber of potato plants



Effect of EDU treatment on yield of potato plants





Symptoms on potato leaves





EDU Treated

Non - EDU Treated

Conclusions

In EDU – treated plants

- Enhancement in plant height, leaf area, biomass accumulation and yield
- Effect on plant growth varied with plants, cultivars, growth stage and concentrations of EDU
- Higher magnitude of protection to yield as compared to growth parameters (high concentration of O₃ during anthesis period)
- Higher magnitude of protection to sensitive than resistant cultivar
- Greater protection during summer as compared to winter season in palak

General Conclusions

- **EDU** can be successfully used for assessing O₃ induced changes in plants under ambient field conditions
- EDU can be used as a tool in biomonitoring programme to map O_3 injury in plants especially in developing countries (major constraints: continuous electricity and non-availability of monitoring equipments)

