DELHI TECHNOLOGICAL UNIVERSITY

(Formerly, Delhi College of Engineering)

Govt. of NCT of Delhi

Shahbad Daulatpur, Main Bawana Rd., Delhi - 110042

REPORT

Event Name: Distinguished Lecture Series, Expert lecture on **"Importance of the Agricultural Sector in Air Quality Management"**.

Date of Event: 18.08.2026

Venue: Seminar Hall, Third Floor, Dept. of Env. Sci. & Engg., DTU

Organizer: Department of Environmental Science & Engineering, Delhi, DTU, in association with Paryavarnam-DTU

Participants:70+

Introduction

The Department of Environmental Science & Engineering, Delhi Technological University, in collaboration with Paryavarnam-DTU, organized a Distinguished Lecture Series on "Importance of the Agricultural Sector in Air Quality Management" on 18th August 2026.

The lecture was delivered by Dr. Pavan Kumar Nagar, Associate Fellow at the Centre for Air Quality Research, The Energy and Resources Institute (TERI), New Delhi. The session focused on the significant role of agricultural activities in shaping regional air quality, particularly through direct particulate emissions, precursor gases, crop residue burning, fertilizer application, livestock and manure management, and field operations. The lecture provided an academic and research-oriented perspective on the relationship between agricultural emissions and ambient air pollution, with particular emphasis on the Indo-Gangetic Plain (IGP) and its influence on urban air quality in cities such as Delhi and Kanpur.

Objectives of the Programme

- To enhance understanding of the contribution of agricultural activities to air pollution.
- To examine agriculture as both a direct emission source and a source of precursors contributing to secondary $PM_{2.5}$.
- To understand the role of crop-residue burning in regional air-quality deterioration.

- To introduce students and researchers to chemical transport modelling and source-apportionment techniques.
- To understand the influence of meteorology, atmospheric transport, and chemical transformation on pollutant concentrations.
- To discuss practical and policy-oriented alternatives to crop-residue burning.
- To promote an integrated and regionally coordinated approach to air-quality management.

Relevance

The lecture provided an important linkage between environmental science, atmospheric chemistry, agricultural practices, air-quality monitoring, and environmental policy.

The speaker emphasized that urban air-quality management in the Indo-Gangetic Plain cannot be considered complete without accounting for rural agricultural emissions and their regional transport. The presentation proposed an integrated framework involving emissions inventories, scientific modelling, source-receptor analysis, seasonal planning, and implementation through farm-level advisories and incentives.

Key Highlights of the Program

1. Agriculture and Air Quality

- The speaker explained that agriculture influences air quality through both direct emissions and precursor emissions.
- Agricultural activities such as crop-residue burning, tillage, and other field operations can release PM_{10}, $PM_{2.5}$, black carbon, and organic aerosols. Fertilizer use, livestock, and residue burning can also release reactive nitrogen compounds such as NH_3 and NO_x, which contribute to the formation of secondary inorganic aerosols.
- The seasonal nature of agricultural activities is particularly important because harvesting periods often coincide with stagnant post-monsoon and winter meteorological conditions, thereby intensifying pollution episodes.

2. Agriculture-Atmosphere Pathways

The lecture presented agriculture as part of a broader atmospheric pollution pathway involving:

- Crop-residue burning
- Fertilizer application
- Livestock and manure
- Tillage and field activities
- Atmospheric transport
- Chemical transformation
- Meteorological conditions
- Urban and rural $PM_{2.5}$ exposure
- Ozone episodes and associated health impacts

The presentation highlighted the need for an air-quality management framework that considers both primary emissions and precursor gases.

3. Crop-Residue Burning in the Indo-Gangetic Plain

A major focus of the lecture was Crop Residue Burning (CRB) in the Indo-Gangetic Plain. The speaker highlighted that crop-residue burning is concentrated particularly in the north-western part of the IGP and can affect air quality across the wider region. Two major seasonal episodes were identified:

- October–November: Rice-residue burning

- April–May: Wheat-residue burning

The presentation cited an estimate of approximately 620 million tonnes of crop residue generated annually, of which around 98 million tonnes were burned on farms. Punjab, Haryana, and Uttar Pradesh accounted for approximately 54% of the burned residue in the cited 2008–09 assessment.

4. Research on Delhi and Kanpur

The lecture discussed research undertaken in the Indo-Gangetic Plain, particularly in **Delhi and Kanpur**, to estimate the contribution of regular sources and crop-residue burning to different components of $PM_{2.5}$.

The study employed the **WRF-Chem chemical transport model** to examine atmospheric processes and pollutant contributions. Air-quality observations from multiple monitoring locations in Delhi and Kanpur were considered for the analysis.

5. WRF-Chem Modelling and Atmospheric Processes

The speaker introduced the application of the Weather Research and Forecasting with Chemistry (WRF-Chem) model for studying air pollution.

The modelling framework considered processes including:

- Horizontal and vertical advection
- Horizontal and vertical diffusion
- Chemical reactions
- Emissions
- Deposition
- Meteorological conditions

The presentation described a modelling configuration using WRF-Chem 3.6.1, with a 12 × 12 km² grid resolution and 70 × 70 grids. Anthropogenic emissions were represented using the EDGAR-HTAP inventory, while biomass-burning emissions were represented using FINN1.5.

6. Source Apportionment

The lecture also discussed source-apportionment approaches, including Chemical Mass Balance (CMB) and Positive Matrix Factorization (PMF), for identifying the contribution of different sources to observed $PM_{2.5}$ concentrations.

The analysis compared the pre-CRB, CRB, and post-CRB periods for 2013 and 2014. The presentation reported that $PM_{2.5}$ concentrations and several particulate components were higher during the crop-residue-burning period.

7. Contribution of Crop-Residue Burning to $PM_{2.5}$

One of the key findings was that crop-residue burning contributed approximately 31–32% of $PM_{2.5}$ in Delhi and 18–22% in Kanpur during the periods examined in the study.

The presentation also discussed seasonal source apportionment in Delhi, showing contributions from secondary inorganic aerosols, biomass burning, vehicles, industrial sources, coal and fly ash, municipal solid waste burning, construction, and other sources.

8. Alternatives to Crop-Residue Burning

The speaker discussed several alternatives to open burning of agricultural residues, including:

- In-situ and ex-situ treatment of crop residues
- Public-private partnerships involving farmers
- Changes in cropping patterns and cropping periods
- Baling and removal of residues from fields
- Captive biomass-energy plants

- Composting and bio-fertilization
- Production of packaging materials and paper
- Biofuel and bio-ethanol production
- Biochar production
- Policy support for collection and transportation costs
- Zero-tillage cropping

The presentation further discussed straw aggregation, baling, and mulching approaches. In particular, rice-straw mulching followed by direct wheat sowing using specialized equipment was presented as an alternative management approach.

9. Biomass Utilization and Rural Economy

The lecture highlighted the potential for crop residues to become a resource rather than being treated as waste. The presentation discussed biomass processing, bio-CNG, compost, and bio-enriched organic manure as potential products.

It was emphasized that village-level biomass aggregation and processing units could enhance the commercial viability of residue-management systems and create economic opportunities in rural areas.

10. Recommended Approach for Air-Quality Management

The lecture concluded with a set of recommended next steps for air-quality management in the Indo-Gangetic Plain:

- Development of a harmonized agricultural emission inventory at district × month × pollutant resolution.
- Mapping of crop calendars, residue generation, and residue-management practices.
- Integration of satellite fire data, NH_3 observations, meteorological information, and CAAQMS data.
- Quantification of agricultural source contributions using chemical transport and source-receptor modelling.
- Identification of priority districts and crop-season interventions.
- Development of monitoring and evaluation frameworks linking farm-level interventions with emission reductions and ambient $PM_{2.5}$ benefits.
- The overarching objective was to move from episodic fire-control measures to year-round, regionally coordinated agricultural air-quality management.

Participation and Outcome

The event drew 70+ students, faculty members, and research scholars.

Learning Outcomes:

- Improved understanding of agricultural contributions to air pollution.
- Awareness of the relationship between crop-residue burning and regional $PM_{2.5}$ pollution.
- Understanding of atmospheric transport, chemical transformation, and meteorological influences.
- Familiarity with WRF-Chem-based chemical transport modelling.
- Understanding of source-apportionment approaches for $PM_{2.5}$.
- Awareness of technological and policy alternatives to crop-residue burning.
- Appreciation of the need for integrated rural–urban air-quality management.

Conclusion

The lecture provided valuable insights into the role of agricultural activities and crop-residue burning in regional air pollution. It highlighted the importance of scientific modeling, source apportionment, and sustainable residue management practices for effective air quality management. The programme successfully enhanced awareness

among participants about the need for coordinated and practical solutions to address air pollution in the Indo-Gangetic Plain.

Glimpses of the Event: