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MUCUSOL PRESERVES TRACHEAL CILIA UNDER *E. COLI* AIRSACCULITIS CHALLENGE IN BROILERS

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New Histology highlights mucociliary protection and repair

Picture the ski lift. Much more efficient than climbing the mountain. Respiratory cilia, like the lift, efficiently carry challenges up and out. When the lift breaks, poultry suffer. The research in this report directly shows how MucuSol keeps broiler cilia working through a respiratory challenge for improved health and performance.

Introduction

Escherichia coli airsacculitis remains a leading cause of broiler mortality and carcass condemnation, particularly where live respiratory vaccination and secondary bacterial challenge overlap in the grow-out cycle. A recent Southern Poultry Research Group (SPRG) study demonstrated MucuSol, an oral expectorant solution delivered in broiler drinking water, significantly reduced pericarditis lesion scores and airsacculitis-related mortality when used as a prevention program, with an intervention program also providing numerical benefits.

Newly reported tracheal histology from the same experiment now shows that MucuSol preserved and restored tracheal cilia under combined viral and pathogenic *E. coli* challenge. It is a mechanistic explanation for the observed performance and lesion improvements.

Study Overview

The trial used 1,250 day-old male Ross broilers placed in floor pens on reused litter to simulate commercial respiratory pressure. All birds received a coccidiosis vaccine, and challenged groups were given live Newcastle (LaSota) and IBV Mass vaccines at day 25 to induce a normal respiratory vaccine reaction and viral cycling.

At day 30, challenged groups were exposed to Avian Pathogenic *E. coli* (APEC X-7122) via coarse spray to establish an airsacculitis challenge relevant to field conditions. MucuSol was administered in drinking water at 100 mL per 1000 kg body weight per day in two programs:

- **T2 – MucuSol Prevention: Day 24–42 (starting the day before vaccination).**
- **T3 – MucuSol Intervention: Day 31–42 (starting at peak vaccine reaction).**

Control groups were:

- T1 – Challenge Control: Vaccinated and challenged, no MucuSol.
- T4 – Unchallenged Control: No ND/IBV or APEC, housed separately.

Tracheal Histology: methods in brief

To understand what was happening at the mucosal surface, and the mechanism behind the improvement, tracheas were collected from one bird per pen in the three challenged groups (T1–T3) and from the unchallenged group (T4) at three time points, focusing analysis on day 36 when challenge effects were most evident.

Each trachea was sampled at upper, middle, and lower levels, fixed in 10% buffered formalin, and scored, emphasizing:

- Respiratory epithelium deciliation (0–5; higher = worse).
- Epithelial cuboidal metaplasia, degeneration, and necrosis.
- Lamina propria inflammation (lymphoid, heterophilic).
- Submucosal inflammation and mucous gland changes.

Mucosal width was also measured at four quadrants per section and averaged to quantify epithelial thickening and edema.

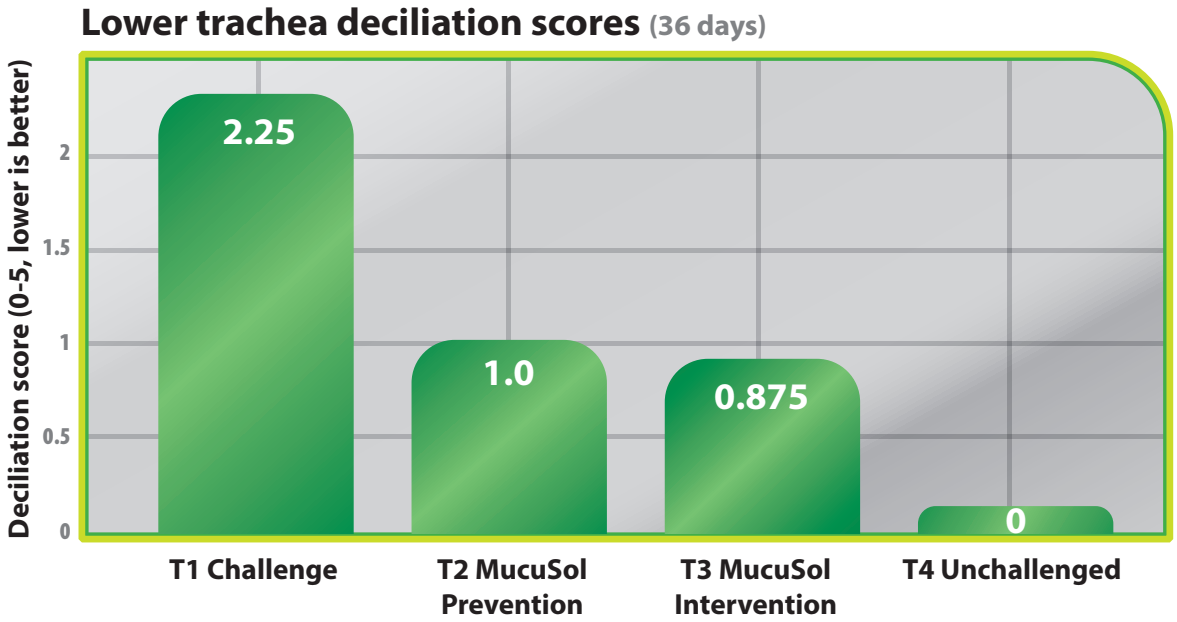

Figure 1. Mean respiratory epithelium deciliation score (0–5; lower is better) in lower trachea at 36 d. MucuSol Prevention (T2) and Intervention (T3) reduced deciliation compared with challenge control (T1), approaching unchallenged controls (T4).

Key Histology Findings

Challenge Control (T1) - Under the combined ND/IBV and APEC challenge, tracheas from T1 birds showed the **highest deciliation scores**, especially in the lower trachea.

Representative sections exhibited diffuse loss of cilia, epithelial degeneration and necrosis, cyst formation, and luminal cellular debris, indicating a severely compromised mucociliary escalator.

Mucosal width in T1 was generally greater than in unchallenged birds, reflecting epithelial hyperplasia and edema, but thickness alone was less informative than cilia integrity.

MucuSol Prevention (T2) and Intervention (T3) - In both MucuSol programs, **deciliation scores were less** than half that of challenge controls, with the most pronounced improvements in the lower trachea. Cilia coverage appeared more continuous and organized, with fewer and smaller deciliated segments and less extensive cuboidal metaplasia and epithelial degeneration.

Interestingly, lamina propria inflammation (lymphoid and heterophilic) remained broadly similar among the three challenged groups, suggesting MucuSol's primary benefit is preservation of epithelial and ciliary structure rather than suppression of inflammatory cell infiltration. This finding may argue for supplementing MucuSol's cilia protection with separate anti-inflammatory treatments such as Uni-Sol® to reduce airway inflammation and constriction.

Unchallenged Control (T4)- Tracheas from T4 birds at 30 and 36 days showed normal mucosal architecture, with a thin, uniform mucosa and dense, continuous "brush border" of cilia lining the respiratory epithelium.

Visualizing Cilia Damage and Protection

High-magnification photomicrographs from the study clearly illustrate the transition from normal ciliation to severe damage and, in MucuSol-treated birds, partial to near-complete restoration.

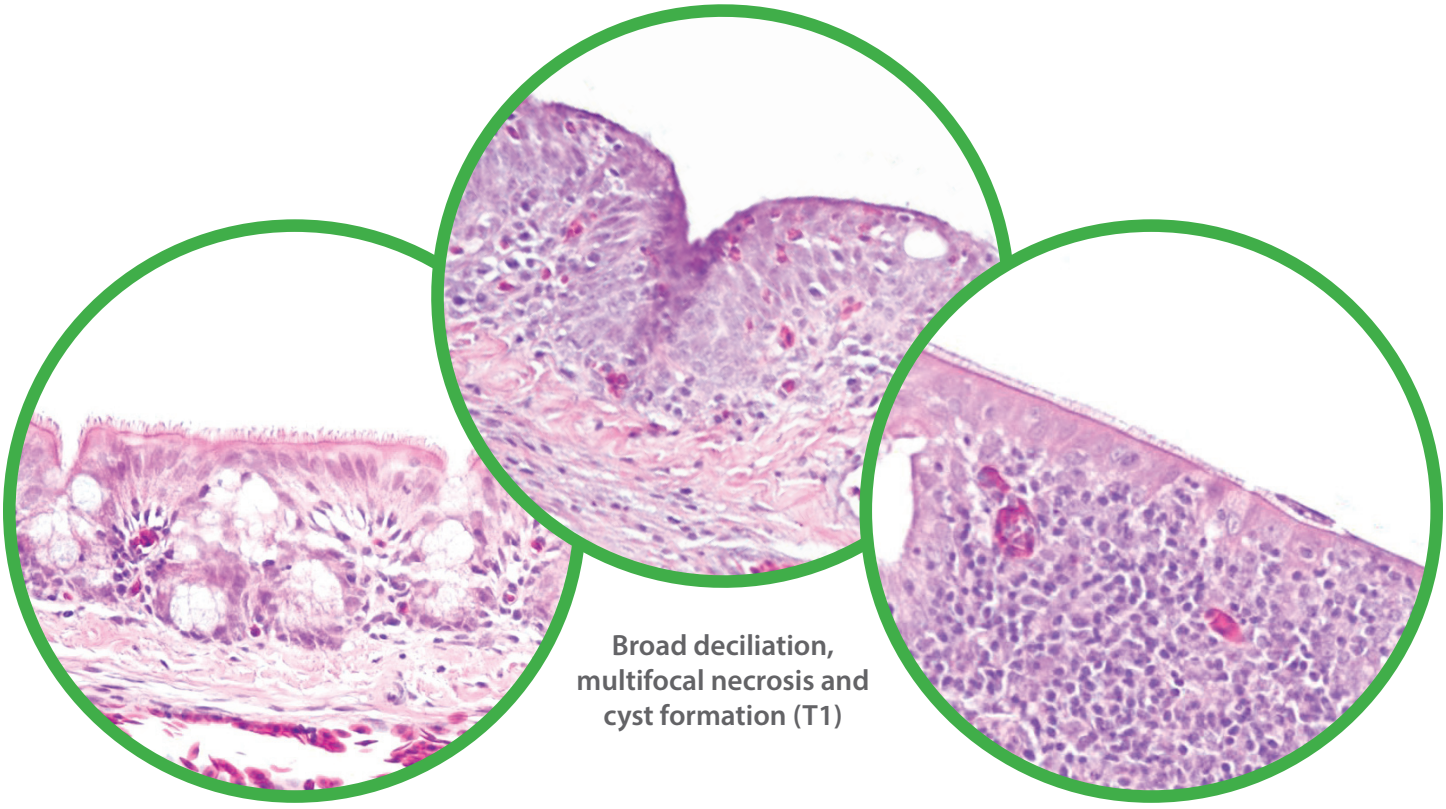

Figure 2. Representative tracheal sections at 36 d. Left: unchallenged control (T4) with normal thin mucosa and continuous cilia. Middle: challenge control (T1) with marked deciliation, epithelial degeneration, and luminal debris. Right: localized deciliation and cuboidal metaplasia in a challenged bird treated with MucuSol intervention (T3)

Linking Histology to Performance

The histology confirms that the challenge model produced the expected pattern of epithelial damage and inflammation, and that MucuSol improved the quality of the mucosal response rather than the presence of inflammation alone.

Challenge controls showed a severely denuded tracheal surface, whereas MucuSol Prevention and Intervention preserved significantly more cilia, especially in the lower trachea, where mucociliary clearance is most critical.

These microscopic differences align with the original gross lesion and mortality results, where MucuSol Prevention significantly reduced pericarditis lesion scores and airsacculitis-related mortality, and Intervention improved outcomes relative to untreated controls. Together, the data indicate that MucuSol-based support of mucociliary clearance before and during peak viral cycling and secondary bacterial exposure can help broilers more effectively clear secretions, limit bacterial load, and reduce lesion severity.

Field Implications

For technical service and field veterinarians, several practical points emerge:

- **Best use is preventive:** Starting MucuSol the day before live respiratory vaccination and continuing through the high-risk window (day 24–42) delivered the most consistent benefits in both lesions and cilia integrity.
- **Intervention still has value:** Beginning treatment when peak vaccine reaction appeared (day 31) still improved tracheal cilia and numerically reduced lesions and mortality, making it a viable response when preventive use was not implemented.
- **Support tool, not a replacement:** MucuSol should be integrated into existing vaccination and management programs as a mucociliary support tool, not as a substitute for vaccination or biosecurity, and there is evidence that supplemental anti-inflammatory treatment may be supportive.

These histologic findings, combined with lesion and mortality data, strengthen the case for MucuSol as a practical, water-soluble tool to help maintain respiratory function in broilers facing complex viral–bacterial respiratory challenges.

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