# The Effect of Dew on Ammonia Volatilization from Surface-Applied Broiler Litter

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## INTRODUCTION

Previous studies have indicated that atmospheric water can lead to increased ammonia ($NH_3$) volatilization from surface-applied broiler litter. While observing the effects of environmental variables on $NH_3$ volatilization from surface-applied broiler litter, we measured an increase in litter water potential from -20 MPa to -11.5 MPa from 12AM to 6AM the following morning. This change in water potential is equivalent to an increase from 30 to 50% in litter water content from atmospheric deposition of water and dew. Increased litter water content from dew deposition can lead to increased mineralization of organic nitrogen and increased loss through $NH_3$ volatilization, leading to an overall decrease in the fertilizer value of broiler litter.

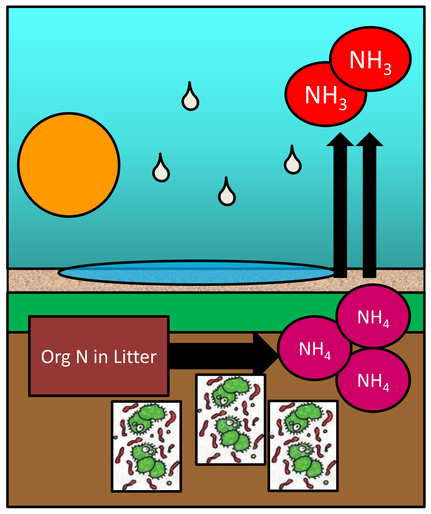


Fig. 1. The effect of dew and atmospheric water deposition on ammonia volatilization.

## OBJECTIVES

1. Determine daily rates of dewfall in pasture located in the Southern Piedmont.
2. Measure $NH_3$ loss from surface-applied broiler litter under diurnal fluctuations with and without dew.

Fig. 2. Typical morning in Piedmont with heavy dews and fog

## MATERIALS AND METHODS

### MEASURING DEW

1. Seven microlysimeters were constructed from PVC and aluminum (Fig. 3.).
2. Grass/soil cores in the sample cup (12.5 o.d. with 4-cm depth).
3. Load cells were connected to CR10X datalogger. Temperature, RH, soil temperature, and wind measured.
4. Dew was calculated as the difference in weight from 10PM to 6AM the following day, for total of 205 days.

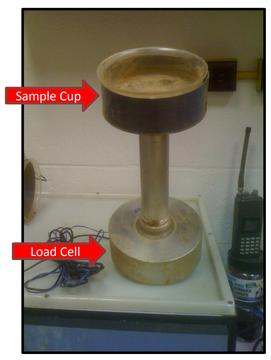


Fig. 3. Constructed dew microlysimeter

### THE EFFECT OF DEW ON AMMONIA LOSS

1. Broiler litter was surface applied to dry soil (packed in acrylic cylinders (4.2 i.d. x 10 cm).
2. Four reps (eight total) received simulated dew treatments equivalent to 0.2 mm of dew every 24 h .
3. Samples were placed in a dynamic flow through system (Fig.4.) with 24-h fluctuations in RH (32-90%) and temperature (7-28°C).
4. Air flow was regulated at 0.2 L $min^{-1}$ and bubbled through 0.5 N $H_2SO_4$ traps to capture $NH_3$. Traps changed days 1, 2, 3, 5, 7, 10 and 15.

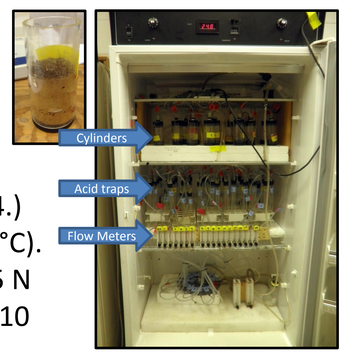


Fig. 4. Dynamic flow through system for measuring ammonia.

## RESULTS: MEASURING DEW

- 188 dew days
- Avg. dew 0.2 mm
- Ranging 0 to 0.45 mm

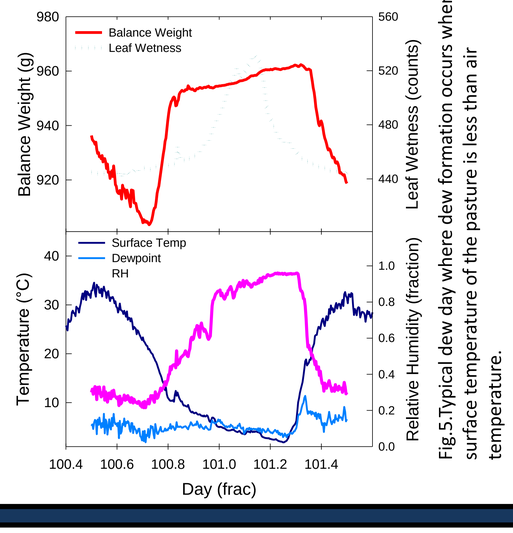


Fig.5.Typical dew day where dew formation occurs when surface temperature of the pasture is less than air temperature.

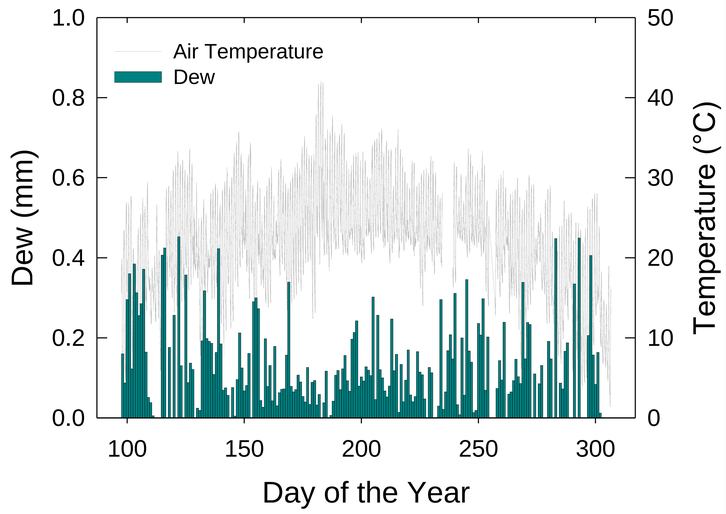


Fig.6. Measured nightly dew and temperature at 2-m height measured at 5-min intervals from April to October 2012.

## RESULTS: AMMONIA LOSS

- With dew loss = 68% applied $NH_4$-N (7.4% Applied TN).
- Without dew loss = 35% applied $NH_4$-N (3.8% Applied TN).

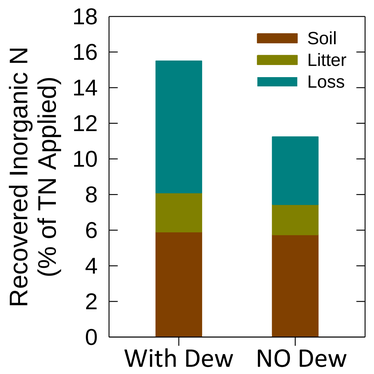


Fig.7. Recovered inorganic N from the application of litter in the soil, litter, and volatilized.

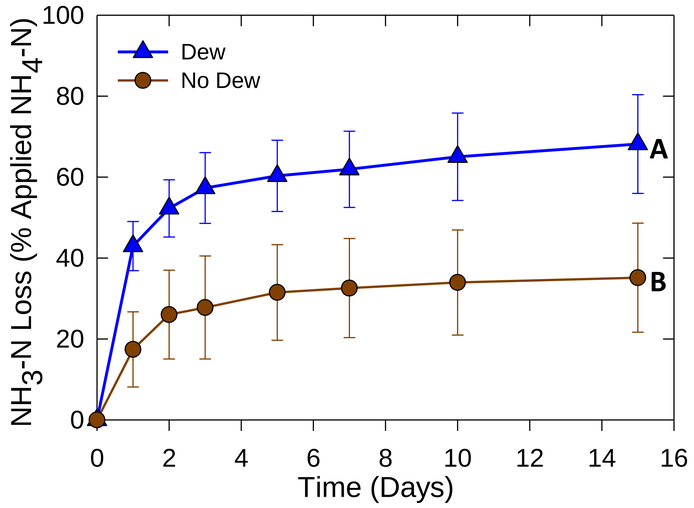


Fig. 8. Cumulative ammonia loss over 15 d.

## CONCLUSIONS

1. Dewfall is common in Southern Piedmont pastures and could lead to significant changes in water content for surface-applied broiler.
2. Under lab conditions, dew significantly increases $NH_3$ volatilization from surface applied litter.

## ACKNOWLEDGEMENTS

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