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COMMUNICATION II

Effect of Air-Flow Rates on Laboratory Measurement of NH_3 Volatilization

ABSTRAK

Satu kajian kesan kadar pengaliran ke atas kehilangan NH_3 daripada urea telah dijalankan terhadap dua jenis tanah. Pada kedua-dua jenis tanah ini kehilangan pemeruapan NH_3 bertambah dengan bertambahnya kadar pengaliran udara sehingga 14 isipadu/min. Pertambahan kadar pengaliran udara lebih 14 isipadu/min. tidak memberi pertambahan yang bererti kepada kehilangan pemeruapan NH_3. Adalah disarankan bahawa penentuan kehilangan pemeruapan NH_3 ditentukan pada kadar pengaliran udara 14 isipadu/min.

ABSTRACT

The effect of air-flow rates on the volatilization loss of NH_3 from urea was studied on two soil types. In both soils, the volatilization loss increased with increasing air flow rates up to 14 volume/min. Further increase in air-flow rate to more than 14 volume/min. did not significantly increase volatilization loss of NH_3. It is suggested that volatilization loss should be measured at an air flow rate of 14 volume/min.

INTRODUCTION

Ammonia volatilization loss from urea applied to soil surface is affected by wind speed; the loss increases with increasing air-flow rates, (Bouwmeester and Vlek, 1981; Fillery *et al.*, 1984; Denmead *et al.*, 1977). Results on NH_3 loss measured under laboratory conditions have been inconsistent. The discrepancies were mainly due to methods of measurement. On most cases, it can be attributed to differences in air-flow rates. It is necessary therefore, to establish a suitable air-flow rate for laboratory measurement of NH_3 volatilisation loss so that results obtained would be consistent.

The objective of this work is to study the effect of air-flow rates for measurement of NH_3 loss from urea in the laboratory.

MATERIALS AND METHODS

The study was carried out on two soils viz; Serdang series (Typic Paleudult) and Holyrood series (Oxic Dystropept) collected at 0–15 cm depth. Their properties are presented in Table 1.

Measurement of NH_3 volatilization was carried out according to the method described by Fenn and Kissel (1973) with a slight modification (*Fig. 1*). A Buuchner flask (500 ml) was used as an air-exchange chamber instead of a cylindrical glass chamber. In this method, soil was placed in the air-exchange chamber leaving a volume of 250 cm^3 above the soil surface for air exchange to take place. The air exchange chamber was connected to an air-pump and another Buuchner flask containing 75 cm^3 of boric acid and a mixed indicator (bromocresol green and methyl red) solution. When NH_3 volatilisation measurement was made, the NH_3 released from the soil in the gas exchange chamber was forced into the boric acid by flowing air from the pump. The NH_3 loss was determined by titration with standard HCI after two days.

Urea was applied evenly on the soil surface in the air exchange chamber at the rate of 400 mg N/g soil. The amount of soil used for each treatment was 300 g and the water content was maintained at 30% (w/w). Amonia loss was measured at air-flow rates of 0, 4, 9, 11, 14 and 15 volume/

TABLE 1
Some physical and chemical properties of the soils used in the study.

Charasteristic	Soils	
	Serdang	Holyrood
Clay (%)	25.6	21.2
Silt (%)	7.4	10.9
Fine sand (%)	13.9	25.0
Coarse sand (%)	35.1	42.9
CEC (meq/100 g. soil)	6.7	6.0
pH (H_20)	4.5	4.4
Organic carbon (%)	1.3	1.9

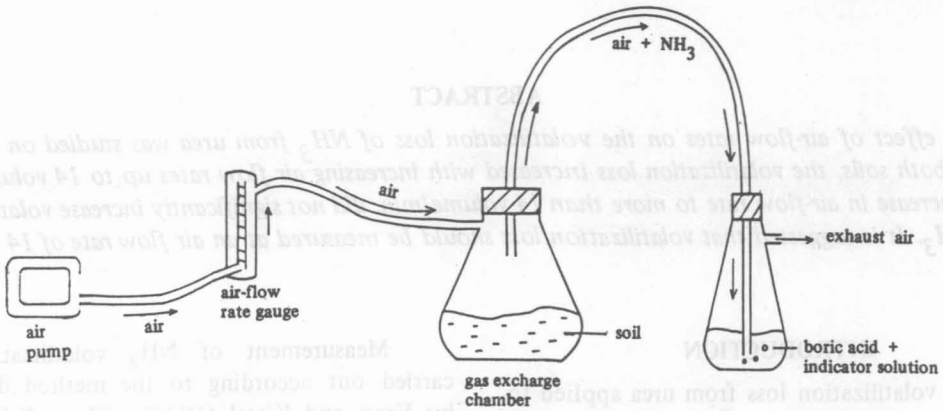

Figure 1: A diagramatic sketch of the volatilisation apparatus used in the study.

min. The flow rates were adjusted with the help of air-flow meters. Each treatment was replicated three times.

RESULTS AND DISCUSSION

The effect of air-flow rates on NH_3 loss by volatilization is shown in *Fig. 2.* In both soils, volatilization loss increased with an increase in air-flow rate until the air-flow rate was 14 volume/min., after which there was no further significant increase.

Thus, although the rate and amount of urea volatilized in these two soils were different, the maximum air-flow rate was similar. It is suggested that for measurement of NH_3 volati-

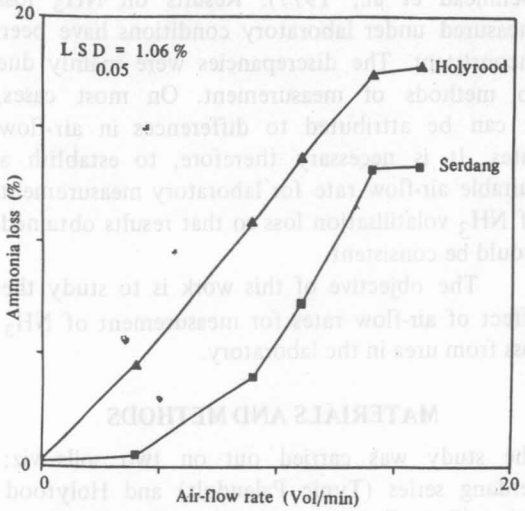

Figure 2: The effect of air-flow rate on volatilisation loss of urea.

lization from urea in the laboratory, an air-flow rate of more than 14 volume/min. should be used so that the volatilization is at the maximum and less variable.

If measurement at 14 volume/min. is not possible, the air-flow rate used should be reported and kept constant for all measurements. The maximum air-flow rate obtained in this study was comparable to the results obtained by Kissel *et al.*, (1977).

CONCLUSION

The amount of NH_3 volatilization loss was affected by air-flow rates. The loss increased with air-flow rate up to 14 volume/min. It is suggested that measurement of NH_3 volatilization from urea in the laboratory is made with an air-flow rate of 14 volume/min. or more.

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