Validation of infrared moisture meter to determine moisture contents of poultry litter materials

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Abstract

Quick and user-friendly methods are important for testing the poultry litter moisture levels at farm level. The objective of the present study was to determine the suitability of the Infrared Moisture Meter (IMM) to test the moisture contents of two types of poultry litters. Three week-old broilers (n=150) were put in to six deep litter cages. Three groups of chicks were reared on paddy husk (PH) based litter while the remaining three groups were raised on refused tea based (RT) litter. Three samples were taken from each cage at weekly intervals for three weeks. Each sample was sub-divided into two sub-samples. The moisture content of one sub-sample was determined by gravimetric method (GMM) while the moisture content of the other sub-sample was determined by IMM (OSK 13804; Ogawa Seiki, Co Ltd). Depending on the moisture content of the sample, time taken to determine the moisture content of a sample by IMM ranged from 20 to 45 minutes (mean 30 minutes). The moisture contents of the RT based litter were 50.3±5% and 49.9±9% when measured by GMM and IMM, respectively. The moisture contents of PH based litter were 41.0±5.7% and 40.9±8% when measured by GMM and IMM method, respectively. On both occasions, there was no significant difference between the moisture content as determined by the two methods (p=0.91). However, on both occasions, the moisture content determined by GMM was higher than that determined by IMM. When the moisture contents of the litter were compared irrespective of the litter material, two methods gave very similar values; 45.71±7.2% by GMM and 45.32±9.7% by IMM. The results of this experiment suggest that IMM method could be successfully used as a tool to determine the poultry litter moisture content.

Key words: poultry litter, moisture, gravimetric, infrared

Introduction

The most popular poultry management system in Sri Lanka is probably the paddy-husk- based deep litter system. This system of management, if properly adopted, is cheap, requires less capital and is known to cause less animal welfare problems compared to other systems such as battery cages and wired-floor systems. However, poor litter management can lead to serious economic losses due to poor performance, mortality and carcass and egg condemnation. The most important reason for the poor litter condition is high litter moisture. Litters become wet due to the spillage of water, birds faeces and microbial actions. An ideal litter should have less than 25-30% moisture. Moisture levels beyond that level can cause a range of adverse effects (Willis, et al., 1997).

To determine the litter moisture level visually or manually, one should be highly experienced in that skill. Gravimetric method is the most widely used method for moisture determination of poultry litter (Brake et al., 1992). Other methods of moisture determination in general, include gypsum block methods and the infrared moisture meter. Though accurate, the gravimetric method requires 12-24 hours to determine the moisture content of a sample. Also it requires equipment such as ovens, scales and desiccators. Therefore, gravimetric method is expensive and complicated to be used at farm level. The infrared moisture meter is widely used to determine the moisture content of materials such as cereals, grains and soil. The determination of moisture content using IMM is straightforward and fast and, therefore can be useful at farm level. The objective of the present study was to determine the suitability of Infrared Moisture Meter (IMM) to test the moisture contents of the two types of poultry litters.

Materials and methods

Three week-old broilers (n=150) were put in to six deep litter cages. Three groups of chicks were reared on paddy husk based litter while the remaining three groups were raised on refused tea based litter. Each cage had a feeder and a bell shaped drinker. Each bird was given 1.3 ft^2 floor spacing. Feed and water were given ad lib. Birds were fed on a commercial broiler finisher diet. Litter was raked every fortnight. Three samples were taken from each cage at weekly intervals for three weeks. Before taking the samples, the litter was raked. Samples were immediately brought to the laboratory for moisture determination. Each sample was sub-divided into two sub-samples. The moisture content of one sub-sample was determined by GMM. Samples were kept at 105 ^{0}C for 12 hours and then cooled in a desiccator and then the moisture content was determined as the weight loss during the heating. The moisture content of the other sub-sample was determined by IMM (OSK 13804; Ogawa Seiki, Co Ltd).

Results and discussion

Moisture contents of the litter materials as determined by GMM and IMM are shown in Table 1. Depending on the moisture content of the sample, time taken to determine the moisture content of a sample by IMM ranged from 20 to 45 minutes (mean 30 minutes). In contrast to determine the moisture content of a sample by GMM was around 14 hours and thus, was more time consuming compared to IMM. Furthermore, irrespective of the number of samples to be tested the oven has to work for twelve hours. Consequently, if the number of samples to be tested is low, the GMM is both time and energy consuming.

To determine the suitability of IMM to test the moisture content of the poultry litter materials, we compared the moisture content of two litter materials by GMM and IMM. The moisture contents on day 0 (materials before being used as litter), day 7, day 14 and day 21 when determined by GMM and IMM were not significantly different. Furthermore, the values obtained by both methods were numerically very close. The highest numerical difference between the moisture contents determined by the two methods was 4.7 % units. The higher differences were observed at relatively higher moisture levels above 32%. When low moisture levels (around 10-12) of PH and RT, before being used as litter materials were tested, the numerical difference between the values given by two methods were very close. It seems that IMM gives closer values to the GMM at low moisture levels.

The moisture contents of the RT based litter were 50.3±5 % and 49.9±9% when measured by GMM and IMM, respectively. The moisture contents of PH based litter were 41.0±5.7 and 40.9±8% when measured by GMM and IMM method, respectively. On both occasions, there was no significant difference between the moisture content as determined by the two methods (p=0.91). However, on both occasions, the moisture content determined by GMM was higher than that determined by IMM. When the moisture contents of the litter were compared irrespective of the litter material, two methods gave very similar values; 45.71±7.2 % by GMM and 45.32±9.7% by IMM.

The moisture contents determined in this experiment, by GMM and IMM ranged from 10.3% to 53%. As discussed earlier, two methods gave very close values at low moisture levels. The moisture content of the poultry litter on GMM could be predicted as GMM % = 16.9 + 0.636y, where y is the moisture content as determined by IMM.

Table 1. Moisture content of RT and PH litters as determined by GMM and IMM

	Litter moisture as determined by		Level of significance
Moisture % ± SD	GMM	IMM	
Day 0			
RT	12.6±1.65	11.9±2	NS
PH	10.3±0.9	12±0.2	NS
Day 7			
RT	51.3±10	53.0±12	NS
PH	42.7±9.3	42.1±9.4	NS
Day 14			
RT	51.6±11.2	52.6±9.9	NS
PH	42.8±8.4	47.1±7.4	NS
Day 21			
RT	48.0±6.6	44.2±11.8	NS
PH	37.5±4.8	32.8±8.5	NS
Day 7-2			
RT	50.3±5	49.9±9	NS
PH	41±5.7	40.9±8	NS
Irrespective of the litter material	45.7±7	45.3±9.7	NS

Conclusion

The results of this experiment suggest that the IMM method could successfully be used as a tool to determine the poultry litter moisture contents. The advantages of the IMM over GMM are more evident when facilities for drying and weighing are not available, rapid results are required and a small number of samples are to be tested. Particularly, the saving of energy of using IMM under such circumstances may be substantial.

References

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