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Assessing the Potential of Using Nylon Bags in Batch Analysis of Crude Fibre and Ether Extract of Livestock Feeds

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Abstract

The objective of this study was to determine the potential of laboratory batch analysis and optimum number of bags to be used. Katambora, veld hay and maize stover were analyzed for Crude Fibre (CF) and Ether Extract (EE) using the proximate analysis procedure but with samples bagged in nylon bags of pore size 60 micron. A completely randomized block design was used with Treatment 1 as the control, Treatment 2 with 1 bagged sample, Treatment 3 with 2 bagged samples, Treatment 4 with 3 bagged samples and Treatment 5 with 4 bagged samples. Results showed that there is a potential to use nylon bags in CF and EE analysis on katambora, veld hay and maize stover. There was an interaction between block and treatment. EE analysis on Katambora showed no significant difference among all treatments (P>0.05) but for maize stover and veld hay, treatment 4 and 5 were significantly different (P<0.05) from all the other treatments. In CF analysis trial, treatment 2 and 3 did not differ significantly (P>0.05) from the control, while treatment 4 and 5 were significantly different from the control for all the diets. It was concluded that there is a potential to do batch analysis with optimum number varying between forage type and component of analysis. The proposed batch analysis is more sensitive with EE than with CF analysis.

Introduction

The nylon bag technique is a very simple and useful biological tool [1] with its use dating back to the early 19th century [2] when the nylon bag was used in *in- vivo* nutrition experiments. The nylon bag technique has been widely adopted to evaluate the rate and extent of degradation through the microbial rumen degradation processes [3]. The principle behind the technique is that feed samples of identified weight are put in the nylon bays with pores allowing entry and exit of the rumen fluid to allow degradation of feed [2] in the pre-weighed bags.

The samples are prepared in duplicates and incubated in the rumen of fistulae animal for a range of times. Degradation of material in the nylon bag is made possible by the ability of the bag to allow entry and exit of rumen fluid. This ability of the nylon bag to allow entry and exit of rumen fluid can also be taken advantage of to reduce cost and time of feed analysis through batch analysis of samples bagged in nylon bags.

While High levels of animal performance and health are dependent on high quality nutrition and management [4], most forage are variable in composition and so feed analysis is required to provide information to farmers, feed manufactures as well as scientist. Stakeholders in the livestock industry are very much aware of the importance of feed quality; however it may not be easy for some poor resourced farmers to obtain quantitative information at affordable prices on a regular base to allow for accurate formulation of diets. The cost of feed analysis does not affect farmers, but even scientist and the industry; as a result efforts to find alternative feeding ingredients could be hampered. The need to provide rapid, low cost and accurate estimates of feed composition is a necessity in developing countries, but according to Adesogan et al. [5] the method of choice also depends on affordability and availability of equipments for analysis. As such financial challenges make it difficult to use such technologies as the near infrared reflectance spectroscopy (NIRS) which could address the issue of cost, insofar as the technique can provide reliable estimates of feed composition at about one fifth of the cost of conventional chemical analyses [5]. In the absence of such technologies, the current conventional analyses can be modified to reduce the cost of analysis as well as time taken to assess the nutritional value of feed stuffs. Based on t its structural features, we hypothesize that the nylon bag has potential to be used in laboratory crude fiber and ether extract batch analysis. Consistent with this hypothesis, the objective of this study was to determine the optimum number of bags that can be used in bath analysis of CF and EE determinations.

Methodology

A completely randomized block design was used for the study, three blocks and five treatments. The three blocks were the samples of feed each with the following treatments: treatment 1 (control), treatment 2 (I bag), and treatment 3 (2 bags), treatment 4 (3 bags) and treatment 5 (4 bags). Samples of Katambora, veld hay and maize stover were ground using a laboratory hammer mill with a 1 mm sieve. For the control samples 1g of each sample was weighed replicated three times and ether extract and crude fiber were analyzed according to the Analytical of Association Chemist [6]. For the bagged sample, 1g of feed was weighed and put directly in the nylon bag and for each sample, 16 bags were made. The bags for each sample type were randomly allocated to the four treatments with treatment 2 and 3 replicated 3 times while treatment 4 and 5 did not require replication since this had been done through batching of the samples. The nylon bags were tightly closed and EE and CF analysis were done using the procedure as described by Analytical of Association Chemist (AOAC) (1990) at the University of Zimbabwe, Animal Science Department [6]. The results were analyzed using SAS (1998) [7]. Cost of analysis for each sample and component was done using the laboratory charges as per cost of analysis in the Department of Animal Science.

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Sample type	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5	Se
Katambora	33.58[a]	33.58[a]	33.50[a]	32.12[b]	30.05[c]	5.38
Maize stover	35.3[a]	34.7[a]	34.5[a]	32.0[b]	31.05[c]	6.43
Veld hay	35.92[a]	35.89[a]	35.87[a]	34.25[b]	33.16[c]	7.09

[abc] Across row means with the same superscript are not different(P<0.05)

Table 1: % Crude fibre analysis for the different treatments.

Sample type	Trt 1	Trt 2	Trt 3	Trt 4	Trt 5	Se
Katambora	1.5[a]	1.49[a]	1.48[a]	1.48[a]	1.46[a]	0.34
Maize stover	1.23[a]	1.22[a]	1.20[a]	0.99[b]	0.88[c]	0.12
Veld hay	1.56[a]	1.54[a]	1.53[a]	1.40[b]	1.33[c]	0.41

[abc] Across row means with the same superscript are not different(P<0.05)

Table 2: % Ether extracts analysis for the different treatments.

Sample type	Trt 1	Trt 2		Trt 3		Trt 4		Trt 5	
		Cost	saved	Cost	saved	cost	saved	cost	saved
EE(US$)	30.00	30.00	0.00	20.00	10.00	10.00	20.00	10.00	20.00
CF(US$)	15.00	15.00	0.00	10.00	5.00	5.00	10.00	5.00	10.00
Total(US$)	45.00	45.00	0.00	30.00	15.00	15.00	30.00	15.00	30.00

Table 3: Cost of CF and EE analysis for the different treatments.

Results and Discussion

Potential of batch analysis in crude fibre determination

The results in table 1 show that treatment 1, 2 and 3 are not significantly different for katambora, maize stover and veld hay (P>0.05). This shows that for the three types of forage, the optimum number of bags for batch analysis is 2. According to table 3, use of more bags would reduce the cost of extraction even more that in treatment 3, but this significantly underestimates the crude fiber content of all the forage types.

In this experiment the crude fiber of maize stover varied between 35.3% and 31.05%. On comparing the crude fiber results from studies some variations were noted. For example the results are slightly varied from Fomunnyam and Meffeja [8] who reported that the crude fibre in maize stover varied between 30.2% during harvest and 36.2% after being left to dry in the field. In another study by Nour et al. [9], 33.2 % crude fibre was reported in maize stover and this concurred with a study by Fomunnyani and Mboni [10] which showed CF value of 33.1%. While the small variations in the crude fibre between the different studies could be a result of the different maize varieties in the different areas of study as suggested by Tong et al. [11], this could also be indicative of the need for specific analysis in different situations against depending on book values all the time. In line with the above observations, the crude fibre in katambora ranged from 30.05% to 33.58% which was higher than 25.2% obtained by Yehge-Erakpotor and Muhammed [12]. Such variations are could be a result of the different stages of maturity with more mature hay showing g higher levels of crude fiber. The crude fiber from veld hay in this study ranged from 33.16 to 35.92 %. Nutritional value of veld hay would depend on the type of grasses found and stage at which it was harvested from the veld. Due to the unavoidable variations resulting from different circumstances, it is always important to do regular nutritional analysis of feed resources.

Potential of batch analysis in ether extract determination

Results for EE extract analysis indicated a significant interaction (p<0.05) between block and treatment effect. As is shown in table 2, there was no significant difference (p<0.05) between all treatments for katambora grass while for maize stove and veld hay, treatment 4 and 5 were significantly different (p<0.05) from the control, treatment 2 and 3. These results indicate that for katambora grass, up to four bags can be used in a batch and this is also supported by the savings resulting from use of more bags (Table 3). This can serve a lot of non renewal energy which is very good for the environment. However for the other two, the optimum number of bags 2 because use of up to 4 bags for maize stover and veld hay although cheaper, (Table 3) would significantly (P<0.05) underestimate ether extract.

On comparing results from other studies, variations in the level of EE obtained. For example, Fomunnyam and Meffeja [8] found EE extract level in maize stover to be 2.7 % at harvest and 1.7% for stover left to dry in the field. Nour et al. [9] also found the ether extract in maize stover to be 1.45%. EE analysis of maize stover in a study by Fomunnyani and Mboni [10] was 2.1%. In this study EE for maize stover varied between 0.88 and 1.23%. According to Ngongoni et al. [13] EE for natural pastures varies between 1.66% to 1.70% depending on the time of harvest between November and March in Zimbabwe, yet this study found values between 1.33 and 1.56%. Such different results indicate that most forage products are variable in composition, thus farmers cannot always depend on book values. There is need for constant check of nutritional information, but this can be facilitated through availability of cheaper ways of analysis.

Conclusion

There is a potential to do batch analysis with optimum number varying between forage type and component of analysis. For crude fiber analysis, the optimum number of bags for all forage types per batch is two. For ether extract determination, the optimum number of bags for Katambora grass is 4 while that for veld hay and maize stover is two. It is recommended that trials using more than one feed sample be done to determine effects of the methods on analysis of different samples in the same flask.

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