# Comparative Tests for the Purposes of a Crude Fibre Analysis Using Both the Official VDLUFA Method and FibreBag Technology (C. Gerhardt)

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## 1. Introduction

The determination of the plant fibre content of feedingstuffs is of great importance for their evaluation and classification. Crude fibre content (XF) describes non-digestible or difficult-to-digest plant cell wall constituents. The analysis of crude fibre content as part of the Weender Analysis is a standard method that is used worldwide and is based on EU feed law (European Commission, 2009).

For the determination of the crude fibre content, feedingstuffs are initially cooked with an acidic and then a basic detergent solution. After every cooking process, the samples must be rinsed and filtrated (VDLUFA, 1993).

The filtration process is performed using a glass frit with a defined porosity. The filtration process can sometimes be protracted, and filtration additives may be necessary to aid progress. A further difficulty with this type of filtration method is the fact that the sintered glass of the frits, with frequent use, brings about changes in porosity. In addition, troublesome seal tightness issues frequently arise as relates to the frits and return cooling.

The C. Gerhardt company has therefore developed systems for the determination of fibre fractions (XF, ADF, $ADF_{OM}$, ADL, NDF, $aNDF_{OM}$) where filtration is performed using filter bags with defined pore sizes. Because these bags are only used once before disposal, there are no concerns relating to wear and tear and the filtration process itself is rapid. For the purposes of incinerating samples, the FibreBags burn without leaving residue. The Fibretherm FT 12 automatically handles all relevant cooking, rinsing and filtration processes for the analysis of XF, ADF, $ADF_{OM}$, NDF and $aNDF_{OM.}$ The objective of this study is to examine, in the context of crude fibre content determination, to what extent this technology leads to results that are comparable to those of the official method (VDLUFA, 1993).

## 2. Material and methods

In comparative testing, crude fibre determinations were performed according to both the official VDLUFA method and using a Fibretherm FT 12 (FibreBag method) produced by C. Gerhardt GmbH & Co. KG. The comparative tests were carried out by the Landwirtschaftliche Untersuchungs- und Forschungsanstalt (LUFA, Agricultural Testing and Research Institute) of Speyer. Using the FibreBag method, samples are weighed out into the filter bags. These bags are then fitted with glass spacers to achieve better wetting. Up to 12 samples are then placed in a sample carousel, which is in turn placed into a boiling vessel. To begin the detergent treatments, the boiling vessel is placed in the Fibretherm FT 12 and a selected program is initiated. A visual inspection is performed during all work stages. For each system (glass frits and FibreBag) at least two determinations are performed. The crude fibre content of pig, poultry and cattle feed was tested. The most important program parameters – which were preset by the manufacturer – are listed in Table 1. Several program parameters were adjusted to lab conditions.

Tab. 1: The most important preset (manufacturer's) program parameters in the crude fibre program; these may in some cases need to be adjusted to lab conditions

| |
|---|
| • First detergent: H2SO4 (storage canister 1) |
| • Volume: 1.3 litres |
| • Heat output: 45% |
| • Circulation of the detergent solution: alternates between 10 second circulation and a 30 second rest period |
| • Filtration (siphoning of detergents): 2.0 min |
| • Second detergent: KOH (storage canister 2) |
| • Volume: 1.3 litres |
| • Heat output: 45% |
| • Circulation of the detergent solution: alternates between 10 second circulation and a 30 second rest period |
| • Filtration (siphoning of detergents): 2.0 min |

## 3. Results

An observation of the program sequences using the Fibretherm FT 12, revealed even cooking of the samples and consistent rotation of the sample carousel in the detergent solution. There was moderate foaming at the set laboratory-specific program parameters. During the pumping processes, every sample bag was wetted once more from above with the detergent solution. The programmed siphoning times were sufficient for the filtration of the sample solutions.

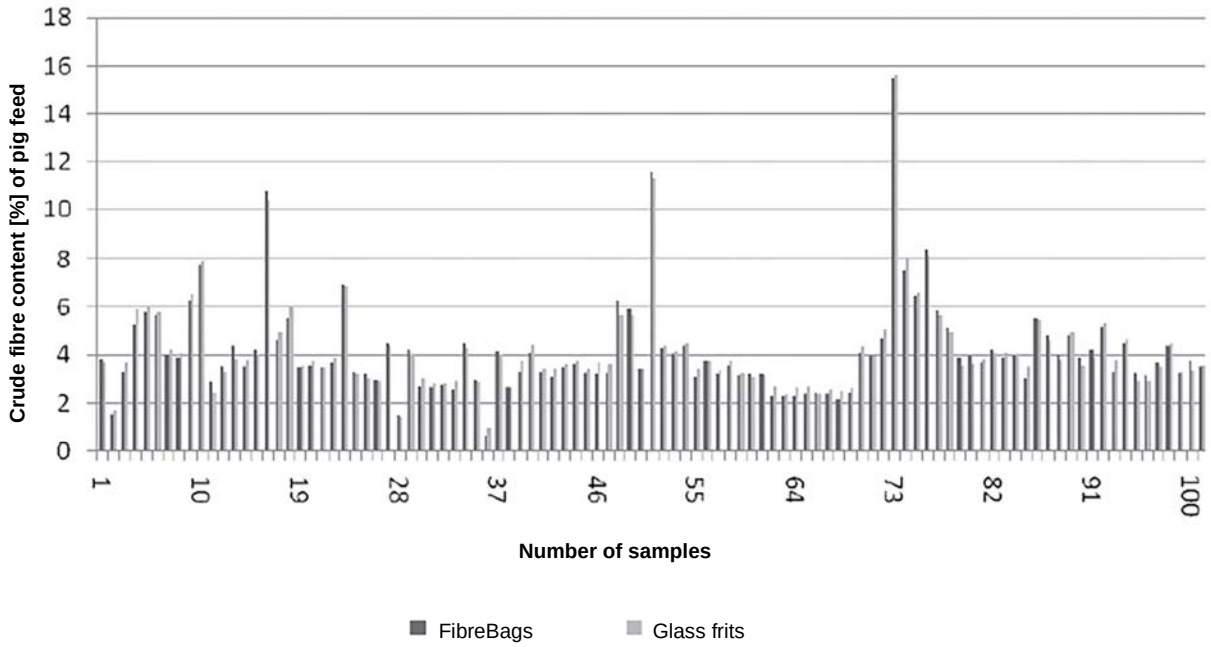


Fig. 1 Crude fibre content (%) of pig feed (shown here: average values from twin determinations)

The average values derived from over 1,044 individual measurements, produced a maximum repeat measurement variance of 0.3%, in line with the requirements of the VDLUFA method (for a crude fibre content of less than 10%) and a maximum repeat measurement variance of 3% (for a crude fibre content of 10% and over, relative to the higher value).

The crude fibre content levels of the examined feedingstuffs were between 0.63% and 15.60% for pig feed, between 2.18% and 4.67% for poultry feed and between 4.40% and 13,31% for cattle feed (Fig. 1, Fig. 2, Fig. 3).

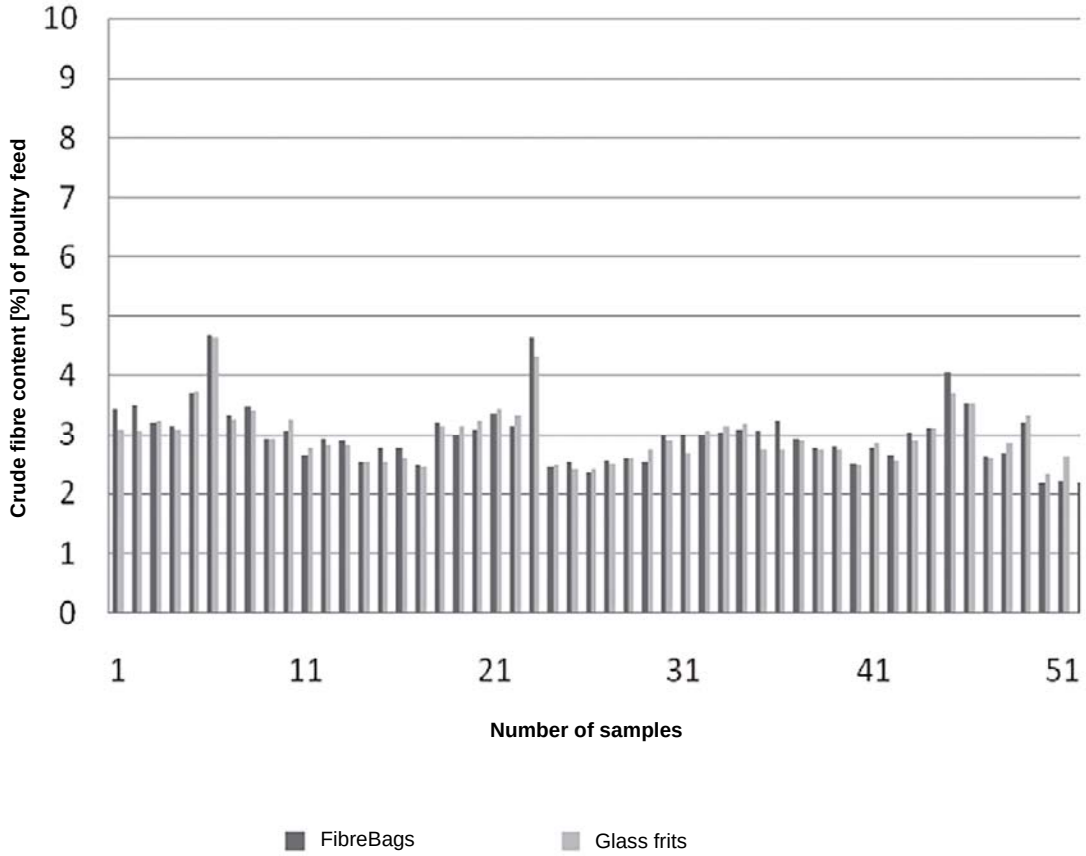


Fig. 2 Crude fibre content of poultry feed (shown here: average values from twin determinations)

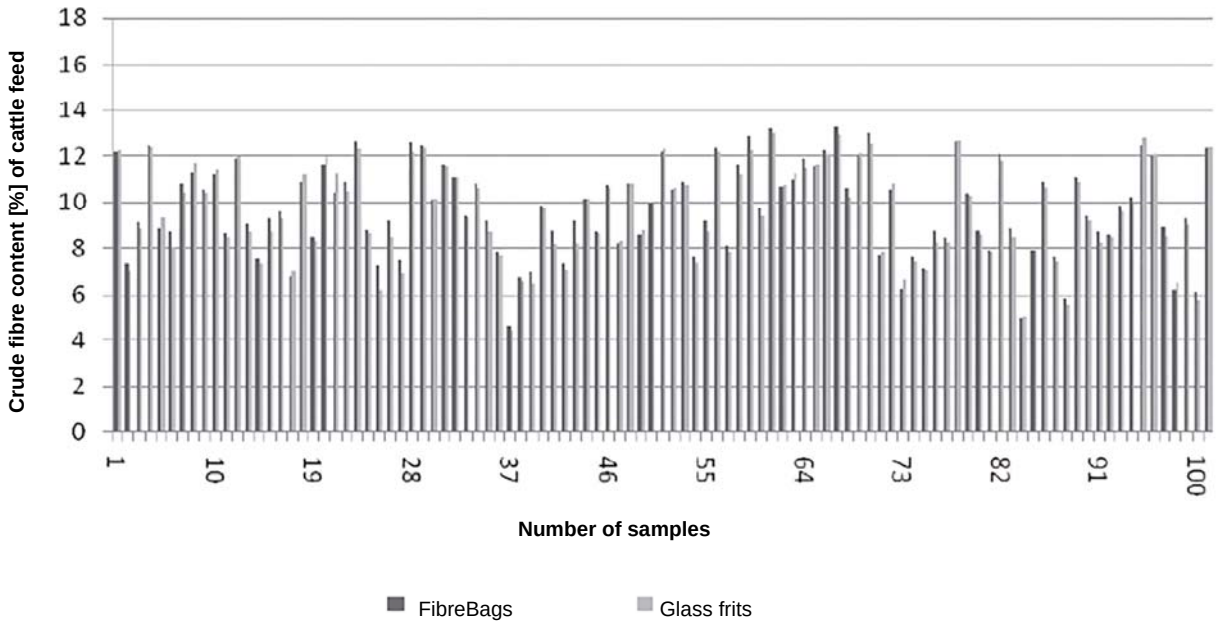


Fig. 3 Crude fibre content of cattle feed (shown here: average values from twin determinations)

Tab. 2: Average deviations of results from the FibreBag system as measured against the glass frit system, in addition to the average of the standard variances between the FibreBag system and the glass frit system

| Feed type | Average deviation [%] | Average of standard variances [%] |
|---|---|---|
| Pig feed | -0.06 | 0.15 |
| Poultry feed | +0.02 | 0.07 |
| Cattle feed | +0.15 | 0.19 |
| All feed types | +0.04 | 0.15 |

The average deviation of the results of the FibreBag system, as set against the glass frit system, was -0.06% for pig feed, +0.02% for poultry feed and +0.15% for cattle feed (Tab. 2). The average of the standard variances was 0.15% for pig feed, 0.07% for poultry feed and 0.19% for cattle feed. The average difference of all samples tested amounted to +0.04%, while the corresponding standard variance was 0.15%. The correlation coefficient between the crude fibre content levels established with glass frits on the one hand, and the Fibretherm FT 12 on the other, was 0.997. The calculated coefficient of determination ($R^2$) stood at 0.994 (Fig. 4).

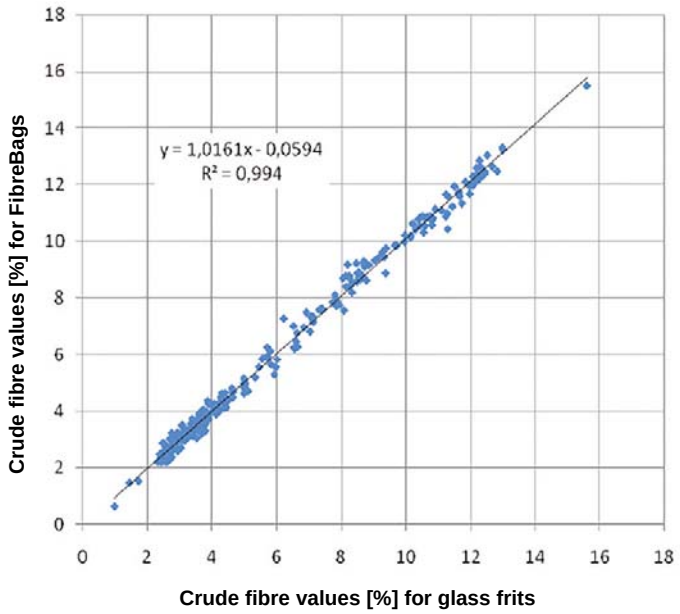


Fig. 4: Values of all feed types with calculated function lines and coefficient of determination ($R^2$)

## 4. Considerations and conclusions

The comparison of results calculated using both methods, shows a very high concordance in crude fibre values for all tested feed types. The large concordances are demonstrated by minute standard variances and high correlation coefficients. These results, which the automatically operated FT 12 system guarantees, are clear to see, and are the result of good wetting of samples with the detergents (via spacers, rotation of the sample carousel and circulation of the detergent solution) and by means of intensive rinsing procedures. Another factor one can take as essential to this high concordance are the effective filtration characteristics of the FibreBags and their precise pore sizes. The results show that for the tested feed types (pig, cattle and poultry) like-for-like values are rendered using the Fibretherm FT 12, as set against the VDLUFA method. As a result of process automation and the high number of samples, crude fibre determination with the Fibretherm FT 12 represents a time and space-saving alternative to the VDLUFA method.

## 5. Summary

Comparative tests were performed to determine the crude fibre content of feedingstuffs, in accordance with both the official VDLUFA method and by using the Fibretherm FT 12, which is produced by the C. Gerhardt company. The Fibretherm FT 12 automatically handles all cooking, rinsing and filtration processes for crude fibre determination of up to 12 samples. In over 1,044 individual measurements, pig, cattle and poultry feed were comparatively analysed. The results demonstrate high concordance between the crude fibre values for all tested feed types. The determined correlation coefficient stands at 0.997. The Fibretherm FT 12 can thus be employed here in the same capacity as the official VDLUFA method for the analysis of crude fibre content of the tested feed types. As a result of automatic sample treatment and the high number of samples that can be tested, this process, as compared to the conventional method, represents a highly efficient, time and space-saving alternative.

## 6. References

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