

EVOLUTION OF THE FEED ANALYSIS CONSORTIUM

Charles G. Schwab¹ and Frederick P. Lundy III²

Dairy Nutrition Research Center,
30 O'Kane Road, Durham, NH 03824
www.feedac.org

¹Board President/Executive Director, Phone: (603) 862-1341, Email: charles.schwab@unh.edu

²Operating Manager, Phone: (603) 862-1724, Email: fred.lundy@feedac.org

History of North American Data Collection Efforts

An excellent review on the history of feed composition data bases can be found in the National Research Council publication entitled: *Building a North American Feed Information System* (1995). The following is an excerpt of that review:

“Recognizing the importance of the nutrient composition of feeds as early as 1809, the first table containing such information was published by Thaer, who compared the nutrient value of feed to that of hay (Oltjen, 1992). The 15th edition of *Feeds and Feeding* included a compilation of the nutrient composition of feeds in the United States. That book was continually revised until the twenty-second edition was published in 1956 (Morrison, 1956). In 1941, the chairman of the Committee on Animal Nutrition (CAN) of the National Research Council (NRC) asked B.H. Schneider of the West Virginia Agricultural Experiment Station to prepare a report examining the results of all studies on the digestibilities and composition of feedstuffs that had been conducted to date. *Feeds of the World, Their Digestibility and Composition* was published as a result of Schneider’s work (Schneider, 1947).

In 1952, NRC's Board on Agriculture took on the challenge of addressing the need for data on the nutrient composition of feed by establishing the Feed Composition Committee. Two publications, *Composition of Concentrate By-Products* (National Research Council, 1956) and *Composition of Cereal Grains and Forages* (National Research Council, 1958), resulted from the efforts of that committee. In 1959, *United States-Canadian Table of Feed Composition: Nutritional Data for United States and Canadian Feeds* was published (National Research Council, 1959). That publication contained chemical and biological data for 1,500 feeds. Scientists at Utah State University began developing a system to describe feeds in 1948, and in 1963 they obtained a grant from the National Institutes of Health to develop an international system for naming feeds and for computerization of feed data. The NRC's Committee on Animal Nutrition made extensive use of the feed data and during the period from 1963 to 1971, the Subcommittee on Feed Composition was charged with converting the data to metric equivalents, in addition to updating and adding new data (Oltjen, 1992). The *Atlas of Nutritional Data on United States and Canadian Feeds* (National Research Council, 1971) was published as a result of the committee's work.

In 1971 the Food and Agriculture Organization of the United Nations (FAO) conducted a survey of ongoing international activities in the field of feed data collection; the systems used to code, store, and retrieve feed data; and possibilities for collaboration on an international basis. Following the survey, FAO invited scientists working in this area to Rome in 1971 and 1972 to explore the feasibility of achieving international cooperation in describing feedstuffs and collecting feed composition data. These meetings brought about the International Network of Feed Information Centres (INFIC). The aim of that group is to contribute to more responsible animal production throughout the world by improving access to reliable information on the composition, nutritive value, and practical use of feeds for animals. The activities of INFIC began with promoting the establishment and effective operation of cooperating centers for the collection, processing, and dissemination of information on the chemical composition and nutritive value of feeds while addressing general information on practical ways to feed animals and the efficient use of feeds. INFIC makes possible the exchange and dissemination of information within and between countries in a simple, uniform, and unambiguous manner.

Prompted by the need for a participatory INFIC center within the United States, the International Feedstuffs Institute (IFI) was organized at Utah State University in 1972. The concept of a feed data base functioning as a tool for the exchange of information was adopted. IFI took on the responsibility for collecting and processing feed composition data in the United States. Scientists from IFI collaborated with scientists at other INFIC centers throughout the world. Data were an invaluable resource used by the CAN Subcommittee on Feed Composition and by other subcommittees in preparing and revising animal nutrient requirements publications. Research scientists, practicing agricultural professionals, producers, and educators relied heavily on the feed composition data base first developed by CAN subcommittees and augmented by IFI at Utah State University. Inclusion of feed composition data in NRC's nutrient requirement publications was a touchstone for the science of animal feeding. The data were and continue to be in demand, with more than 200,000 copies of CAN nutrient requirement and feed composition publications purchased.

Revision of the *United States-Canadian Table of Feed Composition* was completed in 1982 with the publication of its 3rd edition (National Research Council, 1982b). USDA appointed a study group that same year to review the operations of IFI, determine aspects critical to researchers, and recommend a strategy for future data base activity. The study group emphasized the critical need for the data base by users in the United States and abroad and recommended upgrading the domestic aspect, obtaining missing data, and improving the accuracies of specific values (R. R. Oltjen, Agricultural Research Service, U.S. Department of Agriculture, unpublished data, 1982).

Responsibility for the data bank was subsequently transferred to the National Agricultural Library in 1985 as the Feed Composition Data Bank (FCDB). The data base was maintained, and new values obtained from the published literature were incorporated for the next several years. In response to budget constraints, the activities of FCDB were suspended in 1990, halting an organized nutritional science movement toward facilitating sustainable, efficient, and environmentally sound agriculture.”

In lieu of the suspended activities of the FCDB, the U.S. Department of Agriculture requested that the NRC's Board on Agriculture review all issues pertaining to the establishment of a feed information system. A subcommittee chaired by Joseph P. Fontenot (Virginia Polytechnic Institute and State Univ.) and consisting of Dwayne R. Buxton (ARS, Iowa State Univ.), George C. Fahey (Univ. of Illinois), Lawrence R. Jones (Cornell University), James E. Nocek (Agway Inc., Tully, NY), Rodney J. Noel (Office of the Indiana State Chemist and Purdue Univ.), Keith E. Rinehart (Perdue Farms, Inc., Salisbury, MD), and Gerald C. Weigel (Archer Daniels Midland Company, Decatur, Il) was created to specifically address the following:

1. the type, source, and quality of data to be included in the feed information system;
2. the uses of such a system in research, industry, trade, extension, and education;
3. the electronic technology and operations associated with the development, maintenance, and use of a feed information system; and,
4. International use of a feed information system.

To obtain the views and opinions from experienced data base managers and potential contributors or users of the data base, a symposium and ensuing workshop were held in December 1992. From these meetings, the subcommittee developed recommendations on the criteria for establishing a feed information system. The following recommendations were made.

1. A North American feed information system should be maintained within the USDA.
2. An advisory group representing the users of a North American feed information system should be established.
3. A strong relationship with industry and academia that ensures that representative sample information is acquired throughout North America should be developed.
4. The data base system should be adequately staffed to ensure appropriate data handling and rapid information dissemination.
5. The official methods of feed analysis of the Association of Official Analytical Chemists (AOAC) are recommended for routine analyses of the nutrient composition of feeds.
6. Feed ingredients should be classified by ingredient type and source.
7. All chemically measurable components that have biological meaning should be included in the chemical description of each feed.
8. Information on the bioavailabilities of the nutrients in feedstuffs should be included as a standard component of the data base.
9. Data should be obtained from countries within North America and other countries. These sources should primarily include the scientific literature, commercial laboratories, and feed industry.
10. The managers of the data base should go beyond passively collecting compositional data supplied by industry and service laboratories and gather data from the scientific literature by actively participating in the identification of data needs, creating standards of data acceptability, and establishing mechanisms to ensure the accuracy of the data included in the data base.
11. A budget adequate to account for the routine costs incurred by similar data bases already in operation, costs associated with inflation, and costs of timely and efficient information gathering and dissemination is recommended.

A Summary of North American Data Collection Efforts

A summarized and condensed list of collection efforts can be found below (note: many feed production companies and testing laboratories maintain private data collections and are not listed):

- ◆ 1941 – B.H. Schneider, West Virginia AES
 - *Feeds of the World, Their Digestibility and Composition* (1947)
- ◆ 1952 – NRC Board of Agriculture established the Feed Composition Committee. The following publications resulted:
 - *Composition of Concentrate By-Products* (1956)
 - *Composition of Cereal Grains and Forages* (1958)
- ◆ 1959 – *United States- Canadian Table of Feed Composition: Nutritional Data for United States and Canadian Feeds* was published (3 revisions)
- ◆ 1963 – Utah State Data base (USD) effort was initiated.
- ◆ 1971 – The *Atlas of Nutritional Data in United States and Canadian Feeds* (NRC, 1971) was published.
- ◆ 1971 – FAO established the International Network of Feed Information Centres (INFIC). As of 1994, 37 institutions in 20 countries were members
- ◆ 1972 – International Feedstuffs Institute (IFI) was organized at Utah State Univ. to be a participant in INFIC
- ◆ 1985 – USDA moved IFI data base to the National Agriculture Library as the Feed Composition Data Bank (FCDB)
- ◆ 1990 – Activities of FCDB suspended due to USDA budget constraints
- ◆ 1992 – Meeting held in Washington, DC; NRC appointed subcommittee to examine issues pertaining to the need for a North American Feed Information System
- ◆ 1995 – The 1992 appointed subcommittee developed the NRC publication *Building a North American Feed Information System*. No action followed the recommendations
- ◆ 1997 – Ingredients101 (affiliate of LaBudde Group, Inc.) data base established.
- ◆ 2003 – International Life Sciences Institute (ILSI) release Version 1.0 of the Crop Composition Data base (Version 2.0 released in 2004)
- ◆ 2003 – Creation of the Ruminant Feed Analysis Consortium

Feed Analysis Consortium History

In the spring of 2002, a 2-day brainstorming meeting of about 12 ruminant nutritionists, (including the first author of this paper), was held to discuss the most limiting factors in balancing ruminant diets in the 21st century. From this meeting, it was concluded that a need existed for (1) better characterization of feed ingredients and (2) to keep the cost of feed analysis as low as possible. It was also concluded that the animal feed/production industry had gotten ahead of itself with the more advanced ruminant models – lots of successes, but also some failures. The group pondered the questions, is it the models, is it the result of too much reliance on inappropriate default values or reference values in target animals, is the result of less than accurate feed analysis, or is it the result of not analyzing feeds for some chemically measurable components that have significant biological meaning? The first author on this paper was also on the Dairy NRC (2001) committee. Thus, he experienced first hand the frustrations of trying to assemble tables of feed composition to build a diet evaluation model to meet the needs of the animal feed industry without a standardized data base to rely upon. Over a year was spent meeting with ruminant nutritionists to talk about what was needed to prepare the initial vision and mission statements, and to develop an organizational structure that they thought would allow the initiative to succeed. Thus, with the encouragement of others, he was motivated to start the Ruminant Feed Analysis Consortium.

Established in August of 2003 as an industrial consortium at the University of New Hampshire, and with the financial support of 17 Founding Sponsors, the Ruminant Feed Analysis Consortium (RFAC) conducted its first meeting on October 20, 2003 in conjunction with the Cornell Nutrition Conference. The purpose of the meeting was to bring together the Founding Sponsors, along with some researchers and feed analysts to finalize the mission statement, objectives, and organizational structure of the consortium and to make plans for the first year of operation. The initial Mission Statement and Objectives that resulted from the meeting were as follows:

Mission Statement:

The consortium is committed to providing the North American ruminant feed industry with a database of feed analysis information to support and enhance ration formulation and evaluation systems. This effort will encourage research into improved methods of feed analysis and support the development of ration formulation and evaluation systems that more accurately predict animal responses to diet changes, allow for more precise matching of nutrient supply with nutrient requirements, and result in more environmentally sustainable feeding practices. The consortium aims to establish a platform of collaboration and communication among nutritionists, feed analysts, researchers, educators and suppliers of feed and feed additives.

Objectives:

1. Obtain accurate and validated physical, chemical and biological (in vitro and in situ) data for all feedstuffs fed to dairy and beef cattle in North America to support and upgrade diet evaluation/formulation systems.

2. Quantify relationships between the chemical composition of feeds and biologically derived estimates of carbohydrate and protein fractions, ruminal digestion rates, and intestinal digestibility coefficients.
3. Stimulate feed analysis development and standardization.
4. Follow changes in nutritionally important feed characteristics as a result of genetics, processing methods, and the environment.
5. Validate the use of the better databases and revised computer models.
6. Develop sample sets that can be used to promote and validate rapid methods of feed analysis, such as near infrared reflectance spectroscopy (NIRS), to estimate chemical and biologically derived feed characteristics required by ration formulation and diet evaluation models.

Several researchers associated with our Land Grant Universities and the USDA have an interest in feed analysis and ration formulation and diet evaluation models, but collaborations appear to lack an organized structure within which to share ideas and data. Yet, as evidenced by the attendance and participation at the first meeting, there is a genuine interest among researchers and analysts to work together to maximize the use of dollars spent on feed analysis to support existing models and allow for their upgrading. A concern was raised about the future of the NRC publications and computer models. It had been rumored that there won't be another Dairy NRC. The extensive time commitment required of committee members, the lack of federal funding for these initiatives, and the lack of clean and adequate data sets were seen as major obstacles. It also was indicated that the functions of the Committee on Animal Nutrition (CAN) has ceased. This is a major concern. It was indicated that the Board of Agriculture will take over the role of CAN, but with only two animal scientists involved on the Board; the future of CAN was questioned. Given these concerns, coupled with the heightened concerns of the impact of animal agriculture on the environment, it seems that if research in the area of feed composition and nutrient requirements is to be continued, industry support and leadership is needed. While federal funding may be available, broad support and leadership from industry should demonstrate a need and appeal to public granting agencies.

As the Consortium evolved, the challenges of trying to operate as an industrial consortium on a university campus became totally consuming and diverted time and energy away from making progress on feed analysis. Thus, in 2005, it became apparent that incorporating as a non-profit entity was imperative to the success of the initiative. With this in mind, a seven (7) member Board of Directors was created and the Consortium is in the process of incorporating as a 501(c)(3) non-profit organization. There are many reasons for incorporating. Some of these reasons include: 1) the need for creation of a formalized operating structure with by-laws, officers and a board of directors that will ensure that the consortium and its activities will continue as leaders come and go, 2) the need for a business structure that will allow the consortium to enter into relationships with other organizations and to accommodate growth in membership and activities, 3) the elimination of a third party (i.e., the University of New Hampshire) in decision-making and business management, 4) the ability to generate revenue from memberships, contracts and grants, meeting registration fees, etc. without assessments of indirect costs, and 5) the need to put decision-making authority into the hands of more people. The potential scope and activities of the initiative are too wide-ranging to operate as an industrial consortium at a university.

As the scope of activities continues to expand, it was proposed that the Consortium emerge as the “Animal” Feed Analysis Consortium or simply Feed Analysis Consortium, rather than as the “Ruminant” Feed Analysis Consortium. This change is not only in recognition of the need for a North American feed information system that serves all animal industries, but also to bring together all of the interests and expertise that exists in feed analysis and feed analysis research. Excellent “methods research” expertise exists in the swine, poultry, and equine industries, and by working together all interests will be better served. For example, some of the best expertise in the areas of intestinal digestibility measurements of nutrients resides in poultry and swine. Building future quantitative nutrition models for ruminants will also require this information. So while a departure from the more limited scope and mission of RFAC, this move is expected to enhance, rather than dilute, the original goals of the consortium. Including the interests of all farm species also makes the consortium more appealing to companies that provide feeds and feed additives to more than one animal industry.

As the documentation began to be constructed for the incorporation process, it became evident that the mission statement and goals of the Consortium needed some modification to reflect the changes proposed and thus, the modified version follows:

Vision Statement

It is the vision of the Feed Analysis Consortium that there is continued advancement, development and standardization of feed analysis, that there is a comprehensive, evolving and accessible database of feed analysis information for all who can benefit from its use, and that there is continued improvements in the development of quantitative animal nutritional models. These advances will allow for precise matching of nutrient supply with nutrient requirements, improved animal health and production, accurate prediction of animal responses to diet changes, maximum nutrient usage, and more environmentally sustainable feeding practices.

Mission Statement

It is the mission of the Feed Analysis Consortium to serve the feed industry by building and maintaining a comprehensive and evolving database of feed analysis information, developing improved and more rapid methods of feed analysis, and encouraging the development of improved diet formulation and evaluation models.

Technical Goals

To best serve our members, we believe our technical goals should be precise and obtainable while at the same time being all encompassing and futuristic.

1. Establish reference methods for the analysis of all chemical components (including their digestibilities where relevant) and physical factors in feedstuffs that have relevant biological meaning.
2. Obtain accurate and validated chemical, physical, and relevant digestibility data for all feedstuffs fed to animals in North America.
3. Identify changes in feedstuff composition and characteristics as a result of genetics, processing methods, and the environment.

4. Quantify relationships between the chemical composition of feeds and biologically derived estimates of digestion rates and intestinal digestibility coefficients.
5. Evaluate and validate rapid methods of feed analysis (e.g., NIRS).
6. Support the development and continued advancement of diet formulation and evaluation models for practical application in the field.

Communication Goals

To have effective, dynamic, and interactive communications among everyone involved in feed analysis, diet formulation, and suppliers of feed and feed additives.

Two current initiatives to enhance communication are:

1. Consortium Website (www.feedac.org): The website serves as the focal point for day-to-day consortium communications. A forum has been established (restricted to consortium members) to facilitate interaction among members. In addition, separate restricted areas for each committee been set up. A prototype online library of procedures has been constructed (primarily based on NFTA approved procedures). Revisions/modifications to approved consortium procedures will be tracked using an audit trail mechanism, allowing incoming data to be tagged by specific procedure used. Algorithms and interface screens for basic summary analysis of the data have been developed, with further work planned once data starts rolling into the system.
2. Annual Feed Analysis Conference: The conference is intended to promote "face-to-face" interaction among members, to share research results, and to provide a more formal venue to conduct business and report on consortium activities. It is expected that presentations at this conference will be made available via the website, and that the website would be used to maintain continuity between scheduled conferences.

Consortium Accomplishments to Date

1. Identified 17 Founding Sponsors who saw the need for such an initiative and who were willing to give of their time and resources to help get the Consortium started.
2. Established the Consortium as an Industrial Consortium at the University of New Hampshire.
3. Developed the Consortium website, which was built to serve as the primary communications tool for those involved in the Consortium. Current features include different levels of access based on membership status. Basic information regarding the project is available to the general public, while a login is required to access the members & collaborators sections. A public forum, file sharing capability, access to newsletters, and calendar information is also available to these members.
4. Established and defined the scope of feed analysis work for 2004-2005. Six feeds (corn grain, soybean meal, distillers dried grains, blood meal, whole cottonseed, and commercial alfalfa hay) were identified for a first round of analysis. It was decided to

create “Commodity Expert Groups” to help identify and acquire approximately 100 samples of each of the feedstuffs, analyze the feeds for a limited number of analytes, select a minimum of 10 samples of each that reflects natural diversity, and do an intensive analysis of those (chemical, in vitro, in situ, and NIRS spectra).

5. Established “Nutrient Focus Groups” consisting of professionals from academia and industry to help make decisions on specific areas of expertise. Nutrient Focus Groups created thus far include:

Dry Matter	Software/Ration Formulation
Non-Fiber Carbohydrates	Metabolism
Fiber Fractions	NIRS
Protein/Protein Fractionation/AA	In-Situ
Lipids/Fatty Acids	Biological Assessment
Physical Properties	Nutritional Modeling
Research and Development	Field Support for Nutritionists
Data Management/Feed Descriptors	

6. Established directories of all companies, cooperatives and field nutritionists in North America that are associated with the ruminant feed industry. This directory will continue to be updated and expanded to include all species.
7. Developed an annual membership agreement that is compatible with the needs and desires of RFAC members. Specifically, the agreement gives Consortium members the right to access all data and reports as compiled and produced by the Consortium.
8. Resolved Issues pertaining to agreements on business management, consideration of collaborators as sub-contractors or service providers, and membership agreements on June 9, 2004 when a financial agreement between RFAC and the College of Life Sciences and Agriculture (COLSA) at UNH was signed. .
9. Purchased and received the Sepor 48” Rotary Sample Splitter. This machine allows RFAC to split each 50 pound sample into 24 homogenous sub-samples for analysis by the selected feed testing laboratories and academic institutions.
10. Created the “Strategy of Analysis of Samples” document, which outlines the sample analysis timeline for the 6 selected feedstuffs.
11. Selected the first ever Board of Directors and submitted the necessary paperwork to the Consortium lawyer for incorporation as a 501(c)(3) non-profit entity renamed the “Feed Analysis Consortium, Inc.”.

Summary

The Feed Analysis Consortium is positioning itself to create, maintain, and provide a North American Feed Information System. This collaborative effort between academic and industry leaders will allow for sharing of ideas to further the development of feedstuff analysis, methodology and nutritional modeling.

References

1. Morrison, F.B. 1956. Feeds and Feeding, 22nd Ed. Clairmont, Alberta, Canada: Morrison Publishing.
2. National Research Council. 1956. Composition of Concentrate By-Products. Washington, D.C.: National Academy Press.
3. National Research Council. 1958. Composition of Cereal Grains and Forages. Washington, D.C.: National Academy Press.
4. National Research Council. 1959. United States-Canadian Tables of Feed Composition: Nutritional Data for United States and Canadian Feeds. Washington, D.C.: National Academy Press.
5. National Research Council. 1971. Atlas of Nutritional Data on United States and Canadian Feeds. Washington, D.C.: National Academy Press.
6. National Research Council. 1982b. United States-Canadian Tables of Feed Composition, 3rd Ed. Washington, D.C.: National Academy Press.
7. National Research Council. 1995. Building A North American Feed Information System. Washington, D.C.: National Academy Press.
8. Oltjen, R.R. 1992. Background: Status of the Current System. Paper presented at the Symposium on Building a National Feed Composition Data Base, Washington, D.C., December 1-2, 1992.
9. Schneider, B.H. 1947. Feeds of the World: Their Digestibility and Composition. Morgantown: West Virginia Agricultural Experiment Station.