

The Development of the FAO Tropical Feeds Information System

A.W. Speedy

University of Oxford, Department of Plant Sciences, South Parks Road, Oxford OX1 3RB, UK

Background

FAO Tropical Feeds first appeared in 1975, the result of a considerable amount of work by the author Bo Göhl. At that time, published information on the nutritive value of feeds in general was scarce, particularly for tropical feeds. Bo Göhl reviewed some 600 references and produced descriptions and tables for 600 feed materials, including grasses, legumes, fodders, cereals, oilseeds, fruits and vegetables, animal by-products and miscellaneous materials.

At about the same time, FAO agreed to participate in an International Network of Feed Information Centres, designed to provide a means of collecting and disseminating data on the composition and nutritive value of feeds and information on their use. While much effort was put into systems of nomenclature, classification and coding, the INFIC system (which was run from centres in Australia, Canada, the Netherlands and the United States.) failed to add significantly to the value of the earlier work, with its focus clearly on tropical materials.

In a report to FAO in 1991, Speedy (1991) concluded that large scale feed information databases were of limited value for use on small scale projects in developing countries. INFIC had concentrated on detailed analysis of feed composition and the compilation of data from laboratories. However, it paid undue attention to cereals, conventional protein supplements (soya, groundnut, etc.) and much less on the local feed resources of Africa, India, SE Asia and Latin America (alternative crops, by-products, forages and tree foliages).

It became clear that INFIC has failed to realize its objectives as a comprehensive system of feed information for use in developing countries. Indeed, emphasis has changed towards sustainable systems of livestock production based on locally available feed resources (rather than imported grains and supplements), with greater notice given to the biodiversity of plant materials and their role in integrated farming systems. Data is required on the diversity of feeds rather than more detail on the limited range covered by the traditional computer databases of the INFIC system.

Tropical Feeds, however, provided a much wider range of materials and highlighted information that was unavailable elsewhere. While the analytical data was limited, it focused on feed description, including the use of materials for different classes of livestock and the practical problems and limitations. This was achieved by emphasizing text descriptions rather than tabular data.

Hence the decision was taken to develop Tropical Feeds as a computerized database which could be easily used and cheaply distributed worldwide. Initially, the text of the original Tropical Feeds was electronically scanned and converted to computer text with Optical Character Recognition (OCR) software. Then a special program was written to enable selection, viewing and printing of the text and data. Finally the program and data were committed to a single floppy disk, in compressed format, which was distributed by the Feed Resources Group, FAO Animal Production and Health Division.

The key features of the Tropical Feeds Diskette which has made it widely accepted and acclaimed by users include:

- * focus on local feed resources of tropical countries, including legumes, fodders, fruits and vegetables, oilseeds, crop residues and agro-industrial by-products (plus grasses, cereals and conventional feedstuffs).
- * text description including botanical and physical characteristics, processing, antinutritional factors, uses and limitations for different classes of livestock

- * limited data with emphasis on composition of different components and botanical stages (seeds, fruits, immature and mature stages, etc.)
- * full references to sources of information and published articles
- * simple and effective software to search, view and print the text and data

Development of Tropical Feeds 1991-92

Further work on the system (Speedy, 1992) achieved the following results:

- * improved software
- * assemblage of 638 references on tropical feed data from AGRIS, AGRICOLA and CABI databases on disk in WP notebook form.
- * New entries to tropical feeds were written on the following topics: Sugar cane, whole sugarcane, sugarcane tops, sugarcane juice, molasses, filter mud, maize, *Gliricidia sepium*, *Prosopis chilensis*, *Prosopis juliflora*, *Prosopis tamarugo*, *Acacia nilotica*, cottonseed, *Coffea arabica* (text received from R. Bressani), molasses-urea blocks (edited text from Sansoucy et al., FAO Animal Production and Health Paper 72).
- * Revision of entries on rice straw, sweet potatoes and cassava.
- * Addition of data on Dry Matter degradability (provided by Dr E.R. Ørskov, Rowett Research Institute) and additional data on degradability compiled from published information, mainly from Animal Feed Science and Technology. Where necessary, a standard equation was fitted to published data to provide tables of solubility, degradability and rates. DM and nitrogen degradabilities have been included where possible. A total of 90 items on rumen degradability were added.
- * New data on amino acid composition, obtained from the Brazilian national research centre (EMBRAPA) for swine and poultry (CNPSA) have been added.

Proposals for further development of tropical feed information 1992

The report of de Jong and Preston (1992) proposed a scheme for the further development of tropical feed information based on the FAO Tropical Feeds diskette system. In particular, their conclusions and recommendations proposed the following:

- * increased use of local natural resources, based on sustainable livestock systems within integrated crop-livestock systems on small and medium-scale farms;
- * emphasis should be on resources that can be grown by the farmer and processed and used on the farm;
- * the need to collect and interchange information on tropical feed resources, especially those that offer promise as alternatives to cereal grains and protein meals
- * data should include chemical composition (including *in sacco* degradability), physical description, secondary plant compounds and special considerations (toxicity, etc.)
- * how the feed can be used in production systems and for which animal species it is most appropriate, plus the possible role of the feed resource in relation to the sustainability of the production system.

They detailed a scheme which would categorise information by on-farm production systems which in turn would be determined by the target animal and the nature of the basal diet.

They listed the four major fields by animal groups as:

- * ruminants (cattle, buffaloes, sheep, goats and camelids)
- * non-ruminant herbivores (rabbits, guinea-pigs, horses, donkeys)
- * pigs
- * poultry, ducks, geese

They suggest that selection of a particular feed resource would direct the reader to the animal group where it is cited.

Within the animal groups, the main categories of:

- * grasses (grazed and fed in confinement)
- * cereal straws
- * sugarcane and by-products
- * cereals and derivatives

- * roots, tubers, fruits and derivatives
- * oilseeds and derivatives, etc.

were listed with different emphasis in each animal category.

Besides the data and description, they therefore placed increased emphasis on the feeding system, including:

- * how the material is fed
- * amount and method of offer
- * kind and amount of supplementation
- * main role (as fermentable N, by-pass protein, etc.)
- * recommended form of processing
- * levels of production that can be expected

Finally, they listed requirements for future research to include:

- * list of researchers working actively on the particular feed resource
- * list of institutions working actively on the particular feed resource
- * key references for further reading

They recommended that the FAO Tropical Feeds diskette system should be developed in this way.

Interpretation of the 1992 recommendations in the development of Tropical Feeds 1993

In further developing Tropical Feeds, the above recommendations have been taken into account, with particular emphasis on the incorporation of feeding systems information.

Hence a different approach has been taken to collect more information on feeding systems from the published literature. As well as writing new entries on water plants (*Azolla* and *Salvinia* spp.), the editor has searched the available literature from two major sources:

1. A detailed search of abstracts published in the FAO AGRIS bibliographic database relating to feeds and feeding systems in the tropics.
2. Extraction of key papers from the electronic journal Livestock Research for Rural Development relating to feeds and feeding systems.

This produced some 607 abstracts from AGRIS and 85 papers from Livestock Research for Rural Development.

The new system with access to published information on feeds and feeding systems

The recommendations of de Jong and Preston (1992) envisaged categorizing feeds by livestock species and also referring to their use within feeding systems. The most effective way to do this has proved to be by allowing access from the basic feed description to published articles as abstracts and summaries. The advantage of this approach is that the published reports can provide additional information in the following ways:

- * details of feed composition, digestibility, degradability - including comparative data on several feeds under the same laboratory and experimental conditions
- * details of feeding systems including feed mixtures, amounts, animal intake and performance, also on a comparative basis.
- * where more than one feed is cited in a reference (which is usually the case), the reference may be accessed from several locations, thus allowing the reader to see the comparative value of alternatives
- * details of feed preferences by animals, again on a comparative basis
- * details of mixtures either sown or as natural vegetation with indications of performance of specific mixtures (particularly relevant to grasses and grass-legume mixtures)
- * details of appropriate and effective supplements, again particularly relevant to tropical grasses and low-quality forages where supplements such as molasses, molasses-urea blocks, protein supplements, etc. have been provided. Such references are also accessible from both the basal diet component species and from the supplementary feed descriptions.
- * specific reference to the livestock involved, including different species, breeds, ages, starting weights, live weight gains, milk production, etc.
- * details are given of authors and institutions with respect to published material, as well as the source of the full articles and addresses for contact.

The abstracts/summaries give comparisons, details of feeding systems and animal production details under the specific experimental conditions. In some cases, there are a number of references under each category, allowing the reader to compare results and to browse actual data on the feed material in which they are interested. They appear on a separate menu on the feed description page, under the heading 'ADDITIONAL' for additional information.

In addition, the exercise produced 180 new feeds which were not previously included in Tropical Feeds but on which there was published information in the years 1984-1993.

The new feeds have been described on the basis of published material. Latin names and common names were included in the indices and a brief description written for each species, together with a table of composition where available. In addition, two new feed groups were added: Water plants and Toxic plants. However for many of the new feeds information is still very scarce. It is hoped that scientists working in tropical countries will contribute to provide the missing information.

The new computer program

In 1993-94, there was further improvement of the computer software used for compiling, searching, viewing and printing the information from Tropical Feeds (Speedy, 1993, 1994).

The program maintains its previous simplicity of use and general 'feel' but has been completely rewritten using new object code throughout to achieve greater speed, reliability and efficiency. There are two versions, for MSDOS and Windows and the complete system now fits in compressed form on one 1.44 MB 3.5 in. HD floppy disk which is installed to the user's hard disk with an appropriate installation program included in the diskette.

Although twice the size of the previous version of Tropical Feeds, it has been felt appropriate to move to high-density diskettes for distribution as disk drives of this type are now universally available throughout the world.

Graphics capabilities

Tropical Feeds, the book, contained some excellent line drawings which depicted the appearance of plants, including details of leaves, flowers, seeds, pods, etc. This was a useful aid to field workers in identifying materials, particularly with reference to grasses, legumes and other fodder plants. However, the use of computers with colour monitors enables even greater use of pictures, including real photographs which can improve both the appearance and utility of the database. The program was therefore modified to include graphics and 57 colour pictures were obtained from various sources. To make these available requires one additional HD diskette.

French and Spanish versions of Tropical Feeds

Besides the development of the English version, it was decided to produce versions of Tropical Feeds in French and Spanish languages. The two original books: *Piensos Tropicales* and *les Aliments du Bétail sous les Tropiques* have also been converted to electronic format and additional entries added.

Future development - Tropical Feeds as an electronic library

The direction of development of Tropical Feeds permits new possibilities for its future progress. The general concept of the index leading to feed description leading to more detailed articles on the feed, comparisons and systems will permit a system to be developed whereby new publications can be easily incorporated into the database structure. In addition, articles may be commissioned on specific feeds and specific aspects of comparisons and systems and added to the Tropical Feeds library on disk.

Furthermore, continuous updating of the feeds and supporting articles will be undertaken. It is a feature of the computer system and the Tropical Feeds software in particular, that a new edition may be released whenever new information is added. Hence the system can be continuously updated as new material is published and becomes available.

In conclusion. Lessons learned in the compilation of Tropical Feeds

Tropical Feeds is recognized as a valuable book for scientists and development workers operating with feeding systems in developing countries where the emphasis is on local resources, sustainable systems and integrated farming. The diskette version has been widely acclaimed as an efficient and cost-effective way of distributing the information more widely in developing countries. In addition, it is shown to be a good way to operate a continuously updated source of information in the area of tropical feed resources. The process should continue and further develop.

A number of lessons have been learned from the compilation of the new edition. In the work, a large number of sources of information were identified from the literature. However it was clear that there was considerable bias in the numbers of publications relating to different types of feed. Of the 351 feeds referred to in relevant literature sampled from 1984-1993, the statistics applied:

Number of references	Number of feeds
>50	2
45-49	2
40-44	0
35-39	0
30-34	3
25-29	1
20-24	4
15-19	4
10-14	14
5-9	25
0-4	<u>296</u>
	351

The most popular subjects of research were: *Gossypium* spp. (53), *Leucaena leucocephala* (52), *Arachis hypogaea* (49), *Panicum maximum* (48), *Digitaria decumbens* (34), *Pennisetum purpureum* (34), *Zea mays* (34), *Manihot esculenta* (25), *Cynodon nlemfuensis*

(23), Molasses (23), *Cynodon dactylon* (23), *Brachiaria decumbens* (22). 199 species had only one reference to them in the 10 year period.

This is not an accurate reflection of all the literature as it is after some selection by the editor. However, it is clear that there is much emphasis still on a relatively small number of common feed materials and not enough attention is being given to alternative species.

An important objective for the future is to emphasize the role of biodiversity in feedstuffs and to consider alternatives to the traditional feeds, not only maize and soya, but also the other common tropical materials which have been much studied.

In particular, it is clear that there are many alternative legume tree species and other fodder plants and yet there has been almost total concentration on *Leucaena leucocephala* at the exclusion of other, potential candidates.

Future objectives

In the future, a proactive attitude should be adopted towards encouraging new publications on more diverse alternatives, particularly in the area of fodders and legumes, but also in the alternative oilseeds, fruits and the various by-products.

Tropical Feeds should be seen as a vehicle for publishing new research, especially from developing countries, on these categories of feedstuffs. Action should be taken to contact laboratories and research centres to request data and suitable articles for inclusion. It should be stressed that the material required should include: feed comparisons, animal feeding system descriptions, animal performance data and details of antinutritional factors and other problems associated with new alternatives.

Many of these data probably already exist. For example, on a recent visit to Venezuela, it was indicated that a large number of projects do not get published in the literature (approximately 1.5% of projects reach publication). The problem of publishing results from developing countries should be addressed with urgency. Tropical Feeds may be an ideal vehicle to provide a useful method of compiling unpublished data and directing research to more local

alternatives in the field.

The objective is to establish a network of research workers in developing countries with interests in the area of alternative feed resources. The following steps are being taken to:

- 1) Compile an address list of workers and institutions (based initially on known FAO sources plus the extensive list of young research workers funded by IFS, the International Foundation for Science).
- 2) Distribute Tropical Feeds to all workers on the above list.
- 3) Request publications on alternative feeds and feeding systems associated with the lesser-known materials.
- 4) Establish network communications by:
 - a) diskette transfer
 - b) electronic mail and data interchange

In this way, Tropical Feeds can begin to be a medium for data interchange with particular emphasis on local feed resources and on biodiverse alternatives in tropical areas.

The FAO Electronic Conference on Tropical Feeds and Feeding Systems

As a start to the process of developing a 'Tropical Feeds Network', this conference has been started and employs a number of electronic communication methods to reach as many scientists, development workers and other interested persons. These include:

FTP (File Transfer Protocol)

Files are lodged on a computer which is accessible via the Internet and can be downloaded on the users computer. The files available include discussion papers on methodologies, feed descriptions, articles on sustainable production systems, utilities to read the articles and finally, the Tropical Feeds diskettes.

Gopher

A method of transferring the above information over the Internet in text format from a menu index.

World-Wide-Web

The new method of transferring text and graphics over the Internet (developed at the European Particle Physics Laboratory (CERN), Switzerland) and using software such as Mosaic or Netscape on the user's computer. All articles, the Tropical Feeds database and other relevant material is now established on the WWW server at the University of Oxford and on the WAICENT site at FAO.

UUCP (Unix-to-unix-copy-program)

For sites in developing countries, contact has been established using direct telephone connections to central machines in the country. The Oxford computer dials these sites daily and passes electronic mail and files rapidly by UUCP. Connections are in operation to Laos and Vietnam using this method. Local networks are established so that users can exchange mail and obtain the files from the central national site.

Listserver

Discussion of the papers in the conference took place by electronic mail using a listserver program which automatically passed all messages to registered subscribers. An initial list was compiled in consultation between FAO headquarters and the Listserver operators and members were invited to introduce new interested colleagues as the conference proceeds.

Proposed outcome of the conference

The electronic conference enabled contributions from a wide range of participants to the future development of Tropical Feeds. It will be published as an FAO Animal Production and Health paper, as well as providing additional material for the database. Furthermore gave experience of the operation of the new medium of the electronic conferences and data interchange, and serve as a model for future Expert Consultations.

References

- de Jong, C. and Preston, T.R. 1992. Report. FAO Animal Production and Health Division, FAO, Rome.
- Göhl, B. 1971. Tropical Feeds. FAO, Rome.
- Speedy, A.W. 1991. Report. FAO Animal Production and Health Division, FAO, Rome.
- Speedy, A.W. 1992. Report. FAO Animal Production and Health Division, FAO, Rome.
- Speedy, A.W. 1993. Report. FAO Animal Production and Health Division, FAO, Rome.
- Speedy, A.W. 1994. Report. FAO Animal Production and Health Division, FAO, Rome.