INTERNATIONAL FEED DATABANK SYSTEM

An Introduction Into the System with Instructions For Describing Feeds and Recording Data

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Summary

An International Network of Feed Information Centers (INFIC) has been organized to contribute to more efficient animal production by establishing feed information Centers at strategic locations for the dissemination of data throughout the world.

INFIC has developed an International System to describe feeds, record chemical and biological data about feeds, and to code the data so it can be stored, summarized, retrieved, and printed in flexible formats. On-line data is available for calculating diets to obtain maximum profit.

An International Feed Description, which is the basis for a clear identification of feeds, is made up by combining descriptors of six facets:

1. original material (plant, animal or other basic material)
2. parts of the material used as feed
3. processes or treatments the material has been subjected to
4. stage of maturity
5. cutting or crop (for plants only)
6. grade (quality)

International Feed Names have been formulated for use in feed composition tables.

Also, according to their physical and chemical characteristics, feeds are grouped into eight classes as follows:

1. dry forages and roughages
2. pasture, range plants, or forages feed green
3. silages
4. energy feeds
5. protein supplements
6. mineral supplements
7. vitamin supplements
8. additives

Each feed is assigned a 5-digit international feed number, which links the chemical and biological data and the feed descriptions, the International Feed Names and other names together. Usually when printouts or tables are prepared, the feed class number (one digit), previously mentioned, is entered in front of the International feed number.

Apart from the identification of the feed, every attribute which has resulted from an analysis requires identification. A coding system with three digit codes identifies each attribute; examples are: dry matter, code 101; protein, code 109; calcium, code 530.

An extended system for describing factors which have, or may have, influenced the feed value of a sample (specific characteristics) has also been elaborated, for example, country, soil, fertilizer.

This publication describes the INFIC system and gives instructions to personnel in cooperating laboratories for entering feed composition information onto source forms. The completed source forms are sent to Type I INFIC Centers for processing.

1. INTRODUCTION TO THE INFIC SYSTEM

1.1 Background

The need for information concerning the nutritive value of feeds was recognized long ago. Thaer (1809) was among the first to publish tables in which the values of different feeds were compared with the value of hay ("hay equivalents"). Boussingault (1843) calculated such hay equivalents by using the nitrogen content of feeds. Wolff (1861), a feed scientist working in Hohenheim, first compiled extended tables on crude nutrients, nutrient requirements, digestibility and feed prices in 1861. In 1871, he published the first table with mineral values and later (1894) published a table including digestible nutrients.

Such tabulation was possible because Henneberg and Stohmann (1864) had standardized the "Weende" methods for analyzing feeds and for estimating their digestibility. In 1874, Atwater introduced this work in the United States. Armsby (1903) in the USA, and Kellner (1905) in Cermany compiled tables that included the nutrient contents and the energy values of feeds. Since that time, many feed composition tables have been published in different countries. For example, beginning with the 15th edition (1930) of his book "Feeds and Feeding" (first published in 1898) Morrison included feed composition tables. In 1952, the United States National Academy of Sciences recognized a need to review feed composition information. This resulted in two publications, one on the composition of concentrates (National Research Council 1956) and one on the composition of forages and grains (National Research Council 1958).

Since 1952, the predecessor of today's Documentation Center, Hohenheim University, Federal Republic of Germany, started a new series of feed composition tables compiled after a period of systematically collecting feed composition data. These tables are known as "DLG—Futterwerttabellen."

Within recent years comprehensive tables of feed composition have been published (National Academy of Sciences 1971; McDowell et al., 1974a; McDowell et al. 1974b; Göhl 1975; Agriculture Research Council 1976; Kearl et al. 1979 and Hartadi et al. 1980).

1.2 The International Network of Feed Information Centers (INFIC)

It seems to be more than a mere coincidence that in the home countries of the afore-mentioned pioneers in compiling of feed composition tables, Germany and the United States, two separate centers of feed data documentation were established. Feed documentation began in Germany in 1949 (Haendler 1963; Haendler 1966; Haendler and Jager 1971; Haendler and Harris 1973); and in the United States in 1952 (Harris et al. 1968; Harris and Christiansen 1972).

Although there was contact between the centers for several years, it was not possible to combine the two systems nor adapt them to each other. Personnel at the Utah (United States) Center contacted the Food and Agriculture Organization (FAO) of the United Nations concerning the need for world cooperation. FAO, in turn, sent a consultant to review ongoing international activities in the fields of feed data collection and systems for coding, storing, and retrieval of these data; and to report on possibilities for collaboration among these centers on an international basis. In his report, Alderman (1971) enumerated the value of a collaborative effort in this field, both to developing countries and to animal production at the international level. The recommendation was that FAO act as the coordinator for international activities in collecting data on feed composition and its summarization and dissemination.

FAO sponsored the first meeting which was held in 1971, in Rome (INFIC 1978). At that time, representatives from several feed information groups formed the International Network of Feed Information Centers (INFIC). Members were: Australian Feed Information Centre, Blacktown, Australia; Agriculture Canada, Ottawa, Canada, FAO, Rome, Italy; International Feedstuffs Institute, Utah State University, Utah, USA; US AID Feed Composition Project, University of Florida, Florida, USA; and the Documentation Center, Hohenheim University, Stuttgart, Federal Republic of Germany.

At the General INFIC Meeting held in Rome, June, 1980, there were 18 organizations represented. At this meeting, the discussions focused on the ratification of a constitution establishing the organization and governing body of the International Network of Feed Information Centers (INFIC). After some minor modifications, the constitution, as prepared by the policy committee, was ratified by those present.

1.3 The Aims of the International Network of Feed Information Centers (INFIC)

Article III of the INFIC Constitution explains the aims of the Network as follows:

General

To contribute to more efficient animal production throughout the world

By improving access to reliable information on the composition, nutritive value and practical use of feeds for animals.

Particular

To promote the establishment and effective operation of co-operating centers for the collection, processing and dissemination of:

- numerical data on the chemical composition and nutritive value of feeds.
- general information on practical feeding of animals and efficient use of feeds.

To promote widespread adoption of the INFIC International System for describing and recording information on feeds, in order that this information may be exchanged and disseminated in a simple, uniform and unambiguous manner within and between countries.

To encourage the development and use of improved standard methods for analysis of feeds.

1.4 Membership of INFIC

The constitution regulates the question of membership in Article IV as follows:

Membership is available only to institutions and organizations and not to individuals.

To be eligible for membership, a center must

- subscribe to the aims of INFIC.
- agree to abide by and uphold the constitution and by-laws of INFIC.
- where appropriate, meet the technical requirements described in Section V Types of Membership.

Members of INFIC

The constitution of INFIC distinguishes three kinds of members:

- Full Members (Type I)
- Full Members (Type II)
- Observer Members

Only institutions or organizations can be members.

At present there are:

Full Members (Type I)

Australian Feeds Information Centre
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Admission of New Members

Applications for admission to membership shall require a simple majority vote, including postal votes, of all members.

Alteration or Termination of Membership

Membership may be terminated by a member or by a two-thirds majority of all members in a postal vote. Membership may be altered by a two-thirds majority vote, including postal votes of members.

Types of Membership

There shall be two types of members:

- Full Members who have full voting rights
- Observing Members who shall have all privileges except voting rights.

In addition, there shall be two types of Full Members:

Type I Members who shall be substantially and actively engaged in all of the following aspects of processing of information about feeds and feeding:

- collection of data from contributing laboratories and other sources.
- recording and computer processing for the storage, sorting and retrieval of data.
- exchange and dissemination of data for the benefit of users, including other members.

Type II Members shall be substantially and actively engaged in the following aspects of processing information:

- collecting data on feed composition for processing by a Type I Member, and
- disseminating information processed by a Type I Member.

Membership Qualifications

Membership shall not imply any geographical, national, or political jurisdiction or representation and INFIC shall not be involved or concerned with any such matters.

Membership Representation

Each member shall appoint one person to represent it at general meetings and, as appropriate, to act on its behalf on the Executive Committee.

The member must notify the secretariat of such appointment before the delegate may participate in any INFIC affairs.

The actual members of INFIC are named under the section entitled MEMBERS OF INFIC.

1.5 Geographic Responsibilities of INFIC

Members of the INFIC group agreed that some centers would assume major responsibility for collecting data and feed information within specified geographic regions. This arrangement does not preclude some overlapping of data collection in many developing countries due to ongoing international programs entered into between developed and developing countries. Generally speaking however, centers will assume responsibility for collection of information as outlined in Table 1.1.

2. INTERNATIONAL SYSTEM FOR DESCRIBING AND NAMING FEEDS

This publication describes an international system for recording feed names and feed data on source forms and outlines how the data may be stored, summarized, and retrieved. The procedure was first described by Harris (1963) and Harris et al. (1968).

The problem of naming feeds has different aspects:

- An unambiguous identification is needed to permit processing data units in the databank and selecting

them by special characteristics. This is assured by composing an "International Feed Description" according to the "INFIC Feed Thesaurus."

- A system must be maintained for standardizing feed names acceptable in international trade. The International Feed Description is modified in some cases. The modified names are known as International Feed Names.

- Some other technical aspects require additional devices (Feed Classes, International Feed Numbers).

2.1 The International Feed Description

Data documentation requires high precision for the identification of specific items entered into a databank. Such a system requires that single data units be so listed to describe each characteristic of a feed. In other words, the single data units in the feed databank, when combined into a logical sequence, must accurately describe the feed in question. The necessary grade of exactitude demands a very sophisticated system that describes feeds in a systematic way by taking into consideration each single essential characteristic of the feed. This has to be done so that the representation of each characteristic can be used as a selection factor.

This operation requires a logical analysis of the feed and synthesis of fixed terms for describing these characteristics.

The result is the so-called International Feed Description. The terms used in composing such a Feed Description are called Descriptors. The aggregate of all descriptors used for describing feeds is called the International Feed Vocabulary.

For practical use, this Vocabulary must be displayed in a useful order, enriched with explanations (scope notes), relations, references, etc. like a well edited dictionary. This tool is the INFIC Feed Thesaurus.

2.1.1 The INFIC Feed Thesaurus

The INFIC Feed Thesaurus is the main basis for an exact identification and selection-oriented description of feeds. Because of its volume, it exists only in different computer printouts but is in preparation as INFIC publication No. 4 (Haendler et al. in prep.). Nevertheless, the Thesaurus or at least the Vocabulary has been in use for many years and was the basis for composing over 17,000 International Feed Descriptions.

To compose accurate International Feed Descriptions and to understand the full philosophy of describing feeds, the Thesaurus must be used. Therefore, the present publication gives only a general impression of the background of the Thesaurus and its use. The philosophy of the Thesaurus is also explained in Haendler (1979).

The Thesaurus provides information so that the description of a feed can be composed in a systematic and standardized manner. This is possible since the structures of all feeds follow, more or less, the same basic scheme:

- A feed always comes from an original material (plants, animals or others).

- In most cases, only special parts rather than the whole plant or animal is prepared as a feed.

- Furthermore, the material has undergone special processes or treatments.

These three categories must be considered in describing a feed. Occasionally, other categories or characteristics are also relevant such as:

- the stage of maturity of the plants or animals that are being used

- the cutting or crop (for plants only); and

- special grades of quality.

Thus, a system for a systematical description of feeds has to take into consideration six categories of characteristics. The descriptors needed for describing these characteristics, therefore, belong to six different facets of the description system:

Facet 1: original material or origin (plant, animal, other basic material)

Facet 2: parts of the material used as feed as affected by processes

Facet 3: processes or treatments the material has been subjected to

Facet 4: stage of maturity

Facet 5: cutting or crop (for plants only)

Facet 6: grade (quality)

The International Network of Feed Information Centers (INFIC) uses this system for describing feeds. A multilingual Thesaurus was, therefore, developed by putting all descriptors into three versions: English, German, and

French (other language versions are in preparation). This means that each descriptor has three different lingual equivalences, all representing the same concept. Great care was taken to obtain semantic equivalence even when homonymy or polysemy existed in a term in one of the languages.

2.1.2 The Facets of the International Feed Description

Since each facet comprises all the descriptors relevant to the characteristics within each category, each facet has its own parameters to which descriptors are fixed. Also, the information provided by each entry within a facet differs from that of another facet. To illustrate:

Facet 1: Original Material (Origin)

Facet 1 has many options, since an immense number of plants, animals, or other original material (minerals, chemicals, etc.) can be used as feed. Further, many different feed names are in common use for the same original material (synonyms) and sometimes the same name has different meanings (homonyms).

To solve this problem in a multilingual situation, the descriptors of this facet were split into two constituents; one of which is the scientific name (Latin) of the biological subject (or an adequate quasi-scientific name in cases where no real scientific names exist); the other one is a preferred term of each of the system languages (Common terms) chosen from the (possibly existing) different synonyms in the respective language.

It must be said that even scientific names are changed according to scientific progress. Thus, if synonyms exist among the scientific names, the most appropriate has been chosen as the preferred term.

Scientific names are assigned to living things according to common characteristics. Generally, these groupings consist of: (1) genus, (2) species, and as far as appropriate (3) variety. Thus the preferred term, whenever possible, should provide these three elements.

References in order of priority to make up the scientific names are: Hortus Third (1976); Zander (1979); Standardized Plant Names (1942); Göhl (1975); and Hartley (1979) and other miscellaneous publications. If a country uses different scientific names than those in INFIC, publication 5 (Harris et al. 1980) cross references should be used to refer to the Scientific Feed Name used by INFIC.

Usually, common terms follow this principle. Thus, the preferred terms have two or three elements: (1) generic or common name, (2) breed or kind, (3) strain or chemical formula. In other words, the descriptors within Facet 1 consist--in one language version--of up to six elements.

Table 2.1 gives examples of three entries for the main part of Facet 1 as contained in the Thesaurus. The presentation shows in the upper part of the entries (1) the preferred term of the scientific name (language code 000) followed by (2) the three preferred terms (common names) in each of the three system languages (German, English, French) marked by the respective language code (001, 002, 003).

As explained before, the full descriptors within the three languages are in the first example

(German) TRIFOLIUM PRATENSE ROTKLEE
(English) TRIFOLIUM PRATENSE CLOVER RED
(French) TRIFOLIUM PRATENSE TREFLE VIOLETTE

The other examples present descriptors used for a feed of animal origin and mineral origin.

The examples given in Table 2.1 also show that non-descriptor terms are added to the entries with "used for" references. These may be synonyms to the preferred terms in the system languages or equivalent terms in other languages. Each of these "used for" terms is marked with a minus (–) and the respective language code. This applies to scientific synonyms likewise.

These references are the reciprocal references to the "use" references of the "Auxiliary Part" of this Facet which serves as a "lead-in-vocabulary" to the Main Part, i.e. to find the right descriptor in such cases in which the (preferred) scientific name is not known. Thus, lead-in-terms in this meaning are synonyms of scientific names, as well as German, English and French preferred terms and their synonyms and also equivalents in other (non-system) languages. Examples of entries in the Auxiliary Part are given in Table 2.2.

Facet 2: Parts of the Material Used as Feed as Affected by Process

The second Facet is closely related to the first one, because it consists of descriptors that allow a more specific characterization of the material actually used as feed.

Usually the material named by a descriptor of Facet 1 will not be the substance fed to the animal but only a special part of it. Using modern technology, it is possible to separate biological or other material into many

different fractions. Because of this, many industrial by-products are suitable for animal feeds.

To describe unambiguously the specific part of the material being used, a "part" descriptor has to be added to the "original material" descriptor. Thus, by increasing the available products it became necessary to provide a great number of different descriptors describing the parts to be fed. It also became necessary to consider the different fractionating steps and the combinations of such different fractions. Thus, sometimes those "parts" have to be described for which in natural languages or in one of the system languages no usual term exists. In such cases, descriptors had to be coined. Examples are:

WHOLE To denote that the feed comprises all material expressed by the Facet 1 descriptor.

or

AERIAL PART To denote that the parts of a plant above the ground (mostly the green parts) are what is used as feed of the original material. See also Table 2.3.

To assure correct use of all descriptors, they are explained in the Thesaurus by a "scope note" (SN). This may not always be a complete definition but an explanation of how the descriptor is to be used within the area of the INFIC feed description system. Other devices for the right use of the descriptors are the references to broader or narrower terms, which in this Facet are partitive ones (not generic). These are: broader term partitive (BTP) and narrower term partitive (NTP). For instance, the broader term partitive of AERIAL PART is WHOLE (see Table 2.3). The Thesaurus gives (in Facet 2 as well as in other facets) more devices of this kind, which need not be mentioned here.

Facet 3: Processes or Treatments the Material has been Subjected to

The descriptors of this facet represent another category of essential characteristics of a feed. The process or treatment the material has been subjected to changes it into a specific feed.

The many processes or treatments used to prepare feeds must be described by an adequate descriptor. Furthermore, many feeds such as industrial by-products may be consecutively subjected to different processes. In such cases, it is necessary to describe each of the single processes. Since the technical conditions of the INFIC system do not allow post-combinations of descriptors from the same facet, it was necessary to include in Facet 3 a number of precombined descriptors for the designation of multi-processes.

Facet 3 descriptors found in the Thesaurus are explained by scope notes (SN) to ensure their proper use. To avoid confusion, references to related terms (RT) are included to show similar processes that may have to be designated by another descriptor. Examples of Facet 3 descriptors are given in Table 2.4.

Facet 4: Stage of Maturity

The characteristics described by descriptors of the first three facets apply generally, but the stage of maturity is a characteristic applicable only in certain cases. The nutritive value of forage crops is greatly influenced by the stage of maturity. Thus, forages in different vegetative stages have to be considered as different feeds. To overcome this differentiation, a Facet 4 descriptor is assigned to each of these feeds. Feeds of animal origin are sometimes affected by age. Therefore, descriptors for describing the stage of life in which the animal was slaughtered are included in Facet 4. Additional information concerning this Facet are included as scope notes (SN) and "used for" references. These are shown in Table 2.5.

Facet 5: Cutting or Crop

This facet takes into consideration that many forage crops are harvested several times during the year and that a specific cut may influence the value of the forage crop. Therefore, this characteristic has to be designated by a descriptor when applicable. Needless to say, such a Facet comprises only a few simple descriptors like CUT 1, CUT 2, etc.

Facet 6: Grade (Quality)

Generally, the descriptors of the five facets previously mentioned describe a feed sufficiently. But some commercial feeds or feed ingredients may have specific characteristics not explained by the descriptors of the first five facets. The sixth facet makes available further descriptors characterizing grades of quality as used sometimes in the feed trade. Descriptors of this kind are often expressed in terms of "more than" (minimum) and "less than" (maximum) or even "from . . . . to" of designated contents of crude fiber, protein, fat, etc. Generally, artificial grades should not be made up because the feeds are not on the market. Examples of descriptors of this facet are given in Table 2.6.

2.1.3 The International Feed Description and the International Feed Description File

To adequately describe new feeds to be recorded in the databank, it is necessary to select an appropriate

descriptor from all applicable facets. As mentioned heretofore, descriptors of the first three facets are generally necessary to describe the essential characteristics of a feed and in certain cases descriptors of the other three facets are added as appropriate.

Since the Thesaurus is multilingual, the description can be realized in one of the three system languages: German, English or French. Independent of the language, each such composition using the correct descriptors--gives an unambiguous description of the feed.

As explained above, the INFIC Thesaurus gives a list of descriptors (including definitions and how they are to be used) within each of the six facets. "The International Feed Description File" brings the descriptors together to form the "International Feed Descriptions" (Harris et al. 1980).

Table 2.7 shows an example of an International Feed Description in the three languages. Table 2.8 shows examples of International Feed Descriptions with scientific names and without scientific names.

2.2 Feed Classes

For certain practical purposes, it was decided to use--beside the International Feed Description--a system that groups feeds into eight classes on the basis of their composition and the way they are used in formulating diets.

Each feed is assigned to a class according to its most common use in normal feeding practices. The eight classes are shown in Table 2.9.

2.3 The Feed Description File and the International Feed Number

All International Feed Descriptions are listed in the Feed Description File (Harris et al. 1980). Each new entry in this file is assigned a current number for its identification. This is the "International Feed Number" which consists of five digits. The international feed number is the link between the International Feed Description in different languages and also to other information concerning the same feed.

Analytical and biological data entered into the databank are also identified by the international feed number. Thus, when feed composition tables are compiled, the description or name listed under the corresponding entry in the Feed Description File can be printed out with the data by using the international feed number.

The feed class number previously mentioned is usually put in front of the international feed number when feed composition tables or reports are printed.

2.4 International Feed Names

The requirements for an unambiguous and selection-oriented identification of feeds by using the INFIC system compose International Feed Descriptions that are unusual in ordinary communication. For instance, the combination of descriptors like AERIAL PART + SUN-CURED is the result of a correct conceptual analysis and represents well these characteristics of the feed for the purposes of the system. But in ordinary communication, it is usual to call this concept "hay."

Thus denominations used for the feed composition tables must consider usual terminology. But to avoid a relapse to ambiguousness and multiplicity of terms in natural languages and to facilitate using databank information in publications, a standardization of these names is also necessary.

For use in English-speaking countries, special standardized feed names have been formulated. These follow as closely as possible the rules of describing feeds with descriptors, while avoiding, however, complicated phrases and unusual expressions. This is called the International Feed Name (Harris et al. 1980).

There exists only one International Feed Name (in English) for one feed and this is part of the one entry in the list of International Feed Descriptions.

In the area of other languages, there are the same problems as for the English speaking countries. In translating the International Feed Name into other languages, there is the well known problem of different morphological structures of different languages. In these cases, the International Feed Name is translated to give the meaning, but may not be structured exactly the same as the English International Name. The International Feed Names for other languages are also entered into the feed description file. Thus, International Feed Names in all languages can be recalled from the file for information purposes by using the respective International Feed Number.

Table 2.10 shows a comparison of the International Feed Description and the International Feed Name for English and German.

The International Feed Names are coined from the International Feed Description by leaving out descriptors or replacing descriptors for Facet 2, parts (Table 2.11a).

Table 2.11b gives an example of a feed name for each of the Facet 2, parts listed in Table 2.11a. Table 2.12a gives a list of Facet 3, processes which are modified to make up the International Feed Name from the International Feed Description. Table 2.12b gives an example of a feed name for each of the processes listed in Table 2.12a.

2.5 Country or Regional Feed Names

In most countries or regions, local feed names exist. Some of them are very common, others are defined in scientific papers, confirmed by government regulations or established by other organizations.

Since users of feed composition tables may be familiar with these names, they may look for them in the feed tables. Thus, it is necessary to use such "Country Names" as reference terms in feed composition tables, especially in those prepared for a special region. For this purpose, Country Names are recorded in the file of International Feed Descriptions and are marked with their respective country and language codes (see Table 2.10).

2.6 Rules for Naming Pasture

Several classes of feeds may be associated with one origin but may be processed differently (Table 2.13). An example is timothy. It is possible to have Timothy, aerial part, sun-cured (class 1); Timothy, aerial part, fresh (class 2); and Timothy, aerial part, ensiled (class 3). Each class refers to a specific type of product identified by characteristic processes it undergoes before it is fed to the animal (see Table 2.9). In these cases, class 1 feeds are described as forages cut and cured, commonly called hay; class 2 are forages grazed in the field commonly called pasture or cut and fed to the animal in a fresh state; and class 3 are those forages cut and cured through processes of anaerobic fermentation in a silo commonly referred to as silage.

The term pasture refers to plants grown for the feeding (usually by grazing) of animals. Therefore, when the origins of pasture plants are known (up to four plant species) they are entered by scientific and common name. However, for forages used for pasture, hay and silage where five or more kinds of plants are involved, it is not practical to describe each plant. Therefore, since similar mixtures of plants tend to grow in certain localities within countries, these plant communities are referred to as a "Forage Type", and this name may be used as Facet 1 original material. Forage types commonly found in the Western United States (USA) are given in Table 2.14. Examples of feed descriptions (feed names) using forage types found in pasture are given in Table 2.15.

Since forage type plant species are different in various localities, the analytical and biological data would only apply to the locality where the plants are grown. Example feed descriptions that can be coined for plant types used for pasture, hay, or silage in some parts of Europe are shown in Table 2.16. Many of these forage types are also applicable to other Regions.

When a specific plant species is dominant in a plant type, insert the scientific name for that plant in the species area and the kind area of Facet 1 (Table 2.16).

Marsh plants may be growing in fresh water or sea water. For plants grown in fresh water, no descriptor needs to be entered. Plants growing in salt water, however, have the descriptor part IN SEA WATER inserted in the scientific variety area and in the kind area (Table 2.16).

For Africa and similar areas, appropriate descriptions for plant types (genus and generic) would be STEPPE PLANTS, SAVANNA PLANTS, etc.

Sometimes the description of the pasture does not give a plant type. In these situations, the origin descriptor would be GRASS-LEGUME-FORB (Table 2.17).

The forage on land used for pasture is not only grazed, but may also be harvested for hay or silage. Since grazing may affect the composition of the forage, the following descriptor parts (when appropriate) are put in the species and kind areas:

LAND EXTENSIVELY GRAZED under 55% utilization

LAND MODERATELY GRAZED 55 to 70% utilization

LAND INTENSIVELY GRAZED over 70% utilization

Other intensity and methods of grazing may be put in the species and kind areas. See Table 2.17 for examples.

Other appropriate descriptors for pasture are:

Genus and Generic Descriptors

GRASS

LEGUME

FORB

GRASS-LEGUME

GRASS-FORB

CEREALS

Part Descriptors

If used for pasture, hay, or silage, the part descriptor would be AERIAL PART

3. INTERNATIONAL SYSTEM FOR RECORDING FEED DATA

To record feed data, label the feed sample collected, catalogue the description of the sample on a source form, and record the results of chemical or biological analyses on the source form.

3.1 Methods of Collecting Feed Composition Data

Unless the necessary precautions are taken to obtain samples of a feed and preserve it in a state that represents properly the original material as it was collected or will be fed to the animal, the efforts of sampling and laboratory analyses are in vain (AOAC, 1975). Samples must be packaged, transported, and stored so that the nutritive materials to be analyzed are not significantly altered. For materials to be named correctly, it is necessary to have precise information on the sample to be analyzed. This information must be properly and accurately recorded. When a sample is collected, a tag is attached to it (Figure 3.1). The project leader or the person collecting the sample should fill in the project number, experiment number, date when collected, a brief description of the sample, and the name or initials of the person who did the sampling.

3.2 International Source Form for Recording Data

The international source form has been developed to provide a systematic way of recording data and information about animal feeds. The system currently uses six card formats to record approximately 700 attributes about feeds. Additional cards can be added as the need arises.

Figures 3.2 and 3.3 illustrate examples of source forms. Each INFIC center may devise other source forms appropriate to their needs. Figure 3.2 illustrates a source form that may be used to record all the attributes about a sample including toxic and pollution information. Figure 3.3 illustrates a source form for recording data for cards 10, 30 and 4 (see Sections 3.1.1, 3.2.5, and 3.2.6). The data from most feed samples may be recorded on this source form. Items that may be recorded are outlined below; however, only those which are applicable to the particular feed sample are recorded (see examples of completed source forms; Figures 3.2 and 3.3). Completed source forms are forwarded to Type I INFIC centers where the information is coded for entry into the databank. Codes are available from each INFIC center (Kearl et al. 1980). Each source form is designed so that information may be entered on 80-column computer cards, magnetic tape, or by using a remote terminal.

At present, source forms are available in English, German and Arabic. French, Portuguese and Spanish source forms are being prepared.

A description of information to be filled in for each area of the source form follows.

3.2.1 Card 10 Origin of Data, Origin of Sample and Description of Feed Sample

Project No. This number is filled in by the project leader.

Country or Region. Enter the name of the country or region where the laboratory is located that analyzed the feed sample.

State, Province or Department. Enter the name of the state, province, department or similar divisions within the country where the laboratory is located that analyzed the feed sample.

Laboratory Name and Address. Fill in laboratory name and address.

Laboratory Sample No. Enter the number assigned to the sample. When source forms are prenumbered, this number could be used as the laboratory number; however, other numbers may be used. For example, the first sample collected in 1980 could be 80-1, the second 80-2, etc.

Origin of Sample

Date Originally Collected. Record the date the sample was collected. This is especially important for forages as the nutritive value is influenced by the age of the plant.

Country or Region. Enter the name of the country or region where feed originated. For example, Anchovy, fish meal, may have come from Chile and be fed to livestock in Brazil. In this case, enter Chile for country.

Climatic Zone. To be filled in by the INFIC center. This is a geographic area within a country (or countries) with similar altitude, latitude, and rainfall.

Fishing Area. Identify the nearest relevant state, province, department, etc., within a country, and the fishing area where the fish were caught (Table 3.1 and Figure 3.4).

State, Province, Department, Etc. Give name.

County. Record name of county or similar local administrative unit where collected. This will assist in identifying areas where plants exhibit nutritional deficiencies and/or toxic levels of materials when fed to animals. When sufficient data are collected, maps can be drawn outlining these areas.

Bibliographic Reference No. For data that are original and not published, record the name and address of the laboratory furnishing the data. The INFIC Processing Center (Type I) will assign a bibliographic reference number for this data.

When data being reported have been published, fill in the bibliographic reference giving the senior author, year, journal, volume number, and page.

Description of a Feed and International Feed No. When a feed can be identified using the list of international feed descriptions or feed names (Harris et al., 1980), enter the international feed description in the scientific name area. Also, enter the international feed number above the spaces on the source form reserved for this purpose.

When the international feed description cannot be identified, study how to name a feed in Section 2; check the International Feed Description File or feed name file for similar feeds to obtain an idea of how the descriptors should be arranged. Finally, check the Thesaurus (Haendler et al., in prep.) to be sure the correct descriptors are used. After carefully checking these instructions, enter the information in the spaces under scientific name, common name, part, process, maturity, cutting and grade. When access to a name file or a Thesaurus is not possible, enter the information in the most logical order.

Class of Feed. Check one of the spaces: dry forages, cut and fed green, silage, or other.

Scientific Name (Genus and Species). When the international feed description is not entered here, as outlined above, enter the genus and species. These must be specified as all feeds are identified by the scientific name, i.e., *Zea mays.*

Scientific Name (Variety). When this area is not used for the international feed description as outlined above, give the variety, i.e., *Zea mays indentata.* (indentata is the variety.

Common Name for Scientific Name. Common names are important in feed terminology. Many are part of our everyday language. Enter here the common name(s) by which the feed is known in your locality.

Part of Plant, Animal or Other Product. A list of descriptors describing the parts of the plant, animal or feed product are given in the Thesaurus (Haendler et al., In prep.). The parts are integrated together in the Feed Description File to form International feed descriptions (Harris et al. 1980). Study the parts which are used in similar feeds to the one being described. Select a part that fits the feed being described and enter it in this area.

Process(es) Feed has Undergone Before Feeding to Animal. A list of descriptors describing the process the feed has undergone is given in the Thesaurus (Haendler et al., in prep.). The processes are integrated together into feed descriptions in the feed description file (Harris et al. 1980). Study how the processes are used. When there is a word or phrase that fits your feed sample, enter it in the process area.

Other descriptive terms, such as rained on, moldy, frozen, weathered, insect damage, etc. may be added to obtain a more accurate description.

Stage of Plant Maturity or Age of Animal. Use one of the terms listed in Tables 3.2 or 3.3. Some forages, especially those in the tropics, bloom intermittantly. For these, enter the length of time in days since the plant started to grow or since the previous cutting.

When plants are continuously grazed, the stage of maturity should be stated as an estimate of the number of days required (under constant grazing) for the plant to reach its height at the time the sample is taken.

Number of Cut. This refers to the number of times the plant is cut and harvested during the year. Enter first, second, third cut, etc.

Official Grade (Name and Number or Grade). Many countries have an "Official" grading system for hays and grains. If your country has such a system, obtain an official grade on your sample and insert it under this term. Some countries have a "Feed Control Service" that describes feeds that are sold in the marketplace. (Association of American Feed Control Officials 1980; Canada Feed Act, 1967). Also, in some cases, they specify minimum and maximum guarantees for certain attributes. When feeds in your country carry official guarantees, indicate amounts as "more than" (minimum) and "less than" (maximum) or even "from . . . to" of designated contents of crude fiber, protein, etc.

An example: Wheat, flour by-product, less than 2.5% fiber.

Artificial grades should not be formulated. Record only feed grades that are sold on the market. For example, Alfalfa, aerial part, dehydrated, 17% protein; or Soybean, seeds oil residue, solvent extracted ground, 43% protein.

Plant Crosses or Other Feed Products. When a plant cross is on the market as a commercial feed, give the plant cross and state "sold on the market." This name will then be added to the name file. However, if the plant cross is not available in the marketplace, give the plant cross and state "not sold on the market." The plant cross will then be coded by the Type I Center so the data can be retrieved at a later date assuming it becomes a commercial product. The following is an example: The international feed description is Wheat, grain, hard red winter; the new wheat is: Wheat, grain, hard red winter, highland; highland is the strain. Until this strain is important and on the market, all data are put under HARD RED WINTER.

Additives. Give name of additive. These materials are added in small amounts. For example, sodium hydroxide used in treating straw or molasses when added to silage.

Unit Weight for Additive. Check appropriate square, mg, g, or kg.

Amount of Additive. Give amount of additive used per metric ton of feed.

Season. Record one of the following: dry or wet (rainy). These seasons apply primarily to the tropics or to areas which have long, dry and rainy seasons. The stage of maturity takes care of the seasons in temperate climates.

Fertilizer. Record whether fertilizer was used or not used. Do not enter information unless the type of fertilizer and application rates are known (see Section 3.2.2, card 21). When unknown, leave blank.

3.2.2 Card 21 Quality of Feed, Soil and Fertilization.

Feed Quality Designations. The quality of dry forages or hays are described according to the information given in Tables 3.4 and 3.5. Eventually, forages should be analyzed for acid detergent fiber or neutral detergent fiber (Harris, 1970). In the meantime, however, crude fiber values can be used as the basis for establishing quality grades. For each sample of hay record a grade taken from Tables 3.4 or 3.5.

For silages record one of the following grades:

Grade 1 excellent
Grade 2 good
Grade 3 fair
Grade 4 inferior

Note: This is a temporary listing of grades used for silage. A more complete description for each grade will be determined after consultation with agronomists and other interested parties.

Degree of Purity Percent. Give the percent of feed (origin) material present in the sample. Most samples contain impurities. This information is useful in establishing quality grades.

Foreign Material. Record one of the following: sand-earth, mineral contamination, weed seeds, other foreign material.

Soil

Soil Units. Record one of the soil units in Table 3.6.

Soil Textural Classes. Record one of the following:

Coarse textured: sands, loamy sands, and sandy loams with less than 18% clay, and more than 65% sand.

Medium textured: sandy loams, loams, sandy clay loams, silt loams, silt, silty clay loams, and clay loams with less than 35% clay and less than 65% sand; the sand fraction may be as high as 82% when a minimum of 18% clay is present.

Fine textured: clays, silty clays, sandy clays, clay loams, and silty clay loams with more than 35% clay.

Slope Classes. Record one of the following:

Level to gently undulating: dominant slopes ranging between 0 and 8%

Rolling to hilly: dominant slopes ranging between 8 and 30%

Steeply dissected to mountainous: dominant slopes are over 30%

The above descriptions for soils are those used on a world basis by the Food and Agriculture Organization of the United Nations (FAO-UNESCO 1974). Each INFIC center, however, may use the soil classification system used in the country or area they serve.

Soil pH. Enter the pH value of the soil.

Water (Type). Record the type of water application.

rainfall
irrigation (sprinkler)
irrigation (furrow)
irrigation (border flooding)
irrigation (drip)

Irrigation Plus Rainfall. Enter total water in mm. (water applied "by" irrigation plus rainfall).

Fertilization

Nitrogen Fertilizer (Type). Enter the name of nitrogen fertilizer used. For example:

ammonia gas
ammonium nitrate
ammounium sulfa-nitrate
urea
calcium ammonium nitrate
calcium nitrate (nitrate of lime)
calcium cyanamide
nitrate of soda (sodium nitrate)
ammonium sulfate
or the name of other nitrogen fertilizer used.

Quantity in Kilogram per Hectare. Enter kg applied per hectare.

No. of Days Between Last Application and Harvest. Enter number of days.

Phosphorus Fertilizer (Type). Enter the name of phosphorus fertilizer used. For example:

hyperphos
novaphos
thenania phosphate, $CaNaPO_4 + CaSiO_3$
raw phosphate
superphosphate
thomasphosphate, $CA_3P_2O_8 + CaO + CaO \cdot SiO_2$
or the name of other phosphorus fertilizer used.

Quantity in Kilogram per Hectare. Enter kg applied per hectare.

Potassium Fertilizer (Type). Enter the name of potassium fertilizer used. For example:

kainite
potassium magnesia
potassium chloride, 38-42% K_2O
potassium chloride, 48-52% K_2O
potassium chloride, 60% K_2O
potassium sulfate
or the name of other potassium fertilizer used.

Quantity in Kilogram per Hectare. Enter kg applied per hectare.

Calcium Fertilizer (Type). Enter the name of the calcium fertilizer used. For example:

quicklime, burned lime
lime, ground, from iron works
calcium carbonate
slaked lime
or the name of other calcium fertilizer used.

Quantity in Kilogram per Hectare. Enter kg applied per hectare.

Organic Manuring (Type). Enter the name of the organic manuring used. For example:

green manure
guano
semi-liquid manure
horn meal
liquid manure, slurry
sewage sludge
bone meal
compost
garbage
plant residues, plant refuses
peat moss
stable manure, barn manure
or the name of other organic manures used.

Quantity in 100 Kilogram per Hectare. Enter kg applied per hectare.

Trace Element Fertilizer (Type). Enter the name of the trace element fertilizer used:

boron fertilizer
chlorine fertilizer
cobalt fertilizer
iron sulphate
copper sulphate
magnesium fertilizer
manganese sulphate
molybdenum fertilizer
sodium fertilizer
sulphur fertilizer
zinc fertilizer
or the type of trade element fertilizer used.

Quantity in Kilogram per Hectare. Enter kg applied per hectare.

Mixed Fertilizer (Type). Enter the name of the mixed fertilizer used. For example:

phosphorus-potassium
nitrogen-magnesium
phosphate-potassium

phosphate-potassium
phosphorus-potassium
nitrogen-potassium
nitrogen-phosphate
thomasphosphate-potassium
nitrophoska grey (11.5% N, 8.5% P_2O_5, 18% K_2O)
nitrophoska red (13% N, 13% P_2O_5, 21% K_2O)
nitrophoska blue (12% N, 12% P_2O_5, 20% K_2O)
or the name of other mixed fertilizer used.

Quantity in Kilogram per Hectare. Enter kg applied per hectare.

3.2.3 Card 22 Plant Height and Feed Storage

Height When Cut. Enter height of the plant in centimeters.

Height of Stubble. Enter height of the stubble remaining (in centimeters) after cutting.

Storage Place. Enter the name of the storage place. For example:

cellar
pit
trench
kiln
granary
stack

temporary silo

upright high stack silo
upright half high stack silo
attached silo
flat silo
moveable silo
fence silo
metal or plastic silo
silo made with pressed material (plywood)
sealed upright silo
experimental silo

Kind of Building Material Used in Constructing Storage Facilities. Enter one of the following:

concrete
soil
wood
plastic
metal
stone
straw
miscellaneous

Kind of Covering or Lock. Enter the kind of covering or lock. For example:

concrete cover
plastic sheet
inner race lock
clamp lock
mechanical pressing
sound bag lock
seeger retaining ring
dipping cover

Storage Time in Days. Enter the number of days the feed was stored.

Temperature in Storage Container. Enter the temperature to the nearest whole degree in Centigrade.

Air Humidity in Storage Container. Enter the air humidity to the nearest whole percent.

Light and Air Conditions. Enter one of the following:

light with air exchange
semi-dark with air exchange
dark with air exchange
air tight with light
air tight and semi-dark
air tight and dark

3.2.4 Card 24 Environmental Pollution and Pesticides

Pollution Source. Record one of the following:

Natural Source

- volcanos
- dust clouds, dust storm
- inundation

Sources created by human activity

- coal mines

Chemical and adherent industries

- factories for acid, alkali and chlorine production
- potassium industry and saline soda works
- fertilizer factories
- plant protection products industry
- detergents and soap industry
- plastic material industry
- iron works, iron foundries

Metal works and refoundries

- aluminum works
- copper works
- lead works

zinc works
furnaces for steam and energy production
nuclear energy production plants
mineral oil industry

Stone and earth industry

cement industry
mortar factories
limestone factories
brick works
china-ware factories
enamel works
plant for processing animal and vegetable products

Other industries, manufacturers, and agriculture

wood, cellulose, and paper industry
plants for carcass disposal and meat/bone production
compost of garbage (housing) and refuse (industry)

Sewage from

agriculture
household
industry

Traffic

railway
inland navigation
sea navigation
air traffic
automobiles

Agriculture means

fertilizing
applying of plant protection products

Infestation with

fungus
parasites

Pollution Substance. Record toxic materials from attribute deck (see Table 3.9). Examples are:

fluorine
lead
mercury
lindane

State of Substance. Record one of the following:

gasiform (gases and fumes)
dustiform (dusts and aerosols)
liquid (liquids or emulsified substances)
gasiform and dustiform (gases, fumes, dusts, and aerosols)
gasiform, dustiform, and liquid (gases, fumes, dusts, aerosols, and liquids)
gasiform, liquid, or emulsified (gases, fumes, liquids, or emulsified substances)
dustiform, liquid, or emulsified (dusts, aerosols, liquids, or emulsified substances)

Distance Between Source and Receptor. Record one of the following:

0 - 10 m	0.701 - 1,000 km
11 - 20 m	1,001 - 1,500 km
21 - 50 m	1,501 - 2,000 km
51 - 100 m	2,001 - 3,000 km
101 - 150 m	3,001 - 4,000 km
151 - 200 m	4,001 - 5,000 km
201 - 300 m	5,001 - 6,000 km
301 - 400 m	6,001 - 7,000 km
401 - 500 m	7,001 - 8,000 km
501 - 700 m	8,001 - 9,000 km
	over 9,000 km

Wind Direction. Record one of the following:

prevailing wind direction (downwind)
opposite direction to the prevailing wind (upwind)
lateral to the prevailing wind

Unit of Measurement for Pollutant Concentration. Unit (check one) $\mu g/m^3$ air; mg/m^3 air; mg/kg soil; mg/l water.

Pollutant Quantity in Relation to Unit. Record amount of pollutant in terms of units under pollutant concentration.

Intensity of Automobile Traffic. Record one of the following:

stable:	0 - 600 cars/hour
stable:	601 - 1,200 cars/hour
undisturbed:	minimum 1,201 cars/hour

Exposure of Feed Material to Pollutant. Record number of days feed sample was exposed to the pollutant.

Symptoms of Damage on Original Material.

healthy looking
acute damages (exterior and/or interior parts of the plant having been destroyed by gas)
direct chronic damages (malfunction by gas, smoke, and dust influence)
indirect chronic damages (depression of growth and/or yield by gas, smoke, and dust influence)
infested (mycel)

Brand of Pesticide. Record the brand of pesticide used (examples are given in Table 3.7). Also, record the

name and concentration of active ingredients. Keep a record of those you use. Each INFIC Center maintains their own list.

Class of Pesticide. Record one of the following:

acaricides
fungicides
herbicides
insecticides
products against parasites infesting material in storage
molluscocides
nematocides
rodentiacides

Formulation of Pesticide. Record one of the following:

emulsifiable spray products
products emitting fog
products emitting smoke
wet disinfectants (seeds)
spray powder
spreading products
fine spray products

Active Ingredients of Pesticide. Record the amount of active ingredients of pesticide in percent without a decimal point.

Method of Pesticide Application. Record one of the following methods of pesticide application:

spraying (drops minimum 150μ)
fine spraying (drops 50 - 150μ)
fogging (drops maximum 50μ)
spreading
smoking

Type of Application of the Pesticide. Record one of the following:

application in store rooms
soil application
aerial application

Unit for Pesticide. Record one of the following:

g/ha
kg/ha
liter/ha

Pesticide Quantity in Relation to Unit. Record the amount of pesticide in relation to the units given above. Carry two decimal points if necessary.

Number of Pesticide Applications. Record the number of pesticide applications which were put on the crop.

Days Between Last Pesticide Application and Harvest. Record number of days between the last application and harvest.

Unit for Residue of Pesticides in Feed Fed to Animal (Diet or Ration). Record one of the following units:

μg/kg
mg/kg
g/kg

Note concerning columns 56 - 70: Residues of pesticides come through the feed into milk, meat, liver, bones, etc. Therefore, it is necessary to know the quantity of a pesticide in the diet, the daily intake and the feeding period. Such data show the correlation between the quantity of pesticide taken in by the animal from the feed and the quantity found in milk, meat, liver, etc. (carry-over effect).

Quantity of Pesticide in Relation to Unit. Record the amount of pesticide used in relation to the units above. Carry three figures beyond the decimal point if necessary.

Daily Intake of Pesticide. Record the amount of pesticide consumed in mg. Carry one figure beyond the decimal point if necessary.

Feeding Period in Days. Record the number of days pesticide was consumed.

Weight of Animal at Beginning of Feeding Pesticide. Record weight in kilograms. Carry three figures beyond the decimal point if necessary.

Note: If the daily intake of pesticide, feeding period in days and weight of animal at beginning of feeding pesticide are filled in, a card 30 must be filled in giving animal kind.

3.2.5 Card 30 Digestibility Trial

When a digestibility trial has been conducted on the feed sample, enter the information in this section on the source form. For procedures for conducting digestibility trials, see Schneider and Flatt, 1975; Harris 1970.

Animal Kind. The data reported for digestion coefficients, availability, percent rumen digestion (nylon bag), digestible energy, metabolizable energy, nitrogen-equilibrium metabolizable energy, NE_m, NE_{gain}, TDN, or other measures made on animals are associated with a specific animal kind; therefore, animal kind must be filled in when these data are reported. *Do not enter*

estimated data on the source form. Examples of animal kind are cattle, llama, horse, sheep, swine, etc.

Animal Breed. Enter the breed name. When the animal is a crossbreed, list the male first. See Table 3.8 for examples.

Sex. Enter the status of the animal; male, castrate male, female, or spayed female.

Animal Requirements. The nutrient requirements for various physiological functions are recorded here. The data in columns 12-14, 15-17, 18, 21-25, 28-35, 36, and 49-55 are used to arrive at this code. For example, if the animal kind is cattle, breed is Holstein and the animal is lactating, the animal requirement would be for a dairy cow. The processing INFIC center fills this area in.

Age of Animal. Enter age of animal in years and months; months and weeks; or in weeks.

Number of Animals in Treatment. Enter number of animals used in the trial for each feed.

Average Weight of Animals. Enter the actual weight expressed in kilograms.

Physiological State. Check the appropriate space on the source form in each of the following areas:

non-pregnant, pregnant first 2/3, or pregnant last 1/3
losing weight, maintaining weight, gaining weight or fattening
lactating, laying eggs or working
very thin, thin, thrifty, fat, or very fat.

Percent of Test Ingredient in Ration Fed (100.0% Dry Matter). Calculate and enter only when feed is not fed alone.

Ad libitum Feeding or Controlled Feeding. Check which method was used.

Method Used for Digestion Trial. There are two methods used for digestion trials, the direct and indirect. When using the direct method for determining the nutrient digestion coefficients of a feed, the test feed is the only feed given to the animal. When using the indirect method, the test feed is fed with a base feed. Record one of the following:

direct method
indirect method; when no further information is given, record indirect method; however, if more information is given, record one of the methods below:

Addition: Varying proportions of a test feed are added to the base feed.

Exchange: A certain proportion of the base feed is exchanged by the test feed.

Replacement: A certain indigestion component of the base feed is replaced by an adequate proportion of the test feed;

Regression: Varying quantities of a test feed are added to the base feed; digestibility is calculated by regression equations.

Type of Feces Collection. Check one of the following feces measured by the total collection; or by the indicator method.

Length of Digestion Trial. Record the length of the preliminary period and the collection period in days.

Daily Dry Matter Consumed. Record the amount of feed (dry matter) consumed in kilograms per day (decimal in column 52).

Weekly Dry Matter Consumed. Record the amount of feed (dry matter) consumed in kilograms per day (decimal in column 59).

3.2.6 Card 4 Chemical and Biological Data

Each datum unit should represent a single observation; however, when individual attribute values are not available, average values may be used (especially when taken from the published literature).

Check Analysis Wanted. The squares under this headi (Figures 3.2 and 3.3) are put in for convenience of the chemist. The squares on the left of the attribute are checked for the analyses wanted. At this time, chemica analyses work sheets are made by entering the laborato number or source form number in the appropriate chem ical analysis workbook (Harris 1970).

Some attributes to be analyzed on the sample may no be on the source form. Enter additional attributes under other analyses and check for analyses wanted (see Table 3.9).

At this point, the feed sample has been described; the next step is for the chemist to analyse the sample (Harris 1970). The chemical and biological analysis are then copied onto the source form. Pigden et al. (1979) suggested fiber and biological analyses that should be made on feed samples.

Dry Matter. Record the as fed dry matter (attribute identified by number 101 for dry matter) on the source form. A sample may be accepted without an

as fed (as consumed) dry matter providing the data are reported on a partial dry or dry basis (see below).

Dry Matter Basis on Which Analytical Data are Reported on this Form. This area must be filled in for the data to be entered into the system. When possible, the data should be reported on a dry basis (Harris et al., 1969); however, it may be reported on an as fed or partial dry basis. Check appropriate square and enter one dry matter value opposite 102, 103, or 104 to indicate the dry matter basis of the data on the form. Data can be accepted under the following conditions:

1. When a sample has an as fed (as consumed) dry matter:

	Attribute	Data Value in %
a. dry matter as fed	101	25.2
basis of data, as fed	102	25.2
b. dry matter as fed	101	25.2
basis of data, partially dry	103	90.5
c. dry matter as fed	101	25.2
dry (100% dry matter)	104	100.0

2. When a sample does not have an as fed (as consumed) dry matter:

a. basis of data, partially dry	103	94.1
b. basis of data, dry	104	100.0

When the basis of the data is on an "as fed basis", attributes 101 and 102 must be filled in using the same value for each. The following are definitions of as fed, partially dry, and dry:

As Fed. Refers to the feed as it would be if it had been consumed. The term "as collected" is used for materials which are not usually consumed, i.e., urine, feces, etc. If the analysis on a sample are affected by partial drying, the analyses are made on the wet or as collected sample. Similar terms: air dry i.e., hay; as received; fresh; green; wet.

Partially Dry. Refers to a sample of "wet" or "as collected" material that has been dried in an oven (usually with forced air) at a temperature usually about 60° C or freeze dried and has been equilibrated with the air; the sample after these processes would usually contain more than 88% dry matter (12% moisture); some materials are prepared in this way so they may be sampled, chemically analyzed and stored. This analysis is referred to as "partial dry matter % of 'wet' or 'as collected' samples." The partially dry sample must be analyzed for dry matter (determined in an oven at 105° C) to correct subsequent chemical analysis of the samples to a "dry" basis. This analysis is referred to as "dry matter % of partial dry sample." Similar terms: air dry.

Dry. Refers to a sample of material that has been dried at 105° C until all the moisture has been removed. Similar terms: 100% dry matter; moisture free. When dry matter (in an oven at 105° C) is determined on a "wet" sample, it is referred to as "dry matter on wet sample." When dry matter is determined on a partial dry sample, it is referred to as "dry matter of partial dry sample." It is recommended that analysis be reported on the "dry" basis (100% dry matter or moisture free), and, in addition, the "as fed dry matter" should be reported (Harris et al. 1969; Harris 1970).

Chemical and Biological Data. Record the analytical data on the source form in the spaces provided. Definitions for energy terms are given in Section 3.5. Digestion coefficients such as 106.0, 84.0% are to be recorded. Negative digestion coefficients are identified by a minus sign in the column just left of the most significant digit (-50.0). Positive signs are assumed and need not be recorded. Animal kind must be entered in card 30 when biological data such as digestion coefficients, metabolizable energy, etc., are recorded (see Section 3.2.5).

Do not enter calculated values or ruminant values on the source form. Calculated values and ruminant values (average of cattle and sheep values) are made when the data are summarized (see Section 3.3 and 4.3).

Other Analyses and Other Digestion Coefficients. When analyses are determined by a method other than those indicated under method of analyses, record data under "Other Analyses and Other Digestion Coefficients." Also in the space provided, enter analyses not shown on the source form. Specify decimal, unit, kind and method of analyses. See Table 3.9 for a list of attributes (other analyses and other digestion coefficients) which may be recorded on a feed. When recording information on the source form, be sure to use the correct units.

The "International Energy Congress" has adopted the joule as the unit for energy. INFIC also favors the use of the joule. If a country has adopted the joule, enter energy data on the source form in MJ/kg with two

decimal points (Figures 3.2, 3.3 and Table 3.9). However, if a country has not adopted the joule, the energy data could be entered on the source form (a modified one would need to be prepared) in kcal/kg and converted to Mcal/kg for the larger animals (Table 3.9). However, when trading data, it is converted to MJ/kg.

When amino acids are reported on a protein basis (g/16gN), enter the name of the amino acid under other analyses and record the unit as (g/16gN). When a ratio for amino acids is recorded, there must be a protein value and an as fed dry matter, or a protein value with the data recorded on a dry (100% dry matter) basis, otherwise the data are discarded (Figure 3.2). With the above information, the amino acid values are converted to a percent of dry matter and stored in the databank.

When fatty acids are entered as g fatty acids/100 g fat, enter the fatty acid and the unit as g fatty acids/100 g fat.

There must also be a fat (ether extract value) value and an as fed dry matter or a fat value with data recorded on a dry (100% dry matter) basis, otherwise, the data are discarded (Figure 3.2).

When fatty acids are entered as g fatty acids/100 g fatty acids, enter the fatty acid and the unit as g fatty acids/per 100 g fatty acid.

There must also be a total fatty acid value and an as fed dry matter, or a fatty acid value with data recorded on a dry (100% dry matter) basis, otherwise, the data are discarded.

With the above information, the fatty acids are converted to fatty acids as percent of dry matter and stored in the databank.

Supplementary Information About Feeds. Enter additional information about the feed in this space. It is helpful to know other factors which may influence the nutritive value of the feed, such as a complete description of the fertilizer used, whether the crop was irrigated or not irrigated, class of plant, crop badly weathered, or otherwise damaged.

3.3 Attribute Deck

The attribute deck contains the following information (Table 3.9):

Sequence Number Codes. These numbers control the order in which the attributes will appear when feed composition tables are printed using the Atlas Format (see Section 5).

Attribute Codes. These codes identify over 700 different nutrients and other information, such as dry matter intake and gain per hectare.

Animal Kind Codes. These codes identify the different species of animals.

Unit Codes. Each means of expression is coded, such as % and digestion coefficient (dig. coef.)%.

When a table using summarized data is printed, each individual datum entry is identified by the appropriate unit of expression.

Numbers to Right of Decimal Point. This column specifies the number of digits to the right of the decimal point when data are printed.

Working Attribute Deck. For convenience, an abridged attribute deck is made up to list only those attributes most commonly used within each center.

As stated above, INFIC favors the use of joules to express energy, however, some countries still use the calorie system. For these countries, it is suggested that data be entered as kcal. For the larger animals, kcal can be converted to Mcal by multiplying by .001 as shown in the right column. When data are traded among the centers, however, it is converted to MJ/kg.

Data should not be entered on the source form which are calculated. These items are as follows:

Digestible protein
Data for ruminants
Energy for cattle NE_l
Nehring NF_f energy values
Scandinavian Feed Units
Starch equivalent (SE)
Starch unit
Available minerals
Available amino acids
Vitamin A equivalent

3.4 Duplicate Copy of Source Form

As a convenience to personnel in the nutrition laboratory, source forms may be bound in 100-page (duplicate) books (Harris 1970). They can then be used as a laboratory recording system. The original copy is submitted to the INFIC center for processing and the duplication remains in the laboratory as a permanent

record. If this system is followed, the data do not need to be copied from laboratory records to the source forms.

3.5 Card Formats and Their Use

In some cases, it may be more convenient to use card formats for recording data, especially data taken from the literature or when entering data from laboratory records (Kearl et al. 1980). These card formats and how to use card formats should be made by the Type I INFIC center in cooperation with the laboratory providing the data.

3.6 Definitions for Energy Terms

Many terms are used to describe the energy content of feeds. Examples are starch equivalent, total digestible nutrients, and Scandinavian feed unit. These terms are now being replaced by systems which measure energy in heat units (Harris 1966; Blaxter 1962). This system is described below to enable proper and uniform recording of data on the source form.

The joule has been adopted by Le Systeme International d'Unites (SI) and the National Bureau of Standards (USA) as the preferred unit for expressing electrical, mechanical, and chemical energy. In view of this, the joule has replaced the calorie as the unit for energy in nutritional work in some countries. INFIC supports the use of the joule and data are exchanged among centers on this basis. However, some countries have not adopted the joule, so definitions and formulas are given using both joules and calories.

3.6.1 Units of Measurement

Joule (J) A joule, a unit of electrical energy, is the work expended per second by a current of one ampere flowing through one international ohm.

1 joule = 0.239 calorie or 1 Joule = 10^7 erg.

Kilojoule (kJ) A kilojoule is 1,000 joules.

Megajoule (MJ) A megajoule is 1,000 kilojoules or 1,000,000 joules.

calorie (cal) As usually used in nutrition literature, a calorie (sometimes referred to as a small calorie) is the amount of heat required to raise the temperature of one gram water to 15.5°C from 14.5°C.

1 calorie = 4.184 J.

kilocalorie (kcal) A kilocalorie is 1,000 small calories. Kilocalorie is preferred to calorie because it avoids difficulty of differentiating between a calorie (small "c") and a large Calorie (large "C").

Megacalorie (Mcal) A megacalorie is equivalent to 1,000 kcal or 1,000,000 cal. A megacalorie is equivalent to a therm. Megacalorie is the preferred term.

gross energy (GE) The amount of heat, measured in joules or calories, that is released when an organic substance is completely oxidized in a bomb calorimeter containing 25 to 30 atmospheres of oxygen. A similar term is "heat of combustion."

metabolic body size ($W^{0.75}$) The weight of the animal raised to the three-fourths power. It is useful when comparing metabolic rates of animals of different body sizes.

3.6.2 Explanation of Terms Under Conventional Scheme and True Energy Distribution Scheme

Usually the various energy measures are expressed on the basis of a time interval such as 24 hours, but they can be expressed on any time interval by using appropriate factors. When making up feed composition tables, the energy values are usually expressed on a per unit (kg, g, etc.) basis. It is preferable to state the composition on an "as fed" and a "moisture-free" basis; the dry matter should also be stated on an "as fed" basis. If requirements are expressed on a moisture-free basis, it makes computations of diets simpler for calculation by hand or for linear programming (Butcher 1976).

Figure 3.5 (conventional scheme) shows the usual energy distribution for calculating digestible, metabolizable, and net energy for animals, while Figure 3.6a shows the distribution in digestion and metabolism and Figure 3.6b shows the true digestible, true metabolizable, and true net energy. Figure 3.7 shows the conventional scheme for fish.

Under the conventional scheme fecal metabolic energy and endogenous urinary energy are considered part of the losses in digestion and metabolism; in the true energy distribution scheme these fractions are part of the maintenance energy requirement (Figure 3.6b). Because of these facts, digestible, metabolizable, N-corrected metabolizable, net, and maintenance energy are all "apparent" under the conventional scheme. Since the term "apparent" has not been used in the past in connection with energy utilization, with the possible exception of digestible energy, it is omitted to simplify the terms and make them

identical with previous values in the literature. When the metabolizable energy has been corrected to nitrogen equilibrium, the term N-corrected metabolizable energy (ME_n) should be used.

3.6.3 Conventional Scheme

Food-intake gross energy (GE_i) is the gross energy of the food consumed.

GE_i = dry wt of food consumed X GE of food per unit dry wt.

Fecal energy (FE) is the gross energy of the feces. It consists of the energy content of the undigested food and the metabolic (body) fraction of the feces.

FE = dry wt of feces X GE of feces per unit dry wt.

Apparent Digestible Energy (DE) DE is food-intake gross energy minus fecal energy. Similar terms: apparent absorbed energy, energy of apparently digested food.

DE = (GE of food per unit dry wt x dry wt of food)— (GE of feces per unit dry wt x dry wt of feces)

Gross Energy Digestion Coefficient The GE digestion coefficient is the percentage of gross energy apparently absorbed.

$$\frac{\text{(GE of food/unit dry wt x dry wt of food)} - \text{(GE of feces/unit dry wt x dry wt of feces)}}{\text{(GE of food/unit dry wt x dry wt of food)}} \times 100$$

Gaseous Products of Digestion (GPD) GPD includes the combustible gases produced in the digestive tract incident to fermentation of food microorganisms. The energy of these gases (methane) can be estimated from the gross energy of the diet (Blaxter 1962).

Methane makes up the largest portion of the combustible gases; however, hydrogen, carbon monoxide, acetone, ethane, and hydrogen sulfide reach significant amounts under certain dietary conditions. Energy lost as methane in ruminant and nonruminant herbivores is usually the only gas which needs to be considered.

Urinary energy (UE) is the gross energy of the urine. It includes the energy content of the non-utilized portion of the absorbed nutrients and the energy contained in the endogenous (body) fraction of the urine.

Metabolizable energy (ME) is the food intake gross energy minus fecal energy, minus energy in the gaseous products of digestion, minus urinary energy.

$$ME = GE_i - FE - GPD - UE.$$

For fish the gill excretions need to be taken into account (Smith 1980).

$$ME = GE_i - (FE + UE + ZE)^a$$

or per unit weight

$$\frac{ME = GE - (FE + UE + ZE)^a}{\text{Dry weight of feed intake}}$$

[a] ZE stands for gill energy excretion.

The energy in the gill excretions is difficult to measure directly. The dried material will not burn in a calorimeter. Wet oxidation methods can be used, but these methods are too laborious and time consuming for routine work. In view of this, the energy is estimated based on the nitrogen content. In freshwater fish, about 85% of the nitrogen is in the form of ammonia and most of the remaining 15% is in urea. The heat of combustion for ammonia is 83.9 kcal/mol and urea is 151 kcal/mol. This equates to 4.92 kcal/gN for ammonia and 5.39 kcal/gN for urea. The weighted average is 4.99 kcal/gN which is rounded to 5.0 to calculate the energy in the gill excretions.

$$(4.92 \times 0.85) + (5.39 \times 0.15) = 4.99$$

For rainbow trout

ZE = 5.0 kcal/gN in gill excretions

ZN = Nitrogen in gill excretions.

Multiply by 4.184 to convert kcal to kJ.

Nitrogen balance (NB) is the nitrogen in the food intake (NI) minus the nitrogen in the feces (FN), minus nitrogen in the urine (UN). Similar term: nitrogen retention.

$$NB = NI - FN - UN.$$

This formula is used for the calculation of the nitrogen balance, as this value is needed to adjust the metabolizable energy to account for the nitrogen retained in or lost from the body tissues.

For extremely precise work, the nitrogen lost through perspiration and epidermal excreta should be taken into account. For some types of research, the nitrogen in the products synthesized--such as milk, eggs, or wool--should also be considered.

N-corrected metabolizable energy (ME_n) is the food intake gross energy minus fecal energy, minus energy in the gaseous products of digestion, minus urinary energy; the total is then corrected for nitrogen retained or lost from the body. For birds and monogastric mammals, the gaseous products of digestion do not need to be considered.

For mammals, the correction is made as follows: for each gram of nitrogen lost from the body (equal to negative nitrogen balance) 31.17 kJ or 7.45 kcal are added to the metabolizable energy and for each gram of nitrogen retained in the body (equal to positive nitrogen balance) 31.17 kJ or 7.45 kcal are subtracted from the metabolizable energy.

In the case of animals synthesizing products such as milk or eggs, no correction is made for the nitrogen in these products. A similar term for N-corrected metabolizable energy is katabolizable energy.

$$ME_n = GE_i - FE - GPD - UE \pm (NB \times 7.45 \text{ kcal}).$$

Multiply by 4.184 to convert kcal to kJ.

For birds, the factor most often used is 34.39 kJ or 8.22 kcal because it represents the energy equivalent of uric acid per gram of nitrogen. Sometimes the factor 36.53 kJ or 8.73 kcal is used because it gives approximately the average energy content of urine per unit of nitrogen (Titus 1956).

Heat increment (HI) is the increase in heat production following consumption of food when the animal is in a thermoneutral environment. It consists of increased heats of fermentation and of nutrient metabolism. There also may be a slight expenditure of energy in masticating and digesting the food. This heat is wasted except when the temperature of the environment is below the critical temperature. This heat may then be used to help keep the body warm. When used in this manner, it becomes part of the net energy requirement for maintenance (Figure 3.6b).

A method that gives consistent results for measuring the heat increment is as follows:

> HI of food fed = heat production from animal on feed – heat production of animal while fasting

If it is not feasible to fast the animal, the heat production may be determined by feeding at two or more levels of nutrient intake and calculating the difference in heat production. The levels fed should be somewhere near those required for the physiological function to which the data are to apply. The heat increment of specific nutrients may be determined. This has erroneously been referred to as the specific dynamic effect. Similar terms for heat increment are calorigenic effect, thermogenic action, and sometimes specific dynamic effect.

Heat of fermentation (HF) is the heat produced in the digestive tract as a result of microbial action.

Heat of nutrient metabolism (HNM) is the heat produced as a result of the utilization of absorbed nutrients.

Net energy (NE) is the difference between metabolizable energy and heat increment, and includes the amount of energy used either for maintenance only or for maintenance plus production. Net energy can also be expressed as the gross energy of the gain in tissue or of the products synthesized plus the energy requirement for maintenance. Below the critical temperature the heat increment is also part of net energy (Figure 3.6b).

When reporting net energy, it should be clearly stated which fractions are included. For example, there may be values for net energy for maintenance plus production (NE_{m+p}), net energy for maintenance only (NE_m), or net energy for production only (NE_p). The subscripts are suggested because there is often confusion in the literature concerning which energy fractions are contained in net energy.

Net energy for maintenance (NE_m) is the fraction of net energy expended to keep the animal in energy equilibrium. In this state, there is no net gain or loss of energy in the body tissues. The net energy for maintenance for a producing animal may be different than for a non-producing animal of the same weight. This is due to changes in amounts of hormones produced and to differences in voluntary activity. This difference may be charged to maintenance, but in practice, it is usually charged to the production requirement.

Net energy for production (NE_p) is the fraction of net energy required in addition to that needed for body maintenance that is used for work or for tissue gain (growth and/or fat production), or for the synthesis of for example, a fetus, milk, eggs, wool, fur, or feathers. It should always be clearly stated which production fractions are included. For example, there could be: NE_{egg}; NE_{gain}; NE_{milk}; NE_{preg}; NE_{wool}; or NE_{work}.

Basal metabolism (BM) or standard metabolism (SM) BM is the chemical change which takes place in the cells of an animal in the fasting and resting state when it uses just enough energy to maintain vital cellular activity, respiration, and circulation as measured by the basal metabolic rate. For most homeotherms, it is close to a constant and can be computed as kcal/24 hr. = $70(W_{kg}^{.75})$. Multiply by 4.184 to convert kcal to kJ. For the measurement of basal metabolism, the animal must be under basal conditions, i.e., in a thermally neutral environment at post-absorptive state, conscious, and quiescent. In the case of ruminants, since it is difficult to determine just when they reach the post-absorptive state, terms such as fasting heat production (FHP) and fasting heat

catabolism (FHP + urinary energy lost during fast) may be preferred. The length of the fasting period should be specified. Experimentally, it has taken from 48 to 72 hours postprandial to obtain valid fasting metabolic values. In fish SM is used because it is not possible to have a fish completely quiet.

Energy of voluntary activity (VE) is the amount of energy needed by an animal to provide the energy required in, for example, getting up, standing, moving about to obtain food, grazing, drinking, and lying down. (See net energy for maintenance for differences between non-producing and producing animals.)

Heat to keep body warm (HBW) HBW is the additional heat needed to keep the animal's body warm when the temperature of the environment is below its critical temperature. The critical temperature for an animal is defined as that environmental air temperature below which its heat production increases. The heat increment (heats of fermentation and nutrient metabolism), in total or in part, can be used for keeping the animal warm.

In fish this fraction is not applicable, because they assume the temperature of their environment.

Heat to keep body cool (HBC) HBC is the extra energy expended by the animal when the temperature of the environment is above its zone of thermal neutrality. Above the critical air temperature for an animal, the rate of metabolism remains rather constant with a rise in air temperature, until the air becomes so hot that the body temperature increases. This then causes greater heat production by speeding up the body functions (panting, respiration rate, heart rate, etc.) in spite of the animal's already being too hot. If the animal suffers so much from heat that appetite fails, then less total heat may be produced because of the decrease in heat increment due to the lower feed intake.

In fish this fraction is not applicable, because they assume the temperature of their environment.

Total Heat Production (HE) is the total energy lost from an animal system in a form other than as a combustible compound. Heat production may be measured by either direct or indirect calorimetry. In direct calorimetry, heat production is measured directly by physical methods whereas indirect calorimetry involves some indirect measure of heat such as the measurement of oxygen uptake and carbon dioxide production using the thermal equivalent of oxygen based upon respiratory quotient (RQ) and theoretical considerations. The commonly accepted equation for indirect computation of heat production from respiratory exchange is $HE_{(kcal)}$ = 3.866 (Liters O_2) + 1.200 (Liters CO_2) – 1.431 (g UN) – 0.518 (Liters CH_4). Multiply by 4.184 to convert kcal to kJ.

Heat production may also be measured indirectly from the total carbon and nitrogen balance or from a comparative slaughter experiment. Both methods arrive at total heat production by a difference calculation and are subject to systematic error of measurement.

Energy Balance (EB) is the relation of intake of energy to output of useful energy. In the case of an animal raised for meat the energy balance equals the energy content of the gain. However, in the case of a lactating cow, the balance of energy would be the summation of tissue energy, lactation energy and energy in products of conception.

3.6.4 True Energy Distribution Scheme

The true energy distribution scheme was first proposed by Harris (1966). This scheme is shown in Figure 3.6b. Sibbald has worked out a method to measure the true metabolizable energy in chickens (Sibbald 1976). Data using this method can be recorded on the source form.

Under the true energy distribution system metabolic fecal energy and endogenous urinary energy are part of the maintenance requirement (Figure 3.6b). Definitions of terms in the true energy distribution system follow:

Fecal energy, metabolic (FE_m) is the amount of energy contained in the metabolic (body) fraction of feces (i.e., abraded intestinal mucosa, digestive fluids) that is not obtained from unabsorbed ration residues. This fraction measures part of the maintenance requirement and is continually replaced. Because producing animals consume more food than comparable non-producing animals, their food requirements are larger, and hence the metabolic fecal energy fraction is larger, providing the digestibility of the rations is the same. In practice, this difference may be considered a part of the production requirement.

True digestible energy (TDE) is the food-intake gross energy minus fecal energy of food origin (FE minus FE_m) minus energy in gaseous products of digestion minus heat of fermentation.

$$TDE = GE_i - (FE - FE_m) - GPD - HF$$

or

$$TDE = GE_i - FE + FE_m - GPD - HF$$

In the last formula FE_m is shown as a plus item because it is part of the maintenance requirement (Figure 3.6b).

Urinary energy, endogenous (UE_e) is the amount of energy contained in the endogenous (body) fraction of the total urine. This consists of urinary energy not directly of food origin. This fraction measures part of the maintenance requirement and is continually replaced (Figure 3.6b). If hormonal control increases the basal metabolism in producing animals, this fraction may be larger for those animals (See net energy for maintenance).

True metabolizable energy (TME) is the food-intake gross energy minus fecal energy of food origin (FE minus FE_m), minus energy in gaseous products of digestion, minus heat of fermentation energy, minus urinary energy of food origin (UE minus UE_e).

$$TME = GE_i - (FE - FE_m) - GPD - HF - (UE - UE_e)$$

or

$$TME = GE_i - FE + FE_m - GPD - HF - UE + UE_e.$$

In the last formula FE_m and UE_e are shown as plus items because these fractions are part of the maintenance requirement (Figure 3.6b).

N-corrected true metabolizable energy (TME_n) is the food-intake gross energy minus fecal energy of food origin (FE minus FE_m) minus energy in gaseous products of digestion minus heat of fermentation energy minus urinary energy of food origin (UE minus UE_e); the total is then corrected for nitrogen retained or lost from the body.

$$TME_n = GE_i\ (FE - FE_m) - GPD - HF - (UE - UE_e) \pm (NB \times 7.45\ kcal)$$

or

$$TME_n = GE_i - FE + FE_m - GPD - HF - UE + UE_e \pm (NB \times 7.45\ kcal)$$

Multiply by 4.184 to convert kcal to kJ.

See ME_n above for explanation of factors to use for birds in place of 31.97 kJ or 7.45 kcal.

True net energy (TNE) is the food-intake gross energy minus the fecal energy of food origin ($FE - FE_m$) minus energy in gaseous products minus heat of fermentation energy minus urinary energy of direct food origin ($UE - UE_e$) minus heat of nutrient metabolism.

$$TNE = GE_i - (FE - FE_m) - GPD - HF - (UE - UE_e) - HNM$$

or

$$TNE = GE_i - FE + FE_m - GPD - HF - UE + UE_e - HNM$$

In the last formula FE_m and UE_e are shown as plus items because these fractions are part of the maintenance requirement.

True net energy for maintenance (TNE_m) is the sum of the energy required for basal metabolism, voluntary activity, metabolic fecal energy (body origin), and endogenous urinary energy (body origin). The net energy for a producing animal may be different than that for a non-producing animal of the same weight (see net energy for maintenance).

$$TNE = BM + UE + FE_m + UE_e$$

Below the critical temperature and above the point of hyperthermal rise the heat to keep the body warm, or the energy to keep the body cool must also be considered.

4. PROCESSING OF INFORMATION IN THE DATABANK

4.1 Storage of International Feed Descriptions and Data

Processing data for entry into the data file is accomplished by using the international feed description, the international feed number, and the attribute code to identify the specific information.

All data pertaining to the source from which the information came, the environmental factors affecting the material, and the chemical and biological information are coded (Kearl et al. 1980). All information is listed and checked for errors. Data are converted to standard units (the metric system) and a dry basis (100% moisture free). New data being entered are compared to data in the existing data file. When data vary more than two standard deviations from the mean, they are listed for visual inspection by the processor. Erroneous data are corrected or deleted and acceptable data are re-entered into the data file. The corrected data are then merged with the old data and an updated data file is generated.

The international feed descriptions and other feed names are maintained on a separate tape, but they are linked to the data on the data tape by the international feed number.

4.2 Preparing International Feed Descriptions and Data for Publication

To recall feed names (international feed descriptions, international feed names or country names) and data from the databank, make a list of international feed numbers representing the feeds selected for the report in the order the information is to appear in the printout.

After the international feed numbers have been arranged in the proper order, select the name (international feed description, international feed name, or country name) that is to be used. Element tags have been assigned to each international feed name (Kearl et al. 1980). One of these tags is entered following the international feed number for each feed selected (Table 4.1). This makes an eight-digit number (5 digits for the international feed number + 3 digits for the element tag). When printed out, the names will appear in the tables in the order selected using one name (tag 155 or 350) or using a combination of names (tag 155, 350, etc.). The element tag for the international feed description is 155; for the international feed names, 350, 360, or 370; and for country (local names 425, 430, etc. In some cases, language codes (three digits) are used with source element tags (350–425) to print the feed names in that particular language. For specific country (local) names (tag 425, etc.) the country code is put before the international feed number.

When the names have been selected and sorted into the proper order, select and list the attribute codes that are to appear in the tables. A list of those selected are made and placed in the order they are to appear. This order is from left to right (for example 101 code for dry matter, 109 code for protein, etc.). See Table 3.9 for a list of attribute codes.

Data values for the selected international feed numbers and attribute codes are retrieved from the data file using the international feed number. Oftentimes, data from closely associated feeds are combined to present a more complete listing of attributes (nutrients). An example is: data from Alfalfa, aerial part, sun-cured, early bloom cuts 1, 2, 3, etc., may be combined and printed out under Alfalfa, aerial part, sun-cured, early bloom. This gives more complete information for the chemical and biological data for this feed (Kearl et al. 1980). For screening purposes, all attribute data can be listed by individual entry (source form) within each feed (Table 4.2). This is done for visual comparison of all values for those attributes selected for a given feed.

The data are then sorted by parameters selected to list the information requested. Examples of parameters are country, state, laboratory, fishing area, fertilizer, season, or animal kind. See Sections 3.1.1, 3.1.2, 3.1.3, 3.1.4, and 3.1.5 for other parameters.

4.3 Calculation of Averages and Derived Values

Each INFIC center may use their own formula and summarize the data in any way appropriate for local use. Examples of formulas and one way the data may be summarized follow.

Data are stored in the databank by individual source form entry, therefore, to become meaningful in tables of feed composition and other printed reports, the information has to be summarized. Software has been developed to calculate the means for all attribute values, the standard deviation, the coefficient of variation, the maximum and minimum values, and the total number of observations.

Regression equations are used to calculate specific attribute values for missing information using data stored in the databank. INFIC supports the use of the joule, however, some countries have not yet adopted the joule, so data may be reported in publications in joules or in calories.

When printing feed tables, the estimated values are marked with an asterisk (*) for identification purposes. Each Center should select the formula suited to their needs.

All values for each attribute (for each feed) are totaled, means calculated, and when there is four or more values, the coefficient of variability is calculated.

Organic Matter (OM) The mean is calculated:

$$OM = 100 - \% \text{ ash.}$$

Nitrogen Free Extract (NFE) The mean NFE is calculated:

$$NFE(\%) = 100 - \% \text{ ash} - \% \text{ crude fiber} - \% \text{ ether extract} - \% \text{ protein.}$$

NFE is not usually used in the calculation of diets. It is, however, used in the calculation of total digestible nutrients, NE_f, Scandinavian Feed Unit, and starch equivalent.

Conversion Factors To convert calories to joules, use the following conversions:

1 cal = 4.184 J

1 kcal = 4.184 kJ

1 Mcal = 4.184 MJ

To convert joules to calories, use the following conversions:

1 J = 0.2389 cal

1 kJ = 0.2389 kcal

1 MJ = 0.2389 Mcal

Gross Energy Gross energy is calculated as follows (Guenther 1979):

$$GE(MJ/kg\ DM) = 0.0242\ CP + 0.0366\ EE + 0.0209\ CF + 0.017\ NFE - 0.0007\ S.$$

GE(kcal/kg DM) = 5.77 CP + 8.74 EE + 5.00 CF + 4.06 NFE – 0.17 S.

0.0007 S is applied as part of the equation when the sugar content in the dry matter is more than 8%.

CP = crude protein; EE = ether extract; CF = crude fiber; NFE = nitrogen free extract; and S = sugar.

Digestible Energy Digestible energy for each animal kind is calculated from:

a. the mean of digestible energy in kJ/kg or MJ/kg or in kcal/kg or Mcal/kg.

b. DE(kJ/kg DM) = GE(kJ/kg DM) x GE digestion coefficient or

   DE(kcal/kg DM) = GE(kcal/kg DM) x GE digestion coefficient

c. TDN for cattle and sheep (Crampton et al. 1957; Swift 1957):

   DE(kcal/kg DM) = TDN % x 44.09.

   To convert to kJ/kg DM, multiply the answer by 4.184.

d. TDN for horses (Fonnesbeck et al. 1967, and Fonnesbeck, 1968):

   DE(Mcal/kg DM) = .0255 + 0.0366 TDN%

   DE(MJ/kg DM) = 1.07 + 0.153 TDN%

e. TDN for swine (Crampton et al. 1957; Swift 1957):

   DE(kcal/kg DM) = TDN % x 44.09.

   To convert to kJ/kg DM, multiply the answer by 4.184.

Metabolizable Energy Metabolizable energy for each animal kind is calculated from:

a. the average metabolizable energy in kJ/kg or MJ/kg or in kcal/kg or Mcal/kg

b. nitrogen corrected metabolizable energy (ME_n) for chickens and turkeys (Harris 1966)

c. true metabolizable energy (TME) for chickens (Harris 1966; Sibbald 1976)

d. ME for poultry (Haertel et al. 1977):

   ME(MJ/kg DM) = 0.0183 DCP + 0.0388 DEE + 0.0173 DNFE

   ME(kcal/kg DM) = 4.38 DCP + 9.26 DEE + 4.13 DNFE

   DCP = digestible crude protein; DEE = digestible ether extract; DNFE = digestible nitrogen free extract.

e. ME for ruminants (Guenther 1979):

   ME(MJ/kg DM) = 0.0152 DCP + 0.0342 DEE + 0.0128 DCF + 0.0159 DNFE – 0.0007 S.

   ME(kcal/kg DM) = 3.63 DCP + 8.17 DEE + 3.06 DCF + 3.81 DNFE – 0.17 S.

   0.0007 S is applied as part of the equation when the sugar content in the dry matter is more than 8%.

   DCP = digestible crude protein; DEE = digestible ether extract; DCF = digestible crude fiber; DNFE = digestible NFE and S = sugar.

f. DE for cattle and sheep (Moe and Tyrrel 1976):

   ME(Mcal/kg DM) = –0.45 + 1.01 DE(Mcal/kg DM)

   To convert to MJ/kg DM, multiply the answer by 4.184.

Moe and Tyrrell's formula is for dairy cattle, but it can be applied to sheep until a better formula can be found.

g. DE for horses as:

   ME(Mcal/kg DM) = 0.82 DE(Mcal/kg DM)

   To convert to MJ/kg DM, multiply the answer by 4.184.

h. DE for swine (Asplund and Harris 1969):

   ME(kcal/kg DM) = (0.96 – 0.00202 x crude protein %) x DE(kcal/kg DM)

   To convert to kJ/kg DM, multiply the answer by 4.184.

i. ME for fish (Smith 1980):

   $ME(kJ/kg\ DM) = GE_i - (FE + UE + ZE)$

   $ME(kcal/kg\ DM) = GE_i - (FE + UE + ZE)$

   FE = fecal energy; UE = urine energy; ZE = gill energy.

Net Energy Net energy for finishing cattle is calculated from:

a. average net energy for NE_m or NE_g

b. net energy (NE) values for some cattle feeds are calculated from equations developed by Garrett (1977):

   $NE_m(MJ/kg\ DM) = 4.665 - 0.8971\ ME + 0.1555\ ME^2 - 0.005872\ ME^3 + 0.00007816\ ME^4$

   $NE_m(Mcal/kg\ DM) = 1.115 - 0.8971\ ME + 0.6507\ ME^2 - 0.1028ME^3 + 0.005725\ ME^4$

   $NE_g(MJ/kg\ DM) = 3.178\ ME - 0.2066\ ME^2 + 0.007283\ ME^3 - 0.00009266\ ME^4 - 13.912$

$$NE_g(\text{Mcal/kg DM}) = 3.178\ ME - 0.8646\ ME^2 + 0.1275\ ME^3 - 0.006787\ ME^4 - 3.325$$

c. net energy for cattle (NE_l) is calculated from equations of Moe and Tyrrell (1976):

$NE_l(\text{Mcal/kg DM}) = -0.12 + 0.0245\ TDN(\%\ \text{of DM})$

To convert to MJ/kg DM, multiply the answer by 4.184.

d. net energy lactation (NE_l) for ruminants (Guenther 1979):

$NE_l(\text{MJ/kg DM}) = 0.6\ [1 + 0.004\ (q - 57)]\ ME$

$q = (ME/GE)100$

To convert to Mcal/kg DM, multiply the answer by 0.2389.

Total Digestible Nutrients Total digestible nutrients (TDN) for each animal kind are calculated from:

a. average TDN

b. digestible nutrients

digestible protein in %	x 1
digestible crude fiber in %	x 1
digestible nitrogen-free extract in %	x 1
digestible ether extract in %	x 2.25
TDN in %	Total

c. DE for cattle and sheep (Crampton et al. 1957; Swift 1957):

$$TDN\% = \frac{\text{DE in Mcal/kg DM}}{0.04409}$$

d. DE for horses (Fonnesbeck et al. 1967, and Fonnesbeck 1968):

$TDN\% = 20.35 \times DE(\text{Mcal/kg} + 8.90$

This formula is only used for class 1 feeds.

e. ME for cattle and sheep (Crampton et al. 1957; Swift 1957):

$TDN\% = 27.65 \times ME\ \text{in Mcal/kg DM}$

f. TDN% for horses and swine is not calculated from ME.

g. regression equations (see Table 4.3).

INFIC discourages the use of TDN. It is described here because DE, ME, and NE may be calculated from TDN when other data are not available.

Amino Acids and Fatty Acids When amino acids are reported on a protein basis (g/16g N), they are converted to percent amino acid in dry matter of feed and stored in the databank (see Section 3.2.6). When fatty acids are reported on a fat basis (g fatty acids/100g fat) or fatty acid basis (g fatty acids/100g fatty acids) they are converted to fatty acid percent in the dry matter and stored in the databank. To calculate amino acids or fatty acids on a ratio basis, proceed as follows:

Amino acid (g/16g N) =

$$\frac{\%\ \text{amino acid in dry matter}}{\text{protein \% in dry matter}} \times 100$$

Fatty acid (g fatty acid/100g fat) =

$$\frac{\%\ \text{fatty acid in dry matter}}{\text{fat \% in dry matter}} \times 100$$

Fatty acid (g fatty acid/100g fatty acid) =

$$\frac{\%\ \text{fatty acid in dry matter}}{\text{fatty acid \% of dry matter}} \times 100$$

Digestible Protein Digestible protein is calculated for each kind of animal by the usual formula:

a. digestible protein = $\frac{\%\ \text{protein} \times \text{protein dig. coeff.}}{100}$

b. or by equation in Table 4.4 when protein digestion coefficients are not available.

Vitamin A Standards The international standard for vitamin A activity as it relates to vitamin A and beta-carotene are as follows:

IU = international unit

1 IU vitamin A = 1 USP unit vitamin A

= 0.344 microgram crystalline all-trans vitamin A acetate

= 0.300 microgram all-trans vitamin A alcohol

= 0.550 microgram vitamin A palmitate

Beta-carotene (Provitamin A) Equivalents (Based on the Rat)

1 IU vitamin activity = 0.6 microgram beta-carotene

1.0 milligram beta-carotene = 1667 IU vitamin A activity

To convert grams or milligrams of beta-carotene to IU of vitamin A multiply by 1,667,000 or 1,667, respectively.

Vitamin A international standards are based on the utilization of vitamin A and beta-carotene by the rat.

Conversion of carotene to vitamin A varies by species. Therefore, it is suggested that the conversion rates in Table 4.5 be used.

5. USE OF THE FEED DATABANK

5.1 Compilation of Feed Composition Tables

The primary task of the International Network of Feed Information Centers is to collect feed data for publication in feed composition tables. Feed composition tables are one of the most effective means of conveying information to users.

These tables are composed according to different uses and to meet specific needs. One of the most common uses is to select material from the databank to compose a table for a special kind of animal. To meet these needs different tables for ruminants, horses, pigs, and poultry and other animals are prepared. This requires the selection of two sets of data The first one is to select all those feeds, which may be fed to the specific kind of animal; for instance, the main part of feeds for ruminants are not feeds for pigs and poultry, although there is a great overlapping. The second requirement is to put those kinds of nutrients into the table which are important for the specific kind of animal. (See section 4.2 and 4.3 for a discussion of how the data are summarized for feed composition tables.)

The calculation of energy values as well as those of other derived values (for instance of digestible protein) are included in the general process of compiling feed composition tables. Other steps included in this process are the selection of data and the calculation of averages and standard deviation, the sorting of the material and the combination of the data with the right International Feed Descriptions or International Feed Names (or Country names in a specific language).

Another option is the preparation of feed composition tables with special groups of nutrients or substances. For instance, tables with the contents of minerals, trace minerals, toxic minerals (heavy metals), amino acids, vitamins and others are prepared.

When tables are prepared for a broad distribution, they are photoset, based on the magnetic tape, and printed. These tables are generally produced by book publishing companies and available via book dealers.

In cases where more specific information is selected from the databank for a special user, the computer printout or a photocopy of it can be used directly. This procedure leads to the individual use of the databank.

Each center uses the type format best suited to its needs. Example formats are: the Atlas Format with the international feed vocabulary first used by Crampton and Harris (1969) and later by the National Academy of Sciences (1971). This format is illustrated in Table 5.1.

By sorting the raw data before summarization, it is possible to have data organized in different ways: for example, by country, by dry and rainy season, or with or without fertilizer. The headings for country, or for dry or rainy season, or with and without fertilizer may be entered on the same line as the international feed number.

The table column for any one feed is as long as is necessary to include all of the analytical data that are available.

The main advantages of the Atlas Format are that all data are listed in one place and it is economical of printing space when there is wide variation in the number and kind of nutrients between feeds. It is difficult, however, to determine which analytical data are missing and to locate a feed with a particular level of a certain nutrient.

To overcome these problems with the Atlas Format, the Long Format is used. There are many options in printing the feed names.

- In Table 5.2 the generic or common name, Facet 1, is printed first followed by the scientific name, Facet 1. Facets 2–6 are printed below this heading. This format has the advantage of not having to print the common and scientific name more than once when there are several names with the same Facet 1.

- In Table 5.3 the scientific name is printed first followed by the common name, Facet 1. Facets 2–6 are printed below this heading.

- For local use, it is sometimes desirable to print only the International Feed Name (Table 5.4). If the International Feed Name is not fully understood, information can be:

  put in parentheses after the name,

  or official and local names may be inserted directly under the International Feed Name .

The information may also be printed in another language such as Spanish (McDowell et al. 1974b) or in English Turkish and Arabic (Kearl et al. 1979) or in Indonesian (Hartadi et al. 1980) (see Table 5.5).

Feeds are known by many names (Harris et al. 1980). Because of this, it may be necessary to put cross

references in feed composition tables so the local feed names are referred to the International Feed Names. Examples are Corn - see Maize; Blood - see Animal; Lucerne - see Alfalfa.

The data in a feed composition table should be on an as fed and dry basis (moisture free) (Harris et al. 1969).

5.2 Retrieval of Data for Individual Use

The multiplicity of characteristics and codes given to the data units stored in the databank enables the information Centers to retrieve data for special purposes according to different needs. For instance, it is possible to select all information on a specific feed by recalling the data using the international feed number. The data material can be given as averages from all values or as single values alternatively, or when requested, by selecting maximum and/or minimum values.

Other parameters for selecting data from the bank could be specific substances, for instance, those which are not often found or analyzed in feed samples. This occurs when a specific substance becomes of public interest, due to possible harmful effects on animals or humans.

Furthermore, the influence exerted on a feed by the environmental factors to which it may have been subjected to may affect its nutritive value. For instance, the content of heavy metals may be increased through contact with the effluents from the neighborhood industrial plants or intense traffic. Also influences of geographical or geological origin on the feed sample may belong to this category of selection parameters.

5.3 Different Access to the Databank

The more individual view points come into the scope of interests of the user of the databank, the more it seems to be advisable to make access to the bank as convenient as possible. The Information Centers are using different methods to answer the user's questions. One of these is the specific computer printout as mentioned above. Special information can be recalled on a terminal and the information made up in different ways can be transferred to the user.

The ultimate goal of making feed composition data available to the user is to provide him with an on-line access. Today, more and more information terminals are established in universities, research centers, industrial companies, etc. Thus, the way is open to the direct on-line access to the bank from different localities. It should be mentioned, however, that for the near future, such on-line access to users will not provide access to the general feed databank with the original raw data, but only to a databank with aggregated data (averages, standard deviations, etc.). The very multiple and complicated procedure of the raw original databank should be reserved to the specialist in the Feed Information Center.

A special kind of a bank with aggregated data is one which is currently supplemented with current prices (or the cost can be added at the terminal) for feeds in a given area. Such a databank can be used on-line for the calculation of diets and feed mixtures for the most profit (Table 5.6).

The following references give information on how to calculate animal diets (McPherson 1971; Gleaves et al. 1973; Black et al. 1976; Chandler and Brown, 1976; Fonnesbeck, Harris, and Kearl 1976).

5.4 Statistical Use of the Databank

The large size of the original databanks with some hundred thousands of data units permits the material to be used for making certain statistical assessments. For instance, long term trends in the changes of feed composition as caused by the efforts of plant breeders, agricultural methods or the development of industrial processes can be examined. Also the calculation of regression equations, for example, for the estimation of the digestibility or other feed parameters are possible by using this extensive data store. (See section 4.2 and 4.3 for example regression equations.)

5.5 Exchange of Data

The possibilities of providing users with reliable information and for the production of various types of data material are extremely increased by the fact that the INFIC Processing Centers are able to exchange information. The standardization of data recording, describing and processing permits the exchange of material on different data carriers like magnetic tapes. This standardization enables each Processing Center to add the material to its own store, process it according to the same methods as other recorded material and use it to dissiminate better and more reliable information to the users. Raw data are exchanged on a card format basis (Kearl et al. 1980). This raw data is on a dry basis (moisture free) and preferred unit (metric system).

The integration of data material previously processed by different centers is used for example to compile feed composition tables for regions in which only few data are available like in certain developing countries.

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Tables

TABLE 1.1 Responsibilities of INFIC Centers

Region	Collection and Dissemination Center(s)[a]	Processing Center(s)
Africa (without Arab States)	IEMVT, TPI, HUDOC	HUDOC
Australia and Oceania	AFIC	AFIC
Europe	HUDOC, UL	HUDOC
Korea	KFI	IFI
Latin America	IICA, IFI	IFI
Malaysia	UPM	AFIC
Middle East (with Arab States in Africa)	ACSAD, IFI	IFI
North America	IFI, AC	IFI
Philippines	PNFIC	AFIC
United Kingdom	MAFF	IFI
World (for fish)	CF	IFI

[a] AC: Agriculture Canada, Ottawa, Canda

ACSAD: Arab Center for the Studies of Arid Zones and Dry Lands, Damascus, Syria

AFIC: Australia Feeds Information Centre, Sydney (Blacktown), Australia

CF: College of Fisheries, University of Washington Seattle, Washington, USA

HUDOC: Hohenheim University, Documentation Center, Germany, F.R.

IEMVT: Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux, Maisons-Alfort, France

IICA: Instituto Interamericano de Ciencias Agricolas, San Jose, Costa Rica

IFI: International Feedstuffs Institute, Utah State University, Logan, Utah, USA

KFI: Korean Feedstuffs Institute, College of Agriculture, Seoul National University, Suweon, 170–00, Korea

MAFF: Ministry of Agriculture, Fisheries and Food, London London, 2W1P 2AE, United Kingdom

PNFIC: Philippine National Feed Information Centre, University of Philippines at Los Banos, College, Laguna, Philippines

TPI: Tropical Products Institute, London, United Kingdom

UL: Universidade de Lisboa, Cidade Universitaria, Lisbon, Portugal

UPM: Universiti Pertanian Malaysia, Serdang, Selangor, Malaysia

TABLE 2.1 Examples From the International Feed Thesaurus, Facet 1: Original Material, Main Part

Example 1

TRIFOLIUM PRATENSE (L.)
001[a] ROTKLEE
002 CLOVER RED
003 TREFLE VIOLETTE
USED FOR–001 WIESENKLEE
–002 CLOVER PURPLE
–002 CLOVER MEADOW
–003 HERBE A VACHE
–003 TREFLE GRAND
–003 TREFLE ROUGE
–003 TRIMENE
–003 TRIOLET ROUGE
–004 TRIFOGLIO PRATENSE
–004 TRIFOGLIO ROSSO
–005 TREBOL VIOLETA
–005 TREBOL ROJO
–007 ROODE KLAVER
–007 ROODE BRABANTSHCE KLAVER
–008 ROOIKLAWER
–010 ROEDECLOEVER
–014 KLEVER LUGOWOJ
–016 KONICZYNA CTERWONA

Example 2

BOS TAURUS
001 RIND
002 CATTLE
003 BOEUF

Example 3

CALCIUM CARBONATE
001 FUTTERKALK KOHLENSAURER
002 CALCIUM CARBONATE CACO3
USED FOR–001 CACO3
–001 KALZIUMKARBONAT

[a] 001 German, 002 English, 003 French, 004 Italian, 005 Spanish, 007 Netherlandian, 008 Afrikaans (South Africa), 010 Swedish, 014 Russian, 016 Polish.

TABLE 2.2 Examples From the International Feed Thesaurus, Facet 1: Original Material, Auxiliary Part

Lead-in-Terms	Preferred Terms of the Scientific Name
Example 1	
001[a] –WIESENKLEE	TRIFOLIUM PRATENSE (L.)[b]
001 ROTKLEE	TRIFOLIUM PRATENSE (L.)
002 –CLOVER MEADOW	TRIFOLIUM PRATENSE (L.)
002 –CLOVER PURPLE	TRIFOLIUM PRATENSE (L.)
002 CLOVER RED	TRIFOLIUM PRATENSE (L.)
003 –HERBE A VACHE	TRIFOLIUM PRATENSE (L.)
003 –TREFLE GRAND	TRIFOLIUM PRATENSE (L.)
003 –TREFLE ROUGE	TRIFOLIUM PRATENSE (L.)
003 TREFLE VIOLETTE	TRIFOLIUM PRATENSE (L.)
003 –TRIMENE	TRIFOLIUM PRATENSE (L.)
003 –TRIOLET ROUGE	TRIFOLIUM PRATENSE (L.)
004 –TRIFOGLIO PRATENSE	TRIFOLIUM PRATENSE (L.)
004 –TRIFOGLIO ROSSO	TRIFOLIUM PRATENSE (L.)
005 –TREBOL ROJO	TRIFOLIUM PRATENSE (L.)
005 –TREBOL VIOLETA	TRIFOLIUM PRATENSE (L.)
007 –ROODE BRABANTSCHE KLAVER	TRIFOLIUM PRATENSE (L.)
007 –ROODE KLAVER	TRIFOLIUM PRATENSE (L.)
008 –ROOIKLAWER	TRIFOLIUM PRATENSE (L.)
010 –ROEDECLOEVER	TRIFOLIUM PRATENSE (L.)
014 –KLEVER LUGOWOJ	TRIFOLIUM PRATENSE (L.)
016 –KONICZYNA CTERWONA	TRIFOLIUM PRATENSE (L.)
Example 2	
001 RIND	BOS TAURUS
002 CATTLE	BOS TAURUS
003 BOEUF	BOS TAURUS
Example 3	
001 FUTTERKALK KOHLENSAURER	CALCIUM CARBONATE
001 –CACO3	CALCIUM CARBONATE
001 –KALZIUMKARBONAT	CALCIUM CARBONATE
002 CALCIUM CARBONATE CACO3	CALCIUM CARBONATE

[a] See Table 2.1 for language codes.

[b] The initial after the scientific name is not included in the "International Feed Description File" (Harris et al. 1980).

TABLE 2.3 Examples From the International Feed Thesaurus, Facet 2: Parts

Example 1

AERIAL PART

SN:[a] all plant parts above the ground
– not for trees and shrubs (use BROWSE)
– not for mosses and algae (use WHOLE)

RT: BROWSE

BTP: WHOLE

Example 2

MILK

SN: 1. animal product
2. liquid in coconuts

NTP: SKIMMILK

[a] SN scope notes, RT related terms, BTP broader term partitive, NTP narrower term partitive.

TABLE 2.4 Examples From the International Feed Thesaurus, Facet 3: Processes

Example 1

DEHYDRATED

SN:[a] dried by act of artificial heat or having had most of the moisture removed by artificial heat.

RT:[a] DEHYDRATED ON ROLLERS
SPRAY DEHYDRATED
FREEZE DEHYDRATED
FAN AIR DRIED WITH HEAT

UF:[a] artificially dried

Example 2

GROUND

SN: 1. reduced in particle size by impact, shearing or attrition
2. in milling powdered (to flour) and separated from foreign material

RT: FINE GROUND, COARSE GROUND

Example 3

DEHYDRATED GROUND

SN: two consecutive processes DEHYDRATED (see DEHYDRATED) and GROUND (see GROUND)

Example 4

CENTRIFUGED FRESH

SN: process and condition; CENTRIFUGED (see CENTRIFUGED) and FRESH (see FRESH)

RT: CENTRIFUGED DEHYDRATED

[a] SN - scope notes; RT - related terms; UF - used for.

TABLE 2.5 Examples From the International Feed Thesaurus, Facet 4: Stage of Maturity

Example 1

EARLY BLOOM

SN:[a] period between initiation of bloom up to stage at which 1/10 of the plants are in bloom; first flowers in grass heads in anthesis

UF: early anthesis, first flower, headed out, in head

Example 2

DAY OLD

SN: age of birds

UF: one day old

[a] SN scope notes; UF, used for

TABLE 2.6 Examples From the International Feed Thesaurus, Facet 6: Grades (Quality)

Example 1

MORE THAN 7% FIBER

Example 2

LESS THAN 5% FAT

Example 3

17.1–19% PROTEIN

TABLE 2.7 Examples of International Feed Descriptions (English, German, French)

Element	Descriptors (English)	Descriptors (German)	Descriptors (French)
Example 1			
Genus	*TRIFOLIUM*	*TRIFOLIUM*	*TRIFOLIUM*
species	*PRATENSE*	*PRATENSE*	*PRATENSE*
generic	CLOVER	ROTKLEE	TREFLE
kind	RED	---	VIOLETTE
part	AERIAL PART	UEBERERDIGER TEIL	PARTIE AERIENNE
process	DEHYDRATED GROUND	KUENSTLICH GETROCKNET GEMAHLEN	DESHYDRATE BROYE
cut	CUT 2	SCHNITT 2	COUPE 2
grade	17.1–19% PROTEIN	17,1–19% ROHPROTEIN	17.1–19% PROTEINE
Example 2			
Genus	*BOS*	*BOS*	*BOS*
species	*TAURUS*	*TAURUS*	*TAURUS*
generic	CATTLE	RIND	BOEUF
part	SKIMMILK	MAGERMILCH	LAIT ECREME
process	CENTRIFUGED FRESH	ZENTRIFUGIERT FRISCH	CENTRIFUGE FRAIS

TABLE 2.8 Examples of International Feed Descriptions

Components	Feed No. 1	Feed No. 2	Feed No. 3	Feed No. 4	Feed No. 5	Feed No. 6
With Scientific Name						
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
Genus	*TRIFOLIUM*	*AVENA*	*MEDICAGO*	*ZEA*	*BOS*	*MAGNESIUM*
species	*PRATENSE*	*SATIVA*	*SATIVA*	*MAYS*	*TAURUS*	*CARBONATE*
variety	---	---	---	*INDENTATA*	---	---
Generic	CLOVER	OATS	ALFALFA	MAIZE	CATTLE	MAGNESIUM
breed or kind	RED	---	---	DENT	GUERNSEY	CARBONATE
strain	---	---	---	YELLOW	---	$MgCO_3 \cdot Mg(OH)_2$
part	AERIAL PART	AERIAL PART	AERIAL PART	GRAIN	MILK	---
process	SUN–CURED	FRESH	ENSILED	DEHY–DRATED	FRESH	GROUND
maturity	LATE VEGE–TATIVE	EARLY BLOOM	EARLY BLOOM	---	---	---
cutting grade	CUT 2 ---	--- ---	CUT 1 ---	--- GRADE 2 69.5 KG/HL	--- ---	--- ---
International feed number (IFN)	1-01-395	2-03-287	3-07-844	4-02-931	5-08-626	6-02-754
Without Scientific Name						
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
Genus	MEADOW PLANTS	GRASS	LEGUME	BAKERY	ANIMAL	ROCK PHOSPHATE
species	INTERMOUN–TAIN	---	---	---	---	---
variety	---	---	---	---	---	---
Generic	MEADOW PLANTS	GRASS	LEGUME	BAKERY	ANIMAL	ROCK PHOSPHATE
breed or kind	INTERMOUN–TAIN	---	---	---	---	---
strain	---	---	---	---	---	---
part	AERIAL PART	AERIAL PART	AERIAL PART	WASTE	BLOOD	---
process	SUN–CURED	FRESH	ENSILED	DEHY–DRATED	SPRAY DEHYDRATED GROUND	GROUND
maturity	LATE BLOOM	EARLY BLOOM	---	---	---	---
cutting grade	CUT 1 ---	--- ---	--- ---	--- ---	--- ---	--- ---
International feed number (IFN)	1-09-176	2-08-431	3-07-796	4-00-466	5-00-381	6-03-945

TABLE 2.9 Feed Classes

Class Number	Class Denominations and Explanations
1	*Dry forages and roughages* All forages and roughages cut and cured and other products with more than 18% crude fiber or containing more than 35% cell wall (dry basis). Forages and roughages are low in net energy per unit weight usually because of the high cell wall content. Example forages: hay STRAW stover (AERIAL PART WITHOUT EARS WITHOUT HUSKS (for Maize) OR AERIAL PART WITHOUT HEADS (for Sorghum) Example roughages: HULLS PODS
2	*Pasture, range plants, and forages fed fresh* Included in this group are all forage feeds either not cut (including feeds cured on the stem) or cut and fed fresh.
3	*Silages* This class includes only ensiled forages (MAIZE, ALFALFA, GRASS, etc.), but not ensiled FISH, GRAIN, ROOTS, and TUBERS.
4	*Energy feeds* Products with less than 20% protein and less than 18% crude fiber or less than 35% cell wall (dry basis), as for example GRAIN, mill by-products, FRUIT, NUTS, ROOTS, and TUBERS. Also, when these feeds are ensiled they are classified as energy feeds.
5	*Protein supplements* Products which contain 20% or more of protein (dry basis) from animal origin (including ensiled products) as well as oil meals, GLUTEN, etc.
6	*Mineral supplements*
7	*Vitamin supplements* Including ensiled yeast.
8	*Additives* Feed supplements such as antibiotics, coloring material, flavors, hormones, and medicants.

TABLE 2.10 Examples of International Feed Descriptions, International Feed Names, and Country Names From the International Feed Description File

International Feed Description	International Feed Name (English)	International Feed Name (German)	Country Name
Example 1			
TRIFOLIUM PRATENSE, CLOVER, RED, DEHYDRATED GROUND, EARLY BLOOM, 17.1–19% PROTEIN	CLOVER, RED, MEAL DEHYDRATED, EARLY BLOOM, 17.1–19% PROTEIN	ROTKLEE, Gruenmehl, 17,1–19% Rohprotein	
Example 2			
ZEA MAYS, MAIZE GLUTEN, WET MILLED DEHYDRATED GROUND	MAIZE, gluten, meal	Maiskleberfutter, eiweissreich	Durah shami, gluten (Egypt) Misir, gluten (Turkey) Corn gluten meal (USA)

TABLE 2.11a Part Descriptors Changed or Deleted When Composing the International Feed Name from the International Feed Description

Item Number	Descriptors in International Feed Description	Descriptors or Terms Used in International Feed Name
1	AERIAL PART	Deleted
2	AERIAL PART OIL RESIDUE	Deleted
3	BLUBBER OIL RESIDUE	BLUBBER
4	BONE OIL RESIDUE	BONES
5	BRAN WITH GERMS OIL RESIDUE	BRAN WITH GERMS
6	BRAN WITH GERMS WITH HULLS OIL RESIDUE	BRAN WITH GERMS WITH HULLS
7	CARCASS RESIDUE	MEAT
8	CARCASS RESIDUE WITH BLOOD	Tankage
9	CARCASS RESIDUE WITH BLOOD WITH BONE	Tankage with bone
10	CARCASS RESIDUE WITH BLOOD WITH RUMEN CONTENTS	Tankage with rumen contents
11	CARCASS RESIDUE WITH BONE	MEAT WITH BONE
12	FLOUR OIL RESIDUE	FLOUR
13	FRUIT OIL RESIDUE	FRUIT
14	FRUIT WITHOUT PITS OIL RESIDUE	FRUIT WITHOUT PITS
15	FRUIT WITHOUT SEEDS OIL RESIDUE	FRUIT WITHOUT SEEDS
16	GERMS OIL RESIDUE	GERMS
17	GERMS WITHOUT SOLUBLES OIL RESIDUE	GERMS WITHOUT SOLUBLES
18	GLUE BY-PRODUCT	GLUE RESIDUE
19	GLUTEN LOW GLUTAMIC ACID	GLUTEN
20	GRAIN OIL RESIDUE	GRAIN
21	GRAIN SCOURINGS	SCOURINGS
22	GRAIN SCREENINGS	SCREENINGS
23	GRAIN SCREENINGS REFUSE	SCREENINGS REFUSE
24	GRAIN STARCH	STARCH
25	GRITS BY-PRODUCT OIL RESIDUE	GRITS BY-PRODUCT
26	GRITS OIL RESIDUE	GRITS
27	KERNELS OIL RESIDUE	KERNELS
28	KERNELS WITH COATS OIL RESIDUE	KERNELS WITH COATS
29	KERNELS WITH COATS WITH SOME PODS OIL RESIDUE	KERNELS WITH COATS WITH SOME PODS
30	LEAVES OIL RESIDUE	LEAVES
31	LIVERS OIL RESIDUE	LIVERS
32	MEAT OIL RESIDUE	MEAT
33	MEATS OIL RESIDUE	MEATS
34	MEATS WITH HUSKS OIL RESIDUE	MEATS WITH HUSKS
35	MEATS WITH SHELLS OIL RESIDUE	MEATS WITH SHELLS
36	MEATS WITH SOME SHELLS OIL RESIDUE	MEATS WITH SOME SHELLS
37	OIL SLUDGE OIL RESIDUE	OIL SLUDGE

TABLE 2.11a Part Descriptors Changed or Deleted When Composing the International Feed Name from the International Feed Description (Continued)

Item Number	Descriptors in International Feed Description	Descriptors or Terms Used in International Feed Name
38	PITS OIL RESIDUE	PITS
39	POLISHINGS OIL RESIDUE	POLISHINGS
40	PROTEIN OIL RESIDUE	PROTEIN
41	PUPAE OIL RESIDUE	PUPAE
42	ROOTS OIL RESIDUE	ROOTS
43	SEED COATS OIL RESIDUE	SEED COATS
44	SEEDS GUMS ADDED OIL RESIDUE	SEEDS GUMS ADDED
45	SEEDS HULLS ADDED OIL RESIDUE	SEEDS HULLS ADDED
46	SEEDS LOW GOSSYPOL OIL RESIDUE	SEEDS LOW GOSSYPOL
47	SEEDS LOW PROTEIN LOW CARBOHYDRATES OIL RESIDUE	SEEDS LOW PROTEIN LOW CARBOHYDRATES
48	SEEDS OIL	OIL
49	SEEDS OIL RESIDUE	SEEDS
50	SEEDS UNSCREENED OIL RESIDUE	SEEDS UNSCREENED
51	SEEDS WITH SOME HULLS OIL RESIDUE	SEEDS WITH SOME HULLS
52	SEEDS WITHOUT COATS OIL RESIDUE	SEEDS WITHOUT COATS
53	SEEDS WITHOUT HULLS OIL RESIDUE	SEEDS WITHOUT HULLS
54	TUBERS WITHOUT PEELINGS OIL RESIDUE	TUBERS WITHOUT PEELINGS
55	VISCERA WITH FEET WITH HEADS	BY-PRODUCT
56	VISCERA WITH FEET WITH HEADS WITH FEATHERS	BY-PRODUCT WITH FEATHERS
57	WHEY WITHOUT ALBUMIN LOW LACTOSE	WHEY SOLUBLES
58	WHOLE OR CUTTINGS	Deleted
59	WHOLE OR CUTTINGS OIL RESIDUE	Deleted

TABLE 2.11b Example International Feed Description and International Feed Names Corresponding to the Parts Listed in Table 2.11a

International Feed No.	Item No. From Table 3 4a	International Feed Description	International Feed Name
3-07-840	1	ALFALFA, AERIAL PART, WILTED ENSILED, FULL BLOOM, CUT 1	ALFALFA, SILAGE WILTED, FULL BLOOM, CUT 1
1-00-030	2	ALFALFA, AERIAL PART OIL RESIDUE, SOLVENT EXTRACTED GROUND	ALFALFA, MEAL SOLVENT EXTRACTED
4-09-283	3	SEAL, HARBOUR, BLUBBER OIL RESIDUE, SOLVENT EXTRACTED	SEAL, HARBOUR, BLUBBER, SOLVENT EXTRACTED
6-08-338	4	ANIMAL, BONE OIL RESIDUE, BOILED SOLVENT EXTRACTED GROUND	ANIMAL, BONES, MEAL SOLVENT EXTRACTED
4-03-930	5	RICE, BRAN WITH GERMS OIL RESIDUE, SOLVENT EXTRACTED GROUND	RICE, BRAN WITH GERMS, MEAL SOLVENT EXTRACTED
1-13-554	6	RICE, BRAN WITH GERMS WITH HULLS OIL RESIDUE, SOLVENT EXTRACTED GROUND	RICE, BRAN WITH GERMS WITH HULLS, MEAL SOLVENT EXTRACTED
5-00-385	7	ANIMAL, CARCASS RESIDUE, DRY RENDERED GROUND	ANIMAL, MEAT, MEAL RENDERED
5-00-386	8	ANIMAL, CARCASS RESIDUE WITH BLOOD, DRY OR WET RENDERED	ANIMAL, TANKAGE, RENDERED
5-00-387	9	ANIMAL, CARCASS RESIDUE WITH BLOOD WITH BONE, DRY OR WET RENDERED GROUND	ANIMAL, TANKAGE WITH BONE, MEAL RENDERED
5-08-336	10	ANIMAL,CARCASS RESIDUE WITH BLOOD WITH RUMEN CONTENTS, DRY OR WET RENDERED GROUND	ANIMAL, TANKAGE WITH RUMEN CONTENTS, MEAL RENDERED
5-00-388	11	ANIMAL, CARCASS RESIDUE WITH BONE, DRY RENDERED GROUND	ANIMAL, MEAT WITH BONE, MEAL RENDERED
5-03-545	12	PEANUT, FLOUR OIL RESIDUE, MECHANICAL EXTRACTED	PEANUT, FLOUR, MECHANICAL EXTRACTED
4-14-459	13	PEPPER, FRUIT OIL RESIDUE, SOLVENT EXTRACTED	PEPPER, FRUIT, SOLVENT EXTRACTED
4-08-475	14	OLIVE, FRUIT WITHOUT PITS OIL RESIDUE, SOLVENT EXTRACTED GROUND	OLIVE, FRUIT WITHOUT PITS, MEAL SOLVENT EXTRACTED
1-11-746	15	COFFEE, FRUIT WITHOUT SEEDS OIL RESIDUE, MECHANICAL EXTRACTED	COFFEE, FRUIT WITHOUT SEEDS, MECHANICAL EXTRACTED
5-02-894	16	MAIZE, GERMS OIL RESIDUE, DRY MILLED MECHANICAL EXTRACTED GROUND	MAIZE, GERMS, MEAL MECHANICAL EXTRACTED
5-02-898	17	MAIZE, GERMS WITHOUT SOLUBLES OIL RESIDUE, WET MILLED SOLVENT EXTRACTED GROUND	MAIZE, GERMS WITHOUT SOLUBLES, MEAL SOLVENT EXTRACTED
5-01-966	18	FISH, GLUE BY-PRODUCT, DEHYDRATED GROUND	FISH, GLUE RESIDUE, MEAL
5-02-901	19	MAIZE, GLUTEN LOW GLUTAMIC ACID, HYDROLYZED DEHYDRATED	MAIZE, GLUTEN, HYDROLYZED
4-13-332	20	MAIZE, GRAIN OIL RESIDUE, SOLVENT EXTRACTED GROUND	MAIZE, GRAIN, MEAL SOLVENT EXTRACTED
4-02-152	21	CEREALS, GRAIN SCOURINGS	CEREALS, SCOURINGS
4-02-156	22	CEREALS, GRAIN SCREENINGS	CEREALS, SCREENINGS
4-02-151	23	CEREALS, GRAIN SCREENINGS REFUSE	CEREALS, SCREENINGS REFUSE
4-08-023	24	MAIZE, GRAIN STARCH, HEAT HYDROLYZED	MAIZE, STARCH, HEAT HYDROLYZED
4-08-025	25	MAIZE, GRITS BY-PRODUCT OIL RESIDUE, SOLVENT EXTRACTED	MAIZE, GRITS BY-PRODUCT, SOLVENT EXTRACTED
5-04-592	26	SOYBEAN, GRITS OIL RESIDUE, SOLVENT EXTRACTED	SOYBEAN, GRITS, SOLVENT EXTRACTED
5-03-648	27	PEANUT, KERNELS OIL RESIDUE, MECHANICAL EXTRACTED CAKED	PEANUT, KERNELS, MECHANICAL EXTRACTED CAKED
5-26-963	28	PEANUT, KERNELS WITH COATS OIL RESIDUE, SOLVENT EXTRACTED TOASTED GROUND	PEANUT, KERNELS WITH COATS, MEAL SOLVENT EXTRACTED TOASTED
5-24-754	29	PEANUT, KERNELS WITH COATS WITH SOME PODS OIL RESIDUE, MECHANICAL EXTRACTED GROUND, 4.1-8% FAT	PEANUT, KERNELS WITH COATS WITH SOME PODS, MEAL MECHANICAL EXTRACTED, 4.1-8% FAT
2-01-673	30	CREOSOTEBUSH, LEAVES OIL RESIDUE, ALCOHOL EXTRACTED	CREOSOTEBUSH, LEAVES, ALCOHOL EXTRACTED
5-01-968	31	FISH, LIVERS OIL RESIDUE, MECHANICAL EXTRACTED GROUND	FISH, LIVERS, MEAL MECHANICAL EXTRACTED
4-05-163	32	WHALE, MEAT OIL RESIDUE, SOLVENT EXTRACTED GROUND	WHALE, MEAT, MEAL SOLVENT EXTRACTED
5-11-966	33	PALM, COHUNE, MEATS OIL RESIDUE, MECHANICAL EXTRACTED CAKED	PALM, COHUNE, MEATS, MECHANICAL EXTRACTED CAKED

TABLE 2.11b Example International Feed Description and International Feed Names Corresponding to the Parts Listed in Table 2.11a (Continued)

Interna-tional Feed No.	Item No. From Table 3 4a	International Feed Description	International Feed Name
4-12-244	34	CASHEW, COMMON, MEATS WITH HUSKS OIL RESIDUE, MECHANICAL EXTRACTED GROUND	CASHEW, COMMON, MEATS WITH HUSKS, MEAL MECHANICAL EXTRACTED
5-25-591	35	WALNUT, PERSIAN, MEATS WITH SHELLS OIL RESIDUE, MECHANICAL EXTRACTED GROUND	WALNUT, PERSIAN, MEATS WITH SHELLS, MEAL MECHANICAL EXTRACTED
5-25-588	36	BEECH, EUROPEAN, MEATS WITH SOME SHELLS OIL RESIDUE, SOLVENT EXTRACTED GROUND	BEECH, EUROPEAN, MEATS WITH SOME SHELLS, MEAL SOLVENT EXTRACTED
4-20-663	37	OILPALM, AFRICAN, OIL SLUDGE OIL RESIDUE, SOLVENT EXTRACTED	OILPALM, AFRICAN, OIL SLUDGE, SOLVENT EXTRACTED
5-27-525	38	APRICOT, PITS OIL RESIDUE, MECHANICAL EXTRACTED GROUND	APRICOT, PITS, MEAL MECHANICAL EXTRACTED
4-13-300	39	RICE, POLISHINGS OIL RESIDUE, MECHANICAL EXTRACTED	RICE, POLISHINGS, MECHANICAL EXTRACTED
5-09-227	40	FISH, PROTEIN OIL RESIDUE, SOLVENT EXTRACTED	FISH, PROTEIN, SOLVENT EXTRACTED
5-20-950	41	SILKWORM, PUPAE OIL RESIDUE, SOLVENT EXTRACTED	SILKWORM, PUPAE, SOLVENT EXTRACTED
4-26-371	42	LICORICE, ROOTS OIL RESIDUE, MECHANICAL EXTRACTED GROUND	LICORICE, ROOTS, MEAL MECHANICAL EXTRACTED
1-13-575	43	CACAO, SEED COATS OIL RESIDUE, MECHANICAL EXTRACTED GROUND	CACAO, SEED COATS, MEAL MECHANICAL EXTRACTED
5-20-657	44	RAPE, TURNIP, SEEDS GUMS ADDED OIL RESIDUE, SOLVENT EXTRACTED GROUND	RAPE, TURNIP, SEEDS GUMS ADDED, MEAL SOLVENT EXTRACTED
5-09-636	45	COTTON, UPLAND, SEEDS HULLS ADDED OIL RESIDUE, MECHANICAL EXTRACTED GROUND	COTTON, UPLAND, SEEDS HULLS ADDED, MEAL MECHANICAL EXTRACTED
5-09-002	46	COTTON, SEEDS LOW GOSSYPOL OIL RESIDUE, MECHANICAL EXTRACTED GROUND	COTTON, SEEDS LOW GOSSYPOL, MEAL MECHANICAL EXTRACTED
5-04-613	47	SOYBEAN, SEEDS LOW PROTEIN LOW CARBOHYDRATES OIL RESIDUE, SOLVENT EXTRACTED GROUND	SOYBEAN, SEEDS LOW PROTEIN LOW CARBOHYDRATES, MEAL SOLVENT EXTRACTED
4-20-836	48	COTTON, SEEDS OIL	COTTON, OIL
5-02-041	49	FLAX, COMMON, SEEDS OIL RESIDUE, SOLVENT EXTRACTED, 31% PROTEIN	FLAX, COMMON, SEEDS, SOLVENT EXTRACTED, 31% PROTEIN
5-02-057	50	FLAX, COMMON, SEEDS UNSCREENED OIL RESIDUE, MECHANICAL EXTRACTED CAKED	FLAX, COMMON, SEEDS UNSCREENED, MECHANICAL EXTRACTED CAKED
5-14-639	51	COTTON, SEEDS WITH SOME HULLS OIL RESIDUE MECHANICAL EXTRACTED GROUND, 8.1-12% FAT	COTTON, SEEDS WITH SOME HULLS, MEAL MECHANICAL EXTRACTED, 8.1-12% FAT
5-25-582	52	MALLOW, MELUCA, SEEDS WITHOUT COATS OIL RESIDUE, SOLVENT EXTRACTED GROUND	MALLOW, SEEDS WITHOUT COATS, MEAL SOLVENT EXTRACTED
5-20-931	53	BUFFALOGOURD, SEEDS WITHOUT HULLS OIL RESIDUE, SOLVENT EXTRACTED GROUND	BUFFALOGOURD, SEEDS WITHOUT HULLS, MEAL SOLVENT EXTRACTED
4-10-466	54	DASHEEN, TUBERS WITHOUT PEELINGS OIL RESIDUE, SOLVENT EXTRACTED GROUND	DASHEEN, TUBERS WITHOUT PEELINGS, MEAL SOLVENT EXTRACTED
5-30-187	55	POULTRY, VISCERA WITH FEET WITH HEADS, BOILED	POULTRY, BY-PRODUCT, BOILED
5-14-508	56	POULTRY, VISCERA WITH FEET WITH HEADS WITH FEATHERS, HYDROLYZED	POULTRY, BY-PRODUCT WITH FEATHERS, HYDROLYZED
4-01-188	57	CATTLE, WHEY WITHOUT ALBUMIN LOW LACTOSE, CONDENSED	CATTLE, WHEY SOLUBLES, CONDENSED
5-01-974	58	FISH, WHOLE OR CUTTINGS, DEHYDRATED GROUND	FISH, MEAL
5-01-997	59	FISH, FLOUNDER, WHOLE OR CUTTINGS OIL RESIDUE, MECHANICAL EXTRACTED GROUND	FISH, FLOUNDER, MEAL MECHANICAL EXTRACTED

TABLE 2.12a Process Descriptors Changed or Deleted When Composing the International Feed Name from the International Feed Description

Item Number	Descriptors in International Feed Description	Descriptors or Terms Used in International Feed Name
1	ALCOHOL EXTRACTED GROUND	Meal alcohol extracted
2	BOILED DEHYDRATED GROUND	Meal boiled
3	BOILED ENSILED	Silage boiled
4	BOILED MECHANICAL EXTRACTED GROUND	Meal boiled mechanical extracted
5	BOILED PREPRESSED SOLVENT EXTRACTED GROUND	Meal boiled prepressed solvent extracted
6	BOILED SOLVENT EXTRACTED GROUND	Meal boiled solvent extracted
7	CONVENTIONAL COOKER DEHYDRATED GROUND	Meal conventional cooker dehydrated
8	DEHYDRATED COARSE GROUND	COARSE GROUND
9	DEHYDRATED FINE GROUND	FINE GROUND
10	DEHYDRATED GROUND	meal
11	DEHYDRATED OR SUN-CURED	DEHYDRATED
12	DRY MILLED	Deleted
13	DRY MILLED MECHANICAL EXTRACTED GROUND	Meal mechanical extracted
14	DRY MILLED SOLVENT EXTRACTED GROUND	Meal solvent extracted
15	DRY OR WET RENDERED	RENDERED
16	DRY OR WET RENDERED GROUND	Meal rendered
17	DRY RENDERED	Deleted
18	DRY RENDERED GROUND	Meal rendered
19	ENSILED	Silage
20	ENSILED AMMONIATED	Silage ammoniated
21	ENSILED DEHYDRATED	Silage dehydrated
22	ENSILED DEHYDRATED PELLETED	Silage dehydrated pelleted
23	EXTRACTION UNSPECIFIED GROUND	Meal extraction unspecified
24	FLASH DEHYDRATED GROUND	Meal flash dehydrated
25	FREEZE DEHYDRATED GROUND	Meal freeze dehydrated
26	HEAT AND ACID PRECIPITATED DEHYDRATED	Deleted
27	HYDROLYZED DEHYDRATED	HYDROLYZED
28	HYDROLYZED DEHYDRATED GROUND	Meal hydrolyzed
29	MALTASE TREATED DEHYDRATED GROUND	Meal maltase treated
30	MANUALLY EXTRACTED ENSILED	Silage manually extracted
31	MECHANICAL EXTRACTED GROUND	Meal mechanical extracted
32	MECHANICAL EXTRACTED STEAMED GROUND	Meal mechanical extracted steamed
33	MECHANICAL EXTRACTED TOASTED GROUND	Meal mechanical extracted toasted
34	PREPRESSED SOLVENT EXTRACTED GROUND	Meal prepressed solvent extracted

TABLE 2.12a Process Descriptors Changed or Deleted When Composing the International Feed Name from the International Feed Description (Continued)

Item Number	Descriptors in International Feed Description	Descriptors or Terms Used in International Feed Name
35	SOLVENT EXTRACTED AMMONIATED GROUND	Meal solvent extracted ammoniated
36	SOLVENT EXTRACTED AUTOCLAVED GROUND	Meal solvent extracted autoclaved
37	SOLVENT EXTRACTED GROUND	Meal solvent extracted
38	SOLVENT EXTRACTED TOASTED GROUND	Meal solvent extracted toasted
39	SPRAY DEHYDRATED GROUND	Meal spray dehydrated
40	STEAMED DEHYDRATED GROUND	Meal steamed
41	STEAMED ENSILED	Silage steamed
42	SUN-CURED MECHANICAL EXTRACTED GROUND	Meal sun-cured mechanical extracted
43	WASHED ENSILED	Silage washed
44	WATER EXTRACTED DEHYDRATED GROUND	Meal water extracted
45	WET MILLED DEHYDRATED GROUND	Meal
46	WET MILLED MECHANICAL EXTRACTED GROUND	Meal mechanical extracted
47	WET MILLED SOLVENT EXTRACTED GROUND	Meal solvent extracted
48	WILTED ENSILED	Silage wilted

TABLE 2.12b Example International Feed Description and International Feed Names Corresponding to the Processes Listed in Table 2.12a

Interna-tional Feed No.	Item No. From Table 3.5a	International Feed Description	International Feed Name
4-30-154	1	HORSECHESTNUT, COMMON, MEATS WITH SHELLS, ALCOHOL EXTRACTED GROUND	HORSECHESTNUT, COMMON, MEATS WITH SHELLS, MEAL ALCOHOL EXTRACTED
4-07-876	2	GARBAGE, MUNICIPAL, BOILED DEHYDRATED GROUND	GARBAGE, MUNICIPAL, MEAL BOILED
4-03-767	3	POTATO, TUBERS, BOILED ENSILED	POTATO, TUBERS, SILAGE BOILED
5-13-202	4	SESAME, SEEDS OIL RESIDUE, BOILED MECHANICAL EXTRACTED GROUND	SESAME, SEEDS, MEAL BOILED MECHANICAL EXTRACTED
5-13-203	5	COTTON, UPLAND, SEEDS OIL RESIDUE, BOILED PREPRESSED SOLVENT EXTRACTED GROUND	COTTON, UPLAND, SEEDS, MEAL BOILED PREPRESSED SOLVENT EXTRACTED
6-13-775	6	CATTLE, BONE OIL RESIDUE, BOILED SOLVENT EXTRACTED GROUND	CATTLE, BONES, MEAL BOILED SOLVENT EXTRACTED
5-26-005	7	ANIMAL, BLOOD, CONVENTIONAL COOKER DEHYDRATED GROUND	ANIMAL, BLOOD, MEAL CONVENTIONAL COOKER DEHYDRATED
1-02-780	8	MAIZE, COBS, DEHYDRATED COARSE GROUND	MAIZE, COBS, COARSE GROUND
1-02-781	9	MAIZE, COBS, DEHYDRATED FINE GROUND	MAIZE, COBS, FINE GROUND
1-00-018	10	ALFALFA, AERIAL PART, DEHYDRATED GROUND, LATE VEGETATIVE	ALFALFA, MEAL, LATE VEGETATIVE
4-13-452	11	PEACH, FRUIT WITHOUT PITS, DEHYDRATED OR SUN-CURED	PEACH, FRUIT WITHOUT PITS, DEHYDRATED
4-05-190	12	WHEAT, BRAN, DRY MILLED	WHEAT, BRAN
5-25-556	13	MAIZE, GERMS OIL RESIDUE, DRY MILLED MECHANICAL EXTRACTED GROUND, 4.1-8% FAT	MAIZE, GERMS, MEAL MECHANICAL EXTRACTED, 4.1-8% FAT
5-02-868	14	MAIZE, GERMS OIL RESIDUE, DRY MILLED SOLVENT EXTRACTED GROUND	MAIZE, GERMS, MEAL SOLVENT EXTRACTED
5-00-386	15	ANIMAL, CARCASS RESIDUE WITH BLOOD, DRY OR WET RENDERED	ANIMAL, TANKAGE, RENDERED
5-08-786	16	ANIMAL, BY-PRODUCT, DRY OR WET RENDERED GROUND	ANIMAL, BY-PRODUCT, MEAL RENDERED
5-04-791	17	SWINE, CRACKLINGS, DRY RENDERED	SWINE, CRACKLINGS
5-10-142	18	ANIMAL, CARCASS RESIDUE, DRY RENDERED GROUND, 40% PROTEIN	ANIMAL, MEAT, MEAL RENDERED, 40% PROTEIN
3-00-225	19	ALFALFA, AERIAL PART AIV PRESERVATIVE ADDED, ENSILED	ALFALFA, AERIAL PART AIV PESERVATIVE ADDED, SILAGE
3-26-647	20	OATS, STRAW, ENSILED AMMONIATED	OATS, STRAW, SILAGE AMMONIATED
3-13-793	21	SORGHUM, AERIAL PART, ENSILED DEHYDRATED	SORGHUM, SILAGE DEHYDRATED
3-08-812	22	ALFALFA, AERIAL PART, ENSILED DEHYDRATED PELLETED	ALFALFA, SILAGE DEHYDRATED PELLETED
5-24-061	23	FISH, COD, LIVERS OIL RESIDUE, EXTRACTION UNSPECIFIED GROUND	FISH, COD, LIVERS, MEAL EXTRACTION UNSPECIFIED
5-26-006	24	ANIMAL, BLOOD, FLASH DEHYDRATED GROUND	ANIMAL, BLOOD, MEAL FLASH DEHYDRATED
1-14-457	25	LEADTREE, WHITEPOPINAC, LEAVES, FREEZE DEHYDRATED GROUND	LEADTREE, WHITEPOPINAC, LEAVES, MEAL FREEZE DEHYDRATED
5-01-177	26	CATTLE, WHEY ALBUMIN, HEAT AND ACID PRECIPITATED DEHYDRATED	CATTLE, WHEY ALBUMIN
4-01-184	27	CATTLE, WHEY, HYDROLYZED DEHYDRATED	CATTLE, WHEY, HYDROLYZED
5-03-795	28	POULTRY, FEATHERS, HYDROLYZED DEHYDRATED GROUND	POULTRY, FEATHERS, MEAL HYDROLYZED
4-02-885	29	MAIZE, STARCH PROCESS RESIDUE, MALTASE TREATED DEHYDRATED GROUND	MAIZE, STARCH PROCESS RESIDUE, MEAL MALTASE TREATED
4-24-549	30	BEET, SUGAR, PULP, MANUALLY EXTRACTED ENSILED	BEET, SUGAR, PULP, SILAGE MANUALLY EXTRACTED
5-14-666	31	ADANSONIA, GRANDIDIERI, SEEDS OIL RESIDUE, MECHANICAL EXTRACTED GROUND	ADANSONIA, GRANDIDIERI, SEEDS, MEAL MECHANICAL EXTRACTED
5-01-571	32	COCONUT, MEATS OIL RESIDUE, MECHANICAL EXTRACTED STEAMED GROUND	COCONUT, MEATS, MEAL MECHANICAL EXTRACTED STEAMED
5-24-767	33	SOYBEAN, SEEDS OIL RESIDUE, MECHANICAL EXTRACTED TOASTED GROUND	SOYBEAN, SEEDS, MEAL MECHANICAL EXTRACTED TOASTED
5-08-135	34	RAPE, SUMMER, SEEDS OIL RESIDUE, PREPRESSED SOLVENT EXTRACTED GROUND	RAPE, SUMMER, SEEDS, MEAL PREPRESSED SOLVENT EXTRACTED
5-09-352	35	COTTON, SEEDS OIL RESIDUE, SOLVENT EXTRACTED AMMONIATED GROUND	COTTON, SEEDS, MEAL SOLVENT EXTRACTED AMMONIATED
5-26-965	36	PEANUT, KERNELS WITH COATS OIL RESIDUE, SOLVENT EXTRACTED AUTOCLAVED GROUND	PEANUT, KERNELS WITH COATS, MEAL SOLVENT EXTRACTED AUTOCLAVED

TABLE 2.12b Example International Feed Description and International Feed Names Corresponding to the Processes Listed in Table 2.12a

Interna-tional Feed No.	Item No. From Table 3.5a	International Feed Description	International Feed Name
5-25-599	37	AKEE, SEEDS OIL RESIDUE, SOLVENT EXTRACTED GROUND	AKEE, SEEDS, MEAL SOLVENT EXTRACTED
5-04-607	38	SOYBEAN, SEEDS OIL RESIDUE, SOLVENT EXTRACTED TOASTED GROUND	SOYBEAN, SEEDS, MEAL SOLVENT EXTRACTED TOASTED
5-00-381	39	ANIMAL, BLOOD, SPRAY DEHYDRATED GROUND	ANIMAL, BLOOD, MEAL SPRAY DEHYDRATED
6-00-400	40	ANIMAL, BONES, STEAMED DEHYDRATED GROUND	ANIMAL, BONES, MEAL STEAMED
4-25-024	41	ARTICHOKE, JERUSALEM, TUBERS, STEAMED ENSILED	ARTICHOKE, JERUSALEM, TUBERS, SILAGE STEAMED
5-24-020	42	FISH, WHOLE OR CUTTINGS OIL RESIDUE, SUN-CURED MECHANICAL EXTRACTED GROUND	FISH, MEAL SUN-CURED MECHANICAL EXTRACTED
3-22-128	43	BEET, COMMON, LEAVES, WASHED ENSILED	BEET, COMMON, LEAVES, SILAGE WASHED
5-00-396	44	ANIMAL, LIVERS, WATER EXTRACTED DEHYDRATED GROUND	ANIMAL, LIVERS, MEAL WATER EXTRACTED
5-04-388	45	SORGHUM, GLUTEN, WET MILLED DEHYDRATED GROUND	SORGHUM, GLUTEN, MEAL
5-25-555	46	MAIZE, GERMS OIL RESIDUE, WET MILLED MECHANICAL EXTRACTED GROUND, 4.1-8% FAT	MAIZE, GERMS, MEAL MECHANICAL EXTRACTED, 4.1-8% FAT
5-02-898	47	MAIZE, GERMS WITHOUT SOLUBLES OIL RESIDUE, WET MILLED SOLVENT EXTRACTED GROUND	MAIZE, GERMS WITHOUT SOLUBLES, MEAL SOLVENT EXTRACTED
3-00-221	48	ALFALFA, AERIAL PART, WILTED ENSILED	ALFALFA, SILAGE WILTED

TABLE 2.13 Examples of International Feed Descriptions for Forage Type Plants Used as Pasture, Hay, and Silage

Element	Feed No. 1	Feed No. 2	Feed No. 3
Genus	*PHLEUM*	*PHLEUM*	*PHLEUM*
species	*PRATENSE*	*PRATENSE*	*PRATENSE*
variety	—	—	—
Generic	TIMOTHY	TIMOTHY	TIMOTHY
kind	—	—	—
strain	—	—	—
part	AERIAL PART[a]	AERIAL PART[b]	AERIAL PART[c]
process	FRESH[a]	SUN-CURED[b]	ENSILED[c]
maturity	LATE VEGETATIVE	EARLY BLOOM	LATE VEGETATIVE
cut	—	CUT 1	CUT 1
grade	—	—	—
IFN	2-04-903	1-09-003	3-21-072

[a] AERIAL PART, FRESH, is pasture or cut and fed fresh

[b] AERIAL PART, SUN-CURED is hay

[c] AERIAL PART, ENSILED is silage

TABLE 2.14 Forage Type Plants Grazed in the Western United States USA[a]

Type
Tall-grass
Desert-grass
Intermountain shrub
Southern desert-shrub
Chaparral
Oak
Mountain-brush
Pinon-juniper

[a] Taken from Stoddart and Smith (1955).

TABLE 2.15 Example International Feed Descriptions for Forage Types Grazed

Element	Feed No. 1	Feed No. 2	Feed No. 3	Feed No. 4
Genus (type)	MEADOW PLANTS	CHAPARRAL PLANTS	CONIFEROUS TREE PLANTS	PINON-JUNIPER PLANTS
species	—	—	—	—
variety	—	—	—	—
Generic (name type)	MEADOW PLANTS	CHAPARRAL PLANTS	CONIFEROUS TREE PLANTS	PINON-JUNIPER PLANTS
kind	—	—	—	—
strain	—	—	—	—
part	AERIAL PART	BROWSE AND AERIAL PART[a]	BROWSE AND AERIAL PART[a]	BROWSE AND AERIAL PART[a]
process	FRESH	FRESH	FRESH	FRESH
IFN	2-27-463	2-12-325	2-12-361	2-12-362

[a] Some plants are trees or shrubs and others are grasses.

TABLE 2.16 Examples of International Feed Descriptions for Forage Types Which are Grazed or Cut for Hay

International Feed Number	Genus	Species	Variety	Generic Name	Kind	Strain	Part	Process	Cut
2-12-367	CONIFEROUS TREE PLANTS	LARGELY *CYNOSURUS CRISTATUS*	—	CONIFEROUS TREE PLANTS	LARGELY DOGTAIL CRESTED	—	BROWSE AND AERIAL PART	FRESH	—
2-12-364	MEADOW PLANTS	LAND EXTENSIVELY GRAZED	—	MEADOW PLANTS	LAND EXTENSIVELY GRAZED	—	AERIAL PART	FRESH	—
2-12-365	MEADOW PLANTS	LAND INTENSIVELY GRAZED	—	MEADOW PLANTS	LAND INTENSIVELY GRAZED	—	AERIAL PART	FRESH	—
2-12-366	STEPPE PLANTS	—	—	STEPPE PLANTS	—	—	AERIAL PART	FRESH	—
2-27-464	PRAIRIE PLANTS	—	—	PRAIRIE PLANTS	—	—	AERIAL PART	FRESH	—
2-27-463	MEADOW PLANTS	—	—	MEADOW PLANTS	—	—	AERIAL PART	FRESH	—
2-12-368	MEADOW PLANTS	LARGELY CAREX SPP	—	MEADOW PLANTS	LARGELY SEDGE	—	AERIAL PART	FRESH	—
2-12-369	MEADOW PLANTS	LARGELY *ALOPECURUS PRATENSIS*	—	MEADOW PLANTS	LARGELY FOXTAIL MEADOW	—	AERIAL PART	FRESH	—
1-12-370	MEADOW PLANTS	LARGELY *ALOPECURUS PRATENSIS*	—	MEADOW PLANTS	LARGELY FOXTAIL MEADOW	—	AERIAL PART	SUN-CURED	CUT 1
1-12-371	MEADOW PLANTS	LARGELY *ARRHENATHERUM ELATIUS*	—	MEADOW PLANTS	LARGELY OATGRASS TALL	—	AERIAL PART	SUN-CURED	—
2-12-375	MEADOW PLANTS	LARGELY *TRISETUM FLAVESCENS*	—	MEADOW PLANTS	LARGELY OATGRASS YELLOW	—	AERIAL PART	FRESH	—
2-22-998	MARSH PLANTS	—	—	MARSH PLANTS	—	—	AERIAL PART	FRESH	—
2-22-994	MARSH PLANTS	IN SEAWATER	—	MARSH PLANTS	IN SEAWATER	—	AERIAL PART	FRESH	—

TABLE 2.17 Examples of International Feed Descriptions for Forage Type Plants Grown on Extensively or Intensively Grazed Land

International Feed Number	Genus	Species	Variety	Generic Name	Kind	Strain	Part	Maturity	Process	Cut
2-22-962	GRASS-LEGUME-FORB	LAND EXTENSIVELY GRAZED	—	GRASS-LEGUME FORB	LAND EXTENSIVELY GRAZED	— —	AERIAL PART	LATE VEGETATIVE	FRESH	CUT 2
2-12-363	GRASS-LEGUME-FORB	LAND EXTEN SIVELY GRAZED	—	GRASS-LEGUME FORB	LAND EXTENSIVELY GRAZED	—	AERIAL PART	—	FRESH	—
1-23-382	GRASS-LEGUME-FORB	LAND EXTENSIVELY GRAZED	—	GRASS-LEGUME-FORB	LAND EXTENSIVELY GRAZED	—	AERIAL PART	EARLY BLOOM	SUN-CURED[a]	CUT 1
2-22-420	GRASS-LEGUME-FORB	LAND INTENSIVELY GRAZED	—	GRASS-LEGUME-FORB	LAND INTENSIVELY GRAZED	—	AERIAL PART	—	FRESH	—
1-23-395	GRASS-LEGUME-FORB	LAND INTENSIVELY GRAZED	—	GRASS-LEGUME-FORB	LAND INTENSIVELY GRAZED	—	AERIAL PART	—	SUN-CURED[a]	CUT 2
2-22-800	GRASS-LEGUME-FORB	LAND MODERATELY GRAZED	—	GRASS-LEGUME-FORB	LAND MODERATELY GRAZED	—	AERIAL PART	—	FRESH	—

[a] Aerial part + sun-cured = hay.

TABLE 3.1 Major Fishing Areas[a]

Description
Inland Waters
Africa
America, North
America, South
Asia
Europe
Oceania
USSR
Antarctic
Fishing Areas, Atlantic Ocean and Adjacent Seas
Arctic Sea
Atlantic, Northwest
Atlantic, Northeast
Atlantic, Western Central
Atlantic, Eastern Central
Mediterranean and Black Sea
Atlantic, Southwest
Atlantic, Southeast
Atlantic, Antarctic
Fishing Areas, Indian Ocean and Adjacent Seas
Indian Ocean, Western
Indian Ocean, Eastern
Indian Ocean, Antarctic
Fishing Areas, Pacific Ocean and Adjacent Seas
Pacific, Northwest
Pacific, Northeast
Pacific, Western Central
Pacific, Eastern Central
Pacific, Southwest
Pacific, Southeast
Pacific, Antarctic

[a] Taken from yearbook of fishery statistics. 1977.

TABLE 3.2 International Stage of Maturity Terms (Revised 1973)

Preferred term	Definition	Related terms
For Plants that Bloom		
Germinated	Stage in which the embryo in a seed resumes growth after a dormant period	Sprouted
Early vegetative	Stage at which the plant is vegetative and before the stems elongate	Fresh new growth, before heading out, before inflorescence emergence, immature prebud stage, very immature, young
Late vegetative	Stage at which stems are beginning to elongate to just before blooming; first bud to first flowers	Before bloom, bud stage, budding plants heading to bloom, heads just showing, jointing and boot (grasses), prebloom, preflowering, stems elongated
Early bloom	Stage between initiation of bloom and stage in which 1/10 of the plants are in bloom; some grass heads are in anthesis	Early anthesis, first flower, headed out in head, up to 1/10 bloom
Midbloom	Stage in which 1/10 to 2/3 of the plants are in bloom; most grass heads are in anthesis	Bloom, flowering, flowering plants, half bloom, in bloom, mid anthesis
Full bloom	Stage in which 2/3 or more of the plants are in bloom	3/4 to full bloom late anthesis
Late bloom	Stage in which blossoms begin to dry and fall and seeds begin to form	15 days after silking, before milk, in bloom to early pod, late to past anthesis
Milk stage	Stage in which seeds are well formed but soft and immature	After anthesis, early seed, fruiting, in tassel, late bloom to early seed, past bloom, pod stage, post anthesis, post bloom, seed developing, seed forming, soft, soft immature
Dough stage	Stage in which the seeds are of dough–like consistency	Dough stage, nearly mature, seeds dough, seeds well developed, soft dent
Mature	Stage in which plants are normally harvested for seed	Dent, dough to glazing, fruiting, fruiting plants, in seed, kernels ripe, ripe seed
Post ripe	Stage that follows maturity; some seeds cast and plants have begun to weather (applies mostly to range plants)	Late seed, over ripe, very mature
Stem cured	Stage in which plants are cured on the stem; seeds have been cast and weathering has taken place (applies mostly to range plants).	Dormant, mature and weathered, seeds cast
Regrowth early vegetative	Stage in which regrowth occurs without flowering activity; vegetative crop aftermath; regrowth in stubble (applies primarily to fall regrowth in temperate climates); early dry season regrowth	Vegetative recovery growth

TABLE 3.2 International Stage of Maturity Terms (Continued)

Preferred term	Definition	Related terms
Regrowth late vegetative	Stage in which stems begin to elongate to just before blooming; first bud to first flowers; regrowth in stubble with stem elongation (applies primarily to fall regrowth in temperate climates)	Recovery growth, stems elongating jointing and boot (grasses)
Immature	Used for fruit and leaves	
For Plants that Do Not Bloom[a]		
1 to 14 days' growth	A specified length of time after plants have started to grow.	2 weeks' growth
15 to 28 days'growth	A specified length of time after plants have started to grow	4 weeks'growth
29 to 42 days'growth	A specified length of time after plants have started to grow	6 weeks'growth
43 to 56 days'growth	A specified length of time after plants have started to grow	8 weeks'growth
57 to 70 days'growth	A specified length of time after plants have started to grow	10 weeks'growth

[a] These classes are for species that remain vegetative for long periods and apply primarily to the tropics. When the name of a feed is developed, the age classes form part of the name (e.g., Pangolagrass, 15 to 28 days' growth). Do not use terms which apply to plants that bloom and those which do not bloom in same name. For plants growing longer than 70 days, the interval is increased by increments of 14 days.

TABLE 3.3 Maturity Terms for Animals

Ruminants and Non-Ruminants	Poultry	Fish
day old	day old	larval
suckling	chick	fry
grower	broiler	fingerling
adult	adult	grower
aged	aged	adult
		aged

TABLE 3.4 Hay Grades for Legumes and Legume–Grass Mixtures[a]

Grades	Stage of maturity International term	Definition	Physical description	Typical chemical composition–%[b] CP (%)	ADF (%)	NDF (%)	CF (%)	Relative feed value (%)
1 Legume hay	Late vegetative	Bud to first flower; stage at which stems are beginning to elongate to just before blooming.	40 to 50% leaves[c]; green; less than 5% foreign material; free of mold, musty odor, dust, etc.	>19	<31	<40	<25	>140
2 Legume hay	Early bloom	Early to midbloom; stage between initiation of bloom and stage in which 1/2 of plants are in bloom.	35 to 45% leaves[c]; light green to green; less than 10% foreign material; free of mold, musty odor, dust, etc.	17–19	31–35	40–46	25–29	124–140
3 Legume hay	Midbloom	Mid to full bloom; stage in which 1/2 or more of plants are in bloom.	25 to 40% leaves[c]; yellow green to green; less than 15% foreign material; free of mold, musty odor; dust, etc.	13–16	36–41	47–51	30–34	100–123
4 Legume hay	Full bloom	Full bloom and beyond	less than 30% leaves[c]; brown to green; less than 20% foreign material; slight musty odor, etc.	<13	>41	>51	>34	<100
6 Grade– Inferior[d]								

Hay which contains more than a trace of injurious foreign material (toxic or noxious weeds and hardware) or that definitely has objectionable odor or is under cured, heat damaged, hot, wet, musty, moldy, caked, badly broken, badly weathered or stained, extremely overripe, dusty, which is distinctly low quality or contains more than 20% foreign material or more than 20% moisture.

[a] Adapted from Rohweder et al., (1976)

[b] Chemical analyses expressed on dry matter basis. CP = Crude protein; ADF = Acid detergent fiber; NDF = Neutral detergent fiber; Relative feed value = Digestible dry matter intake. Chemical concentrations based on research data from North Central and North East States and Florida, USA. Dry matter (moisture) concentration can affect market quality. Suggested moisture levels are: Grades 1 and 2 - 14%, Grade 3 - 18%, and Grade 4 - 20%.

[c] Proportion by weight.

[d] Slight evidence of any factor will lower a lot of hay by one grade.

TABLE 3.5 Hay Grades for Grass–Legume Mixtures[a]

Grades	Stage of maturity International term	Definition	Physical description	Typical chemical composition–%[b] CP[c] (%)	ADF (%)	NDF[d] (%)	CF (%)	Relative feed value (%)
2 Grass hay	Late vegetative	Late vegetative to early boot; stage at which stems are beginning to elongate to just before heading; 2 to 3 weeks growth.	50% or more leaves[e]; green; less than 5% foreign material; free of mold, musty odor, dust, etc.	> 18	< 33	< 55	< 22	124–140
3 Grass hay	Early bloom to midbloom	Boot to early head; stage between late boot where inflorescence is just emerging until the stage in which 1/2 inflorescences are in anthesis; 4 to 6 weeks growth.	40% or more leaves[e]; light green to green; less than 10% foreign material; free of mold, musty odor, dust, etc.	13–18	33–38	55–60	27–32	101–123
4 Grass hay	Full bloom to late bloom to milk stage	Head to milk; stage in which 1/2 or more of inflorescences are in anthesis and the stage in which seeds are well formed but soft and immature; 7 to 9 weeks regrowth.	30% or more leaves[e]; yellow green to green; less than 15% foreign material; free of mold, musty odor, dust, etc.	8–12	39–41	61–65	33–36	85–100
5 Grass hay	Dough stage to mature	Dough to seed; stage in which seeds are of dough-like consistency until stage when plants are normally harvested for seed; more than 10 weeks growth.	20% or more leaves[e]; brown to green; less than 20% foreign material; slightly musty odor, dust, etc.	< 8	> 41	> 65	> 36	< 85
6 Grade– inferior[f]								

Hay which contains more than a trace of injurious foreign material (toxic or noxious weeds and hardware) or that definitely has objectionable odor or is undercured, heat damaged, hot, wet, musty, moldy, caked, badly broken, badly weathered or stained, overripe, dusty, which is distinctly low quality, or contains more than 20% foreign material or more than 20% moisture.

[a] Adapted from Rohweder et al., (1976)

[b] Chemical analyses expressed on dry matter basis. CP = Crude protein; ADF = Acid detergent fiber; NDF = Neutral detergent fiber; Relative feed value = Digestible dry matter intake. Chemical concentrations based on research data from North Central and North East states and Florida, USA. Dry matter (moisture)concentration can affect market quality. Suggested mositure levels are: Grade 2 14%, Grade 3 18%, and Grade 4 and 5 20%.

[c] Fertilization with nitrogen may increase CP concentration in each grade by up to 40%.

[d] Tropical grasses may have higher NDF concentrations than indicated in this table.

[e] Proportion by weight for grasses that do not flower or for which flowering is indeterminant.

[f] Slight evidence of any factor will lower a lot of hay by one grade.

TABLE 3.6 Soil Units[a]

Code	Description
J	**FLUVISOLS**
Je	Eutric Fluvisols
Jc	Calcaric Fluvisols
Jd	Dystric Fluvisols
Jt	Thionic Fluvisols
G	**GLEYSOLS**
Ge	Eutric Gleysols
Gc	Calcaric Gleysols
Gd	Dystric Gleysols
Gm	Mollic Gleysols
Gh	Humic Gleysols
Gp	Plinthic Gleysols
Gx	Gelic Gleysols
R	**REGOSOLS**
Re	Eutric Regosols
Rc	Calcaric Regosols
Rd	Dystric Regosols
Rx	Gelic Regosols
I	**LITHOSOLS**
Q	**ARENOSOLS**
Qc	Cambic Arenosols
Ql	Luvic Arenosols
Qf	Ferralic Arenosols
Qa	Albic Arenosols
E	**RENDZINAS**
U	**RANKERS**
T	**ANDOSOLS**
To	Ochric Andosols
Tm	Mollic Andosols
Th	Humic Andosols
Tv	Vitric Andosols
V	**VERTISOLS**
Vp	Pellic Vertisols
Vc	Chromic Vertisols
O	**HISTOSOLS**
Oe	Eutric Histosols
Od	Dystric Histosols
Ox	Gelic Histosols
Z	**SOLONCHAKS**
Zo	Orthic Solonchaks
Zm	Mollic Solonchaks
Zt	Takyric Solonchaks
Zg	Gleyic Solonchaks
S	**SOLONETZ**
So	Orthic Solonetz
Sm	Mollic Solonetz
Sg	Gleyic Solonetz
Y	**YERMOSOLS**
Yh	Haplic Yermosols
Yk	Calcic Yermosols
Yy	Gypsic Yermosols
Yl	Luvic Yermosols
Yt	Takyric Yermosols
X	**XEROSOLS**
Xh	Haplic Xerosols
Xk	Calcic Xerosols
Xy	Gypsic Xerosols
Xl	Luvic Xerosols
K	**KASTANOZEMS**
Kh	Haplic Kastanozems
Kk	Calcic Kastanozems
Kl	Luvic Kastanozems
C	**CHERNOZEMS**
Ch	Haplic Chernozems
Ck	Calcic Chernozems
Cl	Luvic Chernozems
Cg	Glossic Chernozems
H	**PHAEOZEMS**
Hh	Haplic Phaeozems
Hc	Calcaric Phaeozems
Hl	Luvic Phaeozems
Hg	Gleyic Phaeozems
N	**NITOSOLS**
Ne	Eutric Nitosols
Nd	Dystric Nitosols
Nh	Humic Nitosols
M	**GREYZEMS**
Mo	Orthic Greyzems
Mg	Gleyic Greyzems
B	**CAMBISOLS**
Be	Eutric Cambisols
Bd	Dystric Cambisols
Bh	Humic Cambisols
Bg	Gleyic Cambisols
Bx	Gelic Cambisols
Bk	Calcic Cambisols
Bc	Chromic Cambisols
Bv	Vertic Cambisols
Bf	Ferralic Cambisols
L	**LUVISOLS**
Lo	Orthic Luvisols
Lc	Chrimic Luvisols
Lk	Calcic Luvisols
Lv	Vertic Luvisols
Lf	Ferric Luvisols
La	Albic Luvisols
Lp	Plinthic Luvisols
Lg	Gleyic Luvisols
D	**PODZOLUVISOLS**
De	Eutric Podzoluvisols
Dd	Dystric Podzoluvisols
Dg	Gleyic Podzoluvisols
P	**PODZOLS**
Po	Orthic Podzols
Pl	Leptic Podzols
Pf	Ferric Podzols
Ph	Humic Podzols
Pp	Placic Podzols
Pg	Gleyic Podzols
W	**PLANOSOLS**
We	Eutric Planosols
Wd	Dystric Planosols
Wm	Mollic Planosols
Wh	Humic Planosols
Ws	Solodic Planosols
Wx	Gelic Planosols

TABLE 3.6 Soil Units (Continued)

Code	Description
A	**ACRISOLS**
Ao	Orthic Acrisols
Af	Ferric Acrisols
Ah	Humic Acrisols
Ap	Plinthic Acrisols
Ag	Gleyic Acrisols
F	**FERRALSOLS**
Fo	Orthic Ferralsols
Fx	Xanthic Ferralsols
Fr	Rhodic Ferralsols
Fh	Humic Ferralsols
Fa	Acric Ferralsols
Fp	Plinthic Ferralsols

[a] Taken from FAO-UNESCO (1974).

TABLE 3.7 Brand of Pesticide

Brand (Commercial Name)	Description
Aldrin–Giessmittel	aldrin
Aglutox–Streumittel	aldrin
Aldrin–Streumittel	aldrin
Deoval, Mon	DDT
Derixol M, UCB	DDT
DiDiTan Ultra, Sch	DDT
Gesarol 50, Spi. Ura	DDT
Mause–Kindrin 391, Mar	endrin
Segetan–Wühlmausmittel	endrin
Shell–Wühlmausmittel	endrin
ST–M3 , ASU	endrin
Basiment 450 extra, Bay	HCH, techn.
Forst–Nexen, CME	HCH, techn.
Forst–Vitton–Emulsion, CME	HCH, techn.
Forst–Vitton–Staub, CME	HCH, techn.
A Ahepta–Saatgutpuder, ASU	heptachlor
Agronex–Hepta, CME	heptachlor
Agronex–Hepta–flussig, CME	heptachlor
Sarea–Samenpille, Uni	heptachlor
Varonit, Bay	hexachlor–benzol (HCB)

TABLE 3.7 Brand of Pesticide (Continued)

Brand (Commercial Name)	Description
Varonit–Morkit, Bay	hexachlor–benzol (HCB)
A Agrano–Krähex, ASU	hexachlor–benzol (HCB)
Abavit–Corbin, Sch	hexachlor–benzol (HCB)
Abavit, Sch	hexachlor–benzol (HCB)
Ceresan–Universal–Trockenbeize–Bay	hexachlor–benzol (HCB)
Falisan–Universal–Trockenbeize–2,5,E.Is	hexachlor–benzol (HCB)
Trockenbeize 4613, Bay	hexachlor–benzol (HCB)
Abavit–Gamma–Corbin, Sch	hexachlor–benzol (HCB)
Kelthane PPS	kelthane
Kelthane Merck, CME	kelthane
Kelthane MF, Spi, Ura	kelthane
Kelthane MR RIEDEL, RdH	kelthane
Kelthane "Spiess–Urania," Spi, Ura	kelthane
Agronex, CME	lindane
Gamma–Betoxin, Pro	lindane
Gamma–Saatgutpuder Bayer, Bay	lindane
Hortex–Saatgutpuder, CME	lindane
Lindan forte, PPS	lindane
Luxan Lindan–Saatgutpuder, Lux	lindane
Nexit–stark, CME	lindane
Verindal, Ultra, Sch	lindane
A Alindan–Inkrusta–S, ASU	lindane
Agronex–Spezial, CME	lindane
Lindamal Neu, Bay	lindane
Verindal Rapsuder, Sch	lindane
Insektenpuder, PPS	lindane
Detia–Pflanzo–Emulsion, DEL	lindane
Oktagam Neu, ASU, Pro	lindane
Cuprogram Neu, ASU	methoxychlor
Kaltnebellösung Methoxychlor N200, CGD	methoxychlor
Methoxychlor–Emulsion, ASU, Pro	methoxychlor
Methoxychlor–Stäubemittel, ASU, Pro	methoxychlor

TABLE 3.8 Animal Breeds

Breed
Ass (Donkey) Code 850
Abyssinian
East African
Somali
Southern African
Sudanese Pacis
Sudanese Riding
Buffalo, water Code 050
Egyptian
Iranian
Iraqi
Cattle Code 070
Aberdeen Angus
Abyssinian-Shorthorned Zebu-Ingessana
Abyssinian-Shorthorned Zebu-Murle
Africander-Bolowana
Africander-Bonsmara
Alur
Angolian-Kisantu
Angolian-Nateba
Ankole-Bahima
Ankole-Bashi
Ankole-Kigezi
Ankole-Watusi
Angoni-Mozambique Angoni
Angoni-Northern Rhodesia
Angoni-Nyasa Zebu
Angoni-Nyasaland
Arado-Asaorta
Arado-Baria and Biberi
Arado-Beja
Arado-Galla
Arado-Tigre
Arado-Wagara
Arado-Wallega
Ayrshire
Barotse, Baila
Basuto, Drakensberger
Beefmaster
Boran-Kenya
Boran-Somali
Boran-Tanaland
Brahman
Brangus
Brown Atlas
Brown Swiss
Charbray
Charolais
Charolais x Brahman
Criollo
Damascus
Danakil
Egyptian
Galloway
German Black Pied
German Brown
German Red
German Red Pied
German Simmental
German Yellow
Guernsey
Hereford
Holstein Friesian
Humped and Humpless Crosses-Bambra or Mere
Humped and Humpless Crosses-Biu
Humped and Humpless Crosses-Borgu
Humped and Humpless Crosses-Djakore (Senegal)
Humped and Humpless Crosses-"Sanga"
Humped (Zebus)-Ar'amawa
Humped (Zebus)-Azaouak
Humped (Zebus)-Diali
Humped (Zebus)-Fellota
Humped (Zebus)-Maure
Humped (Zebus)-Red Bororo
Humped (Zebus)-Senegal Fulani
Humped (Zebus)-Shuwa
Humped (Zebus)-Sokota
Humped (Zebus)-Sudanese Fulani
Humped (Zebus)-Tuareg
Humped (Zebus)-White Fulani
Iranian
Iraqui
Jersey
Karamajong-Karamajong
Karamajong-Toposa

TABLE 3.8 Animal Breeds (Continued)

Breed
Cattle (continued)
Karamajong-Turkana
Korean Native
Kurdi
Lake Chad Cattle-Kuri
Lake Chad Cattle-Kuri x Zebu
Lebanese
Libyan
Madagascar Zebu, Rana
Mashona
Matabele-Goverui
Matabele-Inkoue
Milking Shorthorn
Nilotic
Naganda-Kyoga
Naganda-Serere
Nguni, Bapedi
North Sudan Zebu-Baggara
North Sudan Zebu-Begait
North Sudan Zebu-Kenana
North Sudan Zebu-Red Butana
Nuba Mountain
Oksh
Ovambo
Polled Hereford
Polled Shorthorn
Red Pole
Red Pole x Criollo
Santa Gertrudis
Santa Gertrudis x Criollo
Shorthorn
Small East African Zebu-Lugware
Small East African Zebu-Mongalla
Small East African Zebu-Masai
Small East African Zebu-Nandi
Small East African Zebu-Nkedi
Small East African Zebu-Tanganyika
Small East African Zebu-Zanzibar
Small Humpless Cattle-Baoule (Ivory Coast)
Small Humpless Cattle-Dwarf Shorthorn
Small Humpless Cattle-Gold Coast
Small Humpless Cattle-N'Dama
Small Zebus of the Somaliland-Garre
Small Zebus of the Somaliland-Gasara
Small Zebus of the Somaliland-North Somali
Sukuma
Tonga
Tswana-Batawana
Tswana-Damara
Tswana-Sengola and Sheshaga
Tswana-Southern
Tuli
Tuli or Jiddu
Zebu
Zebu x Criollo
Chickens Code 140
Australorpus
Blue Andalusians
Buff-laced Polish
Buff Cochins
Buff Leghorns
Buff Orpingtons
Buff Plymouth Rocks
Buff Wyandottes
Buttercups
Columbian Wyandottes
Golden Speckled Hamburgs
Jersey Black Giants
Jersey White Giants
Lamonas
Light Bramas
New Hampshire
Partridge Cochins
Partridge Plymouth Rocks
Partridge Wyandottes
Rhode Island Reds
Rhode Island Whites
Shaver
Silver-laced Wyandottes
Silver Penciled Hamburgs
Silver Penciled Plymouth Rocks
Silver Spangled Hamburgs
Single Comb Anconas
Single Comb Black Leghorns
Single Comb Black Minorcas
Single Comb Black Tailed Red Leghorns

TABLE 3.8 Animal Breeds (Continued)

Breed

Chickens (continued)

Single Comb Buff Minorcas
Single Comb Dark Leghorns
Single Comb Light Leghorns
Single Comb Rhode Island Reds
Single Comb White Leghorns
Single Comb White Orpingtons
Speckled Sussex
White Cornish

White Dorking
White-laced Red Cornish
White Minorcas
White Plymouth Rocks
White Wyandottes

Fish Code 255

Trout (rainbow)

Goats Code 350

Angola
Angora
Arab
Benadir, Biunal
Benadir, Garre
Benadir, Tuni
Congo
Damascus

East African, Boran
East African, Kigezi
East African, Nubendi
East African, Small East African
Egyptian
Eritrean and Byssinian, Aruis-Bale
Eritrean and Abyssinian, Kanakil
Eritrean and Abyssinian, Galla-Sidamo

Fouta Djallon
German Improved Fawn
German Improved White
Iraqui
Karakul
Kurdi
Madagascar
Milk Goats
Nubian
Sahel

Breed

Sokoto or Maradi
Somali, Abgal
Somali, Kenya
Somali, Ogaden
Somali, Somaliland Protectorate
Southern Africa, Angola
Southern Africa, Bechuanaland
Southern Africa, Boer

Southern Africa, Northern Rhodesia
Southern Africa, Mozambique
Southern Africa, Nyasaland
Southern Africa, Pafuri
Southern Africa, South West Africa
Southern Africa, Southern Rhodesia
Southern Africa, Swazi

Southern Africa, Zulu
Southern Sudan
Sudanese Desert
Sudanese Nubian
Syrian Mountain

Horse Code 420

Abyssinian-Galla
American Jack
American Quarter
American Saddle
Appaloosa
Arab-Barb Type, Beledougou or Banamba
Arab-Barb Type, Chad
Arab-Barb Type, Hodh

Arab-Barb Type, Horse of the South
Arab-Barb Type, Sahel
Arab-Barb Type, The Djerma
Arabian
Barb
Berber
Dongola
Dongola Type, Dongola

Dongola Type, Dongola-Barb
Dongola Type, Housa
Dongola Type, Songhai
Draft
Dulmer Pony
East Friesian
Egyptian
German Thoroughbred

TABLE 3.8 Animal Breeds (Continued)

Breed
Horses (continued)
Hackney
Hanover
Holstein
Kurdi
Morgan
Mzabite
Oldenburg
Palomino
Persian Arab
Pony
Pony, Bobo or Bodoy
Pony, Kirdi
Pony, Koto-Koli
Pony, N'Bayar
Pony, N'Par
Pony, Torodi
Somali Pony
South African Horse, Boer Horse
South African Horse, Basuto Pony
South African Horse, Cape Horse
South African Horse, Namaqua Pony
Standardbred
Standardbred, Trotter
Syrian
Tennessee Walking
Thoroughbred
Trakehnen
Western Sudan Pony
Sheep Code 770
Abyssinian, Akele Guzai
Abyssinian, Aruri-Bale
Abyssinian, Mens
Abyssinian, Rashaidi
Abyssinian, Tucur
Africander, Damara
Africander, Namaqua
Africander, Ronderib
Africander, Transvaal
Akkaraman (Turkish)
Algerian Arab
Angola Thin-Tailed
Arab
Arabi

Breed
Arrit
Atlantic Coast of Morocco
Ausimi
Awassi
Barbary
Berber
Beni Guil
Bentheim
Black-Faced Highland
Black Head Persian
Black Head Persian Derivatives, Bezuidenhout Africander
Black Head Persian Derivatives, Dorper
Black Head Persian Derivatives, Van Rooy
Black Head Persian Derivatives, Wiltiper
Cheviot
Columbia
Congo Dwarf
Congo Long-Legged
Corriedale
Cotswold
Criolla
Debouillet
Dongola
Dorset
East African Black-Head
East African Long-Tailed, Tanganyka Long-Tailed
East African Long-Tailed, Ruanda Urundi
Fellahi
German Blackheaded Mutton
German Heath
German Mountain
German Mutton Merino
German Whiteheaded Mutton
Hampshire
Iran Fat-Tailed
Iran Thin-Tailed
Karakul
Kurdi
Leine
Lincoln
Macina
Madagascar
Masai, N.E. Uganda
Masai, Nandi

TABLE 3.8 Animal Breeds (Continued)

Breed

Sheep (continued)

Masai, Samburu
Mast Friesian
Merino
Mondombes
Montdale
Morkaraman
Naumi, Bapedi
Naumi, Landim

Naumi, Swazi
Naumi, Zulu
Northern Sudanese Sheep, Baraka
Northern Sudanese Sheep, Gezira
Northern Sudanese Sheep, Sudanese Desert
Northern Sudanese Sheep, Wallega
Oxford
Panama

Rahmani
Rambouillet
Rambouillet x Merino
Rhodesian, Northern Rhodesia
Rhodesina, Nyasaland
Rhodesian, Southern Rhodesia
Romeldale
Romney

Ryeland
Shropshire
Somali, Adali
Somali, Kenya
Somali, Toposa
Southdale
Southdown
Southern Sudan

Suffolk
Suffolk x Western
Tadla
Tadmit
Tailless
Targhee
Thoen
Tswana

West African Dwarf
West African, Fellata
West African, Zaghaw

Breed

West African Long-Legged, Arab (Maure)
West African Long-Legged, Fulani
West African Long-Legged, Taureg
Western-Southdown
Wurttemberg Merino

Swine Code 840

American Landrace
Angeln Saddleback (Angler Sattelschwein)
Berkshire
Chester White
Duroc
German Landrace (Deutsche Landrasse)
German Pasture (Deutsches Weideschwein)

German Yorkshire (Deutsches Weisses Edelschwein)
Hampshire
Hereford
Poland China
Poland China, Spotted
Tamworth
Yorkshire

Turkeys Code 910

Black
Bourbon Red
Broad-Breasted Bronze
Narragansett
White Holland

TABLE 3.9 List of Attributes and Codes

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
0005	105	000	01	ASH	%	1
0010	547	000	01	ASH, ACID INSOLUBLE (SILICA)	%	1
0015	344	000	01	ASH, SOLUBLE	%	1
0020	559	000	01	ASH, NEUTRAL DETERGENT	%	2
0025	106	000	01	CRUDE FIBER	%	1
0030	106D	070	02	CATTLE	DIG COEF %	0
0035	106D	210	02	DOGS	DIG COEF %	0
0040	106D	280	02	FOXES	DIG COEF %	0
0045	106D	350	02	GOATS	DIG COEF %	0
0050	106D	420	02	HORSES	DIG COEF %	0
0055	106D	490	02	MAN	DIG COEF %	0
0060	106D	560	02	MINK	DIG COEF %	0
0065	106D	630	02	RABBITS	DIG COEF %	0
0070	106D	700	02	RATS	DIG COEF %	0
0075	106D	710	02	RUMINANTS	DIG COEF %	0
0080	106D	770	02	SHEEP	DIG COEF %	0
0085	106D	840	02	SWINE	DIG COEF %	0
0090	931D	860	02	IN VITRO	DIG COEF %	0
0095	101	000	01	DRY MATTER	%	1
0100	101D	070	02	CATTLE	DIG COEF %	0
0105	101D	210	02	DOGS	DIG COEF %	0
0110	101D	280	02	FOXES	DIG COEF %	0
0115	101D	350	02	GOATS	DIG COEF %	0
0120	101D	420	02	HORSES	DIG COEF %	0
0125	101D	490	02	MAN	DIG COEF %	0
0130	101D	560	02	MINK	DIG COEF %	0
0135	101D	630	02	RABBITS	DIG COEF %	0
0140	101D	700	02	RATS	DIG COEF %	0
0145	101D	770	02	SHEEP	DIG COEF %	0
0150	101D	840	02	SWINE	DIG COEF %	0
0155	916D	860	02	IN VITRO (TILLY)	DIG COEF %	0
0160	959D	860	02	IN VITRO (BARNES)	DIG COEF %	0
0165	962D	860	02	IN VITRO (VAN SOEST)	DIG COEF %	0
0170	929D	000	02	ESTIMATED (VAN SOEST)	DIG COEF %	0
0175	930D	070	02	CATTLE (NYLON BAG)	DIG COEF %	0
0180	930D	770	02	SHEEP (NYLON BAG)	DIG COEF %	0
0185	107	000	01	ETHER EXTRACT OR CRUDE FAT	%	1
0190	107D	070	02	CATTLE	DIG COEF %	0
0195	107D	210	02	DOGS	DIG COEF %	0
0200	107D	280	02	FOXES	DIG COEF %	0
0205	107D	350	02	GOATS	DIG COEF %	0
0210	107D	420	02	HORSES	DIG COEF %	0
0215	107D	490	02	MAN	DIG COEF %	0
0220	107D	560	02	MINK	DIG COEF %	0
0225	107D	630	02	RABBITS	DIG COEF %	0

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
0230	107D	700	02	RATS	DIG COEF %	0
0235	107D	710	02	RUMINANTS	DIG COEF %	0
0240	107D	770	02	SHEEP	DIG COEF %	0
0245	107D	840	02	SWINE	DIG COEF %	0
0250	108	000	01	NITROGEN FREE EXTRACT	%	1
0255	108D	070	02	CATTLE	DIG COEF %	0
0260	108D	210	02	DOGS	DIG COEF %	0
0265	108D	280	02	FOXES	DIG COEF %	0
0270	108D	350	02	GOATS	DIG COEF %	0
0275	108D	420	02	HORSES	DIG COEF %	0
0280	108D	490	02	MAN	DIG COEF %	0
0285	108D	560	02	MINK	DIG COEF %	0
0290	108D	630	02	RABBITS	DIG COEF %	0
0295	108D	700	02	RATS	DIG COEF %	0
0300	108D	710	02	RUMINANTS	DIG COEF %	0
0305	108D	770	02	SHEEP	DIG COEF %	0
0310	108D	840	02	SWINE	DIG COEF %	0
0315	110	000	01	ORGANIC MATTER	%	1
0320	117	350	63	GOATS DIG ORGANIC MATTER	%	0
0325	117	770	63	SHEEP DIG ORGANIC MATTER	%	0
0330	927D	860	02	IN VITRO (MOORE)	DIG COEF %	0
0335	112D	860	02	IN VITRO (TILLY)	DIG COEF %	0
0340	109	000	01	PROTEIN	%	1
0345	109D	070	02	CATTLE	DIG COEF %	0
0350	109D	210	02	DOGS	DIG COEF %	0
0355	109D	280	02	FOXES	DIG COEF %	0
0360	109D	350	02	GOATS	DIG COEF %	0
0365	109D	420	02	HORSES	DIG COEF %	0
0370	109D	490	02	MAN	DIG COEF %	0
0375	109D	560	02	MINK	DIG COEF %	0
0380	109D	630	02	RABBITS	DIG COEF %	0
0385	109D	700	02	RATS	DIG COEF %	0
0390	109D	710	02	RUMINANTS	DIG COEF %	0
0395	109D	770	02	SHEEP	DIG COEF %	0
0400	109D	840	02	SWINE	DIG COEF %	0
0403	963D	860	02	IN VITRO	DIG COEF %	0
0405	111	070	03	CATTLE	DIG PROT %	1
0410	111	210	03	DOGS	DIG PROT %	1
0415	111	280	03	FOXES	DIG PROT %	1
0420	111	350	03	GOATS	DIG PROT %	1
0425	111	420	03	HORSES	DIG PROT %	1
0430	111	490	03	MAN	DIG PROT %	1
0435	111	560	03	MINK	DIG PROT %	1
0440	111	630	03	RABBITS	DIG PROT %	1
0445	111	700	03	RATS	DIG PROT %	1
0450	111	710	03	RUMINANTS	DIG PROT %	1
0455	111	770	03	SHEEP	DIG PROT %	1
0460	111	840	03	SWINE	DIG PROT %	1

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
0465	212	000	01	NITROGEN	%	1
0470	213	000	01	NITROGEN FACTOR (6.25)		2
0475	963	000	01	NITROGEN, TOTAL	%	1
0480	784	000	01	BIOLOGICAL VALUE (MITCHELL)	%	0
0485	785	000	01	CHEMICAL SCORE (BLOCK)	%	0
				CARBOHYRDATES AND RELATED COMPOUNDS		
0495	341	000	01	ARABINOSE	%	1
0500	325	000	01	CARBOHYRDATES, OTHER	%	1
0505	334	000	01	CARBOHYDRATES BY DIFFERENCE	%	1
0510	321	000	01	CARBOHYDRATES, AVAILABLE	%	0
0515	324	000	01	CELL CONTENTS (FONNESBECK)	%	1
0520	328	000	01	CELL CONTENTS, (NEUTRAL DETERGENT SOLUBLES)(VAN SOEST)	%	1
0525	328D	070	02	CATTLE	DIG COEF %	0
0530	328D	210	02	DOGS	DIG COEF %	0
0535	328D	280	02	FOXES	DIG COEF %	0
0540	328D	350	02	GOATS	DIG COEF %	0
0545	328D	420	02	HORSES	DIG COEF %	0
0550	328D	490	02	MAN	DIG COEF %	0
0555	328D	560	02	MINK	DIG COEF %	0
0560	328D	630	02	RABBITS	DIG COEF %	0
0565	328D	700	02	RATS	DIG COEF %	0
0570	328D	710	02	RUMINANTS	DIG COEF %	0
0575	328D	770	02	SHEEP	DIG COEF %	0
0580	328D	840	02	SWINE	DIG COEF %	0
0585	932D	860	02	IN VITRO	DIG COEF %	0
0590	337	000	01	CELL WALLS (FONNESBECK)	%	1
0595	329	000	01	CELL WALLS (NEUTRAL DETERGENT FIBER) (VAN SOEST)	%	1
0600	329D	070	02	CATTLE	DIG COEF %	0
0605	329D	210	02	DOGS	DIG COEF %	0
0610	329D	280	02	FOXES	DIG COEF %	0
0615	329D	350	02	GOATS	DIG COEF %	0
0620	329D	420	02	HORSES	DIG COEF %	0
0625	329D	490	02	MAN	DIG COEF %	0
0630	329D	560	02	MINK	DIG COEF %	0
0635	329D	630	02	RABBITS	DIG COEF %	0
0640	329D	700	02	RATS	DIG COEF %	0
0645	329D	710	02	RUMINANTS	DIG COEF %	0
0650	329D	770	02	SHEEP	DIG COEF %	0
0655	329D	840	02	SWINE	DIG COEF %	0
0657	933D	860	02	IN VITRO	DIG COEF %	0
0660	237	000	01	NITROGEN IN NEUTRAL DETERGENT FIBER	%	2
0670	327	000	01	CELL WALL CARBOHYDRATES	%	0

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
0675	323	000	01	CELLULOSE (CRAMPTON)	%	1
0680	323D	070	02	CATTLE	DIG COEF %	0
0685	323D	210	02	DOGS	DIG COEF %	0
0690	323D	280	02	FOXES	DIG COEF %	0
0695	323D	350	02	GOATS	DIG COEF %	0
0700	323D	420	02	HORSES	DIG COEF %	0
0705	323D	490	02	MAN	DIG COEF %	0
0710	323D	560	02	MINK	DIG COEF %	0
0715	323D	630	02	RABBITS	DIG COEF %	0
0720	323D	700	02	RATS	DIG COEF %	0
0725	323D	710	02	RUMINANTS	DIG COEF %	0
0730	323D	770	02	SHEEP	DIG COEF %	0
0735	323D	840	02	SWINE	DIG COEF %	0
0740	934D	860	02	CELLULOSE (CRAMPTON) IN VITRO	DIG COEF %	0
0745	338	000	01	CELLULOSE (FONNESBECK)	%	1
0750	314	000	01	CELLULOSE (MATRONE)	%	1
0755	314D	070	02	CATTLE	DIG COEF %	0
0760	314D	210	02	DOGS	DIG COEF %	0
0765	314D	280	02	FOXES	DIG COEF %	0
0770	314D	350	02	GOATS	DIG COEF %	0
0775	314D	420	02	HORSES	DIG COEF %	0
0780	314D	490	02	MAN	DIG COEF %	0
0785	314D	560	02	MINK	DIG COEF %	0
0790	314D	630	02	RABBITS	DIG COEF %	0
0795	314D	700	02	RATS	DIG COEF %	0
0800	314D	710	02	RUMINANTS	DIG COEF %	0
0805	314D	770	02	SHEEP	DIG COEF %	0
0810	314D	840	02	SWINE	DIG COEF %	0
0815	315D	860	02	IN VITRO (MATRONE)	DIG COEF %	0
0820	354	000	01	CELLULOSE (SCHARRER)	%	1
0825	330	000	01	CELLULOSE (VAN SOEST)	%	1
0830	330D	070	02	CATTLE	DIG COEF %	0
0835	330D	210	02	DOGS	DIG COEF %	0
0840	330D	280	02	FOXES	DIG COEF %	0
0845	330D	350	02	GOATS	DIG COEF %	0
0850	330D	420	02	HORSES	DIG COEF %	0
0855	330D	490	02	MAN	DIG COEF %	0
0860	330D	560	02	MINK	DIG COEF %	0
0865	330D	630	02	RABBITS	DIG COEF %	0
0870	330D	700	02	RATS	DIG COEF %	0
0875	330D	710	02	RUMINANTS	DIG COEF %	0
0880	330D	770	02	SHEEP	DIG COEF %	0
0885	330D	840	02	SWINE	DIG COEF %	0
0890	937D	860	02	IN VITRO (VAN SOEST)	DIG COEF %	0
0895	351	000	01	CHITIN	%	1

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
0900	273	000	01	FIBER, ACID DETERGENT (VAN SOEST)	%	1
0905	273D	070	02	CATTLE	DIG COEF %	0
0910	273D	210	02	DOGS	DIG COEF %	0
0915	273D	280	02	FOXES	DIG COEF %	0
0920	273D	350	02	GOATS	DIG COEF %	0
0925	273D	420	02	HORSES	DIG COEF %	0
0930	273D	490	02	MAN	DIG COEF %	0
0935	273D	560	02	MINK	DIG COEF %	0
0940	273D	630	02	RABBITS	DIG COEF %	0
0945	273D	700	02	RATS	DIG COEF %	0
0950	273D	710	02	RUMINANTS	DIG COEF %	0
0955	273D	770	02	SHEEP	DIG COEF %	0
0960	273D	840	02	SWINE	DIG COEF %	0
0965	935D	860	02	FIBER, ACID DETERGENT IN VITRO	DIG COEF %	0
0973	239	000	01	NITROGEN IN ACID DETERGENT FIBER	%	2
0970	349	000	01	FRUCTOSE	%	1
0980	336	000	01	GALACTOSE	%	1
0985	355	000	01	GLUCOSE	%	1
0990	316	000	01	GLUCOSIDES	%	1
0995	317	000	01	HEMICELLULOSE	%	1
1000	317D	070	02	CATTLE	DIG COEF %	0
1005	317D	210	02	DOGS	DIG COEF %	0
1010	317D	280	02	FOXES	DIG COEF %	0
1015	317D	350	02	GOATS	DIG COEF %	0
1020	317D	420	02	HORSES	DIG COEF %	0
1025	317D	490	02	MAN	DIG COEF %	0
1030	317D	560	02	MINK	DIG COEF %	0
1035	317D	630	02	RABBITS	DIG COEF %	0
1040	317D	700	02	RATS	DIG COEF %	0
1045	317D	710	02	RUMINANTS	DIG COEF %	0
1050	317D	770	02	SHEEP	DIG COEF %	0
1055	317D	840	02	SWINE	DIG COEF %	0
1060	936D	860	02	IN VITRO	DIG COEF %	0
1065	339	000	01	HEMICELLULOSE (FONNESBECK)	%	1
1070	320	000	01	HEXOSANS	%	1
1075	348	000	01	HEXOSES	%	1
1080	352	000	01	INULIN	%	1
1085	331	000	01	LACTOSE	%	2
1090	211	000	01	LIGNIN (ELLIS)	%	1
1095	211D	070	02	CATTLE	DIG COEF %	0
1100	211D	350	02	GOATS	DIG COEF %	0
1105	211D	420	02	HORSES	DIG COEF %	0
1110	211D	490	02	MAN	DIG COEF %	0
1115	211D	630	02	RABBITS	DIG COEF %	0
1120	211D	700	02	RATS	DIG COEF %	0

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
1125	211D	710	02	RUMINANTS	DIG COEF %	0
1130	211D	770	02	SHEEP	DIG COEF %	0
1135	211D	840	02	SWINE	DIG COEF %	0
1140	345	000	01	LIGNIN (FONNESBECK)	%	1
1145	272	000	01	LIGNIN (SULLIVAN)	%	1
1150	272D	070	02	CATTLE	DIG COEF %	0
1155	272D	350	02	GOATS	DIG COEF %	0
1160	272D	420	02	HORSES	DIG COEF %	0
1165	272D	490	02	MAN	DIG COEF %	0
1170	272D	630	02	RABBITS	DIG COEF %	0
1175	272D	700	02	RATS	DIG COEF %	0
1180	272D	710	02	RUMINANTS	DIG COEF %	0
1185	272D	770	02	SHEEP	DIG COEF %	0
1190	272D	840	02	SWINE	DIG COEF %	0
1195	270	000	01	LIGNIN (VAN SOEST)	%	1
1200	270D	070	02	CATTLE	DIG COEF %	0
1205	270D	350	02	GOATS	DIG COEF %	0
1210	270D	420	02	HORSES	DIG COEF %	0
1215	270D	490	02	MAN	DIG COEF %	0
1220	270D	630	02	RABBITS	DIG COEF %	0
1225	270D	700	02	RATS	DIG COEF %	0
1230	270D	710	02	RUMINANTS	DIG COEF %	0
1235	270D	770	02	SHEEP	DIG COEF %	0
1240	270D	840	02	SWINE	DIG COEF %	0
1245	280	000	01	LIGNIN KMNO4 (VAN SOEST)	%	1
1250	280D	070	02	CATTLE	DIG COEF %	0
1255	280D	350	02	GOATS	DIG COEF %	0
1260	280D	420	02	HORSES	DIG COEF %	0
1265	280D	490	02	MAN	DIG COEF %	0
1270	280D	630	02	RABBITS	DIG COEF %	0
1275	280D	700	02	RATS	DIG COEF %	0
1280	280D	710	02	RUMINANTS	DIG COEF %	0
1285	280D	770	02	SHEEP	DIG COEF %	0
1290	280D	840	02	SWINE	DIG COEF %	0
1295	347	000	01	MALTOSE	%	1
1300	335	000	01	MANNOSE	%	1
1305	904	000	01	PECTIC SUBSTANCES	%	1
1310	318	000	01	PECTINS	%	1
1315	319	000	01	PENTOSANS	%	1
1320	340	000	01	PENTOSES	%	1
1325	343	000	01	RIBOSE	%	1
1330	326	000	01	STARCH	%	1
1335	346	000	01	SUCROSE	%	1
1340	322	000	01	SUGARS, TOTAL	%	1
1345	332	000	01	SUGARS, NON REDUCING	%	2
1350	333	000	01	SUGARS, REDUCING	%	2
1355	350	000	01	SUGAR, INVERT	%	1
1360	342	000	01	XYLOSE	%	1

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit		Number Digits to Right of Decimal Point
ENERGY UTILIZATION							
1365	421	000	53	ENERGY, GROSS	GE	MJ/KG	2
				ENERGY, DIGESTIBLE			
1370	422	060	54	CATS	DE	MJ/KG	2
1375	422	070	54	CATTLE	DE	MJ/KG	2
1380	422	210	54	DOGS	DE	MJ/KG	2
1385	422	255	54	FISH, SALMON, TROUT	DE	MJ/KG	2
1390	422	260	54	FISH, WARMWATER	DE	MJ/KG	2
1395	422	280	54	FOXES	DE	MJ/KG	2
1400	422	350	54	GOATS	DE	MJ/KG	2
1405	422	420	54	HORSES	DE	MJ/KG	2
1410	422	490	54	MAN	DE	MJ/KG	2
1415	422	560	54	MINK	DE	MJ/KG	2
1420	422	630	54	RABBITS	DE	MJ/KG	2
1425	422	700	54	RATS	DE	MJ/KG	2
1430	422	710	54	RUMINANTS	DE	MJ/KG	2
1435	422	770	54	SHEEP	DE	MJ/KG	2
1440	422	840	54	SWINE	DE	MJ/KG	2
				ENERGY, METABOLIZABLE			
1445	423	060	55	CATS	ME	MJ/KG	2
1450	423	070	55	CATTLE	ME	MJ/KG	2
1453	437	070	55	CATTLE LACTATING	ME	MJ/KG	2
1455	423	210	55	DOGS	ME	MJ/KG	2
1460	423	255	55	FISH, SALMON, TROUT	ME	MJ/KG	2
1465	423	260	55	FISH, WARMWATER	ME	MJ/KG	2
1470	423	280	55	FOXES	ME	MJ/KG	2
1475	423	350	55	GOATS	ME	MJ/KG	2
1480	423	420	55	HORSES	ME	MJ/KG	2
1485	423	490	55	MAN	ME	MJ/KG	2
1490	423	560	55	MINK	ME	MJ/KG	2
1495	423	630	55	RABBITS	ME	MJ/KG	2
1500	423	700	55	RATS	ME	MJ/KG	2
1505	423	710	55	RUMINANTS	ME	MJ/KG	2
1510	423	770	55	SHEEP	ME	MJ/KG	2
1515	423	840	55	SWINE	ME	MJ/KG	2
1520	425	140	55	CHICKENS	ME	MJ/KG	2
1525	424	140	57	CHICKENS	ME-N	MJ/KG	2
1530	424	910	57	TURKEYS	ME-N	MJ/KG	2
				ENERGY, NET			
1535	426	070	58	CATTLE	NE-M	MJ/KG	2
1540	426	710	58	RUMINANTS	NE-M	MJ/KG	2
1545	426	770	58	SHEEP	NE-M	MJ/KG	2
1550	426	840	58	SWINE	NE-M	MJ/KG	2

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point	
1555	427	070	59	CATTLE	NE-GAIN MJ/KG	2	
1560	427	759	59	RUMINANTS	NE-GAIN MJ/KG	2	
1565	427	770	59	SHEEP	NE-GAIN MJ/KG	2	
1570	427	840	59	SWINE	NE-GAIN MJ/KG	2	
1575	428	140	60	CHICKENS	NE-P MJ/KG	2	
1580	438	140	56	CHICKENS	TME MJ/KG	2	
1583	430	070	64	CATTLE	NE-L MJ/KG	2	
1585	433	070	62	CATTLE (NEHRING)	NEF MJ/KG	2	
1590	433	770	62	SHEEP (NEHRING)	NEF MJ/KG	2	
1595	433	840	62	SWINE (NEHRING)	NEF MJ/KG	2	
1605	421	000	11	ENERGY, GROSS	GE KCAL/KG	0	
1610	421	000	32	ENERGY, GROSS	GE MCAL/KG	2	.001 *
1615	421D	070	04	CATTLE	GE DIG COEF %	0	
1620	421D	210	04	DOGS	GE DIG COEF %	0	
1625	421D	280	04	FOXES	GE DIG COEF %	0	
1630	421D	350	04	GOATS	GE DIG COEF %	0	
1635	421D	420	04	HORSES	GE DIG COEF %	0	
1640	421D	490	04	MAN	GE DIG COEF %	0	
1645	421D	560	04	MINK	GE DIG COEF %	0	
1650	421D	630	04	RABBITS	GE DIG COEF %	0	
1655	421D	700	04	RATS	GE DIG COEF %	0	
1660	421D	710	04	RUMINANTS	GE DIG COEF %	0	
1665	421D	770	04	SHEEP	GE DIG COEF %	0	
1670	421D	840	04	SWINE	GE DIG COEF %	0	
				ENERGY, DIGESTIBLE			
1675	422	060	05	CATS	DE KCAL/KG	0	
1680	422	070	32	CATTLE	DE MCAL/KG	2	.001 *
1685	422	070	05	CATTLE	DE KCAL/KG	0	
1690	422	210	05	DOGS	DE KCAL/KG	0	
1695	422	255	05	FISH, SALMON, TROUT	DE KCAL/KG	0	
1700	422	260	05	FISH, WARMWATER	DE KCAL/KG	0	
1705	422	280	05	FOXES	DE KCAL/KG	0	
1710	422	350	32	GOATS	DE MCAL/KG	2	.001 *
1715	422	350	05	GOATS	DE KCAL/KG	0	
1720	422	420	32	HORSES	DE MCAL/KG	2	.001 *
1725	422	420	05	HORSES	DE KCAL/KG	0	
1730	422	490	05	MAN	DE KCAL/KG	0	
1735	422	560	05	MINK	DE KCAL/KG	0	
1740	422	630	05	RABBITS	DE KCAL/KG	0	
1745	422	700	05	RATS	DE KCAL/KG	0	
1750	422	710	32	RUMINANTS	DE MCAL/KG	2	.001 *
1755	422	710	05	RUMINANTS	DE KCAL/KG	0	
1760	422	770	32	SHEEP	DE MCAL/KG	2	.001 *
1765	422	770	05	SHEEP	DE KCAL/KG	0	
1770	422	840	05	SWINE	DE KCAL/KG	0	
				ENERGY, METABOLIZABLE			
1775	423	060	06	CATS	ME KCAL/KG	0	

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit		Number Digits to Right of Decimal Point	
1780	423	070	33	CATTLE	ME	MCAL/KG	2	.001 *
1785	423	070	06	CATTLE	ME	KCAL/KG	0	
1790	437	070	33	CATTLE LACTATING	ME	MCAL/KG	2	.001 *
1795	437	070	06	CATTLE LACTATING	ME	KCAL/KG	0	
1800	425	140	06	CHICKENS	ME	KCAL/KG	0	
1805	423	210	06	DOGS	ME	KCAL/KG	0	
1810	423	255	06	FISH, SALMON, TROUT	ME	KCAL/KG	0	
1815	423	260	06	FISH, WARMWATER	ME	KCAL/KG	0	
1820	423	280	06	FOXES	ME	KCAL/KG	0	
1825	423	350	33	GOATS	ME	MCAL/KG	2	.001 *
1830	423	350	06	GOATS	ME	KCAL/KG	0	
1835	423	420	33	HORSES	ME	MCAL/KG	2	.001 *
1840	423	420	06	HORSES	ME	KCAL/KG	0	
1845	423	490	06	MAN	ME	KCAL/KG	0	
1850	423	560	06	MINK	ME	KCAL/KG	0	
1855	423	630	06	RABBITS	ME	KCAL/KG	0	
1860	423	700	06	RATS	ME	KCAL/KG	0	
1865	423	710	33	RUMINANTS	ME	MCAL/KG	2	.001 *
1870	423	710	06	RUMINANTS	ME	KCAL/KG	0	
1875	423	770	33	SHEEP	ME	MCAL/KG	2	.001 *
1880	423	770	06	SHEEP	ME	KCAL/KG	0	
1885	423	840	06	SWINE	ME	KCAL/KG	0	
1890	438	140	36	CHICKENS	TME	KCAL/KG	0	
1895	424	140	07	CHICKENS	ME-N	KCAL/KG	0	
1900	424	910	07	TURKEYS	ME-N	KCAL/KG	0	
				ENERGY, NET				
1905	426	070	34	CATTLE	NE-M	MCAL/KG	2	.001 *
1910	426	070	08	CATTLE	NE-M	KCAL/KG	0	
1915	426	710	34	RUMINANTS	NE-M	MCAL/KG	2	.001 *
1920	426	710	08	RUMINANTS	NE-M	KCAL/KG	0	
1925	426	770	34	SHEEP	NE-M	MCAL/KG	2	.001 *
1930	426	770	08	SHEEP	NE-M	KCAL/KG	0	
1935	426	840	08	SWINE	NE-M	KCAL/KG	0	
1940	427	070	35	CATTLE	NE-GAIN	MCAL/KG	2	.001 *
1945	427	070	10	CATTLE	NE-GAIN	KCAL/KG	0	
1950	427	710	35	RUMINANTS	NE-GAIN	MCAL/KG	2	.001 *
1955	427	710	10	RUMINANTS	NE-GAIN	KCAL/KG	0	
1960	427	770	35	SHEEP	NE-GAIN	MCAL/KG	2	.001 *
1965	427	770	10	SHEEP	NE-GAIN	KCAL/KG	0	
1970	427	840	10	SWINE	NE-GAIN	KCAL/KG	0	
1975	428	140	09	CHICKENS	NE-P	KCAL/KG	0	
1980	430	070	41	CATTLE	NE-L	MCAL/KG	2	.001 *
1985	433	070	46	CATTLE (NEHRING)	NEF	MCAL/KG	2	.001 *
1990	433	070	61	CATTLE (NEHRING)	NEF	KCAL/KG	0	
1995	433	770	46	SHEEP (NEHRING)	NEF	MCAL/KG	2	.001 *
2000	433	770	61	SHEEP (NEHRING)	NEF	KCAL/KG	0	
2005	433	840	61	SWINE (NEHRING)	NEF	KCAL/KG	0	

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
				TDN		
2015	429	070	01	CATTLE	%	1
2020	429	210	01	DOGS	%	1
2025	429	280	01	FOXES	%	1
2030	429	350	01	GOATS	%	1
2035	429	420	01	HORSES	%	1
2040	429	560	01	MINK	%	1
2045	429	630	01	RABBITS	%	1
2050	429	700	01	RATS	%	1
2055	429	710	01	RUMINANTS	%	1
2060	429	770	01	SHEEP	%	1
2065	429	840	01	SWINE	%	1
2070	436	840	15	SWINE (LEHMANN)	%	1
				SCANDINAVIAN FEED UNIT		
2080	432	070	43	CATTLE	UNIT	2
2085	432	420	43	HORSES	UNIT	2
2090	432	770	43	SHEEP	UNIT	2
2095	432	840	43	SWINE	UNIT	2
2100	431	710	42	STARCH EQUIVALENT (SE)	UNIT	1
2105	006	000	00	CODES FOR SE		
2110	007	000	00	VALUE NUMBER FOR SE		
2115	434	000	00	STARCH UNIT		1
2120	114	000	01	NUTRITIVE MATTER (FONNESBECK)	%	1
2125	116	000	01	NONNUTRITIVE MATTER (FONNESBECK)	%	1
2130	435	000	01	NUTRIENTS,TOTAL	%	1
2135	912	000	01	NUTRITIVE VALUE INDEX (NVI)	%	0
2140	912D	070	01	CATTLE	%	0
2145	912D	210	01	DOGS	%	0
2150	912D	280	01	FOXES	%	0
2155	912D	350	01	GOATS	%	0
2160	912D	420	01	HORSES	%	0
2165	912D	490	01	MAN	%	0
2170	912D	560	01	MINK	%	0
2175	912D	630	01	RABBITS	%	0
2180	912D	700	01	RATS	%	0
2185	912D	770	01	SHEEP	%	0
2190	912D	840	01	SWINE	%	0
2195	917	000	01	RELATIVE INTAKE	%	0
2200	917D	070	01	CATTLE	%	0
2205	917D	210	01	DOGS	%	0
2210	917D	280	01	FOXES	%	0
2215	917D	350	01	GOATS	%	0
2220	917D	420	01	HORSES	%	0
2225	917D	490	01	MAN	%	0
2230	917D	560	01	MINK	%	0
2235	917D	630	01	RABBITS	%	0
2240	917D	700	01	RATS	%	0

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
2245	917D	770	01	SHEEP	%	0
2250	917D	840	01	SWINE	%	0
				MINERALS		
2255	548	000	17	ALUMINUM	MG/KG	2
2260	587	000	17	ANTIMONY	MG/KG	3
2265	585	000	17	ARSENIC	MG/KG	3
2270	567	000	17	BARIUM	MG/KG	3
2275	796	000	17	BERYLLIUM	MG/KG	3
2280	569	000	17	BORON	MG/KG	3
2285	584	000	17	BROMINE	MG/KG	3
2290	588	000	17	CADMIUM	MG/KG	3
2295	530	000	01	CALCIUM	%	2
2300	531	000	01	CHLORINE	%	2
2305	570	000	17	CHROMIUM	MG/KG	3
2310	538	000	17	COBALT	MG/KG	3
2315	539	000	17	COPPER	MG/KG	1
2320	540	000	17	FLUORINE	MG/KG	2
2325	541	000	17	IODINE	MG/KG	3
2330	532	000	17	IRON	MG/KG	0
2335	555	000	17	LANTHANUM	MG/KG	3
2340	550	000	17	LEAD	MG/KG	3
2345	593	000	17	LITHIUM	MG/KG	3
2350	533	000	01	MAGNESIUM	%	2
2355	542	000	17	MANGANESE	MG/KG	1
2360	592	000	17	MERCURY	MG/KG	3
2365	543	000	17	MOLYBDENUM	MG/KG	2
2370	561	000	17	NICKEL	MG/KG	2
2375	534	000	01	PHOSPHORUS	%	2
2380	534D	140	01	CHICKENS, HENS AVAILABILITY	%	0
2385	534D	141	01	CHICKENS,CHICKS AVAILABILITY	%	0
2390	534D	840	01	SWINE AVAILABILITY	%	0
2395	534D	910	01	TURKEYS, HENS AVAILABILITY	%	0
2400	534D	911	01	TURKEYS, POULTS AVAILABILITY	%	0
2405	575	000	01	CHICKENS, CHICKS AVAILABLE	%	2
2410	576	000	01	CHICKENS, HENS AVAILABLE	%	2
2415	577	000	01	SWINE AVAILABLE	%	2
2423	579	000	01	TURKEYS, HENS AVAILABLE	%	2
2420	578	000	01	TURKEYS, POULTS AVAILABLE	%	2
2430	581	000	01	ORTHO PHOSPHATE	%	2
2435	580	000	01	CITRATE SOLUBLE PHOSPHORUS	%	2
2440	582	000	01	PHYTIN PHOSPHORUS	%	2
2445	583	000	01	WATER SOLUBLE PHOSPHORUS	%	2

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
2450	535	000	01	POTASSIUM	%	2
2455	797	000	17	RUBIDIUM	MG/KG	3
2460	909	000	01	SALT (NACL)	%	2
2465	544	000	17	SELENIUM	MG/KG	3
2470	589	000	17	SILVER	MG/KG	3
2475	546	000	01	SILICON	%	2
2480	536	000	01	SODIUM	%	2
2485	537	000	01	SULPHUR	%	2
2490	568	000	17	STRONTIUM	MG/KG	3
2495	551	000	17	THALLIUM	MG/KG	3
2500	590	000	17	TIN	MG/KG	3
2505	591	000	17	TITANIUM	MG/KG	3
2510	549	000	17	TUNGSTON	MG/KG	3
2515	553	000	17	URANIUM	MG/KG	3
2520	586	000	17	VANADIUM	MG/KG	3
2525	545	000	17	ZINC	MG/KG	1
				VITAMINS AND RELATED COMPOUNDS		
2530	656	000	17	ASCORBIC ACID	MG/KG	1
2535	914	000	01	BETAINE	%	3
2540	646	000	17	BIOTIN	MG/KG	2
2543	647	000	17	CAROTINE	MG/KG	1
2545	675	000	17	CAROTENOIDS	MG/KG	2
2550	676	000	17	CAROTENE,TOTAL	MG/KG	2
2555	677	000	17	A-CAROTENE	MG/KG	2
2560	674	000	17	B-CAROTENE	MG/KG	2
2565	678	000	17	G-CAROTENE	MG/KG	2
2570	679	000	17	LUTEIN	MG/KG	2
2575	681	000	17	CRYPTOXANTHIN	MG/KG	2
2580	913	000	17	XANTHOPHYLL	MG/KG	2
2585	680	000	17	ZEAXANTHINE	MG/KG	2
2590	648	000	17	CHOLINE	MG/KG	0
2595	915	000	01	ERGOSTEROL	%	2
2600	649	000	17	FOLIC ACID	MG/KG	2
2605	666	000	17	INOSITOL	MG/KG	3
2610	650	000	17	NIACIN	MG/KG	1
2615	665	000	17	P-AMINOBENZOIC ACID	MG/KG	3
2620	651	000	17	PANTOTHENIC ACID	MG/KG	1
2625	652	000	17	RIBOFLAVIN	MG/KG	1
2630	653	000	17	THIAMINE	MG/KG	1
2635	682	000	17	TOCOPHEROL	MG/KG	2
2640	683	000	17	TOCOPHEROL,TOTAL	MG/KG	2
2645	684	000	17	A-TOCOPHEROL	MG/KG	2
2650	685	000	17	B-TOCOPHEROL	MG/KG	2
2655	687	000	17	D-TOCOPHEROL	MG/KG	2
2660	686	000	17	G-TOCOPHEROL	MG/KG	2

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
2665	655	000	17	VITAMIN B6	MG/KG	2
2670	657	000	17	VITAMIN K	MG/KG	2
2675	658	000	18	VITAMIN B12	UG/KG	1
2680	659	000	19	VITAMIN A	IU/G	1
2685	663	000	19	VITAMIN A EQUIVALENT	IU/G	1
2690	654	000	17	VITAMIN E	MG/KG	1
2695	660	000	19	VITAMIN D2 AND D3	IU/G	1
2700	661	000	19	VITAMIN D3	ICU/G	1
				AMINO ACIDS, AVAILIBILITY AND AVAILABLE		
2705	763	000	01	ALANINE	%	2
2710	764	000	01	ARGININE	%	2
2715	764D	140	01	CHICKENS, CHICKS AVAILABILITY	%	0
2720	764D	840	01	SWINE AVAILABILITY	%	0
2725	764D	910	01	TURKEYS, POULTS AVAILABILITY	%	0
2730	011	000	01	CHICKENS, CHICKS AVAILABLE	%	2
2735	012	000	01	SWINE AVAILABLE	%	2
2740	013	000	01	TURKEY, POULTS AVAILABLE	%	2
2745	765	000	01	ASPARTIC ACID	%	2
2750	766	000	01	CITRULLINE	%	2
2755	768	000	01	CYSTEINE	%	2
2760	767	000	01	CYSTINE	%	2
2762	798	000	01	CYTISINE	%	2
2765	769	000	01	GLUTAMIC ACID	%	2
2770	770	000	01	GLYCINE	%	2
2775	770D	140	01	CHICKENS, CHICKS AVAILABILITY	%	0
2780	770D	840	01	SWINE AVAILABILITY	%	0
2785	770D	910	01	TURKEYS, POULTS AVAILABILITY	%	0
2790	014	000	01	CHICKENS, CHICKS AVAILABLE	%	2
2795	015	000	01	SWINE AVAILABLE	%	2
2800	016	000	01	TURKEYS, POULTS AVAILABLE	%	2
2805	771	000	01	HISTIDINE	%	2
2810	771D	140	01	CHICKENS, CHICKS AVAILABILITY	%	0
2815	771D	840	01	SWINE AVAILABILITY	%	0
2820	771D	910	01	TURKEYS, POULTS AVAILABILITY	%	0
2825	017	000	01	CHICKENS, CHICKS AVAILABLE	%	2
2830	018	000	01	SWINE AVAILABLE	%	2
2835	019	000	01	TURKEYS, POULTS AVAILABLE	%	2
2840	772	000	01	HYDROXYPROLINE	%	2
2845	773	000	01	ISOLEUCINE	%	2

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
2850	773D	140	01	CHICKENS, CHICKS AVAILABILITY	%	0
2855	773D	840	01	SWINE AVAILABILITY	%	0
2860	773D	910	01	TURKEYS,POULTS AVAILABILITY	%	0
2865	022	000	01	CHICKENS, CHICKS AVAILABLE	%	2
2870	023	000	01	SWINE AVAILABLE	%	2
2875	024	000	01	TURKEYS, POULTS AVAILABLE	%	2
2880	774	000	01	LEUCINE	%	2
2885	774D	140	01	CHICKENS, CHICKS AVAILABILITY	%	0
2890	774D	840	01	SWINE AVAILABILITY	%	0
2895	774D	910	01	TURKEYS, POULTS AVAILABILITY	%	0
2900	028	000	01	CHICKENS, CHICKS AVAILABLE	%	2
2905	029	000	01	SWINE AVAILABLE	%	2
2910	030	000	01	TURKEYS, POULTS AVAILABLE	%	2
2912	799	000	01	LUPANINE		
2915	775	000	01	LYSINE	%	2
2920	775D	140	01	CHICKENS, CHICKS AVAILABILITY	%	0
2925	775D	840	01	SWINE AVAILABILITY	%	0
2930	775D	910	01	TURKEYS, POULTS AVAILABILITY	%	0
2935	034	000	01	CHICKENS, CHICKS AVAILABLE	%	2
2940	035	000	01	SWINE AVAILABLE	%	2
2945	036	000	01	TURKEYS, POULTS AVAILABLE	%	2
2950	788	000	01	LYSINE AVAILABLE (CARPENTER)	%	2
2955	776	000	01	METHIONINE AVAILABILITY	%	2
2960	776D	140	01	CHICKENS, CHICKS AVAILABILITY	%	0
2965	776D	840	01	SWINE AVAILABILITY	%	0
2970	776D	910	01	TURKEYS, POULTS AVAILABILITY	%	0
2975	040	000	01	CHICKENS, CHICKS AVAILABLE	%	2
2980	041	000	01	SWINE AVAILABLE	%	2
2985	042	000	01	TURKEYS, POULTS AVAILABLE	%	2
2990	786	000	01	METHIONINE CYSTINE	%	2
2995	777	000	01	PHENYLALANINE	%	2
3000	777D	140	01	CHICKENS, CHICKS AVAILABILITY	%	0
3005	777D	840	01	SWINE AVAILABILITY	%	0
3010	777D	910	01	TURKEYS, POULTS AVAILABILITY	%	0
3015	046	000	01	CHICKENS, CHICKS AVAILABLE	%	2
3020	047	000	01	SWINE AVAILABLE	%	2
3025	048	000	01	TURKEYS, POULTS AVAILABLE	%	2

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
3030	778	000	01	PROLINE	%	2
3035	779	000	01	SERINE	%	2
3040	780	000	01	THREONINE	%	2
3045	780D	140	01	CHICKENS, CHICKS AVAILABILITY	%	0
3050	780D	840	01	SWINE AVAILABILITY	%	0
3055	780D	910	01	TURKEYS, POULTS AVAILABILITY	%	0
3060	052	000	01	CHICKENS, CHICKS AVAILABLE	%	2
3065	053	000	01	SWINE AVAILABLE	%	2
3070	054	000	01	TURKEYS, POULTS AVAILABLE	%	2
3075	781	000	01	TRYPTOPHAN	%	2
3080	781D	140	01	CHICKENS, CHICKS AVAILABILITY	%	0
3085	781D	840	01	SWINE AVAILABILITY	%	0
3090	781D	910	01	TURKEYS, POULTS AVAILABILITY	%	0
3095	058	000	01	CHICKENS, CHICKS AVAILABLE	%	2
3100	059	000	01	SWINE AVAILABLE	%	2
3105	060	000	01	TURKEYS, POULTS AVAILABLE	%	2
3110	782	000	01	TYROSINE	%	2
3115	783	000	01	VALINE	%	2
3120	783D	140	01	CHICKENS, CHICKS AVAILABILITY	%	0
3125	783D	840	01	SWINE AVAILABILITY	%	0
3130	783D	910	01	TURKEYS, POULTS AVAILABILITY	%	0
3135	064	000	01	CHICKENS, CHICKS AVAILABLE	%	2
3140	065	000	01	SWINE AVAILABLE	%	2
3145	066	000	01	TURKEYS, POULTS AVAILABLE	%	2
3150	961	140	01	POULTRY AMINO ACID AVAILABLE	%	0
				LIPIDS, FATTY ACIDS AND FAT SPECIFICATIONS		
3155	563	000	01	INSOLUBLE IN FORMIC ACID	%	1
3160	282	000	01	CHOLESTEROL	%	2
3165	278	000	01	FAT, ROSE GOTTLIEB	%	1
3170	115	000	01	FAT,TOTAL	%	1
3175	271	000	01	TOTAL LIPIDS	%	1
3180	689	000	01	SAPONIFIABLE LIPIDS	%	1
3185	694	000	01	NONSAPONIFIABLE LIPIDS	%	1
3190	274	000	01	FREE FATTY ACID	%	0
3195	275	000	01	PETROLEUM ETHER INSOLUBLES	%	3
3200	210	000	01	FATTY ACIDS	%	1
3205	216	000	01	ACETIC 2:0 (ETHANOIC)	%	3
3210	218	000	01	ARACHIDIC (EICOSANOIC 20:0)	%	3

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
3215	220	000	01	ARACHIDONIC (EICOSATETRAENOIC 20:4)	%	3
3220	287	000	01	BEHENIC (DOCOSANOIC 22:0)	%	3
3225	286	000	01	BEHENOLIC (DOCOSENOIC 22:1)	%	3
3230	222	000	01	BUTANOIC 4:0	%	3
3235	079	000	01	2-BUTYLOCTADECANOIC 22:0	%	3
3240	224	000	01	CAPRIC (DECANOIC 10:0)	%	3
3245	226	000	01	CAPROIC (HEXANOIC 6:0)	%	3
3250	228	000	01	CAPRYLIC (OCTANOIC 8:0)	%	3
3255	866	000	01	CEROTIC (HEXACOSANOIC 26:0)	%	3
3260	224	000	01	DECANOIC 10:0 (CAPRIC)	%	3
3265	283	000	01	DECENOIC 10:1	%	3
3270	085	000	01	2-DECYLOCTADECANOIC 28:0	%	3
3275	898	000	01	DIHYDROXYOCTADECANOIC 18:0	%	3
3280	897	000	01	DIHYDROXYOCTADECENOIC 18:1	%	3
3285	714	000	01	DOCOSADIENOIC 22:2	%	3
3290	287	000	01	DOCOSANOIC 22:0 (BEHENIC)	%	3
3295	230	000	01	DOCOSAHEXAENOIC 22:6	%	3
3300	232	000	01	DOCOSAPENTAENOIC 22:5	%	3
3305	234	000	01	DOCOSATETRAENOIC 22:4	%	3
3310	725	000	01	DOCOSATRIENOIC 22:3	%	3
3315	286	000	01	DOCOSENOIC 22:1 (BEHENOLIC)	%	3
3320	246	000	01	DODECANOIC 12:0 (LAURIC)	%	3
3325	284	000	01	DODECENOIC 12:1	%	3
3330	087	000	01	2-DODECYLOCTADECANOIC 30:0	%	3
3335	791	000	01	DOTRIACONTAHEXAENOIC 32:6	%	3
3340	872	000	01	DOTRIACONTANOIC 32:0	%	3
3345	886	000	01	DOTRIACONTENOIC 32:1	%	3
3350	236	000	01	EICOSADIENOIC 20:2	%	3
3355	218	000	01	EICOSANOIC 20:0 (ARACHIOIC)	%	3
3360	244	000	01	EICOSENOIC 20:1	%	3
3365	238	000	01	EICOSAHEXAENOIC 20:6	%	3
3370	240	000	01	EICOSAPENTAENOIC 20:5	%	3
3375	220	000	01	EICOSATETRAENOIC 20:4 (ARACHIDONIC)	%	3
3380	863	000	01	ENANTHIC (HEPTANOIC 7:0)	%	3
3385	242	000	01	EICOSATRIENOIC 20:3	%	3
3390	216	000	01	ETHANOIC (ACETIC 2:0)	%	3
3395	896	000	01	12,13-EPOXY-9-OCTADECENOIC	%	3
3400	075	000	01	2-ETHYLHEXADECANOIC 18:0	%	3
3405	865	000	01	HENDECANOIC 11:0 (UNDECANOIC)	%	3
3410	086	000	01	2-HENDECYLOCTADECANOIC 29:0	%	3

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
3415	713	000	01	HENEICOSADIENOIC 21:2	%	3
3420	860	000	01	HENEICOSANOIC 21:0	%	3
3425	752	000	01	HENEICOSAHEXAENOIC 21:6	%	3
3430	742	000	01	HENEICOSAPENTAENOIC 21:5	%	3
3435	724	000	01	HENEICOSATRIENOIC 21:3	%	3
3440	732	000	01	HENEICOSATETRAENOIC 21:4	%	3
3445	876	000	01	HENEICOSENOIC 21:1	%	3
3450	790	000	01	HENTRIACONTAHEXAENOIC 31:6	%	3
3455	871	000	01	HENTRIACONTANOIC 31:0	%	3
3460	885	000	01	HENTRIACONTENOIC 31:1	%	3
3465	757	000	01	HEPTACOSAHEXAENOIC 27:6	%	3
3470	867	000	01	HEPTACOSANOIC 27:0	%	3
3475	747	000	01	HEPTACOSAPENTAENOIC 27:5	%	3
3480	737	000	01	HEPTACOSATETRAENOIC 27:4	%	3
3485	881	000	01	HEPTACOSENOIC 27:1	%	3
3490	794	000	01	HEPTACYCLOPROPYLOCTANOIC	%	3
3495	710	000	01	HEPTADECADIENOIC 17:2	%	3
3500	856	000	01	HEPTADECANOIC 17:0 (MARGARIC)	%	3
3505	730	000	01	HEPTADECATETRAENOIC 17:4	%	3
3510	720	000	01	HEPTADECATRIENOIC 17:3	%	3
3515	857	000	01	HEPTADECENOIC 17:1	%	3
3520	863	000	01	HEPTANOIC 7:0 (ENANTHIC)	%	3
3525	717	000	01	HEXACOSADIENOIC 26:2	%	3
3530	746	000	01	HEXACOSAPENTAENOIC 26:5	%	3
3535	756	000	01	HEXACOSAHEXAENOIC 26:6	%	3
3540	866	000	01	HEXACOSANOIC 26:0 (CEROTIC)	%	3
3545	736	000	01	HEXACOSATETRAENOIC 26:4	%	3
3550	728	000	01	HEXACOSATRIENOIC 26:3	%	3
3555	880	000	01	HEXACOSENOIC 26:1	%	3
3560	709	000	01	HEXADECADIENOIC 16:2	%	3
3565	260	000	01	HEXADECANOIC 16:0 (PALMITIC)	%	3
3570	729	000	01	HEXADECATETRAENOIC 16:4	%	3
3575	719	000	01	HEXADECATRIENOIC 16:3	%	3
3580	262	000	01	HEXADECENOIC 16:1 (PALMITOLEIC)	%	3
3585	226	000	01	HEXANOIC 6:0 (CAPROIC)	%	3
3590	890	000	01	HEXATRIACONTENOIC 36:1	%	3
3595	081	000	01	2-HEXYLOCTADECANOIC 24:0	%	3
3600	892	000	01	HYDROXYDECANOIC 10:0	%	3
3605	705	000	01	HYDROXYDOCOSANOIC 22:0	%	3
3610	893	000	01	HYDROXYDODECANOIC 12:0	%	3
3615	704	000	01	HYDROXYEICOSANOIC 20:0	%	3
3620	701	000	01	HYDROXYEICOSENOIC 20:1	%	3
3625	702	000	01	HYDROXYHEXADECANOIC 16:0	%	3

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
3630	700	000	01	HYDROXYOCTADECADIENOIC 18:2	%	3
3635	703	000	01	HYDROXYOCTADECANOIC 18:0	%	3
3640	891	000	01	HYDROXYOCTANOIC 8:0	%	3
3645	899	000	01	9-HYDROXY-12-OCTADECENOIC	%	3
3650	895	000	01	12-HYDROXY-9-OCTADECENOIC	%	3
3655	269	000	01	2-HYDROXYPROPANOIC 3:0	%	3
3660	894	000	01	HYDROXYTETRADECANOIC 14:0	%	3
3665	246	000	01	LAURIC (DODECANOIC 12:0)	%	3
3670	248	000	01	LINOLEIC (OCTADECADIENOIC 18:2)	%	3
3675	250	000	01	LINOLENIC (OCTADECATRIENOIC 18:3)	%	3
3680	856	000	01	MARGARIC (HEPTADECANOIC 17:0)	%	3
3685	241	000	01	16:0 (MULTIPLE BRANCHED)	%	3
3690	964	000	01	17:0 (MULTIPLE BRANCHED)	%	3
3695	214	000	01	18:0 (MULTIPLE BRANCHED)	%	3
3700	215	000	01	19:0 (MULTIPLE BRANCHED)	%	3
3705	217	000	01	20:0 (MULTIPLE BRANCHED)	%	3
3710	219	000	01	21:0 (MULTIPLE BRANCHED)	%	3
3715	221	000	01	22:0 (MULTIPLE BRANCHED)	%	3
3720	223	000	01	23:0 (MULTIPLE BRANCHED)	%	3
3725	225	000	01	24:0 (MULTIPLE BRANCHED)	%	3
3730	227	000	01	25:0 (MULTIPLE BRANCHED)	%	3
3735	229	000	01	26:0 (MULTIPLE BRANCHED)	%	3
3740	231	000	01	27:0 (MULTIPLE BRANCHED)	%	3
3745	233	000	01	28:0 (MULTIPLE BRANCHED)	%	3
3750	235	000	01	30:0 (MULTIPLE BRANCHED)	%	3
3755	712	000	01	3-METHYLBUTANOIC 5:0	%	3
3760	068	000	01	METHYLDECANOIC 11:0	%	3
3765	070	000	01	METHYLDODECANOIC 13:0	%	3
3770	080	000	01	2-METHYLDOCOSANOIC 23:0	%	3
3775	078	000	01	2-METHYLEICOSANOIC 21:0	%	3
3780	074	000	01	15-METHYLHEXADECANOIC 17:0	%	3
3785	077	000	01	METHYLNONADECANOIC 20:0	%	3
3790	067	000	01	8-METHYLNONANOIC 10:0	%	3
3795	076	000	01	10-METHYLOCTADECANOIC 19:0	%	3
3800	073	000	01	14-METHYLPENTADECANOIC 16:0	%	3
3805	721	000	01	4-METHYLPENTANOIC 6:0	%	3
3810	090	000	01	2-METHYLPROPANOIC 4:0	%	3
3815	082	000	01	2-METHYLTETRACOSANOIC 25:0	%	3
3820	072	000	01	2-METHYLTETRADECANOIC 15:0	%	3
3825	071	000	01	METHYLTRIDECANOIC 14:0	%	3
3830	252	000	01	MYRISTIC (TETRADECANOIC 14:0)	%	3

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
3835	254	000	01	MYRISTOLEIC (TETRADECENOIC 14:1)	%	3
3840	759	000	01	NONACOSAHEXAENOIC 29:6	%	3
3845	869	000	01	NONACOSANOIC 29:0	%	3
3850	749	000	01	NONACOSAPENTAENOIC 29:5	%	3
3855	739	000	01	NONACOSATETRAENOIC 29:4	%	3
3860	883	000	01	NONACOSENOIC 29:1	%	3
3865	711	000	01	NONADECADIENOIC 19:2	%	3
3870	858	000	01	NONADECANOIC 19:0	%	3
3875	741	000	01	NONADECAPENTAENOIC 19:5	%	3
3880	731	000	01	NONADECATETRAENOIC 19:4	%	3
3885	722	000	01	NONADECATRIENOIC 19:3	%	3
3890	859	000	01	NONADECENOIC 19:1	%	3
3895	864	000	01	NONANOIC 9:0 (PELARGONIC)	%	3
3900	084	000	01	2-NONYLOCTADECANOIC 27:0	%	3
3905	758	000	01	OCTACOSAHEXAENOIC 28:6	%	3
3910	868	000	01	OCTACOSANOIC 28:0	%	3
3915	748	000	01	OCTACOSAPENTAENOIC 28:5	%	3
3920	738	000	01	OCTACOSATETRAENOIC 28:4	%	3
3925	882	000	01	OCTACOSENOIC 28:1	%	3
3930	248	000	01	OCTADECADIENOIC 18:2 (LINOLEIC)	%	3
3935	266	000	01	OCTADECANOIC 18:0 (STEARIC)	%	3
3940	256	000	01	OCTADECATETRAENOIC 18:4	%	3
3945	250	000	01	OCTADECATRIENOIC 18:3 (LINOLENIC)	%	3
3950	258	000	01	OCTADECENOIC 18:1 (OLEIC)	%	3
3955	228	000	01	OCTANOIC 8:0 (CAPRYLIC)	%	3
3960	793	000	01	OCTYLCYCLOPROPENYLOCTANOIC	%	3
3965	795	000	01	OCTYLCYCLOPROPYLOCTANOIC	%	3
3970	258	000	01	OLEIC (OCTADECENOIC 18:1)	%	3
3975	260	000	01	PALMITIC (HEXADECANOIC 16:0)	%	3
3980	262	000	01	PALMITOLEIC (HEXADECENOIC 16:1)	%	3
3985	864	000	01	PELARGONIC (NONANOIC 9:0)	%	3
3995	862	000	01	PENTACOSANOIC 25:0	%	3
4000	745	000	01	PENTACOSAPENTAENOIC 25:5	%	3
4005	735	000	01	PENTACOSATETRAENOIC 25:4	%	3
4010	879	000	01	PENTACOSENOIC 25:1	%	3
4015	708	000	01	PENTADECADIENOIC 15:2	%	3
4020	855	000	01	PENTADECANOIC 15:0	%	3
4025	718	000	01	PENTADECATRIENOIC 15:3	%	3
4030	089	000	01	PENTADECENOIC 15:1	%	3
4035	268	000	01	PENTANOIC 5:0 (VALERIC)	%	3
4040	889	000	01	PENTATRIACONTENOIC 35:1	%	3
4045	264	000	01	PROPANOIC 3:0 (PROPIONIC)	%	3

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
4050	264	000	01	PROPIONIC (PROPANOIC 3:0)	%	3
4055	069	000	01	6-PROPYLNONANOIC 12:0	%	3
4060	266	000	01	STEARIC (OCTADECANOIC 18:0)	%	3
4065	716	000	01	TETRACOSADIENOIC 24:2	%	3
4070	723	000	01	TETRACOSANOIC 24:0	%	3
4075	878	000	01	TETRACOSENOIC 24:1	%	3
4080	754	000	01	TETRACOSAHEXAENOIC 24:6	%	3
4085	744	000	01	TETRACOSAPENTAENOIC 24:5	%	3
4090	734	000	01	TETRACOSATETRAENOIC 24:4	%	3
4095	727	000	01	TETRACOSATRIENOIC 24:3	%	3
4100	707	000	01	TETRADECADIENCIC 14:2	%	3
4105	252	000	01	TETRADECANOIC14:0 (MYRISTIC)	%	3
4110	254	000	01	TETRADECENOIC 14:1 (MYRISTOLEIC)	%	3
4115	874	000	01	TETRATRIACONTANOIC 34:0	%	3
4120	792	000	01	TETRATRIACONTAHEXAENOIC 34:6	%	3
4125	888	000	01	TETRATRIACONTENOIC 34:1	%	3
4130	760	000	01	TRIACONTAHEXAENOIC 30:6	%	3
4135	870	000	01	TRIACONTANOIC 30:0	%	3
4140	750	000	01	TRIACONTAPENTAENOIC 30:5	%	3
4145	740	000	01	TRIACONTATETRAENOIC 30:4	%	3
4150	884	000	01	TRIACONTENOIC 30:1	%	3
4155	715	000	01	TRICOSADIENOIC 23:2	%	3
4160	753	000	01	TRICOSAHEXAENOIC 23:6	%	3
4165	861	000	01	TRICOSANOIC 23:0	%	3
4170	743	000	01	TRICOSAPENTAENOIC 23:5	%	3
4175	733	000	01	TRICOSATETRAENOIC 23:4	%	3
4180	726	000	01	TRICOSATRIENOIC 23:3	%	3
4185	877	000	01	TRICOSENOIC 23:1	%	3
4190	706	000	01	TRIDECADIENOIC 13:2	%	3
4195	854	000	01	TRIDECANOIC 13:0	%	3
4200	875	000	01	TRIDECENOIC 13:1	%	3
4205	088	000	01	TRIMETHYLOCTACOSANOIC 31:0	%	3
4210	083	000	01	TRIMETHYLTRICOSANOIC 26:0	%	3
4215	873	000	01	TRITRIACONTANOIC 33:0	%	3
4220	887	000	01	TRITRIACONTENOIC 33:1	%	3
4225	865	000	01	UNDECANOIC (HENDECANOIC 11:0)	%	3
4230	268	000	01	VALERIC (PENTANOIC 5:0)	%	3
				CHARACTERISTICS OF FAT QUALITY		
4235	692	000	47	ACID VALUE	MG/G	1
4240	695	000	50	ALDEHYDE VALUE	UG/G FAT	1

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
4245	699	000	52	BUTYRIC ACID VALUE	ML A/5G FAT	1
4250	691	000	48	IODINE ABSORPTION NUMBER	G/100G	0
4255	693	000	49	PEROXIDE VALUE	MILLIMOLE/KG	1
4260	698	000	52	POLENSKE VALUE	ML A/5G FAT	1
4265	697	000	52	REICHERT-MEISSL VALUE	ML A/5G FAT	1
4270	696	000	51	RHODANIC VALUE	I. 100 TEILE	1
4275	690	000	47	SAPONIFICATION NUMBER	MG/G	0
4280	279	000	37	MELTING POINT	DEGREES C	1
				NONPROTEIN NITROGEN		
4285	113	000	01	NONPROTEIN NITROGEN	%	1
4290	848	000	01	AMMONIA	%	2
4295	673	000	01	BIURET	%	2
4300	849	000	01	NITRATE	%	2
4305	850	000	01	NITRITE	%	2
4310	672	000	01	UREA	%	2
				ALKALOIDS AND RELATED COMPOUNDS		
4315	844	000	01	ALLYL-ISOTHIOCYANATE	%	2
4320	903	000	01	CAFFEIN	%	2
4325	845	000	01	GOITRIN	%	2
4330	901	000	01	GOSSYPOL, TOTAL	%	2
4335	902	000	01	GOSSYPOL, FREE	%	2
4340	960	000	17	HYDROCYANIC ACID (HCN)	MG/KG	2
4345	910	000	01	ISOTHIOCYANATE	%	3
4350	840	000	01	LUPINIDIN	%	2
4355	843	000	01	MUSTARD OIL	%	2
4360	841	000	01	NICOTINE	%	2
4365	846	000	01	P-HYDROXYBENZ-ISOTHIOCYAN	%	2
4370	838	000	01	SAPONIN	%	2
4375	842	000	01	SOLANINE	%	2
4380	907	000	01	TANNIC ACID	%	2
4385	905	000	01	THEOBROMINE	%	2
				MYCOTOXINS		
4390	817	000	17	AFLATOXIN B1	MG/KG	3
4395	818	000	17	AFLATOXIN B2	MG/KG	3
4400	819	000	17	AFLATOXIN G1	MG/KG	3
4405	820	000	17	AFLATOXIN G2	MG/KG	3
4410	821	000	17	AFLATOXIN M1	MG/KG	3
4415	822	000	17	AFLATOXIN M2	MG/KG	3

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
4420	823	000	17	ASPERTOXIN	MG/KG	3
4425	824	000	17	B-24-TOXIN	MG/KG	3
4430	825	000	17	CITRININ	MG/KG	3
4435	826	000	17	DIACETOXYSCIRPENOL	MG/KG	3
4440	827	000	17	FUSARENONE	MG/KG	3
4445	828	000	17	ISLANDITOXIN	MG/KG	3
4450	829	000	17	LUTEOSKYRIN	MG/KG	3
4455	830	000	17	NIVALENOL	MG/KG	3
4460	831	000	17	OCHRATOXIN	MG/KG	3
4465	832	000	17	PATULIN	MG/KG	3
4470	833	000	17	RUBRATOXIN	MG/KG	3
4475	834	000	17	STERIGMATOCYSTIN	MG/KG	3
4480	835	000	17	T-2-TOXIN	MG/KG	3
4485	836	000	17	ZEARALENONE	MG/KG	3
				PESTICIDE AND RELATED COMPOUNDS		
4490	801	000	17	ALDRIN	MG/KG	3
4495	789	000	17	ALDRIN AND DIELDRIN	MG/KG	3
4500	802	000	17	CHLORDANE	MG/KG	3
4505	803	000	17	DDE	MG/KG	3
4510	804	000	17	DDD	MG/KG	3
4515	805	000	17	DDT	MG/KG	3
4520	806	000	17	DIELDRIN	MG/KG	3
4525	807	000	17	ENDRIN	MG/KG	3
4530	808	000	17	HEPTACHLOR	MG/KG	3
4535	809	000	17	HEPTACHLOR EPOXIDE	MG/KG	3
4540	787	000	17	HEPTACHLOR & HEPTACHLOR EPOXIDE	MG/KG	3
4545	761	000	17	HEXACHLORO-A-CYCLOHEXANE	MG/KG	3
4550	762	000	17	HEXACHLORO-B-CYCLOHEXANE	MG/KG	3
4555	810	000	17	HEXACHLOROCYCLOHEXANE	MG/KG	3
4560	811	000	17	HEXACHLORBENZOL	MG/KG	3
4565	812	000	17	KELTHANE	MG/KG	3
4570	813	000	17	LINDANE	MG/KG	3
4575	814	000	17	METHOXYCHLOR	MG/KG	3
4580	853	000	17	POLYCHLORINATED BIPHENYL	MG/KG	3
4583	815	000	17	TOXAPHENE	MG/KG	3
				MISCELLANEOUS		
4585	926	070	29	DM INTAKE, CATTLE	KG/DAY	2
4590	944	350	29	DM INTAKE, GOATS	KG/DAY	2
4595	945	420	29	DM INTAKE, HORSES	KG/DAY	2

TABLE 3.9 List of Attributes and Codes (Continued)

Printing Sequence No.	Attribute No.	Animal No.	Unit No.	Attribute	Unit	Number Digits to Right of Decimal Point
4600	946	630	29	DM INTAKE, RABBITS	KG/DAY	2
4605	947	700	29	DM INTAKE, RATS	KG/DAY	2
4610	948	770	29	DM INTAKE, SHEEP	KG/DAY	2
4615	949	840	29	DM INTAKE, SWINE	KG/DAY	2
4620	925	070	39	DM INTAKE, CATTLE	% OF BODY WT	2
4625	950	350	39	DM INTAKE, GOATS	% OF BODY WT	2
4630	951	420	39	DM INTAKE, HORSES	% OF BODY WT	2
4635	952	630	39	DM INTAKE, RABBITS	% OF BODY WT	2
4640	953	700	39	DM INTAKE, RATS	% OF BODY WT	2
4645	954	770	39	DM INTAKE, SHEEP	% OF BODY WT	2
4650	955	840	39	DM INTAKE, SWINE	% OF BODY WT	2
4655	918	070	30	DM INTAKE, CATTLE	G/W 0.75	3
4660	938	350	30	DM INTAKE, GOATS	G/W 0.75	3
4665	939	420	30	DM INTAKE, HORSES	G/W 0.75	3
4670	940	630	30	DM INTAKE, RABBITS	G/W 0.75	3
4675	941	700	30	DM INTAKE, RATS	G/W 0.75	3
4680	942	770	30	DM INTAKE, SHEEP	G/W 0.75	3
4685	943	840	30	DM INTAKE, SWINE	G/W 0.75	3
4690	919	000	29	GAIN, CATTLE	KG/DAY	3
4695	920	000	29	GAIN, GOATS	KG/DAY	3
4700	921	000	29	GAIN, HORSES	KG/DAY	3
4705	922	000	29	GAIN, RABBITS	KG/DAY	3
4710	923	000	29	GAIN, SHEEP	KG/DAY	3
4715	956	000	40	GAIN PER HECTARE, CATTLE	KG	0
4720	957	000	40	GAIN PER HECTARE, SHEEP	KG	0
4725	958	000	40	MILK PER HECTARE, CATTLE	KG	0
4730	928	000	29	FAT CORRECTED MILK (FCM)	KG/DAY	2
4735	924	000	31	AMOUNT AVAILABLE	G	0
4740	906	000	28	PH	PH UNITS	2
4745	353	000	01	SCLEROGEN SUBSTANCES	%	1
4750	908	000	31	WEIGHT PER HECTOLITER	KG	0

TABLE 4.1 Facets, Elements, and Descriptors which Portray the International Feed Description, International Feed Name, and Country Names

Facet No.		Element tag		Descriptors[a]
International Feed Description				
1	Original material (origin)	025	Genus (first)	*TRIFOLIUM*
		030	Species (first)	*PRATENSE*
		035	Variety (first)	
		040	Genus (second)	
		045	Species (second)	
		050	Variety (second)	
		055	Genus (third)	
		060	Species (third)	
		065	Variety (third)	
		070	Genus (fourth)	
		075	Species (fourth)	
		080	Variety (fourth)	
		155	Generic (common) name	CLOVER
		156 for continuation of 155		
		157 for continuation of 156		
		158 for continuation of 157		
		185	Breed or kind	RED
		186 for continuation of 185		
		195	Strain or chemical formula	
		196 for continuation of 195		
2	Part	215		AERIAL PART
		216 for continuation of 215		
		217 for continuation of 216		
3	Process	245		SUN-CURED
		246 for continuation of 245		
		247 for continuation of 246		
4	Maturity	275		EARLY BLOOM
		276 for continuation of 275		
5	Cutting	300		CUT 2

TABLE 4.1 Facets, Elements, and Descriptors which Portray the International Feed Description, International Feed Name, and Country Names (Continued)

Facet No.		Element tag	Descriptors[a]
6	Grade	325	
		326 for continuation of 325	
		327 for continuation of 326	
International Feed Name			
		350	International Feed Name
		351 for continuation of 350	
		352 for continuation of 351	
		360	Alternate International Feed Name
		361 for continuation of 362	
		362 for continuation of 361	
		370	Alternate International Feed Name
		371 for continuation of 370	
		372 for continuation of 371	
Country Feed Names			
		425	Country Feed Name (first)
		426 for continuation of 425	
		427 for continuation of 426	
		430	Country Feed Name (second)
		431 for continuation of 430	
		432 for continuation of 431	
		435	Country Feed Name (third)
		436 for continuation of 435	
		437 for continuation of 436	
		440–504 in groups of five as above	Country Feed Name (fourth–fifteenth)

[a] Facets and descriptors pertain only to the International Feed Descriptions (elements 025 to 325).

TABLE 4.2 Example of Individual Source Data Printed Out by Bibliographic Reference Number and Source Form Number

Bibliographic Reference Number	Source Form Number	Dry Matter (%)	Ash (%)	Crude Fiber (%)	Digestion Coefficient[a] (%)
RYEGRASS, PERENNIAL. *Lolium perenne*					
Ryegrass, perennial, aerial part, sun-cured (international feed description)					
Ryegrass, perennial, hay, sun-cured (international feed name)					
International Feed Number 1-04-077					
8010209	00005917	87.0	---	---	---
8010194	00006540	83.4	9.0	30.4	66.
8010205	00000483	88.0	9.2	27.5	---
8010205	00000483	88.0	---	---	66.
8010194	600004600[b]	83.1	10.2	28.7	75.
8010194	600004601[b]	84.5	10.4	34.6	65.
8010194	600004602[b]	80.9	7.4	30.3	55.
8010424	600007646[b]	96.4	22.5	---	---
	Dry avg.	86.4	11.5	30.3	65.
	As fed avg.	86.4	9.9	26.2	65.

[a] For sheep.

[b] These new source forms are made up by combining data, hence they have nine digits. This gives all analyses figures for the data (see Kearl et al. 1980).

TABLE 4.3 Regression Equations to Estimate Total Digestible Nutrients[a]

Animal Kind	Feed Class	Equation
Cattle	1	% *TDN = 92.464 – 3.338 (CF) – 6.945 (EE) – 0.762 (NFE) + 1.115 (Pr) + 0.031 $(CF)^2$ – 0.133 $(EE)^2$ + 0.036 (CF) (NFE) + 0.027 (EE) (NFE) + 0.100 (EE) (Pr) – 0.022 $(EE)^2$ (Pr)
	2	% *TDN = –54.572 + 6.769 (CF) – 51.083 (EE) + 1.851 (NFE) – 0.334 (Pr) – 0.049 $(CF)^2$ + 3.384 $(EE)^2$ – 0.086 (CF) (NFE) + 0.687 (EE) (NFE) + 0.942 (EE) (Pr) – 0.112 $(EE)^2$ (Pr)
	3	% *TDN = – 72.943 + 4.675 (CF) – 1.280 (EE) + 1.611 (NFE) + 0.497 (Pr) – 0.044 $(CF)^2$ – 0.760 $(EE)^2$ – 0.039 (CF) (NFE) + 0.087 (EE) (NFE) – 0.152 (EE) (Pr) + 0.074 $(EE)^2$ (Pr)
	4	% *TDN = – 202.686 – 1.357 (CF) + 2.638 (EE) + 3.003 (NFE) + 2.347 (Pr) + 0.046 $(CF)^2$ + 0.647 $(EE)^2$ + 0.041 (CF) (NFE) – 0.081 (EE) (NFE) + 0.553 (EE) (Pr) – 0.046 $(EE)^2$ (Pr)
	5	% *TDN = – 133.726 – 0.254 (CF) + 19.593 (EE) + 2.784 (NFE) + 2.315 (Pr) + 0.028 $(CF)^2$ – 0.341 $(EE)^2$ – 0.008 (CF) (NFE) – 0.215 (EE) (NFE) – 0.193 (EE) (Pr) + 0.004 $(EE)^2$ (Pr)
Horses	1	% *TDN = 52.476 + 0.189 (CF) + 3.010 (EE) – 0.723 (NFE) + 1.590 (Pr) – 0.013 $(CF)^2$ + 0.564 $(EE)^2$ + 0.006 (CF) (NFE) + 0.114 (EE) (NFE) – 0.302 (EE) (Pr) – 0.106 $(EE)^2$ (Pr)
Sheep	1	% *TDN = 37.937 – 1.018 (CF) – 4.886 (EE) + 0.173 (NFE) + 1.042 (Pr) + 0.015 $(CF)^2$ – 0.058 $(EE)^2$ + 0.008 (CF) (NFE) + 0.119 (EE) (NFE) + 0.038 (EE) (Pr) + 0.003 $(EE)^2$ (Pr)
	2	% *TDN = – 26.685 + 1.334 (CF) + 6.598 (EE) + 1.423 (NFE) + 0.967 (Pr) – 0.002 $(CF)^2$ – 0.670 $(EE)^2$ – 0.024 (CF) (NFE) – 0.055 (EE) (NFE) – 0.146 (EE) (Pr) + 0.039 $(EE)^2$ (Pr)
	3	% *TDN = – 17.950 – 1.285 (CF) + 15.704 (EE) + 1.009 (NFE) + 2.371 (Pr) + 0.017 $(CF)^2$ – 1.023 $(EE)^2$ + 0.012 (CF) (NFE) – 0.096 (EE) (NFE) – 0.550 (EE) (Pr) + 0.051 $(EE)^2$ (Pr)
	4	% *TDN = 22.822 – 1.440 (CF) – 2.875 (EE) + 0.655 (NFE) + 0.863 (Pr) + 0.020 $(CF)^2$ – 0.078 $(EE)^2$ + 0.018 (CF) (NFE) + 0.045 (EE) (NFE) – 0.085 (EE) (Pr) + 0.020 $(EE)^2$ (Pr)
	5	% *TDN = – 54.820 + 1.951 (CF) + 0.601 (EE) + 1.602 (NFE) + 1.324 (Pr) – 0.027 $(CF)^2$ + 0.032 $(EE)^2$ – 0.021 (CF) (NFE) + 0.018 (EE) (NFE) + 0.035 (EE) (Pr) – 0.0008 $(EE)^2$ (Pr)
Swine	4	% *TDN = 8.792 – 4.464 (CF) + 4.243 (EE) + 0.866 (NFE) + 0.338 (Pr) + 0.0005 $(CF)^2$ + 0.122 $(EE)^2$ + 0.063 (CF) (NFE) + 0.073 (EE) (NFE) + 0.182 (EE) (Pr) – 0.011 $(EE)^2$ (Pr)

[a] In the equations CF = Crude Fiber, EE = Ether Extract, NFE = Nitrogen Free Extract, Pr = Protein.

TABLE 4.4 Equations Used to Estimate Digestible Protein (Y) From Protein (X) for Five Animal Kinds and Four Feed Classes[a]

Animal kind	Feed class	Regression equation
Cattle	1	Y = 0.886 X - 3.06
Cattle	2	Y = 0.850 X - 2.11
Cattle	3	Y = 0.908 X - 3.77
Cattle	4	Y = 0.918 X - 3.98
Goats	1 and 2	Y = 0.933 X - 3.44
Goats	3	Y = 0.908 X - 3.77
Goats	4	Y = 0.916 X - 2.76
Horses	1 and 2	Y = 0.849 X - 2.47
Horses	3	Y = 0.908 X - 3.77
Horses	4	Y = 0.916 X - 2.76
Rabbits	1 and 2	Y = 0.772 X - 1.33
Sheep	1	Y = 0.897 X - 3.43
Sheep	2	Y = 0.932 X - 3.01
Sheep	3	Y = 0.908 X - 3.77
Sheep	4	Y = 0.916 X - 2.76

[a] Knight and Harris (1966).

TABLE 4.5 Conversion of β Carotene to Vitamin A for Different Species

Species	Conversion mg β-Carotene to IU of Vitamin A mg	IU	IU of Vitamin A Activity (calculated from carotene) %
Standard	1 =	1,667	100.0
Beef cattle	1 =	400	24.0
Dairy cattle	1 =	400	24.0
Sheep	1 =	400-500	24.0–30.0
Swine	1 =	500	30.0
Horses			
Growth	1 =	555	33.3
Pregnancy	1 =	333	20.0
Poultry	1 =	1,667	100.0
Dogs	1 =	833	50.0
Rat	1 =	1,667	100.0
Foxes	1 =	278	16.7
Cat	Carotene not utilized		
Mink	Carotene not utilized		
Man	1 =	556	33.3

[a] Taken from Beeson (1965).

TABLE 5.1 Atlas Format for Tables of Feed Composition

Feed Name or Nutrient			As Fed	Dry	No. Analyses	Coeff. of Var.[a]
Wheat, hard red winter, grain *Triticum aestivum* IFN 4-05-268						
Dry matter		%	88.	100.	19	1
Ash		%	1.7	1.9	13	12
Crude fiber		%	2.5	2.8	12	8
Sheep	dig. coef.	%	33.	33.	3	
Ether extract		%	1.6	1.8	15	16
Sheep	dig. coef.	%	72.	72.	2	
Nitrogen free extract		%	69.7	79.2	5	1
Sheep	dig. coef.	%	92.	92.	2	
Protein		%	12.6	14.3	15	6
TDN Ruminant		%	78.	89.	2	
TDN Cattle		%	78.	89.	1	
TDN Sheep		%	78.	89.	1	
DE Ruminant		Mcal/kg	3.43[b]	3.92[b]		
DE Sheep		Mcal/kg	3.46	3.93		
ME Ruminant		Mcal/kg	3.09[b]	3.51[b]		
ME Cattle		Mcal/kg	3.09	3.51		
ME Sheep		Mcal/kg	3.10	3.52		
NE_m Ruminant		Mcal/kg	2.12[c]	2.41[c]		
NE_m Cattle		Mcal/kg	2.12[c]	2.41[c]		
NE_g Ruminant		Mcal/kg	1.46[c]	1.66[c]		
NE_g Cattle		Mcal/kg	1.46[c]	1.66[c]		
ME_n Chicken		kcal/kg	3210.	3648.	3	
NE_p Chicken		kcal/kg	1934.			
TDN Swine		%	76.	86.		
DE Swine		kcal/kg	3318.[c]	3771.[c]		
ME Swine		kcal/kg	3090.[c]	3511.[c]		
DP Ruminants		%	8.5[c]	9.7[c]		
DP Cattle		%	8.0[c]	9.1[c]		
DP Sheep		%	9.1[c]	10.3[c]		
DP Horse		%	9.1[c]	10.3[c]		
Calcium		%	.04	.05	14	11
Chlorine		%	.05	.06	2	
Magnesium		%	.11	.13	10	20
Phosphorus		%	.38	.43	14	8
Potassium		%	.43	.49	12	10
Sodium		%	.02	.02	9	91
Sulfur		%	.13	.15	2	

TABLE 5.1 Atlas Format for Tables of Feed Composition (Continued)

Feed Name or Nutrient		As Fed	Dry	No. Analyses	Coeff. of Var.[a]
Cobalt	mg/kg	.14	.16	8	40
Copper	mg/kg	4.8	5.4	8	20
Iron	mg/kg	31.2	35.4	10	17
Manganese	mg/kg	29.0	32.9	9	20
Selenium	mg/kg	.399	.453	8	88
Zinc	mg/kg	37.7	42.8	8	28
Biotin	mg/kg	.11	.12	1	
Carotene	mg/kg	.1	.1	3	
Choline	mg/kg	1040.	1179.	9	18
Folic acid	mg/kg	.39	.44	4	9
Niacin	mg/kg	53.6	60.9	161	18
Pantothenic acid	mg/kg	9.8	11.1	159	31
Riboflavin	mg/kg	1.4	1.6	160	18
Thiamine	mg/kg	4.2	4.8	159	10
Vitamin B_6	mg/kg	3.0	3.4	154	23
Vitamin E	mg/kg	11.0	12.5	4	25
Arginine	%	.64	.73	9	4
Cystine	%	.32	.36	9	9
Glycine	%	.57	.65	8	4
Histidine	%	.30	.34	9	8
Isoleucine	%	.51	.58	8	9
Leucine	%	.89	1.00	8	6
Lysine	%	.36	.41	9	4
Methionine	%	.21	.24	9	11
Phenylalanine	%	.63	.71	8	6
Serine	%	.59	.67	7	7
Threonine	%	.37	.42	8	11
Tryptophan	%	.17	.19	3	
Tyrosine	%	.43	.49	9	6
Valine	%	.59	.67	8	12

[a] Coefficient of variation is calculated if there are four or more analyses.
[b] Weighted average of cattle and sheep.
[c] Calculated by formula (see Section 4.3).

TABLE 5.2 Example Table with International Feed Names Listed Alphabetically, followed by Scientific Names. Data Expressed (1) As Fed (2) Moisture Free

Entry Number	International Feed Name Scientific Name	International Feed Number	Dry Matter (%)	Calcium (%)	Chlorine (%)	Magnesium (%)	Phosphorus (%)	Potassium (%)	Sodium (%)	Sulfur (%)	Cobalt (%)	Copper (%)
	ALFALFA. *Medicago sativa*											
01	—fresh	2-00-196	24.	.48	.11	.07	.07	.51	.05	.09	.032	2.4
02			100.	1.96	.47	.27	.30	2.09	.19	.37	.133	9.9
03	—hay, sun-cured, early bloom	1-00-059	91.	1.28	.34	.30	.20	2.29	.13	.25	.146	9.9
04			100.	1.41	.38	.33	.22	2.52	.14	.28	.161	10.9
05	—hay, sun-cured, midbloom	1-00-063	91.	1.28	.34	.29	.22	1.55	.11	.26	.327	11.8
06			100.	1.41	.38	.31	.24	1.71	.12	.28	.360	13.0
	ALMOND. *Prunus amygdalus*											
07	—hulls	4-00-359	90.	.21	—	—	.10	.47	—	.10	—	—
08			100.	.23	—	—	.11	.53	—	.11	—	—
	BAHIAGRASS. *Paspalum notatum*											
09	—fresh	2-00-464	30.	.14	—	.07	.06	.43	—	—	—	—
10			100.	.46	—	.25	.22	1.45	—	—	—	—
	BAKERY											
11	—waste, dehydrated (dried bakery product)	4-00-466	92.	.13	1.48	.24	.24	.49	1.14	.02	.968	4.9
12			100.	.14	1.61	.26	.26	.53	1.24	.02	1.053	5.3
	BARLEY. *Hordeum vulgare*											
13	—grain	4-00-549	88.	.04	.16	.14	.34	.41	.03	.15	.087	7.9
14			100.	.05	.18	.15	.38	.47	.03	.17	.099	9.0
15	—hay, sun-cured	1-00-495	87	.20	—	.16	.23	1.03	.12	.15	.058	21.2
16			100.	.23	—	.18	.26	1.16	.14	.17	.066	24.3
17	—straw	1-00-498	91.	.27	.61	.21	.07	2.16	.13	.16	.060	4.9
18			100.	.30	.67	.23	.07	2.37	.14	.17	.066	5.4
	BEET, SUGAR. *Beta vulgaris altissima*											
19	—aerial part with crowns, silage	3-00-660	22.	.35	—	.24	.06	1.28	.12	.13	—	—
20			100.	1.56	—	1.07	.29	5.74	.54	.57	—	—
21	—pulp, dehydrated	4-00-669	91.	.63	.04	.24	.09	.18	.19	.20	.073	12.5
22			100.	.69	04	.27	.10	.20	.21	.22	.081	13.8
	CARROT. *Daucus spp*											
23	—roots, fresh	4-01-145	12.	.05	.06	.02	.04	.33	.12	.02	—	1.2
24			100.	.40	.50	.20	.35	2.80	1.04	.17	—	10.4
	CATTLE. *Bos taurus*											
25	—livers, fresh	5-01-166	28.	.01	—	.01	.23	.20	.10	—	—	6.1
26			100.	.04	—	.04	.82	.72	.35	—	—	21.9
27	—lungs, fresh	5-07-941	21.	.01	—	.01	.15	.07	.15	—	.089	1.0
28			100.	.06	—	.03	.69	.33	.69	—	.416	4.6

TABLE 5.3 Example Table with Scientific Names Listed Alphabetically, followed by International Feed Names. Data Expressed (1) As Fed (2) Moisture Free

Entry Number	Scientific Name International Feed Name	International Feed Number	Dry Matter (%)	Calcium (%)	Chlorine (%)	Magnesium (%)	Phosphorus (%)	Potassium (%)	Sodium (%)	Sulfur (%)	Cobalt (%)	Copper (%)
	BAKERY											
01	—waste, dehydrated (dried bakery product)	4-00-466	92.	.13	1.48	.24	.24	.49	1.14	.02	.968	4.9
02			100.	.14	1.61	.26	.26	.53	1.24	.02	1.053	5.3
	BETA VULGARIS ALTISSIMA. Beet, sugar											
03	—aerial part with crowns, silage	3-00-660	22.	.35	–	.24	.06	1.28	.12	.13	–	–
04			100.	1.56	–	1.07	.29	5.74	.54	.57	–	–
05	—pulp, dehydrated	4-00-669	91.	.63	.04	.24	.09	.18	.19	.20	.073	12.5
06			100.	.69	.04	.27	.10	.20	.21	.22	.081	13.8
	BOS TAURUS. Cattle											
07	—livers, fresh	5-01-166	28.	.01	–	.01	.23	.20	.10	–	–	6.1
08			100.	.04	–	.04	.82	.72	.35	–	–	21.9
09	—lungs, fresh	5-07-941	21.	.01	–	.01	.15	.07	.15	–	.089	1.0
10			100.	.06	–	.03	.69	.33	.69	–	.416	4.6
	DAUCUS SPP. Carrot											
11	—roots, fresh	4-01-145	12.	.05	.06	.02	.04	.33	.12	.02	–	1.2
12			100.	.40	.50	.20	.35	2.80	1.04	.17	–	10.4
	HORDEUM VULGARE. Barley											
13	—grain	4-00-549	88.	.04	.16	.14	.34	.41	.03	.15	.087	7.9
14			100.	.05	.18	.15	.38	.47	.03	.17	.099	9.0
15	—hay, sun-cured	1-00-495	87.	.20	–	.16	.23	1.03	.12	.15	.058	21.2
16			100.	.23	–	.18	.26	1.18	.14	.17	.066	24.3
17	—straw	1-00-498	91.	.27	.61	.21	.07	2.16	.13	.16	.060	4.9
18			100.	.30	.67	.23	.07	2.37	.14	.17	.066	5.4
	MEDICAGO SATIVA. Alfalfa											
19	—fresh	2-00-196	24.	.48	.11	.07	.07	.51	.05	.09	.032	2.4
20			100.	1.96	.47	.27	.30	2.09	.19	.37	.133	9.9
21	—hay, sun-cured, early bloom	1-00-059	91.	1.28	.34	.30	.20	2.29	.13	.25	.146	9.9
22			100.	1.41	.38	.33	.22	2.52	.14	.28	.161	10.9
23	—hay, sun-cured, midbloom	1-00-063	91.	1.28	.34	.29	.22	1.55	.11	.26	.327	11.8
24			100.	1.41	.38	.31	.24	1.71	.12	.28	.360	13.0
	PASPALUM NOTATUM. Bahiagrass											
25	—fresh	2-00-404	30.	.14	–	.07	.06	.43	–	–	–	–
26			100.	.46	–	.25	.22	1.45	–	–	–	–
	PRUNUS AMYGDALUS. Almond											
27	—hulls	4-00-359	90.	.21	–	–	.10	.47	–	.10	–	–
28			100.	.23	–	–	.11	.53	–	.11	–	–

TABLE 5.4 Example Table with International Feed Names Only, Listed Alphabetically. Data Expressed (1) As Fed (2) Moisture Free

Entry Number	International Feed Name	International Feed Number	Dry Matter (%)	Calcium (%)	Chlorine (%)	Magnesium (%)	Phosphorus (%)	Potassium (%)	Sodium (%)	Sulfur (%)	Cobalt (%)	Copper (%)
01	Alfalfa, meal dehydrated, 17% protein	1-00-023	92.	1.40	.47	.29	.23	2.39	.10	.22	.302	9.7
02			100.	1.52	.52	.32	.25	2.60	.11	.24	.329	10.6
03	Bean, seeds, navy	5-00-623	89.	.16	.06	.13	.52	1.31	.04	.23	–	9.9
04			100	.18	.06	.15	.59	1.47	.05	.26	–	11.0
05	Cassava, common, tubers, dehydrated	4-09-598	88.	.25	–	–	.17	.23	–	–	–	–
06			100.	.28	–	–	.19	.26	–	–	–	–
07	Cattle, buttermilk, dehydrated	5-01-160	92.	1.33	.40	.48	.94	.83	.83	.08	–	1.0
08	Dried Buttermilk, feed grade		100.	1.44	.43	.52	1.01	.90	.90	.09	–	1.1
09	Cereals, screenings	4-02-156	90.	.33	–	.12	.35	.30	.40	–	–	–
10			100.	.37	–	.14	.39	.34	.45	–	–	–
11	Corn, dent yellow, aerial part without ears	1-28-233	85.	.49	–	.34	.08	1.24	.06	.15	–	4.3
12	without husks, sun-cured (stover) (straw)		100.	.57	–	.40	.10	1.45	.07	.17	–	5.1
13	Oats, cereal by-product less than 4% fiber	4-03-303	91.	.07	.05	.14	.44	.50	.09	.22	.045	4.4
14	Feeding Oat Meal; Oat Middlings		100.	.08	.06	.16	.49	.55	.10	.24	.049	4.8
15	Poultry, feathers, hydrolyzed	5-03-795	91.	.25	.28	.20	.66	.28	.69	1.47	.043	6.4
16			100.	.28	.30	.22	.72	.31	.76	1.61	.047	7.0
17	Rape, seeds, meal solvent extracted	5-03-871	91.	.61	.10	.55	.95	1.24	.09	1.14	–	–
18			100.	.67	.11	.60	1.04	1.36	.10	1.25	–	–
19	Safflower, seeds	4-07-958	94.	.24	–	.34	.63	.74	.06	–	–	10.0
20			100.	.26	–	.36	.67	.79	.06	–	–	10.7
21	Soybean,seeds, heat processed	5-04-597	90.	.25	–	.21	.59	1.70	.28	.22	–	15.8
22			100.	.28	–	.23	.66	1.89	.31	.24	–	17.6
23	Soybean, straw	1-04-567	88.	1.40	–	.81	.05	.49	.11	.23	–	–
24			100.	1.59	–	.92	.06	.56	.12	.26	–	–
25	Trefoil, hay, sun-cured	1-05-044	92.	1.57	–	.47	.25	1.77	.06	.23	.102	8.5
26			100.	1.70	–	.51	.27	1.92	.07	.25	.110	9.3
27	Wheat, grain, hard red winter	4-05-268	88.	.04	.05	.11	.38	.43	.02	.13	.141	4.8
28			100.	05	.06	.13	.43	.49	.02	.15	.160	5.4
29	Wheat, straw	1-05-175	89.	.16	.28	.11	.04	1.26	.13	.17	.040	3.2
30			100.	.18	.32	.12	.05	1.42	.14	.19	.045	3.6
31	Wheatgrass, crested, fresh	2-05-429	39.	.18	–	.11	.07	–	–	–	–	–
32			100.	.45	–	.28	.19	–	–	–	–	–
33	Yeast, torula, dehydrated	7-05-534	.93	.50	.02	.17	1.59	1.90	.04	.55	.030	13.4
34			100.	.54	.02	.18	1.71	2.04	.04	.59	.032	14.4

TABLE 5.5 Example Table with Scientific Names Listed Alphabetically, followed by Indonesian Feed Names and International Feed Names. Data Expressed (1) As Fed (2) Moisture Free

Nomor Antrian / Entry Number	Nama-Nama Ilmiah / Nama-Nama Bahan Makanan Internasional / Scientific Names / International Feed Name	Nomor Bahan Makanan Ternak Internasional / International Feed Number	Bahan Kering / Dry Matter (%)	Abu / Ash (%)	Ekstrak Eter / Ether Extract (%)	Serat Kasar / Crude Fiber (%)	Betn Nitrogen Free / Extract (%)	Protein Kasar / Crude Protein (%)	Protein Digestible — Sapi / Cattle (%)
	ACHATINA FULICA.								
	Bekicot, keong, daging keong, tanpa rumah, kering, digiling								
0001	Snail, African, giant, meat,	5-29-337	86.	7.2	6.1	-	26.5	44.0	-
0002	dehydrated		100.	8.4	7.1	-	30.8	51.2	-
	Bekicot, keong, keseluruhan keong,								
0003	dengan rumah, kering, digiling	5-12-355	86.	-	-	-	-	28.0	-
0004	Snail, African, giant, whole, meal		100.	-	-	-	-	32.6	-
	ANANAS COMOSUS.								
	Nanas, limbah pengalengan nanas, kulit								
0005	dan sumbu buah, basah	4-26-968	12.	.5	.2	1.7	8.9	.4	-.1*
0006	Pineapple, process residue, fresh		100.	4.3	1.7	14.5	76.1	3.4	-.8*
	ANIMAL.								
0007	Darah hewan, kering, digiling	5-00-380	86.	4.6	1.1	.5	3.0	76.8	-
0008	Animal, blood, meal		100.	5.3	1.3	.6	3.5	89.3	-
0009	Tepung daging, sisa daging, digiling	5-00-385	86.	2.8	7.2	.5	16.9	58.6	42.8+
0010	Animal, meat, meal rendered		100.	3.3	8.4	.6	19.7	68.1	49.8+
	Tepung daging dan tulang, kering,								
0011	digiling	5-00-388	86.	25.5	8.4	1.4	4.0	46.7	42.3+
0012	Animal, meat with bone, meal rendered		100.	29.7	9.8	1.6	4.7	54.3	49.2+
	ARACHIS HYPOGAEA.								
	Kacang tanah, bagian aerial, dewasa,								
0013	tanpa biji/kulit, segar	2-03-637	35.	3.9	.8	8.0	17.2	5.3	3.8*
0014	Peanut, fresh, mature		100.	11.1	2.3	22.7	48.9	15.1	10.7*
	Kacang tanah, bagian aerial, dewasa,								
0015	tanpa biji/kulit, kering	1-03-623	86.	10.6	2.3	25.8	34.7	12.6	8.3*
0016	Peanut, hay, sun-cured, mature		100.	12.3	2.7	30.0	40.3	14.7	9.6*
	Kacang tanah, butiran kering, ekstraksi mekanis, digiling								
0017	Peanut, kernels, meal mechanical	5-03-649	86.	6.2	2.4	11.0	18.0	48.4	40.0+
0018	extracted		100.	7.2	2.8	12.8	20.9	56.3	46.6+
	Kacang tanah, butiran kering, ekstraksi solven, digiling								
0019	Peanut, kernels, meal solvent	5-03-650	86.	6.2	2.4	11.0	18.0	48.4	40.5+
0020	extracted		100.	7.2	2.8	12.8	20.9	56.3	47.1+
	Kacang tanah, butiran dengan kulit,								
0021	lemak penuh, kering, digiling	5-03-652	86.	2.3	42.9	2.4	11.9	26.5	-
0022	Peanut, kernels with coats, ground		100.	2.7	49.9	2.8	13.8	30.8	-
	ARTOCARPUS ALTILIS.								
0023	Daging buah, segar	4-10-619	31.	2.0	1.8	5.5	16.2	5.2	3.6*
0024	Breadfruit, fruit, fresh		100.	6.5	5.9	17.9	52.8	16.9	11.6*
	Sukun, daging buah sisa dari buah,								
0025	kulit dan pulp, segar	4-12-353	13.	1.5	.6	2.4	8.0	.9	.3*
0026	Breadfruit, pomace, fresh		100.	11.2	4.5	17.9	59.7	6.7	2.2*
	Sukun, daging buah pomance tanpa kulit segar								
0027	Breadfruit, pomace without peelings,	4-12-352	15.	1.2	.3	1.4	10.4	1.7	1.0*
0028	fresh		100.	8.0	2.0	9.3	69.3	11.3	6.4*
	ARTOCARPUS HETEROPHYLLUS.								
0029	Nangka, bagian aerial, daun, segar	2-27-195	16.	4.0	.7	3.2	6.1	2.0	1.4*
0030	Jackfruit, leaves, fresh		100.	25.0	4.4	20.0	38.1	12.5	8.5*
	Nangka, bagian aerial, daun, kering								
0031	matahari	1-29-632	86.	21.8	3.8	17.0	32.9	10.5	6.5*
0032	Jackfruit, leaves, sun-cured		100.	25.3	4.4	19.8	38.3	12.2	7.5*

TABLE 5.6 An Example of a Computerized Diet

Least Cost Ration System (Beef) USU - Animal Science Department
John Butcher Ration - April 26, 1978

Ration Restrictions

Animal Type		Steer
Weight	kg	318.2
Gain	kg	1.23
Maximum dry matter intake	kg	8.30
Net energy for maintenance	MJ	26.750
Net energy for gain	MJ	23.548
Total Net Energy	MJ	50.298

Ration Requirements

Item	More than (%)	Less than (%)
Crude protein	11.11	17.00
Digestible protein	7.10	12.00
Crude fiber	8.00	40.00
Calcium	0.43	1.23
Phosphorus	0.31	0.41
Roughage	10.00	100.00
Dry matter	35.00	

Feeds Considered During this Formulation

Feed	As is Cost $/mton[a]	Dry Cost $/mton	Dry Matter (%)	Restrictions (%)		(%)
Corn, silage, 30% dry matter	23.10	82.80	27.90	10.00	LT[b]	0.00[d]
Alfalfa, silage	18.70	66.08	28.30	0.00		0.00
Alfalfa, hay, sun-cured, midbloom	58.30	65.36	89.20	0.00		0.00
Wheat, soft white winter, grain, Pacific coast	107.80	120.86	89.20	0.00		0.00
Barley, grain	114.40	128.54	89.00	0.00		0.00
Corn, dent, yellow, grade 3, 669 G/L	108.90	126.63	86.00	0.00		0.00
Urea, 45% nitrogen 281% protein equivalent	192.50	192.50	100.00	0.90	LT	0.00
Salt, NaCl	28.60	28.60	100.00	0.25	EQ[c]	0.00
Limestone, ground	49.50	49.50	100.00	0.00		0.00
Bordens supplement	253.00	253.00	100.00	0.00		0.00

TABLE 5.6 An Example of A Computerized Diet (Continued)

Feed Composition

Feed	Dig. Protein (%)	Crude Fiber (%)	Calcium (%)	Phosphorus (%)	NE_m (MJ/kg)	NE_g (MJ/kg)
Corn, silage, 30% dry matter	4.90	26.30	0.28	0.21	6.516	4.135
Alfalfa, silage	15.78	28.90	1.40	0.32	4.723	1.684
Alfalfa, hay, sun-cured, midbloom	12.10	30.90	1.35	0.22	5.178	2.465
Wheat, soft white winter, grain, Pacific coast	8.60	3.00	0.14	0.34	8.980	5.932
Barley, grain	9.80	5.60	0.09	0.47	8.899	5.848
Corn, dent, yellow, grade 3, 669 G/L	7.60	2.30	0.02	0.29	9.523	6.182
Urea, 45% nitrogen 281% protein equivalent	243.80	0.00	0.00	0.00	0.000	0.000
Salt, NaCl	0.00	0.00	0.00	0.00	0.000	0.000
Limestone, ground	0.00	0.00	33.84	0.02	0.000	0.000
Bordens supplement	0.00	0.00	31.00	18.00	0.000	0.000

Feeds Rejected from Solution

Feed	Present Cost $/mton	Feasible Cost $/mton
Barley, grain	114.40	108.46
Corn, dent yellow, grade 3, 669 G/L	108.90	107.66
Alfalfa, silage	18.70	15.65
Urea, 45% nitrogen 281% protein equivalent	192.50	136.22

Final Solution

Feed	Feasible Cost Range $/mton		As Fed (%)	Dry (%)	As Fed (kg)
	Low	High			
Corn, silage, 30% dry matter	---	23.96	37.603	15.850	12.088
Alfalfa, hay, sun-cured, midbloom	53.17	60.43	11.221	15.122	1.356
Wheat, soft white winter, grain, Pacific coast	103.84	108.97	50.798	68.457	6.140
Salt, NaCl	---	---	0.172	0.259	0.020
Limestone, ground	0.29	274.00	0.125	0.189	0.015
Bordens supplement	45.34	1220.86	0.081	0.123	0.010
TOTALS			100.000	100.000	12.088

TABLE 5.6 An Example of A Computerized Diet (Continued)

Dry Matter and Cost		
Dry matter	66.19	%
Cost/metric ton as fed	70.30	US$
Cost/metric ton dry matter	106.22	US$
Cost/day	84.984	US¢
Cost/kg gain	69.247	US¢
Dry Matter Composition		
Net energy for maintenance	7.962	MJ/kg
Net energy for gain	5.087	MJ/kg
Crude protein	12.70	%
Digestible protein	8.49	%
Crude fiber	10.90	%
Calcium	0.446	%
Phosphorus	0.321	%
Calcium/phosphorus ratio	1.39	

[a] mton = metric ton

[b] LT = less than

[c] EQ = equal to

[d] This column is used for more than MT

Figures

PREVIOUS PAGE BLANK

Laboratory Sample No._____
Project No._____
Leader _____
Date of Collection: Year/Month/Day _____
Place of Collection _____
Sample Description[a] _____
_____
_____
Initials of person doing work[b] _____

[a]Sufficient data should be put here to give the chemist an idea of what kind of a sample is being analyzed, and to complete the description required on the source form.

[b] The workers initials appearing in this form should be listed in a bound book with full name and address.

FIGURE 3.1 Feed samples should be labeled with this information.

INTERNATIONAL SOURCE FORM FOR COMPOSITION OF FEEDS

Read instructions before filling in form. Please print.

Source Form No. 1

ORIGIN OF DATA CARD 10

Project No. 10

Country United States 12

State Hawaii 17

Laboratory name Department of Animal Sciences 20

Address Honolulu, Hawaii 96822 22

Sample No. 24

ORIGIN OF SAMPLE

Date originally collected: Year: 1966 Month: Day: 30

Country United States 36

Climatic zone or fishing area 39 44

State, Province or Department Hawaii 46

County Honolulu 48

Bibliographic No. author, year, reference 51

Sherrod, L. B. S.M. Ishizaki

1966

Proc Western Sec Am Soc An Sci vol 17

DESCRIPTION OF FEED

Class category: Dry forage (cut and cured) | Forage grazed | Cut and fed green | Silage | Other

Scientific name: Genus PENNISETUM

Species and variety CLANDESTINUM

Author's common name for scientific name KIKUYUGRASS

Parts of plant, animal or other feed product Aerial Part

Processes undergone before fed to animal Dehydrated

Stage plant maturity or age of animal 21 days growth

No. of crop or number of cut Regrowth early vegetative

Grade IFN 58

Plant cross 65

Additives: Name 69

Weight in (check one) mg | g | kg 73

Weight per metric ton 74

Season dry | wet 77

Fertilizer yes | no | unknown 78

DIGESTIBILITY TRIAL CARD 30 10

Animal kind: Sheep 12

Breed Hampshire Sex Wether 15 18

Animal requirements 19

Age: Years 1 Months 10 Weeks 1 21

Number of animals used for digestibility determination of the above feed 26

Average weight of animals, kg 480 28

Physiological state: non-pregnant ✓	pregnant 1st 2/3	pregnant last 1/3	36
losing wt	✓ maintaining wt	gaining wt	fattening 37
lactating	laying eggs	working	38
very thin	thin	thrifty ✓	fat very fat 39

Percent of test ingredient in ration fed (100.0% dry matter) 40

Ad libitum feeding ✓ Controlled feeding 42

Feed fed alone ✓ Feed not fed alone, digestibility by difference 43

Method: Total feces collection ✓ Feces indicator 44

Length of trial: Preliminary days 7 Collection days 7 45 47

Daily dry matter consumed kg 0.4 49

Weekly dry matter consumed kg 56

FIGURE 3.2 This source form may be used to describe the feed sample and record data for card formats

CARD 4

Check analyses wanted	Proximate Principal	Code	Unit	Quantity	Anal. Code Factor	Unit Code	Method of Analyses	Digestion Coefficient %
☑	Dry matter of sample on "as fed" basis	101	%	11.5				
	BASIS OF DATA†							
☐	As fed	102	%					
☐	Partially dry	103	%					
☑	Dry (100.0% dry matter)	104	%	100.0				
☑	Ash	105	%	9.6			Assoc. Official Agr. Chem. 1960	
☑	Protein	109	%	20.8			Kjeldahl	71.2
☑	Nitrogen	212	%	3.3			do	
☑	Ether extract	107	%	3.1			Assoc. Official Agr. Chem. 1960	51.6
☑	Crude fiber	106	%	25.6			Weende	56.6
☑	Nitrogen-free extract	108	%	40.9			By difference	57.5
	ORGANIC MATTER, ETC.							
☑	Organic matter	110	%	90.4			By difference (total minus ash)	60.7
☐	Cell contents	328	%				Van Soest J Animal Sci. 26.119–128 1967	
☐	Cell walls (neutral detergent fiber)	329	%				Van Soest J Assoc Official Anal. Chem 50 50. 1967	
☐	Cellulose	330	%				Van Soest J Assoc. Official Anal. Chem. 51 780. 1968	
☐	Fiber, acid detergent	273	%				Van Soest J. Assoc. Official Agr. Chem. 46 829. 1963	
☐	Lignin, acid detergent	270	%				Van Soest J. Assoc. Official Agr. Chem 46 829 1963	
☐	*in vitro* dry matter digestion coefficient	916					Tilley and Terry J British Grassl Soc. 18 104 1963	
	ENERGY							
☑	Gross energy (GE)	421	MJ/kg	18.133			Bomb calorimeter	55.8
☑	Digestible (DE)	422	MJ/kg	10.217			Harris Natl. Acad. Sci. Natl. Res Council pub 1411. 1966	
☐	Metabolizable (ME)	423	MJ/kg				do	
☐	Metabolizable (ME_n)	424	MJ/kg				do	
☑	TDN	429	%	56.6			Biological	
	MINERALS							
☑	Calcium	530	%	0.32			Chemical ☐ Atomic ☑ Spectrographic ☐	
☑	Magnesium	533	%	0.35			Chemical ☐ Atomic ☑ Spectrographic ☐	
☑	Phosphorus	534	%	0.30			Chemical ☑	
☑	Manganese	542	mg/kg	233.1			Chemical ☐ Atomic ☑	
	VITAMINS							
☐	Carotene	647	mg/kg				Assoc Official Agr. Chem. 1960	
☑	Riboflavin	652	mg/kg	20.4			do	
☐	Thiamine	653	mg/kg				do	
	OTHER ANALYSES AND OTHER DIGESTION COEFFICIENTS† (use two lines if necessary)							
☑	Copper	539	mg/lb	2.31			Atomic absorption	
☑	Potassium	535	mg/lb	6045.			do	
☑	Iron	532	%	.023			do	
☑	Niacin	650	mg/kg	49.8			Chemical	
☑	Arginine	764	g/16gN	2.3			Chromatography by gas	
☑	Fatty acids	210	%	1.8			do	
☑	Linoleic	248	g fatty acid/100 g fat	1.6			do	
☑	Stearic	266	g fatty acid/100 g fat	1.2			do	

† For a list of other analyses and other digestion coefficients see Table 3.9.

10, 21, 22, 24, 30 and 4 (see back of page).

PLANT PROTECTION

CARD 24 (cont.)

Pesticide (brand): Kelthane PPS — 35
Class of pesticide: insecticides — 38
Form of pesticide: fine spray products — 39
Active ingredients %: — 40
Application method: fine spraying — 42
Application type: aerial — 43
Unit for pesticide: g/ha | kg/ha | l/ha — 44
Pesticide quantity in relation to unit: — 45
Number of applications: 2 — 51
Days between last application and harvest: 10 — 53

RESIDUES OF PESTICIDES IN FEED OF ANIMAL ORIGIN

Pesticide in diet unit (check one): µg/kg | mg/kg | g/kg — 56
Quantity of pesticide in relation to unit: — 57
Daily intake of pesticide (mg): — 63
Feeding period, days: 21 — 68
Weight of animals at beginning (kg): 48.0 — 71

SUPPLEMENTARY INFORMATION ABOUT FEEDS

1.19b

QUALITY

CARD 21

Feed quality by class
Degree of purity % 90
Foreign material weed seeds

SOIL

Soil units calcic luvisols
Soil texture class medium texture
Soil slope classes
Soil–pH 7.5
Water (type) furrow irrigation
Irrigation plus rainfall (millimeters)

FERTILIZATION

N–fertilizer: ammonium sulfa-nitrate
quantity in kg per hectare 158
No. of days between last application and harvest 50
P–fertilizer: type super phosphate
quantity in kg per hectare 114
K–fertilizer: type potassium sulfate
quantity in kg per hectare 114
Ca–fertilizer: type
quantity in kg per hectare
Organic manuring: type
quantity in 100kg per hectare
Trace–elements–fertilizer: type
quantity in kg per hectare
Mix fertilizer: type
quantity in kg per hectare

CARD 22

Height when cut (cm) 50.5
Stubble height (cm) 8.0
Storage facility stack
Kind of building material
Kind of covering or lock plastic sheet
No. of days stored 60
Temperature in storage container (C°)
Humidity in container
Light and air in container

CARD 24

POLLUTION

Pollution source industry (sewage)
Pollution substance fluorine
State of substance gasiform
Distance between source and receptor 4-5 km
Wind direction lateral to prevailing wind
Pollutant concentration µg/m³ | ✓ mg/m³ | mg/kg | mg/l
Pollutant quantity in relation to unit 25.0
Intensity of traffic
Time exposed to pollutant: days 21
Damage symptoms on original material healthy looking

International Source Form for Composition of Feeds

Read instructions before filling in form.

Source form No. 1

Origin of data — Card 10

Project No.

Country: United States

State: Hawaii

Laboratory name: Department of Animal Science

Address: Honolulu, Hawaii 96822

Sample No.

Origin of sample

Date originally collected: Year: 1966 Month: Day:

Country: United States

Climatic zone or fishing area Fishing area

State, Province or Department: Hawaii

County or District: Honolulu

Literature reference No.

Description of feed

Class category: Dry forage (cut and cured) | Forage grazed | Cut and fed green | Silage | Other

Scientific name: Genus: PENNISETUM

Species and variety: CLANDESTINUM

Author's common name for scientific name: Kikuyugrass

Parts of plant, animal or other feed product: Aerial Part

Processes undergone before fed to animal: Dehydrated

Stage plant maturity or age of animal: 21 days growth

No. of crop or number of cut: Regrowth early vegetative

Official grade (name and No.) International feed reference number

Short name (filled in at Feed Center)

Plant cross

Additives: Name

Weight in (check one) mg | g | kg

Weight per metric ton

Season: dry | wet ✓

Fertilizer: yes ✓ | no

Digestibility Trial

Card 30

Animal: Kind: Sheep

Breed: Hampshire Sex: wether

Animal requirements

Age: Years Months Weeks

Number of animals used for digestibility determination of the above feed

Average weight of animals, kg

Physiological state: non-pregnant ✓ | pregnant 1st 2/3 | pregnant last 1/3

losing wt ✓ | maintaining wt | gaining wt | fattening

lactating | laying eggs | working

very thin | thin | thrifty ✓ | fat | very fat

Percent of test ingredient in ration fed (100.0% dry matter)

Ad libitum feeding ✓ | Controlled feeding

Feed fed alone ✓ | Feed not fed alone, digestibility by difference

Method: Total feces collection ✓ | Feces indicator

Length of trial: Preliminary days 7 Collection days 7

Daily dry matter consumed kg 0.40

Weekly dry matter consumed kg

Check analyses wanted: ✓

Card 4

Dry Matter

Dry matter of sample on "as fed" basis

Dry Matter Basis

As fed

Partially dry

Dry (100.0% dry matter)

Proximate Principles

Ash

Crude fiber

Ether extract

Nitrogen-free extract

Protein

Nitrogen

Nitrogen factor

Organic Matter

Organic matter

Cell contents

Cell walls (neutral detergent fiber)

Cellulose

Cellulose

Cellulose

Fiber, acid detergent

Lignin

Lignin, acid detergent

Lignin, $KMnO_4$ in vitro dry matter digestion coeff.

Per cent rumen (nylon bag)

Energy

Gross energy

Digestible

Metabolizable

N-equilibrium metabolizable

NE_m

NE gain

TDN

Minerals

Calcium

Iron

Magnesium

Phosphorus

Potassium

Sulfur

Other Analys

Code (leave blank)

†For a list of other analyses and other digestion coefficients see Table 3.9.

FIGURE 3.3 This source form may be used to describe the feed sample and record data from card formats 10, 30 and 4.

Matter

		Dry Matter %	Method of analyses; if analysis was done by another method put under other analyses.	Anal. code factor	Digestion coeff. %	Check analyses wanted
matter of sample s fed" basis	101	11.5	Above 105° C or in vacuum			✓

Matter Basis on Which Analytical Data are Reported on This Form

	Check one only		Fill in one only %
		002	
lly dry		003	
00.0% natter)		004	100.0

NOTE: All analytical data on this sheet, except dry matter, must be expressed as indicated i.e.: as fed, partially dry, dry(100.0% dry matter). Where analytical data for one feed is partly on one basis and partly on another, use separate sheet for each basis or convert to same basis.

imate Principles

		%	Method of analyses; if analysis was done by another method put under other analyses.	Anal. code factor	Digestion coeff. %
	105	9.6	Assoc. Official Agr. Chem. 1960	01	
fiber	106	26.8	Weende	01	
extract	107	3.1	Assoc. Official Agr. Chem. 1960	01	51.6
gen-free extract	108	40.9	By difference	01	57.5
n	109	20.8	Kjeldahl	01	71.2
gen	212	3.3	do	01	
gen factor	213	6.25	Write in factor to convert to protein		

nic Matter, etc.

		%			
ic matter	110	90.4	By difference (total minus ash)	01	60.7
ontents	328		Van Soest J. Animal Sci. 26:119-128 1967		
alls (neutral gent fiber)	329		Van Soest J. Assoc. Official Anal. Chem. 50:50 1967		
ose	323		Crampton J. Nutrition 15:383 1938		
ose	314		Matrone J. Animal Sci. 5:306. 1946		
ose	330		Van Soest J. Assoc. Official Anal. Chem. 51:780 1968		
detergent	273		Van Soest J. Assoc. Official Agr. Chem. 46:829 1963		
	211		Ellis J. Animal Sci. 5:285. 1946		
detergent	270		Van Soest J. Assoc. Official Agr. Chem. 46:829 1963		
, $KMnO_4$	280		Van Soest J. Assoc. Official Anal. Chem. 51:780 1968		
dry matter tion coeff.	916		Tilley and Terry J. British Grassl. Soc. 18:104. 1963		
rumen digestion n bag)	930		48 hours		

gy

		kcal per kg			
energy	421	4334	Bomb calorimeter		55.8
ible	422	2442	Harris Natl. Acad. Sci. Natl. Res. Council pub. 1411 1966		
olizable	423		do		
uilibrium bolizable	424		do		
	426		Lofgreen J. Animal Sci. 27:793. 1968		
sin	427		do		

		%			
	429	56.6	Biological		

rals

		%	Check method of analysis	Anal. code factor	Digestion coef. %
m	530	0.32	Chemical ☐ Atomic ☐ Spectrographic ☐		
	532	.023	Chemical ☐ Atomic ☐ Spectrographic ☐		
sium	533	0.35	Chemical ☐ Atomic ☐ Spectrographic ☐		
orus	534	0.30	Chemical ☐		
um	535	1.34	Chemical ☐ Atomic ☐ Spectrographic ☐		
	537		Chemical ☐		

Analyses and Other Digestion Coefficients †

	Specify decimal, Unit, Kind and Method of Analyses. Use two lines if necessary.	Anal. code factor	Digestion coef. %
onk	Example: 11.6% Starch USA Assoc. Official Agr. Chem. 1960		

Minerals

		milligram per kg	Check method of analysis	Anal. code factor
Cobalt	538		Chemical ☐ Spectrographic ☐	
Copper	539		Chemical ☐ Atomic ☐ Spectrographic ☐	
Fluorine	540		Chemical ☐	
Iodine	541		Chemical ☐ Atomic ☐ Spectrographic ☐	
Manganese	542		Chemical ☐ Atomic ☐	
Molybdenum	543		Chemical ☐ Atomic ☐ Spectrographic ☐	
Selenium	544		Chemical ☐ Atomic ☐ Spectrographic ☐	
Zinc	545		Chemical ☐ Atomic ☐ Spectrographic ☐	

Vitamins

		milligram per kg	Method of analyses; if analysis was done by another method put under other analyses.	Anal. code factor
Carotene	647		Assoc. Official Agr. Chem. 1960	
Choline	648		Microbiological	
Folic Acid	649		do	
Niacin	650	49.8	do	
Pantothenic acid	651		do	
Riboflavin	652	20.4	do	
Thiamine	653		do	
Vitamin E	654		Chemical	
Vitamin B_6	655		Microbiological	
Vitamin A	639	IU per g	Chemical	
Vitamin D_2 and/or D_3	660	IU per kg	Biological (rats)	
Vitamin D_3	661	ICU per kg	Biological (chicks)	

Amino Acids

		%	Check method of analysis: Amino acid analyzer	Microbiological
Alanine	763			
Arginine	764		do	
Aspartic acid	765		do	
Citrulline	766		do	
Cystine	767		do	
Cysteine	768		do	
Glutamic acid	769		do	
Glycine	770		do	
Histidine	771		do	
Hydroxyproline	772		do	
Isoleucine	773		do	
Leucine	774		do	
Lycine	775		do	
Methionine	776		do	
Phenylalanine	777		do	
Proline	778		do	
Serine	779		do	
Threonine	780		do	
Tryptophan	781		do	
Tyrosine	782		do	
Valine	783		do	

Supplementary information about feeds such as: Give complete description of fertilizer used, i e : kind, rate and when applied; irrigation or non-irrigation, crop badly weathered, conditions of growth, harvesting and curing Put on back of sheet if necessary.

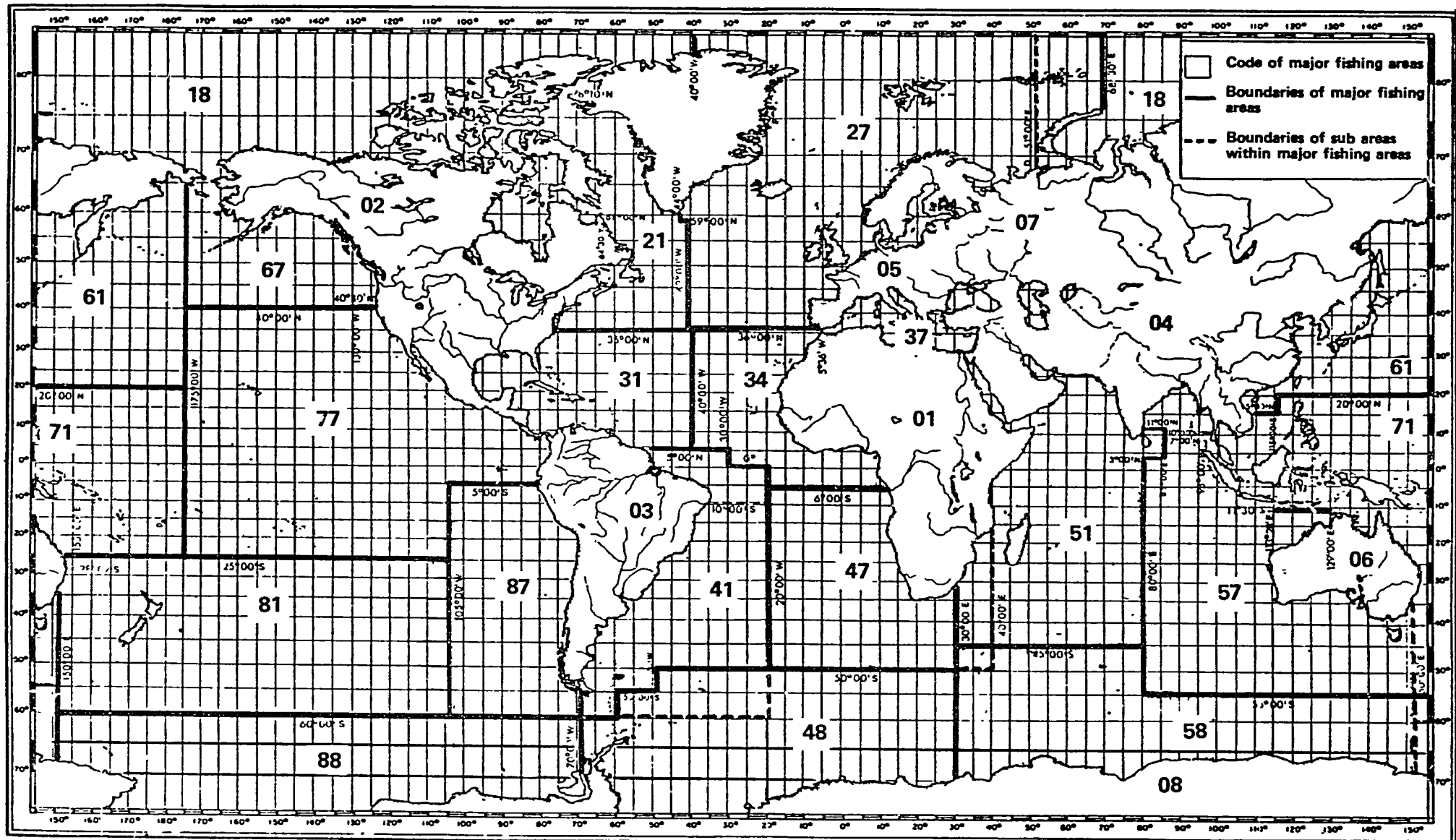

FIGURE 3.4 Map of fishing areas (the numbers on the map are the codes for fishing areas)

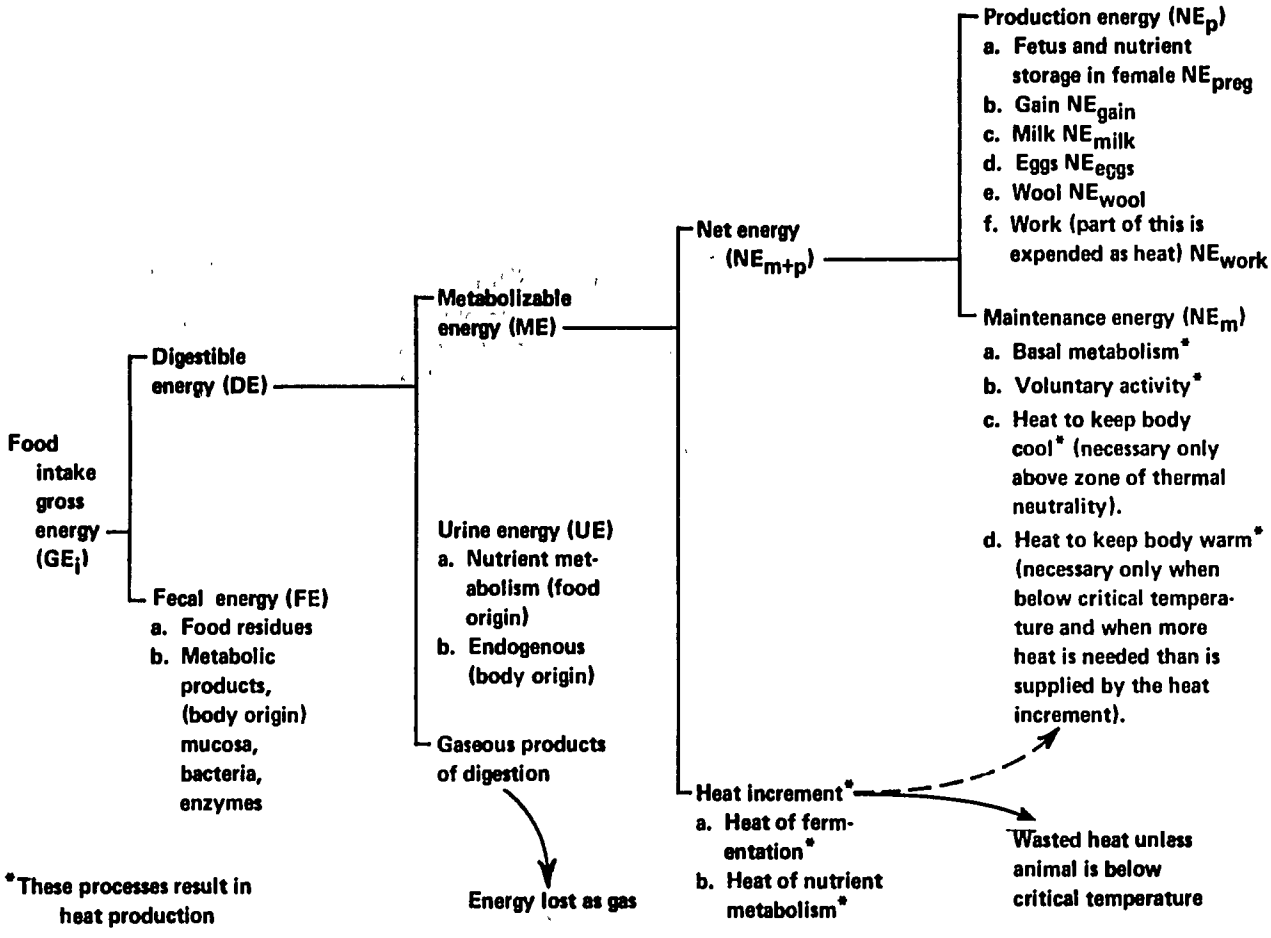

FIGURE 3.5 The partition of energy according to the conventional scheme.

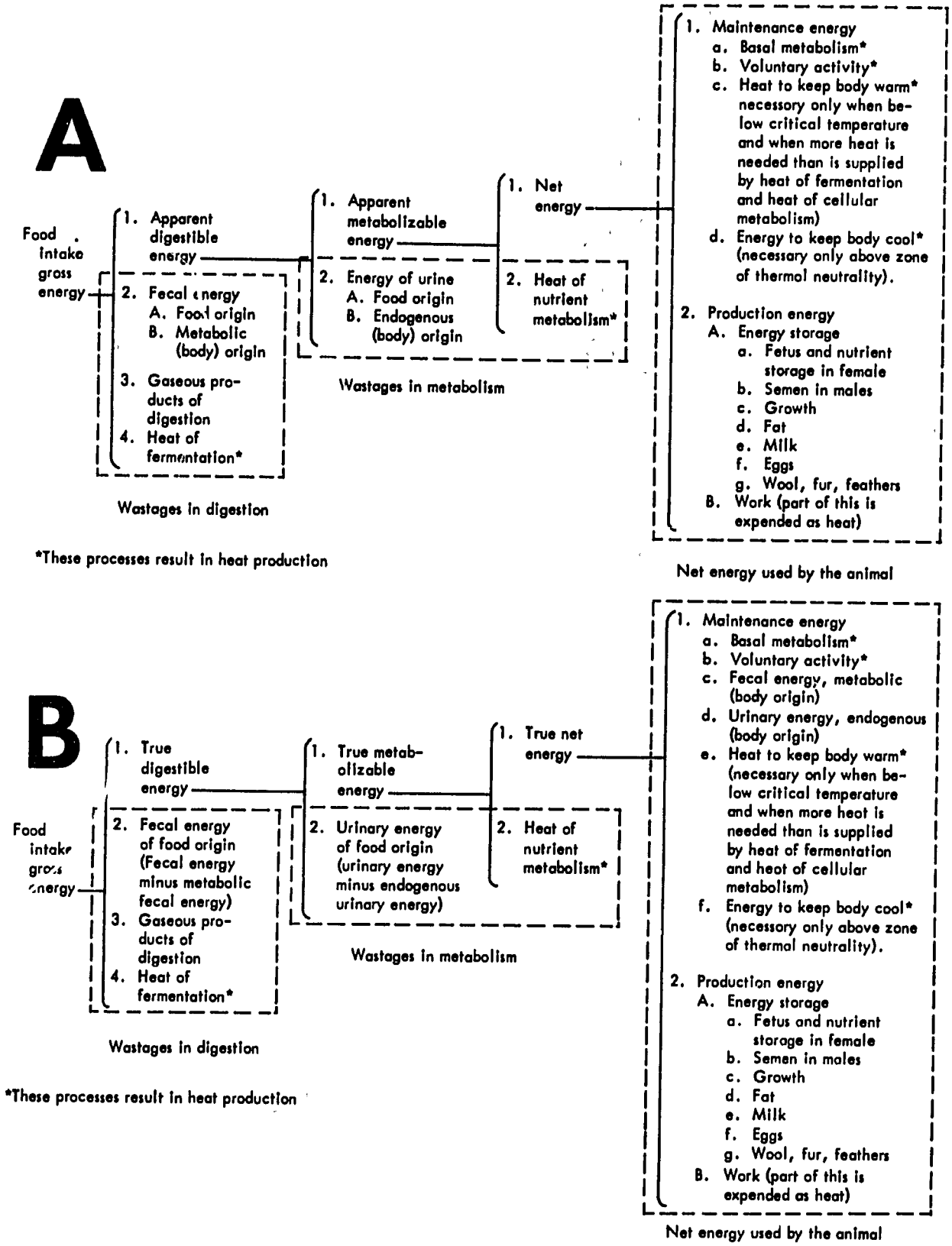

FIGURE 3.6 The utilization of energy (scheme to show where various portions originate). Since some of the fecal energy is of metabolic origin and some of the urinary energy is of endogenous origin, the scheme shown in 3.6a has been modified to give Figure 3.6b. Since the metabolic energy and endogenous energy are part of the net energy requirements under this scheme, these items are shown as part of the maintenance energy.

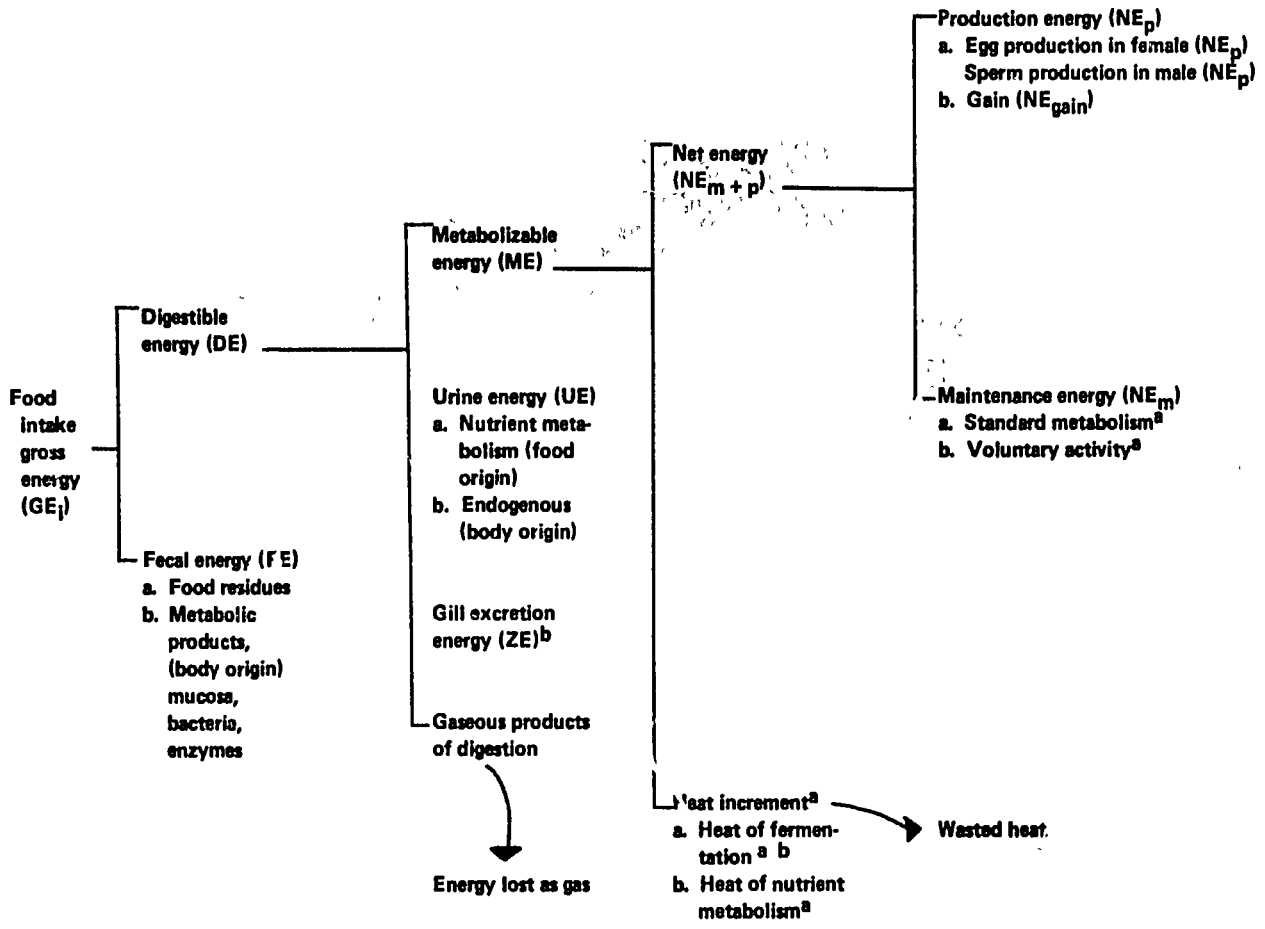

FIGURE 3.7 Conventional biological partition of feed energy in fish.[1]

[a] These processes result in heat production.
[b] Gill excretion energy could be partitioned into that of direct food origin and that of body origin.
[c] For Salmonids: Due to low body temperature and short passage time, there is a limited opportunity for bacteria fermentation, therefore, gaseous products of digestion and heat of fermentation are so small they need not be considered.