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COMPOSITION PROJECT

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PREFACE

A project was initiated, with the assistance of US/AID funds, to gather and compile feed composition data from Latin American countries. A manual of instructions explaining the system utilized by the project is distributed to collaborators. It includes material on data collection and recording, animal research procedures, an international feed nomenclature system, an energy system suitable for expressing feed values and livestock requirements, and laboratory methods for chemical and biological analysis of feedstuffs. A source form book, suitable for use as a permanent laboratory record of each feed and form data transmital to the project center is distributed, also. These materials are available in English, Spanish and Portuguese. Feeds will be identified by international names and numbers, the information coded for machine summarization and all data recorded on computer tapes. The data will be summarized by computers and used in preparation of tables of feed composition which will be made available to collaborating institutions.

A. INTRODUCTION.

Developments in the field of animal nutrition in recent years indicate that some systems of feed analysis and methods of computing livestock diets should be modified. Expanded knowledge of feed composition and nutrient requirements of animals have emphasized the importance of adopting more precise methods of balancing animal diets. Two factors contributing to more precise balancing of animal diets are the use of the calorie system for expressing energy requirements and a systematic nomenclature of feeds. The calorie system utilizes digestible, metabolizable and net energy measurements for stating nutrient requirements and for characterizing feeds. The nomenclature system used for feeds describes precisely the origin and nature of the product so that the analytical data becomes more meaningful. These systems are adapted to natural feedstuffs and by-products from the processing of human and animal feeds.

Knowledge of feed composition is essential for proper feeding of livestock. Little is known concerning the composition of many feeds throughout the world. North American and European feed composition data have been applied in balancing livestock rations therefore, more local data are needed. Although data are available in many parts of the world, much of it is not widely published or distributed. Composition tables, derived from representative world feeds are not generally available. The feed composition project was initiated to gather data from which local tables will be developed. These data, supplemented with National Research Council data, will provide more meaningful information for balancing livestock diets. Collaborating laboratories will receive composition tables and computer summaries of the analyzed data.

B. THE PROJECT.

The project was undertaken to overcome the lack of summarized analytical and biological data from Latin America and may be extended to include other world areas. It will serve to standardize the feed analysis procedures, naming of feeds and reporting of data.

The objectives of the project are: 1) to collect accumulated data on the composition of feeds, 2) to devise a record system which can be used in nutrition laboratories to describe and record chemical and biological data on feeds, and 3) to publish feed composition tables. The system described by Harris et al. (1968) has been followed for data retrieval, assigning international names and summarization procedures.

a) International Feed Nomenclature.

More than 7000 feedstuffs have been given international names. When "common names" were examined, more than 20 percent of them were duplicate names for the same product found in different areas of the world. This unnecessary duplication complicated feedstuff identification. The nomenclature system now in widespread use in North America, was designed to minimize feed identification problems by assigning descriptive names to feedstuffs and to offer a system with the potential for international standardization. The international name should (1) describe the feed, genotypically and morphologically, (2) define the quality or grade, if applicable and (3) indicate proper place in the classification of feeds which will give information to clarify the relative nutritive value.

There are eight name components, each contributing specific information in describing the feedstuff (Harris et al. 1968). These eight components are: (1) Scientific name. Both genus and species are given with reference to the parent substance from which the material originates. The feed name begins with the scientific term and can

be listed alphabetically for official definitions and in analytical data tabulation. (2) Origin, species and variety. This component lists the common feed names that correspond to a given scientific name. When the variety or kind have a marked nutritional influence, i.e., high lysine corn, or hard versus soft wheat, this information is included in the name. When differences due to variety are not significant, the variety term is omitted. (3) Part eaten. This component refers to the actual part of the parent material that is consumed, i.e., with a cereal grain, an animal can eat the grain, the straw, or the chaff separately. In today's modern technology, fractionation of plant and animal by-products provides innumerable products useful as animal feeds. (4) Processes and treatments. When feedstuffs have been processed (by heating, grinding, sifting, extracting, digesting, pelleting, etc.) their nutritive value and means of identification may have changed substantially. The fourth name component reflects changes processed feeds may have undergone before being fed to animals. (5) Stage of maturity. Because of the presence of lignin and cellulosic materials, the nutritive values of roughages are affected by the maturity stage. Stages of maturity are defined in terms of vegetative phases or by the actual number of days of growth. (6) Cutting or crop. This refers to the number of times the plant is harvested per year. (7) Official grade or number. Nutritive quality of a feedstuff is often reflected by assigning a grade or number. When these are applicable, they become a name component. (8) Classification. All feedstuffs have been grouped into eight classes: dry forage or roughage, succulent forage or roughage, silages, energy feeds, protein supplements, mineral supplements, vitamin supplements

and additives. The classes are based upon nutritional composition of the feeds.

As an example of feed names we might have: Medicago sativa, alfalfa, ranger, leaves, dehy grnd pelleted, early bloom, cut 1, gr 1, (1). All eight components are represented. In other feeds, i.e., Zea mays, corn, grain, grnd, (4) all components do not apply.

b) International Record System.

The international record system provides a unified system of handling laboratory data which allows for direct transfer to an electronic computer system and the maintenance of a master file. The system assigns an arbitrary number to each project and to each experiment within a project. It is recommended that the project or experiment number be a two part number with the first part of the number indicating the year and the second part indicating the project. A master listing of the project number, title and project director should be maintained in a bound book. Laboratory samples should be labeled and identified as they are collected. The identifying project, experiment and laboratory sample numbers should be carried with the data for identification in the master record file and in the computer data bank.

c) Feed Composition Data Collection.

The project is gathering analytical data for feeds grown in different localities of the world with present efforts focused in Latin America. To accomplish this task, an instructional brochure has been written that outlines research procedures for the organization of a project or experiment, collecting and labeling samples

for analysis and presents a data source form for recording analytical feed data. A glossary of terms and equivalent terms used in international feed nomenclature is included. The calorie system for balancing livestock diets is outlined. Section II of the brochure gives several chemical and biological methods used in determining feed analyses. These methods have been found satisfactory in time and accuracy for the analyses of biological material.

An international data source form has been devised for collection of feed composition data and is available to laboratories which wish to collaborate in the project. The form is rather detailed as it includes space to record: 1) information about the sample; 2) information concerning digestibility trials if conducted on the sample and 3) data from the chemical and biological analyses of the feed. These forms are prepared to allow a control file of analyses and to provide a duplicate copy of the analyses for the project center at the University of Florida. Upon arrival at the project center the information will be put into an IBM data bank and at periodic intervals electronic computer summaries will be completed.

d) Feed Composition Data Summarization.

For ease of electronic computer identification, feeds are assigned an international reference number and cataloged in an international name file. The assigned numbers, identifiable by computers, provide positive and continued identification for feeds.

The feed sample data are punched into four computer card forms. Card forms one and two refer to the origin and description of the sample. Card form 3 refers to the digestibility trial data, if

applicable. Card form 4 refers to the chemical and biological data, the digestion coefficients, energy values and the dry matter basis information about the feed sample.

The raw data are modified to the preferred system, i.e., metric units, standard terminology and to a 100% dry matter basis. Values for each nutrient for a given feed are totalled, means calculated and coefficients of variation determined. Nitrogen free extract is calculated from the average proximate composition. Digestible protein and energy may be calculated from given digestion coefficients or estimated by equations programmed into the computer system. Equations for the estimation of metabolizable and net energy, for TDN and for vitamin A equivalents are available in the summarization system if the values are not reported. The summarized data are dovetailed with the name file to print feed composition tables including the international feed name, and all available chemical and biological feed data for that feed. All data are reported on an as fed and a 100% dry matter basis.

e) Tables of Feed Composition.

For accurate identification, the feeds scientific name, international name and reference number and other common names are used in the composition tables. A coding system is being developed to show the ecological region from which the feed sample originated. With sufficient information the following component for each feed sample can be listed in the tables: dry matter, ash, crude fiber, ether extract, nitrogen-free extract, crude protein, digestible protein, cellulose, lignin, gross energy, digestible energy, metabolizable energy, net energy, total digestible nutrients, minerals, vitamins

and amino acids. Digestible protein, metabolizable energy, net energy and total digestible nutrients values are given for the appropriate animal species with net energy values partitioned for maintenance and production (gain, pregnancy, milk, eggs and work) when applicable.

When at least four sample analyses for a given feed have been included, the coefficient of variability is given in the composition tables. After becoming familiar with the nomenclature and the tabulation system, the information wanted can usually be found directly, keeping in mind that the feeds are listed alphabetically by scientific name, species and variety.

C. CLASSIFICATION OF ECOLOGICAL ORIGINS OF FEEDSTUFFS.

The source form used to record the feedstuff composition data is also designed to locate the origin of the feedstuff. If the description of the origin is recorded by only the country of origin, the data may be of limited use due to the environmental variations that are found in tropical countries. If certain of the major environmental factors could be recorded then a method of describing the origin in more meaningful terms may indicate differences in the composition of the feedstuff due to ecological influences. Another advantage is that this would offer a more accurate means of comparing the nutrient properties of feedstuffs from different areas of the world.

Therefore, in addition to locating the origin of the feed by country, state and county, the source form incorporates four other factors of latitude, altitude, mean annual precipitation and biotemperature. These four factors are the same as used by Holdridge, (1967) for classification of ecological life zones.

Latitude, rainfall and biotemperature are each assigned a single numeric character in a factorial manner according to their values in the appropriate range of the continuum. Since the ranges of the continuum for altitude are not constant in the Holdridge System, altitudinal values are maintained in meters. This enables the life zone to be identified by a two-part seven digit number. The first part is composed of the three digits corresponding to the coded numeric characters for latitude, biotemperature and rainfall. The second part is the four digit value for altitude in meters. Since each feedstuff is precisely identified by the assigned reference number, a step-wise linear regression equation will allow comparison of the same feedstuff grown under similar environmental conditions but in different geographical areas and an evaluation of the same feedstuff grown in different ecological life zones. This same technique will be used to determine the effects of latitude, altitude, rainfall and biotemperature for a specific feedstuff.

D. SUMMARY.

The Feed Composition Project is designed to standardize feed evaluation systems, to provide an increased amount and more precise data, provide systematic compatability for computer summarization and linear programming in the utilization of feedstuffs by livestock. A descriptive nomenclature system, an international reference number and name file are used for maintaining feed identification. A brochure of instructions and a data source form for recording analytical feed data are used in collecting feed composition information. The collected data are coded, cataloged and summarized for use in developing feed composition tables. The summarized data, showing the applicable feed components, are used to

construct tables for use in calculating diets and mixtures of feeds for livestock consumption. The net affect of the project is to improve the efficiency of livestock production through better nutrition.

E. REFERENCES.

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