ALFI
DATABASE
AUSTRALASIAN LIVESTOCK FEED INGREDIENT DATABASE

User's Guide and Reference

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Printed in South Australia

ALFI DATABASE

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Section A
Introduction

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SARDI

SOUTH AUSTRALIAN RESEARCH AND DEVELOPMENT INSTITUTE

GRDC

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BARNEVELD NUTRITION

Contributions to the ALFI Database have been made from the GRAILE Database and Agriculture WA.

Contents

Section C – Advanced Functions

Section D – Additional Search Information

Section E – Appendices

Section A - Introduction

A1. How to use this guide

The ALFI Database User's Guide and Reference has 5 parts:

- Section A – Introduction
- Section B – Getting Started – Searching for Information on Feed Ingredients and Grains
- Section C – Advanced Functions
- Section D – Additional Search Information
- Section E – Appendices

Section A contains background information about the ALFI Database. Section B is designed to provide user information and to act as a tutorial. A book 🕮 symbol appearing in the margin indicates an example that forms part of the tutorial. By working through this section guide you will be taken through examples of how to retrieve particular information from the ALFI Database. Examples of reports for the exercises are in Section E. Section D contains more background information about how the ingredients are categorised within the database and calculations and assumptions made within the database. Each section is designed to be removed (and replaced when appropriate with upgrades) and pages for notes are included.

Section A - Introduction

A2. About the ALFI Database

A2.1 Background for the development of the ALFI database

There are a number of databases available in Australia and overseas on the nutritional value of feed grains and other livestock feed ingredients. Most are based on small subsets of nutritional information collected over the last fifty years. The following list, which is by no means exhaustive, represents some of the databases commonly used by nutritionists in the livestock feed industry.

1. Standing Committee on Agriculture Feeding Standards for Australian Livestock – Pigs (1987)
2. World Poultry Science Association European Amino Acid Table (1992)
3. National Research Council Nutrient Requirements of Swine (1981)
4. Rhone Poulenc Animal Nutrition Feed Formulation Guide (1994)
5. Queensland Department of Primary Industries Nutrient Composition of Feedstuffs for Pigs and Poultry (1984)
6. CSIRO Composition of Animal Feedstuffs in Australia (1982)
7. Heartland Lysine Amino Acid Tables for Pigs and Poultry (1994)
8. Degussa Ag Amino Acid Composition Tables (1991)
9. BioKyowa Ileal Digestible Lysine Tables (1992)
10. ITCF/Eurolysine Ileal Digestibility of Amino Acids in Feedstuffs for Pigs (1994)
11. AUSPIG Feed Ingredient Database (1994)
12. Danish Institute of Animal Science Tables
13. INRA Feed Composition Database
14. Nutrition Company/Proprietary databases

There are limitations to most existing databases. From the list above, none of these databases provide all the information that is necessary to adequately define the nutritional quality of a feed ingredient, and all provide conflicting and varying information about the nutritive value of the same feed ingredient, making it difficult to utilise the information. Sources of variation and inconsistency include:

- The source and range of the raw ingredients. The country of origin, the growing conditions and the nutritional range of the feed ingredients tested are seldom reported.
- The age of the data. In many cases the existing databases have been derived from research conducted in late 1960's and 1970's when animal production intensified and greater emphasis was placed on "available nutrients". Also, some of the old crop cultivars are no longer grown for animal feed.
- The methodology used to obtain data on both chemical composition and nutritive value. For example, amino acid digestibility values for pigs are currently expressed as either faecal digestible, apparent ileal digestible, apparent-adjusted or standardised ileal digestible, true ileal digestible, real ileal digestible or actual ileal digestible. Values are further confounded if we consider that apparent ileal digestibility can be determined using *in vitro* methods, direct intestinal sampling at slaughter, simple T-piece cannulas, re-entrant cannulas, post-valvular T-caecum cannulas, or ileo-rectal anastomosis. True digestibility can be determined using protein-free diets, regression methods, enzymically hydrolysed casein or isotopically-labelled amino acids. In addition, if total collection of digesta is not used, the type of indigestible marker employed (chromic oxide, titanium dioxide, acid-insoluble ash, n-hexatriacontane, ferric oxide) will influence the accuracy of the final results.
- The number of measurements used to obtain each value. Common feed grains have been assessed on many occasions. However, some widely used feed grains have surprisingly little nutritional data supporting their use.
- Most of these databases are not interactive. Because they are often published in book form, these databases are difficult to update, review and to provide or receive feedback.
- There is no common way of expressing the results.
- There is insufficient information about the samples tested (eg cultivar, condition).
- It is difficult to access the information contained in these databases.
- They lack information in relation to carbohydrate, mineral, vitamin, fatty acid and potential anti-nutritional factors.

- There is limited information about the higher quality grains that have found their way into the feed market.
- There is distinct lack of consistency in the definition of co-products from feed grains.

In order to improve nutrient utilisation by livestock, the feed grains and animal industries require a large amount of information on:

- The nutritional value of feed grains for all livestock species;
- A common set of feed grain standards;
- Specifications on the quality requirements and most appropriate quality parameters for each livestock type;
- A quality assurance program for feed grains.

To meet these fundamental requirements it is essential to build an interactive, standard database on the nutritional value of feed grains, which is based on a common dataset incorporating chemical composition information integrated with available nutrient coefficients (where available) for each livestock species.

A2.2 Features of the ALFI Database

The ALFI database is a relational database developed with financial support from Pig Research and Development Corporation and Grains Research and Development Corporation. The ALFI database includes a central chemical composition dataset and corresponding nutritional data for each livestock type. The chemical composition data includes proximates, amino acids, fatty acids, carbohydrates, non-starch polysaccharides (soluble and insoluble), anti-nutritional factors, vitamins, minerals, residues and toxins. The nutritional value data includes energy (DE, ME, NE), digestibility, availability of nutrient and the methods used to obtain these data.

By incorporating these features the ALFI database has:

- Reduced the variability surrounding existing databases;

- Prevented repetitive collection of information by centralising data collection for all livestock species;
- Provided a means for the recording the large amount of data that will be generated with rapid on-line testing procedures for feed grains (eg. NIR);
- Provided a standard against which plant breeders can compare new cultivars;
- Allowed the accurate assessment of variations in feed grain quality over growing seasons and growing environments;
- Provided the basis for a complete database for all feed ingredients in addition to feed grains.

The ALFI database has the following features which will allow it to become an industry standard:

- Computer-based database that is Internet compatible.
- The ability to be rapidly and easily updated.
- User-Friendly.
- The ability to interact with other databases, especially with 'in-house' databases. The data from the ALFI database can be exported in different formats into a number of the existing databases (such as Access, Excel, FoxPro and Oracle databases etc.).
- A number of levels of reports to accommodate different users (nutritionists, buyers, plant breeders, agronomists, modellers, environmentalists, pig farmers, home mixers and statutory bodies).
- Details of the data, including plant cultivars, growing conditions, analytical methods, processing methods.
- A reference database for the users to trace data to their sources.
- Data catalogued by feed ingredient to allow users to sort data and access the base level data.
- A system to compare feed ingredients and to supply some introduction to and description of the feed ingredient.
- Data fulfilling quality assurance guidelines

A2.3 The uses of the ALFI database

The ALFI Database can be used by members of the livestock feeds industry as a reference against which they can compare their own data. To facilitate comparisons, the ALFI database was built in an interactive form with well-defined parameters to allow users to both incorporate data into local databases and to access the raw data rather than only means of means.

For plant breeding programs, the ALFI database can be used to compare the nutritive value of new cultivars against national standards (ALFI data) to improve quality for animal and human nutrition.

The quality parameters in the ALFI database can be used by grain industries and feed manufacturers as a reference for quality control in trading.

The ALFI database can be used by academics to explore the variation in nutritive value of feed grains and the impact of environment, breeding and selection on the nutritive value of feed grains.

Notes

Notes

ALFI DATABASE

AUSTRALASIAN LIVESTOCK FEED INGREDIENT DATABASE

Section B
Getting Started –

Searching for Information on Feed Ingredients and Grains

Section B – Getting Started

B1. Installation of the ALFI database

Before you set up the ALFI Database, make sure your computer meets the minimum requirements.

B1.1 System requirements

To run the ALFI Database, you need the following:

- An IBM-compatible personal computer with a 486 DX or higher processor (Pentium is recommended).
- A hard disk with 25 MB of free space.
- A Microsoft Mouse or other compatible pointing device.
- An EGA, VGA, or compatible display (VGA or higher is recommended).
- Eight MB of random-access memory.
- MS-DOS operating system version 3.1 or later.
- Microsoft Windows, Windows for Workgroups, Windows NT operating system version 3.1 or later.

B1.2 Setting up the ALFI Database

The ALFI Database will install from floppy disk or CD similar to other computer applications by using the Setup program (setup.exe). The ALFI Database program itself is not different for different versions of Windows or for distribution on either floppy disk or CD-rom. For brevity, the instructions below are detailed using Windows 3.x and floppy disks, and using Windows 95 and CD-Rom. However, the database can be installed using Windows 3.1x from a CD-Rom and using Windows 95 and disks if desired. If you have installed a version before please delete all files from the \alfid\progs directory or rename the old directory.

B1.2.1 Windows 3.1x from floppy disk

1. Start Windows.
2. Insert Disk 1 in drive A.
3. In the Windows Program Manager, choose Run from the File menu.

Windows displays the Run dialog box.

4. Type **a:setup** in the Command Line box.
5. Follow the setup instructions on the screen.

B1.2.2 Windows 95 from CD

1. Start Windows 95
2. Insert Disk 1 in CD-Rom drive.
3. From the Start menu choose Run
4. Windows displays the Run dialog box.
5. Type **x:setup** in the Command Line box (where x is the letter for your cd-rom drive.
6. Follow the setup instructions on the screen.

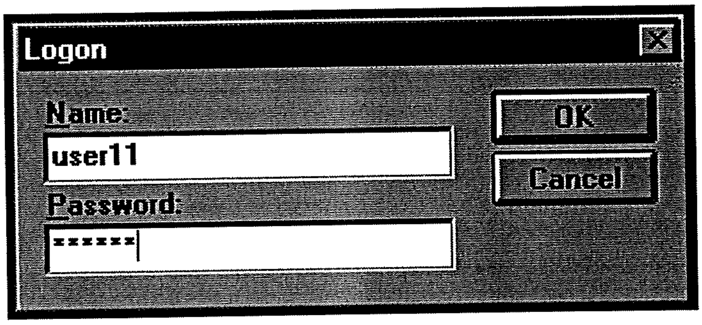
Section B – Getting Started

B2. Introduction to the ALFI Database

This chapter contains both the instructions for starting and quitting the database, as well as some general information on how to get around the ALFI database which can be used as a reference.

B2.1 Starting and quitting the ALFI Database

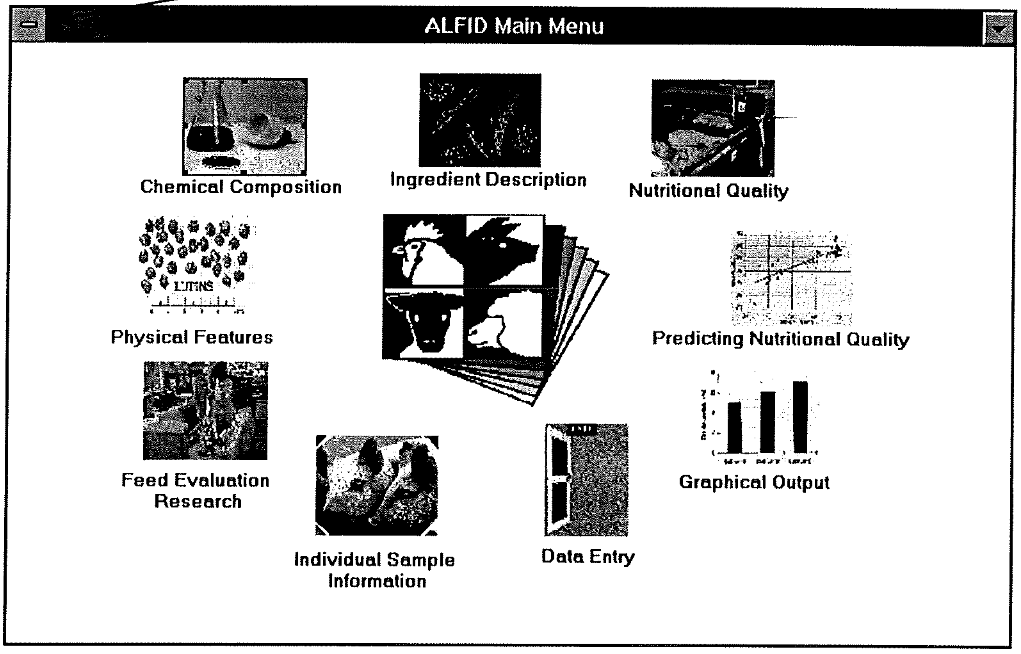
After the ALFI Database setup is complete an icon will appear on your desk-top. Double click on the icon to start the program. A dialogue box will be shown on the screen, into which you need to enter the user ID and password (user11) as shown below. See Section B2.7 to see how to change the password.



The logon box for the ALFI Database

After logging on the Main Menu will appear on screen as shown below. To exit the database double click on the left hand corner (Windows 3.1) or click once on the right hand corner (Windows 95).

Click here to exit the database



The ALFI Database Main Menu

B2.2 Structure of the ALFI Database

The Database has 8 major areas:

- **Ingredient description** – Enter here to retrieve ingredient "Fact Files" complete with a picture of the ingredient. Information on the ingredient's use in animal feeds and limitations such as anti-nutritional factors are included (see Chapter B3).

- **Chemical composition** – Enter here to search for information on the chemical composition of ingredients. You can search through all of the ingredients, or through grains only using their scientific name. You can also search for the amount of a specific component in all of the ingredients, or in just the grains (see Chapter B4).

- **Nutritional quality** – Enter here to search for information on the digestibility, metabolisability and availability of nutrients within a specific ingredient or grain only, such as digestible energy or available lysine. You can also search for the digestibility, metabolisability or availability of a specific component in all of the ingredients, or in just the grains (see Chapter B5).

- **Physical features** – Enter here to examine the physical features of grains, such as test weight (see Chapter B6).

- **Feed evaluation** – Enter here to obtain information on feed evaluation research. Information on the person that contributed information to the database and experimental methods used in research can be found here (see Chapter C1).

- **Individual sample information** – Enter here to explore the detailed information on each sample, eg. the growing conditions and the experimental conditions under which the ingredient was evaluated, including the animals used to assess nutritional quality (see Chapter C2).

- **Graphical output** – Enter here to obtain graphical representation of the data. You can either examine the distribution of the values for chemical composition or nutritional quality, or, for plant-based ingredients you can compare the data either by region or variety (see Chapter C3).

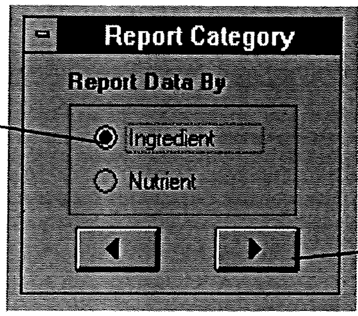
- **Data Entry** – Enter here to add new data to the database (see Chapter C4)

- **Predicting nutritional quality** – *Please note: this part of the database is not operational.*

B2.3 Getting around the ALFI Database

Most sections of the database start with ***report category boxes*** and ***report subcategory boxes*** appearing on screen. These boxes allow you to select the options for your search. Some will look like the one shown on the next page.

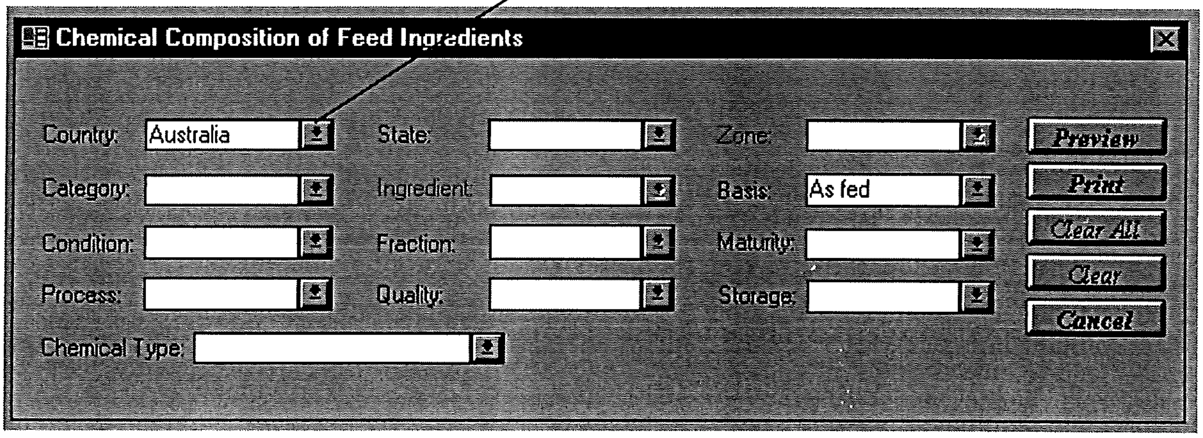
Click here to search the data by ingredient.



Click here to proceed.

The left pointing arrow returns you to the **Main Menu**. Click on the right pointing arrow to proceed. The boxes will automatically close behind you. After selecting the options you require and clicking the forward arrow to proceed, a ***selection form*** will be displayed. These appear different according to the function you are performing within the ALFI Database, however they do all have common attributes and an example is shown below.

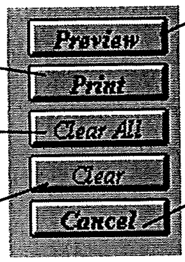
Click on the arrow to make a selection from the drop-list box



Chemical composition of feed ingredients selection form

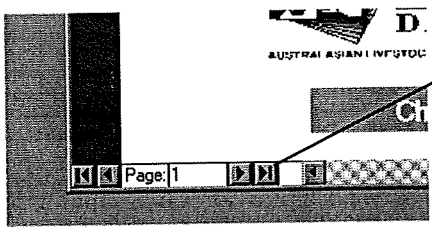
B2.4 Clear, clear all and cancel

If you have made a mistake in selecting the options by which you wish to select data, you can clear all parameters selected and re-select by clicking on the ***Clear All*** button. ***Cancel*** will end the search and return you to the **Main Menu**. To clear the selection in one box, click the text of the selection so that the cursor is within the box and click on the ***Clear*** button.



B2.5 Viewing and printing the data

After selecting all parameters, click ***Preview*** to view the report. ***Print*** will enable you to print the report. To know how many pages there are in a report, click on the arrow in the preview window as shown below.



B2.6 Entering search criteria into selection forms

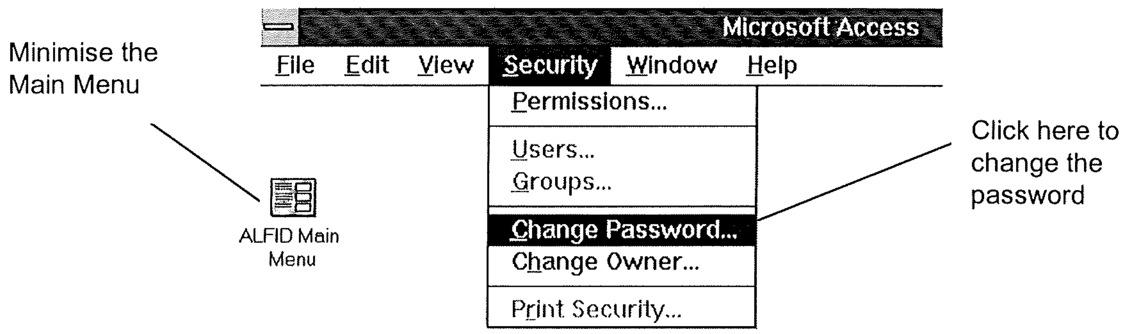
When entering search criteria into selection forms such as the one shown on page B-6, you can either type into the appropriate box or choose an option from the drop-list. Choosing from the drop-list will ensure that you select an option that is included in the database.

On several forms, default selections are already displayed. To change these, place the cursor in the text in the box and pull down the drop-list. Several search categories are compulsory for selection and these will be explained further in subsequent chapters. Other categories may be left blank to get a report featuring "pooled" data.

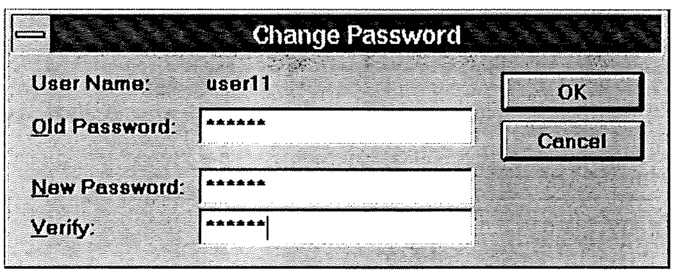
B2.7 Changing the password

The default login and password for the ALFI Database is "user11" as shown in Section B2.1. It is possible to change the password, however the login will remain the same. A password for the ALFI Database can be used to protect any data entered by a user, and to also prevent anyone from incorrectly entering data into the database.

To change the password, go to the main menu and minimise the window. Click on **Security** on the menu bar and select **Change Password**.



A dialogue box will be displayed as shown below. Enter the old password, the new password and a verification of the new password as indicated. Click on OK, and maximise the main menu again to continue with the ALFI Database.



Section B – Getting Started

B3. Searching for general information on feed ingredients

To search for general information such as annual production, livestock consumption, nutrient contribution, uses for livestock, precautions and limitations etc on a particular ingredient, double click on **Ingredient Description** on the ALFI Database Main Menu. The feed ingredient selection form will appear on screen.

Example 1. To obtain information on barley. Before you start selecting parameters for the search, note that *Australia* ***is the default selection for Country. Also, Ingredient is written in grey unavailable for selection until you select a Category.***

The following parameters are available for selection to generate a feed ingredient "fact sheet":

- **Country:** Ingredients are grouped according to their country of origin, even if the analysis of the ingredient has been conducted in Australia. A country ***must*** be selected and Australia has been given as a default. The inclusion of Australian data has been a priority for the ALFI Database so there is little data for other countries at present. In the future we hope to have both links to the International Feeds Information Centre through the Internet, and overseas data incorporated directly into the database where it is relevant to Australian livestock industries.

- **State:** We suggest you leave this blank because this option is designed for future use when more data is available.

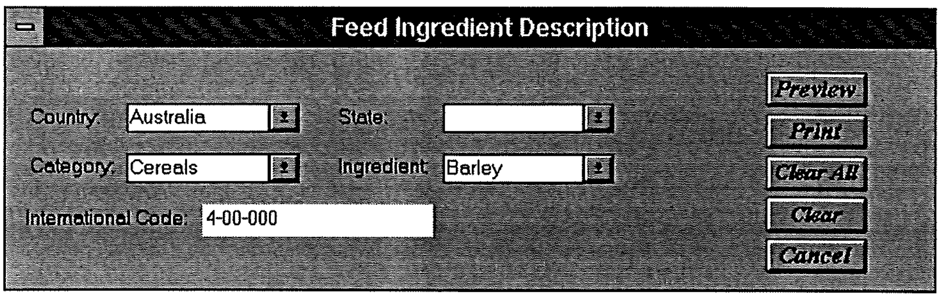
- **Category:** A category ***must*** be selected or you will be unable to select an ingredient and an error message will appear if you try to preview the report. In the ALFI Database feed ingredients are separated into 8 different categories:
    - Additives (eg. enzymes)

- Animal protein (eg. fish meal, milk powder)
- Co-products (co-products from grain processing eg. mill run)
- Cereals
- Vegetable protein (eg lupins and other legumes, oilseed meals such as canola meal.
- Mineral supplements
- Fats and oils (eg maize oil, beef tallow)
- Miscellaneous (eg horticultural wastes)

Select the category** Cereals. **In most areas of the database you <u>must</u> select a category in order to select an ingredient. After selecting** Cereals, **Ingredient should have gone black.

- **Ingredients:** For cereals and vegetable proteins (legume and oilseed grains), the ingredients are entered according to their common name (unless they do not have one). For co-products and animal protein sources, the ingredient name does not include a reference to the processing method because you have an option to select the processing method later on (See Section D for more information)

All of the ingredients in the vegetable protein category will appear in the drop-list in alphabetical order. Select** Barley **as shown below.



The feed ingredient description selection form

- **International Code**: After the Ingredient is selected, an international feed code for this ingredient will automatically appear in this box, and will be printed on the report.

Once you have made all of your selections, the selection form should look like the example above Click on *Preview* ***to view the report. To print, you can either close the preview window and click on*** *Print* ***on the selection form, or use the menu bar as you would in other windows based programs. Once you've closed the preview window you can return to the main menu by clicking on the*** *Cancel* ***button or in the top corner of the form. The report should look like the one shown in Appendix 1, page E-2.***

Section B – Getting started

B4. Searching for data on the chemical composition of feed ingredients or grains

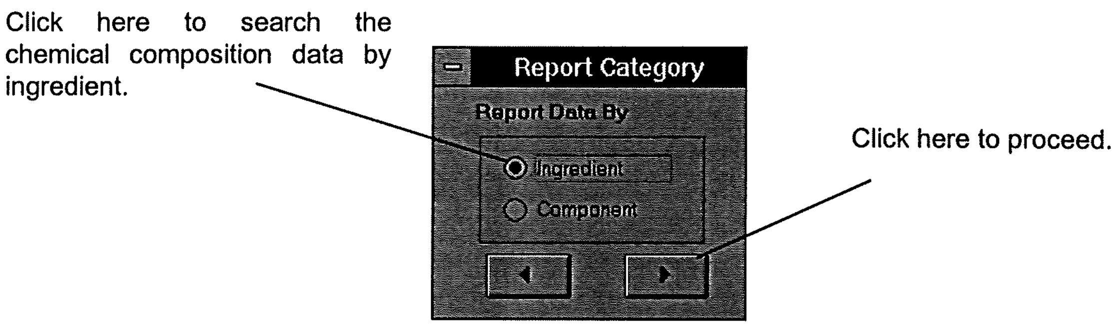
To search for information on the chemical composition of feed ingredients, double click on the **Chemical Composition** image on the main menu of the ALFI Database. For more information about how ingredients and their components are classified in the ALFI Database see Section D.

B4.1 Report category box

The data in the ALFI Database is reported by **Ingredient** or **Component**.

- **Ingredient**: Allows you to search for chemical composition data on a particular ingredient or grain, eg. chemical composition of wheat.

- **Component**: Allows you to search for the content of a specific component in ingredients or grains, eg. crude protein content of all cereals.

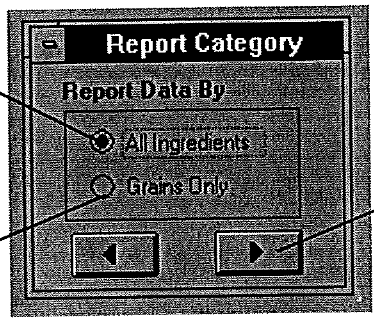


Example 2. To obtain information about the chemical composition of solvent-extracted soybean meal included in the ALFI Database. Select *Ingredient* ***from the report category box and click on the right pointing arrow to proceed.***

B4.2 Report sub-category box

After selecting the report category, you need to select whether to search data on either **all ingredients** or **grains only**.

Click here to search through all ingredients including co-products etc



Click here to proceed.

Click here to search through grains only (cereals, legumes and whole oilseeds)

- **All ingredients**: This category includes co-products, animal proteins and oilseed meals as well as grains, however only common and generic names are used for grains eg barley includes all varieties.

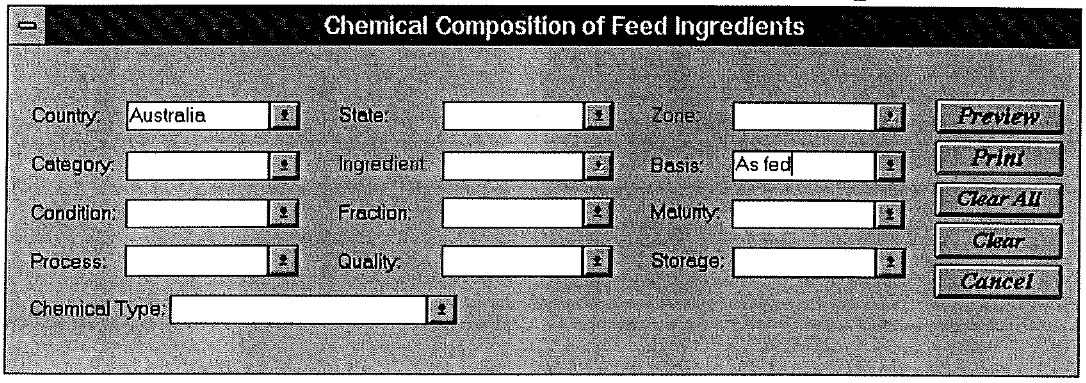
- **Grains only**: Feed ingredients derived from plants are classified according to their *genus*, *species* and/or *variety*. For example, lupin samples are classified as sweet (*L. angustifolius*) and white (*L. albus*) as well as varieties of these species if known. This is particularly useful for the comparison of nutritive value among crop species or varieties.

Because soybean meal is not a grain, select *All Ingredients* ***from the report sub-category box and click on the right-pointing arrow to proceed.***

B4.3 Chemical composition of feed ingredients

After selecting **Ingredient** from the report category box and **All Ingredients** from the report sub-category box, the **Chemical Composition of Feed Ingredients** selection form will appear on screen.

To search for data on the chemical composition of feed ingredients, you need to further define the location, plant parts, maturity of the sample etc.



The chemical composition of feed ingredients selection form

- **Country**: Ingredients are classified according to their country of origin – even if the analysis has been conducted in Australia. A country ***must*** be selected and Australia has been given as a default.

- **State:** Selection will enable you to refine your search to a particular state, however selection is ***optional.*** You will not be able to select a state without selecting a country first. If you do not select a particular state then the data from all states in the country will be reported. We recommend you leave state blank or unselected when searching for information on co-products and animal products.

- **Zone:** As with state, zone is ***optional*** for selection and you will not be able to select a zone unless you select a state. If you want to search for data on a particular region, you need to select one of the zones listed in the drop list box. When the specific zone within a state is unknown, select the name of the state as the zone. In this case, only data that was entered with an unknown zone will be displayed. If you do not select a zone, all data within the state will be pooled.

In this example for soybean meal, leave State and Zone blank.

- **Category:** As explained in chapter B3 (page B-9) the ingredients in the ALFI Database are separated into 8 different categories. **NOTE: You must select one of these categories because you cannot select an ingredient unless you select a category.**

📖 ***From the drop-list for Category, select*** *Vegetable protein.*

- **Ingredients:** For cereals and vegetable protein sources, the ingredients are catalogued according to their common name. There is no reference to processing methods (eg solvent extracted, ring dried) for meals because you have an option to select the processing method later on. Also, for vegetable protein meals, you need to select the original ingredient (eg soybean, canola etc). **NOTE: You must select an ingredient.** For more information on the classification of ingredients see Section D.

📖 ***From the drop-list for Ingredient, select*** *soybean.*

- **Basis:** Selection will allow you to search data expressed on either an **as fed** or **dry matter** basis, and as fed has been given as a default. You ***must*** select one of the options. Data expressed on a dry matter basis has been calculated within the database and for more information see Section D.

- **Condition:** This describes the condition of the sample when it was analysed, for example, samples can be analysed as air-dried, fresh, oven-dried etc. For almost all samples in the database, the condition of the sample when it was analysed is unknown. Condition is therefore ***optional*** for selection and we recommend you leave this blank.

📖 ***In this example, leave Condition blank or unselected.***

- **Fraction:** Because the ALFI database includes data on the chemical composition of different plant parts, the fraction parameter ***must*** be selected.

Variables such as hull, kernel and whole seed are relevant to grains. To search for information on vegetable protein meals, select **meal**. For additives, animal proteins, and co-products, select **not relevant**.

- **Maturity:** Again, this parameter ***must*** be selected. Early flowering, dough stage, ripe seed etc are relevant for grains and grain legumes within the vegetable protein category. For additives, animal proteins and co-products select **not relevant.**

When searching for information on soybean meal, select *meal* ***for Fraction and*** *not relevant* ***for Maturity.***

- **Process:** This parameter defines how the sample was processed, eg. extracted, heated or ground. We recommend you leave this option blank when searching for information on whole grains (although you can select "untreated" as an option), however, this option becomes important for oilseed meals within the vegetable protein category.

For solvent-extracted soybean meal, select *solvent-extracted* ***from the Process drop-list box.***

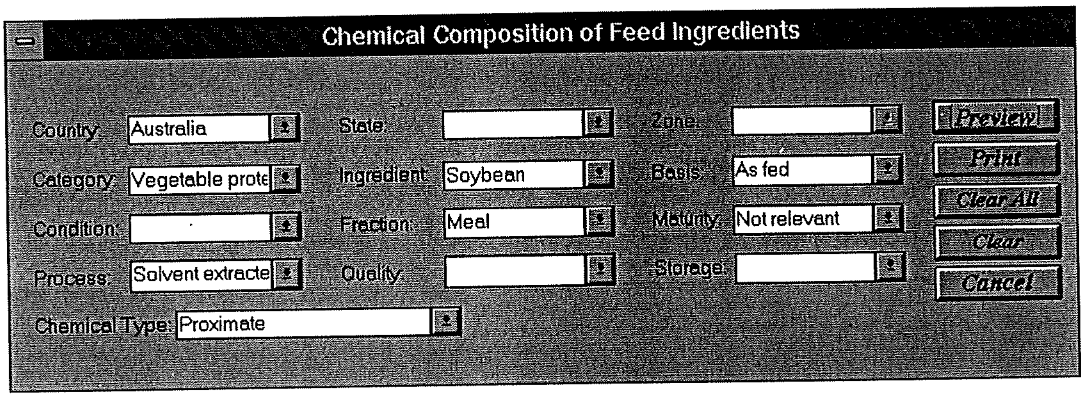
- **Quality:** The data stored in the ALFI database has been ranked at five levels according to the completeness of the dataset. Ingredients with detailed information on sample condition, growing environment, and the method employed for chemical analysis or nutritional evaluation have been ranked as very good (a numerical value of 1) and ingredients without such information have been classified as very poor (a numerical value of 5). For further information on the criteria used to assign quality, see Appendix 2.

- **Storage:** Because storage times and methods are known to influence the chemical composition and nutritional quality of feed ingredients, we have included a field for storage. However, the storage methods for almost all samples in the database at this stage are unknown and we recommend that you leave this selection blank.

When searching for information on soybean meal, leave Quality and Storage blank or unselected.

- **Chemical type**: This is ***optional***. If you want to view a particular component such as those quantified during a proximate analysis (crude protein, ether extract etc), amino acids, minerals, vitamins, dietary fibre and so on, you need to select one of these. If this option is left blank all nutritional data will be reported for the ingredient.

From Chemical type select *Proximate*. ***This will limit the information to that identified by proximate analysis. (To obtain all of the information about the chemical composition of solvent-extracted soybean meal, you could leave Chemical type blank.) After you have made all of your selections as shown on the selection form below, click on*** *Preview* ***to view the report. To print, you can either close the preview window and click on*** *Print* ***on the selection form, or use the menu bar as you would in other windows based programs. The report should look like the one shown in Appendix 2, page E-3.***

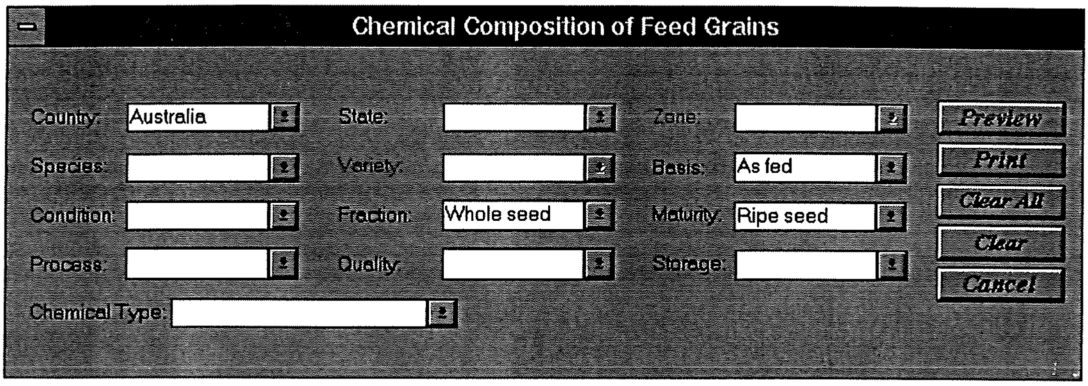


The chemical composition of feed ingredients selection form

B4.4 Chemical composition of grains only

Example 3. To obtain information on the amino acid content of barley (H. vulgare cv Clipper).

After selecting **Ingredient** from the report category box and **Grains Only** from the report sub-category box, the **Chemical Composition of Feed Grains** selection form will appear as shown below.



The chemical composition of feed grains selection form

The chemical composition of feed grains form has defaults for both Country and Basis, as well as for Fraction and Maturity. Selecting data by **Grains Only** is similar to selecting data by **Ingredient** (see B4.3) with the following exceptions:

- **Species:** Because this report was categorised by plant species, this option ***must*** be selected. The plant species names are listed in alphabetical order in the abbreviated form eg *A. sativa* (Oats). Appendix 3 includes a list of common and scientific names.

- **Variety:** Variety is nested within **Species**, which means that only the varieties for that plant species are displayed, and is ***optional***. You will not be able to select a variety until you have selected a species. If the variety parameter is not selected, then data on all varieties for this species will be pooled.

Example 3. Leave State blank for this example. Select *H. vulgare* ***(barley) as the Species. Select*** *Clipper* ***from the Variety drop list and*** *Amino Acids* ***as chemical element. Leave the default selections for Fraction and Maturity and leave Quality and Storage blank. The report should look like the one shown in Appendix 2 on pages E-4 and E-5. You can continue to look at different varieties of barley or leave variety blank to get pooled results.***

B4.5 Searching all ingredients for a specific chemical component

To search for a specific component of feed ingredients, select **Component** from the report category box (see Section B4.1), then select **All Ingredients** from the report subcategory box. The chemical components of ingredients selection form will appear on screen.

Example 4. To identify the amount of lysine in the oilseed meals stored in the ALFI database.

All options are the same as those described in Section B4.3 with the following exceptions:

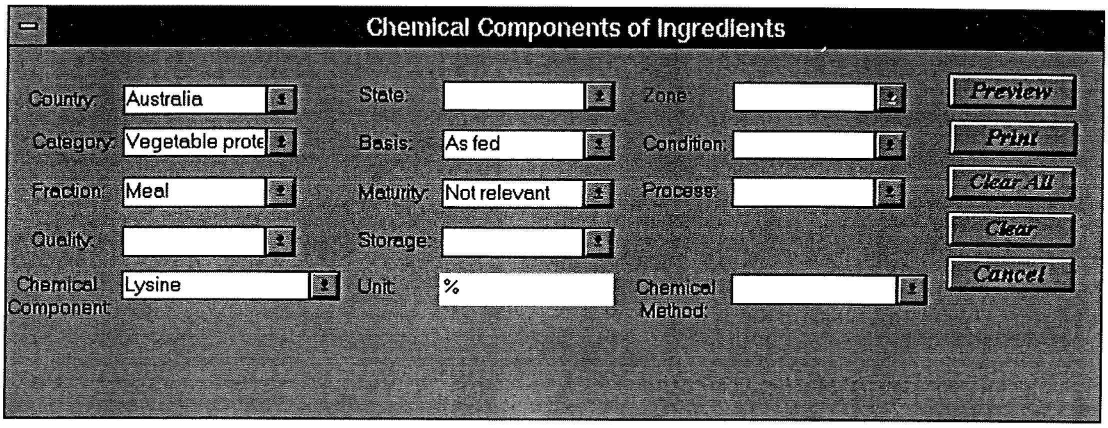
- **Chemical Component:** Select the component of interest (eg crude protein, sulphur, ADF etc.) The components are displayed in alphabetical order within type (ie within amino acids, proximates etc. The order of the chemical types is listed in Section D.

- **Unit:** Displays the units the data is expressed in. This will be automatically generated when you select the chemical element.

- **Chemical Method:** This selection allows you to further refine your search because the values included in the database can be obtained using different chemical methods. For example, crude protein can be estimated using the Kjeldahl or the Dumas method. If you don't select a method the data reported will be a combination of different methods. Only those methods that have been used to analyse samples for the component you chose will be displayed.

Example 4. Make your selections as shown on the selection form below. To search through the oilseed meals you will need to select *Vegetable protein* ***from the Category option (because this category contains legumes, oilseed meal and some data for unprocessed oilseeds). By selecting*** *Meal* ***for fraction you will select out only the oilseed***

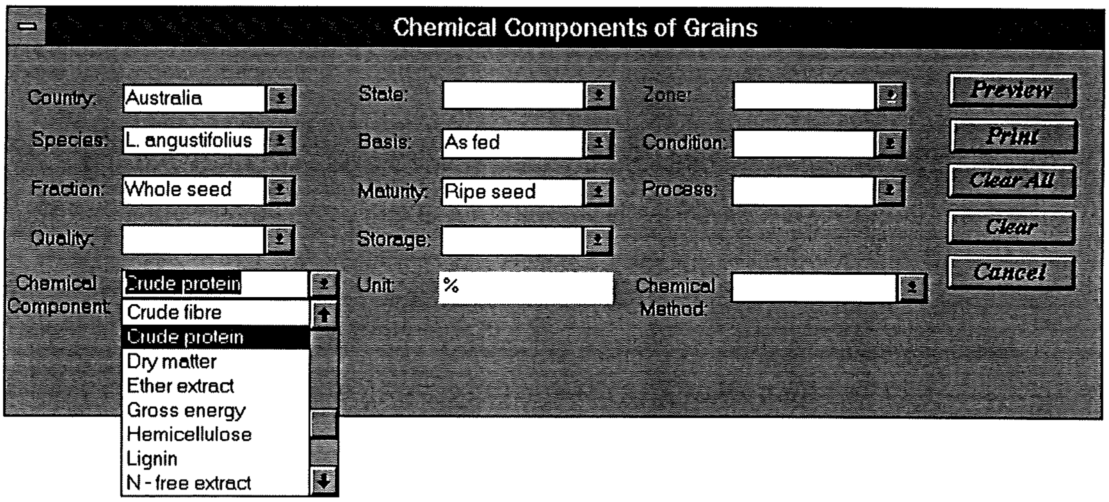
such as Canola meal and Soybean meal (see Section D for more information.) The report should look like the one shown in Appendix 1 on page E-6.



Chemical components of ingredients selection form.

B4.6 Searching grains only for a specific chemical component

From the report category box (see Section B4.1) select **Component**, then **Grains Only** from the report sub-category box and the **Chemical Components of Grains** selection form will appear on the screen as shown below.



The chemical components of grains selection form

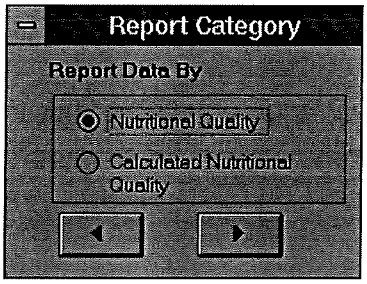
The options to select for refining the search are the same as those described in Section B4.5 except for **Species** which is described in Section B4.4. By using this selection form you can retrieve information about the content of a particular component within a species of grain. Data is reported according to variety and is useful for identifying which varieties have the highest or lowest concentrations of a particular chemical component.

Example 5. To identify the crude protein content of all varieties of L. angustifolius. Make the selections as shown on the previous page. The report should look like the one in Appendix 1 on page E-7.

Section B – Getting Started

B5. Searching for data on the nutritional quality of feed ingredients or grains

To search for information on the nutritional quality of feed ingredients, double click on the **Nutritional Quality** image on the ALFI Database main menu. The first two report category boxes are the same as that described in sections B4.1 and B4.2 (on pages B-12, B-13.) After selecting either **All Ingredients** or **Grains Only** on the second report category box and clicking the right arrow, a third report category box will be displayed as shown below.



The **Nutritional Quality** option will generate a report that is comprised of data entered direct from the literature (ie digestibility coefficients etc). The **Calculated Nutritional Quality** option will generate a report that is a combination of nutritional quality data entered directly from the literature and the data on chemical composition contained within the chemical composition database. See Section D for more information.

B5.1 The nutritional quality of feed ingredients and grains

Example 6. To identify the DE content of wheat. To obtain reported values expressed in MJ/kg, select *Nutritional Quality* ***from the report category and click on the right arrow to proceed to the selection form.***

After selecting **Nutritional Quality** from the report category and proceeding, the nutritional quality of feed ingredients selection form (shown on page B-23) will be displayed. It is similar to the Chemical Composition of Feed Ingredients selection form (as described in section B4.3) with the following exceptions:

- **Vivo/Vitro:** Information on the nutritional quality of feedstuffs can be determined using *in vivo* or *in vitro* methods. In order to obtain meaningful data, you ***must*** select one of these or you will get a report including a combination of both of these methods.

- **Animal Species:** This option was included for when other livestock species such as poultry and fish are included in the ALFI Database. Currently, only data on the nutritional quality of feed ingredients for pigs is included in the database. However, an animal species ***must*** be selected.

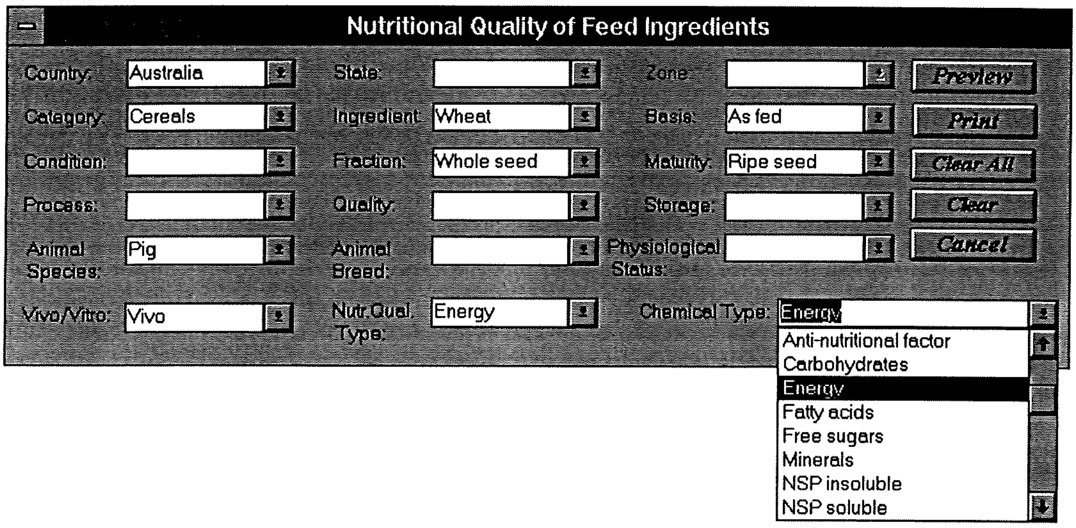
- **Animal Breed:** Once **Animal Species** is selected, the breeds for this species will be available for further selection. However, you can leave this blank and a report will be generated using all data from all breeds, i.e. selection is ***optional***.

- **Physiological State:** This describes the physiological state of animals used in the experiment (eg. lactating, growing.). Selection is ***optional***.

- **Nutritional Quality Type (Nutr. Qual. Type):** This ***must*** be selected for a valid report and allows you to examine data on either digestibility, metabolisability or availability coefficients (expressed as a percentage). The option *energy* allows selection of either digestible energy, metabolisable energy and net energy expressed in MJ/kg.

- **Chemical Type:** This parameter is ***optional***. To refine your report, you can choose to view information on proximates, amino acids, fatty acids, minerals etc. If you leave this blank, all data included in the ALFI Database for the selected ingredient will be displayed in alphabetical order.

📖 ***Make your selections as shown in the example of the selection form shown below. Note that you need to select*** *Energy* ***for both Nutr. Qual. Type and Chemical Type to obtain*** *DE.*



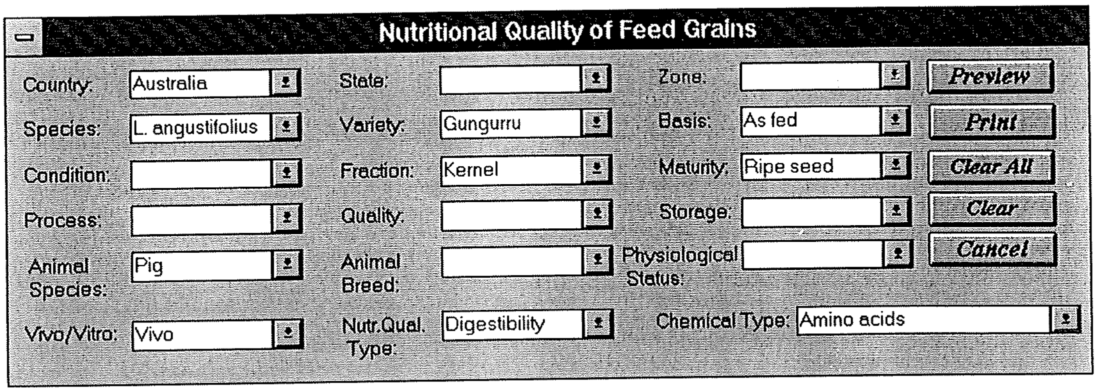
The nutritional quality of feed ingredients form

📖 ***The report should look like the one in Appendix 1 on page E-8.***

📖 ***Example 7. To examine the digestibility coefficients of amino acids in lupin kernels (Lupinus angustifolius cv Gungurru).***

After selecting **Ingredient**, **Grains Only**, and **Nutritional Quality** from the Report Category boxes the Nutritive Quality of Feed Grains Selection form will appear on screen. The options available for selection on this form are similar to those on the Chemical Composition of Feed Grains form (described in Section B4.4) and the Nutritional Quality of Feed Ingredients (described above).

📖 ***The options to select for this example are shown on the figure on the next page. Note that Fraction and Maturity have default options selected and to obtain digestibility coefficients you need to select*** *Digestibility* ***from Nutr. Qual. Type and*** *Amino Acids* ***from Chemical Type. The report generated by this form is in Appendix 1 on page E-9.***



The nutritive value of feed grains

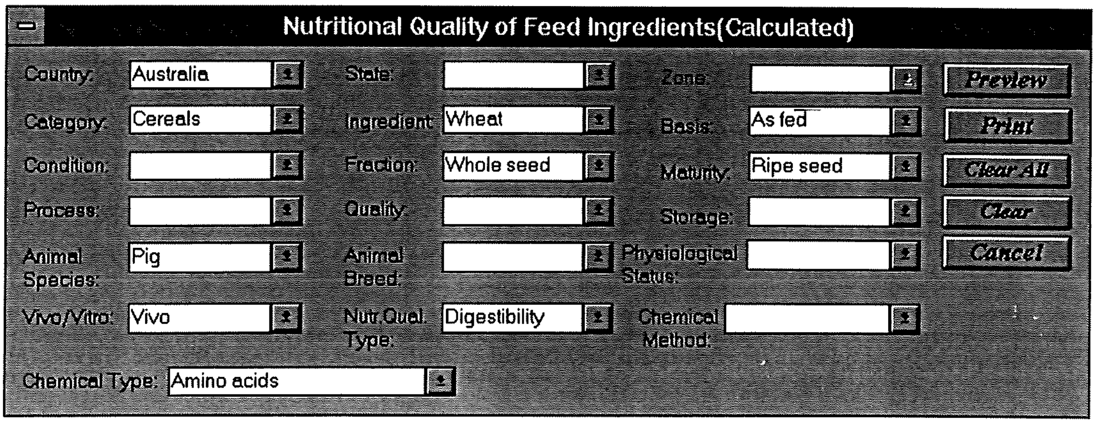
B5.2 Calculated Nutritional Quality

As mentioned previously, the data obtained when using the other nutritional quality searches (ie coefficients of digestibility, DE) has been entered from the literature. Because there are more samples in the database with information on chemical composition than samples with nutritional quality information, the database has the ability to calculate availabilities, digestibilities etc from a *combination* of the chemical composition information and the nutritional quality information for *all* of the samples in the database that match the selection criteria. More information on the expressions used to calculate nutritional quality is contained in Section D.

Example 8. To examine amino acid digestibility in wheat.

After selecting **Calculated Nutritional Quality** from the report category and proceeding, the nutritional quality of feed ingredients selection will be displayed. It is similar to the Nutritional Quality of Feed Ingredients selection form (as described in section B5.1).

The options to select for this example are shown on the figure on the next page. Note that Fraction and Maturity have default options selected and to obtain amino acid digestibility you need to select *Digestibility* ***from Nutr. Qual. Type and*** *Amino Acids* ***from Chemical Type. The report generated by this form is in Appendix 1 on page E-10.***



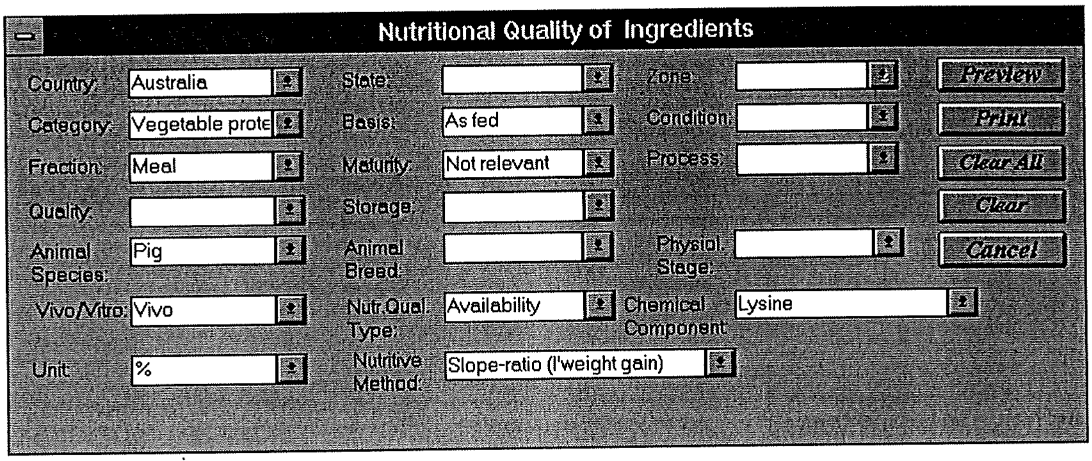
The calculated nutritional quality of feed ingredients form

B5.3 Searching different ingredients and grains for information on a specific nutrient.

After selecting **Component** and **All Ingredients** from the report category boxes, the Nutritional Quality of Different Ingredients Selection form will appear. Note that there is no option for Calculated Nutritional Quality when searching by Component. This part of the database allows you to find information on which ingredients contain a specific nutrient (ie chemical component) and its value for livestock. The selection form is very similar to the Chemical Components of Ingredients form as described in Section B4.5, with the exception of **Vivo/Vitro, Animal Species, Nutr. Qual. Type, Animal Breed** and **Physiological Status** which are described above (Section B5.1) and:

- **Experimental Method:** This option enables you to select data using a particular method for assessing nutritional quality.

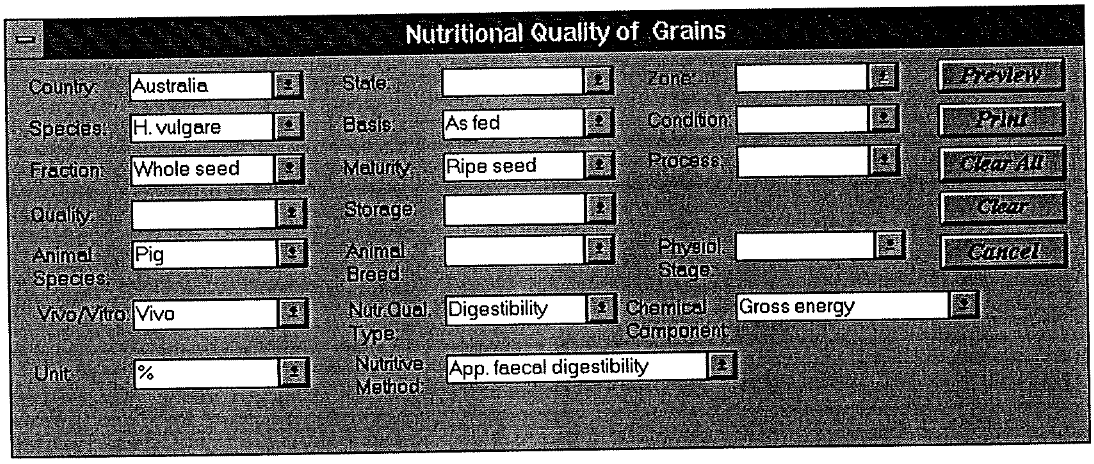
Example 9. To examine the availability coefficients for lysine in oilseed meal samples. Make your selections as shown in the example on the next page. By selecting *Meal* ***for Fraction and*** *Not relevant* ***for Maturity you will only include the oilseed meal in the search through the*** *Vegetable protein* ***category. The report generated by this form is in Appendix 1 on page E-11.***



The nutritional quality of ingredients selection form

After selecting **Grains Only** from the report category, the Nutritional Quality of Different Grains selection form will appear. From the options on this form you can identify which varieties have the highest or lowest concentrations of digestible, available or metabolisable nutrients within a particular grain species. The options available are similar to those mentioned previously for other forms.

Example 10. To examine the digestibility coefficient of energy in the barley samples. Select the options as shown in the example for below. The report generated by this form is in Appendix 1 on page E-12.



The nutritional quality of grains selection form

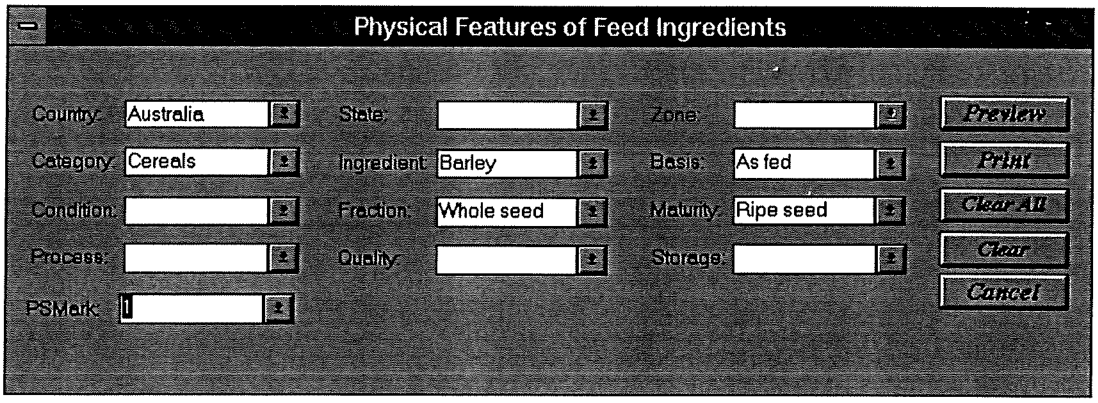
Section B – Getting Started

B6. Searching for data on physical features of feed ingredients

To search for information on the physical features of feed ingredients double click on the **Physical Features** image on the ALFI Database Main Menu. The Report Category box is that same as described in section B4.1.

B6.1 Physical Features of Feed Ingredients

After clicking on **All Ingredients** and the forward arrow, the Physical Features of Feed Ingredients selection form will appear as shown below.



The physical features of feed ingredients selection form

The options available for selection are similar to those described in Chapter B4 with the exception of:

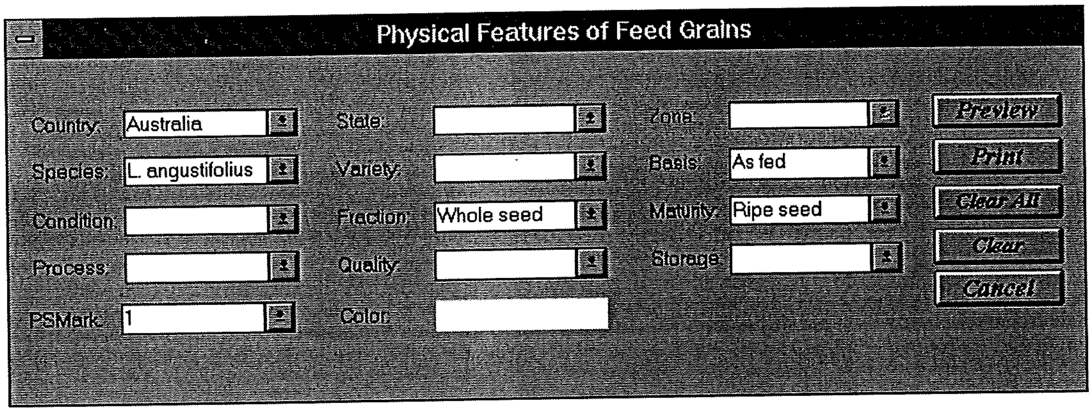
- **PSMark:** This parameter ***must*** to be selected and relates to whether data on either physical characteristics of ingredients (1) or seed quality characteristics (2) are being examined. For more information see Section D.

📖 ***Example 11. To examine the physical features of barley. Enter the parameters as shown on the physical features selection form as shown above. The report should look like the one shown in Appendix 1 on page E-13. Try also searching for same information using***

the Grains Only option (and selecting <u>H. vulgare</u>), or try <u>L. angustifolius</u> as shown below. The report is shown on page E-14.

B6.2 Physical Features of Grains Only

After clicking on Grains Only and the forward arrow on the report category box, the Physical Features of Feed Grains selection form will appear as shown below:



The physical features of feed grains selection form

The options on this selection form are the same as those described in Chapter B4 with the exception of:

- **Colour:** When searching for physical features of feed grains, the colour of the grain is linked to the **Variety** and will automatically appear on the form. (*Note*: Current database design allows one variety to have only one colour). So, if **Species** is selected without defining **Variety** (which is optional as described in Chapter 5), there will be no record in the colour field on the report.

Notes

Notes

Notes

ALFI DATABASE

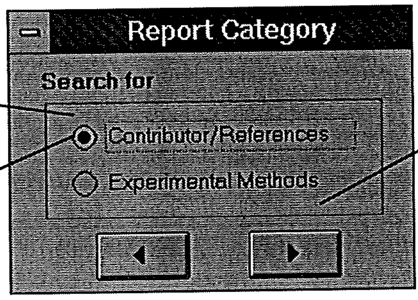
AUSTRALASIAN LIVESTOCK FEED INGREDIENT DATABASE

Section C
Advanced Functions

Section C –Advanced Functions

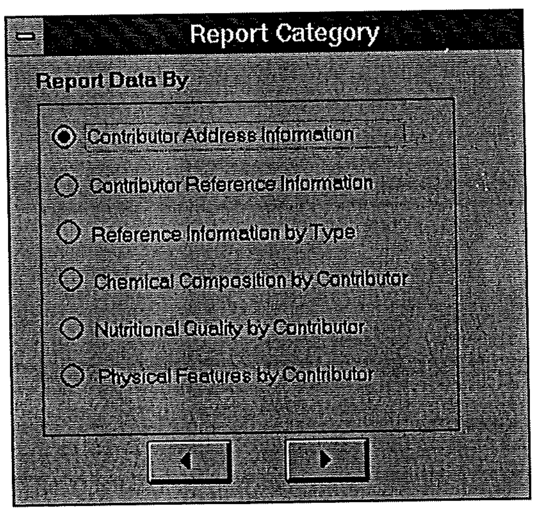
C1. Searching for information on feed evaluation research

The information in the ALFI Database has come from published journals, direct communications or databases and it is referenced so that information on the contributors and their research can be viewed and printed by the user. To search for information such as feed evaluation methods and the contact addresses of contributors, double click on **Feed Evaluation Research** on the ALFI Main Menu. A report category box will appear on screen as shown below.



C1.1 Searching for contributor information and references

If you wish to search for information about the contributors or the references cited in the ALFI database, you should select **Contributor/References**. Click the forward button, and the following options will be available for selection:



The Contributor/Reference Report Category box

From the report category box you can choose to search for the following information:

- **Contributor Address Information:** to search for the current address of a particular scientist. If the current address is not known, the last known work address is entered into the database.

- **Contributor Reference Information:** to search for the reference to the data contributed by an individual eg a scientist's papers or books cited by the ALFI database.

- **Reference Information by Type:** to search through all the references of each type (eg book, journal, or database) cited in the ALFI database.

- **Chemical Composition by Contributor:** to search for data on chemical composition supplied by a particular scientist.

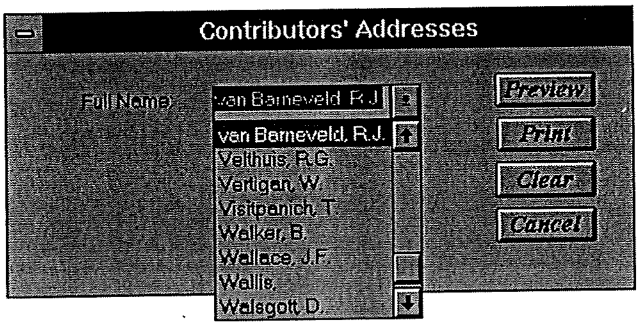
- **Nutritional Quality by Contributor:** to search for data on nutritional quality supplied by a particular scientist.

- **Physical Features by Contributor:** to search for data on physical features of ingredients or grains supplied by a particular provider.

Example 12. To find the details of samples supplied by Dr Robert van Barneveld and his current address.

C1.1.1 Searching for the address of a Contributor

From the report category box, select **Contributor Address Information**, and click the forward button. The **Contributor's Addresses** selection form will appear as shown below. Peoples names are given in the form "van Barneveld, R.J." and can be selected from the drop-list.



The contributor's addresses selection form

To find the address enter the details into the selection form as shown above. The output on the report is shown below.

Full Name: van Barneveld, R.J.

Title: Dr

Name: Robert J van Barneveld

Address: PO Box 42

Lyndoch SA 5351

Australia

Phone: (08) 8524 6477

Fax: (08) 8524 6577

Email: robvanb@dove.net.au

Comments:

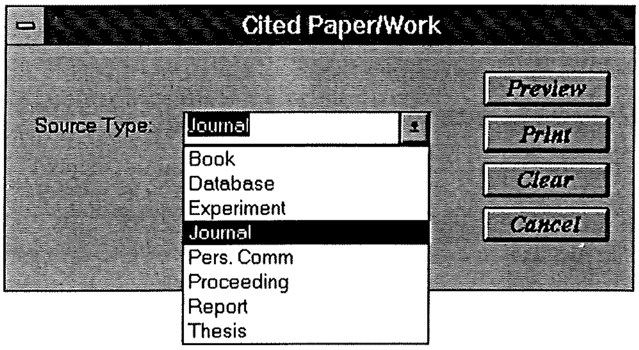
C1.1.2 Searching for references by a contributor

Selecting **Contributor Reference Information** and clicking the forward button on the report category box will allow you to search for papers written by a particular provider. The **Papers Provided by the Contributor** selection form will appear and it has the same format as the **Contributor's Addresses** form shown previously.

Select** van Barneveld, R.J.* ***from the drop-list on the Papers Provided by the Contributor selection form. The report is shown in Appendix 1 on page E-15.

C1.1.3 Searching through references according to reference type

From the report category box select **Reference Information by Type** and click on the forward button to call up the **Cited Paper/Work** selection form as shown below. From the drop list box select the type of reference you want to preview (eg book, database, journal, thesis etc.) Click on **Preview** and all references under that category will be listed in the report.



The Cited Paper/Work selection form

Select** Journal. **from the drop-list on the Cited Paper/Work selection form. The first page of the report shown in Appendix 1 on page E-16.

C1.1.4 Searching for data on chemical composition supplied by a contributor

Select **Chemical Composition by Contributor** from the **Report Category** box and click on the forward button. Select either **All Ingredients** or **Grains Only** from the report category box as described in Section B4.2. After making a selection from the report category box the **Chemical Composition of Ingredients (or Grains) provided by the contributor** selection form will appear Although they are used to search through slightly different datasets, the selection forms for **All Ingredients** and **Grains Only** are both the same as the **Contributor's Address Information** form and are not illustrated in the manual.

To find the chemical composition data contributed by Dr Robert van Barneveld, select his name from the drop-list and click Preview. *The report generated will be several pages long (see Section B2.5 to find out how many) and the first page is shown in Appendix 1 on page E-17.*

C1.1.5 Searching for data on nutritional quality supplied by a contributor

To retrieve information on nutritional quality supplied by a particular contributor select **Nutritional Quality by Contributor** from the **Report Category** box, and click on the forward button. After selecting **All Ingredients** or **Grains Only** the **Nutritional Quality of Ingredients (or Grains)** selection form will appear, similar to the **Contributor's Addresses** form.

To find the nutritional quality data contributed by Dr Robert van Barneveld, select his name from the drop-list and click Preview. *The report generated will be several pages long (see Section B2.5 to find out how many) and the first page is shown in Appendix 1 on page E-18.*

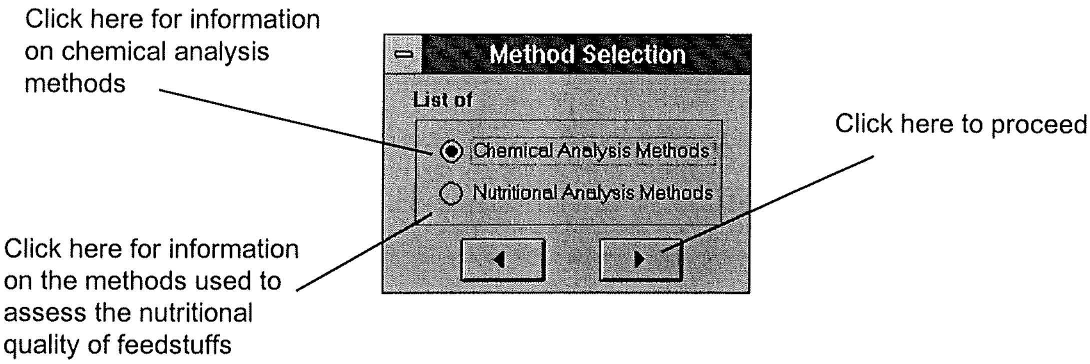
C1.1.6 Searching for data on physical features of ingredients supplied by a contributor

To search for information on the physical features of ingredients or grains supplied by a particular contributor, select **Physical Features by Contributor** from the Report Category box, and then either **All Ingredients** or **Grains Only**. The selection form for the **Physical Features of Ingredients (or Grains) Provided by Contributor** will be displayed and is the same as the previous two forms.

Example 13. To find the data on physical features supplied by Mrs Zihong Miao, a PhD student at the University of Adelaide, select her name from the drop-list and go to the report. It will be several pages long and the first page is shown in Appendix 1 on page E-19.

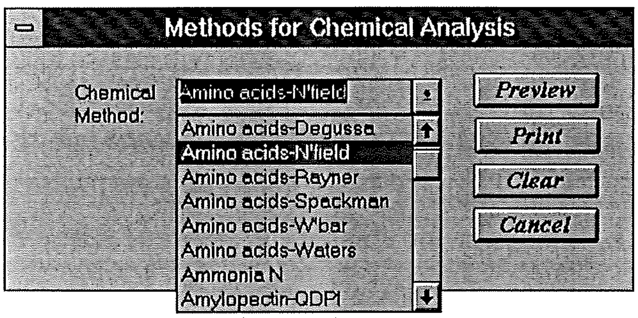
C1.2 Searching for Experimental Methods

To retrieve detailed information about the experimental methods used for chemical analysis or evaluation of nutritional quality, double click on **Feed Evaluation Research** on the main menu of the ALFI database. From the report category dialog box, select the **Experimental Methods** option and click the forward button. In the **Method Selection** report category dialog box, you can select either **Chemical Methods** or **Nutritional Analysis Methods** as shown below.



C1.2.1 Searching for information on chemical analysis methods

To search for information on methods used for determining the chemical composition of feed ingredients select **Chemical Methods** from the **Method Selection** report category dialog box and click the forward button. The methods for chemical analysis selection form will appear as shown below.



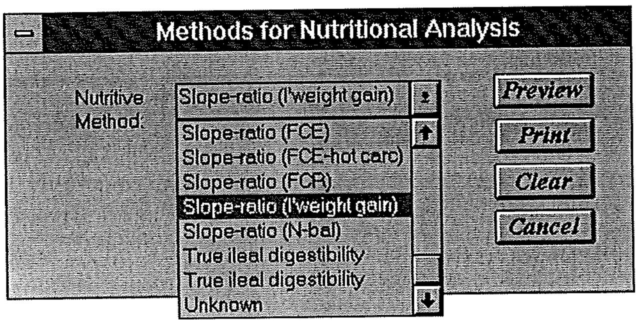
The methods for chemical analysis selection form

From the **Chemical Method** drop list on the selection form you can select any method to **Preview** or **Print**.

Example 14. To find information on the method used for determining Amino Acid content at Northfield. Enter the details as shown above and the report is shown in Appendix 1 on page E-20.

C1.2.2 Searching for information on the experimental methods for nutritional quality

To search for information on methods used for determining the chemical composition of feed ingredients select **Nutritional Analysis Methods** from the **Method Selection** report category dialog box and click the forward button. The **Methods for Nutritional Analysis** selection form will appear as shown. From drop list on the selection form you can select any method to **Preview** or **Print**.



The methods for nutritional analysis selection form

Example 15. To find information on the slope-ratio assay (based on liveweight gain) used to evaluate the availability of lysine. Enter the details as shown above and the report is shown in Appendix 2 on page E-21.

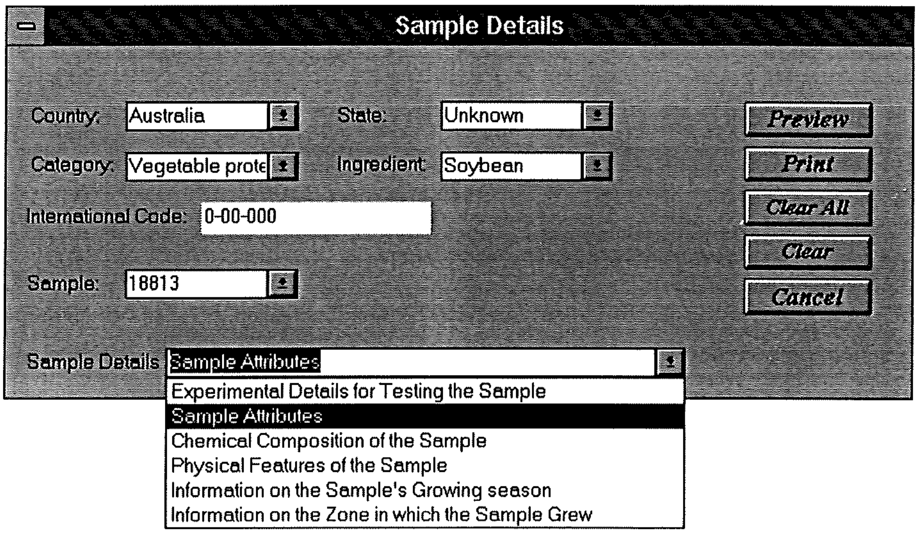
Section C – More Advanced Functions

C2. Individual Sample Information

Individual sample information allows you to access all of the data available for a sample including the growing environment and experimental details for nutritional evaluation where it is available. The data is reported by two categories, **All Ingredients** and **Grains Only**.

C2.1 Sample details (All Ingredients)

After selecting **All Ingredients** from the report category box, the **Sample Details** selection form will appear for you to further narrow your search as shown below.



The sample details selection form

On the **Sample Details** selection form, both *Country* and *State* **must** be selected even though *State* is still nested within *Country*. Both *Category* and *Ingredient* must also be selected.

Once you have selected an ingredient, the International Feed Code for the ingredient will automatically appear in the International Code box (and also be printed on the report.) The International Feed Code is assigned by the International Network of Feed Information Centres which has temporarily suspended operations. In the Sample drop list, individual sample identification numbers (ID's) are displayed which you can select or you can type in a particular sample ID. The Sample ID numbers are solely for identification purposes within the database. Unfortunately there is no way to know in advance which sample ID number corresponds to which sample. From the *Sample Details* drop list you can select one of several options to examine in detail.

C2.1.1 Sample Attributes:

Selecting **Sample Attributes** from the drop list will display the basis on which the data is expressed (as-fed), condition of the sample when it was analysed, what plant fraction the sample is from (kernel, hull or whole seed), maturity of the sample (ripe seed or screenings), processing method (extracted, ground or defatted), data quality and the storage method of the sample before analysis.

Example 16. To examine the available information for a sample of soybean meal. Select the options as shown in the example on the previous page. From the sample details drop-list select *Sample Attributes.* ***The report is shown in Appendix 1 on page E-22.***

C2.1.2 Chemical Composition of the Sample

Selecting **Chemical Composition of the Sample** from the *Sample Details* drop list will allow you to **Preview** or **Print** the report on chemical composition of the selected sample.

After examining and/or printing the sample attributes report, you can close the report window and simply select another set of details to examine. Select *chemical composition of the sample* ***and click*** *preview.* ***The report is shown in Appendix 1 on page E-23.***

C2.1.3 Physical Features of the Sample

From the *Sample Details* drop list, select **Physical Features of the Sample,** then **Print** or **Preview** the report on the physical characteristics of the sample. This option is more relevant to grains.

C2.1.4 Information about the Growing Conditions of the Sample

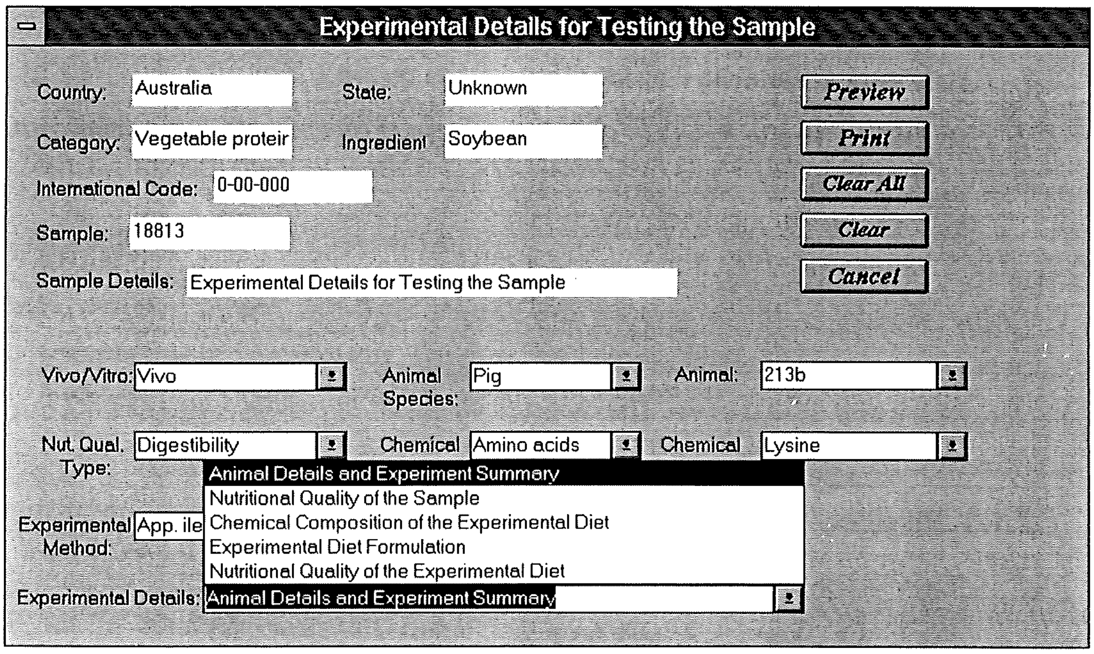
From the *Sample Details* drop list, select **Information on the Sample's Growing Season**, then **Print** or **Preview** the report on growing conditions of the sample. This option is more relevant to grains.

C2.1.5 Information about the Zone in which the Sample Grew

From the *Sample Details* drop list, select **Information on the Zone in which the Sample Grew,** then **Print** or **Preview** the report on general environmental information about the zone where the sample grew. This option is more relevant to grains.

C2.1.6 Experimental Details for Testing the Sample

From the *Sample Details* drop list, select **Experimental Details for Testing the Sample**, and click **Preview**. The **Experimental Details for Testing the Sample** selection form will appear for you to further define the information for which you are searching, as shown below.



The experimental details for testing the sample selection form

The following options on this form need to be selected:

- **Vivo/Vitro:** Defines whether you are searching for samples for which nutritional quality was determined using either *in vivo* or *in vitro* methods.

- **Animal Species:** Although several species are available for selection, currently, only data on pigs is included in the database. The PRDC, GRDC, FRDC, CMRDC, EIRDC (RIRDC) have funded continued development for fish, layer chickens and broiler chickens.

- **Animal:** The *Animal* drop list is a collection of animal identification numbers (ID's) of the different groups of animals used for testing the sample. One sample may correspond with one animal ID, but one sample may also be tested using a number of groups of animals, or one group of animals may also have been used to test a number of samples. Again, these ID numbers are used solely for identification purposes within the database and it is not possible to know in advance which ID numbers correspond to which animals. However, only the animal ID numbers which are linked to the selected sample will be displayed.

- **Nutritional Quality Type (Nut. Qual. Type):** This includes digestibility, metabolisability, availability and energy (DE, ME or NE) (see Section B5.1 for more details).

- **Chemical Type:** Proximates, amino acids, minerals, NSP, vitamins, and so on (see Section B4.3 and Section D for more details).

- **Chemical Component:** After you select the **Chemical Type**, you will be able to select a chemical component or nutrient.

- **Experimental Method:** This option enables you to select data using a particular method for assessing nutritional quality.

After selecting all above parameters, then you need to select one of the following from the **Experimental Details** drop list to **Preview** or **Print**.

Select the *experimental details for testing the sample* ***from the drop-list. Enter the animal details etc as shown in the example on the previous page (the nutritional quality method is*** *apparent ileal digestibility).* ***From the drop-list select*** *animal details and experiment summary.* ***The report is shown in Appendix 1 on page E-24.***

C2.1.6.1 Animal Details and Experimental Summary

This section will display age, sex, breed, physiological status, feeding level, feed form (ie pelleted, mash etc) initial body weight, final body weight, body weight gain, number of animals used, duration of experiment as well as a summary of the experiment

C2.1.6.2 Nutritional Quality of the Sample

After selecting **Nutritional Quality of the Sample** from the Experiment Details drop list, you can **Preview** or **Print** animal breed, physiological status, feeding level and feed form used in this experiment (if they are known) as well as the nutritional quality of the sample.

From the drop-list select *nutritional quality of the sample.* ***The report is shown in Appendix 1 on page E-25.***

C2.1.6.3 Chemical Composition of the Experimental Diet

From the *Experiment Details* drop list, selecting **Chemical Composition of the Experimental Diet** will display the mean values for the chemical composition of the experimental diet and the analysis method used.

C2.1.6.4 Experimental Diet Formulation

Select **Experimental Diet Formulation** from the *Experiment Details* drop list box, then click on **Preview** or **Print** for information on the feed ingredients and their proportions included in the diet.

From the drop-list select *experimental diet formulation.* ***The report is shown on page E-26 in Appendix 1.***

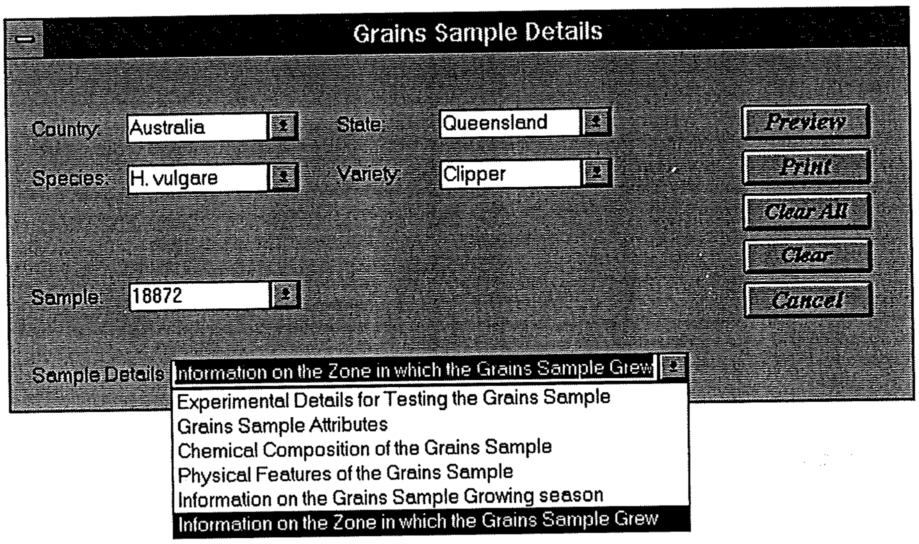
C2.1.6.5 Nutritional Specifications of the Experimental Diet

Select **Nutritional Specifications of the Experimental Diet** from the *Experimental Details* drop list box, then click **Preview** or **Print** for information on the nutritional specifications of the experimental diet and the evaluation method used.

From the drop-list select *nutritional specifications of experimental diet.* ***The report is shown on page E-27 of Appendix 1.***

C2.2 Sample Details (Grains Only)

To search for all the information about an individual grain sample, select **Grains Only** from the report category box and the **Sample Details** selection form will appear for you to further narrow your search as shown below.



The sample details selection form

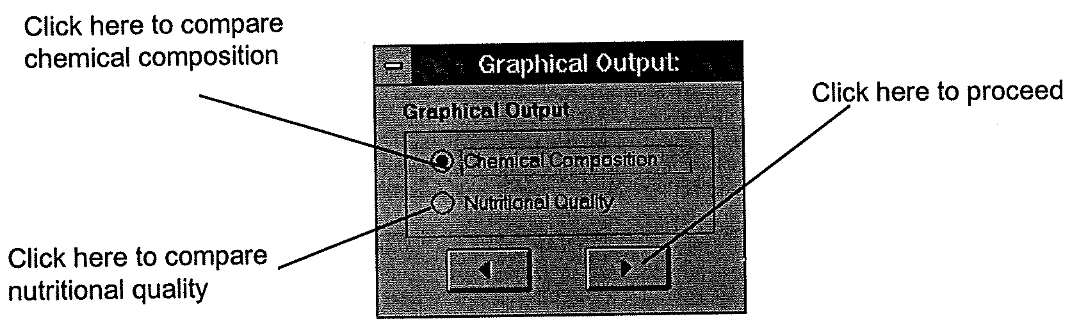
On this **Sample Details** form, Country and State **must** be selected even though State is still nested within Country. Species and Variety **must** also be selected. The remaining options for searching for information on grains are the same as ingredients and have been explained previously in Section C2.1.

Example 17. Using the information given in the above selection form example above, generate reports for the *sample attributes* ***(report on page E-28) and for*** *information on the zone in which the sample grew* ***(The report is shown on page E-29 of Appendix 1.)***

Section C –Advanced Functions

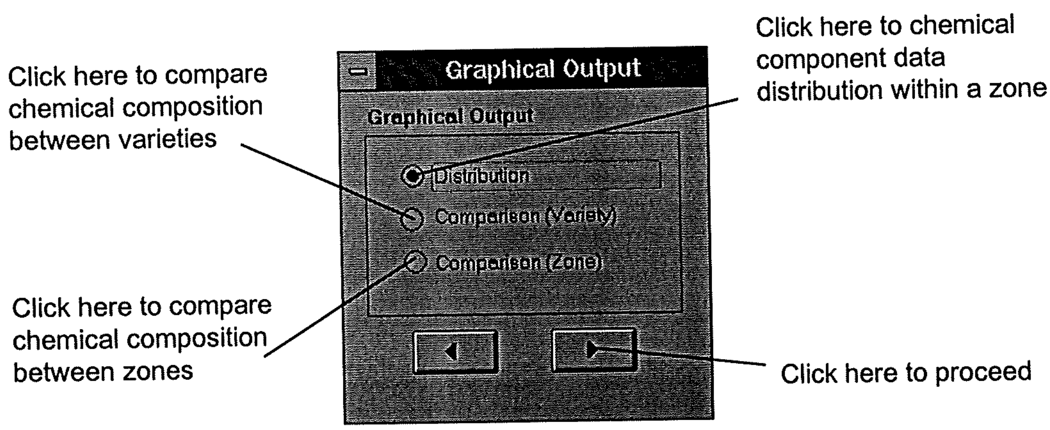
C3. Retrieving Data in Graphical Form

The graphical outputs of the ALFI database allow users to compare the chemical composition and nutritional quality of grains and other plant-derived feeds from different zones and varieties and to examine the distribution of a chemical component within the country or state. To retrieve data in graphical form double click on the **Graphical Output** picture on the main menu of the ALFI database and the graphical output report category box will appear on screen as shown below.



C3.1 Chemical Composition Data

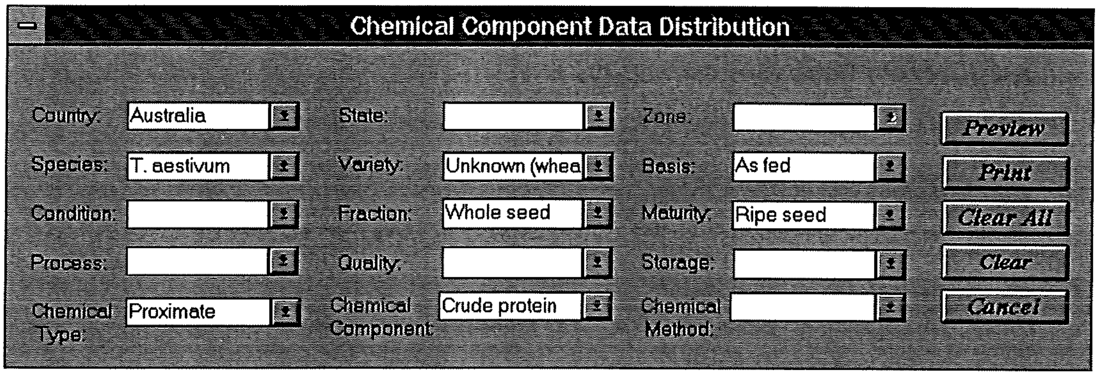
To examine the distribution of a specific chemical component or to make comparisons of chemical composition between plant-derived feeds from different regions or from different varieties, click on chemical composition on the report category box and click the forward arrow. A second report category box will appear as shown below.



C3.1.1. Chemical component data distribution

Example 18. To examine the distribution of crude protein amongst the wheat samples in the database with unknown varieties.

To search the chemical component data distribution pattern within the state, zone or country, select **Distribution** from the report category box and click the forward arrow. The **Chemical Component Data Distribution** selection form will appear as shown below.

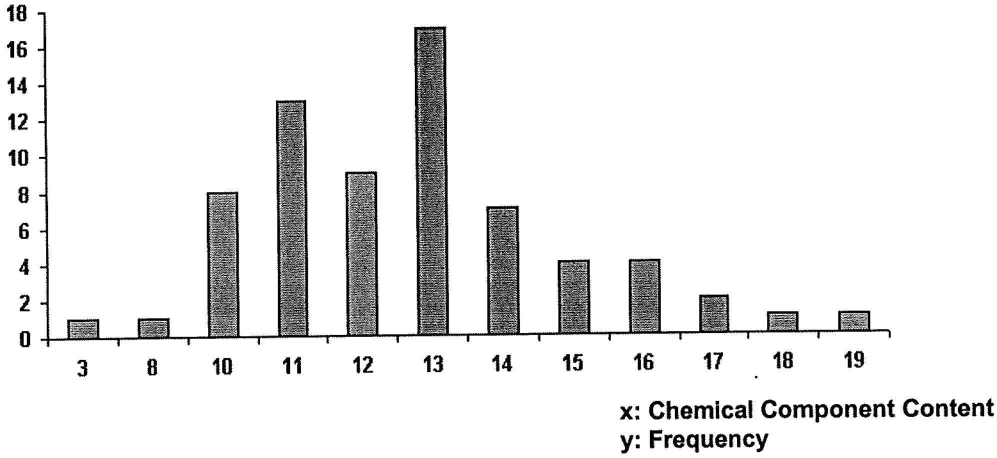


The chemical component data distribution selection form

The options available on this selection form have been discussed previously in Chapter B4. After selecting the zone, plant species and variety and the chemical component you wish to examine click on **Preview** to examine the report.

Select the options as shown in the example above. The graph from the report generated from this selection is shown on the next page.

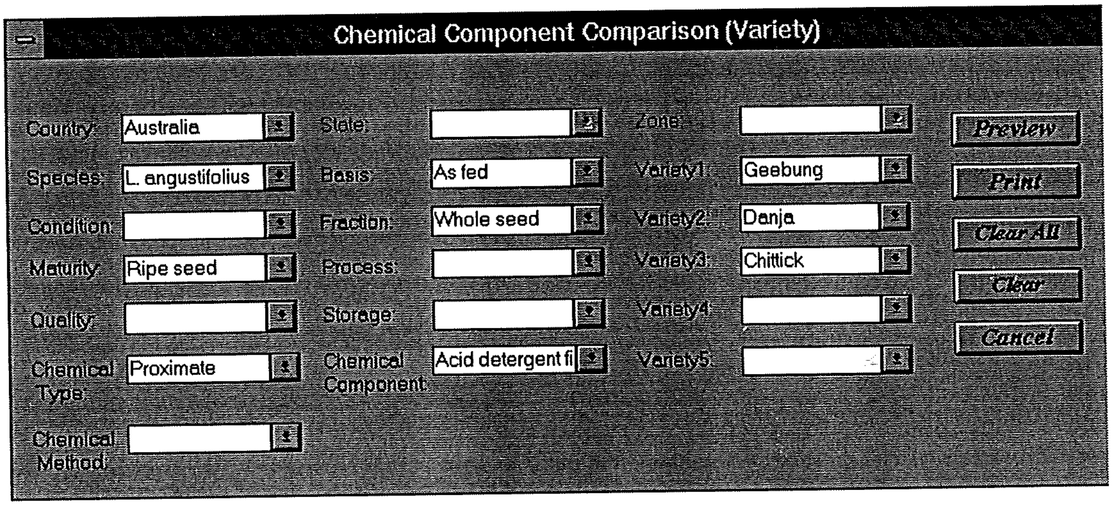
On the graph, the X-axis corresponds to the amount of the particular chemical component, in this case crude protein in the samples. The Y-axis corresponds to the number of samples that have that concentration of crude protein (ie the frequency). In this example it can be seen that the range of crude protein in wheat (from all over Australia and including a mixture of varieties) is from 3 – 19% crude protein (measured with different methods) and that the value for crude protein with the highest frequency is 13%.



C3.1.2 Comparison of chemical composition between varieties

Example 19. To compare the ADF content in samples for lupins (L. angustifolius)

To compare chemical composition among varieties of a plant species, select **Comparison (Variety)** from the report category box. The **Chemical Component Comparison** selection form will appear as shown below.

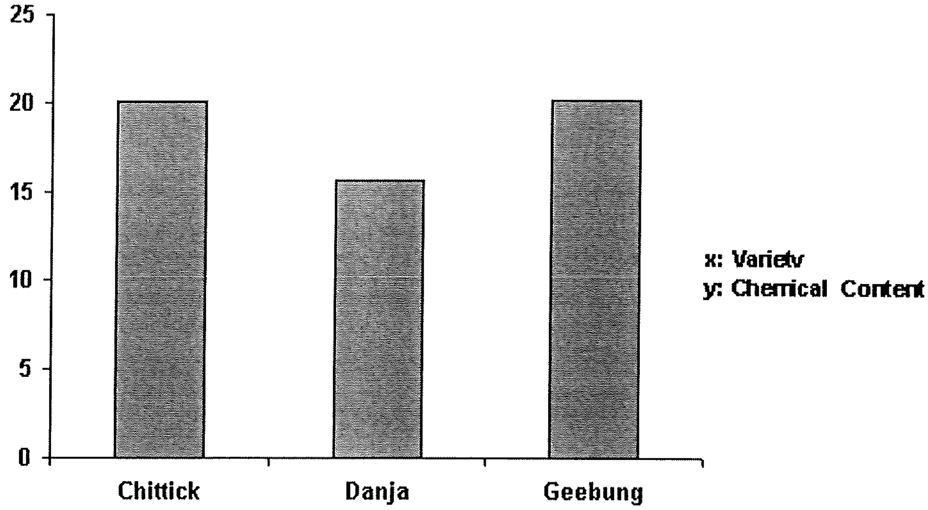


The chemical component comparison selection form

The options available for selection on this form have been described previously in Chapter B4, with the exception of:

- **Variety 1-5**: This allows users to select varieties of interest for comparison. The current database allows you to select a maximum of 5 varieties.

Select the options as shown in the example above. The graph from the report generated from this selection is shown below.



In this graph, the X-axis corresponds to the varieties chosen for comparison and the Y-axis corresponds to the amount of the particular chemical in the ingredient chosen for comparison. In this example the acid-detergent fibre (ADF) content of all of the lupins ranges between 16 and 21% and Geebung has the highest ADF content.

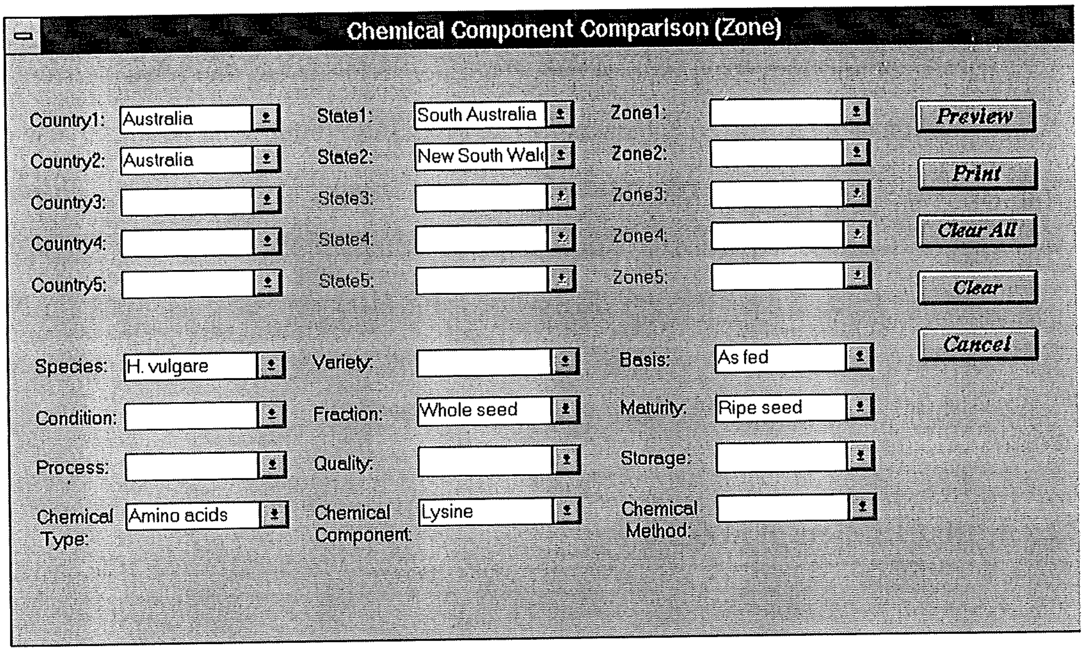
C3.1.3 Comparison of chemical composition between zones

Example 20. To compare the lysine content in samples of barley grown in NSW and SA.

To compare chemical composition of plant-derived feedstuffs from different zones, select **Comparison (Zone)** from the report category box. The **Chemical Component Comparison (Zone)** election form will appear as shown on the next page.

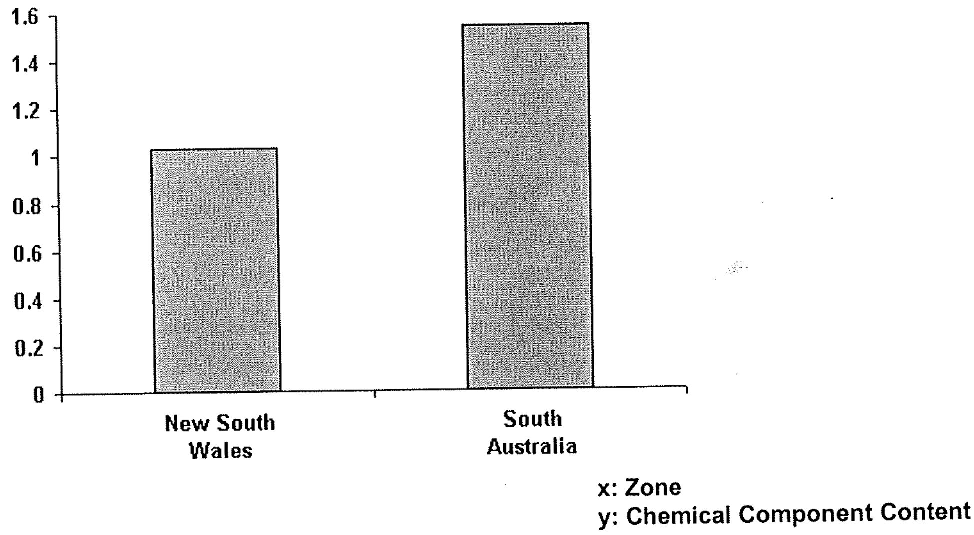
The options available for selection on this form have been described previously in chapter B4. On this form you can select either a country, state and/or zone for comparison. Up to five regions can be compared on the same graph.

Example 21. To compare the lysine content in samples of barley grown in NSW and SA.



The chemical component comparison (zone) selection form

Select the options as shown in the example above. The report will display the graph shown below.



On this graph, the X-axis corresponds to the zone being compared, and the Y-axis corresponds to the amount of the particular chemical component in the ingredient. From this graph it can be seen that the lysine content of barley samples from South Australia (including all varieties) is higher than the lysine content of barley samples from New South Wales included in the ALFI Database.

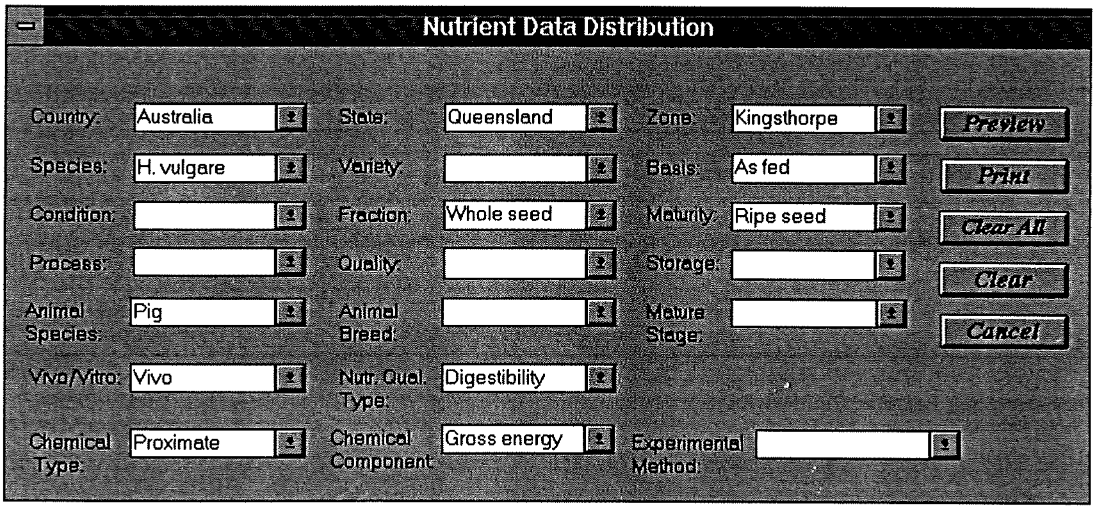
C3.2 Nutritional Quality Data

In the **Graphical Output** section of the ALFI Database, the term nutrient is used to describe a chemical components of a feed ingredient that relate to it's nutritional quality for livestock, (eg digestible energy, available lysine etc). To examine the distribution of a particular nutrient or to compare the nutritional quality of plant-derived feeds from different regions or from different varieties, click on **Nutritional Quality** on the report category box and click the forward arrow. A second report category box will appear as shown in section C3.1.

C3.2.1 Distribution of nutrients

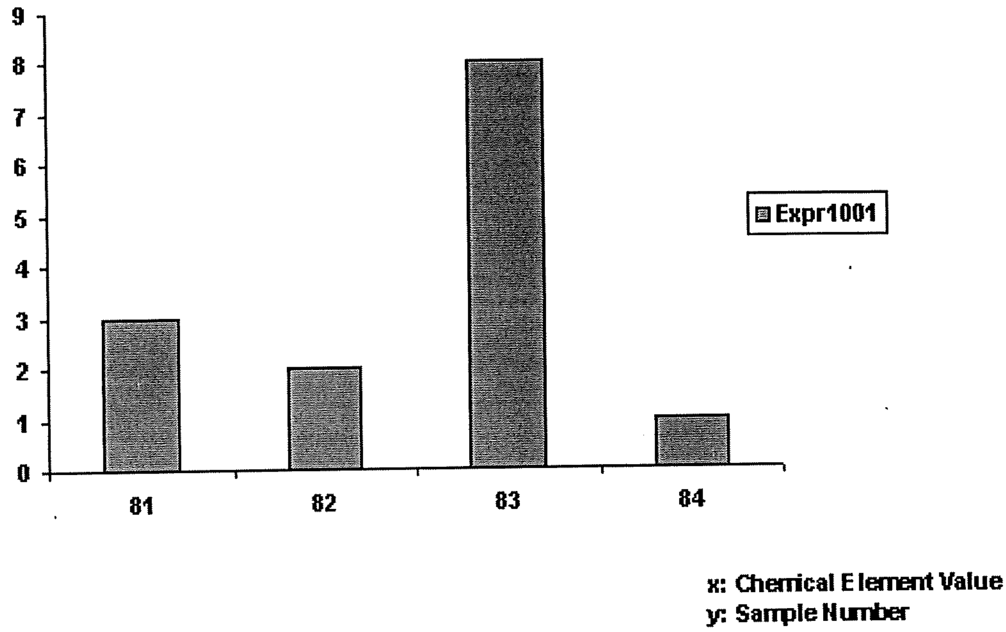
Example 22. To examine the distribution of digestible energy in samples of barley from Kingsthorpe, Queensland.

To examine the pattern of data distribution for a particular nutrient within State, Zone or Country, select **Distribution** from the report category and **the Nutrient Data Distribution** selection form will appear as shown below. The options available on this form have been described previously in Chapter B4.



The nutrient data distribution selection form

Enter the selections as shown in the above example. The graph generated by this form is shown on the next page.



The graph is structured the same as the graph described in section C3.1.1. From this graph it can be seen that the digestibility of gross energy in 8 out of 14 samples of barley from Kingsthorpe in Queensland is 83%.

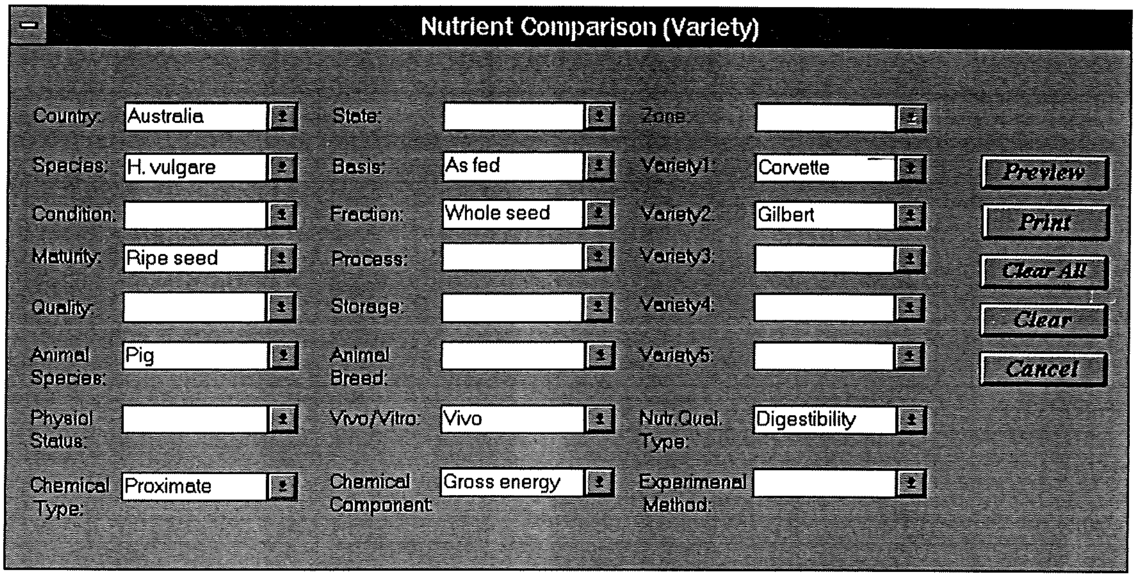
C3.2.2 Comparison between varieties

Example 23. To compare the digestible energy in samples of barley (H. vulgare cv Corvette and cv Gilbert) from Queensland.

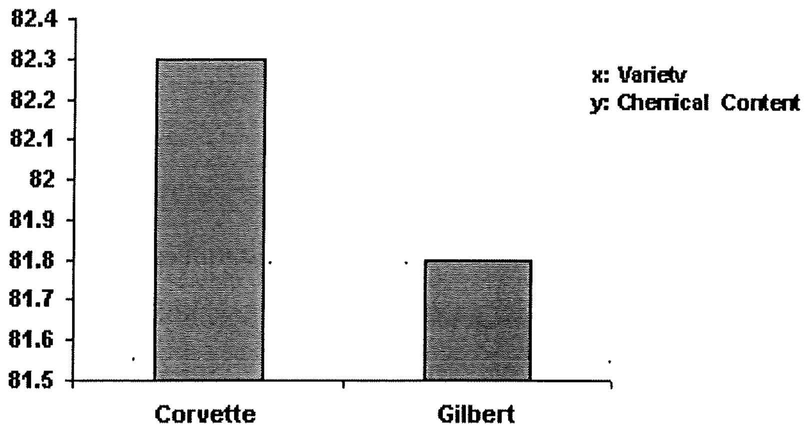
To compare nutritional quality among varieties select **Comparison (Variety)** from the report category box. The **Nutrient Comparison (Variety)** selection form will appear as shown on the next page.

The options available on this selection form have been described in Chapter B4. As with the chemical composition comparison described in section C3.1.2, you can choose up to 5 varieties of the same species of plant to compare.

Enter the selections as shown on the example on the next page. The graph on the report generated by the selection is shown below it.



The nutrient comparison (variety) selection form

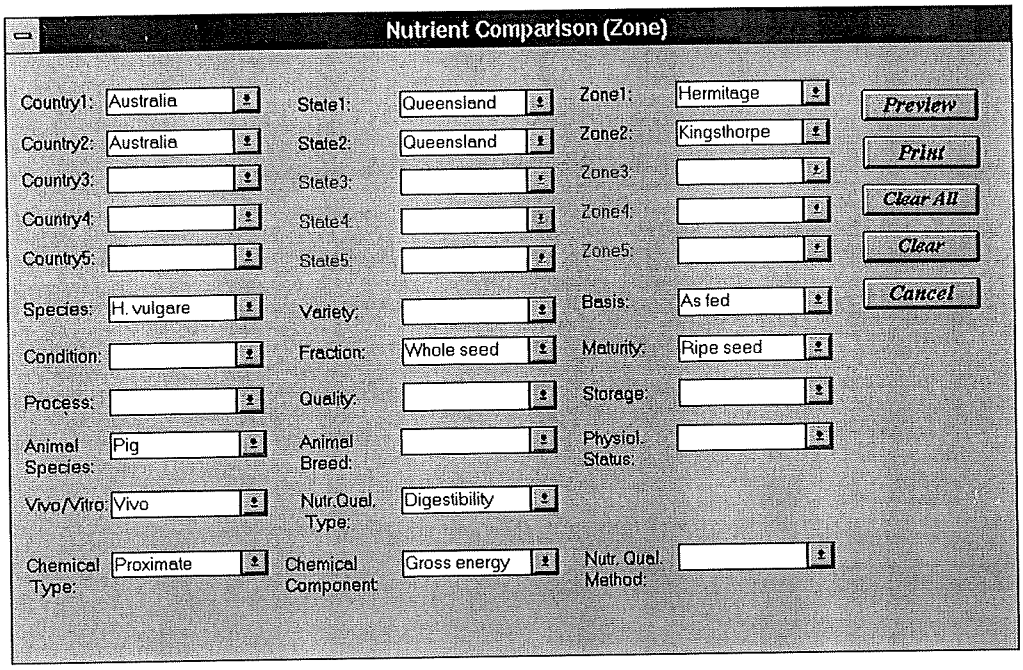


From this graph it can be seen that the digestibility of gross energy is higher in samples of the barley variety Corvette grown in Queensland, than in the Gilbert variety samples grown in the same state.

C3.2.3 Comparison between zones

To compare nutritional quality between states or zones for a particular variety, select **Comparison (Zone)** from the report category box. The **Nutrient Comparison (Zone)** selection form will appear as shown on the next page.

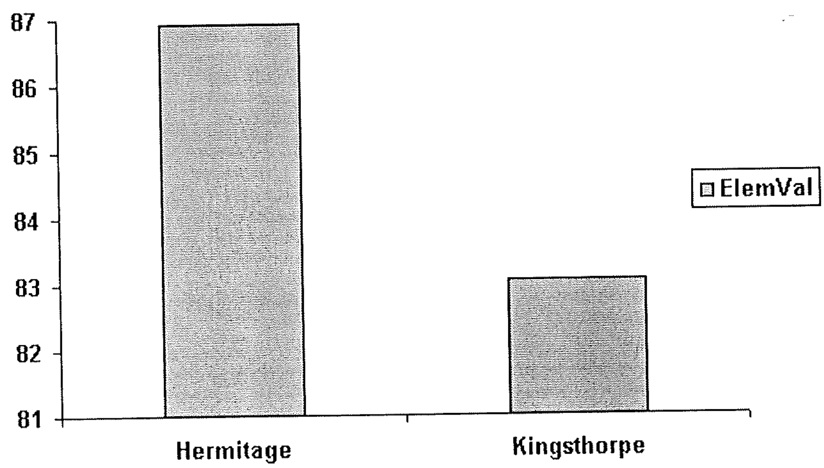
Example 23. To compare the digestible energy in samples of barley grown at Kingsthorpe and Hermitage (Warwick) in Queensland.



The nutrient comparison (zone) selection form

The options available on this selection form have been described in Chapter B4 As with the chemical composition comparison described in section C3.1.3, you can choose up to 5 regions in which to compare the same species or variety of plant.

Enter the selections as shown on the example above. The graph on the report generated by the above selection is shown below.

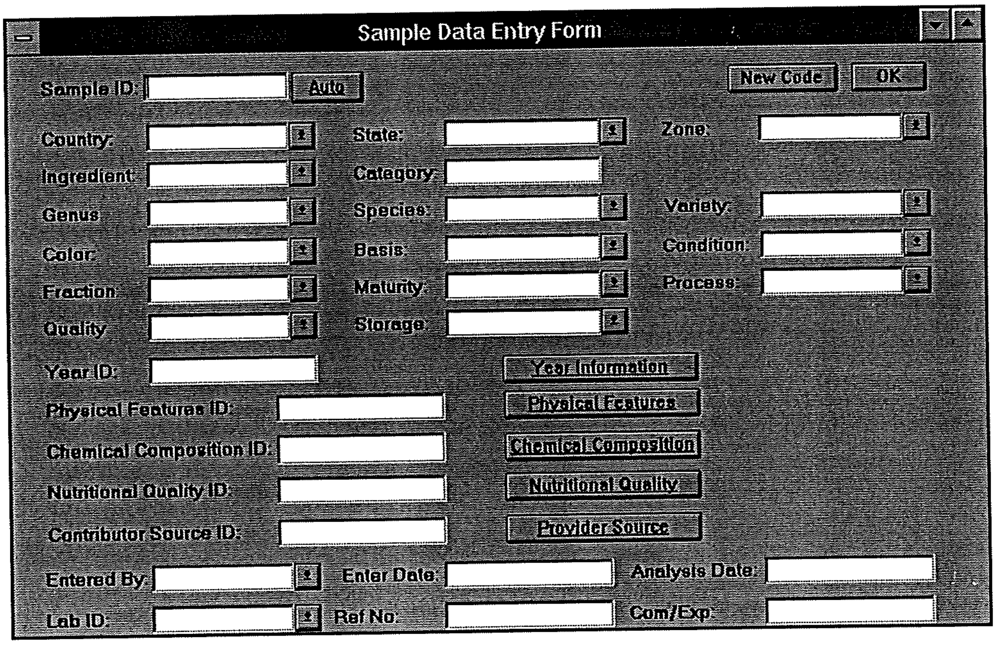


From this graph it can be seen that barley grown at Hermitage (all varieties) has a higher gross energy digestibility than barley grown at Kingsthorpe.

Section C –Advanced Functions

C4. Entering your own data

The ALFI Database includes a facility to enter data for those users that maintain or generate feed evaluation data for themselves. It is preferable that data is submitted to the ALFI Database staff at SARDI in South Australia to be entered centrally and then distributed with updates. However, if you wish to enter your own data you will need to contact ALFI Database staff prior to upgrading to ensure that your own database is maintained. To enter your own data into the ALFI Database double click on the Data Entry image on the ALFI Database main menu. The **Sample Data Entry Form** will appear on screen as shown below.



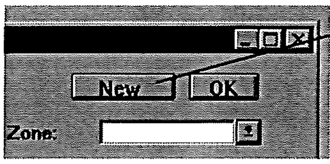
The Sample Data Entry Form

When entering data into the Database it is important to have all your information together. New sample information will often have data on parameters that are already included in the database. However, with some samples you will need to enter **new** information such as new ingredients, methods etc. It is important to enter new information first so that the options are available for selection when entering the data on the particular sample. While you are unfamiliar with the database it may be difficult to identify what is in the database and what isn't. If you assume that the information is not there to begin with and follow the procedure for new information you will be able to see what is in the database and enter/not enter the data accordingly. ***Please note***: when entering new information it is important to make sure it is correct and that you don't disturb the information that is already in the database as this could make the database unusable.

NOTE – THIS EXAMPLE IS AN ILLUSTRATION. THIS DATA HAS ALREADY BEEN ENTERED INTO THE DATABASE. PLEASE DO NOT RE-ENTER THIS DATA INTO THE DATABASE. Example 24. To enter information on a sample of naked oats from van Barneveld et al., 1998 (Naked oats sample A). The paper is supplied in full in Appendix 4, along with a summary and some other information related to the example. As you become familiar with the database you will know what information is relevant to the database, and what is already included.

C4.1 Entering new information

To enter new information for the database, click on new on the sample data entry form.

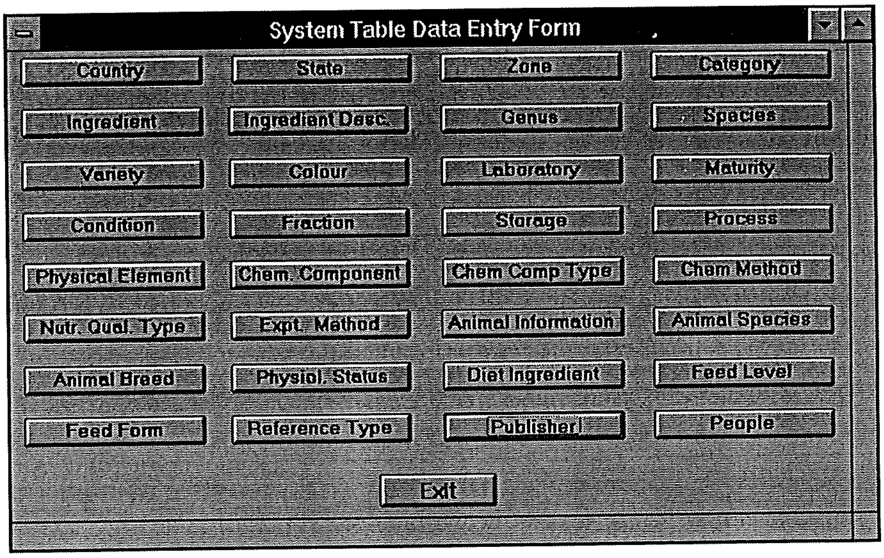


Click here to enter new source information

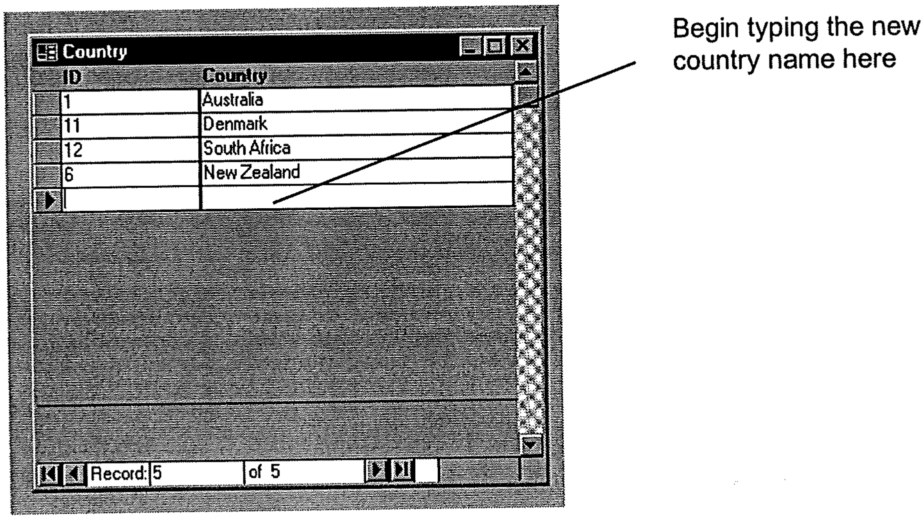
After clicking new on the sample data entry form, the system table data entry form will appear on screen as shown on the next page. From this table you can select to enter information on new countries, varieties etc

C4.1.1 Entering new countries

To enter a new country into the ALFI Database, click once on the country button on the system table data entry form. The country data entry form will appear as shown on the next page. Place the cursor into the next space in the column containing the country names using the mouse. Type the name of the country and press enter. The ALFI Database will automatically assign a new ID number to the country.



The System Table Data Entry Form

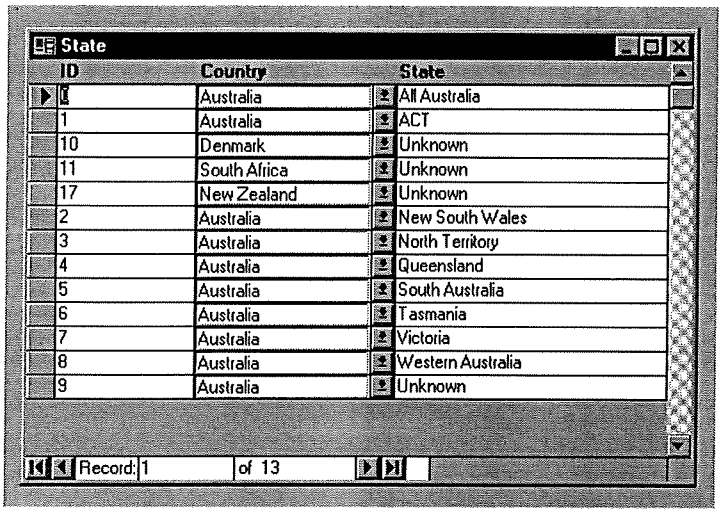


The Country Data Entry Form

You can enter as many countries as you wish. Once you have finished adding new countries click on the cross in the top right hand corner (Windows 95) or left hand corner (Windows 3.1) to return to the System Table Data Entry Form.

C4.1.2 Entering new states

To enter a new state or province for a country, click on the **State** button on the System Table Data Entry Form. The State Data Entry Form will appear on screen as shown. Select the country from the drop-list box (this is why it is important to enter the name of the new country first.) Then, using the mouse and the scroll bar on the left of the screen, place the cursor in the last space in the column containing the state names and type in the name of the state or province. The ALFI Database will generate a new ID number as you enter the information. When you have finished entering the new state, close the box and return to the system table data entry form.


State

ID	Country	State
0	Australia	All Australia
1	Australia	ACT
10	Denmark	Unknown
11	South Africa	Unknown
17	New Zealand	Unknown
2	Australia	New South Wales
3	Australia	North Territory
4	Australia	Queensland
5	Australia	South Australia
6	Australia	Tasmania
7	Australia	Victoria
8	Australia	Western Australia
9	Australia	Unknown

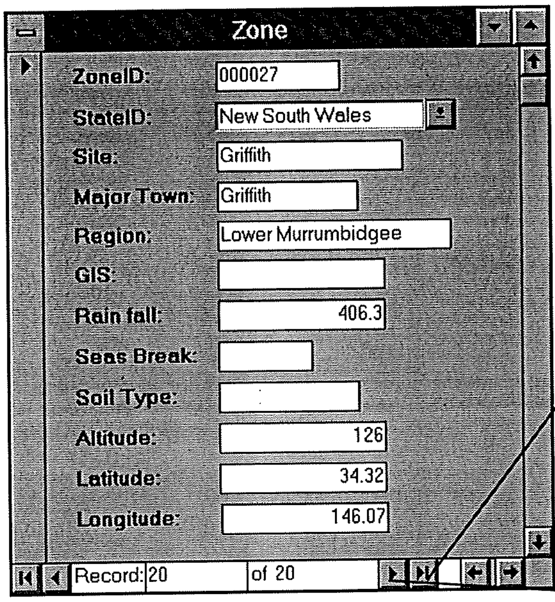
Record: 1 of 13

The State Data Entry Form

C4.1.3 Entering new zones

To enter a new zone, click once on the zone button on the system table data entry form. The Zone data entry form will appear on screen as shown on the next page. Use the mouse to click on the button to get to the last record, then click once on the button to create a new blank record. Choose the state from the drop-list box. As you type in the other information the ALFI Database will automatically assign a new ID number to that zone.

The information that can be entered on this form includes:



Click here to get to the last entry, then….

Click once here to get to a new record in which to enter data

The Zone data entry table

- **Site:** This is the name of the site where the sample was grown. It may be a town or a property name etc. A site name ***must*** be entered.

- **Major town:** This refers to the closest major town to the site.

- **Region:** This refers to which region the site is in using the Australian Standard Geographical Classification (ASGC) system developed by the Australian Bureau of Statistics. This information is published regularly and is available in libraries or direct from the Bureau.

- **GIS:** This refers to the Geographical Information System of using satellites to pin-point the location of the site.

- **Rainfall:** This refers to the average yearly rainfall at the site.

- **Seas Break**: (Season break) This is a term used by agronomists to describe when the "rainy" season starts.

- **Altitude, Latitude and Longitude:** This refers to the altitude, latitude and longitude of the site.

C4.1.4 Entering new ingredient descriptions

Before you enter a new ingredient, you must provide a description of the ingredient. To add a new ingredient description, click on the **Ingredient Desc**. Button on the System Table Data entry form. The **Ingredient Description Data Entry Form** will appear on screen as shown on the next page. Use the mouse to click on the ▶| button to get to the last record, then click once on the ▶ button to create a new blank record. Use the mouse to position the cursor in the box beside common name and type in the name of the ingredient. As you type in the information the ALFI Database will automatically assign a new ID number to that ingredient description. The information that can be entered on this form includes:

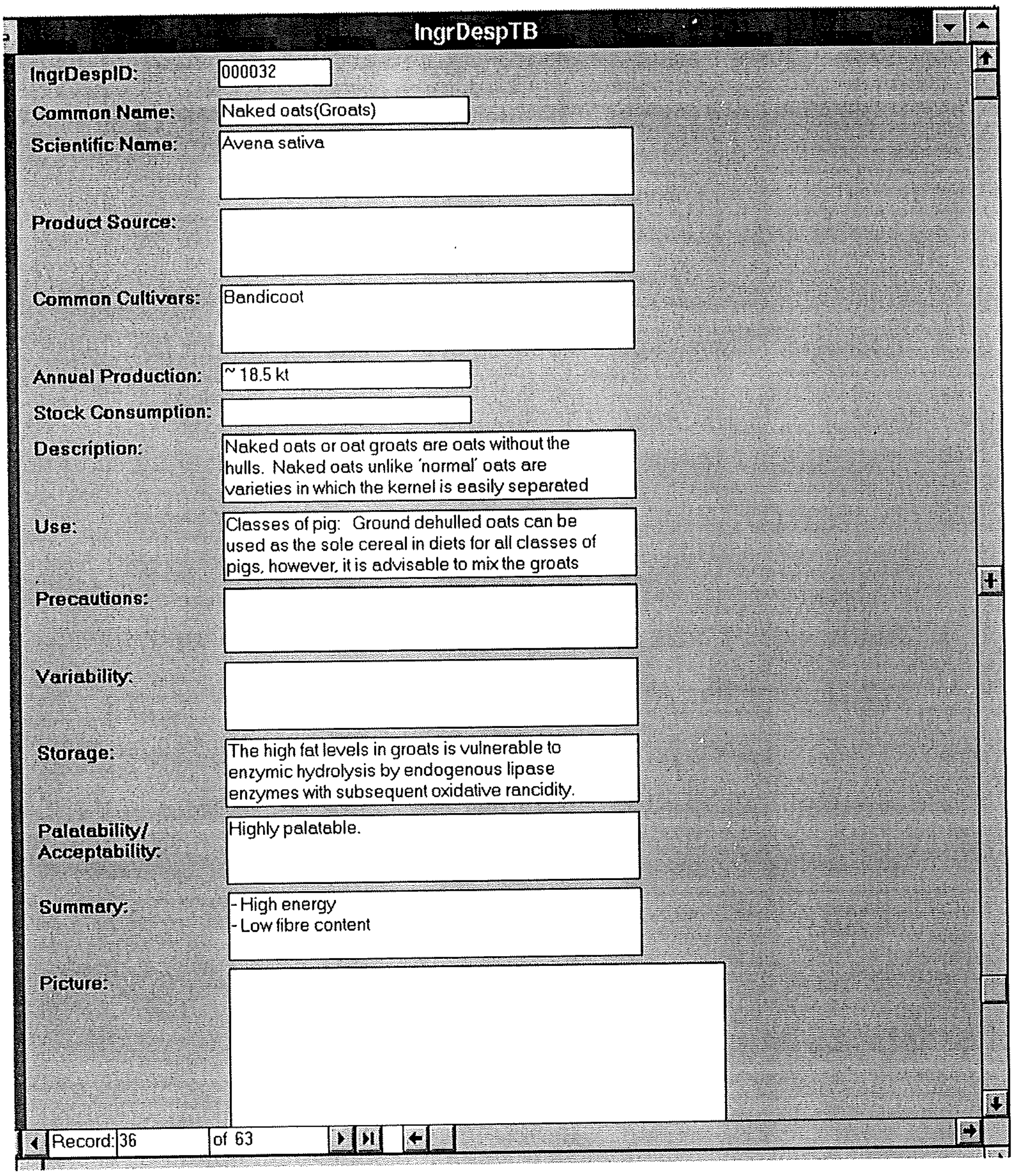
- **Common Name:** The common name of the grain or other ingredient. This information ***must*** be entered. Guidelines for entry of ingredient common names are provided in Section D

- **Scientific Name:** This refers to the scientific name of the plant for plant-derived feeds such as grains. This information ***must*** be entered.

- **Product Source:** This refers to the source of the ingredient for co-products, mineral sources and animal proteins. This information ***must*** be entered.

- **Common Cultivars:** Common cultivars or varieties for plants.

- **Annual Production:** This refers to the amount of the ingredient produced annually.



IngrDespTB

IngrDespID: 000032

Common Name: Naked oats(Groats)

Scientific Name: Avena sativa

Product Source:

Common Cultivars: Bandicoot

Annual Production: ~ 18.5 kt

Stock Consumption:

Description: Naked oats or oat groats are oats without the hulls. Naked oats unlike 'normal' oats are varieties in which the kernel is easily separated

Use: Classes of pig: Ground dehulled oats can be used as the sole cereal in diets for all classes of pigs, however, it is advisable to mix the groats

Precautions:

Variability:

Storage: The high fat levels in groats is vulnerable to enzymic hydrolysis by endogenous lipase enzymes with subsequent oxidative rancidity.

Palatability/ Acceptability: Highly palatable.

Summary: - High energy
- Low fibre content

Picture:

Record: 36 of 63

The ingredient description data entry form

- **Stock Consumption:** This refers to the amount of the ingredient used in animal feeds.

- **Description:** This is a general description about the ingredient and it's uses for animal feed.

- **Use:** This describes the specific use of the ingredient in animal feed such as classes of animals that it can be fed to and maximum inclusion levels.

- **Precautions:** This describes the precautions that need to be taken with the ingredients use such as anti-nutritional factors and toxicity information.

- **Variability:** Is there any variability in the quality of the ingredient?

- **Storage:** How suited is the ingredient to storage and for how long?

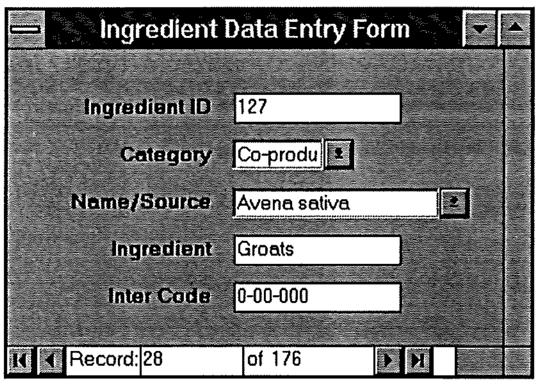
- **Palatability/Acceptability:** What is the palatability/acceptability of the ingredient.

- **Summary:** A brief summary about the ingredient. A guide to entering a summary is included in the Appendix.

- **Picture:** The ALFI Database has the facility for pictures of the ingredients to be attached to the descriptions. These pictures need to be in Windows bitmap (.bmp) format.

C4.1.5 Entering new ingredients

To enter a new ingredient, click once on the ingredient button on the system table data entry form. The ingredient data entry form will appear on screen as shown below.



The ingredient data entry form

To enter a new ingredient, use the mouse to and the scroll bar on the right of the screen to get to the last record and use the cursor to select the following from the appropriate drop-list box:

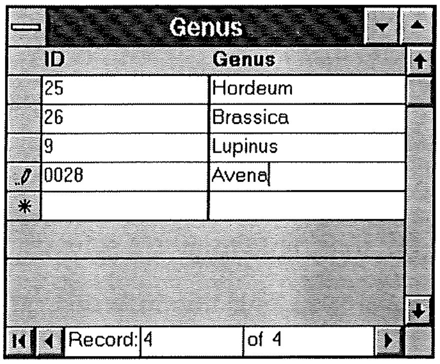
- **Category:** Whether the ingredient can be classified as:
    - Animal protein
    - Vegetable protein
    - Cereal
    - Fats and oils
    - Additives
    - Co-products
    - Mineral supplements
    - Miscellaneous

- **Name/Source:** You need to be able to give a scientific name for plants or a source for co-products etc to be able to link this information to the description you have already typed in. What you entered into the Scientific Name and Product Source boxes should be available for selection.

Once you have selected the category and source for the ingredient, type in **the name of the ingredient** in the next column. As you type in the information the ALFI Database will automatically assign a new ID number to that ingredient. The last column refers to the **international feed ingredient code** for the ingredient. International feed ingredient codes can be obtained from ALFI Database staff. If the ingredient does not yet have a code we will apply for a number on your behalf. At present however, the International Network of Feed Information Centres which assigns the code has temporarily ceased operating. In the meantime you may need to assign a "dummy" number as this space ***must not*** be left blank. This number can be the same as another dummy number in the database.

C4.1.6 Entering a new genus

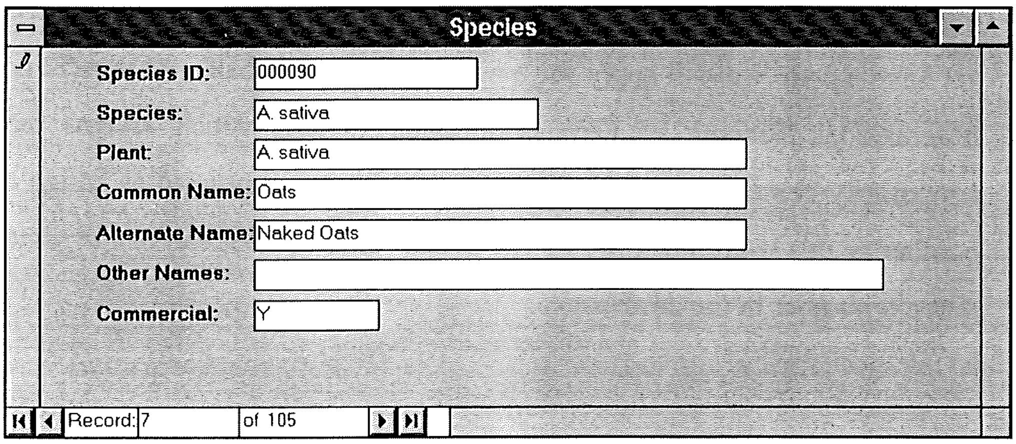
For those ingredients that are plant-derived such as grains, you will need to enter the scientific name in two steps – first genus, then species. Varieties are entered last. To enter a new genus into the database, click once on the genus button on the system table data entry form. The Genus data entry form will appear on the screen as shown on the next page. To enter a new genus, use the mouse to position the cursor in the first blank space in the genus column and start typing. As you type in the information the ALFI Database will automatically assign a new ID number to that genus. They are listed in alphabetical order.



The genus data entry form

C4.1.7 Entering a new species

To enter a new species, click once on the species button on the system data entry table. The Species data entry table will appear as shown below.



The species data entry table

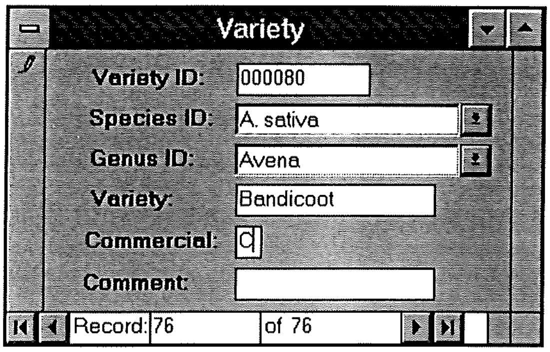
To enter a new species, use the mouse to click on the ▶| button to get to the last record, then click once on the ▶ button to create a new blank record. Use the mouse to position the cursor in the box beside species and type in the scientific name of the plant using the abbreviated form for genus as shown in the above example. As you type in the information the ALFI Database will automatically assign a new ID number to that species. The other information that can be entered on this form includes:

- **Plant:** This refers to the name of the plant in the scientific form
- **Common Name:** This refers to one common name for the plant (ie the most common).
- **Alternate Name:** Several plants have more than one common name. This allows you to enter an alternate name for the plant.
- **Other Names:** Any other alternate names that could be used as a cross reference can be entered here.
- **Commercial:** Is this species in commercial production. Enter Y for yes, N for no.

Once you have completed entering all of the information close the form and you will be returned to the system data entry table.

C4.1.8 Entering a new variety

To enter a new variety, click once on the variety button on the system data entry table. The variety data entry table will appear as shown on the next page. To enter a new species, use the mouse to click on the ▶| button to get to the last record, then click once on the ▶ button to create a new blank record. Select the species and the genus from the drop-list box. As you type in the variety name the ALFI Database will automatically assign a new ID number to that variety.



The variety data entry table

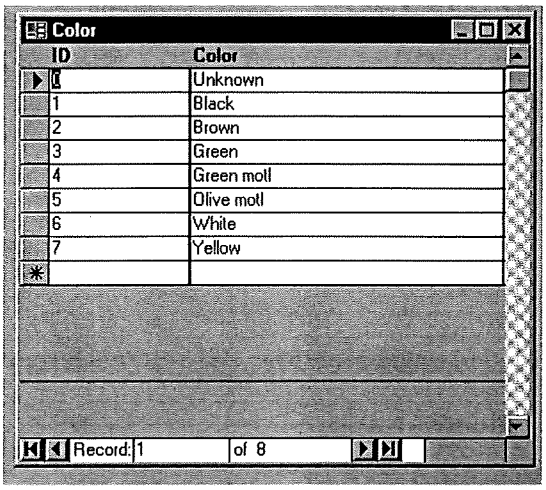
The other information that can be entered on this form includes:

- **Commercial:** As with Species, is the Variety in commercial production? Enter Y for yes, N for no.

- **Comment:** In this space you can add a comment about the variety.

C4.1.9 Entering a new colour

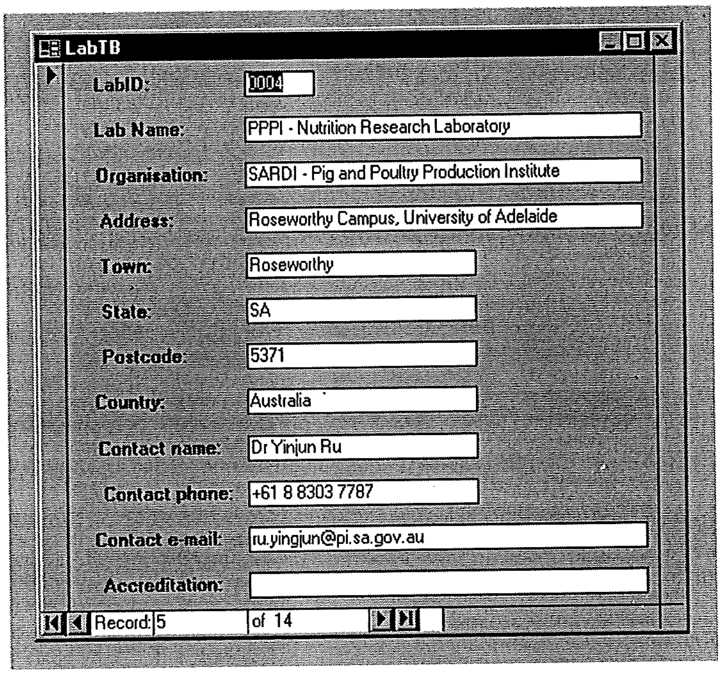
To enter a new colour, click once on the colour button on the system data entry table. The colour data entry table will appear as shown below. To enter a new colour, use the mouse to position the cursor in the first blank space in the colour column and start typing. As you type in the information the ALFI Database will automatically assign a new ID number to that colour.



The colour data entry form

C4.1.10 Entering a new laboratory

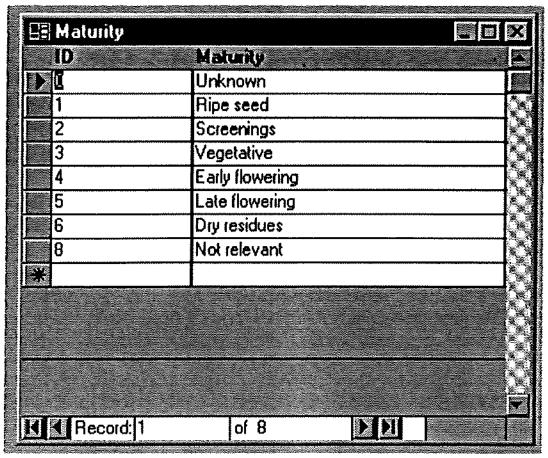
To enter a new laboratory, click once on the laboratory button on the system data entry table. The laboratory data entry table will appear as shown below. Use the mouse to click on the button to get to the last record, then click once on the button to create a new blank record. As you type in the laboratory name the ALFI Database will automatically assign a new ID number to that laboratory. Most of the information on this form is self-explanatory. Accreditation refers to what quality assurance standards and what accreditation the laboratory has.



The laboratory data entry table

C4.1.11 Entering a new plant maturity

To enter a new plant maturity, click once on the maturity button on the system data entry table. The maturity data entry table will appear as shown. To enter a new plant maturity stage, use the mouse to position the cursor in the first blank space in the maturity column and start typing. As you type in the information the ALFI Database will automatically assign a new ID number to that stage of maturity.

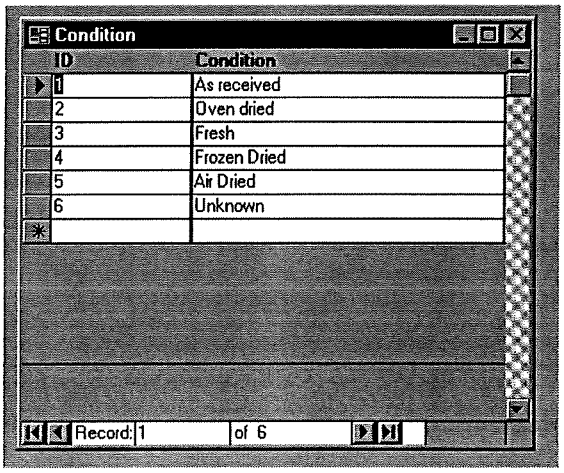


ID	Maturity
0	Unknown
1	Ripe seed
2	Screenings
3	Vegetative
4	Early flowering
5	Late flowering
6	Dry residues
8	Not relevant

The maturity data entry table

C4.1.12 Entering a new condition

To enter a new condition, click once on the condition button on the system data entry table. The condition data entry table will appear as shown below.



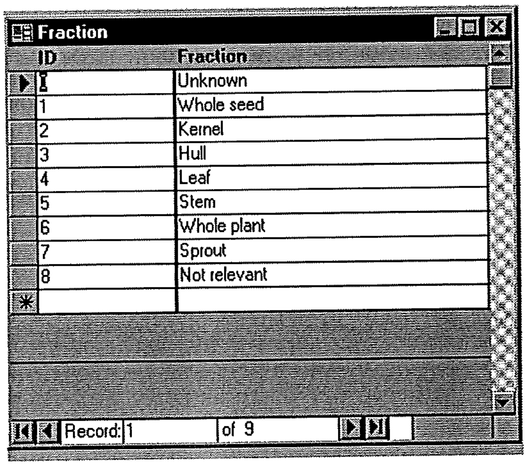
ID	Condition
1	As received
2	Oven dried
3	Fresh
4	Frozen Dried
5	Air Dried
6	Unknown

The condition data entry table

To enter a new condition, use the mouse to position the cursor in the first blank space in the condition column and start typing. As you type in the information the ALFI Database will automatically assign a new ID number to that condition.

C4.1.13 Entering a new fraction

To enter a new fraction, click once on the fraction button on the system data entry table. The fraction data entry table will appear as shown below. Use the mouse to position the cursor in the first blank space in the fraction column and start typing. As you type in the information the ALFI Database will automatically assign a new ID number to that fraction.


Fraction

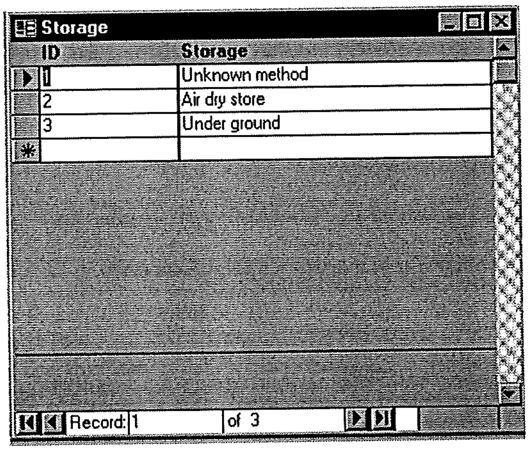
ID	Fraction
	Unknown
1	Whole seed
2	Kernel
3	Hull
4	Leaf
5	Stem
6	Whole plant
7	Sprout
8	Not relevant

Record: 1 of 9

The fraction data entry table

C4.1.14 Entering a new storage method

To enter a new storage method, click once on the storage button on the system data entry table. The storage data entry table will appear as shown below.


Storage

ID	Storage
1	Unknown method
2	Air dry store
3	Under ground

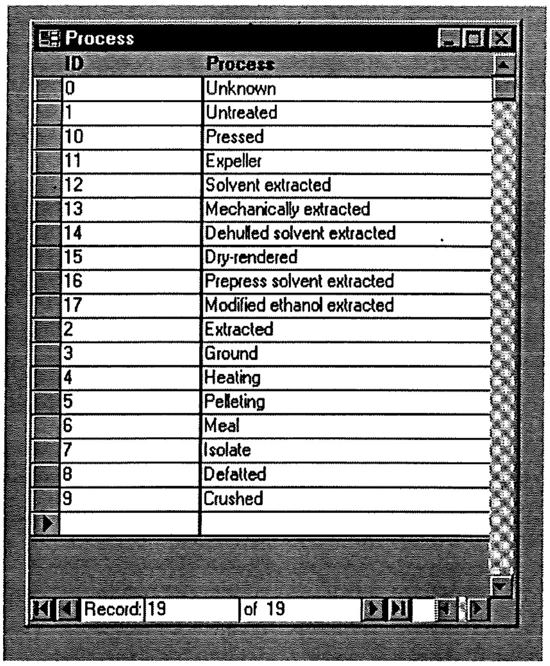
Record: 1 of 3

The storage data entry table

To enter a new storage method, use the mouse to position the cursor in the first blank space in the storage column and start typing. As you type in the information the ALFI Database will automatically assign a new ID number to that method of storage.

C4.1.15 Entering a new processing method

To enter a new processing method, click once on the process button on the system data entry table. The process data entry table will appear as shown below.


Process

ID	Process
0	Unknown
1	Untreated
10	Pressed
11	Expeller
12	Solvent extracted
13	Mechanically extracted
14	Dehulled solvent extracted
15	Dry-rendered
16	Prepress solvent extracted
17	Modified ethanol extracted
2	Extracted
3	Ground
4	Heating
5	Pelleting
6	Meal
7	Isolate
8	Defatted
9	Crushed

Record: 19 of 19

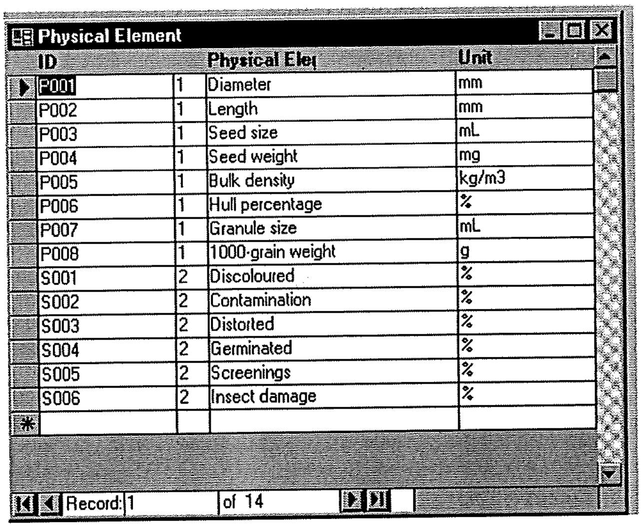
The process data entry table

To enter a new processing method, use the mouse to position the cursor in the first blank space in the process column and start typing. As you type in the information the ALFI Database will automatically assign a new ID number to that method of processing.

C4.1.16 Entering new physical components

To enter a new physical components, click once on the physical component button on the system data entry table. The physical component data entry form will appear as shown on the next page.

To enter a new physical component, use the mouse to position the cursor in the first blank space in the physical component column and start typing. As you type in the information the ALFI Database will automatically assign a new ID number to that physical component. The column beside the ID's (the second column) refers to whether the element refers to the physical characteristics of ingredients (assigned a value of 1) or seed quality characteristics (assigned a value of 2). The final column is for the units the component is expressed in.

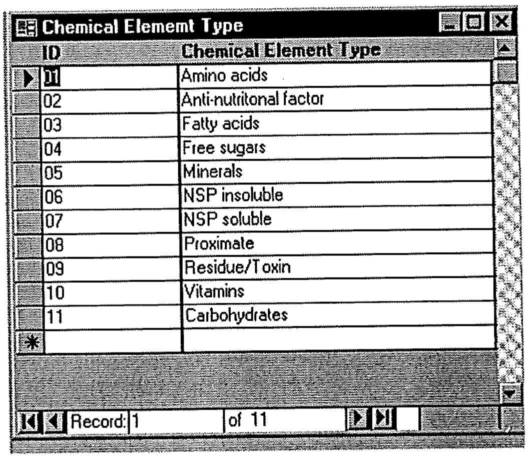


ID		Physical Ele	Unit
P001	1	Diameter	mm
P002	1	Length	mm
P003	1	Seed size	mL
P004	1	Seed weight	mg
P005	1	Bulk density	kg/m3
P006	1	Hull percentage	%
P007	1	Granule size	mL
P008	1	1000-grain weight	g
S001	2	Discoloured	%
S002	2	Contamination	%
S003	2	Distorted	%
S004	2	Germinated	%
S005	2	Screenings	%
S006	2	Insect damage	%

The physical component data entry form

C4.1.17 Entering a new chemical component type

To enter a new chemical component type, click once on the **Chem. Comp. Type** button on the system data entry form. The chemical component type data entry form will appear as shown below.



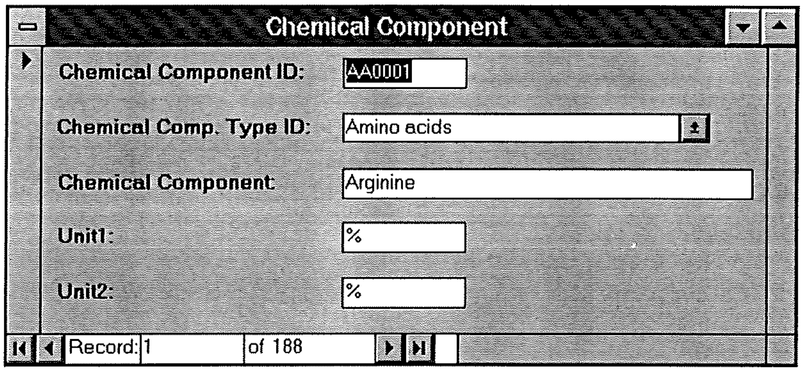
ID	Chemical Element Type
01	Amino acids
02	Anti-nutritonal factor
03	Fatty acids
04	Free sugars
05	Minerals
06	NSP insoluble
07	NSP soluble
08	Proximate
09	Residue/Toxin
10	Vitamins
11	Carbohydrates

The chemical component type data entry table

To enter a new chemical component type, use the mouse to position the cursor in the first blank space in the chemical component type column and start typing. As you type in the information the ALFI Database will automatically assign a new ID number to that chemical component type.

C4.1.18 Entering a new chemical component

To enter a new chemical component, click once on the chemical component button on the system data entry form. The chemical component data entry form will appear as shown below.

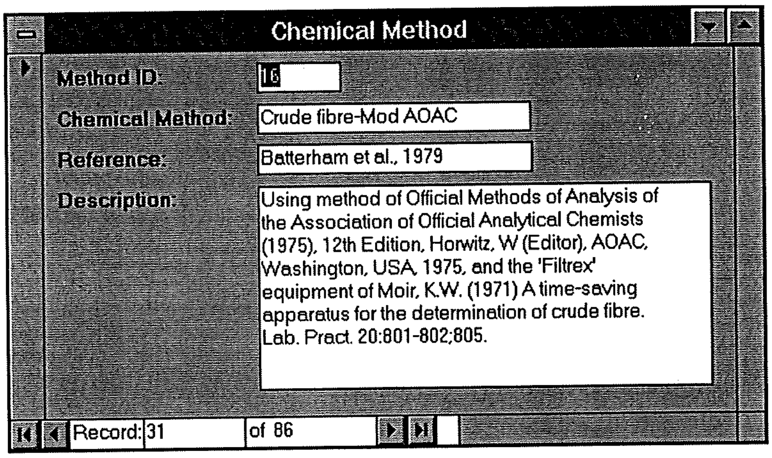


The chemical component data entry table

To enter a new chemical component use the mouse to click on the button to get to the last record, then click once on the button to create a new blank record. Select the chemical component type from the drop-list box. As you type in the chemical component name the ALFI Database will automatically assign a new ID number to that chemical component.

C4.1.19 Entering a new chemical method

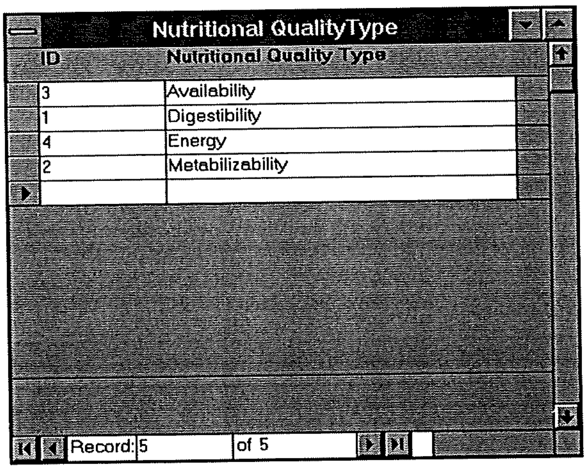
To enter a new chemical analysis method, click once on the Chem Method button on the system data entry form. The chemical method data entry form will appear as shown on the next page. Use the mouse to click on the button to get to the last record, then click once on the button to create a new blank record. As you type in the chemical method name the ALFI Database will automatically assign a new ID number to that method. Reference refers to the abbreviated form of the citation for the method in the ALFI Database. The description allows you to give the original reference for the method and the reference in the ALFI Database in full and to indicate and changes to conventional or published methods.



The chemical method data entry form

C4.1.20 Entering a new nutritional quality type

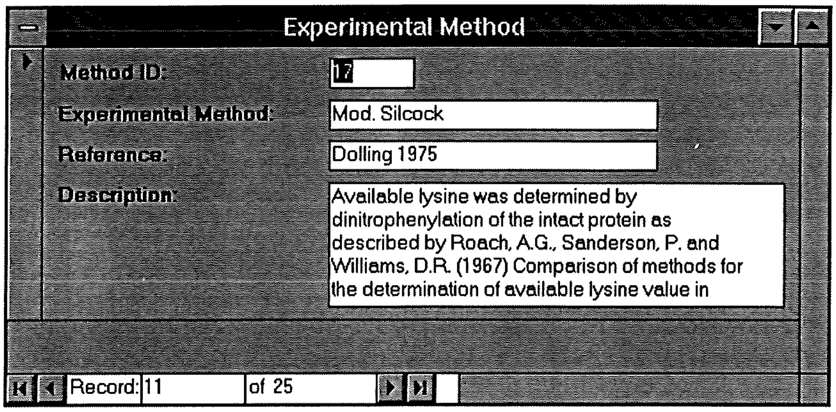
To enter a new nutritional quality type, click once on the Nut. Qual. Type button on the system data entry form. The Nutritional Quality Type data entry form will appear as shown below. Use the mouse to position the cursor in the first blank space in the nutritional quality type column and start typing. As you type in the information the ALFI Database will automatically assign a new ID number to that nutritional quality type.



The nutritional quality type data entry form

C4.1.21 Entering a new experimental method

To enter a new experimental method, click once on the Expt. Method. button on the system data entry form. The experimental method data entry form will appear as shown below.

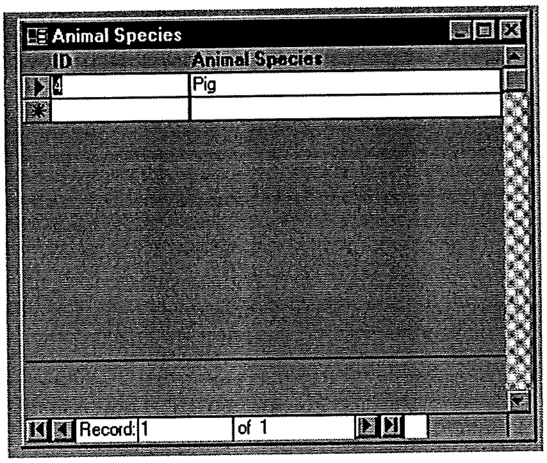


The experimental method data entry form

To enter a new experimental method use the mouse to click on the button to get to the last record, then click once on the button to create a new blank record. As you type in the experimental method name the ALFI Database will automatically assign a new ID number to that method. Reference refers to the abbreviated form of the citation for the method in the ALFI Database. The description allows you to give the original reference for the method and the reference in the ALFI Database in full and to indicate and changes to conventional or published methods.

C4.1.22 Entering a new animal species

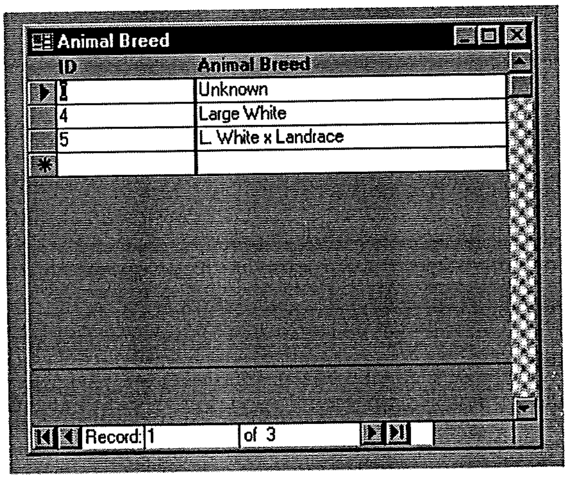
To enter a new animal species, click once on the animal species button on the system data entry form. The animal species data entry form will appear as shown on the next page. Use the mouse to position the cursor in the first blank space in the animal species column and start typing. As you type in the information the ALFI Database will automatically assign a new ID number to that animal species.



The species data entry form

C4.1.23 Entering a new animal breed

To enter a new animal breed, click once on the animal breed button on the system data entry form. The animal breed data entry form will appear as shown below.

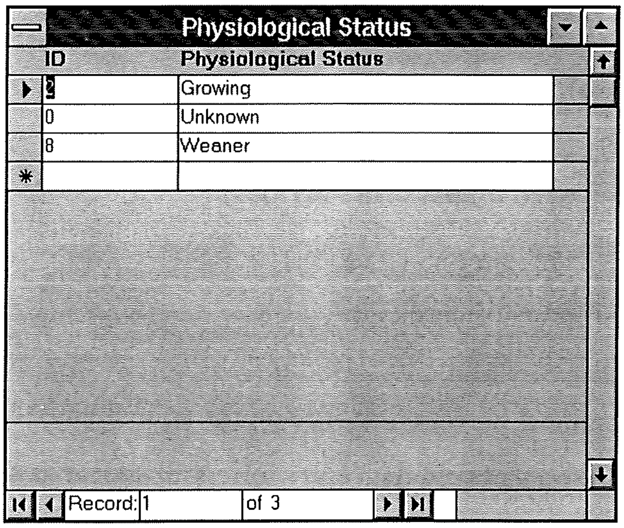


The animal breed data entry form

To enter a new animal breed, use the mouse to position the cursor in the first blank space in the animal breed column and start typing. As you type in the information the ALFI Database will automatically assign a new ID number to that animal breed.

C4.1.24 Entering a new animal physiological status

To enter a new animal physiological status, click once on the **Physiol. Status** button on the system data entry form. The physiological status data entry form will appear as shown below.



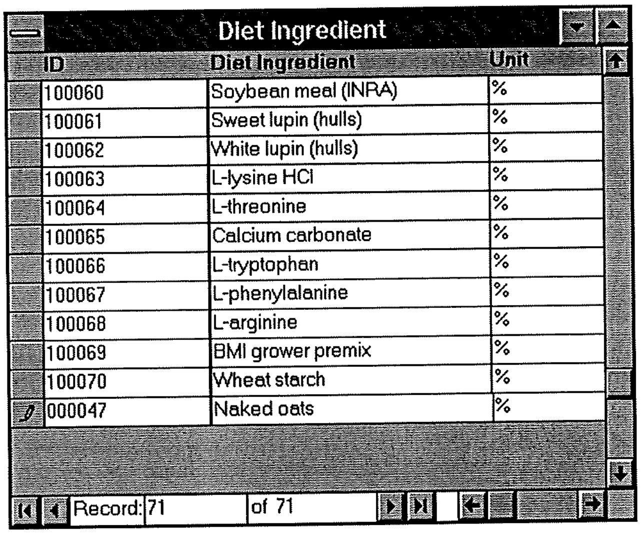
The physiological status data entry form

To enter a new physiological status, use the mouse to position the cursor in the first blank space in the physiological status column and start typing. As you type in the information the ALFI Database will automatically assign a new ID number to that physiological status.

C4.1.25 Entering a new diet ingredient

Diet ingredients refer to the ingredients in a diet used to test the nutritional quality of a particular ingredient, eg, the components of a diet used to test the digestible energy of a particular sample of barley. To enter a new diet ingredient, click once on the diet ingredient button on the system data entry form. The diet ingredient data entry form will appear as shown on the next page. Use the mouse to position the cursor in the first blank space in the diet ingredient column and start typing. As you type in the information the ALFI Database will automatically assign a new ID number to that diet ingredient.

The unit column refers to the units in which the inclusion level of the diet ingredient is expressed. It is best to continue expressing this as a percentage rather than as g/kg to be consistent.



Diet Ingredient

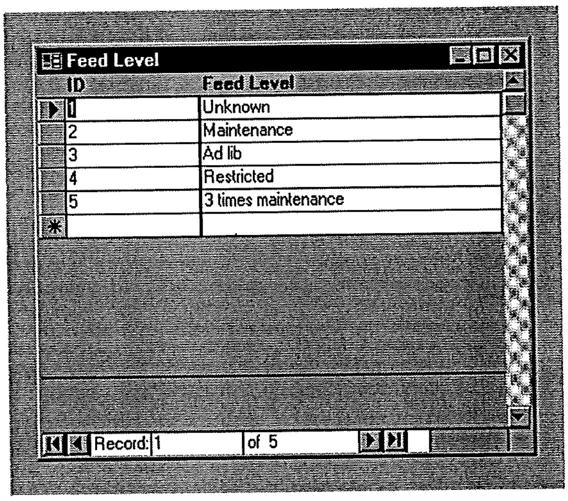
ID	Diet Ingredient	Unit
100060	Soybean meal (INRA)	%
100061	Sweet lupin (hulls)	%
100062	White lupin (hulls)	%
100063	L-lysine HCl	%
100064	L-threonine	%
100065	Calcium carbonate	%
100066	L-tryptophan	%
100067	L-phenylalanine	%
100068	L-arginine	%
100069	BMI grower premix	%
100070	Wheat starch	%
000047	Naked oats	%

Record: 71 of 71

The diet ingredient data entry form

C4.1.26 Entering a new feeding level

Feeding level refers to the level at which test diets are fed to evaluate nutritional quality. To enter a new feeding level, click once on the feed level button on the system data entry form. The feed level data entry form will appear as shown below.



Feed Level

ID	Feed Level
1	Unknown
2	Maintenance
3	Ad lib
4	Restricted
5	3 times maintenance

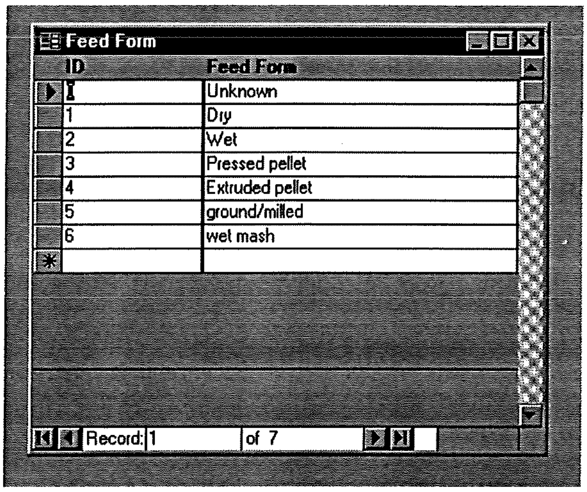
Record: 1 of 5

The feed level data entry form

To enter a new feed level, use the mouse to position the cursor in the first blank space in the feed level column and start typing. As you type in the information the ALFI Database will automatically assign a new ID number to that feed level.

4.1.27 Entering a new feed form

Feed form refers to the form in which test diets are fed to evaluate nutritional quality. To enter a new feed form, click once on the feed form button on the system data entry form. The feed form data entry form will appear as shown below.

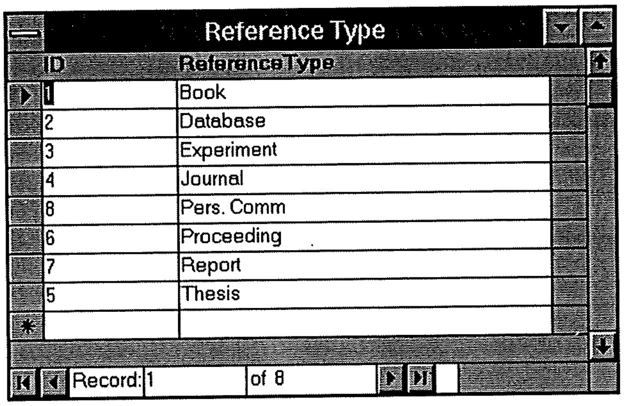


The feed form data entry form

To enter a new feed form, use the mouse to position the cursor in the first blank space in the feed form column and start typing. As you type in the information the ALFI Database will automatically assign a new ID number to that feed form.

4.1.28 Entering a new reference type

Reference type refers to where the information about the sample came from. To enter a new reference type, click once on the reference type button on the system data entry form. The data entry form will appear as shown on the next page.

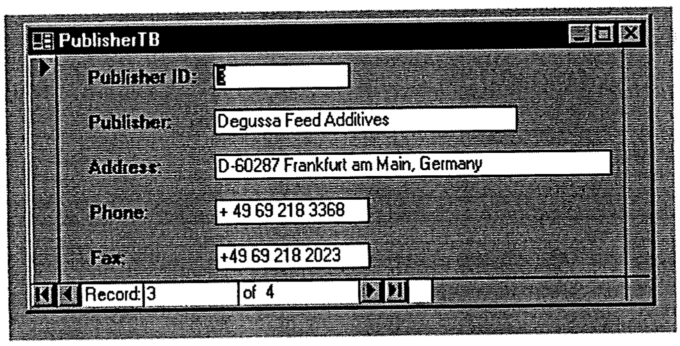


The reference type data entry form

To enter a new reference type, use the mouse to position the cursor in the first blank space in the reference type column and start typing. As you type in the information the ALFI Database will automatically assign a new ID number to that reference type.

4.1.29 Entering a new publisher

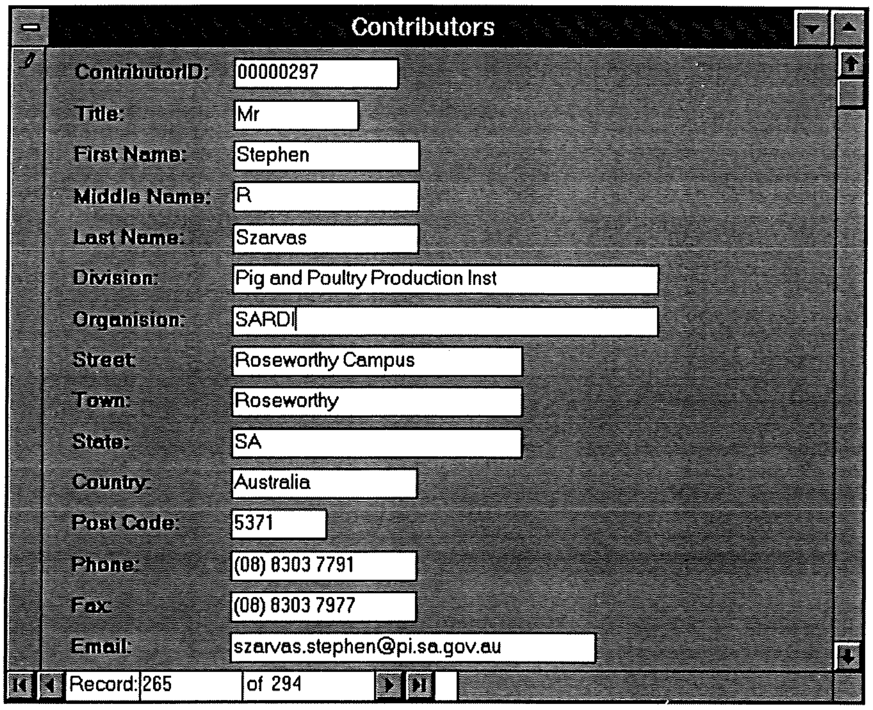
To enter a new publisher, click once on the publisher button on the system data entry form. The publisher data entry form will appear as shown below. Use the mouse to click on the button to get to the last record, then click once on the button to create a new blank record. As you type in the publisher name the ALFI Database will automatically assign a new ID number to that publisher.



The publisher data entry form

C4.1.30 Entering new contributors

To enter a new contributor, such as the author of a scientific work or an editor of a book, click once on the **Contributor** button on the system data entry form. The contributors data entry form will appear as shown below.



Contributors

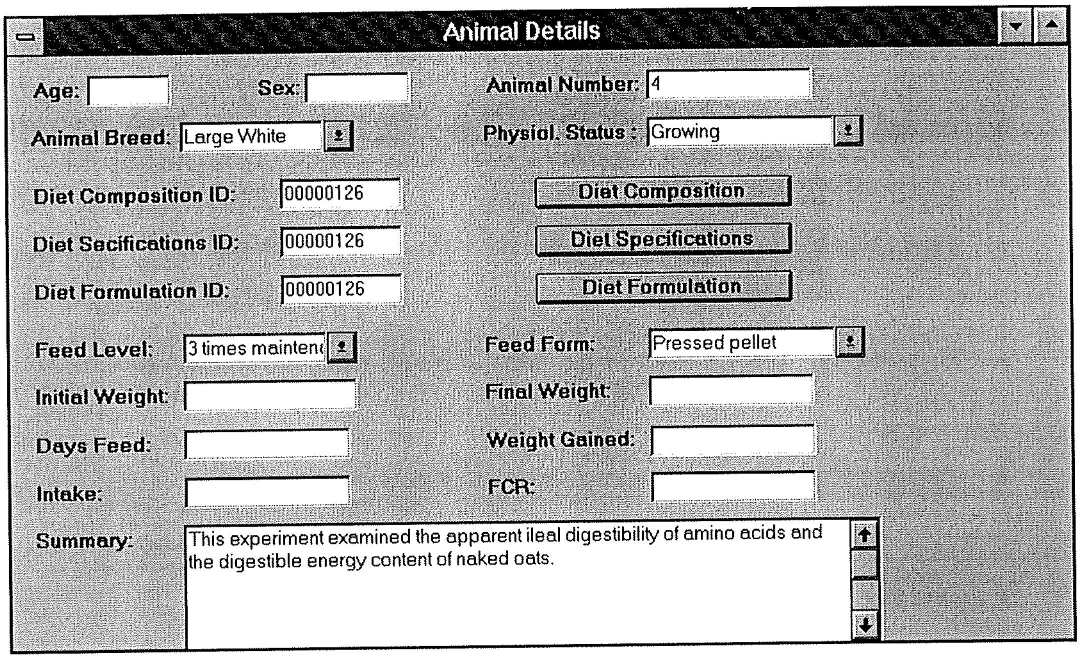
ContributorID: 00000297
Title: Mr
First Name: Stephen
Middle Name: R
Last Name: Szarvas
Division: Pig and Poultry Production Inst
Organision: SARDI
Street: Roseworthy Campus
Town: Roseworthy
State: SA
Country: Australia
Post Code: 5371
Phone: (08) 8303 7791
Fax: (08) 8303 7977
Email: szarvas.stephen@pi.sa.gov.au
Record: 265 of 294

The contributors data entry form

To enter a new contributor use the mouse to click on the button to get to the last record, then click once on the button to create a new blank record. As you type in the contributor's name the ALFI Database will automatically assign a new ID number to that contributor.

C4.1.31 Entering a new animal information

To enter new information about animals used to evaluate the nutritional quality of samples of ingredients, click once on the Animal Information on the system table data entry form. The animal information data entry form will appear on screen as shown on the next page.



The animal information data entry form

This form is similar to the sample data entry form shown on page C-25 and described in section C4.2. To generate a new animal click once on the **Auto** button on the top left hand side of the form. Then, using the mouse place the cursor in the box beside the ID number and double click. This will "fix" the ID number and link it to the other parameters such as diet composition ID, diet specifications ID and diet formulation ID. If you have done this correctly the ID number should appear in the box beside these parameters. On this form, the following parameters can be entered:

- **Age:** Age of the animal (in weeks).
- **Sex:** Type in the sex in full eg, Castrate male, Female etc.
- **Animal Number:** Number of animals fed the sample.
- **Animal Breed:** Select the breed from the drop-list.
- **Physiological Status:** Select the stage of maturity from the drop-list.
- **Feed Level:** Choose the appropriate feeding level from the drop-list.

- **Feed Form:** Choose the appropriate form of feed from the drop-list.

- **Initial Weight:** The weight of the animals at the start of the trial in kilograms.

- **Final Weight:** The weight of the animals at the end of the trial in kilograms.

- **Days Feed:** The number of days the animals were fed the test diet.

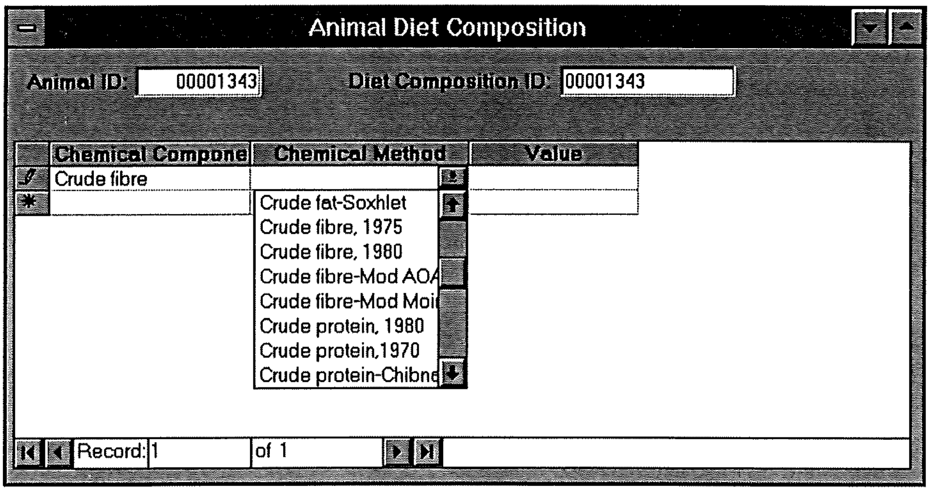
- **Weight Gained:** Body weight gain in grams per day (g/d).

- **Intake:** The daily feed intake of the animals (in g/d)

- **FCR:** Feed conversion ratio (feed/gain)

- **Summary:** A short description of the experiment (eg purpose, major findings etc)

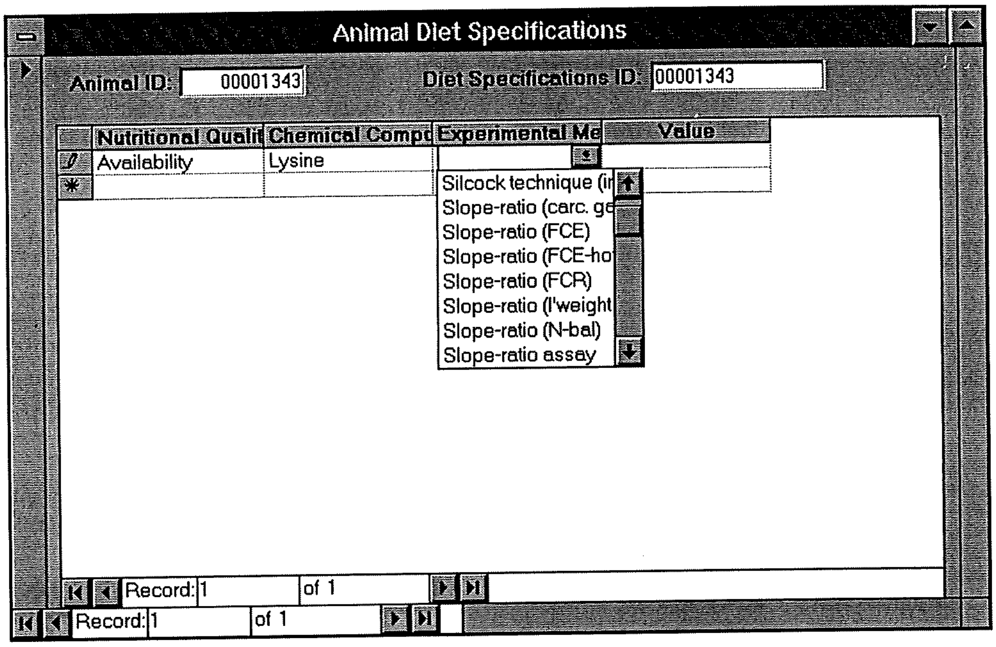
- **Diet Composition:** Clicking on this will bring up the animal diet composition data entry form as shown below:



The animal diet composition data entry form

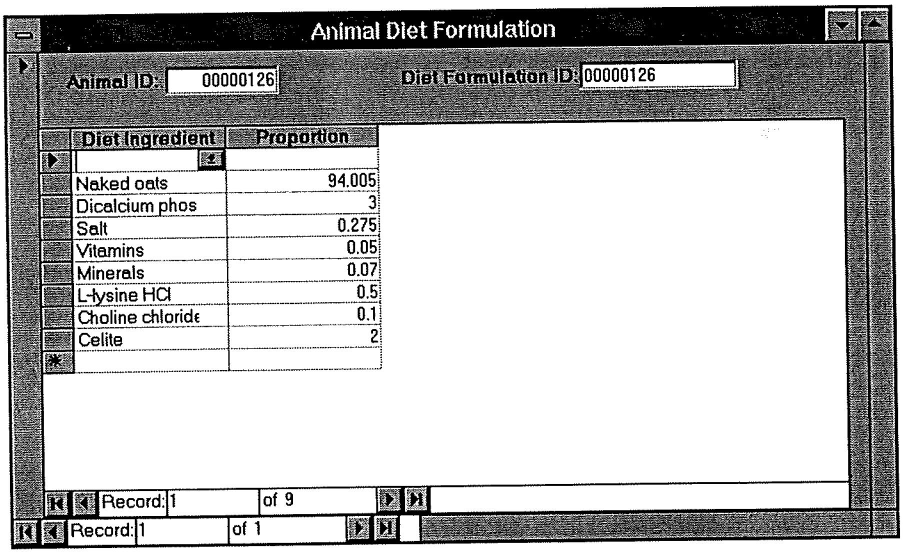
To enter the diet composition, select the component and the method from the drop list. Enter the value in the value column.

- **Diet Specifications:** Clicking on this will bring up the animal diet specifications data entry form as shown below. To enter the diet specifications, select the nutritional quality type, chemical component and experimental method from the drop list. Enter the value in the value column.



The animal diet specifications data entry form

- **Diet Formulation**: Clicking on this will bring up the animal diet formulation data entry form as shown below. To enter the diet formulation, select the ingredient from the drop list. Enter the inclusion level as a percentage in the proportion column.



The animal diet formulation data entry form.

Please note: it is important to record the Animal ID number somewhere as you will need to select this ID number from a drop-list box. Although it should be the last ID number entered it may be confusing when entering several groups of animals at the one time before entering information about several samples.

C4.2 Entering new sample information

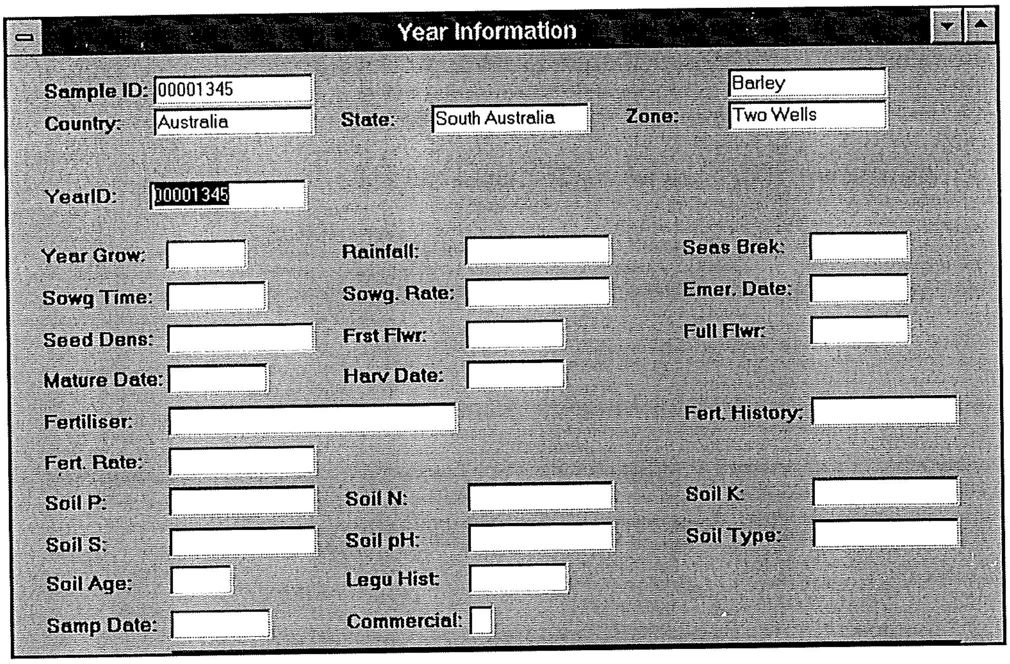
Once you have entered all of the new information relating to a sample (or group of samples) you can begin to enter the specific sample information. Either close the system data entry form or return to the main menu and double click on the data entry image to bring the sample data entry table on screen as shown on page C-25.

To enter new sample information, click once on the Auto button at the top right hand corner of the form to generate a new ID number for the sample. Then, using the mouse, place the cursor in the box beside the ID number and double click. This will "fix" the ID number and it should then appear in the boxes beside Year, Physical Features, Chemical Composition, Nutritional Quality and Reference.

To fill in all of the information about country, state etc, select the appropriate option from the drop-list box. This is why it is important to have added any new information to the database beforehand. **Category** should appear automatically.

Use the drop-list boxes to enter the information about the person entering the sample information, and the laboratory in which the analysis was conducted. Type in the Enter Date and the Analysis date in the normal Australian format (DD/MM/YY). Ref No refers to an internal reference number for use by whoever is entering data into the database (ie to keep track of what data is entered). Com/Exp refers to whether the data is commercial or experimental.

C4.2.1 Entering year information



The year information data entry form

When you get to the year, leave the ID number assigned by the database and click on the year button on the form. The year data entry form will appear as shown above. On this form you can enter information about the following:

- **Year Grow:** The year (season) the plant grew.
- **Rainfall:** The annual rainfall at the site (in the year that the sample grew) in mm.
- **Seas Break:** The date when the season break (rains) occurred.
- **Sowg Time:** The date of sowing.
- **Sowg Rate:** The sowing rate of the plants (in kg/ha).
- **Emer Date:** The date of the emergence of the plants.

- **Seed Dens:** The density of the seedlings.
- **Frst Flwr:** The date when the first flower occurred.
- **Full Flwr:** The date when the plants had fully flowered.
- **Matu Date:** The date when the plants matured
- **Harv Date:** The date when the plants were harvested.
- **Fertiliser:** The name/type of fertiliser used.
- **Fert Rate:** The rate of fertiliser application (kg/ha).
- **Soil P:** Soil phosphorus content in ppm or mg/kg
- **Soil N:** Soil nitrogen content in ppm or mg/kg
- **Soil K:** Soil potassium content in ppm or mg/kg
- **Soil S:** Soil sulphur content in ppm or mg/kg
- **Soil pH:** Soil pH
- **Soil Type:** Soil type
- **Soil Age:** Soil Age
- **Legu Hist:** History of legume growing at the site.
- **Samp Date:** Date the sample was taken

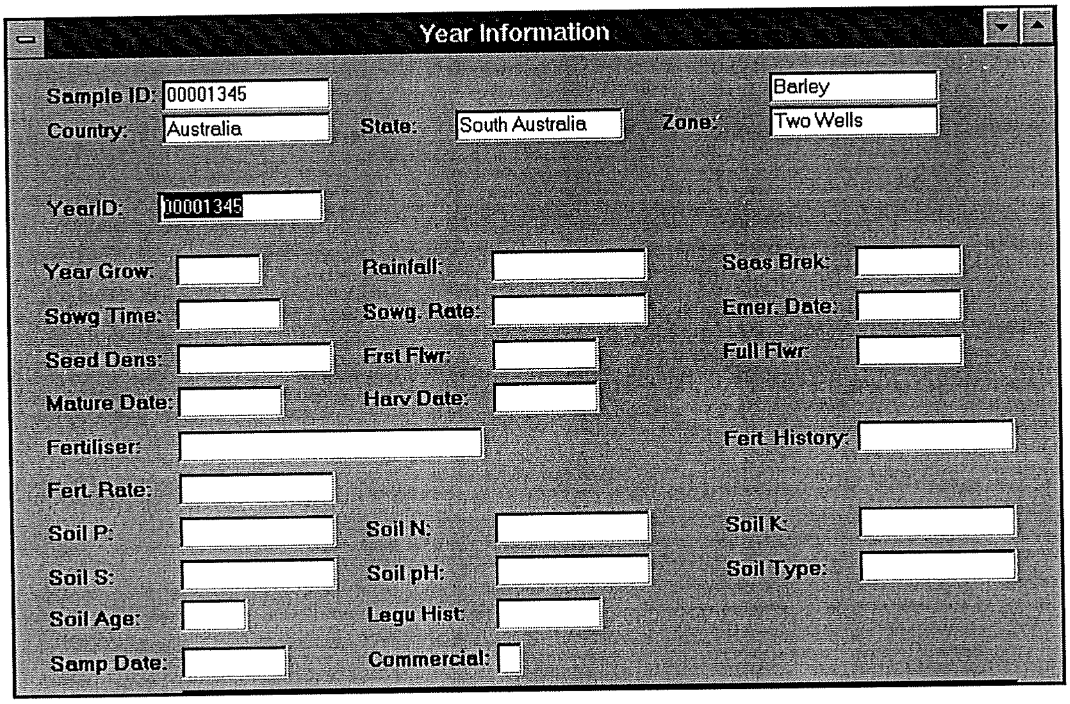
- **Commercial:** Whether the sample was grown under experimental or commercial conditions (enter yes for commercial).

- **Weather:** A short comment about the weather at the site (ie was the weather typical or a period of drought/flood?).

When you have finished entering the data close the form by clicking in the top right or left hand corner and you will be returned to the sample data entry form.

C4.2.2 Entering physical features information

To enter data on the physical features of grain or ingredients, click on the physical features button within the sample data entry form. The physical features data entry form will appear on screen as shown below.

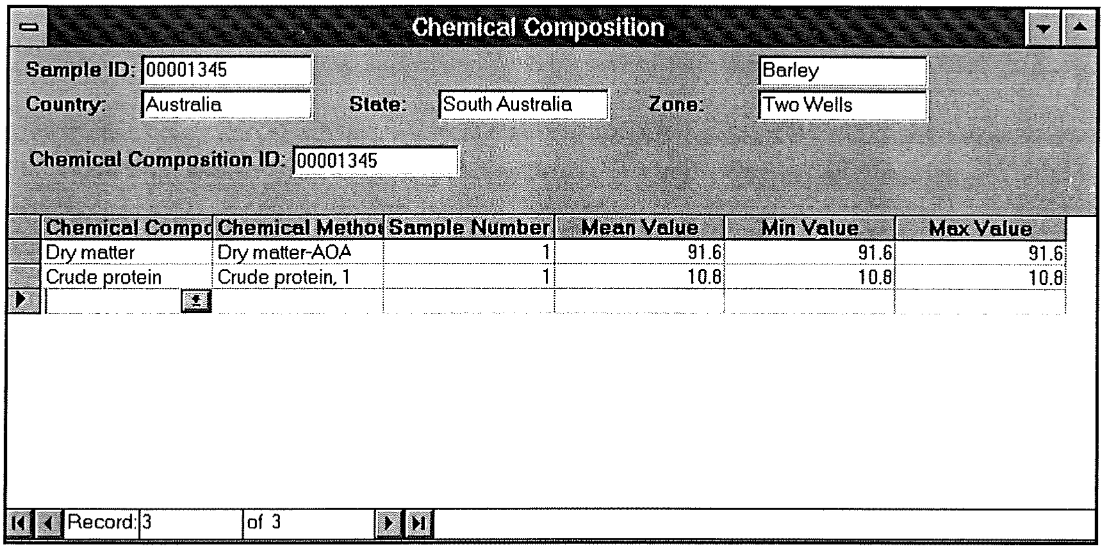


The physical features data entry table

To enter data on physical features, use the drop-list box to select the component for which you have data. Type in the number of samples (sample number) and the mean, maximum and minimum value for that parameter. If there is only one sample, type the same value for mean, maximum and minimum. When you have finished entering the data, close the entry form and you will go back to the sample data entry form.

C4.2.3 Entering chemical composition information

To enter chemical composition data, click on the chemical button on the sample data entry form. The chemical composition data entry form will appear on screen as shown below.


Chemical Composition

Sample ID: 00001345 Barley
Country: Australia State: South Australia Zone: Two Wells

Chemical Composition ID: 00001345

Chemical Compo	Chemical Metho	Sample Number	Mean Value	Min Value	Max Value
Dry matter	Dry matter-AOA	1	91.6	91.6	91.6
Crude protein	Crude protein, 1	1	10.8	10.8	10.8

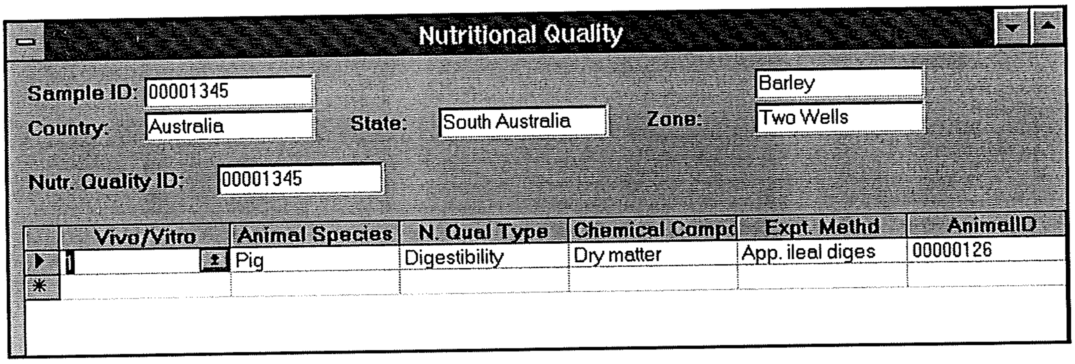
Record: 3 of 3

The chemical composition data entry form

To enter information on chemical composition, select the particular chemical component and chemical method from the drop-list box. Type in the number of samples and the mean, maximum and minimum values. If there is only one sample, type in the same value for mean, maximum and minimum. When you have finished entering the data, close the entry form and you will go back to the sample data entry form.

C4.2.4 Entering nutritional quality information

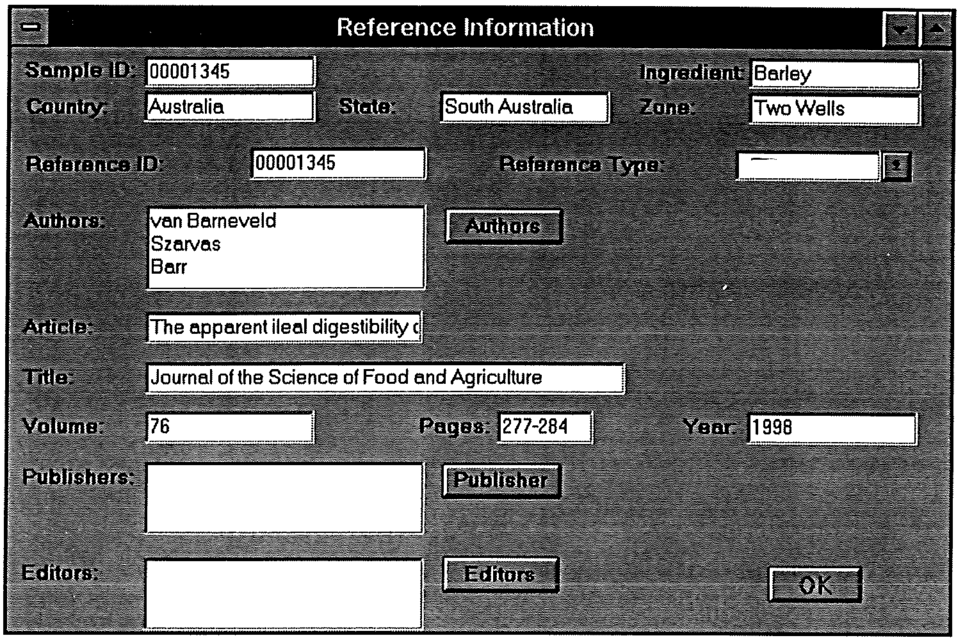
To enter nutritional quality data, click on the nutritional quality button on the sample data entry form. The nutritional quality data entry form will appear on screen as shown on below. To enter information on nutritional quality, select the particular animal species, nutritional quality type (N. Qual Type), chemical component and experimental method from the drop-list box. Select the Animal ID number from the drop list box. This id number should be the last one on the list as you will have entered the details previous to entering the sample information. If not it is important to record the ID number. Type in the number of samples and the mean, maximum and minimum values. If there is only one sample, type in the same value for mean, maximum and minimum. When you have finished entering the data, close the entry form and you will go back to the sample data entry form.



The nutritional quality data entry form

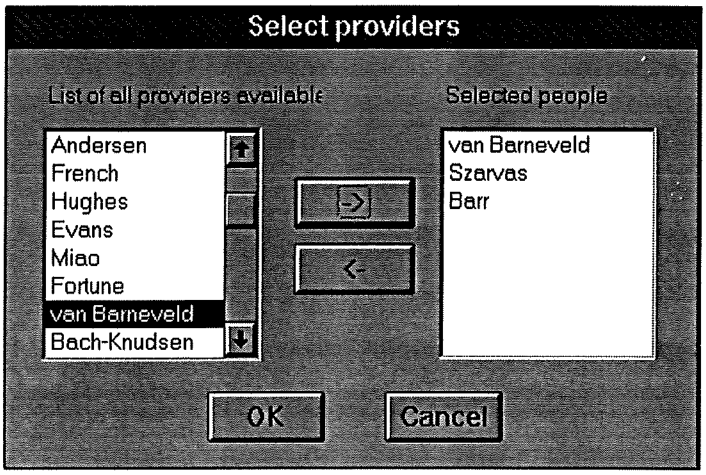
C4.2.5 Entering reference information

To enter reference data, click on the reference button on the sample data entry form. The reference data entry form will appear on screen as shown on the next page.



The reference data entry form

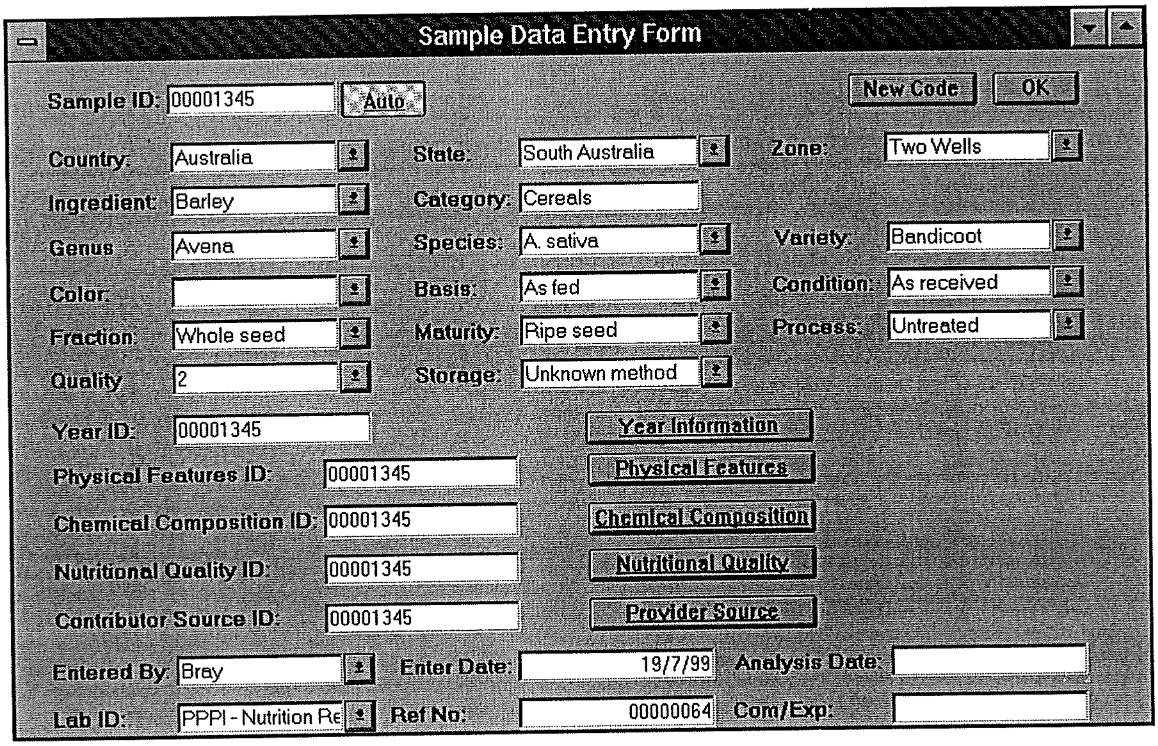
To enter information on references, select the particular reference type from the drop-list box. To select the authors, click on the author button on the data entry form and a selection box will appear on screen as shown below.



The contributors selection box

To select the contributors, click once on the surname of the person and click the arrow pointing to the right. If you make an incorrect selection you can remove people from the list by clicking on them in the right hand side of the box and clicking on the left pointing arrow.

For a journal article, type the title of the article in the space beside article, and the title of the journal in the space beside Title. For books etc type the title of the book in the space beside Title. Enter the volume, issue, pages numbers and year by typing in the appropriate spaces. Enter the publisher and editor information the same way that you entered the authors. When you have finished entering the data, click on the ok button and you will go back to the sample data entry form as shown below.



When you have completed entering all of the information, click on the OK button on the top right of the data entry form.

C4.3 Editing entered information

At any stage, you can edit information that you have entered by bringing the sample data entry form on screen (by double clicking on the image on the main menu). In the box beside the sample ID number type in the number of the sample whose information you wish to edit and with the cursor beside the number in the box double click. This should bring up all of the information relating to that sample. If you need to edit the animal information you will need to go via the system data entry table by clicking on the new button on the sample data entry form and selecting animal information. You can call up the animal ID number for the information you wish to edit by typing in the ID number and double clicking.

Notes

Notes

ALFI DATABASE

AUSTRALASIAN LIVESTOCK FEED INGREDIENT DATABASE

Section D
Additional Search Information

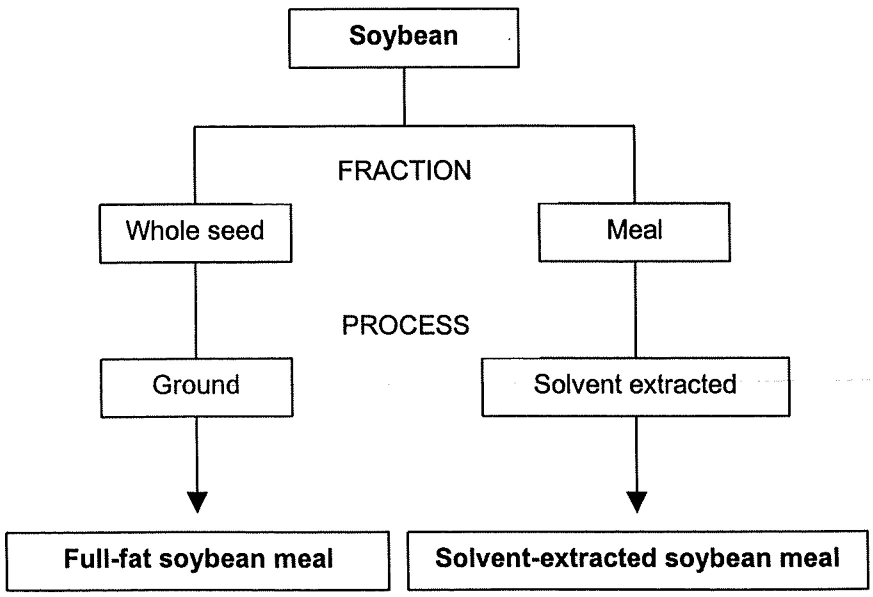
Section D – Additional Search Information

D1. Classifications within the ALFI Database

Because of the large number of different substances used for animal feeds in Australia it is quite difficult to classify feed ingredients. Also, the terminology used for describing feed ingredients is often inconsistent and confusing. The purpose of this section of the manual is to give users more information about how the ingredients are classified within the database and how to search for some specific ingredients.

D1.1 Searching for "meals"

One example of where terminology for feed ingredients can be confusing is use of the term **meal**. In the ALFI database we have used the word meal to describe a by-product of vegetable oil production which has undergone a process to extract the oil from the seed, as well as by-products from animal processing such as fish meal and meat meal. However, meal is often used to describe ground grains, and it is the latter term that is used in the database. A good example of this is soybean meal. The "parent" ingredient is soybean (*Glycine max*), for which data can be searched using either All Ingredients or Grains Only. By selecting All Ingredients you will go to the Selection Form shown on page B-17. The diagram below illustrates the way that full-fat soybean meal, and solvent extracted soybean meal are classified in the database and the selections you need to make to find each.



The Maturity for all processed oilseed meals has been entered as **not relevant**. From the diagram you can see that full fat soybean meal (ie ground whole soybeans) is not considered a meal by the ALFI Database and that information on any "full-fat meal" can be found by searching through **whole seed** for Fraction and through **ground** for Process.

D1.2. Classification of chemical components

The chemical components of feed ingredients have been categorised in the database by "type". These groups are available for selection beside Chemical Type in the Chemical Composition of Feed Ingredients selection form, and are also listed below:

- Amino acids
- Anti-nutritional factors
- Fatty acids
- Free sugars
- Minerals
- Insoluble Non-starch polysaccharides (NSP)
- Soluble Non-starch polysaccharides (NSP)
- Proximate
- Residue/Toxin
- Vitamins
- Carbohydrates
- Energy

Most of these categories are self explanatory, such as amino acids and minerals. However, some categories will require further explanation.

D1.2.1 Anti-nutritional factors, residues and toxins

The ALFI Database has different catagories for anti-nutritional factors and for residues and toxins. Anti-nutritional factors are those components that decrease the nutritional quality of other components of the diets. Residues and toxins are those components which may have a direct effect on the animal eating the feedstuff.

D1.2.2 Free sugars, NSP's and carbohydrates

Strictly speaking, sugars and other polysaccharides are carbohydrates. Within the ALFI Database, these components are classified as free sugars, insoluble non-starch polysaccharides and soluble non-starch polysaccharides (identified using the appropriate chemical method) according to the source information. Where the original data does not specify whether the component is free, soluble or insoluble, the components are placed in the carbohydrate group. The totals for total carbohydrate etc are also in the carbohydrate chemical type.

D1.2.3 Proximates

This section includes those components identified by proximate analysis (crude protein, dry matter, etc) as well as those components associated with proximates, such as gross energy, cell wall content, organic matter etc.

D1.2.5 Energy

Although this chemical type is available for selection within the Chemical Composition section of the database, it is designed for use only in the Nutritional Quality section. DE, ME etc had to be classified as a chemical component in the database because the nutritional quality and chemical composition sections of the database utilise the same list of component names.

D1.3 Use of the term "Unknown"

In the ALFI Database, several drop-lists for search parameters contain the option "Unknown". This will not lead to a search containing pooled results for that parameter. To obtain pooled results for a specific parameter that is not mandatory for selection, you need to leave that field blank. By leaving the field blank you will include all data in you search.

Parameters for samples have been entered as unknown if it has been described that way in the reference, or if no mention of that parameter is mentioned. For example, if a sample has been described as wheat, but no mention of the variety has been made, then it will be entered as unknown.

Section D – Additional Search Information

D2. Calculations within the ALFI Database

The database contains calculations for dry matter, calculated nutritional quality and CV.

D2.1. Dry matter

The ALFI Database has the capacity to generate chemical composition data on either an as-fed or dry matter basis. All data was entered into the database on an as-fed basis. If any data was supplied on a dry matter basis without giving a value for dry matter, the data was not entered, or an average was calculated based on the ingredient, fraction, maturity and process. If dry matter values were given then the data was converted to as-fed prior to entry.

After selecting **Dry matter** as the basis on which you'd like your data expressed, the database then searches through the chemical composition database to find the information you require, and the dry matter value *for that sample* so that the data can be converted. The data is converted to a dry matter basis prior to the calculation of the mean, minimum and maximum for the report.

D2.2. Calculated nutritional quality

One of the advantages of developing an interactive database with information on both chemical composition and nutritive value, is that it is possible to combine these sets of data to obtain better estimates of feed quality for animals.

In the ALFI Database, **Calculated Nutritional Quality** enables you to combine the information on chemical composition and nutritive value contained within it. As mentioned previously (in Section B5.2), the data stored in the nutritive value database has been entered largely from the literature, and this is the information utilised when you select the **Nutritional Quality** option. When you select *a Nutritional Quality*

Type of digestibility for example, only the coefficients have been given. When you select **Calculated Nutritional Quality**, the database identifies the digestibility coefficients of the samples that meet the selection criteria and averages them. The database then locates the concentrations of the particular chemical component of all samples that meet the selection criteria and calculates the mean, min, max, N (number of samples) and CV%. This is multiplied by the average coefficients to generate the values that appear on the report. The formula is shown below.

$$\textbf{Mean} = \frac{(x_1 + x_2 + \ldots x_m)}{m} * \frac{(y_1 + y_2 + \ldots y_n)}{n}$$

$$\textbf{Min} = \frac{(x_1 + x_2 + \ldots x_m)}{m} * \min \{y_i\}$$

$$\textbf{Max} = \frac{(x_1 + x_2 + \ldots x_m)}{m} * \max \{y_i\}$$

Where **Mean, Min** and **Max** are shown on the report.

x = the individual records for nutritional quality (eg coefficients of digestibility) for each sample meeting the selection criteria.

y = the individual records for chemical composition (eg concentration of lysine) for each sample meeting the selection criteria.

m = the number of records for nutritional quality that meet the selection criteria.

n = the number of records for chemical composition that meet the selection criteria. This number is displayed on the report as **N.**

In most cases *n* (the number of records in the chemical composition database) will be much higher than *m* (the number of records in the nutritional quality database).

Notes

Notes

ALFI
DATABASE

AUSTRALASIAN LIVESTOCK FEED INGREDIENT DATABASE

Section E
Appendices

Appendix **One**

Reports from the tutorial examples

The reports can be seen on the following pages:

ALFI DATABASE
AUSTRALASIAN LIVESTOCK FEED INGREDIENT DATABASE

Pig and Poultry Production Institute
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Roseworthy, South Australia 5371
Phone: (08) 83037683
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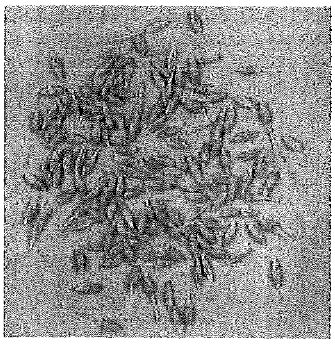
Feed Ingredient Description

29-Jul-99

Country: Australia
Category: Cereals
State:
Ingredient: Barley
International Code: 4-00-000

Ingredient Description ID: 000005



Summary:
- Moderate/High energy
- Low protein
- High fibre

Product Source

Scientific Name: Hordeum vulgare

Common Cultivars: Schooner, Stirling, Galleon, Grimmett

Annual Production: 4.5 million tonnes

Stock Feed Consumption: 1.8 million tonnes

Description: Barley is Australia's 2nd largest field crop, both in area and production and the world's 4th most important after wheat, rice and maize. There are 2 main types, two row and six row. Two row is used for malting (beer production) which is the premium market.

Use: Classes of pig: Barley may be used in diets for all ages of pigs. In very young pigs limit inclusion to 20% maximum due to the negative effects of fibre and reduced digestibility (relative to other grains).

Nutrient contribution: High fibre content and low DE compared to other cereals.

Milling: Remove hulls, grind finely and pellet for maximum utilisation. Digestibility can be extended by various processes eg pearling, extrusion, malting. However, most barley is rolled or hammer-milled for use in pig diets.

Ingredient compatibility: The high soluble NSP content of barley limits its compatibility with legumes such as lupins, in pig and poultry diets.

Limitation/Precaution: Anti-nutritional factors/toxicity: Varying levels of indigestible carbohydrate components such as b-glucans and high crude fibre can result in anti-nutritional effects in young pigs. Responsive to enzyme supplementation.

Variability: Apart from crude protein content, barley is a relatively consistent product.

Storage: Can be stored for long periods (more than 1 year) if moisture is less than 12% and bulk density is greater than 60 kg/hl.

Palatability/Acceptability: No palatability or acceptability problems with any class of pig.

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Chemical Composition of Feed Ingredients

29/07/99

Country:	Australia	**State:**		**Zone:**	
Category:	Vegetable protein	**Ingredient:**	Soybean	**Basis:**	As fed
Condition:		**Fraction:**	Meal	**Maturity:**	Not relevant
Process:	Solvent extracted	**Quality:**		**Storage:**	

Proximate	Unit	Chemical Method	N	Mean	Min	Max	CV%
Acid detergent fibre	%	ADF-van Soest	2	8.010	8.010	8.010	
Ammonia	%	Unknown	16	0.950	0.950	0.950	
Ash	%	Ash-AOAC, 1980	3	8.040	8.040	8.040	
Ash	%	Unknown	33	6.703	6.700	6.800	1.0
Crude fibre	%	Crude fibre, 1980	5	5.812	4.700	6.090	18.2
Crude fibre	%	Unknown	2	5.150	5.000	5.300	4.1
Crude protein	%	Crude protein, 1980	28	47.447	44.600	48.150	4.0
Crude protein	%	Crude protein-Se.	1	45.200	45.200	45.200	
Crude protein	%	Unknown	39	47.207	45.186	49.484	3.2
Dry matter	%	Dry matter-AOAC	7	90.537	89.800	90.660	0.7
Dry matter	%	Unknown	41	93.695	89.000	94.500	2.0
Ether extract	%	Ether extract	7	2.243	1.900	4.300	54.7
Ether extract	%	Unknown	30	0.785	0.740	2.100	67.7
N - free extract	%	Unknown	1	28.000	28.000	28.000	

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Chemical Composition of Feed Grains

29/07/99

Country:	Australia	**State:**		**Zone:**	
Species:	H. vulgare	**Variety:**	Clipper	**Basis:**	As fed
Condition:		**Fraction:**	Whole seed	**Maturity:**	Ripe seed
Process:		**Quality:**		**Storage:**	

Amino acids	Unit	Chemical Method	N	Mean	Min	Max	CV%
Alanine	%	AA's-N'field	1	0.427	0.427	0.427	
Arginine	%	AA's-N'field	2	0.503	0.436	0.570	18.8
Arginine	%	AA's-W'bar	2	0.555	0.510	0.600	11.5
Aspartic acid	%	AA's-N'field	1	0.685	0.685	0.685	
Cyst+Meth	%	AA's-N'field	1	0.460	0.460	0.460	
Cyst+Meth	%	AA's-W'bar	2	0.405	0.370	0.440	12.2
Cystine	%	AA's-N'field	1	0.312	0.312	0.312	
Glutamic acid	%	AA's-N'field	1	2.652	2.652	2.652	
Glycine	%	AA's-N'field	1	0.401	0.401	0.401	
Histidine	%	AA's-N'field	2	0.262	0.230	0.294	17.3
Histidine	%	AA's-W'bar	2	0.220	0.180	0.260	25.7
Isoleucine	%	AA's-N'field	2	0.363	0.347	0.380	6.4
Isoleucine	%	AA's-W'bar	2	0.380	0.360	0.400	7.4
Leucine	%	AA's-N'field	2	0.716	0.712	0.720	0.8
Leucine	%	AA's-W'bar	2	0.680	0.640	0.720	8.3
Lysine	%	AA's-N'field	2	0.354	0.329	0.380	10.2
Lysine	%	AA's-W'bar	2	0.400	0.400	0.400	0.0
Methionine	%	AA's-N'field	1	0.178	0.178	0.178	
Phenylalanine	%	AA's-N'field	1	0.401	0.401	0.401	

Chemical Composition of Feed Grains

29/07/99

Country:	Australia	**State:**		**Zone:**	
Species:	H. vulgare	**Variety:**	Clipper	**Basis:**	As fed
Condition:		**Fraction:**	Whole seed	**Maturity:**	Ripe seed
Process:		**Quality:**		**Storage:**	

Amino acids	Unit	Chemical Method	N	Mean	Min	Max	CV%
Proline	%	AA's-N'field	1	1.130	1.130	1.130	
Serine	%	AA's-N'field	1	0.481	0.481	0.481	
Threonine	%	AA's-N'field	2	0.366	0.350	0.383	6.4
Threonine	%	AA's-W'bar	2	0.365	0.360	0.370	1.9
Tryptophan	%	AA's-N'field	1	0.130	0.130	0.130	
Tyr+Phen	%	AA's-N'field	1	0.890	0.890	0.890	
Tyr+Phen	%	AA's-W'bar	2	0.890	0.780	1.000	17.5
Tyrosine	%	AA's-N'field	1	0.338	0.338	0.338	
Valine	%	AA's-N'field	2	0.553	0.520	0.587	8.6
Valine	%	AA's-W'bar	2	0.510	0.490	0.530	5.5

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Chemical Components of Ingredients

29-Jul-99

Country: Australia **State:** **Zone:**

Category: Vegetable protein **Basis:** As fed

Condition: **Fraction:** Meal **Maturity:** Not relevant

Process: **Quality:** **Storage:**

Chemical Component: Lysine **Unit:** % **Chemical Method:**

Ingredient	N	Mean	Min	Max	CV%
Canola	89	2.090	1.455	2.560	15.0
Linseed	50	1.282	0.946	1.892	7.3
Peanut	19	1.566	1.376	1.990	13.9
Safflower	32	0.976	0.610	1.490	30.2
Sesame	2	1.105	1.070	1.140	4.5
Soybean	249	2.799	2.300	3.550	8.9
Sunflower	106	1.148	0.485	1.700	23.2

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Chemical Components of Grains

29-Jul-99

Country: Australia
State:
Zone:
Species: L. angustifolius
Basis: As fed
Condition:
Fraction: Whole seed
Maturity: Ripe seed
Process:
Quality:
Storage:
Chemical Component: Crude protein
Unit: %
Chemical Method:

Variety	N	Mean	Min	Max	CV%
Chittick	56	30.151	24.190	35.940	9.4
Danja	187	31.381	20.750	39.810	14.3
Geebung	5	29.600	24.700	32.200	10.8
Gungurru	136	30.643	20.810	39.800	14.1
Illyarrie	395	29.760	17.940	38.460	15.7
Marri	2	28.340	24.480	32.200	19.3
Merrit	70	29.338	23.190	37.700	12.9
Myallie	36	30.577	26.130	37.300	9.7
Unicrop	43	31.320	25.000	40.500	10.4
Uniharvest	18	31.659	27.000	33.700	5.4
Uniwhite	3	31.933	28.400	34.350	9.8
Unknown	716	31.444	22.630	40.380	9.2
Variety trial	832	33.876	25.500	44.060	7.2
Wandoo	1	33.500	33.500	33.500	
Warrah	25	26.130	20.560	29.940	7.9
Yandee	111	32.130	28.450	39.140	5.0
Yorrell	39	29.375	22.500	37.100	13.0

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Nutritional Quality of Feed Ingredients

29/07/99

Country: Australia
Category: Cereals
Condition:
Process:
Vivo/Vitro: Vivo
Animal Breed:

State:
Ingredient: Wheat
Fraction: Whole seed
Quality:
Animal Species: Pig
Physiological Status:

Zone:
Basis: As fed
Maturity: Ripe seed
Storage:
Nut. Qual. Type: Energy

Energy	Unit	Nutritive Method	N	Mean	Min	Max	CV%
Digestible energy	MJ/kg	App. faecal digestibility	67	14.439	12.900	15.190	3.4

ALFI DATABASE
AUSTRALASIAN LIVESTOCK FEED INGREDIENT DATABASE

Pig and Poultry Production Institute
Roseworthy Campus
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Phone: (08) 83037683
Fax: (08) 83837977

Nutritional Quality of Feed Grains

29/07/99

Country:	Australia	**State:**		**Zone:**	
Species:	L. angustifolius	**Variety:**	Gungurru	**Basis:**	As fed
Condition:		**Fraction:**	Kernel	**Maturity:**	Ripe seed
Process:		**Quality:**		**Storage:**	
Vivo/Vitro:	Vivo	**Animal Species:**	Pig	**Nut. Qual. Type:**	Digestibility
Animal Breed:		**Physiological Status:**			

Amino acids	Unit	Nutritive Method	N	Mean	Min	Max	CV%
Alanine	%	App. ileal digestibility	1	85.000	85.000	85.000	
Arginine	%	App. ileal digestibility	1	96.000	96.000	96.000	
Aspartic acid	%	App. ileal digestibility	1	93.000	93.000	93.000	
Cystine	%	App. ileal digestibility	1	92.000	92.000	92.000	
Glutamic acid	%	App. ileal digestibility	1	97.000	97.000	97.000	
Glycine	%	App. ileal digestibility	1	66.000	66.000	66.000	
Histidine	%	App. ileal digestibility	1	86.000	86.000	86.000	
Isoleucine	%	App. ileal digestibility	1	90.000	90.000	90.000	
Leucine	%	App. ileal digestibility	1	91.000	91.000	91.000	
Lysine	%	App. ileal digestibility	1	92.000	92.000	92.000	
Methionine	%	App. ileal digestibility	1	86.000	86.000	86.000	
Phenylalanine	%	App. ileal digestibility	1	92.000	92.000	92.000	
Proline	%	App. ileal digestibility	1	60.000	60.000	60.000	
Serine	%	App. ileal digestibility	1	89.000	89.000	89.000	
Threonine	%	App. ileal digestibility	1	86.000	86.000	86.000	
Tyrosine	%	App. ileal digestibility	1	91.000	91.000	91.000	
Valine	%	App. ileal digestibility	1	91.000	91.000	91.000	

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Nutritional Quality of Feed Ingredients(Calculated)

30/07/99

Country: Australia
Category: Cereals
Condition:
Process:
Vivo/Vitro: Vivo
Animal Breed:

State:
Ingredient: Wheat
Fraction: Whole seed
Quality:
Animal Species: Pig
Physiological Status:

Zone:
Basis: As fed
Maturity: Ripe seed
Storage:
Nut. Qual. Type: Digestibility
Chemical Method:

Amino acids	Unit	Nutritive Method	N	Mean	Min	Max	CV%
Alanine	g/kg	App. ileal digestibility	191	3.683	2.844	4.938	15.1
Arginine	g/kg	App. ileal digestibility	416	5.249	3.485	7.820	18.0
Aspartic acid	g/kg	App. ileal digestibility	192	5.124	3.572	7.800	19.5
Cystine	g/kg	App. ileal digestibility	176	2.184	1.204	4.902	32.8
Glutamic acid	g/kg	App. ileal digestibility	192	35.615	16.368	58.759	21.2
Glycine	g/kg	App. ileal digestibility	374	3.103	2.024	4.614	17.0
Histidine	g/kg	App. ileal digestibility	409	2.523	0.932	4.036	23.1
Isoleucine	g/kg	App. ileal digestibility	420	3.612	1.832	5.091	17.1
Leucine	g/kg	App. ileal digestibility	420	7.594	5.530	11.434	18.6
Lysine	g/kg	App. ileal digestibility	440	3.193	1.827	5.394	16.4
Methionine	g/kg	App. ileal digestibility	394	1.523	0.588	2.577	23.3
Phenylalanine	g/kg	App. ileal digestibility	391	5.142	2.236	7.912	22.9
Proline	g/kg	App. ileal digestibility	82	10.088	3.108	15.305	30.8
Serine	g/kg	App. ileal digestibility	374	10.131	3.071	48.970	132.9
Threonine	g/kg	App. ileal digestibility	421	2.885	1.540	4.158	19.2
Tyrosine	g/kg	App. ileal digestibility	199	3.215	0.328	6.306	32.6
Valine	g/kg	App. ileal digestibility	420	4.655	2.440	6.697	16.9

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Nutritional Quality of Ingredients

29/07/99

Country: Australia
State:
Zone:
Category: Vegetable protein
Basis: As fed
Condition:
Fraction: Meal
Maturity: Not relevant
Process:
Quality:
Storage:
Vivo/Vitro: Vivo
Animal Species: Pig
Nut.Qual. Type: Availability
Animal Breed:
Physiological Status:
Nutritive Method: Slope-ratio (l'weight gain)
Chemical Component: Lysine
Unit: %

Ingredient	N	Mean	Min	Max	CV%
Canola	2	102.000	99.000	105.000	4.2
Linseed	1	29.000	29.000	29.000	
Peanut	1	74.000	74.000	74.000	
Soybean	2	100.500	93.000	108.000	10.6
Sunflower	3	92.667	71.000	107.000	20.6

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Nutritional Quality of Grains

29/07/99

Country: Australia
State:
Zone:
Species: H. vulgare
Basis: As fed
Condition:
Fraction: Whole seed
Maturity: Ripe seed
Process:
Quality:
Storage:
Vivo/Vitro: Vivo
Animal Species: Pig
Nut.Qual. Type: Digestibility
Animal Breed:
Physiological Status:
Nutritive Method: App. faecal digestibility
Chemical Component: Gross energy
Unit: %

Variety	N	Mean	Min	Max	CV%
Cameo	3	84.600	83.400	85.200	1.2
Clipper	3	80.300	77.200	84.700	4.9
Corvette	1	82.300	82.300	82.300	
Gilbert	1	81.800	81.800	81.800	
GPL x Koru 137	1	83.900	83.900	83.900	
GPL x Koru 96	1	83.700	83.700	83.700	
Grimmett	1	84.600	84.600	84.600	
Koru	2	83.550	83.200	83.900	0.6
Schooner	2	84.250	83.700	84.800	0.9
Skiff	4	83.400	81.300	85.000	1.9
SNR x Koru 49	1	83.500	83.500	83.500	
SNR x Koru 74	1	83.900	83.900	83.900	
Tallon	2	84.250	83.300	85.200	1.6
TG121-1	1	83.700	83.700	83.700	
TMP x SN	1	82.500	82.500	82.500	
TR2ARUPO	3	83.833	83.500	84.500	0.7
Triumph-Grimmett	2	84.250	84.200	84.300	0.1
WA755:4	1	81.900	81.900	81.900	
WB136	1	84.000	84.000	84.000	

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Physical Features of Feed Ingredients

29/07/99

Country: Australia
State:
Zone:
Category: Cereals
Ingredient: Barley
Basis: As fed
Condition:
Fraction: Whole seed
Maturity: Ripe seed
Process:
Quality:
Storage:

Physical Element	Unit	N	Mean	Min	Max
1000-grain weight	g	1	38.400	38.400	38.400
Test weight	kg/hL	28	68.280	59.300	72.650

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Physical Features of Feed Grains

29/07/99

Country:	Australia	**State:**		**Zone:**	
Species:	H. vulgare	**Variety:**		**Basis:**	As fed
Condition:		**Fraction:**	Whole seed	**Maturity:**	Ripe seed
Process:		**Quality:**		**Storage:**	
Colour:					

Physical Element	Unit	N	Mean	Min	Max
1000-grain weight	g	18	91.311	2.600	418.000
Diameter	mm	18	5.917	4.400	7.400
Hull percentage	%	202	26.365	21.641	33.333
Seed size	mL	57	0.157	0.089	0.349
Seed weight	mg	77	155.509	18.340	413.000
Test weight	kg/hL	128	73.895	50.000	83.980

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Papers Provided by the Contributor

30-Jul-99

Full Name: van Barneveld, R.J.

Name: Robert J van Barneveld

Paper:

Volume: **Pages:** **Year:** 1997

Editor: Unknown

Title: Understanding the nutritional value of lupins: Project DAS33P final report to PRD

Publisher: Unknown

Address:

Phone: **Fax:**

Name: Robert J van Barneveld

Paper:

Volume: **Pages:** **Year:** 1997

Editor: Unknown

Title: Understanding the nutritional value of lupins: Project DAS33P progress report to

Publisher: Unknown

Address:

Phone: **Fax:**

Name: Robert J van Barneveld

Paper: A survey of meat-and-bone meal quality

Volume: **Pages:** **Year:** 1994

Editor: Unknown

Title:

Publisher: Unknown

Address:

Phone: **Fax:**

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Cited Paper/Work

30-Jul-99

Reference Type: Journal

Name:	A	D	Hughes		
Paper:	A comparison of the chemical composition and nutritive value of Clipper with Noye				
Volume:	2	**Pages:**	60-64	**Year:**	1975
Editor:			Unknown		
Title:	Agricultural Record				
Publisher:	Unknown				
Address:					
Phone:		**Fax:**			

Name:	A	D	Hughes		
Paper:	The composition and nutritive value of egg-meal as a supplementary protein for gr				
Volume:	3	**Pages:**	16-19	**Year:**	1976
Editor:			Unknown		
Title:	Agriculture Record				
Publisher:	Unknown				
Address:					
Phone:		**Fax:**			

Name:	A	G	Green		
Paper:	Evaluation of meal from Linola low-linolenic acid linseed and conventional linseed				
Volume:	35	**Pages:**	181-190	**Year:**	1991
Editor:			Unknown		
Title:	Animal Feed Science and Technology				
Publisher:	Unknown				
Address:					
Phone:		**Fax:**			

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Chemical Composition of Ingredients Provided by the Contributor

30-Jul-99

Full Name: van Barneveld, R.J.

Ingredient	Basis	Condition	Fraction	Maturity	Process	Quality	Storage	Chemical Component	Chemical Method	N	Mean
Aust. Sweet lu	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown meth	Acid detergent fibre	Proximate-INRA	1	49.084
Aust. Sweet lu	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown meth	Acid detergent fibre	Unknown	1	52.000
Aust. Sweet lu	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown meth	Alanine	AA's-Waters	1	0.360
Aust. Sweet lu	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown meth	Arabinose	Saponins	3	2.295
Aust. Sweet lu	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown meth	Arginine	AA's-Waters	1	0.920
Aust. Sweet lu	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown meth	Ash	Ash-AOAC, 1980	1	2.800
Aust. Sweet lu	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown meth	Ash	Proximate-INRA	1	2.481
Aust. Sweet lu	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown meth	Aspartic acid	AA's-Waters	1	1.000
Aust. Sweet lu	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown meth	Calcium	Proximate-INRA	1	28700.
Aust. Sweet lu	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown meth	Cobalt	Proximate-INRA	1	1.000
Aust. Sweet lu	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown meth	Copper	Proximate-INRA	1	10.000

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Nutritional Quality of Ingredients Provided by the Contributor

30-Jul-99

Full Name: van Barneveld, R.J.

Ingredient	Basis	Condition	Fraction	Maturity	Process	Quality	Storage	VTMark	Species	Nut.Qual.Type	Chemical Compone	Nutritive Method	N	Mean
Aust. Sweet lup	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown m	1	Pig	Digestibility	Crude fibre	App. faecal digestibility	1	42.100
Aust. Sweet lup	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown m	1	Pig	Digestibility	Crude fibre	App. ileal dig. (anast.)	1	2.700
Aust. Sweet lup	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown m	1	Pig	Digestibility	Crude protein	App. faecal digestibility	1	17.400
Aust. Sweet lup	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown m	1	Pig	Digestibility	Crude protein	App. ileal dig. (anast.)	1	25.300
Aust. Sweet lup	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown m	1	Pig	Digestibility	Ether extract	App. faecal digestibility	1	0.000
Aust. Sweet lup	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown m	1	Pig	Digestibility	Ether extract	App. ileal dig. (anast.)	1	0.000
Aust. Sweet lup	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown m	1	Pig	Digestibility	Gross energy	App. faecal digestibility	1	40.100
Aust. Sweet lup	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown m	1	Pig	Digestibility	Gross energy	App. ileal dig. (anast.)	1	8.200
Aust. Sweet lup	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown m	1	Pig	Digestibility	N - free extract	App. faecal digestibility	1	51.700
Aust. Sweet lup	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown m	1	Pig	Digestibility	N - free extract	App. ileal dig. (anast.)	1	0.000
Aust. Sweet lup	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown m	1	Pig	Digestibility	Organic matter	App. faecal digestibility	1	39.800
Aust. Sweet lup	As fed	As received	Hull	Ripe seed	Untreated	2	Unknown m	1	Pig	Digestibility	Organic matter	App. ileal dig. (anast.)	1	1.100

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Physical Features of Ingredients Provided by the Contributor

30-Jul-99

Full Name: miao, Z.

Ingredient	Basis	Condition	Fraction	Maturity	Process	Quality	Storage	PS Mark	Physical Element	N	Mean
Atlas lupin	As fed	As received	Whole seed	Ripe seed	Untreated	2	Unknown meth	1	Hull percentage	39	29.929
Atlas lupin	As fed	As received	Whole seed	Ripe seed	Untreated	2	Unknown meth	1	Seed size	9	0.186
Atlas lupin	As fed	As received	Whole seed	Ripe seed	Untreated	2	Unknown meth	1	Seed weight	18	135.67
Aust. Sweet lu	As fed	As received	Whole seed	Ripe seed	Untreated	2	Unknown meth	1	Hull percentage	122	24.403
Aust. Sweet lu	As fed	As received	Whole seed	Ripe seed	Untreated	2	Unknown meth	1	Seed size	39	0.121
Aust. Sweet lu	As fed	As received	Whole seed	Ripe seed	Untreated	2	Unknown meth	1	Seed weight	39	154.99
L. pilosus	As fed	As received	Whole seed	Ripe seed	Untreated	2	Unknown meth	1	Hull percentage	28	27.911
L. pilosus	As fed	As received	Whole seed	Ripe seed	Untreated	2	Unknown meth	1	Seed size	6	0.349
L. pilosus	As fed	As received	Whole seed	Ripe seed	Untreated	2	Unknown meth	1	Seed weight	14	206.25
Sandplain lupi	As fed	As received	Whole seed	Ripe seed	Untreated	2	Unknown meth	1	Hull percentage	13	30.756
Sandplain lupi	As fed	As received	Whole seed	Ripe seed	Untreated	2	Unknown meth	1	Seed size	3	0.148

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Chemical Method

30-Jul-99

MethodID: 25

Chemical Method: AA's-N'field

Reference: Davies, 1975

Description: Acid hydrolysis was carried out by refluxing with 6N hydrochloric acid for 18 hours under and atmosphere of nitrogen under the conditions described by Dustin, J.P., Czajkowska, C., Moore, S. and Bigwood, E.S. (1953) A study of the chromatographic determination of amino acids in the presence of large amounts of carbohydrates. Analytica chimica acta 9:256, with respect to the concentration of protein. Excess hydrochloric acid was removed by vacuum distillation at a temperature not exceeding 40°C. (i) the acidic and neutral amino acids were separates on a 150cm column operated under the conditions described by Moore, S., Spackman, D.H. and Stein, W.H. (1958) Chromatography of amino acids on sulphonated polystyrene resins: an improved system. Analytical Chemistry 30:1185, for protein hydrolysates. (ii) Cystine and methionine were determined as cyteic acid and methionine sulphone respectively following performic acid oxdidation as described by Moore, S. (1963) On the determination of cystine as cysteic acid. Journal of Biological Chemistry 238:235. (iii) the basic amino acids were separated on a 50cm column operated under the conditions described by Spackman, D.H., Stein, W.H. and Moore, S. (1958) Automatic recording apparatus for use in the chromatography of amino acids. Analytical Chemistry 30 :1190, for physiological fluids. The acidic, neutral and basic amino acids were determined colorimetrically with the modified ninhydrin reagent described by Moore, S. and Stein, W.H. (1954) A modified ninhydrin reagent for the photometric determination of amino acids and related compounds. Journal of Biological Chemistry 211:907. Reference: Davies, R (1975) Agricultural Record, 2:60-64.

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Nutritive Method

30-Jul-99

Nutritive MethodID: 8

Nutritive Method: Slope-ratio (l'weight gain)

Reference: Batterham et al 1979

Description: The slope-ratio technique (Finney, D.J. (1964) Statistical Method in Biological Assay, 2nd edn. London, Griffin.) is applied to a growth trial in which the animals response to graded levels of an amino acid contained within protein (or test amino acid) are compared with to the animals response to graded levels of a standard or free amino acid. In this case, the response is daily liveweight gain. Care must be taken with the interpretation of these results as they can be influenced by gut-fill. Reference: Batterham et al (1979) British Journal of Nutrition, 41:383-391.

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Sample Attributes

30/07/99

Country:	Australia	**State:**	Unknown		
Category:	Vegetable protein	**Ingredient:**	Soybean	**International Code:**	0-00-000
SampleID:	18813				

Basis:	As fed
Condition:	Unknown
Fraction:	Meal
Maturity:	Not relevant
Process:	Prepress solv. extr.
Quality:	3
Storage:	Unknown method

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Chemical Composition of the Sample

30/07/99

Country: Australia **State:** Unknown

Category: Vegetable protein **Ingredient:** Soybean **International Code:** 0-00-000

SampleID: 18813

Chemical Type	Chemical Component	Chemical Method	Unit	Mean Value
Amino acids	Cystine	AA's-W'bar	%	1.500
Amino acids	Histidine	AA's-W'bar	%	1.200
Amino acids	Isoleucine	AA's-W'bar	%	1.900
Amino acids	Leucine	AA's-W'bar	%	3.000
Amino acids	Lysine	AA's-W'bar	%	2.300
Amino acids	Methionine	AA's-W'bar	%	0.500
Amino acids	Phenylalanine	AA's-W'bar	%	2.100
Amino acids	Threonine	AA's-W'bar	%	1.700
Amino acids	Tyrosine	AA's-W'bar	%	1.200
Amino acids	Valine	AA's-W'bar	%	2.000
Proximate	Ash	Ash-AOAC, 1980	%	6.100
Proximate	Crude fibre	Crude fibre-Mod AOAC	%	5.900
Proximate	Crude protein	Crude protein-Se.	%	42.500
Proximate	Dry matter	Dry matter-AOAC	%	89.600
Proximate	Ether extract	Petrol ether extract	%	1.300
Proximate	Gross energy	GE-Ballistic	MJ/kg	17.600

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Animal Details and Experiment Summary

30-Jul-99

Country: Australia
State: Unknown
Category: Vegetable protein
Ingredient: Soybean
International Code: 0-00-000
SampleID: 18813

Vitro/Vivo: Vivo
Animal Species: Pig
Nut. Qual. Type: Digestibility
Chemical Type: Amino acids
Chemical Component: Lysine
Nutritive Method: App. ileal digestibility

Animal: 213b

Age:	
Sex:	Male
Animal Number:	4
Animal Breed:	Large White
Physiological Status:	Growing
Feed Level:	Unknown
Feed Form:	Unknown
Initial Weight:	65
Final Weight:	
Days Fed:	
Weight Gain:	
Intake:	

Summary:

This paper reports experiments designed to investigate the relationship between the availability and ileal digestibilty of lysine in three cottonseed meals and a soyben meal for pigs. The opportunity was taken wtih the slope-ratio assa to invesigate further the realative merits of FCE and protein deposition as variables of response and to determine if differences in energy retention by the pigs influences the assay values. The usefulness of the slope ratio values in dietary formulations for grower pigs was assessed. Pigs given diets formulateed to the same qavailable lysine concentration grew at similar rates and retained the same amount of lysine in the carcasses. The results indicate thea for meals of high availability (soybean meal), reduced ileal digestibility appears to be the main reason for reduced availability. However, for meals of low availability (cottonseed meal), reduced ileal digestibility only accounts for part of the reduced availability. Thus, ileal digestibility of lysine is not a reliable indicator of lysine availability.

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Nutritional Quality of the Sample

30-Jul-99

Country: Australia
State: Unknown
Category: Vegetable protein
Ingredient: Soybean
International Code: 0-00-000
SampleID: 18813
Vitro/Vivo: Vivo
Animal Species: Pig
Nut. Qual. Type: Digestibility
Chemical Type: Amino acids
Chemical Component: Lysine
Nutritive Method: App. ileal digestibility
Animal: 213b

Animal Breed	Physiological Status	Feed Level	Feed Form	Mean Value
Large White	Growing	Unknown	Unknown	88.000

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Experimental Diet Formulation

30-Jul-99

Country: Australia **State:** Unknown
Category: Vegetable protein **Ingredient:** Soybean **International Code:** 0-00-000
SampleID: 18813
Vivo/Vitro: Vivo **Animal Species:** Pig **Nut. Qual. Type:** Digestibility
Chemical Type: Amino acids **Chemical Component:** Lysine **Nutritive Method:** App. ileal digestibility
Animal: 213b

Diet Ingredient	Proportion (%)
Chromic oxide	0.2
Dicalcium phosphate	1.5
Salt	0.2
Soybean meal	30.0
Vitamins and mineral	0.5
Wheat	67.6

ALFI DATABASE
AUSTRALASIAN LIVESTOCK FEED INGREDIENT DATABASE

Pig and Poultry Production Institute
Roseworthy Campus
Roseworthy, South Australia 5371
Phone: (08) 83037683
Fax: (08) 83837977

Nutritional Specifications of the Experimental Diet

30-Jul-99

Country: Australia
State: Unknown
Category: Vegetable protein
Ingredient: Soybean
International Code: 0-00-000
SampleID: 18813
Vivo/Vitro: Vivo
Animal Species: Pig
Nut. Qual. Type: Digestibility
Chemical Type: Amino acids
Chemical Component: Lysine
Nutritive Method: App. ileal digestibility
Animal: 213b

Chemical Component	Nutritive Value Type	Nutritive Method	Mean Value
Alanine	Digestibility	App. ileal digestibility	81.000
Arginine	Digestibility	App. ileal digestibility	89.000
Aspartic acid	Digestibility	App. ileal digestibility	82.000
Dry matter	Digestibility	App. ileal digestibility	70.000
Glutamic acid	Digestibility	App. ileal digestibility	89.000
Glycine	Digestibility	App. ileal digestibility	74.000
Histidine	Digestibility	App. ileal digestibility	87.000
Isoleucine	Digestibility	App. ileal digestibility	86.000
Leucine	Digestibility	App. ileal digestibility	86.000
Lysine	Digestibility	App. ileal digestibility	87.000
Methionine	Digestibility	App. ileal digestibility	90.000
Nitrogen	Digestibility	App. ileal digestibility	83.000
Phenylalanine	Digestibility	App. ileal digestibility	83.000
Proline	Digestibility	App. ileal digestibility	86.000
Serine	Digestibility	App. ileal digestibility	82.000
Threonine	Digestibility	App. ileal digestibility	76.000
Tyrosine	Digestibility	App. ileal digestibility	83.000
Valine	Digestibility	App. ileal digestibility	83.000

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Information on the Zone in which the Sample Grew

30-Jul-99

Country:	Australia	**State:**	Queensland		
Category.	Cereals	**Ingredient.**	Barley	**International Code:**	4-00-000
SampleID	18872				

ZoneID:	423
StateID:	4
Site:	Hermitage
Region:	Darling Downs
Town:	Warwick
GIS:	
Rain Fall:	
Season Break	
Soil Type:	
Altitude:	
Latitude:	28° 21'
Longitude:	152° 10'

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Fax: (08) 83837977

Sample Attributes

30/07/99

Country: Australia
State: Queensland
Category: Cereals
Ingredient: Barley
International Code: 4-00-000
SampleID: 18872

Basis:	As fed
Condition:	Unknown
Fraction:	Whole seed
Maturity:	Ripe seed
Process:	Unknown
Quality:	3
Storage:	Unknown method

Appendix **Two**

Criteria used to assign a value for data quality

The ALFI Database has the capacity to take into account the "quality" of the data when searching for information on feed ingredients. Data quality refers to the completeness of the dataset and the information that is provided about the sample. The following table is a brief description of the criteria used to assign a value for quality.

Value	Criteria
1	Complete or very close to complete information about the sample including the information required for the *zone* and *year* tables, as well as *processing*, *fraction* and *condition* etc. Information on the laboratory and methods used to accompany *chemical composition* and *nutritive value* information (including *animal* information). Full information on the *provider source* and *researchers* responsible for the data.
2	Intermediate between 1 and 3. Data from PhD theses and progress reports will fall into this category as there is more information than that contained in peer reviewed journals.
3	Most data falls into this category, for example that published in peer review journals. Enough sample information is supplied to complete the sample table, although the information on the zone, year etc may not be complete. Information in the methods used to determine chemical composition and nutritive value is required, although it may only be a reference. The animal data may not be complete, but there must be some description of animals used to determine nutritive value.
4	Most databases fall into this category, although this is because they have been an accepted reference rather than because of the data they contain. Data in this category should include most of the

	information required for the sample table. Often methods will not be included, or information on animals used to determine information on nutritive value.
5	The information about the sample is not complete, but there must be some information about the provider source for it to be included in the database at all.

Appendix **Three**

Scientific and common names for plants

Although references to species names should be made in italic font, the database cannot display italic, bold and underlined fonts at the same time as normal fonts. Also, to minimise the space taken up on the forms, the genus for all plant names is abbreviated. The table below contains the **species, genus** and **common name** for each plant described in the ALFI Database. If a plant has the same species and common name, then a common name is not known for that plant.

Species	Genus	Common name
A. acutifolia	Atylosia	A. acutifolia
A. byzantina	Avena	Red oats
A. coriacea	Acacia	Wiry wattle
A. hypogaea	Arachis	Peanut
A. murayana	Acacia	A. murayana
A. sativa	Avena	Oats
A. tenuissima	Acacia	A. tenuissima
A. terminalis	Acacia	A. terminalis
A. victoriae	Acacia	Prickly watttle
B. campestris	Brassica	Canola
B. napus	Brassica	Canola
C. arietinum	Cicer	Chickpea (general)
C. arietinum Desi	Cicer	Chickpea-Desi
C. arietinum Kabuli	Cicer	Chickpea-Kabuli
C. australe	Castanospermum	C. australe
C. cajan	Cajanus	Pigeon pea
C. ensiformis	Canavalia	C. ensiformis
C. siliqua	Ceratonia	Carob bean
C. tetragonoloba	Cyamopsis	Guar
C. tinctorius	Carthamus	Safflower
E. utilis	Echinochloa	Japanese millet
F. esculentum	Fagopyrum	Buckwheat
G. max	Glycine	Soybean
G. soya	Glycine	G. soya
G. tomentalla	Glycine	G. tomentalla
H. annus	Helianthus	Sunflower
H. vulgare	Hordeum	Barley
L. albus	Lupinus	White lupin
L. angustifolius	Lupinus	Australian Sweet lupin
L. aphaca	Lathyrus	L. aphaca
L. atlanticus	Lupinus	Atlas lupin
L. cicera	Lathyrus	Flat pod pea vine
L. clymenum	Lathyrus	L. clymenum
L. cosentini	Lupinus	Sandplain lupin
L. culinaris	Lens	Lentil

L. digitatus	Lupinus	L. digitatus
L. hartweigii	Lupinus	L. hartweigii
L. luteus	Lupinus	Yellow lupin
L. mutabilis	Lupinus	Tarwi lupin
L. ochrus	Lathyrus	Cyprus vetch
L. palestinium	Lupinus	L. palestinium
L. pilosus	Lupinus	L. pilosus
L. princei	Lupinus	L. princei
L. purpureus	Lablab	Lablab
L. sativus	Lathyrus	Chickling vetch
L. usitatissimum	Linum	Linseed
Lupinus sp	Lupinus	Lupin
M. sativa	Medicago	Lucerne
M. uniflorum	Macrotyloma	Horse gram
Mucuna sp	Mucuna	Mucuna sp.
O. sativa	Oryza	Rice
P. acutifolius	Phaseolus	Tepary bean
P. canariensis	Phalaris	Canary grass
P. coccineus	Phaseolus	P. coccineus
P. elegans	Phaseolus	P. elegans
P. helvolus	Phaseolus	P. helvolus
P. leucanthus	Phaseolus	P. leucanthus
P. lunatus	Phaseolus	Lima bean
P. peduncularis	Phaseolus	P. peduncularis
P. pilosus	Phaseolus	P. pilosus
P. racardianus	Phaseolus	P. racardianus
P. sativum	Pisum	Field pea
P. schottii	Phaseolus	P. schottii
P. semierectus	Phaseolus	P. semierectus
P. tetragonoloba	Psophocarpus	P. tetragonoloba
P. vulgaris-culinary	Phaseolus	Borlotti bean
P. vulgaris-navy	Phaseolus	Navy bean
S. bicolor	Sorghum	Sorghum
S. cereale	Secale	Rye
S. grandiflora	Sesbania	S. grandiflora
S. indicum	Sesamum	Sesame seed
S. italica	Setaria	Italian millet
S. sesban	Sesbania	S. sesban
T. aestivum	Triticum	Wheat
T. foenumgraecum	Trigonella	T. foenumgraecum
Triticale	XTriticosecale	Triticale
V. aconitifolia	Vigna	Moth bean
V. angularis	Vigna	Adzuki bean
V. articulata	Vicia	One-flowered vetch
V. atropurpurea	Vicia	V. atropurpurea
V. benghalensis	Vicia	Purple vetch
V. ervilia	Vicia	Bitter vetch
V. faba	Vicia	Faba bean

V. hybrida	Vicia	V. hybrida
V. lanceolata	Vigna	V. lanceolata
V. mungo	Vigna	Black Mung bean
V. narbonensis	Vicia	Narbon bean
V. radiata	Vigna	Green Mung bean
V. sativa	Vicia	Common vetch
V. sublobata	Vigna	V. sublobata
V. trilobata	Vigna	V. trilobata
V. umbellata	Vigna	Rice bean
V. unguiculata	Vigna	Cowpea
V. vexillata	Vigna	V. vexillata
V. villosa dasycarpa	Vicia	Woolly pod vetch
Z. mays	Zea	Maize

Appendix **Four**

Information for Example 23 (Chapter 11)

<u>Summary</u>: van Barneveld, Szarvas and Barr (1998) J. Sci. Food Agric. 76:277-284. (Paper is shown in full on the following pages)

- **Sample Information:**

- Naked Oats (Avena sativa cv Bandicoot) from Griffith, NSW (see below for zone information not supplied in the paper)
- Air dry basis (see chemical composition)
- Condition – as received
- Fraction – whole seed
-

- **Animals:**

- Ileal digestibility of amino acids and digestible energy content of the sample was assessed using 4 Large White entire male pigs of 38 kg.

- Pigs were fitted with simple T-piece cannulae according to the method described by van Barneveld (1993).
- Daily feeding rates were adjusted to three times maintenance
- Diets were pelleted (pressed)

- **Chemical composition**

- (given in table 1.)

- **Note**: air dry basis, g kg^{-1} (*so these values need to be converted to %*)

- **Chemical analyses:**

- Chemical analyses for the following were according to the method of the AOAC (1984)
- Crude protein
- Dry matter
- Light petroleum extract
- Crude fibre
- Neutral detergent fibre
- Ash
- Acid-insoluble ash was determined using the method described by Choct *et al* (1992)
- Amino acids – *although this is not specified in the paper, this method is the Waters system used at the PPPI*

- **Diet composition:**

- (given in Table 2.)
- **Note**: air dry basis, g kg^{-1} (*so these values need to be converted to %*)
- Some ingredients will already be in the database and can be seen in the data entry table

- **Ileal digestibility results:**

- Dry matter, nitrogen and gross energy given in table 3. **Note**: air dry basis, proportion of total (*so these values need to be converted to %*)
- Amino acids given in table 4. **Note**: air dry basis, proportion of total (*so these values need to be converted to %*)

J Sci Food Agric 1998, **76**, 277–284

The Apparent Ileal Digestibility of Amino Acids and the Digestible Energy Content of Naked Oats (*Avena sativa* cv Bandicoot) Fed to Growing Pigs

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Abstract: An experiment was conducted to determine the apparent ileal digestibility of amino acids and the digestible energy (DE) content of two samples of naked oats (*Avena sativa* cv Bandicoot) and to compare these parameters in wheat (*Triticum aestivum* cv Machete) and dehulled oats (groats; *Avena sativa* cv Echidna). Four Large White male pigs were fitted with simple T-piece ileal cannulae and allocated to experimental diets in a 4 × 4 Latin square design. Amino acid digestibility coefficients were determined after continuous eight hour collections of digesta over two consecutive days using acid-insoluble ash as an indigestible marker. Digestible energy was determined using grab samples of faeces. No significant difference between the four test cereals was found in the digestibility of all amino acids, except for proline and lysine. The apparent ileal digestibility of lysine in wheat (0·87) and two samples of naked oats (0·89 and 0·82, respectively) was lower ($P < 0{\cdot}05$) than dehulled oats (0·91). The mean DE value of the naked oats samples was 16·96 MJ kg^{-1} (air-dry basis). The results suggest that Bandicoot naked oats and dehulled oats are superior amino acid and DE sources to wheat and have potential for use in weaner and grower pig diets.

J Sci Food Agric **76**, 277–284 (1998)

Key words: ileal digestibility; amino acids; digestible energy; naked oats; pigs

INTRODUCTION

The use of conventional oats has traditionally been limited in pig diets due to significant amounts of fibre contributed from the husks, which constitute approximately 30% of the whole seed. Dehulled oats (groats), in comparison, are an excellent energy source for monogastrics, however, the added cost of dehulling restricts their use to when the price of whole oats is low. Naked oats have been bred so that the lemma and palea of the seed thresh free at harvest and hence require no further processing (apart from coarse crushing) prior to inclusion in animal diets. Hence, naked oats have a large potential as a feed ingredient in pig diets if cost-competitive.

As the primary goal of modern pig nutrition is to match the nutrient composition of diets as closely as possible to the pigs requirements for the least possible cost, it is necessary to define clearly the nutritive value of ingredients used in pig diets. Simulation models such as AUSPIG (Black *et al* 1986) also require detailed diet and ingredient specifications to function accurately. Determining the availability of nutrients such as amino acids and energy is the best way to establish the nutritive value of a feed ingredient. In cereals, ileal digestibility values can be used to estimate amino acid availability assuming all digested amino acids are utilised by the pig (Batterham 1992). Although net energy is the most accurate and desirable way of expressing the

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Contract/grant sponsor: Grains Research and Development Corp.
Contract/grant number: DAS 170C.

availability of energy, DE is currently accepted in many countries to express the energy content of feed ingredients for pigs due to the relative ease of measurement. van Barneveld *et al* (1994a) showed that grab samples of faeces can be used to estimate DE simultaneously with ileal amino acid determinations in pigs fitted with simple T-piece cannulae.

Avena sativa (cv Bandicoot) was selected primarily in South Australia (SA) and to a limited extent in West Australia (WA) and New South Wales (NSW). Selection was concentrated primarily on yield, plant type, resistance to leaf disease, high fat content and high metabolisable energy (derived from chicken experiments). Seed was multiplied in 1990 and accepted for registration in 1991 (Registration number: AUS 799 032). In 1993, Bandicoot naked oats were grown in every state in Australia (with the exception of Tasmania) over an estimated area of 15 000 ha (Barr and Teague 1994). Variety trials have revealed that Bandicoot is best suited to regions receiving over 450 mm annual rainfall in southern Australia where it averages 70% of the yield of conventional oats (*Avena sativa* cv Echidna; Barr *et al* 1990). In most environments, Bandicoot produces grain with less than 5% husks (Barr and Teague 1994).

Bandicoot naked oats are characterised by low crude fibre content, high crude protein, fat and gross energy. Based on their chemical composition, they would be best suited for use in diets for young pigs (eg up to 50 kg liveweight). To date, however, limited evaluation of Bandicoot naked oats has been completed for pigs. The DE content has been determined for weaner and grower pigs with the estimated range falling between 16·6 and 18·2 MJ kg^{-1} dry matter (DM; Barr and Teague 1994). Bandicoot naked oats have also been included in commercial weaner pig diets with positive growth responses.

The objectives of this study were to (1) determine the digestibility of amino acids in Bandicoot naked oats using growing pigs fitted with simple T-piece ileal cannulas, (2) determine the DE of Bandicoot naked oats using grab samples of faeces, and (3) compare these parameters for Bandicoot naked oats with the same from dehulled oats and wheat.

EXPERIMENTAL

Cereal grains

Wheat, dehulled oats (groats) and two samples of naked oats were evaluated in this study (Table 1). Wheat (*Triticum aestivum* cv Machete; ex Roseworthy, SA) was included as a control and dehulled oats (*Avena sativa* cv Echidna; ex Bordertown, SA) were included for comparison with naked oats. The two samples of naked oats (*Avena sativa* cv Bandicoot; Naked oat Sample A ex Griffith, NSW; Naked oat Sample B ex Booleroo Centre, SA) were selected to represent different growing regions and crude protein levels. All cereals were evaluated 'as-received' apart from coarse-crushing through a roller mill prior to mixing the experimental diets.

Diets

The test cereals were incorporated as the sole protein source in the experimental diets (with the exception of L-lysine monohydrochloride in diets 1, 2 and 3; Table 2) so the ileal digestibility of amino acids could be determined without confounding from amino acids from other sources. L-Lysine monohydrochloride was added to diets 1–3 to improve the amino acid balance and to increase the dietary protein levels. Celite® (diatomaceous earth; Celite Corporation, Lompoc, CA, USA) was included in the diets as an added source of acid-insoluble ash for use as an indigestible marker to facilitate the digestibility calculations. Diets were mixed in a vertical mixer prior to cold-press pelleting.

Animals and procedures

The ileal digestibility of amino acids and the DE content of the wheat, dehulled oats and naked oats was assessed using four Large White entire male pigs of 38 (±2) kg liveweight. The pigs were fitted with simple T-piece cannulae about 150 mm anterior to the ileo-caecal valve as described by van Barneveld (1993) with the exception that skin barriers for use around stoma in human ileostomy patients (Stomahesive® System 2 with 70 mm flange; Bristol-Myers Squibb, Princeton, NJ, USA) were incorporated between the flange of the cannula and the skin to promote healing of the wound and to prevent any leakage around the cannula. Following surgery, pigs were housed individually in solid-sided pens (1·5 × 2·2 m) and fed a commercial grower diet (0·7 g available lysine MJ^{-1} DE; 14·0 MJ DE kg^{-1}) for a recovery period of 7 days. The pigs were then allocated to each experimental diet according to a 4 × 4 Latin square design. Daily feeding rates were adjusted to three times maintenance (3 × 0·5 kg^{-1} body $weight^{0·75}$ = MJ DE day^{-1}). Daily rations were halved and fed at 12 h intervals and water was provided *ad libitum* via nipple drinkers. Experimental diets were introduced over a 3 day transition period and then fed for a further 5 days. On the final day of diet adaption, pigs were transferred to metabolism cages to facilitate digesta collections. Pig transfer was achieved using a hydraulic lift under a mobile crate to ensure they were not stressed during the process. In addition, the pigs were allowed a 12 h adaptation period in the crates prior to the commencement of digesta collection. Continuous 8 h collections of digesta were achieved using plastic bags attached to the cannulae over two consecutive days. Digesta samples were

TABLE 1
Proximate analysis, gross energy and amino acid composition (g kg^{-1}, air-dry basis) of wheat, dehulled oats and two samples of naked oats used in experimental diets (Values in brackets represent amino acid results in g 16 g N^{-1}, air-dry basis)

	Cereal			
	Wheat	*Dehulled oats*	*Naked oats Sample A*	*Naked oats Sample B*
Crude protein (N × 6·25)	111	93	108	158
Dry matter	885	917	916	917
Light petroleum extract (bp 40–60°C)	20	101	116	97
Fibre extract:				
Crude	35	17	21	23
Neutral-detergent	127	109	92	98
Ash	24	17	19	19
Gross energy (MJ kg^{-1})	16·3	18·5	18·6	18·4
Amino acids				
Aspartic acid	5·7 (5·1)	7·8 (8·3)	8·7 (8·0)	13·1 (8·3)
Threonine	3·4 (3·1)	3·4 (3·6)	3·9 (3·6)	5·6 (3·5)
Serine	5·4 (4·9)	5·2 (5·6)	5·7 (5·3)	8·2 (5·2)
Glutamic acid	32·5 (29·3)	21·4 (23·0)	24·2 (22·2)	36·1 (22·8)
Proline	9·5 (8·5)	4·3 (4·7)	5·3 (4·9)	7·6 (4·8)
Glycine	4·5 (4·0)	4·5 (4·9)	5·3 (4·9)	7·2 (4·6)
Alanine	4·2 (3·8)	4·8 (5·1)	5·4 (5·0)	7·5 (4·7)
Cystine	2·6 (2·4)	2·7 (2·9)	3·7 (3·4)	4·5 (2·8)
Valine	4·9 (4·5)	5·0 (5·3)	5·6 (5·2)	8·4 (5·3)
Methionine	1·7 (1·5)	1·4 (1·5)	1·8 (1·7)	2·5 (1·6)
Isoleucine	3·9 (3·5)	3·7 (4·0)	4·3 (3·9)	6·5 (4·1)
Leucine	7·1 (6·4)	6·7 (7·2)	7·8 (7·1)	11·4 (7·2)
Tyrosine	1·9 (1·8)	2·1 (2·3)	2·5 (2·3)	3·9 (2·5)
Phenylalanine	4·5 (4·1)	4·5 (4·8)	5·1 (4·7)	7·8 (5·0)
Lysine	3·3 (3·0)	4·0 (4·3)	4·8 (4·4)	6·3 (4·0)
Histidine	2·1 (1·9)	1·8 (2·0)	2·1 (1·9)	3·2 (2·0)
Arginine	5·1 (4·6)	6·1 (6·5)	7·2 (6·6)	10·5 (6·6)

immediately stored at −20°C following collection. Following the 2 day collection periods, pigs were returned to their solid-sided pens, diets re-allocated based on the Latin square design, and the procedures repeated until each pig had received each diet.

While the pigs were housed in the metabolism cages for continuous collection of digesta, random grab samples of faeces voided during this two day period were collected, bulked and stored at −20°C for determination of DE. At the end of each collection period, samples of digesta and faeces were thawed, subsampled, freeze-dried and ground prior to chemical analyses.

Chemical analyses

Chemical analyses for crude protein, dry matter, light petroleum extract, crude and neutral-detergent fibre, and ash were undertaken using the methods of the AOAC (1984). Gross energy was determined by adiabatic bomb calorimetry. Acid-insoluble ash was determined using the method described by Choct *et al* (1992).

Amino acids in the cereals, mixed diets and ileal digesta were separated by ion-exchange chromatography following a 24 h hydrolysis at 110°C with constant boiling point 6 M HCl under N_2 and measured after reaction with ninhydrin. Norleucine was used as an internal standard with accepted recoveries falling between ±0·025 g kg^{-1} of the batch mean. Methionine and cystine in the cereals only were measured following preoxidation of the samples with performic acid before hydrolysis and subsequent measurement as methionine sulphone and cysteic acid, respectively.

Statistical analysis

The results were analysed by analysis of variance of the Latin-square design, utilising a general linear model, and the treatment means were separated by least significant difference (LSD). The presence of outlying measurements was assessed using the RANK procedure in SAS (1988) and normal scores computed from the ranks based on the Blom (1958) version. As no outlying measurements were detected using the RANK procedure, all

TABLE 2
Components of diets (g kg^{-1}, air-dry basis) used for digestibility experiments

Ingredient	*Diet* 1	2	3	4
Wheat	940·05	—	—	—
Dehulled oats	—	940·05	—	—
Naked oats, sample A	—	—	940·05	—
Naked oats, sample B	—	—	—	945·05
Dicalcium phosphate	30·00	30·00	30·00	30·00
Salt	2·75	2·75	2·75	2·75
Vitamins[a]	0·50	0·50	0·50	0·50
Minerals[b]	0·70	0·70	0·70	0·70
L-Lysine monohydrochloride	5·0	5·0	5·0	—
Choline chloride	1·00	1·00	1·00	1·00
Celite®[c]	20·0	20·0	20·0	20·0

[a] Contributed the following (kg^{-1} diet): retinol equivalent, 960 mg; cholecalciferol, 12 mg; α-tocopherol, 20 mg; thiamin, 1·5 mg; riboflavin, 3 mg; nicotinic acid, 14 mg; pantothenic acid, 10 mg; pyridoxine, 2·5 mg; cyanocobalamin, 15 mg; menadione, 2 mg (as Hetrazeen—50% menadione dimethyl pyrimidinol bisulphite (54% menadione activity)); pteroylmonoglutamic acid, 2 mg; ascorbic acid, 10 mg; biotin, 0·1 mg.
[b] Contributed the following (kg^{-1} diet): iron, 60 mg; zinc, 100 mg; manganese, 30 mg; copper, 5 mg; iodine, 2 mg; selenium, 0·15 mg.
[c] Celite®: Diatomaceous earth containing crystalline silica quartz CAS #91053-39-3 and cristobalite CAS #68855-54-9.

were used in the calculation of digestibility estimates for all parameters, respectively.

RESULTS

Naked oats Sample B had a high crude protein content of 158 g kg^{-1}, 50 g kg^{-1} (air-dry basis) greater than naked oats Sample A and 65 g kg^{-1} greater than dehulled oats (Table 1). In addition, naked oats Sample B had a lower crude fat (light petroleum extract), crude fibre and neutral-detergent fibre content than naked oats Sample A, but amino acid levels were similar when expressed as a proportion of the protein content (g 16 g N^{-1}; Table 1).

There was no significant difference in the ileal digestibility of dry matter, N and energy in the wheat, dehulled oats and naked oats Sample A and Sample B (Table 3).

Differences ($P < 0·05$) were detected in the ileal digestibility of proline and lysine between the wheat, dehulled oats and naked oats Sample A and B (Table 4). There were no significant differences in the ileal digestibility of all other amino acids between the test cereals. The ileal digestibility of proline in the dehulled oats (0·41) was lower ($P < 0·001$) than in naked oats Sample A (0·66) and in naked oats Sample B (0·70) which, in turn, was lower ($P < 0·05$) than wheat (0·74). The ileal digestibility of lysine in dehulled oats (0·91) was higher ($P < 0·05$) than in wheat (0·87), naked oats Sample A

TABLE 3
The ileal digestibility (proportion of total; air-dry basis) of diet dry matter, N and energy in wheat, dehulled oats and two samples of naked oats fed to growing pigs (38 ± 2 kg)

	Diet[a] 1 *Wheat*	2 *Dehulled oats*	3 *Naked oats, Sample A*	4 *Naked oats, Sample B*	*Statistics* *Diet*	*SEM*
Dry matter	0·68	0·78	0·76	0·71	NS[b]	0·028
Nitrogen	0·78	0·78	0·79	0·79	NS	0·021
Energy	0·74	0·82	0·81	0·77	NS	0·025

[a] For diet details see Table 2.
[b] NS, not significant.

TABLE 4

The ileal digestibility (proportion of total; air-dry basis) of amino acids in wheat, dehulled oats and two samples of naked oats fed to growing pigs (38 ± 2 kg)[a]

	Cereal[b]				*Statistics*[c]	
	Wheat	*Dehulled oats*	*Naked oats, Sample A*	*Naked oats, Sample B*	*Diet*	*SEM*
Aspartic acid	0·78	0·81	0·83	0·83	NS	0·016
Threonine	0·77	0·76	0·77	0·78	NS	0·018
Serine	0·83	0·79	0·80	0·81	NS	0·016
Glutamic acid	0·93	0·90	0·90	0·90	NS	0·008
Proline	0·74a	0·41b	0·64c	0·61c	***	0·016
Glycine	0·58	0·58	0·66	0·70	NS	0·033
Alanine	0·79	0·80	0·82	0·81	NS	0·015
Cystine	0·86	0·77	0·78	0·74	NS	0·025
Valine	0·83	0·83	0·85	0·85	NS	0·013
Methionine	0·84	0·82	0·85	0·81	NS	0·019
Isoleucine	0·80	0·82	0·82	0·84	NS	0·014
Leucine	0·86	0·85	0·85	0·85	NS	0·012
Tyrosine	0·82	0·81	0·82	0·81	NS	0·015
Phenylalanine	0·86	0·86	0·87	0·87	NS	0·012
Lysine	0·87a	0·91b	0·89a	0·82c	**	0·008
Histidine	0·84	0·83	0·84	0·84	NS	0·015
Arginine	0·85	0·88	0·89	0·89	NS	0·011

[a] Values within a row with different following letters differ significantly, $P < 0{\cdot}05$.
[b] For diet details see Table 2.
[c] NS, not significant; **, $P < 0{\cdot}01$; ***, $P < 0{\cdot}001$.

(0·89) and naked oats Sample B (0·82). In addition, the ileal digestibility of lysine in naked oats Sample B was lower ($P < 0{\cdot}01$) than lysine in naked oats Sample A. When calculating digestibility coefficients for lysine in diets 1–3, it was assumed that L-lysine monohydrochloride added to these diets was completely digested by the pigs and hence did not contribute to any of the lysine measured in the ileal digesta samples.

The faecal digestibility of dry matter and energy in dehulled oats, naked oats Sample A and naked oats Sample B was higher ($P < 0{\cdot}01$) than in wheat as was the DE content of these cereals (Table 5). The DE content of naked oats Sample A was also higher ($P < 0{\cdot}001$) than the DE content of dehulled oats and naked oats Sample B.

DISCUSSION

All pigs maintained perfect health for the duration of the experiment and leakage of digesta around the cannulae was minimal, if at all. The use of Stomahesive® ileostomy patches under the cannula flange ensured the

TABLE 5

The faecal digestibility (proportion of total; air-dry basis) of diet dry matter and energy and the digestible energy (DE; MJ kg^{-1}) of wheat, dehulled oats and two samples of naked oats fed to growing pigs (38 ± 2 kg)[a]

	Diet[b]				*Statistics*[c]	
	1 *Wheat*	*2* *Dehulled oats*	*3* *Naked oats, Sample A*	*4* *Naked oats, Sample B*	*Diet*	*SEM*
Dry matter	0·83a	0·88b	0·89b	0·87b	**	0·007
Energy	0·86a	0·90bc	0·91b	0·89c	**	0·006
DE (air-dry basis)	14·61a	16·80b	17·17c	16·74b	***	0·105
DE (90% DM basis)	16·24a	18·67b	19·07c	18·60b	***	0·117

[a] Values within a row with different following letters differ significantly, $P < 0{\cdot}05$.
[b] For diet details see Table 2.
[c] **, $P < 0{\cdot}01$; ***, $P < 0{\cdot}001$.

wound at the site of cannula externalisation healed quickly following surgery thus reducing subsequent leakage. Experimental diets were well accepted and all pigs consumed their entire daily ration. Cold-pressing of the experimental diets prior to feeding resulted in the collection of large amounts (0·5–0·7 kg day^{-1}, air-dry basis) of highly consistent digesta. The large collections of digesta suggest that highly representative samples of ileal digesta were collected via the simple T-piece cannulae during this experiment.

Chemical composition of naked oats

Comparison of the chemical composition of the two naked oats samples used in this study suggest that crude protein and crude fat should be routinely analysed prior to formulation of least-cost diets for pigs. Other values such as amino acid content (as a proportion of crude protein) appear to be consistent between samples. This should be confirmed by a wider analyses of naked oats samples.

Ileal digestibility of amino acids

The crude protein of the diets ranged from 92·4 g kg^{-1} (air-dry basis; dehulled oats) up to 149·3 g kg^{-1} (air-dry basis; naked oats Sample B). Without supplementing the diets with another protein source, or adding additional free amino acids thus complicating the determination of digestibility coefficients, it was not possible to elevate or equalise the protein content of these diets. As the crude protein content of the experimental diets was not equal, differing proportions of endogenous N contributions may have influenced the results (Eggum, 1973; de Lange *et al* 1990). Sauer *et al* (1989) suggested that apparent ileal digestibility values should only be compared under standardised conditions with dietary protein contents of at least 150 g kg^{-1}, yet van Barneveld *et al* (1994b) showed that little difference was observed in the apparent ileal digestibility of diets with crude protein levels above 105 g kg^{-1}, a level exceeded by all but one of the diets (dehulled oats) in the current study. Lin *et al* (1987) determined the apparent ileal digestibility of N and amino acids in oat groats using this cereal as the sole protein source in the experimental diet. Despite a dietary crude protein content of 158 g kg^{-1} (air-dry basis), there is very close agreement between the apparent ileal digestibility coefficients derived by Lin *et al* (1987) and those obtained using a diet containing only 92·4 g kg^{-1} of crude protein in the current study. Heartland Lysine Inc (1992) have also published similar digestibility coefficients for dehulled oats. Although it is important to be aware of the potential impact of comparing digestibility coefficients derived using diets with crude protein contents below 150 g kg^{-1}, there is evidence to suggest that using wheat, dehulled oats and naked oats as the sole protein source in the experimental diets has not resulted in a large difference between the apparent and true ileal digestibility of amino acids and nitrogen, and comparisons between the three test cereals can be justified.

Bandicoot naked oats and dehulled oats represent a superior amino acid source to wheat of similar crude protein content even though there was no significant difference in the ileal digestibility of all amino acids except proline and lysine between these four test cereals. This is due to higher levels of most essential amino acids as a proportion of crude protein in Bandicoot naked oats and dehulled oats than in wheat (Table 1). As the ileal digestibility of lysine in Bandicoot naked oats is significantly lower than dehulled oats and wheat, adjustments should be made when conducting least-cost diet formulations to ensure an adequate dietary amino acid balance.

It is difficult to explain the differences in apparent ileal digestibility of proline and lysine in the four cereals. Suggestions that lysine is less digestible due to its predominant location in the less digestible grain fractions such as the aleurone cells (Eggum 1973) does not hold if we consider that wheat has a greater proportion of aleurone cells than either dehulled oats or naked oats. It is likely that other factors such as enzyme-resistant bonds, interactions between oxidised lipids and amino acids or particularly slow absorption (Taverner *et al* 1981) may be responsible for differences in proline and lysine digestibility in these cereals.

The ileal digestibility of methionine and cystine in the four cereals was determined using diet and digesta samples that were analysed for amino acids following normal 24 h hydrolysis only. As these samples were not oxidised prior to hydrolysis, it is likely that degradation of some of the methionine and cystine occurred (Robel 1973). Assuming degradation of methionine and cystine was consistent in all samples, digestibility coefficients can still be calculated and used for comparative purposes, although the absolute values for these two amino acids should be interpreted with caution. This assumption is supported if the estimates for methionine and cystine in the current study are compared with previous estimates of 0·84 and 0·82 for methionine and 0·81 and 0·77 for cystine in wheat and dehulled oats respectively (Heartland Lysine Inc 1992). In addition, digestibility estimates for methionine and cystine have been shown to change only marginally when calculations have been repeated using measurements derived from pre-oxidised samples (E. S. Batterham, unpublished data).

Digestible energy

In addition to superior protein quality, Bandicoot naked oats have a higher DE content in comparison to wheat. The higher DE levels in naked oats and dehulled oats in this study can largely be attributed to higher levels of crude fat (light petroleum extract; Table 1) present in these cereals. Although crude fibre and neutral-detergent fibre levels are lower in dehulled oats and Bandicoot naked oats than in wheat, there was little difference between the proportion of diet dry matter and energy digested in the hind gut (determined by comparing the ileal digestibility of diet dry matter and energy (Table 3) with the faecal digestibility (Table 5). Hence, fibre levels in these cereals appear to have had only a small influence on the differences in DE estimates.

The value of 14·6 MJ kg^{-1} (air-dry basis) for wheat is similar to the mean value of 14·3 MJ kg^{-1} and 14·1 MJ kg^{-1} (air-dry basis) reported by the Standing Committee on Agriculture (1987) and Smith *et al* (1987), respectively, and agrees well with the range of estimates reported by Batterham *et al* (1980). As the wheat was included as a control treatment and agrees well with previous estimates, we can have confidence in the estimates obtained for dehulled oats and naked oats, assuming the naked oats samples are 'typical' of the bulk of Bandicoot naked oats available for use in stockfeeds.

Previous estimates for DE in dehulled oats fall in the vicinity of 15·7–16·3 MJ kg^{-1} (air-dry basis; Lin *et al* 1987; National Research Council 1988; Galloway and Ewan 1989; Barr and Teague 1994). This is substantially lower than the estimate of 16·8 MJ kg^{-1} (air-dry basis) determined in the current study, however, the crude fat of the sample used in this experiment (109 g kg^{-1}, air-dry basis) is considerably higher than previously reported levels (57 g kg^{-1}, Lin *et al* 1987; 61 g kg^{-1}, National Research Council 1988; 56 g kg^{-1}, Galloway and Ewan 1989).

The mean DE value for the two naked oats samples in this experiment was 16·96 MJ kg^{-1} (air-dry basis). This is in good agreement with estimates of 16·47 MJ kg^{-1} (air-dry basis) determined previously with 30 kg pigs (Davies and Barr, unpublished data), however, it is higher than estimates obtained with 45 kg pigs (15·68 MJ kg^{-1}, air-dry basis, Friend *et al* 1989; 15·3 MJ kg^{-1}, air-dry basis; Barr and Teague 1994) and 50 kg pigs (15·65 MJ kg^{-1}, air-dry basis; Mullan, pers comm). The naked oats (*Avena nuda*) assessed by Friend *et al* (1989) had a crude fat content of 47 g kg^{-1}, which is significantly lower than the levels of 116 and 97 g kg^{-1} in the samples tested in this experiment, respectively, and may have contributed to the lower DE estimate. If a DE of 16·5 MJ kg^{-1} can be attained with 30 kg pigs, it is reasonable to assume that an equal or greater DE could be attained with heavier pigs. It is also unlikely that the partial faeces collection technique contributed to higher DE values in the current study. Although not significantly different, the DE values determined using partial faeces collection reported by van Barneveld *et al* (1994a) tended to be lower for raw proteins than those determined by total faeces collection.

CONCLUSIONS

Bandicoot naked oats and dehulled oats have higher total levels of most amino acids than wheat, and are, therefore, a superior amino acid source, despite having similar apparent ileal amino acid digestibility coefficients. The superior protein quality and DE content in comparison to wheat suggests that Bandicoot naked oats would be best suited to diets for weaner or grower pigs.

Further research is required to establish the most efficient way to incorporate Bandicoot naked oats into pig diets. In particular, definitive information is required on the storage life of Bandicoot naked oats in comparison to dehulled oats and other cereals, the effect of high linoleic acid levels in Bandicoot naked oats on backfat firmness in pigs, and the effect of inclusion level of Bandicoot naked oats in balanced pig diets on body composition and pig performance. Other factors, such as the possible discomfort (itchiness) associated with milling naked oats may also require investigation to confirm their viability as an ingredient in pig diets.

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