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BY-PRODUCTS AND UNUSUAL FEEDSTUFFS IN LIVESTOCK RATIONS

A Western Regional Extension Publication

This publication discusses feeding trials and experiments with some by-products and unusual feedstuffs, and describes how they can be integrated into a feeding program. A list of by-products and unusual feedstuffs and (when available) their chemical analysis and nutrient content is included.

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BY-PRODUCTS

UNUSUAL FEEDSTUFFS

LIVESTOCK RATIONS

INTRODUCTION

Feed cost, the largest single expense in animal production, may be reduced by including locally grown cull fruits, vegetables, seeds, and by-products in animal rations.

Although these unusual feeds may be available at reasonable prices, cost is not the only factor to consider. Animals sometimes react unfavorably to radical changes in feeds, no matter how good the new feed. Most unusual feedstuffs should be used with caution and introduced into the ration gradually, even when low prices favor their use. The feeds' nutritive values, palatability, possible toxicity or contamination with pesticides or heavy metals, and the effects upon digestion and utilization of the total ration are factors that must also be carefully considered.

Labor costs resulting from the use of unusual feeds can soemtimes offset the lower feed prices, and thus must be evaluated. Furthermore, many by-product feeds are not consistent in nutrient content because of different milling and processing procedures. In these cases it is important to purchase the feeds and formulate rations on the basis of a guaranteed laboratory analysis of each lot of feed.

This publication discusses feeding trials and experiments with some by-products and unusual feedstuffs, and describes how they can be integrated into a feeding program. A list of by-products and unusual feedstuffs, and (when available), their chemical analysis and nutrient content is included.

HIGH-MOISTURE CONTENT FEEDS

Dairy cattle will eat about 2.5 to 3.5 percent of their body weight per day when the feed is in a dry form such as hay and grains, but they cannot eat this much dry matter if it is high in moisture content. A cow's rumen (stomach) does not hold enough high-moisture feed to fulfill the animal's nutrient needs. High-moisture feeds are often palatable and cows may fill up on such feeds to satisfy their appetites. The result is weight loss and reduced milk production. Better results are obtained when high-moisture feeds make up less than half of the total dry matter in the ration. Even when it is economically desirable to feed the maximum amount of wet feed, the ration still should contain at least 0.5 to 1 percent of body weight as dry hay and concentrates. The maximum dry matter intake of an all high-moisture ration is about 2 to 2.5 percent of body weight.

Large amounts of cull vegetables or fruits can be very laxative, and must be fed with care. Dairymen and livestock producers must be aware of possible pesticide residues on fruits and vegetables, and should have them tested before feeding them to cattle or sheep.

Other points to be considered when feed-

ing high-moisture feeds are the rate of decay of fresh fruits and vegetables, and the high labor and transportation costs involved in handling.

Silages from cull vegetables and other high-moisture feeds

Ensiling a crop does not improve its feeding value, but it does make the feed available at a later date when it would otherwise be lost through spoilage. Most plants can be made into silage by reducing the moisture by wilting to about 70 percent, and by adding 50 pounds of grain or molasses per ton of silage to enhance fermentation. Cull vegetables such as lettuce, carrots, cabbage, etc., make a very palatable silage with a feeding value comparable to that of silages made from more common feeds.

High-moisture feeds in complete mixed rations

A recent trend in cattle feeding consists of mixing chopped or cubed hay, silage, and concentrate in mixer trucks or wagons for delivery to outside feed bunks. Cull fruits, vegetables, and other high-moisture feeds can easily be included in such a feeding system, and mixing insures that all cattle get the proper proportion of wet and dry feeds. When properly balanced with other feed, rations containing sizable amounts of high-moisture feeds can result in excellent weight gains and milk production at considerable savings.

TYPES OF FEEDS

Livestock feeds are divided into two main categories—concentrates and roughages. In the concentrate category, they are further subdivided into energy feeds and protein feeds. Many unusual feeds are available fresh (containing high levels of moisture) and also are available dried.

By-product Concentrates

Energy Feeds

Some of the more important energy feeds are almond hulls, apple pomace, bakery waste, beet pulp, brewers' grains, citrus pulp, whole cottonseed, fat, grain screenings, grape pomace, hominy feed, molasses, pineapple bran and other pineapple residues, rice bran, wheat bran and other milling residues, and whey. Additionally, many fresh fruits and vegetables are sometimes in excess supply and available for feeding to livestock.

Almond hulls. Almond hull products vary considerably due to varietal differences and harvesting procedures. Soft almond hull having about 10 percent crude fiber is a good feed and has about 85 percent of the energy value of barley grain. However, some supplies of almond hulls are contaminated with sticks, dirt, hard shells and other foreign materials at the harvest time—this greatly reduces their feeding value and acceptability by livestock. California studies showed that the total digestible nutrients (TDN) of almond hull-shell meal could be predicted by the equation: % TDN = 66.53-1.14 CF, where CF is the percentage of crude fiber on an as-fed basis. Using this equation, a typical sample of almond hulls in commercial channels with 15 percent crude fiber would have a TDN value of 49 percent. Therefore, the 15 percent CF almond hulls would have only about 66 percent of the energy value of barley grain.

State regulations in California, where most of the almonds are grown, require that samples containing more than 15 percent crude fiber must be labelled "almond hulls and shells." If ash exceeds 9 percent, it must be labelled "almond hulls and dirt." Soft-shelled varieties have a greater percentage of fleshy outer hulls than hard-shelled varieties, and shells of the soft-shell varieties have less fiber and lignin, which makes them more digestible. Almond hulls are low in protein, with typical samples having a mean crude protein content of 3.8 percent. They are also low in calcium and phosphorus.

Almond hulls are used as a partial roughage replacement when supplies are short and forage prices are high, with up to 6 pounds per cow fed in some dairy rations. Higher levels can be included in rations when energy and protein concentrations are not as critical as for high-producing dairy cows. When mixed with other ingredients in commercial concentrate mixes, almond hulls usually are restricted to 20 percent or less in order to maintain high nutrient levels and palatability of the concen-

trate mix. In complete feedlot rations, almond hulls are limited to about 30 percent or less.

Apple pomace. Apple pomace is the by-product of apples used for cider or vinegar production. It can be fed fresh, ensiled, or dried. Modern processing plants use rice hulls or similar materials in the squeezing operation, resulting in contamination of the pomace with the hulls. Rice hulls have very little feeding value, so they reduce the feeding value of the pomace.

Two problems have hampered feeding of apple pomace in recent years. Pesticide contamination has been a problem in some areas, making the pomace unacceptable in dairy and (occasionally) beef rations. However, this is less of a problem now due to stricter control of pesticides. A second problem is that urea or other nonprotein nitrogen compounds should not be fed with apple pomace due to the possibility of abortions and/or abnormalities of offspring. The reason for this is not known but the problem is being investigated.

Apple pomace is a highly palatable feed, medium in energy, but very low in protein. When properly supplemented, it has been used successfully up to about one-third of the concentrates in dairy cattle rations and 15 to 20 percent in complete feedlot rations.

Bakery waste. Large amounts of unsold bread, doughnuts, cakes and other pastries are available in some areas and are excellent energy sources for ruminant rations. They usually are high in fat and low in crude fiber. Protein levels on a dry-matter basis in the range of 10 to 12 percent are typical. The low fiber content of the baked material and baking process itself result in a feed which tends to stimulate ruminal propionate and reduce ruminal acetate production. This is desirable for feedlot cattle being fattened for market but is detrimental for maintaining milk fat percentage in milk from lactating cows. Therefore, bakery waste is usually restricted to 15 percent or less of dairy concentrate mixes to avoid problems with depressed fat test. Up to about 10 percent can be included in feedlot rations when supplies and economics are favorable. Supplies should be fed quickly because toxic molds can develop during storage.

Beet pulp. One of the best by-product feeds for ruminants, beet pulp results from processing sugar beets. It can be fed wet, either fresh or ensiled, or after being dehydrated. Molasses is sometimes added to the pulp before drying, resulting in a product called molasses dried beet pulp. All forms of the product, wet or dry, have approximately the same energy value on a dry-matter basis. Work in California with dairy cattle showed dried beet pulp to have about 95 percent of the energy value of barley grain when fed as 45 percent of the concentrate mix. Similar results have been obtained with feedlot cattle and fattening lambs.

Beet pulp is low in protein—typical samples have 8 to 10 percent crude protein in the dry matter. It contains 17 to 22 percent crude fiber, which is relatively high compared with most by-product concentrates. However, the fiber is highly digestible, making beet pulp an excellent ingredient for maintaining normal milk fat test when dairy cows are fed restricted roughage rations. Beet pulp is high in calcium and low in phosphorus. Unfortunately, this can aggravate the undesirably high calcium-to-phosphorus ratio in rations which contain large amounts of alfalfa or other legumes.

Beet pulp is very palatable and is relished by all classes of farm ruminants. Up to 50 percent beet pulp in dairy concentrate mixes, and 15 to 30 percent in feedlot cattle rations, have been used successfully. Beet pulp silage has been used as the primary feed source in fattening rations for cattle near sugar-processing plants. However, its high moisture content and consequent higher transportation costs, makes it economically unfeasible to feed wet beet pulp very far from processing plants.

Brewers' grains. Brewers' grains have 20 to 25 percent crude protein on a dry-matter basis, making them a good protein source in addition to their energy value. The brewing process makes this protein less soluble than that from many protein supplements. This could be valuable in rations, such as silages supplemented with nonprotein nitrogen, which contain large amounts of soluble protein.

Brewers' grains are fed both wet and dried. Dry, they have about 80 percent of the energy value of barley grain (the energy value varies

depending on the brewery and additives used in the brewing process). They are not as palatable in the dried form as the original grain and usually are included as 25 percent or less of a dairy concentrate mix, and 15 to 20 percent in feedlot rations. Cattle like wet brewers' grains, and dairymen have fed as much as 80 pounds per cow daily with good results.

Citrus pulp. Like beet pulp, citrus pulp is classified as a concentrate but is also valuable as a partial roughage replacement because of its high level of digestible fiber. It commonly contains about 15 percent crude fiber in the dry matter. Its energy value is similar to that of beet pulp, having about 94 percent the value of barley grain. It has only about 7 percent crude protein in the dry matter.

Citrus pulp usually is fed dehydrated—it must be introduced gradually into a ration to let cattle get accustomed to its distinctive smell and taste. Once cattle are accustomed, levels of 40 percent or more of the concentrate mix are highly palatable to them. Levels up to 15 to 20 percent are acceptable in feedlot rations.

Citrus pulps also can be fed fresh or as silage. Both are very acceptable to cattle, but pulp and peels from lemons are somewhat more acceptable than those from oranges and grapefruit. Common feeding levels of fresh pulps are about 25 to 30 pounds per cow per day. Transportation costs preclude the wet pulp from being fed very far from processing plants.

Citrus pulps are high in calcium and low in phosphorus, and, like beet pulp, aggravate the high calcium-to-phosphorus ratio in a ration when fed with legumes such as alfalfa. Unless counter-balanced by other feeds low in calcium and high in phosphorus, this relationship between calcium and phosphorus can result in higher incidences of milk fever (parturient paresis) in cattle at, or soon after, parturition.

Cottonseed, whole. Whole cottonseed has the unique distinction of being high in energy, fat, protein and fiber and highly palatable to cattle. Seldom are these nutrients found at such high levels in one ingredient. The high energy and protein levels provide needed nutrients to maintain high milk production or growth rates. The high fiber content is particularly helpful in maintaining normal milk fat tests from dairy cattle fed limited amounts of roughages. Also, much of the fat in whole cottonseed apparently escapes microbial digestion in the rumen due to its encapsulation by the seed coat. When the seed is digested in the abomasum and intestines, some of the fat is incorporated intact into milk fat. This increases fat tests above normal, and changes the fatty acid pattern in the milk fat to one similar to that noted when fats "protected" by outer coatings of casein and formalin are fed to lactating ruminants.

Another effect of protected fats in dairy rations is lowered protein content of the milk, primarily in the casein fraction. Recent research in California showed the same effect was obtained when whole cottonseed made up 15 to 30 percent of the total ration. Therefore, when feeding whole cottonseed as 15 percent or more of the total ration to lactating cattle, milk fat tests are increased but milk protein and solids-not-fat tests are decreased.

Whole cottonseed is frequently in limited supply and expensive when cottonseed oil and cottonseed meal are in much demand. However, it has been fed up to 8 pounds per cow per day with excellent results, and thus is desirable when reasonably priced.

Contamination of cottonseed with aflatoxin has been a problem in the southwestern states. Treatment of contaminated supplies with ammonia reduces the concentration of aflatoxin to allowable levels for feeding to livestock.

Fat. Fats and oils have an energy value about 2.25 times that of carbohydrates. Fats are also used to settle the dust and as a lubricant for feed processing. Two to five percent fat is an accepted level in commercial feedlot rations, but fat should be restricted to three percent or less in dairy rations.

Grain screenings. Grain screenings result from the cleaning of small grains before they are milled for human consumption. The best grade of screenings consists primarily of broken and shrunken kernels of grain, wild oats and other palatable weed seeds. When ground, good screenings approach grain in

feeding value and have been used as 25 percent or more of concentrate mixes for dairy cattle and 15 to 20 percent in feedlot rations. However, light, chaffy screenings are much higher in fiber and resemble straw more than grain in feeding value—such screenings should be restricted to 10 percent or less of concentrate mixes for dairy cattle.

If screenings contain much mustard, lamb's quarters, and pig weed, feeding value is very low and the feed may be unpalatable. Some weed seeds may even cause an objectionable flavor in the milk and meat of animals consuming large quantities of seeds. Additionally, some weed seeds will pass through the animal and contaminate fields where the manure is deposited.

Grape pomace. Grape pomace, the refuse in the production of grape juice and wine, consists mainly of grape seeds, stems, and skins. It has little feeding value, being very low in both energy and protein. When included in a concentrate mix, it can be considered only a filler to reduce the price of the mix. With new harvesting and winery techniques, grape pomace containing few or no stems can be produced. This waste feed has been fed successfully at a 15 to 20 percent level in complete feedlot rations.

Hominy feed. Hominy feed contains corn bran, germ and some of the starchy portion of the corn kernel resulting from the production of degermed corn meal for human consumption. It is about equal to ground corn in feeding value and is highly palatable to livestock. Levels of 50 percent or more of the concentrate mix have been used successfully in dairy cattle rations. In complete feedlot rations, as high as 70 percent has been fed successfully, although a 10 to 15 percent level is more common. Normally, hominy feed contains 6 percent or more of fat; when part of the fat is removed the resulting feed is somewhat lower in energy value. Both forms are good energy sources, however, and have higher protein levels than do the corn grains from which they are produced.

Molasses. There are several sources of molasses used in livestock feeds. The most common is cane molasses resulting from the processing of sugarcane. However, considerable amounts of citrus molasses, beet molasses, and wood molasses are also used in livestock rations. Although there are some differences in nutrient composition between them, all are useful as minor parts of livestock rations (seldom are any used as more than 10 percent of cattle rations). Even lower levels are often necessary in order to avoid mixing problems with some ingredients, or to avoid clogging of mixing equipment or feed-delivery systems.

All types of molasses are good energy sources but are low in protein. Net energy value of cane molasses decreased rapidly when it was increased from 10 to 30 percent of the total ration of dairy cattle in Hawaiian trials. It commonly is restricted to 2 to 3 pounds per cow daily in dairy rations, but levels as high as 12 pounds per cow daily are reported in some Hawaiian herds. Reduced utilization of energy from the ration, and depressed fat test of the milk, can be a problem when it is fed at high levels. In feedlot rations, up to 15 percent is an acceptable level.

Pineapple bran. Pineapple bran is composed of the outer shell of the pineapple plus other pineapple cannery waste products. It has a relatively high fiber level but the fiber is not as digestible as that from such products as beet pulp or citrus pulp. It is also somewhat lower in energy, making it intermediate between roughages and concentrates. During periods of forage shortages, it frequently is used as a partial roughage replacement in cattle rations. Levels up to 15 pounds per cow daily have been fed in Hawaii with good results.

Rice bran. Rice bran results from processing of rice grain for human consumption. Besides the bran itself, it contains the germ from the grain and fragments of the hull not removed in milling. Rice bran is available in a high-fat and a solvent-extracted form. The high-fat form is more susceptible to rancidity when in storage, and this can produce palatability problems. However, when fresh it is fairly palatable and is used at levels of up to 25 percent of some concentrate mixes. Levels of 15 percent or less are more common in dairy concentrate mixes, and levels of up to 15 percent have been fed successfully to beef cattle. At these levels, it is roughly equivalent to wheat bran in nutritional value.

Wheat bran and other wheat by-products. Wheat bran consists of the coarse outer coatings of wheat kernels. It is a bulky feed relatively high in protein and phosphorus. It is highly palatable to cattle and is utilized efficiently when included up to 25 percent of the concentrate mix. Ten to twenty percent of wheat bran and other wheat by-products can be used in feedlot diets. Other wheat milling by-products include standard middlings, flour middlings, wheat red dog, brown shorts, gray shorts, white shorts, and wheat mill run. All of these intermediate by-products are used efficiently in cattle rations, and have slightly higher feeding value than wheat bran because they are lower in fiber. However, the bulky nature of wheat bran and its high phosphorus content make it one of the most popular by-product feeds for cattle.

Whey. Whey is the residue from cheese production and consists primarily of lactose, minerals, and water. It can be fed dry or liquid. Pollution control regulations and the high cost of drying have resulted in increasing amounts fed liquid in recent years.

Dried whey is a major component of many dry milk replacers fed to young calves. It usually is too expensive to be included in rations for older animals, but sometimes is included at low levels in pelleted feeds because of its binding characteristics as well as its nutrients. When fed as 10 percent of dairy cow rations, dried whey helps to prevent milk fat depression when the cows are fed restricted roughage rations.

Liquid whey contains only 6 to 7 percent solids and must be fed quickly or it will spoil. In cool climates it can be stored for 3 to 4 days before feeding; in warm climates it should be fed the same day that it is delivered.

Some cows never develop a taste for whey, but most will drink it well within a week. Restriction of water when whey feeding is started encourages cattle to start drinking whey sooner. Whey resulting from production of cottage cheese is more acidic and is not as palatable as sweet whey from hard cheese.

Liquid whey frequently is available for only the hauling cost, making it an inexpensive source of nutrients for animals located near cheese plants. However, supplies frequently are variable and storage of whey increases fly problems.

Cull fruits and vegetables. In areas where fruits and vegetables are commercially grown, surpluses and culls are sometimes available for feeding to livestock. The following observations were made in feeding trials conducted in California.

Carrots

Carrots sometimes are available as a by-product from dehydrating plants. Culls, tips, crowns, and tops that are not dehydrated make an excellent feed. Carrots are fed on the ground or in racks. It is estimated that cattle can eat about 35 pounds of carrots per cow per day in addition to grain hay, rolled barley, or cottonseed cake. They should gain about 1.5 pounds per day on such a ration.

Lettuce

The feeding value of lettuce depends on its water content. Fresh lettuce in the field contains about 93 percent moisture and is highly palatable. Cull leaves probably retain from 85 to 88 percent moisture after a short haul—it usually does not pay to haul lettuce very far. On a dry basis, lettuce is comparable to low-grade oats, having about 70 percent TDN and 10 percent crude protein. Lettuce supply is not always dependable during the season: it may be cut off for a few days, or at times it may have to be taken in larger amounts than can be used (irrigated pastures help during periods of inadequate supply). After being off lettuce for a few days, it may take a week to get cattle back to a full lettuce ration.

About half a load of cull lettuce consists of heads; the other half is cull leaves. Cattle will eat the heads first. Lettuce heats up after being dumped; cattle like it warm. Lettuce is good for 3 to 5 days, then begins to spoil and is of little value.

Cattle gain about 1 pound per day on straight lettuce: when 6 to 7 pounds of grain hay is added they gain about 1.25 pounds per day. Greater gains can be expected with more hay and grain plus a protein supplement.

Peaches, fresh

Both cling and freestone peaches were tested, and even though some had begun to deteriorate cattle took them readily, eating about 20 pounds of clings daily and 30 pounds of freestones. The animals swallowed a few pits but discarded most of them after removing the pulp. In spite of some spoiling and pit swallowing, no detrimental effects were noted. After 10 days of continuous feeding, the peaches were still relished and there was no evidence of scouring.

Peaches, dried

When as much as 6 pounds of dried peaches were fed daily, scouring followed, and after 3 days the animals refused the fruit. Three pounds daily were fed for ten days without any detrimental effects.

Pears, fresh

The animals did not take to pears quite so readily as to peaches; spoiled pears seemed to be more objectionable than spoiled peaches. Dry cows and 2-year-old heifers consumed an average of about 20 pounds of pears daily without noticeable bad effects.

Pears, dried

A somewhat larger quantity of dried pears than of dried peaches can be fed. There was no noticeable loss of appetite when 4.5 pounds were fed. No laxative effect was observed.

Prunes, fresh

When much more than 15 pounds of fresh prunes per animal were fed daily, scouring started and the animals refused the fruit. When less was given, it was eaten readily and bowel condition was normal. Pits were not eaten.

Prunes, dried

As much as 6 pounds of dried prunes were eaten daily. Only slight scouring was noticed. Cows did not eat the pits.

Grapes

Table grapes were used. As much as 35 pounds daily were consumed. No scouring was noticed. Cows probably can be fed all the grapes they will consume.

Raisins (dried grapes)

As much as 6 pounds of raisins were fed daily without any noticeable bad effects.

Dates

There are only limited data about date meats and date pits as cattle feed. Practical information indicates that a level of 5 to 10 percent can be used in a complete feedlot ration.

Onions

Cull onion bulbs have been fed free-choice to sheep, and up to 20 pounds per day have been fed to beef cattle. However, onions contain an alkaloid that can cause anemia and toxicity in cattle, horses and (to a lesser extent) sheep. There is no known satisfactory treatment for onion poisoning, so feeding them as a major part of the ration can be risky and may result in death.

Tomato pomace

Feeding value of tomato pomace on a dry basis is comparable to good-quality hay. Variability (especially moisture content) is one of the main problems associated with the use of this by-product feed. In one study, dry matter varied from a high of 27.5 percent to a low of 11.9 percent. Pesticide contamination can also be a major problem with tomato pomace.

Protein Feeds

Many crops grown for oil production also produce by-products high in protein. These by-products are the primary source of supplemental protein in livestock rations. These include coconut meal, corn gluten meal, cottonseed meal, linseed meal, safflower meal, soybean meal, and sunflower meal. Additionally, such by-products as distillers' grains are used extensively as protein supplements in cattle rations. Brewers' grains and whole cottonseed, previously discussed as energy feeds, also are relatively high in protein content.

Coconut meal. Coconut meal, popularly known as copra, is one of the most palatable feeds available for cattle. High in energy and containing about 20 percent protein, it has been used at levels of up to 50 percent of the concentrate mix for dairy cattle when competitively priced. Supplies have been limited in recent years due to problems with aflatoxin contamination in some areas. However, it is a by-product highly prized by dairymen because of its high energy and protein content. Rancidity can be a problem during storage if the meal is high in fat (expeller process), but high-fat copra contains considerably more energy than does copra produced by the solvent process.

Corn gluten meal and feed. Corn gluten meal and corn gluten feed, which is a mixture of gluten meal and corn bran, are common protein supplements in dairy cattle rations. They are not quite as palatable as corn grain itself and usually are restricted to 25 percent or less of concentrate mixes. The meal contains about 40 percent protein whereas corn gluten feed is blended with enough corn bran to bring it down to about 25 percent protein. The meal is also much higher in energy than is gluten feed.

Cottonseed meal. One of the most common protein supplements for cattle is cottonseed meal, a by-product of the production of cotton lint and cottonseed oil. It contains about 40 percent protein and is well-liked by cattle. In southern and western states, it is the primary protein supplement in dairy and beef cattle rations. The amount of oil left in the meal affects its energy value (amounts vary according to the method of processing). However, energy levels are somewhat lower than those found in some other protein supplements such as coconut meal, soybean meal, and linseed meal.

In some areas where cottonseed meal is less expensive than grains large amounts have been fed to mature cattle with no problems. However, cottonseed meal is usually included as 25 percent or less in dairy concentrate mixes. Aflatoxin contamination can be a problem in some areas.

Distillers' dried grains. These are by-products of the production of distilled liquors from grains. Solubles from fermentation are sometimes added to grains before drying, resulting in a product called distillers' dried grains with solubles—such products are additionally identified by the type of grain from which they are made. Corn distillers' dried grains contain about 26 percent protein and are also an excellent energy source. They are a popular ingredient in dairy rations and are commonly used up to 25 percent of dairy concentrate mixes. Other grains, such as rye, sorghum, and wheat, are sometimes used for alcohol production but are of minor importance compared with corn.

Linseed meal. Linseed meal, the by-product of the extraction of linseed oil from flaxseed, is an excellent protein supplement for cattle. Protein content varies from about 30 to 38 percent depending on the source and processing method. It is not used as extensively in livestock rations as cottonseed meal or soybean meal because it usually is higher priced. When reasonably priced, however, it can be used as the only protein supplement in cattle rations because it is very palatable. Because of the availability of less expensive protein supplements, linseed meal rarely exceeds 10 percent of the concentrate mix.

Safflower meal. Safflower meal has increased in availability and importance as a protein supplement in recent years because of the popularity of safflower oil in human diets. Safflower meal from unhulled seeds has only about 20 percent protein and is high in fiber and relatively low in energy. Meal made from well-hulled seeds has about 40 percent protein and is much higher in energy. However, safflower meal from either source is not as palatable to cattle as the more common protein supplements and is usually restricted to 20 percent or less of the concentrate mix for dairy cattle.

Soybean meal. The most commonly used protein supplement in the U.S. is soybean meal. It contains from 40 to 50 percent protein, is high in energy, and is highly palatable to cattle. Frequently it is the only protein supplement in cattle rations, particularly in eastern and midwestern states where it is readily available and competitively priced. It can be fed by itself or as a top dressing on other feeds, but usually will make up 50 percent or less of a concentrate mix for dairy cattle.

Sunflower meal. Sunflower seeds are only a small crop in the U.S., but small amounts of sunflower meal are periodically available for feeding to livestock. It is a popular dairy feed in Europe because of its palatability to cattle. Protein levels vary from about 20 to 50 percent, depending on whether the seed is hulled or not, and the processing method. It is roughly equivalent to cottonseed meal as a protein supplement for cattle.

By-product Roughages

Corn Cannery Waste

Waste from corn canneries contains only 18 to 25 percent dry matter, but is similar in nutrient content to corn silage on a dry-matter basis. It can be fed liberally to low and medium-producing cows in place of part of the hay or silage in the ration. However, it should not be fed in large amounts to high-producing cows because of its high-moisture content.

Cottonseed Hulls

Cottonseed hulls are used extensively as a livestock roughage in the southern part of the U.S. They are low in protein, calcium, and phosphorus, and these must be supplied by other ingredients when hulls are the principal roughage. When properly supplemented, hulls are approximately equal to fair-quality grass hay. Even though they do not appear so, they are quite palatable to cattle. They can be used as the only roughage in cattle rations but have greater value when part of the roughage is legume hay, silage, or pasture. The hulls are sometimes included in concentrate mixes at low levels to increase the fiber content and bulkiness of a mixture of heavy concentrates. This is particularly helpful in maintaining fat test in the milk of dairy cows fed restricted roughage and low-fiber rations.

Cotton Gin Trash

This by-product is composed of fragments of burs and stems, small amounts of immature cottonseed, lint, leaf fragments, and dirt. It is about equal to cottonseed hulls in feeding value, but pesticide contamination has restricted its feeding to cattle, particularly dairy cattle, in recent years. It should be tested for pesticides and cleared before including it in livestock rations. Even then, it should be fed at a low level because of its limited nutritional value.

Pineapple Greenchop

Pineapple greenchop, a fresh, succulent roughage successfully fed to dairy and beef cattle, consists of the chopped upper 1/2 to 3/4 portion of the mature pineapple plant after the plant is no longer used for fruit production. It is a highly palatable, medium-quality roughage, with a very low apparent digestible protein level. Lactating dairy cattle are successfully fed from 20 to 70 pounds of pineapple greenchop per cow per day in Hawaii. The product ferments rapidly and dairymen will allow the product to ferment or ensile for 3 to 7 days before feeding to ensure a more consistent acidity level in the feed and thus avoid potential digestive upsets. Recommended feeding levels in Hawaii are from 20 to 35 pounds of greenchop per cow per day. Dairymen occasionally run into problems feeding higher levels, quite possibly because of mineral imbalances or deficiencies.

Pineapple Juice Presscake

Pineapple juice presscake (also called juice plant pulp, juice press residue, pressed pineapple core, pineapple presscake, Beloit presscake and presscake) is a high-moisture by-product of the pineapple juice press. Hawaiian dairies have successfully fed up to 30 pounds per cow per day. Pineapple presscake can be used as a replacement or substitute for pineapple bran or pineapple greenchop. One pound of pineapple bran can be replaced by 4 pounds of pineapple presscake. Two pounds of pineapple presscake can be substituted for three pounds of pineapple greenchop. Pineapple juice presscake is also naturally high in acid and cows should be gradually adjusted to the product. Because of this acidity, the product does not undergo a normal ensiling fer-

mentation process, but it does keep well (if stacked) for approximately 2 weeks.

Pineapple Stump Meal

Pineapple stump meal or pineapple stem meal is a by-product of the production of the proteolytic enzyme bromelain from pineapple stumps or stems. It is generally available as a semi-moist product with relatively short particle length, and has successfully been fed to dairy and beef cattle as a substitute for, or in addition to, pineapple bran. It is about equal in energy to pineapple bran on a dry-matter basis, but it is not quite as palatable. Under normal feeding conditions 2 pounds of pineapple stump meal can be substituted for 1 pound of pineapple bran. Because of its intermediate moisture level it spoils readily if stored and has an effective keeping life of only about one week. Successful feeding levels range from 5 to 35 pounds per cow per day.

Rice Hulls

Rice hulls have practically no value as a feedstuff and should be used only for bedding material. They are very high in silica and fiber, but the fiber is indigestible. Net energy and protein values are practically zero. During extreme feed shortages, ground rice hulls may temporarily substitute for a small part of the roughage in cattle rations. Other than this, they have no place in a normal feeding program.

Snap Bean Cannery Waste

Cannery waste from snap beans is higher in protein on a dry basis than is corn cannery waste but contains only about 10 percent dry matter. It can be used to replace part of the hay or silage in a ration, but because of its high moisture content should not be fed in large amounts to high-producing dairy cows.

Straws

Straws are much lower in feeding value and are less palatable than is hay made from the same plants before they have matured. Straws are most useful in rations for animals not being fed for high production (wintering cattle, for example). Of the cereal straws, oat straw is the most nutritious; barley straw, wheat straw and rye straw are less palatable and digestible. They are usually used for bedding unless supplemented with other feeds that supply additional amounts of energy, protein, minerals, and vitamin A. Rice straw also is very indigestible and in the past it was burned after harvest. Treatment with sodium hydroxide, ammonia, and other substances shows promise of increasing the feeding value of straws and other indigestible by-products.

Sugarcane Bagasse

Sugarcane bagasse, the fibrous residue of sugarcane stalks which remains after the juice is pressed out, is one of the principal by-products of the sugar-making process. In Hawaii, bagasse is becoming less available as a potential feedstuff in many areas due to its high fuel value—it is burned by the sugar mills to generate heat and electricity. Bagasse can be used as a dairy cattle feedstuff but because of its low digestibility it is mostly classified as an emergency roughage. It can be used in limited amounts in regular feeding as a low-quality fiber source. Because of its absorptive properties, it has been used in fairly high levels in feeding of lactating dairy cattle—an example would be its use as a carrier for tallow or molasses. If stored for appreciable periods of time, bagasse will mold and become unsuitable as a feedstuff.

Sugarcane Strippings

Sugarcane strippings (also called sugarcane trash, or strip cane) is a by-product of the sugarcane plant resulting when cane is harvested with some or all of the leaves attached. The stalks with leaves are brought to the mill and the leaves and leaf sheaths are stripped from the stalks. This material (strippings) is available for use as a cattle feedstuff; it varies considerably in quality from mill to mill and from season to season. The highest quality strippings are those that are given an additional wash and then have the excess water squeezed out. The resulting product is at best a low-to medium-grade roughage, but can be successfully fed to lactating cows as a fiber source in amounts of 5 to 20 pounds per cow per day.

Strippings have a small amount of available carbohydrate, and therefore will undergo some natural fermentation if stacked. The keeping

quality of this stacked, fermented product is poor due to insufficient lactic acid production and its poor packing ability due to its relative dryness and bulky, fibrous nature. An improved silage can be obtained by mixing the strippings with molasses or pineapple greenchop prior to stacking and then covering the stack with weighted plastic.

Because of the relatively good fiber quality of this product it could possibly play an important role as a limited fiber source in feeding dairy cattle in Hawaii.

Recommended feeding levels are in the range of 5 to 15 pounds per head per day. This product's protein is also poorly digested and should be ignored when balancing rations.

Wastes, Animal

Research has established the possibility of recycling animal waste as feed for beef cattle and sheep. Broiler or layer-house litter is currently being used as a protein and energy substitute in California and other states. The feeding level of broiler or layer-house litter in growing and finishing rations for beef cattle and sheep is 5 to 15 percent. Animal wastes are not approved as a feed for lactating dairy cattle.

The values in the Table (page 15) were taken from various sources, including National Academy of Sciences bulletins on *Nutrient Requirements of Dairy Cattle*, *Nutrient Requirements of Beef Cattle*, and the *Atlas of Nutritional Data on United States and Canadian Feeds*; Morrison's *Feeds and Feeding*; Schneider's *Feeds of the World*; University of California Leaflet 21014, *Unusual Feedstuffs in Livestock Rations*; and unpublished data from various governmental and private laboratories.

The following abbreviations are used in the Table*:

ADF	= Acid detergent fiber
Ca	= Calcium
CF	= Crude fiber
CP	= Crude protein
DE	= Digestible energy
DM	= Dry Matter
EE	= Ether extract (crude fat)
K	= Potassium
Mcal	= Megacalorie
Mech-extd	= Mechanically extracted
Mg	= Magnesium
Ne_g	= Net energy for gain
NE_l	= Net energy for lactation
NE_m	= Net energy for maintenance
NFE	= Nitrogen-free extract
P	= Phosphorus
S-C	= Sun cured
Solv-Extd	= Solvent extracted
TDN	= Total digestible nutrients

*A dash (-) in the table indicates no information available for that nutrient.

Energy values in the Table marked with an asterisk (*) were calculated from chemical analysis data when actual energy values were not available from digestibility trials. The values were then reduced by 10 percent to provide a safety factor when using them for ration formulation. The formulae used are as follows (all constituents on a dry-matter basis):

1) $\%TDN = 1.15CP\% + 1.75EE\% + .45CF\% + .0085NFE^2\% + .25NFE\% - 3.4$

2) NE_l (Mcal/lb) = (.0245TDN% − .12) x .4536

3) $DE(Mcal/lb) = .0229CP\% + .0349EE\% + .0091CF\% + .00017NFE^2\% + .005NFE\% - .068$

4) $NE_m(Mcal/lb) = .655DE(Mcal/lb) - .185$

5) $NE_g(Mcal/lb) = .815DE(Mcal/lb) - .0497DE^2(Mcal/lb) - .625$

The composition of many feedstuffs varies widely because of differences in climate, soil conditions, maturity, variety, and many management and processing factors. Therefore, data in the Table should be considered as a guide to typical nutrient content rather than a precise statement of nutrient composition.

Composition of By-Products and Unusual Feedstuffs.

FEED NAME	AS FED (%DM)	DRY TDN (%)	DRY NE(L) (MCAL/LB)	DRY NE(M) (MCAL/LB)	DRY NE(G) (MCAL/LB)	MATTER BASIS CP (%)	EE (%)	CF (%)	ADF (%)	ASH (%)	CA (%)	P (%)	K (%)	MG (%)
ACORNS	70.0	47.0	0.47	0.43	0.10	4.8	5.4	13.9	17	1.7	-	-	-	-
ACORNS,WHITE OAK	50.0	46.8	0.47	0.43	0.09	3.7	5.3	2.2	3	1.9	-	-	-	-
ALDER LEAVES,S-C	85.0	47.8	0.48	0.44	0.11	22.0	6.0	17.0	21	5.9	-	-	-	-
ALFALFA SEED SCREENINGS	90.0	86.0	0.90	0.94	0.63	34.4	10.9	12.3	15	5.6	-	-	-	-
ALFILERIA	20.0	55.4	0.56	0.54	0.22	14.2	4.6	23.6	30	8.6	1.76	0.46	-	-
ALMOND HULLS,13% CF	91.0	57.0	0.58	0.55	0.25	4.4	4.0	14.0	27	6.6	0.23	0.11	-	-
ALMOND HULLS,15% CF	91.0	54.0	0.55	0.52	0.20	4.2	4.0	17.0	31	6.6	0.23	0.11	-	-
ALMOND HULLS AND SHELLS, 20%CF	91.0	48.0	0.48	0.44	0.10	3.3	2.2	22.0	41	9.9	0.22	0.11	-	-
APPLE POMACE,DRIED	89.0	69.0	0.71	0.72	0.44	4.9	5.1	17.0	26	2.2	0.13	0.12	0.48	0.07
APPLE PULP SILAGE	21.4	74.0	0.77	0.78	0.47	7.8	6.3	20.6	26	4.9	0.10	0.10	-	-
APPLES	17.0	70.0	0.72	0.72	0.44	2.8	2.2	7.3	9	2.2	0.06	0.06	0.78	0.29
APRICOTS,DRIED	90.0	77.1	0.80	0.83	0.51	-	-	0.0	0	-	-	-	-	-
ARTICHOKE SILAGE	30.0	48.0	0.48	0.43	0.11	7.2	1.7	27.3	34	18.5	-	-	-	-
ARTICHOKE TUBERS	20.0	77.0	0.80	0.81	0.51	9.8	0.5	3.9	5	4.9	-	0.29	2.00	-
ARTICHOKE,AERIAL PART	27.0	60.0	0.61	0.59	0.28	5.1	1.1	18.0	23	7.7	1.62	0.11	1.36	-
ASPARAGUS BUTTS,DRIED	91.0	49.0	0.49	0.45	0.13	15.6	1.0	31.9	40	7.7	-	-	-	-
ASPEN LEAVES,S-C	85.0	48.9	0.49	0.46	0.12	17.2	5.4	24.5	31	9.1	-	-	-	-
AVOCADO OIL MEAL	91.0	50.0	0.50	0.46	0.13	20.3	1.2	19.3	24	12.4	-	-	-	-
AVOCADO SEEDS	41.0	90.0	0.95	0.99	0.68	4.9	3.8	5.9	7	-	0.04	0.20	1.26	-
AVOCADO SKINS	24.0	90.0	0.95	1.00	0.69	6.9	34.9	24.5	31	-	0.11	0.18	1.82	-
BABASSU MEAL,MECH-EXTD	91.0	75.7	0.79	0.81	0.49	21.8	6.5	16.1	20	5.1	0.20	1.00	-	0.97
BABASSU MEAL,SOLV-EXTD	92.7	66.4	0.68	0.68	0.37	21.3	2.5	19.0	24	6.8	0.13	0.71	-	0.97
BAHIAGRASS HAY,MATURE,S-C	90.8	55.9	0.57	0.55	0.22	4.7	1.6	33.6	42	5.9	0.45	0.19	1.45	0.25
BAKERY WASTE,DRIED	92.0	89.0	0.94	0.99	0.65	11.9	14.9	1.0	1	1.7	0.07	0.11	-	-
BANANA SKINS,DRIED,GROUND	88.0	59.3	0.60	0.59	0.27	7.7	8.1	8.6	11	10.5	-	-	-	-
BANANAS	24.3	84.1	0.88	0.92	0.61	4.5	0.8	2.1	3	3.3	0.03	0.11	-	-
BANANAS,DRIED	86.0	74.0	0.77	0.77	0.49	4.1	0.6	1.2	2	3.0	0.03	0.11	1.52	-
BARLEY BRAN	91.0	59.0	0.60	0.57	0.29	12.5	4.3	21.3	27	7.0	-	-	-	-
BARLEY DISTILLERS DRIED GRAINS	92.0	69.0	0.71	0.70	0.43	30.1	12.6	11.0	14	2.0	-	-	-	-
BARLEY MALT SPROUTS	92.0	68.0	0.70	0.69	0.42	28.0	1.6	15.6	20	-	0.26	0.84	0.23	-
BARLEY MIDDLINGS	89.0	68.0	0.70	0.69	0.42	16.3	5.0	10.4	13	4.8	-	-	-	-
BARLEY MILL RUN	90.0	70.0	0.72	0.71	0.44	11.7	2.8	15.7	20	4.6	-	-	-	-
BARLEY SCREENINGS	89.0	66.0	0.68	0.67	0.39	11.6	2.7	9.1	11	3.5	0.46	0.32	1.38	0.14
BARLEY STRAW	90.0	39.0	0.38	0.33	0.00	4.1	1.8	41.8	52	6.6	0.37	0.11	2.28	0.19
BARLEY,PEARL,BY-PRODUCT	89.6	75.5	0.78	0.80	0.49	14.7	3.9	11.9	15	5.7	0.05	0.46	-	-
BARLEY,SPROUTED 5 DAYS	13.2	70.0	0.72	0.73	0.42	18.1	5.2	19.7	25	4.1	-	-	-	-
BEAN HULLS,VELVET	86.8	58.3	0.59	0.58	0.26	13.4	2.2	28.2	35	7.0	-	-	-	-
BEAN PODS WITH SEEDS,CAROB	87.7	79.0	0.82	0.85	0.54	6.3	3.0	9.9	12	2.8	-	-	-	-
BEAN PODS WITH SEEDS,MESQUITE,DRIED	91.5	63.1*	0.65*	0.64*	0.32*	11.5	1.7	20.1	25	4.6	-	-	-	-
BEAN PODS WITH SEEDS,VELVET	88.7	59.1	0.60	0.59	0.27	19.4	4.8	14.5	18	5.3	0.27	0.42	1.35	0.24
BEAN PODS,BROAD,DRIED,GROUND	92.5	63.4	0.65	0.65	0.33	16.6	1.1	17.8	22	7.3	-	-	-	-
BEAN PODS,BROAD,S-C	91.8	52.0	0.52	0.50	0.17	7.7	1.1	37.9	47	4.2	0.85	0.11	-	-
BEAN PODS,CAROB	83.9	73.6	0.76	0.78	0.47	5.7	1.7	9.5	12	4.2	-	-	-	-
BEAN PODS,LIMA	28.2	55.7*	0.56*	0.54*	0.22*	7.2	1.9	38.6	48	-	-	-	-	-
BEAN PODS,VELVET	88.6	60.4	0.62	0.61	0.29	5.2	0.9	31.6	40	7.9	-	-	-	-
BEAN STRAW	90.0	51.0	0.51	0.49	0.12	6.8	1.5	44.5	56	8.2	1.85	0.14	1.14	0.13
BEAN STRAW MEAL	92.1	44.1*	0.44*	0.39*	0.05*	7.7	1.5	39.6	50	11.8	-	-	-	-
BEAN STRAW MEAL,LIMA	88.8	51.3*	0.52*	0.49*	0.16*	11.3	2.4	31.4	39	9.3	-	-	-	-
BEAN STRAW,BROAD	89.1	48.7	0.49	0.45	0.12	6.8	1.6	45.0	56	8.3	1.87	0.15	-	-
BEAN STRAW,GREEN	89.0	51.0	0.51	0.47	0.15	20.5	1.7	24.0	30	14.5	1.44	0.27	-	-

FEED NAME	AS FED (%DM)	DRY TDN (%)	DRY NE(L) (MCAL/LB)	DRY NE(M) (MCAL/LB)	DRY NE(G) (MCAL/LB)	DRY MATTER CP (%)	DRY MATTER EE (%)	DRY MATTER CF (%)	BASIS ADF (%)	BASIS ASH (%)	CA (%)	P (%)	K (%)
BEAN STRAW,KIDNEY	86.0	55.0	0.56	0.53	0.22	9.9	1.6	34.7	43	10.4	-	-	-
BEAN STRAW,LIMA	90.0	58.0	0.59	0.57	0.25	7.6	1.8	31.0	39	8.2	-	-	-
BEANS,ALGAROBA	85.4	62.4*	0.64*	0.63*	0.31*	10.8	2.4	22.4	28	4.1	0.10	0.41	1.88
BEANS,BLACKEYE	91.5	74.0*	0.77*	0.78*	0.47*	23.4	1.4	3.0	4	5.2	-	-	-
BEANS,BROAD OR HORSE	86.0	84.1	0.88	0.92	0.61	29.2	1.9	7.7	10	2.4	-	-	-
BEANS,BUTTER	85.8	73.2*	0.76*	0.77*	0.46*	21.1	2.1	5.7	7	4.6	-	-	-
BEANS,CANNERY RESIDUE	9.4	72.5*	0.75*	0.76*	0.45*	23.5	3.0	13.5	17	-	-	-	-
BEANS,CAROB	81.2	79.0	0.82	0.85	0.54	6.2	0.4	7.5	9	2.5	-	-	-
BEANS,CAROB,GROUND	87.5	77.5	0.81	0.83	0.52	13.0	2.1	9.3	12	3.3	0.39	0.09	-
BEANS,COMMON,CRACKED	89.0	68.6*	0.71*	0.71*	0.40*	27.6	1.4	3.3	4	9.0	-	-	-
BEANS,FIELD OR NAVY	90.0	87.0	0.91	0.97	0.64	25.4	1.5	4.7	6	4.6	0.17	0.63	1.41
BEANS,GREEN	89.0	63.0	0.65	0.63	0.35	16.9	3.8	25.3	32	9.0	-	-	-
BEANS,HORSE	87.3	78.8	0.82	0.85	0.54	29.2	1.5	8.8	11	4.0	0.15	0.62	-
BEANS,HORSE,GROUND	88.4	73.4*	0.76*	0.78*	0.46*	29.2	1.6	4.4	6	4.0	-	-	-
BEANS,HORSE,HULLED	88.3	77.0*	0.80*	0.82*	0.51*	33.1	2.2	0.9	1	3.0	-	-	-
BEANS,KIDNEY	89.0	83.0	0.87	0.90	0.60	24.7	1.5	4.7	6	4.2	0.12	0.45	1.10
BEANS,LIMA	90.0	83.0	0.87	0.90	0.60	23.1	1.5	5.1	6	-	0.09	0.42	1.80
BEANS,LOCUST	90.8	73.6	0.76	0.78	0.47	7.3	0.6	9.8	12	3.1	-	-	-
BEANS,MUNG	90.0	84.0	0.88	0.91	0.61	26.6	1.4	4.3	5	4.2	0.14	0.38	1.15
BEANS,NAVY	90.0	83.0	0.87	0.90	0.60	25.3	1.6	4.7	6	4.6	0.17	0.58	1.38
BEANS,PINTO	90.0	83.0	0.87	0.90	0.60	25.2	1.4	4.5	6	4.8	0.16	0.39	-
BEANS,TEPARY	90.5	74.4	0.77	0.79	0.48	24.5	1.5	3.8	5	4.6	-	-	-
BEANS,VELVET	89.3	87.1	0.91	0.96	0.64	23.8	5.4	10.8	14	3.7	0.27	0.36	-
BEEF SCRAP,DRIED	87.8	73.6	0.76	0.78	0.47	68.3	15.0	1.9	2	12.7	9.67	4.76	0.63
BEET CROWNS WITH TOPS,SUGAR,SILAGE	21.0	54.0	0.55	0.52	0.20	12.7	2.6	13.0	16	33.0	2.32	0.20	5.79
BEET CROWNS,SUGAR	18.0	58.3	0.59	0.58	0.26	16.8	1.8	10.4	22	19.9	-	-	-
BEET PULP,DRIED	91.0	78.0	0.81	0.81	0.54	8.0	0.7	22.0	34	3.9	0.75	0.11	0.23
BEET PULP,MOLASSES DRIED	92.0	78.0	0.81	0.81	0.54	9.9	0.6	17.0	26	6.4	0.61	0.11	1.78
BEET PULP,SILAGE	11.1	75.0	0.78	0.80	0.52	13.5	1.9	31.9	40	4.0	-	-	-
BEET TAILINGS SILAGE,SUGAR	18.9	50.4*	0.51*	0.47*	0.15*	9.5	5.3	23.8	30	16.4	-	-	-
BEET TOPS,MANGELS	12.6	60.7	0.62	0.61	0.29	17.0	4.2	11.4	14	19.2	-	-	-
BEET TOPS,RED	9.0	53.0	0.53	0.50	0.19	24.2	3.3	14.3	18	-	-	-	-
BEET TOPS,SUGAR	17.0	58.0	0.59	0.56	0.27	15.1	1.1	11.2	14	22.9	1.31	0.44	6.26
BEETS,COMMON	13.0	80.3	0.84	0.87	0.56	12.3	0.8	6.9	9	11.5	1.01	0.22	5.79
BEETS,MANGELS	13.8	79.2	0.83	0.85	0.54	11.3	0.6	7.5	9	9.7	0.23	0.31	2.15
BEETS,RED	12.7	76.8	0.80	0.82	0.51	12.6	0.8	6.3	8	8.7	0.22	0.22	1.98
BREAD,DRIED	92.0	89.0	0.94	0.99	0.65	13.3	3.1	1.0	1	2.0	0.13	0.26	-
BREWERS DRIED GRAINS,CALIF	92.0	60.0	0.61	0.58	0.32	22.2	6.3	20.0	29	4.1	0.09	0.16	0.16
BREWERS DRIED GRAINS,25% PROTEIN	92.0	66.0	0.68	0.65	0.39	26.0	7.2	16.0	23	4.1	0.29	0.54	0.11
BREWERS GRAINS,WET	24.0	67.0	0.69	0.66	0.40	26.0	7.2	16.0	23	4.1	0.29	0.54	0.09
BROCCOLI	11.0	70.0	0.72	0.73	0.41	33.0	2.8	13.8	17	10.1	0.29	0.54	0.09
BRUSSEL SPROUTS	15.0	73.0	0.76	0.77	0.46	33.1	2.7	10.8	14	8.1	0.92	0.73	3.49
BUCKWHEAT	86.6	70.7	0.73	0.74	0.53	12.5	2.8	13.5	17	2.3	0.27	0.54	2.64
BUCKWHEAT MIDDLINGS	88.7	83.7	0.88	0.91	0.60	33.5	8.2	8.3	10	5.5	-	-	-
CABBAGE	9.5	85.3	0.89	0.93	0.63	25.3	4.2	15.8	20	14.7	0.64	1.15	-
CABBAGE LEAVES	14.8	66.7	0.69	0.69	0.37	14.4	2.6	14.3	18	15.6	0.63	0.35	2.53
CABBAGE POWDER,DRIED	88.3	67.8*	0.70*	0.70*	0.39*	16.9	4.5	9.5	12	7.9	-	0.21	-
CACTUS,PRICKLY PEAR	20.6	58.8	0.60	0.59	0.26	4.8	2.3	13.4	17	18.9	9.16	-	-
CACTUS,SPINELESS	5.3	49.2*	0.49*	0.46*	0.13*	13.5	1.7	11.0	14	23.0	-	0.12	1.21
CANTALOPE	10.0	66.0	0.68	0.68	0.37	20.4	8.3	20.6	26	-	-	-	-

FEED NAME	AS FED (%DM)	DRY TDN (%)	DRY NE(L) (MCAL/LB)	DRY NE(M) (MCAL/LB)	DRY NE(G) (MCAL/LB)	MATTER CP (%)	MATTER EE (%)	MATTER CF (%)	BASIS ADF (%)	BASIS ASH (%)	CA (%)	P (%)	K (%)	MG (%)
CAPROCO	88.2	60.7*	0.62*	0.61*	0.29*	13.5	12.2	41.4	52	2.7	-	-	-	-
CARAWAY SEEDS,UNSPEC-EXTN,GROUND	86.2	89.5	0.94	0.99	0.83	24.9	16.1	15.9	20	7.8	-	-	-	-
CARROT PULP	14.0	62.8*	0.64*	0.64*	0.32*	6.4	7.8	18.6	23	8.6	-	-	-	-
CARROT TOPS	16.0	74.0	0.77	0.77	0.49	13.1	3.8	18.1	23	15.0	1.94	0.19	1.88	-
CARROTS	13.0	82.0	0.86	0.88	0.59	10.3	1.4	9.1	11	9.7	0.37	0.32	2.50	0.17
CASSAVA ROOTS,DRIED,GROUND	90.9	79.4	0.83	0.86	0.54	2.9	0.7	4.9	6	2.3	-	0.03	-	-
CAULIFLOWER	9.0	70.0	0.72	0.73	0.42	30.0	2.2	11.1	14	-	0.22	0.67	3.33	-
CELERY	6.0	62.0	0.63	0.61	0.33	15.3	1.7	10.2	13	16.9	0.66	0.47	5.78	-
CELERY POWDER,DRIED	91.9	51.9*	0.52*	0.50*	0.17*	23.1	6.3	10.2	13	25.7	-	-	-	-
CHEESE,COTTAGE	21.0	81.2	0.85	0.88	0.57	81.0	1.4	0.0	0	4.8	0.43	0.86	-	-
CHERRY LEAVES,BLACK,S-C	76.1	59.9	0.61	0.60	0.28	15.5	3.5	22.6	28	4.1	-	-	-	-
CHESTNUT MEATS	47.5	87.5	0.92	0.96	0.65	6.1	3.2	2.3	3	2.1	0.06	0.19	-	-
CHICKPEAS (GARBANZO BEANS),DRIED	89.0	89.0	0.93	0.99	0.65	21.9	4.4	7.9	10	3.3	0.17	0.37	0.89	-
CITRUS PULP	18.3	82.5	0.86	0.90	0.72	6.6	3.3	12.6	16	7.7	-	-	-	-
CITRUS PULP,DRIED	90.0	77.0	0.80	0.80	0.53	6.9	3.8	14.0	23	7.0	2.07	0.13	0.62	0.16
CITRUS PULP,SILAGE	20.0	83.0	0.87	0.89	0.59	7.3	10.4	16.0	20	5.7	2.04	0.15	0.62	0.16
CLOVER SEED SCREENINGS	88.1	68.8	0.71	0.72	0.40	33.1	7.7	13.1	16	13.0	-	-	-	-
CLOVER SEED,BUR	93.4	57.8*	0.59*	0.57*	0.25*	23.0	5.7	26.8	34	9.5	-	-	-	-
CLOVER SEED,SWEET	92.0	67.0	0.69	0.68	0.40	40.6	4.6	12.3	15	3.8	-	-	-	-
COCONUT MEAL,MECH-EXTD	93.0	81.0	0.85	0.86	0.57	21.9	7.4	13.0	20	7.2	0.23	0.66	1.65	0.23
COCONUT MEAL,SOLV-EXTD	92.0	74.0	0.77	0.75	0.49	23.1	2.7	16.0	24	7.3	0.18	0.66	1.32	0.39
COCONUT MEATS,DRIED	96.0	109.0	1.16	1.32	0.75	7.5	67.3	4.0	5	-	0.03	0.20	0.61	-
COFFEE HULLS (COFFEE CHAFF)	90.0	51.1	0.51	0.48	0.16	17.3	8.2	36.2	45	5.4	-	-	-	-
COMFREY,PRICKLY	13.2	58.3	0.59	0.58	0.26	19.7	2.4	13.8	17	18.2	-	0.55	-	-
CORN COBS,GROUND	90.0	47.0	0.47	0.46	0.07	2.8	0.4	35.0	44	1.8	0.12	0.04	0.84	0.07
CORN DIST'S DRIED FERMENTATION SOLUBLES	93.0	88.0	0.92	0.98	0.64	28.9	5.7	4.0	6	7.2	0.38	1.47	1.87	0.69
CORN DISTILLERS DRIED GRAINS	92.0	84.0	0.88	0.90	0.60	29.5	9.9	13.0	20	2.7	0.10	0.40	0.10	0.07
CORN EARS,GROUND	87.0	80.0	0.84	0.86	0.55	9.3	3.5	8.9	11	1.5	0.05	0.26	0.56	0.17
CORN GLUTEN FEED	90.0	82.0	0.86	0.90	0.60	27.5	2.8	8.0	10	8.6	0.45	0.89	0.60	0.32
CORN GLUTEN MEAL	90.0	87.0	0.91	0.99	0.65	48.0	2.4	4.2	5	3.9	0.15	0.45	0.02	0.05
CORN STOVER	90.0	50.0	0.50	0.48	0.15	5.9	1.3	37.1	46	5.8	0.49	0.09	0.09	0.45
CORN,BROOM	88.4	77.3*	0.80*	0.83*	0.52*	10.6	4.8	5.8	7	4.1	-	-	-	-
CORN,CANNERY WASTE	23.0	70.0	0.72	0.73	0.42	8.8	2.7	22.0	29	5.9	3.40	0.63	-	-
CORN,CANNERY WASTE,SILAGE	29.0	72.0	0.75	0.76	0.44	8.8	2.7	27.0	34	5.9	0.34	0.63	-	-
CORN,EGYPTIAN	85.7	82.6*	0.86*	0.90*	0.59*	11.7	3.8	2.3	3	2.4	-	-	-	-
CORN,EGYPTIAN BROWN	89.0	82.6*	0.86*	0.90*	0.59*	12.6	4.3	2.6	3	2.0	-	-	-	-
CORN,KAFIR	90.7	90.9	0.96	1.01	0.69	10.9	3.3	1.5	2	1.6	0.03	0.34	0.37	0.17
COTTON GIN TRASH	90.0	44.0	0.43	0.39	0.03	7.4	1.7	36.7	46	5.9	0.65	0.12	-	-
COTTONSEED HULLS	90.0	38.0	0.37	0.39	0.00	4.3	1.0	50.0	71	2.9	0.16	0.10	0.84	0.14
COTTONSEED MEAL,41% PROTEIN,MECH-EXTD	94.0	77.0	0.80	0.80	0.53	43.6	6.7	13.0	20	7.2	0.17	1.28	1.49	0.60
COTTONSEED MEAL,41% PROTEIN,SOLV-EXTD	92.0	75.0	0.78	0.77	0.50	44.8	2.3	13.0	20	6.9	0.17	1.31	1.20	0.61
COTTONSEED MEAL,50% PROTEIN,SOLV-EXTD	92.0	75.0	0.78	0.77	0.50	54.0	2.3	9.0	12	6.9	0.17	1.09	1.20	0.50
COTTONSEED,WHOLE	93.0	98.0	1.04	1.17	0.73	24.9	21.1	18.0	29	3.9	0.15	0.73	1.20	0.35
COWPEA HAY,S-C	90.5	58.9	0.60	0.59	0.27	17.7	2.9	26.9	34	11.7	1.52	0.37	1.99	0.43
DATE SEEDS,GROUND	90.0	78.0	0.81	0.83	0.54	6.6	9.0	15.7	20	-	-	-	-	-
DURRA,BROWN	88.7	90.2	0.95	1.00	0.68	12.1	3.6	1.8	2	2.1	-	-	-	-
DURRA,WHITE	89.0	90.2	0.95	1.00	0.68	11.9	4.1	1.5	2	2.4	-	-	-	-
DYNA-FERM	75.0	48.0	0.48	0.48	0.28	29.3	0.1	0.3	1	2.7	-	-	-	-
EGGS WITHOUT SHELLS,DRIED	96.0	130.0	1.39	1.74	0.60	49.0	43.0	0.0	0	3.8	0.20	0.83	0.48	-
FAT	95.0	200.0	1.97	2.14	1.34	0.0	100.0	0.0	0	-	-	-	-	-

FEED NAME	AS FED (%DM)	DRY MATTER BASIS TDN (%)	NE(L) (MCAL/LB)	NE(M) (MCAL/LB)	NE(G) (MCAL/LB)	CP (%)	EE (%)	CF (%)	ADF (%)	ASH (%)	CA (%)	P (%)	K (%)	MG (%
FEATHER MEAL	90.0	63.0	0.65	0.63	0.35	87.4	2.9	0.6	1	3.8	0.20	0.75	-	-
FENUGREEK SEED	90.7	71.7*	0.74*	0.75*	0.44*	29.2	6.2	10.4	13	4.0	-	-	-	-
FETERITA	88.6	84.8*	0.89*	0.93*	0.61*	10.7	2.4	1.5	2	1.7	-	-	-	-
FIGS,DRIED	76.0	76.2	0.79	0.81	0.50	-	-	0.0	0	-	-	-	-	-
FILAREE,MATURE,DRIED	89.0	48.1	0.48	0.45	0.11	3.9	1.7	35.3	44	9.6	-	-	-	-
FISH MEAL	88.0	67.0	0.69	0.68	0.40	67.2	6.3	1.1	1	20.8	6.20	3.77	0.44	0.1
FISH SOLUBLES,DRIED	93.7	78.6	0.82	0.84	0.53	69.9	9.9	0.5	1	15.8	1.36	1.80	-	-
FLAX HULLS	91.0	38.0	0.37	0.31	0.00	8.5	1.5	31.5	39	10.4	-	-	-	-
FLAX SEED SCREENINGS	91.0	66.0	0.68	0.67	0.39	17.3	10.9	14.2	18	7.8	0.40	0.47	-	-
FLAX SEEDS	94.0	115.0	1.22	1.43	0.74	25.6	38.3	6.7	8	5.2	0.23	0.55	0.84	-
GRAPE MEAL,DRIED	90.0	30.2	0.28	0.21	0.00	-	-	0.0	0	-	-	-	-	-
GRAPE POMACE,DRIED	91.0	30.0	0.28	0.34	0.00	12.7	7.6	33.0	54	5.5	0.51	0.40	1.20	0.1
GRAPE POMACE,WITHOUT STEMS,DRIED	90.6	61.5	0.63	0.62	0.30	14.0	7.9	33.3	42	6.0	-	-	-	-
GRAPE SEEDS	85.0	52.9*	0.53*	0.51*	0.18*	11.5	6.5	47.2	59	3.2	-	-	-	-
GRAPE/PEAR/APPLE POMACE,DRIED	92.2	40.1	0.39	0.34	0.00	7.3	4.0	25.3	32	3.5	0.24	0.20	0.41	0.0
GRAPEFRUIT	14.0	85.0	0.89	0.93	0.62	8.1	4.4	10.3	13	3.7	0.51	0.15	-	-
GRAPEFRUIT PULP,DRIED	91.0	80.0	0.83	0.85	0.57	6.7	1.5	13.9	17	6.0	1.48	0.18	-	-
GUAYULE THINNINGS	92.4	49.8*	0.50*	0.47*	0.14*	10.7	5.1	26.8	34	15.4	-	-	-	-
HEGARI FODDER	90.0	61.0	0.62	0.53	0.23	6.8	1.9	20.2	25	8.5	0.30	0.18	-	-
HEGARI STOVER	90.0	48.0	0.48	0.45	0.11	6.2	2.0	31.1	39	11.0	0.37	0.09	-	-
HEMPSEED	91.1	90.1*	0.95*	1.00*	0.68*	20.0	35.8	16.5	21	4.6	-	-	-	-
HEMPSEED MEAL	92.8	47.0	0.47	0.43	0.10	33.8	5.5	25.1	31	9.4	-	-	-	-
HOMINY FEED,LOW FAT	91.0	90.0	0.95	1.03	0.65	11.3	5.2	5.0	11	2.6	0.06	0.58	0.68	0.2
HOMINY FEED,5% FAT	91.0	92.0	0.97	1.05	0.68	11.8	7.2	6.0	12	3.0	0.06	0.58	0.68	0.2
HOPS,SPENT,DRIED	93.0	32.0	0.30	0.24	0.00	24.8	5.1	24.3	30	6.0	-	-	-	-
KALE,AERIAL PART	11.6	65.9	0.68	0.68	0.36	20.8	4.5	13.6	17	15.8	1.61	0.51	-	-
KALE,THOUSAND-HEADED	14.8	72.5	0.75	0.76	0.45	17.7	3.4	9.8	12	11.8	-	-	-	-
KELP,DRIED	91.0	32.0	0.30	0.23	0.00	7.1	0.5	7.0	10	38.6	2.72	0.31	-	0.9
KOLIANG,BROWN	89.8	90.9	0.96	1.01	0.69	11.4	3.7	1.9	2	2.4	-	-	-	-
KOLIANG,WHITE	89.2	90.9	0.96	1.01	0.69	13.1	4.4	2.7	3	2.9	-	-	-	-
LEMON PULP,DRIED	93.0	77.0	0.80	0.81	0.53	6.9	1.5	15.9	20	5.7	-	-	-	-
LENTIL SEEDS	88.5	75.2*	0.78*	0.80*	0.49*	28.0	1.3	3.8	5	2.9	0.09	0.42	-	-
LETTUCE	5.0	51.0	0.51	0.47	0.15	22.0	4.1	11.2	14	15.9	0.86	0.46	4.52	-
LETTUCE POWDER,DRIED	90.0	57.8*	0.59*	0.57*	0.25*	22.9	5.0	12.7	16	16.0	-	-	-	-
LIME PULP,DRIED	85.0	70.0	0.72	0.72	0.44	9.1	3.4	17.9	22	-	-	-	-	-
LINSEED MEAL,36% PROTEIN,SOLV-EXTD	90.0	82.0	0.86	0.81	0.54	40.7	1.1	10.3	13	6.4	0.43	0.95	1.52	0.6
LINSEED MEAL,37% PROTEIN,MECH-EXTD	90.0	85.0	0.89	0.87	0.58	41.7	6.5	9.1	11	6.3	0.43	0.95	1.10	0.6
LOCUST BLOSSOMS,BLACK	10.0	61.9*	0.63*	0.63*	0.31*	29.2	5.1	20.0	25	9.0	-	-	-	-
LOCUST LEAVES,BLACK	21.0	68.3*	0.70*	0.71*	0.40*	30.5	4.1	9.2	12	7.0	-	-	-	-
LUPINE HAY,COMPOSITE SAMPLE	94.1	63.6	0.65	0.65	0.33	16.4	3.3	24.8	31	8.2	1.05	0.20	-	-
MALT SPROUTS,24% PROTEIN	92.0	68.0	0.70	0.69	0.42	28.0	1.6	15.6	20	6.7	0.26	0.84	0.23	0.2
MALT,BARLEY	91.0	88.0	0.92	0.97	0.64	15.8	1.8	2.0	3	2.5	0.09	0.52	0.47	0.2
MALT,BARLEY,NORTHWEST	91.0	77.0	0.80	0.82	0.51	32.2	7.2	18.0	24	4.0	3.22	0.57	-	-
MALVA	20.5	58.7*	0.60*	0.58*	0.26*	31.5	4.9	14.6	18	16.3	-	-	-	-
MANURE,CAGE LAYER,DRIED	90.0	52.0	0.52	0.49	0.17	28.0	2.0	12.7	16	-	8.80	2.50	2.33	-
MANURE,CATTLE,DRIED	93.0	45.0	0.45	0.40	0.05	12.7	2.5	37.5	47	-	0.87	1.60	0.50	-
MELON SEEDS,CITRON	91.5	64.5*	0.66*	0.66*	0.34*	9.1	19.1	45.9	57	2.4	-	-	-	-
MELONS	4.1	70.7	0.73	0.74	0.43	11.5	3.3	23.0	29	6.6	-	-	-	-
MELONS,PIE	6.1	74.6	0.77	0.79	0.48	11.5	3.3	23.0	29	6.6	-	-	-	-
MILK,BUTTERMILK	9.7	86.0	0.90	0.94	0.62	41.2	5.2	0.0	0	7.2	1.38	0.95	0.72	0.6

FEED NAME	AS FED (%DM)	TDN (%)	NE(L) (MCAL/LB)	NE(M) (MCAL/LB)	DRY MATTER NE(G) (MCAL/LB)	CP (%)	EE (%)	CF (%)	BASIS ADF (%)	ASH (%)	CA (%)	P (%)	K (%)	MG (%
MILK,BUTTERMILK,DRIED,FEED GRADE	93.0	86.0	0.90	0.94	0.62	34.2	5.6	0.4	1	10.8	1.07	0.73	1.35	0.1
MILK,CATTLE,SKIM	10.0	93.0	0.98	1.07	0.69	36.0	4.6	0.0	0	7.4	1.41	1.17	1.90	0.1
MILK,CATTLE,SKIM,DRIED	94.0	86.0	0.90	0.94	0.62	36.0	1.1	0.3	0	8.5	1.25	1.03	1.62	0.1
MILK,CATTLE,WHOLE	12.0	130.0	1.39	1.64	0.91	25.8	28.5	0.0	0	5.8	0.89	0.72	1.16	0.0
MILK,CATTLE,WHOLE,DRIED	94.0	130.0	1.39	1.64	0.91	26.9	27.1	0.0	0	5.6	0.89	0.72	1.16	0.0
MILK,COLOSTRUM	24.8	130.0	1.39	1.64	0.91	45.9	24.2	0.0	0	4.5	-	-	-	-
MILLET HULLS	88.4	13.6	0.10	0.00	0.00	4.4	1.4	51.8	65	10.8	-	-	-	-
MILLET SEEDS	89.9	66.8	0.69	0.69	0.38	13.5	4.5	7.2	9	3.3	0.06	0.31	0.48	0.1
MOLASSES,BEET	75.0	75.0	0.78	0.87	0.55	11.2	0.0	0.0	0	13.5	0.07	0.03	5.93	0.3
MOLASSES,CANE	75.0	72.0	0.75	0.73	0.47	4.3	0.0	0.0	0	12.6	1.19	0.11	3.17	0.4
MOLASSES,CANE,3% H3PO4	75.0	70.0	0.72	0.70	0.44	4.2	0.0	0.0	0	12.2	1.15	0.95	3.17	0.4
MOLASSES,CITRUS	65.0	77.0	0.80	0.80	0.53	10.9	0.3	0.0	0	6.6	2.00	0.14	0.14	0.2
MOLASSES,WOOD (MASONEX)	60.0	76.7*	0.80*	0.82*	0.51*	0.8	0.8	1.7	2	10.0	0.83	0.12	-	-
OAT HULLS	93.0	35.0	0.33	0.28	0.00	3.8	1.5	32.2	40	6.5	0.16	0.11	0.52	-
OAT MIDDLINGS	91.0	95.0	1.00	1.08	0.70	17.4	6.4	3.2	4	2.6	0.08	0.51	0.55	-
OAT MILL BY-PRODUCT	92.0	31.0	0.29	0.23	0.00	6.1	2.1	29.4	37	6.4	0.16	0.22	0.60	0.8
OAT MILL FEED	92.9	33.7	0.32	0.26	0.00	3.1	1.1	35.1	44	6.4	0.11	0.05	-	-
OAT SHORTS	91.0	60.0	0.61	0.59	0.30	14.1	6.1	14.8	19	5.3	-	-	-	-
OAT STRAW	90.0	45.0	0.45	0.41	0.09	4.5	2.4	40.3	50	7.0	0.27	0.10	2.23	0.1
OATS,SPROUTED 5 DAYS	13.2	70.0	0.72	0.73	0.42	18.1	5.2	19.7	25	4.1	-	-	-	-
OLIVE PULP WITH PITS,DRIED	92.0	40.0	0.39	0.34	0.00	6.4	16.9	39.7	50	2.7	-	-	-	-
OLIVE PULP WITHOUT PITS,DRIED	95.0	78.0	0.81	0.83	0.54	14.7	28.8	20.3	25	3.6	-	-	-	-
OLIVE PULP WITHOUT PITS,SOLV-EXTD	91.0	36.0	0.35	0.29	0.00	14.2	3.9	26.9	34	8.5	-	-	-	-
OLIVE WASTE,DRIED	91.3	38.9	0.38	0.32	0.00	14.2	3.9	26.9	34	9.3	-	-	-	-
OLIVES,CULL	42.0	89.0	0.93	0.99	0.67	4.5	35.5	27.2	34	5.1	0.01	0.10	-	-
ONION WASTE,DRIED	89.4	61.2*	0.63*	0.62*	0.30*	9.7	4.9	22.1	28	6.4	-	-	-	-
ONIONS	91.4	57.6*	0.59*	0.57*	0.25*	12.6	2.0	22.6	28	8.0	1.80	0.21	1.76	0.1
ORANGE BY-PRODUCTS,DRIED	90.6	70.2*	0.73*	0.73*	0.42*	8.3	3.0	14.7	18	3.4	0.71	0.11	-	-
ORANGE PULP,AMMONIATED,DRIED	89.0	73.0	0.76	0.77	0.46	16.5	3.7	13.9	17	3.8	0.71	0.11	-	-
ORANGE PULP,DRIED	88.0	78.0	0.81	0.81	0.54	8.5	1.7	10.0	16	3.8	0.71	0.11	-	-
ORANGE PULP,SILAGE	11.3	64.9*	0.67*	0.66*	0.35*	8.8	2.2	17.7	22	5.3	-	-	-	-
ORANGE PULP,WET	25.0	77.0	0.80	0.83	0.51	8.9	1.8	13.0	16	3.8	0.21	0.28	1.05	-
ORANGES	12.8	78.1	0.81	0.84	0.53	7.5	1.9	11.3	14	4.4	0.57	0.13	-	-
PALM NUT MEAL	89.6	83.7	0.88	0.91	0.60	18.8	10.6	26.8	34	4.8	-	-	-	-
PARSNIPS	13.7	89.2	0.94	0.98	0.67	11.7	1.4	7.3	9	5.1	-	-	-	-
PEA HAY	88.0	58.0	0.59	0.56	0.27	13.6	2.5	30.2	38	7.6	1.39	0.28	1.42	0.3
PEA MEAL,DRIED	90.0	84.0	0.88	0.91	0.61	19.7	1.6	26.3	33	3.4	-	-	-	-
PEA PODS,DRIED	88.0	67.0	0.69	0.68	0.40	10.8	1.1	35.6	45	5.3	1.47	0.23	-	-
PEA VINE SILAGE	24.0	56.0	0.57	0.54	0.23	13.1	3.3	30.0	49	8.2	1.31	0.24	1.40	0.3
PEA VINE STRAW	85.0	56.0	0.57	0.54	0.24	8.9	1.8	39.5	49	6.8	1.00	0.11	1.20	-
PEACHES	10.0	80.0	0.83	0.86	0.55	8.7	3.7	10.3	13	-	-	-	-	-
PEACHES,DRIED	90.0	77.8	0.81	0.83	0.52	-	-	0.0	0	-	-	-	-	-
PEANUT HAY,S-C	91.0	58.0	0.59	0.56	0.27	10.9	5.6	33.0	41	10.7	1.23	0.17	1.38	0.4
PEANUT MEAL,MECH-EXTD	89.0	88.0	0.92	0.89	0.59	50.6	8.2	7.6	10	5.9	0.18	0.62	1.25	0.3
PEANUT MEAL,SOLV-EXTD	91.0	77.0	0.80	0.80	0.53	51.8	1.3	14.3	18	5.9	0.22	0.71	1.25	0.0
PEANUT SKINS	94.0	65.0	0.67	0.65	0.37	17.4	25.5	12.6	16	3.0	0.19	0.20	-	-
PEAR PULP,DRIED,GROUND	91.5	70.6	0.73	0.74	0.43	6.1	2.1	23.8	30	4.0	2.38	0.12	-	-
PEARS	17.3	86.7	0.91	0.95	0.64	-	-	0.0	0	-	-	-	-	-
PEARS,CANNERY RESIDUE	15.2	69.3	0.72	0.72	0.41	3.9	1.3	17.1	21	2.0	-	-	-	-
PEAS,CANADA,FIELD	85.0	71.0*	0.73*	0.75*	0.43*	27.9	0.9	9.3	12	2.8	-	-	-	-

FEED NAME	AS FED (%DM)	DRY TDN (%)	DRY NE(L) (MCAL/LB)	DRY NE(M) (MCAL/LB)	DRY NE(G) (MCAL/LB)	MATTER CP (%)	MATTER EE (%)	MATTER CF (%)	BASIS ADF (%)	BASIS ASH (%)	CA (%)	P (%)	K (%)	MG (%
PEAS,COW	85.2	74.1*	0.77*	0.79*	0.47*	24.4	1.6	4.8	6	3.8	0.10	0.50	-	-
PEAS,CULL,DRIED	90.0	83.0	0.87	0.89	0.59	26.5	1.2	6.0	9	3.1	0.13	0.47	-	-
PEAS,FIELD	90.7	82.2	0.86	0.89	0.58	25.8	1.3	6.7	8	3.3	0.19	0.55	1.14	-
PINEAPPLE BRAN (PULP)	87.0	73.0	0.76	0.74	0.48	4.6	1.9	18.0	28	3.4	0.24	0.12	-	-
PINEAPPLE GREENCHOP	18.0	56.0	0.57	0.55	0.24	7.6	2.2	27.0	35	6.4	0.28	0.08	-	-
PINEAPPLE JUICE PRESSCAKE	21.0	71.0	0.74	0.75	0.45	5.3	0.7	26.0	34	2.6	0.28	0.08	-	-
PINEAPPLE STUMPMEAL	46.0	64.0	0.66	0.65	0.36	3.0	0.8	22.0	30	1.9	0.28	0.08	-	-
PINEAPPLE TOPS	16.0	42.8	0.42	0.38	0.04	10.0	3.1	23.1	29	9.4	-	-	-	-
PINEAPPLES	14.7	80.1	0.84	0.86	0.55	2.7	1.4	2.7	3	2.7	0.14	0.07	-	-
POMEGRANATE PULP	26.0	68.4*	0.71*	0.71*	0.40*	8.4	4.9	16.6	21	4.0	-	-	-	-
POTATO MEAL,DRIED	91.0	77.0	0.80	0.81	0.53	10.6	0.3	2.3	3	4.7	0.08	0.22	2.15	-
POTATOES	23.0	80.0	0.83	0.85	0.57	9.6	0.3	2.4	3	4.7	0.05	0.24	2.26	0.1
POTATOES,DRIED	90.0	77.0	0.80	0.80	0.53	8.7	0.3	2.0	3	4.8	0.07	0.21	2.19	-
POTATOES,SILAGE	25.0	79.0	0.82	0.83	0.55	8.2	0.4	4.0	5	5.5	0.04	0.23	2.13	-
PRUNE MIX	81.8	54.7	0.55	0.53	0.21	6.3	2.4	19.8	25	6.2	-	-	-	-
PRUNES,DRIED	90.0	77.8	0.81	0.83	0.52	-	-	0.0	0	-	-	-	-	-
PRUNES,WITH PITS	82.0	81.0	0.85	0.88	0.56	5.3	2.9	13.1	16	-	0.13	0.11	-	-
PRUNES,WITHOUT PITS	80.0	93.0	0.98	1.04	0.72	4.1	1.4	2.2	3	-	0.04	0.12	-	-
PUMPKINS	9.0	85.0	0.89	0.93	0.62	16.2	8.9	14.2	18	8.9	0.24	0.43	#3.32	-
RAISIN PULP,DRIED	89.0	53.0	0.53	0.50	0.19	10.7	8.7	18.0	23	6.0	-	-	-	-
RAISINS,CULL	85.0	48.0	0.48	0.44	0.10	4.0	1.1	5.2	7	3.5	-	-	-	-
RAPESEED OILMEAL,CANADIAN,MECH-EXTD	94.0	71.8	0.74	0.76	0.44	37.4	7.4	16.5	21	7.2	0.76	1.06	-	-
RAPESEED OILMEAL,CANADIAN,SOLV-EXTD	92.0	70.9	0.73	0.74	0.43	44.0	1.2	10.1	13	7.8	0.72	1.01	-	-
RAPESEED OILMEAL,MECH-EXTD	92.0	77.0	0.80	0.81	0.53	34.2	9.3	13.2	17	7.8	1.00	1.40	0.90	0.5
RAPESEED OILMEAL,SOLV-EXTD	91.0	68.0	0.70	0.69	0.42	41.0	1.7	12.9	16	7.8	0.67	1.04	-	-
RICE BRAN,SOLV-EXTD	90.0	62.0	0.64	0.63	0.34	15.9	3.4	13.0	17	15.1	0.07	1.62	1.91	1.0
RICE BRAN,13% FAT	91.0	76.0	0.79	0.81	0.55	14.0	15.1	12.0	16	14.8	0.07	1.62	1.91	1.0
RICE BY-PRODUCT (BRAN AND HULLS)	91.0	33.0	0.31	0.25	0.00	6.7	5.6	33.0	53	19.1	0.08	0.59	-	-
RICE HULLS	92.0	15.0	0.07	0.02	0.00	3.1	0.9	44.5	72	20.8	0.09	0.08	0.34	-
RICE MIDDLINGS	88.1	66.9*	0.69*	0.69*	0.38*	15.6	6.8	9.6	12	9.6	-	-	-	-
RICE POLISHINGS	90.0	91.0	0.96	0.99	0.65	14.2	14.9	3.0	4	9.9	0.05	1.31	1.30	0.7
RICE STRAW	91.0	41.0	0.40	0.35	0.02	4.5	1.4	35.1	44	16.6	0.21	0.08	1.32	0.1
RUTABAGA TOPS	10.9	68.4	0.71	0.71	0.40	18.6	4.6	14.1	18	19.9	-	-	-	-
RUTABAGA TOPS,DRIED	87.3	55.1	0.56	0.54	0.21	11.2	2.2	9.8	12	39.4	-	-	-	-
RUTABAGAS	11.4	85.6	0.90	0.94	0.62	10.5	1.8	11.4	14	10.5	0.49	0.29	1.84	0.1
RYE BRAN	91.0	61.0	0.62	0.60	0.32	17.5	3.4	7.6	10	5.2	-	-	-	-
RYE DISTILLERS DRIED GRAINS	92.0	48.0	0.48	0.44	0.10	22.1	8.1	14.4	18	2.7	0.14	0.45	0.08	0.1
RYE DISTILLERS DRIED GRAINS WITH SOLUBLES	90.5	62.1	0.64	0.63	0.31	30.1	4.5	9.0	11	7.1	-	-	-	-
RYE DISTILLERS DRIED SOLUBLES	94.4	69.6*	0.72*	0.73*	0.41*	37.2	1.3	3.6	5	7.6	0.37	1.26	-	-
RYE MIDDLINGS	90.0	80.0	0.83	0.85	0.57	18.4	3.8	5.8	7	4.0	0.07	0.70	0.70	-
RYE MILL RUN	90.0	75.0	0.78	0.79	0.51	18.5	3.7	5.1	6	4.2	0.08	0.71	0.66	0.2
SAFFLOWER HULLS	91.3	13.3	0.09	0.00	0.00	3.6	3.7	58.2	73	1.8	-	-	-	-
SAFFLOWER MEAL,20% PROTEIN,MECH-EXTD	91.0	57.0	0.58	0.55	0.25	22.8	7.6	36.0	45	4.2	0.28	0.78	0.79	0.3
SAFFLOWER MEAL,20% PROTEIN,SOLV-EXTD	92.0	55.0	0.56	0.53	0.22	23.9	1.1	34.0	43	4.3	0.37	0.80	0.79	0.3
SAFFLOWER MEAL,42% PROTEIN,SOLV-EXTD	90.0	76.0	0.79	0.78	0.52	46.5	1.1	17.0	21	7.1	0.44	1.41	1.33	1.3
SAFFLOWER SEEDS	92.0	89.0	0.94	1.00	0.65	19.5	32.0	31.0	40	3.1	0.25	0.67	0.79	0.3
SAGEBRUSH,BROWSE	50.5	49.9	0.50	0.47	0.14	12.9	9.2	24.8	31	9.7	1.01	0.25	-	0.4
SALTGRASS HAY,S-C	89.2	53.5	0.54	0.52	0.19	8.9	2.1	31.6	40	12.7	2.37	0.10	-	-
SCREENINGS,GRAIN,GOOD GRADE	90.0	70.0	0.72	0.70	0.44	14.2	5.2	13.1	16	9.8	0.48	0.43	-	-
SCREENINGS,REFUSE	90.0	56.0	0.57	0.55	0.29	11.5	4.3	31.0	40	10.6	0.46	0.32	-	-

FEED NAME	AS FED (%DM)	DRY TDN (%)	DRY NE(L) (MCAL/LB)	DRY NE(M) (MCAL/LB)	DRY NE(G) (MCAL/LB)	MATTER CP (%)	MATTER EE (%)	MATTER CF (%)	BASIS ADF (%)	BASIS ASH (%)	CA (%)	P (%)	K (%)	M (%
SESAME MEAL,MECH-EXTD	92.0	79.0	0.82	0.77	0.50	48.0	9.4	5.8	7	11.2	2.16	1.44	1.35	0.
SESAME OIL CAKE	94.7	88.8*	0.93*	0.98*	0.67*	38.0	26.0	4.0	5	7.8	-	-	-	-
SESAME SEEDS	92.0	104.0	1.10	1.23	0.74	24.2	46.6	11.2	14	6.1	-	-	-	-
SLOUGHGRASS,AMERICAN,HAY,MATURE,S-C	94.6	53.2	0.54	0.51	0.19	5.0	1.3	37.9	47	11.6	1.02	0.76	-	-
SORGHUM DIST'S DRIED GRAINS WITH SOLUBLES	95.0	84.0	0.88	0.91	0.61	34.9	9.9	10.7	13	4.4	0.42	0.14	-	-
SORGHUM DISTILLERS DRIED GRAINS	94.0	81.0	0.85	0.87	0.58	33.3	9.0	13.1	16	4.2	0.18	0.97	-	-
SORGHUM DISTILLERS DRIED SOLUBLES	93.0	83.0	0.87	0.90	0.60	28.5	5.9	4.2	5	9.1	0.15	0.63	-	-
SORGHUM GLUTEN FEED,DRIED	91.0	76.0	0.79	0.80	0.52	28.6	3.6	7.8	10	9.4	0.40	0.66	-	-
SORGHUM SILAGE,30% DM	30.0	57.0	0.58	0.67	0.30	7.3	2.7	26.0	33	5.3	0.10	0.66	1.61	0.4
SORGHUM STOVER,DRIED	90.0	48.0	0.48	0.45	0.11	5.3	2.3	32.6	41	6.6	0.33	0.20	1.54	0.3
SORREL SEEDS	86.8	67.7*	0.70*	0.70*	0.39*	9.1	4.4	19.4	24	2.4	0.40	0.11	1.20	-
SOYBEAN HAY,S-C	88.0	55.0	0.56	0.53	0.22	16.6	3.3	31.9	40	7.7	-	-	-	-
SOYBEAN HULLS	92.0	64.0	0.66	0.64	0.36	12.4	2.8	36.1	45	4.2	1.25	0.25	0.97	0.7
SOYBEAN MEAL,44% PROTEIN,SOLV-EXTD	89.0	81.0	0.85	0.86	0.57	49.6	1.4	7.0	10	6.8	0.59	0.17	1.03	-
SOYBEAN MEAL,48% PROTEIN,SOLV-EXTD	89.0	81.0	0.85	0.86	0.57	54.0	1.4	3.0	5	6.8	0.36	0.75	2.21	0.3
SOYBEAN MILL FEED,GROUND	89.4	48.4	0.48	0.45	0.12	14.9	1.8	36.9	46	5.0	0.36	0.75	2.21	0.3
SOYBEAN MILL RUN	88.0	44.0	0.43	0.39	0.03	13.6	1.4	40.7	51	5.1	0.42	0.21	-	-
SOYBEAN SILAGE	27.5	54.1	0.55	0.52	0.26	17.5	2.6	28.6	36	10.0	0.42	0.21	-	-
SOYBEAN STRAW	88.0	44.0	0.44	0.44	0.00	5.2	1.4	44.0	55	5.8	1.39	0.46	0.93	0.3
SOYBEANS,WHOLE	91.0	91.0	0.96	1.01	0.67	41.7	19.2	5.8	7	5.4	1.59	0.06	0.53	0.9
SUGARCANE BAGASSE	55.0	39.0	0.26	0.32	0.00	1.5	0.4	49.0	61	5.5	0.27	0.63	1.77	0.3
SUGARCANE STRIPPINGS	45.0	44.0	0.44	0.39	0.03	3.6	0.9	45.0	56	10.3	0.35	0.27	0.50	0.1
SUNFLOWER MEAL,MECH-EXTD	93.0	70.0	0.72	0.70	0.44	44.1	5.2	13.0	33	6.3	0.35	0.27	-	-
SUNFLOWER MEAL,SOLV-EXTD	93.0	65.0	0.67	0.64	0.38	50.3	1.2	12.0	30	6.3	0.46	1.12	1.16	0.7
SUNFLOWER SEEDS	94.0	83.0	0.87	0.90	0.60	17.9	27.7	31.0	39	3.3	0.40	1.10	1.07	0.8
SUNFLOWER SEEDS WITHOUT HULLS	95.0	121.0	1.29	1.55	0.71	27.1	46.5	5.3	7	4.0	0.18	0.56	0.71	-
SWEET POTATO MEAL	90.0	80.0	0.83	0.85	0.57	5.4	1.0	3.7	5	4.5	0.17	0.94	0.96	-
SWEET POTATO TOPS	20.0	49.4*	0.50*	0.46*	0.13*	19.5	2.5	14.5	18	22.0	0.17	0.16	-	-
SWEET POTATO TOPS,DRIED	91.0	57.0	0.58	0.55	0.25	13.9	3.6	21.0	26	11.3	-	-	-	-
SWEET POTATOES	31.0	80.0	0.83	0.85	0.57	5.0	1.3	6.0	8	3.6	-	-	-	-
TANGERINE PULP,DRIED	87.0	80.0	0.83	0.87	0.55	8.1	5.7	11.0	14	5.0	0.09	0.13	1.19	0.16
TAPIOCA MEAL (CASSAVA,STARCH BY-PRODUCT)	86.8	81.1	0.85	0.88	0.57	1.0	0.8	5.3	7	2.1	1.57	0.14	-	-
TOMATO LEAVES WITH STEMS	14.0	46.7*	0.47*	0.43*	0.09*	26.4	1.7	15.4	19	26.6	-	0.03	-	-
TOMATO POMACE,DRIED	92.0	73.0	0.76	0.75	0.48	23.9	10.6	26.3	33	3.5	-	-	-	-
TOMATO POMACE,SILAGE	29.5	63.9*	0.66*	0.65*	0.34*	19.2	14.6	44.9	56	4.5	0.44	0.59	3.63	-
TOMATO SKINS WITH JUICE,DRIED	89.6	63.0	0.65	0.64	0.32	20.7	2.5	19.1	24	9.8	~0.50	0.47	-	-
TOMATOES	6.0	69.0	0.71	0.70	0.43	16.4	5.0	9.1	11	-	0.61	0.46	-	-
TURNIP TOPS	13.0	67.0	0.69	0.68	0.40	21.8	2.6	10.3	13	16.8	0.16	0.49	4.21	-
TURNIPS	9.0	84.0	0.88	0.91	0.61	14.0	2.1	11.8	15	8.4	2.92	0.51	3.00	0.92
VETCH SEEDS	90.7	68.1	0.70	0.71	0.39	32.6	0.9	6.3	8	3.4	0.64	0.21	2.79	0.22
WALNUT MEAL,BLACK	93.0	70.8*	0.73*	0.74*	0.43*	31.7	11.4	18.2	23	5.7	-	-	-	-
WALNUT MEAL,ENGLISH	93.3	66.7	0.69	0.69	0.37	17.1	6.4	26.8	34	4.9	-	-	-	-
WALNUT MEATS,GROUND	91.0	94.0	0.99	1.06	0.69	45.8	9.6	3.8	5	5.8	-	-	-	-
WATERGRASS SEED	90.0	69.1*	0.71*	0.72*	0.41*	7.3	3.9	14.2	18	5.0	-	-	-	-
WHEAT BRAN	89.0	70.0	0.72	0.69	0.44	18.0	5.0	11.0	14	6.8	-	-	-	-
WHEAT CHAFF,S-C	92.6	39.8	0.39	0.34	0.00	5.5	1.7	32.2	40	18.0	0.12	1.32	1.39	0.62
WHEAT GERM MEAL	90.0	95.0	1.00	1.11	0.70	28.1	10.2	4.0	5	5.8	0.20	0.15	-	-
WHEAT MIDDLINGS	90.0	83.0	0.87	0.89	0.59	19.1	5.7	8.9	11	4.8	0.06	1.16	0.98	0.28
WHEAT MILL RUN	90.0	74.0	0.77	0.73	0.49	17.0	4.8	9.0	11	5.8	0.16	1.01	1.08	0.41
WHEAT SHORTS,7% CF	87.0	83.0	0.87	0.94	0.63	18.1	5.5	7.3	9	4.5	0.10	1.13	1.42	0.57
											0.10	0.84	0.94	0.29

FEED NAME	AS FED (%DM)	TDN (%)	NE(L) (MCAL/LB)	NE(M) (MCAL/LB)	NE(G) (MCAL/LB)	DRY MATTER BASIS CP (%)	EE (%)	CF (%)	ADF (%)	ASH (%)	CA (%)	P (%)	K (%)	MG (%
WHEAT STRAW	90.0	41.0	0.40	0.35	0.02	3.6	0.0	41.5	52	7.2	0.19	0.09	1.11	0.1
WHEY PRODUCT,DRIED	93.0	78.0	0.81	0.81	0.54	17.0	1.4	0.0	0	16.7	1.67	1.11	-	-
WHEY, DRIED	90.0	84.0	0.88	0.93	0.61	14.2	0.8	0.2	0	9.0	0.95	0.80	0.92	0.1
WHEY,CONDENSED,42% SOLIDS	42.0	78.0	0.81	0.81	0.54	14.0	4.3	0.0	0	10.1	0.98	0.81	-	-
WHEY,LIQUID	7.0	78.0	0.81	0.81	0.54	14.0	4.3	0.0	0	10.1	0.98	0.81	-	-
YEAST,BREWERS,DRIED	93.0	78.0	0.81	0.81	0.54	48.3	0.8	3.0	4	7.7	0.14	1.54	1.85	0.2
YEAST,TORULA,DRIED	93.0	80.0	0.84	0.84	0.56	51.5	1.3	3.0	4	8.8	0.63	1.81	2.02	0.1