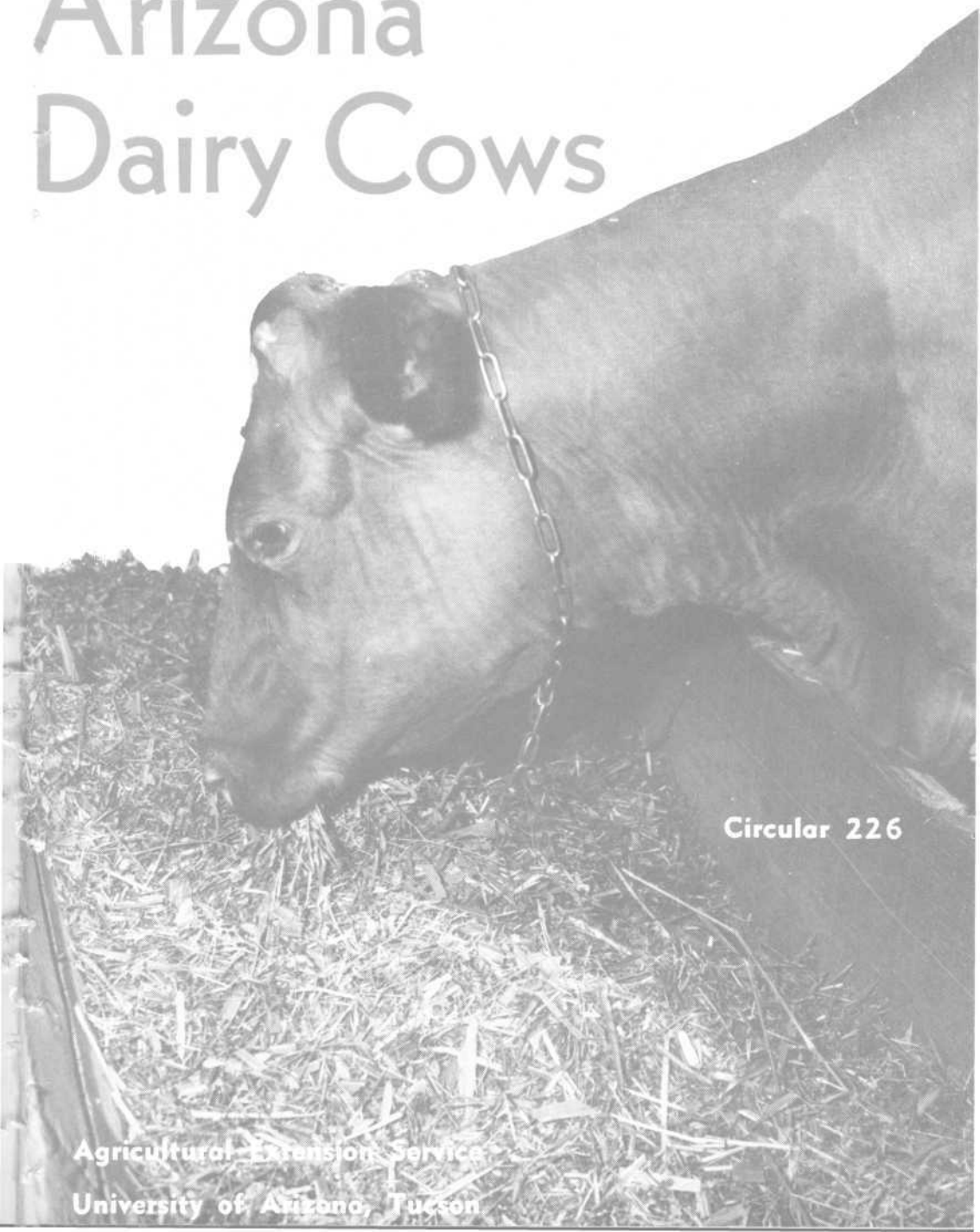
Feeding Arizona Dairy Cows



Circular 226

Agricultural Extension Service
University of Arizona, Tucson

Contents

University of Arizona
College of Agriculture Agricultural Extension Service
Chas U Pickrell Director
Cooperative extension work in agriculture and home economics the University of Arizona College of Agriculture and the United States Department of Agriculture cooperating Distributed in furtherance of the Acts of Congress of May 8 and June 30 1914

5M—May 1955—Circular 226

Feeding Arizona Dairy Cows

By W. R. Van Sant, Extension Specialist in Poultry and Dairying

Efficiency and economy are key factors to successful dairying.

To maintain dairying on a profitable basis, cost of production must be kept as low as possible. Many items such as labor, equipment, land, taxes, and feed enter into this cost. Of these, the dairyman is able

Proper feeding and management are essential for economical production.

to do more about feed than anything else.

A cow will not produce in excess of her inheritance. Yet feed, management, and health influence the expression of an animal's inheritance. A cow with inheritance for high production may be a low, uneconomical producer if inadequate and poor quality feed is used (especially low-quality roughage). On the other hand, best results cannot be obtained from plenty of high quality feed with cows of an inheritance of low production.

Information from dairy-herd-improvement association records shows how rapidly income over feed cost rises and how feed cost per hundred pounds of milk drops as the production level increases.

The producing efficiency of any dairy herd can be improved by the same basic methods that D.H.I.A. members have used to improve their herds—the adoption of sound culling, feeding, and breeding practices in herd management.

Every dairyman needs to feed his cows so that they will produce to the best of their ability at all times. The average production of dairy cattle in Arizona can be greatly increased by more careful feeding.

Feed Costs in Relation to Milk Production

Level of Milk Production	Value of Product	Feed Cost	Income Over Feed Cost	Feed Cost per 100 Pounds of Milk
Pounds	Dollars	Dollars	Dollars	Dollars
5,000[1]	269	135	134	2.70
7,000	356	152	204	2.17
9,000[2]	421	165	256	1.83
11,000	473	176	297	1.60
13,000	533	189	344	1.45
15,000	600	200	400	1.33
17,000	660	212	448	1.25

[1] *Approximate level of milk production of all cows milked in the United States.*

[2] *Approximate level of milk production of D.H.I.A. cows in the United States.*

How the Dairy Cow Uses Her Feed

There are two principal uses to which the dairy cow puts her feed. These are (1) maintenance, and (2) milk production.

Maintenance

The cow uses much of her feed to maintain body weight, to maintain body temperature, and to provide the energy for all organic and muscular activity. The feed used for maintenance obviously takes precedence over that used for production, and can be likened to overhead expense.

The amount required varies with the size of the cow. To maintain a cow weighing 1100 pounds will require a daily allowance of nutrients equivalent to about 18 pounds of good-quality hay, or 50 pounds of silage, or 12 pounds of grain. The amount of feed consumed above the maintenance requirements is used for milk production.

Production

The more feed a cow consumes and uses efficiently above her maintenance requirements, the less it costs to produce milk and butterfat. For example, the average milk cow of the United States (producing about 5,000 pounds of milk) uses two-thirds of her feed for maintenance and one-third for production. The average cow of dairy-herd-improvement associations (producing about 9,000 pounds of milk) uses only a little over half her feed for maintenance. The proportion of the total feed used for milk may vary from about 30 percent with low-producing cows to 60 percent or more with very high-producing cows.

The dairy cow is able to convert more of a given amount of feed into an edible food for man than any other animal. As she is a hard-working animal, she should not be expected to expend a large amount of energy in grazing poor pastures or in eating and digesting large quantities of low-grade roughages and yet produce efficiently and economically.

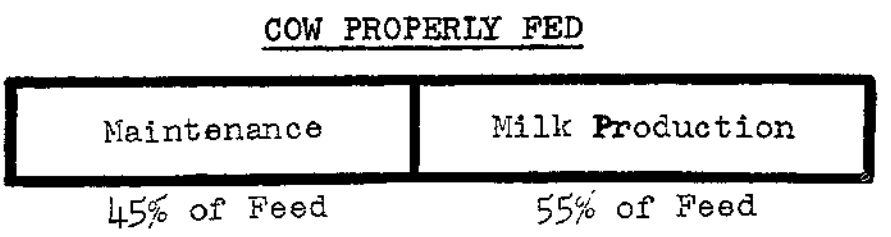
Minor Uses of Feed

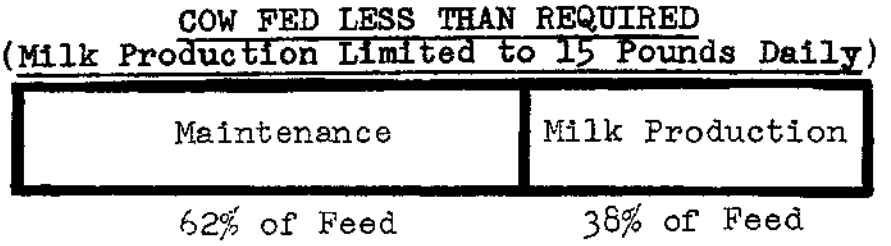
Dairy cows do not reach their full mature weight until they are about six years old. Ordinarily a cow makes some 200 or more pounds of growth after her first calving. About one-half of this is made in the interval between first and second calvings.

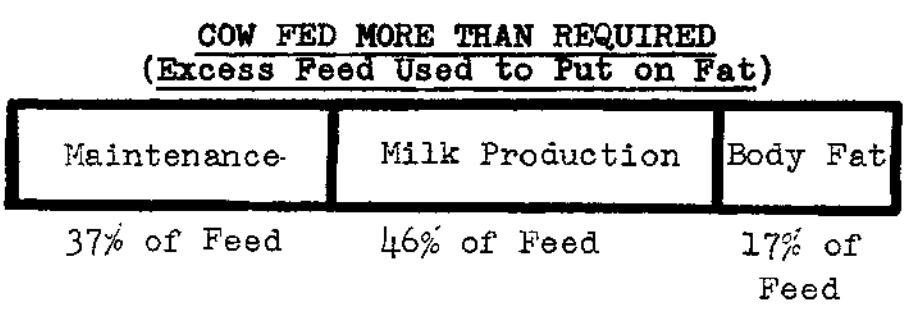
A gain of 100 pounds in body weight will require about 300 pounds of digestible nutrients. This amount would be contained in 400 pounds of a good grain mixture. First-calf heifers, therefore, should be fed an extra pound or more of grain a day during the first lactation to permit them to make a normal growth.

Some of the feed is used for the development of the fetus. Feeding is important during the dry period

Utilization of Feed by 1000-Pound Cow Capable of Producing 30 Pounds of 4% Milk Daily







when the greatest development of the fetus takes place.

Dairy cows ordinarily use some of their feed to make body fat during the latter part of the gestation period. This fat is drawn on for a few weeks after calving when the cow's feed consumption is not proportional to her milk production.

The cow uses feed first to meet body maintenance requirements. Economical feeding requires that the cow be given all the feed she will need for maintenance and for milk production.

Feeding less than required results in decline in milk production. Feeding too much is uneconomical as the cow will put on body fat, but will not increase production. Over feeding in the late lactation period is desirable as it allows the cow to replenish her body reserves for the ensuing lactation.

Roughages for Dairy Cows

Large amounts of roughages such as hay, silage, green chop (soiling crops or soilage) and pasture should be fed to all dairy animals. The better the quality of roughage, the more the animals will eat and the less grain they require. It is essential not only to grow an abundance of roughage crops, but also to harvest or graze them when they are most nutritious and to preserve the nutrients.

Hay

The importance of good hay cannot be over-emphasized. Good hay is that which has been cut early and cured in such a way that most of its leaves and much of its natural green color are retained.

Such hay contains more protein, less fiber, more carotene, more leaves, and fewer stems than poor hay. It is also more palatable. The calcium of green-cured hay is more completely used than that of hay which has become discolored through exposure to dew or rain.

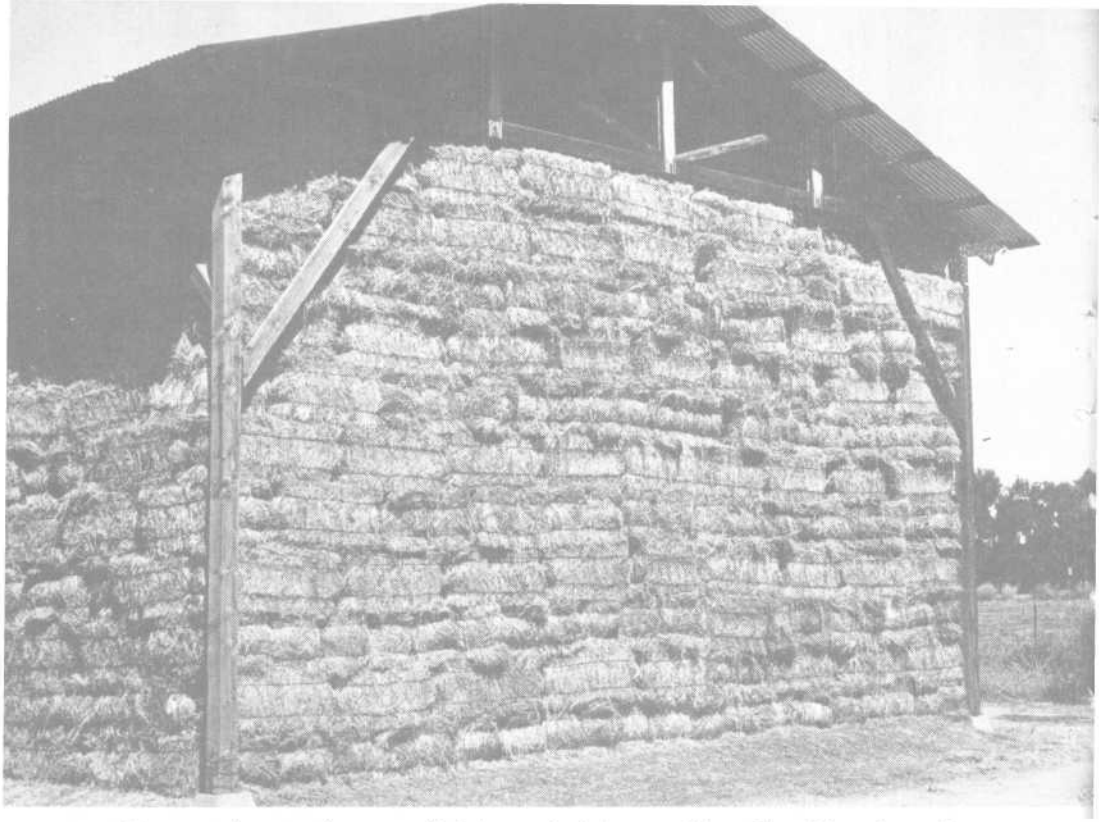
Alfalfa gives the largest yields of high-grade hay if it is cut when one-tenth to one-quarter bloom (just beginning to bloom). At that stage about half the total weight and three-fourths of the protein is in the leaves. Loss of leaves means a reduction in the protein content of the remaining hay.

Alfalfa leaves have about two and one-half times as much protein as in the stems. The protein in the leaves is more digestible than the

Effect of Stage of Maturity on Yield of Alfalfa and on its Milk-Producing Value*

	State of Maturity When Harvested		
	Initial bloom	Half bloom	Full bloom
	Pounds	Pounds	Pounds
Yield from hay per acre			
Dry matter	7,896	7,778	6,061
Total Digestible Nutrients	4,670	4,413	3,269
Digestible Protein	1,106	1,106	722
Milk Producing value, per acre			
Production of 4% fat-corrected milk	6,330	5,254	3,970
Hay consumed by experimental cows			
Per cow per day	40.6	41.0	40.9
Per pound of butterfat produced	36.8	44.5	45.4

**From Dawson, J. R. et al. Yield, Chemical Composition and Feeding Value for Milk Production of Alfalfa Hay Cut at Three Stages of Maturity. U.S. Dept. Agr. Tech. Bull 739. 52pp illus. 1940.*



Proper storage is essential to maintain quality. It will reduce losses in feed value and waste.

protein in the stems. Haying methods that save leaves help to retain far more food nutrients than the saving in weight would indicate.

Maturity

For best results, cut crops to be used for hay at a relatively early state of maturity. The table (page 7) shows that the best time to cut alfalfa is during the initial bloom (1/10 to 1/4 bloom). This helps preserve total digestible nutrients (TDN) and digestible protein yield, and therefore increases milk-producing value. Data in the table are from tests made by the U.S.D.A.

Methods of Harvesting

The time-honored method of harvesting forage is to field-cure it as hay. This method is effective when hay-curing weather is good. However, when harvesting is subject to rain during hay-making, considerable losses may result from leaching, bleaching, and leaf shattering.

Among harvesting methods used to overcome the hazards of weather is the making of silage. Silage making offers the most practical and economical substitute for field curing.

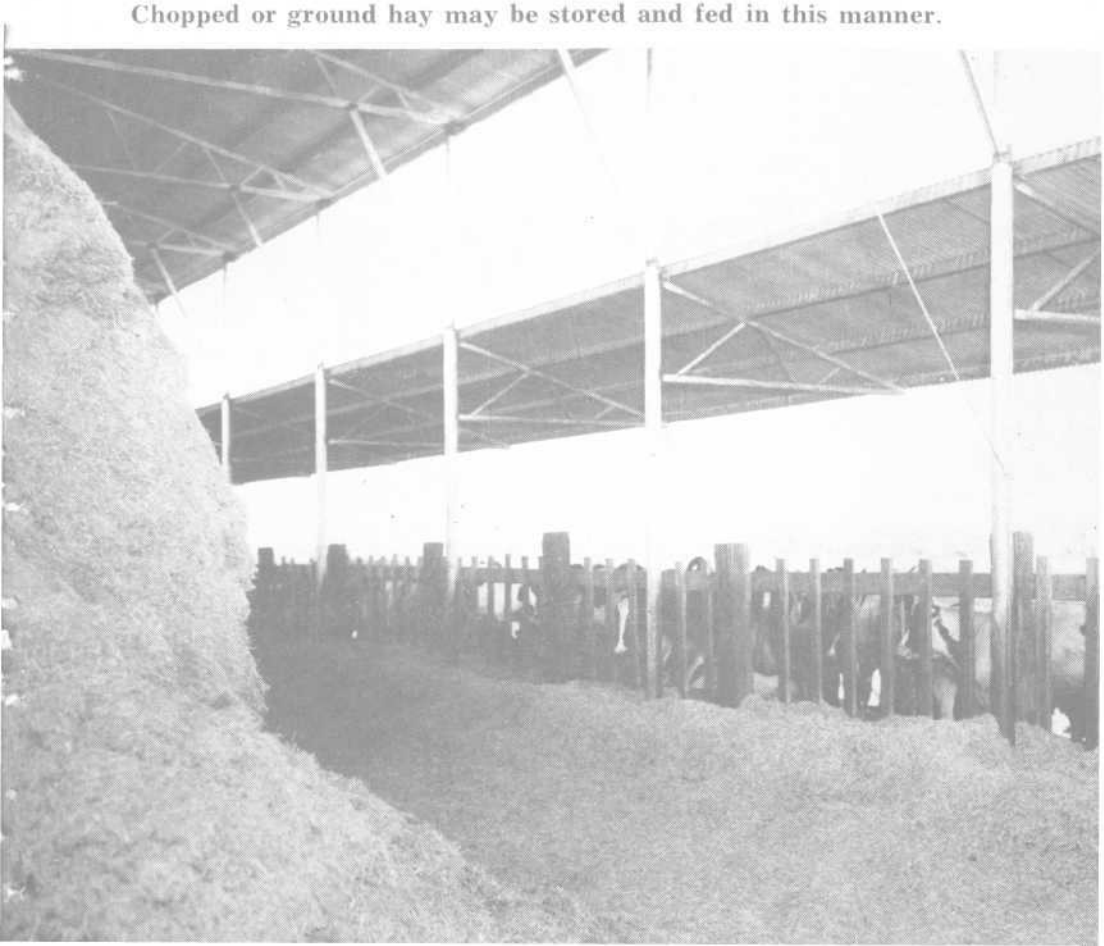
Silage has an advantage over hay in two ways. (1) More of the nutrients are saved in the field; and (2) The product is frequently more nutritious providing the crop is properly ensiled.

Dry Matter and Protein Preservation in Alfalfa by Two Methods of Harvesting*

	Crop as cut	Crop Preserved for Feed As		
		Silage	Field-Cured Hay	
			No rain	Rain
	Percent	Percent	Percent	Percent
Dry Matter Preserved	100	84	75	60
Protein Preserved	100	84	69	49

**From Moore, L. A. New Values in Good Hay and Silage for Dairy Cows. B.D.I. Inf. 117. 1951.*

Chopped or ground hay may be stored and fed in this manner.



Ground or Chopped Hay

Ground or chopped hay has about the same feeding value as regular hay. Grinding or chopping decreases waste by utilizing stems and leaves together, but does not increase the digestibility or palatability of the hay.

Desirability of grinding or chopping hay depends upon the equipment on hand, labor, storage space, and supply of roughage. Finely ground hay may cause impaction of the rumen. Grinding hay increases the overall feed cost.

All dairymen who buy or sell hay should be able to determine by observation the quality of various classes and grades of hay, as given in the United States Department of Agriculture Handbook of Official Hay Standards. See your County Agricultural Agent for a copy of Official Hay Standards.

Hay Requirements

Hay is one of the cheaper feeds produced on the farm. Since dairy cows are well adapted to its use, it should be fed in large amounts. The amount that a cow will eat, however, depends upon the quality of the hay and the amount of other feed.

Because of its bulky nature, hay alone cannot be consumed by cows in sufficient quantity to produce maximum amounts of milk. It usually is fed with concentrates or in combination with other roughages and concentrates. Ordinarily, a moderate grain ration with fairly heavy roughage feeding is to be recommended.

The general rule for feeding hay is to feed all the cows will clean up. As stated before, the amount that they consume depends upon the quality of the hay and the amount

For best results feed hay daily. The amount will vary with the amount and kind of other roughages fed.

and kind of other feeds.

Too many dairymen overlook the quality factor in feeding hay and fail to recognize the fact that dairy cows will not clean up poor quality hay. Therefore, they are not getting all the nutrients needed for maximum production.

It is necessary to feed more of the poor quality hay and remove from the feed mangers the portion which is refused by the cow. It never pays to force the dairy cow to clean up when feeding hay of poor quality.

Additional grain will be necessary when feeding poor quality hay to make up for the lack of nutrients that a good quality hay provides. When fed with corn or hegari silage and a full grain ration, cows will consume about 1½ pounds of hay and 3 pounds of silage for each 100 pounds of live weight.

When alfalfa hay is fed without silage and a full grain ration, cows will consume about 2½ pounds of hay to each 100 pounds of live weight. One pound of hay is equivalent to about 3 pounds of hegari or corn silage in digestible nutrients, but the legume hay contains more protein. Therefore, 1 pound of hay can be substituted for 3 pounds of silage.

When fed without silage but on a limited grain ration, cows will consume as much as 3 to 3½ pounds of hay to each 100 pounds of live weight.

The consumption figures are simply guides that you might use in figuring the amount of hay necessary under different feeding methods.

The experience of Arizona dairymen has shown that 2 to 3 tons of alfalfa hay per cow in storage on October 1 will provide sufficient amount to carry through until the first cutting is harvested in the spring.

Pasture

Pasture is the natural and ideal feed of dairy cattle. Good pasture is palatable, nutritious, and economical. Pasture furnishes the right kind of nutrients for good health, production, and reproduction.

Forages at the pasture stage of maturity are more palatable than the same plant when mature. Also, the dry matter is more digestible and contains a higher percentage of protein, minerals, and carotene.

At the National Agriculture Research Center, Holstein cows consumed over 150 pounds of pasture grass a day. This furnished enough nutrients to maintain the body and produce 45 pounds of milk, testing 3.5 percent fat.

The quality of the pasture must be good at all times. Many dairymen fail to recognize this fact, and milk production decreases.

There is an advantage in feeding hay or grass silage to cows on pasture. This practice will encourage cows to eat more roughage. Also, as the feeding capacity of pastures declines, cows will eat more hay or silage, thus maintaining a higher level of production.

Hay fed on pasture may be a factor in maintaining body condition as well as in controlling bloat. Furthermore, cows crave dry roughage when on pasture.

The experience of Arizona dairymen has shown that the following

If you are following a pasture program, good pasture is essential to maintain efficient and maximum production.

Greater yields and more pasture days are obtained by rotational grazing by the use of an electric fence.

program is very efficient in maintaining maximum production:

(1) Rotational pasturing of milk cows, (followed with dry stock and heifers) two to three hours per day following the morning milking.

(2) All the good quality alfalfa hay that they will eat.

(3) A simple grain ration fed according to production.

Soiling Crops (Green Chop)

Soiling crops are green feeds that are harvested and fed instead of being grazed. This practice is becoming the accepted method of harvesting all kinds of pasture crops in the main dairy sections of Arizona.

The 1954 Dairy Herd Improvement report showed half of its membership feeding green chop. This "revolution" in pasture management has been made possible by machinery improvement so that only a limited amount of labor is involved.

Advantages of Green Feeding

The principal advantages of using green chop are as follows:

1. Increased yield. Forage is not trampled or soiled by urine and feces. All forage is consumed, as compared to selective grazing when crops are pastured.

When a few borders are cut, that portion of the field can be irrigated allowing regrowth to start immediately. This allows about two extra cuttings per year on alfalfa. Increased yields have been reported to be 25 to 35 percent greater than when pastured.

2. Uniform feed. Quality and quantity of feed are more uniform from day to day than pasture.

3. Costly fencing can be eliminated to a greater extent.

4. Better control of irrigation is possible.

5. Ditch banks and borders are not damaged.

6. Frequent cutting aids in weed control.

7. A good water supply and shade are more easily provided.

8. Cattle can be watched more closely for bloat.

9. Manure can be spread evenly over the field and on the field where it is needed.

10. One rather intangible advantage, and a very important one, is the fact that green feeding forces the dairyman to plant and manage crops so that he will receive good forage yields.

This is not always the case with pasture. He may send his dairy cows out to look for forage when little is available, but if he goes out to cut with a forage harvester and the yield is low, he will usually do something about it.

Disadvantages of Green Feeding

The principal disadvantages of a green chop feeding program are as follows:

1. Coordinating the feed needed and a forage crop production program at the best stage of growth

Harvesting a good crop of green chop.

Feed green chop in combination with alfalfa at the rate of one pound of alfalfa hay and 6 pounds of green chop per 100 pounds of body weight.

for cutting and feeding is a problem.

2. Use of low producing land is not profitable. High production per acre is essential in the efficient use of machinery.

3. Investment in machinery is high. In order to hold labor at a minimum and to handle a green feeding program properly, the dairyman will need a forage harvester, mechanical unloading feed wagon, and tractor.

4. Breakdowns are a problem. Many large dairymen find it necessary to have an extra forage harvester and feeding wagon so that the feeding operation can be maintained while repairs are made.

5. This feeding program is not

well adapted for use by the small dairymen due to the high machinery costs.

Some dairymen expect the green feeding program to fit into their old system with very little or no change. This very seldom works satisfactorily, as the timing and coordination of crops have to be more carefully planned than with pasturage.

The program works best when the dairyman considers first his land. He works out a definite rotation for the basic crops to be used for green feeding.

The green feeding program and silage work together very well. The green feed equipment is ideal for making grass silage as most of the silos are the trench type. Also, when the crops are growing faster than can be used as green feed, they can be harvested as silage. Then, the silage will fit into the feeding program much better than other feeds when green feed is not available.

On green feed alone, dairymen have reported a maximum daily consumption of 125 to 150 pounds per cow. However, the feeding of green feed alone is not desirable. For the best results, some hay must be fed. Experience of Arizona dairymen indicates that a feeding of 8 to 12 pounds of hay with green feed gives the best results.

The value of green feed is figured on the basis of 4 pounds of green feed equaling 1 pound of good quality alfalfa hay. Therefore, a combination of 1 pound of alfalfa hay and 6 pounds of green feed per 100 pounds of live weight can be recommended.

Silage

The preservation of feeds by means of the silo has several advantages when properly ensiled.

(1) The silo offers the one means of taking the entire forage plant from the field and preserving it in a succulent form. A crop can be harvested and stored at the stage of development when it has the greatest milk-producing value.

(2) More feed nutrients can be grown per acre.

(3) Less waste results when crops are put into the silo than when they are handled in the dry state.

(4) The crop can be harvested and stored as silage cheaper, quicker, and with less labor than in other methods of harvesting. This is because most of the work is done with machinery and the crop is handled but once.

(5) Feed stored as silage is not subject to fire hazards as is hay.

(6) Practically any green forage crop is suitable for ensiling.

(7) The use of the silo makes saving of the hay crops possible, even under unfavorable weather for hay.

(8) Silage provides a succulent feed at all times of the year.

(9) A silage program will fit in with the green chopped feed system to store excess feed produced for green feed.

Crops for Silage

All of the forage crops grown in Arizona have been successfully

Harvesting corn for silage.

made into silage. Small grains make a sweet smelling, palatable silage. They should be ensiled while in the soft dough stage. No preservative is necessary. Packing to exclude air may be difficult due to air being trapped in the hollow stems. Thorough packing from the start is necessary.

Sudan grass makes good silage. It should be ensiled when in the boot or when the first heads appear. If cut too early, the silage tends to be slimy. If it is cut when too mature, palatability and feed value are reduced. Dairymen report good milk production from sudan silage, but cows have a tendency to lose body weight unless adequate grain is fed. No preservative is necessary.

Alfalfa makes an excellent silage if a preservative is used and if the crop is properly ensiled. The proper stage to cut alfalfa is in the early bloom stage (1/10 to 1/4 bloom).

There are several conditions when it would seem advisable to make silage out of alfalfa.

1. Summer cuttings of alfalfa make less desirable hay, but have given good results when made into silage. Some dairymen report palatability increased over the same crop fed as "green chop."

2. Small grains grown in depleted alfalfa stands may meet winter pasture or green feed requirements. However, if winter requirements are met, much surplus forage is produced in the spring. This can be converted into high quality silage. This type of program allows the first and last cuttings of alfalfa to be made into high quality hay.

Corn and hegari give satisfactory yield and quality silage. These plants are high in available sugars, so that normal fermentation takes place without the addition of preservatives. The making of corn or hegari silage is easier than from alfalfa, small grains, and grasses.

Good silage, however, cannot be made out of a poor forage.

Feeding Silage

Hay-crop silage is lower in total digestible nutrients and net energy than good corn or hegari silage with the same amount of dry matter. But it is higher in protein, minerals, and carotene. Because of its higher protein content, less protein

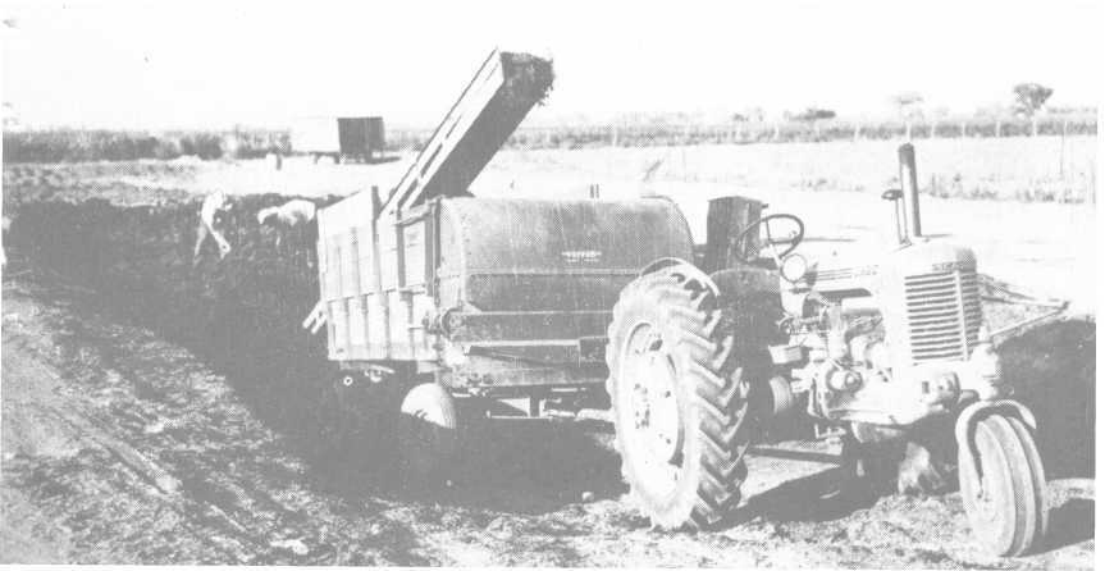
Thorough packing of the crop is essential to get quality silage.

is needed in the grain mixture.

The amount of silage fed to cows depends upon the amount available and also upon the size of the cow. Usually it ranges between 20 and 40 pounds. The general rule is to feed it at the rate of 3 pounds silage and 1½ pounds of hay for each 100 pounds of live weight. Experiments have shown that 3 pounds of silage can be substituted for 1 pound of hay and fed with about equal results.

Crops for silages are profitable

Loading alfalfa silage into feed wagon.



For best results feed 3 pounds of silage and 1½ pounds of hay for each 100 pounds body weight per day.

to grow if the cost per ton of silage is not more than one-third that of good quality alfalfa hay. Exceptions to this favor silage on the saving of crops that would otherwise be lost by bad weather and the utilization of forages that would not make good quality hay.

Alfalfa Pellets

Dehydrated alfalfa pellets are being fed by many Arizona dairymen. The principal advantage of alfalfa pellets is the uniformity in quality and total digestible nutrients.

Research has shown that cows fed alfalfa pellets to supplement poor-quality hay have produced more milk than those receiving other roughages. The difference in production is credited to a higher intake of digestible protein.

Whether dairymen can profit by feeding alfalfa pellets depends on the price of the hay, the concentrates, and the milk. If the cost of the pellets is about mid-way between that of good quality hay and feed concentrates, adding pellets to the ration will probably pay. The milk price, of course, helps determine whether the income from the extra milk produced will outweigh the cost of the pellets.

Dehydrated alfalfa pellets also benefit young dairy calves as a source of roughage and carotene to supplement starter pellets. Best results have been obtained when pellets were fed at about 18 percent of the ration.

Usually, practical rations can be worked out for dairy cows and calves, especially to supplement poor quality hay.

Concentrate Feeding

The main purpose of feeding concentrates is to provide each cow with nutrients adequate in quantity and quality to maintain efficient production at the maximum level of which she is capable. Cows producing 25 pounds of butterfat a month, or 250 pounds a year, can obtain all the nutrients needed from roughage, if given all the good quality hay, pasture, green chop, and silage they will eat

But cows capable of producing more than 30 pounds of fat a month may not be able to eat sufficient bulky roughage to furnish enough nutrients to maintain high production. It is necessary to vary the concentrate feeding with the production of each cow

How to Compound Rations

To simplify the compounding of rations, roughages may be divided into three general classes. These are (1) protein roughages, including the legume hays, silages, and all green pastures or green chop; (2) carbonaceous roughages, which are the grain hays and sorghum or corn silages; and (3) mixed roughages or those made up of such combinations as alfalfa hay and hegari silage or oat hay.

Since roughages usually are lower in cost than concentrates, it is desirable to provide an ample supply of a good-quality roughage at all times. If a poor quality roughage is used, a more liberal feeding of concentrate mixture is necessary

Rules for Concentrate Mixture

The primary purpose of feeding concentrates is to supplement the roughage. Each concentrate mixture should furnish, at lowest possible cost, the nutrients in which the particular roughage may be deficient.

A good dairy cow ration should not only be economical, but it should contain sufficient protein of good quality, a minimum amount of indigestible material, variety, bulk, and common salt.

To insure these desirable ingredients, the following rules have been designed for compounding grain mixtures.

1. When a protein roughage is being fed, the amount of crude protein required in the grain mixture is 14 to 16 percent.

2. For supplementing mixed roughage, the proportion of crude protein required in the grain mixture is 16 to 18 percent.

3. With a carbonaceous roughage, 18 to 20 percent of crude protein in the grain mixture is required.

4. In order to insure the proper bulk, each concentrate mixture should weigh 1 pound to the quart

5. The feeds comprising the concentrate mixture should be derived from at least four plant sources, each of which should be present to the extent of at least 10 percent and

no one to more than 50 to 60 percent

6 The minimum of total digestible nutrients should be approximately 1400 pounds per ton of feed

7 Each ton should contain 20 pounds of salt

Grains to Use in Ration

The economy of a ration is determined by the cost per pound of digestible protein and total digestible nutrients (TDN) The TDN cost is the most important in formulating a ration

By using the table on page 28 and bringing it up to date with current feed prices, the cost of the ingredients in a ration can be determined

The Protein Method

Balancing rations for the dairy herd by the protein method is an easy, simple way of making a grain mixture to be fed with a certain kind of roughage or roughages The method gets its name from the fact that the protein content of the grain mixture is varied to fit a particular kind of a roughage-feeding program

In figuring a grain mixture, the amount of crude protein to be included is determined as follows

1 When the roughage is alfalfa hay, or alfalfa hay and pasture or green chop, the amount of crude protein required in the grain mixture is 14 to 16 percent

2 When the roughage consists of mixed hay or alfalfa hay with hegari or corn silage, this proportion of crude protein required in the grain mixture is 16 to 18 percent

3 When the roughage contains no alfalfa hay, but consists entirely of silage fodder, sudan grass oat or barley hay 18 to 20 percent of the required crude protein should be provided in a grain mixture

Example: Let us assume that we have a good-quality alfalfa hay and hegari silage for roughage The cheapest grains according to the results figured by using the table on page 28 "Determining Comparative Costs of Digestible Protein and Total Digestible Nutrients," are rolled barley, rolled hegari, wheat bran, cottonseed meal and dried beet pulp With that kind of roughage (see 2 above) a grain mixture containing 16 to 18 percent crude protein is required

By referring to the tables (pages 29 and 30), "Nutrients in Various Dairy Feeds " you can compute the proportion of each concentrate needed

The grain mixture shown on page 21 can be used as a guide in formulating a satisfactory concentrate.

Amount to Feed

Economical feeding demands that all cows be fed in accordance with their individual production The general principle of feeding dairy cows according to individual production has been well demonstrated to result in higher average production with lower feeding cost

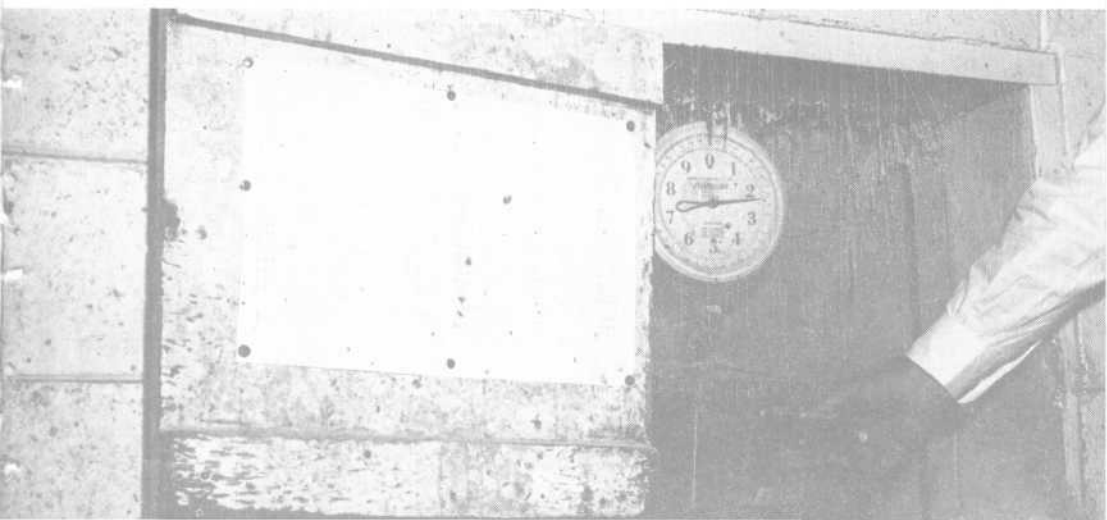
It is impossible to feed with economy where all cows are given the same amount Under such condi-

Grain Mixture

Feed Used in Grain Mixture	Amount Used in Grain Mixture lbs.	Amount of Crude Protein	
		in 100 lbs. of feed	in amount of feed in mixture
Rolled barley	600	12.7	76.2
Rolled hegari	400	9.6	38.4
Wheat bran	400	16.9	67.6
Cottonseed meal (43%)	360	43.9	158.0
Dried beet pulp	200	9.2	18.4
Salts	20	—	—
Steamed bone meal	20	—	—
	2000 lbs.		358.6 lbs.

358.6 divided by 2,000 equals .1793; multiplied by 100 equals 17.9 percent crude protein in grain mixture.

Feed the grain mixture according to production. The list of cows and amount to feed each cow is posted on the door of the grain bin. The amount is easily weighed.



tions, feed is wasted in two ways: (1) good cows do not receive enough to enable them to maintain maximum production and body weight; and (2) poor cows receive more feed than they need. Only those cows in the middle range would receive the approximate amount they should have.

There is no mathematical formula which will make it possible to feed all cows accurately, since careful attention must be given to the physical condition of the cow as well as to her production record and stage of lactation, to secure best results. The feeding programs shown below may be used with a fair degree of accuracy.

These rules for feeding according to the amount of fat produced apply quite accurately to all breeds of dairy cattle. They are well adapted for use of herds that are following a production testing program. When cows receive all of the good quality roughage that they will consume, the following grain feeding programs have proved satisfactory.

Grain Feeding Program

Method 1. A method which has been quite successful and follows the level of production closely is as follows: First, subtract 25 from the number of pounds of butterfat produced per month, and divide the remainder by 2 to arrive at the amount to feed per day.

Under this plan, more concentrates will be fed at the higher levels of production and a lesser amount will be fed at the lower levels of production.

Method 2. Where a normal relationship exists between prices of the roughages and concentrates, divide by 5 the number of pounds of butterfat produced monthly to arrive at the number of pounds of concentrates to feed daily. When the price of concentrates is high compared with roughage, divide by 6, and when the concentrates are cheap, divide by 4.

With the above method, the amount of concentrates given at the higher levels of production is somewhat inadequate to provide for extremely high production and, at the same time, maintain body weight. At the lower levels of production, the amount of concentrates tends to be somewhat high compared with the level of production.

Method 3. Where no testing is done, and the dairyman desires to feed according to production of milk, the following rules may be used. With Holsteins, 1 pound of grain per day can be given for every 4 pounds of milk produced daily above 20 pounds. With Jersey and Guernsey, 1 pound of grain may be given daily for every 3 to 4 pounds of milk produced above 15-18 pounds.

Method 4. Many dairymen feed grain according to the following milk yield. For Holsteins or Ayrshires, feed about 1 pound of grain for each 4 to 6 pounds of milk. For Jersey or Guernsey, feed about 1 pound of grain for each 3 to 5 pounds of milk.

Some dairymen provide a maximum of around 12 to 14 pounds of concentrates daily above which

they do not go regardless of production. Such a plan is desirable because some cows are not able to handle satisfactorily larger quantities of concentrates. With high production, cows will lose flesh which can be put back on during the latter stages of their lactation by giving consideration to their physical condition as well as to production in the amount of concentrates fed.

Measuring the feed with a scoop.

Measuring Feed

It is not necessary to weigh the feed for each feeding. A simpler way from a labor standpoint is to use a feeding scoop of known capacity. If the scoop holds approximately 2 pounds of grain, then 2 scoops can be given when a cow is to be fed 4 pounds at each feeding. Many dairymen prefer a scoop that automatically weighs the feed.

There are several methods of individual feeding of dairy cows. When cows come into the same stanchion at each milking, follow the simple procedure of indicating (with a piece of chalk or other marker such as a card) on a convenient holder on the front of the stanchion the number of scoops to be given to the cow.

After the tester's visit each month, the amount can be changed easily. In the milking parlor, a list of the herd with the amount to be fed each cow is placed near the feed bin or container.

Where cows are handled in large groups and do not come into the same stanchions, it may be necessary to mark each cow. One of the most satisfactory methods is to fasten a numbered chain around the cow's neck. The number on the neck chain is then listed on a chart with the amount to feed the cow.

Another system is to group the cows according to production and use celluloid chicken leg-bands of different colors fastened to the neck chains to indicate the number of scoops to feed.

Such systems have been highly successful in reducing the cost of concentrates and in increasing production—thereby lowering the cost of feed per pound of milk or fat.

Commercial Feeds

According to Arizona state law, all commercially mixed feeds must be registered and tagged with the minimum percent of protein, fat, and the maximum percent of fiber. Furthermore, the feed tag must indicate all the ingredients which the feed contains.

On the feed tags of commercial feeds, protein is tested as crude protein. To estimate the approximate amount of digestible protein present, multiply the total crude protein by 0.75.

Fat content of a feed mixture is important because a pound of digestible fat furnishes 2¼ times as much energy as a pound of digestible carbohydrates.

Ordinarily, the higher the fiber content, the lower is the nutritive value of the feed. A feed containing 10 percent fiber will supply more digestible nutrients than one containing 14 percent. If a 16 percent protein feed with 10 percent fiber content costs $4.00 per hundred pounds, a 16 percent protein feed with 14 percent fiber would be worth only $3.60 per hundred pounds in value of total digestible nutrients.

Feeding The Dry Cow

Cows normally lose weight for 3 to 6 weeks after calving, because they cannot eat enough feed to provide for both the milk flow and the maintenance of body weight. In order that they may not become too thin after calving they must carry considerable flesh at calving time. Cows in good condition at calving time will start the lactation period at a higher level of production than will thin cows. This results in a larger yield of milk for the year.

Cows need a reserve of body tissues on which to draw until they recover from the effects of calving. There is no economy in having cows thin at calving time. The value of the additional milk yielded by cows in good condition will more than offset the cost of the feed required to put them in good condition.

Dry cows can be fed the same roughage as if in milk. With good roughage, such as alfalfa hay, silage, green chop or pasture, the cow will put on considerable flesh. A cow properly fed throughout her lactation, and given all the good quality roughage that she can eat during her dry period, may not need any grain. However, if she is thin or the roughage is not of good quality, it becomes necessary to feed some grain. The amount will depend on the individual need.

There are two approaches to feeding grain during the dry period. One is to feed grain rather heavily during the later part of the lactation and feed less grain during the dry period, merely maintaining the cow in satisfactory condition. The second method is to feed grain according to milk production during the declining stages of lactation and then feed more heavily during the dry period.

While both methods are satisfactory, the first enables cows to produce a few extra pounds of milk toward the end of the lactation. Also, it will eliminate the necessity

of feeding grain during the dry period when an abundance of good quality roughage is fed.

About one week before calving the concentrate allowance is discontinued.

The Cow At Calving Time

Keep the cow under close observation during the last ten days before her expected calving date, because she may need special attention when calving. Provide feed and water as usual up to calving time.

Place the cow in clean, well-bedded calving quarters a few days before the expected date of calving.

A warm bran mash given just after calving may help to keep the digestive system functioning properly. Unless complications interfere, it is important to get cows in full feed as soon after calving as is reasonably possible.

After the calving day, increase the grain gradually. About three weeks is required to get high producers on their required feed allowance.

General Rules For Feeding

1. Provide two to three hours good pasture per day, allow the cows to eat all the good alfalfa hay that they will eat, and feed a simple grain mixture according to milk production, for the most efficient and economical milk production.

2. If roughage is plentiful and comparatively cheap, feed all that the cows will clean up. If cows are getting alfalfa hay without grain, they will eat 2½ to 3 pounds of hay per 100 pounds of live weight. If in addition, they are fed silage, they will eat only about 1½ to 2 pounds of hay per 100 pounds of live weight.

3. Feed the grain mixture in proportion to the amount of milk yield. For a Jersey or Guernsey, feed about 1 pound of grain for each 4 or 5 pounds of milk. For Holstein or Ayrshire, feed about 1 pound of grain for each 5 or 6 pounds of milk.

4. Give the cows some succulent feed, either silage, pasture, or soiling crop. Cows will eat from 20 to 45 pounds of silage, average about 30 pounds.

5. Feed the cows three times as much weight of soiling crops as of dry roughage.

6. Watch the condition of the cows. If they tend to fatten, cut down on the grain ration. If they become thin in flesh, increase the amount of grain.

7. Make fresh water accessible to the cattle at all times. Salt should be available daily.

8. Feed regularly and make changes gradually. A radical change in the amount or kind of feed, if made suddenly, will likely produce indigestion and cause a shock to the nervous system.

Grain Mixtures

In making grain mixtures, consider the kind of roughage fed and the comparative market price of feeds (see table, page 28). If no alfalfa hay or pasture is provided, more protein will be required in the grain ration.

Any shortage of protein in the total ration will reduce the production of milk. Therefore, it is important to have enough protein in the grain mixture to make up for any deficiency in the roughage.

Grain mixtures of about 14 to 16 percent crude protein to be fed with alfalfa hay or pasture:

No. 1	No. 2
300 lbs. Rolled barley	600 lbs. Rolled barley, hegari or milo
130 lbs. Rolled hegari or milo	
200 lbs. Wheat bran	200 lbs. Wheat bran
150 lbs. Citrus meal or beet pulp	
150 lbs. CSM (43%)	100 lbs. CSM (43%)
50 lbs. Molasses	10 lbs. Salt
10 lbs. Salt	
10 lbs. Bone meal or deflournated phosphate or commercial mineral (15.9 to 16% crude protein)	10 lbs. Bone meal or deflournated phosphate or commercial mineral (14.1 to 16.3% crude protein)

Grain mixtures containing 16 to 18 percent crude protein to be fed with alfalfa hay and silage:

No. 3	No. 4
300 lbs. Rolled barley	200 lbs. Coconut meal (Copra)
230 lbs. Rolled hegari or milo	150 lbs. CSM (43%)
200 lbs. Wheat bran	225 lbs. Rolled oats
150 lbs. CSM (43%)	50 lbs. Rolled barley
100 lbs. Citrus meal or beet pulp	250 lbs. Wheat bran
10 lbs. Salt	100 lbs. Molasses (Blackstrap)
10 lbs. Bone meal or deflournated phosphate or commercial mineral (16.3 to 17.3% crude protein)	10 lbs. Salt
	10 lbs. Bone meal or deflournated phosphate or commercial mineral (18.7% crude protein)

Grain mixtures containing 18 to 20 percent crude protein to be fed with non-legume roughage such as barley hay, mixed hay, and silage:

No. 5	No. 6
200 lbs. Wheat bran	200 lbs. Wheat Bran
250 lbs. Rolled barley	250 lbs. Rolled barley
200 lbs. Rolled hegari or milo	250 lbs. Rolled hegari or milo
150 lbs. CSM (43%)	200 lbs. CSM (43%)
100 lbs. Citrus or beet pulp	100 lbs. Citrus or beet pulp
100 lbs. Rolled oats	10 lbs. Salt
100 lbs. Coconut meal (Copra)	10 lbs. Bone meal, deflournated phosphate or commercial mineral (18.7% crude protein)
10 lbs. Salt	
10 lbs. Bone meal, deflournated phosphate or commercial mineral (19.3% crude protein)	

Determining Comparative Cost of Digestible Protein and Total Digestible Nutrients

Feed	Price Per 100 lbs.	Digestible Protein		Digestible Nutrients	
		Percent	Cost of One Pound (cents)	Percent	Cost of One Pound (cents)
Barley (Rolled)	3 35	10.0	33.5	78.7	4.3
Beet Pulp	4.10	4.3	95.3	67.8	6.0
Citrus Pulp	3.75	2 5	150.0	74.4	5.0
Coconut Oil Meal	5.00	18 1	27 6	77.7	6 4
Corn No. 2 dent	4.50	6.6	68.2	80.1	5.6
Cottonseed meal (43%)	4.00	36.4	10.9	75.8	5.3
Hegari	3.35	7.5	44.7	80.5	4.2
Molasses (Cane)	1.95	0	—	54.0	3.6
Oats	4.65	9.4	49 5	70.1	6.6
Wheat	4.85	11.1	43.7	80.0	6.1
Wheat Bran	3.75	13.7	27.4	67.2	5.8
Alfalfa Hay	1.60 ($32.00 per ton)	10.5	15.2	50.3	3.2
Green Chop (Alfalfa)	.40 ($8.00 per ton)	3.4	11.8	14.7	2.7
Silage (Hegari)	.50 ($10.00 per ton)	1.0	50.0	18.7	2.7
Pasture (Alfalfa)	.25 per day (100 lbs.)	3.4	7.3	14.7	1.7

These figures can be brought up to date any time by securing the current feed prices and substituting in column two under "Price per 100 lbs." The following example shows how correction can be made. There are 10.0 pounds of digestible protein in every 100 pounds of rolled barley. Therefore, $3.35 divided by 10 equals 33.5 cents, the cost of one pound of digestible protein, and $3.35 divided by 78.7 equals 4.3 cents, the cost per pound of digestible nutrients.

Nutrients in Various Dairy Feeds

Feed	Total Dry Matter (percent)	Total Protein (percent)	Digestible Protein (percent)	Total Digestible Nutrients (percent)
CONCENTRATES				
Alfalfa-molasses feed	86.0	11.4	5.4	52.1
Alfalfa seed screenings	90.3	31.1	26.1	81.0
Barley, Common	89.4	12.7	10 0	77.7
Beet pulp, dried	90.1	9.2	4.3	67.8
Citrus pulp, dried	90.1	5.9	2 5	74 4
Coconut oil meal (copra)	93.2	21.3	18 1	77 7
Corn, dent, Grade No. 2	85.0	8.6	6 6	80.1
Corn gluten feed, all analyses	90.9	25.5	21.9	76.0
Cottonseed, Whole	92.7	23.1	17 1	90.8
Cottonseed meal, 45%	93.5	46.2	37 9	78.4
Cottonseed meal, 43%	92.7	43.9	36.4	75.8
Hegari grain	89.7	9.6	7.5	80.5
Linseed meal, old process, 37%	90.9	38.0	33.1	77.4
Manamar	93.8	40.9	31.9	51.9
Milo grain	89.4	11.3	8.8	80.1
Molasses, beet	80.5	8.4	4.4	60.8
Molasses, cane or blackstrap	74.0	2.9	0.0	54.0
Oats	90.2	12.0	9.4	70.1
Soybean, oil meal, 43%	91.2	44.6	37.5	78.6
Wheat bran	90.1	16.9	13.7	67.2
Wheat	89.5	13.2	11 1	80.0

Nutrients in Various Dairy Feeds

Feed	Total Protein (percent)	Total Dry Matter (percent)	Digestible Protein (percent)	Total Digestible Nutrients (percent)
DRY ROUGHAGES				
Alfalfa hay, all analyses	90.5	14.8	10.5	50 3
Alfalfa hay, leafy	90.5	15 8	11.7	51 5
Alfalfa hay, stemmy	90.5	12.1	8.1	46 2
Alfala hay, dehydrated	92.0	16.1	11.3	55 4
Barley hay	90.8	7.3	4.0	51.9
Bermuda grass hay	90.7	7.3	3.7	43.0
Cottonseed hulls	90.7	3.9	00.0	43.7
Hegari stover	87.0	5 6	1.9	48.7
Johnson grass hav	90.1	6.5	2.9	50.3
Milo stover	91.0	3.2	1.1	48 7
Oat hay	88.1	8 2	4 9	47 3
Sudan grass hay, before bloom	89.6	11.2	6 3	50 0
SUCCULENT ROUGHAGES				
Alfalfa green, all analyses	25.3	4.5	3.4	14.7
Alfalfa, immature, to 10" high	19.5	5.2	4.4	13.4
Alfalfa, after bloom	29.8	2.9	2.0	13 9
Bermuda grass, in bloom	35.0	3.6	1.9	20 8
Barley Pasture	20.0	5.2	3.8	12.4
Johnson grass pasture	25.0	3.6	1.8	14 4
Oat pasture, before heading	14.0	3.2	2.4	9 1
Sudan grass, pasture stage	21 6	3.3	2.4	14 3
SILAGES				
Alfalfa, wilted	36.0	6.0	4.1	21.3
Corn, dent, well matured	28.4	2.3	1.3	20.0
Hegari	33.4	1.9	1.0	18 7
Barley	25.0	2.6	1.4	12 7