

# Pack #110, Item 10

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**Backgrounder: Dairy production**

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***Introduction***

***Why is this subject important to listeners?***

Because farmers involved in dairy production should know:

* How to design and construct a proper cow barn.
* The breeds best suited for dairy production in their environment.
* How to feed dairy cows to ensure maximum milk production.
* How to milk cows properly.
* How to handle milk to prevent contamination.
* The quantity, type, and sources of feed needed for dairy cows and how to prepare them.

***What are some key facts?***

* Dairy cows should have access to quality feed and water for at least 22 hours per day.
* Dairy cows require 12-14 hours daily rest where they lie down.
* A dairy cow that produces at least 30 litres of milk daily (a “high milk production cow”) should consume 4% of its body weight in dry matter every day.
* High milk production cows can drink over 150 litres of water daily in hot seasons.
* An increase in temperature of four degrees Celsius increases water needs by 6-7 litres daily.
* Pregnant and milking cows require more minerals, and in particular large amounts of calcium and phosphorous.
* In tropical East Africa, lactating cows require 60-70 litres of water daily for maintenance, and an extra 4-5 litres of water for every litre of milk they produce.

***What are the big challenges in dairy production?***

* Dairy farmers lack knowledge of proper feeding routines, including how to prepare nutritionally balanced feed for their cows.
* The high cost of dairy feed inputs such as commercial feed concentrates, vaccines, and mineral salt licks.
* The high cost of good quality dairy animals.
* Dairy farmers lack knowledge of proper breeding methods.
* The high costs of dairy production and low market prices for milk.
* Lack of availability of land for dairy production.
* Lack of cooling facilities to preserve fresh milk.
* Lack of knowledge of diseases that affect dairy cows.

***Gender aspects of dairy production***

* In Bunyala sub-county in western Kenya, two-thirds of small-scale dairy farmers are men.
* In Ethiopia, women are primarily responsible for feeding and rearing dairy cows, while men are more involved in commercial aspects such as milk collection, processing, and marketing.
* In Kenya, a higher percentage of male-headed households rear improved cow breeds.
* In Uganda, men and women consider transporting water from water sources to cows the greatest challenge in rearing dairy cows.

*For further information, please see documents 2, 5, 6, 7, 11, 12, 13, and 15.*

***Key information about dairy production***

**Feeding systems**

Dairy cows can be reared in zero grazing (cut and carry systems), or released in pastures to graze freely.

*Zero grazing*: Farmers keep cows in a pen full-time and bring feed and water to the pen. Farmers gather fodder, Napier grass, pasture grass, weeds, and maize and legume crop residues from farms, as well as natural grass from forests, riverbanks, and roadsides. This method of feeding is labour-intensive and time-consuming compared to letting cows graze freely. Also, because movement is restricted, cows are more likely to be lame because concrete floors harm their hooves, causing joint swelling and wounds. To prevent such harm, farmers can lay rubber mats on concrete surfaces for cows to walk or stand on. Hard-packed earth will likely not damage hooves either.

Advantages of zero grazing:

* Cows are fed on selected, nutritionally-balanced feed, unlike in pastures where they can largely feed on grass alone.
* It is easy to gather cow dung for use as crop manure.
* Cows are not exposed to harsh weather.
* Cows are relatively protected from predators and diseases.
* Cows are likely to produce more milk because they do not spend energy looking for feed.

However:

* Zero grazing requires a lot of capital to start—for buildings, purchase of high-grade cows, establishing fodder plots, and purchase of equipment.

*Pasturing*: Dairy cows graze freely in grass pastures. Cows that feed on pastures are more vulnerable to parasites such as ticks that can carry diseases transferred from dogs and other small mammals.

Advantages of pasturing:

* Reduced labour costs.
* Cows can exercise and so are less likely to suffer from hoof problems.

**Nutrition**

Dairy feed consists of water and dry matter\* and provides cows with energy, protein, fibre, minerals, and vitamins. The amount a dairy cow consumes depends on its size, age, body condition, breed, health, and level of milk production, pregnancy status, and physical activities.

Dairy cattle feed includes roughages and concentrates. Roughages include Napier grass, maize stover, banana stems, sweet potato vines, lucerne, and leucaena. Farmers can easily grow these feeds. Dairy cattle feed also includes commercial concentrates such as dairy meal, maize bran, cubes and pellets, germ meals, brewer’s waste, and copra cake, all designed to boost milk production. It’s common among successful small-scale dairy farmers to blend their own concentrates with the right nutrient portions, so long as they are knowledgeable about blending nutrient-balanced feeds.

* A mature cow should consume 2-4% of its weight in quality dry matter feed, with 4% being recommended for high milk production cows.
* A cow that is being milked should consume at least 3% of its body weight in dry matter. For example, a 600-kilogram cow should consume at least 18 kilograms of dry matter as part of a balanced diet every day.
* For every 2-3 litres of milk, a dairy cow should consume 1 kilogram of concentrate.
* Lactating dairy cows require 60-70 litres of water daily, and an extra 4-5 litres for every litre of milk they produce.
* A dairy cow’s need for water increases with increasing temperatures and increased dry matter or salt intake. A rise of 4 degrees Celsius increases water needs by 6-7 litres daily.
* In hot seasons, high milk production cows can consume over 150 litres of water daily.
* Cows need enough protein to compensate for what is lost in milk production. A cow that produces 25 litres a day loses almost 1 kilogram of protein to the milk daily.
* The dry matter portion of a dairy cow’s diet should contain 30-35% fibre and 15-18% protein by weight (see sources and table below).
* A dairy cow weighing 500 kilograms should consume about 2.7 kg of protein daily. (See sources and table below.)
* Carbohydrate-rich feeds such as grains and forages should constitute 50-80% of dry matter feed.
* Napier grass fed to dairy cows should be one metre in height. Napier grass is less nutritious when higher than one metre.
* Calliandra, a protein-rich leguminous tree, can be added to dairy cows’ diet when cows are fed on protein-poor Napier or other grasses.

**Feed sources**

Dairy cows need a balanced diet—comprised of protein, vitamins, minerals, and energy foods—to be healthy enough for peak milk production.

*Energy foods:* Include green grass, hay, and postharvest residues of maize bran and germ, sorghum, wheat bran and pollard, and rice. Other sources are dried cassava chips, brewer’s grain, barley, and commercial feeds.

*Protein feed:*Includes protein-rich oilseeds and cakes, sunflower meal or cake, coconut meal, palm kernel cake, fish meal, brewer’s grain, soybean curd, and calliandra. Calliandra contains 20-25% protein. Three kilograms of fresh Calliandra contain as much protein as one kilogram of commercial dairy meal.

**Rations**

The table below gives typical daily feed rations for a 500-kilogram high production dairy cow at peak milk production (0 to 70 days of lactation), during first calving (at 70-140 days of lactation), and at 140-305 days of lactation.

* At 0-70 days, the cow has little appetite, but produces about 25 litres of milk daily.
* At 70-140 days, milk production begins declining but feeding increases and the cow produces about 20 litres of milk daily.
* At 140-305 days, milk production is still declining, and the cow produces about 18 litres of milk.

*Table 1: Recommended daily intake of various feeds at three different lactation stages*

|  |  |  |  |
| --- | --- | --- | --- |
| **Ingredients** | **Kg at 0-70 days lactation** | **Kg at 70-140 days lactation** | **Kg at 140-305 days lactation** |
| Napier grass (18% dry matter) | 20  | 30 | 30 |
| Rhodes grass hay | 5 | 5 | 6 |
| Cotton seed meal | 1.5 | 1.5 | 0.5 |
| Maize germ | 2.5 | 2.5 | 1.5 |
| Pollard | 2.5 | 2.5 | 1.5 |
| Molasses | 1 | 1 | 1 |
| Urea | 0.15 | 0.15 | 0.1 |
| Mineral lick | 0.1 | 0.1 | 0.05 |
| High yield dairy meal | 5 | 5 | 3 |
| Total fresh weight\* | 37.75 | 47.75 | 43.65 |
| Total dry matter | 18.65 | 20.5 | 17.0 |

*For further information, please see documents 2, 3, 6, 8, 9, 10, and 14.*

**Dairy cow house design**

A free stall system (cubicle housing) is most suited for Kenyan dairy farmers. It gives cows higher levels of comfort, a reduced risk of udder and teat injuries, and it’s hygienic.

Dairy farmers should consider the following factors when building a cow house:

* Comfort and safety
* Durability and expandability
* The age of cows
* Cost-effectiveness
* Maximum efficiency in the flow of feed, manure, cows, labour, information, and materials.

**Housing sections**

It’s recommended that housing for dairy farmers with larger herds include sections for:

* Lactating cows
* Calving
* Dry cows (waiting to give birth)
* Calf rearing
* Heifers (12-15 months old)
* Young calves (4-11 months)
* Pregnant heifers 16-19 months old
* Pregnant heifers at 20 months to delivery
* Handling and treatment area
* Milking section
* Milk and machine room
* Store for feed and drugs
* Chaff cutter room

Most small-scale dairy farmers have few animals—three or less—so housing would not include all these sections. However, it is important to keep dry cows separate to ensure they are not accidentally milked and to reduce the risk of them being attacked by other cows.

*For further information, please see documents 5 and 15.*

**Milking**

To collect and store milk, use containers that minimize contamination, such as seamless aluminum or stainless steel cans. After milking, clean milking cans and other milking equipment with hot water and detergent and rinse with cold water. Then place on a rack outside for the sun to dry the containers and kill bacteria. Store after use in a clean and well-ventilated room.

* Before milking, ensure that the milking area is hygienic.
* Gently lead the cow to the milking section to avoid stressing it. Stress can cause the animal to withdraw milk.
* Milkers should wash their hands with soap and water and dry with a dry towel.
* Ensure that milkers have short nails and hair is short or covered.
* Clean udder and teats with warm water and disinfectant, and dry with a dry towel before applying milking jelly.
* Milk a few drops and use a strip cup\* to check for abnormalities such as mastitis.
* Milk cows with mastitis last.
* To milk, squeeze the teats; do not pull them.
* Milking should require 7-10 minutes and should not be interrupted.
* Squeeze the teats to release the last drops of milk. Incomplete milking can increase the risk of mastitis.
* After milking, dip the teats in a teat dip disinfectant to stop bacteria from infecting the udder. The risk of udder infection is much higher after milking.
* Ensure that milked cows stand for at least one hour by providing adequate water and feed. This prevents loose teats from coming into contact with the ground, which can result in infections.

**Handling milk**

Milk is highly perishable and spoils if poorly handled. In a hot environment, milk spoils in three to four hours. To ensure that milk to be delivered to processors is in good condition, farmers should use the following practices:

* To avoid contamination, ensure milk handlers are clean and healthy.
* Pour milk from one container to another when transferring it instead of scooping it with containers. Scooping increases the risk of spoilage and contamination.
* After milking, filter milk immediately with a white filter cloth or sieve. After filtering, disinfect, wash, and dry filter cloths and sieves.
* Do not mix warm, recently obtained milk with cold milk from an earlier milking.
* Deliver milk to the processor as quickly as possible.
* Make deliveries in the early morning or evening when it’s cool. Heat increases the risk of spoilage.

**Storage**

* Store milk in a clean, cool, chemical-free room to prevent contamination or spoilage.
* If storing milk overnight, keep in a refrigerator or place milk container in chilled or cold water.
* If possible, cool milk to 20 degrees Celsius or below during storage.
* When cooling fresh milk under shade, loosen the lids to allow warm air to escape.

**Processing milk**

Fresh milk can be processed into products such as cheese, butter, powdered milk, ghee, yogurt cream, and fat. Processing preserves milk in another form and stops losses due to spoilage. Processing milk increases dairy farmers’ income and generates employment better than selling fresh milk.

*For further information, please see documents 2, 3, and 6.*

**Breeds**

The breeds best suited for high dairy production are listed below.

Keep in mind that, while these breeds are best suited to produce a higher volume of milk, high milk production is mainly determined by how well the cow is housed, kept free from diseases, and fed. A dairy cow fed well and housed in good conditions will produce more milk.

*Holstein/Friesian:* This breed has a large body, is a high milk producer, and is easily recognizable by its black and white colour. On average, it produces 20-25 litres of milk daily with a butterfat content of 3.5%. If well-fed and well-managed, it can produce 40-50 litres a day. A mature Friesian cow has a live weight of more than 600 kilograms.

*Jersey:* This breed is a light brown colour with or without white markings. Its horns face forward and are tapered towards the tips. Jersey cows mature quickly and produce 15-20 litres of milk daily, with 4.5% butterfat content. When mature, Jerseys have an average live weight of slightly less than 400 kilograms.

*Guernsey:* This breed is light brown and yellowish in colour with white markings. Most Guernsey cows have a triangular white mark on the forehead. Its horns face forward and are tapered at the tips. On average, it produces 16 litres of milk daily with 4.5% butterfat content. The milk and butterfat have a yellowish colour. At maturity, the Guernsey has a live weight of about 450 kilograms.

*Ayrshire:* This breed is red with shades of orange to dark brown and white markings. The horns are long and curved at the ends, and its meat has lots of white fat. Average daily milk production is 20 litres with 4% butterfat content. At maturity, the Ayrshire weighs about 475 kilograms.

*For further information, please see documents 6 and 11.*

**Health**

Farmers should closely monitor the health of dairy cows to prevent disease and ensure cows remain productive. It’s better to vaccinate dairy cows before they are infected with disease than to treat them after infection. Treatment after infections may cure diseases, but compromise the long-term health of the cow, thereby affecting productivity and the health of any calves they subsequently give birth to.

Here are some basic measures dairy farmers can take to protect their animals from diseases:

* Practise good hygiene by disinfecting all environments where dairy cows are kept.
* Ensure that feed is balanced and served in a clean trough.
* Separate sick dairy cows from healthy ones.
* Ensure that dairy cows can access clean drinking water.
* Ensure that vaccinations are administered on time and by qualified personnel to protect against diseases.

Dairy farmers should monitor their cows for the following signs of illness:

* If the cow is chewing cud (ruminating) less than 40 times a minute.
* If the cow is not walking properly or looks drained of energy.
* A sudden drop in daily milk production.
* Poor feeding caused by loss of appetite.
* A rough and less shiny coat, skin, and horns.
* A discharge of tears and a drier than usual muzzle.
* A drop in body temperature and the cow feels cold to the touch.
* Irregular discharges of urine and dung.

**Diseases**

In Africa, dairy cows are vulnerable to anthrax, rinderpest, foot-and-mouth disease, brucellosis, and hemorrhagic septicemia. Farmers should ensure their animals are vaccinated against these diseases.

Among young calves, diarrhea and pneumonia cause most deaths.

* Calves can die of diarrhoea in the first 2-3 weeks after birth. The signs of diarrhoea in calves are white, liquid dung with a pungent smell and a low appetite for milk.
* Feeding calves with colostrum within two hours of birth in a hygienic environment helps prevent diarrhoea. Treatment with antibiotics is recommended if diarrhoea and home remedies fail.
* Calves can die of pneumonia within months of birth. Symptoms include coughing, high fever, running nose, and watery eyes.
* Maintaining hygiene in the shed and feeding calves with colostrum after birth can help prevent pneumonia. If infected, farmers should call a veterinarian to treat calves with antibiotics for at least five days.

Worms

* Worms are common in calves, heifers, and dairy cows, causing them to lose weight and have pot belly. Worms thrive in hot and humid conditions. Prevention includes maintaining hygienic conditions in sheds. Farmers should deworm calves starting at two months old, and then every 3-4 months until the cow is two years old.

Ticks

Dairy cows grazed in pastures are more vulnerable to tick infestation and contracting tickborne diseases, causing them to be weak and unproductive.

* If a cow has only a few ticks, farmers can remove them by hand, but acaricides\* are the most effective tick control method in dairy production. Because chemical acaracides may be harmful to humans and animals, natural or organic acaracides such as neem oil are also used to control ticks.
* Spraying against ticks depends on the *breed of tick and the season.* In regions with East Coast Fever, spray twice a week for Friesian breeds. In regions with blue ticks, spray once every three weeks. For advice regarding seasonal tick prevalence, consult local experts.
* Dairy cattle can also be vaccinated against East Coast Fever. Vaccination can be done from three months of age, and is done once in a lifetime. The vaccine is administered by a trained, approved vaccinator.

*Trypanosomiasis (sleeping sickness)*

Trypanosomiasis is transmitted by tsetse flies and can result in abortions, anemia, infertility, and death.

* Prevent by minimizing contact between cattle and wild animals, and with flies, and by controlling tsetse flies (for example, with insecticides and traps). In high-risk areas, a drug that is used to treat trypanosomiasis can also be administered to prevent animals from becoming ill. However, it is advisable to consult a local veterinarian.

*Hoof infections*

Overgrown or infected hoofs can stress a cow and reduce milk production. Hygienic housing, trimming hoofs, and foot baths can prevent hoof infections, as can feeding a balanced diet rich in zinc.

*Mastitis*

Udder infections or mastitis can be prevented by keeping milking equipment and the udder clean, through disinfecting the teats and udder, by feeding cows after milking so that they don’t lie down, and ensuring that bedding is clean. Milk from cows infected by mastitis has flakes, a watery appearance, and a foul smell. There is also reduced milk production, and udder pain makes it difficult to milk.

* Milk and massage the udders of cows with mastitis every two hours.
* Wash the udder alternately with cold and hot water and massage with ointment.
* Milk cows infected with mastitis last.
* Use antibiotics to treat clinical cases of mastitis.
* When drying a cow, infuse all quarters of the udder with long-acting antibiotics to prevent mastitis from developing.
* Cull/remove cows with chronic mastitis.

*Milk fever*

Cows that produce high amounts of milk are more prone to milk fever, a nutritional condition that occurs soon after calving. A cow with milk fever doesn’t eat or stand up and lies with its head on one side. The muzzle dries up, the ears get cold, the eyes stare, and the cow can die. Milk fever is caused by a calcium deficiency in the blood which may be caused by feeding cows too little or excess calcium and phosphorous supplement in the dry period when a cow is not being milked.

Prevent milk fever by feeding cows with an adequate but not excessive amount of mineral supplement during the dry period. Cows with chronic milk fever shouldn’t be completely milked out after giving birth. To treat a cow with milk fever, inject with calcium.

*Retained placenta*

After calving, a cow should release the placenta within 12 hours. If it doesn’t, the cow loses appetite, milk production drops, and infections occur. You can prevent a retained placenta by ensuring that the cow doesn’t gain too much weight before calving. Milking the cow or letting the calf suckle lowers the likelihood of retained placenta. Vaccination against brucellosis and providing adequate minerals and vitamins during pregnancy also reduces the likelihood of a retained placenta.

*For further information, please see documents 2, 6, and 16.*

**Definitions**

*Acaracides:* Substances, including chemical pesticides, that kill ticks and mites.

*Balanced diet*: Feed that contains all the nutrients needed by the cow in the right proportions.

*Brucellosis*: A highly contagious bacterial disease that infects cows, pigs, goats, horses, and sheep, causing abortions, stillbirths, and infertility. It can be transmitted to humans if they consume infected raw milk because raw milk is more likely to be infected with the brucellosis bacteria.

*Dry matter*: The part of feed that remains after water has been removed.

*Fresh weight*: Weight of feed when it is in the form in which it is fed to animals—for example, fresh Napier grass or grass.

*Mastitis:* A bacterial disease that causes inflammation of a cow’s udder tissue and mammary glands.

*Strip cup*: A cup used to check milk for mastitis. A few drops of milk are squirted into the strip cup and examined.

*Units:* A part of whole feed expressed as a specific measure. Farmers should contact their local livestock production officer for specific ratio measures for nutrients.

***Where can I find other resources on this topic?***

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Contributed by: James Karuga, Agricultural journalist, Kenya

Reviewed by: Margaret Lukuyu, Livestock consultant, Nairobi, Kenya