

FAQs Commercial Dairy Farming on Enviromentally Controlled Housing (ECH) System



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1 Disclaimer

This information memorandum is to introduce the subject matter and provide a general idea and information on the said matter. Although, the material included in this document is based on data/information gathered from various reliable sources; however, it is based upon certain assumptions, which may differ from case to case. The information has been provided on as is where is basis without any warranties or assertions as to the correctness or soundness thereof. Although, due care and diligence has been taken to compile this document, the contained information may vary due to any change in any of the concerned factors, and the actual results may differ substantially from the presented information. SMEDA, its employees or agents do not assume any liability for any financial or other loss resulting from this memorandum in consequence of undertaking this activity. The contained information does not preclude any further professional advice. The prospective user of this memorandum is encouraged to carry out additional diligence and gather any information which is necessary for making an informed decision, including taking professional advice from a qualified consultant/technical expert before taking any decision to act upon the information.

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2 Introduction to SMEDA

Small and Medium Enterprises Development Authority (SMEDA) is an apex SME development agency working under the Ministry of Industries and Production (MoI&P), Government of Pakistan. In pursuit of its mission, SMEDA has adopted an integrated strategy that comprises SME sectors & clusters development, Business Development Services (BDS), and Policy advocacy to protect and promote SME interests.

SMEDA offers a broad spectrum of business development services to SMEs which include prefeasibility studies, identification of experts and consultants, delivery of need based capacity building programs in addition to business guidance through help desk services.

3 Purpose of the Document

This document highlights Frequently Asked Questions (FAQs) for entrepreneurs who are interested in ‘Commercial Dairy Farming through ECH System’ particularly businesses categorized as Small & Medium Enterprises (SMEs). The FAQs are designed to help SMEs understand operational modalities of ECH system for use in commercial dairy farming and to make it a profitable enterprise.

4 Dairy Farming

4.1 What is dairy farming?

Dairy Farming is a branch of agriculture that encompasses the on-farm raising of dairy animals through recommended husbandry practices including housing, breeding, feeding and disease management practices, or the production of milk and other value added dairy products such as yogurt, ghee, butter and cheese etc. primarily from cows and buffaloes

4.2 Can I start dairy farming without prior experience?

You can invest in dairy farming and utilize it as a potential investment opportunity by implementing good dairy farming practices. Factors affecting farm productivity depend upon timely on-farm decision making particularly in following areas;

- Layout Design and Construction of Farm / Housing
- Farm production
 - Genetics,
 - Breeding,
 - Feeding and Nutrition,
 - Disease Prevention,
 - Record Maintenance etc.)
- Efficient farm labour
- Compliance with law or local convention
- Market exploration for milk and/or other dairy products
- Customer feedback mechanism

Please read SMEDA Prefeasibility study on Dairy Farm for 25, 50 and 100 cows on www.smeda.org.pk.

4.3 What are good dairy farming practices (GDFP)?

Good Agricultural Practices (GAP) applicable for dairy farms are called Good Dairy Farming Practices (GDFP) and highlight proper implementation of recommended practices on dairy farms. These practices must ensure that milk and milk products produced at farm are safe and suitable for their intended use and also that the dairy farm enterprise is viable in the future; from economic, social and environmental perspectives. Dairy farmers should apply GDFP in the following areas to achieve the desired outcome; Housing, Nutrition (feed and water), Breeding and genetics, Milking hygiene, Animal health and welfare and Environment Protection.

5 Environmentally Controlled Housing (ECH) System

5.1 What is Environmentally Controlled Housing (ECH) system?

Dairy production is an all-inclusive activity, related to dairy animal care, reproduction, feeding, housing and disease management. It encompasses all aspects and activities related to raising dairy animals during various phases of life to get maximum productivity in terms of hygienic milk. A dairy farm where cows with proven pedigree and high genetic worth are kept comfortably primarily for milk production in a purpose-built



Figure 1: Ventilation System in ECH Dairy Farm

Environmentally Controlled Housing (ECH) system is designed to maintain the relative humidity and temperature within it especially in hot and humid summer months. Some features of this system are;

- Concrete tunnel structure with low roof height with proper insulation to prevent heat from all sides.
- Maintenance of optimum temperature of 20-26°C inside the shed area irrespective of outside temperature through 'Heating, Ventilation & Air Conditioning Control' (HVAC) designed and planned as per engineering principles
- Low or no accumulation of gases, odor or smell inside the shed due to proper ventilation system
- Proper waste and manure handling through the designs of floors with natural flow of wastes and water resulting in minimum human efforts for cleanliness.
- Cows are fed Total Mixed Ration (TMR), which is a high energy and protein rich nutritionally balanced formulated feed.
- Cows are bred by proven pedigreed genetics through the Artificial Insemination method to attain maximum genetic potential.
- Mechanized and hygienic milking through machines with special focus on udder health.
- Proper mechanized storage of milk through chillers at temperature of 4° C.



Figure 2: Cows in ECH system

5.2 What are the advantages & disadvantages of adopting ECH system in dairy farming?

Advantages:

- Higher and sustainable milk production per cow i.e. average 35-40 litres per day.
- Cost of production per litre of milk is lesser i.e. Rs. 40 – 45 as compared to conventional farming system with local cows i.e. Rs. 55 – 60, hence higher profit margins.
- Maximum quantity of milk is available to consumer in lean period (summer season).
- Adopting ECH requires implementation of synchronized breeding program, which results in more numbers of pedigreed and genetically superior heifers.

Disadvantages:

Dairy farming on ECH system is a high-tech business that needs uninterrupted and continuous supply of electricity to run the automated machinery for milking and milk collection. For this purpose generators need to be installed for the project.

5.3 What is the minimum viable number of cows to start ECH Dairy Farm?

As per SMEDA prefeasibility studies, 25 to 50 milking cows is an advisable number to start a dairy farm on ECH system. The project provides 25-32% as an average Internal Rate of Return (IRR) with approximately 4.90 years of payback period. SMEDA has developed prefeasibility studies on ECH dairy farm with different number of cows such as 25, 50 and 100. A brief comparison may help you in deciding the size of dairy farm to start;

Table 1: Economic Comparison of Dairy Farms with Different Number of Cows

Particulars	25 Cows	50 Cows	100 Cows
Total Investment (Rs. Million)	19.46	36.79	70.55
Internal Rate of Return (IRR) %	25	32	35
Capital Investment (Rs. Million)	18.76	35.61	68.55
Working Capital (Rs. Million)	0.707	1.18	1.99
Payback Period (Years)	4.91	4.90	4.55
Employment Generation (Persons)	6	7	11
Revenues from Milk (Rs. Million)	14.48	25.14	50.28
Total Revenues (Rs. Million)	14.96	26.49	52.97
Total Milk Production (Litres/ Year)	241,338	419,020	838,040
Selling price of Milk (Farm Gate) (Rs./Litre)	60	60	60
Total Assets after 10 years in million	100	380	790

5.4 Is there consistent supply of skilled manpower for ECH dairy farms?

Yes, competent and skilled manpower is available in all provinces. Many academic institutions offer different levels of courses i.e. degree, diploma and certificate programs on dairy and livestock farming. Some of the relevant academic institutions are:

- National Agriculture Research Centre, Islamabad
- University of Agriculture, Faisalabad, Punjab
- University of Veterinary and Animal Sciences, Lahore, Punjab
- Sindh Agriculture University, Tandojam, Sindh
- University of Agriculture, Peshawar, Khyber Pakhtunkhwa
- Lasbela University of Agriculture, water and Marine Sciences, Lasbela, Balochistan

6 Breeding and Reproductive Management

Raising cows for milk production requires close attention to Herd breeding program with proper focus on reproductive management of cows so that they produce milk to their maximum genetic potential. This requires proper planning, close observations, recording of scheduled breeding through Artificial Insemination (AI) and regular recording of milk production.

6.1 What are the production & certification parameters of cow selection for ECH dairy farm?

Production: average milk production of Holstein Friesian cows is 30 Litres / day or 9,000 litres per lactation period of 305 days.

Certification: Certified through 3-generation pedigree paper provided by the respective Government of the country of import and / or breed associations. Additionally, certification may also be done through DNA testing, known as Genomics. The accuracy of predicted results is expected to be 65% in Pedigree cows and 80% in Genomics.

However, it is pertinent to mention that these cows can perform optimally if kept in an Environmentally Controlled Housing (ECH) system with controlled humidity and temperatures. For further details, please see SMEDA Prefeasibility study on Dairy Farming (ECH System), developed for a farm of 25, 50 and 100 cows separately, available on SMEDA's official website www.smeda.org.pk.

6.2 Which cow breeds are suitable for optimal production in ECH dairy farm in Pakistan?



Figure 3: Holstein Friesian Cow

Usually, Holstein Friesian cows are considered best commercial dairy breeds throughout the world. These cows may be imported from USA and / or Europe. Heifers of this breed can also be sourced from already established local ECH commercial dairy farms and relevant breed associations. There are also many farmers in Pakistan who sell surplus purebred cows at the time of culling and the same is also advertised in local newspapers and other media sources.

6.3 What are common breed characteristics of Holstein Friesian cows?

Holstein cows are classic black and white cows. They are by far the most popular, yet expensive dairy breeds, as they are known for yielding highest milk production in one lactation. Holsteins are usually black and white, however, they can also be red and white. Their adult average live body weight is typically around 1,500 lbs. (680 kg) and their height is 58 inches (1.47 meters). They can thrive in a variety of dairy farm arrangements as per weather requirements. They produce an average 30-40 litres of milk daily.

6.4 What are some common problems of Holstein Friesian cows?

- Sensitive to environmental stress caused by high temperature and high relative humidity
- Breeding issues such as metritis, dystocia, problem in heat detection etc.
- Since these cows need high energy ration, hence, more prone to metabolic diseases¹ such as Acidosis², Ketosis³, Milk fever (Hypocalcaemia)⁴ and Hypomagnesemia⁵ etc.

¹ Metabolic disorders relates to disturbances of one or more metabolic processes in the cows which usually happens to the animals three weeks before and after calving. The reasons are related to hormonal changes, moving from non-lactating to lactating stage, changing of diet from roughages to highly fermentable feed.

² Acidosis is a metabolic disease of cows which occurs when pH of the rumen falls to less than 5.5 (normal is 6.5 to 7.0) resulting in rapid and shallow breathing, fatigue and loss of appetite etc.

- Lameness or foot rot
- More prone to ecto-parasitic infestations and diseases such as Theileriosis⁶, Tick fever⁷ and Bovine Ephemeral Fever (Three Days Sickness)⁸ etc. caused by ticks.

6.5 What are the source countries for Holstein Friesian cows?

USA is providing pedigreed cows with 40 litres / day average milk production whereas Europe is providing cows with average milk production of 30 litres / day.

In Pakistan, modern dairy farming on ECH systems has to rely on imported genetics as in Pakistan, a pedigreed and uniform herd of cows with average milk production of 30-40 litres / day / cow are difficult to find from one breeder however, the same may be sourced from exporters such as US Livestock Exporters Association⁹. Breeders' associations such as Holstein Association, USA¹⁰ provides cows with all pedigree papers and requirements.

Following companies have supplied US pedigreed cows to Pakistan in last few years. The farmers may directly contact them through following contact details;

1) A: T.K. Exports, Inc.

P.O. Box 91, 45 Thorn ridge Lane, Boston, VA 22713, USA

Phone 1: 540-825-2067, Fax: 540-825-2948

E-mail: tkexports@gmail.com, Website: www.livestockgeneticsbytk.com

2) Strickland Ranch & Exports Inc.

24615 Oak Knoll Road, Myakka City, FL 34251, USA.

Ph: 1: 941-720-2635, Fax: 877-298-8795

E-mail: email@stricklandranch.com, Web: www.stricklandranch.com

³ Ketosis is a metabolic disorder that occurs in cows when energy demands (e.g. high milk production) exceed energy intake and result in a negative energy balance. Cows often have low blood glucose concentrations

⁴ Milk fever is a metabolic disease caused by low blood calcium level (hypocalcaemia) in pregnant cows near calving. Common symptoms are loss of appetite, excitability, nervousness, hypersensitivity, weakness etc. The affected animal may turn its head into its flank or may extend its head.

⁵ Hypomagnesemia is seen mostly in lactating cows in winter and early spring and is associated with low levels of magnesium in the blood. characterised by nervous signs including initial excitement, bellowing, muscle spasms, tetany, convulsions and sudden death.

⁶ Theileriosis is a disease caused by a species of Theileria, which is a blood-borne parasite affecting only cattle and is primarily transmitted by ticks.

⁷ Tick fever or 'red water' is a disease of cattle caused by blood parasites that are transmitted by cattle ticks.

⁸ Bovine Ephemeral Fever (BEF) is a viral disease of cattle in which affected animals are only sick for a few days, hence the alternative name is 'Three Day Sickness'.

⁹ www.livestockexportusa.com/

¹⁰ www.holsteinusa.com

An example of pedigree paper is shown below;

Huge PA-TPI & different pedigree

4. 1st Choice Male

From donor
Index

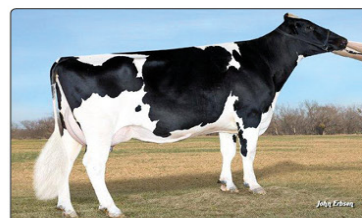
Seagull-Bay My Octavia-ET | Reg.no. US 3128978122 | D.O.B. 14-08-2015
Seagull-Bay My Octavia-ET
US 12/16 +1608M +0.05%F +0.02%P +72F +55P NM\$ 839 / GTPI +2711
US 12/16 PL +8.1 / SCS 2.84 / DPR +3.1 / HCR +1.8 / CCR +3.9 / SCE 8.3 / DCE 4.3 / DSB 5.4
US 12/16 UDC +1.98 / FLC +1.00 / PTAT +1.92
CA 12/16 +2205M +0.20% +0.12% +105F +84P / SCS 2.93 / Conf. +7 / DGV-LPI +3340
DE 12/16 +1811M -0.02%F -0.02%P 70F 59P / RZM 143 / RZS 105 / RZN 129 / RZR 115 / RZE 125 / RZG +155

Details

- **Huge PA-TPI & different pedigree**
- **Dam is one of the most exciting heifers in the breed: GTPI +2711 / RZG +155**
- **One of the greatest AI families ever**
- **Same family as the #1 GTPI Bull in the breed: JEDI!!**
- **Sire Burley is not available in Europe**



3rd dam: S-S-I Bookem Modesto 7269 VG-87-USA



4th dam: Royleane Shot Mindy VG-86-USA DOM



4th dam: Seagull-Bay Manat Mirage EX-90

Pine-Tree BURLEY-ET
(Boastful x Oak x O-Style)

Seagull-Bay My Octavia-ET

- One of the most exciting flush age heifers in the breed! (GTPI +2711 / RZG +155)
- Mogul & Supersire free!
- Maternal sister to: S-S-I 1stclass FEDERAL @ Generations (GTPI +2613)
- Same family as: Shep, Gun, AltaSpring, Mayflower, Midnight, King Royal, Robust & many others!
- Topseller Pedigree Power Sale II for \$ 78.000
- Modesty daughter @ GTPI +2869

Ladys-Manor OCTOBERFEST-ET

S-S-I Moonray 9071-ET VG-85-USA 2yr.
Conf. VG-85-USA 2yr

2.01 365d 15.118kgM 4.0% 605F 3.3%500P

- Dam to: Maldives @ ABS (GTPI +2728), Matters @ Semex (GTPI +2724), Merek @ ST (GTPI +2669), Federal @ Generations (GTPI +2613) & others
- Same maternal line as: JEDI, JETT & FLAGSHIP!

De-Su Rb MOONRAY 11038-ET

S-S-I Bookem Modesto 7269-ET VG-87-USA
Conf. VG-87-USA DOM

2-00 365d 11.873kgM 4.0% 476F 3.4% 401P

- Grand dam to: JEDI - #1 GTPI Bull in the breed!! (GTPI +2891)

NEXT DAMS

4th Royleane Shot Mindy VG-86-USA DOM
5th Seagull-Bay Oman Mirror VG-86-USA
6th Seagull-Bay Manat Mirage EX-90-USA GMD DOM
7th Lynmead Celcius Minnow EX-91-USA GMD DOM
8th CMV Melwood Mindy VG-85-USA GMD DOM
9th Briarpatch-R Misty VG-85-USA GMD DOM
10th Rilara Mars Las Ravena EX-91-USA GMD DOM
11th Rilara Haven Charming Las VG-87-USA GMD DOM
12th Rag Apple Loust-Grove Charm VG-86-USA GMD DOM



Online Elite Bull Sale | March 2017 | www.onlinebullsale.com

Figure 4: Pedigree Paper

7 Housing and Ventilation

7.1 What is A suitable location for establishing ECH dairy farm?

ECH dairy farm, like any commercial dairy farm should ideally be established 10 - 15 KM away from the main city i.e. peri – urban areas. Proper location and housing is conducive to good health, comfort and protection from extreme weather and enables the animals to utilize their genetic ability and feed for optimal production. For construction of farm buildings, site selection is of utmost importance. Before selecting a site, consider the following points;

- Soil must be suitable for strong foundation.
- There should be sufficient area to construct all components of dairy farm building. It should also include space for future expansion of farm.
- Proper drainage of rain and subsoil water should be provided to maintain a healthy environment and to protect the building from dampness.
- Plenty of water is needed for farm operations like washing, cleaning, drinking and processing of milk and by-products. Hence a water source that provides water constantly is essential.
- Electricity should be available at the site. It is needed for operating various machines used in the farm and acts as a light source for animals.
- Ensure protection from wind and solar radiation. If the farm building is in an open or exposed area, the wind breaks in the farm. It is advisable to grow trees near the building to reduce wind velocity and solar radiation.
- Farm site should be away from noise producing factory/chemical industries and sewage-disposing areas. Industrial effluents in the form of gaseous or liquid may pollute surrounding resources. Noise is also found to affect animal production.
- The farm should be easily accessible by the target customer. Farm buildings should be provided with good road networks and also have accessibility to reach the market. This will reduce transportation cost and avoid spoilage of products.
- To retain your dairy farm it is further suggested that prevalence of other facilities such as nearby school for children of farm workers, hospital / clinic / medical centre, post office and markets / bazaars should be considered.

7.2 What is the difference between natural and mechanical ventilation?

When we cool down the cows in hot and dry weather through wetting them by water sprinkling, this process is called cow cooling. On the other hand, cooling through cooling pads and exhaust fans in ECH system is called mechanical ventilation.

The following picture shows the layout of a typical dairy farm on ECH system, supported by cooling and evaporation pads, facilitating mechanical ventilation throughout the shed.

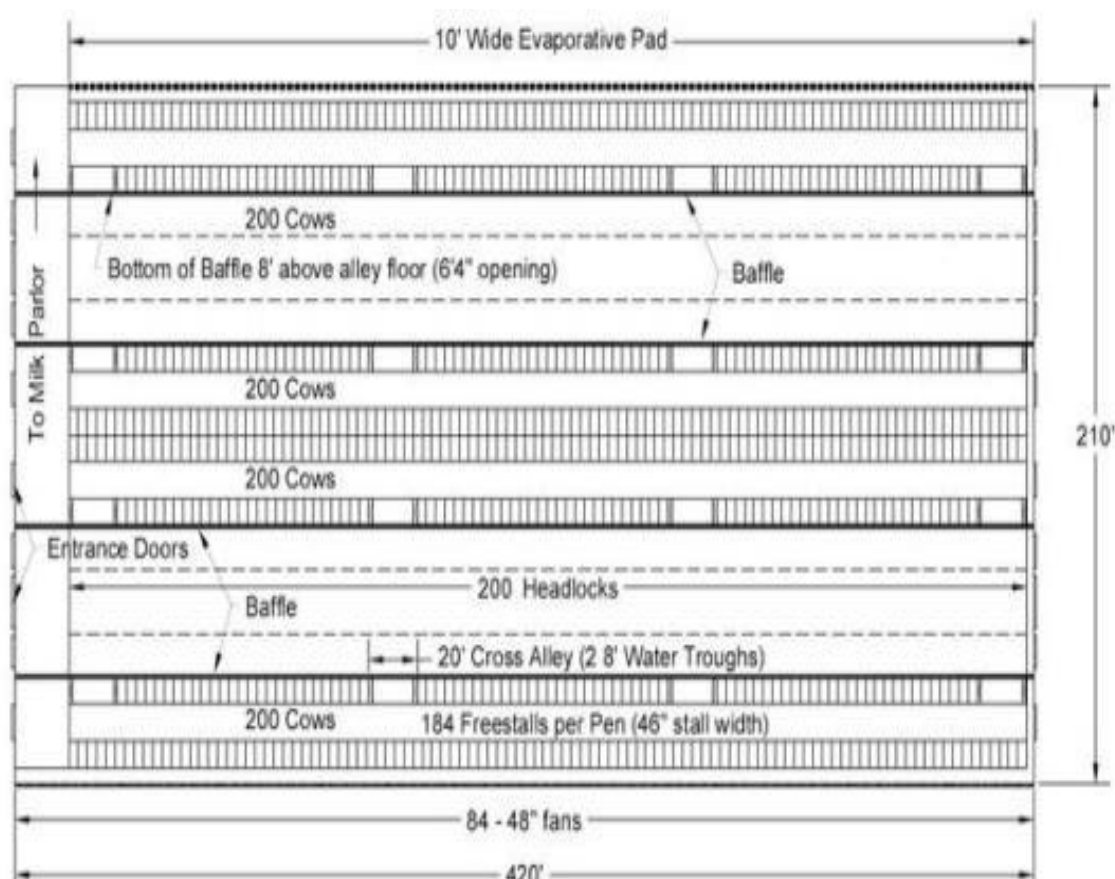


Figure 5: Sample Design of ECH Dairy shed with mechanical ventilation system

7.3 Which months require maximum use of ECH system?

Considering the objective of using ECH, which is, to control both temperature and humidity levels in the environment, use of the system is widely applicable during the summer and monsoon season. In Pakistan, summer season begins as a hot and dry period with high temperatures, beginning from the month of May and ending approximately in the mid of July when monsoon showers begin. From August to October the environment is moderately hot with high levels of humidity.

Dairy farms on ECH system perform at maximum efficiency (90-95%) in months of May till mid July, whereas from August to October the system works at 70% to 80% efficiency.

7.4 How to control humidity in the months of Monsoon?

Air velocity is usually within the range of 5-7 km per hour in months of May to mid July. In the months from August to October, due to increased humidity, increase in air velocity is required to maintain optimal environmental factors. Therefore, it is advisable to set the air velocity 3 to 4 times more than 5 – 7 km per hour, i.e. 22-25 Km per hour.

During the humid months, the system can be improved through extra ventilation in the shed area where the cows are resting, through installation of storm and exhaust fans as shown in the picture below.



Figure 6: A ventilator



Figure 7: Ventilation system in ECH Dairy farm

7.5 How to manage ECH system during the winter season?

The control shed can be easily turned into a natural ventilated barn by opening the doors and cooling pad area.

7.6 What additional costs maybe incurred during load shedding hours?

It is advisable to establish the farm at a safe distance from big cities or industrial estates. The usage of energy efficient fans will help in reduction of electricity consumption cost.

However during load shedding hours, to maintain uninterrupted supply of electricity, the use of generators is necessary for smooth operations and working efficiency of the ECH system, chilling units and other electricity run equipment. Further, alternate sources of energy, solar power and biogas generation can also be considered.

8 Disease Prevention

8.1 How can animal welfare be ensured on a dairy farm?

The following five key points can ensure animal welfare. These are related to freedom from; Thirst, hunger and malnutrition, discomfort, pain, injury and disease, fear and engaging in abnormal animal behaviours

8.2 How can I establish dairy herd's resistance to disease?

Choose dairy breeds and animals well suited to the environment and farming system. Determine herd size and stocking rate based on management skills, local conditions, availability of land & infrastructure, feed, and other inputs. Larger herds and higher stocking rates generally require a higher level of organisation, infrastructure and skills to manage. The risks are high in these specialised dairy-farming systems. Disease burdens can be higher and individual animals requiring intervention can be more difficult to identify and treat. Good planning and management skills are required to manage risks that have serious consequences.

Drastic seasonal changes such as monsoons, high temperatures, high humidity or heat etc. may require different system settings in the ECH system depending upon the time of year. Fodder supplies must be carefully planned for all contingencies, as dairy animals require a constant source of good quality feed and water throughout the year.

Vaccinate all animals as recommended and required by local veterinary health departments. Animal health departments and private consultants can provide information about vaccines recommended for a specific area. Usually, dairy farmers are required by law to vaccinate their stock against serious contagious diseases such as Foot and Mouth Disease (FMD).

8.3 What factors influence culling of dairy cows?

Some of the important factors that determine whether a cow should / not be culled are productivity, lameness, mastitis infections, reproductive issues and temperament. An animal's temperament determines how it reacts in stressful situations, which may also influence its general health and well being.

8.4 How can I prevent entry of disease on the dairy farm?

Buy cows of known health status and control their introduction to the farm using quarantine measures. The most effective way to prevent the spread of infectious diseases is to keep a closed herd, i.e. no new animals enter the herd and previously resident animals do not re-enter after they have left the herd. This is difficult to achieve in practice, so strict control of animal introductions is needed.

Increased risk of disease also occurs when animals share grazing or other facilities. Prior to entry on the farm, all dairy animals should be screened for diseases, which are significant to their area of origin and new location. All animals should have:

- An identification system to enable trace back to their source (a birth to death identification system).
- Some form of Vendor Declaration or certification that details the health/disease status of animals and any appropriate tests, treatments, vaccinations or other procedures that have been or are being carried out.

It is a good practice to consider treating all introduced animals for internal parasites on arrival. Keep records of animal movements to and from the farm. Sick animals should be rejected. Ensure that animal transport on / off the farm does not introduce diseases. A suitably trained veterinarian / technician should carry out any relevant test required on-farm.

The disposal of diseased and dead animals should be done in a way that minimizes the risk of disease spread and must be in line with GDFP guidelines. Monitor risks from adjoining land and neighbours and have secure boundaries. Be aware of local (endemic) diseases and/or exotic diseases, which have the potential to affect the health of the herd, especially from neighbouring farms. Contain animals appropriately to ensure there is no risk of disease spread between farms and within farms.

Where possible, limit access of people and wildlife to the Dairy Farm. People (and vehicles) visiting a number of farms may spread disease between the farms. Keep milk tank, pick up access and public tracks clear of faecal contamination. Restrict access to 'as needed' basis and put in place appropriate processes to minimize disease spread. Visitors to the farm should wear clean protective clothing and clean, disinfected footwear if entering areas that pose a high risk of transferring disease onto or from the farm. Records of all visitors should be kept as appropriate. Disease can be spread both from and to humans and wildlife.

Have a vermin control programme in place. Ensure that appropriate vermin controls are in place in all areas where vermin could breed, introduce disease and/or affect milk safety and quality. Vermin breeding sites should be eliminated, especially if those sites also harbour disease pathogens, such as manure heaps, livestock disposal sites etc. Vermin control measures may also be required in the milking shed, feed and water storages and animal housing areas. Vermin species vary geographically but can include indigenous animals, rodents, birds and insects.

Only use clean equipment from a known source. Ensure all agricultural and veterinary equipment introduced on the farm is clean and steps have been taken to prevent the introduction of disease.

8.5 How can I have an effective herd health management program in place?

Use a permanent identification system that allows all animals to be identified individually from birth to death e.g. ear tagging. Herd health programs aim to keep all livestock healthy and productive. They should include the farm's practices for diagnosis, treatment, prevention and control of relevant animal diseases, including internal and external parasites. It is important to ensure a consistent approach to herd health; therefore, all staff should be aware of and understand the farm's herd health programme. The programme should cover all aspects of animal husbandry and handling, milk harvesting as well as other dairy farm management practices relevant to animal health. This may include disease screening, vaccination and/or control measures being required by animal health authorities or supply contracts. Where effective vaccines are available, they may be used to increase resistance to disease. Prophylactic treatments may be required as protective measures when no viable alternative strategy exists. Effective herd health programmes should be developed in consultation with appropriately skilled people such as veterinarians.

Observe all animals regularly and use proven methods to aid in detection and accurate diagnosis of infectious disease. Some useful tools may include observation of animal's body temperatures through rectal thermometers, observations of animal behaviour and body condition, and examination of milk by surf test for mastitis. Laboratory or other tests may be necessary to screen animals for disease. Herd and/or animal-level disease testing may also be available through provincial disease control programmes or milk collection/herd improvement centres. Detailed breeding and reproductive records should be maintained.

Animals should be observed at appropriate stages, as many diseases are associated with reproduction. Clinical diseases should be investigated to determine the underlying cause(s) so that animals can be treated and further cases could be prevented. Regular management practices such as hoof care programmes can reduce the incidence of lameness.

Sick animals should be attended to quickly and in an appropriate manner. Treat all disease, injury and poor health by proven methods after accurate diagnosis. Treat diseased animals appropriately to minimize prevalence of infection and the source of pathogens.

Keep sick animals isolated on the farm to minimize the spread of contagious disease. Prompt treatment can limit the spread of infectious agents. Clean and disinfect equipment after it has been in contact with sick animals and ensure people coming into contact with these animals take precautions to avoid infections.

Separate milk from sick and under-treatment animals. Follow appropriate procedures to separate milk from sick animals and animals under treatment. This milk is not suitable for human consumption and if stored on farm should be clearly labelled. Clean milking equipment and utensils thoroughly to avoid cross contamination.

Keep written records of all treatments and identify treated animals appropriately. It is important that staff, veterinarians and others involved with handling dairy animals on the farm know what treatments have been given to which animals. Put in place an appropriate system to readily identify treated animals, and record appropriate details in accordance with local regulations and to manage withholding periods for milk and meat.

Manage animal diseases that can affect public health (zoonosis). Follow local regulations recommendations to control zoonosis. Ensure the safe disposal of animal waste and carcasses. Prevent the contamination of milk with faeces and urine or other animal wastes. Do not use milk from sick animals for human consumption.

8.6 How can I use chemicals and veterinary medicines as directed?

Use only those chemicals that have been assessed and registered for dairy production by the relevant veterinary departments. Calculate dosages carefully and observe the appropriate withholding period. Be aware of chemicals that can leave residues in milk. These may include detergents, teat disinfectants, dairy sanitizers, anti-parasitic, antibiotics, herbicides, pesticides and fungicides.

Store chemicals and veterinary medicines securely to ensure they are not used inappropriately or do not unintentionally contaminate milk and feed. Check and observe product expiry dates. Chemicals and their containers should also be disposed of in a way that will not cause contamination to animals or the farm environment.

9 Feeding and Nutrition

9.1 What are the basic principles of feeding & nutrition for dairy cows?

During lactation, dairy cows have very high nutritional requirements relative to most other species (see **Table 2: Feeding Guidelines for Large Sized Dairy Cows**). Meeting these requirements, especially for energy and protein, is challenging. Diets must have sufficient nutrient concentrations to support production and metabolic health, while also supporting rumen health and the efficiency of digestion.

9.2 What are the nutritional requirements of dairy cows?

Most practical management conditions advocate that dairy cows and growing dairy heifers are fed *ad libitum* i.e. freely available as per cow's choice. Thus, voluntary feed intake is the major limitation to nutrient supply in dairy cattle. Feed intake is usually characterized as Dry Matter Intake (DMI) to compare diets of variable moisture concentrations.

Table 2: Feeding Guidelines for Large Sized Dairy Cows¹¹

Age/ Physiological Status	Average Live Body Weight (Kgs)	DMI ¹² (kg/day)	Milk Production (Litres/ Day)	Crude Protein (CP ¹³) %
Heifers age (Months)				
a. 6	200	5	0	12.3
b. 12	300	7	0	11.4
c. 18	450	11	0	8.8
d. 24	625	10	0	15.0
Cow Fresh (After Calving)	675	15	35	19.5
Cow Early Lactation	675	30	55	16.7
Cow Middle Lactation	675	24	35	15.2
Cow Late Lactation	675	20	25	14.1
Cow, Dry	675	14	0	10.0

The daily DMI of high-producing cows may be 5% of body weight and even higher in extremely high-producing cows. More typical peak DMI values are in the range of 3.5%–4% of live body weight.

In mature cows, DMI as percentage of body weight is lowest during the non-lactating, or dry period. In most cows, DMI declines to its lowest rate in last 2–3 weeks of gestation. Typical DMI during this period is less than 2% of body weight daily. Feed intake during this period has an important relationship to postpartum health as with low DMI and associated pre-partum negative energy balance, the risk of postpartum diseases increases.

After calving, DMI increases as milk production increases; however, the rate of increase in feed consumption is such that energy intake lags behind energy requirements for the first several weeks of lactation. Milk production and associated energy requirements generally peak around 6–10 weeks into lactation, whereas DMI usually does not peak until 12–14 weeks into lactation. This lag in DMI relative to energy requirements creates a period of negative energy balance in early lactation. Cows are at greater risk of metabolic disease during this period than at other times during their lactation cycle. Management and nutritional strategies should be designed to maximize DMI through the period of late gestation and early lactation.

9.3 What factors affect dry matter intake in cows?

Animal, Feed and Environment factors affect Dry Matter Intake (DMI). Major animal factors include; body size, milk production, and stage of lactation and/ or gestation.

¹¹ www.merckvetmanual.com

¹² Dry Matter Intake

¹³ Value is on Dry matter basis

Feed factors also affect DMI. Moisture concentrations in ration less than 50% generally decrease DMI especially in silage feeds. Rations high (>30%) in fibre may also limit feed intake.

Environment also affects feed intake; temperatures above the thermal neutral zone i.e. 20-25°C resulting in reduced DMI.

Monitoring DMI, when possible, is a useful tool in diagnosing nutritional problems in diets of dairy cows.

10 Managing Milk Production and Marketing

10.1 What critical points should I consider to improve milk quality?

- Healthy and disease free cows, attaining 60% of adult body weight at 11-12 months of age e.g. a mature Holstein cow typically weighs 680-770 kg and stands 58-65 inches tall at the shoulder. Holstein heifers should be bred by 11 to 14 months of age, when they weigh 317-340 kgs or 55-60% of adult weight. Generally, breeders plan for Holstein heifers to calve for the first time between 21 and 24 months of age and at 80% of adult bodyweight.
- Strict on-farm milking procedures and regular milk testing for quality parameters
- Quick cooling of milk and immediate transportation to the manufacturer or market

10.2 Is it feasible to market the milk by the farmer himself?

Yes, it is preferred to market the milk through farmer's own channels especially where demand is high and supply is less such as big cities e.g. Lahore, Karachi, Quetta, Peshawar, etc. However, milk may be sold directly to milk contractors or wholesalers. For getting maximum profit, around 70-80 % of farm milk must be obtained in months of April to November through synchronized breeding program.

11 Institutional Support

11.1 What is the role of government departments and other institutions for dairy business development?

Government institutions such as Provincial Livestock Departments are working for improvement of farming systems through provision of services such as Mass Vaccination program for control of Foot and Mouth Disease (FMD), information sharing on feeding management, capacity building.

They provide information and training on various aspects of farming such as feeding, Artificial Insemination (AI) services, vaccination, hay and silage production etc. For contacting these departments, please refer to "Section 11: Useful Links" in SMEDA Prefeasibility Studies on dairy farming. Other relevant institutions working for the support and capacity building of dairy businesses are;

- **Solve Agri Pak (Private) Limited**
62-Tipu Block, Garden Town, Lahore.
Ph: 0423-5867801, 5867803-4
Fax: 0423-5867802
Email: info@solveagripak.com
- **Geentech International**
- Mumtaz Centre, Suite No. 3, 2nd Floor,
15-A, Shahrah-e-Fatima Jinnah, Lahore
Phone: 0423-36301714
Cell: 0333-4231714
Fax: 042-36363499
Email: auawan@gmail.com / info@geentechintl.com
- **Al-Barkah Dairy & Livestock Feeds**
Plot No. 156, P-Block, Gulberg III, Lahore
Phone: 0423-546 5837
Cell: 0341-200 2111
Email: info@albarkahfeeds.com.pk
Web: www.albarkahfeeds.com.pk

11.2 What is the role of SMEDA for dairy business development?

SMEDA provide Business Development Services such as prefeasibility studies, Business Counselling, Training and capacity building, networking with experts and service providers, etc. to all sectors, including Dairy and Livestock Sector.